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Annual Site Environmental Report for Sandia National Laboratories, New Mexico

Matthew Sneddon, Susan Koss, Rebecca Sanchez and Charlene Cunningham

Prepared by
Sandia National Laboratories
Albuquerque, New Mexico 87185

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ABSTRACT

Sandia National Laboratories, New Mexico (SNL/NM) is a government-owned/contractor-operated laboratory. Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, manages and operates the laboratory for the U.S. Department of Energy (DOE), National Nuclear Security Administration (NNSA). The DOE/NNSA Sandia Site Office (SSO) administers the contract and oversees contractor operations at the site. This annual report summarizes data and the compliance status of Sandia Corporation's environmental protection and monitoring programs through December 31, 2006. Major environmental programs include air quality, water quality, groundwater protection, terrestrial surveillance, waste management, pollution prevention (P2), environmental restoration (ER), oil and chemical spill prevention, and the National Environmental Policy Act (NEPA). Environmental monitoring and surveillance programs are required by DOE Order 450.1, *Environmental Protection Program* (DOE 2005) and DOE Manual 231.1-1A, *Environment, Safety, and Health Reporting* (DOE 2004).

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NOTE TO THE READER

The goals for the Annual Site Environmental Report are to present summary environmental data regarding environmental performance, compliance with environmental standards and requirements, and to highlight significant facility programs. In addition, the U.S. Department of Energy views this document as a valuable tool for maintaining a dialogue with our community about the environmental health of this site.

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

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Attention: Karen Agogino

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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
	AFV	alternative fuel vehicles
	AHCF	Auxiliary Hot Cell Facility
	AIRFA	American Indian Religious Freedom Act
	ALARA	as low as reasonably achievable
	ALT	annual limits on intake
	AMPF	Advanced Manufacturing Prototype Facility
	AMPL	Advanced Manufacturing Process Laboratory
	ANOVA	Analysis of Variance
	APPDL	Advanced Pulse Power Development Laboratory
	AQC	Air Quality Compliance
	AOC	area of concern
	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	BGS	below ground surface
	BMP	Best Management Practice
	BTU	British Thermal Units
	BV	Background Volume
C	C&D	Construction and Demolition
	CA	Compliance Agreement
	CAA	Clean Air Act
	CAAA	Clean Air Act Amendments
	CAC	Corrective Action Complete
	CAMU	Corrective Action Management Unit
	CAN	Clean Air Network
	CAP	Consolidated Audit Program
	CAP88	Clean Air Act Assessment Package-1988
	CCCL	Cleaning and Contamination Control Laboratory
	CEARP	Comprehensive Environmental Assessment and Response Program
	CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
	CFCs	Chlorofluorocarbons
	CFR	Code of Federal Regulations
	CINT	Center for Integrated Nanotechnologies
	CMS	Corrective Measures Study
	CMI	Corrective Measures Implementation
	COA	City of Albuquerque
	COC	Contaminants of Concern
	COD	Chemical Oxygen Demand
	COoC	Compliance Order on Consent
	CPMS	Criteria Pollutant Monitoring Station
	CPR	Corporate Process Requirements
	CPV	Compliance Plan Volume
	CRIO	Community Resources Information Office
	CWA	Clean Water Act
	CWL	Chemical Waste Landfill
	CWP	corporate work process
	CY	Calendar Year

D	D&D	decontamination and demolition
	DCG	Derived Concentration Guide
	DESIGN	Design Engineering and Science Integration for Generating Neutrons
	DI	de-ionized
	DoD	U.S. Department of Defense
	DOE	U.S. Department of Energy
	DQO	data quality objective
	DSO	Disassembly Sanitization Operation
	DSS	Drain and Septic Systems
	DSSI	Diversified Scientific Services, Inc.
E	EA	Environmental Assessment
	ECF	Explosive Components Facility
	ECO	energy conservation opportunities
	EDE	effective dose equivalent
	EEANM	Environmental Education Association of New Mexico
	EID	Environmental Information Document
	EIS	Environmental Impact Statement
	EHD	Environmental Health Department
	EM	Environmental Management
	EMS	Environmental Management System
	EO	Executive Order
	EPA	U.S. Environmental Protection Agency
	EPEAT	Electronic Product Enviromental Assessment Tool
	EPCRA	Emergency Planning and Community Right-to-Know Act
	EPP	Environmentally Preferable Purchasing
	ER	Environmental Restoration
	ES&H	Environment, Safety, and Health
	ESA	Endangered Species Act
F		
	FEC	Federal Electronics Challenge
	FFCA	Federal Facilities Compliance Act
	FFCO	Federal Facility Compliance Order
	FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
	FLAME	Fire Laboratory used for the Authentication of Modeling and Experiments
	FONSI	finding of no significant impact
	FOP	field operating procedures
	FY	Fiscal Year
G	GEL	General Engineering Laboratories
	GIF	Gamma Irradiation Facility
	GPP	General Plant Projects
	GSA	General Services Administration
	GWPP	Groundwater Protection Program
	GWS	groundwater system
H	HAP	hazardous air pollutant
	HAZWOPER	Hazardous Waste Operations and Emergency Response
	HBWSF	High-Bay Waste Storage Facility
	HCECs	Hydrochlorofluorocarbons
	HCF	Hot Cell Facility
	HDRV	Historical Disposal Requests Validation
	HE	high explosives
	HF	hydrofluoric
	HERMES-III	High Energy Radiation Megavolt Electron Source-III
	HLW	high-level radioactive waste
	HSWA	Hazardous and Solid Waste Amendments

	HWB	Hazardous Waste Bureau
	HWMF	Hazardous Waste Management Facility
I	ICM	Interim Corrective Measure
	IGPP	Institutional General Plant Projects
	ILMS	Integrated Laboratory Management System
	IRP	Installation Restoration Program
	ISMS	Integrated Safety Management System
	ISO	International Organization for Standardization
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
	LDR	Land Disposal Restrictions
	LE	Landfill Excavation
	LECS	Liquid Effluent Control System
	LEED	Leadership in Energy and Environmental Design
	LLRI	Lovelace Respiratory Research Institute
	LLW	low-level waste
	LTES	Long-Term Environmental Stewardship
	LTS	Long-Term 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 activities
	MDL	Micorelectronics Development Laboratory (Chapters 1, 5, 6)
	MDL	minimum detection limit (Chapters 4, 7)
	MEI	maximally exposed individual
	MESA	Microsystems and Engineering Sciences Application
	MIPP	Medical Isotope Production Project
	MNA	monitored natural attenuation
	MOC	Management and Operating Contract
	MOW	members of the workforce
	MP	monitoring point
	MSB	Manzano Storage Bunkers
	MSDS	Material Safety Data Sheet
	MW	mixed waste
	MWL	Mixed Waste Landfill
N	N/A	not available or not applicable
	NAAQS	National Ambient Air Quality Standards
	NARAC	National Atmospheric Release Advisory Center
	NEPA	National Environmental Policy Act
	NESHAP	National Emission Standards for Hazardous Air Pollutants
	NFA	No Further Action
	NGF	Neutron Generator Facility
	NGPF	Neutron Generator Production Facility
	NHPA	National Historic Preservation Act
	NISAC	National Infrastructure Simulation and Analysis Center

	NMAC	New Mexico Administrative Code
	NMSA	New Mexico Statutes Annotated
	NMAAQS	New Mexico Ambient Air Quality Standards
	NMED	New Mexico Environment Department
	NMHWA	New Mexico Hazardous Waste Act
	NMWQCC	New Mexico Water Quality Control Commission
	NNSA	National Nuclear Security Administration
	NOD	Notice of Disapproval
	NON	Notification on Non-compliance
	NOV	Notice of Violation
	NPDES	National Pollutant Discharge Elimination System
	NPL	National Priorities List
	NPN	nitrate plus nitrite
	NRC	National Response Center (Chapter 6)
	NRC	U.S. Nuclear Regulatory Commission (Chapter 2)
	NSPS	New Source Performance Standards
	NSR	New Source Review
	NWS	National Weather Service
O	ODS	Ozone-depleting substance
	OEM	Original Equipment Manufacturer
	OR	Occurrence Reporting
	ORPS	Occurrence Reporting Processing System
P	P2	Pollution Prevention
	PA/SI	Preliminary Assessment/Site Inspection
	PCB	polychlorinated biphenyl
	PCCP/PA	Post-Closure Care Plan/Permit Application
	PEP	Performance Evaluation Plan
	PER	Performance Evaluation Report
	PETL	Processing and Environmental Technology Laboratory
	pH	potential of Hydrogen
	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
	PPOA	Pollution Prevention Opportunity Assessment
	PQL	Practical quantitation limit
	PRD	Process Research Development
	PSL	Primary Subliner
	PVC	polyvinylchloride
Q	QA	quality assurance
	QAP	Quality Assurance Program
	QAPP	Quality Assurance Project Plan
	QC	quality control
	QNR	Qualified NEPA Reviewers
	QSAS	Quality Systems Analytical Services
R	RAP	Remedial Action Proposal
	RCRA	Resource Conservation and Recovery Act
	R&D	research and development
	RFP	Request for Proposals
	RHEPP	Repetitive High Energy Pulsed Power (an accelerator facility)
	RITS	Radiographic Integrated Test Stand
	RMMA	Radioactive Material Management Areas
	RMWMF	Radioactive and Mixed Waste Management Facility

	ROD	Record of Decision
	RPSD	Radiation Protection Sample Diagnostics
	RQ	reportable quantity
	RSI	Request for Supplemental Information
	RWNMDD	Radioactive Waste/Nuclear Material Disposition Department
S	SAP	Sampling and Analysis Plan
	SARA	Superfund Amendments and Reauthorization Act
	SD	sustainable design
	SDWA	Safe Drinking Water Act
	SER	Sandia Engineering Reactor
	SGWS	shallow groundwater system
	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
	SPEIS	Supplemental Programmatic Environmental Impact Statement
	SPCC	Spill Prevention Control and Countermeasures (plan)
	SPHINX	Short Pulse High Intensity Nanosecond X-Radiator (an accelerator facility)
	SPR	Sandia Pulsed Reactor
	SSO	Sandia Site Operations
	ST	stabilization treatment
	START	Sandia Tomography and Radionuclide Transport Laboratory
	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
	SWMU	Solid Waste Management Unit
	SWP3	Storm Water Pollution Prevention Plan
	SWTF	Solid Waste Transfer Facility
T	TA	Technical Area
	TAG	Tijeras Arroyo Groundwater
	TAL	Target Analyte List
	TCE	trichloroethylene
	TCLP	toxicity characteristic leaching procedure
	TDS	total dissolved solids
	TESLA	Tera-Electron Volt Energy Superconducting Linear Accelerator
	TLD	Thermoluminescent Dosimeter
	TLV	threshold limit value
	TMDL	Total Maximum Daily Load
	TNMHC	total non-methane hydrocarbon
	TOC	Total Organic Carbon
	TOMP	Toxic Organic Management Plans
	TOP	Technology and Operations Prototype
	TOX	total halogenated organics
	TRI	Toxic Release Inventory
	TRU	transuranic (radioactive waste)
	TSCA	Toxic Substances Control Act
	TSD	treatment, storage, and disposal
	TSP	total suspended particulate
	TSS	total suspended solids
	TTC	Thermal Test Complex
	TTF	Thermal Treatment Facility
	TTR	Tonopah Test Range

U	UAW	unaccounted for water
	UNM	University of New Mexico
	USAF	U.S. Air Force
	USDA	U.S. Department of Agriculture
	USFS	U.S. Forest Service
	USGBC	U.S Green Building Council
	USGS	U.S. Geological Survey
	UST	underground storage tank
V	VCA	Voluntary Corrective Action
	VCM	Voluntary Corrective Measure
	VOC	volatile organic compound
	VSA	Vertical Sensor Array
	VZMS	Vadose Zone Monitoring System
W	WERC	a consortium for environmental education and technology development established through a cooperative agreement with DOE
	WFO	work for others
	WIPP	Waste Isolation Pilot Plant
	WQG	Water Quality Group

UNITS OF MEASURE

bgs	below ground surface
°C	degrees Celsius
cm	centimeter
°F	degrees Fahrenheit
fasl	feet above sea level
ft	feet
g	gram
gal	gallon
gpcd	gallons per capita per day
kg	kilogram
km	kilometer
kW	kilowatt
L	liter
lb	pound
mb	millibar
m/s	miles per second
mg	milligram
mm	million
mph	miles per hour
ppb	parts per billion
ppbv	parts per billion by volume
ppm	parts per million
scf	standard cubic feet
tpy	tons per year
yr	year

RADIOACTIVITY MEASUREMENTS

rem	roentgen equivalent man	Sv	Sievert
mrem	millirem (unit of radiation dose)	Ci	curie
person-Sv	person-Sievert (unit of radiation dosage)	pCi	picocurie
person-rem	radiation dose to population (also man-rem)	µg	microgram
mSv	millisievert (unit of radiation dosage)	mR	milliroentgen
µR/hr	microroentgen per hour	Std Dev	standard deviation

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)	9/5 °C+ 32=°F	Fahrenheit (°F)
Sievert (Sv)	100	roentgen equivalent man (rem)

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EXECUTIVE SUMMARY

Included are summaries of the following Environmental Programs in place at Sandia National Laboratories, New Mexico (SNL/NM):

Waste Management and Pollution Prevention (P2)
Environmental Restoration (ER) Project
Terrestrial Surveillance
Water Quality
Groundwater Protection
Air Quality
National Environmental Policy Act (NEPA) Activities

Sandia National Laboratories, New Mexico (SNL/NM) is one of the nation's premier multi-program national security laboratories. Sandia Corporation (Sandia), a wholly owned subsidiary of Lockheed Martin Corporation, manages and operates the laboratory for the U.S. Department of Energy (DOE)/National Nuclear Security Administration (NNSA). The DOE/NNSA/Sandia Site Office (SSO) administers the contract and oversees contractor operations at the site. This Annual Site Environmental Report (ASER) was prepared in accordance with and as required by DOE Order 450.1, *Environmental Protection Program* (DOE 2005) and DOE Manual 231.1-1A, *Environment, Safety, and Health Reporting* (DOE 2004).

This ASER summarizes the environmental protection, restoration, and monitoring programs in place at SNL/NM for Calendar Year (CY) 2006. It also discusses Sandia's compliance with environmental statutes, regulations, DOE orders and permit provisions, and it highlights significant environmental program efforts and accomplishments. This ASER is a key component of DOE's effort to keep the public informed about environmental conditions throughout the DOE/NNSA nuclear weapons complex.

Environmental Programs

Sandia's methodology for managing and implementing its Environment, Safety, and Health (ES&H) Program is outlined in the Integrated Safety Management System (ISMS). The ISMS is centered upon five safety management functions that provide processes to guide management in identifying and controlling hazards. Furthermore, Sandia implemented an Environmental Management System (EMS) to enhance the ISMS. The EMS is the component of ISMS that addresses the environmental aspects and impacts of SNL/NM's activities, products, and services. In 2006, SNL/NM continued to improve environmental management (EM) by utilizing best management practices (BMPs), benchmarking, and process improvements. Further information about EMS and ISMS can be found in Chapters 3 and 8, respectively.

In December 2005, Sandia informed the DOE/NNSA/SSO that it had fully implemented its EMS in accordance with the requirements outlined in DOE Order 450.1. Thus, the EMS fully serves as Sandia's proactive approach to managing environmental risks and protecting the environment.

While all 2006 program activities are performed continuously, they are reported in this ASER on a CY basis, unless otherwise noted (programs based on the Fiscal Year [FY] run from October 1st through September 30th, annually). The primary environmental programs in place at SNL/NM are summarized below.

Waste Management and Pollution Prevention (P2)

Waste at SNL/NM is processed at five facilities: the Hazardous Waste Management Facility (HWMF), the Thermal Treatment Facility (TTF), the Radioactive and Mixed Waste Management Facility (RMWMF), the Manzano Storage Bunkers (MSB), and the Solid Waste Transfer Facility (SWTF).

The P2 program provides assessment and guidance to the line to implement measures that reduce resource use and generated waste and to enhance the overall efficiency of processes and organizations within SNL/NM. In 2006, SNL/NM received several awards for P2 accomplishments.

Environmental Restoration (ER) Project

At the close of 2006, there were 61 regulated ER sites remaining to be completed at SNL/NM. Fifty-four of these sites are pending final regulatory approval by the New Mexico Environment Department (NMED) through the Class III Permit modification process. Five of the seven remaining sites have been submitted to NMED for a Corrective Action Complete (CAC) determination, which is required prior to the permit modification process. This includes the Chemical Waste Landfill (CWL), which is on a separate regulatory path requiring a stand alone permit. Of the two remaining sites, the Solid Waste Management Unit (SWMU) 58 investigation report will be submitted in early FY 2007, and the Mixed Waste Landfill (MWL) will continue into FY 2009 or beyond. Final remedies for groundwater contamination at three areas of conern (AOC), the Technical Area (TA) V, Tijeras Arroyo Groundwater (TAG), and Burnsite Groundwater (BSGW) AOCs, are pending.

Long-Term Environmental Stewardship (LTES)

The SNL/NM LTES program provides environmental stewardship for past, present, and future activities at Sandia. LTES "promotes the long-term stewardship of a site's natural and cultural resources throughout its operational, closure, and post-closure life cycle" (DOE/SNL 2006). The environmental programs referred to in this document support that stewardship. A component of the LTES program is long-term stewardship (LTS) of legacy sites (i.e. former ER sites).

LTS activities have been increasing as the ER Project completion approaches. The ER Project focuses on project closure, while also working with SNL/NM's Environmental Management (EM) Department on transitioning LTS activities to EM.

Terrestrial Surveillance

The terrestrial surveillance sampling objectives are conducted to detect any potential releases or migration of contaminated material to off-site locations. Soil, sediment, and vegetation are collected from on-site, perimeter, and off-site locations (community locations outside Kirtland Air Force Base [KAFB] boundaries). In 2006, there were no terrestrial sample results indicating concerns that would prompt actions at locations that are not already being addressed by the ER Project.

In lieu of routine sampling at all locations for non-radiological parameters, a special sampling campaign and summary report of all non-radiological results was prepared for 37 locations surrounding the newly constructed Thermal Test Complex (TTC) to serve as a baseline for future reference regarding non-radiological results in nearby soils (SNL 2007). Furthermore, in the future, routine sampling for non-radiological parameters at fixed locations will be reduced, and more emphasis will be placed on sampling specific areas of interest with potential environmental impact. The total number of samples collected annually, however, should remain approximately the same.

Water Quality

- ***Wastewater*** – Wastewater from SNL/NM is discharged from five on-site outfalls permitted by the City of Albuquerque (COA). Wastewater monitoring is conducted to ensure that all discharges meet the standards set by the COA's publicly owned treatment works (POTW). During 2006, there were two COA reportable events. In May 2006, the COA potential of hydrogen (pH) limit was exceeded for approximately two hours due to a valve failure at the Acid Waste Neutralization (AWN) system that caused an uncontrolled injection of sodium hydroxide into the system. This resulted in a pH exceedence in two of the on-site permitted outfalls. Subsequently, the COA issued two violations with no fines for each of the outfalls. In November 2006, hydrofluoric acid (HF) was inadvertently discharged into the laboratory acid waste drain instead of the laboratory HF drain, which flows to the fluoride removal system. The city was notified when the fluoride concentration exceeded the COA fluoride concentration limit. No COA violations were issued. All other discharge parameters met the COA standards, resulting in SNL/NM receiving three "Gold Pre-Treatment Awards" and two "Silver Pre-Treatment Awards" from the COA for the 2005-2006 reporting year.

- ***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 29 internal requests made for individual discharges to the surface in 2006. All requests met the NMED New Mexico Water Quality Control Commission (NMWQCC) standards and were approved by Sandia. Additionally, routine surface discharges are made to two evaporation lagoons that service the Pulsed Power Facility under an existing discharge permit. All permit requirements for both lagoons were met during CY 2006. In 2006, there were seven unplanned surface releases reported to NMED. These reportable releases are documented in Sections 2.2.2 and 6.2.2 of this report.

- ***Storm Water Runoff*** – In FY 2006, the only analytical monitoring that was required under SNL/NM's National Pollutant Discharge Elimination System (NPDES) Multi-Sector General Permit for Storm Water Discharges Associated with Industrial Activities (Multi-Sector General) was for an annual fecal coliform analysis required by the State of New Mexico. Several environmental surveillance samples were also collected. The current NPDES permit requires that quarterly analytical sampling be conducted in the second and fourth year of the five year permit, weather permitting. FY 2004 was the fourth year of the permit and was the last year analytical monitoring was required.

The permit also requires visual observations be performed every quarter, weather permitting. No visual observations were collected for the first three quarters of FY 2006 due to the lack of adequate runoff during normal business hours. There were no unusual characteristics noted in the sample collected during the fourth quarter of FY 2006. The permit was due for renewal in FY 2005, but the U.S. Environmental Protection Agency (EPA) did not issue a new permit and extended the current permit into 2007.

- ***Oil Storage and Spill Control*** – A Spill Prevention Control and Countermeasures (SPCC) Plan is required under the Clean Water Act (CWA). Sandia's SPCC Plan describes the oil storage facilities and the mitigation controls in place to prevent inadvertent discharges of oil. The facilities at SNL/NM that are subject to regulations include oil storage tanks (above ground storage tanks [ASTs] and underground storage tanks [USTs]), bulk storage areas (multiple containers), and temporary or portable tanks. SNL/NM currently operates 51 ASTs and five USTs.

Groundwater Protection

- ***Groundwater Protection Program (GWPP)*** The GWPP conducts general surveillance of water quality from a network of wells not directly associated with ER Project sites. Annual sampling was conducted from 15 wells and one spring. Analyses were conducted for metals, volatile organic compounds (VOCs), inorganics (including nitrate and cyanide), phenolics, alkalinity, total halogenated organics (TOXs), gross alpha, gross beta, and selected radionuclides. Perchlorate analysis was conducted on samples obtained from four wells as required by the Compliance Order on Consent (COoC) between Sandia, DOE, and NMED. One groundwater sample for EOD Hill was analyzed for perchlorate to confirm previously obtained results. All of the exceedances, except for perchlorate, are attributed to naturally occurring sources. NMED has been notified of the EOD results. Further action is pending NMED response.

- ***ER*** – The ER Project collects groundwater samples at five general project areas: the CWL, the MWL, TA-V, TAG, and BSGW. Water quality results reported by the ER Project were consistent with past years' results.

Air Quality

- ***Ambient Air Monitoring*** **–** Sandia measures ambient air quality at six locations throughout SNL/NM and compares results with National Ambient Air Quality Standards (NAAQS) and local ambient air regulations. The network monitors criteria pollutants and VOCs.

- ***Air Quality Compliance*** (AQC) – Air quality standards are implemented by regulations promulgated by local and federal governments in accordance with the Clean Air Act (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.

  The AQC program currently maintains 12 issued authority-to-construct (ATC) New Source Review (NSR) permits and four issued NSR source registrations from the COA. There is currently one ATC NSR permit and seven NSR source registrations pending issuance with the COA. The AQC program is currently consolidating applicable permits and registrations into three sitewide permits—sitewide generators, sitewide boilers, and sitewide chemicals—to create more efficient management compliance with permitting units.

  In 2006, the AQC program was issued a notice of violation (NOV) and a monetary fine from the COA for boilers installed at Central Utility Building (CUB) 858J that did not have the required permit.

- ***Radiological National Emission Standards Hazardous Air Pollutants Compliance*** (NESHAP) **–** Subpart H of NESHAP regulates radionuclide air emissions from DOE/NNSA facilities, with the exception of naturally occurring radon. In 2006, there were 17 SNL/NM facilities reporting NESHAP regulated emissions. Of these 17 sources, 16 were point sources and one a diffuse source. In 2006, the primary radionuclides released were tritium and argon-41. In 2006, the on-site maximally exposed individual (MEI) was located on KAFB. The MEI dose of 0.0016 millirems per year (mrem/yr) at Kirtland Storage Site resulted primarily from releases of argon-41 from the Annual Core Research Reactor (ACRR) and the Sandia Pulsed Reactor in TA-V. The off-site MEI was located at the Eubank Gate Area. The MEI of 0.00079 mrem/yr at the Eubank Gate Area resulted primarily from releases of tritium from the Neutron Generator Facility (NGF) in TA-I. Both doses are well below the EPA standard of 10 mrem/yr.

National Environmental Policy Act (NEPA) Activities

In 2006, the DOE/NNSA/SSO prepared a Supplement Analysis (SA) (DOE/EIS-0281-SA-04) to determine whether the Site-Wide Environmental Impact Statement (SWEIS) for SNL/NM (DOE/EIS-0281) would continue to adequately address the environmental effects of ongoing operations at SNL/NM or whether additional documentation under NEPA was needed. The SA specifically compared key impact assessment parameters analyzed in the SWEIS with new information, new and proposed projects, and modifications to existing projects since the SWEIS was issued in 1999. On October 10, 2006, DOE/NNSA/SSO determined that the proposed action does not constitute substantial changes to the SNL/NM Record of Decision (ROD), and no further NEPA documentation would be required.

The NEPA team participated in the initial planning and data collection for two NEPA documents that are at various stages of preparation: (1) an environmental assessment (EA) for Thunder Range at SNL/NM, and (2) a Supplement to the Stockpile Stewardship and Management Programmatic Environmental Impact Statement--Complex 2030 (Complex 2030 SPEIS) (DOE/EIS-0236-S4).

The NEPA team reviewed a total of 531 proposed projects in the ISMS NEPA Module or in the Experimental Development Plan System (the TA-III project review system with its own environmental evaluation component), and they transmitted 71 NEPA checklists to the DOE/NNSA/SSO for review and determination in 2006.

Sandia employee releasing a Great Horned Owl.

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chapter one

INTRODUCTION

In This Chapter...

- Sandia Corporation's (Sandia) History and Mission
- Site Operations
- Site Setting
- Geology
- Hydrological Setting
- Regional Climate
- Regional Ecology

Environmental Snapshot

In 2006, Sandia's EMS Program issued Environmental Excellence Awards to members of SNL/NM's workforce for implementing innovative and creative ways to protect the environment, reduce waste, and save water and energy.

This Annual Site Environmental Report (ASER) describes the environmental protection programs currently in place at Sandia National Laboratories, New Mexico (SNL/NM). This report is prepared in accordance with the requirements set forth for all large U.S. Department of Energy (DOE)/National Nuclear Security Administration (NNSA) facilities, of which SNL/NM is one. This ASER represents a key component of DOE's effort to keep the public informed about environmental conditions at DOE/NNSA sites.

SNL/NM is located 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 Mountains, named for the watermelon color seen on the mountains at sunset, and the nearby Manzanita Mountains provide the beautiful setting at SNL/NM.

Sandia Corporation (Sandia), a wholly owned subsidiary of Lockheed Martin Corporation, has provided technological innovations "in service to the national interest" since its inception. The majority of SNL/NM activities are conducted within five technical areas (TAs) and several remote locations.

In support of its mission, Sandia addresses environment, safety, and health (ES&H) issues through its environmental management (EM) programs. These programs include waste management, pollution prevention (P2), environmental restoration (ER), long-term environmental stewardship (LTES), terrestrial surveillance, water quality (surface and waste water), oil storage, spill prevention, groundwater, air quality, National Enviromental Policy Act (NEPA), chemical inventory management, and quality assurance (QA).

General Site Location and Characteristics

KAFB is a 51,559 acre military installation that includes 20,486 acres withdrawn from the Cibola National Forest through an agreement with the U.S. Forest Service (USFS) (Figure 1-1). Located at the foot of the Manzanita Mountains, it has a mean elevation of 5,384 feet and a maximum elevation of 7,986 feet. KAFB and SNL/NM are located adjacent the City of Albuquerque (COA), which borders KAFB on its north, northeast, west, and southwest boundaries.

KAFB is host to more than 150 tenant groups. SNL/NM is located on the east side of KAFB. The total area of DOE/NNSA owned property dedicated to SNL/NM facilities and operations is approximately 8,585 acres. Sandia conducts operations within 2,841 acres of that land. An additional 5,817 acres in remote areas are provided to DOE through land use agreements with the U.S. Air Force (USAF) and Isleta Pueblo indian reservation. An additional 9,000 acres serve as a buffer zone near the southwest boundary of KAFB. This buffer zone, leased from the State of New Mexico and Isleta Pueblo (that both own the land), provides margins of safety and sound buffers for SNL/NM testing activities. Additional information on local geology, hydrology, and ecology is presented at the end of this chapter.

Last year, development of a 12,500 acre mixed-use urban community called Mesa del Sol began on the COA land adjacent the western boundry of KAFB. The development's master plan projects that the population of Mesa del Sol will ultimately reach 90,000 residents. To date, several business and industrial facilities have been completed, however, no residential development has begun.

Operations Contract

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

- DOE Order 450.1, *Environmental Protection Program* (DOE 2005)
- DOE Manual 231.1-1A, *Environment, Safety, and Health Reporting* (DOE 2004)
- DOE Manual 231.1-2, *Occurrence Reporting and Processing of Operations Information* (DOE 2003)
- DOE Order 435.1, Chg 1, *Radioactive Waste Management* (DOE 2001)
- DOE Order 5400.5, Chg 2, *Radiation Protection of the Public and the Environment* (DOE 1993)
- SEN-22-90, *DOE Policy on Signatures of RCRA Permit Applications* (DOE 1990)

1.1 SANDIA CORPORATION'S HISTORY AND MISSION

History

SNL/NM began operations as Z Division in 1945 as the ordnance design, testing, and assembly arm of Los Alamos. The division moved to Sandia Base

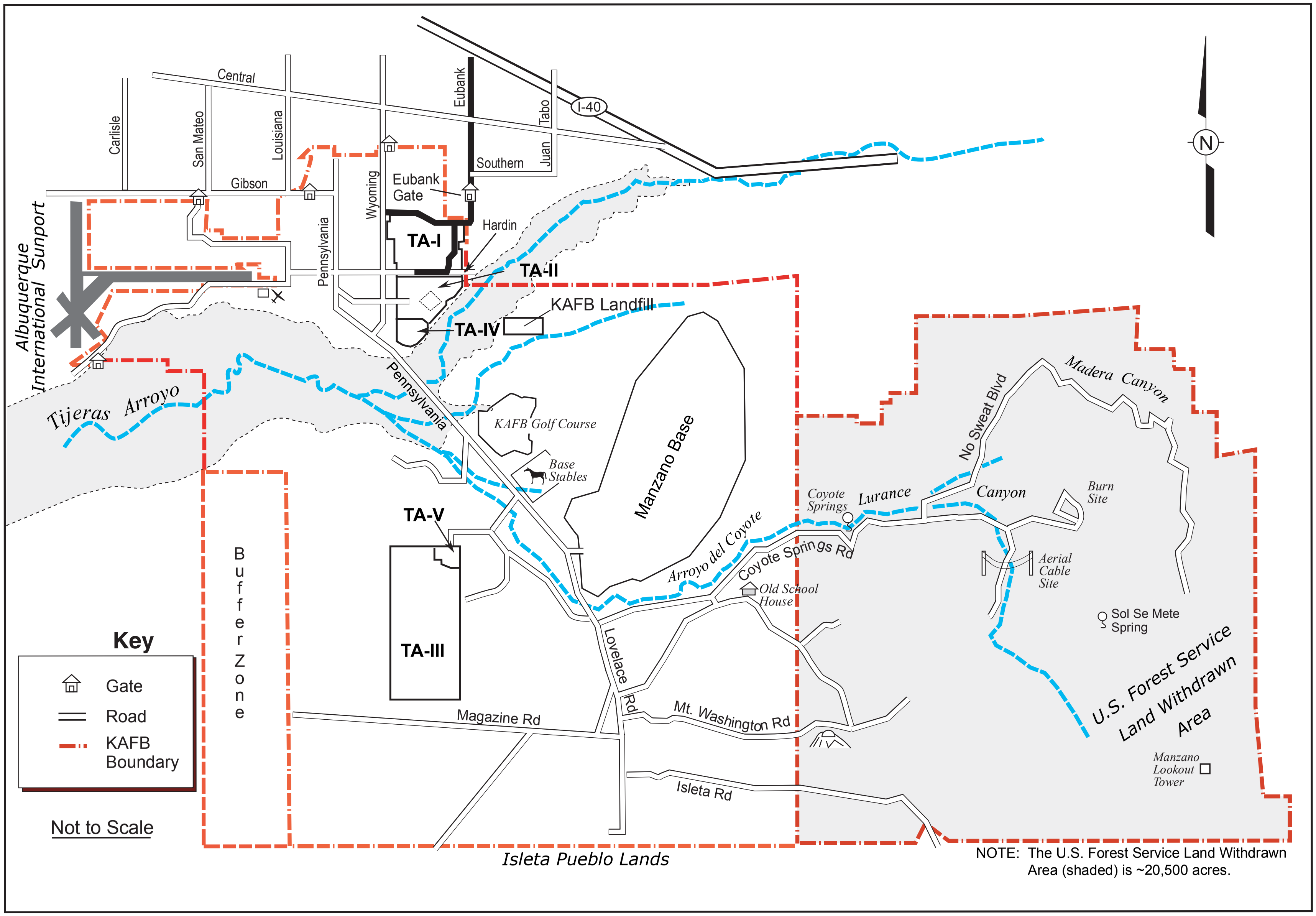

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FIGURE 1-1. SNL/NM Technical Areas and the U.S. Forest Service Land Withdrawn Area (now merged into KAFB), then on the outskirts of Albuquerque, to be near an airfield and to work closely with the military. Due to its growth, Z Division was renamed Sandia Laboratory in 1948 and became a separate branch of Los Alamos. On November 1, 1949, Sandia Corporation, as a subsidiary of Western Electric, began managing SNL/NM. In 1979, Congress recognized Sandia as a national laboratory. Starting in 1993, SNL/NM management and operations continued under Sandia Corporation (Sandia) for DOE/NNSA, however, now as a wholly owned subsidiary of Lockheed Martin Corporation (formally Martin Marietta).

Mission

Sandia's enduring mission is to provide science and engineering support for the nation's nuclear weapons stockpile. Today, that mission has grown to include other critical 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 protecting and preventing the disruption of critical infrastructures such as the nation's energy supply and financial networks. Sandia also collaborates with representatives from the industrial sector, universities, and other government agencies to develop and commercialize new technologies. Recent technologies developed at SNL/NM can be found at the following link:

http://www.sandia.gov/LabNews

Managing a Legacy of Contamination

In a ranking of DOE sites, SNL/NM was ranked one of the least contaminated facilities. Currently, 263 of 265 Environmental Restoration (ER) sites are classified as DOE complete (accepted for NMED approval). One of the remaining sites, Solid Waste Management Unit (SWMU) 58, is scheduled for completion in 2007; however, there has been a significant delay in the receipt of final regulatory approval for the Mixed Waste Landfill (MWL). Some sites require long-term monitoring to ensure that any residual contamination does not migrate from the site. Detailed information about EM cleanup efforts throughout DOE can be found at DOE's website, as well as Sandia's LTES website:

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

http://www.sandia.gov/ltes/

A History of Progress

Sandia has achieved substantial growth and progress in building its comprehensive ES&H Program. The ES&H Manual (SNL 2006), a dynamic online resource available to all Sandia personnel, clearly describes ES&H requirements for all levels of work conducted. 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. Several audits have been conducted in recent years by the U.S. Environmental Protection Agency (EPA), various DOE/NNSA offices, the COA, and the State of New Mexico. The results of these audits, as well as SNL/NM internal audits, support Sandia's ongoing commitment to ES&H practices at SNL/NM.

Sandia's strategy for managing and implementing its ES&H Program is described in the Integrated Safety Management System (ISMS). The ISMS is structured around five safety management functions: (1) plan work, (2) analyze hazards, (3) control hazards, (4) perform work, and (5) feedback and improvement. The ISMS provides processes that guide line management to identify and control hazards. For further information on audits and appraisals, see Section 2.3.

Environmental Management System (EMS)

Sandia implemented an EMS to improve the environmental elements of ISMS. The EMS serves as the basis to manage environmental compliance, controls, and improvements. Furthermore, P2 goals were incorporated to strengthen the EMS. This strategy ensures that ES&H considerations are incorporated into each element of all work processes being conducted by Sandia. For further information on EMS, see Section 3.1.

1.2 SITE OPERATIONS

Technical Area (TA) I

TA-I is the focus of SNL/NM's operations and houses the main administrative center and a close grouping of laboratories and offices. A majority of activities performed in TA-I are dedicated to the design and research and development (R&D) of weapon systems, the limited production of weapon systems components, and energy research programs. Facilities in TA-I include the main technical library, several assembly/manufacturing areas, the Steam Plant, and various laboratories such as the Advanced Manufacturing Processes Laboratory (AMPL), the Microelectronics Development Laboratory (MDL), the Neutron Generator Facility (NGF), the Processing and Environmental Technology Laboratory (PETL), and the Joint Computational Engineering Laboratory (JCEL). The Microsystems and Engineering Sciences Applications (MESA) Project is the largest major capital construction project ever undertaken at SNL and supports the Microsystems Engineering effort. The project will create three facilities and provide the equipment required to design and prototype qualified microsystem-based components for nuclear weapons. Construction is continuing for parts of the MESA Complex. The MicroLab is operational. Semiconductor tools are currently being installed in the MicroFab, which is expected to be operational in Fall 2007. All construction at the Weapons Integration Facility (WIF) is expected to be completed by the end of 2007.

TA-II

TA-II includes facilities and lands south of the TA-I boundary at Hardin Boulevard and extends to the northern boundary of TA-IV. The Explosive Components Facility (ECF), the Hazardous Waste Management Facility (HWMF), the Facilities Command Center, the Solid Waste Transfer Facility (SWTF), and the Construction and Demolition (C&D) Recycle Center are within TA-II. The National Infrastructure Simulation & Analysis Center (NISAC) was completed in 2006.

TA-III

TA-III is the largest and most remote area of all the TAs and is characterized by facilities separated by extensive undeveloped areas. TA-III is used to accommodate large-scale engineering test activities requiring large safety and/or security area buffers such as collision testing sled tracks, centrifuges, and the Thermal Test Complex (TTR). Other facilities include the Radioactive and Mixed Waste Management Facility (RMWMF), the MWL, and the Corrective Action Management Unit (CAMU).

TA-IV

TA-IV, located south of TA-II, houses facilities used to conduct R&D activities in inertial-confinement fusion, pulsed power, and nuclear particle acceleration. Accelerators located in TA-IV include the Z Accelerator (Z-Machine), the Advanced Pulsed Power Development Laboratory (APPDL), the Radiographic Integrated Test Stand (RITS), the Tera Electron Volt Energy Superconducting Linear Accelerator (TESLA), the High Energy Radiation Megavolt Electron Source III (HERMES III), the Saturn Accelerator, the Repetitive High Energy Pulsed Power I (RHEPP I) Accelerator, the High Power Microwave Laboratory (HPML), and the Short-Pulse High Intensity Nanosecond X Radiator (SPHINX).

TA-V

TA-V, located adjacent to the northeast corner of TA-III, includes facilities that routinely handle radioactive materials used in experimental R&D programs. TA-V houses the Sandia Pulsed Reactor (SPR), the Gamma Irradiation Facility (GIF), the Annular Core Research Reactor (ACRR), the Hot Cell Facility (HCF), and the Auxiliary Hot Cell Facility (AHCF).

Remote Test Areas

Several remote test areas are located east and southeast of TA-III and within the canyons and foothills of the U. S. Forest Service (USFS) withdrawn area (Lurance Canyon and Coyote Canyon). These areas are used for explosive ordnance testing, rocket firing experiments, and open burn thermal tests.

Facilities Outside KAFB Boundaries

Facilities that are or will be utilized by SNL/NM personnel, but outside the boundaries of KAFB, include the Center for Integrated Nanotechnologies (CINT) that became operational in 2006, the MESA Technology and Operations Prototype (TOP), and the International Programs building. All are located in the Sandia Science and Technology Park along Eubank Boulevard. A new National Museum of Nuclear Science & History is proposed for construction on Eubank Boulevard.

1.3 SITE SETTING

Regional Topography and Layout

KAFB has a widely varied topography, ranging 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 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 the 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 mile long escarpment distinguished by steep cliffs, pinnacles, and narrow canyons. At 10,678 feet, Sandia Crest 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 Tijeras Arroyo and smaller arroyos and washes.

Tijeras Arroyo
At 4,265 feet wide and 108 feet deep, Tijeras Arroyo is a significant topographic feature that cuts diagonally northeast to southwest 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 normally dry except during heavy downpours, which can cause significant flash floods. The arroyo originates in Tijeras Canyon and runs coincident with the Tijeras Fault for several miles before deviating to the southwest, where it discharges to the Rio Grande about eight miles from the west boundary of KAFB.

Rio Grande
Today, water from the Rio Grande is primarily used for agricultural irrigation. Construction is currently underway to build a water treatment plant that will use water from the river to supplement the COA's drinking water supply.

Counties and Population
New Mexico is the fifth largest state in the U.S., approximately 121,666 square miles in size. Its population is approximately 1.93 million. A recent count of the population within an 80-kilometer (50 mile) radius of SNL/NM was 854,211 residents (DOC 2007). Most reside in the Albuquerque metropolitan area, approximately 723,296 (DOC 2007). Nine counties are contained, or partly included, in this radius (Figure 1-2).

1.4 GEOLOGY

1.4.1 Regional Setting

The regional geologic setting in which SNL/NM and KAFB are situated has been subjected to relatively recent episodes of basaltic volcanism and ongoing regional 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 miles from Leadville, Colorado to northern New Mexico.

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 miles wide, 100 miles long, and 3,000 square miles in area (Grant 1982). On the east, uplifted fault blocks manifested by the Sandia, Manzanita, and Manzano Mountains bound 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 its 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.

Regional Fault Systems
As shown in Figure 1-3, several major faults are located on KAFB. Tijeras Fault, which has been traced as far north as Madrid, New Mexico, trends southwesterly through Tijeras Canyon and across KAFB. Tijeras Canyon was formed by preferential erosion along the fault. 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 major groundwater regimes at KAFB.

The Sandia Fault is thought to be the primary boundary between the Sandia Mountains and the Albuquerque Basin. The Sandia Fault converges with the Tijeras Fault and the Hubbell Springs Fault. Both the Sandia Fault and Hubbell 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 1977).

1.5 HYDROLOGICAL SETTING

The hydrogeological system 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 50 to 315 feet deep. Previously, the extent to which the depth to water in this area was believed to reach was 90 feet; however, a new Burn Site Goundwater (BSGW) well has registered a depth to water reaching as far as 315 feet below the surface. On the west side of the Tijeras Fault Complex, within the basin, groundwater levels range from 295 feet to 492 feet below the surface at KAFB.

A perched groundwater system (PGWS) overlies the regional aquifer in the north portion of KAFB. The PGWS extends southward from TA-I to the KAFB Golf Course. The western extent of the PGWS is somewhere midway between Wyoming Boulevard and the Albuquerque Sunport east-west runway. The eastern extent is just east of the KAFB landfill and may be bounded by the West Sandia Fault.

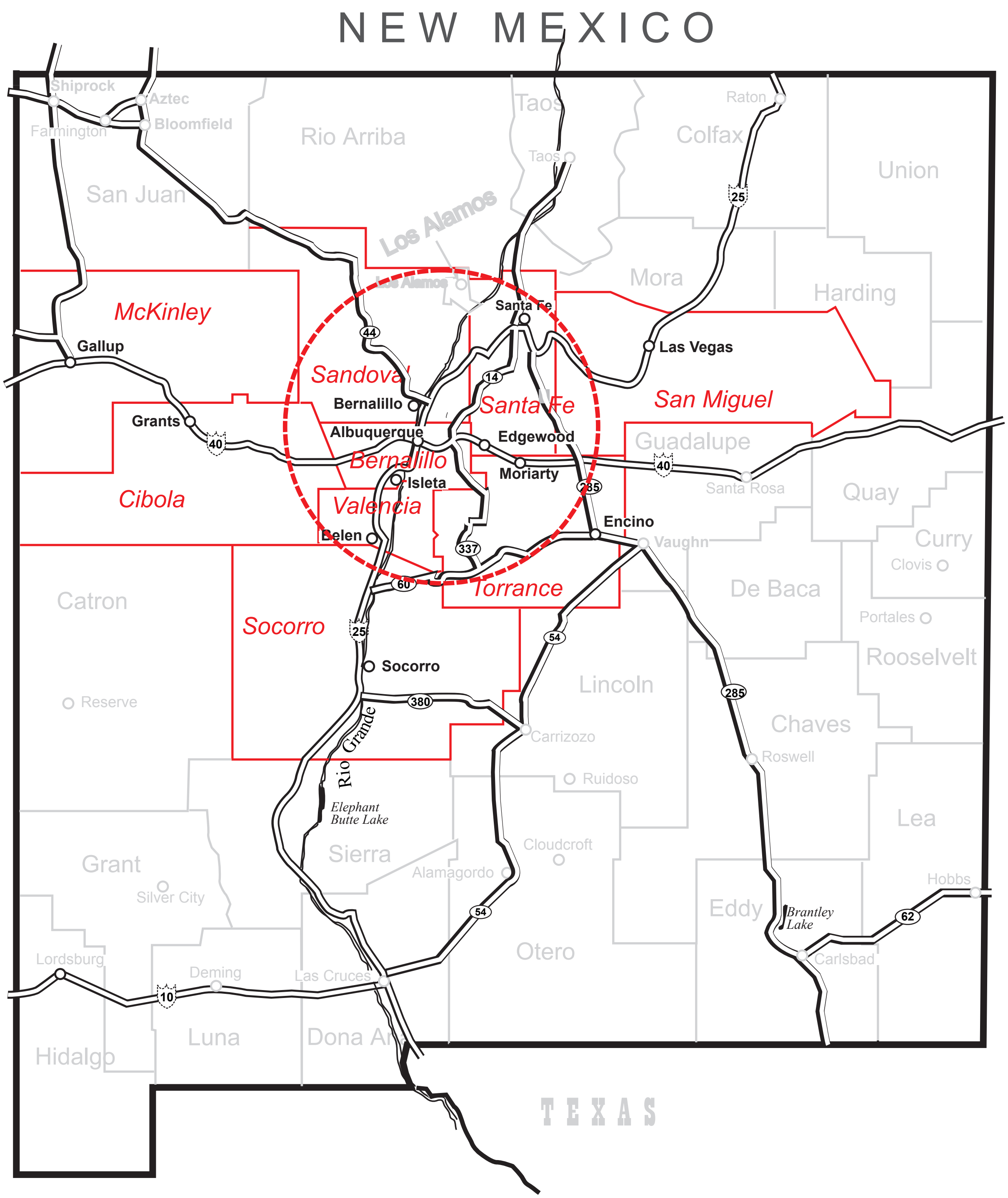

FIGURE 1-2. State of New Mexico Map
The overlay shows major roads, cities, county lines, and the 50-mile radius from SNL/NM facilities (dashed circle).

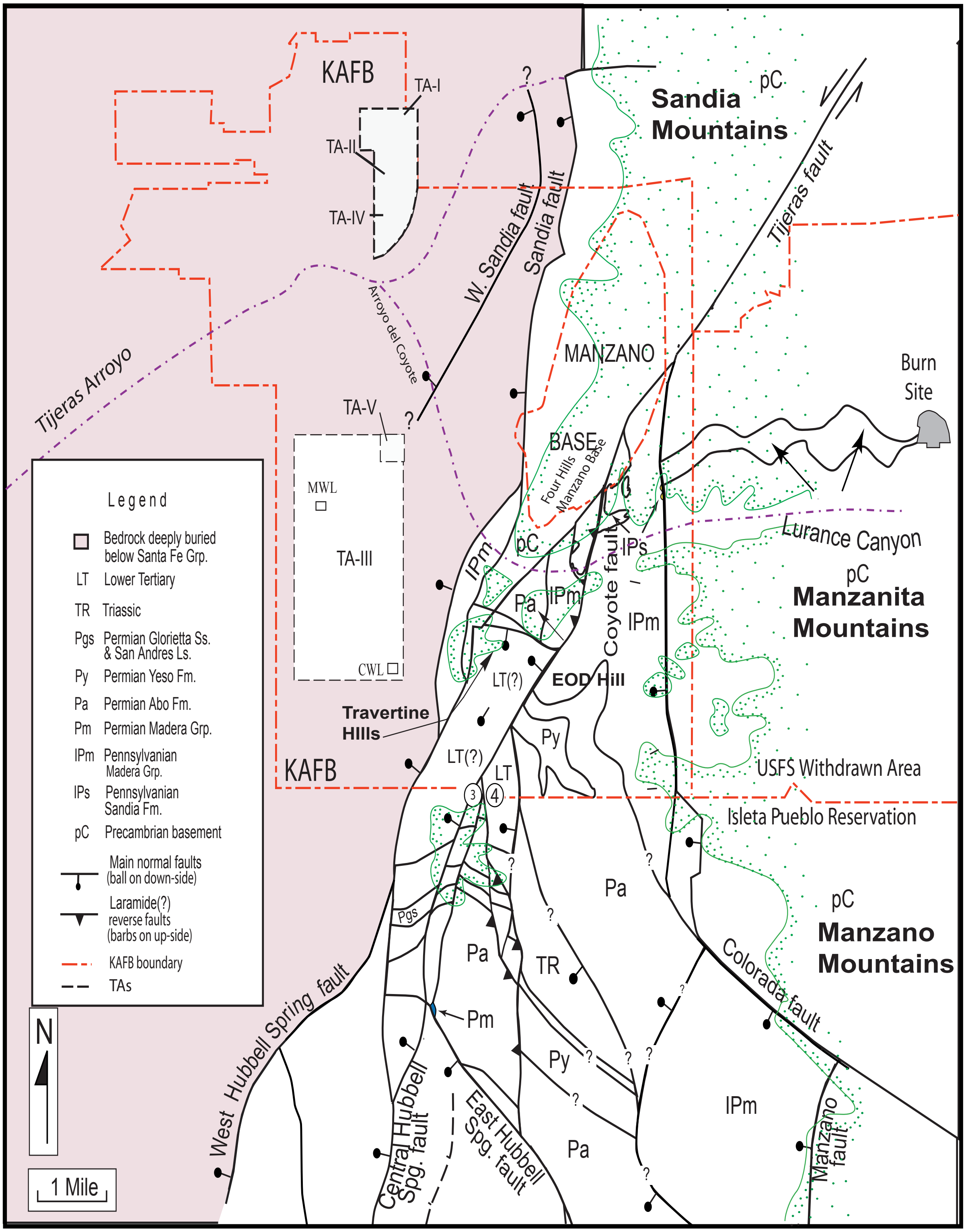

FIGURE 1-3. Generalized Geology in the Vicinity of SNL/KAFB

The groundwater gradient within the PGWS is to the southeast with the depth to water approximately 270 feet below ground level in the western part and 420 feet to groundwater in the east.

Natural Springs

There are two perennial springs located on KAFB: Coyote Springs and Sol Se Mete Spring. Additionally, there is one perennial spring (Hubbell Spring) located immediately south of the KAFB boundary on Isleta Pueblo. Numerous ephemeral springs occur within the foothills and in the eastern reach of Arroyo del Coyote.

Groundwater Production

The primary regional aquifer in the Albuquerque Basin is within the upper unit and, to a lesser degree, the middle unit of the Santa Fe Group. Most COA water supply wells are located on the east side of the Rio Grande, which is the most productive portion of the aquifer. 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 in the area of KAFB was primarily to the southwest. As a result of groundwater withdrawal, the local water table has dropped by as much as 141 feet (Thorn et al. 1993). Groundwater withdrawal from KAFB and COA 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

Large diurnal temperature ranges, summer monsoons, and frequent drying winds are characteristic of the regional climate in the Albuquerque Basin and the Sandia, Manzanito, and Manzano Mountains.

Temperatures are typical of mid-latitude dry continental climates with summer high temperatures in the basin in the 90s° F and winter high temperatures around 50° F. Daily low temperatures range from around 60° F in the summer to the low 20s° F in the winter. The dry continental climate also produces low average humidities in the late spring and summer prior to the onset of the monsoon season. Daytime relative humidities can be between 10 and 20 percent in the spring and early summer, with an average humidity near 30 percent. Average winter relative humidities range near 50 percent.

Precipitation varies across the region with many locations in the higher elevations of the mountains receiving twice the annual rainfall of locations in the Albuquerque Basin. Most precipitation falls between July and October mainly in the form of brief, heavy rain showers. Average annual precipitation, based on 10 years of data collected between 1995 and 2004, is approximately 8.5 inches at SNL/NM, with 10.9 inches in the lower foothills. Annual precipitation recorded at National Weather Service (NWS) cooperative stations in mountain elevations varies between 10 and 23 inches. The winter season in the Albuquerque Basin, and around SNL/NM, is generally dry with an average of less than 1.5 inches of precipitation falling between December and February.

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 an upslope-downslope diurnal pattern to wind flows. Winds tend to blow toward the mountains or up the Rio Grande Valley 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 southwestern U.S. The strongest winds occur in the spring when monthly wind speeds average 10.3 miles per hour. Wind gusts commonly reach 50 miles per hour.

1.7 REGIONAL ECOLOGY

The SNL/NM facilities area is influenced by two major physiographic provinces:

Mesa and Plains – much of central New Mexico, including the middle Rio Grande and much of SNL/NM, is comprised of this physiography. Major landforms are valleys, lowlands, outwash plains, and alluvial fans and terraces. Grama and galleta grasses and four-wing saltbush occur with sand sage at lower elevations, pinon-juniper at higher elevations, and conifers in the scattered mountain ranges. Riparian strips along water courses have cottonwood, willow, and non-native salt cedar.

Southern Rocky Mountains – the Sandia and Manzano Mountains form the southern extension of the Rocky Mountains. The eastern portion of SNL/NM is located in, and bordered by, the Manzano Mountains. Vegetation in these steep, rugged mountains varies greatly on the basis of elevation and aspect. Due to topography, weather, fire, insect outbreaks, and disease, forests in the Southern Rocky

Mountains tend to be patchy. The landscape is a complex mosaic of open meadows and forest stands of varying age and species composition.

These physiographic provinces each have an influence on the typical landforms, flora, and fauna predominant within the SNL/NM area. The topography at KAFB ranges from lowland grasslands to high elevation coniferous forests. With much of the area undeveloped, there is great diversity in plant and animal communities living on KAFB. At least 267 plant species and 195 animal species occur on KAFB (DOE 1999). Table 1-1 lists the most common species of birds, mammals, reptiles, amphibians, and plants that have been identified on-site.

1.7.1 Regional Life Zones Occurring on KAFB

Ponderosa Pine Forest or Transition Life Zone (7,000 – 8,000 feet) A closed canopy of ponderosa pine, piñon-pine, juniper, scrub oak, grassy meadows, streams, marshes, and canyons are typical of this zone. The USFS withdrawn area in the eastern portion of KAFB reaches an elevation of just over 7,900 feet.

Pinon-Juniper Woodland Zone (6,000 – 7,000 feet) A mostly open canopy of piñon-pine and juniper sparsely populate this zone of foothills and mesas. Animals typical of this woodland include the piñon mouse and piñon jay. Much of the rolling terrain in the withdrawn area is comprised of this zone.

Upper Sonoran Life Zone (below 6,000 feet) This short grass prairie zone occurs on alluvial fans, mesas, and gently rolling or sloping plains. Pioneer plants include tumbleweed, goathead, and spurge; intermediate plants include galleta and burro grass, cactus, and mixed weeds; climax vegetation is grama grass. Animals include prairie dogs, burrowing owls, and kangaroo rats. The non-withdrawn area of KAFB land falls within this zone.

TABLE 1-1. Common Plants and Animals Identified at KAFB

BIRDS			
American robin	*Turdus migratorius*	Horned lark	*Eremophila alpestris*
American kestrel	*Falco sparverius*	Killdeer	*Charadrius vociferus*
Black-chinned hummingbird	*Archilochus alexandris*	Loggerhead shrike	*Lanius ludovicianus*
Black-headed grosbeak	*Pheucticus melanocephalus*	Mountain bluebird	*Sialia currucoides*
Broad-tailed hummingbird	*Selasphorus platycercus*	Red-tailed hawk	*Buteo jamaicensis*
Dark-eyed junco	*Junco hyemalis*	Rufous-sided towhee	*Pipiloerythro melanocephalus*
MAMMALS			
Black bear	*Ursus americanus*	Deer mouse	*Peromyscus maniculatus*
Bobcat	*Felis rufus*	Gunnison's prairie dog	*Cynomys gunnisoni*
Banner-tailed kangaroo rat	*Dipodomys spectabilis*	Gray fox	*Urocyon cinereoargenteus*
Black-tailed jackrabbit	*Lepus californicus*	Mule deer	*Odocoileus hemionus*
Desert cottontail	*Sylvilagus audubonii*		
REPTILES AND AMPHIBIANS			
Collared lizard	*Crotaphytus collaris*	Great plains skink	*Eumeces obsoletus*
Chihuahuan spotted whiptail	*Aspidoscelis exsanguis*	Great plains toad	*Bufo cognatus*
Round-tailed horned lizard	*Phrynosoma modestum*	Western diamondback rattlesnake	*Crotalus atrox*
Prairie lizard	*Sceloporus consobrinus*	Side-blotched lizard	*Uta stansburiana*
Gopher snake	*Pituophis catenifer*	Short-horned lizard	*Phrynosoma hernandesi*
PLANTS			
Apache plume	*Fallugia paradoxa*	Goathead	*Tribulus terrestris*
One-seed juniper	*Juniperus monosperma*	India ricegrass	*Achnatherum hymenoides*
New Mexico needlegrass	*Hesperostipa 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	*Dithyrea wislizenii*	Black grama	*Bouteloua eriopoda*

RECENT PHOTOS OF WILDLIFE AT THE CAMERA STATIONS

Black bear mom and her cubs.

Owl drinking water.

Each year the ASER highlights certain programs and environmental activities. This year the 2006 EMS Excellence Awards are spotlighted. The EMS Excellence Awards recognize exemplary advancements made by individuals or teams that contribute to the vision of Sandia's EMS. The vision of the Sandia EMS includes:

- Implementing and maintaining a prevention-based system that goes beyond compliance
- Providing value-added service to line customers
- Continuously improving Sandia's environmental performance
- Gaining customer, stakeholder, and public recognition of Sandia's environmental achievements

The Environmental Management System (EMS)

The EMS Program team promotes environmental awareness at Sandia by recognizing environmental improvements and enhancements throughout the laboratories. One of the most effective and visible ways to accomplish this is through the EMS Excellence Award and Lecture Series. EMS Excellence Awards are given to individuals or teams to recognize exemplary advancements – including excellence in proactive programs, innovation, or process changes – that contribute to the vision of Sandia's EMS.

In 2006, environmental excellence awards were given on a quarterly basis in categories that included water and energy reduction, procedure improvements, risk mitigation, environmental protection, waste minimization, green purchasing, and recycling. For each category, winners were chosen based on a scoring process. The winners received their awards during the EMS Excellence Awards and Lecture Series events that were held quarterly.

This program has resulted in numerous innovative and creative ways to protect the environment, reduce waste, and save water and energy, while lowering environmental risks and saving money. Highlights of the 2006 Environmental Excellence Awards are described below.

HERMES. Staff at the High-Energy Radiation Megavolt Electron Source (HERMES III) Accelerator are at the forefront of waste minimization at Sandia. The HERMES III Accelerator is a gamma ray simulation source that is used to deliver photon bursts that simulate the effects of prompt radiation. One of the most impressive examples of waste minimization at the HERMES III is the Used Dielectric Oil Reuse and Recycling Program. Prior to implementing the program, the HERMES III used 100,000 gallons of dielectric oil per week that was routinely disposed of as hazardous waste during periodic maintenance activities; now, all contaminated oil is reused or recycled. Other initiatives have been implemented, which in total save thousands of dollars each month as well as reduce the amount of hazardous materials produced by the accelerator. These include sulfur hexafluoride (SF_6) optimization, the elimination of hazardous chemicals for parts and equipment cleaning, and the reuse of equipment that includes aluminum cylinders and vacuum system pumps.

Energy Contest. Occupants in several Sandia buildings participated in a contest to reduce the most electrical energy based on the previous years' metered energy rates. Members of each team, called "Energy Monitors," worked with their building occupants, building managers, and maintenance personnel to reduce electrical energy. Based on the results of the data, the Energy Contest resulted in a reduction of electrical use by approximately 443,300 kilowatt hours – the equivalent of reducing approximately 400 tons of carbon dioxide emissions.

Paint Shop Inventory Reduction. The Facilities Paint Shop, in conjunction with the building warehouse storage area, implemented two strategies that resulted in a significant reduction of hazardous paint inventories. By implementing hazardous inventory control measures, the Paint Shop reduced the volume of paint stock by more than 750 gallons in two years. In addition, the Paint Shop imposed stricter controls on the chemical constituents making up their inventory, helping them meet the Green Seal standard for paint. Additionally, through the Facilities Chemical Review Process, the Paint Shop participated in a pilot test of a bio-based paint stripper that is less hazardous than previously used materials.

Hazardous Solvent Replacement. The Plastics Laboratory previously used a mixture of isopropyl alcohol, ethanol, and acetone to clean equipment. Use of these materials, particularly acetone, presented several risks that include employee exposure to hazardous chemicals, hazardous spills, and flammability. An individual award was presented for the concept of substituting a traditional cleaning substance, *white vinegar*, in place of acetone. The vinegar worked perfectly and is not hazardous, not an environmental or exposure hazard, and not flammable. In addition, substitution of vinegar for acetone resulted in an annual cost savings of approximately $1,000.

Roofing Program. The Sandia Roofing Team developed a roofing program that incorporates sustainability concepts for more than 3 million square feet of roofing. Sustainable design concepts that were incorporated into the new specifications included the use of ENERGY STAR roofing materials, requirements for a recycled content of 9 percent and a factor of R-30 for insulation, and use of high reflectivity materials to reduce heat build-up. As a result of these innovations, new roofs at Sandia will last 15 years longer and will reduce maintenance roof tickets by 90 percent, and the peak cooling demand of those buildings by up to 15 percent.

Neutron Tubes. An individual award was presented for a proposed change in the established policy for monitoring MC4300 neutron tubes to guarantee stockpile lifetime estimates. The change eliminates the need to build an additional 150 neutron tubes over the MC4300 production life, saving more than $3 million. Additionally, because neutron tubes contain radioactive tritium, they are considered classified, mixed waste with special–and costly–disposal requirements. Thus, by removing the need for additional tubes, purchase and disposal costs are eliminated.

One winner of the EMS Excellence Award shaking hands with the Vice President of 10000

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chapter two

COMPLIANCE SUMMARY

In This Chapter...

Compliance Status with Federal Regulations
2006 Releases, Compliance Issues, and Environmental Occurrences
2006 Audits and Appraisals
Summary of Reporting Requirements
Summary of Environmental Permits
Environmental Performance Measures

Environmental Snapshot

The 2006 U.S. DOE Performance Evaluation Report indicates that Sandia's overall score is OUTSTANDING.

Sandia Corporation (Sandia) 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 pursue complete compliance with applicable regulations. As a part of these federal, state, and locally mandated regulations, SNL/NM adheres to strict reporting and permitting requirements.

This chapter summarizes Sandia's compliance status with major environmental regulations, statutes, and DOE orders that are applicable to operations conducted at SNL/NM (see page 2-4 and Section 2.1.16). Compliance issues, corrective actions, environmental occurrences, and environmental audits and appraisals are also discussed in this chapter.

Current permits held by Sandia, DOE, the National Nuclear Security Administration (NNSA), and the Sandia Site Office (SSO) are listed in Chapter 9.

Compliance Order on Consent (COoC)

A COoC was agreed to by the New Mexico Environment Department (NMED), DOE, and Sandia in 2004. The COoC provides requirements and establishes schedules and deliverables. The COoC is mandated under the New Mexico Hazardous Waste Act (NMHWA) and the New Mexico Solid Waste Act (NMSWA).

Compliance Agreement (CA)

A CA was signed by the City of Albuquerque (COA) and DOE in 2005 that requires and establishes schedules and deliverables for Steam Plant testing and reporting. The CA is mandated by and through the Environmental Health Department (EHD), which is authorized by the COA, Bernalillo County, and the Albuquerque Bernalillo County Air Quality Control Board (ABC/AQCB).

2.1 COMPLIANCE STATUS WITH FEDERAL REGULATIONS

Most environmental regulations and statutes applicable to Sandia, along with their websites, are discussed on page 2-4. Detailed descriptions follow.

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

The CERCLA, commonly referred to as the "Superfund," provides cleanup funds and/or assessment requirements for inactive waste sites at all federal facilities. A Preliminary Assessment/Site Inspection (PA/SI), as required by CERCLA, was performed at SNL/NM in 1988. This inspection confirmed that Sandia does not own any sites that would qualify for the National Priorities List (NPL), which lists the nation's high priority cleanup or "Superfund" sites. Therefore, with respect to inactive hazardous waste sites, Sandia has no CERCLA reporting requirements. Amendments under the Superfund Amendments and Reauthorization Act (SARA) require additional reporting in the event of a reportable quantity (RQ) release. Sandia was in full compliance with CERCLA/SARA in 2006 as illustrated in Tables 2-1 and 2-7 and Section 2.1.2.

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

The EPCRA, also known as SARA Title III, establishes emergency planning requirements for federal, state, and local governments and industry.

EPCRA ensures that communities have the right to know about and be informed of potential hazards such as the type and location of large quantities of toxic chemicals used and stored by facilities in or near the community. EPCRA specifically mandates that chemical information be made available to local emergency response organizations such as fire departments and hospitals. Any inadvertent release must be reported to appropriate state and local authorities. All subsequent reports must be made accessible to the public. The four major reporting requirements designated by specific sections of EPCRA are shown in Table 2-1.

Information on EPCRA can be found at the following U.S. Environmental Protection Agency (EPA) website:

http://yosemite.epa.gov/oswer/CeppoWeb.nsf/content/epcra_law.htm

TABLE 2-1. 2006 SARA Title III (or EPCRA) Reporting Requirements Applicable to SNL/NM

Section	SARA Title III Section Title	Requires Reporting? Yes	Requires Reporting? No	Description
302 - 303	Emergency Planning	✓		Sandia submits an annual report listing chemical inventories above the reportable Threshold Planning Quantities listed in 40 CFR Part 355 Appendix B, location of the chemicals and emergency contacts. The report is prepared for the DOE/NNSA/SSO, which distributes it to the required entities.
304	Emergency Notification		✓	An RQ release of sodium hydroxide occurred in November 2006 and was reported to the National Response Center and NMED. The release entered a nearby storm drain but did not leave SNL boundaries.
311-312	Hazardous Chemical Storage Reporting Requirements	✓		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 lb and for all extremely hazardous substances present at the facility in an amount greater than or equal to 500 lb 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	✓		SNL/NM was above the reporting thresholds for CY 2006 for submitting a TRI Report for lead. A majority of the lead was from the use of lead-containing solders for laboratory benchmark solders.

NOTES: MSDS = Material Safety Data Sheets (gives relevant chemical information)
RQ = reportable quantity
TRI = Toxic Release Inventory
EPA = U.S. Environmental Protection Agency
SSO = Sandia Site Office
SARA = Superfund Amendments and Reauthorization Act
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
EPCRA = Emergency Planning and Community Right-to-Know Act
DOE = U.S. Department of Energy
NNSA = National Nuclear Security Administration
SNL/NM = Sandia National Laboratories, New Mexico
CFR = Code of Federal Regulations
NMED = New Mexico Environment Department

Toxic Release Inventory (TRI) Reporting

EPCRA regulations 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. The threshold value for listed chemicals requiring a TRI report is 10,000 pounds per year (lb/yr), unless otherwise specified.

Each year, nearly 23,000 facilities report to the EPA under the TRI Program. The proposed TRI Reporting Forms Modification Rule (1674 Federal Register/Vol. 70, No. 6/ Monday, January 10, 2005) sought comment on eliminating certain information from the reports, simplifying other reporting data, and, in some cases, reducing duplicate data collection efforts. The options being proposed reduce the cost of compiling and submitting TRI reports, while maintaining the quality and practical utility of the TRI data. This rule became effective on September 12, 2005. The first reports with the revised reporting requirements have been incorporated into the 2006 submissions.

In 2006, chemical use at SNL/NM was above the reporting threshold for submitting a TRI report for lead, and Sandia continues to document its toxic chemical use in the Chemical Inventory Report Calendar Year (CY) 2006 (SNL/Outrider Corporation 2007), which documents all purchases of chemicals at SNL/NM, Tonopah Test Range (TTR), and Kauai Test Facility (KTF) for CY 2006. This chemical inventory supports compliance with SARA Title III, as well as reporting for COA inventory requirements.

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. *http://www.eh.doe.gov/oepa/laws/aea.html*

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

Clean Water Act (CWA)
Provides general water quality standards to protect the nation's water sources and byways. *http://www.epa.gov/region5/water/cwa.htm*

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
Provides federal funding for cleanup of inactive waste sites on the National Priorities List (NPL) and mandates requirements for reportable releases of hazardous substances. *http://www.epa.gov/region5/defs/html/cercla.htm*

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

Endangered Species Act (ESA)
Provides special protection status for federally listed endangered or threatened species. *http://www.epa.gov/region5/defs/html/esa.htm*

Executive Orders (EOs)
Several EOs provide specific protection for wetlands, floodplains, environmental justice in minority and low-income populations, and encourages greening the government through leadership in EM. *http://www.archives.gov/federal-register/executive-orders/disposition.html*

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

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)
Controls the distribution and use of various pesticides. *http://www.epa.gov/region5/defs/html/fifra.htm*

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

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

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

Resource Conservation and Recovery Act (RCRA)
Mandates the management of solid and hazardous waste and certain materials stored in underground storage tanks (USTs). *http://www.epa.gov/region5/defs/html/rcra.htm*

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

Superfund Amendments and Reauthorization Act (SARA)
SARA,Title III, also known as the Emergency Planning and Community-Right-to-Know Act (EPCRA), mandates comunication standards for hazardous materials over a threshold amount that are stored or used in a community. *http://www.epa.gov/region5/defs/html/sara.htm*

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

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 NMHWA, and with delegated authority from the EPA under RCRA, the NMED administers hazardous and solid waste regulatory programs in New Mexico. Hazardous and solid waste management activities at SNL/NM are conducted under NMED regulations. Some additional RCRA requirements and EPA regulations also apply. Applicable regulations are listed in Chapter 9.

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

Sandia generates hazardous waste and MW through normal operations and through its ongoing environmental restoration (ER) project, which is responsible for the cleanup of sites that were formerly used for operations such as testing and disposal. Sandia currently implements an active and successful program to minimize hazardous waste and MW through product substitutions, process changes, material re-use, and recycling. See Chapter 3, Section 3.3 for more details. (Chapter 3 summarizes Sandia's hazardous waste management activities during 2006.)

Permits – On February 6, 2002, Sandia and DOE submitted a comprehensive RCRA Part B (final) permit request for operating nine units used for hazardous and MW management. The permit request included renewal of the existing permits for the Hazardous Waste Management Facility (HWMF) and the Thermal Treatment Facility (TTF); updated applications for operating permits for the Radioactive and Mixed Waste Management Facility (RMWMF), the High Bay Waste Storage Facility (HBWSF), and seven Manzano Storage Bunkers (MSB); a new application for operation of the Auxiliary Hot Cell Facility (AHCF); and requests for the renewal of existing permits and authorizations for the Corrective Action Management Unit (CAMU) and associated treatment operations. Sandia and DOE operate under existing permits during the permit renewal process. Since the initial submittal, Sandia and DOE have revised the permit request several times in response to NMED comments, NMED requests for additional information, and changes in waste management operations. Sandia and DOE withdrew the permit applications for the HBWSF and two MSBs because these units will not be needed for future hazardous waste and MW management. Sandia and DOE requested significant modifications to the permit for the CAMU to reflect the completion of treatment activities, the placement of all soils in the containment cell, and the construction of the cover on the cell during 2003. The most recent revision was submitted on October 25, 2005. Active permits are listed in Chapter 9.

During 2006, Sandia and DOE also requested minor modifications to the existing permits for the HWMF to reflect changes in personnel and operations. NMED reviewed and approved the changes and also approved minor modifications to existing permits for the HWMF and TTF that were requested by Sandia and DOE in 2005.

Closures

During 2006, Sandia continued closure and post-closure care activities for hazardous waste management units that are no longer in use, as follows:

Chemical Waste Landfill (CWL) - The CWL was used for hazardous waste disposal under interim status until 1985. Sandia and DOE continued closure activities during 2006. Details are included in Chapter 3, Page 3-5.

CAMU – Sandia and DOE are currently conducting post-closure care. Details are included in Chapter 3, Page 3-6.

HBWSF – Sandia no longer needs the waste storage capacity provided by the HBWSF. In 2006, Sandia completed closure activities under the NMED approved closure plan and submitted a report to NMED, which subsequently approved closure in July 2006.

MSB – Sandia no longer needs the waste storage capacity provided by two of the seven MSBs. These units were not used for storage of hazardous waste or MW under interim status. After Sandia and DOE submitted a letter to NMED stating that the units were not used, NMED approved closure of the bunkers in October 2006.

2.1.4 Federal Facility Compliance Act (FFCA)

The FFCA requires federal facilities to comply with all federal, state, and local requirements for hazardous and solid waste. On October 4, 1995, NMED, DOE, and Sandia entered into a Federal Facility Compliance Order (FFCO) for management of MW at SNL/NM. A general Site Treatment Plan (STP) and a schedule for processing the waste were developed.

In 2006, Sandia continued to characterize and treat MW and to package wastes for shipment to permitted off-site treatment, storage, and disposal (TSD) facilities. Sandia met all of the milestones outlined in the STP.

2.1.5 Atomic Energy Act (AEA)

In 1946, the AEA was enacted 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 control of nuclear energy and nuclear materials primarily to DOE, the U.S. Nuclear Regulatory Commission (NRC), and the EPA. Federal regulations control radioactive emissions and the transportion of nuclear materials. The authority for controlling radioactive waste is retained by DOE and governed by DOE orders.

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 nation's air quality. The EPA is responsible for describing and regulating air pollutants from stationary and mobile sources and for setting ambient air quality standards. The COA has direct delegation from EPA Region VI to locally administer these standards as well as specific air emission permits and registrations, as shown in Chapter 9, Table 9-1.

The CAA requires the EPA to develop a list of air pollutants from all sources that could harm public health or the environment. The EPA identified six substances as "criteria pollutants" and subsequently developed National Ambient Air Quality Standards (NAAQS) for these pollutants.

The EPA program for the attainment and maintenance of NAAQS requires local agencies to develop a comprehensive permitting program. The Air Quality Control Board (AQCB) has developed a set of regulations governing mobile and stationary sources of air pollution.

In addition to the regulations for criteria pollutants, the EPA's National Emission Standards for Hazardous Air Pollutants (NESHAP) program prescribes emission limitations for hazardous air pollutants (HAPs).

Radiological NESHAP

Subpart H of 40 Code of Federal Regulations (CFR) 61 specifically regulates radionuclide emissions (other than radon) from DOE facilities. As required by the regulation, Sandia calculates an annual dose from actual or calculated emissions to potentially exposed members of the public. The regulation requires that Sandia 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 2006, the MEI was located at the Kirtland Storage Site. The dose at this location was 0.0016 mrem/yr; the result, primarily, of releases of argon-41 from the Annular Core Research Reactor (ACRR) and the Sandia Pulsed Reactor in Technical Area (TA) V. The off-site MEI was located at the Eubank Gate Area. The dose at this location was 0.00079 mrem/yr; the result, primarily, of releases of tritium from the Neutron Generator Facility (NGF) in TA-I. Both doses are well below EPA standards. For perspective, the annual radiation dose from natural background radiation is approximately 360 mrem/yr. Sandia met all NESHAP compliance requirements in 2006.

Fugitive Dust Permitting

The COA enforces 20.11.20 New Mexico Administrative Code (NMAC) to ensure that all persons conducting active operations that result in disturbed surface areas, or that involve bulk material handling, use reasonably available control measures (or other effective measures) on an ongoing basis to prevent or abate injury to human health, animal and plant life, and to prevent or abate unreasonable interference with public welfare, visibility, and the reasonable use of property.

National Emissions Inventory (NEI)
As required by the Consolidated Emission Reporting Rule (CERR), 67 Federal Register (FR) 3960, the emission inventory requests annual emissions of volatile organic compounds (VOCs), nitrogen oxides (NO_X), carbon monoxide (CO), sulfur dioxide (SO_2), lead (Pb), ammonia (NH_3), particulate matter with a diameter of equal to or less than 10 microns (PM_{10}), particulate matter with a diameter of equal to or less than 2.5 microns ($PM_{2.5}$), and HAPs.

New Source Review (NSR) Requirements
The NSR permitting program was established as part of the 1977 CAAA.

NSR requirements provide assurance to the public that any large, new, or modified industrial source in their neighborhood will be as clean as possible and that advances in pollution control occur concurrently with industrial expansion.

New Source Performance Standard (NSPS) Requirements
As part of an effort to control pollution in the U.S., the EPA provides NSPS requirements that dictate the level of pollution that a new stationary source may produce. These standards are authorized by Section 111 of the CAA, and the regulations are published in 40 CFR Part 60. An NSPS has been established for a number of individual industrial or source categories, including boilers and generators.

Open Burn Permitting
The COA enforces 20.11.21 NMAC to ensure that all persons conduct open burning in a manner that prevents or abates emissions that are visible and that produce noxious by-products of combustion.

Ozone Depleting Substances (ODS) Requirements
Based on the requirements of the CAA, the EPA has established regulations that affect many aspects of the refrigeration industry.

Title V Operating Permit
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 tons per year (tpy) or greater of any criteria pollutant,
- 10 tpy of any HAP, or
- 25 tpy of any combination of HAPs.

2.1.7 Clean Water Act (CWA)

The CWA establishes guidelines to protect the "Waters of the U.S." by regulating 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 COA administers regulations for sanitary sewer discharges based on federal pretreatment standards, (2) the EPA and the NMED administer regulations concerning oil storage and surface discharges, and (3) the EPA administers regulatory authority over storm water discharges and mandates requirements for oil storage and secondary containment.

New Mexico Stream Standards
By 2008, the State of New Mexico intends to obtain the authority to regulate discharges under the National Pollutant Discharge Elimination System (NPDES). Until then, EPA Region VI remains the permitting agency. New Mexico has enacted 20.6.4 NMAC *Standards for Interstate and Intrastate Surface Waters* to protect the quality of surface waters in the state. Due to hydrologic conditions at SNL/NM, Sandia does not specifically monitor for compliance with these standards. SNL/NM does compare analytical results from NPDES sampling with the 20.6.4 NMAC. Some contaminants of concern (COC) in New Mexico's standards not on the NPDES analyte list have been added to confirm compliance.

COA Sewer Discharge Regulations
There are five wastewater monitoring stations, or outfalls, operating under the COA permit at SNL/NM. Four of these stations discharge directly to the COA's public sewer; one is a categorical pretreatment station located upstream of the general outfalls. During 2006, there were two self-reported events that exceeded permitted limits established by the COA. No fines or penalties were issued by the COA for these 2006 events, however, one of the events (a pH exceedence) resulted in two COA violations. These reportable releases are documented in Section 6.1.6.

Surface Discharge

Surface discharges made to the ground or to containment areas must be evaluated for compliance with regulations implemented through the New Mexico Water Quality Control Commission (NMWQCC) standards. Sandia issued 29 one-time internal surface discharge permits in 2006. Additionally, two evaporation lagoons in TA-IV are permitted by NMED. The TA-IV lagoons are used to contain and evaporate accumulated storm water pumped from the secondary containment areas around seven oil tanks that support the pulsed power accelerators. All permit conditions for the TA-IV lagoons permitted sites (DP-530) were met in 2006. In 2006, there were seven reportable surface releases that met NMED reporting standards that were reviewed by the Surface Discharge Program. These reportable releases are documented in Section 6.2.2.

NPDES

NPDES implements the requirements that are specific to all discharges made to "Waters of the U.S." as defined in the CWA and "Surface Waters of the State" as defined in New Mexico's *Standards for Interstate and Intrastate Surface Waters* (20.6.4 NMAC). At SNL/NM, all point sources discharge to either state or federal waters and are evaluated for compliance with their respective regulations.

Historically, collecting visual and analytical samples at SNL/NM has been a challenge due to Albuquerque's climatic conditions. Analytical sampling was not required in Fiscal Year (FY) 2006, but visual assessments are conducted every quarter, sufficient runoff permitting (Section 6.3.4).

2.1.8 Safe Drinking Water Act (SDWA)

The SDWA authorizes EPA to set national standards for drinking water sources, treatment systems, and water distribution. These standards are promulgated by the EPA as primary and secondary drinking water regulations. Specific water quality criteria are established to protect human health by limiting the maximum allowable concentration (MAC) of specific organic and inorganic chemical substances and biological organisms in potable water.

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 routinely samples its water and conducts analyses to establish that its water quality conforms to EPA standards. In support of KAFB compliance with NMED Drinking Water Standards, DOE/NNSA/SSO and Sandia provide KAFB with an annual certification that all backflow preventers installed in the Sandia potable water distribution system have been properly tested and maintained.

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

http://www.epa.gov/safewater

Specific water quality data and system performance are published by KAFB in the Annual Consumer Confidence Report on the Quality of Drinking Water.

2.1.9 Toxic Substances Control Act (TSCA)

TSCA provides regulations regarding 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 was in full compliance with TSCA in 2006. Details related to TSCA are in Chapter 3 (Section 3.2.1).

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

FIFRA regulates pesticide use and is enforced under the New Mexico Pesticide Control Act. Sandia's Biological Control Activity compiles information on pesticide use at SNL/NM, as discussed in Section 3.5. Sandia was in full compliance with FIFRA in 2006.

2.1.11 National Environmental Policy Act (NEPA)

NEPA requires federal agencies (and other organizations that perform federally sponsored projects) to consider environmental issues associated with proposed actions, be aware of the potential environmental impacts associated with these issues, and include this information in early project planning and decision making. Additionally, if a proposed action is not within a class of actions previously determined to have environmentally "insignificant" impacts, the agency must prepare an environmental assessment (EA) or an environmental impact statement (EIS) before making an irretrievable commitment of resources or funding. Although a major objective of NEPA is to preserve the environment for future generations, the law does not require an agency to choose a course of action with the least environmental impact. Details are provided in Section 3.6.

2.1.12 Endangered Species Act (ESA)

The ESA ensures that any action authorized, funded, or carried out by a party will not jeopardize the continued existence of a "threatened or endangered species" or result in adverse modifications to its habitat. At SNL/NM, ESA compliance is coordinated with NEPA compliance reviews and the Ecology Program. Table 2-2 lists the threatened and endangered species potentially occurring in Bernalillo County.

2.1.13 Migratory Bird Treaty Act (MBTA)

The MBTA of 1918 implemented the 1916 Convention for the Protection of Migratory Birds. The original statute implemented the agreement between the U.S. and Great Britain (for Canada), and later amendments implemented treaties between the U.S. and Mexico, the U.S. and Japan, and the U.S. and Russia. The MBTA prevents the taking, possession, killing, transportation, or importation of migratory birds, their eggs, parts, or nests. At SNL/NM, the MBTA is coordinated with NEPA compliance reviews and the Ecology Program.

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 defined by NHPA, and other implementing regulations, include archaeological sites and historic buildings and structures. Historic

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

Species		Federal Status	State Status	Observed at KAFB
MAMMALS				
Spotted Bat	*Euderma maculatum*	--	Threatened	
New Mexican Jumping Mouse	*Zapus hudsonius luteus*	--	Threatened	
FISH				
Rio Grande Silvery Minnow	*Hybognathus amarus*	Endangered	Endangered	
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	
Yellow-billed Cuckoo	*Coccyzus Americanus*	Candidate	--	

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

buildings and structures may include those over 50 years of age that are historically significant or younger structures of exceptional significance.

There are no known archaeological sites located on DOE/NNSA owned property, however, cultural and historic sites do exist on and in close proximity to DOE/NNSA permitted property and ER sites. These areas are located on U.S. Air Force (USAF) property and on portions of the Cibola National Forest land withdrawn area. Sandia's activities are planned to avoid potential impacts to these sites. It is DOE/NNSA's responsibility to ensure that impacts to cultural resources are assessed and appropriate actions taken to mitigate impacts to them.

Historical Building Assessment
In 2006, with regard to SNL/NM, DOE/NNSA/SSO completed consultation with the New Mexico State Historic Preservation Office (SHPO) on 15 individual buildings. Of these, only one building was found to be eligible for the National Register of Historic Places. A report documenting the site is underway. Consultation was also completed on buildings affected by SNL/NM's proposed Heating Systems Modernization (HSM) project. Of the 48 buildings included in HSM, eight were found eligible for the National Register. In addition, documentation continued on the environmental test facilities included in the Test Capabilities Revitalization Project. Previously, one building and four districts were found eligible for the National Register of Historic Places.

2.1.15 Environmental Compliance Executive Orders (EOs)

EOs related to environmental compliance include:

Floodplain Management (EO 11988), as amended, 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, mud flats, and areas around natural springs. There are several natural springs on KAFB with a limited wetland setting. These springs, located on lands withdrawn from Cibola National Forest, are managed by the USAF and the U.S. Forest Service (USFS). These 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, 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. DOE/NNSA/SSO and SNL/NM perform a periodic analysis to assess whether their existing or proposed operations cause any disproportionate impacts on minority or low-income populations within the area of influence of SNL/NM operations.

Greening the Government Through Waste Prevention, Recycling, and Federal Acquisition (EO 13101) requires all federal agencies to incorporate waste prevention and recycling into daily activities and to participate in affirmative procurement. Waste minimization and pollution prevention (P2) activities at SNL/NM are discussed in Section 3.4.

Greening the Government Through Efficient Energy Management (EO 13123) calls for improvements in energy management including the promotion of energy efficiency, water conservation, the use of renewable energy products, and fostering markets for emerging technologies.

Greening the Government Through Leadership in Environmental Management (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 are the development and implementation of environmental management systems (EMS) 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 is currently working under DOE Order 450.1 to meet the requirements of this EO (DOE 2005).

Greening the Government Through Federal Fleet and Transportation Efficiency (EO 13149) encourages the reduction of petroleum consumption through improvements in fleet fuel efficiency and the use of alternative fuel vehicles (AFVs) and fuels. Sandia utilizes vehicles that use bio-based fuels and natural gas, and electric carts, as well.

EOs 13101, 13123, 13148, and 13149 were revoked by EO 13423 in January 2007; however, they are listed here as they were in force during 2006. EO 13423 combines the EOs it replaces into an omnibus EO that instructs federal agencies to conduct their missions "in an environmentally, economically and fiscally sound, integrated, continuously improving, efficient, and sustainable manner." (EO 13423)

2.1.16 DOE Directives

DOE directives on the contract baseline that pertain to environmental protection and management are discussed in Chapter 1, "Operations Contract." In 2006, Sandia met all requirements stated in these DOE directives.

2.1.17 Summary of Radiological Releases

A summary of radiological releases and public doses resulting from Sandia operations is provided in Table 2-3. More detailed information is found in Chapters 5 and 6 of this report.

TABLE 2-3. SNL/NM Radiological Dose Reporting for Calendar Year 2006

Pathway	Dose to MEI		Percent 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	1.6E-3	1.6E-5	0.001 percent	8.4E-2	8.4E-4	793,740	-	-
Water	0	0	0	0	0	0	-	-
Other Pathways	0	0	0	0	0	0	-	-
All Pathways	1.6E-3	1.6E-5	0.001 percent	8.4E-2	8.4E-4	793,740	2.9E5	2.9E3

Radiological Atmospheric Releases for 2006 (in Curies)

Tritium	Kr^{85}	Noble Gases ($t_{1/2}$ <40 days)	Fission and Activation Products ($t_{1/2}$ <3 hr)	Fission and Activation Products ($t_{1/2}$ >3 hr)	Total Radio-iodine	Total Radio-strontium	Total U	Pu	Other Actinides	Other
32.0	0	7.01	9.8E-4	1.2E-7	0	8.6E-8	0	0	1.1E-5	0

Liquid Effluent Releases of Radioactive Material for 2006

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

NOTES: mrem = millirem
mSv = millisievert
DOE = U.S. Department of Energy
km = kilometer
U = Uranium
Pu = Plutonium
MEI = maximally exposed individual

2.2 2006 RELEASES, COMPLIANCE ISSUES, AND ENVIRONMENTAL OCCURRENCES

Under DOE Manual 231.1-2, an occurrence is defined as one or more (i.e., recurring) events or conditions that adversely affect, or may adversely affect, DOE (including NNSA) or contractor personnel, the public, property, the environment, or the DOE mission. Events or conditions meeting criteria thresholds identified in DOE M 231.1-2, or determined to be recurring through performance analysis, are considered occurrences. There are environmental releases that may not meet DOE M 231.1-2 reporting thresholds, however, they are still reportable to outside agencies (see Sections 2.2.2 and 6.2.2).

2.2.1 Occurrence Tracking

DOE Occurrence Reporting (OR) is tracked by the Environment, Safety, and Health (ES&H) Assurance, Planning, and Behavior-Based Safety Department. All SNL/NM occurrences are entered into DOE's Occurrence Reporting Processing System (ORPS) database, which also tracks corrective actions and closure of occurrence reports.

For all categories, during 2006 there were 92 occurrences: 12 were environmentally related at SNL/NM, one of which was a recurrance.

DOE Manual 231.1-2 2006 Environmental Occurrences

Table 2-4 lists the DOE Manual 231.1-2 environmental and environmentally related occurrences for the five year period spanning 2002 to 2006. This table shows all occurrences for which the "nature of occurrence" (pre-August 25, 2003) and "reporting criteria" (post-August 25, 2003) included "environmental." In 2006, there were 12 reportable environmental occurrences. One occurrence was categorized as Significance Category 2, seven occurrences were categorized as Significance Category 3, three were categorized as Significance Category 4 (the lowest level occurrence), and one was catagorized as a recurrance.

Table 2-5 summarizes each DOE Manual 231.1-2 2006 Reportable Environmental Occurrence.

NA--SS-SNL-10000-2006-0008 - Recurring: Notice of Violation (NOV).

During a review, laboratory personnel identified a negative trend for the time period of October 2005 through May 2006 with respect to air quality permit non-compliance. The reporting criteria for this recurring NOV was Group 9 Non-compliance Notifications. Note: This report is not included in Table 2-4 since that would be redundant.

2.2.2 Environmental Release Tracking

Environmental releases include both those not tracked through ORPS and notifications to outside agencies.

2006 Environmental Releases

In 2006, there were seven environmental releases reportable to the NMED and two to the COA. Detailed information regarding these releases can be found in Sections 6.1.6 and 6.2.2.

2.3 2006 AUDITS AND APPRAISALS

Operations at SNL/NM and DOE/SSO are routinely subjected to audits by external regulatory agencies. Sandia also conducts its own self-assessments and appraisals. Environmental audits and appraisals conducted by external agencies in 2006 are listed in Table 2-6.

2.4 SUMMARY OF REPORTING REQUIREMENTS

External reporting requirements (other than to DOE) are necessary for both routine and non-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 2-7 summarizes the primary reporting requirements for releases applicable to SNL/NM.

2.5 SUMMARY OF ENVIRONMENTAL PERMITS

Table 9-1 in Chapter 9 lists all environmental permits and registrations that were in effect in 2006. It includes pending permit applications under review by various agencies.

2.6 ENVIRONMENTAL PERFORMANCE MEASURES

Environmental performance at SNL/NM is tracked through performance measures and indicators. It is reported through management reports and annual summaries such as this report.

SNL/NM executive management has established the following high-level corporate ES&H objectives:

- Zero job-related injuries and illnesses,
- Zero environmental incidents, and
- Zero operations fines, violations, or penalties.

In support of these objectives, seven key ES&H measures have been adopted that have specific numerical expectations for each. The four of these that regard environmental performance measures are listed in Table 2-8.

Environmental performance is also assessed through performance measures in the Performance Evaluation Plan (PEP) agreement between DOE/NNSA/SSO and Sandia. On the basis of the PEP, DOE/NNSA/SSO prepares an annual Performance Evaluation Report (PER) that assesses SNL/NM's performance for the FY. For FY 2006, the overall score for Sandia was outstanding.

Fox in a tree outside the Solar Towers.

TABLE 2-4. Environmentally-related Occurrences for Five Years (2002-2006)

Nature of Occurrence or Reporting Criteria					
	2002	**2003**	**2004**	**2005**	**2006**
Group 2 - Personnel Safety and Health					
Environmental - Radionuclide Releases - 2A Note: This is a pre-August 2003 Nature of Occurence	1				
Personal exposure to chemical, biological, or physical hazards above limits - 2A(5) (Post-August 2003 Reporting Criteria)					4
Environmental - Release of Hazardous Substance/Regulated Pollutants/Oil - 2B (NOTE - this is a pre-August 2003 Nature of Occurrence)	4				
Group 5 - Environmental					
Environmental releases above permitted levels and exceeds report quantities specified in 40 CFR 302 or 40 CFR 355 - 5A(1)		1			1
Any discharge that exceeds 100 gallons in any form - 5A(2)				1	
Release of Hazardous Substance, Material or Waste above permitted levels and exceeds percent of report quantities specified in 40 CFR 302 or 40 CFR 355 - 5A(3)					
Release of Hazardous Substance, Material, or Waste that must be reported to outside agencies in a format other then routine periodic reports (oil spills <10 gal need not be reported) - 5A(4)			4	2	1
Group 7 (Pre-August 2003 Nature of Occurrence - does not exist in post-2003 Reporting Criteria)					
Value Basis Reporting - Cost Based Occurrences - 7A	2				
Group 9[1] - Noncompliance Notifications					
Any enforcement action (other than associated with the Price Anderson Amendment Act) involving ten or more cited violations, and/or an assessed fine of $10,000 or more - 9(1)					3
Any written notification from an outside regulatory agency that a site/facility is considered to be in noncompliance with a schedule or requirement - 9(2)	6	2	1	1	1
Group 10 - Management Concerns					
Any event, condition, or series of events that does not meet any of the other reporting criteria, but is determined by the Facility Manager or line management to be of safety significance or of concern to other facilities or activities in the DOE complex - 10(2)			3	1	1
A near miss, where no barrier or only one barrier prevented an event from having a reportable consequence - 10(3)					1
An event that results in a significance concern by affected state, tribal, or local officials, press, or general population; that could damage the credibility of the Department or that may result in inquiries to Headquarters - 10(4)				1	

TABLE 2-5. DOE Manual 231.1-2 2006 Reportable Environmental Occurrence

Date	Occurrence Significance Category	Reporting Criteria	Description
January	3	2A(5)	The analytical results of a worker's air sampler were received indicating an employee, who previously performed welding activities in a permit-required confined space at TA-IV, Building 983, was exposed to manganese fumes which exceeded the occupational limit. Local exhaust ventilation had been used, however, the worker was not wearing a respirator. The worker was notified and welding operations in Building 983 confined spaces were suspended.
February	3	2A(5)	Breathing zone air monitoring results for the Tech Area III, Building 6710 Welding Shop, taken in late January 2006, indicated that the Occupational Exposure Limit for ozone was exceeded during one of six air monitoring events. Management directed that future plasma cutting operations take place outside of the building.
March	4	5A(4)	Approximately 3,500 gallons of water leaked from an underground tank, near Building 6588, that collects water from various areas within Tech Area V. The water, based on information provided in the spill reports to NMED, exceeded ground water standards for cadmium. Mitigative actions were taken and appropriate notifications made to NMED officials.
April	3	10(3)	After employees noticed an unusual natural gas odor during lunch in the Sandia National Laboratory cafeteria, Building 861, a hand-held carbon monoxide (CO) monitor was utilized and indicated elevated levels of CO around the eating/cashier areas, ranging from 36-83 parts per million (ppm), as compared to the threshold limit value of 25 ppm and the OSHA permissible exposure limit of 50 ppm. Readings of up to 1,000 ppm were obtained directly above the natural gas grill/fryer equipment. The grill/fryer were removed from service and the natural gas source was locked out. Appropriate repair actions were initiated, and following completion of the work, subsequent CO air monitoring results were zero.
May	4	9(2)	Due to a valve failure of the Acid Waste Neutralization System in Building 858N, approximately 270 gallons of sodium hydroxide (a caustic material with a pH above 11.5) spilled into a containment area, and approximately 50 gallons overflowed and was released to the COA sanitary sewer. The remaining 220 gallons were recovered and will be re-used. The leaking valve was isolated and an administrative lock installed. The COA was notified of the spill within 24 hours, as required. This release resulted in 2 COA violations for basin G and I.
May	3	9(1)	The COA notified Sandia National Laboratories via facsimile with a Notice of Violation (NOV) with a $20,000 penalty regarding the Central Utility Building 858J. The NOV is an apparent follow-on to a Post Inspection Notification (PIN) issued by the City on March 21, 2005, based on an inspection that same day. The NOV was based on the failure to properly apply for an Authority-to-Construct Permit prior to construction of boilers requiring New Source Performance Standards (NSPS). The issue had been self-identified by the Laboratory.
June	Recurrance[1]	9(1)	During a review, laboratory personnel identified a negative trend for the time period October 2005 through May 2006 with respect to air quality permit noncompliances.

TABLE 2-5. DOE Manual 231.1-2 2006 Reportable Environmental Occurrence (continued)

Date	Occurrence Significance Category	Reporting Criteria	Description
June	3	2A(5)	Preliminary results of crystalline silica dust samples that were collected from April 26 to May 2, 2006, during the demolition of Building 806 in Tech Area I, indicated that the American Conference of Governmental Industrial Hygienists occupational threshold limit of 0.025 milligram/cubic meter was exceeded for two contract employees. Despite the one-time exceedance of the limit for the two employees, no medical significance is expected from these exposures. A "stop work" order was issued to the contractor for all dust-producing activities. Work will restart following Laboratory approval of a corrective action plan from the contractor that includes additional work controls to prevent a recurrence.
August	4	10(2)	After the Laboratory shipped four waste containers of a sulfuric acid solution to an off-site vendor, the vendor's routine incoming screening procedures unexpectedly identified the presence of mercury in all of the containers, and one of the containers had mercury levels exceeding the regulatory limit. The vendor will treat the waste using a different treatment process than originally specified. There were no personal injuries or environmental impacts resulting from this discovery. An investigation was initiated.
October	3	2A(5)	Four personnel air monitoring samples were taken during stainless-steel welding operations at the Z Tank Upgrade Project, and one sample result exceeded the American Conference of Governmental Industrial Hygienists threshold limit value (TLV) for hexavalent chromium (CrVI). During a subsequent meeting, several concerns were expressed regarding sampling methods, TLVs, and sampling results. All stainless-steel welding operations were suspended until sampling issues can be appropriately resolved.
November	2	5A(1)	While attempting to off-load a 300-gallon chemical tote from a vendor's truck using a forklift, the tote fell to the ground breeching the container. Approximately 60 gallons of the 45% sodium hydroxide solution was recovered, and the remaining solution flowed toward a nearby storm drain. The area around the truck and the tote was cordoned off, and spill pillows were installed around storm drains to minimize flow into the sewer. Due to the exceedance of reportable quantity, National Response Center and the State of New Mexico Environment Department officials were notified.
November	3	9(1)	The site received a Notice of Violation with a proposed civil penalty totaling $41,150 from the New Mexico Environment Department for five alleged violations identified during no-notice audits conducted in May 2005 and November 2005. The violations included open containers, waste at or near the point of generation, failure to label hazardous waste, and failure to obtain a permit for waste stored longer than 90 days.

NOTE: [1] The June occurance listed in the table is a recurrance and signifies a trend, not an actual event.

TABLE 2-6. Environmental Program Audits and Appraisals Conducted In 2006

Appraising Agency	Title	Date	Summary
External Audits and Appraisals			
LMC	DOE Corrective Action Verification & ES&H Management Systems Audit	March 2006	Final report issued: 6 Issues
Internal Audits and Appraisals			
DOE/SSO	ISMS/ISMS Programs	May - June 2006	Completed: 2 Findings, 1 Observation
Sandia 12870	Environmental Protection/Air Quality "Air Quality Program Assessment Report	March 2006	Final report issued: 3 Issues 6 Observations 2 Strengths
Sandia 12870	Radioactive & Mixed Waste/ Nuclear Facilities "SNL Nuclear Criticality Safety Program"	May 2006	Final report issued: 7 Issues 3 Observations 4 Strengths
Sandia 12870	Waste Management/Waste Management Program "Waste Mangement" Self-Assessment Report 2	July 2006	Final report issued: 4 Issues 7 Observations
Sandia 12870	ISMS/ISMS "Integrated Safety Management System at SNL"	August 2006	Final report issued: 7 Issues 2 Strengths

NOTES: ISMS = Integrated Safety Management System
NMED = New Mexico Environment Department
NOV = Notice of Violation
RCRA = Resource Conservation and Recovery Act
COA = City of Albuquerque
ES&H = Environment, Safety & Health
SNL = Sandia National Laboratories
DOE OA = Department of Energy, Office of Independent Oversight and Performance Assurance
SSO = Sandia Site Office
LMC = Lockheed Martin Corporation

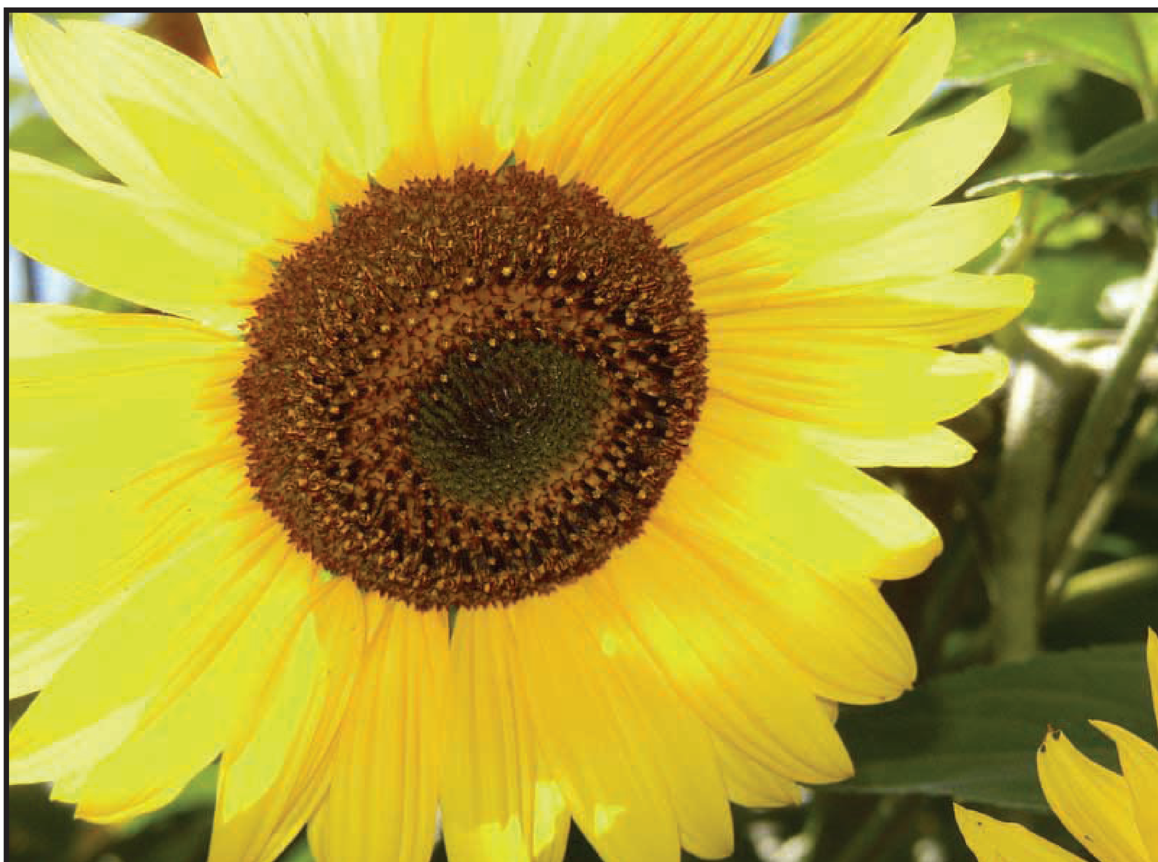
TABLE 2-7. Summary of Sandia Reporting Requirements to Outside Agencies (Other than DOE) for Releases of Pollutants or Hazardous Substances

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 to the NRC. CERCLA and EPCRA are discussed in Section 2.1.1 and 2.1.2 of this report. As discussed in Section 2.1.2, there was one reportable releases at SNL/NM under CERCLA or EPCRA in November 2006.	NRC 40 CFR 302
Toxic Release Inventory (TRI) Report	EPCRA, Sections 302, 311, 312, and 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 is currently required to submit a TRI report because its chemical use is above the reporting threshold.	EPA 40 CFR 372, Subpart B
Notification of Discharge	NMED requires reporting of oil or other water contaminant, 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 NMED. Within one week, the owner and/or operator shall send written notification to the appropriate Bureau Chief verifying the prior oral notification. Within 15 days, the owner and/or operator shall send written notification to the appropriate Bureau Chief describing any corrective actions taken and/or to be taken relative to the discharge. Seven surface discharge releases occurred in 2006. Details are summarized in Section 6.2.2.	NMED 20.6.2.1203 NMAC
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. Two events were reported to the City of Albuquerque in 2006. Details are summarized in Section 6.1.6..	Bernalillo County Water Utility Authority *Sewer Use and Wastewater Control Ordinance*

NOTES: 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
NMED= New Mexico Environment Department
POTW = Publicly-Owned Treatment Works
NMAC = New Mexico Administrative Code
SNL/NM = Sandia National Laboratories, New Mexico
CFR = Code of Federal Regulations
COA = City of Albuquerque

TABLE 2-8. Environmental Performance Measures

Measure	2004 Actual	2005 Goal	2005 Actual	2006 Goal	2006 Actual	2007 Goal
Hazardous Waste Generated (metric tons)	42.7	45	39.19	39.2	27.5	5% reduction
Percent Solid Waste Recycled	45.9	45	52	57	46	50
Number of Notices of Violation (NOV)	2	0	1	0	3	0
Amount of fines or penalties	Negotiated $619,980 for 2003 NMED RCRA	$0	$97,080 Air Quality NOV	$0	$20,000 Air Quality NOV' $41,150 Waste NOV	$0



Sunflower
Photo by: Mark Miller

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chapter three

ENVIRONMENTAL PROGRAMS INFORMATION

<u>**In This Chapter...**</u>

Environmental Management System (EMS)
Environmental Restoration (ER) Project
Waste Management
Pollution Prevention (P2) Program
Biological Control Activities
National Environmental Policy Act (NEPA) Compliance Activities
Environmental Education Outreach Program

Environmental Snapshot

The Environmental Education Outreach Program participated in the following events in 2006:

- *The School to World Conference*
- *The PNM Excellence Conference*
- *The Teacher Open House*
- *The New Mexico Environmental Health Conference*

Environmental programs at Sandia National Laboratories, New Mexico (SNL/NM) are in place to protect the environment, safety, and health (ES&H) of its employees and the community. Sandia Corporation (Sandia) has established and implemented environmental management (EM) programs to meet or exceed the requirements of federal, state, and local environmental regulations, as well as U.S. Department of Energy (DOE) orders in the Prime Contract between Sandia and DOE. Presidential Executive Orders (EOs) and DOE guidance documents are also used to establish program criteria.

Commitment to Health and the Environment

It is the policy of both Sandia and the DOE/National Nuclear Security Administration (NNSA)/Sandia Site Office (SSO) to minimize risks to the public and the environment to "as low as reasonably achievable" (ALARA) levels. For example, Sandia frequently exceeds regulatory requirements through pollution prevention (P2) measures that are implemented on a corporate-wide basis.

Environmental Monitoring History at SNL/NM

Environmental monitoring began at SNL/NM in 1959 when the principle 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.

ES&H Policy

Sandia's ES&H policy is implemented to protect and preserve the environment and to ensure the safety and health of its employees, contractors, visitors, and the public while maintaining the corporate vision and mission. Sandia's corporate ES&H Program mandates compliance with all applicable laws, regulations, and DOE directives included in the Prime Contract between DOE and Sandia, internal Corporate Process Requirements (CPRs), and permit requirements. As such, Sandia has committed to the following:

- Plan work incorporating safety awareness, protective health practices, environmental management, P2, and the long-term stewardship of resources;
- Identify hazards and evaluate, monitor, and manage risks with effective ES&H systems;
- Implement controls that prevent injury, exposure to hazardous materials, and the release of materials that could be hazardous to the environment;
- Perform quality work while protecting people, the environment, and our nation's security;
- Continually improve ES&H performance by establishing, meeting, and assessing measurable ES&H goals, objectives, targets, and milestones; and
- Regularly communicate ES&H issues to our members of the workforce (MOW), the community, regulators, and our stakeholders.

Integrated Safety Management System (ISMS)

Sandia's methodology for managing and implementing its ES&H Program is outlined in the Integrated Safety Management System (ISMS). The ISMS is centered upon five safety management functions that provide processes to guide management in identifying and controlling hazards: (1) plan work, (2) analyze hazards, (3) control hazards, (4) perform work, and (5) feedback and improvement.

3.1 ENVIRONMENTAL MANAGEMENT SYSTEM (EMS)

In accordance with DOE Order 450.1, *Environmental Protection Program*, Sandia implemented an EMS as part of the ISMS. The EMS is the framework by which SNL/NM manages, and continually improves, its environmental compliance and sustainability practices. The EMS identifies the environmental consequences of SNL/NM's activities, products, and services and develops objectives and measurable targets to mitigate potential impacts to the environment.

SNL/NM implemented its EMS in December 2005. Since that time, Sandia has worked to fully implement and establish the EMS in conjunction with ISMS in all site operations. Some major accomplishments of the EMS for Fiscal Year (FY) 2006 include:

- Corporate and division level EMS objectives and targets were established and tracked quarterly to survey progress;
- Internal and external outreach events were conducted to increase environmental awareness;
- The EMS Award Program and Lecture Series was established to celebrate environmental accomplishments at Sandia;

- Corporate and division level EMS self-assessments were conducted and identified deficiencies were addressed;
- Environmental program plans that detail requirements, roles and responsibilities, schedules, deliverables, and budgets were created; and
- International Organization for Standardizations (ISO) 14001 Overview and Internal Auditor Training was conducted.

The EMS is a continuous improvement system that includes all environmental programs in an integrated approach to effectively minimize the impact of SNL/NM's operations on the environment. Each year, SNL/NM's work processes are reviewed, and new objectives and measurable targets are set to ensure continued improvement in our environmental performance.

3.2 ENVIRONMENTAL RESTORATION (ER) PROJECT

Sandia's ER Project was created under the DOE Office of EM to identify, assess, and remediate sites potentially contaminated by past spill, release, or disposal activities.

The remediation and cleanup activities of legacy waste sites 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 (with the exception of the Chemical Waste Landfill [CWL] that is regulated by a RCRA Closure Plan). 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).

There are additional areas of concern (AOC) at SNL/NM not regulated as SWMUs (primarily closed-out septic systems) that have also been investigated as a part of the ER Project. These AOCs were not identified at the time of the issuance of Module 4 of the RCRA Part B Operating Permit; however, they were identified by the New Mexico Environment Department (NMED) as requiring investigation. Consequently, they were investigated and addressed as if they had been SWMUs listed on the permit.

Sandia, DOE, and NMED negotiated a Compliance Order on Consent (COoC) during 2003 that was signed in April 2004. The COoC is the regulatory document governing corrective action for releases of hazardous waste or hazardous constituents at SNL/NM, and it addresses current and future Hazardous Waste Facilities Permit requirements for SNL/NM with the exception of new releases from an operating unit, closure and post-closure care requirements, implementation of controls–including long-term monitoring–and any releases of hazardous waste or hazardous constituents that occur after the date the COoC terminates.

3.2.1 Cleanup and Site Closures

Waste generated from SNL/NM ER sites includes hazardous waste, radioactive low-level waste (LLW), mixed hazardous/radioactive waste (MW), Toxic Substances Control Act (TSCA) waste (primarily polychlorinated biphenyls [PCBs] with some asbestos), and industrial solid waste. The waste management section in this chapter shows the waste volumes generated by the ER Project.

Corrective Action Complete (CAC) Status

ER sites are proposed for CAC status based on insignificant contamination present or after remediation has been completed. At SNL/NM, remediation is accomplished through Voluntary Corrective Measures (VCMs) or Voluntary Corrective Actions (VCAs), with the exception of the Mixed Waste Landfill (MWL). The MWL is subject to a Final Order for Corrective Measures for the MWL issued by the Secretary of NMED. Once NMED grants CAC status, a site is placed in a table titled "Corrective Actions Complete Without Controls" or "Corrective Actions Complete With Controls," based on its land-use category. The majority of ER sites are granted CAC status under a risk-based scenario. Risks to human health and the ecosystem are calculated for sites with residual contamination according to U.S. Environmental Protection Agency (EPA) and NMED guidelines. The level of contamination remaining and the appropriate land-use category (i.e.,

TABLE 3-1. Summary of ER Project Status

	A	B	C	D	E	F[2]
Year	Total ER Sites Remaining Start of FY	ER Sites Proposed for CAC	Sites Approved for CAC	Corrective Actions Completed by End of Year	New ER Sites Identified During Year	Total ER Sites Remaining End of FY
2006	**110**	**6**	**49**	**3**	**0**	**61**
2005	126	21	18	51	+2[3]	110
2004	125	41	0	1	+1[4]	126
2003	126	15	0	5	-1	125
2002	158	3	30	2	-2	126
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[5]	48	28	3	0	191
1993	219[5]	0	0	0	0	219
1992	172	0	0	0	47	219

NOTES: FY = Fiscal Year
ER = Environmental Restoration
CAC = Corrective Action Complete
Column A is the Total ER Sites remaining to be removed from the RCRA Permit
Column B is ER Sites submitted for CAC including reinvestigations per NMED
Column C is the ER Sites receiving final regulatory approval (Class III Permit Mod) by NMED
Column D is fieldwork completed including reinvestigations
Column E is newly identified sites or sites reopened by NMED
Column F is Total Sites remaining on the RCRA Permit at the end of the FY
[1]Includes all final submittals of CAC documentation including RSEs and NODs
[2]Column totals: F = A - C + E
[3]Two DSS sites determined inactive in FY05 were submitted for CAC
[4]One DSS AOC was determined to be inactive in FY04 and submitted for CAC
[5]Some of the original 219 sites included Tonopah Test Range (TTR), Kauai Test Facility (KTF), and other off-site areas

industrial, residential, or recreational use) are used as inputs to determine the risk to human health and the ecosystem.

Table 3-1 shows the ER project status since 1992. Sandia continues to actively pursue the closure of proposed CAC sites by working with NMED to provide adequate verification for a successful determination.

3.2.2 2006 Status and Activities

At the close of 2006 there were 61 regulated ER sites remaining on Sandia's RCRA Part B Operating Permit. All remediation activities, except the Corrective Measure Implementation (CMI) at the MWL, are complete. In 2006, five of the seven remaining sites to be proposed for CAC were submitted to NMED, including CWL documentation. All CAC proposals and Class III Permit modifications are available for review at the University of New Mexico (UNM) Zimmerman Library and the Community Resources Information Office (CRIO), 2017 Yale Boulevard SE, Suite E Albuquerque, NM 87106.

During 2006, final investigation and remediation activities were completed at sites 58, 105, and 1101. Field activities for these sites were classified "additional scope required" by the NMED. The MWL continued to experience schedule delays due to regulatory requests for information as a result of the public comment process. Sub-grade preparation activities at the MWL that were required prior to cover construction were initiated and continue into FY 2007.

ER Project History
The initial identification of ER sites at SNL/NM was completed in 1987. At that time, 117 sites under Sandia's jurisdiction were identified in the initial *Comprehensive Environmental Assessment and Response Program (CEARP) Phase I: Installation Assessment* (DOE 1987).

Since then, a total of 500 individual sites, potential sites, or individual historical activities have 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 past Sandia operations. In addition to the SNL/NM site, other sites included in the original scope of Sandia's ER Project were Sandia National Laboratories, Livermore, California (SNL/CA), the Kauai Test Facility (KTF), and the Tonopah Test Range (TTR). There were also a number of miscellaneous sites located in other areas, nationwide and internationally.

Currently, the only ER sites remaining to be addressed are the MWL and the Burnsite Groundwater (BSGW), Tijeras Arroyo Groundwater (TAG), and Technical Area (TA) V AOCs that are located at SNL/NM.

3.2.3 Long-Term Environmental Stewardship (LTES) Activities

The SNL/NM LTES involves stewardship for past, present, and future activities at SNL/NM. The LTES program "promotes the long-term stewardship of a site's natural and cultural resources throughout its operational, closure, and post-closure life cycle" (DOE 2005). The environmental programs mentioned in this document support that stewardship.

A component of the LTES program is long-term stewardship (LTS) of legacy sites. Stewardship of legacy sites is defined as activities necessary to maintain long-term protection of human health, the environment, and natural and cultural resources from hazards associated with residual radioactive and hazardous contamination at former ER sites. Sandia's LTS activities are increasing as remedial activities required by ER sites are completed. This increase in activity led to the completion of an LTES Implementation Plan (DOE/SNL 2006) in 2006.

Please visit the LTES website for more information:

www.sandia.gov/ltes

Public Outreach and Communication

Stakeholders participate in quarterly DOE/Department of Defense (DoD) meetings on ER, as well as periodic LTES working groups and meetings. These meetings drive community input regarding LTES and offer the opportunity for progress reports on the current status of LTES. Stakeholders prioritized potential outreach activities during one of these meetings. The LTES team then implemented them, developing an LTS website for the public, a traveling LTS exhibit for use at conferences and workshops, an LTS curriculum for educational use, and a permanent LTS exhibit at the National Atomic Museum.

3.2.4 ER Management Units at SNL/NM

CWL

The former CWL is approximately 1.9 acres and is located in the southeast corner of TA-III. Disposal operations at the CWL began in 1962. From 1962 until 1981, the CWL was used for the disposal of chemical and solid waste generated by SNL/NM research activities. Disposal of liquid waste in unlined pits and trenches ended in 1981; after 1982, all liquid waste disposal was terminated. From 1982 through 1985, only solid waste was disposed of at the CWL; after 1985, all waste disposal ended. The CWL was also used as a hazardous waste drum storage facility from 1981 to 1989. The primary contaminants of concern (COC) at the CWL are volatile organic compounds (VOCs) and metals.

Excavation of the landfill began September 30, 1998 as part of the Landfill Excavation (LE) VCM. Except for one verification sampling grid point that was excavated in January 2003, all excavation was completed in February 2002. Over 52,000 cubic yards (yd^3) of soil and debris were excavated from the landfill between 1998 and 2002. The excavation process, waste management activities, final verification soil sampling analytical results, and final risk assessment were presented in the LE VCM Final Report (SNL 2003), which was approved by NMED on December 16, 2003 (Moats W, 2003).

The majority of the soils were managed at the Corrective Action Management Unit (CAMU), adjacent to CWL, for treatment and/or placement into the containment cell for long-term management. Sampling and final cleanup of the site operational boundary was completed in February 2004 and documented in a report approved by NMED in October 2005.

As part of the CWL closure process defined in the amended Chapter 12 of the closure plan, Sandia and DOE/NNSA/SSO submitted a compilation of documents to NMED on May 20, 2003 that included the CWL Corrective Measures Study (CMS) Report, Remedial Action Plan (RAP), and Post-Closure Care Plan (PCCP). On December 12, 2003, NMED rejected the CWL CMS Report and postponed review of the RAP and PCCP, pending approval of a revised CMS Report (Kieling 2003). The December 2003 NMED letter contained general and specific comments on the CMS Report and requested the report be resubmitted by December 31, 2004.

A revised CMS Report was submitted in December 2004, as requested by NMED, which included a revised RAP as an annex. A revised PCCP was submitted to NMED as a permit application in September 2005 after receiving an NMED request for supplemental information (RSI) in July 2005 on the revised CMS Report. In addition to submitting revised versions of the three original May 2003 documents (CMS Report, RAP, and PCCP), Sandia and DOE/NNSA/SSO requested NMED approval of an Interim Corrective Measure (ICM) to allow construction of the at-grade landfill cover design, originally presented in the May 2003 RAP, prior to NMED approval of the revised CMS Report. The ICM request was submitted to NMED in April 2004 and was approved in September 2004. Backfilling of CWL to four feet below ground surface (bgs) was completed in February 2004. The CWL cover installation began in March 2005 and was completed in September 2005. The CMS, RAP, and PCCP are still under review and awaiting approval by the NMED.

CAMU

The CAMU is permitted under RCRA and TSCA for the management of remediation waste (primarily contaminated soil) generated during the VCA conducted by the ER Project at the CWL. Storage, treatment, and containment activities are authorized under the CAMU permit (EPA 1997). The CAMU is located in TA-III next to the CWL and the Radioactive and Mixed Waste Management Facility (RMWMF). Two treatment processes, Low Temperature Thermal Desorption (LTTD) and stabilization treatment (ST), were used as needed to treat soil wastes before they were placed in the containment cell. LTTD treatment operations were completed in December 2002. The remaining ST treatment activities at the CAMU were performed during January 2003.

The staging, treatment, and support areas at the CAMU were clean-closed under the RCRA and TSCA provisions outlined in the closure plan (SNL 2002c). The CAMU containment cell cover was installed in July 2003, which encapsulated the CWL remediation waste in place. The CAMU was certified closed on October 15, 2003 in compliance with the closure requirements documented in the RCRA Closure Report (SNL 2003a). The CAMU containment cell, where the treated waste remains, will continue to be monitored and maintained in accordance with post-closure requirements.

The CAMU containment cell design consists of engineered barriers and incorporates a bottom liner system with a leachate collection system, a final cover system, and a vadose zone monitoring system (VZMS). The VZMS provides information on soil conditions under the cell for early detection of leaks. The VZMS consists of three subsystems that include the primary subliner (PSL), a vertical sensor array (VSA), and the CWL and sanitary sewer line (CSS) monitoring subsystems. VZMS monitoring of the containment cell was conducted on a monthly basis through May 2005. In June 2005, quarterly monitoring was initiated. The PSL, VSA, and CSS monitoring subsystems were monitored for the composition of soil gases and soil moisture content.

In 2005, 2,905 gallons (gal) of leachate were pumped from the containment cell leachate collection system. In 2006, the amount of leachate pumped was 1,648 gal. At the beginning of 2006, the amount of leachate being pumped was 45 gal per week (gal/week), down from the rate of 75 gal/week for the previous year; and, by the close of 2006, the amount was 25 gal/week compared to 45 gal/week for the comparable period in 2005. Monitoring results for 2006 were generally consistent with baseline data established between January 1999 and December 2000. VZMS monitoring results are compiled and reported on an annual basis; the most recent report was submitted in September 2006 (SNL 2005). The annual VZMS monitoring reports are submitted to NMED as required by the CAMU permit (EPA also receives a copy).

Groundwater Management Units

In 2006, SNL/NM ER performed groundwater monitoring at CWL, MWL, the BSGW and TAG investigations, and TA-V. SNL/NM will continue groundwater monitoring as a part of CMI and LTES. The Corrective Measures Evaluation (CME) report for TA-V was submitted to NMED in July 2005, and the CME report for TAG was submitted in September

2005. After regulatory selection and public review of the preferred remedy, CMI plans can be prepared for TAG and TA-V. Revised monitoring under the CMI plan for TAG and TA-V cannot begin until regulatory review and approval of the CME reports and review and approval of CMI plans.

MWL

The MWL was established in 1959 as a disposal area for radioactive waste and MW generated at SNL/NM research facilities. The landfill accepted approximately 100,000 cubic feet (feet^3) of LLW and minor amounts of mixed waste from March 1959 through December 1988. Tritium is the contaminant of primary concern at the MWL. It has been detected in surface and subsurface soils in and around the classified area of the landfill. However, there is no indication that tritium or other contaminants have migrated to groundwater, which is approximately 500 feet bgs at the MWL. Tritium is released from MWL soils to the atmosphere at low levels, which do not pose a threat to human health or the environment.

A monitoring well network consisting of seven wells has been installed at the MWL. These wells are sampled annually for radionuclides, metals, VOCs and major ion chemistry. Sampling of these wells has been conducted since 1990. The background well MWL-BW1 no longer has sufficient water for sampling and will be replaced in CY 2007. Additional information is in Section 7.2.2.

MWL Closure Status

On October 11, 2001, NMED directed Sandia and DOE/NNSA/SSO to conduct a CMS for the MWL. The MWL CMS Report was submitted to NMED on May 21, 2003 for technical review and comment. The purpose of the CMS was to identify, develop, and evaluate corrective measures alternatives and recommend the corrective measure(s) to be taken at the MWL. Based upon detailed evaluation and risk assessment, using guidance provided by EPA and NMED, Sandia and DOE/NNSA/SSO recommended that a vegetative soil cover be deployed as the preferred corrective measure for the MWL.

NMED held a public comment period on the MWL CMS from August 11, 2004 to December 9, 2004. Public hearings were conducted on the MWL CMS on December 2-3 and 8-9, 2004. On May 26, 2005, the Secretary of NMED selected a vegetative soil cover with a bio-intrusion barrier as the remedy for the MWL. The selection was based on the administrative record and the hearing officer's report. The Secretary requested that a CMI Plan incorporating the final remedy be developed within 180 days following the selection of the remedy.

On November 9, 2005, DOE/NNSA/SSO and Sandia submitted a CMI Plan to NMED documenting the plans for construction of a cover for the MWL. The document contains a description of the selected remedy, the objectives for the remedy, detailed engineering design drawings and construction specifications, a construction quality assurance (QA) plan, and a health and safety plan. The cover design consists of a 3 feet thick, vegetated soil cover overlying a 1 foot thick rock bio-intrusion barrier. The design will rely upon soil thickness and evapotranspiration to provide long-term performance and stability.

The CMI Plan also included the results of a comprehensive fate and transport model that was used to assess the performance of the MWL and monitoring triggers for future action. The triggers identify and detail specific monitoring results that would initiate an evaluation process to determine whether corrective action was necessary.

In June 2006, the DOE/NNSA/SSO and Sandia began clearing and grubbing the subgrade at the MWL in preparation for eventual cover construction activities. NMED submitted a Notice of Disapproval (NOD) for the MWL CMI Plan in November 2006, requesting additional information regarding landfill construction plans and performance modeling. The MWL NOD also requested additional and more restrictive triggers for corrective action should the proposed remedy design fail to protect human health and the environment. DOE/NNSA/SSO and Sandia responses to the MWL NOD were submitted to NMED in December 2006 and January 2007. Once NMED has completed their review of the NOD response documents, their approval of the MWL cover design is anticipated and cover construction activities would commence.

DOE/NNSA/SSO and Sandia are in the process of developing a Long-Term Monitoring and Maintenance Plan (LTMMP) to address monitoring, maintenance, and physical and institutional controls for the MWL. Anticipating the development of the LTMMP, a baseline sampling effort was conducted prior to the start of cover construction in order to obtain reference levels for certain radionuclides, metals, and biota (SNL 2007a).

3.3 WASTE MANAGEMENT

Waste at SNL/NM is processed at five facilities: the Hazardous Waste Management Facility (HWMF), the Thermal Treatment Facility (TTF), the RMWMF, the Manzano Storage Bunkers (MSB), and the Solid Waste Transfer Facility (SWTF). The primary waste types handled by these waste management facilities are shown below.

3.3.1 Hazardous and Chemical Waste

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; if there is a spill or release, this is monitored before discharging. Hazardous waste is tracked from the point of generation to final disposal through meticulous “cradle to grave” documentation at each waste handling step. Each waste item received at the HWMF is labeled with a unique bar code, linking the item to the original disposal request. An individually coded waste item typically is a bottle, plastic bag, or other small item that contains chemical materials.

All waste is reviewed at the HWMF before being placed in temporary storage. After sufficient quantities of items have accumulated in the storage 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 90 days of receipt.

Applicable regulations for hazardous and chemical waste handled by the HWMF are listed in Chapter 9.

2006 Activities at the HWMF
In 2006, a total of 12,561 package items were handled by the HWMF. The HWMF shipped a total of 78,116 kg (171,855 lb) of RCRA-regulated hazardous waste (including recyclable waste). Specific waste categories handled and shipped in 2006 are shown in Table 3-2.

Hazardous and Chemical Waste Minimization
Per the requirements of Section B.1 of the RCRA and HSWA, Sandia certifies that they have a “program in place to reduce the volume and toxicity of hazardous waste generated by the facility’s operation to the degree determined by the Permittee to be economically practicable.” Waste minimization efforts are promoted by the P2 program and investigated and implemented by line organizations with the support and technical assistance of the P2 program.

Hazardous and Chemical Recycling
Sandia 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 3,884 kg (8,545 lb) of RCRA hazardous waste and 6,384 kg (14,045 lb) 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 79,458 kg (174,807 lb) of material was recycled in this category. Waste recycled at SNL/NM in 2006 is summarized in Table 3-3.

Asbestos Waste Handling
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 are contained in 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. In 2006, a total of 154,900 kg (340,779 lb) of asbestos waste was generated and disposed.

PCB Handling

TABLE 3-2. Waste Shipped By the HWMF in 2006

Waste Categories Handled at the HWMF	2006 Waste Shipped	
RCRA Waste	**(kg)**	**(lb)**
Hazardous Waste	72,395	159,269
Hazardous Waste (Generated by ER Project)	5,721	12,586
Total	**78,116**	**171,855**
TSCA		
Asbestos	154,900	340,779
PCB (recycled NR)	2,327	5,119
PCB (incin NR)	53,563	117,838
PCB (incin RCRA)	63.4	139
Total	**210,853**	**463,876**
BIOHAZARDOUS		
Infectious Waste	**564**	**1,241**
OTHER		
NR Waste (minus asbestos, PCB, subtitle D, ER, recycled)	620,060	1,364,132
Non-hazardous Solid Waste (RCRA Subtitle D)	15,519	34,142
Non-RCRA (Generated by ER Project)	7	15
Used Oil	6,384	14,045
Other (recycled) – various batteries, fluorescent lamps, and non-PCB (ballasts, capacitors, and oils)	79,458	174,807
Total	**721,428**	**1,587,141**
Total Waste and Recyclables Shipped	**1,010,960**	**2,224,112**

NOTES: PCB = Polychlorinated Biphenyl
ER = Environmental Restoration
lbs = pounds
RCRA = Resource Conservation and Recovery Act
TSCA = Toxic Substances Control Act (primarily regulates asbestos and PCBs)
NR = non-RCRA regulated
kg = kilograms

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. The domestic production and distribution of PCBs was banned in 1979, and their use continues to be phased out.

Sandia has identified and replaced most PCBs and PCB-containing equipment. Previously, the largest quantity of regulated PCB-containing equipment in use at SNL/NM were capacitors contained inside fluorescent light ballasts manufactured before July 2, 1979. These have been almost completely eliminated due to an aggressive lighting retrofit program which has taken place since 1998. This program has removed all known PCB-containing ballasts running T12 lamps and replaced them with energy efficient, electronic (non-PCB) ballasts and T8 lamp technology. Other than fluorescent light ballasts, six PCB regulated items remain in use at SNL/NM. Seven areas of existing PCB spill contamination from old transformers that have been removed from service are being actively managed in compliance with an EPA/TSCA use authorization.

In 2006, Sandia performed a self-implementing on-site cleanup and disposal of PCB remediation waste at one existing PCB spill contamination area as part of the decommission and demolition of Building 806. All resulting waste was shipped off-site for disposal, and the area was sampled to verify that the cleanup objectives were met.

In 2006, a total of 55,953 kg (123,096 lb) of PCB waste was shipped (Table 3-2) from HWMF for disposal and recycle (the majority of PCB waste items came from building demolition).

Explosive Waste

Explosive waste generated at SNL/NM is generally managed at the point of generation until it can be shipped to a treatment facility. SNL/NM operates the TTF, a unit permitted for the treatment of certain explosive waste streams. In 2006, 427 kg (941 lb) of waste was treated in the TTF. In 2006, 14,450 kg (31,828 lb) of other explosive waste was transferred to KAFB for treatment.

3.3.2 Radioactive Waste and MW

The RMWMF and MSB are used to manage LLW, MW, transuranic (TRU) waste, and TRU/MW. The waste processing functions at the RMWMF include waste characterization, segregation, treatment, packaging, storage, and shipment to permitted off-site facilities. Wastes are stored at the MSB.

No high-level radioactive waste (HLW) is generated at SNL/NM. Although Sandia 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.

All LLW, TRU, and MW generators must contact the Radioactive Waste Program before generating waste to obtain prior approval. This will ensure that a proper waste pathway is in place before any waste is generated. The LLW and MW managed at the RMWMF is generated through a variety of processes. During 2006, both LLW and MW consisted of legacy wastes (wastes originally generated between 1990 and 1998), newly generated wastes from production processes, wastes from ER activities, and wastes generated during waste management activities at the RMWMF. MW also included wastes that had been treated at the RMWMF. TRU and TRU/MW wastes consisted of legacy wastes.

Applicable DOE orders and regulations for LLW and MW management are listed in Chapter 9. Normally, radioactive waste is shipped off-site within a one-year time frame in accordance with DOE orders. This is similar to the requirements for hazardous waste and MW. Some LLW may remain on-site longer than one year. Generally, this is to achieve full utilization of transport vehicles by ensuring that vehicles are full prior to leaving the site.

2006 Activities at the RMWMF and MSB

In 2006, the RMWMF managed all four waste types (LLW, MW, TRU, and TRU/MW). Wastes were stored at both locations. On-site treatment at the RMWMF included chemical deactivation (including potential of hydrogen [pH] neutralization), thermal deactivation, stabilization, macroencapsulation, and physical treatment (volume reduction).

In 2006, the RMWMF shipped 40,037 kg (88,242 lb) of LLW, and 22,878 kg (50,423 lb) of MW (1,138 feet^3) to permitted off-site facilities for treatment and/or disposal. A five-year summary of radioactive waste shipped at SNL/NM that includes 2006 is shown in Figure 3-1.

SNL/NM's Radioactive Waste

***Low Level Waste** 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's LLW inventory generally consists of laboratory waste, decontamination and demolition (D&D) debris, and personnel protection equipment (PPE).*

***Mixed Waste** 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.*

***Transuranic (radioactive) Waste** 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.*

In 2006, 1,152 kg (2,539 lb) of MW was treated at the RMWMF to meet applicable hazardous waste treatment standards. Of the treated waste, 1,152 kg (2,539 lb) were rendered non-hazardous. The treated wastes were then stored at the RMWMF or MSB, or they were shipped to permitted off-site facilities.

TRU and TRU/MW were stored at SNL/NM during 2006. The 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.

3.3.3 MW Regulatory Status

As discussed in Section 2.1.4, Sandia manages MW that is subject to the Federal Facilities Compliance Order (FFCO) (NMED 2004). 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.

SNL/NM compliance history regarding MW and the FFCO is shown in Chapter 9, Table 9-3.

MW Treatment
Chapter 9, Table 9-4 lists the current MW categories (TG-1 to TG-27, including TRU/MW) with the preferred treatment options and the status for each category. Five of the treatment technologies listed in Table 9-4 are performed on-site at the RMWMF as described in the current RCRA Part B permit request (most recently submitted to NMED in 2005).

MW Inventory in 2006
At the end of 2006, the majority of MW stored on-site consisted of inorganic debris and radioactive metallic objects with hazardous waste constituents and wastes that have been treated to meet hazardous waste treatment standards.

3.3.4 Solid Waste

The primary function of the SWTF is to collect, process, and ship for disposal SNL/NM solid waste in compliance with all applicable regulations. The SWTF primarily accepts commercial solid waste. It does not accept hazardous, radioactive, residential, or food service wastes.

SWTF Operations
Processing commercial solid waste at the SWTF consists of screening 100 percent of the waste for prohibited materials, which are removed if identified. The waste is further screened when it is placed on a conveyor that passes under a radiation detection system. If radiation is detected above background levels, the conveyor is automatically shut down and the source is investigated. (Screening 100 percent of the commercial solid waste is not a requirement of any regulations and is a good faith effort to prevent prohibited materials from inadvertently ending up in the landfill.) The conveyor then feeds the waste into a baler where it is compressed into desk-sized bales. The bales are weighed, individually tracked, and loaded into a trailer for transport to a local landfill.

The SWTF also processes and ships (but does not collect) commercial solid waste from KAFB and DOE/NNSA. In 2006, the SWTF received 1,012,840 kg (2,230,925 lb) of SNL/NM commercial solid waste and 1,358,859 kg (2,993,081 lb) of KAFB and DOE/NNSA commercial solid waste.

Recyclables
The secondary function of the SWTF is to collect, process (screen, bale, and track), market, and ship the following recyclable materials from SNL/NM: cardboard, white paper, mixed paper, aluminum cans, scrap metals, printer consumables, and plastics (Table 3-3). Proceeds from the sale of recyclable materials are used to reinvest in the recycling

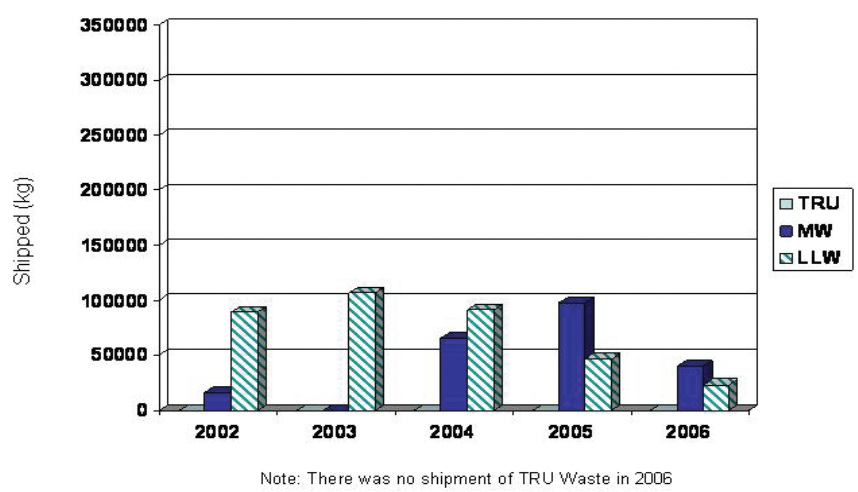

FIGURE 3-1. Five-Year Summary of Total Radioactive Waste Shipped at SNL/NM

program. The SWTF also provides some recycling support for KAFB and DOE/NNSA.

In support of small SNL/NM construction and demolition projects, the Construction and Demolition (C&D) Recycle Center accepts small quantities of C&D waste, but it is managed separately from the commercial solid waste. The C&D Recycle Center provides contractors of small C&D projects a location to recycle cardboard, wood, and scrap metal.

TTF and MSB

The TTF is operated by SNL/NM as a treatment facility for certain explosive waste streams. The MSB stores LLW.

3.4 P2 Program

3.4.1 Program Scope

The focus of the P2 Program is to provide guidance and technical support to reduce waste generation and resource consumption and to enhance the overall efficiency of processes and organizations within SNL/NM. The program focuses on reducing all waste streams, air emissions, water discharges, and hazardous, radioactive, and solid wastes; which can also result in an optimization of processes. Additional efforts focus on energy and water conservation, as well as the reduction of overall impacts to the environment. P2 staff assists programs in meeting regulatory goals associated with recycling, waste reduction, purchase of material containing recycled content, and reduction of energy use.

The P2 Program partners with numerous organizations at SNL/NM, including ES&H. P2 researches waste reduction technologies, products, and strategies applicable to SNL/NM work processes, performs cost-benefit analyses, and assists with developing proposals or requests for funding for new waste reduction processes. The P2 program is directed by and guided by federal laws, DOE orders, and federal EOs as listed in Chapter 9.

3.4.2 Awareness and Outreach

The P2 staff conducts awareness programs and outreach activities that promote P2 and teach techniques to waste generators and MOW. P2 has an internal website and a recently updated external

TABLE 3-3. Categories of Waste Recycled at SNL/NM in 2006

*** Scrap Metal	2,033,104
** Paper/Cardboard	896,435
* Aluminum Cans	2,383
Used Oil	90,340
** Batteries	145,858
Computers	11,680
Tires	10,000
** Electric Scrap	88,775
Other (e.g., light bulbs, ballasts, PCB)	131,690
Toner Cartridges	27,215
*** Construction/Remodeling (includes concrete, wallboard, ceiling tiles, wood, carpet, and asphalt)	6,371,508

Icons represent 10,000 lb except where noted * = 1,000 ** = 100,000 *** = 1,000,000

Recycling at SNL/NM

Recycled Steel

White Paper

Aluminum Cans

website (http://p2.sandia.gov) that presents P2 information and successes. Articles and press releases are regularly created that showcase P2 activities. P2 staff submit nominations for federal (DOE, EPA) and local award programs.

The P2 Program's premier awareness event last year was the celebration of Earth Day on April 18, 2006 at SNL/NM's Steve Schiff Auditorium that featured Nobel Prize Chemistry Laureate Dr. Mario Molina, who spoke about "The Impact of Human Activities on the Atmosphere." Supporting the event were various P2 and P2-related display booths.

P2 Awards

In 2006, Sandia received several awards for P2 accomplishments:

EPA WasteWise Award

Sandia received an EPA WasteWise Honorable Mention award in the Federal Facilities category. This is the sixth consecutive year that Sandia has been recognized by EPA for its accomplishments in waste minimization, recycling collection, and buying recycled-content products. EPA's WasteWise Program is a voluntary partnership program to help businesses and institutions find practical methods for reducing solid waste.

White House Closing the Circle Award

Sandia received the prestigious White House Closing the Circle Award in May 2006 for its comprehensive Environmentally Preferable Purchasing (EPP) program. EPA's Comprehensive Procurement Guidelines regarding recycled-content products, U.S. Department of Agriculture's (USDA) bio-based product preferences, and the EPA Energy Star guidelines are used as the starting point for all EPP efforts.

DOE Awards for P2 Accomplishments

Sandia won two of the eight DOE P2 Star Awards that were awarded throughout the entire DOE agency complex. One for the EPP program mentioned above, and the other for the creation of a printer supplies exchange in Summer 2005, which continues to the present. The program has now saved cumulatively almost $110,000 in effectively re-applying over 1000 surplus toner cartridges, keeping over two tons out of the landfill, and saving over 750 gal of oil used in the manufacture of new toner cartridges.

For work completed in 2006, Sandia received five awards in four different categories from the DOE/NNSA P2 Program. Three of the five awards have been submitted to be considered for the prestigious White House Closing the Circle Award in 2007.

Waste Minimization–Best-in-Class: The High-Energy Radiation Megavolt Electron Source (HERMES III) Accelerator. In 2005-2006, a HERMES III technician developed and implemented waste reduction procedures and measures that minimize the use of hazardous chemicals, extend the life of de-ionized (DI) resin beds, reuse and modify test hardware, and reduce the need for sulfur hexafluoride process gas—waste minimization techniques that have saved tens of thousands of dollars. See the special EMS highlight at the end of Chapter 1 for details.

Recycling–Best-in-Class: The Disassembly Sanitization Operation (DSO) process. This process supports weapon disassembly and disposition by using recycling to minimize the amount of disposed material. As a result, overall recycling of material sent through the DSO process has enabled 70-to-80 percent of these components to be recycled. In 2006, the first year of full-scale operation, the DSO process recycled approximately 7,000 lb of metal, 1500 lb of which was lead or lead-contaminated components.

Electronics Stewardship–Honorable Mention: Sandia has created a more environmentally sound life cycle management process for electronic office equipment. Sandia buys a large volume of "green" computers, uses those computers and peripherals more efficiently on a large network scale, and evaluates and reworks their end-of-life processes—which all systems must go through—to guarantee their appropriate reuse and recycling. Each of these life cycle stages have been developed, expanded, and refined to the point that SNL/NM is being recognized for its efforts to protect the environment.

Waste Minimization–Honorable Mention: A team of SNL/NM employees simplified what had previously been a complicated process cleaning Styrofoam packages used to transport explosive material. The team developed a simple, nearly waste free nitrogen blow-off process that replaced a time-consuming, hand washing system, and the result has been significant reductions in cost, waste, and energy and water usage.

Recycling Bins at SNL/NM

Environmental Management Systems–Honorable Mention: In SNL/NM Centers 2400 and 2700, the Employee Safety and Security Program (ESSP) has proved to be an effective tool for building support for ES&H and security initiatives from the bottom up. In 2005 and 2006, as part of an initiative for the center's EMS, the program incorporated environmental awareness into its charter. This approach fosters environmental excellence through awareness by capitalizing on the well-established program.

3.4.3 EPP Program

Sandia seeks to purchase environmentally preferable products and employ the most environmentally aware companies. Sandia communicates these requirements through its contracts and has issued single source contracts to supply some items. When a single source contract is not appropriate, EPP requirements are included in Request for Proposals (RFPs) and used to evaluate the award of a contract. The toner cartridge and motor oil single source contracts also require the vendor to collect and recycle their used product. These two commodity streams are examples of Sandia "closing the loop," by recycling used products and then buying replacement products that have recycled content.

Sandia recognizes the importance of training and awareness in maintaining high levels of EPP. Throughout the year, P2 communicates with counterparts in the procurement, fleet, and construction departments, as well as the general population at SNL/NM. Procurement was invited to participate in an introductory Electronic Product Environmental Assessment Tool (EPEAT) teleconference. By the end of this single teleconference, procurement was prepared to not only integrate preferential EPEAT language into current and future technology contracts, but was also interested in developing our own environmental ranking matrix to encourage both vendors and employees to seek and purchase "green" printers, which EPEAT has yet to address. Revised contract language identifying EPEAT was put in place beginning in December 2006. Thanks to Dell, HP, and Apple's progressive business lines of computers and SNL/NM's Chief Information Officer's internal "preferred systems list" (which designates what computer systems employees are allowed to order), the laboratories spent over $7.5 million to purchase computer systems in 2006 that became registered as EPEAT Silver.

To comply with bio-based purchasing regulations from USDA, Sandia continues to evaluate bio-based equivalents to replace petroleum and other chemical-based products currently being purchased. Most recently, both Fleet Services and Facilities have been piloting different brands and forms of bio-based penetrating lubricant; and one laboratory has been using a bio-based vacuum pump oil in its equipment—sharing its positive results with a NASA laboratory.

In 2006, 96 percent of the EPA mandated products purchased by Sandia were compliant with the EPA's recycled-content guidance. Procurement Card data was included this year, and for the past two years the number of products that construction contractors report on has increased. As a result, the dollar amount of products tracked increased by about 60 percent from 2004 to 2005 and totaled more $7.3 million in 2006.

3.4.4 Sustainable Design (SD)

Sandia pursues the concept of SD in a majority of its new construction projects. The goal of SD is to incorporate resource productivity and P2 for life cycle savings into a facility's construction and operation. Aspects of SD include: proper site selection, energy and water efficiency, environmentally preferable materials; recycling construction waste; and enhancement of the indoor environmental quality for the building occupant through the use of daylighting, elimination of indoor air pollutant sources, and connection to the outdoors.

Integrating SD into construction projects at SNL/NM involves the collaborative effort of project managers, building owners, operations, maintenance personnel, environmental professionals, engineers, and architects. Design team members look at materials, components, and systems from different perspectives and work together for optimum solutions. The solutions are based on the following parameters:

- Quality of workplace
- Initial cost
- Life cycle cost
- Overall efficiency
- Environmental impact
- Productivity
- Creativity
- Future flexibility

Sandia has taken steps to ensure that all construction projects institutionalize SD principles as part of basic design requirements. Architect and engineering firms are evaluated and chosen to design new facilities partially based on their experience with SD. Construction specifications require the use of environmentally preferable products and the selection of energy and water efficient equipment. Sandia continues to use the United States Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) rating system to guide its SD efforts.

Small Office Buildings - Sandia constructed three new small office buildings through customer funded General Plant Projects (GPP) or corporate funded Institutional General Plant Projects (IGPP). Green design principles are incorporated via performance specification 01000S standard specifications containing sustainability requirements, and/or project-specific specifications and design requirements.

In November, Sandia was notified that its Joint Computational Engineering Laboratory (JCEL) building had been awarded its LEED Silver certification. JCEL is Sandia's first LEED certified building.

USGBC LEED certification is being pursued for the Microelectronics Engineering Systems Applications (MESA) building and the Center for Integrated Technology (CINT) building as described in previous Annual Site Environmental Reports (ASERs).

3.4.5 Waste Reduction

Sandia continues to reduce volumes of generated waste. Hazardous waste reduction of 2.3 percent was achieved in 2006. LLW generation was reduced 7 percent compared to 2005. Sanitary waste generation was reduced 4 percent compared to 2005.

Through a structured analysis known as P2 Opportunity Assessments (PPOA), processes generating wastes are assessed and waste reduction measures and strategies are investigated and recommended. The P2 program initiated two PPOAs in 2006. The P2 staff also provides less structured technical assistance on an ongoing basis, and Sandia mission programs personnel accomplish waste minimization on their own initiative, such as those identified in the awards section on page 3-13.

Efforts were made in 2006 to standardize an inventory control system to reduce waste and ensure that only necessary materials/chemicals are in laboratories at any one time. Several meetings were held with various departments on the topic of inventory control for chemicals.

3.4.6 Recycling

SNL/NM Property Reapplication Services receive and redistribute material that still has value. A large portion of the material they receive is computer electronics. In 2006, Sandia joined the Federal Electronics Challenge (FEC) to commit to improved purchase, use, and recycling or disposal of computer electronics.

Over the past four years, SNL/NM's waste concrete from construction contractors, and other on-site projects, have been delivered to the KAFB landfill for stockpiling and eventual crushing. In 2006, Sandia crushed almost 3,000 tons of concrete for SNL/NM's recycling program to be used for various on-site projects. A new accumulation area for stockpiling concrete/asphalt was established and opened on SNL/NM property where materials began being staged for recycling.

Coyote Springs Wetlands

A marketing program is being used to raise recycling awareness with small construction project contractors by informing construction contractors about the SWTF C&D Recycling Center for collecting construction/remodeling project recyclables. In December, a new specification was issued for Construction Waste Management, Section 01505. This new specification represents a site-wide requirement for recycling C&D waste on all small or large construction projects and renovation work.

Site-wide recycling awareness continues in an ongoing campaign with articles discussing aspects of the recycling program routinely published in on-site publications. In 2006, 1,200 pledges were received from Sandia's MOW to either increase their recycling efforts, buy more recycled content products, or both.

As described under the waste management sections of this chapter, Sandia routinely recycles a variety of materials at our waste management facilities. Additionally, Fleet Services sends tires to be retreaded and the facilities department sends construction materials and demolished building components for recycling. Computers that are usable are donated to local schools and printer consumables are sent for remanufacturing. In 2006, 50 percent of routinely generated materials that my have become solid waste disposed in landfills were diverted for recycling.

3.5 *BIOLOGICAL CONTROL ACTIVITIES*

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 assistance in resolving nuisance animal problems are relayed and documented through Sandia's Facilities Telecon Organization. This effort may involve interacting, 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., Hantavirus) through activities such as disinfecting, sanitizing, and cleaning up 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 uses EPA-registered pesticides that are 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.

3.6 *NATIONAL ENVIRONMENTAL PROTECTION ACT (NEPA) COMPLIANCE ACTIVITIES*

Sandia provides DOE/NNSA/SSO with technical assistance supporting compliance with NEPA and the National Historic Preservation Act (NHPA). Under a self-managed program, the SNL/NM NEPA Team reviews projects for conformance to existing DOE NEPA documents and determinations. The use of the

ISMS NEPA Module software facilitates SNL/NM NEPA Compliance Reviews, citing existing NEPA documentation as appropriate. The NEPA Module also streamlines DOE/NNSA/SSO's review and approval of NEPA compliance, when required, and supports QA by providing a consistent framework that makes NEPA compliance documentation and information readily available. For some projects, a NEPA Compliance Review or an Air Force Form 813 is prepared for DOE review and determination, if the proposed action:

1. Does not fall within the analysis of an existing SNL/NM NEPA document, or
2. Would occur on USAF property (permitted, or requested to be permitted, for SNL/NM use).

NEPA program documents and regulations are listed in Chapter 9.

Part of the self-managed NEPA program at SNL/NM includes the training and employing of Qualified NEPA Reviewers (QNRs), who are usually ES&H Coordinators. Once qualified and approved by DOE/NNSA/SSO, QNRs use the ISMS NEPA Module software (under supervision of the NEPA Team) to review proposed project activities against existing NEPA assessments and reviews (becoming expert in the process) on environmental aspects and impacts associated with their organizations.

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

Consistent with NEPA regulations, DOE prepares a SWEIS for its large, multiple-facility sites. In November 1999, DOE issued the final SWEIS for SNL/NM (DOE 1999a) and, in December 1999, issued the Record of Decision (ROD) selecting "Expanded Operations" as the preferred alternative for assessing the environmental impacts of SNL/NM operations.

The SWEIS allows DOE to tier subsequent NEPA documents to the larger analysis and reduce the need for new impact analysis for project work consistent with activities analyzed in the SWEIS. In 2006, the DOE/NNSA/SSO prepared a Supplement Analysis (SA) (DOE/EIS-0281-SA-04) to determine whether the SWEIS for SNL/NM (DOE/EIS-0281) would continue to adequately address the environmental effects of ongoing operations or whether additional documentation under NEPA was needed. The SA specifically compared key impact assessment parameters analyzed in the SWEIS with new information, new and proposed projects, and modifications to existing projects, since the SWEIS was issued in 1999. On October 10, 2006, DOE/NNSA/SSO determined that the proposed action does not constitute substantial changes to the SNL/NM ROD and that no further documentation would be required.

2006 NEPA Documentation

The NEPA team participated in the initial planning and data collection for two NEPA documents that are at various stages of preparation: (1) an environmental assessment (EA) for Thunder Range at SNL/NM, and (2) a Supplement to the Stockpile Stewardship and Management Programmatic Environmental Impact Statement--Complex 2030 (Complex 2030 SEIS or SEIS) (DOE/EIS-0236-S4).

The NEPA team reviewed a total of 531 proposed projects in the ISMS NEPA Module or in the Experimental Development Plan System (the TA-III project review system with its own environmental evaluation component), and they transmitted 71 NEPA checklists to the DOE/NNSA/SSO for review and determination in 2006.

Summary data for SNL/NM NEPA reviews performed in 2006 are detailed in Table 3-4.

3.7 ENVIRONMENTAL EDUCATION OUTREACH PROGRAM

Sandia's Environmental Outreach Program reaches out to the community at large. Presentations and information booths on both local and national environmental issues and concerns are held at community centers, schools, environmental conferences, and on-site at SNL/NM. In 2006, Sandia participated in the following events:

- The School to World Conference
- The PNM Excellence Conference
- The Teacher Open House
- The New Mexico Environmental Health Conference

Sandia also co-sponsors the Annual Youth Conference on the Environment. Additional sponsors included the Environmental Education Association of New

Mexico (EEANM), and the City of Albuquerque's (COA) South Broadway Cultural Center. The 2006 conference theme was "Ecological Footprint: How Big is Your Footprint." During the day, students attended seminars in P2, global climate change, and urban planning.

Students also attended a panel discussion that addressed topics such as locally grown food, alternative fuel vehicles, and energy and water conservation.

In 2006, the Environmental Outreach Program also focused on "Inreach" to MOW at SNL/NM by holding a quarterly awards ceremony and lecture series to recognize individuals or teams that demonstrated exemplary advancements that contributed to the vision of Sandia's EMS.

For additional information, please visit the website:

http://www.sandia.gov/ciim/ASK/html/elementary/environment.htm

Students having lunch at the youth conference.

TABLE 3-4. Summary Data for SNL/NM NEPA Compliance Reviews Performed in 2006

NEPA Reviews	Review Breakouts	Quantity
NEPA Module Reviews[1]	Total Reviewed by NEPA Team	348
	DOE Checklist Submittals[2]	69
EDP Reviews[3]	Total Reviewed by NEPA Team	81
	DOE Checklist Submittals[2]	2
	SNL/NM Reviews (Total)	500
Air Force (AF) NEPA Reviews[4]	Land Use Permit Renewals	11
	Land Use Permit Terminations	3
	Land Use Permit Modifications	17
	AF-813 Submittals (Total)	31
GRAND TOTAL of ALL NEPA REVIEWS		531
PERCENTAGE of TOTAL REVIEWS REQUIRING SUBMITTAL to DOE[5]		14 percent
Verification of Work For Others (WFO) NEPA Citations[6]		718
Verification of Cooperative Research and Development Agreement (CRADA) NEPA Citations[7]		34

NOTES:

[1] SNL reviews cite existing NEPA documents; where existing documents are not available, NEPA checklists are prepared and Submitted to DOE. Environmental Restoration (ER) reviews are now included in the Total Reviewed by NEPA Team.

[2] These are proposed projects that, after initial review, needed to be transmitted to DOE for review and determination in CY2006.

[3] Experiment Development Plan (EDP): An electronic system used by the Albuquerque Full-Scale Experimental Complex (AFSEC) to record project information, including NEPA reviews. DOE/SSO has approved the EDP review process to be equivalent to the NEPA module reviews. The NEPA Team subsequently reviews all EDPs.

[4] The NEPA Team, in cooperation with the project originator, prepares all Air Force NEPA documents.

[5] Represents a percentage of only DOE NEPA reviews (500) because all Air Force NEPA documents must be transmitted through DOE/SSO to the U.S. Air Force.

[6] SNL/NM supports DOE/SSO in verifying WFO NEPA citations accompanying funding requests.

[7] SNL/NM supports DOE/SSO in verifying CRADA NEPA citations accompanying funding requests.

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chapter four

TERRESTRIAL AND ECOLOGICAL SURVEILLANCE

Photo by R. Roberts

In This Chapter...

Terrestrial Surveillance Program
- Objectives
- Sample Media
- Sampling Locations
- Radiological Parameters and Results
- Non-Radiological Parameters and Results

Ecological Surveillance

Environmental Snapshot

In the future, routine sampling for non-radiological parameters at fixed locations will be reduced and more emphasis placed on sampling specific areas of interest with potential environmental impact.

4.1 TERRESTRIAL SURVEILLANCE PROGRAM

Terrestrial surveillance is conducted at Sandia National Laboratories, New Mexico (SNL/NM) to detect the possible deposition or 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 Surveillance 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.

The number of sampling locations has increased to account for the growth of the laboratory. Some of the older sampling locations are no longer relevant for current operations, and various sample locations have been in use from one to 20 years. In the future, routine sampling for non-radiological parameters at fixed locations will be reduced and more emphasis placed on sampling specific areas of interest with potential environmental impact. However, the total number of samples collected annually should remain approximately the same. Several significant programmatic changes have occurred over the years and are documented in this chapter.

4.1.1 Program Objectives

The Terrestrial Surveillance Program is designed to meet the objectives of the U.S. Department of Energy (DOE) Order 450.1, *Environmental Protection Program* (DOE 2005):

- 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 Prevention (P2) and 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 some radiological or non-radiological constituents in surface soils, vegetation, or sediments. However, Sandia 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. However, if anomolies are observed, there are various guidance documents to assess the risk, such as DOE Order 5400.5 (DOE 1993).

In addition, sample results for metals in surface soils are compared to U.S. surface soil average concentrations (Kabata-Pendias 2000), local/regional surface soil average concentrations, (Dragun and Chekiri 2005), or site-specific surface soil concentrations (Dinwiddie 1997). A summary report of metals-in-soils at SNL/NM collected annually between 1993 and 2005 has been prepared and serves as another point of reference (SNL 2006a). In summary, the mean value of metals in soils (non-radiological constituents) is less than the residential level of the State of New Mexico soil screening guidelines, with the exception of arsenic. However, the mean value for arsenic is less than the industrial level set by state soil screening guidelines. A full report is provided in Appendix E that is in the CD included in the back of the report. In the future, routine sampling for non-radiological parameters at fixed locations will be reduced and more emphasis placed on sampling specific areas of interest with potential environmental impact.

The DOE Oversight Bureau of the New Mexico Environment Department (NMED) split samples with Sandia, at several locations, for an added measure of verification.

Statistical Analysis

Samples are generally collected from fixed locations to effectively enable 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 Sandia 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. In addition, a qualitative visual inspection of a graphical presentation of the data is conducted to compare sampling results to regional, local, and site-specific concentrations. This step is performed to ensure that anomalous data that would otherwise pass statistical scrutiny is flagged for further investigation.

Beginning in 2001, the analysis was limited to a five-year period. The reason for the change was that in 2000 Sandia changed to analytical laboratories 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 (or five sample events where samples are not collected annually), the trend analysis is more meaningful. The analysis in 2006 utilized data from the same analytical laboratory for the five year period.

In some instances, this qualitative inspection of the data is augmented by the graphical evaluation methodology described and documented in Section 4.1.5 (SNL 2007b). This enables the visual identification of anomalies in the data that stand out from the data population for the entire site, or just that location. This is particularly useful where insufficient data exists for trending, but comparison of new data to "expected values" is desired.

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 (g) of sample is collected from the top two inches of soil in accordance with SNL/NM field operating procedures (FOPs). In 2006, soil samples were collected from locations indicated in Tables 4-2, 4-3 and 4-4. In addition, a special sampling campaign and summary report of all non-radiological parameters (Target Analyte List [TAL]) was prepared for 37 locations surrounding the newly constructed Thermal Test Complex (TTC) in Technical Area (TA) III to serve as a baseline for future reference regarding non-radiological results in nearby soils (SNL 2007). Likewise, in the future, routine sampling for non-radiological parameters at fixed locations will be limited, but supplemental sampling will be conducted as needed in specific areas of interest with potential environmental impact.

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 soil in accordance with SNL/NM FOPs. Sediment samples were collected from locations indicated in Tables 4-2, 4-3, and 4-4.

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

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

NOTES: Based on Statistical Analysis Prioritization Methodology (Shyr, Herrera, and Haaker 1998).

*Some sites may appear higher than off-site, however, there may not be a statistically significant difference.

Vegetation
Vegetation is sampled to monitor for potential uptake of radioactive pollutants, which could provide an exposure pathway to foraging 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 g of sample is collected, preferably from perennial grass, by cutting back several inches of growth from the plant. If grass is not available, samples from small leafy plants may be collected. In 2006, vegetation was collected from locations indicated in Tables 4-2, 4-3, and 4-4.

Gamma Radiation Levels
Gamma radiation levels are measured using thermoluminescent dosimeters (TLDs) to determine the impact, if any, of SNL/NM's operations on ambient radiation levels. The TLDs are changed out on a quarterly basis and processed at an on-site laboratory. TLDs were collected from locations indicated in Tables 4-2, 4-3, and 4-4.

4.1.3 Sampling Locations

To the extent practicable, "sentinel" sampling locations are consistent from year to year in order to establish trends. Occasionally, sampling locations are added or dropped for different reasons such as the start-up of a new facility or operation, closure of an existing facility or operation, additional characterization of areas with elevated concentrations or increasing trends, or other technical or budgetary reasons. These locations are shown in Figure 4-1. Locations sampled are shown in Tables 4-2 through 4-4.

In some instances, special "sampling campaigns" (radiological or non-radiological) near operations of interest (such as described in Section 4.1.5) may be conducted in addition to, or in partial substitution for, fixed "sentinel" locations.

On-site
On-site locations (Figure 4-1 and Table 4-2) are selected within or near areas of past or current SNL/NM operations. Sample locations are chosen near sites with known contamination from past operations, or 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.

Perimeter
Perimeter locations (Figure 4-1 and Table 4-3) are selected to determine if contaminants are migrating from SNL/NM sites toward the off-site community. Perimeter locations are typically situated off SNL/NM property, but (with a few exceptions) within the boundary of KAFB.

Off-site
Off-site locations (Figure 4-2 and Table 4-4) 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 mile (mi) radius of SNL/NM.

4.1.4 Radiological Parameters and Results

Radiological analyses are performed on all soil, sediment, and vegetation samples and are summarized in this section. The 2006 radiological parameters and analytical results are found in Appendix C of this report. The detailed statistical analyses are documented in the 2006 Data Analysis in Support of the Annual Site Environmental Report (SNL 2007b). It was decided that tritium would not be collected from the soil samples due to the low moisture content caused by the on-going drought (that relented later in the summer of 2006).

Radiological Results
The results of the statistical analysis showed no on-site or perimeter soil, sediment, or vegetation locations that were Priority-1 (both higher than off-site and with an increasing trend). Three locations were identified as Priority-2 (higher than off-site) and four locations were identified as Priority-3 (increasing trend). The Priority-2 and Priority-3 locations and parameters are listed in Tables 4-5 and 4-6.

<u>Cesium-137</u>
Two perimeter locations (12 and 64) continue to be identified as Priority-2 for cesium-137 in surface soils. Location 12 is located on the U.S. Forest Service (USFS) land withdrawn area. Location 64 is located north of Manzano Base near the KAFB boundary. These locations are at slightly higher elevation, which receive greater precipitation that results in slightly higher cesium-137 levels from fallout. Cesium-137 is prevalent in surface soils worldwide as a result of historical nuclear weapons testing. Over the past five years, the values for cesium-137 at these perimeter locations ranged from 0.49 to 1.53 picocuries per gram (pCi/g). These levels are not cause for concern.

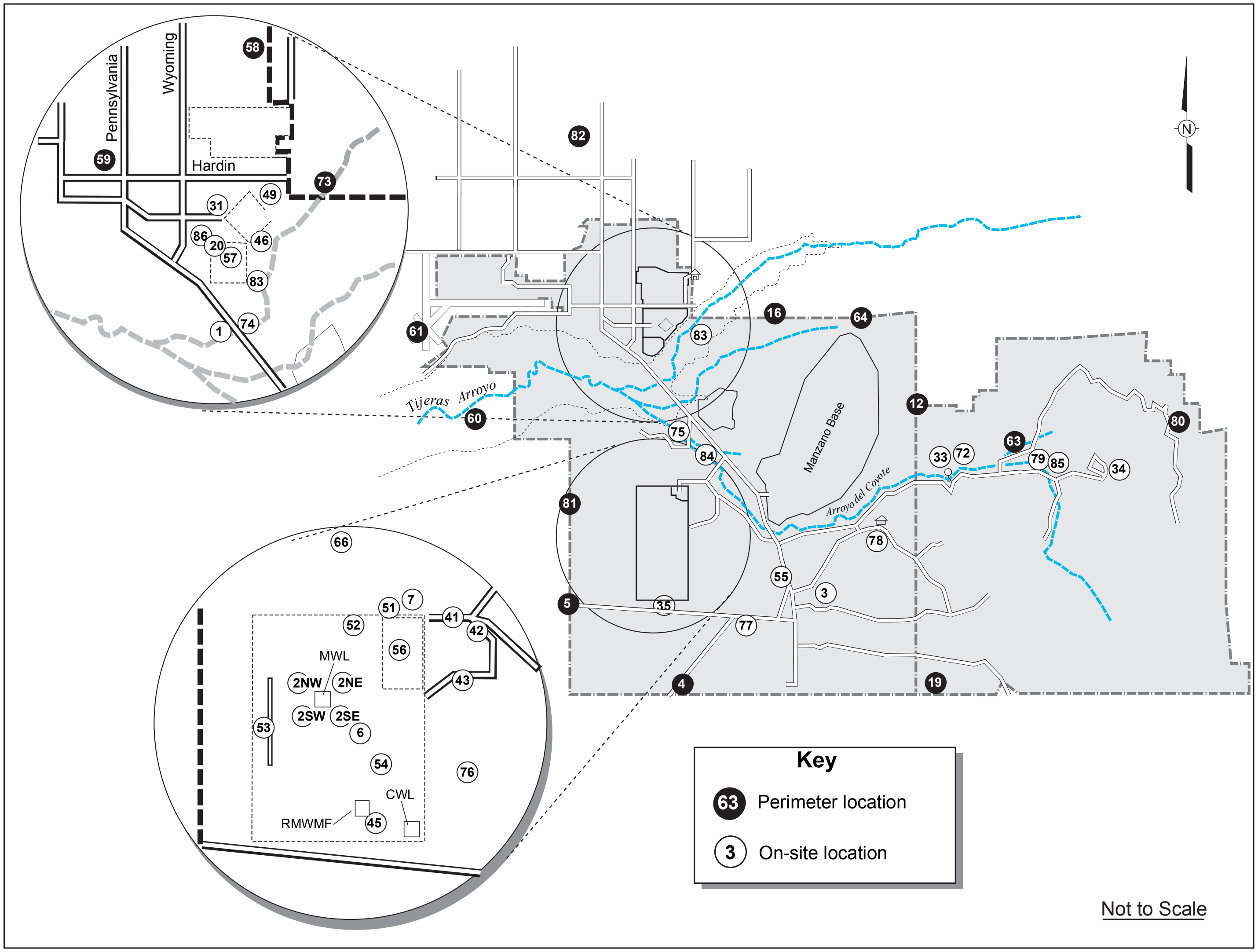

FIGURE 4-1. Terrestrial Surveillance Program On-site and Perimeter Sampling Locations

On-site locations are within areas of SNL/NM operations. Perimeter locations are located both on and off KAFB property.

TABLE 4-2. On-site Terrestrial Radiological Surveillance Locations and Sample Types

Location Number	Sampling Location	Soil	Sediment	Vegetation	TLD
1	Pennsylvania Ave.	X			X
2NW	Mixed Waste Landfill (MWL) (northwest)	X			X
2NE *	MWL (northeast)	X			
2SE	MWL (southeast)	X			
2SW	MWL (southwest)	X			
3	Coyote Canyon Control	X			X
6	Tech Area (TA) III (east of water tower)	X			X
7 *	Unnamed Arroyo (north of TA-V)	X			X
20*	TA-IV (southwest) (KAFB Skeet Range)	X		X	X
27	Albuquerque Fire Station 11, Southern SE				X
31	TA-II Guard Gate				X
33	Coyote Springs	X		X	
34	Lurance Canyon Burn Site	X			
35	Chemical Waste Landfill (CWL)	X			
41	TA-V (northeast fence)	X			X
42	TA-V (east fence)	X			X
43	TA-V (southeast fence)	X		X	X
45	Radioactive and Mixed Waste Management Facility (RMWMF), TA-III (northwest corner)	X			X
45E	RMWMF, TA-III (east fence)				X
46	TA-II (south corner)	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			
52	TA-III, northeast of Bldgs. 6716 and 6717	X			
53 *	TA-III south of long sled track	X			
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			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)	X	X		
83	Tijeras Arroyo GW Well		X		
84	Storm Water Monitoring Point (SWMP)-10		X		
85	Arroyo del Coyote Cable Site		X		
86	Corner of Wyoming and "S" Street	X			X

NOTES: *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 dosimeter

TABLE 4-3. Perimeter Terrestrial Radiological Surveillance Locations and Sample Types

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

NOTES: *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

TABLE 4-4. Off-site Terrestrial Radiological Surveillance Locations and Sample Types

Location Number	Sampling Location	Soil	Sediment	Vegetation	TLD
8	Rio Grande, Corrales Bridge (up-gradient)	X	X	X	
9	Sedillo Hill, I-40 (east of Albuquerque)	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		

NOTES: *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

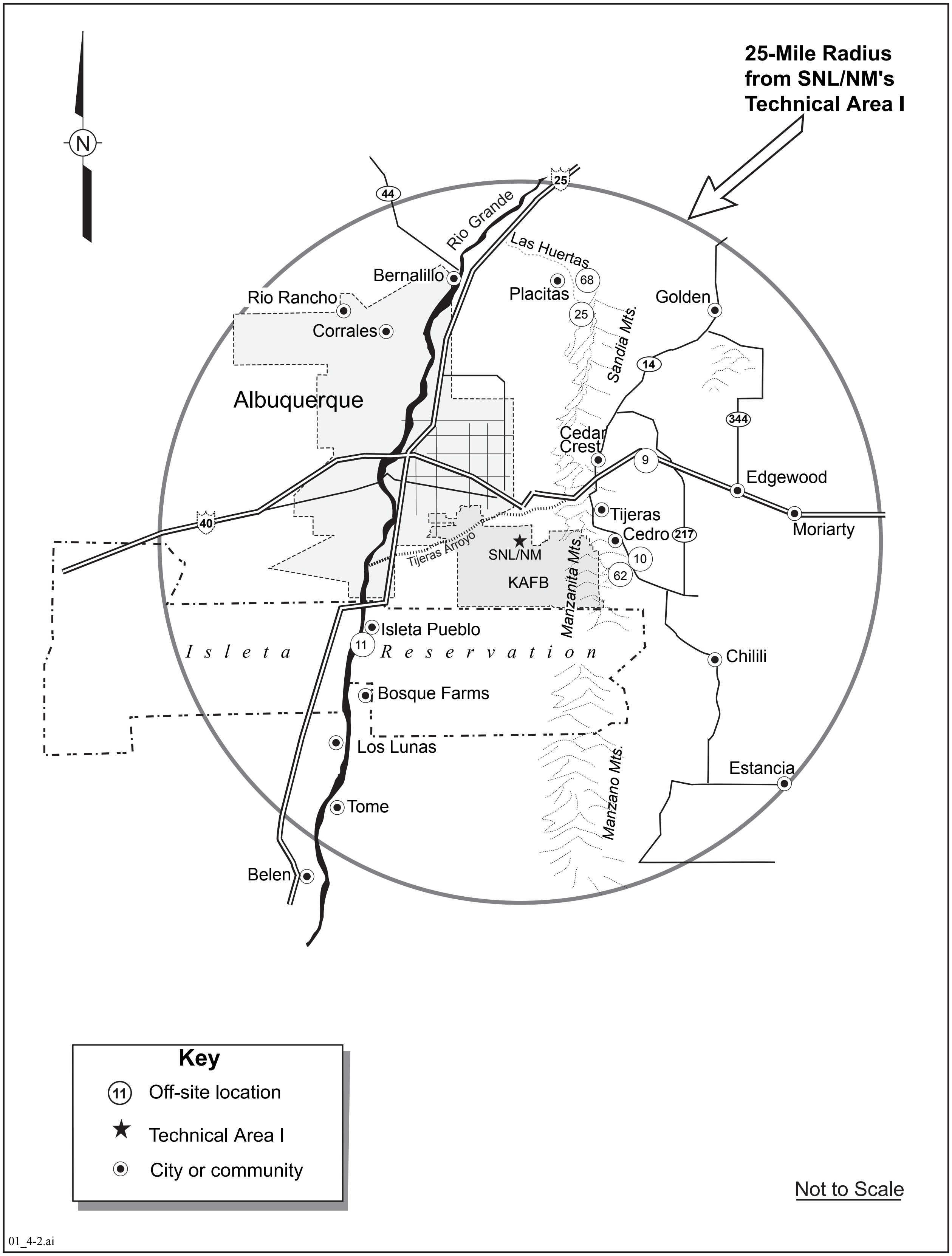

FIGURE 4-2. Terrestrial Surveillance Program Off-site Sampling Locations

One perimeter location (61) was identified as Priority-3 (increasing trend) for cesium-137 in surface soils. Location 61 is located at the Albuquerque International Sunport, which is west of TA-III. Over the past five years, the values for cesium-137 have ranged from 0.017 to 0.042 pCi/g. The observed values are not cause for concern.

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

Tritium

Tritium is not a significant indicator radionuclide for operations at SNL/NM, and the low soil moisture in the area will always make low activity assay difficult. Hence, as stated earlier, for 2006, tritium was not collected from soil samples.

Total Uranium

There was one on-site location (79) identified as Priority-2 (higher than off-site) for sediment. Location 79 is located up-gradient in the Arroyo del Coyote. The values observed at this location ranged from 1.10 to 1.58 milligrams per kilogram (mg/kg). This location is at a higher elevation where slightly higher natural concentrations are expected. The levels are not cause for concern. Three locations (P-16, P-64, and C-11) were identified as Priority-3 (increasing trend) for soil. The observed values are not cause for concern.

All vegetation sample locations, as well as the remaining soil and perimeter sampling locations, were identified as Priority-4 (consistent with off-site values and no increasing trends).

TLDs

TLD exposure by quarter and exposure rate for each location class for 2006 is shown in Appendix C. The exposure rate summary statistics for each location class are also presented in Appendix C. In 2006, all TLDs were collected every quarter. If a TLD is not collected for a quarter, it is excluded from the statistical analysis.

Data for 2002 through 2006 were analyzed to determine if any statistical differences were observed for either location class (on-site, perimeter, or community) or year. If a TLD was missing a quarter sample in any of the five years of interest, it was deleted from the analysis. Operational locations are also excluded from the statistical analysis. The statistical analysis shows three distinct groupings: 2005 was greater than 2003, which was greater than each of 2002, 2004, and 2006. There was no statistical difference between on-site, perimeter, or off-site locations. Table 4-7 shows the overall exposure rate summary statistics for 2002-2006. Figure 4-3 shows the TLD exposure rates by year and location class.

TABLE 4-5. Radiological Results Summary Statistics for Sample Locations (2002-2006) noted as PRIORITY-2 During 2006

Sample Media	Analyte	Units	Location	Sample Size	Average	Median	Std Dev	Min	Max
Soil	Cesium-137	pCi/g	12	5	0.98	0.96	0.49	0.49	1.53
			64	5	0.74	0.71	0.30	0.47	1.24
Sediment	Total Uranium	mg/kg	79	4	1.36	1.36	0.18	1.10	1.58

NOTES: Std Dev = Standard deviation
pCi/g = picocurie per gram
mg/kg = milligram per kilogram

TABLE 4-6. Radiological Results Summary Statistics for Sample Locations (2002-2006) noted as PRIORITY-3 During 2006

Sample Media	Analyte	Units	Location	Sample Size	Average	Median	Std Dev	Min	Max
Soil	Cesium-137	pCi/g	61	5	0.02	0.02	0.02	0.017	0.042
Soil	Total Uranium	mg/kg	16	5	1.06	0.84	0.48	0.61	1.72
Soil	Total Uranium	mg/kg	64	5	1.04	0.51	0.29	0.69	1.38
Soil	Total Uranium	mg/kg	11	5	0.55	0.49	0.04	0.52	0.61

NOTES: Std Dev = Standard deviation
pCi/g = picocurie per gram
mg/kg = milligram per kilogram

TABLE 4-7. Summary Statistics for TLD Exposure Rates, 2002-2006

Location Class	No. of Obs	Units	Mean	Median	Std Dev	Min	Max
Community	55	mR/hr	96.8	94.2	14.0	77.1	147.6
Perimeter	40	mR/hr	97.5	97.3	11.5	78.5	132.2
On-Site	67	mR/hr	96.5	94.8	9.1	80.9	118.3

NOTES: Std Dev = Standard deviation
mR/hr = microroentgen per hour (10^{-6} roentgen per hour)

4.1.5 Non-Radiological Parameters and Results

In the summer of 2006, a special sampling campaign and summary report of all non-radiological results was prepared for 37 locations surrounding the newly constructed TTC in TA-III to serve as a baseline for future reference regarding non-radiological results in nearby soils (SNL 2007). The TTC, and subsequent samples, were taken in the vicinity of sample location 52, as seen in Figure 4-1. The full report, and a detailed figure, is also provided in Appendix D. These samples were submitted to an analytical laboratory for metals-in-soils analyses, and the results are presented here. These data will provide Sandia with a sound baseline data reference set with which to assess potential future operational impacts of the facility. In the future, routine sampling for non-radiological parameters at fixed locations will be reduced and more emphasis placed on sampling specific areas of interest with potential environmental impact. These results are summarized in Table 4-8. The results are consistent with Table 4-9, and in no instance do they exceed NMED industrial/occupational soil screening guidelines.

An additional sampling effort was conducted in support of a special project to safely burn a surplus Spartan Rocket motor that had been stored for several years at SNL/NM. As a best management practice (BMP), aluminum in soil along the plume pathway was sampled before and after the burn to demonstrate that no environmental impact occurred. An internal Sandia report from November 2006, *Spartan Post-Burn Sampling Report*, confirmed Sandia's predictions of no environmental impact (Miller, M. 2007). The full report is provided in Appendix F that is in the CD included in the back of the report.

4.2 ECOLOGICAL SURVEILLANCE

Biota monitoring began in 1996 as an additional element of environmental monitoring within the Terrestrial Surveillance Program. The objectives of the Ecological Surveillance Program are to:

- Collect ecological resource inventory data to support site activities while preserving ecological resources and to maintain regulatory compliance,
- Collect information on plant and animal species present to further the understanding of ecological resources on-site,
- Collect biota contaminant data on an as needed basis in support of site projects and regulatory compliance,
- Assist SNL/NM organizations in complying with regulations and laws,
- Educate the SNL/NM community regarding ecological resource conservation, and
- Support line organizations with biological surveys in support of site activities.

The biota data collected are consistent with the requirements under DOE Order 450.1 (DOE 2005). Data are collected on mammal, reptile, amphibian, bird, and plant species that currently inhabit SNL/NM. Data collected include information on presence, abundance, species diversity, and land use patterns. Since no significantly elevated levels of radionuclides or metals were observed in soil or vegetation samples, no contaminant analysis of radionuclides and metals on wildlife were performed in 2006. Table 1-1 in Chapter 1 represents common species identified at KAFB.

These data are primarily utilized to support NEPA documentation and land use decisions on a corporate level. Data also support wildlife communication campaigns to ensure safe work environments and sustainable decision making strategies.

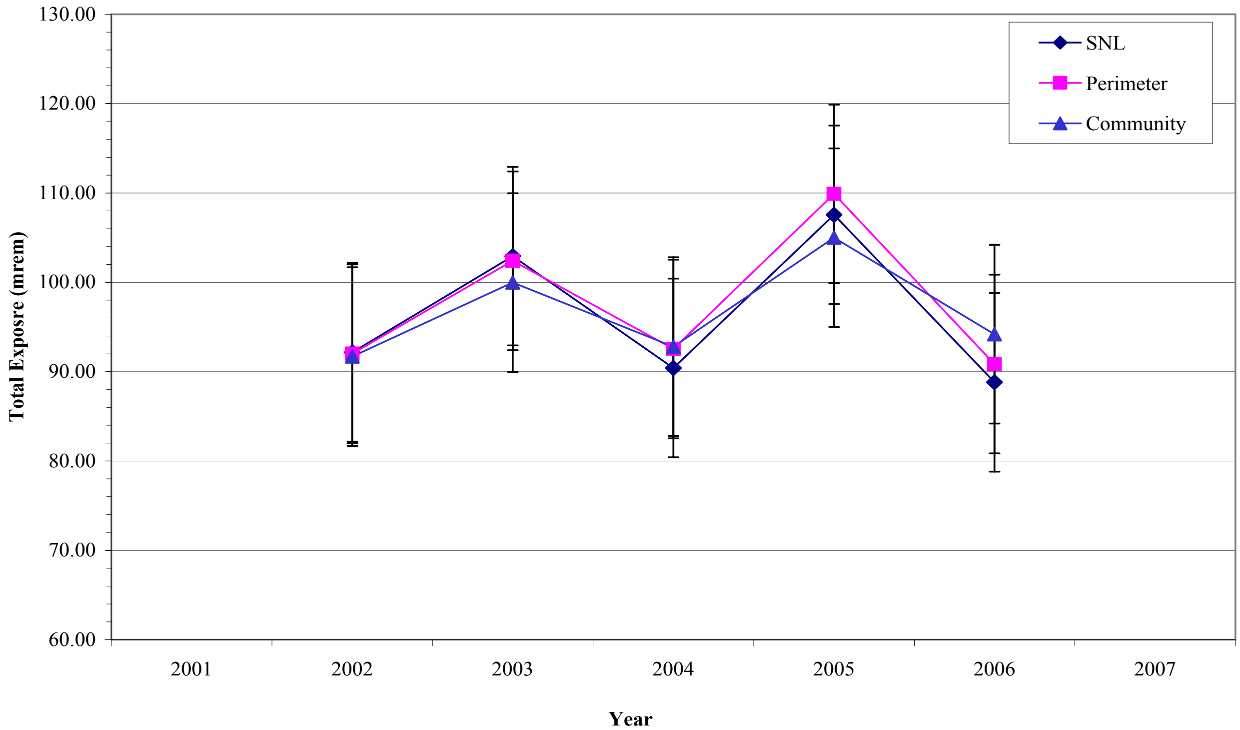

FIGURE 4-3. TLD Exposure Rates by Year and Location Class

TABLE 4-8. Analyte Summary Statistics for TTC Metals in Soil

Analyte	Mean	St Dev	Minimum	Median	Maximum
Aluminum	10053	2335	7390	9610	20100
Antimony	0.69	0.15	0.40	0.73	0.99
Arsenic	2.37	0.51	1.48	2.35	3.78
Barium	77.75	16.32	54.20	74.90	123.00
Beryllium	0.48	0.10	0.35	0.45	0.86
Cadmium	0.19	0.05	0.10	0.19	0.30
Calcium	7375	10277	1180	2820	39100
Chromium	10.66	2.21	7.41	9.85	16.90
Cobalt	3.48	0.75	2.40	3.34	5.32
Copper	7.36	1.65	4.68	6.99	12.30
Iron	11556	1972	8120	11300	17400
Lead	8.47	2.01	5.56	8.24	15.20
Magnesium	2630	722	1710	2450	4600
Manganese	190	44	134	174	284
Mercury	0.0087	0.0027	0.0036	0.0088	0.0147
Nickel	7.47	1.77	5.00	6.73	12.50
Potassium	2218	574	1360	2060	4590
Silver	0.13	0.21	0.10	0.10	1.40
Sodium	54.14	17.63	34.40	48.30	111.00
Thallium	0.49	0.01	0.48	0.49	0.50
Uranium	0.50	0.13	0.34	0.46	0.92
Vanadium	21.61	3.85	15.00	21.00	31.30
Zinc	29.93	6.24	20.80	28.80	45.20

TABLE 4-9. Various Reference Values for Metals-in-Soil

	NM Soil Concentrations[1]		NMED Industrial/ Occupational Soil Screening Levels[2]	US Soil Concentrations[3]	
Analyte	**Lower Limit**	**Upper Limit**		**Lower Limit**	**Upper Limit**
Aluminum	5000	10000	100000	4500	100000
Antimony	0.2	1.3	434	0.25	0.6
Arsenic	2.5	19	17	1	93
Barium	230	1800	100000	20	1500
Beryllium	1	2.3	2250	0.04	2.54
Cadmium	ND	11	564	0.41	0.57
Calcium	600	320000	n/a	n/a	n/a
Chromium	7.6	42	3400	7	1500
Cobalt	2.1	11	20500	3	50
Copper	2.1	30	45400	3	300
Iron	1000	100000	100000	5000	50000
Lead	7.8	21	800	10	70
Magnesium	300	100000	n/a	n/a	n/a
Manganese	30	5000	48400	20	3000
Mercury	0.01	0.06	100000	0.02	1.5
Molybdenum	1	6.5	5680	0.8	3.3
Nickel	2.8	19	22700	5	150
Potassium	1900	63000	n/a	n/a	n/a
Selenium	0.2	0.8	5680	0.1	4
Silica (Silicon)	150000	440000	n/a	24000	368000
Silver	0.5	5	5680	0.2	3.2
Sodium	500	100000	n/a	n/a	n/a
Strontium	88	440	100000	7	1000
Thallium	n/a	n/a	74.9	0.02	2.8
Titanium	910	4000	n/a	20	1000
Vanadium	15	94	1140	0.7	98
Zinc	18	84	100000	13	300

NOTES: ND = not detectable
n/a = not available
[1]Dragun, James, A. Chiasson, *Elements in North American Soils*, 2005, Hazardous Materials Control Resources Institute. (Used San Juan Basin, A Horizon to determine values.)
[2]NMED Soil Screening Levels (SSL), New Mexico Environmental Department Hazardous Waste Bureau and Ground Water Quality Bureau Voluntary Remediation Program, *Technical Background Document for Development of Soil Screening Levels*, Rev. 4.0. NMED 2006.
[3]US Soil Surface Concentrations, Kabata-Pendias, A., Pendias, H., CRC, *Trace Elements in Soils and Plants*, 3rd Edition, 2002.

chapter five

AIR QUALITY COMPLIANCE AND METEOROLOGICAL MONITORING

In This Chapter...

Meteorological Monitoring Program
Ambient Air Surveillance Program
Radiological Air Emissions
Assessment of Potential Dose to the Public
Air Quality Requirements and Compliance Strategies

Environmental Snapshot

The new 30-meter tower built near the A15 site is meeting the needs of the expanding laboratory and can be used to reflect meteorological conditions of SNL/NM facilities just outside the Eubank gate.

Sandia National Laboratories, New Mexico (SNL/NM) conducts air quality monitoring and surveillance under three programs:

- **Clean Air Network (CAN) Program** conducts meteorological monitoring and ambient air surveillance,
- **National Emission Standards for Hazardous Air Pollutants (NESHAP) Program** coordinates with facility owners to meet radiological air emission regulations, and
- **Air Quality Compliance (AQC) Program** ensures that all non-radiological air emission sources at SNL/NM, such as generators, boilers, chemical users, and vehicles, meet applicable air quality standards and permitting requirements.

Meteorological Monitoring Towers

All meteorological towers are instrumented to measure temperature and wind velocity* at 3- and 10-meter levels. Temperature and wind velocity are also measured at the top of the two tallest towers (30- 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).*

5.1 METEOROLOGICAL MONITORING PROGRAM

The main objective of the Meteorological Monitoring Program is to provide site-specific representative data for SNL/NM. The data are 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 supporting various environmental activities and programs and providing data to SNL/NM research and development (R&D) projects.

U.S. Department of Energy (DOE) orders and regulations applicable to the Meteorological Monitoring Program are listed in Chapter 9.

Tower and Network Instrumentation

Sandia Corporation (Sandia) 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 30-meter tower
- 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. 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 the availability of data at all instrument levels. Data for the A13 30-meter tower, which was not used in 2005 annual comparisons, can be used in this year's analysis since a complete year is available. The 2006 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 the transport and dispersion of pollutants, which are important in atmospheric emergency release scenarios and air dispersion modeling. Figure 5-2 shows some of the variations and extremes found in meteorological measurements across SNL/NM.

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 representation 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

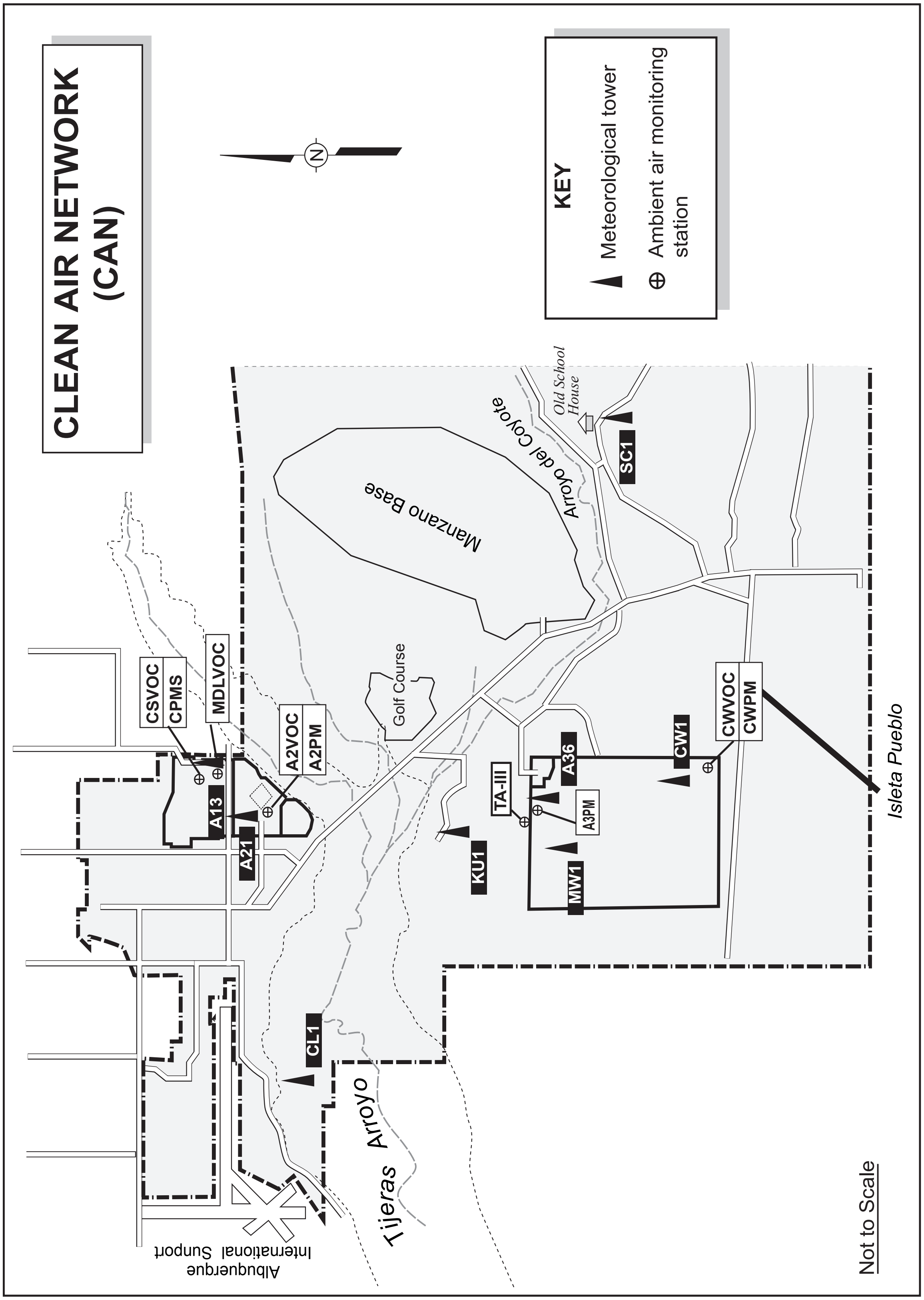

FIGURE 5-1. The Clean Air Network (CAN) of Meteorological Towers and Ambient Air Monitoring Stations

TABLE 5-1. 2006 Annual Climatic Summary from Tower A36

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Temperature (°C)													
Average Daily High	10.31	12.83	14.82	22.48	27.90	32.14	30.87	27.04	23.14	19.05	14.49	6.39	20.12
Average Daily Low	-2.82	-1.60	2.10	7.70	13.09	17.24	18.24	16.36	10.87	6.92	1.71	-3.55	7.19
Monthly Mean	4.36	6.14	8.71	15.39	21.00	24.95	24.34	21.35	17.20	13.24	8.68	1.77	13.93
Extremes (°C)													
High	14.94	22.73	22.83	28.33	32.66	36.10	35.56	31.38	27.11	26.98	21.45	14.89	36.10
Low	-9.21	-9.70	-8.28	1.49	7.05	7.51	14.00	13.41	4.01	-0.02	-11.00	-11.59	-11.59
Relative Humidity (percent)	32.47	27.52	35.19	21.31	20.90	25.86	45.82	62.98	49.42	48.10	40.61	57.96	39.01
Precipitation (cm)													
Monthly	0.05	0.00	0.41	0.23	0.00	2.77	10.31	15.44	2.18	3.99	0.03	3.63	39.04
24 Hour Max	0.05	0.00	0.30	0.23	0.00	1.17	3.20	6.50	0.99	3.48	0.03	1.19	6.50
Wind (m/sec)													
Monthly	3.25	3.56	4.65	4.55	4.50	4.56	3.69	3.16	3.49	3.53	3.03	2.91	3.74
24 Hour Max	6.51	7.08	7.38	7.31	9.51	8.29	6.59	5.68	8.14	7.87	7.65	6.63	9.51
Maximum Gust	19.30	23.06	25.14	24.26	27.78	28.86	23.98	18.38	21.62	19.02	23.10	23.30	28.86
Barometric Pressure (mb)	835.58	834.54	831.18	832.08	832.74	835.42	836.82	836.73	835.59	834.52	835.50	836.12	834.74

NOTES: Barometric Pressure sensor slow degradation produced approximately 0.5 mb increase in Oct-Dec values.

Conversions to English Units:

	Temperature = °F = (1.8)(°C) + 32	°C = degree centigrade
	Wind Speed = mph = (2.2369)(m/s)	cm = centimeter
	Rainfall. = in. = (2.54)(cm)	m/sec = meters per second
	mb = millibars	

significantly across SNL/NM. Although not shown, the annual wind frequency distribution for Technical Area (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.

The diurnal pattern of wind flow common through many areas at 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 and channel into canyons or up the Rio Grande Valley.

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) (20.2.3 NMAC). Ambient air surveillance is also important to establish background concentration levels for pollutants of concern and to evaluate the 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.

Wind Speed

	Minimum (m/sec)	Maximum (m/sec)	Spread (m/sec)
Average Annual Wind Speed	3.66 tower A21	3.90 tower CW1	0.24
Greatest Difference in Wind Speed over 24 hours	5.02 tower KU1	9.20 tower A13	4.18 in Feb
Greatest Difference in Daily Maximum Wind Speed	25.0 tower SC1	38.1 tower MW1	13.1 in June
Average Difference in Daily Wind Speed	~0.94		

Temperature

	Minimum (°C)	Maximum (°C)	Spread (°C)
Average Annual Temperature	13.72 tower SC1	14.44 tower A13	0.72
Network Annual Temperature Extremes	-12.12 tower CW1	36.79 tower CL1	48.91
Greatest Difference in Daily Minimum Temperature	-5.36 tower MW1	0.83 tower SC1	6.19 in Nov
Greatest Difference in Average Daily Temperature	-7.48 tower CL1	-3.17 tower SCI	4.31 in Dec
Greatest Difference in Daily Maximum Temperature	-1.97 tower CL1	3.09 tower SC1	3.1 in Sep

Precipitation

	Minimum (cm)	Maximum (cm)	Spread (cm)
Annual Precipitation (Extremes)	34.29 tower SC1	39.04 tower A36	4.75
Daily Rainfall Variation	3.94 tower SC1	6.50 tower A36	2.56 in August
Greatest Monthly Precipitation Difference	8.13 tower SC1	15.44 tower A36	7.31 in August
Greatest in Monthly Rainfall occurred in August		15.44 tower A36	

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

FIGURE 5-2. Variations and Extremes in Meteorological Measurements Across the Meteorological Tower Network During 2006.

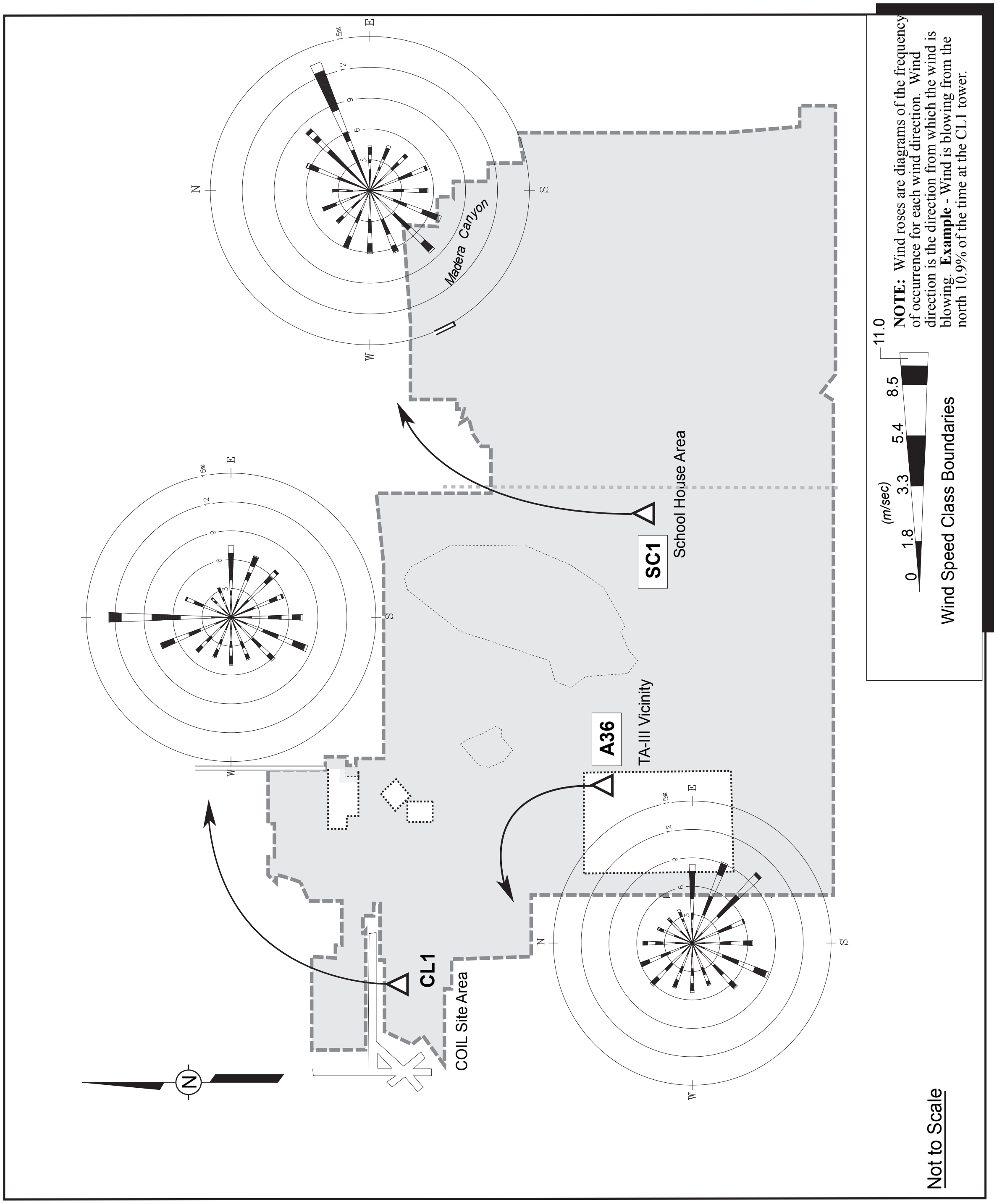

FIGURE 5-3. 2006 Annual Wind Roses for Towers CL1, A36, and SC1

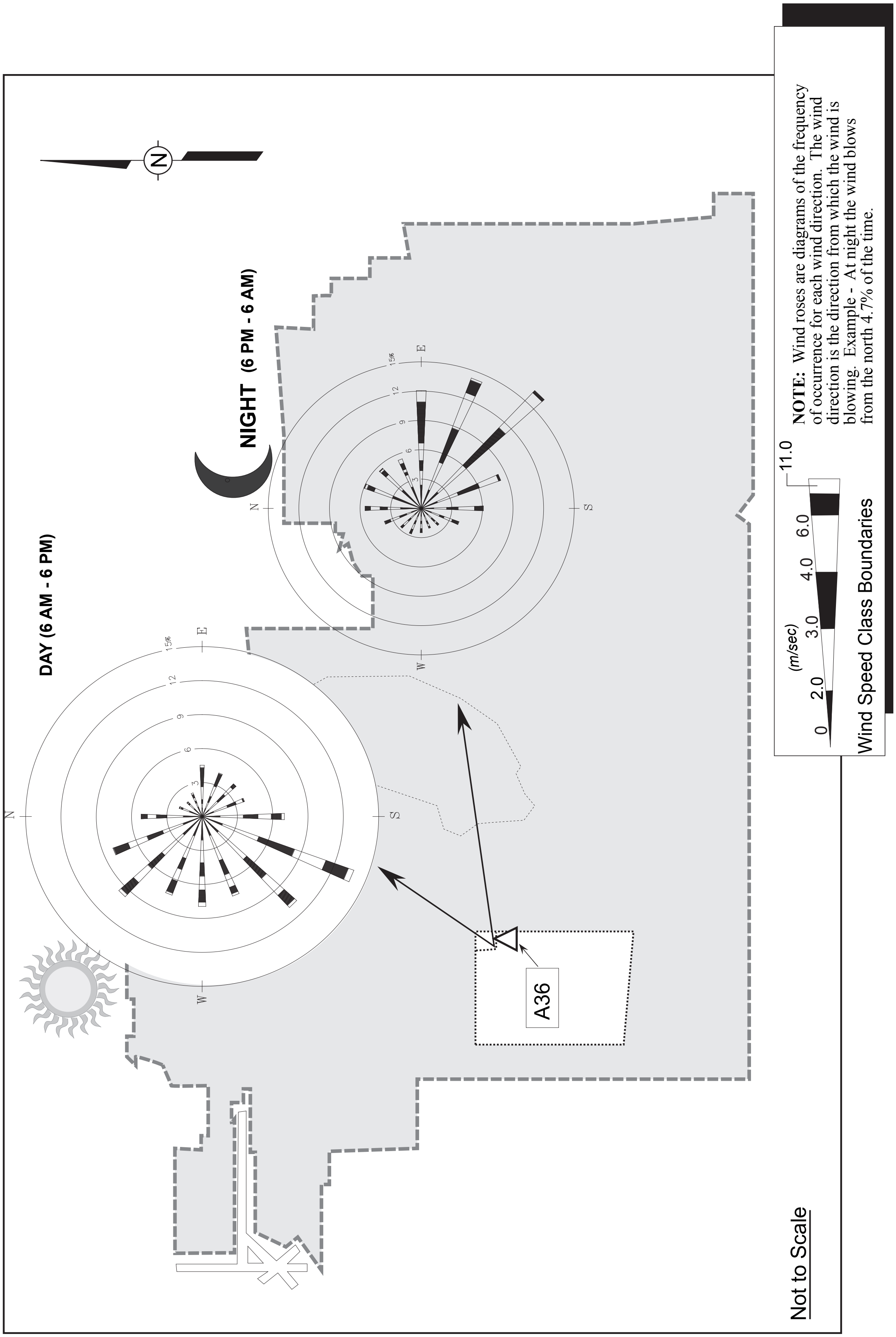

FIGURE 5-4. 2006 Annual Wind Roses for Daytime and Nighttime Wind Frequency at the A36 Tower

Ambient air surveillance is performed at six locations (illustrated in Figure 5-1).

Criteria Pollutant Monitoring Station (CPMS) – There is one CPMS in the CAN network. The CPMS is located in the northeast corner of TA-I. Criteria pollutants are the set of six common pollutants for which the U. S. Environmental Protection Agency (EPA) must set national ambient standards according to the Clean Air Act (CAA). For more information on air pollutants, go to the following website:

http://www.epa.gov/ebtpages/air.html

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) monitor is a part of the CPMS. Lead, a criteria pollutant, is one of 23 metals analyzed from PM samples at this station.

PM_{10} Stations – PM with a diameter equal to or less than 10 microns are measured at four monitoring locations (CPMS, A2PM, A3PM, and CWPM). 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 and are radiologically screened using gross alpha, gross beta, and gamma spectroscopy.

$PM_{2.5}$ Stations – PM with a diameter equal to or less than 2.5 microns is measured at two locations (CPMS and TA-III) at SNL/NM. $PM_{2.5}$ is measured continuously and recorded in hourly concentrations 24 hours a day, 365 days a year. Filters are not manually weighed with this system. The mass is calculated with microprocessor measurements. $PM_{2.5}$ and PM_{10} measurements at SNL/NM are done with different instruments and should not be quantitatively compared with each other due to differing instrument limitations and processing techniques. $PM_{2.5}$ filters are not sent to a laboratory for chemical analysis.

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.

5.2.1 Ambient Air Monitoring Results

Criteria Pollutants

In December 2006, the EPA revoked the annual PM_{10} standard and modified the $PM_{2.5}$ standard. In addition, for all but fourteen areas, the one hour ozone standard is no longer in effect. Since the standards were in effect for most of the year, the data for the standards that are no longer in effect will be provided this final time. The latest EPA standards for criteria pollutants can be found at:

http://www.epa.gov/air/criteria.html

In 2006, the automated data recovery for criteria pollutants was approximately 99 percent. Table 5-2 lists the results from the CPMS, PM_{10} and $PM_{2.5}$ monitors and compares them to NAAQS and NMAAQS for criteria pollutants.

Although violations of annual federal standards for criteria pollutants are not allowed, exceedances for short-term standards are allowable once a year. State standards also allow short-term exceedances due to meteorological conditions such as in the case of an atmospheric inversion where air mixing may be extremely restricted. There were no exceedances of the criteria pollutant standards in 2006.

PM_{10}

Data recovery for PM_{10} was 93 percent complete based on an every sixth day sampling schedule. The highest daily particulate loading occurred at the CPMS and A2PM sites. A PM_{10} concentration of 36 micrograms per cubic meter (ug/m^3) occurred at both locations in June 2006.

The monthly and annual averages for PM_{10} are listed in Table 5-3. The annual PM concentrations for 2006 are slightly higher than the results for 2005. A cursory comparison of the monthly averages shows that for the first 6 months of the year PM_{10} was higher than 2005. Dry conditions over the area contributed to this increase. Trending of the particulate data is not presented here due to the effects natural phenomena have on trending results, which mask the influence of SNL/NM operations on particulate concentrations.

All filters collected from the PM_{10} stations that have complete field data are analyzed for 23 metals plus the radiological analyses. Filters are collected every sixth day and are consolidated into monthly composites for analyses. In 2006, monthly composites varied from three to six filters per month, depending on the sampling schedule and sampler power problems. In an attempt to provide better analytical information, results are included in averages only when they are actually higher than the radiological decision levels or instrument detection limits. Table 5-5 lists the averaged results of the PM_{10} analysis. It should be noted that most of the radionuclides are naturally occurring, or are short-lived decay daughter products found while the sample was in the counter, and are not emitted from SNL/NM sources. Many of the radionuclide averages in Table 5-5 are based on the results of one or two samples in the year identifying small concentrations of the constituent.

An Analysis of Variance (ANOVA) was performed to determine if statistical differences existed between stations. The results of the ANOVA indicated that the concentrations of barium and zinc at the CPMS were statistically different and slightly higher than the other sites. These two metals are commonly used in industrial applications and could be expected to be higher due to the type of operations that take place in the area of the CPMS.

TABLE 5-2. 2006 Criteria Pollutant Results as Compared to Regulatory Standards

Criteria Pollutant	Averaging Time	Unit	NMAAQS Standard	NAAQS Standard	Maximum or Measured Concentrations
Carbon Monoxide	1 hour 8 hours	ppm ppm	13.1 8.7	35 9	3.14 2.52
Nitrogen Dioxide	24 hours Annual	ppm ppm	0.10 0.05	- 0.053	0.040 0.012
Sulfur Dioxide§	3 hours 24 hours Annual	ppm ppm ppm	- 0.10 0.02	0.50 0.14 0.03	0.025 0.004 <0.001
Ozone	1 hour 8 hour	ppm ppm	0.12 -	0.12 0.08	0.096 0.073[a]
PM_{10}	24 hours Annual	$\mu g/m^3$ $\mu g/m^3$	- -	150[b] 50	36 12.4
$PM_{2.5}$	24 hours Annual	$\mu g/m^3$ $\mu g/m^3$	- -	35 15.0	22.3[c] 9.2
Lead	Any quarter	$\mu g/m^3$	1.5	1.5	0.0018

NOTES: 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.
[a] Reported as the fourth highest average of the year – per regulatory standards.
[b] Not to be exceeded more than once per year - per updated regulatory standards
[c] Reported as the three year 98th percentile value - per regulatory standards

TABLE 5-3. Monthly and Annual Averages for PM_{10} (Air)

Sample Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
A2PM	8.8	7.8	9.2	17.4	17.2	18.5	12.8	7.8	13.0	11.2	13.6	8.4	12.1
CPMS	12.5	9.2	11.8	16.4	14.6	21.2	12.3	11.2	8.2	8.2	12.0	11.2	12.4
CWPM	6.2	11.0	8.6	14.6	12.4	14.7	15.3	8.5	7.4	5.8	9.0	7.2	10.1
A3PM	9.4	8.0	10.8	14.3	12.2	18.3	12.6	8.0	8.0	8.0	10.0	7.2	10.6

TABLE 5-4. Monthly and Annual Averages for $PM_{2.5}$ (Air)

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
CPMS	6.89	7.35	7.02	9.16	13.36	19.28	9.15	6.88	7.04	7.76	8.64	8.00	9.21
TA-III	6.19	6.37	6.51	8.38	9.22	10.54	8.13	6.12	6.31	6.30	7.03	5.95	7.25

TABLE 5-5. Averaged Results of PM_{10} Analysis (Air)

Analyte	Units	A2PM	CPMS	CWPM	A3PM	TLV
Aluminum	ug/m3	0.20986	0.16048	0.18193	0.17826	2000
Antimony	ug/m3	0.00036	0.00040	0.00020	0.17826	500
Arsenic	ug/m3	0.00028	0.00040	0.00019	0.00025	10
Barium	ug/m3	0.00361	0.00530	0.00203	0.00019	50
Cadmium	ug/m3	ND	<0.00001	ND	0.00312	10
Calcium	ug/m3	0.64477	0.47723	0.38134	ND	2000
Chromium	ug/m3	0.00043	0.00061	0.00031	0.46863	10
Copper	ug/m3	0.01854	0.01947	0.01918	0.00023	1000
Iron	ug/m3	0.14185	0.16752	0.15073	0.01101	5000
Lead	ug/m3	0.00085	0.00120	0.00086	0.12696	150
Magnesium	ug/m3	0.12683	0.09674	0.06607	0.10057	10000
Manganese	ug/m3	0.00368	0.00316	0.00403	0.00387	200
Nickel	ug/m3	0.00030	0.00033	0.00035	0.00021	50
Potassium	ug/m3	0.14352	0.13222	0.06623	0.09724	2000
Silver	ug/m3	0.00007	0.00042	0.00007	0.00003	10
Sodium	ug/m3	0.07119	0.13028	0.11454	0.08445	5000
Thallium	ug/m3	0.00041	ND	ND	ND	100
Vanadium	ug/m3	0.00032	0.00030	0.00036	0.00032	50
Zinc	ug/m3	0.00393	0.00311	0.00682	0.00287	10
Uranium	ug/m3	0.00001	0.00001	0.00002	0.00001	200
Gross Alpha	pCi/m3	0.00276	0.00334	0.00252	0.00387	
Gross Beta	pCi/m3	0.01765	0.01931	0.01543	0.01796	
Actinium-228	pCi/m3	ND	ND	0.00617	ND	100
Beryllium-7	pCi/m3	0.16619	0.18767	0.17088	0.16367	40000
Bismuth-214	pCi/m3	ND	ND	0.00185	ND	2000
Cesium-137	pCi/m3	ND	ND	0.00167	ND	400
Cobalt-57	pCi/m3	ND	0.00024	ND	ND	2000
Cobalt-60	pCi/m3	ND	0.00220	ND	0.0012	80
Lead-212	pCi/m3	ND	0.00180	ND	ND	80
Lead-214	pCi/m3	0.00193	0.00271	0.00278	0.00102	2000
Mercury-203	pCi/m3	ND	0.00496	ND	ND	3000
Potassium-40	pCi/m3	ND	ND	0.00608	0.00402	900
Radium-224	pCi/m3	0.00870	0.01455	ND	0.00812	4
Radium-226	pCi/m3	0.00348	0.00457	0.00185	ND	1
Thorium-234	pCi/m3	0.02302	ND	0.03923	ND	400
Uranium-235	pCi/m3	0.00489	0.00372	ND	0.0155	0.1
Uranium-238	pCi/m3	0.02302	ND	0.03923	ND	0.1

NOTES: $\mu g/m^3$ = micrograms per cubic meter
pCi/m^3 = picocuries per cubic meter
TLV= threshold limit value (TLVs are guidelines and not legal standards. TLV guidelines assist in the control of health hazards) (ACGIH 2006).
The TLVs listed for the radionuclides are derived from DOE Order 5400.5 dose concentration guidelines defined for 100 m/rem.
ND = not detected

PM$_{2.5}$

$PM_{2.5}$ is also known as "fine particulate." Fine particulates are thought to be a greater health hazard than PM_{10} because the smaller sized particles can lodge deep in the lungs. Most $PM_{2.5}$ is created either directly from the combustion of all types of fossil fuels, including wood burning, or by secondary reactions of gases created in the combustion process with other gases in the atmosphere. The data recovery for $PM_{2.5}$ measurements was approximately 99 percent.

The monthly and annual averages for $PM_{2.5}$ are listed in Table 5-4. In 2006, the highest concentrations were found in the beginning of the summer and were most likely the result of wildland fire smoke transported from areas outside of SNL/NM. In addition, local operations in the vicinity of the CPMS produced several days of high concentrations in June. Concentrations of $PM_{2.5}$ in the Sandia area dropped quickly with the onset of rains in late June.

VOCs

The VOCs generally observed at SNL/NM are products or by-products of fossil fuels or from lab operations. In 2006, the data recovery for VOC monitoring was 93 percent. Monthly VOC samples were analyzed for 26 VOC species plus total non-methane hydrocarbon (TNMHC). Table 5-6 shows the compiled results for compounds detected.

The concentrations in Table 5-6 show that there is no one site with the highest concentration for all analytes, though the greatest numbers of contaminants are found at the Micorelectronics Development Laboratory (MDL)VOC site. The high average of 1,1,1–Trichloroethane (111-TCA) at the MDLVOC was driven by warm season concentrations.

An ANOVA was performed to determine if statistical differences existed between locations for each VOC. The ANOVA revealed that there were several statistically valid differences. The statistically valid differences found for the MDL site included 1,1,1-TCA, Benzene, TNMHC, and Xylene. The concentrations measured at the MDL were higher than at least one other sampling site. At the CWVOC site, while the concentrations of Butene were small, they were found to be statistically significant over all other sampling sites. Due to the type of operations in the vicinity of the MDLVOC, it is reasonable to find slightly higher—though still very low—concentrations of a few air contaminants.

5.3 RADIOLOGICAL AIR EMISSIONS

The U.S. Environmental Protection Agency (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 maximally exposed individual (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 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 DOE,/National Nuclear Security Administration (NNSA)/Sandia Site Office (SSO) submits the annual report to EPA and the City of Albuquerque (COA) Environmental Health Division. The NESHAP report prepared in 2007 includes the *NESHAP Annual Report for Calendar Year CY06*, Sandia National Laboratories, New Mexico (SNL 2007c).

5.3.2 SNL/NM NESHAP Facilities

SNL/NM currently has 17 potential 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.

A new NESHAP facility that has been added to the Annual Site Environmental Report (ASER) this year is the Process Research Development (PRD) Laboratory in TA-I. The facility is currently in standby mode. The laboratory, which would allow the handling of tritium, has yet to be used. Due to the uncertainty associated with the operation of the PRD, an emissions inventory will continue to be submitted unless tritium operations are permanently terminated.

TABLE 5-6. VOC Average Concentrations Compiled from Monthly Results at Four Stations (Air)
Average was computed using only detected results.

Compound	CS VOC	CW VOC	MDL VOC	TA-II VOC	TLV
1,1,1-Trichloroethane **	ND	4.65	18.59	0.29	350000
1,1,2-Trichlorotrifluoroethane **	ND	ND	0.19	0.11	1000000
1-Butene/Isobutene	0.70	4.42	1.33	0.13	NA
2,2,4-Trimethylpentane	0.14	0.31	0.16	0.31	NA
2-Butanone (MEK)	0.56	1.11	0.73	0.53	200000
2-Methylbutane	2.54	9.73	6.69	1.12	1770000
3-Methylpentane	0.18	0.25	0.29	0.11	500000
Acetone	6.19	7.14	6.41	5.04	500000
Benzene	0.30	0.18	0.44	0.22	500
Carbon tetrachloride **	ND	ND	0.46	ND	5000
Chloromethane	0.55	0.52	0.59	0.50	50000
Dichlorodifluoromethane **	0.58	0.56	0.66	0.58	1000000
Ethylbenzene	0.13	0.12	0.22	ND	1000000
Isohexane	0.22	0.22	0.72	0.16	100000
Methylene chloride	0.45	0.60	0.62	ND	50000
n-Butane	0.76	0.64	1.45	0.55	800000
n-Hexane	0.18	0.26	0.26	0.13	50000
n-Pentane	0.97	1.30	1.73	0.34	600000
o-Xylene	0.10	0.09	0.18	ND	100000
p-Xylene/m-Xylene	0.26	0.21	0.44	ND	100000
Tetrachloroethene	ND	0.16	ND	ND	25000
Toluene	0.84	1.91	1.11	0.33	50000
Trichlorofluoromethane **	0.35	0.33	0.41	0.31	1000000
TNMHC	19.72	30.07	30.23	10.82	NA

NOTES: ppbv = parts per billion by volume
ND = not detected
NA = not available
VOC = volatile organic compounds. VOCs may be shown 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 2006)
** Ozone depleting compounds

TABLE 5-7. Summary of Radionuclide Releases from the 17 NESHAP Sources in 2006

TA	Facility Name	Monitoring Method *	Used in Dose Calculation?	Radionuclide	Reported Release (Ci/yr)
I	Sandia Tomography and Radionuclide Transport (START) Laboratory	Calculation	No	N/A	0
I	Radiation Laboratory	Calculation	No	^{3}H ^{13}N ^{41}Ar	1.0E-05 2.0E-07 1.0E-09
I	Calibration Laboratory	Calculation	No	^{3}H	2.0E-05
I	Neutron Generator (NGF)	Continuous	Yes	^{3}H	31.8
I	TANDEM Accelerator	Calculation	No	^{3}H	1.0E-05
I	Metal Tritide Shelf-Life Laboratory	Calculation	No	^{3}H	5.0E-09
I	Cleaning and Contamination Control Laboratory (CCCL)	Calculation	No	Activities Terminated	0
I	Process Research Development (PRD) Laboratory	Calculation	No	N/A	0
I	Radiation Protection Sample Diagnostics Laboratory (RPSD)	Calculation	No	^{241}Am ^{243}Am ^{36}Cl ^{244}Cm ^{57}Co ^{60}Co ^{134}Cs ^{137}Cs ^{55}Fe ^{3}H ^{54}Mn ^{63}Ni ^{236}Pu ^{238}Pu ^{239}Pu ^{241}Pu ^{242}Pu ^{226}Ra ^{228}Ra ^{90}Sr ^{99}Tc ^{232}Th ^{232}U ^{233}U ^{236}U ^{238}U ^{65}Zn	1.0E-05 3.9E-13 1.2E-08 1.3E-10 1.3E-10 1.3E-10 1.2E-08 1.2E-08 1.3E-10 1.2E-08 1.3E-10 1.3E-10 3.9E-13 3.9E-13 3.9E-13 3.9E-13 3.9E-13 1.3E-10 1.3E-10 1.3E-10 1.2E-08 1.3E-10 3.9E-13 3.9E-10 1.3E-10 1.3E-10 1.0E-15
II	Explosive Components Facility (ECF)	Calculation	No	^{3}H	8.0E-04
III	Mixed Waste Landfill (MWL)	Periodic	Yes	^{3}H	0.09
III	Radioactive & Mixed Waste Management Facility (RMWMF)	Continuous	Yes	^{3}H ^{241}Am ^{90}Sr ^{137}Cs	10 HTO, 0.74 elemental 2.2E-05 3.5E-07 1.4E-07
IV	High Energy Radiation Megavolt Electron Source III (HERMES III)	Periodic	No	^{13}N ^{15}O	1.4E-03 1.4E-04
IV	Z-Facility (Accelerator)	Calculation	No	^{3}H	6.6E-03
V	Hot Cell Facility (HCF)	Periodic	Yes	N/A	N/A
V	Annular Core Research Reactor (ACRR)	Periodic	Yes	^{41}Ar	4.86
V	Sandia Pulsed Reactor (SPR)	Periodic	Yes	^{41}Ar	7.0E-03

NOTES: *Monitoring Method: Periodic = Based on periodic measurements; Continuous = Based on continuous air monitoring results; Calculation = Calculated from known parameters
TA= Technical Area
Ci/yr = curies per year
N/A = not available

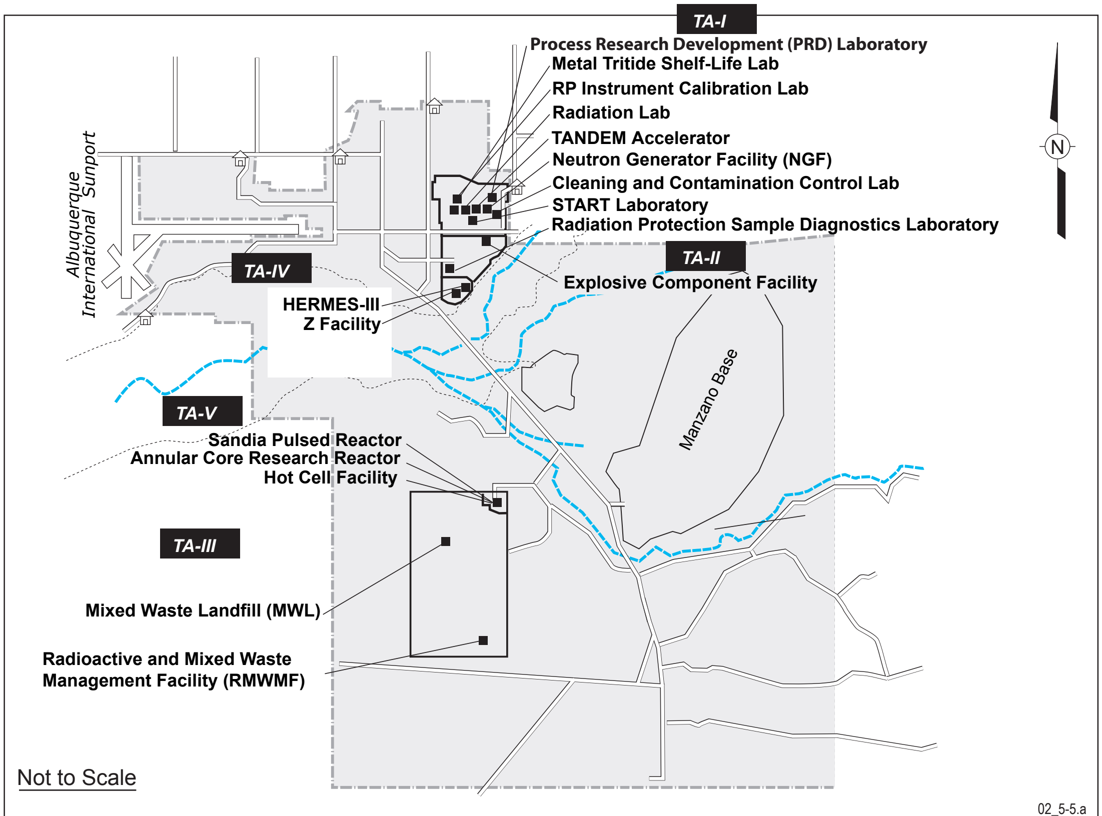

FIGURE 5-5. Locations of the 17 Facilities at SNL/NM that Provided Radionuclide Release Inventories in 2006

Table 5-7 lists the radionuclides and the total reported emissions (in curies [Ci]) from each SNL/NM NESHAP source in 2006. Of the 17 sources, 16 were point sources and one was a diffuse source (landfill). Four of the 17 facilities reported no emissions in 2006.

The 17 SNL/NM NESHAP facilities are illustrated in Figure 5-5 and described below.

<u>TA-I Sources</u>

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

Cleaning and Contamination Control Laboratory (CCCL) – The radiological activities at the CCCL were terminated at the end of CY 2005, therefore there were no emissions for CY 2006. This facility will be permanently removed from the potential facility list.

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. This facility currently emits only tritium. The facility has two stacks, but only utilizes the main stack in the Tritium Envelope North Wing. In 2006, the NGF emitted the largest amount of radionuclides at SNL/NM at 31.8 Ci, based on continuous stack monitoring. Although anticipated tritium releases do not exceed the regulatory threshold requiring continuous monitoring, it is performed voluntarily at NGF as a best management practice (BMP). The increase of tritium at NGF from the previous year was due to an unplanned release of 24 Ci during October 2006 associated with a transfer of about 250 Ci from the mass spectrometer to the Tritium Capture System (TCS).

Process Research Development (PRD) Laboratory – This laboratory is capable of handling and conducting research on tritium materials. It is currently in standby mode and has yet to be operational; therefore, there were no emissions from this laboratory in CY06.

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

Radiation Protection Sample Diagnostics Laboratory (RPSD) – Small-scale radiometric sample analyses on an as-needed basis.

Sandia Tomography and Radionuclide Transport (START) Laboratory – This laboratory is used to perform small-scale experiments. In 2006, there were no radiological emissions from this laboratory.

TANDEM Accelerator – This is an ion solid interaction and defect physics accelerator facility. Although the TANDEM did not operate in 2006, the facility reported potential emissions of tritium housed in the facility.

TA-II Sources

Explosive Components Facility (ECF) – The ECF conducts destructive testing on neutron generators. In 2006, the facility reported emissions of tritium.

TA-III Sources

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, 1993, and 2003, special studies were conducted to quantify the tritium emissions (Anderson 2004). The most recent value, from 2003, is used for their annual inventory.

Radioactive and Mixed Waste Management Facility (RMWMF) – The RMWMF primarily handles low-level waste (LLW), mixed waste (MW), and some transuranic (TRU) waste. In 2006, 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. In 2006, the facility reported releases of nitrogen-13 and oxygen-15.

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, then released as an intense concentrated burst (shot) at a target. In 2006, the facility reported releases of tritium.

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 2006.

Hot Cell Facility (HCF) – The HCF provides full capability to remotely handle and analyze radioactive materials such as irradiated targets. In 2006 there were no reportable emissions.

Sandia Pulsed Reactor (SPR) – The SPR is used to produce intense neutron bursts for effects testing on materials and electronics. Argon-41, an air activation product, was the only reported release in 2006. It was placed into long-term storage in mid-year and will not be re-activated in the foreseeable future.

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 Chapter 9.

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 seven "primary" sources (ACRR, SPR, HCF, Z Facility, NGF, RMWMF, and MWL) are modeled using EPA's CAA Assessment Package-1988 (CAP88) (EPA 2005) to estimate the annual dose to each of 35 identified public receptors.

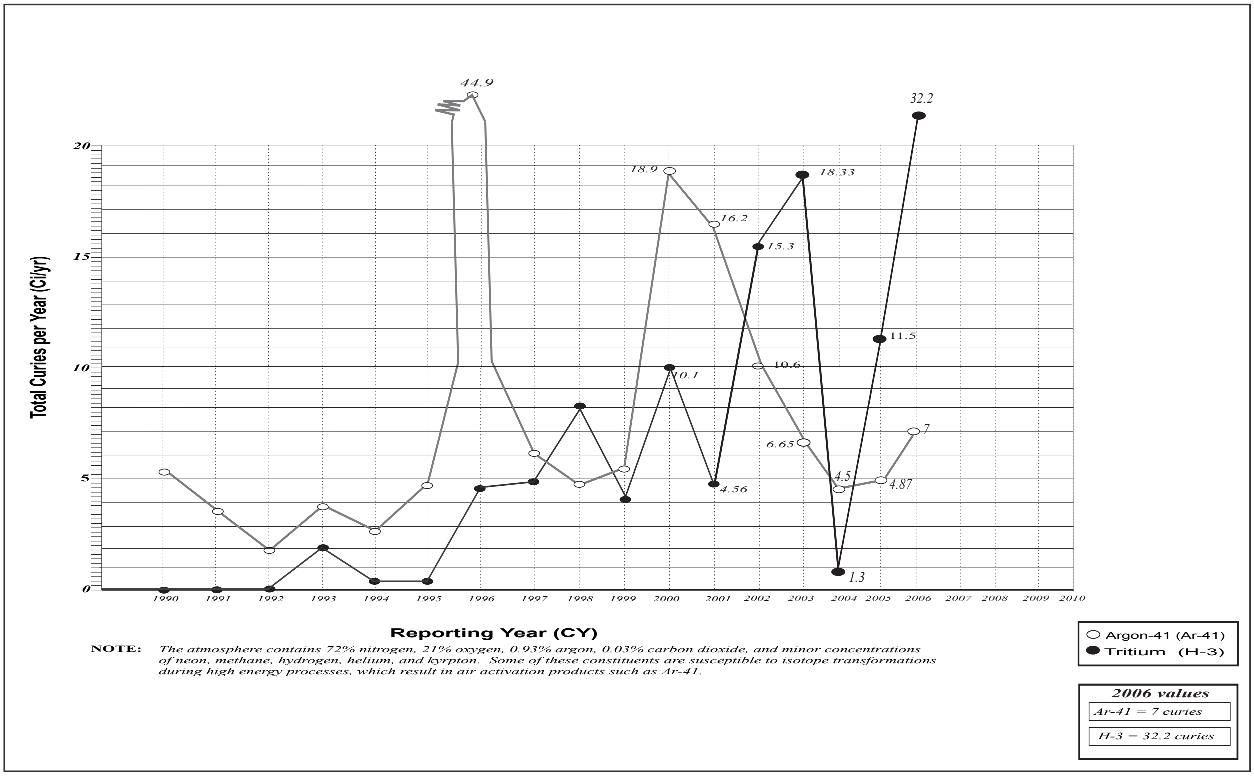

FIGURE 5-6. Summary of Atmospheric Releases in Argon-41 and Tritium from SNL/NM Facilities Since 1990 (Emissions vary from year to year based on operations within the facility)

Primary sources are those that determine their emissions by direct measurements or by calculations based on measured operational parameters. The HCF was the only primary source to report no emissions in 2006.

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 perform continuous stack monitoring. Other facilities base their emission estimates on periodic confirmatory measurements or engineering calculations. In 2006, the highest emissions were tritium and argon-41. The increase in the tritium release in 2006 was due to an unplanned release of tritium from the NGF during a transfer activity. 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 Ci) of tritium and argon-41 over the past 16 years.

Demographic Data

Demographic data includes the resident population, the number of beef and dairy cattle, and the utilized food crop area fraction for a 50 mile (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 2006 the NESHAP calculation for resident population was based on the State's 2000 to 2001 estimated urban and county population data and U.S. Census Bureau data (DOC 2007). The beef and dairy cattle numbers and food crop area fraction were calculated using 1998 agricultural statistics. The statistics were supplied by the New Mexico Department of Agriculture (NMDOA 2007). The following values were used in the 2006 CAP88 calculation:

1.927	Dairy cattle/km^2
1.156	Beef cattle/km^2
8.1E-04	Acres of food crops/m^2
793,740	Population (within 50-mi radius)

On-site and Off-site Public Receptors

A total of 31 receptor locations (20 on-site at KAFB and 11 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 Pueblo indian reservation, the Four Hills subdivision north of KAFB, the Manzanita Mountains (with east mountain residents), and areas near the Albuquerque

TABLE 5-8. Annual Source-Specific Effective Dose Equivalent (EDE) to Off-site Receptors in 2006

Receptor	ACRR	MWL	NGF	ECF	SPR	RMWMF	Z Facility	EDE (mrem/ yr)
Albuquerque City Offices	1.30E-05	2.70E-07	2.20E-04	1.30E-08	9.60E-06	5.20E-06	7.40E-08	2.48E-04
East Resident	1.10E.05	2.50E-07	2.20E-04	1.30E-08	7.70E-06	3.40E-06	7.20E-08	2.42E-04
Eubank Gate Area	1.00E-04	4.00E-07	6.00E.04	4.00E-08	6.70E-05	2.30E-05	1.80E-07	7.91E-04
Four Hills Resident	7.40E-06	2.60E-07	2.20E-04	1.30E-08	5.40E-06	2.40E-06	7.20E-08	2.38E.04
Isleta	1.20E-05	2.70E-07	2.20E-04	1.30E-08	8.50E-06	3.60E-06	7.40E-08	2.44E-04
La Luz Childcare	4.40E-05	2.90E-07	2.40E-04	1.40E-08	3.00E-05	1.20E-05	8.30E-08	3.26E-04
Manzano Mesa Apartments	2.10E-05	2.70E-07	2.30E-04	1.40E-08	1.50E-05	5.60E-06	7.80E-08	2.72E-04
Tijeras Arroyo (West)	1.40E-05	2.70E-07	2.20E-04	1.30E-08	9.70E-06	5.20E-06	7.40E-08	2.49E-04
U.S. Geological Survey	2.90E-05	2.90E-07	2.30E-04	1.40E-08	2.00E-05	1.70E-05	7.70E-08	2.96E-04
Veteran's Hospital	2.70E-05	3.20E-07	2.30E-04	1.40E-08	2.00E-05	4.40E-06	7.90E-08	2.82E-04
Willow Wood Housing	2.00E-05	2.70E-07	2.30E-04	1.40E-08	1.40E-05	6.00E-06	7.70E-08	2.70E-04

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

TABLE 5-9. Annual Source-Specific Effective Dose Equivalent (EDE) to On-site Receptors in 2006

Receptor	ACRR	MWL	NGF	ECF	SPR	RMWMF	Z Facility	EDE (mrem/ yr)
Airport	1.70E-04	2.00E-07	2.10E-04	8.80E-09	1.30E-04	2.70E-05	1.20E-07	5.37E-04
ANG Communications Flight	9.00E-05	1.70E-07	2.00E-04	7.40E-09	6.30E-05	2.30E-05	1.00E-07	3.70E-04
Bernalillo County Sheriff Training	1.50E-04	2.30E-07	4.70E-05	2.90E-09	9.70E-05	3.90E-05	2.70E-08	3.33E-04
Chestnut Site	2.00E-04	3.80E-07	2.60E-05	1.60E-09	1.30E-04	3.80E-04	2.20E-08	7.36E-04
Golf Course Club House	4.20E-04	4.70E-07	8.00E-05	6.80E-09	2.40E-04	5.60E-05	1.10E-07	7.97E-04
Golf Course Maintenance Area	3.00E-04	3.60E-07	1.10E-04	1.10E-08	1.80E-04	4.50E-05	1.40E-07	8.36E-04
Honeywell Systems/Support Site	1.20E-04	1.60E-07	1.10E-03	3.70E-08	7.70E-05	2.60E-05	3.40E-07	1.32E-03
LRRI/Lovelace	5.90E-05	1.20E-07	1.90E-05	1.20E-09	4.10E-05	4.00E-05	1.20E-08	1.59E-04
KAFB Fire Station	9.10E-05	1.30E-07	4.20E-04	1.90E-08	6.40E-05	2.20E-05	1.60E-07	5.97E-04
KAFB Landfill	4.50E-05	8.90E-08	2.40E-05	1.60E-09	4.10E-05	1.60E-05	1.60E-08	1.28E-04
Kirtland Storage Site	8.80E-04	8.70E-07	6.60E-05	4.60E-09	5.90E-04	6.70E-05	9.40E-08	1.60E-03
Manzano Fire Station	1.90E-04	2.40E-07	4.50E-05	2.80E-09	1.00E-04	4.20E-05	2.50E-08	3.77E-04
Maxwell Housing	2.00E-05	4.90E-08	1.20E-05	5.40E-10	1.50E-05	6.20E-06	6.30E-09	8.33E-05
New Housing	8.30E-05	1.10E-07	2.20E-04	1.30E-08	5.70E-05	2.00E-05	5.80E-05	3.80E-04
Pershing Park Housing	7.30E-05	1.10E-07	1.90-E04	8.70E-09	5.20E-05	1.90E-05	9.00E-08	3.34E-04
Riding Club	3.80E-04	3.00E-07	5.70E-05	3.70E-09	2.00E-04	6.20E-05	3.70E-08	6.99E-04
Sandia Area Federal/Credit Union	1.00E-04	1.20E-07	2.70E-04	1.40E-08	5.50E-05	2.00E-05	1.10E-07	9.17E-04
Sandia Elementary School	8.10E-05	1.20E-07	2.70E-04	1.40E-08	5.50E-05	2.00E-05	1.10E-07	4.26E-04
Shandiin Childcare	1.00E-04	1.50E-07	3.60E-04	1.40E-08	7.00E-05	2.40E-05	1.80E-07	5.54E-04
Vehicle Maintenance Flight	9.00E-05	1.70E-07	1.80E-04	8.30E-09	6.30E-05	2.30E-05	9.10E-08	3.68E-04

NOTES: ACRR = Annular Core Research Reactor
SPR = Sandia Pulsed Reactor
RMWMF = Radioactive Mixed Waste Management Facility
mrem/yr = millirem per year
ANG = Air National Guard
MWL = Mixed Waste Landfill
NGF = Neutron Generator Facility
LLRI = Lovelace Respiratory Research Institute
KAFB = Kirtland Air Force Base
ECF = Explosive Components Facility
Capeheart East Housing, listed in previous years, was vacant in 2006, undergoing demolition

TABLE 5-10. Calculated Dose Assessment Results for On-site and Off-site Receptors and for Collective Populations in 2006

Dose to Receptor	Location	2006 Calculated Dose	NESHAP Standard
Individual Dose			
On-site Receptor EDE to the MEI	KAFB Storage Facility	0.0016 mrem/yr *(0.000016 mSv/yr)*	10 mrem/yr *(0.1 mSv/yr)*
Off-site Receptor EDE to the MEI	Eubank Gate Area	0.000791 mrem/yr *(0.0000079 mSv/yr)*	10 mrem/yr *(0.1 mSv/yr)*
Collective Dose			
Collective Regional Population[1]	Residents within an 80-km (50-mi) radius	0.084 person-rem/yr *(0.084 person-Sv/yr)*	No standard available
Collective KAFB Population[2]	KAFB housing	0.00074 person-rem/yr *(0.00074 person-Sv/yr)*	No standard available

NOTES: [1]Based on a population of 793,740 people estimated to be living within an 80-km (50-mi) radius.
[2]Based on a population of 953 people estimated to be living in permanent on-base housing.
NESHAP = National Emissions Standards for Hazardous Air Pollutants
mSv/yr = millisievert per year
person-Sv/yr = person-sievert per year
mrem/yr = millirem per year
EDE = effective dose equivalent
MEI = maximally exposed individual
KAFB = Kirtland Air Force Base

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.

Meteorology

Data from four meteorological towers (CW1, A36, A21, and MW1) in the proximity of NESHAP emission sources were used in 2006. Data from each tower consisted of approximately 35,000 hourly observations of wind direction, wind speed, and stability class (inferred from wind and solar insulation 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 horizontal and vertical directions. Individual EDEs to off-site and on-site receptors are presented in Tables 5-8 and 5-9, respectively. Dose assessment results are summarized in Table 5-10.

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 2006, the on-site MEI was located on KAFB at the KAFB Storage Site, NW of TA-V. The on-site MEI was located at the KAFB Storage Site in CY 2005, as well. The MEI dose of 0.0016 mrem/yr at the KAFB Storage Site resulted primarily from releases of argon-41 from the ACRR and SPR, in nearby TA-V. The off-site MEI was located at the Eubank Gate Area. The MEI was 0.00079 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).

Collective Dose

The collective population dose resulting from all SNL/NM radiological emissions was calculated for both KAFB and the regional area (Table 5-10). 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. Sandia 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 2006 was 0.084 person-mrem/yr. This is comparable with the average over the past five years of regional collective population dose data. 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 793,740 residents by doses per sector.

• **KAFB** – A collective population dose for KAFB residents was calculated based on three main housing areas (Maxwell, Pershing Park, and New Housing). Housing demolition and new housing construction at KAFB resulted in fewer residential structures during 2006; however the overall population increased as new housing was brought online. The total population dose for KAFB was obtained by summing the three areas based upon a total residential population of 2,888—a three fold increase over the previous year's population. The CY 2006 calculation resulted in an estimated population dose of 0.0007 person-mrem/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. A complete list of air quality regulations applicable to SNL/NM is given in Chapter 9.

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 (Pb). For these criteria and other pollutants, the EPA:

- Sets ambient air quality standards, including those for motor vehicle emissions;
- Requires state implementation 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 20.11.08 NMAC *Ambient Air Quality Standards*. Compliance with criteria pollutant standards for ambient air is met through on-going applicability determinations on potential criteria pollutant emission sources that require the following: aquisition of the necessary permits and registrations for applicable sources from the appropriate regulatory agencies; fuel throughput tracking, monitoring, and reporting; ambient air surveillance; and periodic direct emission sampling. As discussed previously, ambient air measurements taken in the vicinity of SNL/NM facilities have been well below maximum TLVs and standards for criteria pollutants.

The significant sources of criteria pollutants at SNL/NM are defined as sources that require a permit or registration from a regulatory agency. A majority of the permits and registrations held by SNL/NM are multi-source (including a combination of criteria pollutant emission sources). Significant sources at SNL/NM are listed below.

BOILERS

During CY 2006, SNL/NM maintained six permits and registrations for applicable boilers sitewide. Table 5-11 of this document illustrates the annual fuel usage and associated emissions for CY 2006. The boilers associated with the permits and registrations include:

ECF Boilers – two 4.437 million (MM) British Thermal Units (Btu) natural gas units used to heat the facility.

Processing and Environmental Technology Laboratory (PETL) Boilers – ten 1.4 MMBtu natural gas units used to heat the facility.

Advanced Manufacturing Prototype Facility (AMPF) Boilers – two 1.8 MM Btu natural gas units used to heat the facility

Steam Plant Boilers – Five boilers (three 78.57 MMBtu, one 117.09 MM Btu, and one 214.2 MMBtu) produce steam heat for buildings in TA-I and run primarily on natural gas (but also burn diesel fuel).

Center for Integrated Technology (CINT) Boilers – two 6 MMBtu natural gas units used to heat the facility.

TABLE 5-11. Boiler Usage and Emission Data for CY2006

Permit #	Fuel Usage	Emissions (tpy)				
		NOx	CO	PM_{10}	SO_2	VOC
R#936	17,995,251 scf	0.90	0.76	0.07	0.02	0.05
R#1406	3,485,914 scf	0.39	0.65	0.06	0.005	0.04
#1705	462,020,364 scf	7.21	18.93	1.71	0.14	1.24
	32,498 gallons	0.39	0.08	0.03	0.73	0.003
#1725	5,836,339 scf	0.29	0.25	0.02	0.002	0.02
#1820	34,082,799 scf	0.85	1.43	0.13	0.03	0.09

Microelectronics Engineering Systems Applications (MESA) Complex Boilers – two 20.412 MMBtu and one 10.206 MMBtu natural gas units used to heat the facility

EMERGENCY GENERATORS

During CY 2006, SNL/NM maintained nine permits and registrations for applicable emergency generators sitewide. Table 5-12 of this document illustrates the annual hours of operation and associated emissions for CY 2006. The emergency generators associated with the permits and registrations include:

ECF Emergency Generator – 134.1 hp generator provides emergency power during an unplanned power outage and runs on diesel fuel.

NGF Emergency Generator – 469 hp generator provides emergency power during an unplanned power outage and runs on diesel fuel.

Building 862 Standby Diesel Generators – Four 805 hp generators provide back-up power to various buildings throughout TA-I of SNL/NM and run on diesel fuel.

(RMWMF) Emergency Generator – 192 hp generator provides emergency power during an unplanned power outage and runs on diesel fuel.

Building 702 Emergency Generator – 805 hp generator provides emergency power during an unplanned power outage and runs on diesel fuel.

PETL Emergency Generator – 671 hp generator provides emergency power during an unplanned power outage and runs on diesel fuel.

MESA Complex Emergency Generators – 999 hp and 1609 hp generators provide emergency power during an unplanned power outage and run on diesel fuel.

CINT Emergency Generator – 469 hp generator provides emergency power during an unplanned power outage and runs on diesel fuel.

SE Area of TA-I Back-up Generator–750 hp generator provides emergency power during an unplanned power outage and runs on diesel fuel.

TABLE 5-12. Generator Hours and Emission Data for CY2006

Permit Number	Hours/ CY2006	Emmissions (tpy)				
		NO_x	CO	PM_{10}	SO_2	VOC
#374-M1	10	0.072	0.016	0.005	0.005	0.006
#402a	19.4	0.68	0.18	0.01	0.09	0.02
	18.5					
	18.3					
	19.2					
#415-M1	2.3	6.8E-03	1.5E-03	4.9E-04	4.5E-04	5.4E-04
#924	9	0.081	0.022	0.001	0.010	0.002
#925-M1	9	0.068	0.018	0.001	0.006	0.002
#1678-M1	14	0.16	0.04	0.02	0.01	0.02
	14	0.25	0.07	0.02	0.02	0.03
#1725	8	0.043	0.009	0.003	0.003	0.003
#1828	10	0.09	0.021	0.003	0.030	0.003

a – The emission limits stated in the permit are combined emissions, therefore they are calculated annually as a summed emission for all four units.

CHEMICAL USAGE (HAPS)

During CY 2006, SNL/NM maintained six permits and registrations for applicable HAP chemical usage sitewide. The HAP chemical usage associated with the permits and registrations is for general laboratory usage for R&D purposes. Table 5-13 of this document illustrates the amount of chemicals purchased at the associated facility for CY 2006. The following facilities have permits or registrations for chemical usages:

- ECF HAP Chemical Usage
- PETL HAP Chemical Usage
- AMPF HAP Chemical Usage
- NGF HAP Chemical Usage
- RMWMF HAP Chemical Usage

TABLE 5-13. HAP Chemical Usage Reportable Data for CY2006

Permit #	Pounds/Year	Tons/Year
R#936	1,199	0.60
R#1406	4	0.002
#374-M1	32	0.02

MISCELLANEOUS NEW SOURCE REVIEW (NSR) PERMITS

- **Document Disintegrator** is an industrial-size, classified document shredder.
- **Thermal Test Complex (TTC)** is an enclosed R&D fire test complex and an important element in the revitalization of SNL/NM test capabilities needed for test article qualification, development, surveillance, investigation, and modeling. Table 5-14 of this document illustrates the reportable emissions associated with the TTC for CY 2006

TABLE 5-14. TTC Reportable Emissions for CY2006

Pollutant	Emissions (tpy)
NO_x	7.3E-03
CO	0.40
PM_{10}	0.37
SO_x	0.02
VOC	0.67
HAP	0.14

OPEN BURN PERMITS

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, R&D activity), and
- **Igniting Rocket Motors** (with greater than 4,000 lb of fuel).

FUGITIVE DUST

As required by 20.11.20 NMAC, *Fugitive Dust Control*, DOE obtains fugitive dust permits for each of Sandia's applicable projects that will disturb greater than ¾ acre of soil.

VEHICLES

The majority of government vehicles at SNL/NM are owned and managed by the General Services Administration (GSA). 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 20.11.100 NMAC, *Motor Vehicle Inspection Decentralized*, Sandia submits an annual vehicle inventory update and inspection plan to the COA for the applicable SNL/NM owned vehicles.

5.5.2 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 tons per year (tpy) or greater of any criteria pollutant,
- 10 tpy of any single HAP, and
- 25 tpy of any combination of HAPs.

Background

The DOE/NNSA/SSO submitted Sandia Operating Permit application 515 (DOE 2002a) on March 1, 1996, since potential emissions for SNL/NM were greater than 100 tpy of criteria pollutants. The COA has yet to issue the final permit. An updated application will be submitted to COA during CY 2007 to reflect current emission sources and their associated potential emissions.

Permit Fee Structure

The COA regulations require source owners to pay air emission fees, which are implemented under 20.11.02 NMAC, *Permit Fees*. The sources included in the fee determination for SNL/NM include the COA NSR permitted and registered sources as summarized in Chapter 9 Table 9-1. Total fees are based on the permitted emission limits that are requested in the NSR permit/registration applications, which are incorporated into the issued NSR permit/registration. In 2006, Sandia paid an annual fee of $8,014 based on a rate of $31 per ton of permitted emissions.

5.5.3 Stratospheric Ozone Protection

Title VI of the CAAA of 1990 required EPA to establish regulations to phase out the production and consumption of ozone depleting substances (ODS). ODS are defined as chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), and other halogenated chemicals that have been found to contribute to the depletion of the stratospheric ozone layer. EPA has established regulations in 40 CFR Part 82 that require the following: recycling of ODS during servicing of equipment; establishment of requirements for recycling and recovery equipment, technicians, and reclaimers; repair of substantial leaks in refrigeration equipment containing greater than 50 pounds of refrigerant; and establishment of safe disposal standards.

At SNL/NM, ODS are mainly used for comfort cooling for buildings, air conditioning units in vehicles, and water cooling units in drinking fountains. Halon is contained in some fire suppression systems and some fire extinguishers.

Sandia remains committed to the reduction of ODS and has been working towards replacing Class I refrigerant chillers with a cooling capacity of 150 tons or greater—a secretarial goal set by the DOE. Replacement is part of a larger upgrade to improve the reliability and overall efficiency of the associated chilled water systems. There are currently 92 refrigerant chillers (>50 pounds) that exist at SNL/NM. Of the existing chillers, twelve of those contain Class I refrigerants and are on the list for replacement.

Section 5.5.4 Compliance Strategies

In 2006 the AQC Program was issued a notice of Violation (NOV) from the COA for boilers installed at the Central Utility Building (CUB) 858J. The boilers installed at CUB 858J were initially registered with the COA for their potential emissions; however, two of the boilers were large enough to trigger the New Source Performance Standards (NSPS) size threshold 10 MMBtu, which requires a permit for the boilers. A negotiation was reached with COA, which allowed SNL to continue operation in the interim of a permit being issued in exchange for an NOV accompanied by a monetary fine. The permit (#1820) was received on September 28, 2006.

The AQC Program has established an annual review process for all issued NSR permits and registrations to ensure compliance with all conditions listed in the permits and registrations. Annual self assessments are completed on the open burn permits, fugitive dust permits, and ODS equipment, as well.

Mule Deer at Coyote Springs

chapter six

WASTEWATER, SURFACE DISCHARGE, STORM WATER MONITORING PROGRAMS & OIL STORAGE AND SPILL CONTROL

In This Chapter...

Wastewater Discharge Program
Surface Discharge Program
Storm Water Program
Oil Storage and Spill Control

Environmental Snapshot

In 2006, the City of Albuquerque (COA) awarded SNL/NM three GOLD and two SILVER "Pretreatment Awards" for outstanding P2 and compliance efforts.

Sandia National Laboratories, New Mexico (SNL/NM) conducts effluent monitoring through wastewater, surface water, and storm water monitoring and surveillance programs. Sandia Corporation (Sandia) 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 (COA). Currently, EPA Region VI implements storm water regulations under the National Pollutant Discharge Elimination System (NPDES). SNL/NM's five wastewater monitoring stations are permitted by the COA. Storm water is the only discharge at SNL/NM regulated by NPDES. Sandia also adheres to the water quality guidelines contained in U.S. Department of Energy (DOE) Orders 450.1, *Environmental Protection Program* (DOE 2005) and 5400.5, Chg 2, *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 closely monitors its liquid effluent discharges to meet regulatory compliance. Sandia 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 3.4.

6.1.1 SNL/NM and the COA Sewer System

COA Publicly Owned Treatment Works (POTW)

SNL/NM's sewer system connects to the COA's sanitary sewer line at four permitted outfalls. SNL/NM also has one additional industrial permitted wastewater outfall (2069G) at the Microelectronics Development Laboratory (MDL), which is upstream of the final discharge location, COA Permit 2069I. During Calendar Year (CY) 2006, SNL/NM submitted a permit application to the COA for the Center for Integrated Nanotechnology (CINT) facility. The COA issued the permit with an effective date of January 5, 2007. Wastewater effluent discharged from the current five outfalls, and the new CINT permit, must meet the COA'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 COA's Code of Ordinances:

www.amlegal.com/albuquerque_nm/

All SNL/NM effluent discharge parameters were within the COA's SUWCO established limits during 2006, except for one potential of hydrogen (pH) event in May 2006 and one fluoride event in November 2006. The events were self-reported, and although they exceeded permitted limits established by the COA, they did not impact the operations of the Publicly Owned Treatment Works (POTW). The May 2006 event caused two excursions at separate locations, hence, those two pH excursions resulted in two COA violations for the single event. These reportable releases are documented in Section 6.1.6 and 6.2.2.

Wastewater Compliance Awards

The COA's reporting requirements are defined under its SUWCO. The SUWCO specifies the discharge quality and requirements that the COA will accept at its POTW. Sandia received three "Gold Pre-Treatment Awards" and two "Silver Pre-Treatment Awards" from the COA for the 2005 to 2006 reporting year (November 2005 through November 2006). A "Gold Pre-treatment Award" is given based on a facility's 100 percent compliance with reporting requirements and discharge limits set in permits or exceptional source reduction and P2.

6.1.2 Permitting and Reporting

The COA POTW, Water Reclamation Division, implements the EPA's water quality standards under the authority of the SUWCO. The DOE/National Nuclear Security Administration (NNSA)/Sandia Site Office (SSO) and Sandia submit semi-annual wastewater reports to the COA. The primary regulatory drivers for the Wastewater Program and important program documents and reports are listed in Chapter 9.

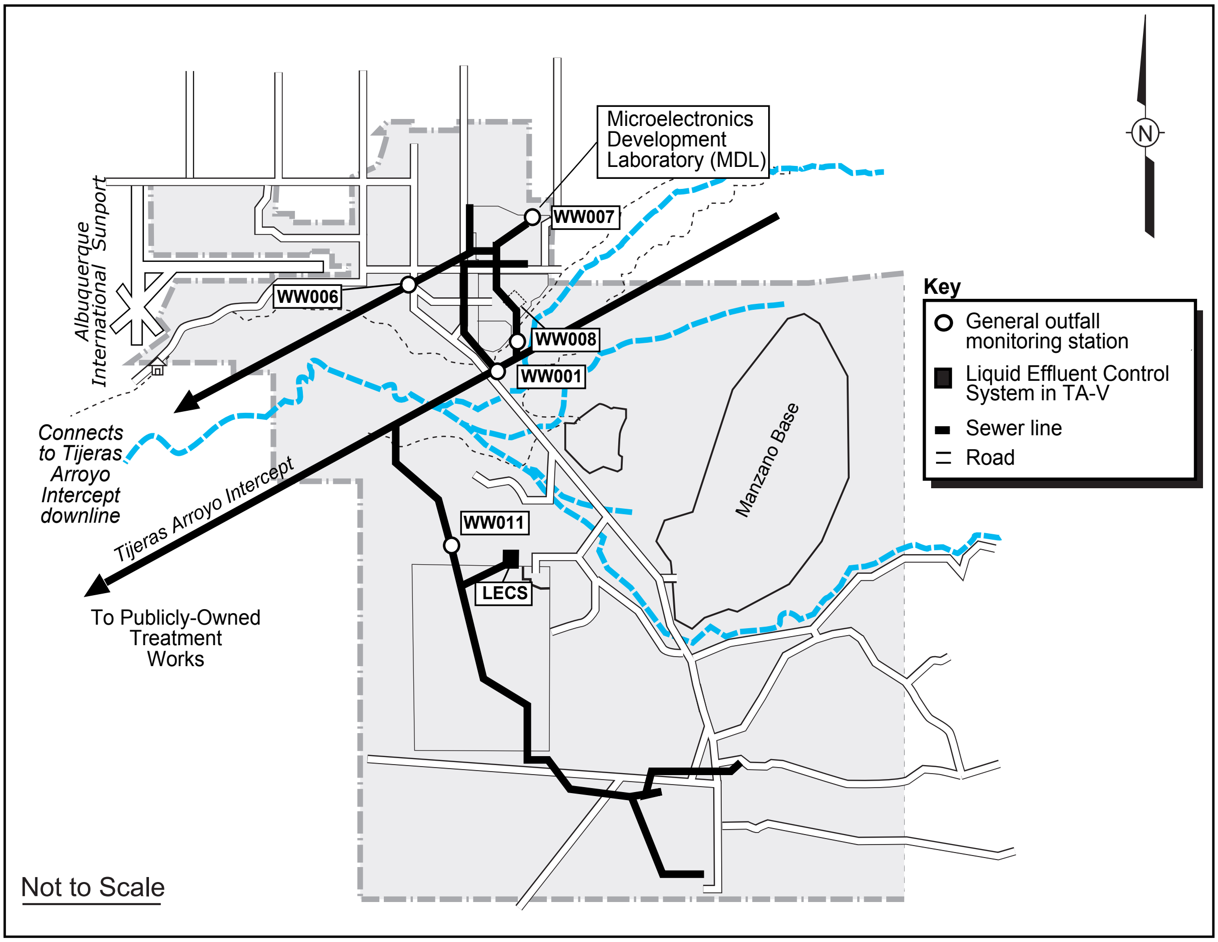

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FIGURE 6-1. Wastewater Monitoring Station Locations

Discharge Control Program

The Water Quality Group (WQG) at SNL/NM 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. 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 restroom lavatories, sinks, and fountains, are not required to obtain an internal permit.

6.1.3 Wastewater Monitoring Stations

DOE/NNSA/SSO and Sandia have five on-site outfalls permitted by the COA (Figure 6-1). Wastewater permits are listed in Chapter 9, Table 9-1. 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 800,000-1,000,000 gallons (gal) of wastewater per day to the public sewer.

The EPA has established categorical pre-treatment standards for specified classes of industrial discharges. Station WW007 (COA Permit 2069G) monitors the wastewater discharged from the Acid Waste Neutralization (AWN) System at the MDL in Technical Area (TA) I.

Wastewater Monitoring

All outfall stations are equipped with flow meters and pH sensors to continuously monitor wastewater

Wastewater Analyte Parameters

Metals
Aluminum, Arsenic, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Silver, Zinc

Radiological
Gamma spectroscopy, Gross alpha, Gross beta, Tritium

General Chemistry
chemical oxygen demand (COD), Cyanide, Formaldehyde, Oil and grease, Phenolic compounds,

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

General Outfall	
WW001	All waste streams
WW006	All waste streams
WW008	All waste streams
WW011	All waste streams
Categorical	
WW007	MDL
Not Permitted	
LECS	Radiological screening of TA-V process water

NOTES: "All waste streams" include both domestic and industrial discharges.
TA-V = Technical Area V
LECS = Liquid Effluent Control System
MDL = Microelectronics Development Laboratory

24 hours-a-day, 365 days-a-year. In the event that permit limits are exceeded, an auto-dialer will contact personnel at SNL/NM, and the DOE/NNSA/SSO is required to notify the COA within 24 hours. Wastewater Discharge Permits and Station Characteristics are listed in Table 6-1.

Sandia splits wastewater samples taken from SNL/NM outfalls with the COA 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 sends SNL/NM split samples to an EPA-approved laboratory for analysis. Sampling results are compared with results obtained by the COA. Currently, the procedure is to sample randomly from a list of potential pollutants. The COA determines which parameters it plans to analyze. Station parameters are listed in the shaded box (shown above).

Septic Systems

Sandia maintains five 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 periodically obtains samples from these active tanks prior to pumping and discharge.

6.1.4 TA-V Radiological Screening

Sandia maintains research and engineering reactors in TA-V. These reactors and support facilities have the potential to produce radioactive process wastewater that includes liquids from floor drains, lab sinks and other drains located in buildings that use, process, or store radioactive materials. To ensure that all wastewater from these facilities meets regulatory standards, liquid effluent is separated into two process streams defined as reactor and non-reactor wastewater. Non-reactor wastewater is from restrooms and non-radioactive laboratory activities. Reactor process wastewater from areas that use, process, or store radioactive materials is channeled to holding tanks where it can be screened for radiological contaminants within the Liquid Effluent Control System (LECS).

The LECS was developed as a control system to maintain the integrity of COA's sanitary sewer system by collecting, analyzing, and handling SNL/NM reactor process wastewater from TA-V reactor activities. 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 regulatory limits, the water will not be released to the sanitary sewer system, 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 medical radioisotopes. Once the activity is at or below regulatory levels, the water can be safely discharged to the public sewer system. The LECS consists of three 5,000 gal holding tanks with liquid level and radioactive alarm systems, a control room, and an ion exchange filtration unit (treatment processor). The LECS is an engineered facility operating within an established safety envelope. Discharges to the sanitary sewer from the LECS, and other SNL/NM activities, have not exceeded standards for radionuclides at any of SNL/NM's wastewater monitoring stations.

6.1.5 Summary of Monitoring Results

During 2006, Sandia split SNL/NM wastewater samples with both the COA and the NMED. In 2006, laboratory analytical results for these wastewater samples, based on the parameters shown on page 6-4, confirmed that Sandia was in compliance with all COA regulations. COA staff also inspected SNL/NM facilities to ensure that Sandia was in compliance with COA discharge requirements. All water discharged from the LECS in 2006 also met federal regulatory standards and DOE orders for radiological levels in wastewater. All analytical results can be found in Appendix A.

6.1.6 Sanitary Sewer System Releases in 2006

Reportable occurrences and environmental releases in 2006 are discussed in Section 2.2.1. There were two reportable events to the COA in 2006.

The 2006 reportable releases are documented and summarized as follows:

On May 28, 2006, the pH limit of 5 to 11.5 was exceeded for approximately two hours due to a valve failure at the AWN system within Building 858 that caused an uncontrolled injection of sodium hydroxide into the system. A maximum pH of 12 was recorded at permitted station 2069G, and a maximum of 12.6 was recorded at permitted station 2069I. (Basin G flows into Basin I [as stated in 6.1.1], and violations were issued for both Basin G and Basin I, though no monetary penalties were issued). The COA was notified, the faulty valve was isolated and replaced, and the AWN system resumed control of normal operations. Subsequently, significant corrective actions were developed to reduce the risk of future violations at the MDL by implementing changes in operational practices, as well as physical controls such as installing berms and new auto-dialer alarms.

On November 27, 2006, hydrofluoric acid (HF) was inadvertently discharged into the laboratory acid waste drain instead of the laboratory HF drain, which flows to the fluoride removal system. Site operating personnel were notified and immediately began monitoring the effluent fluoride concentration. COA was notified when the fluoride concentration exceeded the fluoride concentration limit of 36 ppm and continued to climb to the maximum monitoring limit of 100 ppm. The fluoride level remained above the maximum COA discharge limit of 36 ppm until the residual fluoride passed through the system; at which time, the fluoride concentration returned to < 10 ppm, which is well within normal operating parameters.

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 state's groundwater and surface water for potential use as a domestic potable water source (Table 6-2). The primary regulations and 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 Internal Surface Discharge

Program. 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 NMED water quality standards, alternative methods of disposal are found.

2006 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 2006, 29 individual surface discharge requests were made; all met state standards and were approved by the Surface Discharge Program.

6.2.2 Surface Discharge Releases in 2006

The Surface Discharge Program must be contacted in the event of an accidental release or spill to the ground surface. In 2006, seven surface discharge releases were reported to outside agencies. All seven were reported to NMED. One of these also required notification to the National Response Center (NRC). Environmental releases and occurrences are briefly summarized below and in Section 2.2.2.

On February 15, 2006, a release of chilled water was reported to NMED. The release occurred on property of the DOE/Sandia located on KAFB, Bernalillo County, New Mexico in the NW quadrant of TA-I, near Building 802. The release began at approximately 3:30 PM on a Wednesday, and the flow was stopped at approximately 3:45 PM. The release was reported to NMED at approximately 11:45 AM on February 16, 2006. SNL Facilities personnel were notified shortly after the release began and were able to shut down the flow approximately 20 minutes after it began. The line was repaired and evaluated for potential failure in the future. Due to the small volume of water released and the low concentration of additives, it was determined the environmental impact was negligible, and no cleanup was conducted. The decision to report this incident to NMED was based on the release to a storm drain, not environmental impacts.

A leak at a sanitary sewer cleanout north of Building 820 was noted at approximately 4:45 PM Monday February 20, 2006. The following morning the cleanout was opened and a sewer blockage removed at approximately 10:30 AM, and DOE/NNSA/SSO was notified. The release was reported to NMED at approximately 10:00 AM on February 22, 2006. The source of the release was a blocked sanitary sewer pipe caused by several cloth rags. It is estimated that less than ten gal of untreated sewage was released, and less than two gal entered the storm drain system. Approximately three gal of water mixed with chlorine bleach was applied to the wet asphalt, then the area was flushed with potable water. An attempt was made to locate the person responsible for the incident to inform them it is against Sandia policy to dispose of any cloth material via the sanitary sewer system.

On March 23, 2006, approximately 3,500 gal of water leaked from an underground tank, near Building 6588, that collects water from various areas within TA-V. The water, based on information provided in the spill reports to NMED, exceeded ground water standards for cadmium. Mitigative actions were taken and appropriate notifications made to NMED officials. A subsequent release, after heavy reains, was reported to NMED on June 28, 2006, resulting from the same conditions that were noted in the previous March 2006 report to NMED. The leaking tank was subsequently cleaned, which reduced the potential for future releases of contaminants to the soil column. Since the tank was in a small enclosure 25 feet underground, it was determined to be unsafe for entry. SNL/NM utilized a unique sludge removal process that incorporated a remote controlled robot called SWARMY that accomplished complete removal of sludge from the tank. Sandia Engineering Reactor (SER) Tank 2 has now been isolated, and future collection of water is not expected.

An old spill was located at the west side of Building 20358, formally a DOE operated museum. The stained soil was brought to the attention of DOE on April 21, 2006. The age and duration of the discharge is unknown. The visible soil staining covers a roughly elliptical area approximately six feet by four feet. The depth of the stain is approximately five inches at the darkest location. The volume of the discharge is unknown. Samples of the stained soil were collected and preparations for removal of all stained soil were conducted. All material was removed in May 2006, and the sampling at the spill site after clean up showed total petroleum hydrocarbon loads to be below New Mexico residential standards.

A dielectric oil release occurred on the property of the DOE/SNL located on KAFB, Bernalillo County, New Mexico from TA-I at Building 888. The release was detected during a routine monthly inspection of an underground storage tank (UST) system on May 11, 2006 at approximately 9:30 AM. The initial release is suspected to have occurred on May 4, 2006. The source of the release is from a six inch, wrapped, steel pipe that is connected to two 20,000 gal USTs. The pipe is the return line from a test unit in Building 888 back to the USTs. The leak occurred at a pipe joint approximately one inch above ground level. The pipe is normally empty because the oil is either in the test unit inside Building 888 or in the USTs. The volume of the release was approximately two to three ounces. The soil adjacent to the pipe was dry and showed no visible signs of contamination 1/2 inch below the ground surface. The tank and piping passed a tightness test on September 19, 2005. Corrective actions taken are: the pipe is empty and has been placed out of service, a local storage tank vendor has been contacted to repair the piping system, and all contaminated soil has been cleaned up and will be managed as a New Mexico Special Waste. Soil samples were analyzed for Total Petroleum Hydrocarbons (TPH) after the pipe had been repaired. All sample results were transmitted to NMED. A 15 day report was sent to NMED as required by 20.5.7.700 B New Mexico Administrative Code (NMAC).

A release of sodium hydroxide (NaOH) began at approximately 10:30 AM Wednesday November 29, 2006 during delivery of a chemical tote containing 300 gal of a 45 percent solution of NaOH. The tote fell from the delivery truck and landed on its side, and the top bung failed resulting in an initial release of 100 to 150 gal of NaOH. The tote also sustained structural damage and continued to lose fluid until a recovery team was able to transfer the remaining NaOH to another container. The incident was under control at approximately 2:50 PM. The release was reported to DOE on November 29, 2006 at approximately 11:45 AM. At approximately 3:25 PM it was determined that a reportable quantity (RQ) of NaOH had been released. A report was made to the NRC at 4:20 PM and NMED at approximately 4:35 PM. At the request of SNL Environment, Safety, and Health (ES&H) personnel, and with concurrence from the SNL Incident Command, two earthen check dams were constructed in the open storm channel to prevent further transport of NaOH. Approximately 15,000 gal of water was then introduced to the inlet at Building 858 to flush the below grade section of the drainage system. Vinegar (5 percent acetic acid) was also added at various points to neutralize the flush water. The water was allowed to pond overnight at the first check dam to assist with the mixing/neutralization process. The exact amount of material that went into the storm drain versus that which was recovered is unknown.

TABLE 6-2. NMWQCC Monitoring and Reporting Requirements

Action	Frequency	Reporting
Inspection of Lagoons	Monthly	Documented in checklists
Drain, clean and inspect lagoon and liner	Annual	Annual
Water-level readings	Annual	Annual
Major cations, anions, and TDS	Biennial	Biennial
Purgeable organics using EPA Method 8240	Biennial	Biennial
Extractable organics using EPA Method 8270	Biennial	Biennial

NOTES: NMWQCC = New Mexico Water Quality Control Commission
TDS = total dissolved solids
EPA = U.S. Environmental Protection Agency

It is estimated that anywhere from 150 to 240 gal may have flowed into the storm drain. A causal analysis investigation was initiated to determine what actions Sandia can take to prevent this type of accident in the future, which resulted in revision of procedures and the development of new operational checklists. On December 4, 2006, authorization was obtained from the COA to discharge the neutralized liquid to the sanitary sewer.

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 in a Discharge Plan (DP-530). 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 secondary containments are designed to hold the entire contents of a tank in the event of an accidental release. Significant volumes of precipitation can collect in the containments during storm events. The water is visually inspected for oil contamination, and any oil present is skimmed off prior to discharge to the TA-IV lagoons.

The DP-530 was first approved for SNL/NM Pulsed Power Development Facilities located in TA-IV for Lagoons 1 and 2 on March 8, 1988. The discharge plan was submitted pursuant to 20.6.2.3106 NMAC of the NMWQCC Regulations and was approved pursuant to 20.6.2.3109 NMAC. A renewal application was submitted to NMED during December 2006 that reflects current operations within TA-IV for Lagoons 1 and 2. During 2006, both lagoons were drained, cleaned, and inspected (the lagoons were drained to the sanitary sewer after testing prior to discharge). Monthly inspections were performed and documented in checklists filed in the Customer Funded Record Center and with DOE/NNSA/SSO.

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. The Storm Water Program works in coordination with the P2 Group, the Surface Discharge Program, Facilities Engineering, 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 controls potential contaminants that may be picked up by storm water runoff by routing all industrial waste water to the sanitary sewer and storing most chemicals indoors. Sandia also limits storm water contact with chemical storage containers and carefully controls 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 these basins 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. Appropriate approvals must be granted by the state for discharges to the storm drain system or by the COA for discharges to the sanitary sewer. Required approval to outside agencies is obtained through the DOE/NNSA/SSO.

National Pollutant Discharge Elimination System (NPDES) Regulations

NPDES regulations, under the Clean Water Act (CWA), require any point source discharges to be permitted. Any runoff that flows into the Tijeras Arroyo through a channel, arroyo, conduit, or pipe is considered a discharge point. Overland surface

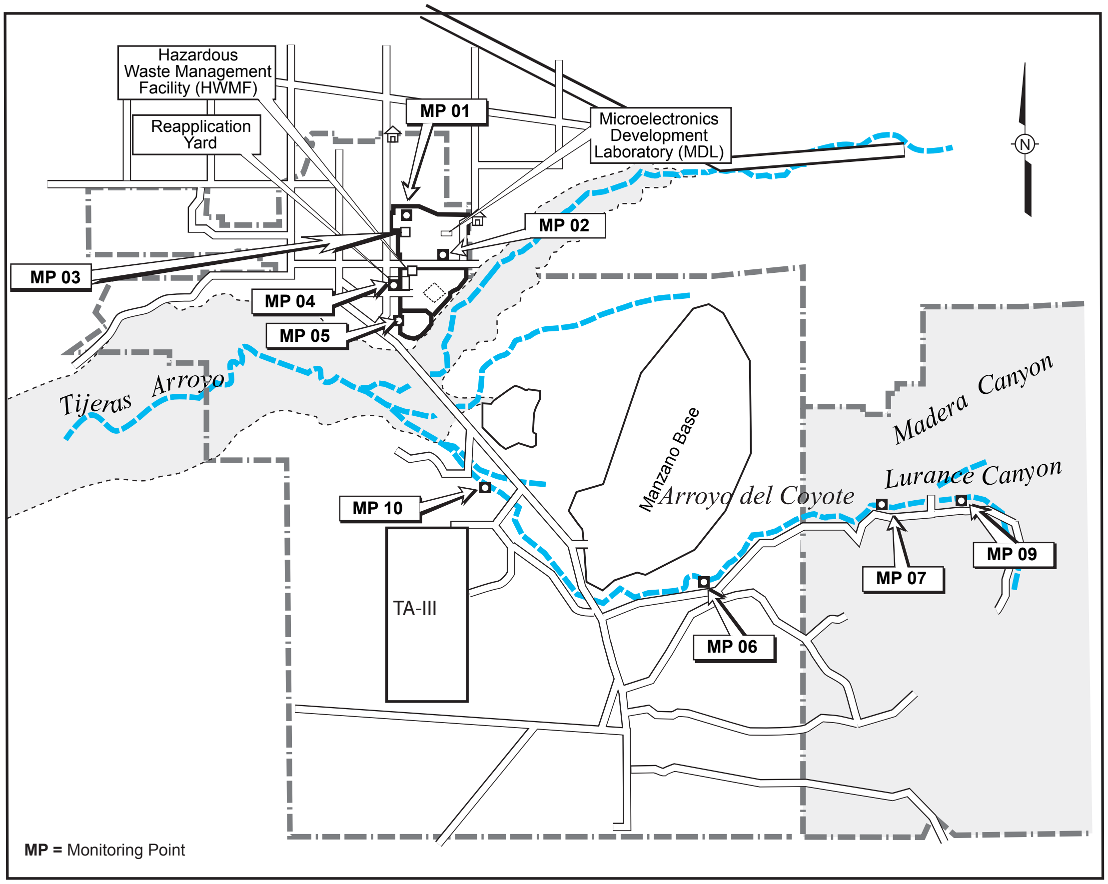

FIGURE 6-2. Storm Water Monitoring Point Locations at Nine Sites

flow, or "sheet" flow, that drains into Tijeras Arroyo is not considered a point source discharge.

The State of New Mexico has defined "Surface Waters of the State" to include "Waters of the U.S." and all other surface water in the State. In order to assist New Mexico in protecting its water resources, the EPA can apply NPDES regulations to discharges to New Mexico's surface waters, even if those waters are not "Waters of the U.S."

As shown in Figure 6-2, Tijeras Arroyo enters KAFB from the northeast, flows just south of TAs I, II, and IV, exits at KAFB's west boundary, and continues about eight miles to its discharge point at the Rio Grande. 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.

Watersheds at SNL/NM

NPDES permits are required if storm water runoff discharges to "Waters of the U.S." or "Surface Waters of the State." Sandia facilities in TAs I, II, and 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 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.", but they do discharge to "Surface Waters of the State"; therefore, NPDES permits are also required for facilities in this area. TAs III and V, and several remote sites, are located in this area.

A new NPDES industrial permit was issued to SNL/NM in January 2001. Four storm water monitoring stations were added to monitor runoff in the Arroyo del Coyote watershed at that time.

NPDES Permit

The EPA provides regulatory oversight for SNL/NM's Storm Water Program. SNL/NM facilities

TABLE 6-3. 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 radio-active waste	- HWMF - Manzano Storage Complex - SWMUs (including those in Lurance and Madera Canyons)
Electronic and Electrical Equip-ment Manufacturing	- Raw chemical storage such as acid and sodium hydroxide - Electroplating processes	- MDL - AMPL - CSRL
Fabricated Metal Products	- Metal Fabrication - Drilling - Turning - Milling	- Machine Shop
Short-Term Construction Permits		
Major Construction Activities in 2005	- Building material pollutants - Disturbed soil	- MESA - CINT - WIF

NOTES: *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 2001b).

AMPL = Advanced Manufacturing Process Laboratory
CSRL = Compound Semi-Conductor Research Laboratory
HWMF = Hazardous Waste Management Facility
SNL/NM = Sandia National Laboratories, New Mexico
MESA = Microsystems & Engineering Sciences Applications
MDL = Microelectronics Development Laboratory
SWMU = Solid Waste Management Unit
CINT = Center for Integrated Nano-Technologies
WIF = Weapons Integration Facility

are covered under the NPDES *Multi-Sector General Permit for Storm Water Discharges Associated With Industrial Activities* issued by the EPA in January 2001 (EPA 2001). Currently, there are nine SNL/NM monitoring points (MPs) on the permit, eight of which collect samples for analytical analysis. This permit was reissued in 2001 for five years and covers four primary industrial activities at SNL/NM as defined in 40 CFR 122.

The current industrial permit expired on September 30, 2005, and EPA has not issued a replacement. However, EPA has authorized current permit holders to continue operations under the expired permit. EPA has indicated a new industrial permit will be issued sometime in 2007. Sandia anticipates adding several new monitoring locations for compliance with this new permit.

Key facilities affected by NPDES regulations are listed in Table 6-3. Chapter 9 lists all applicable regulations and program documents.

Beginning in 2003, construction activities that disturb over one acre (previously, five acres) also require permitting under NPDES. A construction permit requires protection of storm water runoff during and after construction. All areas of the site that are susceptible to erosion must be stabilized upon completion of the project. In December 2006, 15 storm water construction permits and two permit waivers were active. Two permits were pending, and one permitted project was on hold due to funding issues. Construction permits are listed in Chapter 9, Table 9-1.

6.3.2 Storm Water Monitoring Stations

Figure 6-2 illustrates the location of the nine montoring points (MP). MPs 1 through 5 monitor runoff from the majority of industrial activities in TA-I, TA-II, and TA-IV. MPs 6,7,9, and 10 monitor discharges in Arroyo del Coyote.

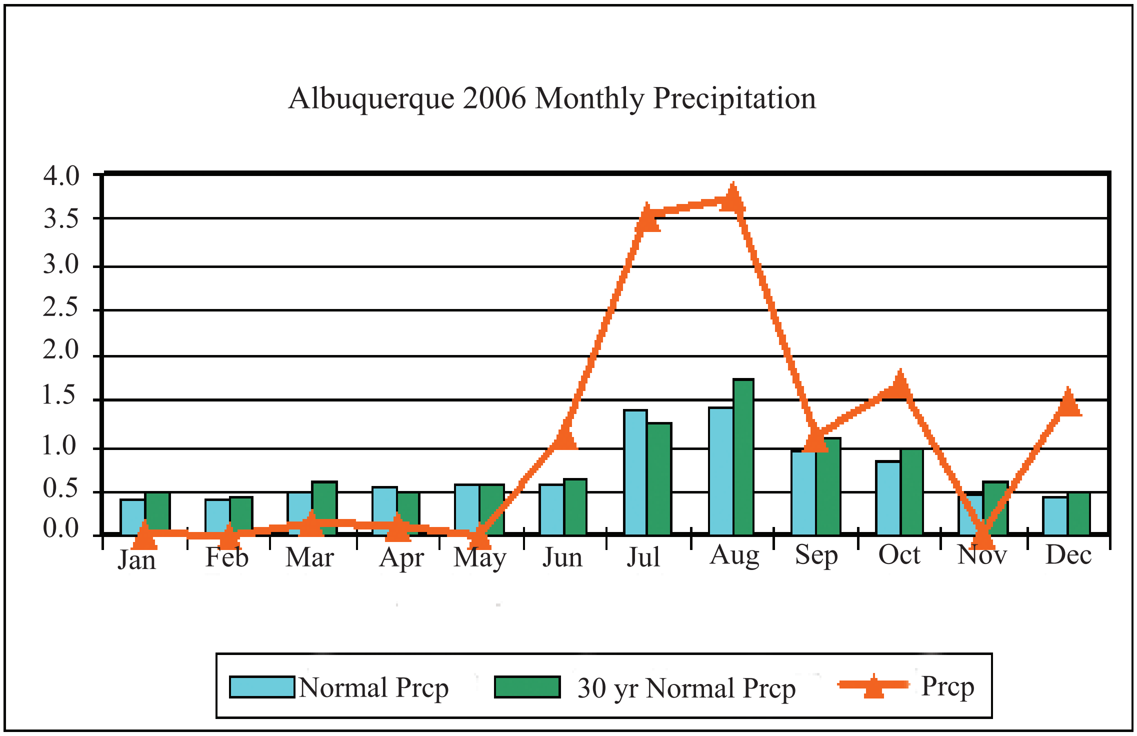

FIGURE 6-3. 2006 Albuquerque Precipitation

6.3.3 Routine Inspections

All routine inspection results are attached to the Storm Water Pollution Prevention Plan (SWP3). Routine inspections include the following:

- ***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 (visual monitoring)*** 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. The pH of the discharge is also measured and recorded. 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 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 the 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 are initiated. If potential pollution problems are uncovered, they are noted in the report along with a schedule for addressing those 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 (Figure 6-3). 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 each monitoring 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 2006 Activities

2006 Sampling Results

Quarterly visual sampling was conducted in 2006. Analytical sampling was not required for this year of the permit.

Visual samples were collected at the five MPs in the developed TAs during the fourth quarter of Fiscal Year (FY) 2006. Visual observations are not conducted at the remote MPs due to safety concerns for personnel in remote areas during inclement weather. No visual observations were made during the first three quarters of FY 2006 due to a lack of runoff or because the runoff occurred outside normal business hours. The visual observations that were performed in FY 2006 were conducted as described under "wet weather inspections." No unusual characteristics were noted.

NMED had previously detected potential depleted uranium (DU) in storm water runoff at ER Site 28-2. A portable sampler was placed at the site and a sample of runoff collected on July 13, 2006 and analyzed for radiation contamination. Uranium total (U_{tot}) was 0.000449 milligrams per liter (mg/L). The gross alpha was 8.39 picocuries per liter (pCi/L), which is well below New Mexico's Surface Water Standard of 30.0 pCi/L for livestock watering. It was concluded that there is no DU contamination in runoff from this site.

A fecal coliform sample was collected on July 17, 2006 to comply with New Mexico requirements in the Multi-Sector General Permit. The result was transmitted to NMED. The sample exceeded the Total Maximum Daily Load (TMDL) value that has been set for the reach of the Rio Grande that receives the Tijeras Arroyo discharge. This does not infer that the TMDL was exceeded at SNL/NM. Only one sample was collected for compliance purposes. In order to determine the actual load that was discharged by SNL/NM, a series of flow weighted samples collected over a 24 hour period would be required. The analytical results from this series would then be statically analyzed to determine the actual load discharged at SNL/NM. Regulations do not require this. The actual flow lasted approximately two hours at SNL/NM's outfall and may not have reached the Rio Grande. There is not enough information from the one required sample to determine a daily load, and Sandia is not required to calculate a daily load. Sandia fully complied with the permit by collecting a single sample and submitting the results to NMED.

6.4 OIL STORAGE AND SPILL CONTROL

Sandia has an oil storage capacity of 3.6 million gal in 51 aboveground storage tanks (ASTs) and five USTs. This does not include oil-containing equipment and transformers. Additional oil storage capacity in 55 gal drums occurs throughout the site on an as needed basis. All oil storage sites with regulated containers must be equipped with secondary spill containment. Secondary containment structures include concrete-lined basins, retaining walls, containment reservoirs, earthen berms, sloped pads, trenches, and containment pallets.

A Spill Prevention Control and Countermeasures (SPCC) Plan is required under the CWA. SNL/NM's SPCC Plan was revised in 2005 to incorporate changes to 40 CFR 112 and 20.5 NMAC. 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, and 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.

SNL/NM's SPCC Plan describes oil storage facilities and the mitigation controls in place to prevent inadvertent discharges of oil. Facilities at SNL/NM subject to the regulations include:

- Oil storage tanks (USTs and ASTs)
- Bulk storage areas (multiple containers)
- Temporary or portable tanks

Table 9-1 lists the permit numbers for those tanks that are registered with NMED. SNL/NM's State of New Mexico Owner ID Number is 14109.

USTs

Five USTs are currently operating at SNL/NM. Two 20,000 gal fiberglass USTs at SNL/NM are registered with NMED; one additional UST, used solely for emergency power generation, is exempt from New Mexico requirements, but is covered by federal regulations in 40 CFR 280; and two USTs in TA-III are exempt from state and federal requirements because they contain insignificant quantities of regulated substances.

ASTs

Fifty-one ASTs are currently operating at SNL/NM. In 2002, the State of New Mexico passed oil storage regulations that required the registration of all oil storage tanks with a storage capacity greater than 1,320 gal, but less than 55,000 gal. Seven ASTs at SNL/NM are registered with NMED.

Aboveground Storage Tank
Photo by: Chip Roma

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chapter seven
GROUNDWATER PROGRAMS

Environmental Snapshot

The Groundwater Protection Program (GWPP) is responsible for tracking information on all wells owned by Sandia, including Environmental Restoration (ER) Project wells and characterization boreholes. The primary purpose of the GWPP Well Registry and Oversight Task is to ensure that all wells owned by Sandia are properly constructed and maintained to protect groundwater resources.

<u>In This Chapter...</u>

Overview of Groundwater Programs at SNL/NM
Groundwater Quality Analysis Results
Water Levels

The Groundwater Protection Program (GWPP) and the Environmental Restoration (ER) Project collect groundwater data at Sandia National Laboratories, New Mexico (SNL/NM). Both programs coordinate to monitor wells throughout SNL/NM operational areas and ER sites. Groundwater monitoring is conducted on a quarterly, semi-annual, or annual basis, depending on individual project areas. Water level measurements are conducted monthly and quarterly.

Specific tasks performed in Fiscal Year (FY) 2006 by the GWPP and ER 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 and the ER Project.

Figure 7-2 shows groundwater wells located on and around Kirtland Air Force Base (KAFB). Wells shown in Figure 7-2 include ER monitoring wells, GWPP surveillance wells, City of Albuquerque (COA) production wells, KAFB production wells, U.S. Geological Survey (USGS) monitoring wells, and KAFB Installation Restoration Program (IRP) wells. In FY 2006, 77 wells were sampled by the GWPP or the ER Project and are shown in Figure 7-2.

Please note that groundwater data is reported for the FY 2006 (from October 1, 2005 through September 30, 2006).

7.1 OVERVIEW OF GROUNDWATER PROGRAMS AT SNL/NM

7.1.1 GWPP Activities

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

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

The GWPP is responsible for tracking information on all wells owned by Sandia, 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 by SNL/NM are properly constructed and maintained to protect groundwater resources and ensure groundwater sample representativeness. The GWPP works together with SNL/NM well owners 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 for the abandonment or replacement of a well or borehole is required.

In 2006, groundwater surveillance sampling was conducted at 15 wells and one spring.

U.S. Department of Energy (DOE) orders, the Compliance Order on Consent (COoC), and requirements applicable to the GWPP are listed in Chapter 9 and discussed in Chapter 2.

Trend Data
The GWPP performs trending on groundwater surveillance results by comparing past years' data with current year results. Trend plots for analytes exceeding maximum contaminant levels (MCLs) and human health related maximum allowable concentrations (MACs) are presented in Appendix B, which provides data trends and graphical representation. Data are analyzed to determine if the results are within the 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 below regulatory concern. Conversely, unchanging baseline levels demonstrate Sandia's successful best management practices (BMPs) for groundwater protection.

7.1.2 ER Project Groundwater Activities

ER Project activities are directed by Resource Conservation and Recovery Act (RCRA) regulations that mandate the cleanup and management of active and inactive treatment, storage, and disposal (TSD) facilities. The COoC also provides requirements. Applicable regulations are listed in Chapter 9. The regulatory basis for the ER Project is discussed in Section 3.2.

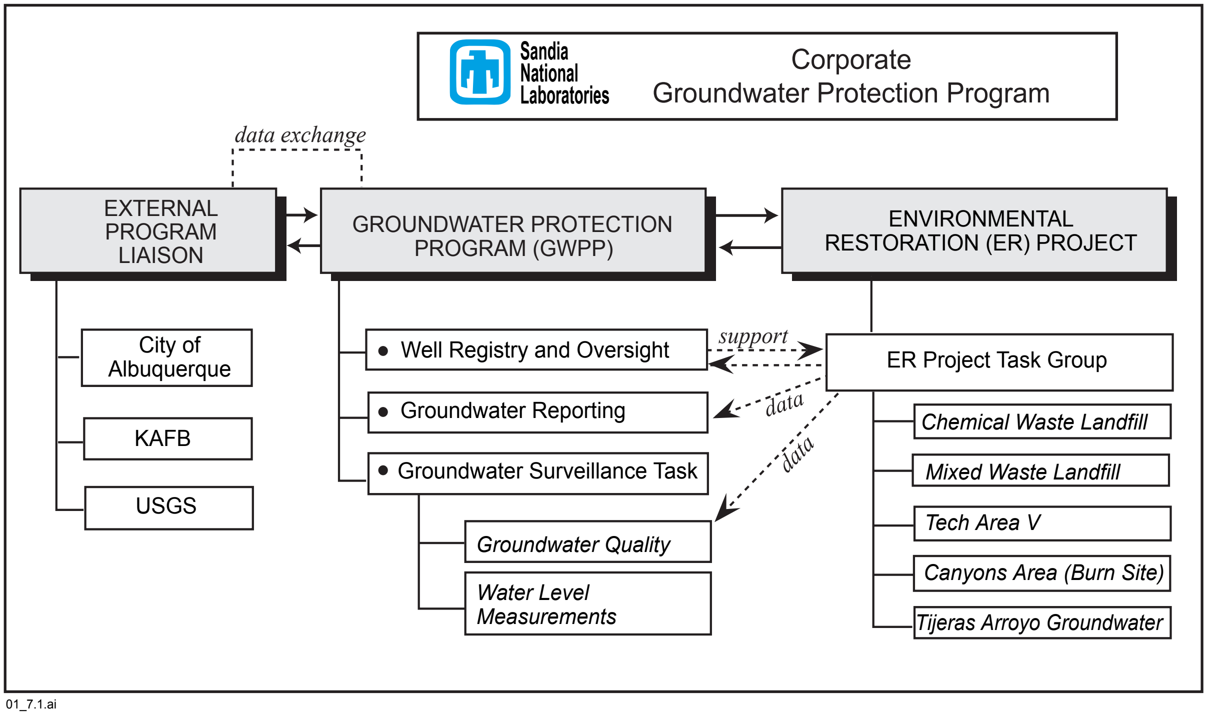

FIGURE 7-1. SNL/NM's Groundwater Programs and Interfaces

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

- Chemical Waste Landfill (CWL),
- Mixed Waste Landfill (MWL),
- Technical Area (TA) V Groundwater Investigation,
- Tijeras Area Groundwater (TAG) Investigation (TA-I, TA-II, & Tijeras Arroyo), and
- Burn Site Groundwater Investigation (Lurance Canyon).

CWL – The CWL is a 1.9 acre former disposal site at the southeast corner of TA-III. From 1962 until 1981, the CWL was used for the disposal of chemical, radioactive, and solid waste generated by SNL/NM research activities. From 1981 through 1985, only solid waste was disposed of at the CWL. In addition, the CWL was used as a hazardous waste drum storage facility from 1981 to 1989. A comprehensive summary of the CWL disposal history is presented in the NMED approved Closure Plan (SNL 1992) and Landfill Excavation Voluntary Corrective Measure (LE VCM) Final Report (SNL 2003). Groundwater contaminants of concern (COC) include Volatile Organic Compounds (VOC) and chromium. The monitoring network at the CWL consists of 13 wells. A total of nine monitoring wells were sampled in FY 2006, including two background wells and seven downgradient monitoring wells. The CWL is discussed further in section 7.2.2.

MWL – The MWL is a 2.6 acre site located in TA-III that was operational from 1959 to 1988 and used to dispose of low-level radioactive and mixed waste (MW). Tritium is the primary COC that has been released to adjacent soils from the MWL. The groundwater monitoring well network at the MWL consists of seven wells.

TA-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 in unsaturated soils. Groundwater COCs at the LWDS are nitrates and VOCs such as trichloroethene (TCE), which was first detected in the groundwater in 1993. There are currently 13 active monitoring wells at this site.

TAG – The TAG Investigation includes groundwater beneath TA-I, TA-II, and Tijeras Arroyo. In FY 2006, there were 21 monitoring wells routinely sampled in the TAG study area. Of these, 11 are regional aquifer wells and 10 are perched groundwater system (GWS) wells. The perched GWS consists of water-bearing strata located several hundred feet above

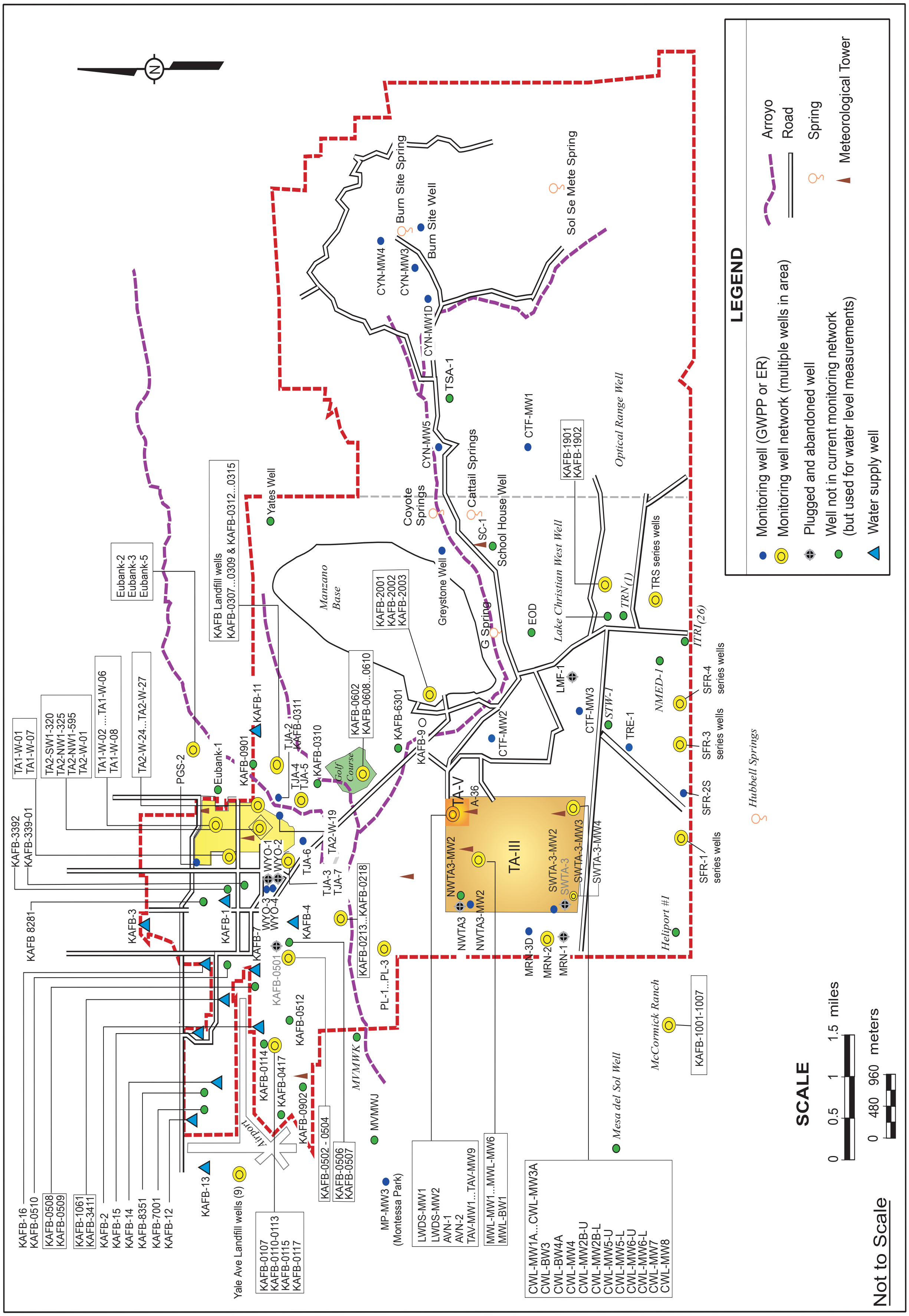

FIGURE 7-2. Wells and Springs on SNL/NM and KAFB

the regional water table that have insufficient yield to be developed for domestic use. TCE and nitrates are the COCs for TAG.

BSGW – The BSGW 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; in 1999, two additional wells were installed, including two piezometers to detect and monitor groundwater flow at the interface of the arroyo sediments and bedrock. To date, both piezometers have remained dry. Three new wells were installed in 2005.

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 shown in Table 7-1. The frequency of groundwater monitoring performed at SNL/NM is shown in Table 7-2. All groundwater samples are analyzed in accordance with EPA protocols.

Water quality results for both the GWPP and the ER Project are summarized in the following pages and in Table 7-3. Exceedances of regulatory criteria for samples collected by SNL/NM monitoring activities appear in Table 7-4 on page 7-14.

7.2.1 GWPP Surveillance Results

Annual sampling of groundwater was conducted by the GWPP Groundwater Surveillance Task during the period of February 14, 2006 to March 13, 2006. Samples were collected from 15 wells and one spring. Groundwater surveillance samples for the GWPP were analyzed for the following parameters: VOCs, dissolved metals (except for mercury), major ions (including nitrate), alkalinity/total phenols, total halogenated organics (TOX), gamma spectroscopy, selected radionuclides, and 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 from each well was analyzed for total mercury.

Groundwater samples from, SWTA3-MW4, MRN-MW2, MRN-3D, NWTA3-MW2, and EOD Hill were analyzed for perchlorate in addition to the above listed analytes. The perchlorate analyses for the first four wells listed were conducted per requirements of the COoC, effective in 2004. The perchlorate analysis of EOD Hill groundwater was conducted to verify prior year analytical results.

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. VOCs were detected in water samples from ten monitor wells. Acetone and methylene chloride were detected in the sample from the EOD Hill well; however, acetone was also identified in the trip blank. This suggests that the sample may have been contaminated during shipment to the laboratory or in the laboratory itself. Similarly, methylene chloride was detected in an associated laboratory method blank indicating laboratory contamination of the sample. Seven wells (Greystone-MW2, MRN-2, MRN-3D, NWTA3-MW2, NWTA3-MW3D, PL-2, and PL-3) had detectable levels of carbon disulfide. In all but the PL-2 results, the values are "J" qualified, which indicates that the amount detected is above the detection limit, but not in a sufficient amount to be quantified reliably. No MCL or MAC values have been established for carbon disulfide. Chloroform was detected at 0.887 µg/L in the sample from the TRE-1 well. The analytical value is also qualified by a "J" designation. Although there is no specific MCL established for chloroform, an MCL of 0.1 µg/L is established for total trihalomethanes. Chloroform is a trihalomethane. In drinking water systems, trihalomethanes are the by-product of disinfection with chlorine containing chemicals. The MAC established by the NMWQCC for chloroform specifically is 100 µg/L.

Non-metal Inorganic Compounds and Phenolics

No groundwater samples exceeded established MCLs for any of the following non-metallic inorganic constituents: nitrate plus nitrite (NPN [reported as nitrogen]), phenolics, TOX, total cyanide, alkalinity (calcium carbonate), and anions (bromide, chloride, fluoride, and sulfate).

TABLE 7-1. Guidelines Used for Groundwater Quality Sample Comparisons

Regulation/Requirements	Standards and Guides	Regulating Agency
National Primary Drinking Water Regulations (40 CFR 141)	Maximum contaminant level (MCL)	U.S. Environmental Protection Agency (EPA)
New Mexico Water Quality Control Commission (NMWQCC) (1) Standards for Groundwater (20 6.2.3103A NMAC Human Health Standards)	Maximum allowable concentration (MAC)	NMWQCC
DOE Drinking Water Guidelines for Radioisotopes (2) (DOE Order 5400.5)	Derived concentration guide (DCG)	Department of Energy (DOE 1993)

NOTES: (1) MACs for Human Health and Domestic Water Supply Standards are identified in the analytical results tables in the appendices. Domestic water supply standards are based on aesthetic considerations, not on direct human health risks.
(2) DOE drinking water guidelines set allowable radionuclide levels in drinking water. The levels are calculated based on published DCGs and correspond to a 4 millirem-per-year (mrem/yr) dose from chronic exposures. This is equivalent to 4 percent of the DCG for ingestion, which is based on an exposure of 100 mrem/yr. These may be different than EPA's standards, where established.

TABLE 7-2. Sample Collection Periods for Groundwater Quality Monitoring at SNL/NM During FY06

Sampling Period	GWPP	CWL	MWL	TA-V	TAG	BSG
Oct 05		√			√	
Nov 05				√		
Dec 05						√
Jan 06				√	√	
Feb 06	√					
Mar 06						√
Apr 06		√	√		√	
May 06				√		
Jun 06						√
Jul 06					√	
Aug 06				√		
Sep 06						√

The fluoride concentration in groundwater samples from TRE-1, SFR-2S, SFR-4T, and Coyote Springs exceeded the NMWQCC MAC for the human health standard of 1.6 milligrams per liter (mg/L). The elevated concentrations are from natural sources and consistent with background concentrations determined for these locations. None of the groundwater samples exceeded the NMED Drinking Water MCL of 4 mg/L. Specific values for fluoride concentrations exceeding the MAC criteria can be found in Table 7.4. Figures B-1 through B-4 and Appendix B illustrate the historic concentration of fluoride in these wells.

Perchlorate was not detected greater than MDL in wells SWTA3-MW4, MRN-MW2, MRN-3D, NWTA3-MW2 sampled per the COoC protocol. Perchlorate was detected in the EOD Hill well at concentrations of 1.26 mg/L and 1.08 mg/L. KAFB, as owner of the land, notified the NMED of the elevated perchlorate detected at the EOD Hill well. Further actions are contingent upon NMED's response.

Metals

The analyses were conducted for dissolved metals on filtered groundwater samples; except for mercury, for which the total concentration was determined in an unfiltered aliquot of sampled groundwater. The groundwater standards of the NMWQCC are based on dissolved concentrations.

The analysis of the water sample from Coyote Springs yielded a beryllium concentration of 8.05 µg/L, which exceeds the 4.0 µg/L MCL for beryllium. Beryllium at this concentration appears to be of natural origin at this location and consistent with previous analyses. See Figure B-5 for the beryllium concentration trend. The uranium concentration in the EOD Hill well, at 39 µg/L, exceeds the recently established MCL of 30 µg/L. The MCL is based on the toxic characteristics of uranium as a metal rather than its radioactive properties. See Figure B-6 for the trend plot. All other analytical results for metals are below MCLs and MACs. Mercury was not detected in any of the groundwater samples.

TABLE 7-3. Summary of SNL/NM Groundwater Monitoring Activities During Fiscal Year 2006

	Remediation	Environmental Surveillance
Number of Active Wells Monitored	54	12
Number of Samples Taken	144	12
Number of Analyses Performed	8,339	1,007
Percent of Analyses that are Non-Detect	84%	67%

	Remediation	Environmental Surveillance	MCL	MAC
Range of Results for Positive Detections				
Tritium (pCi/L)	347	ND	N/A	N/A
TCE (µg/L)	0.291 - 15.8	ND	0.005	100,000
Chloroform (µg/L)	0.25 - 0.424	0.887	N/A	100
Other VOCs (µg/L)				
Acetone	1.47 - 17.5	1.84-6.5	N/A	N/A
Methylene chloride	2.1 - 2.93	2.06 - 2.27	N/A	N/A
Trace Metals (mg/L) / (MCL, MAC)				
Aluminum	0.00516 - 3.63	0.01 - 0.01	N/A	5
Antimony	0.000535 - 0.00064	0.000501 - 0.000501	0.006	N/A
Arsenic	0.00157 - 0.00813	0.00153 - 0.00478	0.01	0.1
Barium	0.00467 - 0.221	0.0113 - 0.149	2	1
Beryllium	0.000118 - 0.000312	0.000111 - 0.000211	0.004	N/A
Cadmium	0.000103 - 0.000569	0.00031 - 000312	0.005	0.01
Calcium	25.5 - 321	36.7 - 165	N/A	N/A
Chromium	0.00109 - 0.232	0.00104 - 0.00395	0.1	0.05
Cobalt	0.000109 - 0.00477	0.000115 - 0.000652	N/A	0.05
Copper	0.000273 - 0.0136	0.000656 - 0.00838	1.3	1
Fluoride	0.18 - 1.84	0.363 - 2.67	4	1.6
Iron	0.0658 - 4.22	0.163 - 0.81	N/A	1
Lead	0.00055 - 0.00743	ND	0.015	0.05
Magnesium	9.44 - 38.6	3.6 - 34.6	N/A	N/A
Manganese	0.00055 - 0.0771	0.00663 - 0.0303	N/A	0.2
Mercury	ND	ND	0.002	0.002
Nickel	0.000744 - 0.467	0.00137 - 0.0442	N/A	0.2
Potassium	1.62 - 5.92	1.71 - 7.13	N/A	N/A
Selenium	0.00268 - 0.0294	ND	0.05	0.05
Silver	0.000416 - 0.00082	ND	N/A	0.05
Sodium	17.3 - 71.8	20-1130	N/A	N/A
Thallium	0.000453 - 0.000976	0.000409 - 0.000976	0.002	N/A
Uranium	0.000053 - 0.0129	0.000273 - 0.017	0.03	5
Vanadium	0.00233 - 0.0189	0.0021 - 0.0081	N/A	N/A
Zinc	0.00218 - 0.126	0.00275 - 0.0591	N/A	10
Other Contaminants				
Nitrate as N (mg/L)	0.0684 - 29	0.165 - 5.66	10	10
Nitrate plus Nitrite			10	10
Perchlorate	ND -.00752	ND - 1.26	N/A	N/A

NOTES: Analytes whose observed values exceed MCL and/or MAC are shown in bold italics

ER = Environmental Restoration
pCi/L = picocurie per liter
µg/L = microgram per liter
mg/L = milligram per liter
N/D = not detected
GWPP = Groundwater Protection Program
N/A = not applicable
MCL = maximum contaminant level
MAC = maximum allowable concentration

Radionuclide Activity

Analyses for radioisotopes were conducted on all samples. Specific analyses included: gamma spectroscopy, gross alpha/beta, radium-226 and -228, uranium-233/234, and uranium-235 & -238.

Gamma spectroscopic analysis was limited to the following radioisotopes: americium-241, cesium-137, cobalt-60, and potassium-40. None of the listed isotopes were detected above the Minimum Detectable Activity (MDA). Uncorrected gross alpha activities for samples from EOD Hill, Greystone-MW2, SFR-2S, and TRE-1 exceeded the MCL of 15 pCi/L. When the results are corrected by subtracting the uranium activities at these locations, only the result from the EOD Hill groundwater sample exceeds the MCL. Wells with elevated uranium are located east of the Tijeras fault complex (Figure 2-3). In this region, groundwater contacts bedrock material that contains minerals naturally high in uranium.

The radium-226 picocuries per liter (pCi/L) concentration in the SFR-2S well sample (Figure 4-8) was above the MCL of 5 pCi/L for combined radium-226 and radium-228. In this instance, the combined concentration value is 8.24 pCi/L.

7.2.2 ER Project Water Quality Results

CWL Results

Groundwater monitoring at the CWL was performed during October 2005 and April 2006. Groundwater samples were collected from nine monitoring wells. Groundwater samples were submitted for Appendix IX VOCs, metals, Semi-volatile Organic Compounds (SVOC), chlorinated herbicides, polychlorinated biphenyl (PCB), cyanide, sulfide, and dissolved chromium analyses. Sample results were compared with MCLs, where established. Water quality parameters for specific conductivity, oxidation-reduction, pH, turbidity, and dissolved oxygen were measured prior to sampling each well.

VOCs, SVOCs, Herbicides, and PCBs

No VOCs or SVOCs were detected above established MCLs during FY 2006. No herbicides or PCBs were detected above laboratory MDLs.

Cyanide and Sulfide

Cyanide was not detected above the MCL concentration of 0.2 mg/L in CWL groundwater samples. Cyanide was reported at concentrations ranging from not detected to concentrations above the MDL to 0.00427 mg/L. There are no established regulatory limits for sulfide. During FY 2006, sulfide concentrations ranged from not detected to concentrations above the MDL to 2.40 mg/L.

Total Metals

As required by the NMED's Hazardous Waste Bureau (HWB), all metals samples were analyzed for total metals. No metals concentrations were detected above established MCLs. Detected metals concentrations were comparable to historical values.

Dissolved Metals

Dissolved chromium was detected in CWL-MW6U below the MCL of 0.10 mg/L at a concentration of 0.0018 mg/L. No other wells had detected levels of dissolved chromium.

MWL Results

Annual groundwater sampling of the seven monitoring wells at the MWL was conducted in April 2006. Groundwater samples were analyzed for VOCs, Target Analyte List (TAL) metals and total uranium, NPN (reported as nitrogen), major anions, tritium, gross alpha/beta radioactivity, and gamma-emitting radionuclides. Sampling results were compared with MCLs, where established. Water quality parameters were measured at the time of sample collection at each well.

VOCs and SVOCs

Groundwater samples from MWL monitoring wells had no detections for VOCs greater than the practical quantifation limits (PQLs), except in one sample. Acetone was detected in the sample from MWL-MW6 at an estimated concentration of 1.89 µg/L; which is less than the PQL, but greater than the MDL. Detections of acetone in MWL-MW1, MWL-MW3, MWL-MW4, and MWL-MW5 were qualified as 'not detected during data validation' due to results from the quality control (QC) samples. Acetone was also detected in the sample from MWL-BW1, but the result was qualified as 'not detected due to a contamination source' introduced at the laboratory from samples that were not from SNL/NM.

Samples from MWL-MW1 and MWL-MW2 contained low concentrations of carbon disulfide and toluene. These results were qualified as 'not detected during data validation' because of similar concentrations of the compounds in associated QC samples.

Major Anions
Groundwater samples were analyzed for bromide, chloride, fluoride, sulfate, NPN (reported as nitrogen), and alkalinity. Fluoride was detected below the MAC of 1.6 mg/L at concentrations ranging from 0.766 mg/L at MWL-BW1 to 0.997 mg/L at MWL-MW4. NPN (as nitrogen) was detected below the MCL of 10 mg/L at concentrations ranging from 0.877 mg/L at MWL-MW6 to 4.58 mg/L at MWL-BW1. All other anions do not have MCLs or MACs associated with human health.

Metals
Unfiltered samples were analyzed for total TAL metals. Chromium concentrations in the sample and duplicate sample from MWL-MW1 (0.219 and 0.208 mg/L, respectively) and in the sample from MWL-MW3 (0.133 mg/L) exceed the EPA MCL of 0.1 mg/L. The samples were reanalyzed for chromium on June 14, 2006, and reanalyses confirmed the original analyses. The chromium concentration in MWL-MW3 represents the first time the MCL has been exceeded in this well. See Figure B-9 for the chromium concentration trends at these wells. Chromium concentrations exceeding EPA MCL values correlate with nickel results and may be attributed to corrosion of Type 304 stainless steel well screens (Oakley & Korte 1996, Goering, T. et al. 2002).

Total uranium results from the April 2006 samples are consistent with data from previous sampling events and well within the range of total uranium concentrations established by the USGS for the Middle Rio Grande Basin (USGS 2002).

Radionuclide Activities
Radionuclides analyzed in MWL groundwater samples included tritium, gross alpha/beta activities, and gamma-emitting radionuclides. No radiological parameters were detected above established MCLs.

Gross alpha and beta activity levels were detected above laboratory reporting limits in all environmental samples. Gross alpha activity levels range from 2.13 ± 0.547 pCi/L in the MWL-BW1 sample to 14.7 ± 2.23 pCi/L in the MWL-MW3 sample. Gross beta activity levels range from 3.11 ± 0.963 pCi/L in the MWL. Neither tritium (analyzed by EPA Method 906.0) nor gamma-emitting isotopes (analyzed by EPA Method 901.1) were detected above the MDA in any of the groundwater samples. Uranium-238 and -235 were determined as mass concentrations during metals analysis on the inductively-coupled plasma mass spectrometer (using EPA Method 6020).

TA-V Results
Quarterly groundwater sampling at TA-V was performed in November/December 2005, January/February/March 2006, May 2006 at thirteen wells and August/September 2006 at twelve wells. Due to a decline of the water table, monitoring well AVN-2 was unable to produce sufficient water to collect a sample. In May 2006, NMED approved temporarily removing AVN-2 from the TA-V groundwater monitoring well network (Bearzi 2006).

Analytes Sampled
Quarterly groundwater samples were analyzed for VOCs and NPN (reported as nitrogen). In addition to the quarterly analytes, analyses were conducted on the fourth quarter samples for cations (calcium, magnesium, and sodium), anions (bromide, chloride, fluoride, and sulfate), alkalinity, TAL metals, PCBs, total uranium, tritium, gross alpha/beta, and selected radionuclides by gamma spectroscopy. Water quality parameters were measured in the field immediately prior to sampling.

VOC and PCB Analyses
TCE concentrations in excess of the MCL of 5µg/L were detected in samples from TA-V monitoring wells LWDS-MW1, TAV-MW1, and TAV-MW6. The results were 14.9 µg/L, 5.37 µg/L, and 6.34 µg/L, respectively. The trend of TCE concentrations in LWDS-MW1 is decreasing; for TAV-MW1 and TAV-MW6 the concentrations are increasing. The TCE concentration trends for the wells are shown in Figures B-11 through B-13. No other VOCs were detected above MCLs in any other monitoring well, and no PCBs were detected in samples from any of the monitoring wells.

Anion Analyses
Among the anion analytes NPN (reported as nitrogen), bromide, chloride, fluoride, and sulfate, only fluoride and NPN have an MCL or MAC. Fluoride concentrations did not exceed the MAC of 1.6 mg/L, which is the lower of the two regulatory limits. NPN (reported as nitrogen) concentrations

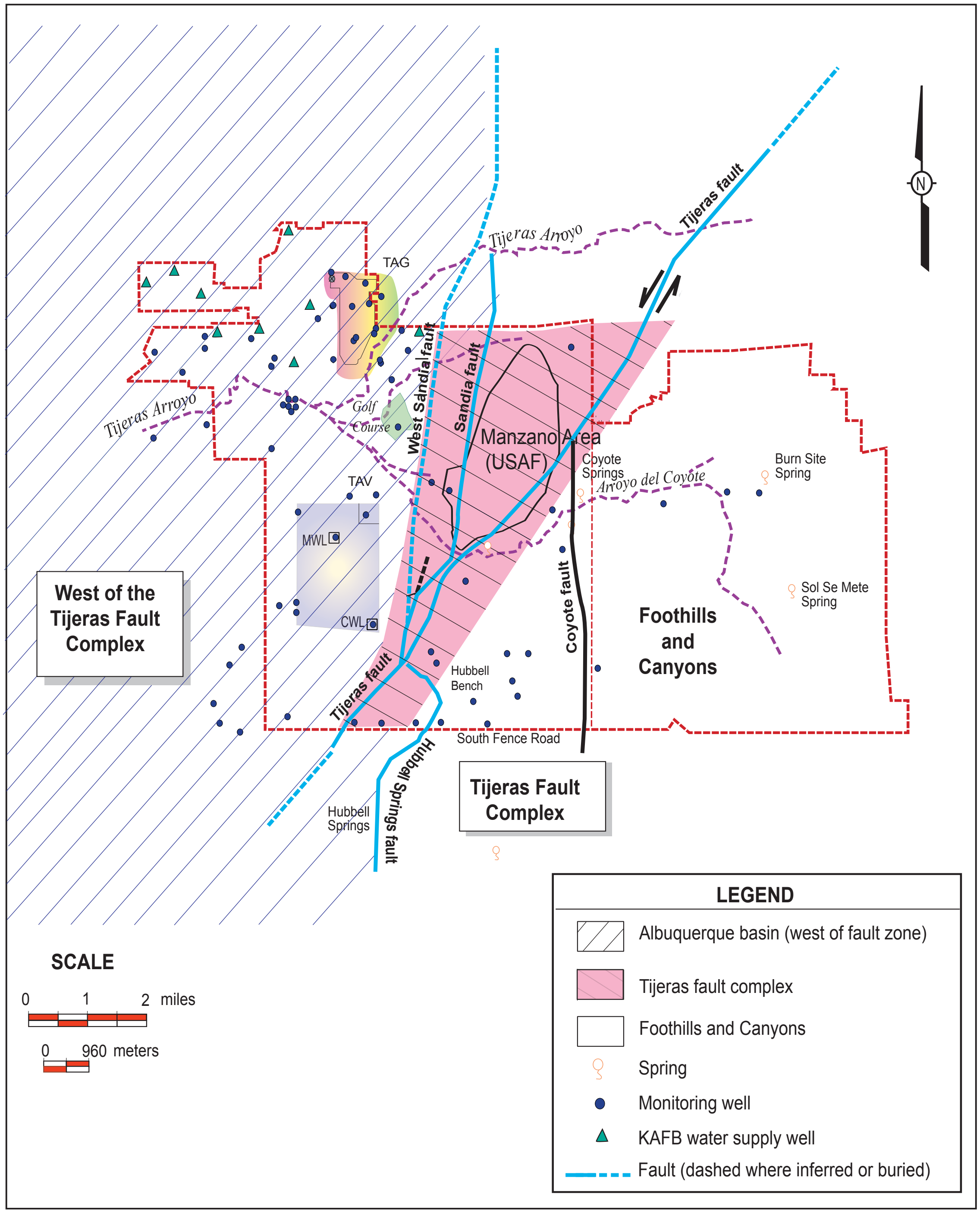

FIGURE 7-3. Hydrogeologically Distinct Areas at KAFB

FIGURE 7-3. Hydrogeologically Distinct Areas at KAFB

exceeded the MCL of 10 mg/L in LWDS-MW1 for three of the four quarters of FY 2006, and TAV-MW1 for the third quarter of FY 2006. The nitrate in LWDS-MW1 has consistently exceeded the MCL over the past six years; however, the concentrations appear to be decreasing slightly over time. The nitrate concentrations in TAV-MW1 rarely exceeded the MCL and appear to be increasing slightly over time. See Figure B-14 and B-15 for the nitrate concentrations at these wells.

Metals

Total metal analyses were conducted on the groundwater samples collected during the fourth quarter of FY 2006. No metal concentrations exceeded established MCLs.

Radionuclide Activities

Gamma spectroscopy, gross alpha/beta, and tritium analyses were conducted on all wells in the 4th quarter of FY 2006. Uncorrected gross alpha activity in LWDS-MW2 was 15.7 ± 1.92 pCi/L in the August/September sample, which slightly exceeds the MCL of 15 pCi/L. The gross alpha activities trend is illustrated in Figure B-16. However, when the number is corrected by subtracting the activity equivalent of the total uranium concentration, the value drops below the MCL. A reanalysis of this sample yielded 5.42 ± 1.42 pCi/L of activity. Gamma spectroscopy analysis did not detect any isotopes above their associated MDAs, except for potassium-40. Potassium-40 activities were reported in TAV-MW3 and TAV-MW5 at 57 ± 50.4 pCi/L and 90.9 ± 62.3 pCi/L, respectively. There is no direct MCL for potassium-40, however, the EPA primary drinking water standards limit the exposure from ingested water to 4 mrem. The derived concentration guide value for potassium-40 is 280 pCi/L.

TAG Results

TAG wells are either screened in the regional aquifer or the perched GWS that is several hundred feet above the regional aquifer. COCs include TCE and nitrate, which have been detected at concentrations exceeding the EPA's established MCLs for drinking water. Samples were collected from 21 wells−ten perched GWS wells, and eleven regional aquifer wells. Samples collected quarterly were analyzed for NPN (reported as nitrogen) and VOCs. Additional analyses including anions, metals, PCBs, tritium, gamma spectroscopy, and gross alpha/beta were conducted during the 4th quarter of FY 2006. Field water quality measurements were taken at each well prior to sample collection.

VOC and PCBs Analyses

TCE was detected in groundwater samples from several wells in the perched GWS. Monitoring well WYO-4 (perched GWS) consistently had TCE concentrations above the MCL (5.0 µg/L) with a maximum TCE concentration of 7.87 µg/L. TCE concentrations in well WYO-4 have been consistent to slightly increasing over the life of the well. See Figure B-17 for the TCE concentration trend. In addition, monitoring well TA2-W-19 (perched GWS) had TCE concentrations above the MCL during the October 2005 sampling event, with a maximum concentration of 5.01 µg/L. TCE concentrations in well TA2-W-19 have been generally increasing over the life of the well, but are relatively consistent over the last three years. Figure B-18 illustrates the TCE concentration history in TA2-W-19.

Inorganic Chemical Analyses

Inorganic chemical analyses of quarterly groundwater samples consisted of NPN (reported as nitrogen). Additional major anions such as bromide, chloride, fluoride, and sulfate were added to the 4th quarter sample analytical protocol. Nitrate concentrations exceeded the MCL of 10 mg/L in five wells. TJA-7, TA2-SW1-320, and TJA-4 had nitrate concentrations two to three times the MCL; whereas, TA2-W-19 and TJA-2 had nitrate concentrations that only slightly exceeded the MCL. Nitrate concentrations in these five wells are generally stable to slightly decreasing over time. See Figure B-19 through B-23 for the nitrate concentration trends in the wells. All other analyzed anions were below MCLs, where established.

Metals

Total metals analyses were performed on the samples collected during the 4th quarter. The results were all below the respective MCLs, where established.

Radionuclide Activities

Gamma spectroscopy, gross alpha/beta, and tritium analyses were conducted on 21 wells in FY 2006. All radionuclide activities were below MCLs, where established.

Burn Site Groundwater Results

Quarterly sampling was conducted on six wells located in Lurance Canyon near the SNL/NM

Burn Site Facility. The samples were analyzed for VOCs, SVOCs, High Explosives (HE), diesel-range organics, gasoline-range organics, major ions, NPN (reported as nitrogen), TAL metals, uranium, thorium, radium-226, radium-228, gross alpha/beta, tritium, and radionuclides by gamma spectroscopy. Perchlorate analysis, per the requirements of the COoC, was conducted on the samples from wells CYN-MW1D, CYN-MW6, CYN-MW7, and CYN-MW8. Field water quality parameters were measured during the pre-sample purging of each well.

VOCs and Other Organic Compounds
No VOCs, SVOCs, or HE compounds were detected above MCLs. Other organics found in groundwater samples included low levels of diesel-range organics in all wells, with up to 61.8 µg/L in a sample from CYN-MW8. All but one of the detections of diesel-range organics were qualified as non-detect during the data validation process. All analyses of samples from monitor wells for gasoline-range organics were non-detect. MCLs have not been established for diesel-range organics or gasoline-range organics.

Major and Minor Anions
NPN (reported as nitrogen) results exceeded the MCL of 10 mg/L in the samples from CYN-MW6 for all sampling events. Nitrate concentrations in this well have consistently exceeded the MCL. The nitrate concentration history in CYN-MW6 is shown in Figure B-24. Fluoride exceeded the MAC of 1.6 mg/L in CYN-MW1D in all sampling events with a maximum of 1.84 mg/L. The samples collected from well CYN-MW6 had a maximum perchlorate value of 6.99 parts per billion (ppb), this is above the 4 ppb action level established by the COoC. Sandia will continue to collect quarterly samples from the well and analyze for perchlorate.

No MCL or MAC currently exists for perchlorate, although the NMED identifies perchlorate as a potential toxic pollutant. All other major ion results were below established MCLs.

Metals Results
No metal concentrations above MCLs were detected in any of the wells sampled in FY 2006.

Radionuclide Activity
Groundwater samples were analyzed for gross alpha/beta, tritium, and gamma spectroscopy. All radionuclide activities were below MCLs, except for gross alpha in wells CYN-MW4 and CYN-MW8. Gross alpha in CYN-MW4 was measured at 37.8 pCi/L and has consistently exceeded the MCL in the samples collected from the well. Gross alpha activities at this location are shown in Figure B-25. The value in CYN-MW8 was 34 pCi/L. This is the first gross alpha determination for this well, therefore, no trend graph is provided. Gamma spectroscopy analysis did not detect any isotopes above associated MDAs.

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 the DOE/National Nuclear Security Administration (NNSA)/Sandia Site Office (SSO), data is solicited for U.S. Air Force (USAF) IRP, COA, and USGS wells. In 2006, data from 141 wells were incorporated into the monitor well water level database. Water levels were measured monthly or quarterly.

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 foot per year. The regional aquifer which underlies the western part of KAFB is comprised of the saturated coarse-grained strata of the upper and middle units of the Santa Fe Group. Most of the COA and KAFB water supply wells are completed in this aquifer. Groundwater withdrawl at these wells is manifested as declining water levels throughout the region.

Water level information, with respect to the regional water table in the KAFB area, can be categorized into three general areas. Groundwater levels east of the Tijeras Fault Complex are approximately 100 to 150 feet below the surface. The water table west of the Tijeras Fault Complex and the Sandia Fault are approximately 500 feet or more below ground surface (bgs). This area is part of the regional

Albuquerque Basin aquifer system. Between the east and west region is a transition zone comprised of the fault complex. The aquifer system within the fault complex and to the east is not well documented due to the complex geology of the area and the limited number of wells available to characterize the system.

Regional Groundwater Table

The 2006 Regional Groundwater Elevation Contour map for SNL/KAFB is presented in Figure 7-4. The extent of the contoured map area was constructed using static water level data from 53 wells west of the Tijeras Fault Complex. This map represents the water table in the time period spanning September/October 2006. Generally, these monitor 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 conditions.

The contour lines shown in Figure 7-4 represent lines of equal elevation of the groundwater table. Groundwater withdrawal as a consequence of pumping by KAFB production wells at the northern part of the KAFB and nearby COA production wells has created a depression in the regional water table. This "U" shaped depression, with the top of the "U" pointing north, extends south to 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 flow is perpendicular to the contour lines in the direction of decreasing elevation. The direction of groundwater flow within the region is toward the production wells. This pumping-induced flow to the north is in contrast with the southwesterly flow direction reported in 1961 at a time of significantly lower groundwater withdrawl (Bjorklund and Maxwell 1961).

Perched GWS Wells

A group of perched GWS wells exist in the northern part of KAFB in the vicinity of SNL/NM TAs-I, -II, and -III, extending southward to the location of the former KAFB sewage lagoons. The eastward extent of the perched GWS wells extends to under the KAFB Landfill and to the southeast of KAFB Golf Course. The elevation data of the first saturated water interval in the perched GWS wells are illustrated in Figure 7-5. The contours indicate a gradient to the east-southeast. The western-most elevation contour, near the eastern edge of the former lagoons, is at 5,153 feet above sea level (fasl). This elevation corresponds to a depth to water from the surface of approximately 207 feet. At the same location the regional water table is 495 feet bgs. Along the eastern boundary of the perched GWS wells the elevation of first water is at 5,006 fasl. This elevation is similar to the elevation of the regional water table, which is 4,928 fasl at this location. Because of the eastern dip of the perched GWS wells and the western dip of the regional system, the two systems appear to merge near this location.

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 for the GWS is directly related to the amount of precipitation. The regional climate for the Albuquerque Basin area is semi-arid, as described in Chapter 1. KAFB water production wells supply most of the water used by SNL/NM and KAFB. KAFB production wells extract groundwater from the upper and middle units of the Santa Fe Group at a depth of up to 2,000 feet. These units constitute the primary aquifer for the Albuquerque metropolitan area. In FY 2006, KAFB pumped approximately 1.08 billion gallons (gal) (3,323 acre-ft) of groundwater from ten water supply wells. In comparison, 1.10 billion gal (3,362 acre-ft) of water were pumped for the same period of time in 2005.

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 has resulted in a general decline in water levels. Figure 7-6 shows the contour map of the annual water table elevation changes recorded for the western area of KAFB over the one year period between 2005 and 2006.

The largest amount of decline over the period is approximately 1.2 feet/yr, a slightly lower rate of decline than the 1.3 feet/yr reported in the previous year's report. The largest declines continue to be in the vicinity of McCormick Ranch, which is located along KAFB's southeastern border with Isleta Pueblo. 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 increasing slightly. This area coincides with a potential recharge area associated with Tijeras Arroyo. The water level trends for perched GWS wells indicate a decrease in water level elevations in the western portion of KAFB (Figure 7-7). The water level elevations in the central part of the system seem to be relatively stable. The water levels in the eastern part appear to be increasing, which is consistent with the notion that the perched GWS is draining to the east and merging with the regional system.

TABLE 7-4. Summary of Exceedances at Sampling Wells in Fiscal Year 2006

Analyte	Wells	Exceedance	Date
BERYLLIUM MCL = 0.004 mg/L	Coyote Springs	0.00805 mg/L	February/March 2006
RADIUM 226 MCL = 5 pCi/L 226 + 228	SFR-2S	8.24 pCi/L	February/March 2006
FLUORIDE MAC = 1.6 mg/L	Coyote Springs	1.64 mg/L	February/March 2006
	SFR-2S	1.61 mg/L	February/March 2006
	SFR-4T	2.67 mg/L	February/March 2006
	SFR-4T (dup)	2.66 mg/L	February/March 2006
	TRE-1	1.62 mg/L	February/March 2006
	SWTA3-MW4	1.82 mg/L	February/March 2006
URANIUM MCL = 0.030 mg/L	EOD	0.039 mg/L	February/March 2006
CHROMIUM MCL = 0.1 mg/L	MWL-MW1	0.219/0.232 mg/L+	April 2006
	MWL-MW1 (dup)	0.208/0.197 mg/L+	April 2006
	MWL-MW3	0.133/0.169 mg/L+	April 2006
TRICHLOROETHENE (TCE) MCL = 5 μg/L	LWDS-MW1	15.3 μg/L	November/December 2005
	LWDS-MW1	15.8 μg/L	January/February/March 2006
	LWDS-MW1	14.9 μg/L	May 2006
	LWDS-MW1	12.9 μg/L	August/September 2006
	TAV-MW1	5.37 μg/L	May 2006
	TAV-MW1 (dup)	5.81 μg/L	November/December 2005
	TAV-MW6	6.34 μg/L	August/September 2006
	TA2-W-19	5.07 μg/L	October/November 2005
	WYO-4	7.61 μg/L	October/November 2005
	WYO-4	7.85 μg/L	January/February 2006
	WYO-4	6.73 μg/L	April/May 2006
	WYO-4	7.87 μg/L	July/August 2006

TABLE 7-4. Summary of Exceedances at Sampling Wells in Fiscal Year 2006 (Concluded)

Analyte	Wells	Exceedance	Date
NPN (AS NITROGEN) MCL = 10 mg/L	LWDS-MW1	10.6 mg/L	November/December 2005
	LWDS-MW1	13.3 mg/L	January/February/March 2006
	LWDS-MW1	13.0 mg/L	August/September 2006
	TAV-MW1	12.0 mg/L	May 2006
	TA2-SW1-320	25.2 mg/L	October/November 2005
	TA2-SW1-320	25.2 mg/L	January/February 2006
	TA2-SW1-320	25.5 mg/L	April/May 2006
	TA2-SW1-320 (dup)	24.9 mg/L	April/May 2006
	TA2-SW1-320	28.8 mg/L	July/August 2006
	TA2-W-19	10.2 mg/L	January/February 2006
	TA2-W-19 (dup)	10.2 mg/L	January/February 2006
	TJA-2	10.1 mg/L	January/February 2006
	TJA-7	25.4 mg/L	October/November 2005
	TJA-7	26.1 mg/L	January/February 2006
	TJA-7	25.2 mg/L	April/May 2006
	TJA-7	17.4 mg/L	July/August 2006
	TJA-4	28.0 mg/L	October/November 2005
	TJA-4	29.0 mg/L	January/February 2006
	TJA-4	28.9 mg/L	April/May 2006
	TJA-4	27.5 mg/L	July/August 2006
	TJA-4 (dup)	20.6 mg/L	July/August 2006
	CYN-MW6	23.9 mg/L	March 2006
	CYN-MW6 (dup)	24.1 mg/L	March 2006
	CYN-MW6	32.6 mg/L	June 2006
	CYN-MW6 (dup)	29.5 mg/L	June 2006
	CYN-MW6	30.4 mg/L	September 2006
GROSS ALPHA (CORRECTED) MCL = 15 pCi/L	EOD	21.68 pCi/L*	February/March 2006
GROSS ALPHA (UNCORRECTED) MCL = 15 pCi/L	LWDS-MW2	15.7 ± 1.92 pCi/L	August 2006
	CYN-MW4	37.8 ± 11.1 pCi/L	June 2006
	CYN-MW8	34.0 ± 10.6 pCi/L	June 2006

NOTES: dup = duplicate
mg/L = milligrams per liter
MCL = maximum contaminant level
µg/L = micrograms per liter
pCi/L = picocuries per liter
MAC = maximum allowable concentration
* Uncorrected gross alpha results for samples from SFR-2S, and TRE-1 exceeded the MCL of 15.0 pCi/L. When the results are corrected by subtracting the uranium activity, the results for SFR-2 and TRE-1 are below the MCL.

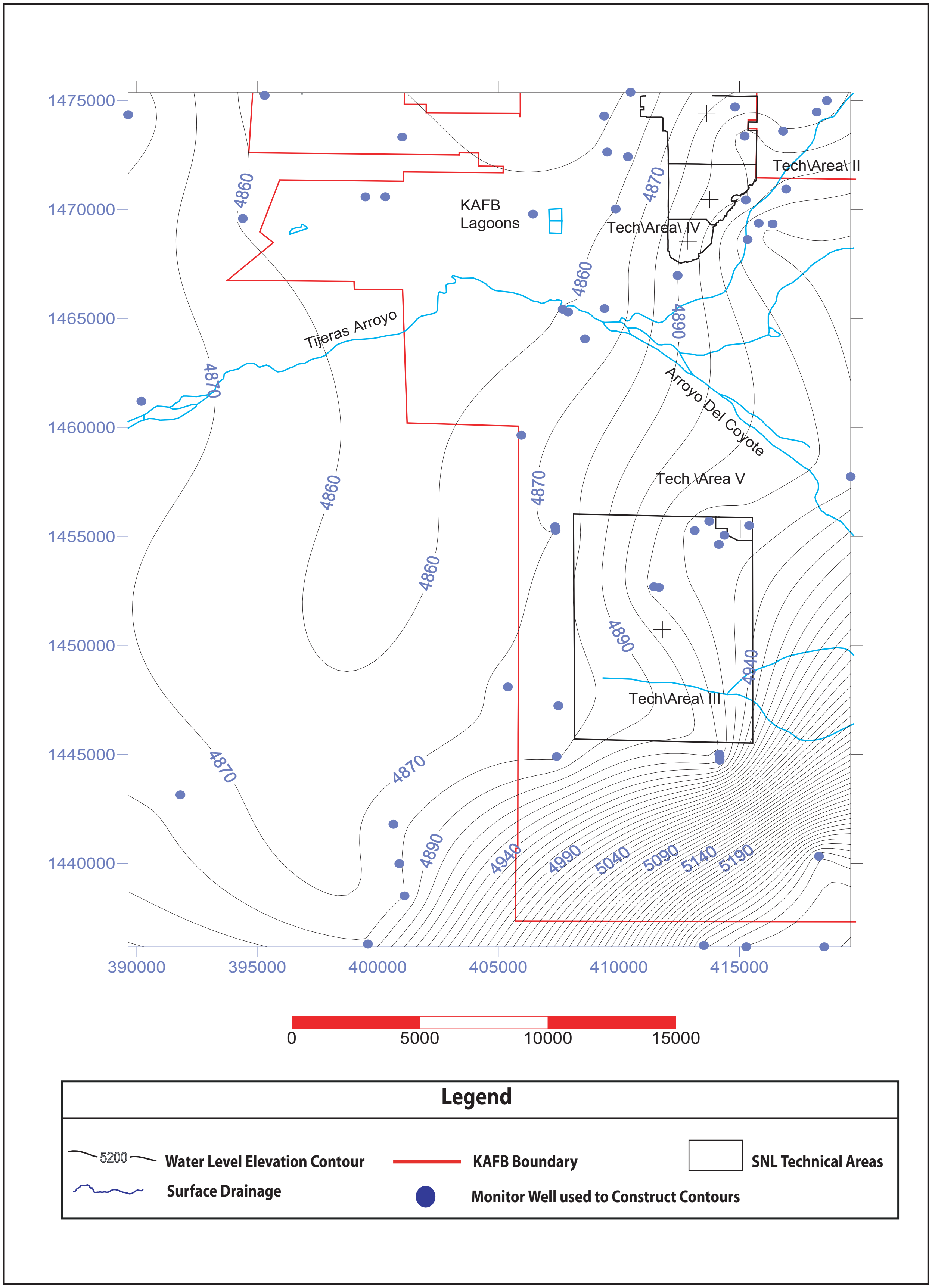

FIGURE 7-4. Regional Groundwater Elevation Map for SNL/KAFB, 2006

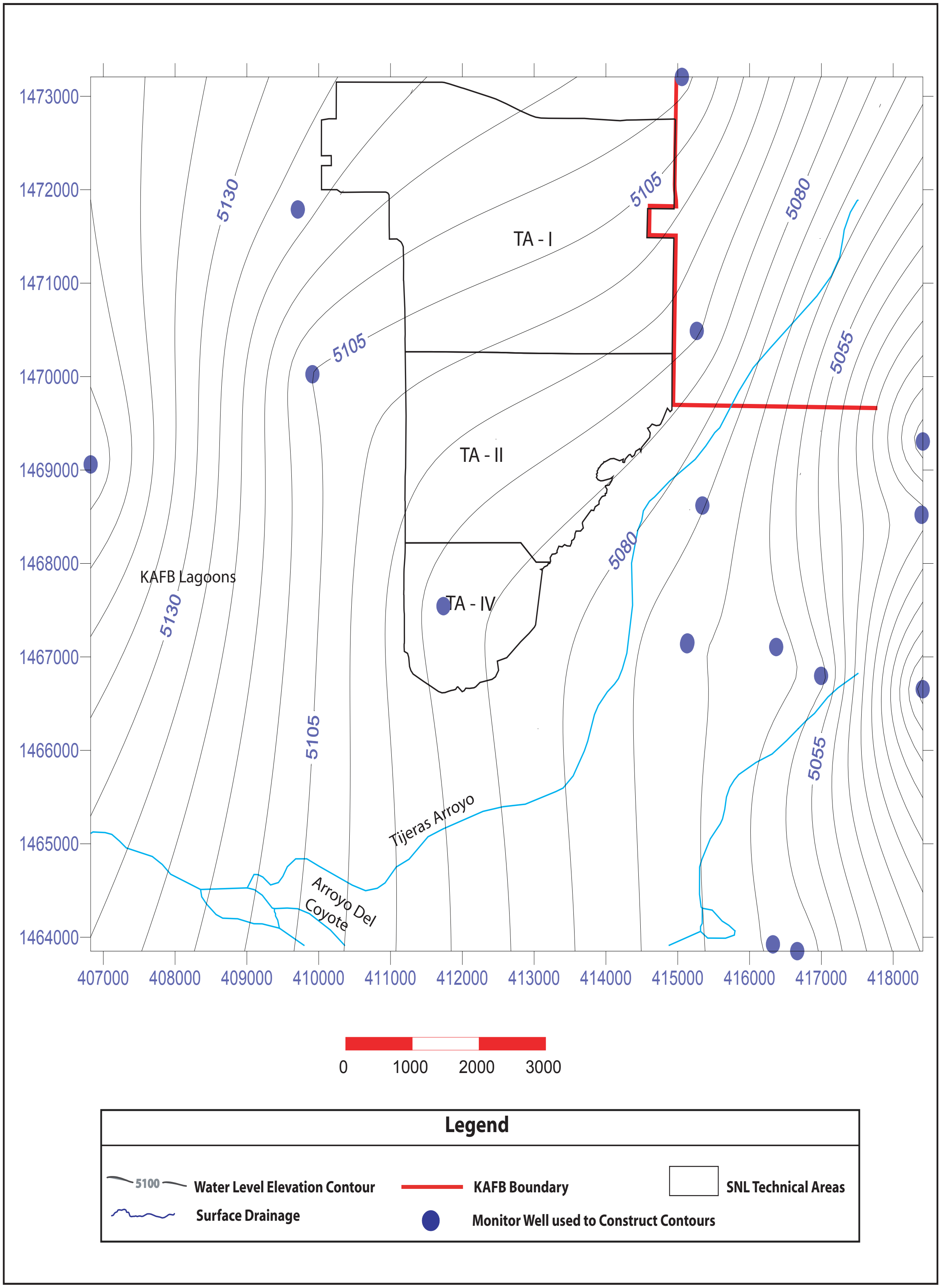

FIGURE 7-5. Perched Groundwater System Water Elevation Map

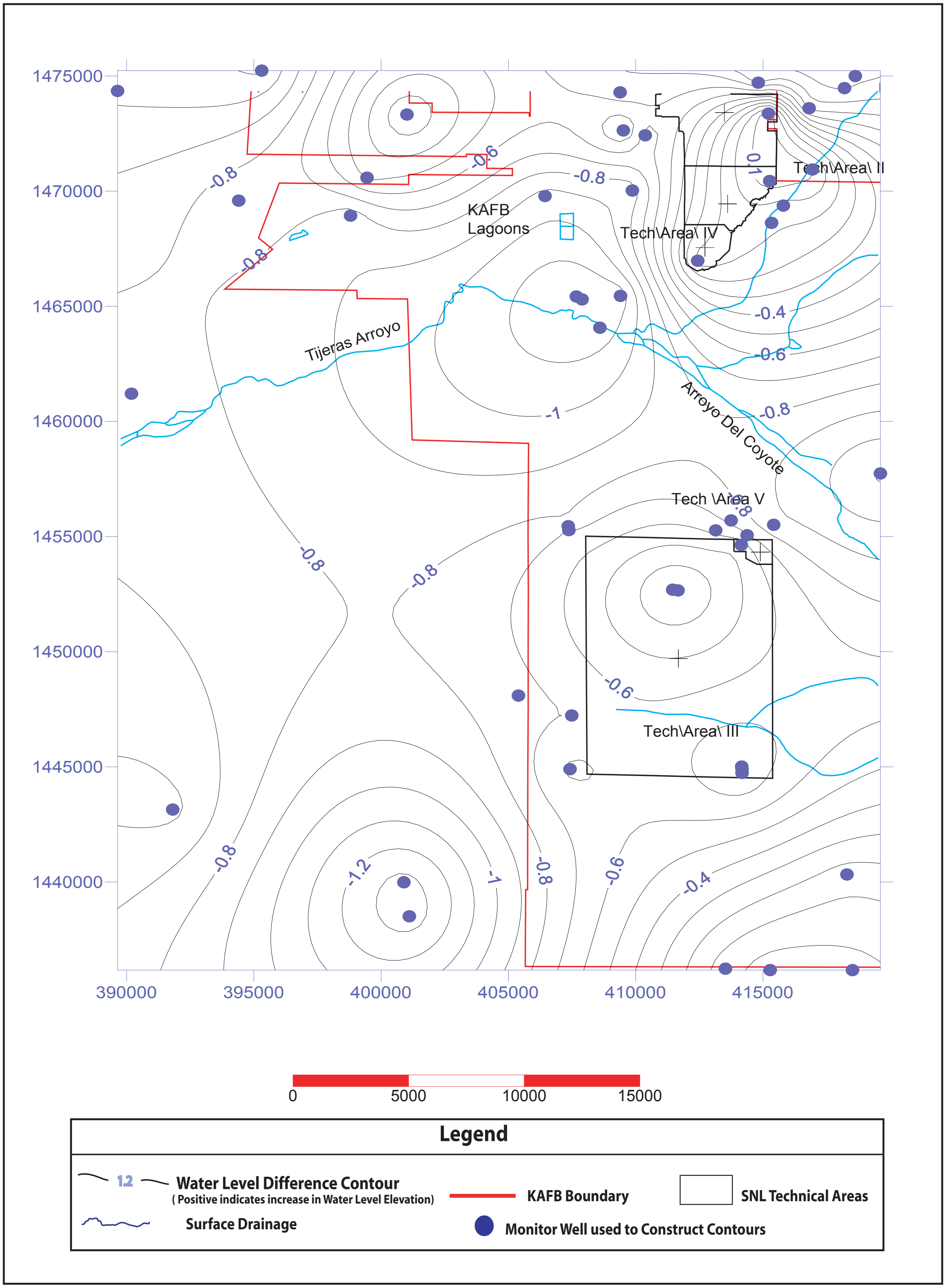

FIGURE 7-6 Annual Regional Groundwater Elevation Difference For SNL/KAFB, FY05-FY06

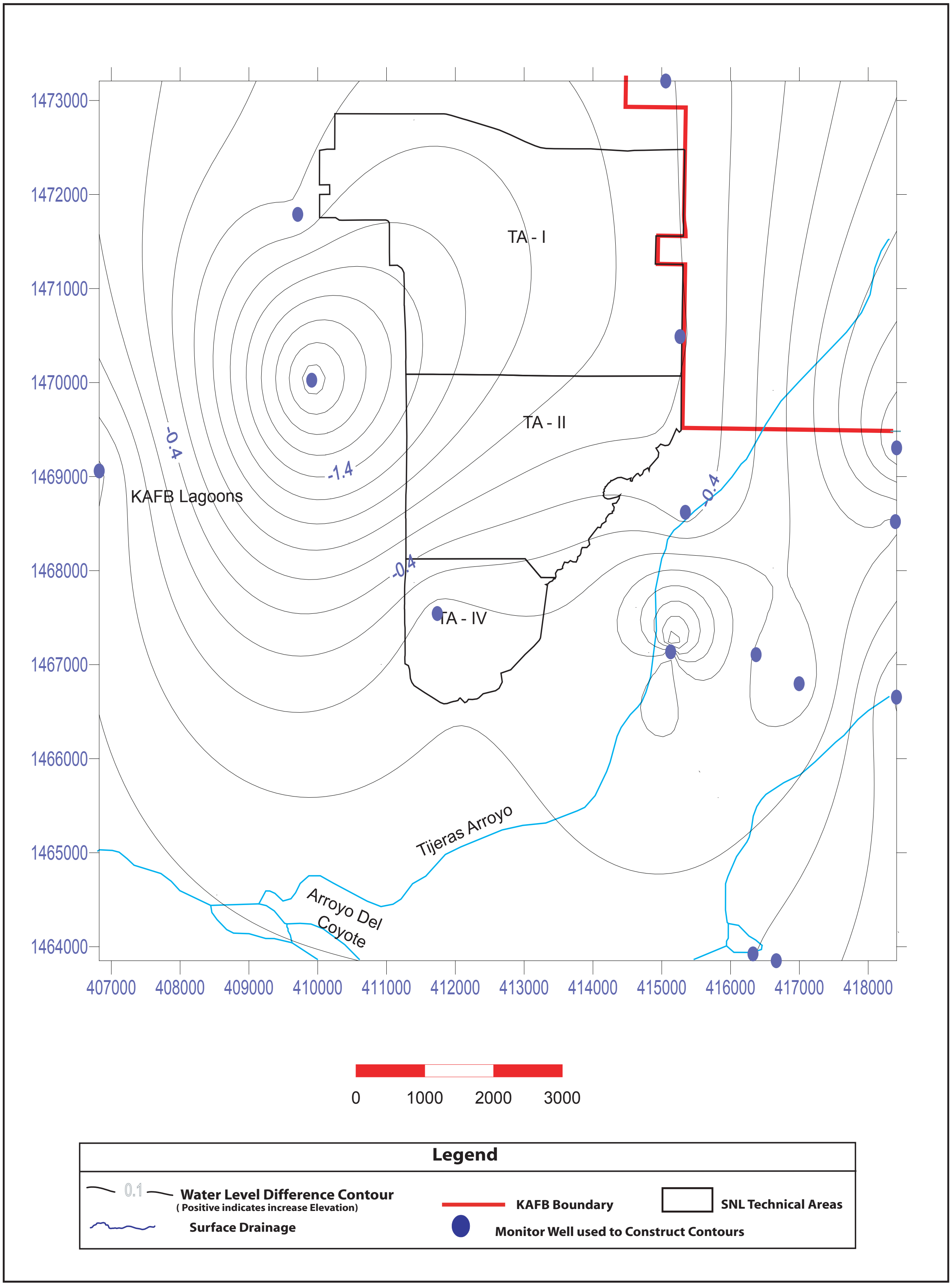

FIGURE 7-7. Perched Groundwater System Elevation Changes, 2005-2006

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chapter eight

QUALITY ASSURANCE

<u>In This Chapter...</u>

Corporate Level Quality Assurance (QA)
Environmental Program QA
Environmental Sampling and Analysis
2006 Sample Management Office (SMO) Activities

Environmental Snapshot

In 2006, the SMO processed a total of 6,458 samples in support of Sandia projects. Of these, 2,475 were for environmental monitoring and surveillance projects.

8.1 CORPORATE LEVEL QUALITY ASSURANCE (QA)

Sandia Corporation's (Sandia) Integrated Laboratories Management System (ILMS) is the framework for all management requirements at Sandia. Management formality and rigor are commensurate with the nature and complexity of the work, customer requirements, and associated risks. ILMS ensures consistent application of quality management principles. The main process activities of ILMS are to provide leadership, engage the customer/stakeholder, accomplish the mission, and achieve mission success through operational excellence. The laboratory conducts work according to the Corporate Work Process (CWP). The CWP defines a five-element process for managing and performing work that applies to all activities, facilities, organizations, and employees. The five elements are: Plan Work, Evaluate Risk, Implement Controls, Perform Work, and Improve Process.

Corporate Quality Assurance (QA) Program

Sandia's corporate QA program defines the process for flowing down the quality requirements from the ILMS to all work performed at Sandia.

- Plan Work: Managers determine the nature and complexity of the processes and the associated requirements of work for which they are responsible. They determine how the quality requirements of U.S. Deparment of Energy (DOE) Order 414.1C, *Quality Assurance* (DOE 2005a), apply to planned work.
- Evaluate Risk: Managers identify and evaluate the risks associated with planned work.
- Implement Controls: Managers are required to conduct work and control the risks in accordance with Sandia's Corporate Business Rules using a risk-based, graded approach.
- Perform Work: Managers ensure that the performance of the work complies with Sandia's Corporate Business Rules and customer requirements.
- Improve Process: Managers review item characteristics, process implementation, and other quality-related information to identify and address items, services, and processes that need improvement.

Environment, Safety and Health (ES&H) Policy

Sandia's ES&H policy is to protect and preserve the environment and to ensure the safety and health of its employees, contractors, visitors, and the public while maintaining the corporate vision and mission. As part of its mission, Sandia has adopted three key ES&H principles:

- All Members of the Workforce (MOW) take responsibility and are accountable for ES&H performance at SNL.
- All MOW operate from an unwavering belief that job-related injuries, illnesses, and environmental incidents are preventable and unacceptable.
- Working safely is a condition of employment.

Integrated Safety Management System (ISMS)

Sandia is committed to performing work safely and ensuring the protection of MOW, the public, and the environment. ES&H performance at Sandia National Laboratories, New Mexico (SNL/NM) is based upon the core functions and guiding principles of the ISMS. The Environmental Management System (EMS) is integrated into the ISMS; it is a continual cycle of planning, implementing, evaluating, and improving processes and actions for the achievement of environmental goals.

Sandia's corporate ES&H program mandates compliance with all applicable laws, regulations, DOE directives, internal corporate policy requirements, and permit requirements. Sandia has committed to:

- Plan work that incorporates safety awareness, protective health practices, environmental management, pollution prevention, and long-term stewardship of resources;
- Identify hazards and evaluate, monitor, and manage risks with effective ES&H systems;
- Implement controls to prevent injuries, exposure to hazardous materials, and the release of materials that could be hazardous to the environment;
- Do quality work while protecting people, the environment, and our nation's security;
- Continually improve our ES&H performance by establishing, assessing, and meeting measurable ES&H goals, objectives, targets, and milestones; and

- Communicate ES&H issues to MOW, the community, regulators, and stakeholders.

Sandia's corporate ES&H mission success requires leadership in ES&H in order to:

- Provide cost-effective, innovative, and integrated ES&H solutions that enable Sandia to accomplish its mission work through effectively managing risks and protecting both the MOW and the environment;
- Pursue mission and operational excellence through diligent and mindful safety, health, and environmental stewardship behaviors and continuous improvement; and
- Perform operations that are planned and conducted to avoid adverse impact while being in full compliance with all applicable ES&H laws, regulations, permit requirements, and corporate policy requirements, as well as DOE directives included in the Prime Contract between Sandia and DOE.

Sandia is committed to achieving performance excellence in all aspects of work through its ES&H Performance Excellence Objectives:

- **Worker and Public Safety**: We value our workforce and drive for worker and public safety; public and worker safety is a sacred trust.
- **Environmental Stweardship**: We will be good environmental stewards and leave our environment in as good a condition as it was when we started our operations.
- **Mission Fulfillment**: We serve our nation's critical needs by faithfully delivering our mission products and services and doing so in a safe and secure way.
- **Stakeholder and Customer Confidence**: We ensure that our customers and stakeholders have confidence in our ability to meet our commitments. We earn their complete trust in the way that we meet those commitments.

Sandia demonstrates its corporate values of:

- Integrity–ensuring we meet our obligation to report incidents and unsafe conditions,
- Excellence–striving for ES&H excellence in our work performance,
- Service to the nation–stewardship in ensuring that our operations protect the quality of the human and natural environment,
- Concern for each other–working to protect one another and our community, and
- Teamwork–understanding that ES&H is part of every job and enables mission success.

8.2 ENVIRONMENTAL PROGRAM QA

Environmental Sampling

Environmental samples are collected by personnel in 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.

Samples are packaged, shipped, and tracked to off-site laboratories by the Sample Management Office (SMO) as discussed in Section 8.3. Some samples are processed and analyzed for radiological constituents by the SNL/NM Radiation Protection Sample Diagnostics (RPSD) laboratory in accordance with RPSD procedures.

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 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.

The SMO is responsible for QA and Quality Control (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 critical elements: procedures for sample collection, sample preservation and handling, sample control, references to analytical methods, laboratory QC and procedures, field QC, health and safety, and schedules and frequency of sampling and reporting.

Selection of a Contract Laboratory

All off-site contract laboratories are selected based on performance objectives and appraisal (pre-award assessment) as described in the *Quality Assurance Project Plan* (QAPP) *for the SMO* (SNL 2003b). 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 the SMO Statement of Work (SOW). All calibrations and detection limits must be verified before sample analysis and data reporting. Once a laboratory has passed the initial appraisal and has been awarded a contract, the SMO is responsible for continuously monitoring laboratory performance to ensure that the laboratories are audited annually and meet their contractual requirements.

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.

Project QC

Project specified QC samples are submitted to contract laboratories in order to meet project Data Quality Objectives (DQOs) and SAP requirements. Various field QC samples are collected to assess the quality and final usability of the data. Errors that can be introduced into the sampling process include potential sample contamination in the field or during the transportation of samples, some of which are unavoidable. Additionally, the variability present at each sample location can also affect sample results.

Laboratory QC

With each SNL/NM sample batch, laboratory QC samples are concurrently prepared at defined frequencies and analyzed in accordance with

SMO Sample Processing

The SMO processed the following types of samples in 2006 in support of SNL/NM projects:

- *Radioactive waste*
- *Mixed waste*
- *Hazardous waste*
- *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*

established methods. Analytical accuracy, precision, contamination, and matrix effects associated with each analytical measurement are determined.

QC sample results are compared to either statistically established control criteria or method prescribed control limits 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 2006 SMO ACTIVITIES

In 2006, the SMO processed a total of 6,458 samples in support of Sandia projects, including environmental monitoring (air and water), waste characterization, decontamination and demolition (D&D), and Environmental Restoration (ER). Of these, 2,475 were for environmental monitoring and surveillance projects. The completion of several ER groundwater sampling regimens and a reduction in Corrective Action Management Unit (CAMU) sampling (from a monthly to quarterly basis), accounted for the reduction in sampling from 2005. A total of 801 samples were submitted as field and analytical QC samples to assist with data validation and decision making. Approximately, 443 QC samples were taken for environmental monitoring and surveillance projects.

SMO contract laboratories perform work in compliance with the Sandia SOW for analytical laboratories (Puissant 2003).

Inter-Laboratory Comparisons

SMO contract laboratories are required to participate in the DOE Mixed Analyte Performance Evaluation Program (MAPEP). They also participate in commercial vendor programs designed to meet the requirements given in the proficiency testing section (Chapter II) of the NELAC Standard. 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 performance evaluation provider. Windows are typically two or three standard deviations around the true value.

Laboratory QA

In 2006, the SMO continued on-site data package assessments and validation at the NELAC approved laboratories used by Sandia. 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 2006, Sandia 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; Austin, Texas; and Arvada, Colorado; and Hall Laboratory, Albuquerque, New Mexico.

QA Audits

The DOE Consolidated Audit Program (DOECAP), conducted audits in 2006 at the primary SMO contract laboratories using DOECAP Quality Systems Analytical Services (QSAS) requirements. The audit reports, responses from the labs, and closure letters are all posted and tracked through the DOECAP website. The SMO works closely with contract laboratories to expeditiously resolve audit findings. Decisions regarding sample distribution to contract laboratories are based on audit information, including outstanding corrective actions. In 2006, no Priority-1 findings that impacted SMO work were documented during laboratory audits. All corrective actions were expeditiously resolved.

Data Validation and Records Management

Sample collection, Analysis Request, and Chain of Custody (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 data were validated according to the laboratory's QA plan, standard operating procedures (SOPs), and client specific requirements;
- By a qualified member of Sandia's SMO staff who reviews the analytical reports and corresponding sample collections and ARCOC documentation for completeness and laboratory contract compliance; and
- By the Sandia project leader responsible for program objectives, regulatory compliance, and project-specific data quality requirements. The project leader makes the final decision regarding the usability of the data.

In addition, a predetermined percentage of data are validated to detailed method-specified requirements and qualified in accordance with the *Data Validation Procedure for Chemical and Radiochemical Data* (SNL 2003c).

Ant Traffic at Mixed Waste Landfill

chapter nine

REFERENCES, DOCUMENTS, PERMITS, LAWS, REGULATIONS, AND STANDARDS FOR ENVIRONMENTAL PROGRAMS

In This Chapter...

References
Executive Orders
DOE Orders
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40 CFR 50 "National Primary and Secondary Ambient Air Quality Standards"

40 CFR 51 "Requirements for Preparation, Adoption, and Submittal of Implementation Plans"

40 CFR 58 "Ambient Air Quality Surveillance"

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 68 "Chemical Accident Prevention Provisions"

40 CFR 110 "Discharge of Oil"

40 CFR 112 "Oil Pollution Prevention"

40 CFR 122-125 "National Pollutant Discharge Elimination System (NPDES) Regulations"

40 CFR 122 "EPA Administered Permit Programs: The National Pollutant Discharge Elimination System" (NPDES)

40 CFR 123	"State Program Requirements" (NPDES)
40 CFR 124	"Procedures for Decisionmaking" (NPDES)
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"
40 CFR 141.26	"Monitoring Frequency and Compliance Requirements for Radionuclides in Community Water Systems"
40 CFR 143	"National Secondary Drinking Water Regulations"
40 CFR 260-279	RCRA regulations for hazardous waste (as it pertains to mixed waste)
40 CFR 260	"Hazardous Waste Management System: General"
40 CFR 261	"Identification and Listing of Hazardous Waste" (20.4.1.200 NMAC)
40 CFR 262	"Standards Applicable to Generators of Hazardous Waste" (20.4.1.300 NMAC)
40 CFR 263	"Standards Applicable to Transporters of Hazardous Waste" (20.4.1.400 NMAC)
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" (20.4.1.500 NMAC)
40 CFR 265	"Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities" including Subpart F, "Groundwater Monitoring" (20.4.1.600 NMAC)
40 CFR 266	"Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities" (20.4.1.700 NMAC)
40 CFR 268	"Land Disposal Restrictions" (20.4.1.800 NMAC)
40 CFR 270	"EPA Administered Permit Programs: The Hazardous Waste Permit Program" (20.4.1.900 NMAC)
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"
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"
40 CFR 300	"National Oil and Hazardous Substances Pollution Contingency Plan" (NCP)
40 CFR 302	"Designation, Reportable Quantities, and Notification" (CERCLA Implementing Regulation)
40 CFR 355	"Emergency Planning and Notification"
40 CFR 370	"Hazardous Chemical Reporting: Community Right-to-Know"

40 CFR 372	"Toxic Chemical Release Reporting: Community Right-to-Know" (EPCRA Implementing Regulation)
40 CFR 403	"General Pretreatment Regulations for Existing and New Sources of Pollution"
40 CFR 761	"Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions"
40 CFR 763	"Asbestos"
40 CFR 1500-1508	"Council on Environmental Quality, Executive Office of the President, Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act."
49 CFR 100-199	(Department of Transportation regulations)
49 CFR 171–180	(Department of Transportation regulations for hazardous and radioactive waste shipments)

ACTS AND STATUTES

- American Indian Religious Freedom Act (AIRFA) of 1978 (42 U.S.C. §1996)
- Archaeological Resources Protection Act (ARPA) of 1979 (16 U.S.C. §470aa)
- 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 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 Environmental Policy Act (NEPA) of 1969 (42 U.S.C. §4321)
- National Historic Preservation Act of 1966, as amended (16 U.S.C. §470 et seq.)
- Pollution Prevention Act of 1990 (42 U.S.C. §13101 et seq.)
- Quiet Communities Act of 1978 (42 U.S.C. §4901 et seq.)
- Resource Conservation and Recovery Act (RCRA) of 1976 (42 U.S.C. §6901 et seq.)
- Safe Drinking Water Act (SDWA) (42 U.S.C §300f)
- Superfund Amendments and Reauthorization Act (SARA) of 1986 (see CERCLA)
- Toxic Substances Control Act (TSCA) of 1976 (15 U.S.C. §2601 et seq.)

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

APPLICABLE LOCAL AND STATE LAWS AND REGULATIONS FOR ENVIRONMENTAL PROGRAMS

Water Quality

20.6.2 NMAC, "Ground and Surface Water Protection"
20.6.4 NMAC, "Standards for Interstate and Intrastate Surface Waters"
20.7.3 NMAC, "Liquid Waste Disposal and Treatment" (includes effluents to sewer and septic tanks)
20.7.10 NMAC, "Drinking Water"
Albuquerque/Bernalillo County Water Utility Authority, "Sewer Use and Wastewater Control Ordinance."

Air Quality

20.2.3 NMAC, “New Mexico Ambient Air Quality Standards”
20.11 NMAC, “Albuquerque/Bernalillo County Air Quality Control Board Regulations”
20.11.02 NMAC, “Permit Fees”
20.11.08 NMAC, “New Mexico Ambient Air Quality Standards”
20.11.20 NMAC, “Fugitive Dust Control”
20.11.21 NMAC, “Open Burn Permitting”

Miscellaneous

NMSA 76-4-1 et seq.,“New Mexico Pesticide Control Act”
21.17.50 NMAC, “Pesticides”

Oil Storage and Spill Containment

Oil Storage Programs
20.5 NMAC, “Petroleum Storage Tanks”

Waste Management

Hazardous Waste Management Program
20.4.1 NMAC, “Hazardous Waste Management”
20.4.3 NMAC, “Annual Hazardous Waste Fees”

Solid Waste Program
20.9.1 NMAC, “Solid Waste Management”

TABLE 9-1. Summary of Environmental Permits and Registrations in Effect During 2006

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-6	7/1/03	12/31/07	COA
General	WW006 Station Manhole, at Pennsylvania Ave.	2069 F-6	8/1/03	1/31/08	COA
Microelectronics Development Laboratory (MDL)	WW007 Station Manhole, TA-I	2069 G-6	10/12/05	8/31/09	COA
General	WW008 Station Manhole, south of TA-II at Tijeras Arroyo	2069 I-5	2/1/004	7/31/08	COA
General	WW011 Station Manhole, north of TA-III (includes TAs-III and V, and Coyote Test Field sewer lines)	2069 K-5	11/17/04	12/31/08	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 (UST)					
UST (20,000 gallons)	TA-I	1368	6/1/05	6/30/06	NMED
UST (20,000 gallons)	TA-I	1369	6/1/05	6/30/06	NMED
ABOVE GROUND STORAGE TANKS (AST)					
AST / 10,000	TA-I	1370	6/1/05	6/30/06	NMED
AST / 10,000	TA-I	1370	6/1/05	6/30/06	NMED
AST / 10,000	TA-I	1370	6/1/05	6/30/06	NMED
AST / 1,500	TA-I	1370	6/1/05	6/30/06	NMED
AST / 2,000	TA-I	1370	6/1/05	6/30/06	NMED
AST / 5,000	TA-III	1370	6/1/05	6/30/06	NMED
AST / 25,000	CTF	1370	6/1/05	6/30/06	NMED
WATER Line Permits					
Permit to Operate a Treatment Plant	Tonopah Test Range (TTR)	NY-3014-TP11-12NTNC	9/14/06	9/30/07	NDEP
Permit to Operate a Water System	Tonopah Test Range (TTR)	NY-3014-12NTNC	9/14/06	9/30/07	NDEP

See notes at end of table.

TABLE 9-1. Summary of Environmental Permits and Registrations in Effect During 2006 *(continued)*

Permit Type and/or Facility Name	Location	Permit Number	Issue Date	Expiration Date	Regulatory Agency
STORM WATER					
National Pollution Discharge Elimination System (NPDES) "Multi-sector General" Permit	Storm water discharges from Points (MP) 01 through MP 10	NMR05A961	2/01	9/30/05 EPA has indefinitely extended this Permit	EPA
NPDES Construction Permits					
Center for Integrated Nanotechnology (CINT) CORE Facility Construction Project	Eubank	NMR15DC23	10/21/03	6/30/06	EPA
Microsystems and Engineering Science Applications (MESA) Facility	TA-I	NM0002376	N/A	7/31/09	EPA
Exterior Communication Infrastructure Modernization (ECIM) Project	TA-I	NMR15DC79	3/1/04	6/30/06	EPA
Photovoltaics Parking Lot	Photovoltaics Parking Lot	NMR15DV49	11/05/04	6/30/05	EPA
Building 956 - Lot A	Building 956	NMR15DW01	11/12/04	5/30/05	EPA
Building 1090	TA-I	NMR15E170	2/8/2005	9/30/2005	EPA
20th Street Stockpile Area	TA-I	NMR15E764	04/29/05	3/30/2007	EPA
46kV Line Partial Circuit #2 Replacement	TA-III-IV	NMR15ED84	07/14/05	1/30/2006	EPA
National Infrastructure Simulation and Analysis Center (NISAC) Building 1008	TA-II	NMR15EL42	11/1/2005	11/30/2006	EPA
TA-1 Waterline Replacement Phase III	TA-I	NMR15EO38	12/16/2005	3/28/2007	EPA
46kV Feeder #1 Replace & Switching Station	TA-III-IV	NMR15EO48	12/21/2005	10/30/2007	EPA
New Master Substation Utility - Sub-42	TA-IV	NMR15EO73	12/23/2005	5/30/2007	EPA
WAIVERS					
Building 1090 Parking Lot	TA-II	NMLEW0297	12/14/2005	7/1/2006	EPA
9990 Com Trench	TA-III	NMLEW0303	12/27/2005	6/30/2006	EPA
COMPLETED PROJECTS					
Aerial Cable Facilities Renovation	Sol se Mete Canyon	NMR15DD44	3/12/04	5/30/05	EPA
Building 755	Building 755	NMR15DK40	8/9/04	4/15/05	EPA
TA-I Waterline Rehabilitation Project	TA-I	NMR15DR15	9/9/04	10/30/05	EPA
Building 702 Construction	Building 702	NMLEW108	8/9/2004	4/15/05	EPA
Building 758 Construction	Building 758	NA	12/21/04	7/8/05	EPA
TA-II & TA-IV Improvements	TA-II and TA-IV	NMR15DY00	12/8/04	6/30/05	EPA
Building 729	Building 729	NMR15DY97	1/4/05	7/31/05	EPA
ECOLOGICAL					
U.S. Fish and Wildlife Service Special Purpose Salvage Permit	Site-Wide Ecological Monitoring	MB040780-0	5/30/01	12/31/05	U.S. Fish and Wildlife Service
U.S. Fish and Wildlife Service Special Purpose Relocate Permit	Site-Wide Ecological Monitoring Activity	MB105852-0	5/26/05	6/30/05	U.S Fish and Wildlife Service

See notes at end of table.

TABLE 9-1. Summary of Environmental Permits and Registrations in Effect During 2006 *(continued)*

Permit Type and/or Facility Name	Location	Permit Number	Issue Date	Expiration Date	Regulatory Agency
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 (storage)	NM5890110518-1	8/6/92	08/06/02 [a] ** (request for renewal submitted 2/6/02, most recent revision submitted 5/12/2006)	NMED
RCRA Part B Operating Permit Module IV - Hazardous and Solid Waste Amendments (HSWA) Portion for Solid Waste Management Units (SWMUs)	Environmental Restoration (ER) Sites	NM5890110518-1	8/26/93	9/20/02 [a]** (request for renewal submitted 2/6/02, most recent revision submitted 5/12/2006)	EPA/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	12/4/04a ** (request for renewal submitted 2/6/02, most recent revision submitted 5/12/2006)	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	NM5890110518	9/25/97	9/20/02 [a]** (request for renewal submitted 2/6/02, most recent revision submitted 8/2004)	NMED
RCRA Part A Permit Application for Hazardous Waste Management Units for the hazardous component in mixed waste stored and/or treated at ten waste management areas.	RMWMF (storage and treatment); 7 Manzano Bunkers (storage only); Auxiliary Hot Cell Facility (storage and treatment)	NM5890110518	Application for interim status first submitted 8/90; most recent revision 5/12/2006	Under Review[a] (No expiration date)	NMED
RCRA Part B Permit Application for Hazardous Waste Management Units for the hazardous component in mixed waste stored and/or treated at seven waste management areas.	RMWMF (MW treatment and storage); 5 Manzano Bunkers (storage only); Auxiliary Hot Cell Facility (storage and treatment)	NM5890110518	Application first submitted in 1992. Most recent revision submitted 5/12/2005	Under Review [a]	NMED
TSCA					
Risk-Based Approval Request under 40 CFR 761.61(c); Risk-Based Method for Management of PCB Materials; Chemical Waste Landfill and Corrective Action Management Unit (CAMU)	Chemical Waste Landfill and CAMU, co-located in TA-III	N/A	6/26/02	CAMU Closure Report submitted 4/19/04. CWL permit continues until closure. CWL closure delayed pending NMED remedy selection process; closure expected late 2007.	EPA, Region 6

See notes at end of table.

TABLE 9-1. Summary of Environmental Permits and Registrations in Effect During 2006 *(continued)*

Permit Type and/or Facility Name	Location	Permit Number	Issue Date	Expiration Date	Regulatory Agency
Open Burn Permits*					
Thermal Treatment Facility	TTF	#05-0246	1/1/06	12/31/06	COA
Large Pool Fire 250 gal	Lurance Burn Site	#06-0001	1/1/06	12/31/06	COA
Igloo Building 9830	Lurance Burn Site	#06-0002	1/1/06	12/31/06	COA
2K# Propellant Qualification	10,000' Sled Track	#06-0003	1/1/06	12/31/06	COA
Wood Crib Fire Tests	Burn Site/Sled	#06-0004	1/1/06	12/31/06	COA
Explosive Applications	Impact Test Facility	#06-0005	1/1/06	12/31/06	COA
Propellant Applications	Impact Test Facility	#06-0007	1/1/06	12/31/06	COA
Thermite Applications	Impact Test Facility	#06-0008	1/1/06	12/31/06	COA
Hydrogen Peroxide (H_20_2)	Explosives Testing	#06-0015	2/15/06	12/31/06	COA
Fire Extinguisher Training	Fire Extinguisher	#06-0016	2/1/05	12/31/05	COA
D Box Explosive Tests	Above Ground	#06-0030	2/20/06	12/31/06	COA
Large Pool Fire 4K gal #1	Lurance Burn Site	#06-0031	3/14/06	4/14/06	COA
Explosive Applications	Explosives Testing	#06-0034	3/27/06	12/31/06	COA
Large Pool Fire 4K gal #2	Lurance Burn Site	#06-0037	4/14/06	5/14/06	COA
Large Wood Crib Fire Test	Burn Site/Sled	#06-0038	4/14/06	5/14/06	COA
Thermite Applications	Thunder Range	#06-0045	5/11/06	12/31/06	COA
Liquid Natural Gas (LNG)	Water Impact Facility	#06-0048	6/1/06	12/31/06	COA
Spartan Rocket Demolition	Thunder Range	#06-0049	7/8/06	8/7/06	COA
Large Pool Fire 2500 gal #1	Lurance Burn Site	#06-0076	11/20/06	12/10/06	COA
Large Pool Fire 2500 gal #2	Lurance Burn Site	#06-0079	11/22/06	12/22/06	COA
AIR (Permits & Registrations)					
Document Disintegrator Facility	TA-III	144-M1	9/28/2006	Annual Review	COA
Fire Laboratory used for the Authentication of Modeling and Experiments (FLAME)	Burn Site	196	5/19/88	Annual Review	COA
Neutron Generator Facility (NGF)	TA-I	374- M1	7/17/98	Annual Review	COA
Standby diesel generators at Bldg 862	TA-I	402	5/07/96	Annual Review	COA
Radioactive and Mixed Waste Management Facility (RMWMF)	TA-III	415- M1	5/10/97	Biennial update	COA
Title V Operating Permit	Site-Wide	515 (pending)	Submitted[a] 3/1/96	Pending (5 yr renewal)	COA

See notes at end of table.

TABLE 9-1. Summary of Environmental Permits and Registrations in Effect During 2006 *(concluded)*

Permit Type and/or Facility Name	Location	Permit Number	Issue Date	Expiration Date	Regulatory Agency
AIR (Permits & Registrations) (concluded)					
Emergency Generator at Building 702	TA-I	924	5/5/98	Annual Review	COA
Processing and Environmental Technology Laboratory (PETL) Emergency Generator	TA-I	925-M1	3/5/01	Annual Review	COA
PETL Boilers and HAP Chemicals	TA-I	936	5/5/04	Annual Review	COA
Advanced Manufacturing Prototype Facility (AMPF)	TA-I	1406	11/6/00	Annual Review	COA
Microelectronics Development Laboratory (MDL)	TA-I	1678-M1	12/23/02	Annual Review	COA
Steam Plant	TA-I	1705	11/10/04	Annual Review	COA
Thermal Test Complex	TA-III	1712	4/9/04	Annual Review	COA
Center for Integrated Nanotechnology (CINT)	Sandia Science & Technology Park	1725	10/11/04	Annual Review	COA
Microsystems and Engineering Sciences Applications (MESA) Boilers	TA-I Bldg 858J	1820	9/26/2006	Annual Review	COA
SE Area of TA-I Emergency Generator	SE Area of TA-I	1828	9/28/2006	Annual Review	COA
FUGITIVE DUST CONTROL AND DEMOLITION PERMIT FILE* (Permits & Registrations)**					
ESH Building 1090	TA-II	10-86-3058	1/19/2005	9/1/2006	COA
Building 729	TA-I	10-204-3060	1/24/2005	1/24/2006	COA
Building 758	TA-I	10-468-3070	1/31/2005	1/31/2006	COA
CWL's Cover	TA-III	10-411-3090	3/2/2005	3/2/2006	COA
Soil Stockpile	TA-I	10-348-3106	3/16/2005	3/16/2006	COA
Building 755	TA-I	10-344-3128	3/6/2005	3/6/2006	COA
Building 6536	TA-I	10-210-3224	7/22/2005	7/22/2006	COA
TA-II Building Demolition	TA-II	10-210-3251	9/1/2005	9/1/2006	COA
Building 9940 Programmatic	Outside TA-III	P05-0057	11/10/2005	11/10/2010	COA
Thunder Range Programmatic	Outside TA-III	P06-0004	5/2/2006	5/2/2011	COA

NOTES: [†] Registration = Certificate - no permit required

Approval = EPA did not issue a permit to NMED on 02/06/2002

[a] Combined with application for permit renewal submitted to NMED on 02/06/2002

PCB = polychlorinated biphenyl

*Open Burn Permits are issued by the City of Albuquerque for no more than a year at any one time.

**Sandia submitted a timely application for permit renewal (RCRA Part A and Part B permit applications) to NMED on 02/06/2002. The old permit remains in force until the new one is issued.

***Permits are obtained by general contractors directly from City of Albuquerque

COA= City of Albuquerque

TA= technical area

EPA = U.S. Environmental Protection Agency

N/A = not applicable

NMED = New Mexico Environment Department

RCRA = Resource Conservation and Recovery Act

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TABLE 9-2. Federal and State Air Regulations Applicable to SNL/NM

CAA Title	CAA Section	Federal Regulation	Local Regulation	Subject
I	176(c)	40 CFR 51 40 CFR 93	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 11.08	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	Fugitive Dust Control
		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	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: Decentralized
			20 NMAC 11.101	Motor Vehicle Inspection: Centralized
		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) <u>Subpart H</u> – Radionuclides <u>Subpart M</u> – 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	Stratospheric Ozone Protection
VII	113-114	40 CFR 64	20 NMAC 11.90	Administration, Enforcement, Inspection

NOTES: CAA = Clean Air Act
NMAC = New Mexico Administrative Code
CFR = Code of Federal Regulations

TABLE 9-3. Summary of Compliance History with Regard to Mixed Waste (MW) at SNL/NM

Date	Milestone	Comment
1984	Amendments to Resource Conservation and Recovery Act (RCRA) and Hazardous and Solid Waste Amendments (HSWA) in 1984	MW became an issue after amendments to RCRA and HSWA enforced Land Disposal Restrictions (LDRs), including prohibition on storage of wastes for more than one year.
Aug 1990	RCRA Part A Interim Status Permit Application	Submitted RCRA Part A Interim Status Permit application for MW storage. Later revisions to the interim status permit added proposed MW treatment processes.
Oct 1992	Federal Facilities Compliance Act (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 1992	Notice of Noncompliance (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 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, when it was replaced with new sorting procedures
Oct 1995	Federal Facility Compliance Order (FFCO) 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 1995	Compliance Order Issued	NMED issued a Compliance Order enforcing the STP
Sep 1996	First MW Shipment	First MW shipment made to Perma-Fix/DSSI
Oct 1996	FFCO Amendment No. 1	FFCO amended
Dec 1996	Revisions to Proposed Treatment Methods	DOE and Sandia re-submitted Part A and B permit application, to reflect revisions to proposed on-site treatment methods
May 1997	FFCO Amendment No. 2	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
1997	STP Milestones Met	Treated wastes on site and shipped mixed wastes to off-site treatment and disposal facilities, meeting all treatment and disposal milestones. Updated STP to reflect FY 1996 activities, and changes to proposed treatment technologies. NMED approved Revision 1 to STP, revising waste volumes and treatment/disposal technologies, and establishing new deadlines.
1998	STP Milestones Met	Treated wastes on site and shipped mixed wastes to off-site treatment and disposal facilities, meeting all treatment and disposal milestones. Updated STP to reflect FY 1997 activities, and changes to proposed treatment technologies. NMED approved Revision 2 to STP, revising waste volumes and treatment/disposal technologies, and establishing new deadlines.
1999	STP Milestones Met	Treated wastes on site and shipped mixed wastes to off-site treatment and disposal facilities, meeting all treatment and disposal milestones. Updated STP to reflect FY 1998 activities, and changes to proposed treatment technologies. NMED approved Revision 3 to STP, revising waste volumes and treatment/disposal technologies, and establishing new deadlines.

See notes at end of table.

TABLE 9-3. Summary of Compliance History with Regard to Mixed Waste (MW) at SNL/NM (concluded)

Date	Milestone	Comment
2000	STP Milestones Met	Treated wastes on site and shipped mixed wastes to off-site treatment and disposal facilities, meeting all treatment and disposal milestones. Updated STP to reflect FY 1999 activities, and changes to proposed treatment technologies. NMED approved Revision 4 to STP, revising waste volumes and treatment/disposal technologies, and establishing new deadlines.
2001	STP Milestones Met	Treated wastes on site and shipped mixed wastes to off-site treatment and disposal facilities, meeting all treatment and disposal milestones. Updated STP to reflect FY 2000 activities, and changes to proposed treatment technologies. NMED approved Revision 5 to STP, revising waste volumes and treatment/disposal technologies, and establishing new deadlines.
2001	FFCO Amendment No. 3	FFCO amended
2002	STP Milestones Met	Treated wastes on site and shipped mixed wastes to off-site treatment and disposal facilities, meeting all treatment and disposal milestones. Updated STP to reflect FY 2001 activities, and changes to proposed treatment technologies. NMED approved Revision 6 to STP, revising waste volumes and treatment/disposal technologies, and establishing new deadlines.
Feb 2002	Revisions to Permit Application	DOE and Sandia submitted updated Part A and B permit application, to reflect revisions to on-site waste management operations. Permit application for mixed waste management units is combined with permit renewal request for hazardous waste management units at SNL/NM.
2003	STP Milestones Met	Treated wastes on site and shipped mixed wastes to off-site treatment and disposal facilities, meeting all treatment and disposal milestones. Updated STP to reflect FY 2002 activities, and changes to proposed treatment technologies. NMED approved Revision 7 to STP, revising waste volumes and treatment/disposal technologies, and establishing new deadlines.
2004	STP Milestones Met	Treated wastes on site and shipped mixed wastes to off-site treatment and disposal facilities, meeting all treatment and disposal milestones. Updated STP to reflect FY 2003 activities, and changes to proposed treatment technologies. NMED approved Revision 8 to STP, revising waste volumes and treatment/disposal technologies, and establishing new deadlines.
2004	FFCO Amendment No. 4	FFCO amended
2005	STP Milestones Met	Treated wastes on site and shipped mixed wastes to off-site treatment and disposal facilities, meeting all treatment and disposal milestones. Updated STP to reflect FY 2004 activities, and changes to proposed treatment technologies. NMED approved Revision 9 to STP, revising waste volumes and treatment/disposal technologies, and establishing new deadlines.
2006	STP Milestones Met	Treated wastes on site and shipped mixed wastes to off-site treatment and disposal facilities, meeting all treatment and disposal milestones. Updated STP to reflect FY 2005 activities, and changes to proposed treatment technologies. NMED approved Revision 10 to STP, revising waste volumes and treatment/disposal technologies, and establishing new deadlines.

NOTES: 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.
FY = fiscal year
DOE = Department of Energy
HDRV = Historical Disposal Requests Validation
STP = Site Treatment Plan
FFCO = Federal Facility Compliance Order
MW = Mixed Waste

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TABLE 9-4. Mixed Waste Treatment and Disposal Status (End of FY 2006)

Waste Category	Volume (m^3)	Description	Status and Plans
TG 1	0	Inorganic Debris with Explosive Component	No waste currently in inventory
TG 2	0	Inorganic Debris with a Water Reactive Component	No waste currently in inventory.
TG 3	0	Reactive Metals	No waste currently in inventory.
TG 4	0	Elemental Lead	No waste currently in inventory.[a]
TG 5	0	Aqueous Liquids (Corrosive)	No waste currently in inventory.
TG 6	0	Elemental Mercury	No waste currently in inventory.
TG 7	0	Organic Liquids I	No waste currently in inventory.
TG 8	0	Organic Debris with Organic Contaminants	No waste currently in inventory.
TG 9	0.003	Inorganic Debris with TCLP Metals	Utilizing on-site treatment or shipping to off-site treatment and disposal facilities. [a]
TG 10	0.2	Heterogeneous Debris	Sort waste as needed to determine more suitable treatability groups.
TG 11	0	Organic Liquids II	No waste currently in inventory.
TG 12	1.6	Organic Debris with TCLP Metals	Utilizing off-site treatment and disposal options. [a]
TG 13	0	Oxidizers	No waste currently in inventory.
TG 14	0	Aqueous Liquids with Organic Contaminants	No waste currently in inventory.
TG 15	0	Soils <50 percent Debris & Particulates with TCLP Metals	No waste currently in inventory.
TG 16	0	Cyanide Waste	No waste currently in inventory.
TG 17	0.04	Liquid/Solid with Organic and/or Metal Contaminants	Utilizing on-site treatment and off-site treatment and disposal options. [a]
TG 18	0	Particulates with Organic Contaminants	No waste currently in inventory.
TG 19	0	Liquids with Metals	No waste currently in inventory.
TG 20	1.0	Propellant with TCLP Metals	Utilizing on-site treatment and off-site treatment and disposal options. [a]
TG 21	0.007	Sealed Sources with TCLP Metals	Utilizing on-site treatment and off-site treatment and disposal options.
TG 22	0	Reserved	Not Applicable
TG 23	0	Thermal Batteries	No waste currently in inventory.
TG 24	0.02	Spark Gap Tubes with TCLP Metals	Utilizing on-site treatment and off-site treatment options, and investigating off-site disposal options. [a]
TG 25	8.6	Classified Items with TCLP Metals	Sort waste as needed to determine more suitable treatability groups.
TG 26	0	Debris Items with Reactive Compounds & TCLP Metals	No waste currently in inventory
TG 27	0	High Mercury Solids & Liquids	No waste currently in inventory
TRU/MW	1.05	TRU/MW	Investigating off-site treatment and disposal options.

NOTES: [a] Treatment and/or disposal at one or more permitted off-site mixed waste management facilities.
Treatments are detailed in the *Site Treatment Plan for Mixed Waste, Sandia National Laboratories, New Mexico* (SNL 2006d) and the *Site Treatment Plan for MW, FY05 Update* (SNL 2006e).
TCLP = toxicity characteristic leaching procedure m^3 = cubic meters
TRU/MW = transuranic/mixed waste

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 DOE Order 5400.5, *Radiation Protection of the Public and the Environment* (DOE 1993). Environmental monitoring requirements for DOE operations are given in DOE Order 450.1, *Environmental Protection Program* (DOE 2005). 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 9-5 lists the DCGs pertinent to activities at SNL/NM and to this report.

TABLE 9-5. 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

NOTES: 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 (DOE 1993).

- *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 9-6 summarizes the public radiation protection standards that are applicable to DOE facilities.

WATER QUALITY MONITORING PARAMETERS

Resource Conservation and Recovery Act (RCRA)

Table 9-7 lists the 40 CFR 265, Subpart F, parameters required for groundwater monitoring analysis, implemented under RCRA. Table 9-8 gives the EPA interim primary drinking water standards (40 CFR 265, Appendix III) for the groundwater monitoring parameters. Table 9-9 gives EPA secondary drinking water standards. At SNL/NM, this regulation applies to Environmental Restoration (ER) sites. Table 9-10 gives New Mexico Water Quality Control Commission (NMWQCC) Standards for groundwater.

TABLE 9-6. 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 calculates doses resulting from all potential air depositions and direct inhalation (e.g., emissions, ground shine, food crops)

NOTES: *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 DOE = Department of Energy

TABLE 9-7. 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

NOTES: *Resource Conservation and Recovery Act (RCRA)
†40 CFR 265, Appendix III.
pH = potential of hydrogen (acidity)

TABLE 9-8. EPA Primary Drinking Water Supply Standards/New Mexico Drinking Water Standards

Inorganic Chemicals	MCL	Units
Antimony	0.006	mg/L
Arsenic	0.010	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]	0.2	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 9-8. 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
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

NOTES: EPA = Enviromental Protection Agency
*action level concentrations which trigger systems into taking treatment steps if 10 percent 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 9-9. 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

NOTES: EPA = Environmental Protection Agency
mg/L = milligram per liter
pH = potential of hydrogen (acidity)

TABLE 9-10. New Mexico Water Quality Control Commission (NMWQCC) Standards for Groundwater of 10,000 mg/L total dissolved solid (TDS) Concentration or Less

Contaminant	NMWQCC Standard	Units
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	0.75	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 Disolved Solids	1000.0	mg/L
Zinc	10.0	mg/L
pH	Between 6 and 9	

NOTES: mg/L = milligram per liter
MAC = maximum allowable concentration
pH = potential of hydrogen (acidity)
pCi/L = picocurie per liter

TABLE 9-10. New Mexico Water Quality Control Commission (NMWQCC) Standards for Groundwater of 10,000 mg/L total dissolved solid (TDS) Concentration or Less *(concluded)*

Contaminant	NMWQCC Standard	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

NOTES: mg/L = milligram per liter
MAC = maximum allowable concentration
pCi/L = picocurie per liter

GLOSSARY

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A

Abatement – Reducing the degree or intensity of, or eliminating, pollution.

Absorbent material – a material having capacity or tendency to absorb another substance.

Absorption – The uptake of water, other fluids, or dissolved chemicals by a cell or an organism (as tree roots absorb dissolved nutrients in soil.)

Alluvial – Relating to and/or sand deposited by flowing water.

Ambient Air – Any unconfined portion of the atmosphere: open air, surrounding air.

Analyte – A substance or chemical constituent that is undergoing analysis.

Antimony – A metallic element having four allotropic forms, the most common of which is a hard, extremely brittle, lustrous, silver-white, crystalline material. It is used in a wide variety of alloys, especially with lead in battery plates, and in the manufacture of flame-proofing compounds, paint, semiconductor devices, and ceramic products.

Appraisal – A documented activity performed according to written procedures and specified criteria to evaluate the compliance and conformance of an organization with programs, standards, and other requirements contained in orders, laws, and regulations, or other requirements invoked by SNL.

Aquifer – An underground geological formation, or group of formations, containing water. A source of groundwater for wells and springs.

Arroyo – A deep gully cut by an intermittent stream; a dry gulch.

Asbestos – A mineral fiber that can pollute air or water and cause cancer or asbestosis when inhaled. Uses for asbestos-containing material include, but are not limited to, electrical and heat insulation, paint filler, reinforcing agents in rubber and plastics (e.g., tile mastic), and cement reinforcement.

Attenuation – The process by which a compound is reduced in concentration over time, through absorption, adsorption, degradation, dilution, and/or transformation. Can also be the decrease with distance of sight caused by attenuation of light by particulate pollution.

Audit – 1. An examination of records or financial accounts to check their accuracy. 2. An adjustment or correction of accounts. 3. An examined and verified account.

B

Background radiation – Relatively constant low-level radiation from environmental sources such as building materials, cosmic rays, and ingested radionuclides in the body.

Basin – 1. A low-lying area, wholly or largely surrounded by higher land, that varies from a small, nearly enclosed valley to an extensive, mountain-rimmed depression. 2. An entire area drained by a given stream and its tributaries. 3. An area in which the rock strata are inclined downward from all sides toward the center. 4. An area in which sediments accumulate.

Best management practice – The preferred methods and practices for managing operations.

Biological niche – A role played by a species in the environment.

Biota – The animal and plant life of a given region.

Borehole – A hole created or enlarged by a drill or auger. Also known as drill hole.

C

Catchment basin – The geographical area draining into a river or reservoir.

Cesium-137 – A radioactive isotope of cesium used in radiation therapy.

Commercial solid waste –Includes all types of solid waste generated by stores, offices, restaurants, warehouses, and other non-manufacturing activities, excluding residential, household and industrial wastes. At SNL, such waste includes office trash, packaging material, empty containers, cardboard, newspaper, broken glass, and food debris.

Coniferous Forest – A type of forest characterized by cone-bearing, needle-leaved trees

Containment – An enclosed space or facility to contain and prevent the escape of hazardous material.

Containment cell – An engineered structure designed to contain and prevent the migration of hazardous waste.

Contamination – Introduction into water, air, and soil of microorganisms, chemicals, toxic substances, wastes, or wastewater in a concentration that makes the medium unfit for its next intended use. Also applies to surfaces of objects, buildings, and various household and agricultural use products.

Corrective action – 1. EPA can require treatment, storage and disposal (TSDF) facilities handling hazardous waste to undertake corrective actions to clean up spills resulting from failure to follow hazardous waste management procedures or other mistakes. The process includes cleanup procedures designed to guide TSDFs toward in spills. 2. An action identified to correct a finding that, when completed, fixes the problem or prevents recurrence.

D

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

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

Discharge – Any liquid or solid that flows or is placed on or onto any land or into any water. This includes precipitation discharges to the storm drains, accidental or intentional spilling, leaking, pumping, pouring, emitting, emptying, or dumping of any material or substance on or into any land or water.

Discharge Limits – The maximum concentration of a specified pollutant allowed to be discharged in a volume of water or wastewater.

Discharge point – The site or location of a release, flow or runoff of any waste governed by regulation.

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

Dosimeter – A device used to measure the dose of ionizing radiation received by an individual.

Drawdown – 1. The drop in the water table or level of water in the ground when water is being pumped from a well. 2. The amount of water used from a tank or reservoir. 3. The drop in the water level of a tank or reservoir.

E

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

Ecosystem – The interacting system of a biological community and its non-living environmental surroundings.

Effective dose equivalent (EDE) – The weighted average of dose equivalents in certain organs or tissues of the body; this can be used to estimate the health-effects risk of the exposed individual.

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

Electroplating – To coat or cover with a thin layer of metal by electrodeposition.

Environment – The sum of all external conditions affecting the life, development and survival of an organism.

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

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

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

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

Environmental Monitoring -- The collection and analysis of samples or direct measurements of environmental media such as air, water, and soil.

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

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

Environmental restoration (ER) site – Any location listed on the environmental restoration (ER) site list that has been identified as an area that is (or may be) contaminated-either on or beneath the land surface-as a result of SNL operations. Contaminants may be chemicals, radioactive material, or both.

Environmental Surveillance – A program including surveys of soil and vegetation, water sampling and analysis, in an attempt to identify and quantify long-term effects of pollutants resulting from SNL operations.

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

Exceedance – Violation of the pollutant levels permitted by environmental protection standards.

Explosive waste – Any explosive substance, article, or explosive-contaminated item that cannot be used for its intended purpose and does not have a legitimate investigative or research use.
Examples include:

- Unstable explosive substances or articles
- Wipes, filters, or debris contaminated with explosives
- Scraps, cuttings, chips, fines, etc. from plastic, composite, or sheet explosives
- Explosives dissolved in solvents
- Damaged or misfired explosive articles
- Small quantities of bulk explosives, pyrotechnics, and propellants for which there are no known reapplication uses

Any of the above examples that have an investigative or research use are not waste until the owner determines that there is no further legitimate need or use for them.

F

Fault – A fracture in the continuity of a rock formation caused by a shifting or dislodging of the earth's crust, in which adjacent surfaces are displaced relative to one another and parallel to the plane of fracture.

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

Flora – 1. Plants. 2. The plant life characterizing a specific geographic region or environment.

Flow channel – the part of a stream bed that is occupied by water under normal flow conditions

G

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

Groundwater – The supply of fresh water found beneath the Earth's surface, usually in aquifers, which supply wells and springs. Because ground water is a major source of drinking water, there is growing concern over contamination from leaching agricultural or industrial pollutants or leaking underground storage tanks.

H

Hazardous substance – 1. Any material that poses a threat to human health and/or the environment. Typical hazardous substances are toxic, corrosive, ignitable, explosive, or chemically reactive. 2. Any substance designated by EPA to be reported if a designated quantity of the substance is spilled in the waters of the United States or is otherwise released into the environment.

Hazardous waste – Waste that meets any of the following conditions:

- On analysis, exhibits any of the characteristics of a hazardous waste as defined in 40 CFR 261 Subpart C
- Has been named as a hazardous waste and is listed as such in 40 CFR 261 Subpart D
- A mixture containing a listed hazardous waste and a nonhazardous solid waste
- A waste derived from the treatment, storage, or disposal of a listed hazardous waste
- Is not excluded from regulation as a hazardous waste
- Defined as hazardous waste by specific state regulations

Hazardous waste landfill – An excavated or engineered site where hazardous waste is deposited and covered.

Hazardous waste site – Any facility or location at which hazardous waste operations take place.

Herbicides – A chemical pesticide designed to control or destroy plants, weeds, or grasses.

High-level radioactive waste (HLW) – Waste generated in core fuel of a nuclear reactor, found at nuclear reactors or by nuclear fuel reprocessing; is a serious threat to anyone who comes near the waste without shielding.

Hydrology – The science dealing with the properties, distribution, and circulation of water.

I

Illicit discharges – The absolute prohibitions against the release of certain substances.

Implementation plan (IP) – The plan developed by the Operational Readiness Review (ORR) or Readiness Assessment (RA) team that describes the specifics of approach, schedule, methodology, team members and their qualifications, and reporting requirements of the ORR or RA. The Implementation Plan (IP) is used by the team leader to execute the ORR or RA.

Industrial discharges – The absolute prohibitions against the release of certain substances.

Inertial-confinement fusion – A method of controlled fusion in which the rapid implosion of a fuel pellet, produced by laser, electron, or ion beams, raises the temperature and density of the pellet core to levels at which nuclear fusion can take place before the pellet flies apart.

Infiltration – 1. The penetration of water through the ground surface into sub-surface soil or the penetration of water from the soil into sewer or other pipes through defective joints, connections, or manhole walls. 2. The technique of applying large volumes of waste water to land to penetrate the surface and percolate through the underlying soil.

Inhalation hazard – Risk from materials or chemicals that present a hazard if respired (inhaled) into the lungs.

Insecticides – A pesticide compound specifically used to kill or prevent the growth of insects.

Integrated Safety Management System – Systematically integrates safety into management and work practices at all levels so that missions are accomplished while protecting the worker, the public, and the environment.

L

Lagoons – 1. A shallow pond where sunlight, bacterial action, and oxygen work to purify wastewater; also used for storage of wastewater. 2. Shallow body of water, often separated from the sea by coral reefs or sandbars.

Landfill – 1. Sanitary landfills are disposal sites for non-hazardous solid wastes spread in layers, compacted to the smallest practical volume, and covered by material applied at the end of each operating day. 2. Secure chemical landfills are disposal sites for hazardous waste, selected and designed to minimize the chance of release of hazardous substances into the environment.

Leachate – Water that collects contaminants as it trickles through wastes, pesticides or fertilizers. Leaching may occur in farming areas, feedlots, and landfills, and may result in hazardous substances entering surface water, ground water, or soil.

Leached – The process by which soluble constituents are dissolved and filtered through the soil by a percolating fluid.

Legacy contamination – Contamination that remains after facilities, operations, or activities that created it have gone out of existence or ceased, often resulting in an orphan site in need of remediation or institutional control.

Line Management – The process of managing workers through individual Integrated Job Structure assignments (i.e., work titles) and contractor positions that support SNL's mission core processes and enabling processes.

Long-term Environmental Stewardship – Activities necessary to maintain long-term protection of human health and the environment from hazards posed by residual radioactivity and chemically hazardous materials.

Low-Level Radioactive Waste (LLW) – Wastes less hazardous than most of those associated with a nuclear reactor; generated by hospitals, research laboratories, and certain industries. The Department of Energy, Nuclear Regulatory Commission, and EPA share responsibilities for managing them.

Low Temperature Thermal Desorption (LTTD) – A process of removing organic compounds from soil by heating it and causing the organics to volatilize and/or decompose. The volatilized compounds may be further degraded by after burning or catalysis.

M

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

Members of the Workforce – For purposes of CPR400.1.1/MN471001, ES&H Manual, and its supplements, Members of the Workforce are: Sandia employees and contractor employees as specified in CPR400.1.1/MN471001, ES&H Manual, Section 1B, "What Is the Scope."

Migratory birds – All birds listed within the Migratory Bird Treaty Act, 50 CFR 10.13, or which are a mutation or hybrid of any such species, including any part, nest, or egg.

Mixed Low-Level Waste (MLLW) – Waste containing both hazardous and low-level radioactive components.
Mixed waste – Radioactive waste that contains both source material, special nuclear material, or by-product material subject to the Atomic Energy Act of 1954, as amended; and a hazardous component subject to the Resource Conservation and Recovery Act (RCRA), as amended.

Mixed waste generator – Any person or organization generating mixed waste or causing a material to be subject to mixed waste regulations. Generators are responsible for the generation and subsequent management of mixed waste as part of their occupation or position. Generators may include managers, their employees, and contractors.

N

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

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

National Pollutant Discharge Elimination System (NPDES) – A provision of the Clean Water Act which prohibits discharge of pollutants into waters of the United States unless a special permit is issued by EPA, a state, or, where delegated, a tribal government on an Indian reservation.

Natural resources – Resources (actual and potential) supplied by nature.

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

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

Nitrogen Dioxide – A poisonous brown gas, NO2, often found in smog and automobile exhaust fumes and synthesized for use as a nitrating agent, a catalyst, and an oxidizing agent.

Non-Methane Hydrocarbon (NMHC) – The sum of all hydrocarbon air pollutants except methane; significant precursors to ozone formation.

Non-radiological Contaminants – A source of contamination that has no radiological components.

Nuclear energy – The energy released by a nuclear reaction.

Nuclear particle acceleration – Imparting large kinetic energy to electrically charged sub-atomic nuclear particles (e.g., protons, deuterons, electrons) by applying electrical potential differences for the purpose of physics experiments.

O

Outfalls – The place where effluent is discharged into receiving waters.

Overland surface flow – A land application technique that cleanses waste water by allowing it to flow over a sloped surface. As the water flows over the surface, contaminants are absorbed and the water is collected at the bottom of the slope for reuse.

Ozone – A colorless gas (O3) soluble in alkalis and cold water; a strong oxidizing agent; can be produced by electric discharge in oxygen or by the action of ultraviolet radiation on oxygen in the stratosphere (where it acts as a screen for ultraviolet radiation).

P

PM10 – Particulate matter (diameter equal to or less than 10 microns)

PM2.5 – Respirable particulate matter (diameter equal to or less than 2.5 microns)

Passive soil vapor – Used in the context of soil gas sampling by placing a porous material into contact with the soil. Gases present in the soil will adsorb to the material. The porous material is removed from the soil after a sufficient time of exposure and sent to a laboratory for analysis of the adsorbed gases.

Perched groundwater – Groundwater that is unconfined and separated from an underlying main body of groundwater by an unsaturated zone (also known as perched water).

Perennial spring – A spring that flows continuously, as opposed to an intermittent spring or periodic spring.

Physiography – The study of the natural features of the earth's surface, especially in its current aspects, including land formation, climate, currents, and distribution of flora and fauna (also called physical geography).

Piezometer – An instrument for measuring pressure, especially high pressure.

Point Source – A stationary location or fixed facility from which pollutants are discharged; any single identifiable source of pollution; e.g. a pipe, ditch, ship, ore pit, factory smokestack.

Point source discharges – Any discernible, confined, and discrete conveyance from which pollutants are or may be discharged.

Pollutant – Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.

Pollutant, water – Defined by the Environmental Protection Agency (EPA) as any physical, chemical, biological, or radiological substance that has an adverse affect on water.

Pollution Prevention (P2) – The use of materials, processes, and practices that reduce or eliminate the generation and release of pollutants, contaminants, hazardous substances, and waste into land, water, and air. For DOE, this includes recycling.

Polychlorinated biphenyls – PCB" and "PCBs" are chemical terms limited to the biphenyl molecule that has been chlorinated to varying degrees or any combination of substances that contains such substance. Because of their persistence, toxicity, and ecological damage via water pollution, their manufacture was discontinued in the U.S. in 1976.

Potable Water – Water free from impurities present in quantities sufficient to cause disease or harmful physiological effects.

Practical quantitation limit (PQL) – The lowest level of analytical determination that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions.

Pulsed power – Technology is used to generate and apply energetic beams and high-power energy pulses.

Q

Quality Assurance – A system of procedures, checks, audits, and corrective actions to ensure that all EPA research design and performance, environmental monitoring and sampling, and other technical and reporting activities are of the highest achievable quality.

R

Radiation-generating device (RGD) – Collective term for devices which produce ionizing radiation, sealed sources which emit ionizing radiation, small particle accelerators used for single-purpose applications which produce ionizing radiation (e.g., radiography), and electron-generating devices that produce x-rays incidentally.

Radioactive waste – Any waste that emits energy as rays, waves, streams or energetic particles. Radioactive materials are often mixed with hazardous waste, from nuclear reactors, research institutions, or hospitals.

Radiological Contaminants – Radioactive material deposited in any place where it is not desired, particularly where its presence may be harmful.

Radionuclide – Radioactive particle, man-made (anthropogenic) or natural, with a distinct atomic weight number. Can have a long life as soil or water pollutant.

Radon – A colorless naturally occurring, radioactive, inert gas formed by radioactive decay of radium atoms in soil or rocks.

Reportable quantity (RQ) – Quantity of material or product compound or contaminant which when released to the environment is reportable to a regulatory agency.

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

S

Sample Management Office – An SNL office that manages environmental analytical laboratory contracts and assists with the processing and tracking of samples undergoing chemical and radiochemical analyses performed at these laboratories.

Sampling plan – A plan stating sample sizes and the criteria for accepting or rejecting items or taking another sample during inspection of a group or items.

Sanitary discharges – The portion of liquid effluent exclusive of industrial wastewater and storm water. The liquid discharges from rest rooms and food preparation activities.

Screened intervals – The section of water well piping below ground that is perforated or in some manner made porous to allow water to enter the interior of the casing and prohibit the entry of sand and rocks.

Seasonal recharge – Recharge of groundwater during and after a wet season, with a rise in the level of the water table.

Secondary containment – Any structure or device that has been installed to prevent leaks, spills, or other discharges of stored chemicals, waste, oil, or fuel from storage, transfer, or end-use equipment from being released to the environment. Examples of secondary containment include pans, basins, sumps, dikes, berms, or curbs.

Semi-confined aquifer – An aquifer partially confined by soil layers of low permeability through which recharge and discharge can still occur.

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

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

Sieve – A utensil of wire mesh or closely perforated metal, used for straining, sifting, ricing, or puréeing.

Statement of Work – A comprehensive description of the goods, services, or combination of goods and services for which SNL contracts.

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

Sulfur Dioxide – A colorless, extremely irritating gas or liquid, SO2, used in many industrial processes, especially the manufacture of sulfuric acid.

Surface discharge – Spilling, leaking, pumping, pouring, emitting, emptying, 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.

SWEIS – Site-Wide Environmental Impact Statement – A detailed public document, for which a federal agency is responsible, that provides analysis of the expected impacts on the human environment of a proposed action and alternatives to the proposed action.

T

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

Threatened and endangered species – A species present in such small numbers that it is at risk of extinction.

Time-weighted composites – A sample consisting of several portions of the user's discharge collected during a 24-hour period in which each portion of the sample is collected with a specific time frame that is irrespective of flow.

Topography – The physical features of a surface area including relative elevations and the position of natural and man-made (anthropogenic) features.

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

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

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

Toxic (chemicals) – Any chemical listed in EPA rules as "Toxic Chemicals Subject to Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986."

Turbidity – 1. Haziness in air caused by the presence of particles and pollutants. 2. A cloudy condition in water due to suspended silt or organic matter.

U

USFS (U.S. Forest Service) Withdrawn Area – A portion of Kirtland Air Force Base consisting of land within the Cibola National Forest, which has been withdrawn from public access for use by the US Air Force and the US Department of Energy.

Unconsolidated basin sediment – 1. A sediment that is loosely arranged or unstratified, or whose particles are not cemented together, occurring either at the surface or at depth. 2. Soil material that is in a loosely aggregated form.

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

Up-gradient – In the direction of higher water levels.

Upstream – In, at, or toward the source of a stream.

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

V

Vadose Zone – The zone between land surface and the water table within which the moisture content is less than saturation (except in the capillary fringe) and pressure is less than atmospheric. Soil pore space also typically contains air or other gases. The capillary fringe is included in the vadose zone.

Vanadium – A bright white, soft, ductile metallic element found in several minerals, notably vanadinite and carnotite, having good structural strength and used in rust-resistant high-speed tools, as a carbon stabilizer in some steels, as a titanium-steel bonding agent, and as a catalyst.

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

W

Waste Characterization – Identification of chemical and microbiological constituents of a waste material.

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

Wastewater – The spent or used water from a home, community, farm, or industry that contains dissolved or suspended matter. Water Pollution: The presence in water of enough harmful or objectionable material to damage the water's quality.

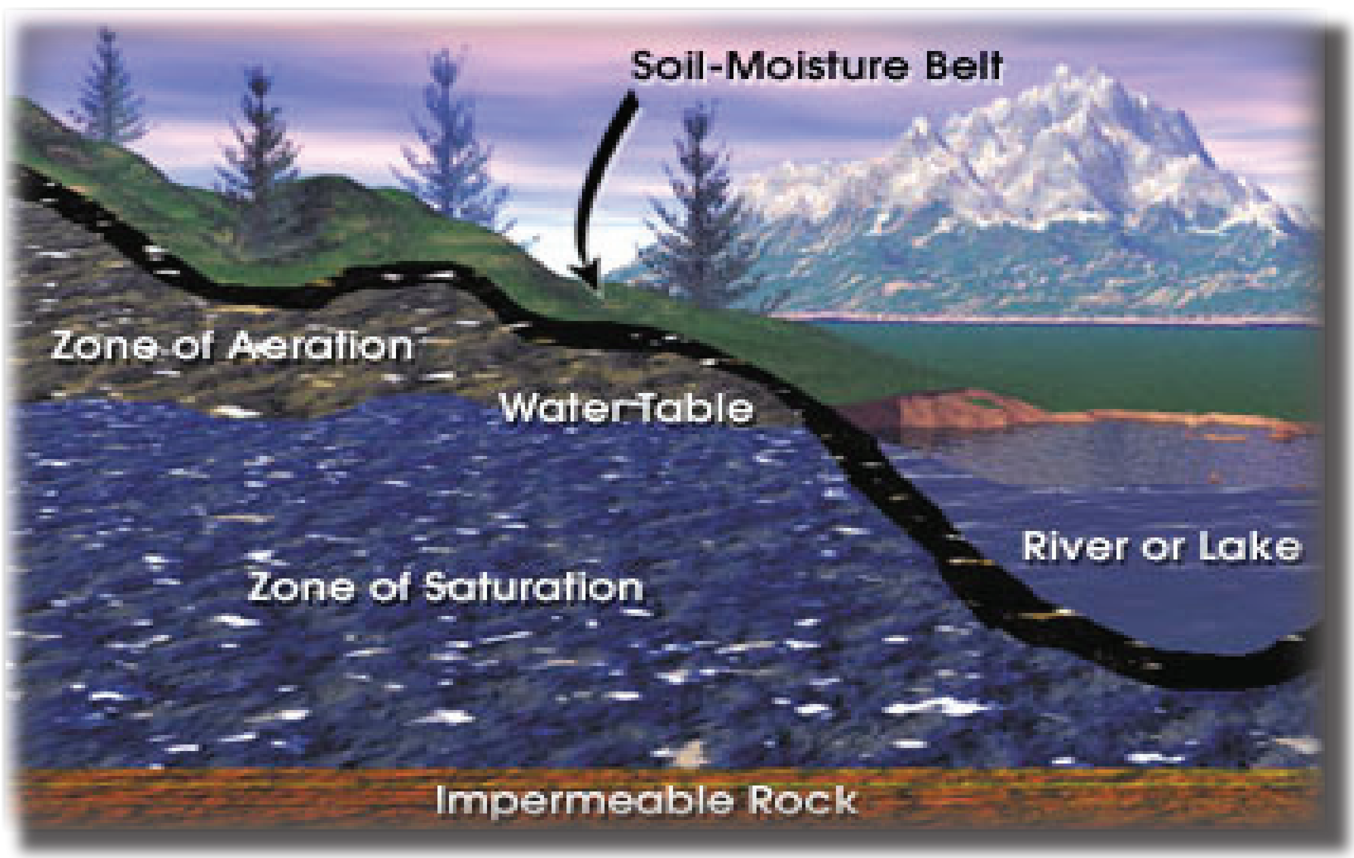
Water-bearing strata – Ground layers below the standing water level.

Watershed – The land area that drains into a stream; the watershed for a major river may encompass a number of smaller watersheds that ultimately combine at a common point.

Water table – The level of groundwater.

Wetland – An area that is saturated by surface or ground water with vegetation adapted for life under those soil conditions, as swamps, bogs, fens, marshes, and estuaries.

Wind rose – A wind rose is a graphical presentation of wind speed and direction frequency distribution.



Example of a Water Table

APPENDIX A
2006 WASTEWATER MONITORING RESULTS

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TABLE A-1. Permitted Sanitary Outfalls, March 2006
(All results in milligrams per liter [mg/L] unless otherwise noted.)

Permit Number:	2069-A		2069F-4		2069G-2		2069I-3		2069-K		Regulatory
Station:	**WW001**		**WW006**		**WW007**		**WW008**		**WW011**		**Limit**
Date Collected:	**3/7/2006**		**3/7/2006**		**3/7/2006**		**3/7/2006**		**3/7/2006**		**COA**
Sample ID:	**075304-001**		**075305-001**		**075306-001**		**075307-001**		**075308-001**		**(mg/L)**
Analyte											
Aluminum	0.0859	J	0.068	U	0.068		0.341		0.068	U	900
Arsenic	0.0113	J	0.011	J	0.011	U	0.00746	J	0.006	U	0.051
Boron	0.137		0.164		0.164	J	0.102		0.31		NE
Cadmium	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.5
Chromium	0.00211	J	0.00159	J	0.00159	J	0.00233	J	0.0022	J	4.1
Copper	0.0657		0.00977	J	0.00977	J	0.0156		0.0223		5.3
Fluoride	0.79	B	0.686	B	0.686	B	1.3	B	0.484	B	36
Lead	0.0025	U	0.0025	U	0.0025	U	0.0025	U	0.0025	U	1
Molybdenum	0.213		0.0439		0.0439		0.0976		0.0428		2
Nickel	0.00243	J	0.00167	J	0.00167	J	0.00156	J	0.00237	J	2
Selenium	0.006	U	0.00613	J	0.00613	U	0.006	U	0.006	U	0.46
Silver	0.001	U	0.00151	J	0.00151	U	0.001	U	0.001	U	5
Zinc	0.0877	B	0.0202	B	0.0202	BJ	0.0397	B	0.0683	B	2.2

Permit Number:	2069-A		2069F-4		2069G-2		2069I-3		2069-K		Regulatory
Station:	**WW001**		**WW006**		**WW007**		**WW008**		**WW011**		**Limit**
Date Collected:	**3/8/2006**		**3/8/2006**		**3/8/2006**		**3/8/2006**		**3/8/2006**		**COA**
Sample ID:	**075309-001**		**075310-001**		**075311-001**		**075312-001**		**075313-001**		**(mg/L)**
Analyte											
Aluminum	0.123	J	0.0776	J	0.0776		0.662		0.068	U	900
Arsenic	0.0111	J	0.0106	J	0.0106	U	0.00832	J	0.006	U	0.051
Boron	0.161		0.219		0.219	J	0.112		0.343		NE
Cadmium	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.5
Chromium	0.0019	J	0.0015	J	0.0015	U	0.00207	J	0.00156	J	4.1
Copper	0.0482		0.0164		0.0164	J	0.0113		0.0228		5.3
Fluoride	0.733	B	0.77	B	0.77	B	3.16	B	0.473	B	36
Lead	0.0025	U	0.0025	U	0.0025	U	0.0025	U	0.0025	U	1
Molybdenum	0.168		0.107		0.107	J	0.0679		0.0364		2
Nickel	0.00298	J	0.00273	J	0.00273	J	0.00199	J	0.00396	J	2
Selenium	0.006	U	0.006	U	0.006	U	0.006	U	0.006	U	0.46
Silver	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	5
Zinc	0.0878	B	0.0415	B	0.0415	BJ	0.0275	B	0.072	B	2.2

Permit Number:	2069F-4		2069G-2		2069I-3		Regulatory
Station:	**WW006**		**WW007**		**WW008**		**Limit**
Date Collected:	**3/7/2006**		**3/6/2006**		**3/6/2006**		**COA**
Sample ID:	**075314-001**		**075315-001**		**075316-001**		**(mg/L)**
Analyte							
Cyanide, Total	0.00353	J	0.0205		0.0025	U	0.45

NOTES: COA = City of Albuquerque
J = Estimated value, the analyte concentration fell above the effective (MDL) minimum detection limit and below the effective (PQL) practical quantitation 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 MDL. For radiochemical analytes the result is less than the decision level.
B = The analyte was found in the blank above the effective MDL (organics), or the effective PQL (inorganics).
NE = Not established.

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TABLE A-2. Summary of Sanitary Outfalls of Radiological Analyses, March 2006

(All Results in picocuries per liter [pCi/L] unless otherwise noted.)

Permit Number:	2069-A			2069F-4			2069I-3			2069-K			Regulatory Sewer Release Limits* (Monthly Avg)
Station:	WW001			WW006			WW008			WW011			
Date Collected:	3/7/2006			3/7/2006			3/7/2006			3/7/2006			
Sample ID:	075304-004			075305-004			075307-004			075308-004			
Analyte	Activity		MDA	Activity		MDA	Activity		MDA	Activity		MDA	
Actinium-228	3.47 ± 7.13	U	6.21	9.98 ± 6.9	U	6.33	7.03 ± 10.1	U	6.96	4.31 ± 7.57	U	6.66	300,000
Americium-241	0.891 ± 13.4	U	6.73	0.394 ± 9.6	U	7.12	-8.3 ± 10.8	U	6.64	-25.8 ± 10.5	U	7.86	200
Antimony-124	-3.98 ± 7.33	U	4.88	-2.98 ± 5.74	U	4.45	-0.993 ± 6.16	U	5.15	-1.07 ± 6.33	U	5.12	NE
Antimony-125	-4.64 ± 5.45	U	4.35	-0.793 ± 6.06	U	4.39	2.38 ± 5.6	U	4.76	-2.32 ± 5.31	U	4.38	NE
Barium-133	0.716 ± 3.09	U	2.28	-2.02 ± 2.65	U	2.17	0.53 ± 2.99	U	2.2	-2.37 ± 2.52	U	2.04	NE
Beryllium-7	17.1 ± 21.8	U	18.8	9.69 ± 20.3	U	17.4	0.728 ± 21.6	U	18	-4.28 ± 21.1	U	17.6	NE
Bismuth-211	14.8 ± 19.1	U	10.5	2.73 ± 17.2	U	10.8	14.3 ± 15	U	10.6	-11.3 ± 17.2	U	10.3	NE
Bismuth-212	-5.19 ± 27.5	U	14.8	16.2 ± 16.7	U	14.5	4.57 ± 32.3	U	13.5	2.8 ± 15.6	U	13	NE
Bismuth-214	2.74 ± 11.4	U	3.98	-0.741 ± 7.13	U	3.81	4.97 ± 9.75	U	4	-1.54 ± 7.09	U	3.73	NE
Cadmium-109	38.1 ± 49.4	U	36.8	-36.2 ± 47	U	33.2	-92.9 ± 46.2	U	35.4	-37.1 ± 47.8	U	33.8	NE
Cerium-139	-0.0499 ± 2.19	U	1.55	-0.345 ± 1.85	U	1.51	1.41 ± 1.9	U	1.59	-0.996 ± 1.79	U	1.45	NE
Cerium-141	1.49 ± 6.65	U	3.65	2.47 ± 7.07	U	3.6	4.47 ± 6.97	U	3.54	1.89 ± 6.03	U	3.6	NE
Cerium-144	-4.82 ± 13.2	U	10.7	-3.14 ± 12.1	U	9.92	2.53 ± 13	U	10.7	-4.19 ± 12.4	U	10.1	30,000
Cesium-134	0.96 ± 2.29	U	1.91	-0.372 ± 2.29	U	1.86	-1.21 ± 2.23	U	1.83	-0.294 ± 2.28	U	1.85	9,000
Cesium-137	-1.3 ± 2.05	U	1.61	-1.25 ± 2.05	U	1.63	-0.758 ± 2.16	U	1.73	-0.0821 ± 2.05	U	1.69	10,000
Chromium-51	-0.985 ± 28.3	U	23.8	4.67 ± 27.1	U	23.2	-14.4 ± 29.7	U	24.6	-26.4 ± 27.9	U	22.9	5,000,000
Cobalt-57	-1.13 ± 2.15	U	1.32	0.678 ± 1.49	U	1.25	-0.733 ± 2.15	U	1.32	-0.127 ± 1.49	U	1.23	NE
Cobalt-60	-0.442 ± 2.17	U	1.76	-0.907 ± 2.81	U	1.93	-0.0464 ± 2.34	U	1.93	-0.674 ± 2.17	U	1.76	30,000
Europium-152	0.424 ± 6.38	U	4.9	-1.96 ± 5.6	U	4.7	1.62 ± 5.94	U	5.05	0.804 ± 5.63	U	4.82	NE
Europium-154	8.12 ± 7.24	U	5.42	-4.21 ± 5.9	U	4.62	13.4 ± 9.75	U	5.38	5.41 ± 6.23	U	5.56	NE
Iron-59	-0.977 ± 5.49	U	4.53	4.54 ± 5.28	U	4.72	3.9 ± 5.43	U	4.79	4.84 ± 5.3	U	4.76	100,000
Lead-211	-0.704 ± 53.5	U	44.8	-7.6 ± 53.1	U	44.4	-42.7 ± 69.2	U	44.3	-51.7 ± 58.9	U	39.9	NE
Lead-212	4.52 ± 8.03	U	2.98	4.33 ± 6.38	U	3.45	5.06 ± 8.26	U	4.4	5.56 ± 6.14	U	3.48	20,000
Lead-214	5.13 ± 6.64	U	3.9	-0.215 ± 6.02	U	3.76	4.98 ± 5.22	U	3.84	-2.34 ± 5.93	U	3.59	1,000,000
Manganese-54	-2.87 ± 3.69	U	1.67	1.28 ± 2.02	U	1.79	-4.53 ± 3.74	U	1.62	1.52 ± 3.36	U	1.69	NE
Mercury-203	1.95 ± 2.88	U	2.49	-0.0332 ± 2.7	U	2.31	1.24 ± 2.89	U	2.49	2.6 ± 2.72	U	2.4	NE
Neptunium-237	-16.1 ± 27.1	U	10.9	0.305 ± 13.7	U	10.1	-23.4 ± 26.8	U	10.7	2.37 ± 13.7	U	10.1	NE
Neptunium-239	-24.6 ± 14.9	U	9.17	-10.1 ± 10.8	U	8.68	-10.7 ± 14.4	U	9.19	-5.28 ± 11.2	U	9.14	NE
Niobium-95	1.81 ± 3.42	U	2.63	-1.09 ± 3.74	U	2.58	3.6 ± 3	U	2.73	1.81 ± 3.11	U	2.64	NE
Nitrogen, Ammonia	28.5 ±	B	0.1	13.9 ±	B	0.1	2.96 ±	B	0.01	23.3 ±	B	0.1	NE
Potassium-40	-31.2 ± 40.7	U	26.5	102 ± 38.6		16.8	-30 ± 38.6	U	24.4	93.7 ± 36.1		15.6	40,000

See notes at end of table.

TABLE A-2. Summary of Sanitary Outfalls of Radiological Analyses, March 2006 (concluded)
(All Results in picocuries per liter [pCi/L] unless otherwise noted.)

Permit Number:	**2069-A**			**2069F-4**			**2069I-3**			**2069-K**			**Regulatory**
Station:	**WW001**			**WW006**			**WW008**			**WW011**			**Sewer Release**
Date Collected:	**3/7/2006**			**3/7/2006**			**3/7/2006**			**3/7/2006**			**Limits***
Sample ID:	**075304-004**			**075305-004**			**075307-004**			**075308-004**			**(Monthly Avg)**
Analyte	**Activity**		**MDA**	**Activity**		**MDA**	**Activity**		**MDA**	**Activity**		**MDA**	
Protactinium-231	4.85 ± 93.9	U	79.8	2.53 ± 89	U	76.2	-29.2 ± 94	U	78.7	-36.5 ± 90	U	75.8	NE
Protactinium-233	-6.44 ± 6.47	U	3.32	2.55 ± 3.7	U	3.23	-2.41 ± 6.44	U	3.43	-1.57 ± 3.71	U	3.11	NE
Protactinium-234	11.6 ± 16.3	U	14.3	14.1 ± 16.7	U	14.8	19.9 ± 17.3	U	13.9	6.48 ± 16.2	U	13.9	NE
Radium-223	5.95 ± 45.7	U	33.7	-7.1 ± 37.7	U	31.8	33 ± 41.5	U	35.7	1.25 ± 38	U	32.5	NE
Radium-224	169 ± 49.1	U	40.1	104 ± 43.1	U	35.1	197 ± 52.1	U	42.5	77.3 ± 43.2	U	34.6	NE
Radium-226	2.74 ± 11.4	U	3.4	-0.741 ± 7.13	U	3.81	4.97 ± 9.75	U	3.34	-1.54 ± 7.09	U	3.73	600
Radium-228	3.47 ± 7.13	U	6.21	9.98 ± 6.9	U	6.33	7.03 ± 10.1	U	6.96	4.31 ± 7.57	U	6.66	600
Radon-219	7.28 ± 23.8	U	20.2	6.94 ± 23.6	U	20.2	27.4 ± 22	U	19.7	11.1 ± 22.3	U	19.2	NE
Rhodium-106	-6.13 ± 19.3	U	15.6	-2.42 ± 27.3	U	16.1	9.68 ± 19.3	U	16.3	-26.8 ± 27.6	U	15.2	NE
Ruthenium-103	0.673 ± 3.06	U	2.23	1.03 ± 2.76	U	2.35	0.546 ± 3.13	U	2.62	0.534 ± 2.79	U	2.36	300,000
Ruthenium-106	-9.25 ± 19.7	U	15.7	11.4 ± 18.6	U	15.9	5.9 ± 19.5	U	16.3	-3.48 ± 18.8	U	15.4	30,000
Selenium-75	1.82 ± 2.7	U	2.34	-0.826 ± 2.72	U	2.3	-0.258 ± 2.82	U	2.39	-0.546 ± 2.73	U	2.32	NE
Sodium-22	2.92 ± 2.59	U	1.87	-1.53 ± 2.12	U	1.66	4.82 ± 3.49	X	1.73	1.95 ± 2.24	U	2	NE
Strontium-85	-10.2 ± 3.87	U	2.88	-10.6 ± 3.84	U	2.88	-5.68 ± 3.99	U	3.15	-8.06 ± 3.93	U	3.06	NE
Thallium-208	2.76 ± 5.36	U	1.65	3.99 ± 4.15	U	2.09	0.191 ± 4.65	U	2.39	1.73 ± 3.54	U	2.02	NE
Thorium-227	5.85 ± 23.3	U	19.9	4.88 ± 22	U	19	-0.716 ± 23.1	U	19.6	10.3 ± 22.3	U	19.4	NE
Thorium-231	-4.69 ± 10.7	U	8.98	5.48 ± 10.4	U	9.05	8.24 ± 11	U	9.53	6.4 ± 10.7	U	9.32	300
Thorium-232	4.42 ± 7.84	U	4.03	4.22 ± 6.23	U	3.37	4.93 ± 8.05	U	2.89	5.42 ± 5.99	U	3.39	500,000
Thorium-234	-101 ± 106	U	64.5	43.6 ± 121	U	58.1	-48.1 ± 106	U	66.6	-12 ± 116	U	73.1	50,000
Tin-113	-0.812 ± 2.84	U	2.35	1.98 ± 2.62	U	2.28	2.83 ± 1.99	U	2.36	1.69 ± 2.8	U	2.43	NE
Tritium	-11.2 ± 125	U	105	2.81 ± 126	U	106	-59 ± 118	U	101	30.4 ± 126	U	104	10,000,000
Uranium-235	4.15 ± 18.5	U	10.8	6.82 ± 19.6	U	10	12.1 ± 19	U	10.4	5.12 ± 16.4	U	10.2	3,000
Uranium-238	-101 ± 106	U	64.5	43.6 ± 121	U	58.1	-48.1 ± 106	U	66.6	-12 ± 116	U	73.1	3,000
Yttrium-88	-0.698 ± 2.69	U	2.21	0.528 ± 2.43	U	2.12	-0.611 ± 2.52	U	2.07	0.884 ± 2.72	U	2.39	100,000
Zinc-65	1.83 ± 4.59	U	3.95	-3.11 ± 4.78	U	3.84	-5.62 ± 4.72	U	3.55	-2.24 ± 5.17	U	3.56	NE
Zirconium-95	3.39 ± 5.07	U	3.68	-2.73 ± 4.4	U	3.46	2.22 ± 4.08	U	3.59	2.51 ± 4.33	U	3.69	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.
X = Presumptive evidence analyte is not present.
B = The analyte was found in the blank above the effective MDL (organics), or the effective PQL (inorganics).
NE = Not established.
MDA = minimum detectable activity.
* = The monthly average concentration values for release of sanitary sewage were derived by taking the most restrictive occupational stochastic oral ingestion annual limits on intake (ALT) for a reference mean.

TABLE A-3. Summary of Sanitary Outfalls of Semi-Volatile Organic Compounds, March 2006
(All Results in micrograms per liter [ug/L] unless otherwise noted.)

Permit Number:	2069-A		2069F-4		2069I-3		2069-K	
Station:	WW001		WW006		WW008		WW011	
Date Collected:	3/7/2006		3/7/2006		3/7/2006		3/7/2006	
Sample ID:	075304-007		075305-007		075307-007		075308-007	
Analyte								
1,2,4-Trichlorobenzene	1.96	U	1.98	U	2	U	1.92	U
2,4,6-Trichlorophenol	1.96	U	1.98	U	2	U	1.92	U
2,4-Dichlorophenol	1.96	U	1.98	U	2	U	1.92	U
2,4-Dimethylphenol	1.96	U	1.98	U	2	U	1.92	U
2,4-Dinitrophenol	9.8	U	9.9	U	10	U	9.62	U
2,4-Dinitrotoluene	1.96	U	1.98	U	2	U	1.92	U
2,6-Dinitrotoluene	1.96	U	1.98	U	2	U	1.92	U
2-Chloronaphthalene	0.343	U	0.347	U	0.35	U	0.337	U
2-Chlorophenol	1.96	U	1.98	U	2	U	1.92	U
2-Methyl-4,6-dinitrophenol	2.94	U	2.97	U	3	U	2.88	U
2-Nitrophenol	1.96	U	1.98	U	2	U	1.92	U
4-Chloro-3-methylphenol	1.96	U	1.98	U	2	U	1.92	U
4-Nitrophenol	1.96	U	1.98	U	2	U	1.92	U
Acenaphthene	0.304	U	0.307	U	0.31	U	0.298	U
Acenaphthylene	0.196	U	0.198	U	0.2	U	0.192	U
Anthracene	0.196	U	0.198	U	0.2	U	0.192	U
Benzo(a)anthracene	0.196	U	0.198	U	0.2	U	0.192	U
Benzo(a)pyrene	0.196	U	0.198	U	0.2	U	0.192	U
Benzo(b)fluoranthene	0.196	U	0.198	U	0.2	U	0.192	U
Benzo(ghi)perylene	0.196	U	0.198	U	0.2	U	0.192	U
Benzo(k)fluoranthene	0.196	U	0.198	U	0.2	U	0.192	U
bis(2-Chloroethoxy)methane	2.94	U	2.97	U	3	U	2.88	U
bis(2-Chloroethyl) ether	1.96	U	1.98	U	2	U	1.92	U
bis(2-Chloroisopropyl)ether	1.96	U	1.98	U	2	U	1.92	U
bis(2-Ethylhexyl)phthalate	1.96	U	1.98	U	2	U	1.92	U
Chrysene	0.196	U	0.198	U	0.2	U	0.192	U
Dibenzo(a,h)anthracene	0.196	U	0.198	U	0.2	U	0.192	U
Dibenzofuran	1.96	U	1.98	U	2	U	1.92	U
Diethylphthalate	1.96	U	1.98	U	2	U	1.92	U
Di-n-butylphthalate	1.96	U	1.98	U	2	U	1.92	U
Di-n-octylphthalate	2.94	U	2.97	U	3	U	2.88	U
Fluoranthene	0.196	U	0.198	U	0.2	U	0.192	U
Fluorene	0.196	U	0.198	U	0.2	U	0.192	U
Hexachlorobenzene	1.96	U	1.98	U	2	U	1.92	U
Hexachlorobutadiene	1.96	U	1.98	U	2	U	1.92	U
Hexachlorocyclopentadiene	1.96	U	1.98	U	2	U	1.92	U
Hexachloroethane	1.96	U	1.98	U	2	U	1.92	U
Indeno(1,2,3-cd)pyrene	0.196	U	0.198	U	0.2	U	0.192	U
Isophorone	1.96	U	1.98	U	2	U	1.92	U
Naphthalene	0.294	U	0.297	U	0.3	U	0.288	U
Nitrobenzene	2.94	U	2.97	U	3	U	2.88	U
N-Nitrosodipropylamine	1.96	U	1.98	U	2	U	1.92	U
Pentachlorophenol	1.96	U	1.98	U	2	U	1.92	U
Phenanthrene	0.196	U	0.198	U	0.2	U	0.192	U
Phenol	0.98	U	0.99	U	1	U	0.962	U
Pyrene	0.294	U	0.297	U	0.3	U	0.288	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.

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TABLE A-4. Summary of Sanitary Outfalls of Volatile Organic Compounds, March 2006
(All Results in micrograms per liter [ug/L] unless otherwise noted.)

Permit Number:	**2069-A**		**2069F-4**		**2069I-3**		**2069-K**	
Station:	**WW001**		**WW006**		**WW008**		**WW011**	
Date Collected:	**3/7/2006**		**3/7/2006**		**3/7/2006**		**3/7/2006**	
Sample ID:	**075304-006**		**075305-006**		**075307-006**		**075308-006**	
Analyte								
1,1,1-Trichloroethane	0.3	U	0.3	U	0.3	U	0.3	U
1,1,2,2-Tetrachloroethane	0.25	U	0.25	U	0.25	U	0.25	U
1,1,2-Trichloroethane	0.25	U	0.25	U	0.25	U	0.25	U
1,1-Dichloroethane	0.3	U	0.3	U	0.3	U	0.3	U
1,1-Dichloroethylene	0.3	U	0.3	U	0.3	U	0.3	U
1,2-Dichlorobenzene	1.96	U	1.98	U	2	U	1.92	U
1,2-Dichloroethane	0.25	U	0.25	U	0.25	U	0.25	U
1,2-Dichloropropane	0.25	U	0.25	U	0.25	U	0.25	U
1,3-Dichlorobenzene	1.96	U	1.98	U	2	U	1.92	U
1,4-Dichlorobenzene	1.96	U	1.98	U	2	U	1.92	U
2,4,5-Trichlorophenol	0.98	U	0.99	U	1	U	0.962	U
2-Butanone	1.25	U	1.25	U	1.25	U	1.25	U
2-Hexanone	1.25	U	1.25	U	1.25	U	1.25	U
2-Methylnaphthalene	0.294	U	0.297	U	0.3	U	0.288	U
3,3'-Dichlorobenzidine	0.98	U	0.99	U	1	U	0.962	U
4-Bromophenylphenylether	1.96	U	1.98	U	2	U	1.92	U
4-Chloroaniline	1.96	U	1.98	U	2	U	1.92	U
4-Chlorophenylphenylether	1.96	U	1.98	U	2	U	1.92	U
4-Methyl-2-pentanone	1.25	U	1.25	U	1.25	U	1.25	U
Acetone	11.4		6.83		46.6		25.4	
Benzene	2.55		0.3	U	0.3	U	0.3	U
Bromodichloromethane	0.25	U	0.737	J	0.25	U	0.25	U
Bromoform	0.25	U	0.25	U	0.25	U	0.25	U
Bromomethane	0.5	U	0.5	U	0.5	U	0.5	U
Butylbenzylphthalate	1.96	U	1.98	U	2	U	2.28	J
Carbazole	0.196	U	0.198	U	0.2	U	0.192	U
Carbon disulfide	1.91	J	8.19		1.25	U	1.25	U
Carbon tetrachloride	0.25	U	0.25	U	0.25	U	0.25	U
Chlorobenzene	0.25	U	0.25	U	0.25	U	0.25	U
Chloroethane	0.5	U	0.5	U	0.5	U	0.5	U
Chloroform	0.25	U	1.17		0.25	U	0.721	J
Chloromethane	0.5	U	0.5	U	0.5	U	0.5	U
cis-1,2-Dichloroethylene	0.3	U	0.3	U	0.3	U	0.3	U
cis-1,3-Dichloropropylene	0.25	U	0.25	U	0.25	U	0.25	U
Dibromochloromethane	0.25	U	0.602	J	0.25	U	0.25	U
Dimethylphthalate	1.96	U	1.98	U	2	U	1.92	U
Diphenylamine	2.94	U	2.97	U	3	U	2.88	U
Ethylbenzene	0.25	U	0.25	U	0.25	U	0.25	U
m,p-Cresol	2.94	U	2.97	U	3.03	J	2.88	U
Methylene chloride	2	U	2	U	2	U	2	U
m-Nitroaniline	1.96	U	1.98	U	2	U	1.92	U
o-Cresol	1.96	U	1.98	U	2	U	2.2	J
o-Nitroaniline	1.96	U	1.98	U	2	U	1.92	U
p-Nitroaniline	2.94	U	2.97	U	3	U	2.88	U
Styrene	0.25	U	0.25	U	0.25	U	0.25	U

See notes at end of table

TABLE A-4. Summary of Sanitary Outfalls of Volatile Organic Compounds, March 2006 (concluded)
(All Results in micrograms per liter [ug/L] unless otherwise noted.)

Permit Number:	**2069-A**		**2069F-4**		**2069I-3**		**2069-K**	
Station:	**WW001**		**WW006**		**WW008**		**WW011**	
Date Collected:	**3/7/2006**		**3/7/2006**		**3/7/2006**		**3/7/2006**	
Sample ID:	**075304-006**		**075305-006**		**075307-006**		**075308-006**	
Analyte								
Tetrachloroethylene	0.25	U	0.25	U	0.25	U	0.25	U
Toluene	0.25	U	0.25	U	0.25	U	1.41	
trans-1,2-Dichloroethylene	0.3	U	0.3	U	0.3	U	0.3	U
trans-1,3-Dichloropropylene	0.25	U	0.25	U	0.25	U	0.25	U
Trichloroethylene	0.25	U	0.25	U	0.25	U	0.25	U
Vinyl acetate	1.5	U	1.5	U	1.5	U	1.5	U
Vinyl chloride	0.5	U	0.5	U	0.5	U	0.5	U
Xylenes (total)	0.25	U	0.25	U	0.25	U	0.25	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.

J = Estimated value, the analyte concentration fell above the effective MDL and below the effective PQL.

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 A-5. Permitted Sanitary Outfalls of Non-radiological (Metals) Analyses, CY 2006
(All Results in milligrams per liter [mg/L] unless otherwise noted.)

Permit Number	Station	Analyte	Sample Size	Mean	Std Dev	Minimum	Maximum	Regulatory Limit COA
2069-A	WW001	Aluminum	4	0.114	0.029	0.0859	0.15	900
		Arsenic	4	0.014	0.003	0.0111	0.0168	0.051
		Boron	4	0.131	0.023	0.113	0.161	NE
		Cadmium	4	0.001	0.000	0.001	0.00144	0.5
		Chromium	4	0.002	0.000	0.00154	0.00211	4.1
		Copper	4	0.036	0.026	0.0124	0.0657	5.3
		Fluoride	4	0.750	0.032	0.717	0.79	36
		Lead	4	0.003	0.000	0.0025	0.0025	1
		Molybdenum	4	0.148	0.056	0.0826	0.213	2
		Nickel	4	0.002	0.001	0.001	0.00298	2
		Selenium	4	0.006	0.000	0.006	0.006	0.46
		Silver	4	0.001	0.000	0.001	0.001	5
		Zinc	4	0.092	0.005	0.0877	0.0988	2.2
2069F-4	WW006	Aluminum	4	0.081	0.020	0.068	0.111	900
		Arsenic	4	0.013	0.003	0.0106	0.016	0.051
		Boron	4	0.187	0.033	0.153	0.219	NE
		Cadmium	4	0.001	0.000	0.001	0.00113	0.5
		Chromium	4	0.001	0.000	0.00105	0.00159	4.1
		Copper	4	0.011	0.004	0.00779	0.0164	5.3
		Fluoride	4	0.758	0.086	0.686	0.874	36
		Lead	4	0.003	0.000	0.0025	0.0025	1
		Molybdenum	4	0.080	0.027	0.0439	0.107	2
		Nickel	4	0.002	0.001	0.001	0.00273	2
		Selenium	4	0.006	0.000	0.006	0.00613	0.46
		Silver	4	0.001	0.000	0.001	0.00151	5
		Zinc	4	0.036	0.014	0.0202	0.0523	2.2
2069G-2	WW007	Aluminum	4	0.735	0.813	0.0897	1.85	900
		Arsenic	4	0.007	0.001	0.006	0.00805	0.051
		Boron	4	0.020	0.008	0.0123	0.0285	NE
		Cadmium	4	0.001	0.000	0.001	0.001	0.5
		Chromium	4	0.001	0.000	0.001	0.0013	4.1
		Copper	4	0.004	0.001	0.003	0.00577	5.3
		Fluoride	4	2.533	1.499	1.39	4.57	36
		Lead	4	0.003	0.000	0.0025	0.0025	1
		Molybdenum	4	0.020	0.020	0.00875	0.0498	2
		Nickel	4	0.002	0.000	0.00128	0.00193	2
		Selenium	4	0.006	0.000	0.006	0.006	0.46
		Silver	4	0.001	0.000	0.001	0.001	5
		Zinc	4	0.004	0.001	0.00376	0.00501	2.2
2069I-3	WW008	Aluminum	4	0.308	0.259	0.101	0.662	900
		Arsenic	4	0.011	0.004	0.00746	0.015	0.051
		Boron	4	0.089	0.021	0.0666	0.112	NE
		Cadmium	4	0.001	0.000	0.001	0.00107	0.5
		Chromium	4	0.002	0.000	0.00207	0.00265	4.1
		Copper	4	0.013	0.002	0.0113	0.0156	5.3
		Fluoride	4	1.975	0.866	1.3	3.16	36
		Lead	4	0.003	0.000	0.0025	0.0025	1
		Molybdenum	4	0.090	0.015	0.0679	0.102	2
		Nickel	4	0.001	0.000	0.0012	0.00199	2

See notes at end of table.

TABLE A-5. Permitted Sanitary Outfalls of Non-radiological (Metals) Analyses, CY 2006 (concluded)
(All Results in milligrams per liter [mg/L] unless otherwise noted.)

Permit Number	Station	Analyte	Sample Size	Mean	Std Dev	Minimum	Maximum	Regulatory Limit COA
2069I-3	WW008	Selenium	4	0.006	0.000	0.006	0.006	0.46
		Silver	4	0.001	0.000	0.001	0.001	5
		Zinc	4	0.032	0.006	0.0275	0.0397	2.2
2069-K	WW011	Aluminum	4	0.071	0.006	0.068	0.0806	900
		Arsenic	4	0.009	0.003	0.006	0.0119	0.051
		Boron	4	0.235	0.106	0.141	0.343	NE
		Cadmium	4	0.001	0.000	0.001	0.00116	0.5
		Chromium	4	0.002	0.001	0.00156	0.00322	4.1
		Copper	4	0.018	0.005	0.0115	0.0228	5.3
		Fluoride	4	0.500	0.042	0.473	0.563	36
		Lead	4	0.003	0.000	0.0025	0.0025	1
		Molybdenum	4	0.044	0.007	0.0364	0.0525	2
		Nickel	4	0.002	0.001	0.001	0.00396	2
		Selenium	4	0.006	0.000	0.006	0.006	0.46
		Silver	4	0.001	0.000	0.001	0.001	5
		Zinc	4	0.081	0.029	0.0599	0.123	2.2

NOTES: COA = City of Albuquerque
NE = Not established
Std Dev = Standard Deviation

TABLE A-6. Permitted Sanitary Outfalls of Radiological Analyses, CY 2006
(All Results in picocuries per liter [pci/L] unless otherwise noted.)

Permit Number	Station	Analyte	Sample Size	Mean	Std Dev	Minimum	Maximum	Regulatory Limit COA
2069-A	WW001	Actinium-228	2	8.04	6.46	3.47	12.6	300,000
		Americium-241	2	-0.36	1.77	-1.61	0.891	200
		Antimony-124	2	-0.71	4.62	-3.98	2.56	NE
		Antimony-125	2	-0.84	5.38	-4.64	2.97	NE
		Barium-133	2	1.01	0.41	0.716	1.3	NE
		Beryllium-7	2	8.47	12.20	-0.156	17.1	NE
		Bismuth-211	2	13.00	2.55	11.2	14.8	NE
		Bismuth-212	2	0.83	8.51	-5.19	6.84	NE
		Bismuth-214	2	6.47	5.28	2.74	10.2	NE
		Cadmium-109	2	22.22	22.46	6.34	38.1	NE
		Cerium-139	2	-1.09	1.48	-2.14	-0.0499	NE
		Cerium-141	2	0.95	0.76	0.409	1.49	NE
		Cerium-144	2	-4.86	0.06	-4.9	-4.82	30,000
		Cesium-134	2	0.89	0.11	0.811	0.96	9,000
		Cesium-137	2	-0.02	1.82	-1.3	1.27	10,000
		Chromium-51	2	0.59	2.23	-0.985	2.17	5,000,000
		Cobalt-57	2	-0.14	1.40	-1.13	0.846	NE
		Cobalt-60	2	0.14	0.82	-0.442	0.714	30,000
		Europium-152	2	0.74	0.44	0.424	1.05	NE
		Europium-154	2	5.44	3.79	2.76	8.12	NE
		Gross Alpha	2	3.51	1.96	2.12	4.89	NE
		Gross Beta	2	22.55	3.18	20.3	24.8	NE
		Iron-59	2	-2.30	1.88	-3.63	-0.977	100,000
		Lead-211	2	-10.95	14.49	-21.2	-0.704	NE
		Lead-212	2	2.37	3.04	0.224	4.52	20,000
		Lead-214	2	4.52	0.86	3.91	5.13	1,000,000
		Manganese-54	2	-1.66	1.71	-2.87	-0.453	NE
		Mercury-203	2	1.26	0.98	0.561	1.95	NE
		Neptunium-237	2	-7.12	12.70	-16.1	1.86	NE
		Neptunium-239	2	-11.86	18.02	-24.6	0.883	NE
		Niobium-95	2	0.91	1.27	0.0117	1.81	NE
		Nitrogen, Ammonia	4	30.45	14.70	20.3	51.8	NE
		Potassium-40	2	0.65	45.04	-31.2	32.5	40,000
		Protactinium-231	2	11.63	9.58	4.85	18.4	NE
		Protactinium-233	2	-3.67	3.92	-6.44	-0.891	NE
		Protactinium-234	2	4.15	10.54	-3.31	11.6	NE
		Radium-223	2	-0.74	9.46	-7.43	5.95	NE
		Radium-224	2	115.95	75.02	62.9	169	NE
		Radium-226	2	6.47	5.28	2.74	10.2	600
		Radium-228	2	8.04	6.46	3.47	12.6	600
		Radon-219	2	5.98	1.84	4.68	7.28	NE
		Rhodium-106	2	-1.40	6.70	-6.13	3.34	NE
		Ruthenium-103	2	0.46	0.30	0.252	0.673	300,000
		Ruthenium-106	2	-6.02	4.57	-9.25	-2.79	30,000

See notes at end of table.

TABLE A-6. Permitted Sanitary Outfalls of Radiological Analyses, CY 2006 (continued)
(All Results in picocuries per liter [pci/L] unless otherwise noted.)

Permit Number	Station	Analyte	Sample Size	Mean	Std Dev	Minimum	Maximum	Regulatory Limit COA
2069-A	WW001	Selenium-75	2	-0.29	2.98	-2.39	1.82	NE
		Sodium-22	2	1.95	1.37	0.986	2.92	NE
		Strontium-85	2	-10.45	0.35	-10.7	-10.2	NE
		Thallium-208	2	2.04	1.02	1.32	2.76	NE
		Thorium-227	2	6.03	0.25	5.85	6.2	NE
		Thorium-231	2	-6.83	3.02	-8.96	-4.69	300
		Thorium-232	2	2.32	2.97	0.22	4.42	500,000
		Thorium-234	2	44.00	205.06	-101	189	50,000
		Tin-113	2	-0.62	0.27	-0.812	-0.437	NE
		Tritium	2	2.95	20.01	-11.2	17.1	10,000,000
		Uranium-235	2	2.97	1.67	1.79	4.15	3,000
		Uranium-238	2	44.00	205.06	-101	189	3,000
		Yttrium-88	2	-0.29	0.58	-0.698	0.121	100,000
		Zinc-65	2	0.16	2.36	-1.51	1.83	NE
		Zirconium-95	2	2.60	1.12	1.8	3.39	200,000
2069F-4	WW006	Actinium-228	2	6.28	5.24	2.57	9.98	300,000
		Americium-241	2	-1.85	3.17	-4.09	0.394	200
		Antimony-124	2	-2.45	0.75	-2.98	-1.92	NE
		Antimony-125	2	-0.31	0.69	-0.793	0.176	NE
		Barium-133	2	-1.37	0.92	-2.02	-0.715	NE
		Beryllium-7	2	3.26	9.09	-3.17	9.69	NE
		Bismuth-211	2	16.07	18.86	2.73	29.4	NE
		Bismuth-212	2	17.05	1.20	16.2	17.9	NE
		Bismuth-214	2	1.44	3.09	-0.741	3.63	NE
		Cadmium-109	2	-11.75	34.58	-36.2	12.7	NE
		Cerium-139	2	-0.74	0.56	-1.14	-0.345	NE
		Cerium-141	2	1.84	0.89	1.21	2.47	NE
		Cerium-144	2	-0.12	4.28	-3.14	2.91	30,000
		Cesium-134	2	0.24	0.87	-0.372	0.858	9,000
		Cesium-137	2	-0.80	0.64	-1.25	-0.345	10,000
		Chromium-51	2	3.55	1.58	2.43	4.67	5,000,000
		Cobalt-57	2	0.16	0.74	-0.365	0.678	NE
		Cobalt-60	2	-0.68	0.32	-0.907	-0.449	30,000
		Europium-152	2	-0.23	2.45	-1.96	1.51	NE
		Europium-154	2	-1.48	3.87	-4.21	1.26	NE
		Gross Alpha	2	6.28	6.54	1.65	10.9	NE
		Gross Beta	2	39.90	6.36	35.4	44.4	NE
		Iron-59	2	3.36	1.68	2.17	4.54	100,000
		Lead-211	2	0.51	11.47	-7.6	8.62	NE
		Lead-212	2	2.72	2.28	1.1	4.33	20,000
		Lead-214	2	4.05	6.03	-0.215	8.31	1,000,000
		Manganese-54	2	0.55	1.03	-0.177	1.28	NE
		Mercury-203	2	0.33	0.51	-0.0332	0.692	NE
		Neptunium-237	2	-2.77	4.35	-5.84	0.305	NE

See notes at end of table.

TABLE A-6. Permitted Sanitary Outfalls of Radiological Analyses, CY 2006 (continued)
(All Results in picocuries per liter [pci/L] unless otherwise noted.)

Permit Number	Station	Analyte	Sample Size	Mean	Std Dev	Minimum	Maximum	Regulatory Limit COA
2069F-4	WW006	Neptunium-239	2	-6.21	5.51	-10.1	-2.31	NE
		Niobium-95	2	0.37	2.06	-1.09	1.82	NE
		Nitrogen, Ammonia	5	14.14	5.95	6.42	21.1	NE
		Potassium-40	2	80.25	30.76	58.5	102	40,000.00
		Protactinium-231	2	-10.49	18.41	-23.5	2.53	NE
		Protactinium-233	2	1.01	2.17	-0.524	2.55	NE
		Protactinium-234	2	10.92	4.50	7.74	14.1	NE
		Radium-223	2	-22.15	21.28	-37.2	-7.1	NE
		Radium-224	2	77.75	37.12	51.5	104	NE
		Radium-226	2	1.44	3.09	-0.741	3.63	600
		Radium-228	2	6.28	5.24	2.57	9.98	600
		Radon-219	2	10.02	4.36	6.94	13.1	NE
		Rhodium-106	2	-3.91	2.10	-5.39	-2.42	NE
		Ruthenium-103	2	0.43	0.85	-0.177	1.03	300,000.00
		Ruthenium-106	2	2.60	12.45	-6.21	11.4	30,000
		Selenium-75	2	0.03	1.21	-0.826	0.88	NE
		Sodium-22	2	-0.54	1.41	-1.53	0.459	NE
		Strontium-85	2	-14.20	5.09	-17.8	-10.6	NE
		Thallium-208	2	4.64	0.92	3.99	5.29	NE
		Thorium-227	2	0.23	6.58	-4.42	4.88	NE
		Thorium-231	2	4.11	1.94	2.73	5.48	300
		Thorium-232	2	2.65	2.22	1.08	4.22	500,000
		Thorium-234	2	42.40	1.70	41.2	43.6	50,000
		Tin-113	2	1.05	1.31	0.124	2	NE
		Tritium	2	-16.05	26.66	-34.9	2.81	10,000,000
		Uranium-235	2	5.41	2.00	3.99	6.82	3,000
		Uranium-238	2	42.40	1.70	41.2	43.6	3,000
		Yttrium-88	2	-0.16	0.97	-0.846	0.528	100,000
		Zinc-65	2	-0.31	3.97	-3.11	2.5	NE
		Zirconium-95	2	-0.42	3.27	-2.73	1.9	200,000
2069G-2	WW007	Nitrogen, Ammonia	4	1.43	0.64	0.598	2.05	NE
2069I-3	WW008	Actinium-228	2	8.97	2.74	7.03	10.9	300,000
		Americium-241	2	-1.44	9.70	-8.3	5.42	200
		Antimony-124	2	-0.61	0.54	-0.993	-0.228	NE
		Antimony-125	2	1.65	1.03	0.921	2.38	NE
		Barium-133	2	-4.36	6.91	-9.24	0.53	NE
		Beryllium-7	2	-0.71	2.03	-2.14	0.728	NE
		Bismuth-211	2	21.80	10.61	14.3	29.3	NE
		Bismuth-212	2	8.29	5.25	4.57	12	NE
		Bismuth-214	2	8.69	5.25	4.97	12.4	NE
		Cadmium-109	2	-61.95	43.77	-92.9	-31	NE
		Cerium-139	2	-0.14	2.19	-1.69	1.41	NE
		Cerium-141	2	4.00	0.66	3.53	4.47	NE

See notes at end of table.

TABLE A-6. Permitted Sanitary Outfalls of Radiological Analyses, CY 2006 (continued)
(All Results in picocuries per liter [pci/L] unless otherwise noted.)

Permit Number	Station	Analyte	Sample Size	Mean	Std Dev	Minimum	Maximum	Regulatory Limit COA
2069I-3	WW008	Cerium-144	2	3.20	0.94	2.53	3.86	30,000
		Cesium-134	2	-0.64	0.81	-1.21	-0.0645	9,000
		Cesium-137	2	0.55	1.85	-0.758	1.86	10,000
		Chromium-51	2	-10.43	5.61	-14.4	-6.46	5,000,000
		Cobalt-57	2	0.26	1.41	-0.733	1.26	NE
		Cobalt-60	2	-1.07	1.45	-2.09	-0.0464	30,000
		Europium-152	2	1.86	0.34	1.62	2.1	NE
		Europium-154	2	5.20	11.60	-3	13.4	NE
		Gross Alpha	2	5.13	1.87	3.8	6.45	NE
		Gross Beta	2	18.56	12.79	9.51	27.6	NE
		Iron-59	2	1.37	3.59	-1.17	3.9	100,000
		Lead-211	2	-40.20	3.54	-42.7	-37.7	NE
		Lead-212	2	4.84	0.31	4.62	5.06	20,000
		Lead-214	2	8.29	4.68	4.98	11.6	1,000,000
		Manganese-54	2	-1.81	3.85	-4.53	0.915	NE
		Mercury-203	2	1.37	0.18	1.24	1.5	NE
		Neptunium-237	2	-2.75	29.20	-23.4	17.9	NE
		Neptunium-239	2	-12.50	2.55	-14.3	-10.7	NE
		Niobium-95	2	2.29	1.85	0.978	3.6	NE
		Nitrogen, Ammonia	3	3.05	0.32	2.78	3.41	NE
		Potassium-40	2	22.85	74.74	-30	75.7	40,000
		Protactinium-231	2	-73.10	62.08	-117	-29.2	NE
		Protactinium-233	2	-0.95	2.06	-2.41	0.502	NE
		Protactinium-234	2	12.22	10.86	4.54	19.9	NE
		Radium-223	2	4.30	40.59	-24.4	33	NE
		Radium-224	2	121.70	106.49	46.4	197	NE
		Radium-226	2	8.69	5.25	4.97	12.4	600
		Radium-228	2	8.97	2.74	7.03	10.9	600
		Radon-219	2	14.30	18.53	1.19	27.4	NE
		Rhodium-106	2	7.18	3.54	4.67	9.68	NE
		Ruthenium-103	2	-0.03	0.82	-0.614	0.546	300,000
		Ruthenium-106	2	6.18	0.39	5.9	6.45	30,000
		Selenium-75	2	-0.74	0.68	-1.22	-0.258	NE
		Sodium-22	2	1.87	4.18	-1.09	4.82	NE
		Strontium-85	2	-4.85	1.17	-5.68	-4.02	NE
		Thallium-208	2	0.57	0.54	0.191	0.948	NE
		Thorium-227	2	-10.26	13.49	-19.8	-0.716	NE
		Thorium-231	2	4.86	4.79	1.47	8.24	300
		Thorium-232	2	4.74	0.27	4.55	4.93	500,000
		Thorium-234	2	53.95	144.32	-48.1	156	50,000
		Tin-113	2	1.74	1.54	0.649	2.83	NE
		Tritium	2	-46.80	17.25	-59	-34.6	10,000,000
		Uranium-235	2	9.81	3.24	7.52	12.1	3,000

See notes at end of table.

TABLE A-6. Permitted Sanitary Outfalls of Radiological Analyses, CY 2006 (continued)
(All Results in picocuries per liter [pci/L] unless otherwise noted.)

Permit Number	Station	Analyte	Sample Size	Mean	Std Dev	Minimum	Maximum	Regulatory Limit COA
2069I-3	WW008	Uranium-238	2	53.95	144.32	-48.1	156	3,000
		Yttrium-88	2	-0.60	0.01	-0.611	-0.59	100,000
		Zinc-65	2	-3.37	3.18	-5.62	-1.12	NE
		Zirconium-95	2	1.19	1.46	0.161	2.22	200,000
2069-K	WW011	Actinium-228	3	3.97	3.57	0.24	7.35	300,000
		Americium-241	3	-9.88	14.01	-25.8	0.563	200
		Antimony-124	3	-0.74	0.88	-1.41	0.264	NE
		Antimony-125	3	1.07	3.39	-2.32	4.45	NE
		Barium-133	3	0.02	2.15	-2.37	1.8	NE
		Beryllium-7	3	5.32	10.07	-4.28	15.8	NE
		Bismuth-211	3	4.62	14.03	-11.3	15.2	NE
		Bismuth-212	3	8.09	5.07	2.8	12.9	NE
		Bismuth-214	3	1.98	3.09	-1.54	4.23	NE
		Cadmium-109	3	-44.43	72.18	-120	23.8	NE
		Cerium-139	3	-0.48	0.93	-1.03	0.59	NE
		Cerium-141	3	2.14	2.28	-0.00665	4.53	NE
		Cerium-144	3	-3.64	0.64	-4.19	-2.94	30,000
		Cesium-134	3	0.10	0.34	-0.294	0.335	9,000
		Cesium-137	3	0.27	1.02	-0.523	1.43	10,000
		Chromium-51	3	-8.28	17.30	-26.4	8.07	5,000,000
		Cobalt-57	3	-0.05	0.23	-0.227	0.217	NE
		Cobalt-60	3	0.92	1.68	-0.674	2.68	30,000
		Europium-152	3	-0.08	4.53	-4.98	3.95	NE
		Europium-154	3	1.68	3.25	-0.483	5.41	NE
		Gross Alpha	2	4.14	1.63	2.99	5.29	NE
		Gross Beta	2	19.12	14.40	8.94	29.3	NE
		Iron-59	3	2.26	2.33	0.311	4.84	100,000
		Lead-211	3	-16.55	31.44	-51.7	8.87	NE
		Lead-212	3	2.41	2.73	0.663	5.56	20,000
		Lead-214	3	2.13	3.98	-2.34	5.27	1,000,000
		Manganese-54	3	0.83	0.71	0.0994	1.52	NE
		Mercury-203	3	2.46	1.49	0.902	3.87	NE
		Neptunium-237	3	-1.93	4.89	-7.25	2.37	NE
		Neptunium-239	3	1.29	6.54	-5.28	7.8	NE
		Niobium-95	3	2.19	0.49	1.81	2.74	NE
		Nitrogen, Ammonia	4	16.28	7.67	8.93	23.3	NE
		Potassium-40	3	44.23	42.84	19	93.7	40,000
		Protactinium-231	3	-19.40	34.04	-41.5	19.8	NE
		Protactinium-233	3	0.16	1.80	-1.57	2.02	NE
		Protactinium-234	3	3.55	2.95	0.582	6.48	NE
		Radium-223	3	2.04	7.43	-4.97	9.83	NE
		Radium-224	3	-10.60	146.74	-180	77.3	NE
		Radium-226	3	1.98	3.09	-1.54	4.23	600

See notes at end of table.

TABLE A-6. Permitted Sanitary Outfalls of Radiological Analyses, CY 2006 (concluded)
(All Results in picocuries per liter [pci/L] unless otherwise noted.)

Permit Number	Station	Analyte	Sample Size	Mean	Std Dev	Minimum	Maximum	Regulatory Limit COA
2069-K	WW011	Radium-228	3	3.97	3.57	0.24	7.35	600
		Radon-219	3	11.89	4.66	7.68	16.9	NE
		Rhodium-106	3	-6.50	17.74	-26.8	5.99	NE
		Ruthenium-103	3	-0.82	1.64	-2.64	0.534	300,000
		Ruthenium-106	3	-0.07	6.58	-4.24	7.52	30,000
		Selenium-75	3	0.29	1.48	-0.592	2	NE
		Sodium-22	3	0.61	1.17	-0.171	1.95	NE
		Strontium-85	3	-10.17	8.58	-19.6	-2.84	NE
		Thallium-208	3	0.13	3.10	-3.45	2.1	NE
		Thorium-227	3	-1.21	10.01	-7.94	10.3	NE
		Thorium-231	3	-0.71	6.39	-5.96	6.4	300
		Thorium-232	3	2.34	2.67	0.653	5.42	500,000
		Thorium-234	3	46.27	72.17	-12	127	50,000
		Tin-113	3	0.47	1.06	-0.221	1.69	NE
		Total Uranium	1	0.00		0.00302	0.00302	NE
		Tritium	2	-1.70	45.40	-33.8	30.4	10,000,000
		Uranium-235	1	0.00		0.000021	0.000021	3,000
		Uranium-235	3	10.74	4.92	5.12	14.3	3,000
		Uranium-238	1	0.00		0.003	0.003	3,000
		Uranium-238	3	46.27	72.17	-12	127	3,000
		Yttrium-88	3	1.03	0.14	0.884	1.16	100,000
		Zinc-65	3	0.15	2.08	-2.24	1.55	NE
		Zirconium-95	3	1.12	1.25	0.0807	2.51	200,000

NOTES: COA = City of Albuquerque
NE = Not established
Std Dev = Standard Deviation

TABLE A-7. Permitted Sanitary Outfalls, September 2006
(All results in milligrams per liter [mg/L] unless otherwise noted.)

Permit Number:	2069-A		2069F-4		2069G-2		2069I-3		2069-K		Regulatory
Station:	WW001		WW006		WW007		WW008		WW011		Limit
Date Collected:	9/6/2006		9/6/2006		9/6/2006		9/6/2006		9/6/2006		COA
Sample ID:	080647-001		080648-001		080649-001		080650-001		080651-001		(mg/L)
Analyte											
Aluminum	0.15	J	0.111	J	0.111	J	0.101	J	0.0806	J	900
Arsenic	0.0168		0.0146	J	0.0146	J	0.0128	J	0.0119	J	0.051
Boron	0.114		0.153		0.153	J	0.0759		0.147		NE
Cadmium	0.00144	J	0.00113	J	0.00113	U	0.001	U	0.00116	J	0.5
Chromium	0.00164	J	0.00127	J	0.00127	J	0.00265	J	0.00322	J	4.1
Copper	0.0124		0.0105		0.0105	U	0.0137		0.0169		5.3
Fluoride	0.717		0.701		0.701		2.08		0.479		36
Lead	0.0025	U	0.0025	U	0.0025	U	0.0025	U	0.0025	U	1
Molybdenum	0.0826		0.0787		0.0787		0.102		0.0434		2
Nickel	0.00139	J	0.001	U	0.001	J	0.00123	J	0.0014	J	2
Selenium	0.006	U	0.006	U	0.006	U	0.006	U	0.006	U	0.46
Silver	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	5
Zinc	0.0988		0.0523		0.0523	J	0.0344		0.123		2.2

Permit Number:	2069-A		2069F-4		2069G-2		2069I-3		2069-K		Regulatory
Station:	WW001		WW006		WW007		WW008		WW011		Limit
Date Collected:	9/7/2006		9/7/2006		9/7/2006		9/7/2006		9/7/2006		COA
Sample ID:	080652-001		080653-001		080654-001		080655-001		080656-001		(mg/L)
Analyte											
Aluminum	0.0956	J	0.068	U	0.068	J	0.127	J	0.068	U	900
Arsenic	0.0165		0.016		0.016	J	0.015	J	0.0108	J	0.051
Boron	0.113		0.212		0.212	J	0.0666		0.141		NE
Cadmium	0.00124	J	0.00104	J	0.00104	U	0.00107	J	0.001	U	0.5
Chromium	0.00154	J	0.00105	J	0.00105	J	0.00217	J	0.00201	J	4.1
Copper	0.0158		0.00779	J	0.00779	U	0.0127		0.0115		5.3
Fluoride	0.759		0.874		0.874		1.36		0.563		36
Lead	0.0025	U	0.0025	U	0.0025	U	0.0025	U	0.0025	U	1
Molybdenum	0.129		0.0913		0.0913		0.0913		0.0525		2
Nickel	0.001	U	0.001	U	0.001	J	0.0012	J	0.001	U	2
Selenium	0.006	U	0.006	U	0.006	U	0.006	U	0.006	U	0.46
Silver	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	5
Zinc	0.0919		0.0283		0.0283	J	0.0281		0.0599		2.2

Permit Number:	2069-A		2069F-4		2069G-2		2069I-3		Regulatory
Station:	WW001		WW006		WW007		WW008		Limit
Date Collected:	9/19/2006		9/5/2006		9/5/2006		9/5/2006		COA
Sample ID:	080660-001		080657-001		080658-001		080659-001		(mg/L)
Analyte									
Cyanide, Total	0.0015	U	0.0015	U	0.0015	U	0.0015	U	0.45

NOTES: COA = City of Albuquerque
J = Estimated value, the analyte concentration fell above the effective (MDL) minimum detection limit and below the effective (PQL) practical quantitation 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 MDL. For radiochemical analytes the result is less than the decision level.
NE = Not established.

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TABLE A-8. Summary of Sanitary Outfalls of Radiological Analyses, September 2006

(All Results in picocuries per liter [pCi/L] unless otherwise noted.)

Permit Number:	2069-A			2069F-4			2069I-3			2069-K			Regulatory
Station:	WW001			WW006			WW008			WW011			Sewer Release
Date Collected:	9/6/2006			9/6/2006			9/6/2006			9/6/2006			Limits*
Sample ID:	080647-004			080648-004			080650-004			080651-004			(Monthly Avg)
Analyte	Activity		MDA	Activity		MDA	Activity		MDA	Activity		MDA	
Actinium-228	12.6 ± 6.71	U	6.1	2.57 ± 13.1	U	5.82	10.9 ± 14.9	U	6.43	0.24 ± 14.1	U	5.76	300,000
Americium-241	-1.61 ± 8.09	U	6.94	-4.09 ± 8.79	U	6.69	5.42 ± 9.66	U	7.47	-4.41 ± 5.79	U	4.29	200
Antimony-124	2.56 ± 4.28	U	3.76	-1.92 ± 4.06	U	3.31	-0.228 ± 4.64	U	3.35	0.264 ± 3.73	U	3.15	NE
Antimony-125	2.97 ± 4.32	U	3.8	0.176 ± 4.28	U	3.63	0.921 ± 4.93	U	4.06	1.08 ± 8.48	U	3.96	NE
Barium-133	1.3 ± 2.18	U	1.72	-0.715 ± 2.07	U	1.75	-9.24 ± 3.14	U	1.93	0.637 ± 2.35	U	1.8	NE
Beryllium-7	-0.156 ± 14.5	U	12.4	-3.17 ± 15.5	U	13	-2.14 ± 16.6	U	14.2	4.45 ± 15.5	U	13.3	NE
Bismuth-211	11.2 ± 19.3	U	7.81	29.4 ± 9.99	U	9.29	29.3 ± 11.8	U	10.5	9.95 ± 21.6	U	8.16	NE
Bismuth-212	6.84 ± 14.3	U	10.2	17.9 ± 16	U	10	12 ± 13.6	U	11.9	12.9 ± 16.1	U	12.3	NE
Bismuth-214	10.2 ± 4.78	U	3.46	3.63 ± 7.19	U	2.67	12.4 ± 4.04	U	3.77	3.26 ± 6.97	U	2.99	NE
Cadmium-109	6.34 ± 57.3	U	28.1	12.7 ± 37.5	U	28.9	-31 ± 62.7	U	33.4	23.8 ± 36.3	U	27.8	NE
Cerium-139	-2.14 ± 1.41	U	1.12	-1.14 ± 1.42	U	1.15	-1.69 ± 1.66	U	1.36	-1.03 ± 1.48	U	1.2	NE
Cerium-141	0.409 ± 6.12	U	2.51	1.21 ± 5.9	U	2.38	3.53 ± 3.47	U	3	-0.00665 ± 3.17	U	2.63	NE
Cerium-144	-4.9 ± 10	U	8.33	2.91 ± 9.81	U	8.27	3.86 ± 11.1	U	9.48	-2.94 ± 10.4	U	8.61	30,000
Cesium-134	0.811 ± 1.83	U	1.55	0.858 ± 1.78	U	1.49	-0.0645 ± 1.9	U	1.59	0.335 ± 2	U	1.67	9,000
Cesium-137	1.27 ± 1.85	U	1.59	-0.345 ± 1.74	U	1.42	1.86 ± 3.64	U	1.51	1.43 ± 1.72	U	1.49	10,000
Chromium-51	2.17 ± 18.4	U	14.9	2.43 ± 17.3	U	15	-6.46 ± 21	U	17.2	-6.51 ± 18.8	U	16.1	5,000,000
Cobalt-57	0.846 ± 1.26	U	1.08	-0.365 ± 1.21	U	1	1.26 ± 1.72	U	1.17	-0.227 ± 1.3	U	1.08	NE
Cobalt-60	0.714 ± 1.84	U	1.59	-0.449 ± 1.81	U	1.47	-2.09 ± 1.98	U	1.49	0.767 ± 1.54	U	1.36	30,000
Europium-152	1.05 ± 4.53	U	3.95	1.51 ± 4.45	U	3.86	2.1 ± 5.26	U	4.39	3.95 ± 6.12	U	4.11	NE
Europium-154	2.76 ± 4.89	U	4.31	1.26 ± 4.55	U	3.88	-3 ± 4.99	U	3.89	-0.483 ± 4.11	U	3.47	NE
Iron-59	-3.63 ± 3.64	U	2.86	2.17 ± 3.84	U	3.35	-1.17 ± 3.93	U	3.18	1.62 ± 3.33	U	2.95	100,000
Lead-211	-21.2 ± 41.5	U	34.8	8.62 ± 45.3	U	34.3	-37.7 ± 47.3	U	37.4	-6.81 ± 44	U	37.3	NE
Lead-212	0.224 ± 6	U	2.25	1.1 ± 5.06	U	2.72	4.62 ± 5.76	U	2.59	0.663 ± 6.2	U	2.45	20,000
Lead-214	3.91 ± 6.7	U	3.18	8.31 ± 3.52	U	3.22	11.6 ± 4.11	U	3.66	3.46 ± 7.51	U	2.88	1,000,000
Manganese-54	-0.453 ± 1.77	U	1.43	-0.177 ± 1.52	U	1.29	0.915 ± 1.67	U	1.44	0.885 ± 1.8	U	1.53	NE
Mercury-203	0.561 ± 1.98	U	1.63	0.692 ± 2.02	U	1.65	1.5 ± 2.18	U	1.85	0.902 ± 2.06	U	1.69	NE
Neptunium-237	1.86 ± 16.8	U	8.73	-5.84 ± 10.3	U	8.66	17.9 ± 13.5	U	10.6	-0.921 ± 9.94	U	8.34	NE
Neptunium-239	0.883 ± 9.29	U	7.88	-2.31 ± 9.23	U	7.71	-14.3 ± 10.4	U	8.52	7.8 ± 11.5	U	7.93	NE
Niobium-95	0.0117 ± 2.13	U	1.76	1.82 ± 2.08	U	1.79	0.978 ± 2.2	U	1.9	2.74 ± 2.25	U	1.97	NE
Nitrogen, Ammonia	20.3 ±		1	21.1 ±		1	2.78 ±		0.1	8.93 ±		0.1	NE
Potassium-40	32.5 ± 44.3	X	13.6	58.5 ± 47.6		12.7	75.7 ± 22.6	U	22.6	19 ± 44.2	U	11.6	40,000
Protactinium-231	18.4 ± 97	U	63.2	-23.5 ± 76.7	U	61.1	-117 ± 84.6	U	67	19.8 ± 78.9	U	64.3	NE
Protactinium-233	-0.891 ± 3.34	U	2.67	-0.524 ± 3.01	U	2.58	0.502 ± 3.53	U	2.93	0.0226 ± 3.11	U	2.7	NE
Protactinium-234	-3.31 ± 13	U	11	7.74 ± 12.7	U	11.2	4.54 ± 14.1	U	12	0.582 ± 12.7	U	10.4	NE
Radium-223	-7.43 ± 32.8	U	26.2	-37.2 ± 30	U	24.7	-24.4 ± 36	U	29	-4.97 ± 32.2	U	27.7	NE
Radium-224	62.9 ± 35.2	U	27.7	51.5 ± 34.5	U	26.5	46.4 ± 41	U	31.2	70.9 ± 38.6	U	29.5	NE
Radium-226	10.2 ± 4.78	X	2.87	3.63 ± 7.19	U	3.59	12.4 ± 4.04	U	3.77	3.26 ± 6.97	U	2.99	600
Radium-228	12.6 ± 6.71	U	6.1	2.57 ± 13.1	U	5.82	10.9 ± 14.9	U	6.43	0.24 ± 14.1	U	5.76	600

See notes at end of table.

TABLE A-8. Summary of Sanitary Outfalls of Radiological Analyses, September 2006 (concluded)
(All Results in picocuries per liter [pCi/L] unless otherwise noted.)

Permit Number:	2069-A			2069F-4			2069I-3			2069-K			Regulatory Sewer Release Limits* (Monthly Avg)
Station:	**WW001**			**WW006**			**WW008**			**WW011**			
Date Collected:	**9/6/2006**			**9/6/2006**			**9/6/2006**			**9/6/2006**			
Sample ID:	**080647-004**			**080648-004**			**080650-004**			**080651-004**			
Analyte	**Activity**		**MDA**	**Activity**		**MDA**	**Activity**		**MDA**	**Activity**		**MDA**	
Radon-219	4.68 ± 18.5	U	16.1	13.1 ± 22.3	U	15.8	1.19 ± 21	U	17.2	7.68 ± 19.6	U	17	NE
Rhodium-106	3.34 ± 15.1	U	12.8	-5.39 ± 14.4	U	11.7	4.67 ± 16.1	U	13.9	5.99 ± 15.7	U	13.4	NE
Ruthenium-103	0.252 ± 1.91	U	1.63	-0.177 ± 1.9	U	1.59	-0.614 ± 2.16	U	1.84	-0.346 ± 2	U	1.69	300,000
Ruthenium-106	-2.79 ± 15.1	U	12.5	-6.21 ± 14.4	U	11.7	6.45 ± 16.1	U	13.9	7.52 ± 15.8	U	13.5	30,000
Selenium-75	-2.39 ± 2.18	U	1.7	0.88 ± 2.14	U	1.76	-1.22 ± 2.42	U	1.98	2 ± 2.45	U	1.81	NE
Sodium-22	0.986 ± 1.75	U	1.54	0.459 ± 1.63	U	1.39	-1.09 ± 1.79	U	1.39	-0.171 ± 1.47	U	1.24	NE
Strontium-85	-10.7 ± 2.93	U	2.2	-17.8 ± 2.86	U	1.91	-4.02 ± 2.96	U	2.45	-19.6 ± 3.15	U	1.93	NE
Thallium-208	1.32 ± 4.49	U	1.75	5.29 ± 1.88	U	1.74	0.948 ± 4.07	U	1.39	2.1 ± 4.9	U	1.84	NE
Thorium-227	6.2 ± 19.4	U	16	-4.42 ± 19.1	U	15.4	-19.8 ± 24.2	U	17	-5.98 ± 20.4	U	16.4	NE
Thorium-231	-8.96 ± 8.79	U	6.87	2.73 ± 8.73	U	7.14	1.47 ± 9.57	U	7.99	-2.57 ± 10.3	U	7.37	300
Thorium-232	0.22 ± 5.9	U	2.68	1.08 ± 4.99	U	2.14	4.55 ± 5.67	U	2.55	0.653 ± 6.11	U	2.41	500,000
Thorium-234	189 ± 69.2	U	63.4	41.2 ± 157	U	53.7	156 ± 140	X	58	23.8 ± 84.1	U	37.2	50,000
Tin-113	-0.437 ± 2.02	U	1.72	0.124 ± 2.37	U	1.79	0.649 ± 2.41	U	2	-0.221 ± 2.25	U	1.92	NE
Tritium	17.1 ± 87	U	72.6	-34.9 ± 87.3	U	74.2	-34.6 ± 86.5	U	73.5	-33.8 ± 84.4	U	71.8	10,000,000
Uranium-235	1.79 ± 19.5	U	8.94	3.99 ± 19.5	U	8.81	7.52 ± 13	U	9.82	14.3 ± 10.8	U	9.02	3,000
Uranium-238	189 ± 69.2	U	63.4	41.2 ± 157	U	53.7	156 ± 140	X	58	23.8 ± 84.1	U	37.2	3,000
Yttrium-88	0.121 ± 2.07	U	1.7	-0.846 ± 1.96	U	1.6	-0.59 ± 1.96	U	1.6	1.06 ± 2.09	U	1.6	100,000
Zinc-65	-1.51 ± 3.54	U	2.92	2.5 ± 4.2	U	3.23	-1.12 ± 4.81	U	3.36	1.55 ± 3.22	U	2.52	NE
Zirconium-95	1.8 ± 3.1	U	2.66	1.9 ± 3.13	U	2.66	0.161 ± 3.21	U	2.72	0.755 ± 3.29	U	2.76	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.
X = Presumptive evidence analyte is not present.
NE = Not established.
MDA = minimum detectable activity.
* = The monthly average concentration values for release of sanitary sewage were derived by taking the most restrictive occupational stochastic oral ingestion annual limits on intake (ALT) for a reference mean.

TABLE A-9. Summary of Sanitary Outfalls of Volatile Organic Compounds, September 2006

(All Results in micrograms per liter [ug/L] unless otherwise noted.)

Permit Number:	**2069-A**		**2069F-4**		**2069I-3**		**2069-K**	
Station:	**WW001**		**WW006**		**WW008**		**WW011**	
Date Collected:	**9/6/2006**		**9/6/2006**		**9/6/2006**		**9/6/2006**	
Sample ID:	**080647-006**		**080648-006**		**080650-006**		**080651-006**	
Analyte								
1,1,1-Trichloroethane	0.3	U	0.3	U	0.3	U	0.3	U
1,1,2,2-Tetrachloroethane	0.25	U	0.25	U	0.25	U	0.25	U
1,1,2-Trichloroethane	0.25	U	0.25	U	0.25	U	0.25	U
1,1-Dichloroethane	0.3	U	0.3	U	0.3	U	0.3	U
1,1-Dichloroethylene	0.3	U	0.3	U	0.3	U	0.3	U
1,2-Dichlorobenzene	20.2	U	19.6	U	8.51	U	17.5	U
1,2-Dichloroethane	0.25	U	0.25	U	0.25	U	0.25	U
1,2-Dichloropropane	0.25	U	0.25	U	0.25	U	0.25	U
1,3-Dichlorobenzene	20.2	U	19.6	U	8.51	U	17.5	U
1,4-Dichlorobenzene	20.2	U	19.6	U	8.51	U	17.5	U
2,4,5-Trichlorophenol	10.1	U	9.8	U	4.26	U	8.77	U
2-Butanone	2.28	J	2.33	J	10.9		3.61	J
2-Hexanone	1.25	U	1.25	U	1.25	U	1.25	U
2-Methylnaphthalene	3.03	U	2.94	U	1.28	U	2.63	U
3,3'-Dichlorobenzidine	10.1	U	9.8	U	4.26	U	8.77	U
4-Bromophenylphenylether	20.2	U	19.6	U	8.51	U	17.5	U
4-Chloroaniline	20.2	U	19.6	U	8.51	U	17.5	U
4-Chlorophenylphenylether	20.2	U	19.6	U	8.51	U	17.5	U
4-Methyl-2-pentanone	1.25	U	1.25	U	1.25	U	1.25	U
Acetone	22.1		34.5		69.4		52	
Benzene	0.3	U	0.3	U	0.3	U	0.3	U
Bromodichloromethane	0.25	U	0.25	U	0.25	U	0.25	U
Bromoform	0.793	J	0.25	U	0.472	J	0.25	U
Bromomethane	0.5	U	0.5	U	0.5	U	0.5	U
Butylbenzylphthalate	20.2	U	19.6	U	8.51	U	17.5	U
Carbazole	2.02	U	1.96	U	0.851	U	1.75	U
Carbon disulfide	1.25	U	1.25	U	1.25	U	1.25	U
Carbon tetrachloride	0.25	U	0.25	U	0.25	U	0.25	U
Chlorobenzene	0.25	U	0.25	U	0.25	U	0.25	U
Chloroethane	0.5	U	0.5	U	0.5	U	0.5	U
Chloroform	0.558	J	0.25	U	1.01		0.712	J
Chloromethane	0.5	U	0.5	U	0.5	U	0.5	U
cis-1,2-Dichloroethylene	0.3	U	0.3	U	0.3	U	0.3	U
cis-1,3-Dichloropropylene	0.25	U	0.25	U	0.25	U	0.25	U
Dibromochloromethane	0.25	U	0.25	U	0.297	J	0.25	U
Dimethylphthalate	20.2	U	19.6	U	8.51	U	17.5	U
Diphenylamine	30.3	U	29.4	U	12.8	U	26.3	U
Ethylbenzene	0.25	U	0.25	U	0.25	U	0.25	U
m,p-Cresol	30.3	U	29.4	U	12.8	U	26.3	U
Methylene chloride	2	U	2	U	2	U	2	U
m-Nitroaniline	20.2	U	19.6	U	8.51	U	17.5	U
o-Cresol	20.2	U	19.6	U	8.51	U	17.5	U
o-Nitroaniline	20.2	U	19.6	U	8.51	U	17.5	U
p-Nitroaniline	30.3	U	29.4	U	12.8	U	26.3	U
Styrene	0.25	U	0.25	U	0.25	U	0.25	U
Tetrachloroethylene	0.25	U	0.25	U	0.25	U	0.25	U
Toluene	0.25	U	0.25	U	0.25	U	0.44	J
trans-1,2-Dichloroethylene	0.3	U	0.3	U	0.3	U	0.3	U
trans-1,3-Dichloropropylene	0.25	U	0.25	U	0.25	U	0.25	U

See notes at end of table

TABLE A-9. Summary of Sanitary Outfalls of Volatile Organic Compounds, September 2006 (concluded)
(All Results in micrograms per liter [ug/L] unless otherwise noted.)

Permit Number:	**2069-A**		**2069F-4**		**2069I-3**		**2069-K**	
Station:	**WW001**		**WW006**		**WW008**		**WW011**	
Date Collected:	**9/6/2006**		**9/6/2006**		**9/6/2006**		**9/6/2006**	
Sample ID:	**080647-006**		**080648-006**		**080650-006**		**080651-006**	
Analyte								
Trichloroethylene	0.25	U	0.25	U	0.25	U	0.25	U
Vinyl acetate	1.5	U	1.5	U	1.5	U	1.5	U
Vinyl chloride	0.5	U	0.5	U	0.5	U	0.5	U
Xylenes (total)	0.25	U	0.25	U	0.25	U	0.25	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.

J = Estimated value, the analyte concentration fell above the effective MDL and below the effective PQL.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 A-10. Summary of Sanitary Outfalls of Radiological Analyses, April 2006

(All Results in picocuries per liter [pCi/L] unless otherwise noted.)

Permit Number:	**2069-K**			**Regulatory**
Station:	**WW011**			**Sewer Release**
Date Collected:	**4/3/2006**			**Limits***
Sample ID:	**076360-002**			**(Monthly Avg)**
Analyte	**Activity**		**MDA**	
Actinium-228	7.35 ± 6.78	U	5.47	300,000
Americium-241	0.563 ± 14.3	U	5.78	200
Antimony-124	-1.41 ± 5.82	U	4.09	NE
Antimony-125	4.45 ± 4.93	U	4.25	NE
Barium-133	1.8 ± 2.47	U	1.86	NE
Beryllium-7	15.8 ± 18.6	U	16	NE
Bismuth-211	15.2 ± 18	U	8.63	NE
Bismuth-212	8.58 ± 28.2	U	12.1	NE
Bismuth-214	4.23 ± 8.15	U	3.22	NE
Cadmium-109	-120 ± 56.6	U	30.7	NE
Cerium-139	0.59 ± 1.86	U	1.34	NE
Cerium-141	4.53 ± 7.46	U	3.14	NE
Cerium-144	-3.8 ± 11	U	8.92	30,000
Cesium-134	0.26 ± 3.31	U	1.66	9,000
Cesium-137	-0.523 ± 1.8	U	1.45	10,000
Chromium-51	8.07 ± 24.7	U	21.1	5,000,000
Cobalt-57	0.217 ± 1.35	U	1.11	NE
Cobalt-60	2.68 ± 1.97	U	1.61	30,000
Europium-152	-4.98 ± 5.08	U	4.12	NE
Europium-154	0.101 ± 5.4	U	4.48	NE
Iron-59	0.311 ± 4.57	U	3.84	100,000
Lead-211	8.87 ± 48	U	40.2	NE
Lead-212	1.01 ± 6.72	U	3.55	20,000
Lead-214	5.27 ± 6.25	U	3.29	1,000,000
Manganese-54	0.0994 ± 1.79	U	1.52	NE
Mercury-203	3.87 ± 2.46	U	2.17	NE
Neptunium-237	-7.25 ± 16	U	9.12	NE
Neptunium-239	1.34 ± 9.98	U	8.24	NE
Niobium-95	2.02 ± 2.72	U	2.3	NE
Potassium-40	20 ± 35.5	U	23.3	40,000
Protactinium-231	-41.5 ± 80.4	U	67	NE
Protactinium-233	2.02 ± 3.31	U	2.85	NE
Protactinium-234	3.59 ± 14.2	U	12.1	NE
Radium-223	9.83 ± 33.4	U	28.4	NE
Radium-224	-180 ± 76.4	U	35.2	NE
Radium-226	4.23 ± 8.15	U	3.22	600
Radium-228	7.35 ± 6.78	U	5.47	600
Radon-219	16.9 ± 21.1	U	18.1	NE
Rhodium-106	1.31 ± 15.9	U	13.1	NE
Ruthenium-103	-2.64 ± 3.03	U	2.04	300,000
Ruthenium-106	-4.24 ± 16.1	U	13	30,000
Selenium-75	-0.592 ± 2.44	U	2.06	NE
Sodium-22	0.0392 ± 1.94	U	1.61	NE
Strontium-85	-2.84 ± 3.29	U	2.66	NE
Thallium-208	-3.45 ± 3.49	U	1.94	NE
Thorium-227	-7.94 ± 19.8	U	16.6	NE
Thorium-231	-5.96 ± 9.33	U	7.77	300
Thorium-232	0.961 ± 6.56	U	3.46	500,000
Thorium-234	127 ± 119	U	58.7	50,000

See notes at end of table.

TABLE A-10. Summary of Sanitary Outfalls of Radiological Analyses, April 2006 (concluded)
(All Results in picocuries per liter [pCi/L] unless otherwise noted.)

Permit Number:	2069-K			Regulatory
Station:	WW011			Sewer Release
Date Collected:	4/3/2006			Limits*
Sample ID:	076360-002			(Monthly Avg)
Analyte	**Activity**		**MDA**	
Tin-113	-0.0714 ± 2.5	U	2.09	NE
Total Uranium	0.00302 ±		0.000	NE
Uranium-235	0.000021 ±	J	0.000	3,000
Uranium-235	12.8 ± 19.6	U	9.22	3,000
Uranium-238	0.003 ±		0.000	3,000
Uranium-238	127 ± 119	X	46.1	3,000
Yttrium-88	1.16 ± 2.34	U	2.05	100,000
Zinc-65	1.15 ± 4.8	U	3.51	NE
Zirconium-95	0.0807 ± 3.56	U	3.03	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.

X = Presumptive evidence analyte is not present.

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

NE = Not established.

MDA = minimum detectable activity.

* = The monthly average concentration values for release of sanitary sewage were derived by taking the most restrictive occupational stochastic oral ingestion annual limits on intake (ALT) for a reference mean.

TABLE A-11. Summary of Sanitary Outfalls of Semi-Volatile Organic Compounds, September 2006
(All Results in micrograms per liter [ug/L] unless otherwise noted.)

Permit Number:	2069-A		2069F-4		2069I-3		2069-K	
Station:	WW001		WW006		WW008		WW011	
Date Collected:	9/6/2006		9/6/2006		9/6/2006		9/6/2006	
Sample ID:	080647-007		080648-007		080650-007		080651-007	
Analyte								
1,2,4-Trichlorobenzene	20.2	U	19.6	U	8.51	U	17.5	U
2,4,6-Trichlorophenol	20.2	U	19.6	U	8.51	U	17.5	U
2,4-Dichlorophenol	20.2	U	19.6	U	8.51	U	17.5	U
2,4-Dimethylphenol	20.2	U	19.6	U	8.51	U	17.5	U
2,4-Dinitrophenol	101	U	98	U	42.6	U	87.7	U
2,4-Dinitrotoluene	20.2	U	19.6	U	8.51	U	17.5	U
2,6-Dinitrotoluene	20.2	U	19.6	U	8.51	U	17.5	U
2-Chloronaphthalene	3.54	U	3.43	U	1.49	U	3.07	U
2-Chlorophenol	20.2	U	19.6	U	8.51	U	17.5	U
2-Methyl-4,6-dinitrophenol	30.3	U	29.4	U	12.8	U	26.3	U
2-Nitrophenol	20.2	U	19.6	U	8.51	U	17.5	U
4-Chloro-3-methylphenol	20.2	U	19.6	U	8.51	U	17.5	U
4-Nitrophenol	20.2	U	19.6	U	8.51	U	17.5	U
Acenaphthene	3.13	U	3.04	U	1.32	U	2.72	U
Acenaphthylene	2.02	U	1.96	U	0.851	U	1.75	U
Anthracene	2.02	U	1.96	U	0.851	U	1.75	U
Benzo(a)anthracene	2.02	U	1.96	U	0.851	U	1.75	U
Benzo(a)pyrene	2.02	U	1.96	U	0.851	U	1.75	U
Benzo(b)fluoranthene	2.02	U	1.96	U	0.851	U	1.75	U
Benzo(ghi)perylene	2.02	U	1.96	U	0.851	U	1.75	U
Benzo(k)fluoranthene	2.02	U	1.96	U	0.851	U	1.75	U
bis(2-Chloroethoxy)methane	30.3	U	29.4	U	12.8	U	26.3	U
bis(2-Chloroethyl) ether	20.2	U	19.6	U	8.51	U	17.5	U
bis(2-Chloroisopropyl)ether	20.2	U	19.6	U	8.51	U	17.5	U
bis(2-Ethylhexyl)phthalate	20.2	U	19.6	U	8.51	U	17.5	U
Chrysene	2.02	U	1.96	U	0.851	U	1.75	U
Dibenzo(a,h)anthracene	2.02	U	1.96	U	0.851	U	1.75	U
Dibenzofuran	20.2	U	19.6	U	8.51	U	17.5	U
Diethylphthalate	20.2	U	19.6	U	8.51	U	17.5	U
Di-n-butylphthalate	20.2	U	19.6	U	8.51	U	17.5	U
Di-n-octylphthalate	30.3	U	29.4	U	12.8	U	26.3	U
Fluoranthene	2.02	U	1.96	U	0.851	U	1.75	U
Fluorene	2.02	U	1.96	U	0.851	U	1.75	U
Hexachlorobenzene	20.2	U	19.6	U	8.51	U	17.5	U
Hexachlorobutadiene	20.2	U	19.6	U	8.51	U	17.5	U
Hexachlorocyclopentadiene	20.2	U	19.6	U	8.51	U	17.5	U
Hexachloroethane	20.2	U	19.6	U	8.51	U	17.5	U
Indeno(1,2,3-cd)pyrene	2.02	U	1.96	U	0.851	U	1.75	U
Isophorone	20.2	U	19.6	U	8.51	U	17.5	U
Naphthalene	3.03	U	2.94	U	1.28	U	2.63	U
Nitrobenzene	30.3	U	29.4	U	12.8	U	26.3	U
N-Nitrosodipropylamine	20.2	U	19.6	U	8.51	U	17.5	U
Pentachlorophenol	20.2	U	19.6	U	8.51	U	17.5	U
Phenanthrene	2.02	U	1.96	U	0.851	U	1.75	U
Phenol	10.1	U	9.8	U	4.26	U	8.77	U
Pyrene	3.03	U	2.94	U	1.28	U	2.63	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.

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APPENDIX B
2006 GROUNDWATER CONTAMINANT CONCENTRATION TRENDS

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Groundwater Protection Program Wells

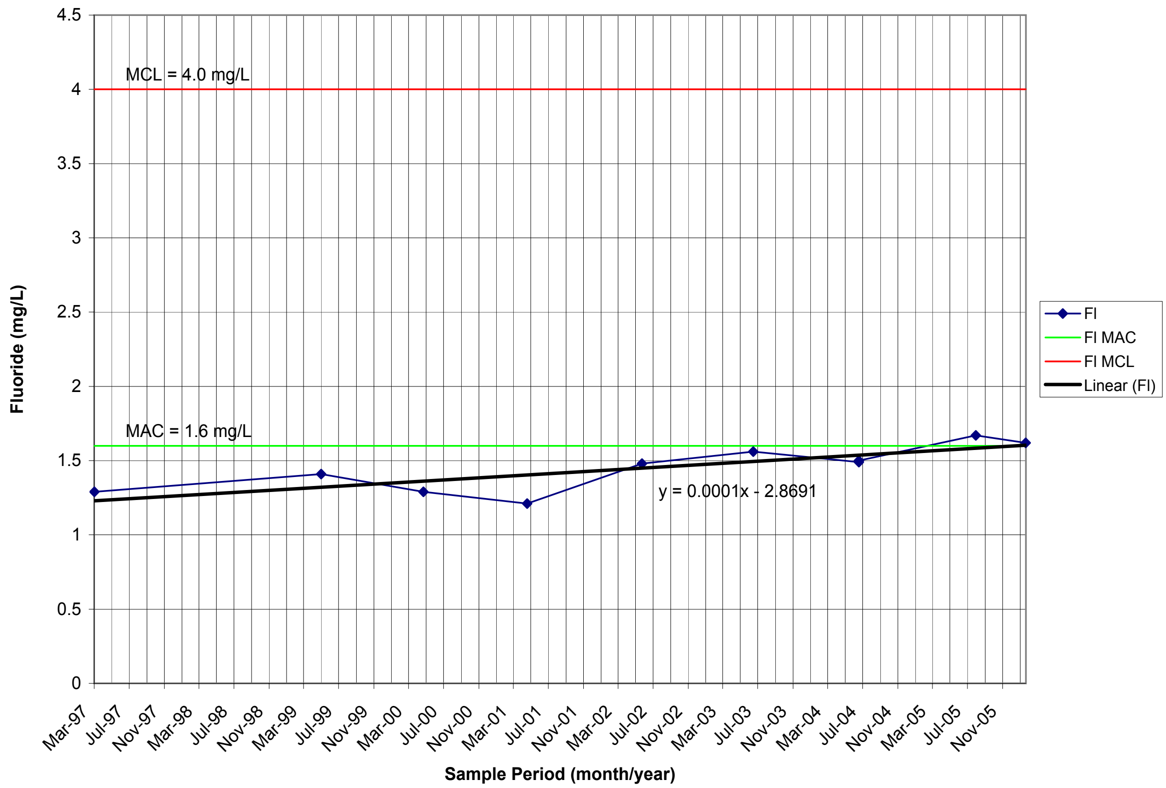

FIGURE B-1. Fluoride Concentrations, TRE-1

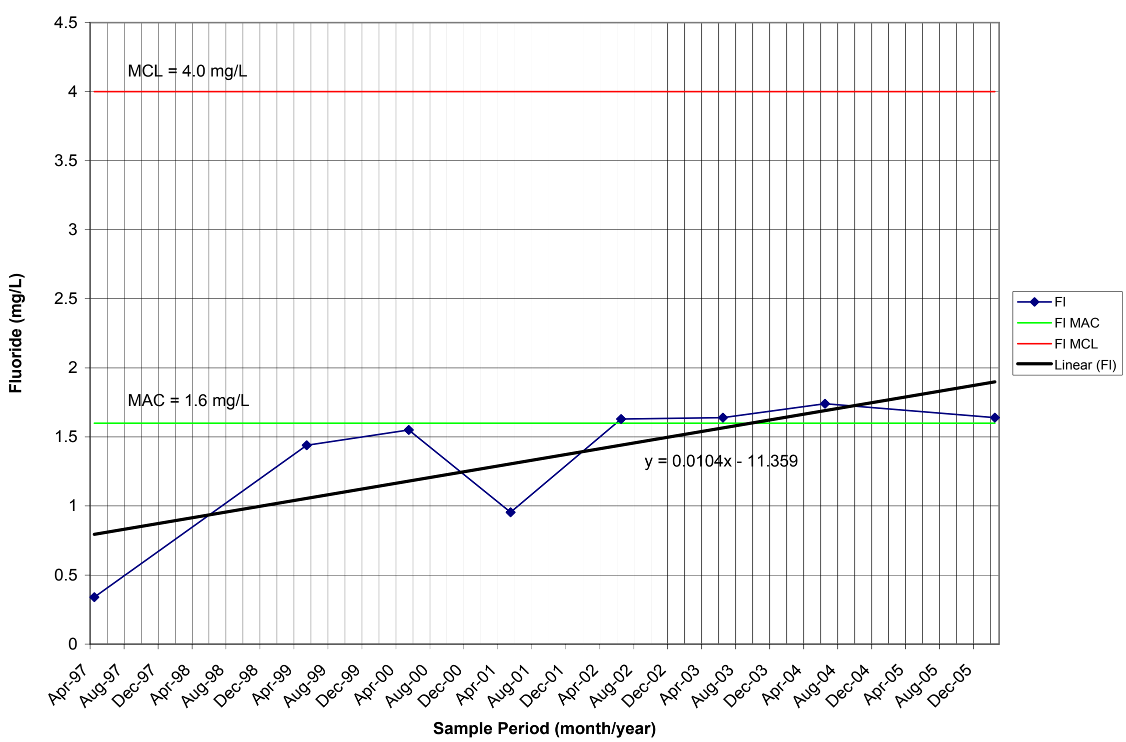

FIGURE B-2. Fluoride Concentrations, Coyote Springs

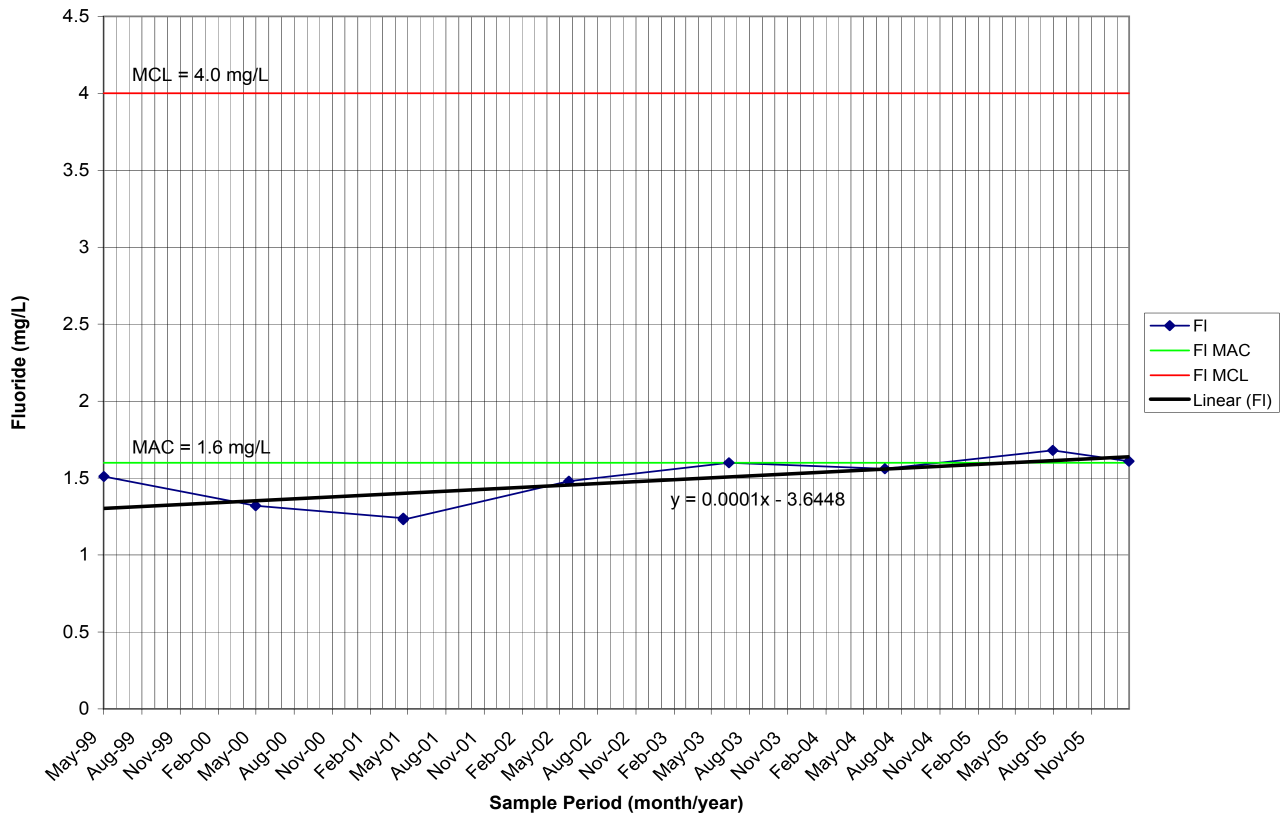

FIGURE B-3. Fluoride Concentrations, SFR-2S

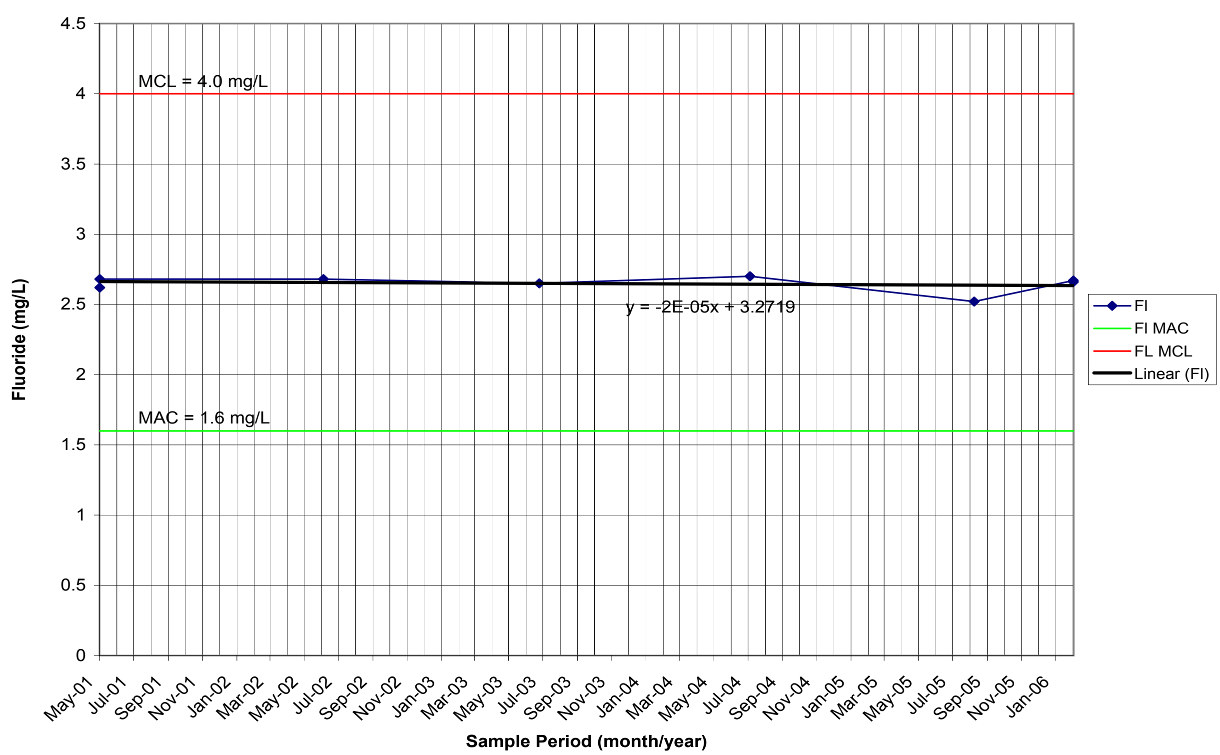

FIGURE B-4. Fluoride Concentrations, SFR-4T

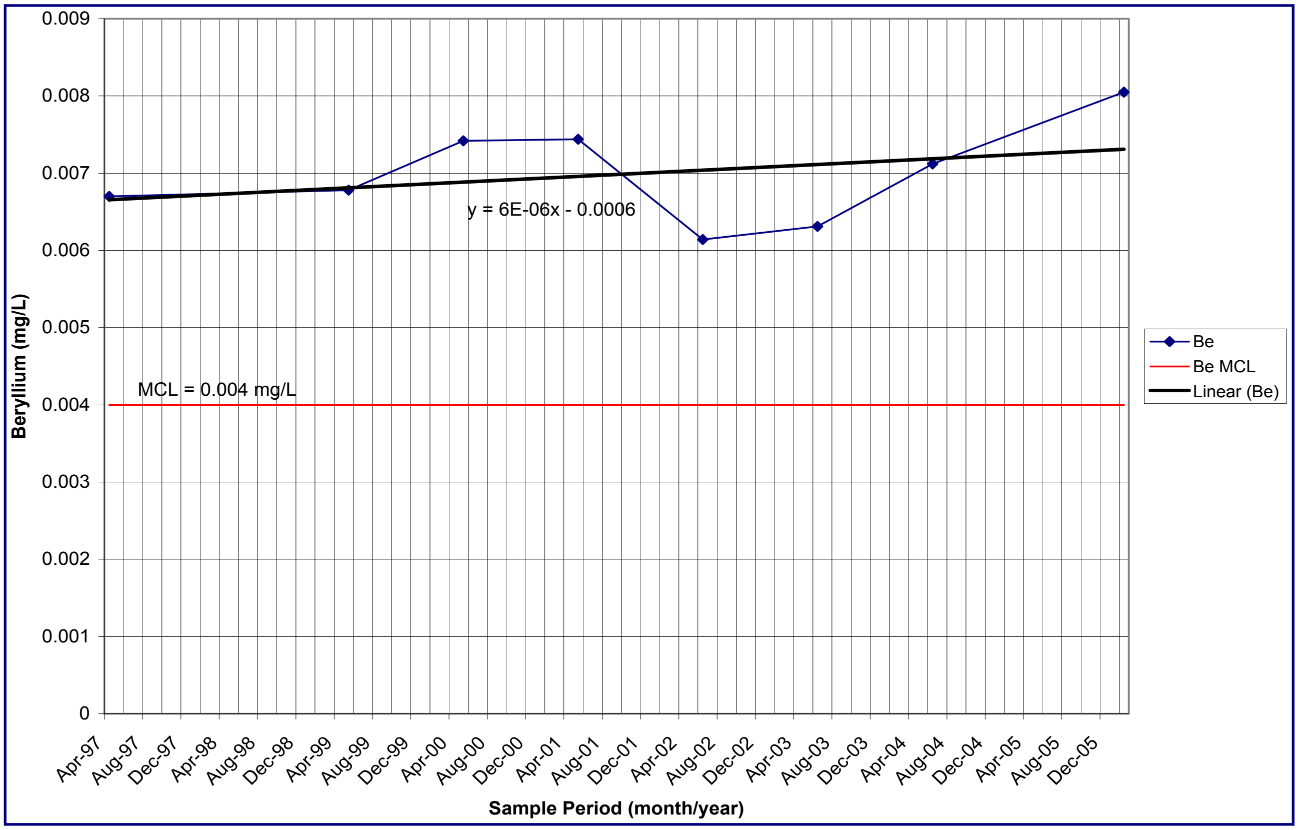

FIGURE B-5. Beryllium Concentrations, Coyote Springs

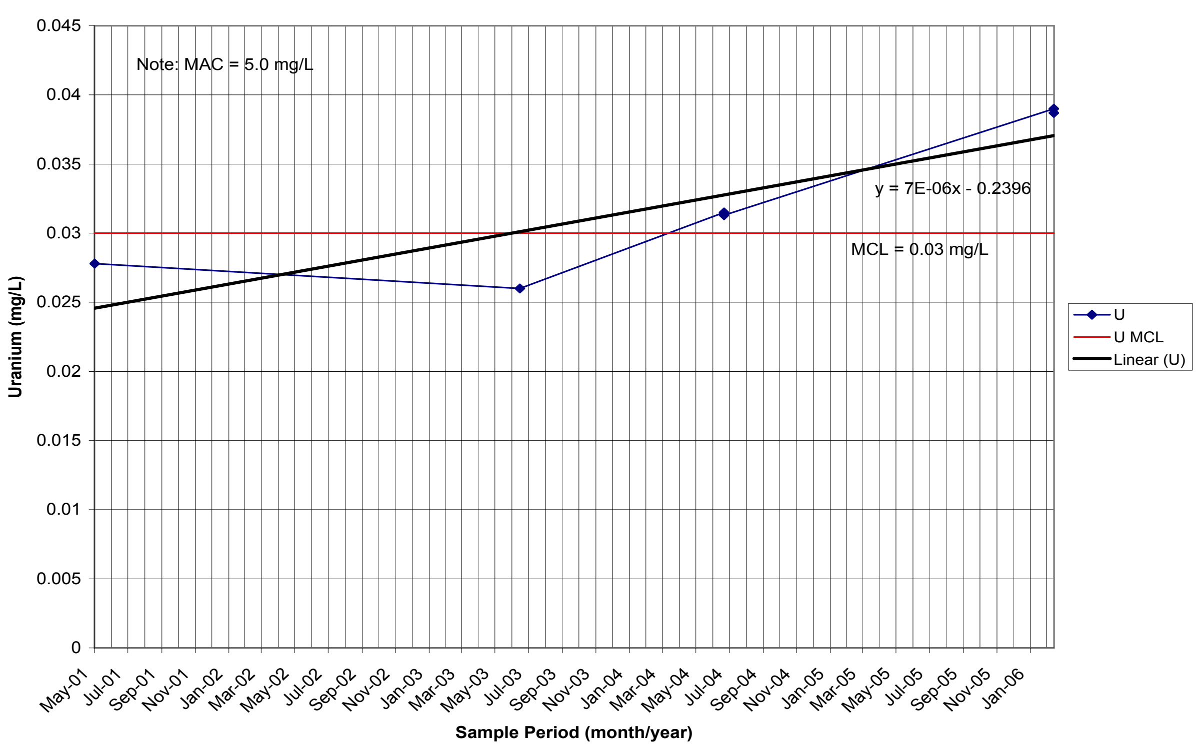

FIGURE B-6. Uranium Concentrations, EOD Hill

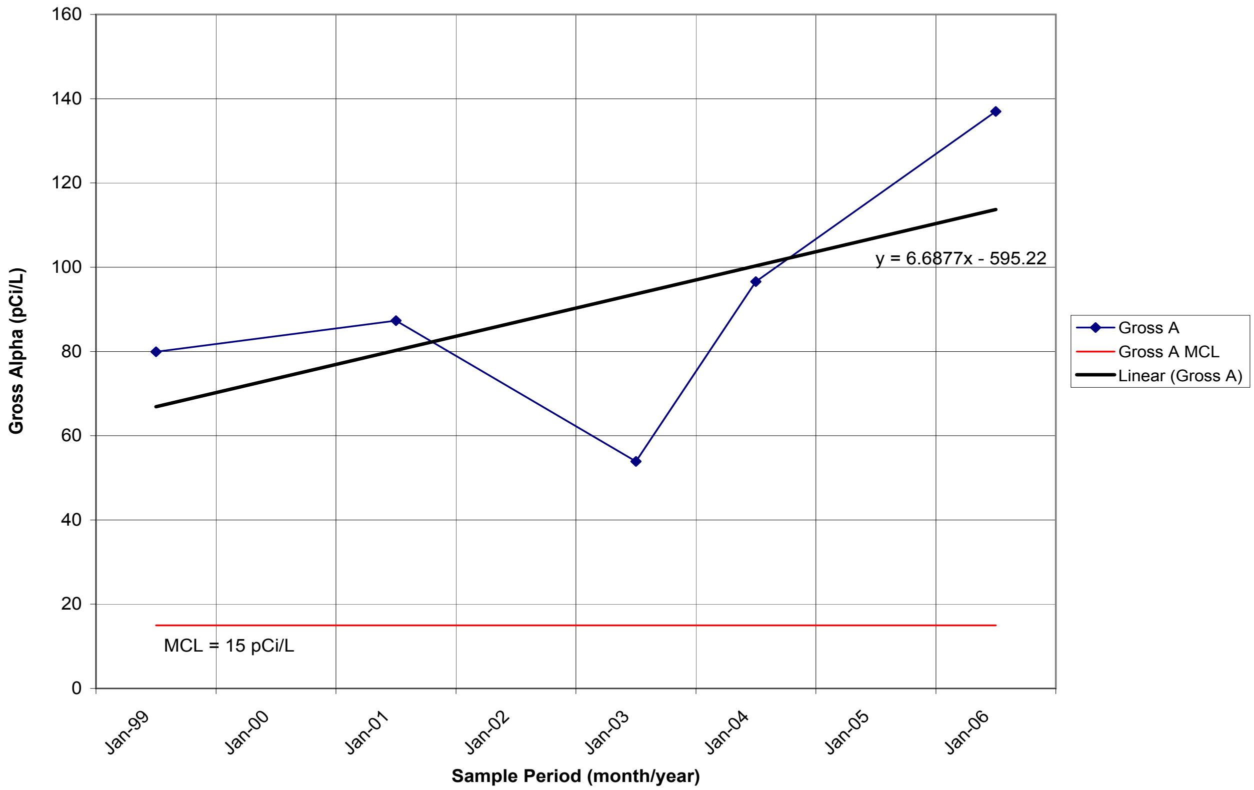

FIGURE B-7. Gross Alpha Activities, EOD Hill

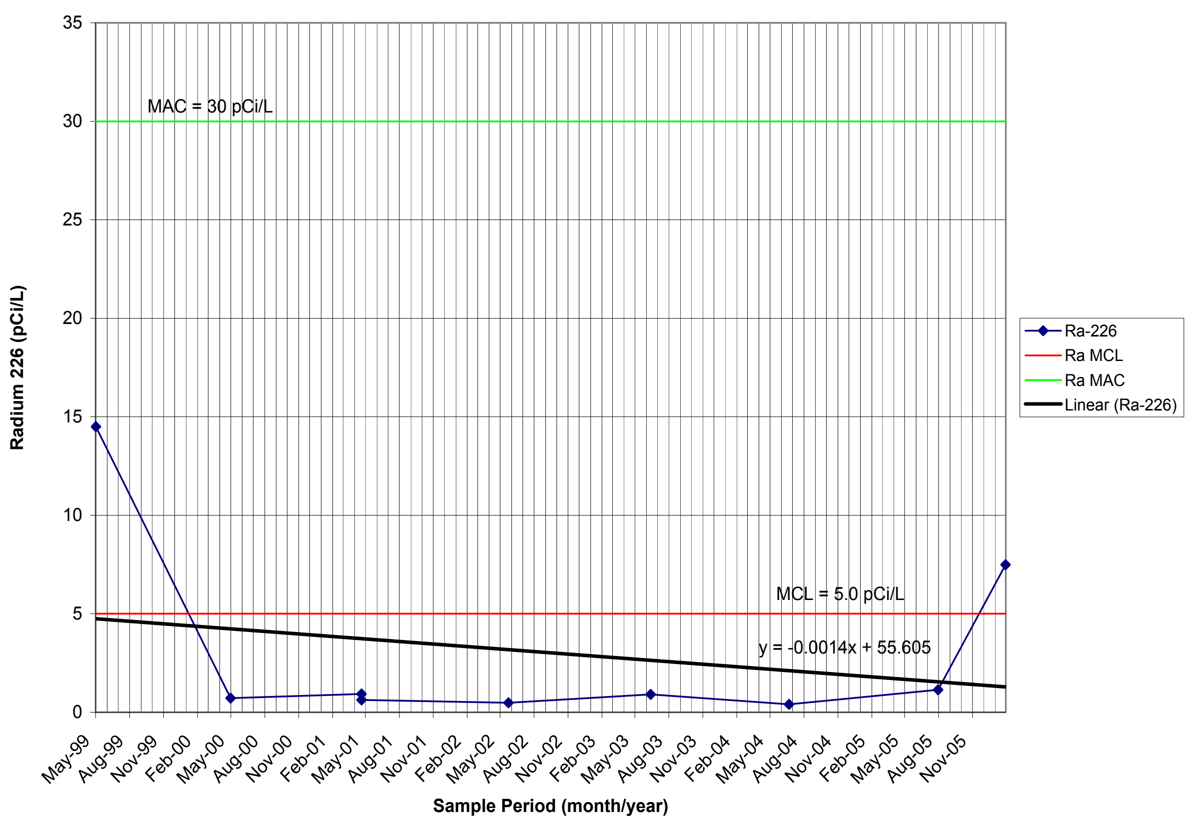

FIGURE B-8. Radium-226 Activities, SFR-2S

Mixed Waste Landfill Wells

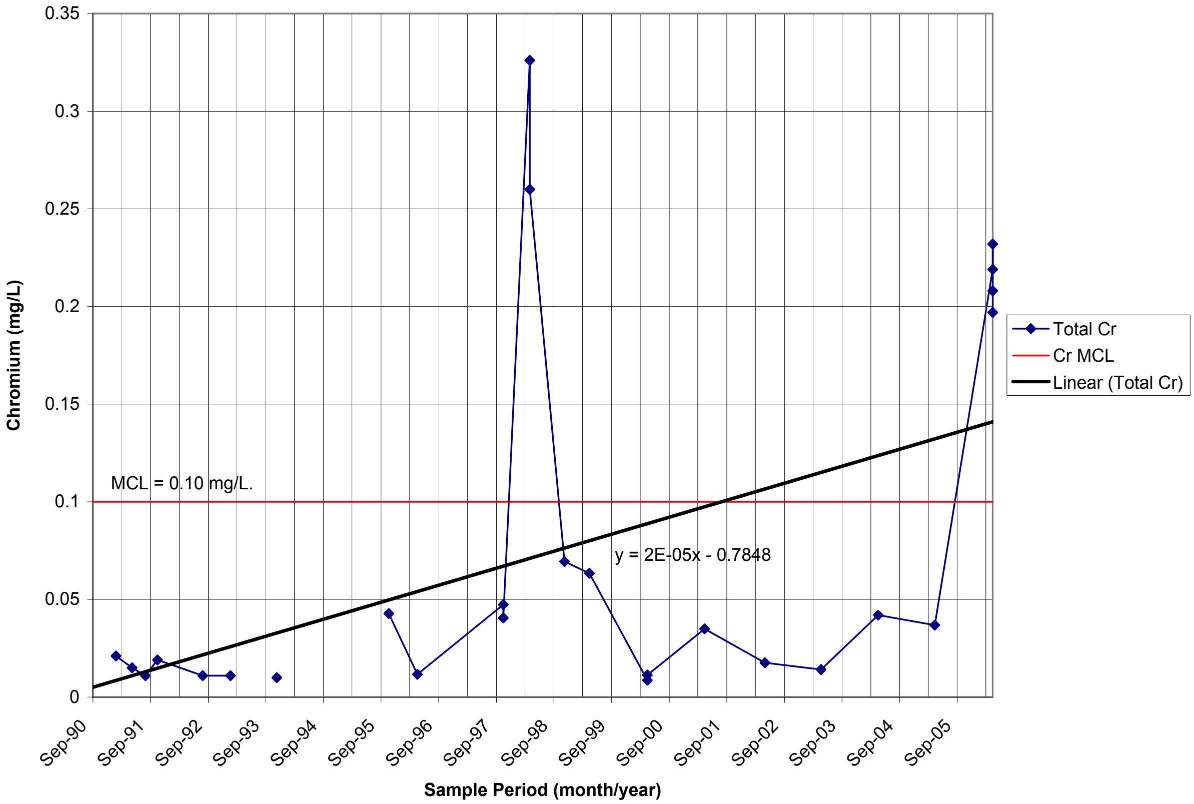

FIGURE B-9. Chromium Concentrations, MWL-MW1

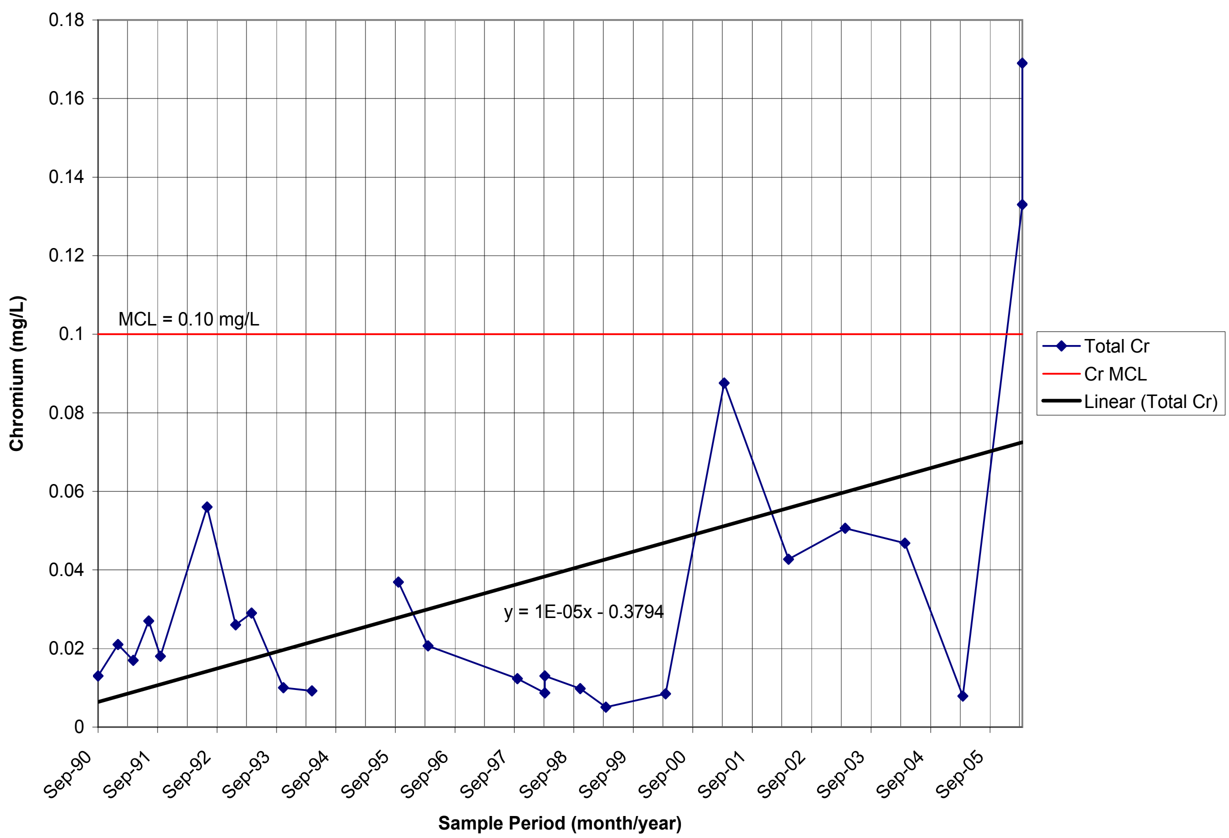

FIGURE B-10. Chromium Concentrations, MWL-MW3

Technical Area V Wells

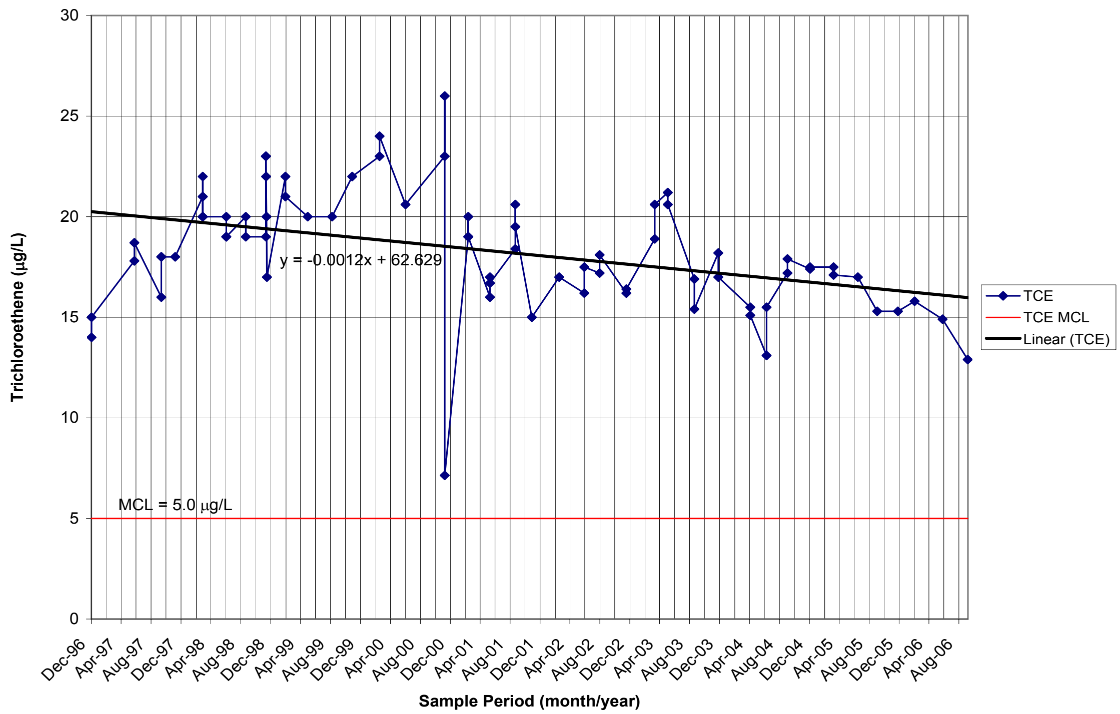

FIGURE B-11. TCE Concentrations, LWDS-MW1

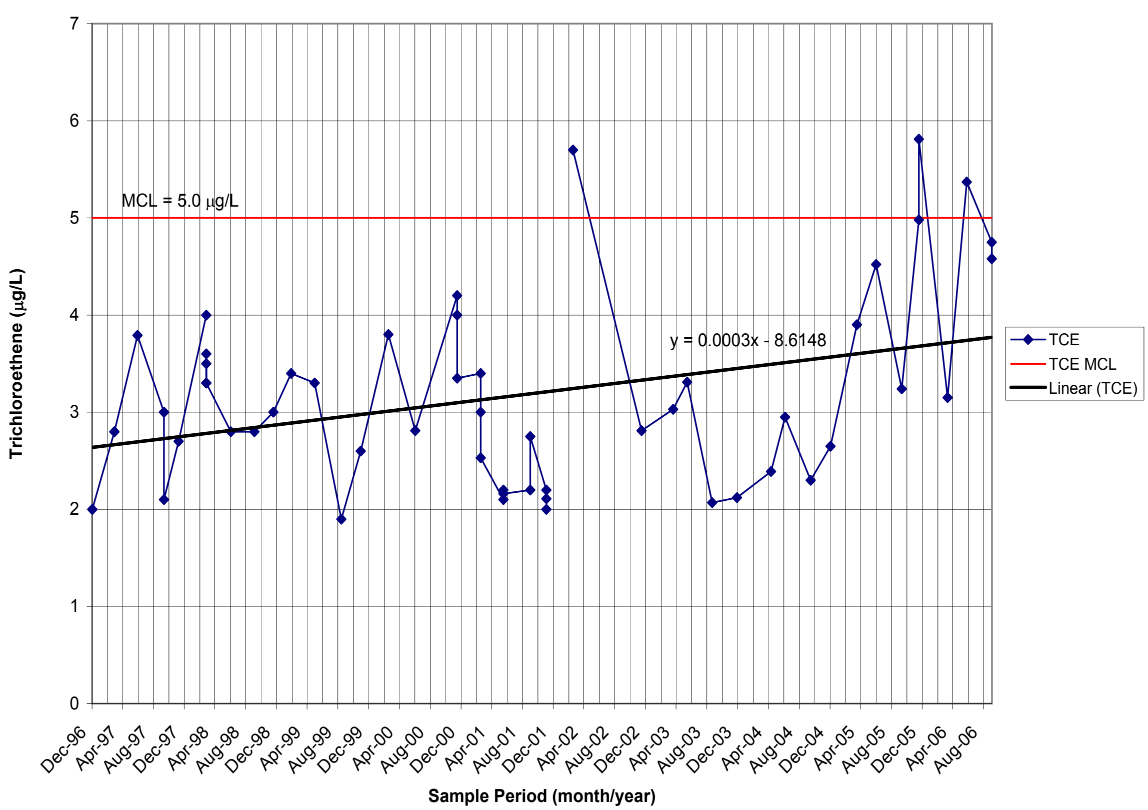

FIGURE B-12. TCE Concentrations, TAV-MW1

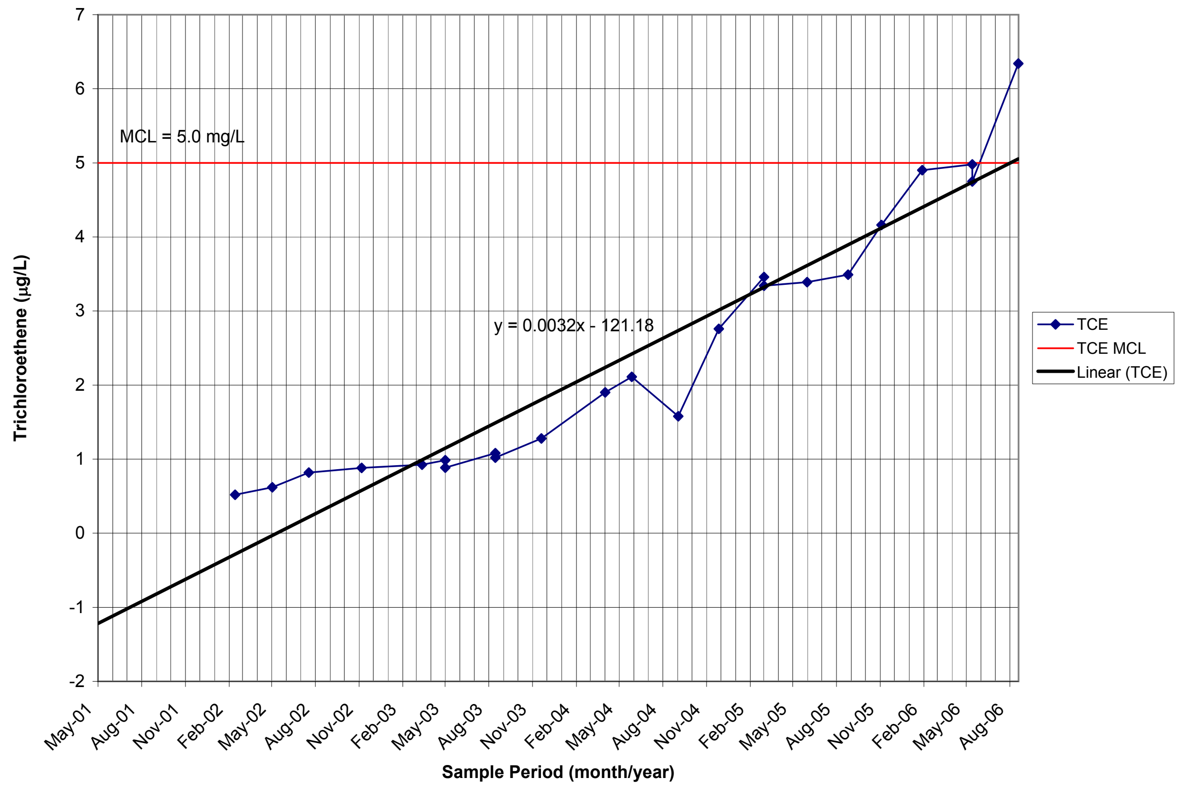

FIGURE B-13. TCE Concentrations, TAV-MW6

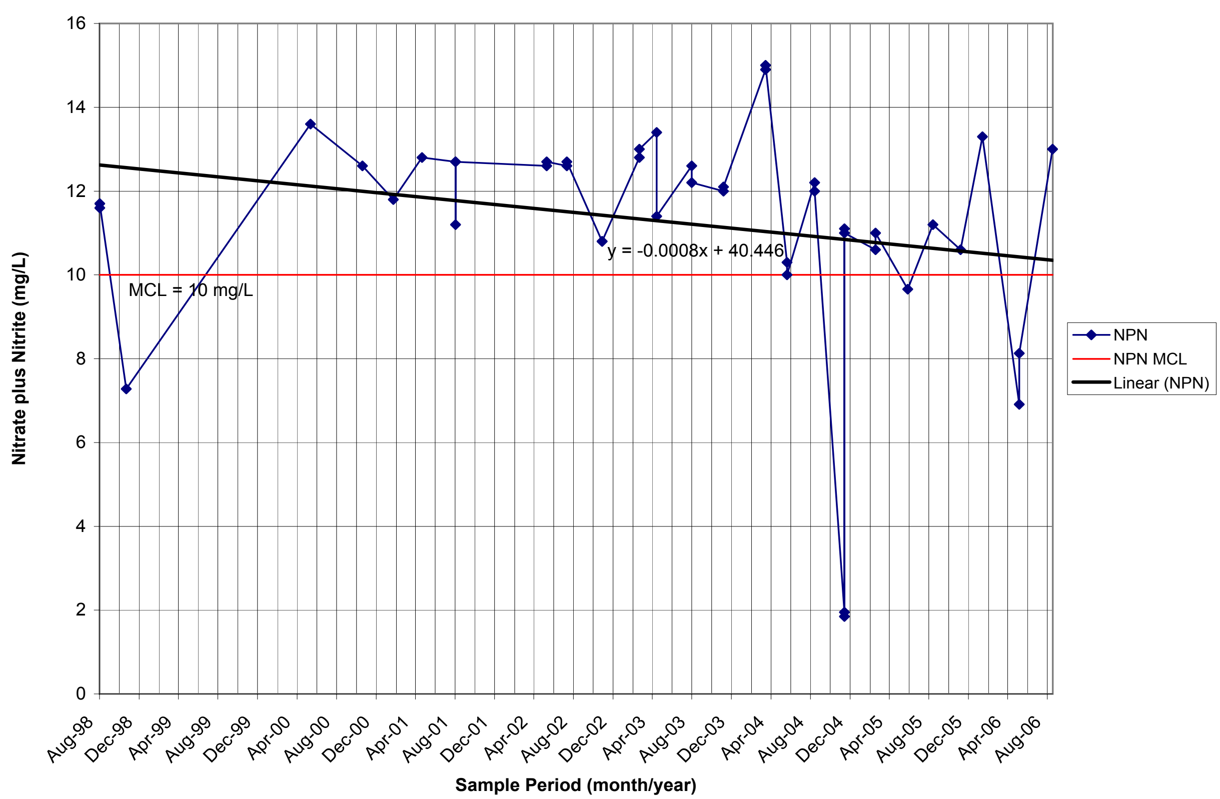

FIGURE B-14. Nitrate plus Nitrite Concentrations, LWDS-MW1

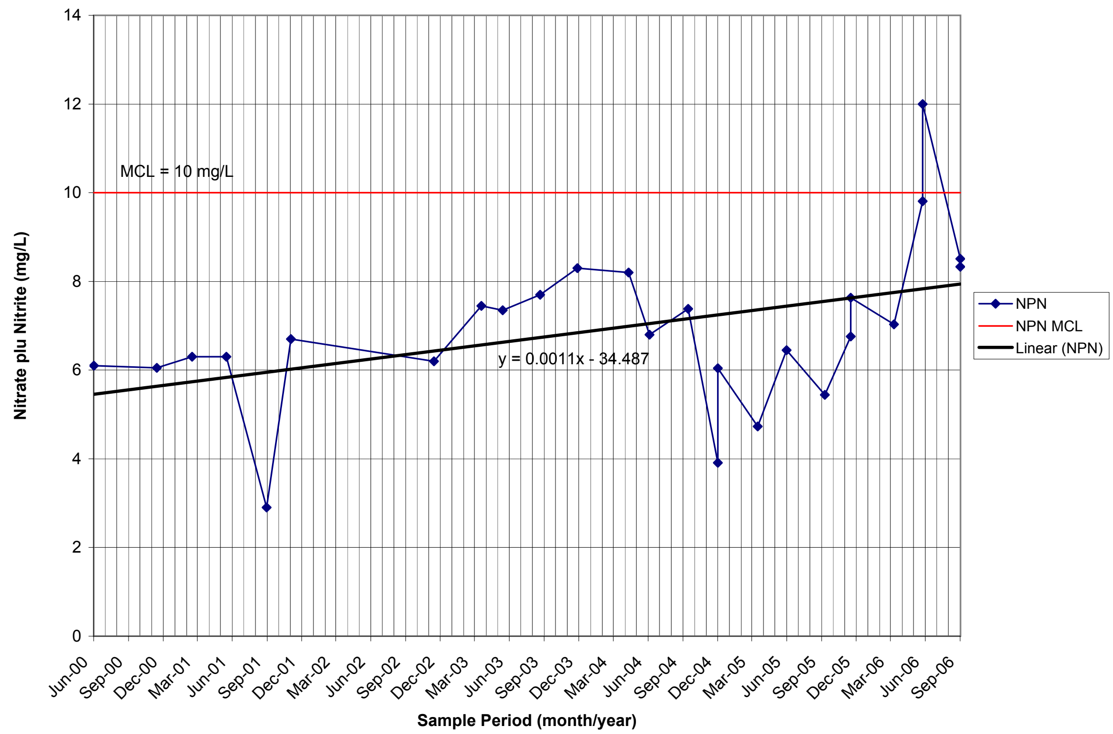

FIGURE B-15. Nitrate plus Nitrite Concentrations, TAV-MW1

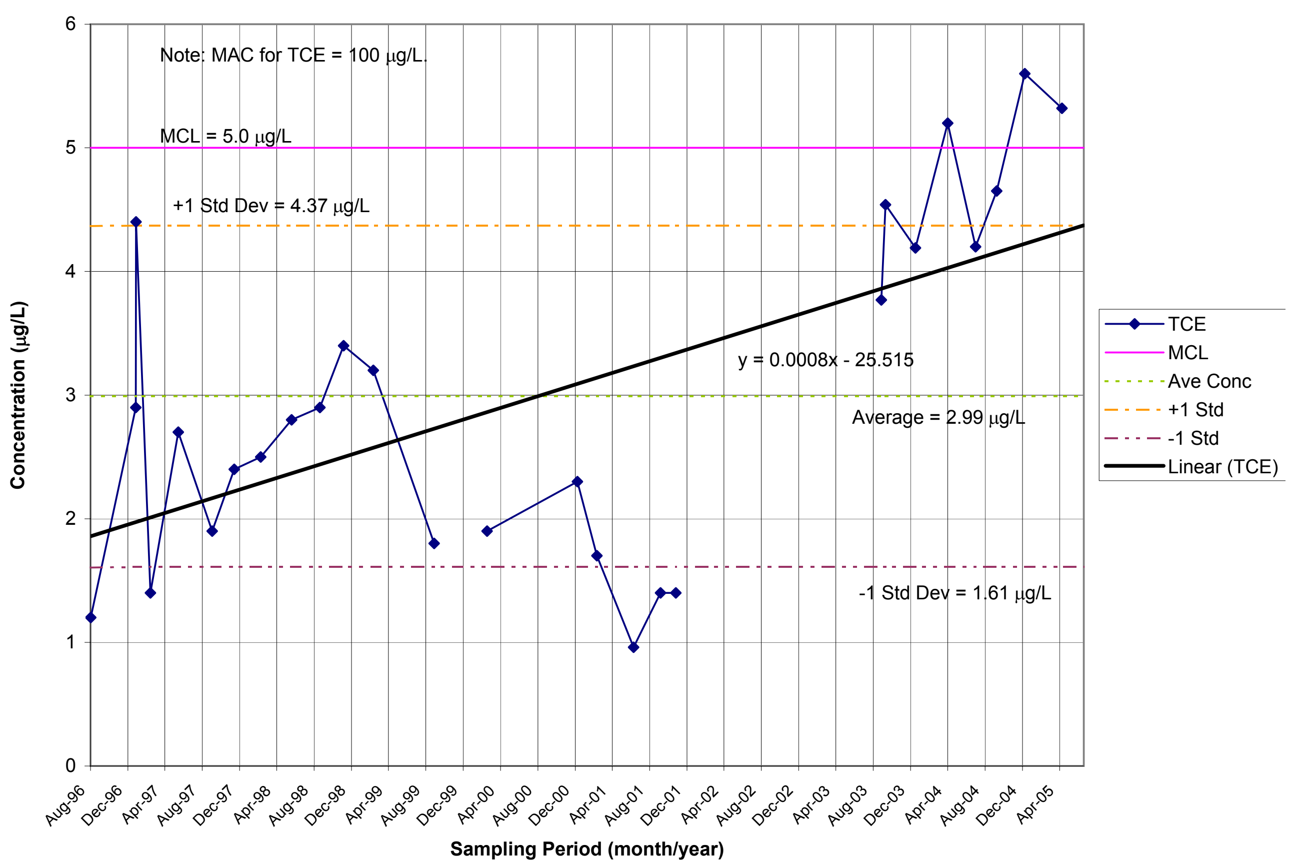

FIGURE B-16. Gross Alpha Activities, LWDS-MW2

Tijeras Arroyo Groundwater Wells

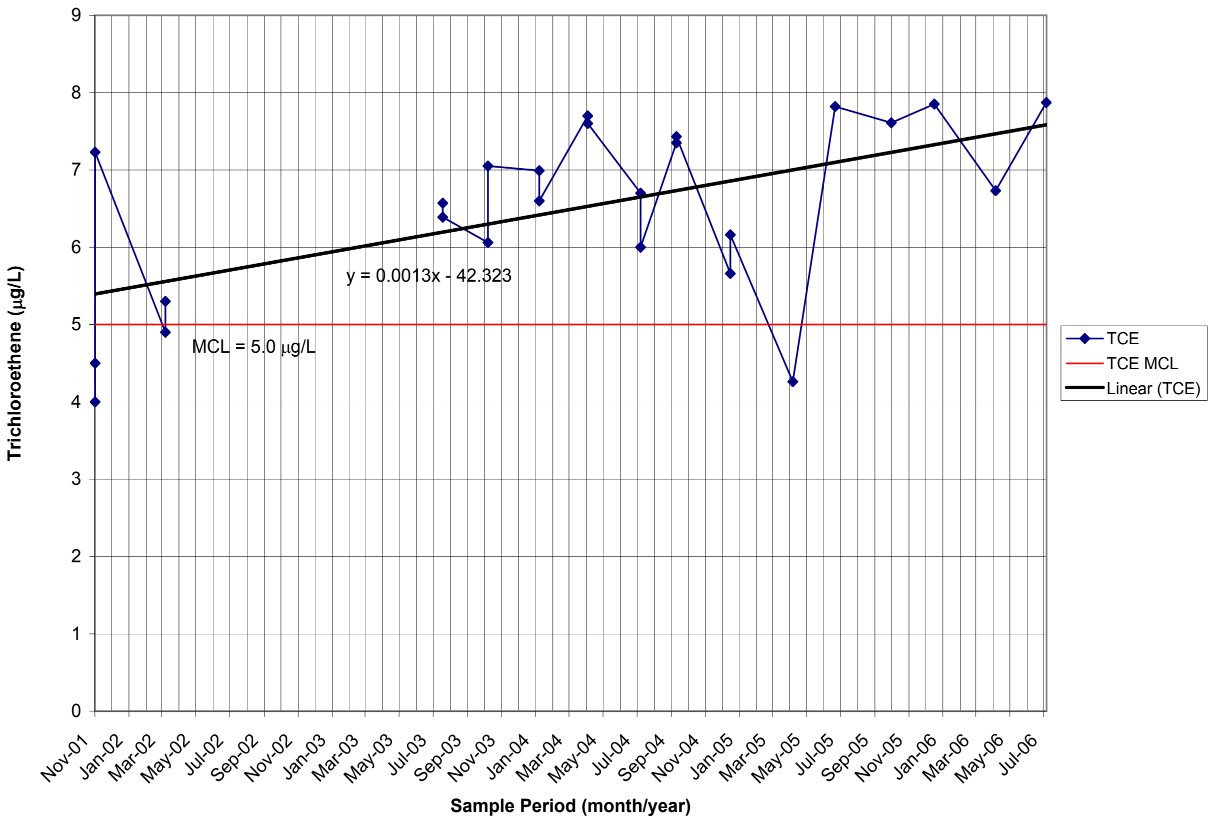

FIGURE B-17. TCE Concentrations, WYO-4

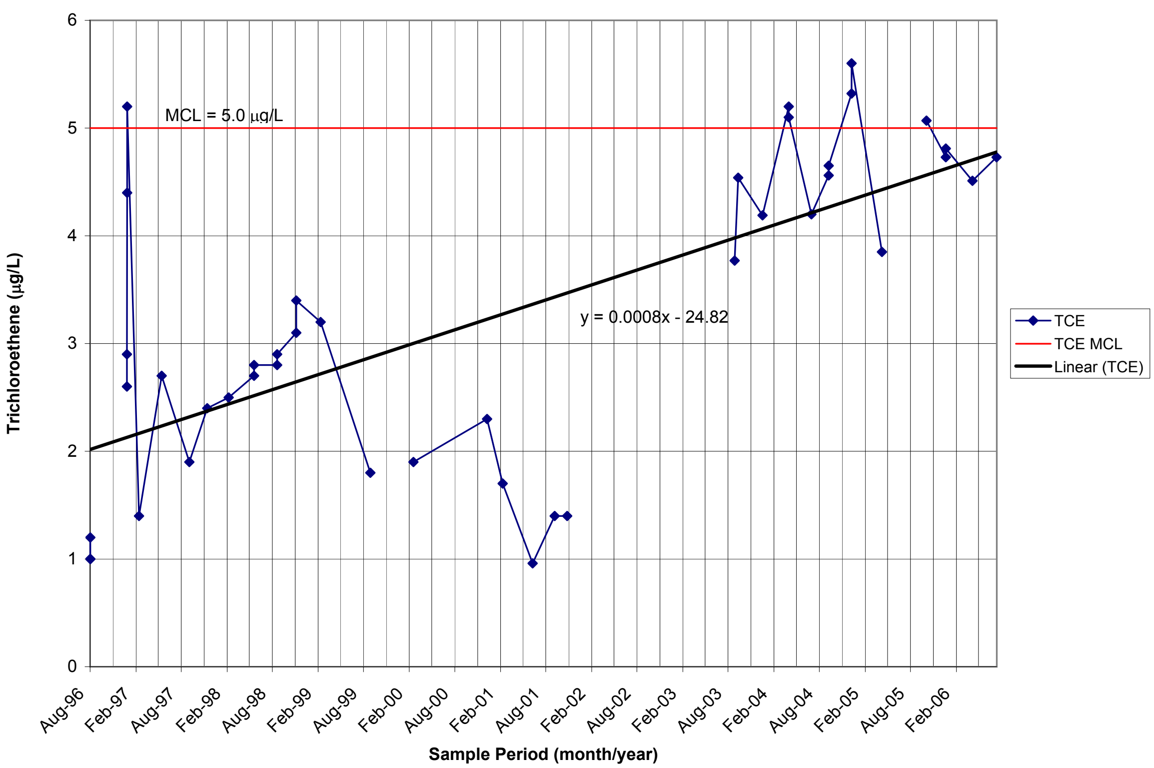

FIGURE B-18. TCE Concentrations, TA2-W-19

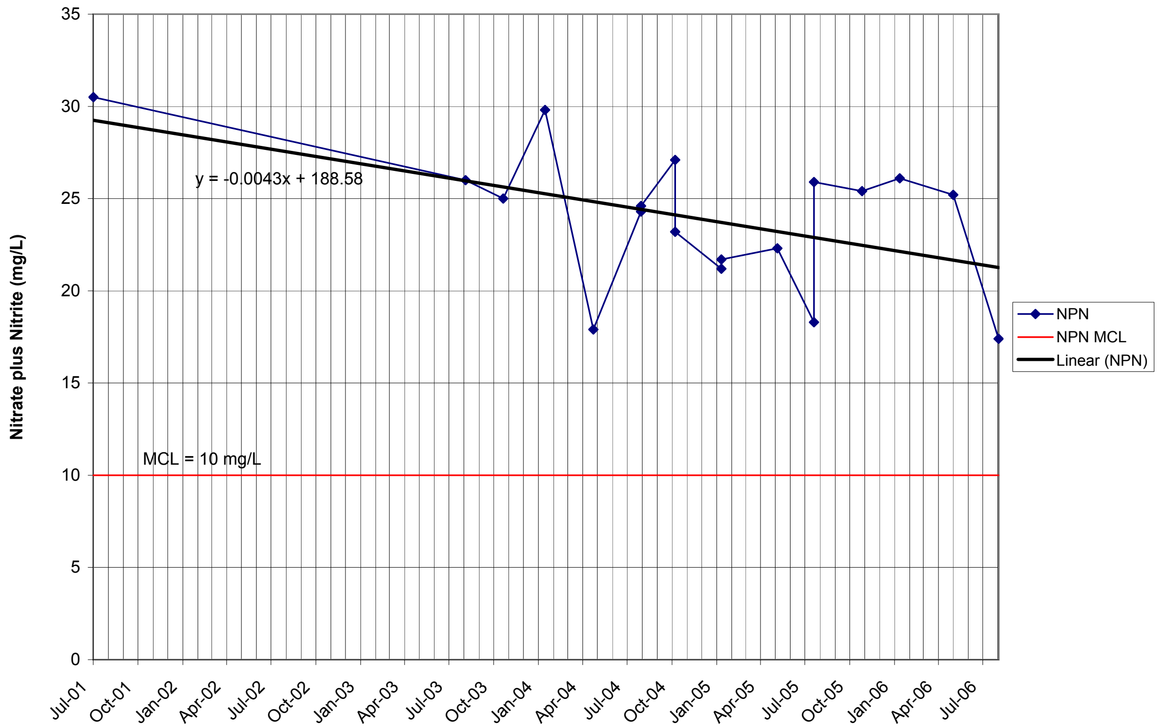

FIGURE B-19. Nitrate Plus Nitrite Concentrations, TJA-7

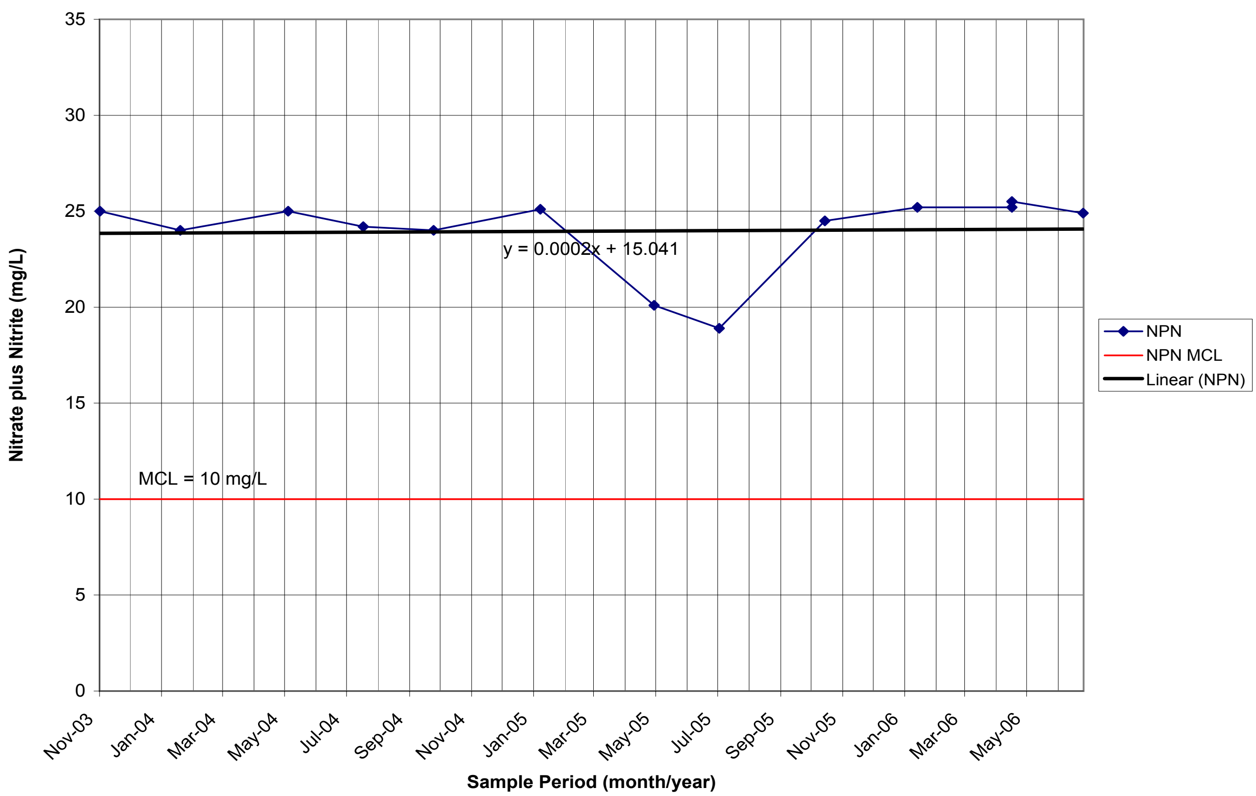

FIGURE B-20. Nitrate plus Nitrite Concentrations, TA2-SW1-320

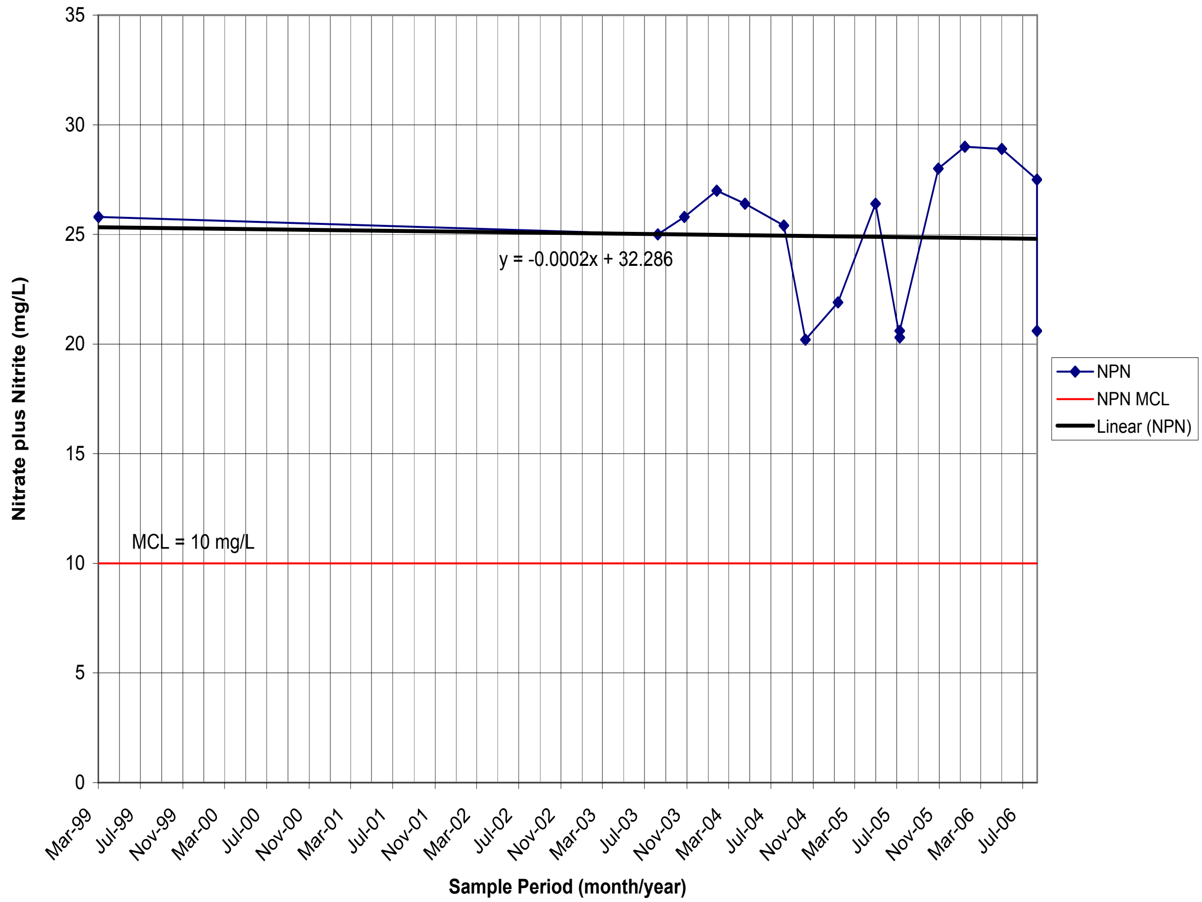

FIGURE B-21. Nitrate plus Nitrite Concentrations, TJA-4

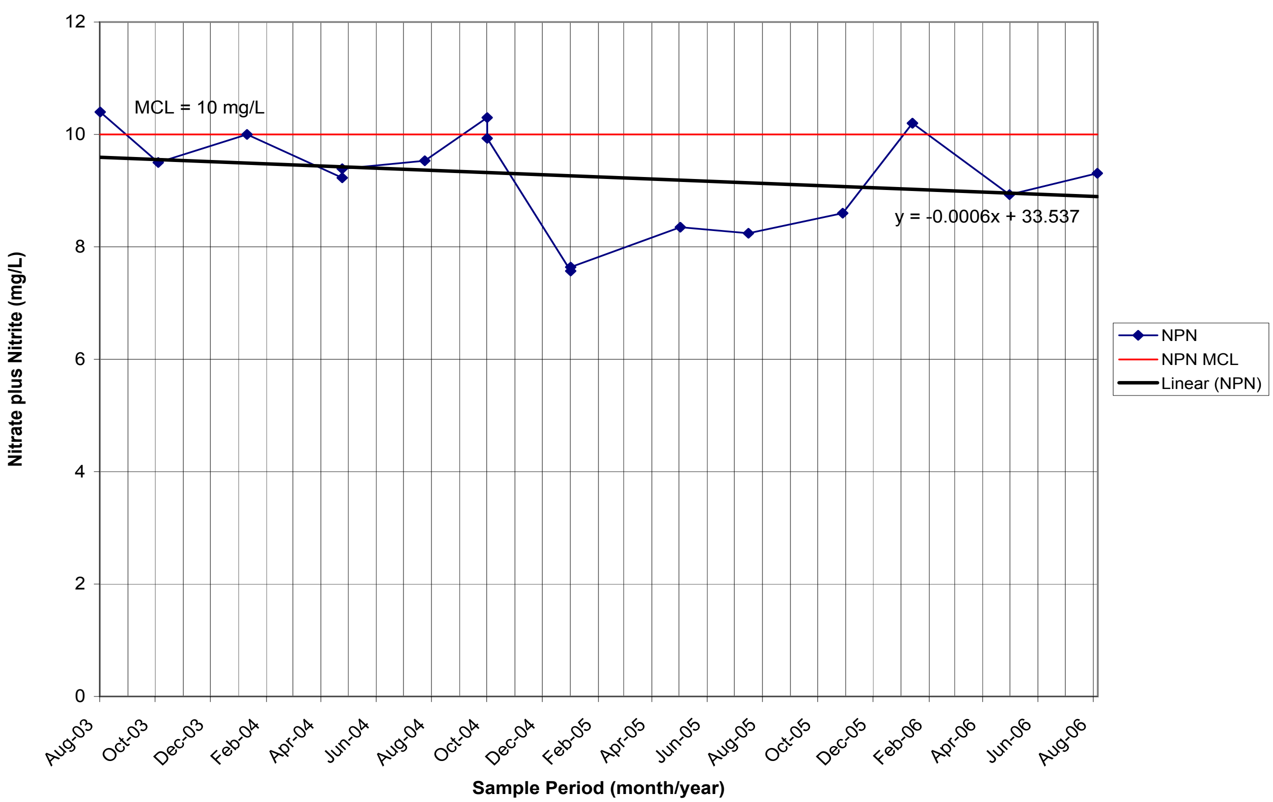

FIGURE B-22. Nitrate plus Nitrite Concentrations, TA2-W-19

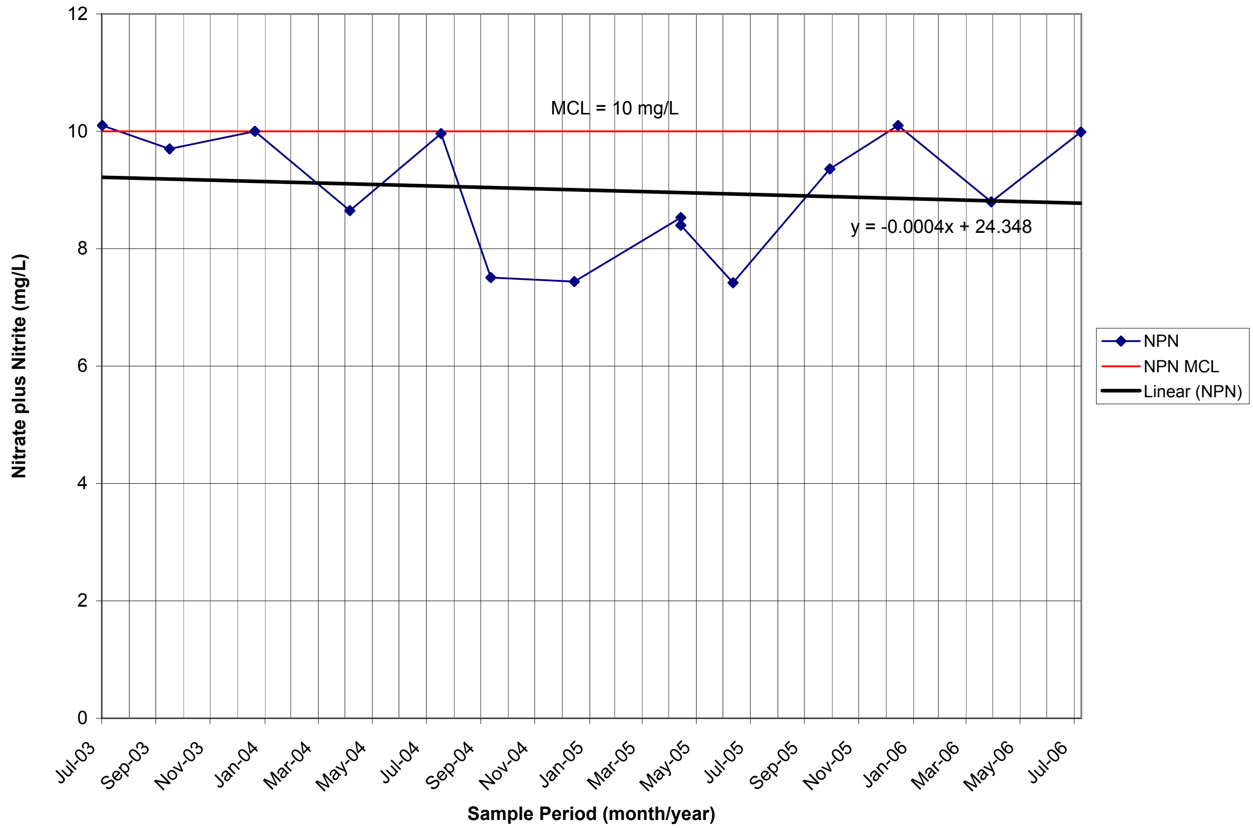

FIGURE B-23. Nitrate Plus Nitrite Concentrations, TJA-2

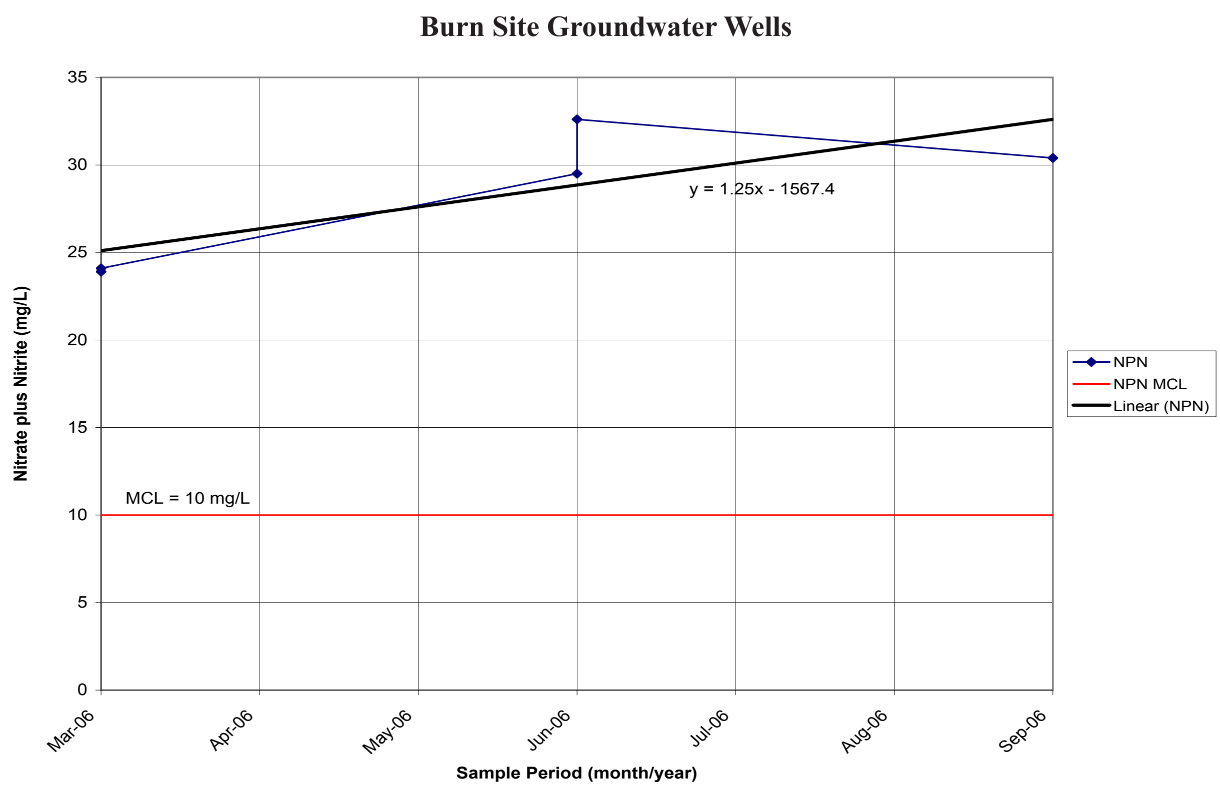

FIGURE B-24. Nitrate plus Nitrite Concentrations, CYN-MW6

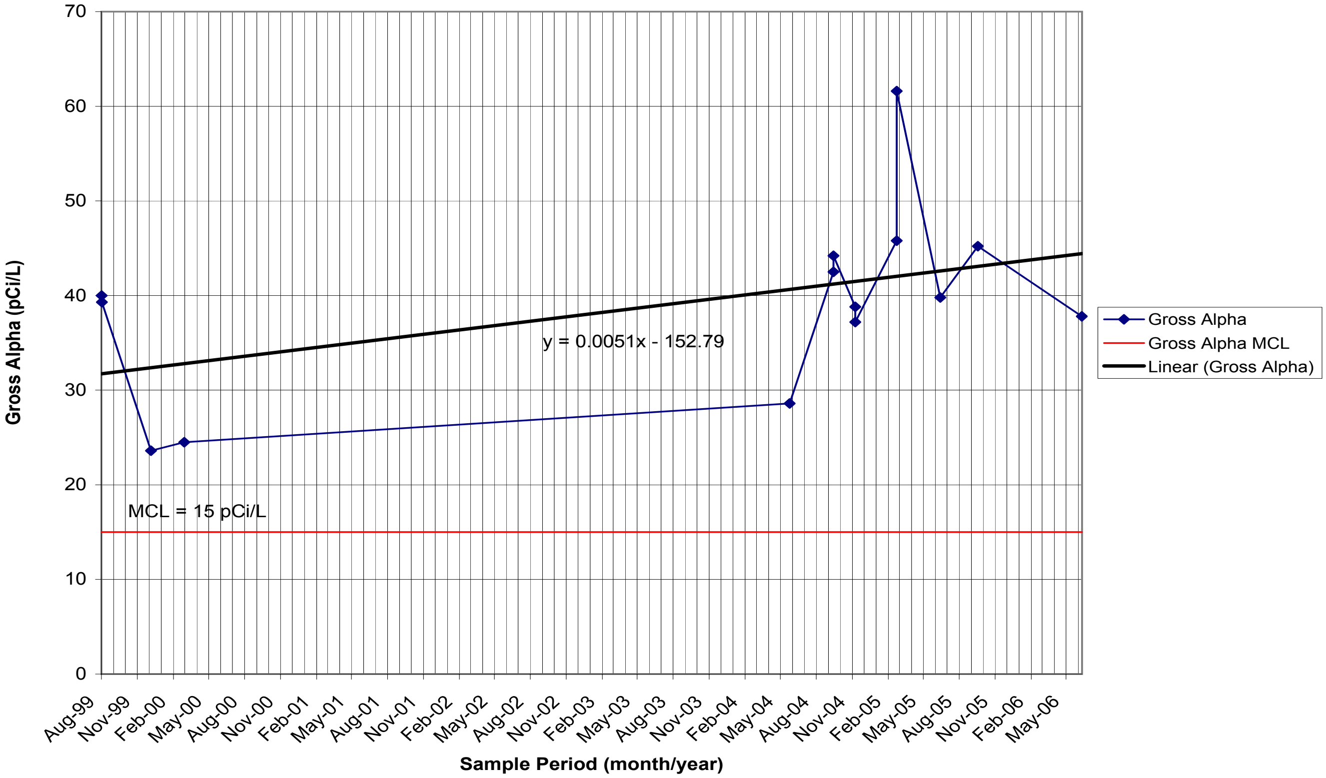

FIGURE B-25. Gross Alpha Performance, CYN-MW4

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APPENDIX C

2006 TERRESTRIAL SURVEILLANCE RESULTS

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C.1 Radiological Parameters:

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 as a result of fallout from past atmospheric nuclear weapons testing. It is also a possible contaminant associated with research and development (R&D).

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

Non-Radiological parameters:

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

Definitions:
The following terminology is utilized in the tables in this appendix:

<u>Definitions for Radiological Analysis Tables</u>
Decision Level (or Critical Level): The activity concentration above which a sample is considered to have activity above the instrument background at a prescribed level of confidence. The decision level is calculated such that there is a five percent probability of reporting a false positive result for a sample containing no activity.

Detection Limit (or Minimum Detectable Activity): The true activity concentration in a sample that, if present, can be detected (i.e., above the decision level) at a prescribed level of confidence. The detection limit is calculated such that there is a five percent probability of reporting a false negative result for a sample containing activity at the detection limit.

<u>Definitions for Metals Tables</u>
Decision Level (or Method Detection Limit): The lowest concentration at which a substance can be detected in a sample at a prescribed level of confidence.

Detection Limit (or Practical Quantification Limit): The lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions.

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TABLE C-1. Radiological Results by Location for Calendar Year 2006, Soil

Location Type	Analyte	Location	Units	Activity (±2σ) And/or Concentration		Decision Level	Detection Limit
Off-Site	Americium-241	8	pCi/g	-0.0359 ± 0.0663	U	0.0582	0.119
		9	pCi/g	-0.00937 ± 0.0543	U	0.0476	0.0967
		10	pCi/g	-0.0218 ± 0.0405	U	0.0389	0.079
		11	pCi/g	0.0638 ± 0.0885	U	0.057	0.116
		25	pCi/g	-0.018 ± 0.0314	U	0.0303	0.0617
		62	pCi/g	0.0344 ± 0.0513	U	0.0461	0.0937
	Cesium-137	8	pCi/g	0.0235 ± 0.0159		0.00859	0.0177
		9	pCi/g	0.573 ± 0.0242		0.00785	0.0161
		10	pCi/g	0.189 ± 0.0224		0.00969	0.0199
		11	pCi/g	0.0461 ± 0.015		0.00906	0.0187
		25	pCi/g	0.0143 ± 0.00887	U	0.00832	0.0172
		62	pCi/g	0.0849 ± 0.017		0.00906	0.0187
	Uranium	8	µg/g	1.03		0.00958	0.0383
		9	µg/g	0.51		0.00958	0.0383
		10	µg/g	0.545		0.00988	0.0395
		11	µg/g	0.608		0.00988	0.0395
		25	µg/g	0.541		0.00986	0.0394
		62	µg/g	1.01		0.0096	0.0384
On-Site	Americium-241	1	pCi/g	0.0212 ± 0.0161	U	0.015	0.0304
		3	pCi/g	-0.067 ± 0.0631	U	0.0521	0.106
		4	pCi/g	0.0204 ± 0.0266	U	0.0248	0.0502
		5	pCi/g	0.0346 ± 0.0373	U	0.0321	0.0649
		6	pCi/g	0.0246 ± 0.043	U	0.0384	0.0778
		7	pCi/g	-0.0407 ± 0.0635	U	0.0539	0.11
		12	pCi/g	0.0195 ± 0.0579	U	0.0466	0.0946
		16	pCi/g	0.00113 ± 0.0366	U	0.0336	0.0681
		33	pCi/g	-0.0351 ± 0.0625	U	0.044	0.0894
		34	pCi/g	-0.0414 ± 0.0455	U	0.0419	0.0851
		35	pCi/g	-0.0154 ± 0.0159	U	0.0149	0.03
		41	pCi/g	0.0385 ± 0.0452	U	0.0369	0.0737
		42	pCi/g	0.0056 ± 0.0332	U	0.0313	0.0636
		43	pCi/g	0.00369 ± 0.0508	U	0.0495	0.101
		45	pCi/g	-0.00459 ± 0.0149	U	0.0133	0.0269
		46	pCi/g	0.0177 ± 0.0176	U	0.0149	0.0301
		49	pCi/g	0.00739 ± 0.0542	U	0.0473	0.0959
		51	pCi/g	0.00991 ± 0.0363	U	0.0342	0.0694
		52	pCi/g	0.0112 ± 0.017	U	0.0152	0.0308
		53	pCi/g	-0.0302 ± 0.0457	U	0.0395	0.0805
		54	pCi/g	0.000211 ± 0.0322	U	0.0303	0.0615
		55	pCi/g	-0.031 ± 0.0639	U	0.055	0.112
		57	pCi/g	-0.016 ± 0.0854	U	0.0597	0.122

See notes at end of table.

TABLE C-1. Radiological Results by Location for Calendar Year 2006, Soil (continued)

Location Type	Analyte	Location	Units	Activity (±2σ) And/or Concentration		Decision Level	Detection Limit
On-Site (continued)	Americium-241	66	pCi/g	0.0215 ± 0.0185	U	0.0141	0.0282
		76	pCi/g	0.0188 ± 0.0194	U	0.0179	0.0363
		77	pCi/g	0.0126 ± 0.0144	U	0.0132	0.0268
		78	pCi/g	0.032 ± 0.0231	U	0.0171	0.0342
		86	pCi/g	0.0118 ± 0.0534	U	0.0419	0.0851
		2NE	pCi/g	-0.00784 ± 0.0114	U	0.0103	0.021
		2NW	pCi/g	0.0187 ± 0.053	U	0.0498	0.101
		2SE	pCi/g	-0.000904 ± 0.0175	U	0.0157	0.0317
		2SW	pCi/g	0.0684 ± 0.0449	U	0.0392	0.0796
	Cesium-137	1	pCi/g	0.232 ± 0.0344		0.0113	0.0234
		3	pCi/g	0.251 ± 0.0264		0.00785	0.0161
		4	pCi/g	0.292 ± 0.0177		0.0057	0.0117
		5	pCi/g	0.177 ± 0.017		0.00732	0.015
		6	pCi/g	0.241 ± 0.0172		0.00613	0.0125
		7	pCi/g	0.296 ± 0.0283		0.00743	0.0153
		12	pCi/g	1.53 ± 0.0457		0.0117	0.0241
		16	pCi/g	0.157 ± 0.0169		0.00748	0.0153
		33	pCi/g	0.0567 ± 0.0161		0.00859	0.0178
		34	pCi/g	0.116 ± 0.0225		0.00983	0.0202
		35	pCi/g	0.433 ± 0.0315		0.0105	0.0215
		41	pCi/g	0.118 ± 0.021		0.00971	0.0194
		42	pCi/g	0.0668 ± 0.0149		0.00767	0.0158
		43	pCi/g	0.0498 ± 0.0164		0.00699	0.0144
		45	pCi/g	0.0495 ± 0.0164		0.0101	0.0206
		46	pCi/g	0.157 ± 0.033		0.00997	0.0205
		49	pCi/g	0.532 ± 0.0237		0.00784	0.0161
		51	pCi/g	0.0638 ± 0.015		0.00713	0.0147
		52	pCi/g	0.0201 ± 0.0271	U	0.0116	0.024
		53	pCi/g	0.0367 ± 0.0157		0.00997	0.0206
		54	pCi/g	0.124 ± 0.0175		0.0075	0.0154
		55	pCi/g	0.516 ± 0.0388		0.00797	0.0164
		57	pCi/g	0.132 ± 0.0256		0.00832	0.0172
		66	pCi/g	0.0771 ± 0.0214		0.0108	0.0215
		76	pCi/g	0.143 ± 0.0198		0.00735	0.0151
		77	pCi/g	0.419 ± 0.0521		0.00959	0.0197
		78	pCi/g	0.692 ± 0.0743		0.0124	0.0247
		86	pCi/g	0.0392 ± 0.0145		0.00848	0.0175
		2NE	pCi/g	0.0823 ± 0.0161		0.00915	0.0188
		2NW	pCi/g	0.0986 ± 0.0218		0.00815	0.0169
		2SE	pCi/g	0.188 ± 0.0278		0.0122	0.0251
		2SW	pCi/g	0.0554 ± 0.0153		0.00873	0.018

See notes at end of table.

TABLE C-1. Radiological Results by Location for Calendar Year 2006, Soil (continued)

Location Type	Analyte	Location	Units	Activity (±2σ) And/or Concentration		Decision Level	Detection Limit
On-Site (continued)	Tritium	45	pCi/g	-61.8 ± 135	U	117	248
		2NE	pCi/L	1580 ± 202		115	240
		2NW	pCi/L	504 ± 161		116	242
		2SE	pCi/L	168 ± 146	U	116	242
		2SW	pCi/L	876 ± 176		116	240
	Uranium	1	µg/g	0.781		0.00975	0.039
		3	µg/g	0.411		0.00978	0.0391
		4	µg/g	0.366		0.00977	0.0391
		5	µg/g	0.273		0.00971	0.0388
		6	µg/g	0.383		0.00967	0.0387
		7	µg/g	0.438		0.00954	0.0382
		12	µg/g	0.778		0.00986	0.0394
		16	µg/g	1.41		0.00984	0.0394
		33	µg/g	1.43		0.00973	0.0389
		34	µg/g	0.599		0.0096	0.0384
		35	µg/g	0.468		0.0096	0.0384
		41	µg/g	0.479		0.00971	0.0388
		42	µg/g	0.467		0.0099	0.0396
		43	µg/g	0.32		0.00973	0.0389
		45	µg/g	0.324		0.00952	0.0381
		46	µg/g	0.689		0.00982	0.0393
		49	µg/g	0.617		0.00994	0.0398
		51	µg/g	0.468		0.00984	0.0394
		52	µg/g	0.408		0.00988	0.0395
		53	µg/g	0.34		0.0099	0.0396
		54	µg/g	0.316		0.00971	0.0388
		55	µg/g	0.588		0.00982	0.0393
		57	µg/g	1.14		0.0098	0.0392
		66	µg/g	0.421		0.00998	0.0399
		76	µg/g	0.432		0.00952	0.0381
		77	µg/g	0.479		0.00975	0.039
		78	µg/g	0.395		0.00971	0.0388
		86	µg/g	0.773		0.00977	0.0391
		2NE	µg/g	0.379		0.00977	0.0391
		2NW	µg/g	0.288		0.0098	0.0392
		2SE	µg/g	0.391		0.00977	0.0391
		2SW	µg/g	0.865		0.00996	0.0398

See notes at end of table.

TABLE C-1. Radiological Results by Location for Calendar Year 2006, Soil (concluded)

Location Type	Analyte	Location	Units	Activity (±2σ) And/or Concentration		Decision Level	Detection Limit
Perimeter	Americium-241	19	pCi/g	0.0237 ± 0.0174	U	0.0162	0.0328
		58	pCi/g	0.0174 ± 0.0146	U	0.0134	0.0271
		60	pCi/g	0.0292 ± 0.0327	U	0.0203	0.0413
		61	pCi/g	0.0011 ± 0.018	U	0.0158	0.0321
		63	pCi/g	0.0547 ± 0.0468	U	0.0391	0.0793
		64	pCi/g	0.0943 ± 0.054	U	0.0431	0.0943
		80	pCi/g	-0.0214 ± 0.0389	U	0.0353	0.0715
		81	pCi/g	0.00116 ± 0.0432	U	0.0382	0.0774
		82	pCi/g	0.0262 ± 0.0422	U	0.0349	0.0708
	Cesium-137	19	pCi/g	0.55 ± 0.0645		0.0108	0.0223
		58	pCi/g	0.0918 ± 0.0197		0.0103	0.0211
		60	pCi/g	0.068 ± 0.0286		0.0162	0.0338
		61	pCi/g	0.0419 ± 0.0214		0.012	0.0247
		63	pCi/g	0.151 ± 0.0211		0.0102	0.0209
		64	pCi/g	0.76 ± 0.055		0.00996	0.0199
		80	pCi/g	0.339 ± 0.0212		0.00836	0.0172
		81	pCi/g	0.556 ± 0.0206		0.00629	0.0129
		82	pCi/g	0.0172 ± 0.0119		0.00806	0.0166
	Uranium	19	µg/g	0.504		0.00978	0.0391
		58	µg/g	0.806		0.00971	0.0388
		60	µg/g	0.478		0.00978	0.0391
		61	µg/g	0.629		0.00994	0.0398
		63	µg/g	0.795		0.00994	0.0398
		64	µg/g	1.27		0.00956	0.0382
		80	µg/g	0.769		0.00975	0.039
		81	µg/g	0.401		0.00952	0.0381
		82	µg/g	0.954		0.00963	0.0385

NOTES: pCi/g = picocurie per gram
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. Some tritium results reported in pCi/g due to inadequate soil moisture to run standard analytical method (results are included for qualitative, not quantitative purposes).

TABLE C-2. Radiological Results by Location for Calendar Year 2006, Sediment

Location Type	Analyte	Location	Units	Activity (±2σ) And/or Concentration		Decision Level	Detection Limit
Off-Site	Americium-241	8	pCi/g	0.0209 ± 0.0178	U	0.0146	0.0292
		11	pCi/g	0.0215 ± 0.067	U	0.0511	0.102
		68	pCi/g	-0.0585 ± 0.0636	U	0.0549	0.112
	Cesium-137	8	pCi/g	0.0264 ± 0.017		0.0116	0.0232
		11	pCi/g	0.219 ± 0.0299		0.014	0.0281
		68	pCi/g	0.0451 ± 0.0182		0.00826	0.017
	Uranium	8	µg/g	0.268		0.00973	0.0389
		11	µg/g	0.707		0.00986	0.0394
		68	µg/g	1.32		0.00956	0.0382
On-Site	Americium-241	56	pCi/g	0.0259 ± 0.0165	U	0.0134	0.0267
		72	pCi/g	0.0238 ± 0.0324	U	0.0317	0.0641
		75	pCi/g	-0.034 ± 0.0658	U	0.0561	0.114
		79	pCi/g	0.0719 ± 0.0359	U	0.0286	0.0719
		83	pCi/g	-0.0352 ± 0.0543	U	0.0427	0.0869
		84	pCi/g	0.0227 ± 0.0552	U	0.0479	0.0973
		85	pCi/g	0.00153 ± 0.0381	U	0.0314	0.0628
		74N	pCi/g	-0.0285 ± 0.0569	U	0.0488	0.0993
	Cesium-137	56	pCi/g	-0.00904 ± 0.0125	U	0.00989	0.0198
		72	pCi/g	0.0391 ± 0.0123		0.00695	0.0143
		75	pCi/g	0.0652 ± 0.0194		0.00814	0.0167
		79	pCi/g	0.156 ± 0.0214		0.00942	0.0188
		83	pCi/g	0.136 ± 0.0233		0.0105	0.0217
		84	pCi/g	0.161 ± 0.0211		0.00908	0.0188
		85	pCi/g	0.0213 ± 0.0117		0.00811	0.0162
		74N	pCi/g	0.0299 ± 0.0177		0.00992	0.0205
	Uranium	56	µg/g	0.629		0.00984	0.0394
		72	µg/g	0.659		0.00952	0.0381
		75	µg/g	0.741		0.0096	0.0384
		79	µg/g	1.32		0.00994	0.0398
		83	µg/g	0.651		0.00984	0.0394
		84	µg/g	0.952		0.00965	0.0386
		85	µg/g	0.887		0.00982	0.0393
		74N	µg/g	1.32		0.00952	0.0381

See notes at end of table.

TABLE C-2. Radiological Results by Location for Calendar Year 2006, Sediment (concluded)

Location Type	Analyte	Location	Units	Activity (±2σ) And/or Concentration		Decision Level	Detection Limit
Perimeter	Americium-241	60	pCi/g	-0.00557 ± 0.0864	U	0.0769	0.157
		73	pCi/g	-0.000112 ± 0.0178	U	0.0165	0.0333
	Cesium-137	60	pCi/g	0.0293 ± 0.0151	U	0.0134	0.0293
		73	pCi/g	0.0467 ± 0.0207		0.0116	0.0239
	Uranium	60	µg/g	0.727		0.00988	0.0395
		73	µg/g	1.22		0.00954	0.0382

NOTES: pCi/g = picocurie per gram
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 C-3. Radiological Replicate Results by Location for Calendar Year 2006, Soil

Location Type	Analyte	Location	Sample ID	Units	Activity (±2σ) And/or Concentration		Decision Level	Detection Limit	Average	Std Dev	CV
On-Site	Americium-241	2NE	077700-001	pCi/g	-0.00784 ± 0.0114	U	0.0103	0.021	0.005	0.011	225.38%
		2NE	077700-002	pCi/g	0.00922 ± 0.0183	U	0.0159	0.0322			
		2NE	077700-003	pCi/g	0.0138 ± 0.0497	U	0.0438	0.0891			
		33	077732-001	pCi/g	-0.0351 ± 0.0625	U	0.044	0.0894	0.025	0.055	219.20%
		33	077732-002	pCi/g	0.0718 ± 0.041	U	0.0525	0.107			
		33	077732-003	pCi/g	0.0381 ± 0.0392	U	0.0339	0.0686			
		53	077695-001	pCi/g	-0.0302 ± 0.0457	U	0.0395	0.0805	0.014	0.039	277.10%
		53	077695-002	pCi/g	0.0451 ± 0.0474	U	0.0373	0.0758			
		53	077695-003	pCi/g	0.0278 ± 0.0368	U	0.0357	0.0727			
	Cesium-137	2NE	077700-001	pCi/g	0.0823 ± 0.0161		0.00915	0.0188	0.099	0.03	30.27%
		2NE	077700-002	pCi/g	0.0804 ± 0.0214		0.0126	0.026			
		2NE	077700-003	pCi/g	0.133 ± 0.0139		0.00688	0.0142			
		33	077732-001	pCi/g	0.0567 ± 0.0161		0.00859	0.0178	0.041	0.014	35.35%
		33	077732-002	pCi/g	0.0355 ± 0.0138		0.00844	0.0175			
		33	077732-003	pCi/g	0.0294 ± 0.0164		0.00777	0.016			
		53	077695-001	pCi/g	0.0367 ± 0.0157		0.00997	0.0206	0.043	0.006	13.26%
		53	077695-002	pCi/g	0.044 ± 0.0172		0.00915	0.0189			
		53	077695-003	pCi/g	0.0479 ± 0.0177		0.00832	0.0172			
	Tritium	2NE	077700-001	pCi/L	1580 ± 202		115	240	1653.333	144.684	8.75%
		2NE	077700-002	pCi/L	1820 ± 209		114	238			
		2NE	077700-003	pCi/L	1560 ± 199		114	237			
	Uranium	2NE	077700-001	µg/g	0.379		0.00977	0.0391	0.354	0.044	12.41%
		2NE	077700-002	µg/g	0.303		0.00984	0.0394			
		2NE	077700-003	µg/g	0.379		0.00984	0.0394			
		33	077732-001	µg/g	1.43		0.00973	0.0389	1.37	0.06	4.38%
		33	077732-002	µg/g	1.31		0.00954	0.0382			
		33	077732-003	µg/g	1.37		0.00998	0.0399			

See notes at end of table.

TABLE C-3. Radiological Replicate Results by Location for Calendar Year 2006, Soil (concluded)

Location Type	Analyte	Location	Sample ID	Units	Activity (±2σ) And/or Concentration		Decision Level	Detection Limit	Average	Std Dev	CV
On-Site (concluded)	Uranium	53	077695-001	µg/g	0.34		0.0099	0.0396	0.352	0.019	5.34%
		53	077695-002	µg/g	0.343		0.00996	0.0398			
		53	077695-003	µg/g	0.374		0.00984	0.0394			
Perimeter	Americium-241	64	077743-001	pCi/g	0.0943 ± 0.054	U	0.0431	0.0943	0.034	0.054	157.11%
		64	077743-002	pCi/g	-0.00949 ± 0.0599	U	0.056	0.113			
		64	077743-003	pCi/g	0.0179 ± 0.0237	U	0.0219	0.0445			
	Cesium-137	64	077743-001	pCi/g	0.76 ± 0.055		0.00996	0.0199	0.677	0.091	13.50%
		64	077743-002	pCi/g	0.692 ± 0.0583		0.0088	0.018			
		64	077743-003	pCi/g	0.579 ± 0.0786		0.015	0.031			
	Uranium	64	077743-001	µg/g	1.27		0.00956	0.0382	1.105	0.174	15.71%
		64	077743-002	µg/g	0.924		0.00984	0.0394			
		64	077743-003	µg/g	1.12		0.00962	0.0385			

NOTES: pCi/g = picocurie per gram
pCi/L = picocurie per liter
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.
CV = coefficient of variation
Std Dev = standard deviation

TABLE C-4. Radiological Results by Location for Calendar Year 2006, Vegetation

Location Type	Analyte	Location	Units	Activity (±2σ) And/or Concentration		Decision Level	Detection Limit
Off-Site	Americium-241	8	pCi/g	0.0771 ± 0.195	U	0.124	0.247
		11	pCi/g	-0.045 ± 0.15	U	0.103	0.212
		33	pCi/g	-0.00296 ± 0.251	U	0.155	0.317
	Cesium-137	8	pCi/g	-0.00297 ± 0.06	U	0.0464	0.0927
		11	pCi/g	0.0727 ± 0.0282	U	0.0244	0.0727
		33	pCi/g	0.0243 ± 0.0429	U	0.0339	0.07
	Uranium	8	µg/g	0.0396		0.00965	0.0386
		11	µg/g	0.0112	J	0.01	0.04
		33	µg/g	0.00998	U	0.00998	0.0399

NOTES: pCi/g = picocurie per gram
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.
J = Estimated value, the analyte concentration fell above the effective MDL and below the effective PQL.

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TABLE C-5. Radiological Replicate Results by Location for Calendar Year 2006, Vegetation

Location Type	Analyte	Location	Sample ID	Units	Activity (±2σ) And/or Concentration		Decision Level	Detection Limit	Average	Std Dev	CV
On-Site	Americium-241	33	077733-001	pCi/g	-0.00296 ± 0.251	U	0.155	0.317	0.058	0.073	126.20%
			077733-002	pCi/g	0.0375 ± 0.0602	U	0.0436	0.0892			
			077733-003	pCi/g	0.138 ± 0.18	U	0.113	0.226			
	Cesium-137	33	077733-001	pCi/g	0.0243 ± 0.0429	U	0.0339	0.07	-0.014	0.041	-298.73%
			077733-002	pCi/g	-0.0579 ± 0.0693	U	0.0434	0.0906			
			077733-003	pCi/g	-0.00799 ± 0.0638	U	0.0471	0.0941			
	Uranium	33	077733-001	µg/g	0.00998	U	0.00998	0.0399	0.015	0.005	32.19%
			077733-002	µg/g	0.0112	J	0.00984	0.0394			
			077733-003	µg/g	0.0178	J	0.0099	0.0396			

NOTES: pCi/g = picocurie per gram
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.
J = Estimated value, the analyte concentration fell above the effective MDL and below the effective PQL.
CV = coefficient of variation
Std Dev = standard deviation

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TABLE C-6. Radiological Replicate Results by Location for Calendar Year 2006, Sediment

Location Type	Analyte	Location	Sample ID	Units	Activity (±2σ) And/or Concentration		Decision Level	Detection Limit	Average	Std Dev	CV
On-Site	Americium-241	74N	077747-001	pCi/g	-0.0285 ± 0.0569	U	0.0488	0.0993	-0.045	0.015	-34.75%
			077747-002	pCi/g	-0.0594 ± 0.0404	U	0.0378	0.0766			
			077747-003	pCi/g	-0.0458 ± 0.0668	U	0.0572	0.116			
	Cesium-137	74N	077747-001	pCi/g	0.0299 ± 0.0177		0.00992	0.0205	0.030	0.000	0.71%
			077747-002	pCi/g	0.0164 ± 0.0132	U	0.00861	0.0177			
			077747-003	pCi/g	0.0302 ± 0.0147		0.00918	0.019			
	Uranium	74N	077747-001	µg/g	1.32		0.00952	0.0381	1.150	0.166	14.41%
			077747-002	µg/g	0.989		0.00978	0.0391			
			077747-003	µg/g	1.14		0.00996	0.0398			

NOTES: pCi/g = picocurie per gram
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.
CV = coefficient of variation
Std Dev = standard deviation

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TABLE C-7. Special Sampling for radiological Results by Location for Calendar Year 2006, Soil

Location Type	Analyte	Location	Units	Activity (±2σ) And/or Concentration		Decision Level	Detection Limit
On-Site	Americium-241	MWL-CL-ANT1	pCi/g	0.0185 ± 0.103	U	0.0919	0.186
		MWL-CL-ANT2	pCi/g	0.0187 ± 0.0522	U	0.0407	0.0825
		MWL-CL-ANT3	pCi/g	-0.0191 ± 0.0264	U	0.0239	0.0483
		MWL-CL-BUR1	pCi/g	-0.0258 ± 0.0353	U	0.032	0.065
		MWL-CL-BUR2	pCi/g	-0.0575 ± 0.0556	U	0.0437	0.0885
		MWL-CL-BUR3	pCi/g	0.0541 ± 0.0583	U	0.0496	0.101
		MWL-UCL-ANT1	pCi/g	0.00981 ± 0.0322	U	0.017	0.0345
		MWL-UCL-ANT2	pCi/g	-0.0158 ± 0.0323	U	0.0289	0.0587
		MWL-UCL-ANT3	pCi/g	0.0115 ± 0.058	U	0.0488	0.0993
		MWL-UCL-BUR1	pCi/g	0.0191 ± 0.016	U	0.0147	0.0299
		MWL-UCL-BUR2	pCi/g	-0.0272 ± 0.044	U	0.0389	0.0794
		MWL-UCL-BUR3	pCi/g	-0.0275 ± 0.0487	U	0.0405	0.0824
		SNL-BKG-ANT1	pCi/g	-0.0237 ± 0.0391	U	0.0326	0.0661
		SNL-BKG-ANT2	pCi/g	0.011 ± 0.0467	U	0.0387	0.0788
		SNL-BKG-BUR1	pCi/g	0.0597 ± 0.0523	U	0.0465	0.0946
		SNL-BKG-BUR2	pCi/g	-0.00871 ± 0.0437	U	0.0398	0.0808
	Cesium-137	MWL-CL-ANT1	pCi/g	16.7 ± 1.02		0.0131	0.0268
		MWL-CL-ANT2	pCi/g	0.0996 ± 0.0131		0.00659	0.0135
		MWL-CL-ANT3	pCi/g	0.0191 ± 0.0158	X	0.00569	0.0117
		MWL-CL-BUR1	pCi/g	0.0332 ± 0.0189		0.00853	0.0175
		MWL-CL-BUR2	pCi/g	6.51 ± 0.077		0.0104	0.0213
		MWL-CL-BUR3	pCi/g	0.03 ± 0.0125		0.00881	0.0182
		MWL-UCL-ANT1	pCi/g	0.127 ± 0.0326		0.0135	0.0278
		MWL-UCL-ANT2	pCi/g	0.136 ± 0.0157		0.00666	0.0137
		MWL-UCL-ANT3	pCi/g	0.0825 ± 0.0161		0.00841	0.0173
		MWL-UCL-BUR1	pCi/g	0.124 ± 0.0268		0.0109	0.0226
		MWL-UCL-BUR2	pCi/g	0.13 ± 0.0219		0.00973	0.0202
		MWL-UCL-BUR3	pCi/g	0.11 ± 0.0175		0.00913	0.0188
		SNL-BKG-ANT1	pCi/g	0.392 ± 0.0199		0.00702	0.0145
		SNL-BKG-ANT2	pCi/g	0.247 ± 0.031		0.00881	0.0183
		SNL-BKG-BUR1	pCi/g	0.104 ± 0.0218		0.00898	0.0186
		SNL-BKG-BUR2	pCi/g	0.549 ± 0.0377		0.00963	0.0199

See notes at end of table.

TABLE C-7. Special Sampling for radiological Results by Location for Calendar Year 2006, Soil (continued)

Location Type	Analyte	Location	Units	Activity (±2σ) And/or Concentration		Decision Level	Detection Limit
On-Site (continued)	Cobalt-60	MWL-CL-ANT1	pCi/g	0.00506 ± 0.0129	U	0.011	0.0229
		MWL-CL-ANT2	pCi/g	-0.000028 ± 0.00932	U	0.00764	0.0158
		MWL-CL-ANT3	pCi/g	0.00467 ± 0.00521	U	0.00576	0.0119
		MWL-CL-BUR1	pCi/g	0.00838 ± 0.00848	U	0.00862	0.0179
		MWL-CL-BUR2	pCi/g	-0.000221 ± 0.012	U	0.01	0.021
		MWL-CL-BUR3	pCi/g	0.0115 ± 0.0111	U	0.0098	0.0205
		MWL-UCL-ANT1	pCi/g	-0.0084 ± 0.0169	U	0.0137	0.0285
		MWL-UCL-ANT2	pCi/g	-0.00377 ± 0.00872	U	0.00702	0.0146
		MWL-UCL-ANT3	pCi/g	-0.00534 ± 0.0104	U	0.00823	0.0172
		MWL-UCL-BUR1	pCi/g	-0.00181 ± 0.0127	U	0.0104	0.022
		MWL-UCL-BUR2	pCi/g	-0.00502 ± 0.0128	U	0.0106	0.0225
		MWL-UCL-BUR3	pCi/g	-0.00248 ± 0.0108	U	0.00893	0.0187
		SNL-BKG-ANT1	pCi/g	-0.00209 ± 0.00902	U	0.00747	0.0156
		SNL-BKG-ANT2	pCi/g	0.00825 ± 0.0119	U	0.0107	0.0225
		SNL-BKG-BUR1	pCi/g	-0.00137 ± 0.0121	U	0.0101	0.0212
		SNL-BKG-BUR2	pCi/g	-0.000124 ± 0.0116	U	0.00979	0.0206
	Uranium	MWL-CL-ANT1	µg/g	0.947		0.00969	0.0388
		MWL-CL-ANT2	µg/g	0.434		0.00984	0.0394
		MWL-CL-ANT3	µg/g	0.63		0.01	0.04
		MWL-CL-BUR1	µg/g	0.522		0.00998	0.0399
		MWL-CL-BUR2	µg/g	1.21		0.0096	0.0384
		MWL-CL-BUR3	µg/g	0.532		0.0096	0.0384
		MWL-UCL-ANT1	µg/g	0.517		0.00988	0.0395
		MWL-UCL-ANT2	µg/g	0.6		0.00952	0.0381
		MWL-UCL-ANT3	µg/g	0.924		0.01	0.04
		MWL-UCL-BUR1	µg/g	0.521		0.00962	0.0385
		MWL-UCL-BUR2	µg/g	0.667		0.00958	0.0383
		MWL-UCL-BUR3	µg/g	0.42		0.00952	0.0381
		SNL-BKG-ANT1	µg/g	0.351		0.00952	0.0381
		SNL-BKG-ANT2	µg/g	0.298		0.00967	0.0387
		SNL-BKG-BUR1	µg/g	0.325		0.00962	0.0385
		SNL-BKG-BUR2	µg/g	0.428		0.00958	0.0383
		TTC-1	µg/g	0.429		0.0096	0.0384
		TTC-2	µg/g	0.432		0.00975	0.039
		TTC-3	µg/g	0.422		0.00986	0.0394
		TTC-4	µg/g	0.451		0.00978	0.0391
		TTC-5	µg/g	0.548		0.00956	0.0382
		TTC-6	µg/g	0.387		0.00984	0.0394

See notes at end of table.

TABLE C-7. Special Sampling for radiological Results by Location for Calendar Year 2006, Soil (concluded)

Location Type	Analyte	Location	Units	Activity (±2σ) And/or Concentration		Decision Level	Detection Limit
On-Site (concluded)	Uranium	TTC-7	µg/g	0.437		0.00958	0.0383
		TTC-8	µg/g	0.351		0.00963	0.0385
		TTC-9	µg/g	0.427		0.00998	0.0399
		TTC-10	µg/g	0.404		0.00996	0.0398
		TTC-11	µg/g	0.335		0.00986	0.0394
		TTC-12	µg/g	0.409		0.00978	0.0391
		TTC-13	µg/g	0.63		0.00988	0.0395
		TTC-14	µg/g	0.45		0.00984	0.0394
		TTC-15	µg/g	0.512		0.0098	0.0392
		TTC-16	µg/g	0.475		0.00992	0.0397
		TTC-17	µg/g	0.406		0.00984	0.0394
		TTC-18	µg/g	0.405		0.00978	0.0391
		TTC-19	µg/g	0.463		0.00973	0.0389
		TTC-20	µg/g	0.87		0.00977	0.0391
		TTC-21	µg/g	0.689		0.00977	0.0391
		TTC-22	µg/g	0.504		0.00952	0.0381
		TTC-23	µg/g	0.588		0.0098	0.0392
		TTC-24	µg/g	0.559		0.01	0.04
		TTC-25	µg/g	0.673		0.00975	0.039
		TTC-26	µg/g	0.924		0.00984	0.0394
		TTC-27	µg/g	0.587		0.00967	0.0387
		TTC-28	µg/g	0.489		0.00973	0.0389
		TTC-29	µg/g	0.472		0.00971	0.0388
		TTC-30	µg/g	0.617		0.01	0.04
		TTC-31	µg/g	0.611		0.00984	0.0394
		TTC-32	µg/g	0.562		0.00994	0.0398
		TTC-33	µg/g	0.517		0.00977	0.0391
		TTC-34	µg/g	0.367		0.00982	0.0393
		TTC-35	µg/g	0.43		0.00982	0.0393
		TTC-36	µg/g	0.442		0.00998	0.0399
		TTC-37	µg/g	0.386		0.0096	0.0384

NOTES: pCi/g = picocurie per gram
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.
X = Presumptive evidence that analyte is not present.

Table C-8. Special Sampling for Non-radiological Results by Location for Calendar Year 2006, Soil
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Analyte	Location	Result	Decision Level	Detection Limit
Aluminum	TTC-1	9270	6.59	19.4
	TTC-2	9210	6.76	19.9
	TTC-3	11300	6.72	19.8
	TTC-4	9760	6.68	19.6
	TTC-5	8830	6.73	19.8
	TTC-6	9610	6.61	19.5
	TTC-7	10600	6.73	19.8
	TTC-8	8380	6.5	19.1
	TTC-9	10500	6.5	19.1
	TTC-10	8820	6.73	19.8
	TTC-11	7750	6.48	19
	TTC-12	9740	6.48	19
	TTC-13	10900	6.69	19.7
	TTC-14	11300	6.61	19.5
	TTC-15	13800	6.48	19
	TTC-16	7390	6.71	19.7
	TTC-17	7840	6.67	19.6
	TTC-18	8750	6.5	19.1
	TTC-19	8900	6.71	19.7
	TTC-20	8890	6.69	19.7
	TTC-21	7460	6.72	19.8
	TTC-22	10500	6.69	19.7
	TTC-23	10900	6.73	19.8
	TTC-24	11700	6.71	19.7
	TTC-25	12000	6.5	19.1
	TTC-26	10100	6.75	19.8
	TTC-27	12500	6.72	19.8
	TTC-28	12300	6.56	19.3
	TTC-29	9490	6.77	19.9
	TTC-30	12300	6.58	19.3
	TTC-31	20100	32.5	95.6
	TTC-32	8370	6.72	19.8
	TTC-33	9770	6.55	19.3
	TTC-34	7710	6.77	19.9
	TTC-35	8740	6.54	19.2
	TTC-36	7740	6.71	19.7
	TTC-37	8750	6.68	19.6

See notes at end of table.

Table C-8. Special Sampling for Non-radiological Results by Location for Calendar Year 2006, Soil (continued)
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Analyte	Location	Result		Decision Level	Detection Limit
Antimony	TTC-1	0.741	J	0.388	0.969
	TTC-2	0.398	U	0.398	0.994
	TTC-3	0.707	J	0.395	0.988
	TTC-4	0.751	J	0.393	0.982
	TTC-5	0.739	J	0.396	0.99
	TTC-6	0.87	J	0.389	0.973
	TTC-7	0.725	J	0.396	0.99
	TTC-8	0.849	J	0.382	0.956
	TTC-9	0.986		0.382	0.956
	TTC-10	0.717	J	0.396	0.99
	TTC-11	0.623	J	0.381	0.952
	TTC-12	0.742	J	0.381	0.952
	TTC-13	0.745	J	0.394	0.984
	TTC-14	0.854	J	0.389	0.973
	TTC-15	0.489	J	0.381	0.952
	TTC-16	0.801	J	0.394	0.986
	TTC-17	0.723	J	0.392	0.98
	TTC-18	0.748	J	0.382	0.956
	TTC-19	0.877	J	0.394	0.986
	TTC-20	0.893	J	0.394	0.984
	TTC-21	0.7	BJ	0.395	0.988
	TTC-22	0.694	BJ	0.394	0.984
	TTC-23	0.745	BJ	0.396	0.99
	TTC-24	0.632	BJ	0.394	0.986
	TTC-25	0.765	BJ	0.382	0.956
	TTC-26	0.797	BJ	0.397	0.992
	TTC-27	0.56	BJ	0.395	0.988
	TTC-28	0.552	BJ	0.386	0.965
	TTC-29	0.398	BU	0.398	0.996
	TTC-30	0.61	BJ	0.387	0.967
	TTC-31	0.838	BJ	0.382	0.956
	TTC-32	0.497	BJ	0.395	0.988
	TTC-33	0.893	BJ	0.385	0.963
	TTC-34	0.398	BU	0.398	0.996
	TTC-35	0.455	BJ	0.385	0.962
	TTC-36	0.45	BJ	0.394	0.986
	TTC-37	0.642	BJ	0.393	0.982

See notes at end of table.

Table C-8. Special Sampling for Non-radiological Results by Location for Calendar Year 2006, Soil (continued)
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Analyte	Location	Result		Decision Level	Detection Limit
Arsenic	TTC-1	2.38		0.581	1.45
	TTC-2	2.02		0.596	1.49
	TTC-3	2.31		0.593	1.48
	TTC-4	2.54		0.589	1.47
	TTC-5	2.7		0.594	1.49
	TTC-6	2.06		0.584	1.46
	TTC-7	2.14		0.594	1.49
	TTC-8	1.75		0.574	1.43
	TTC-9	2.35		0.574	1.43
	TTC-10	1.75		0.594	1.49
	TTC-11	1.77		0.571	1.43
	TTC-12	1.85		0.571	1.43
	TTC-13	2.11		0.591	1.48
	TTC-14	2.72		0.584	1.46
	TTC-15	3.05		0.571	1.43
	TTC-16	1.48		0.592	1.48
	TTC-17	1.68		0.588	1.47
	TTC-18	2.23		0.574	1.43
	TTC-19	2.54		0.592	1.48
	TTC-20	2.79		0.591	1.48
	TTC-21	2.92		0.593	1.48
	TTC-22	2.35		0.591	1.48
	TTC-23	2.22		0.594	1.49
	TTC-24	3.62		0.592	1.48
	TTC-25	2.77		0.574	1.43
	TTC-26	3.15		0.595	1.49
	TTC-27	2.41		0.593	1.48
	TTC-28	2.61		0.579	1.45
	TTC-29	2.45		0.598	1.49
	TTC-30	2.57		0.58	1.45
	TTC-31	3.78		0.574	1.43
	TTC-32	2.3		0.593	1.48
	TTC-33	2.45		0.578	1.45
	TTC-34	1.88		0.598	1.49
	TTC-35	1.8		0.577	1.44
	TTC-36	2.41		0.592	1.48
	TTC-37	1.92		0.589	1.47

See notes at end of table.

Table C-8. Special Sampling for Non-radiological Results by Location for Calendar Year 2006, Soil (continued)
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Analyte	Location	Result		Decision Level	Detection Limit
Barium	TTC-1	62.6		0.0969	0.484
	TTC-2	68.3		0.0994	0.497
	TTC-3	73.1		0.0988	0.494
	TTC-4	72.6		0.0982	0.491
	TTC-5	78.6		0.099	0.495
	TTC-6	74.7		0.0973	0.486
	TTC-7	75.4		0.099	0.495
	TTC-8	60		0.0956	0.478
	TTC-9	74.9		0.0956	0.478
	TTC-10	62.7		0.099	0.495
	TTC-11	58.7		0.0952	0.476
	TTC-12	69.5		0.0952	0.476
	TTC-13	74.9		0.0984	0.492
	TTC-14	75.9		0.0973	0.486
	TTC-15	89.6		0.0952	0.476
	TTC-16	54.2		0.0986	0.493
	TTC-17	59.1		0.098	0.49
	TTC-18	69.1		0.0956	0.478
	TTC-19	87		0.0986	0.493
	TTC-20	109		0.0984	0.492
	TTC-21	80		0.0988	0.494
	TTC-22	80.5		0.0984	0.492
	TTC-23	83.5		0.099	0.495
	TTC-24	113		0.0986	0.493
	TTC-25	93.3		0.0956	0.478
	TTC-26	99.7		0.0992	0.496
	TTC-27	89.4		0.0988	0.494
	TTC-28	92.7		0.0965	0.483
	TTC-29	70.5		0.0996	0.498
	TTC-30	81.8		0.0967	0.484
	TTC-31	123		0.0956	0.478
	TTC-32	64		0.0988	0.494
	TTC-33	100		0.0963	0.482
	TTC-34	56.5		0.0996	0.498
	TTC-35	68.1		0.0962	0.481
	TTC-36	66.8		0.0986	0.493
	TTC-37	63.9		0.0982	0.491

See notes at end of table.

Table C-8. Special Sampling for Non-radiological Results by Location for Calendar Year 2006, Soil (continued)
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Analyte	Location	Result		Decision Level	Detection Limit
Beryllium	TTC-1	0.446	J	0.0969	0.484
	TTC-2	0.435	J	0.0994	0.497
	TTC-3	0.514		0.0988	0.494
	TTC-4	0.464	J	0.0982	0.491
	TTC-5	0.421	J	0.099	0.495
	TTC-6	0.449	J	0.0973	0.486
	TTC-7	0.477	J	0.099	0.495
	TTC-8	0.393	J	0.0956	0.478
	TTC-9	0.444	J	0.0956	0.478
	TTC-10	0.395	J	0.099	0.495
	TTC-11	0.349	J	0.0952	0.476
	TTC-12	0.438	J	0.0952	0.476
	TTC-13	0.549		0.0984	0.492
	TTC-14	0.547		0.0973	0.486
	TTC-15	0.648		0.0952	0.476
	TTC-16	0.347	J	0.0986	0.493
	TTC-17	0.371	J	0.098	0.49
	TTC-18	0.411	J	0.0956	0.478
	TTC-19	0.452	J	0.0986	0.493
	TTC-20	0.413	J	0.0984	0.492
	TTC-21	0.419	J	0.0988	0.494
	TTC-22	0.511		0.0984	0.492
	TTC-23	0.528		0.099	0.495
	TTC-24	0.642		0.0986	0.493
	TTC-25	0.612		0.0956	0.478
	TTC-26	0.521		0.0992	0.496
	TTC-27	0.559		0.0988	0.494
	TTC-28	0.582		0.0965	0.483
	TTC-29	0.459	J	0.0996	0.498
	TTC-30	0.581		0.0967	0.484
	TTC-31	0.858		0.0956	0.478
	TTC-32	0.399	J	0.0988	0.494
	TTC-33	0.459	J	0.0963	0.482
	TTC-34	0.352	J	0.0996	0.498
	TTC-35	0.4	J	0.0962	0.481
	TTC-36	0.378	J	0.0986	0.493
	TTC-37	0.4	J	0.0982	0.491

See notes at end of table.

Table C-8. Special Sampling for Non-radiological Results by Location for Calendar Year 2006, Soil (continued)
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Analyte	Location	Result		Decision Level	Detection Limit
Cadmium	TTC-1	0.0969	U	0.0969	0.484
	TTC-2	0.0994	U	0.0994	0.497
	TTC-3	0.0988	U	0.0988	0.494
	TTC-4	0.216	J	0.0982	0.491
	TTC-5	0.22	J	0.099	0.495
	TTC-6	0.176	J	0.0973	0.486
	TTC-7	0.206	J	0.099	0.495
	TTC-8	0.171	J	0.0956	0.478
	TTC-9	0.187	J	0.0956	0.478
	TTC-10	0.304	J	0.099	0.495
	TTC-11	0.189	J	0.0952	0.476
	TTC-12	0.231	J	0.0952	0.476
	TTC-13	0.278	J	0.0984	0.492
	TTC-14	0.217	J	0.0973	0.486
	TTC-15	0.257	J	0.0952	0.476
	TTC-16	0.168	J	0.0986	0.493
	TTC-17	0.166	J	0.098	0.49
	TTC-18	0.213	J	0.0956	0.478
	TTC-19	0.261	J	0.0986	0.493
	TTC-20	0.204	J	0.0984	0.492
	TTC-21	0.192	J	0.0988	0.494
	TTC-22	0.187	J	0.0984	0.492
	TTC-23	0.271	J	0.099	0.495
	TTC-24	0.147	J	0.0986	0.493
	TTC-25	0.23	J	0.0956	0.478
	TTC-26	0.218	J	0.0992	0.496
	TTC-27	0.161	J	0.0988	0.494
	TTC-28	0.198	J	0.0965	0.483
	TTC-29	0.141	J	0.0996	0.498
	TTC-30	0.18	J	0.0967	0.484
	TTC-31	0.216	J	0.0956	0.478
	TTC-32	0.158	J	0.0988	0.494
	TTC-33	0.135	J	0.0963	0.482
	TTC-34	0.0996	U	0.0996	0.498
	TTC-35	0.138	J	0.0962	0.481
	TTC-36	0.239	J	0.0986	0.493
	TTC-37	0.188	J	0.0982	0.491

See notes at end of table.

Table C-8. Special Sampling for Non-radiological Results by Location for Calendar Year 2006, Soil (continued)
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Analyte	Location	Result		Decision Level	Detection Limit
Calcium	TTC-1	4780		3.49	9.69
	TTC-2	2820		3.58	9.94
	TTC-3	2110		3.56	9.88
	TTC-4	2990		3.54	9.82
	TTC-5	12300		3.56	9.9
	TTC-6	10300		3.5	9.73
	TTC-7	3720		3.56	9.9
	TTC-8	1820		3.44	9.56
	TTC-9	5220		3.44	9.56
	TTC-10	2290		3.56	9.9
	TTC-11	2820		3.43	9.52
	TTC-12	1850		3.43	9.52
	TTC-13	2410		3.54	9.84
	TTC-14	2230		3.5	9.73
	TTC-15	3810		3.43	9.52
	TTC-16	1290		3.55	9.86
	TTC-17	1420		3.53	9.8
	TTC-18	2540		3.44	9.56
	TTC-19	13100		3.55	9.86
	TTC-20	28600		3.54	9.84
	TTC-21	28300	B	3.56	9.88
	TTC-22	2150	B	3.54	9.84
	TTC-23	2160	B	3.56	9.9
	TTC-24	39100	B	3.55	9.86
	TTC-25	10100	B	3.44	9.56
	TTC-26	36800	B	3.57	9.92
	TTC-27	1910	B	3.56	9.88
	TTC-28	3790	B	3.47	9.65
	TTC-29	3450	B	3.59	9.96
	TTC-30	1900	B	3.48	9.67
	TTC-31	3150	B	3.44	9.56
	TTC-32	2360	B	3.56	9.88
	TTC-33	24000	B	3.47	9.63
	TTC-34	1180	B	3.59	9.96
	TTC-35	1370	B	3.46	9.62
	TTC-36	1480	B	3.55	9.86
	TTC-37	1250	B	3.54	9.82

See notes at end of table.

Table C-8. Special Sampling for Non-radiological Results by Location for Calendar Year 2006, Soil (continued)
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Analyte	Location	Result		Decision Level	Detection Limit
Chromium	TTC-1	9.09		0.0969	0.484
	TTC-2	10		0.0994	0.497
	TTC-3	11.2		0.0988	0.494
	TTC-4	9.85		0.0982	0.491
	TTC-5	8.7		0.099	0.495
	TTC-6	9.04		0.0973	0.486
	TTC-7	10.4		0.099	0.495
	TTC-8	9.55		0.0956	0.478
	TTC-9	9.03		0.0956	0.478
	TTC-10	9.17		0.099	0.495
	TTC-11	8.38		0.0952	0.476
	TTC-12	9.65		0.0952	0.476
	TTC-13	11.8		0.0984	0.492
	TTC-14	11.6		0.0973	0.486
	TTC-15	13		0.0952	0.476
	TTC-16	8.85		0.0986	0.493
	TTC-17	9.06		0.098	0.49
	TTC-18	9.75		0.0956	0.478
	TTC-19	9.51		0.0986	0.493
	TTC-20	10.4		0.0984	0.492
	TTC-21	15.8		0.0988	0.494
	TTC-22	11.6		0.0984	0.492
	TTC-23	12.4		0.099	0.495
	TTC-24	11.3		0.0986	0.493
	TTC-25	14.6		0.0956	0.478
	TTC-26	14.3		0.0992	0.496
	TTC-27	12.2		0.0988	0.494
	TTC-28	12.8		0.0965	0.483
	TTC-29	10.4		0.0996	0.498
	TTC-30	12.7		0.0967	0.484
	TTC-31	16.9		0.0956	0.478
	TTC-32	9.15		0.0988	0.494
	TTC-33	9.35		0.0963	0.482
	TTC-34	7.41		0.0996	0.498
	TTC-35	8.61		0.0962	0.481
	TTC-36	8.14		0.0986	0.493
	TTC-37	8.86		0.0982	0.491

See notes at end of table.

Table C-8. Special Sampling for Non-radiological Results by Location for Calendar Year 2006, Soil (continued)
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Analyte	Location	Result		Decision Level	Detection Limit
Cobalt	TTC-1	2.98		0.194	0.484
	TTC-2	3.08		0.199	0.497
	TTC-3	3.34		0.198	0.494
	TTC-4	3.22		0.196	0.491
	TTC-5	2.74		0.198	0.495
	TTC-6	2.98		0.195	0.486
	TTC-7	3.56		0.198	0.495
	TTC-8	2.83		0.191	0.478
	TTC-9	2.74		0.191	0.478
	TTC-10	2.92		0.198	0.495
	TTC-11	2.6		0.19	0.476
	TTC-12	3.2		0.19	0.476
	TTC-13	3.64		0.197	0.492
	TTC-14	3.82		0.195	0.486
	TTC-15	4.4		0.19	0.476
	TTC-16	2.77		0.197	0.493
	TTC-17	2.91		0.196	0.49
	TTC-18	3.38		0.191	0.478
	TTC-19	3.16		0.197	0.493
	TTC-20	3.9		0.197	0.492
	TTC-21	3.53		0.198	0.494
	TTC-22	4.5		0.197	0.492
	TTC-23	4.21		0.198	0.495
	TTC-24	3.79		0.197	0.493
	TTC-25	4.62		0.191	0.478
	TTC-26	5.32		0.198	0.496
	TTC-27	4.36		0.198	0.494
	TTC-28	4.39		0.193	0.483
	TTC-29	3.35		0.199	0.498
	TTC-30	3.99		0.193	0.484
	TTC-31	5.29		0.191	0.478
	TTC-32	3.19		0.198	0.494
	TTC-33	3.38		0.193	0.482
	TTC-34	2.4		0.199	0.498
	TTC-35	2.72		0.192	0.481
	TTC-36	2.64		0.197	0.493
	TTC-37	2.81		0.196	0.491

See notes at end of table.

Table C-8. Special Sampling for Non-radiological Results by Location for Calendar Year 2006, Soil (continued)
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Analyte	Location	Result		Decision Level	Detection Limit
Copper	TTC-1	6.94		0.291	0.969
	TTC-2	7.38		0.298	0.994
	TTC-3	8.7		0.296	0.988
	TTC-4	6.99		0.295	0.982
	TTC-5	6.63		0.297	0.99
	TTC-6	6.44		0.292	0.973
	TTC-7	7.37		0.297	0.99
	TTC-8	6.08		0.287	0.956
	TTC-9	6.37		0.287	0.956
	TTC-10	6.59		0.297	0.99
	TTC-11	5.22		0.286	0.952
	TTC-12	6.51		0.286	0.952
	TTC-13	7.75		0.295	0.984
	TTC-14	7.64		0.292	0.973
	TTC-15	8.86		0.286	0.952
	TTC-16	5.12		0.296	0.986
	TTC-17	5.64		0.294	0.98
	TTC-18	6.43		0.287	0.956
	TTC-19	6.67		0.296	0.986
	TTC-20	7.48		0.295	0.984
	TTC-21	9.24		0.296	0.988
	TTC-22	8.22		0.295	0.984
	TTC-23	8.49		0.297	0.99
	TTC-24	8.03		0.296	0.986
	TTC-25	9.85		0.287	0.956
	TTC-26	11.5		0.298	0.992
	TTC-27	8.61		0.296	0.988
	TTC-28	8.82		0.29	0.965
	TTC-29	6.59		0.299	0.996
	TTC-30	8.09		0.29	0.967
	TTC-31	12.3		0.287	0.956
	TTC-32	7.3		0.296	0.988
	TTC-33	6.11		0.289	0.963
	TTC-34	4.68		0.299	0.996
	TTC-35	5.82		0.288	0.962
	TTC-36	5.73		0.296	0.986
	TTC-37	5.94		0.295	0.982

See notes at end of table.

Table C-8. Special Sampling for Non-radiological Results by Location for Calendar Year 2006, Soil (continued)
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Analyte	Location	Result		Decision Level	Detection Limit
Iron	TTC-1	11300		1.74	9.69
	TTC-2	12500		1.79	9.94
	TTC-3	13500		1.78	9.88
	TTC-4	11000		1.77	9.82
	TTC-5	10200		1.78	9.9
	TTC-6	10200		1.75	9.73
	TTC-7	11800		1.78	9.9
	TTC-8	10400		1.72	9.56
	TTC-9	9780		1.72	9.56
	TTC-10	10700		1.78	9.9
	TTC-11	9170		1.71	9.52
	TTC-12	10500		1.71	9.52
	TTC-13	12700		1.77	9.84
	TTC-14	12500		1.75	9.73
	TTC-15	14100		1.71	9.52
	TTC-16	9820		1.78	9.86
	TTC-17	10000		1.76	9.8
	TTC-18	11000		1.72	9.56
	TTC-19	10800		1.78	9.86
	TTC-20	11900		1.77	9.84
	TTC-21	12700	B	1.78	9.88
	TTC-22	12200	B	1.77	9.84
	TTC-23	13100	B	1.78	9.9
	TTC-24	11500	B	1.78	9.86
	TTC-25	14800	B	1.72	9.56
	TTC-26	15100	B	1.79	9.92
	TTC-27	13100	B	1.78	9.88
	TTC-28	13400	B	1.74	9.65
	TTC-29	11500	B	1.79	9.96
	TTC-30	13300	B	1.74	9.67
	TTC-31	17400	B	1.72	9.56
	TTC-32	9950	B	1.78	9.88
	TTC-33	9990	B	1.73	9.63
	TTC-34	8120	B	1.79	9.96
	TTC-35	9210	B	1.73	9.62
	TTC-36	8960	B	1.78	9.86
	TTC-37	9370	B	1.77	9.82

See notes at end of table.

Table C-8. Special Sampling for Non-radiological Results by Location for Calendar Year 2006, Soil (continued)
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Analyte	Location	Result		Decision Level	Detection Limit
Lead	TTC-1	6.47		0.242	0.969
	TTC-2	9.18		0.249	0.994
	TTC-3	9.72		0.247	0.988
	TTC-4	7.87		0.246	0.982
	TTC-5	6.65		0.248	0.99
	TTC-6	6.61		0.243	0.973
	TTC-7	8.78		0.248	0.99
	TTC-8	6.89		0.239	0.956
	TTC-9	5.64		0.239	0.956
	TTC-10	8.44		0.248	0.99
	TTC-11	7.11		0.238	0.952
	TTC-12	8.1		0.238	0.952
	TTC-13	9.37		0.246	0.984
	TTC-14	9.03		0.243	0.973
	TTC-15	8.3		0.238	0.952
	TTC-16	5.98		0.247	0.986
	TTC-17	7.3		0.245	0.98
	TTC-18	8.75		0.239	0.956
	TTC-19	7.64		0.247	0.986
	TTC-20	5.56		0.246	0.984
	TTC-21	7.29		0.247	0.988
	TTC-22	10		0.246	0.984
	TTC-23	11.8		0.248	0.99
	TTC-24	7.44		0.247	0.986
	TTC-25	12.4		0.239	0.956
	TTC-26	10.4		0.248	0.992
	TTC-27	10.1		0.247	0.988
	TTC-28	10.7		0.241	0.965
	TTC-29	8.24		0.249	0.996
	TTC-30	10.1		0.242	0.967
	TTC-31	15.2		0.239	0.956
	TTC-32	8.06		0.247	0.988
	TTC-33	6.04		0.241	0.963
	TTC-34	6.44		0.249	0.996
	TTC-35	7.88		0.24	0.962
	TTC-36	8.84		0.247	0.986
	TTC-37	8.96		0.246	0.982

See notes at end of table.

Table C-8. Special Sampling for Non-radiological Results by Location for Calendar Year 2006, Soil (continued)
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Analyte	Location	Result		Decision Level	Detection Limit
Magnesium	TTC-1	2220		8.24	29.1
	TTC-2	2160		8.45	29.8
	TTC-3	2480		8.4	29.6
	TTC-4	2320		8.35	29.5
	TTC-5	2370		8.42	29.7
	TTC-6	2310		8.27	29.2
	TTC-7	2450		8.42	29.7
	TTC-8	2050		8.13	28.7
	TTC-9	2340		8.13	28.7
	TTC-10	2130		8.42	29.7
	TTC-11	1850		8.1	28.6
	TTC-12	2330		8.1	28.6
	TTC-13	2810		8.37	29.5
	TTC-14	2870		8.27	29.2
	TTC-15	3280		8.1	28.6
	TTC-16	1720		8.38	29.6
	TTC-17	1890		8.33	29.4
	TTC-18	2130		8.13	28.7
	TTC-19	2570		8.38	29.6
	TTC-20	3420		8.37	29.5
	TTC-21	3010		8.4	29.6
	TTC-22	2680		8.37	29.5
	TTC-23	2910		8.42	29.7
	TTC-24	3800		8.38	29.6
	TTC-25	3870		8.13	28.7
	TTC-26	4600		8.43	29.8
	TTC-27	2830		8.4	29.6
	TTC-28	3000		8.2	29
	TTC-29	2680		8.47	29.9
	TTC-30	2960		8.22	29
	TTC-31	4560		8.13	28.7
	TTC-32	2170		8.4	29.6
	TTC-33	3130		8.19	28.9
	TTC-34	1710		8.47	29.9
	TTC-35	1950		8.17	28.8
	TTC-36	1810		8.38	29.6
	TTC-37	1940		8.35	29.5

See notes at end of table.

Table C-8. Special Sampling for Non-radiological Results by Location for Calendar Year 2006, Soil (continued)
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Analyte	Location	Result		Decision Level	Detection Limit
Manganese	TTC-1	134		0.194	0.969
	TTC-2	164		0.199	0.994
	TTC-3	158		0.198	0.988
	TTC-4	171		0.196	0.982
	TTC-5	140		0.198	0.99
	TTC-6	146		0.195	0.973
	TTC-7	168		0.198	0.99
	TTC-8	167		0.191	0.956
	TTC-9	138		0.191	0.956
	TTC-10	162		0.198	0.99
	TTC-11	145		0.19	0.952
	TTC-12	177		0.19	0.952
	TTC-13	207		0.197	0.984
	TTC-14	217		0.195	0.973
	TTC-15	230		0.19	0.952
	TTC-16	167		0.197	0.986
	TTC-17	175		0.196	0.98
	TTC-18	181		0.191	0.956
	TTC-19	144		0.197	0.986
	TTC-20	261		0.197	0.984
	TTC-21	194		0.198	0.988
	TTC-22	273		0.197	0.984
	TTC-23	238		0.198	0.99
	TTC-24	198		0.197	0.986
	TTC-25	255		0.191	0.956
	TTC-26	284		0.198	0.992
	TTC-27	253		0.198	0.988
	TTC-28	254		0.193	0.965
	TTC-29	197		0.199	0.996
	TTC-30	215		0.193	0.967
	TTC-31	262		0.191	0.956
	TTC-32	174		0.198	0.988
	TTC-33	146		0.193	0.963
	TTC-34	135		0.199	0.996
	TTC-35	161		0.192	0.962
	TTC-36	167		0.197	0.986
	TTC-37	158		0.196	0.982

See notes at end of table.

Table C-8. Special Sampling for Non-radiological Results by Location for Calendar Year 2006, Soil (continued)
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Analyte	Location	Result		Decision Level	Detection Limit
Mercury	TTC-1	0.00569	J	0.00249	0.00997
	TTC-2	0.00865	J	0.0025	0.00998
	TTC-3	0.00727	J	0.00248	0.00993
	TTC-4	0.0108		0.0022	0.0088
	TTC-5	0.00566	J	0.00233	0.0093
	TTC-6	0.00965		0.00236	0.00945
	TTC-7	0.00925	J	0.0024	0.0096
	TTC-8	0.00885	J	0.00242	0.00969
	TTC-9	0.00441	J	0.00218	0.00871
	TTC-10	0.00656	J	0.00248	0.00992
	TTC-11	0.00631	J	0.00236	0.00943
	TTC-12	0.00954		0.00226	0.00902
	TTC-13	0.00949	J	0.00245	0.00979
	TTC-14	0.0147		0.00237	0.00949
	TTC-15	0.0107		0.00229	0.00915
	TTC-16	0.00546	J	0.00222	0.00888
	TTC-17	0.00707	J	0.0022	0.00881
	TTC-18	0.00872	J	0.00229	0.00916
	TTC-19	0.00708	J	0.00246	0.00985
	TTC-20	0.00432	J	0.00242	0.00968
	TTC-21	0.0036	J	0.00244	0.00976
	TTC-22	0.00984		0.00235	0.00942
	TTC-23	0.009	J	0.00235	0.0094
	TTC-24	0.0114		0.00241	0.00963
	TTC-25	0.00882	J	0.00238	0.00951
	TTC-26	0.00744	J	0.00243	0.00972
	TTC-27	0.0136		0.00236	0.00945
	TTC-28	0.0131		0.00243	0.00971
	TTC-29	0.0092	J	0.00244	0.00977
	TTC-30	0.0106		0.00247	0.00987
	TTC-31	0.0145		0.00236	0.00943
	TTC-32	0.0101		0.00227	0.00908
	TTC-33	0.00768	J	0.0024	0.00958
	TTC-34	0.00878	J	0.00248	0.0099
	TTC-35	0.00915	J	0.00246	0.00984
	TTC-36	0.00806	J	0.00246	0.00984
	TTC-37	0.0073	J	0.0022	0.00881

See notes at end of table.

Table C-8. Special Sampling for Non-radiological Results by Location for Calendar Year 2006, Soil (continued)
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Analyte	Location	Result		Decision Level	Detection Limit
Nickel	TTC-1	6.53		0.0969	0.484
	TTC-2	6.73		0.0994	0.497
	TTC-3	8.52		0.0988	0.494
	TTC-4	6.61		0.0982	0.491
	TTC-5	6.51		0.099	0.495
	TTC-6	6.68		0.0973	0.486
	TTC-7	7.17		0.099	0.495
	TTC-8	6		0.0956	0.478
	TTC-9	6.29		0.0956	0.478
	TTC-10	6.1		0.099	0.495
	TTC-11	5.33		0.0952	0.476
	TTC-12	6.54		0.0952	0.476
	TTC-13	8.01		0.0984	0.492
	TTC-14	8.13		0.0973	0.486
	TTC-15	9.37		0.0952	0.476
	TTC-16	5.6		0.0986	0.493
	TTC-17	5.76		0.098	0.49
	TTC-18	6.5		0.0956	0.478
	TTC-19	6.58		0.0986	0.493
	TTC-20	10.9		0.0984	0.492
	TTC-21	8.51	B	0.0988	0.494
	TTC-22	8.28	B	0.0984	0.492
	TTC-23	8.28	B	0.099	0.495
	TTC-24	8.81	B	0.0986	0.493
	TTC-25	10.1	B	0.0956	0.478
	TTC-26	11.2	B	0.0992	0.496
	TTC-27	8.94	B	0.0988	0.494
	TTC-28	8.81	B	0.0965	0.483
	TTC-29	7.03	B	0.0996	0.498
	TTC-30	8.45	B	0.0967	0.484
	TTC-31	12.5	B	0.0956	0.478
	TTC-32	6.4	B	0.0988	0.494
	TTC-33	7.07	B	0.0963	0.482
	TTC-34	5	B	0.0996	0.498
	TTC-35	5.65	B	0.0962	0.481
	TTC-36	5.54	B	0.0986	0.493
	TTC-37	5.94	B	0.0982	0.491

See notes at end of table.

Table C-8. Special Sampling for Non-radiological Results by Location for Calendar Year 2006, Soil (continued)
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Analyte	Location	Result		Decision Level	Detection Limit
Potassium	TTC-1	1970		4.84	14.5
	TTC-2	2130		4.97	14.9
	TTC-3	2500		4.94	14.8
	TTC-4	2210		4.91	14.7
	TTC-5	1860		4.95	14.9
	TTC-6	1980		4.86	14.6
	TTC-7	2120		4.95	14.9
	TTC-8	1920		4.78	14.3
	TTC-9	1910		4.78	14.3
	TTC-10	1920		4.95	14.9
	TTC-11	1720		4.76	14.3
	TTC-12	2240		4.76	14.3
	TTC-13	2470		4.92	14.8
	TTC-14	2640		4.86	14.6
	TTC-15	2810		4.76	14.3
	TTC-16	1490		4.93	14.8
	TTC-17	1810		4.9	14.7
	TTC-18	1870		4.78	14.3
	TTC-19	2040		4.93	14.8
	TTC-20	1530		4.92	14.8
	TTC-21	1360		4.94	14.8
	TTC-22	2480		4.92	14.8
	TTC-23	2670		4.95	14.9
	TTC-24	2570		4.93	14.8
	TTC-25	2700		4.78	14.3
	TTC-26	2760		4.96	14.9
	TTC-27	2630		4.94	14.8
	TTC-28	2670		4.83	14.5
	TTC-29	2500		4.98	14.9
	TTC-30	2860		4.84	14.5
	TTC-31	4590		23.9	71.7
	TTC-32	1950		4.94	14.8
	TTC-33	2060		4.82	14.5
	TTC-34	1620		4.98	14.9
	TTC-35	1840		4.81	14.4
	TTC-36	1700		4.93	14.8
	TTC-37	1950		4.91	14.7

See notes at end of table.

Table C-8. Special Sampling for Non-radiological Results by Location for Calendar Year 2006, Soil (continued)
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Analyte	Location	Result		Decision Level	Detection Limit
Selenium	TTC-1	0.581	U	0.581	1.45
	TTC-2	0.67	J	0.596	1.49
	TTC-3	0.967	J	0.593	1.48
	TTC-4	0.589	U	0.589	1.47
	TTC-5	0.594	U	0.594	1.49
	TTC-6	0.584	U	0.584	1.46
	TTC-7	0.594	U	0.594	1.49
	TTC-8	0.574	U	0.574	1.43
	TTC-9	0.605	J	0.574	1.43
	TTC-10	0.594	U	0.594	1.49
	TTC-11	0.571	U	0.571	1.43
	TTC-12	0.571	U	0.571	1.43
	TTC-13	0.591	U	0.591	1.48
	TTC-14	0.584	U	0.584	1.46
	TTC-15	0.696	J	0.571	1.43
	TTC-16	0.592	U	0.592	1.48
	TTC-17	0.71	J	0.588	1.47
	TTC-18	0.574	U	0.574	1.43
	TTC-19	0.592	U	0.592	1.48
	TTC-20	0.591	U	0.591	1.48
	TTC-21	0.593	U	0.593	1.48
	TTC-22	0.591	U	0.591	1.48
	TTC-23	0.594	U	0.594	1.49
	TTC-24	0.592	U	0.592	1.48
	TTC-25	0.574	U	0.574	1.43
	TTC-26	0.595	U	0.595	1.49
	TTC-27	0.593	U	0.593	1.48
	TTC-28	0.579	U	0.579	1.45
	TTC-29	0.598	U	0.598	1.49
	TTC-30	0.58	U	0.58	1.45
	TTC-31	0.574	U	0.574	1.43
	TTC-32	0.593	U	0.593	1.48
	TTC-33	0.578	U	0.578	1.45
	TTC-34	0.598	U	0.598	1.49
	TTC-35	0.577	U	0.577	1.44
	TTC-36	0.592	U	0.592	1.48
	TTC-37	0.589	U	0.589	1.47

See notes at end of table.

Table C-8. Special Sampling for Non-radiological Results by Location for Calendar Year 2006, Soil (continued)
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Analyte	Location	Result		Decision Level	Detection Limit
Silver	TTC-1	0.0969	U	0.0969	0.484
	TTC-2	0.0994	U	0.0994	0.497
	TTC-3	0.0988	U	0.0988	0.494
	TTC-4	0.0982	U	0.0982	0.491
	TTC-5	0.099	U	0.099	0.495
	TTC-6	0.0973	U	0.0973	0.486
	TTC-7	0.099	U	0.099	0.495
	TTC-8	0.0956	U	0.0956	0.478
	TTC-9	0.0956	U	0.0956	0.478
	TTC-10	0.099	U	0.099	0.495
	TTC-11	0.0952	U	0.0952	0.476
	TTC-12	0.0952	U	0.0952	0.476
	TTC-13	0.0984	U	0.0984	0.492
	TTC-14	0.0973	U	0.0973	0.486
	TTC-15	0.0952	U	0.0952	0.476
	TTC-16	0.0986	U	0.0986	0.493
	TTC-17	0.098	U	0.098	0.49
	TTC-18	0.0956	U	0.0956	0.478
	TTC-19	1.4		0.0986	0.493
	TTC-20	0.0984	U	0.0984	0.492
	TTC-21	0.0988	U	0.0988	0.494
	TTC-22	0.0984	U	0.0984	0.492
	TTC-23	0.099	U	0.099	0.495
	TTC-24	0.0986	U	0.0986	0.493
	TTC-25	0.0956	U	0.0956	0.478
	TTC-26	0.0992	U	0.0992	0.496
	TTC-27	0.0988	U	0.0988	0.494
	TTC-28	0.0965	U	0.0965	0.483
	TTC-29	0.0996	U	0.0996	0.498
	TTC-30	0.0967	U	0.0967	0.484
	TTC-31	0.0956	U	0.0956	0.478
	TTC-32	0.121	J	0.0988	0.494
	TTC-33	0.0963	U	0.0963	0.482
	TTC-34	0.0996	U	0.0996	0.498
	TTC-35	0.0962	U	0.0962	0.481
	TTC-36	0.0986	U	0.0986	0.493
	TTC-37	0.0982	U	0.0982	0.491

See notes at end of table.

Table C-8. Special Sampling for Non-radiological Results by Location for Calendar Year 2006, Soil (continued)
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Analyte	Location	Result		Decision Level	Detection Limit
Sodium	TTC-1	37.9		4.36	14.5
	TTC-2	43		4.47	14.9
	TTC-3	40.8		4.45	14.8
	TTC-4	43.7		4.42	14.7
	TTC-5	62.9		4.46	14.9
	TTC-6	36.1		4.38	14.6
	TTC-7	41.1		4.46	14.9
	TTC-8	44.7		4.3	14.3
	TTC-9	35.8		4.3	14.3
	TTC-10	34.8		4.46	14.9
	TTC-11	34.4		4.29	14.3
	TTC-12	40.4		4.29	14.3
	TTC-13	50.3		4.43	14.8
	TTC-14	50.4		4.38	14.6
	TTC-15	48.3		4.29	14.3
	TTC-16	37.7		4.44	14.8
	TTC-17	39.9		4.41	14.7
	TTC-18	44.1		4.3	14.3
	TTC-19	54.2		4.44	14.8
	TTC-20	111		4.43	14.8
	TTC-21	93.1		4.45	14.8
	TTC-22	68.6		4.43	14.8
	TTC-23	69.8		4.46	14.9
	TTC-24	64.6		4.44	14.8
	TTC-25	78.5		4.3	14.3
	TTC-26	85		4.46	14.9
	TTC-27	61.3		4.45	14.8
	TTC-28	62.1		4.34	14.5
	TTC-29	60.3		4.48	14.9
	TTC-30	58.9		4.35	14.5
	TTC-31	73.3		4.3	14.3
	TTC-32	63.4		4.45	14.8
	TTC-33	55.7		4.34	14.5
	TTC-34	38.7		4.48	14.9
	TTC-35	45		4.33	14.4
	TTC-36	47.6		4.44	14.8
	TTC-37	45.6		4.42	14.7

See notes at end of table.

Table C-8. Special Sampling for Non-radiological Results by Location for Calendar Year 2006, Soil (continued)
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Analyte	Location	Result		Decision Level	Detection Limit
Thallium	TTC-1	0.484	U	0.484	1.94
	TTC-2	0.497	U	0.497	1.99
	TTC-3	0.494	U	0.494	1.98
	TTC-4	0.491	U	0.491	1.96
	TTC-5	0.495	U	0.495	1.98
	TTC-6	0.486	U	0.486	1.95
	TTC-7	0.495	U	0.495	1.98
	TTC-8	0.478	U	0.478	1.91
	TTC-9	0.478	U	0.478	1.91
	TTC-10	0.495	U	0.495	1.98
	TTC-11	0.476	U	0.476	1.9
	TTC-12	0.476	U	0.476	1.9
	TTC-13	0.492	U	0.492	1.97
	TTC-14	0.486	U	0.486	1.95
	TTC-15	0.476	U	0.476	1.9
	TTC-16	0.493	U	0.493	1.97
	TTC-17	0.49	U	0.49	1.96
	TTC-18	0.478	U	0.478	1.91
	TTC-19	0.493	U	0.493	1.97
	TTC-20	0.492	U	0.492	1.97
	TTC-21	0.494	U	0.494	1.98
	TTC-22	0.492	U	0.492	1.97
	TTC-23	0.495	U	0.495	1.98
	TTC-24	0.493	U	0.493	1.97
	TTC-25	0.478	U	0.478	1.91
	TTC-26	0.496	U	0.496	1.98
	TTC-27	0.494	U	0.494	1.98
	TTC-28	0.483	U	0.483	1.93
	TTC-29	0.498	U	0.498	1.99
	TTC-30	0.484	U	0.484	1.93
	TTC-31	0.478	U	0.478	1.91
	TTC-32	0.494	U	0.494	1.98
	TTC-33	0.482	U	0.482	1.93
	TTC-34	0.498	U	0.498	1.99
	TTC-35	0.481	U	0.481	1.92
	TTC-36	0.493	U	0.493	1.97
	TTC-37	0.491	U	0.491	1.96

See notes at end of table.

Table C-8. Special Sampling for Non-radiological Results by Location for Calendar Year 2006, Soil (continued)
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Analyte	Location	Result		Decision Level	Detection Limit
Vanadium	TTC-1	18.7		0.0969	0.484
	TTC-2	20.3		0.0994	0.497
	TTC-3	22.1		0.0988	0.494
	TTC-4	20		0.0982	0.491
	TTC-5	18.7		0.099	0.495
	TTC-6	19.3		0.0973	0.486
	TTC-7	20.9		0.099	0.495
	TTC-8	19		0.0956	0.478
	TTC-9	18.2		0.0956	0.478
	TTC-10	20		0.099	0.495
	TTC-11	17.5		0.0952	0.476
	TTC-12	19.1		0.0952	0.476
	TTC-13	23.4		0.0984	0.492
	TTC-14	22.9		0.0973	0.486
	TTC-15	26.8		0.0952	0.476
	TTC-16	18.7		0.0986	0.493
	TTC-17	18.7		0.098	0.49
	TTC-18	21.4		0.0956	0.478
	TTC-19	21		0.0986	0.493
	TTC-20	24.1		0.0984	0.492
	TTC-21	23.9		0.0988	0.494
	TTC-22	23.1		0.0984	0.492
	TTC-23	24.4		0.099	0.495
	TTC-24	25		0.0986	0.493
	TTC-25	29		0.0956	0.478
	TTC-26	30.8		0.0992	0.496
	TTC-27	24.1		0.0988	0.494
	TTC-28	24.7		0.0965	0.483
	TTC-29	21.9		0.0996	0.498
	TTC-30	24.8		0.0967	0.484
	TTC-31	31.3		0.0956	0.478
	TTC-32	18.2		0.0988	0.494
	TTC-33	21.4		0.0963	0.482
	TTC-34	15		0.0996	0.498
	TTC-35	16.8		0.0962	0.481
	TTC-36	16.6		0.0986	0.493
	TTC-37	17.6		0.0982	0.491

See notes at end of table.

Table C-8. Special Sampling for Non-radiological Results by Location for Calendar Year 2006, Soil (concluded)
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Analyte	Location	Result		Decision Level	Detection Limit
Zinc	TTC-1	23.5	B	0.194	0.969
	TTC-2	27.1	B	0.199	0.994
	TTC-3	28.8	B	0.198	0.988
	TTC-4	27.8	B	0.196	0.982
	TTC-5	32.4	B	0.198	0.99
	TTC-6	25.2	B	0.195	0.973
	TTC-7	28.5	B	0.198	0.99
	TTC-8	25.1	B	0.191	0.956
	TTC-9	25.8	B	0.191	0.956
	TTC-10	25.6	B	0.198	0.99
	TTC-11	22.6	B	0.19	0.952
	TTC-12	27	B	0.19	0.952
	TTC-13	31.6	B	0.197	0.984
	TTC-14	31.2	B	0.195	0.973
	TTC-15	32.9	B	0.19	0.952
	TTC-16	22.2	B	0.197	0.986
	TTC-17	23.5	B	0.196	0.98
	TTC-18	26.3	B	0.191	0.956
	TTC-19	40.1	B	0.197	0.986
	TTC-20	30.2	B	0.197	0.984
	TTC-21	38.6	B	0.198	0.988
	TTC-22	31.1	B	0.197	0.984
	TTC-23	34.7	B	0.198	0.99
	TTC-24	28.9	B	0.197	0.986
	TTC-25	38.2	B	0.191	0.956
	TTC-26	39.6	B	0.198	0.992
	TTC-27	33	B	0.198	0.988
	TTC-28	33.9	B	0.193	0.965
	TTC-29	30.1	B	0.199	0.996
	TTC-30	33.2	B	0.193	0.967
	TTC-31	45	B	0.191	0.956
	TTC-32	25.3	B	0.198	0.988
	TTC-33	45.2	B	0.193	0.963
	TTC-34	20.8	B	0.199	0.996
	TTC-35	24.3	B	0.192	0.962
	TTC-36	24.1	B	0.197	0.986
	TTC-37	24	B	0.196	0.982

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

TABLE C-9. TLD Measurements by Quarter and Location Class for Calendar Year, 2006

Location Class	Location Number	1st Quarter (91 Days) Exposure (mR)	Error	2nd Quarter (85 Days) Exposure (mR)	Error	3rd Quarter (91 Days) Exposure (mR)	Error	4th Quarter (99 Days) Exposure (mR)	Error	Exposure Rate uR per hour	Error
Off-Site	10	31.9	0.8	25.3	1.3	27.1	0.6	30.4	2.2	13.1	0.3
	11	25.1	0.6	16.8	2.5	20	1	22.6	1.1	9.6	0.3
	21	27.9	0.3	19	0.7	22	1.3	26.3	0.8	10.8	0.2
	22	29.2	1.6	21.1	1.5	23.4	0.5	27.8	0.7	11.6	0.3
	23	27.2	1.2	18.3	1.4	20.2	1.1	24	1.2	10.2	0.3
	24	23.3	0.9	15.9	0.7	18.5	1	21	0.8	9.0	0.2
	25	26.1	0.5	19.3	1.1	19.8	1	23	1.1	10.0	0.2
	26	31.3	1.1	23.8	1.8	28	1.6	27.8	1.8	12.6	0.4
	27	27.8	1.2	20.4	0.4	21.7	0.6	26	0.6	10.9	0.2
	28	25.8	0.7	17.7	0.8	19.3	0.6	22.5	1.2	9.7	0.2
	29	23.9	1	16	0.5	18.5	0.8	21.5	0.9	9.1	0.2
	30	29	0.3	23.4	0.7	23.7	1.1	29.7	0.9	12.0	0.2
Perimeter	4	23.5	0.9	17.9	1.3	21.1	0.7	24.2	0.7	9.9	0.2
	5	22.2	0.8	18.4	1.3	21.7	0.8	25.7	0.5	10.0	0.2
	16	28.5	0.8	22.5	1.1	25	0.7	30.3	0.8	12.1	0.2
	18	23.6	0.8	18.8	1.7	21.6	0.7	24.5	0.9	10.1	0.3
	19	26.9	0.9	20.8	1.4	23	0.7	27.7	0.4	11.2	0.2
	39	21.9	0.6	17.2	1.2	18.3	1.4	21.1	0.4	8.9	0.2
	40	22.5	1.2	18	1.3	21.6	0.8	23.8	1	9.8	0.2
	81	25.3	1.4	19.9	1	22.8	0.7	26.5	0.5	10.8	0.2
On-Site	1	23.2	1.5	19.2	3.3	21.8	1.1	25.1	0.5	10.2	0.4
	2NW	21.5	1.5	18.1	1.6	20.7	0.7	28.5	4.8	10.1	0.6
	3	23.2	0.5	18.7	1.2	22.1	0.7	24.1	0.5	10.0	0.2
	6	23.6	0.4	19.1	1.1	20.3	0.7	23.6	0.5	9.9	0.2
	7	25.7	1.5	21.2	1.1	21.5	0.9	26.4	1.3	10.8	0.3
	20	24.8	1.8	20.5	1.9	21.3	1.1	27	1.1	10.7	0.3
	31	21.4	0.8	17	1.2	20.1	0.7	23.4	0.4	9.3	0.2
	41	25.8	1.7	19.4	1.4	21.1	1.3	23.9	0.6	10.3	0.3
	42	21	0.7	16.2	1.8	20.8	0.8	22.9	0.4	9.2	0.2
	43	22.7	1.2	18.6	1.9	20.6	0.8	22.1	0.6	9.6	0.3
	46	24.1	1.1	21.3	1.3	21.6	0.9	24.9	0.8	10.5	0.2
	47	24.3	1	19.3	1	21.3	0.8	26	1	10.3	0.2
	48	26.5	1.6	19.9	1.4	22.4	0.9	24.4	0.5	10.6	0.3
	66	24.4	0.9	18.9	1.1	21.4	0.9	24.6	0.4	10.2	0.2
Operational	45	24.4	1.5	18	1.7	20.9	1.7	25.3	2.4	10.1	0.4
	45E	23.4	0.9	19.9	1.5	21.9	0.7	26.9	0.5	10.5	0.2

NOTES: mR = Milliroentgen (10^{-3} roentgen); uR = microroentgen (10^{-6} roentgen)
"Operational" refers to TLD locations that are near ongoing operations that may influence readings, such that they may not truly reflect "environmental" conditions.

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TABLE C-10. Summary TLD Results for Calendar Year 2006, SNL/NM

Location Class	Number of Locations	Mean Exposure Rate (uR/hour)	Std Dev.	Minimum	Maximum
Off-Site	12	10.7	1.4	9.0	13.1
Perimeter	8	10.3	1.0	8.9	12.1
On-Site	14	10.0	0.5	9.2	10.8
Operational	2	10.3	0.3	10.1	10.5

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

"Operational" refers to TLD locations that are near ongoing operations that may influence readings, such that they may not truly reflect "environmental" conditions.

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APPENDIX D

TTC Metals in Soil Summary
Supplement to Appendix C

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Chemical Analyses of Soil Samples Collected from the Vicinity of the Thermal Test Complex at Sandia National Laboratories, New Mexico Environs, 2006

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Appendix D

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Chemical Analyses of Soil Samples Collected from the Vicinity of the Thermal Test Complex at Sandia National Laboratories, New Mexico Environs, 2006

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Abstract

In the summer of 2006, the Environmental Programs and Assurance Department of Sandia National Laboratories in Albuquerque, New Mexico (SNL/NM), collected surface soil samples at 37 locations within one mile of the vicinity of the newly constructed Thermal Test Complex (TTC) for the purpose of determining baseline conditions against which potential future impacts to the environs from operations at the facility could be assessed. These samples were submitted to an offsite analytical laboratory for metal-in-soil analyses. This work provided the SNL Environmental Programs and Assurance Department with a sound baseline data reference set against which to assess potential future operational impacts at the TTC. In addition, it demonstrates the commitment that the Laboratories have to go beyond mere compliance to achieve excellence in its operations. This data are presented in graphical format with narrative commentaries on particular items of interest.

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Introduction

In order to establish a baseline for trace metals that exist in the soils in the vicinity of the Thermal Test Complex (TTC) in Technical Area III at Sandia National Laboratories, New Mexico (SNL/NM), the Environmental Programs and Assurance Department at SNL/NM collected soil samples at 37 locations within one mile of the TTC for the purpose of determining baseline conditions against which potential future impacts to the environs from operations at the facility could be evaluated. The sampling plan was designed to collect and analyze soils for this purpose and was assembled in consultation with subject matter experts within the Environmental Programs and Assurance Department to ensure that a true multi-media approach was taken in the process of determining the location of the various sampling points. The locations are shown in Figure 1, and tabulated in Table 1. Samples were submitted to an analytical laboratory for metal-in-soil analyses (target analyte list [TAL] metals) plus metallic uranium.

These soil results are presented in graphical format for quick reference. In some cases, the ratio between two or more elements can be used to determine if the observed concentrations are natural or anthropogenic (Hooper 2004). When more than one distribution is observed in these plots, the data are assumed to be heterogeneous (i.e., a separate source is associated with each distribution) (McLish 1994). This work provided the SNL Environmental Programs and Assurance Department with a sound baseline data reference against which to compare future operational impacts at the TTC or other nearby facilities.

First of all, it was desirable to collect a sufficient number of samples from the area of interest to enable statistical evaluation of the data (e.g., MIN, MAX, MEAN, RANGE. etc). Also, since the primary vector for the occurrence of non-natural concentrations of the metals in soils would be air deposition, consultations were made with the Environmental Programs and Assurance meteorologist to identify primary wind patterns so that samples would be collected in likely “downwind” (and “upwind”) directions from the facility effluent stack. (Depositional modeling results are actually available for this facility, which suggest deposition patterns extending further than indicated in Figure 1. However, as a practical consideration, the distances considered here were limited to a one-mile radius.)

Existing nearby monitoring stations that already exist for other reasons were also considered in the selection of sample locations. For example, there are PM-10 and PM-2.5 stations within the 0.5 mile radius where samples were collected for possible correlation with materials collected on the air filters. Soil samples were also collected near the existing groundwater monitoring wells in the selected sampling area, since contaminants in the surface soils are potential contaminants of the groundwater, if they are mobile in the vadose zone. Of course, in the desert environment at SNL with the groundwater table over 500 feet below the ground surface, the likelihood of this scenario is remote.

With that general background guiding the approach to selection of the sampling points, Figure 1 below depicts the general locations sampled.

Figure 1. Sampling Locations in the Vicinity of the TTC to Establish Baseline Metals-in Soils Concentrations

The precise GPS location of each sample point was logged at the time of sample collection to record the exact location from which each sample was collected. Table 1 below lists the locations, their sampling coordinates, and the rationale for sampling at that location.

Table 1. TTC Metals-in-Soil Sampling Locations (NM State Plane Coordinates)

Number	Easting	Northing	Rationale
1	358557	3874028	N of PM-2.5
2	358627	3873976	E of PM-2.5
3	358551	3873920	S of PM-2.5
4	358486	3873973	W of PM-2.5
5	359824	3873545	Upwind Transect Day Wind Rose (N of A36 Met Tower)
6	359857	3873485	Upwind Transect Day Wind Rose (N of A36 Met Tower)
7	359782	3873472	Upwind Transect Day Wind Rose (N of A36 Met Tower)
8	359758	3873512	Upwind Transect Day Wind Rose (N of A36 Met Tower)
9	359050	3873302	Upwind Transect Day Wind Rose (N of A36 Met Tower)
10	359108	3873241	Upwind Transect Day Wind Rose (N of A36 Met Tower)
11	359042	3873186	Upwind Transect Day Wind Rose (N of A36 Met Tower)
12	358993	3873256	Upwind Transect Day Wind Rose (N of A36 Met Tower)
13	358208	3874837	Downwind Transect Night Wind Rose
14	358360	3874665	Downwind Transect Night Wind Rose
15	358472	3874539	Downwind Transect Night Wind Rose
16	358638	3874371	Downwind Transect Night Wind Rose
17	358746	3874255	Downwind Transect Night Wind Rose
18	358955	3874051	Downwind Transect Night Wind Rose
19	359163	3873847	Downwind Transect Night Wind Rose
20	359320	3873694	Downwind Transect Day Wind Rose
21	359422	3873786	Downwind Transect Day Wind Rose
22	359722	3874105	Downwind Transect Day Wind Rose
23	359883	3874276	Downwind Transect Day Wind Rose
24	360058	3874468	Downwind Transect Day Wind Rose
25	360230	3874642	Downwind Transect Day Wind Rose
26	360430	3874855	Downwind Transect Day Wind Rose
27	360772	3873008	Downwind Transect Day Wind Rose
28	360552	3873114	Downwind Transect Day Wind Rose
29	360375	3873189	Downwind Transect Day Wind Rose
30	360197	3873282	Downwind Transect Day Wind Rose
31	360038	3873355	Downwind Transect Day Wind Rose
32	359222	3873485	Downwind Transect Day Wind Rose
33	358979	3872967	Downwind Transect Day Wind Rose
34	358868	3872736	Downwind Transect Day Wind Rose
35	358778	3872537	Downwind Transect Day Wind Rose
36	358709	3872383	Downwind Transect Day Wind Rose
37	358639	3872236	Downwind Transect Day Wind Rose

The results from the laboratory were received, evaluated, tabulated, and summarized. This summary will constitute the baseline information against which any future potential environmental impact from TTC operations can be evaluated. By logging the precise locations from which these samples were collected, any future samples can be collected from essentially the same locations, reducing the potential error that may be attributable to sampling variability due to location.

Results of the soil samples were evaluated using probability plotting, which provided a visual representation of the entire data set for all locations. If the results were similar, or fit a linear distribution when plotted on logarithmic or log-probability scales, then the results were attributable to natural origin. Summary statistics for each element were imbedded in each plot. If any samples indicated concentrations greater than expected from the rest of the sample distribution, further evaluation was conducted to determine possible explanations responsible for the observed result. Table 2 provides various reference values for metals-in-soil. NMED Screening Levels (if available) (ftp://ftp.nmenv.state.nm.us/hwbdocs/HWB/guidance_docs/NMED_June_2006_SSG.pdf, NMED 2006) for Industrial and Residential use are indicated for reference purposes on some of the graphs.

Appendix A contains a detailed description of the mechanics of log-normal plotting.
Appendix B contains the plots of the soil data, sorted alphabetically by analyte name as it appears on the Periodic Table of the Elements (common name is also included in parenthesis). Associated with each plot presented are the summary statistics for each analyte.

Table 2. Various Reference Values for Metals-in-Soil

	NM Soil Concentrations[1]		NMED Industrial/Occupational Soil Screening Levels[2]	US Soil Concentrations[3]	
Analyte	**Lower Limit**	**Upper Limit**		**Lower Limit**	**Upper Limit**
Aluminum	5000	100000	100000	4500	100000
Antimony	0.2	1.3	454	0.25	0.6
Arsenic	2.5	19	17	1	93
Barium	230	1800	100000	20	1500
Beryllium	1	2.3	2250	0.04	2.54
Cadmium	ND	11	564	0.41	0.57
Calcium	600	320000	n/a	n/a	n/a
Chromium	7.6	42	3400	7	1500
Cobalt	2.1	11	20500	3	50
Copper	2.1	30	45400	3	300
Iron	1000	100000	100000	5000	50000
Lead	7.8	21	800	10	70
Magnesium	300	100000	n/a	n/a	n/a
Manganese	30	5000	48400	20	3000
Mercury	0.01	0.06	100000	0.02	1.5
Molybdenum	1	6.5	5680	0.8	3.3
Nickel	2.8	19	22700	5	150
Potassium	1900	63000	n/a	n/a	n/a
Selenium	0.2	0.8	5680	0.1	4
Silica (Silicon)	150000	440000	n/a	24000	368000
Silver	0.5	5	5680	0.2	3.2
Sodium	500	100000	n/a	n/a	n/a
Strontium	88	440	100000	7	1000
Thallium	n/a	n/a	74.9	0.02	2.8
Titanium	910	4000	n/a	20	1000
Vanadium	15	94	1140	0.7	98
Zinc	18	84	100000	13	300

ND = not detectable
n/a = not available
(1) Dragun, James, A. Chiasson, *Elements in North American Soils*, 1991, Hazardous Materials Control Resources Institute, (Used San Juan Basin, A Horizon to determine values).
(2) NMED Soil Screening Levels (SSL), New Mexico Environmental Department Hazardous Waste Bureau and Ground Water Quality Bureau Voluntary Remediation Program, *Technical Background Document for Development of Soil Screening Levels*, Rev. 4.0, NMED 2006
(3) US Soil Surface Concentrations
Kabata-Pendias, A., Pendias, H., CRC, *Trace Elements in Soils and Plants*, 3rd Edition, 2002

Summary

In the summer of 2006, the Environmental Programs and Assurance Department of Sandia National Laboratories in Albuquerque, New Mexico (SNL/NM) collected soil samples at 37 locations within one mile of the vicinity of the newly constructed TTC in Technical Area III. These samples were submitted to an analytical laboratory for metal-in-soil analyses and the results presented herein. These data will provide SNL with a sound baseline data reference set against which to assess potential future operational impacts of the facility. Table 3 below presents summary statistics for the analytes reported.

Table 3. Analyte Summary Statistics for TTC Metals-in-Soil

Analyte	Mean	St Dev	Minimum	Median	Maximum
Aluminum	10053	2335	7390	9610	20100
Antimony	0.69	0.15	0.40	0.73	0.99
Arsenic	2.37	0.51	1.48	2.35	3.78
Barium	77.75	16.32	54.20	74.90	123.00
Beryllium	0.48	0.10	0.35	0.45	0.86
Cadmium	0.19	0.05	0.10	0.19	0.30
Calcium	7375	10277	1180	2820	39100
Chromium	10.66	2.21	7.41	9.85	16.90
Cobalt	3.48	0.75	2.40	3.34	5.32
Copper	7.36	1.65	4.68	6.99	12.30
Iron	11556	1972	8120	11300	17400
Lead	8.47	2.01	5.56	8.24	15.20
Magnesium	2630	722	1710	2450	4600
Manganese	189.62	44.35	134.00	174.00	284.00
Mercury	0.0087	0.0027	0.0036	0.0088	0.0147
Nickel	7.47	1.77	5.00	6.73	12.50
Potassium	2218	574	1360	2060	4590
Silver	0.13	0.21	0.10	0.10	1.40
Sodium	54.14	17.63	34.40	48.30	111.00
Thallium	0.49	0.01	0.48	0.49	0.50
Uranium	0.50	0.13	0.34	0.46	0.92
Vanadium	21.61	3.85	15.00	21.00	31.30
Zinc	29.93	6.24	20.80	28.80	45.20

Appendix A - Data Analysis

The data in this report are presented in the form of log-normal probability plots. Such plots are useful tools for conveniently cataloguing and evaluating large amounts of data, as well as providing a first approximation of the similarity (or differences) of the data. The basis for using log-normal plotting is experience which has shown that large quantities of environmental data (many similar analyte/media combinations) yield a straight line when plotted on a log-probability or logarithmic scale (Miller 1977). The presumption of log-normal distribution is never a bad presumption and is never worse than the presumption of arithmetic-normal (Michels 1971). Because the data are represented graphically, the mean, standard deviation, expected upper limits, and any abnormalities can be readily determined visually (Waite 1975).

Characteristics of special importance in the use of log-normal plots are linearity (denoting data from a common population), standard geometric deviation ($\sigma_{g,}$ an indicator of variability or range), and geometric mean (X_g). The unit of slope in a log-normal plot involves a logarithmic increment. Thus, the standard deviation is a multiplier of the geometric mean (Michels 1971).The values for σ_g and X_g can be obtained from the graphs by the ratio of the 84%/50% intercepts and the 50% intercepts, respectively (Miller 1977). Linearity of the graph implies that any potential SNL/NM contribution to the observed concentration is indistinguishable from regional levels of the element. Anomalous results (i.e., potentially attributable to SNL/NM operations) must necessarily occur at a higher concentration than would be expected from regional distributions. For convenience, summary statistics for each element are imbedded in each plot of the 2006 TTC soils data and the 1993-2005 SNL/NM soils data. Included in this list is the Upper Tolerance Limit (UTL), which is defined as:

$$95^{th}\ UTL = \overline{X} + K*S$$

Where UTL = Upper Tolerance Limit
X = Sample Arithmetic Mean
S = Sample Standard Deviation
K = One-sided normal tolerance factor

Values for K are commonly determined from tables such as those provided by Lieberman (Leiberman 1958). This UTL can be used to estimate a level above which a sample result may not be attributable to naturally occurring "background" levels of the element.

Whenever a particular results appears elevated (on the log-normal plot) compared to the expected concentration based on the population comprised of all the other locations, further investigation to determine a plausible explanation responsible for the observed phenomenon may include (but should not be limited to) the following:

- What is the geographical location of the sample? Is there a detectable pattern to the anomalous observation or is the sample from an area in close proximity to a facility which has the potential for release of the analyte or contaminant?
- Does the location of the sample(s) show elevated levels for other analytes?
- If several locations appear to be elevated, what might be a plausible explanation? How did these compare to other "site results"?

As can be observed in many of the graphs, data at the lower end of the range frequently "fall off" in a manner that suggests that these results do not belong in the distribution being plotted, or are otherwise anomalous. However, in almost all instances, these results represent reported values that were at the extreme lower limit of the analytical method employed at the time of analysis. This is not atypical, since the plotted values do not include the analytical uncertainty or method detection level (MDL) for a given result. Also, the MDL changes (frequently becomes better) over time as the state-of-the-art for analytical science improves, and the aggregated data may include data that actually have a range of MDLs, which only becomes noteworthy if the given analyte's concentration is near the MDL. In several of the plots, many of the same reported values appear as a "flat line". These values are typically the "less than" values (sometimes coded as "U" or not detected) reported by the laboratory when the analyte was not otherwise detected.

Appendix B contains the plots of the soil data, sorted alphabetically by analyte name as they appear in the Periodic Table of the Elements. Any noteworthy anomalies in the plots are discussed by notes within the given plot. Associated with each plot presented in Appendix B are the summary statistics and (for reference) NMED Screening Levels for each analyte.

Useful tips for interpreting the graphs

- Consider the data in each graph as the entire "population" under consideration. Outliers or anomalies are the primary items that may require further investigation.
- The X-axis (Percent) is the indicator of the "spread" of the data. For example, the 80^{th} percent value in the Aluminum graph is 11,300 mg/kg. This means that 80 percent of the data "population" have values below 11,300 and 20 percent of the data "population" have values greater than 11,300.
- The NMED Screening Values indicated on the graphs are for reference only. They have no direct regulatory significance.
- Notice the "stair step" appearance in the Cadmium and Mercury (and some other) graphs of SNL/NM Soils from 1993-2005. This is typical of data that is collected over a period of many years. The explanation is typically that the "plateau values" are from earlier times when the laboratory's analytical capabilities (their MDLs) were higher than more recent, better analytical capabilities. The lab typically reported these as "less than" values, and they were logged as such.
- The Lognormal – 95% CI blue lines are the statistical 95% confidence intervals for the data population in the graphs.

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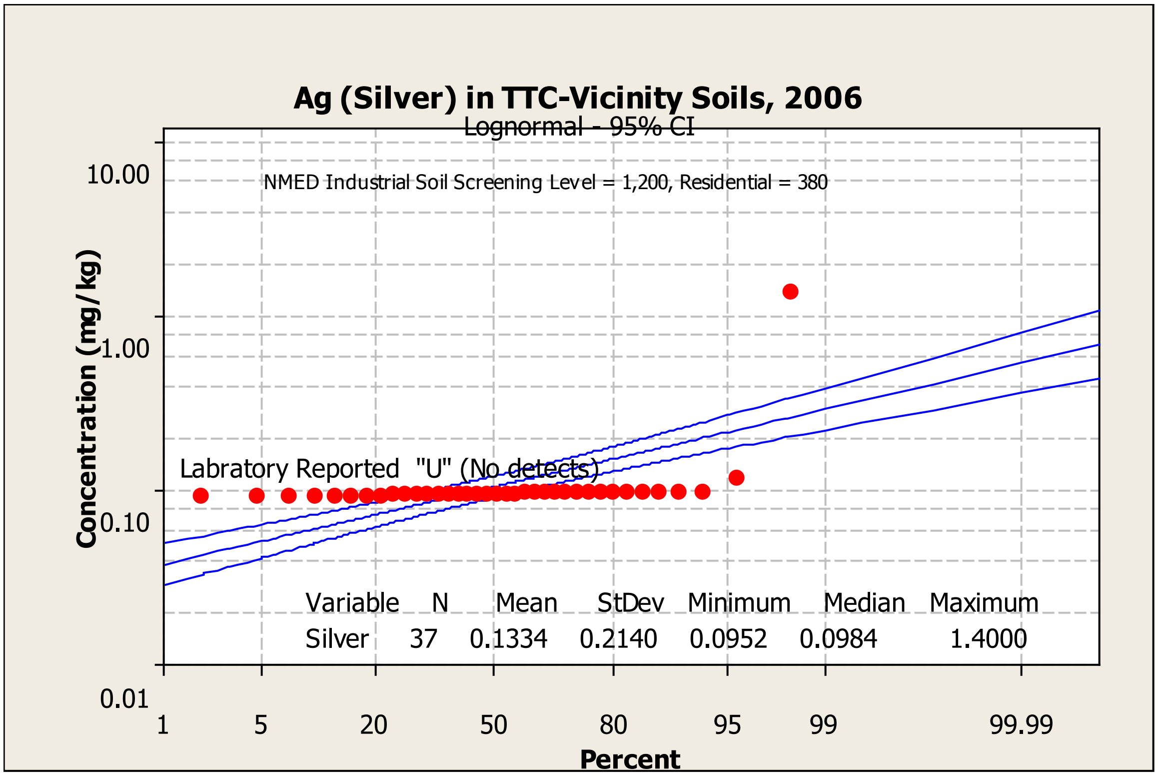
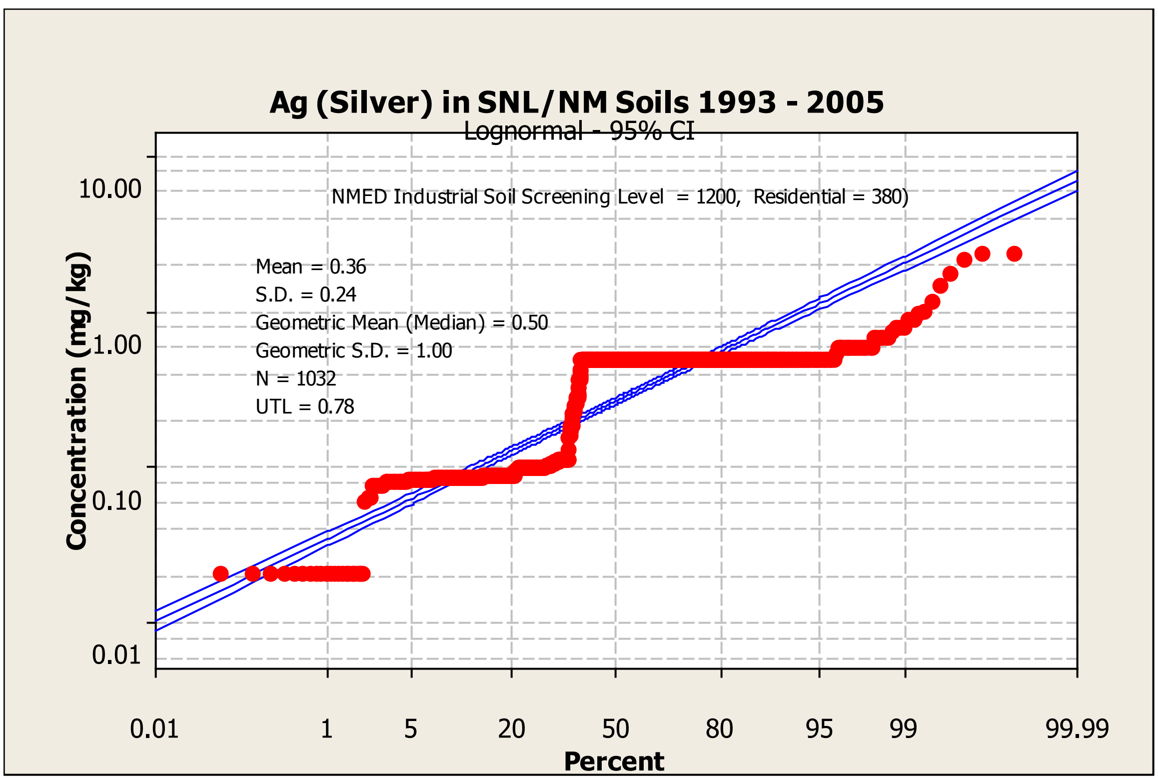
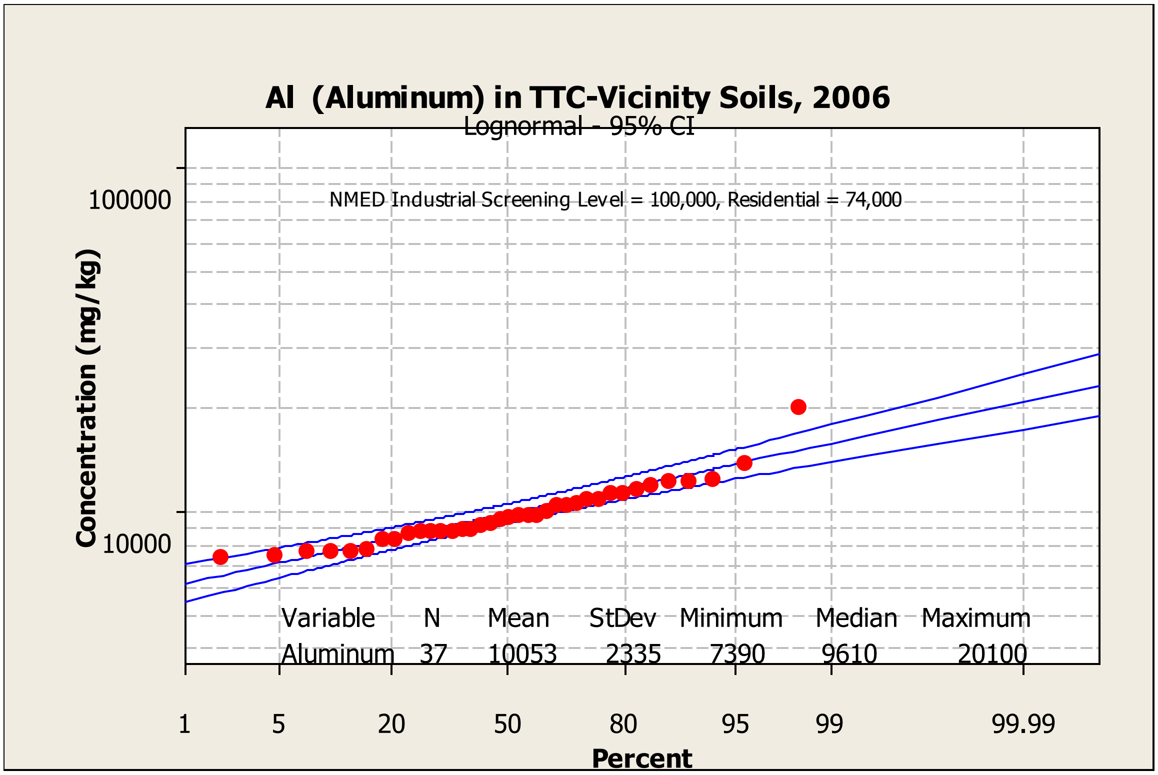
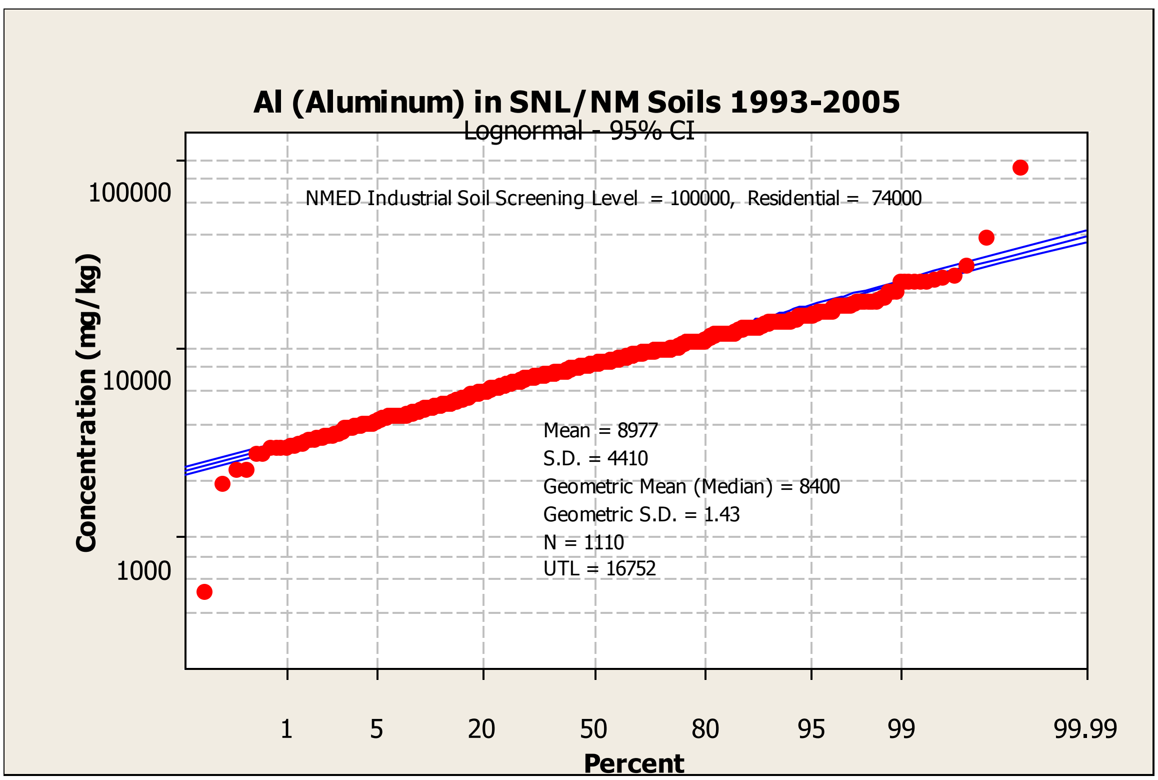


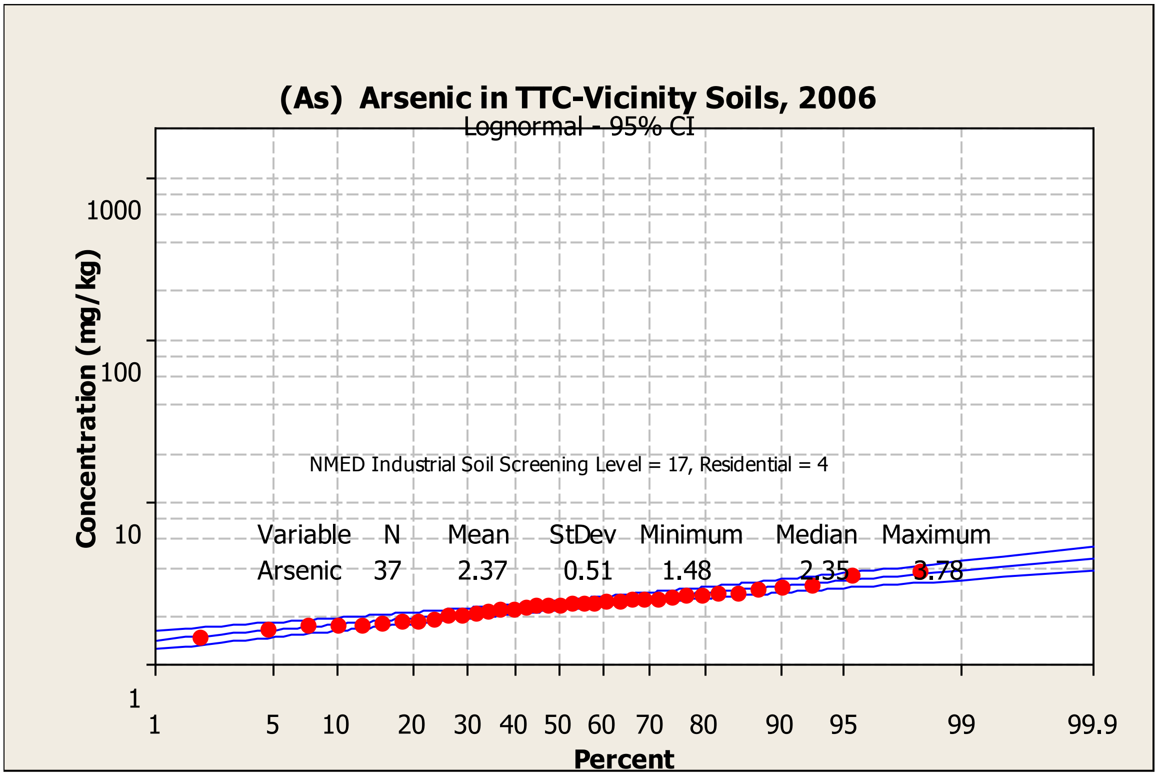
Ag (Silver) in TTC-Vicinity Soils, 2006
Lognormal - 95% CI
NMED Industrial Soil Screening Level = 1,200, Residential = 380
Labratory Reported "U" (No detects)
Variable N Mean StDev Minimum Median Maximum
Silver 37 0.1334 0.2140 0.0952 0.0984 1.4000
Concentration (mg/kg)
10.00
1.00
0.10
0.01
1
5
20
50
80
95
99
99.99
Percent

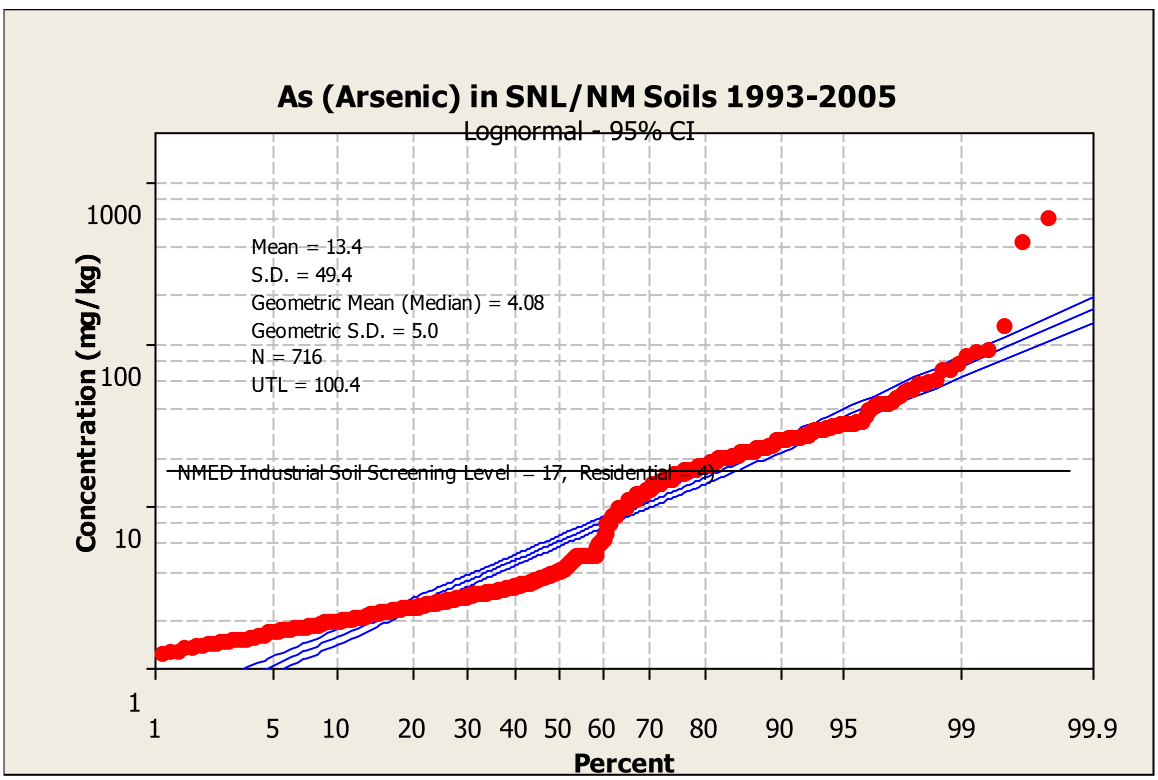


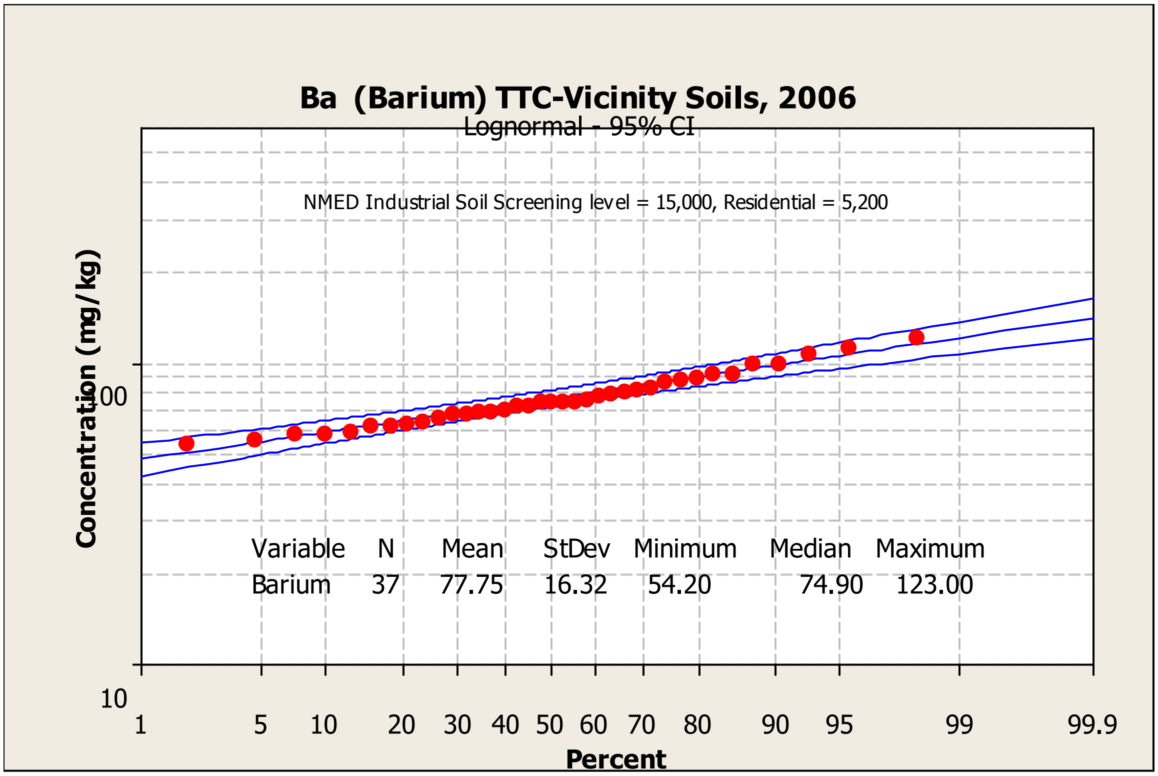
Ag (Silver) in SNL/NM Soils 1993 - 2005
Lognormal - 95% CI
NMED Industrial Soil Screening Level = 1200, Residential = 380)
Mean = 0.36
S.D. = 0.24
Geometric Mean (Median) = 0.50
Geometric S.D. = 1.00
N = 1032
UTL = 0.78
Concentration (mg/kg)
10.00
1.00
0.10
0.01
0.01
1
5
20
50
80
95
99
99.99
Percent

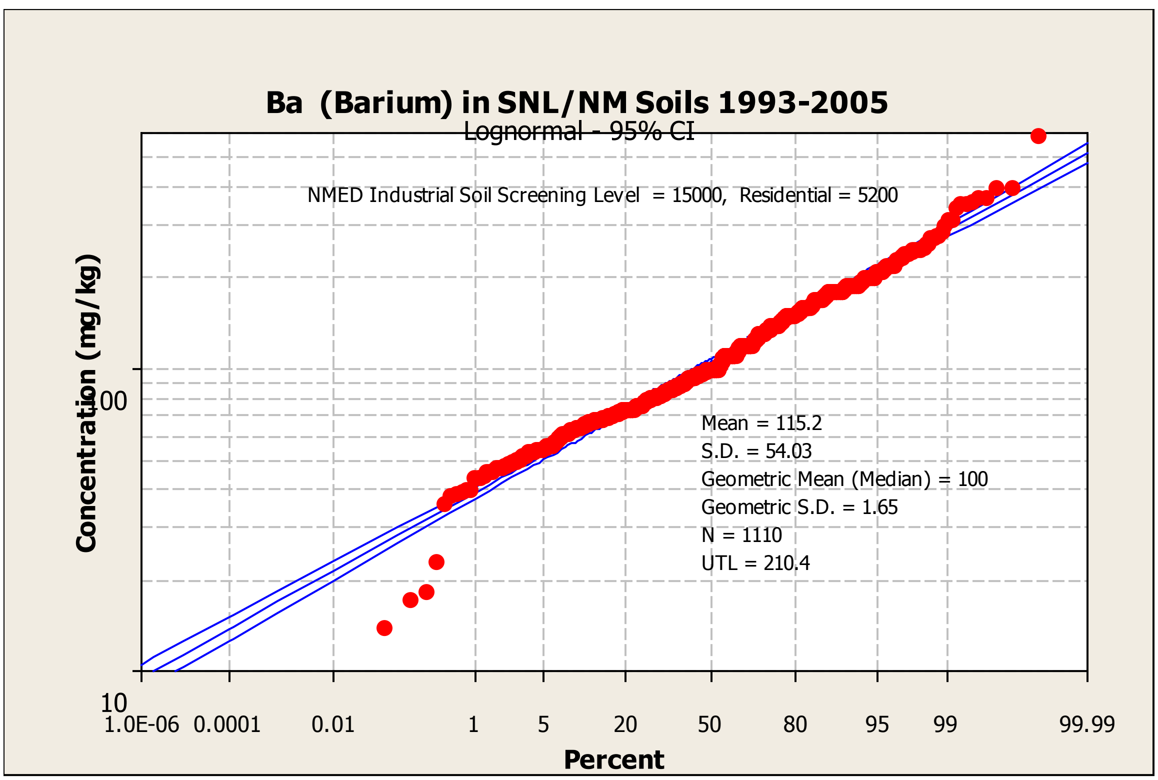

Al (Aluminum) in TTC-Vicinity Soils, 2006
Lognormal - 95% CI
NMED Industrial Screening Level = 100,000, Residential = 74,000
Concentration (mg/kg)
100000
10000
Variable N Mean StDev Minimum Median Maximum
Aluminum 37 10053 2335 7390 9610 20100
1
5
20
50
80
95
99
99.99
Percent

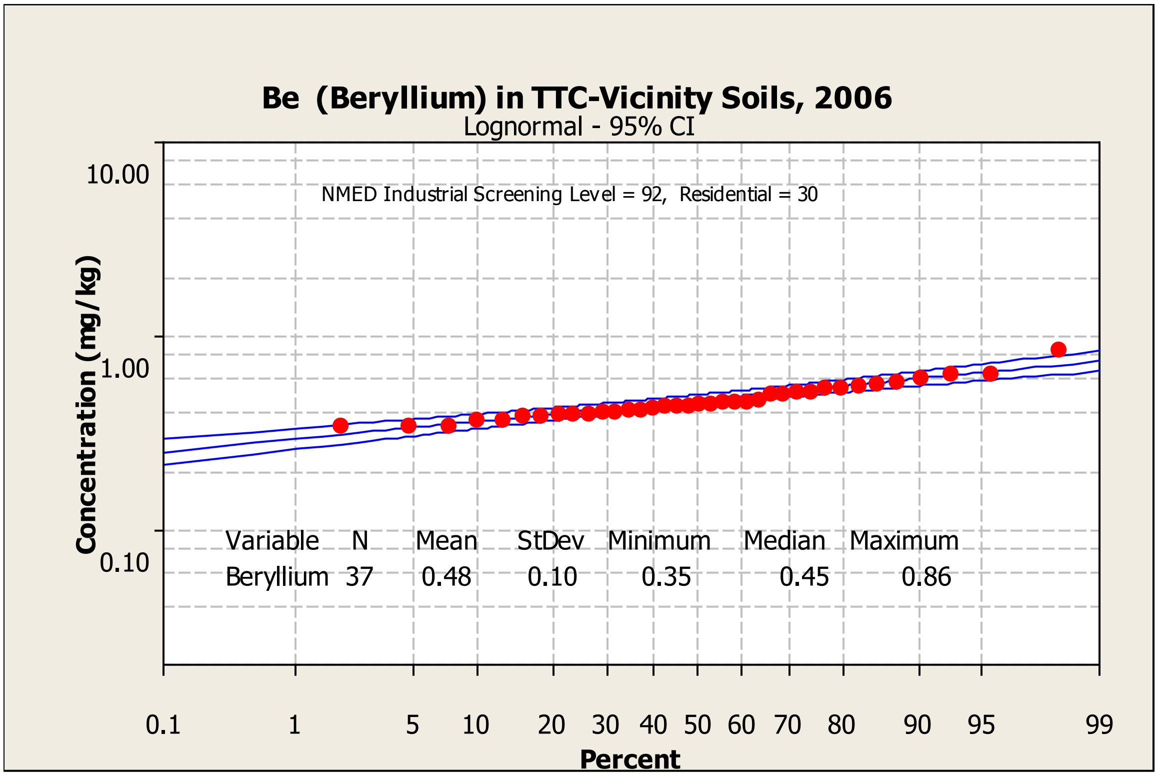

Al (Aluminum) in SNL/NM Soils 1993-2005
Lognormal - 95% CI
NMED Industrial Soil Screening Level = 100000, Residential = 74000
Concentration (mg/kg)
100000
10000
1000
Mean = 8977
S.D. = 4410
Geometric Mean (Median) = 8400
Geometric S.D. = 1.43
N = 1110
UTL = 16752
1
5
20
50
80
95
99
99.99
Percent

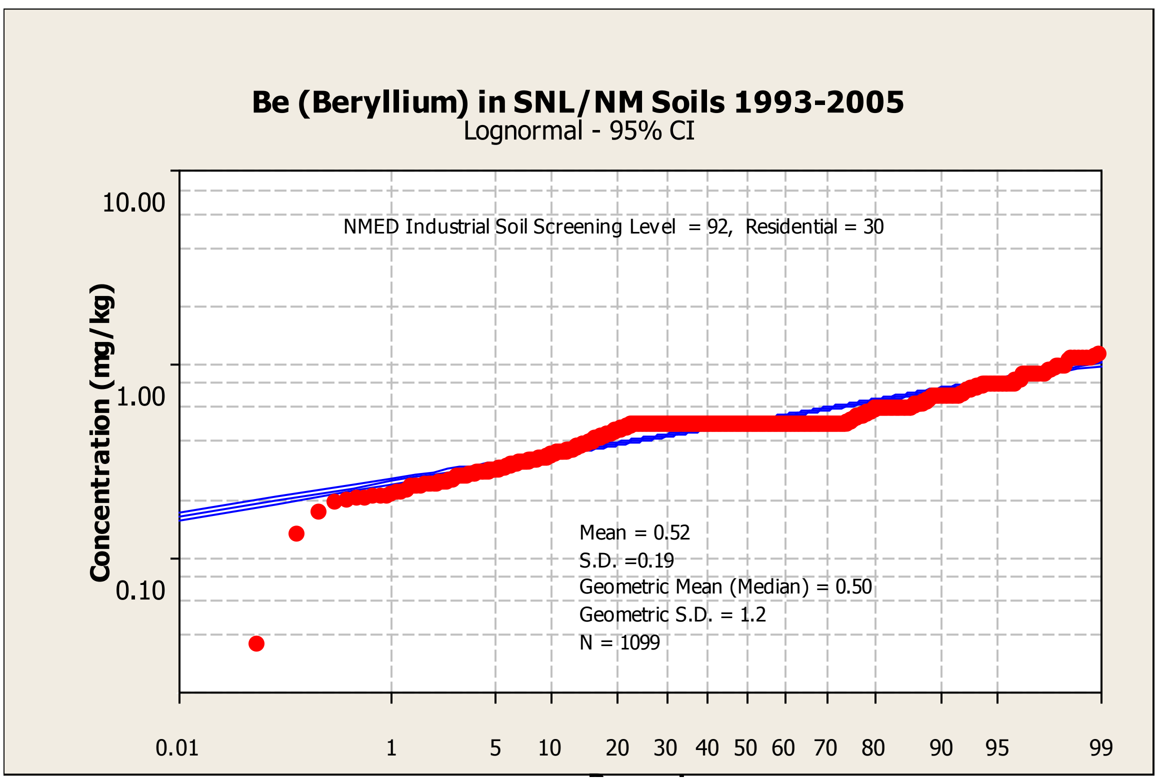

(As) Arsenic in TTC-Vicinity Soils, 2006
Lognormal - 95% CI
Concentration (mg/kg)
1
10
100
1000
NMED Industrial Soil Screening Level = 17, Residential = 4
Variable N Mean StDev Minimum Median Maximum
Arsenic 37 2.37 0.51 1.48 2.35 3.78
1
5
10
20
30
40
50
60
70
80
90
95
99
99.9
Percent

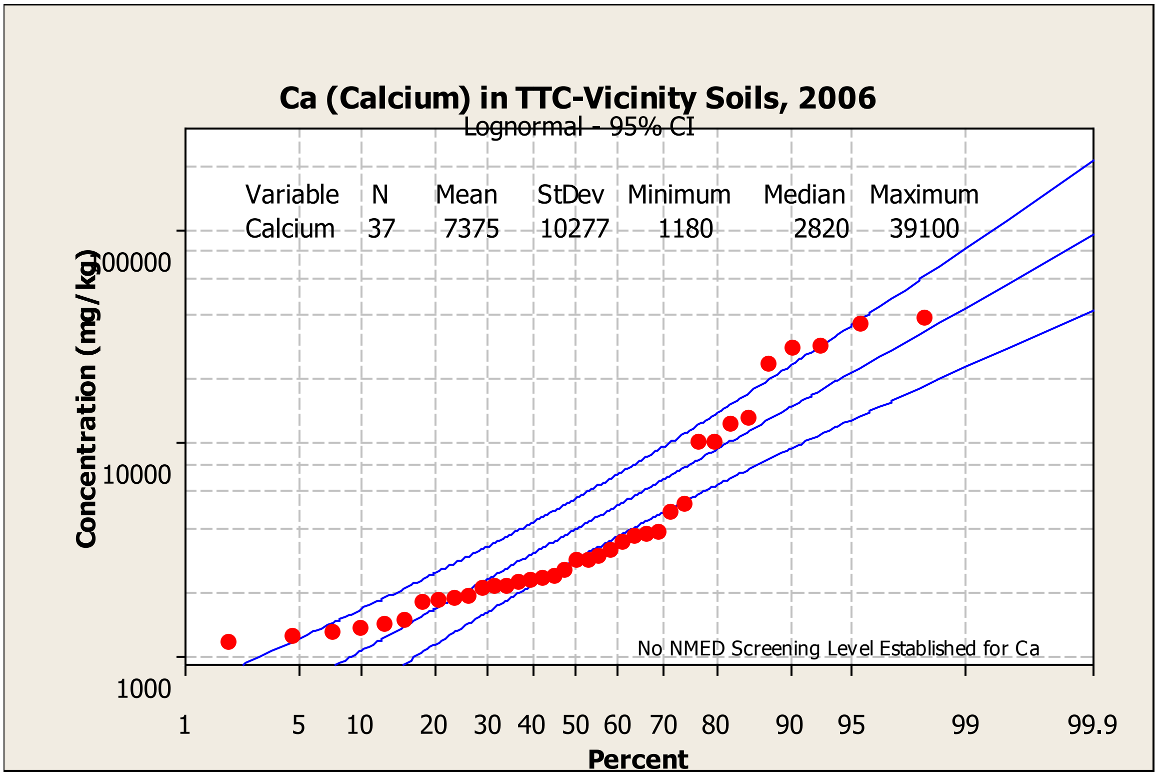

As (Arsenic) in SNL/NM Soils 1993-2005
Lognormal - 95% CI
Concentration (mg/kg)
1
10
100
1000
Mean = 13.4
S.D. = 49.4
Geometric Mean (Median) = 4.08
Geometric S.D. = 5.0
N = 716
UTL = 100.4
NMED Industrial Soil Screening Level = 17, Residential = 4)
1
5
10
20
30
40
50
60
70
80
90
95
99
99.9
Percent

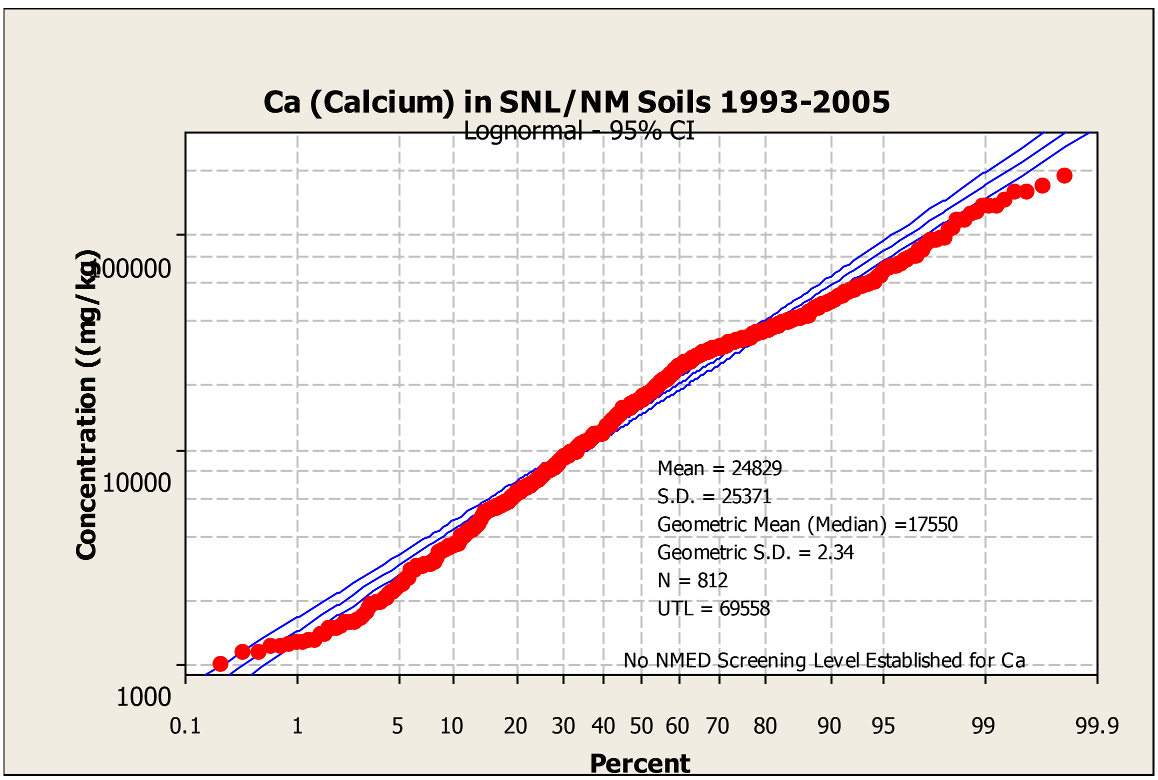

Ba (Barium) TTC-Vicinity Soils, 2006
Lognormal - 95% CI
NMED Industrial Soil Screening level = 15,000, Residential = 5,200
Concentration (mg/kg)
100
10
Variable N Mean StDev Minimum Median Maximum
Barium 37 77.75 16.32 54.20 74.90 123.00
1
5
10
20
30
40
50
60
70
80
90
95
99
99.9
Percent

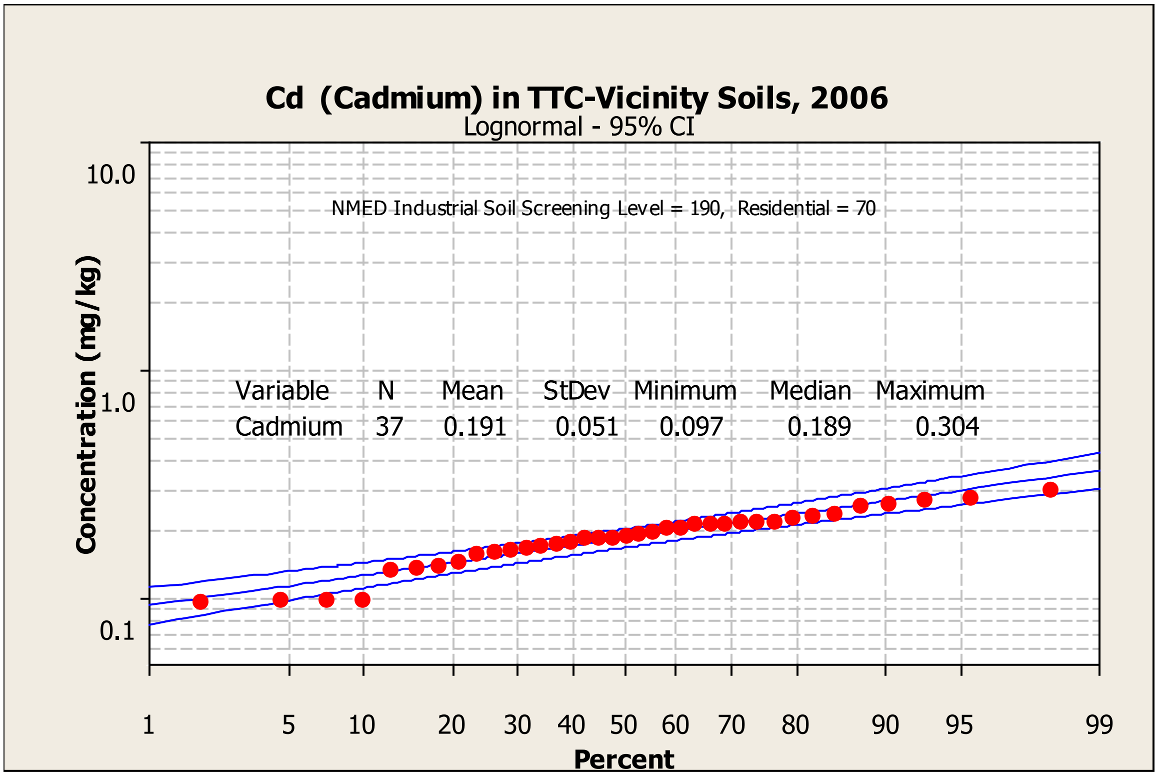

Ba (Barium) in SNL/NM Soils 1993-2005
Lognormal - 95% CI
NMED Industrial Soil Screening Level = 15000, Residential = 5200
Concentration (mg/kg)
100
10
Mean = 115.2
S.D. = 54.03
Geometric Mean (Median) = 100
Geometric S.D. = 1.65
N = 1110
UTL = 210.4
1.0E-06
0.0001
0.01
1
5
20
50
80
95
99
99.99
Percent

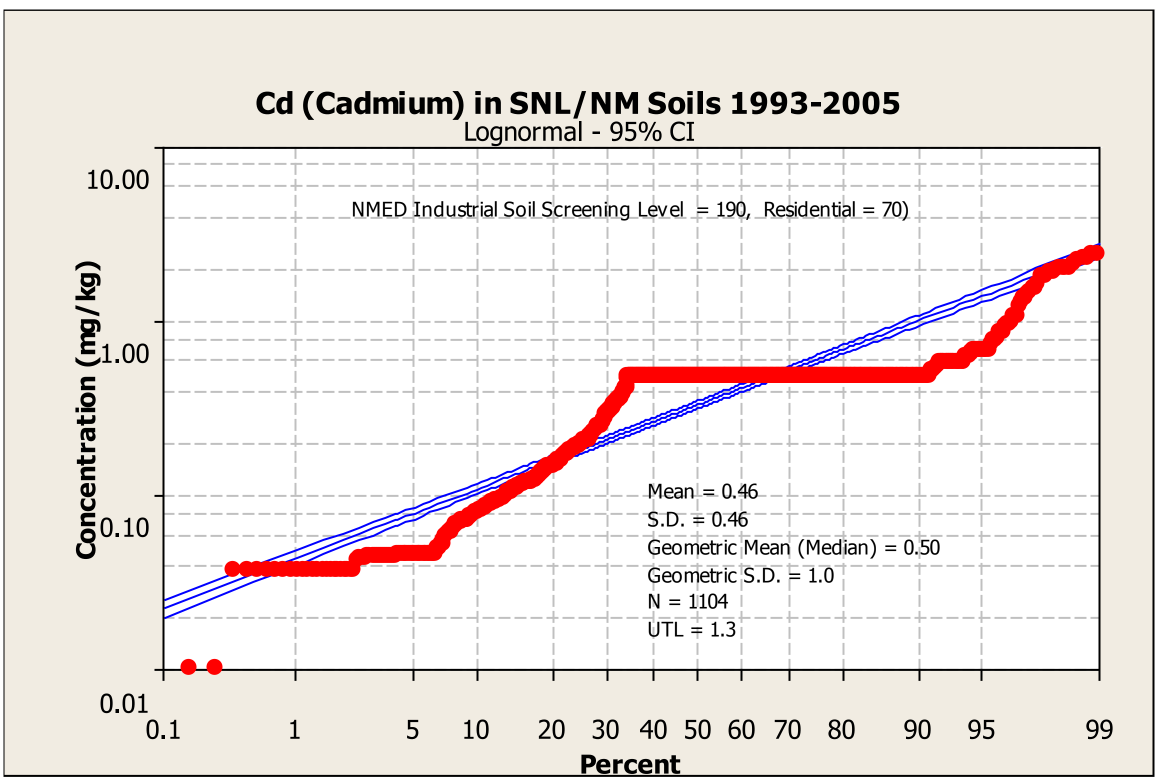

Be (Beryllium) in TTC-Vicinity Soils, 2006
Lognormal - 95% CI
NMED Industrial Screening Level = 92, Residential = 30
Concentration (mg/kg)
10.00
1.00
0.10
Variable N Mean StDev Minimum Median Maximum
Beryllium 37 0.48 0.10 0.35 0.45 0.86
0.1
1
5
10
20
30
40
50
60
70
80
90
95
99
Percent

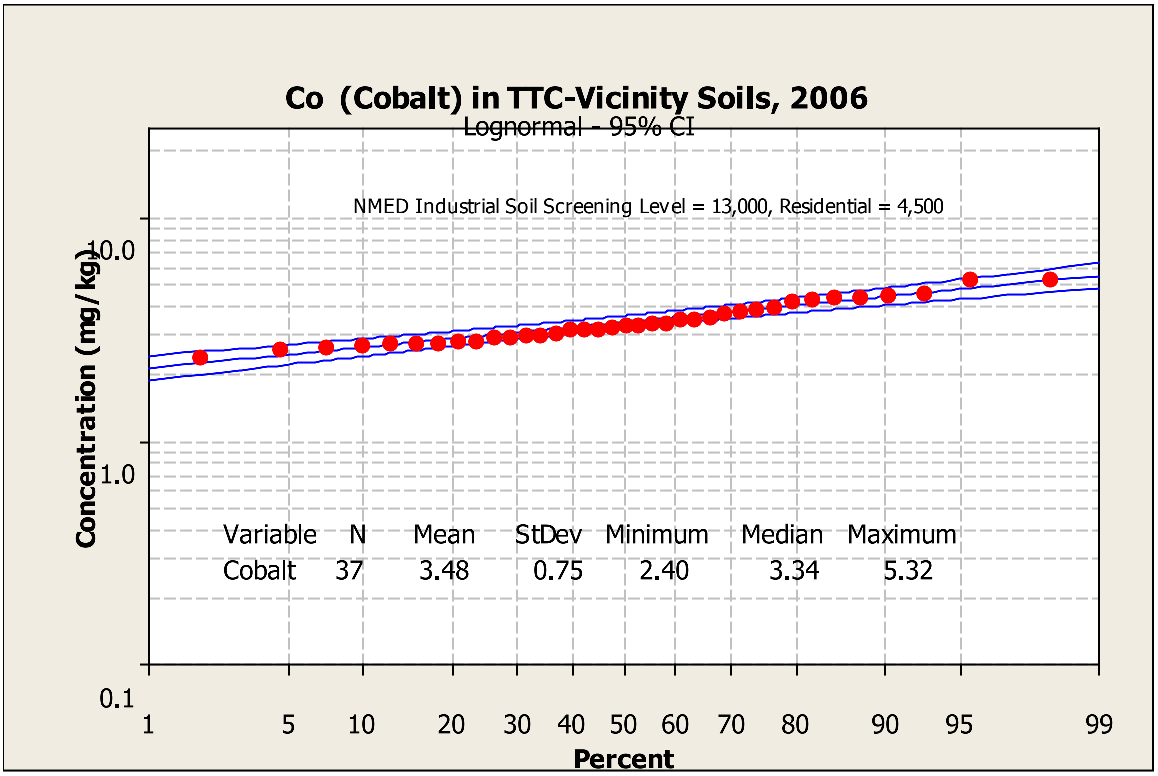

Be (Beryllium) in SNL/NM Soils 1993-2005
Lognormal - 95% CI
NMED Industrial Soil Screening Level = 92, Residential = 30
Concentration (mg/kg)
10.00
1.00
0.10
Mean = 0.52
S.D. =0.19
Geometric Mean (Median) = 0.50
Geometric S.D. = 1.2
N = 1099
0.01
1
5
10
20
30
40
50
60
70
80
90
95
99

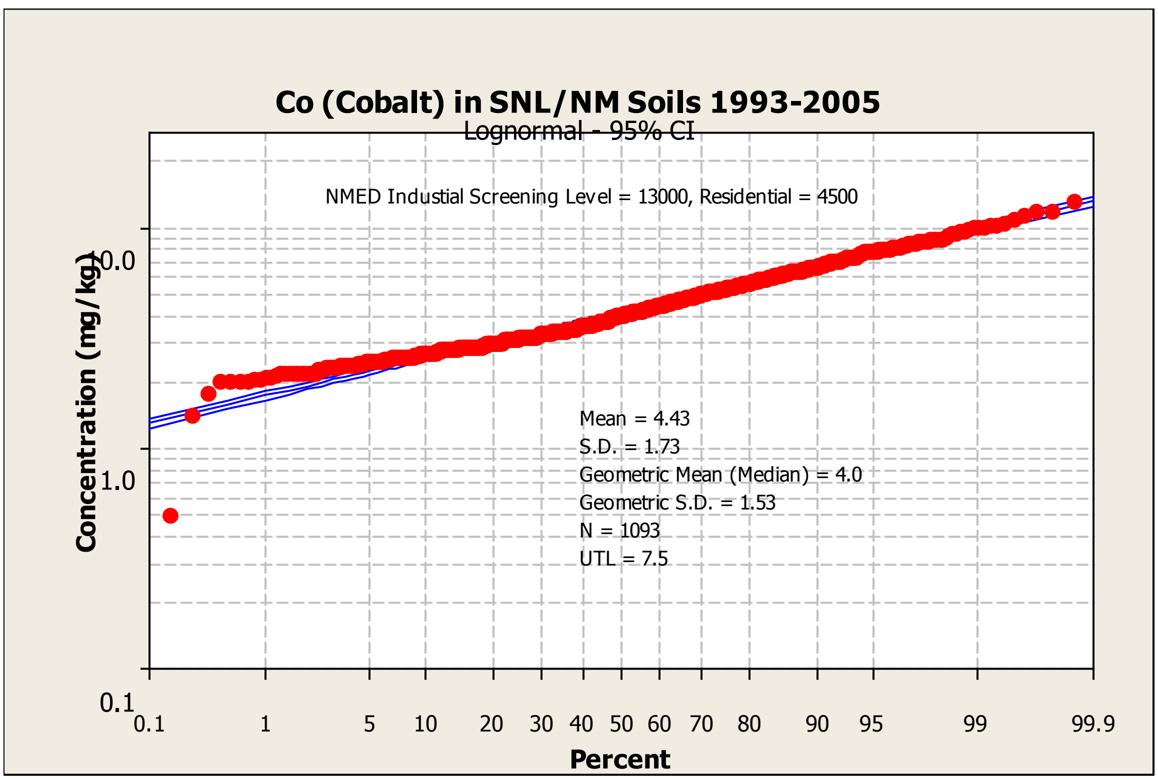

Ca (Calcium) in TTC-Vicinity Soils, 2006
Lognormal - 95% CI
Variable N Mean StDev Minimum Median Maximum
Calcium 37 7375 10277 1180 2820 39100
Concentration (mg/kg)
100000
10000
1000
No NMED Screening Level Established for Ca
1 5 10 20 30 40 50 60 70 80 90 95 99 99.9
Percent

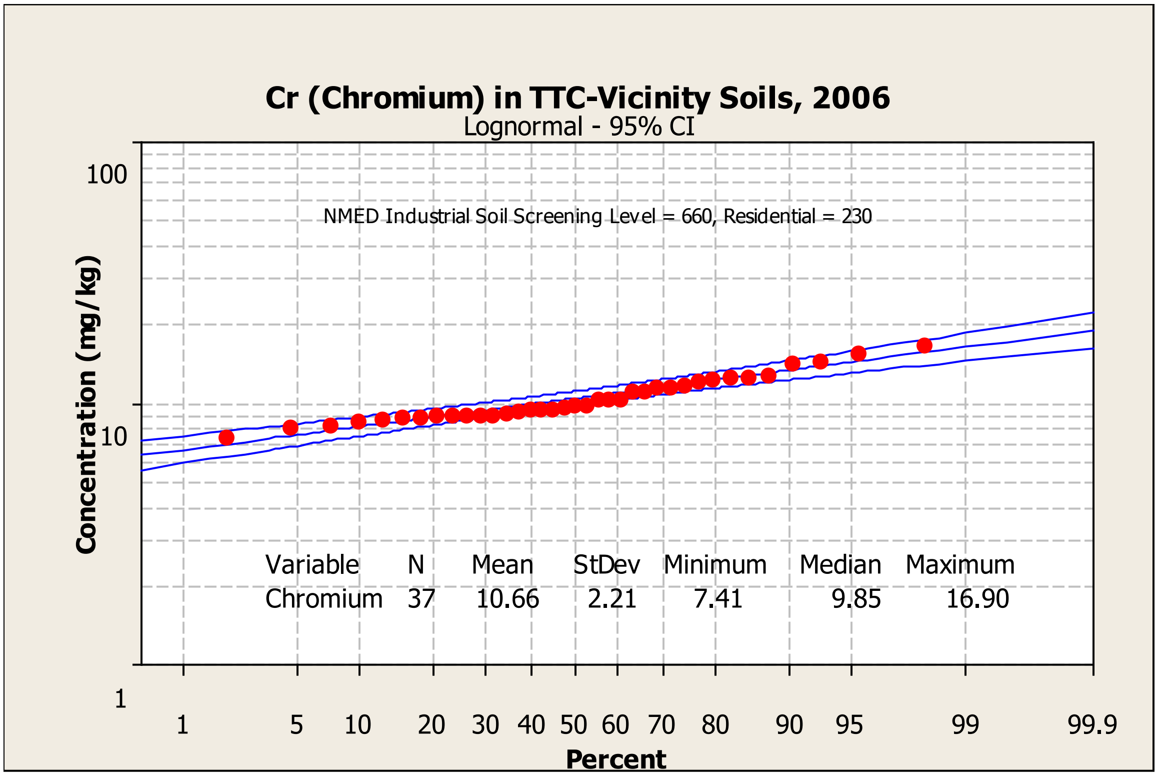

Ca (Calcium) in SNL/NM Soils 1993-2005
Lognormal - 95% CI
Concentration ((mg/kg)
100000
10000
1000
Mean = 24829
S.D. = 25371
Geometric Mean (Median) =17550
Geometric S.D. = 2.34
N = 812
UTL = 69558
No NMED Screening Level Established for Ca
0.1 1 5 10 20 30 40 50 60 70 80 90 95 99 99.9
Percent

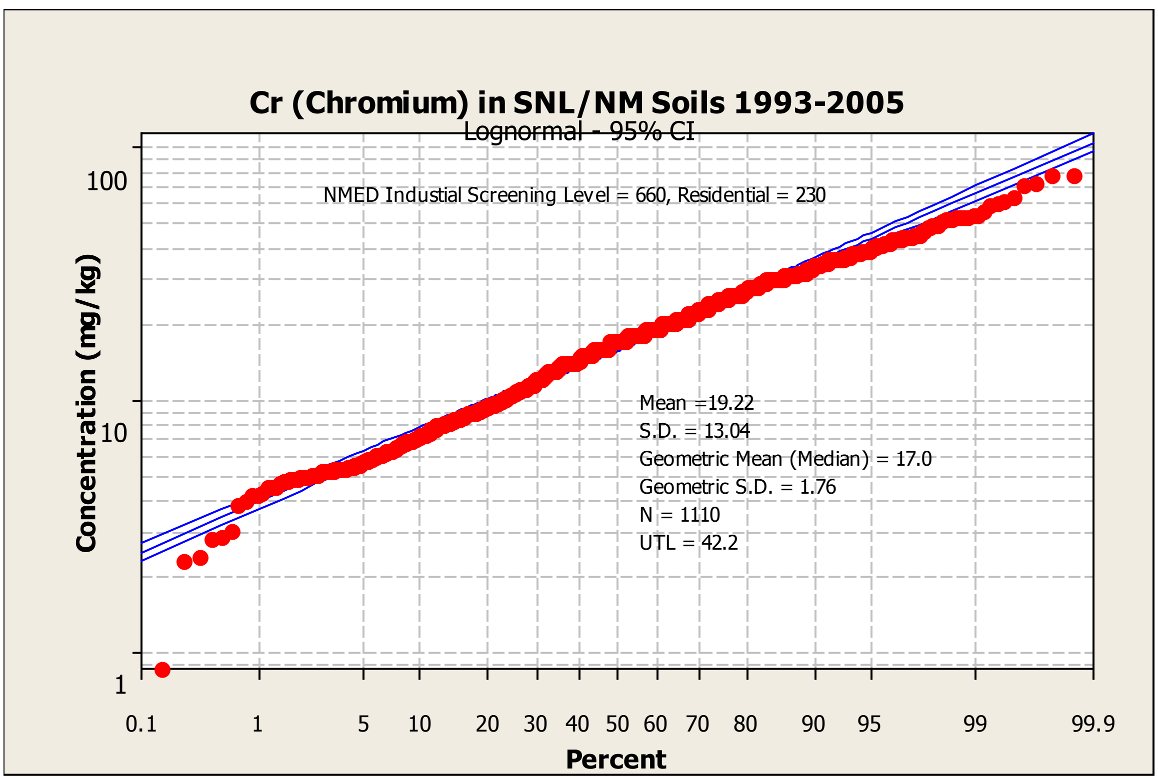

Cd (Cadmium) in TTC-Vicinity Soils, 2006
Lognormal - 95% CI
Concentration (mg/kg)
10.0
1.0
0.1
NMED Industrial Soil Screening Level = 190, Residential = 70
Variable N Mean StDev Minimum Median Maximum
Cadmium 37 0.191 0.051 0.097 0.189 0.304
1 5 10 20 30 40 50 60 70 80 90 95 99
Percent

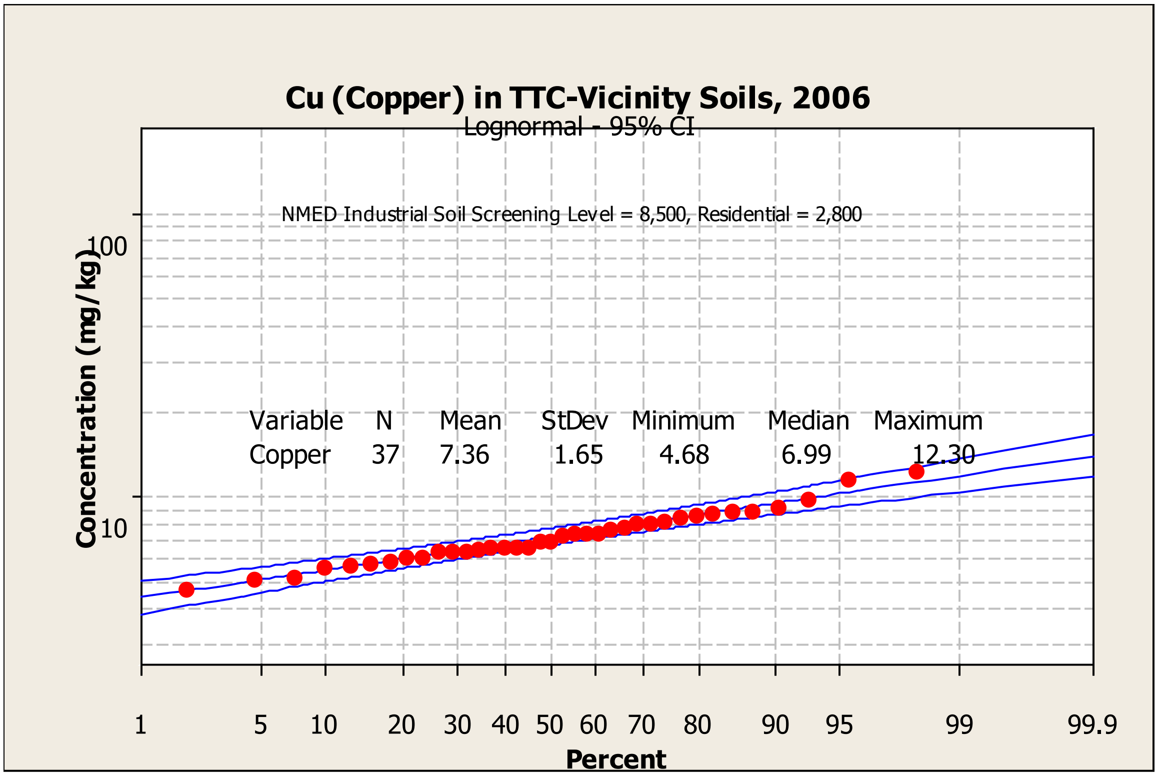

Cd (Cadmium) in SNL/NM Soils 1993-2005
Lognormal - 95% CI
Concentration (mg/kg)
10.00
1.00
0.10
0.01
NMED Industrial Soil Screening Level = 190, Residential = 70)
Mean = 0.46
S.D. = 0.46
Geometric Mean (Median) = 0.50
Geometric S.D. = 1.0
N = 1104
UTL = 1.3
0.1 1 5 10 20 30 40 50 60 70 80 90 95 99
Percent

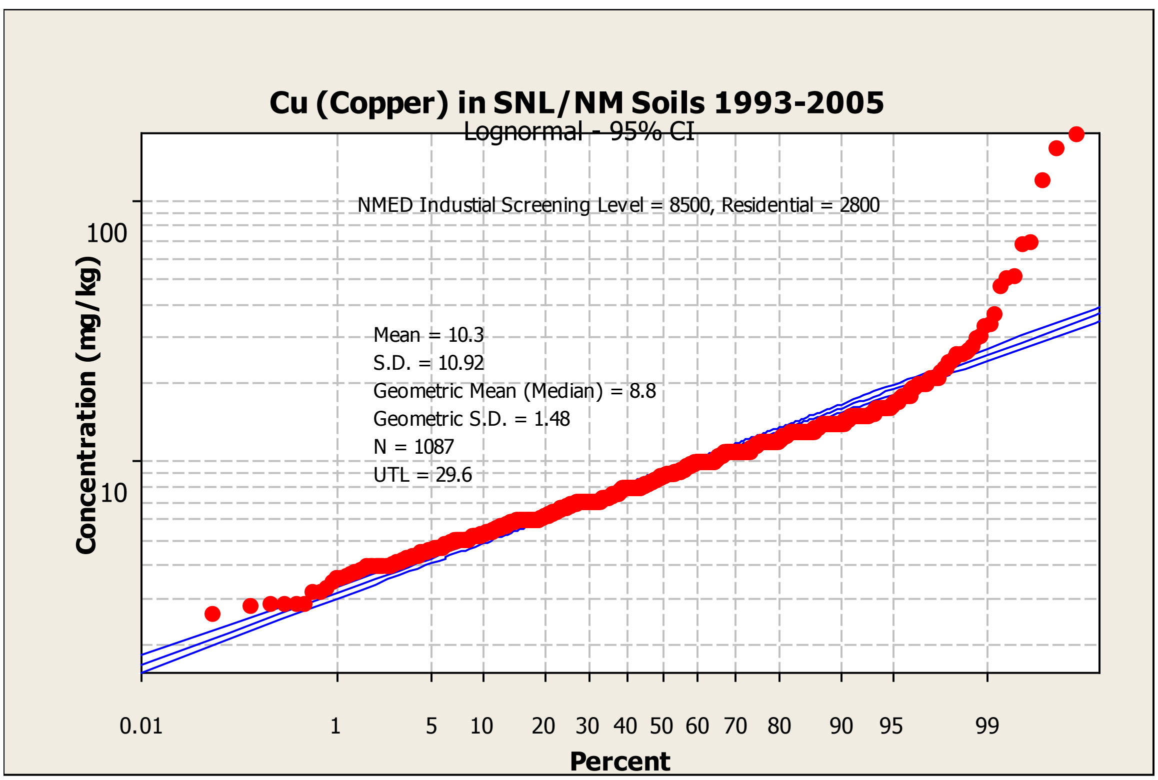

Co (Cobalt) in TTC-Vicinity Soils, 2006
Lognormal - 95% CI
NMED Industrial Soil Screening Level = 13,000, Residential = 4,500
Concentration (mg/kg)
10.0
1.0
0.1
Variable N Mean StDev Minimum Median Maximum
Cobalt 37 3.48 0.75 2.40 3.34 5.32
1 5 10 20 30 40 50 60 70 80 90 95 99
Percent

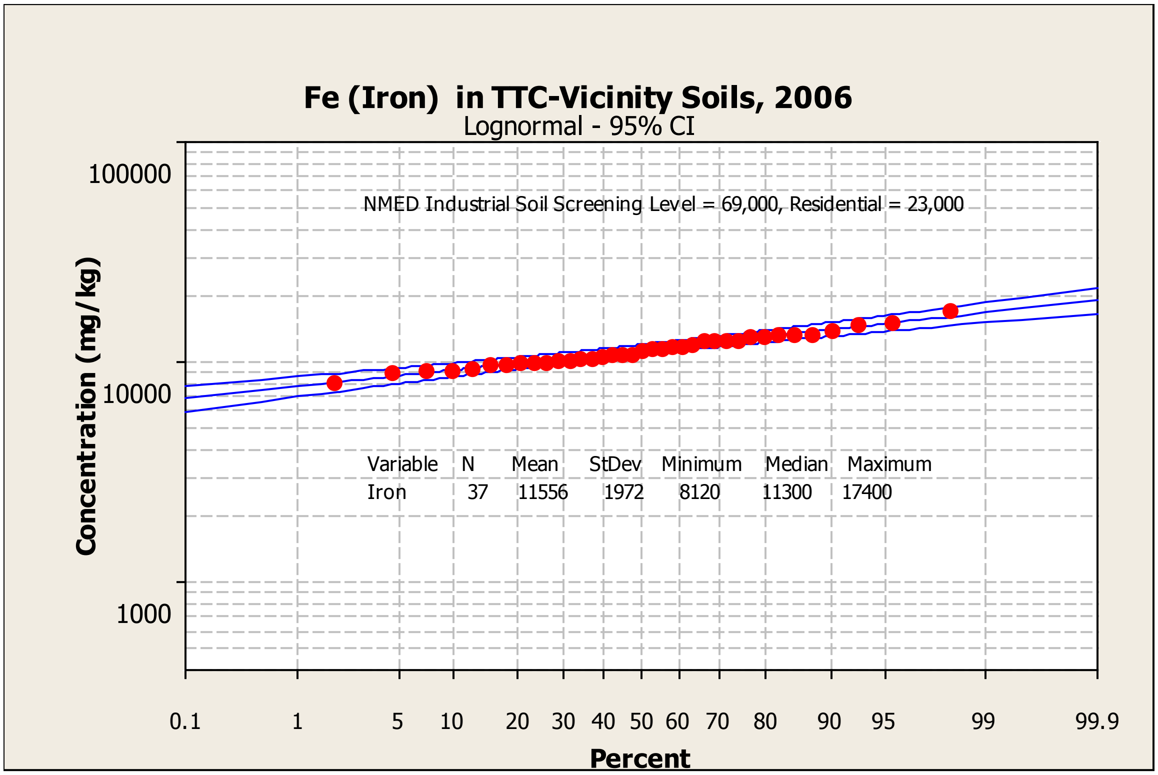

Co (Cobalt) in SNL/NM Soils 1993-2005
Lognormal - 95% CI
NMED Industial Screening Level = 13000, Residential = 4500
Concentration (mg/kg)
10.0
1.0
0.1
Mean = 4.43
S.D. = 1.73
Geometric Mean (Median) = 4.0
Geometric S.D. = 1.53
N = 1093
UTL = 7.5
0.1 1 5 10 20 30 40 50 60 70 80 90 95 99 99.9
Percent

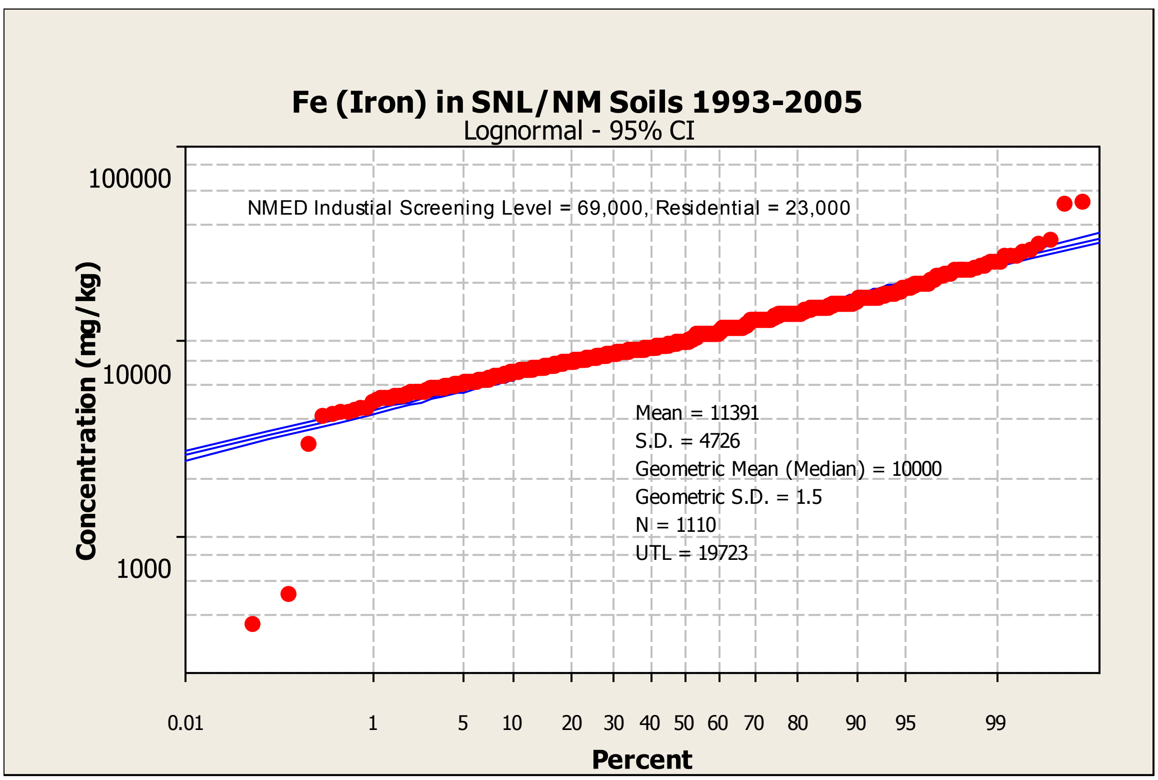

Cr (Chromium) in TTC-Vicinity Soils, 2006
Lognormal - 95% CI
NMED Industrial Soil Screening Level = 660, Residential = 230
Concentration (mg/kg)
100
10
1
Variable N Mean StDev Minimum Median Maximum
Chromium 37 10.66 2.21 7.41 9.85 16.90
1 5 10 20 30 40 50 60 70 80 90 95 99 99.9
Percent

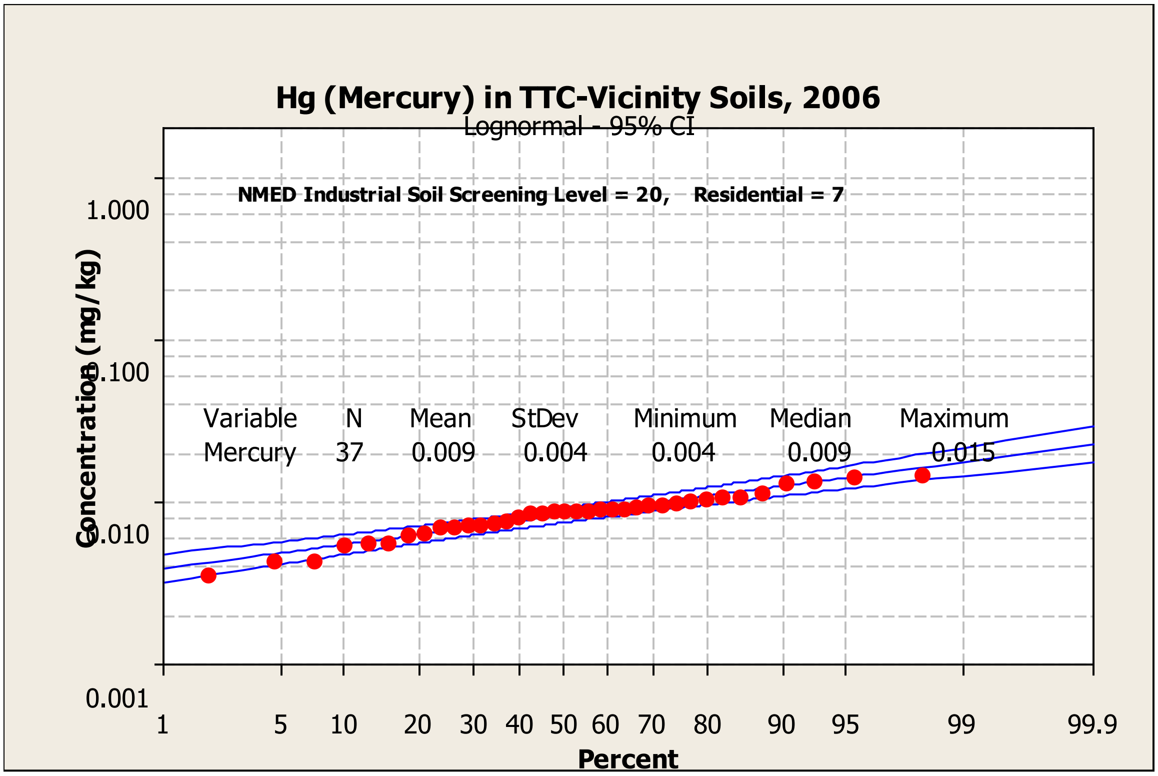

Cr (Chromium) in SNL/NM Soils 1993-2005
Lognormal - 95% CI
NMED Industial Screening Level = 660, Residential = 230
Concentration (mg/kg)
100
10
1
Mean =19.22
S.D. = 13.04
Geometric Mean (Median) = 17.0
Geometric S.D. = 1.76
N = 1110
UTL = 42.2
0.1 1 5 10 20 30 40 50 60 70 80 90 95 99 99.9
Percent

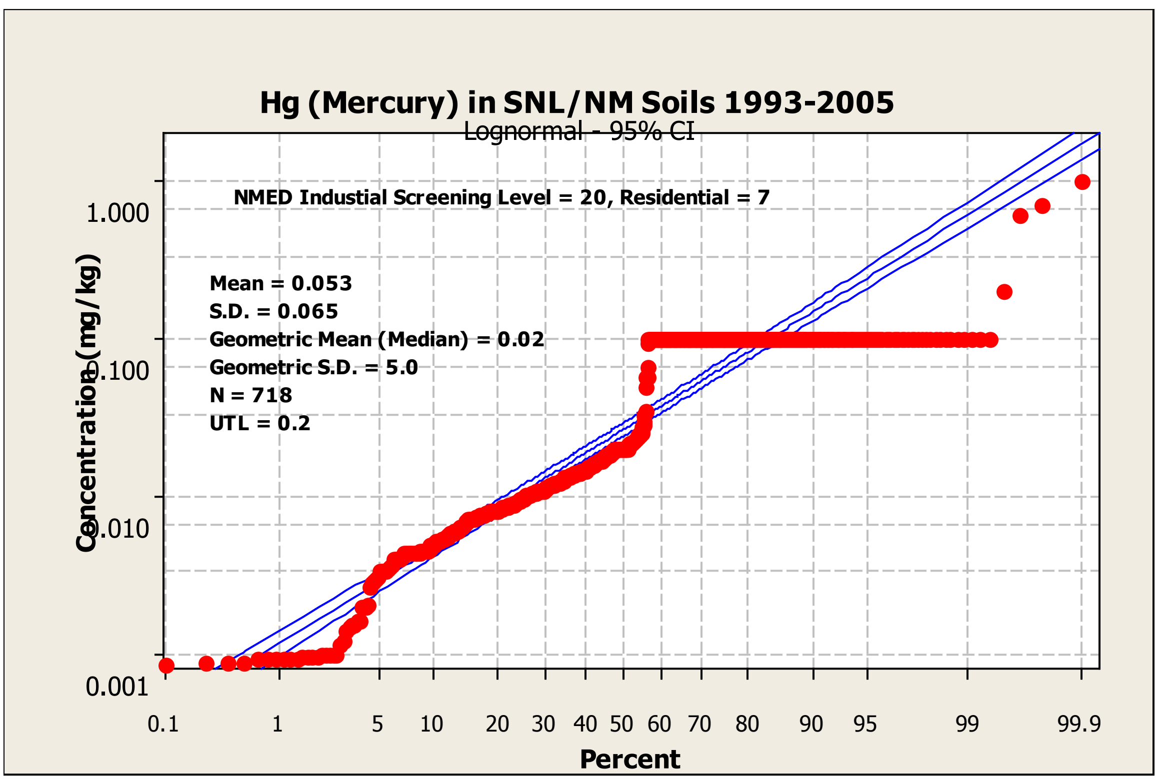

Cu (Copper) in TTC-Vicinity Soils, 2006
Lognormal - 95% CI
NMED Industrial Soil Screening Level = 8,500, Residential = 2,800
Variable N Mean StDev Minimum Median Maximum
Copper 37 7.36 1.65 4.68 6.99 12.30
Concentration (mg/kg)
100
10
1 5 10 20 30 40 50 60 70 80 90 95 99 99.9
Percent

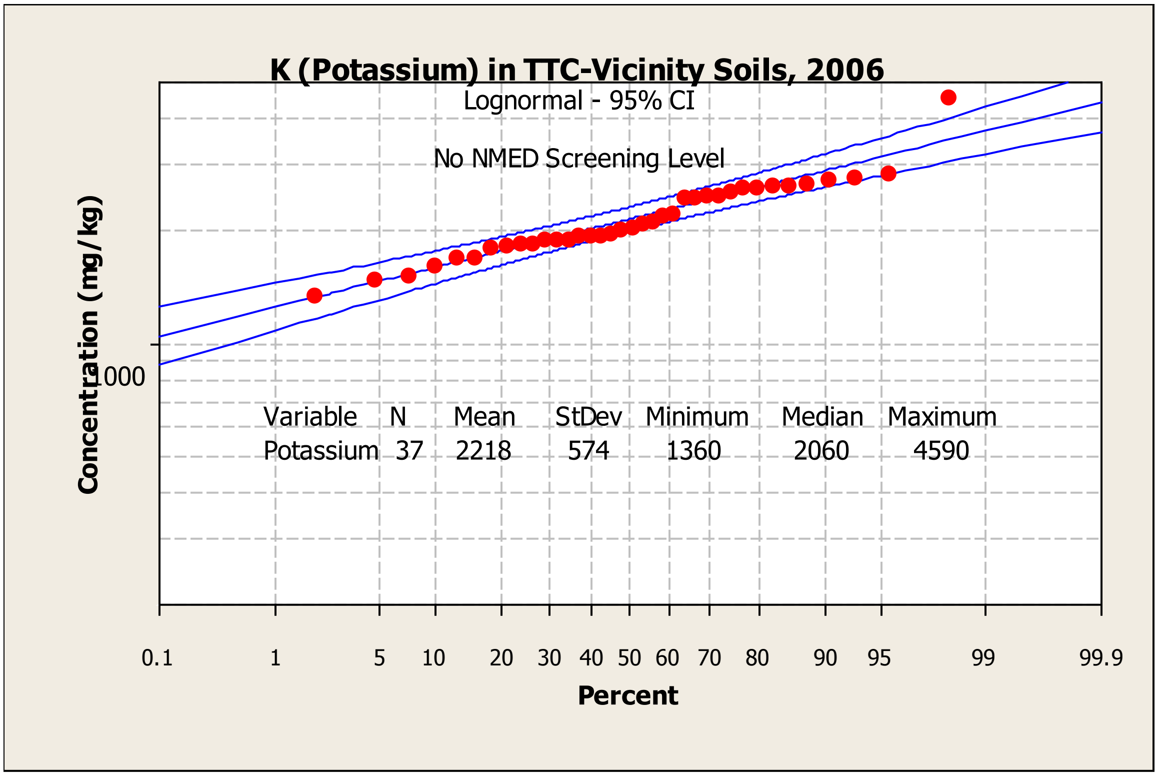

Cu (Copper) in SNL/NM Soils 1993-2005
Lognormal - 95% CI
NMED Industial Screening Level = 8500, Residential = 2800
Mean = 10.3
S.D. = 10.92
Geometric Mean (Median) = 8.8
Geometric S.D. = 1.48
N = 1087
UTL = 29.6
Concentration (mg/kg)
100
10
0.01 1 5 10 20 30 40 50 60 70 80 90 95 99
Percent


Fe (Iron) in TTC-Vicinity Soils, 2006
Lognormal - 95% CI
NMED Industrial Soil Screening Level = 69,000, Residential = 23,000
Variable N Mean StDev Minimum Median Maximum
Iron 37 11556 1972 8120 11300 17400
Concentration (mg/kg)
100000
10000
1000
0.1
1
5
10
20
30
40
50
60
70
80
90
95
99
99.9
Percent

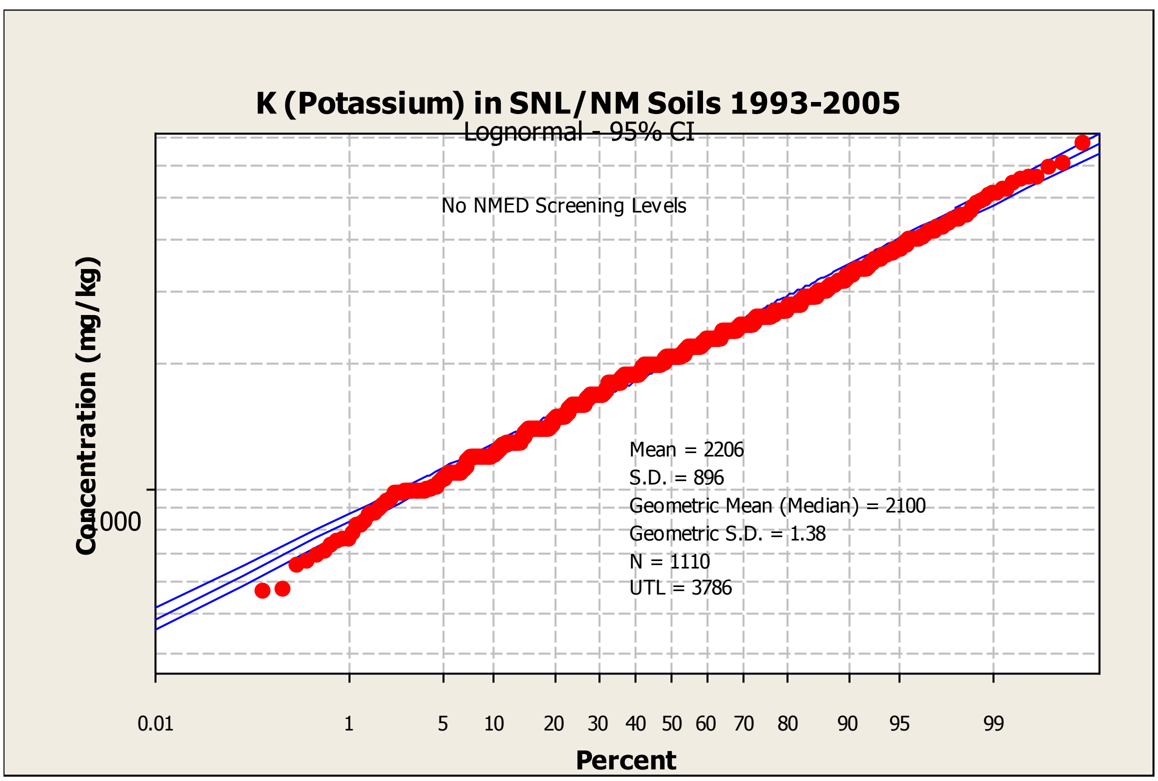

Fe (Iron) in SNL/NM Soils 1993-2005
Lognormal - 95% CI
NMED Industial Screening Level = 69,000, Residential = 23,000
Mean = 11391
S.D. = 4726
Geometric Mean (Median) = 10000
Geometric S.D. = 1.5
N = 1110
UTL = 19723
Concentration (mg/kg)
100000
10000
1000
0.01
1
5
10
20
30
40
50
60
70
80
90
95
99
Percent


Hg (Mercury) in TTC-Vicinity Soils, 2006
Lognormal - 95% CI
NMED Industrial Soil Screening Level = 20, Residential = 7
Variable N Mean StDev Minimum Median Maximum
Mercury 37 0.009 0.004 0.004 0.009 0.015
Concentration (mg/kg)
1.000
0.100
0.010
0.001
1
5
10
20
30
40
50
60
70
80
90
95
99
99.9
Percent

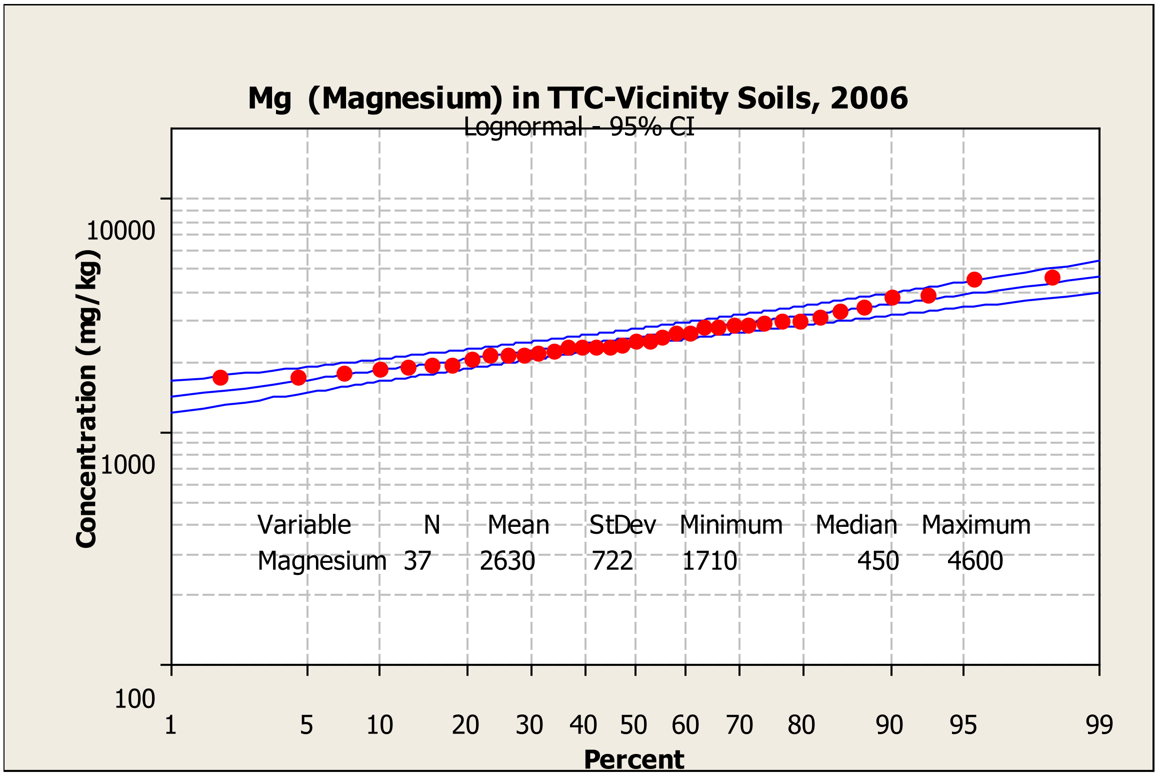

Hg (Mercury) in SNL/NM Soils 1993-2005
Lognormal - 95% CI
NMED Industial Screening Level = 20, Residential = 7
Mean = 0.053
S.D. = 0.065
Geometric Mean (Median) = 0.02
Geometric S.D. = 5.0
N = 718
UTL = 0.2
Concentration (mg/kg)
1.000
0.100
0.010
0.001
0.1
1
5
10
20
30
40
50
60
70
80
90
95
99
99.9
Percent



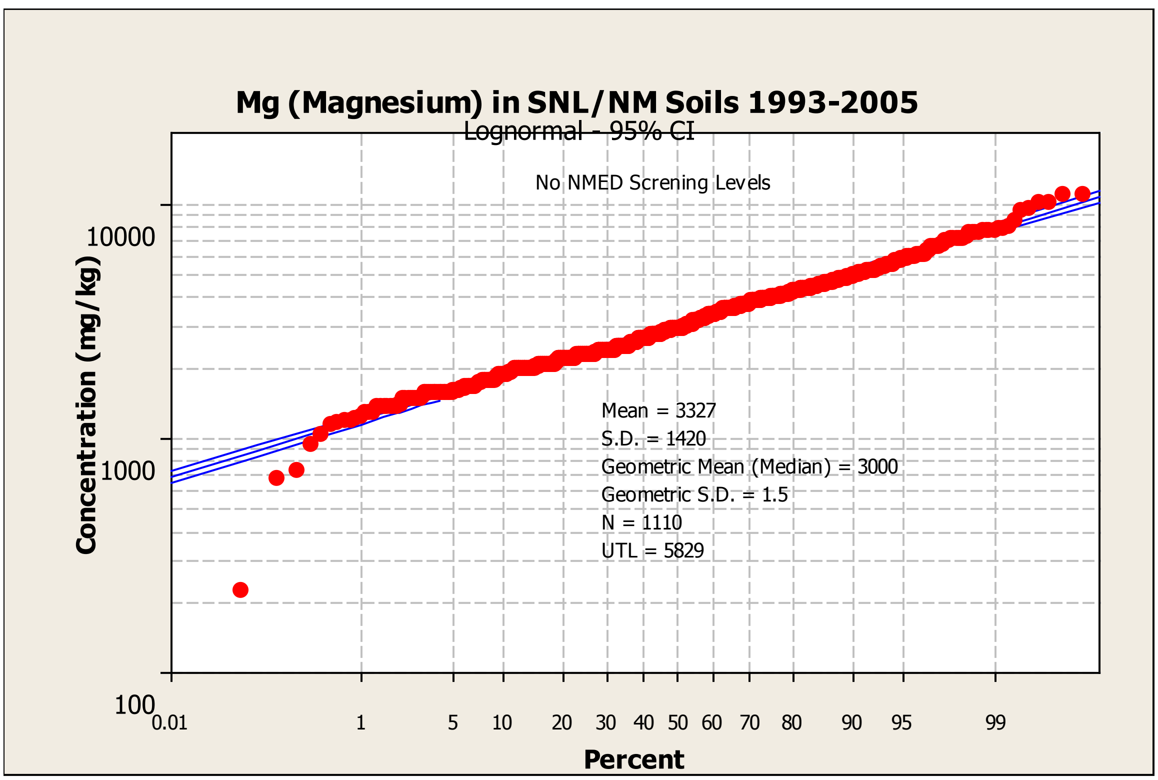
K (Potassium) in TTC-Vicinity Soils, 2006
Lognormal - 95% CI
No NMED Screening Level
Concentration (mg/kg)
1000
Variable N Mean StDev Minimum Median Maximum
Potassium 37 2218 574 1360 2060 4590
0.1 1 5 10 20 30 40 50 60 70 80 90 95 99 99.9
Percent



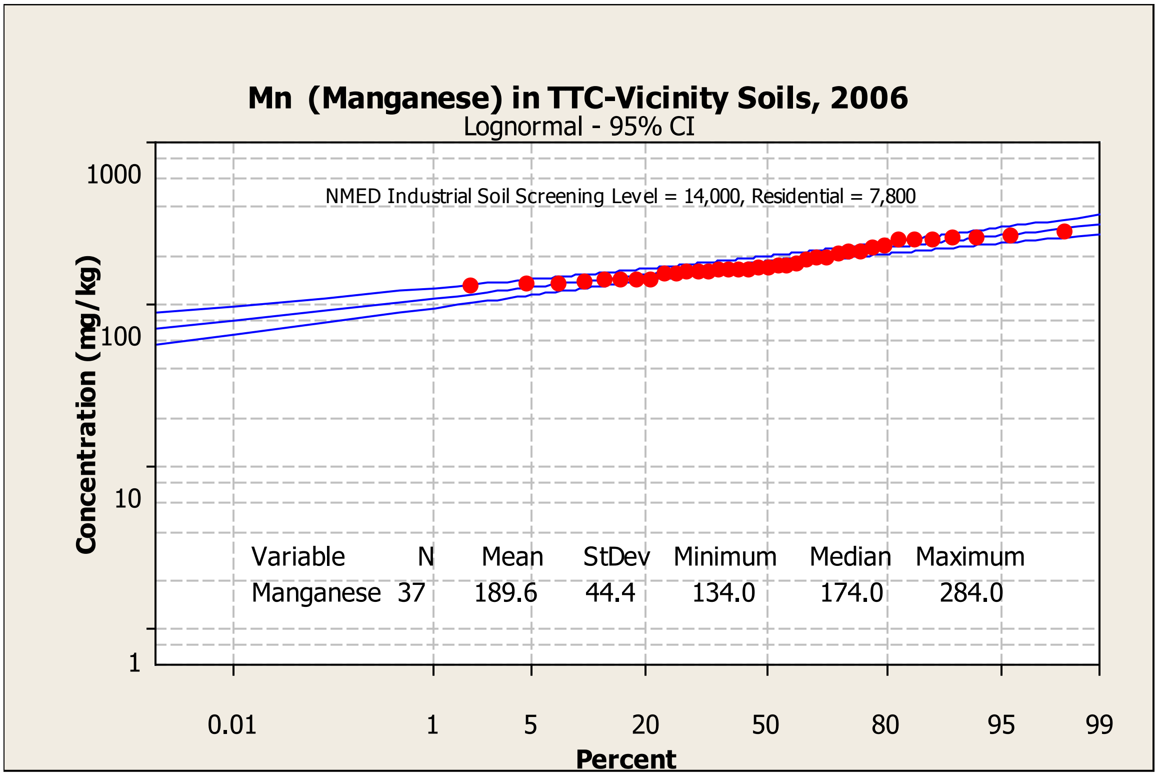
K (Potassium) in SNL/NM Soils 1993-2005
Lognormal - 95% CI
No NMED Screening Levels
Concentration (mg/kg)
1000
Mean = 2206
S.D. = 896
Geometric Mean (Median) = 2100
Geometric S.D. = 1.38
N = 1110
UTL = 3786
0.01 1 5 10 20 30 40 50 60 70 80 90 95 99
Percent



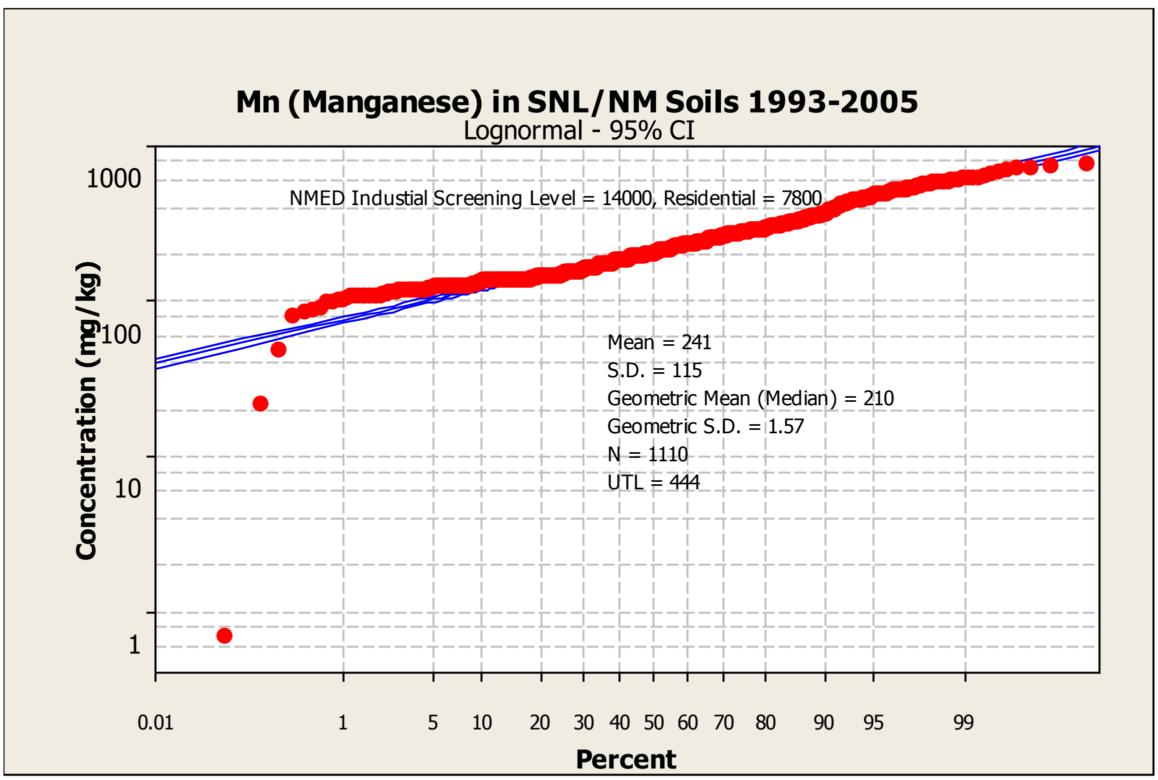
Mg (Magnesium) in TTC-Vicinity Soils, 2006
Lognormal - 95% CI
Concentration (mg/kg)
10000
1000
100
Variable N Mean StDev Minimum Median Maximum
Magnesium 37 2630 722 1710 450 4600
1
5
10
20
30
40
50
60
70
80
90
95
99
Percent



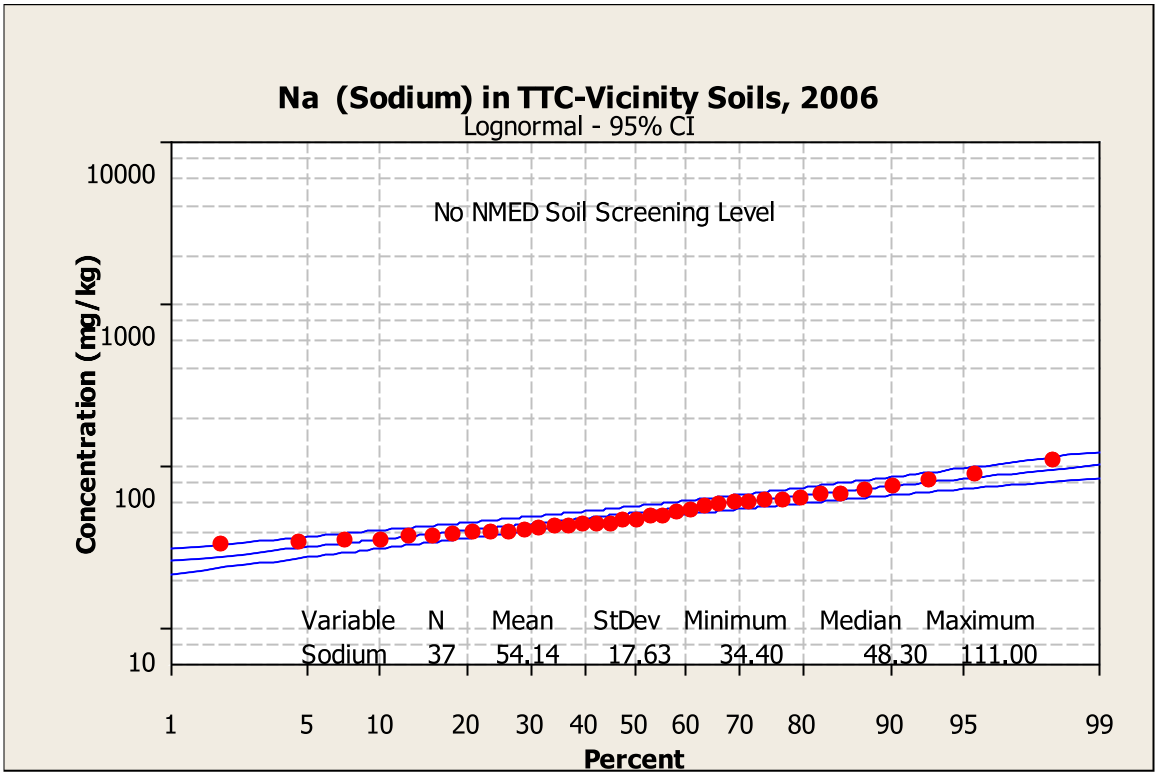
Mg (Magnesium) in SNL/NM Soils 1993-2005
Lognormal - 95% CI
No NMED Screning Levels
Concentration (mg/kg)
10000
1000
100
Mean = 3327
S.D. = 1420
Geometric Mean (Median) = 3000
Geometric S.D. = 1.5
N = 1110
UTL = 5829
0.01
1
5
10
20
30
40
50
60
70
80
90
95
99
Percent

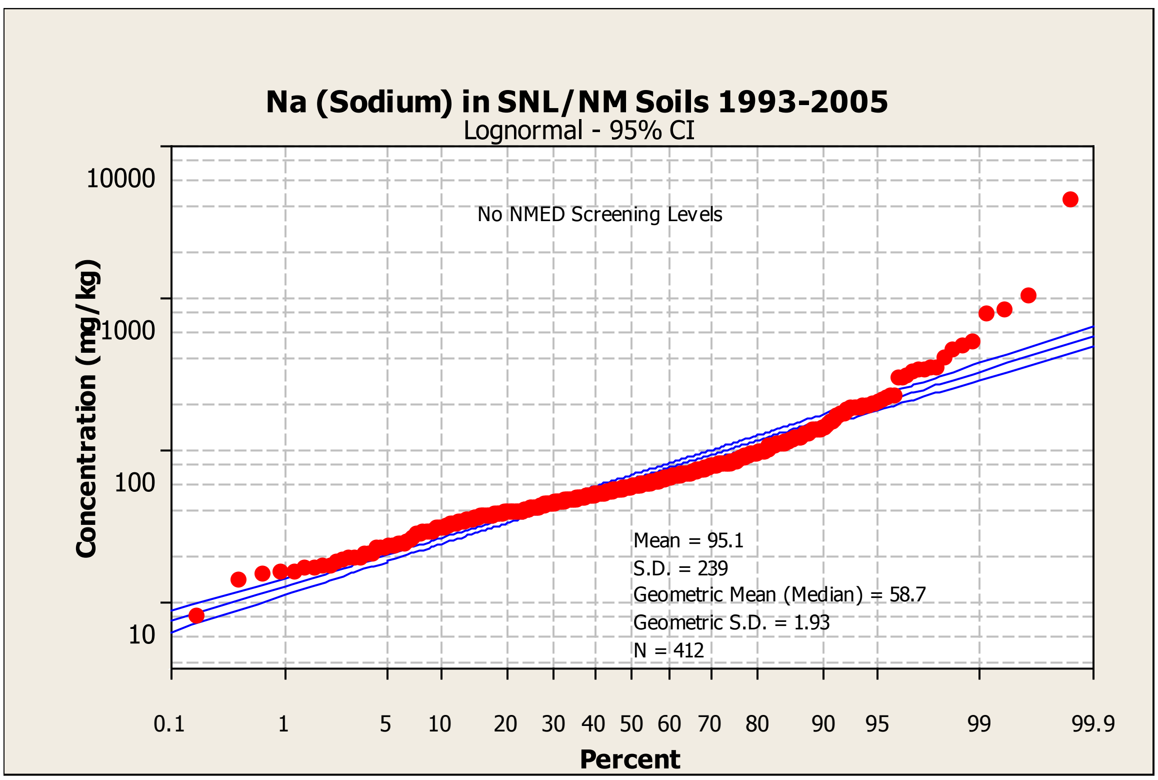


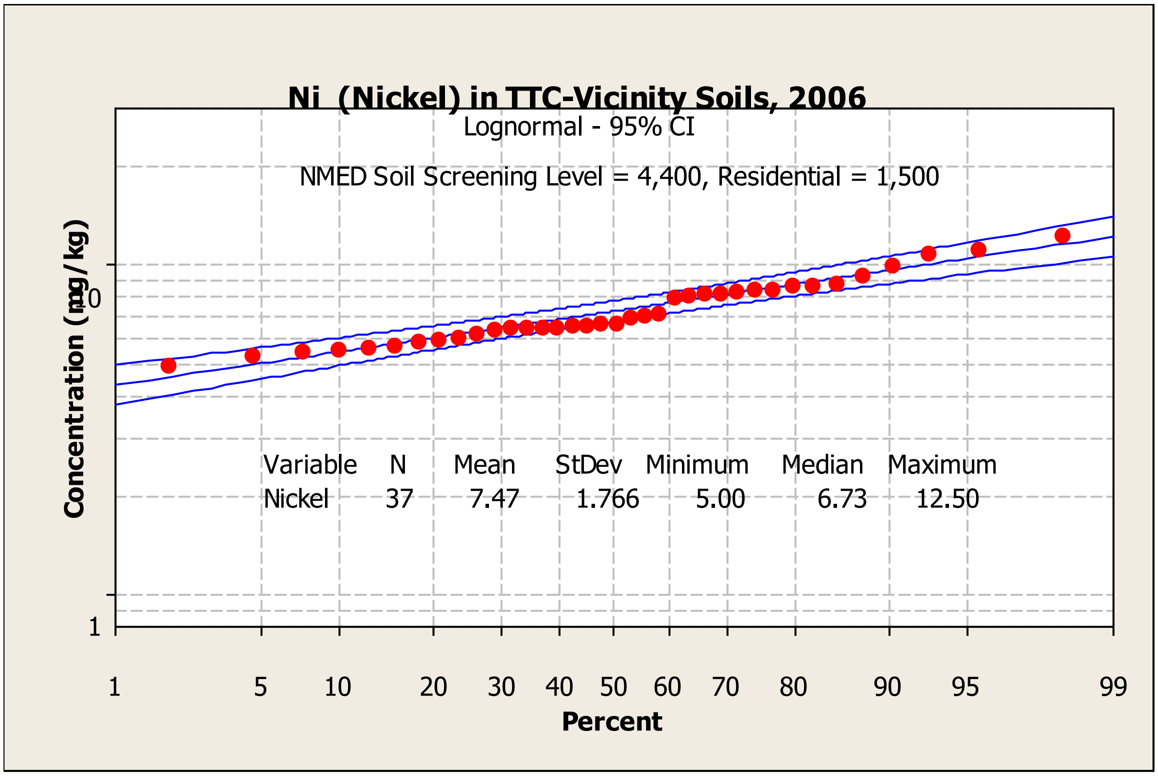
Mn (Manganese) in TTC-Vicinity Soils, 2006
Lognormal - 95% CI
NMED Industrial Soil Screening Level = 14,000, Residential = 7,800
Variable N Mean StDev Minimum Median Maximum
Manganese 37 189.6 44.4 134.0 174.0 284.0
Concentration (mg/kg)
1000
100
10
1
0.01
1
5
20
50
80
95
99
Percent

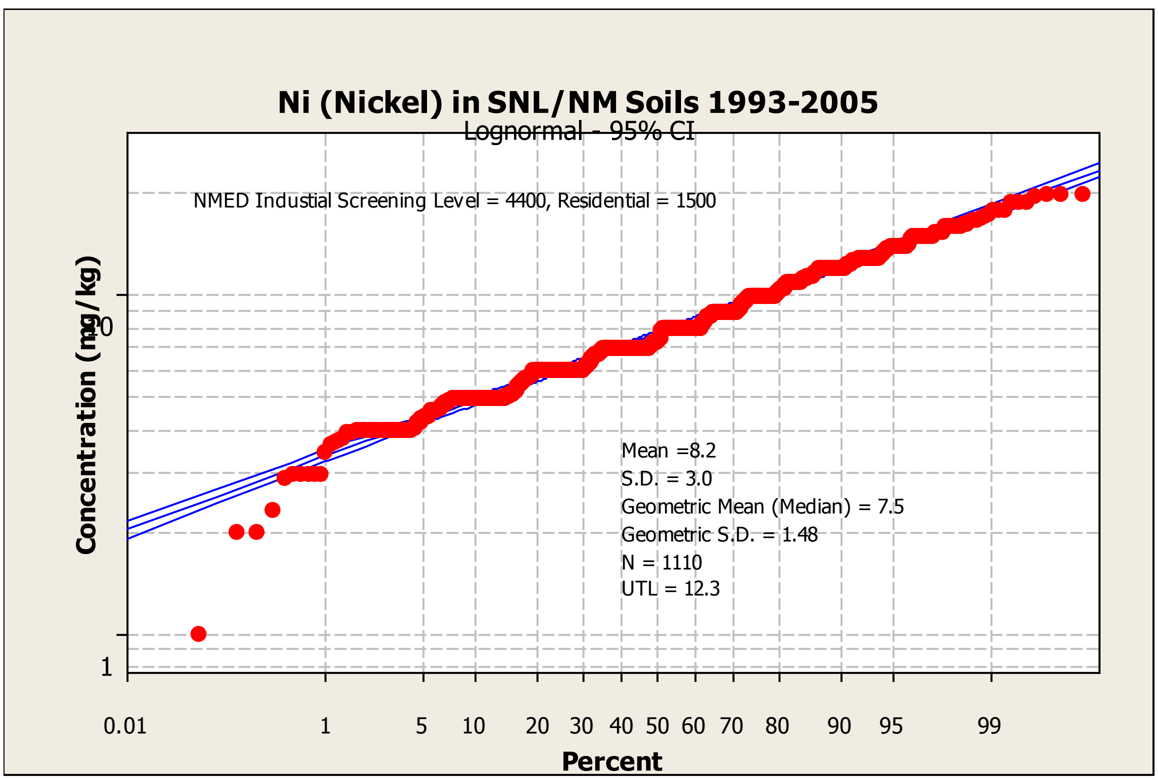


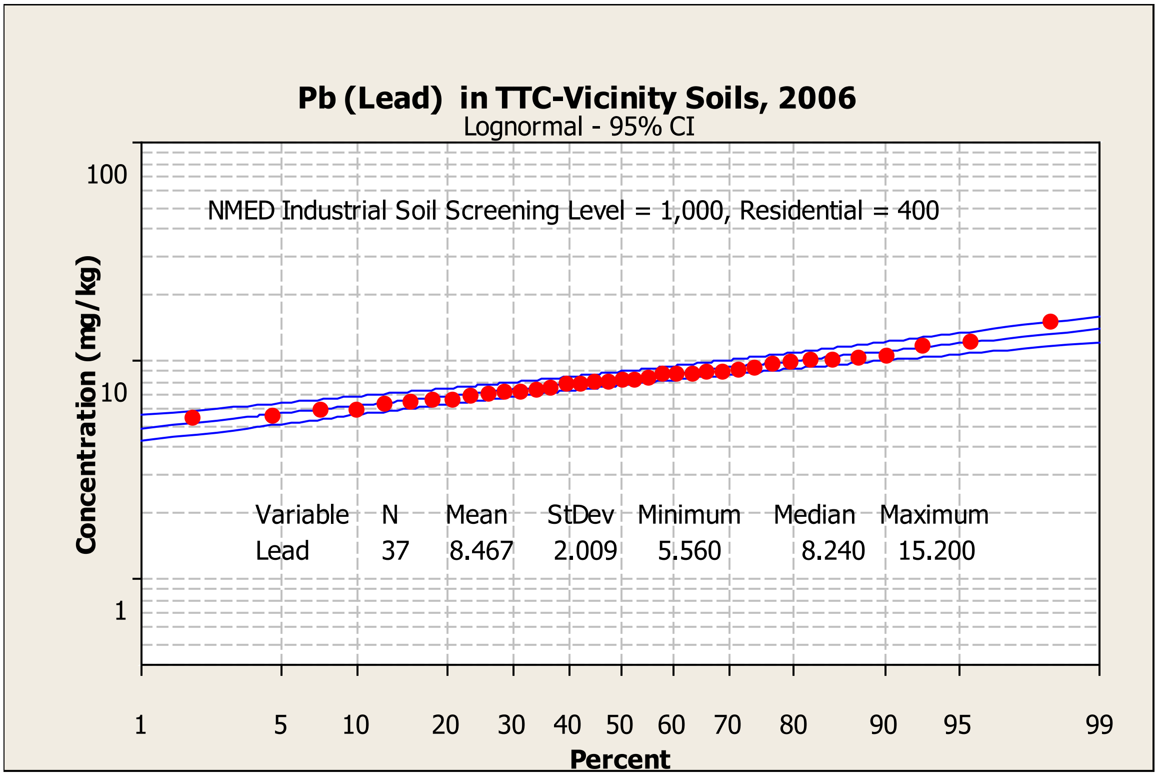
Mn (Manganese) in SNL/NM Soils 1993-2005
Lognormal - 95% CI
NMED Industial Screening Level = 14000, Residential = 7800
Mean = 241
S.D. = 115
Geometric Mean (Median) = 210
Geometric S.D. = 1.57
N = 1110
UTL = 444
Concentration (mg/kg)
1000
100
10
1
0.01 1 5 10 20 30 40 50 60 70 80 90 95 99
Percent

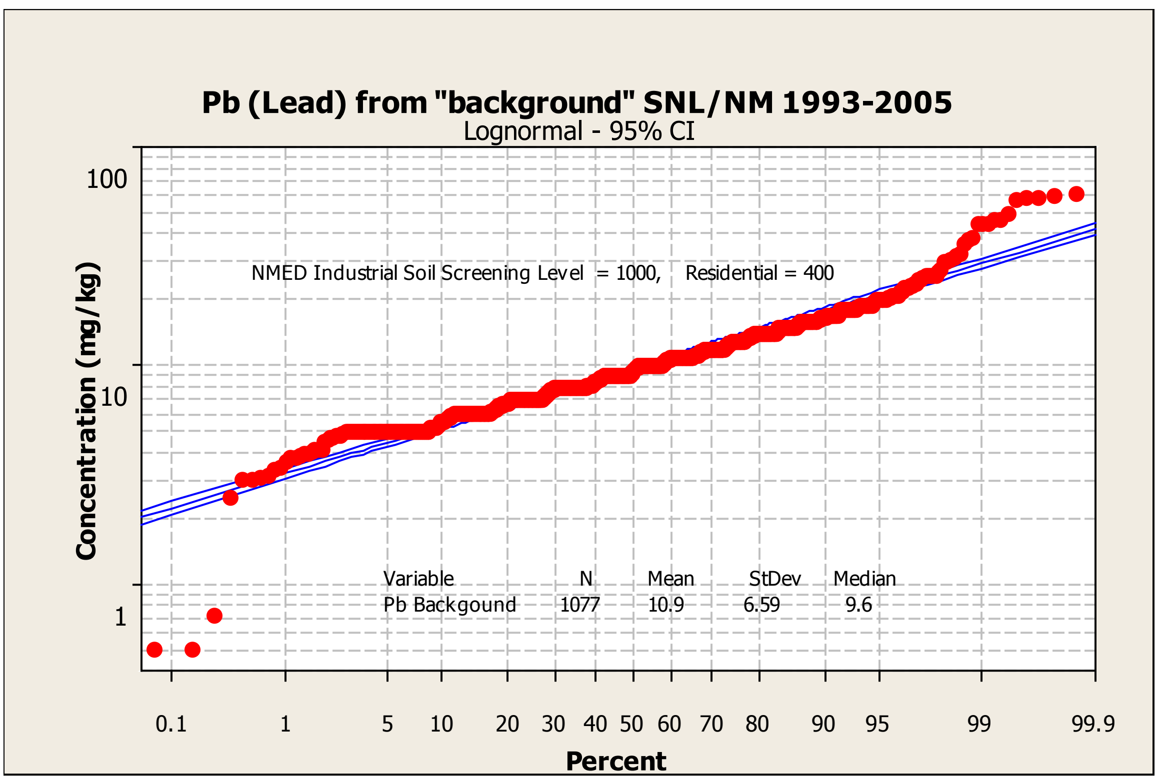

Na (Sodium) in TTC-Vicinity Soils, 2006
Lognormal - 95% CI
No NMED Soil Screening Level
Concentration (mg/kg)
10000
1000
100
10
Variable N Mean StDev Minimum Median Maximum
Sodium 37 54.14 17.63 34.40 48.30 111.00
1 5 10 20 30 40 50 60 70 80 90 95 99
Percent

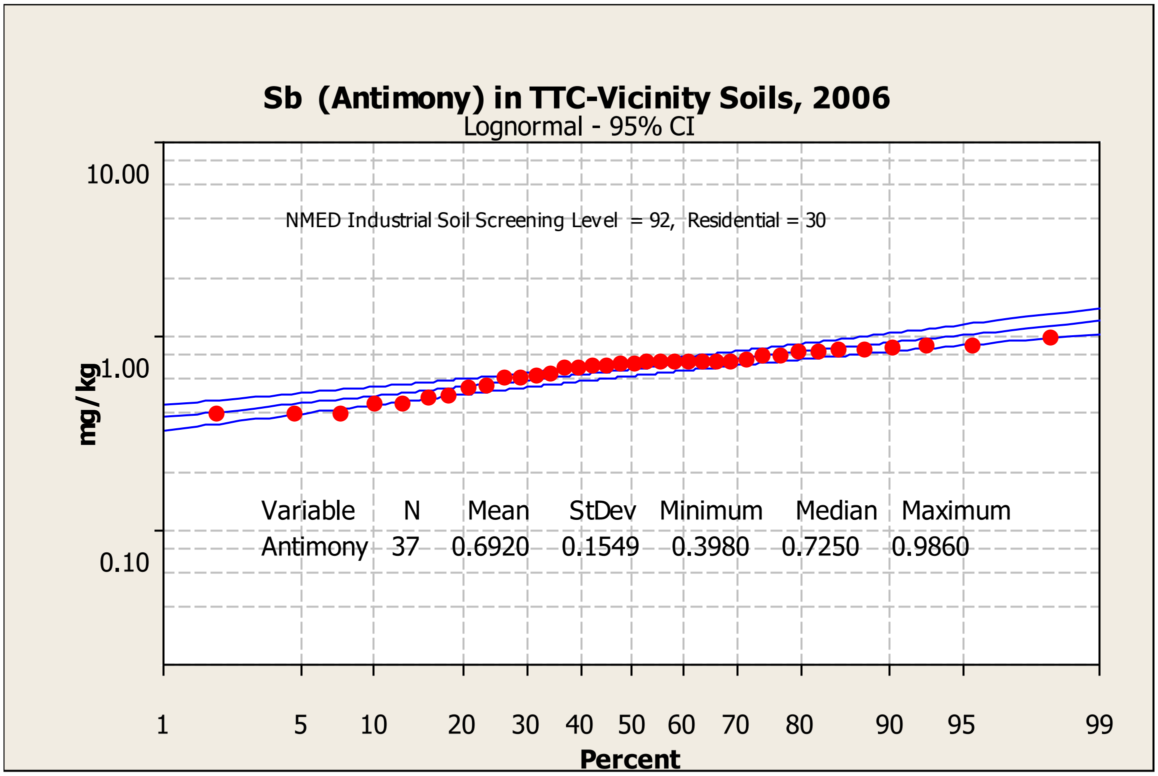

Na (Sodium) in SNL/NM Soils 1993-2005
Lognormal - 95% CI
No NMED Screening Levels
Concentration (mg/kg)
10000
1000
100
10
Mean = 95.1
S.D. = 239
Geometric Mean (Median) = 58.7
Geometric S.D. = 1.93
N = 412
0.1 1 5 10 20 30 40 50 60 70 80 90 95 99 99.9
Percent

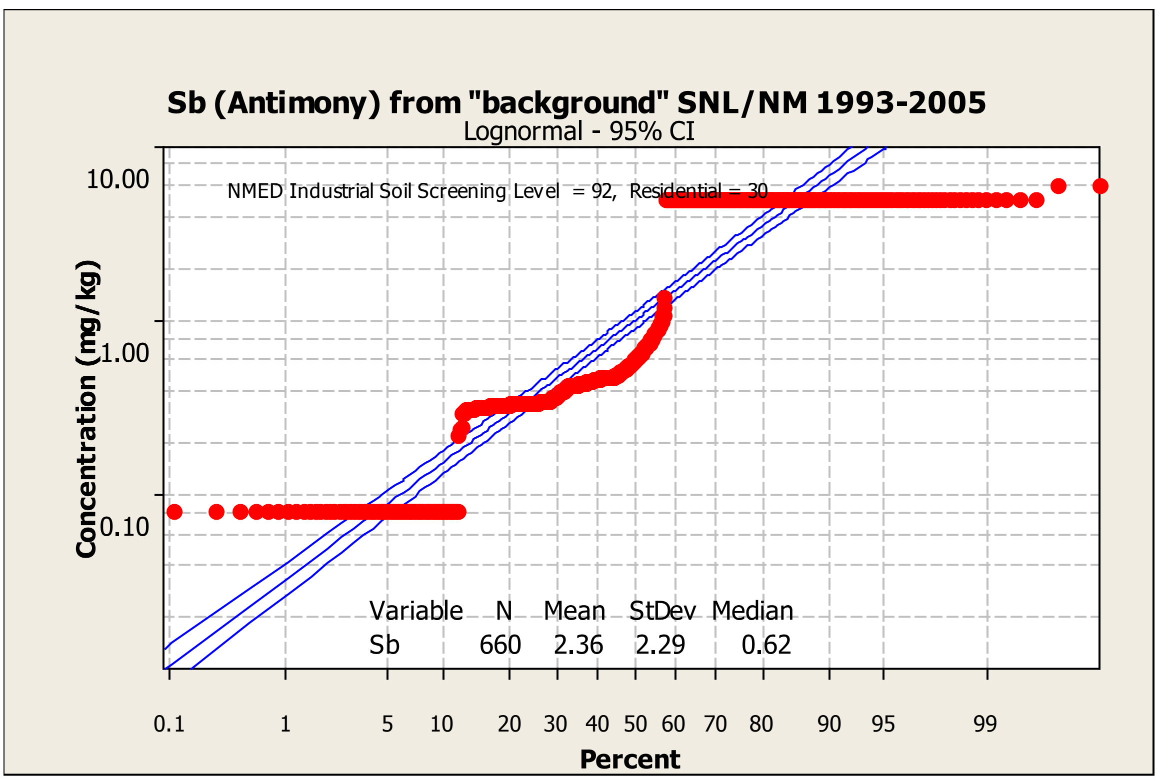

Ni (Nickel) in TTC-Vicinity Soils, 2006
Lognormal - 95% CI
NMED Soil Screening Level = 4,400, Residential = 1,500
Concentration (mg/kg)
10
1
Variable N Mean StDev Minimum Median Maximum
Nickel 37 7.47 1.766 5.00 6.73 12.50
1 5 10 20 30 40 50 60 70 80 90 95 99
Percent

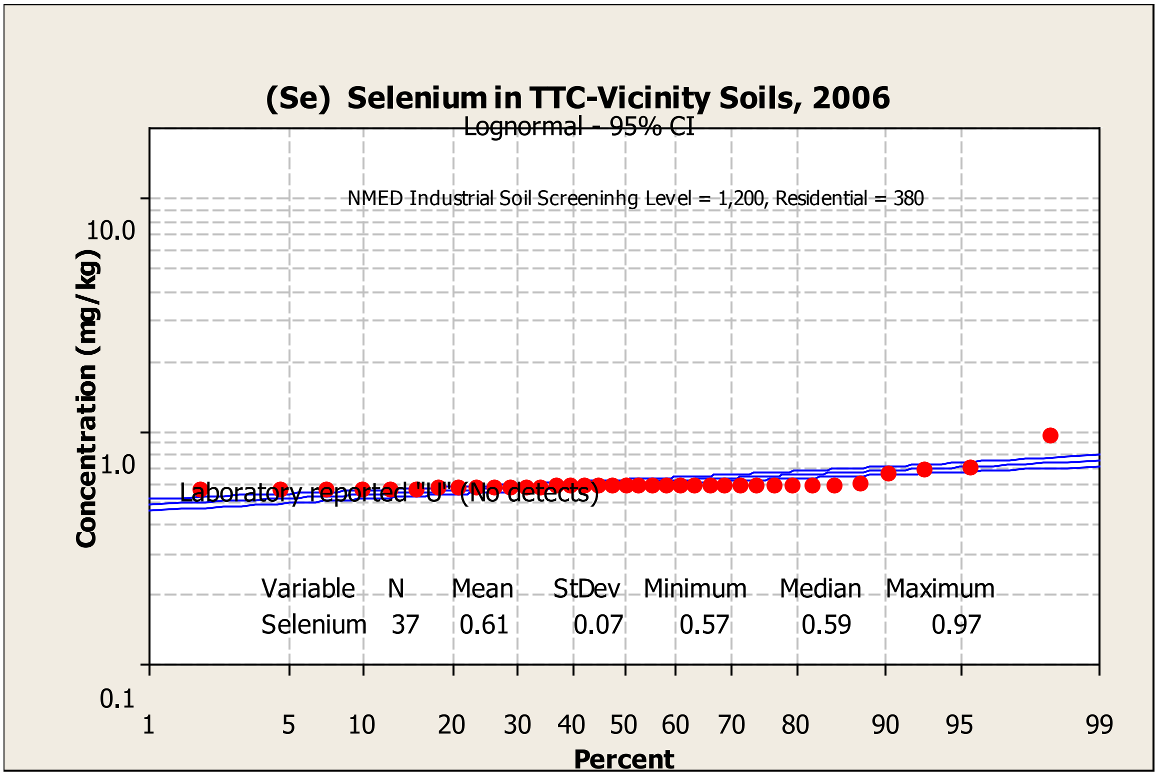

Ni (Nickel) in SNL/NM Soils 1993-2005
Lognormal - 95% CI
NMED Industial Screening Level = 4400, Residential = 1500
Concentration (mg/kg)
10
1
Mean =8.2
S.D. = 3.0
Geometric Mean (Median) = 7.5
Geometric S.D. = 1.48
N = 1110
UTL = 12.3
0.01 1 5 10 20 30 40 50 60 70 80 90 95 99
Percent

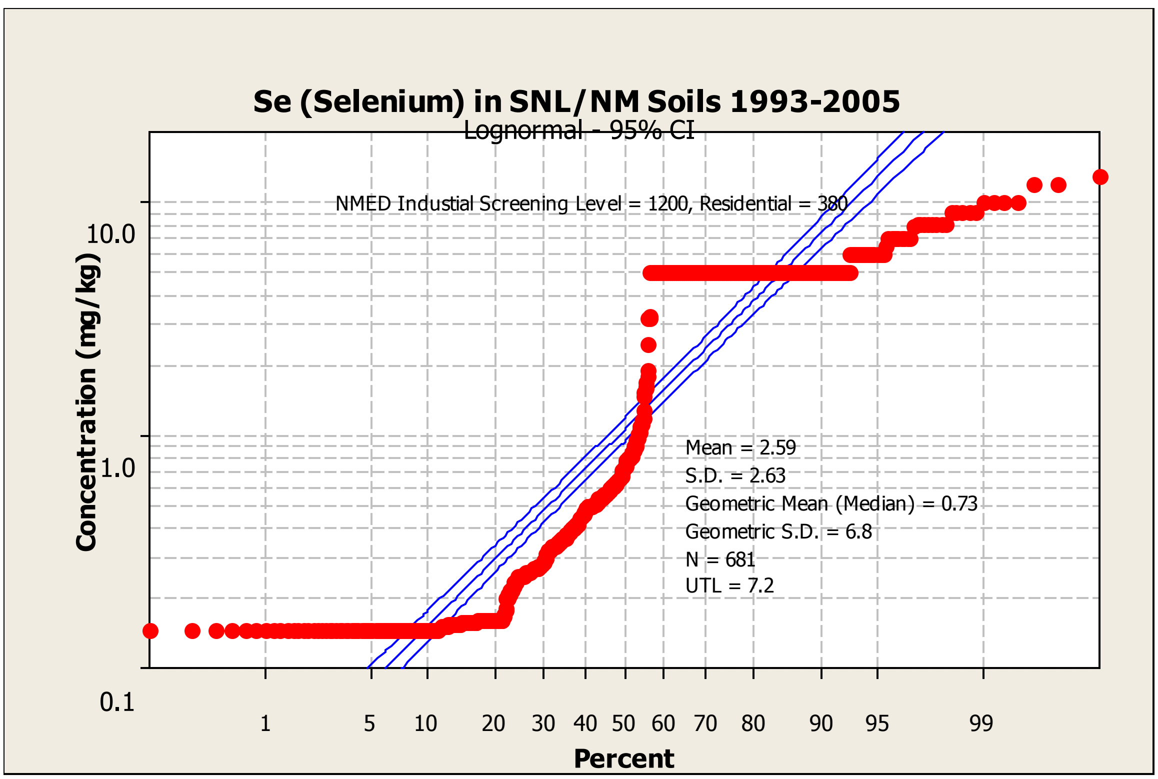

Pb (Lead) in TTC-Vicinity Soils, 2006
Lognormal - 95% CI
NMED Industrial Soil Screening Level = 1,000, Residential = 400
Variable N Mean StDev Minimum Median Maximum
Lead 37 8.467 2.009 5.560 8.240 15.200
Concentration (mg/kg)
100
10
1
1 5 10 20 30 40 50 60 70 80 90 95 99
Percent

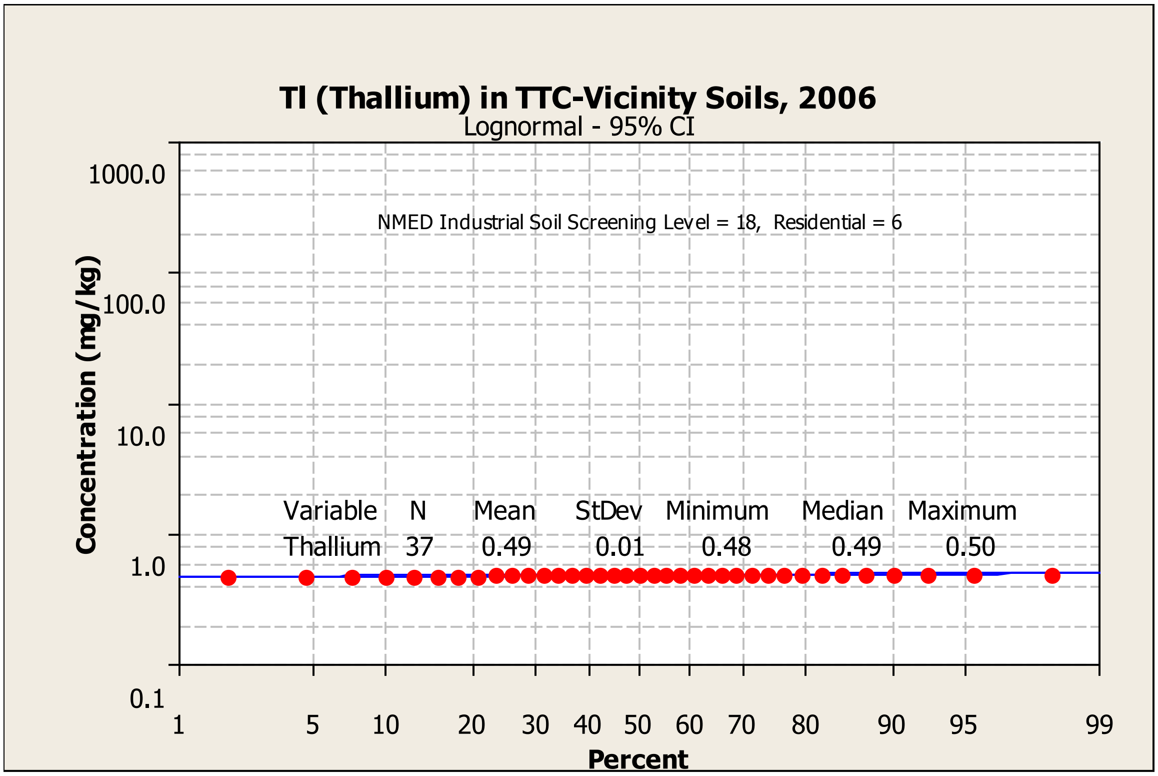

Pb (Lead) from "background" SNL/NM 1993-2005
Lognormal - 95% CI
NMED Industrial Soil Screening Level = 1000, Residential = 400
Variable N Mean StDev Median
Pb Backgound 1077 10.9 6.59 9.6
Concentration (mg/kg)
100
10
1
0.1 1 5 10 20 30 40 50 60 70 80 90 95 99 99.9
Percent

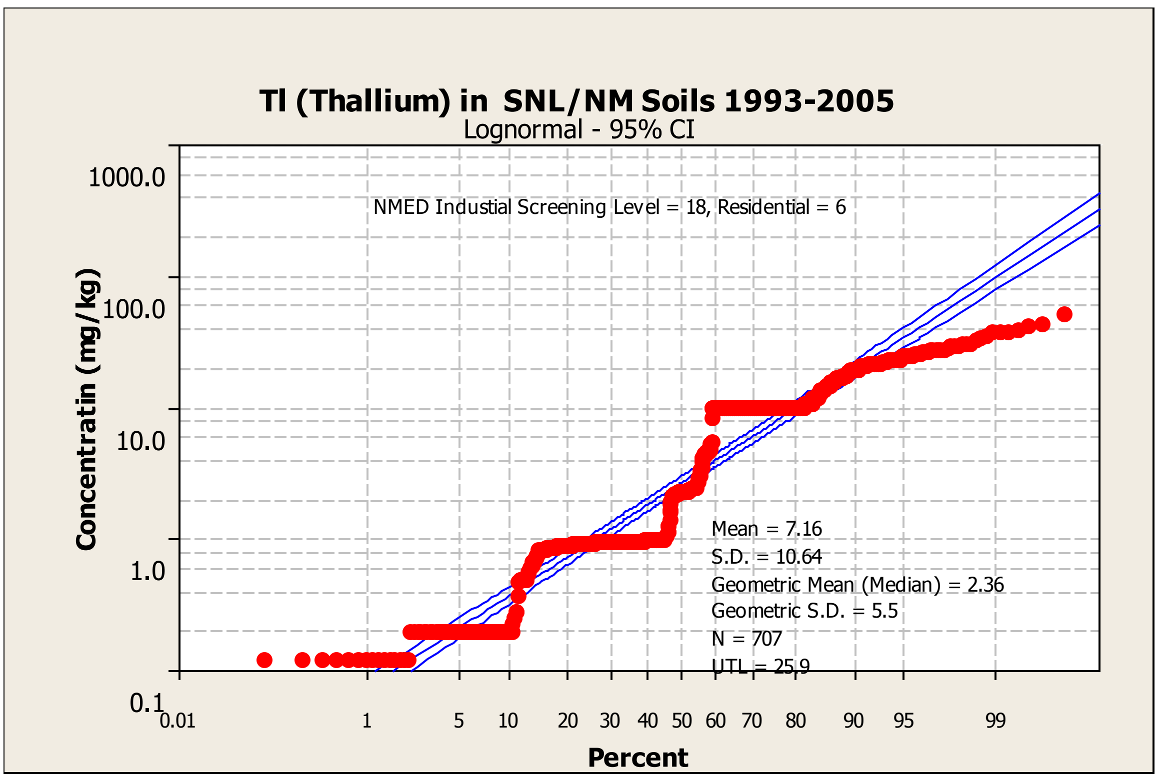

Sb (Antimony) in TTC-Vicinity Soils, 2006
Lognormal - 95% CI
NMED Industrial Soil Screening Level = 92, Residential = 30
Variable N Mean StDev Minimum Median Maximum
Antimony 37 0.6920 0.1549 0.3980 0.7250 0.9860
mg/kg
10.00
1.00
0.10
1 5 10 20 30 40 50 60 70 80 90 95 99
Percent

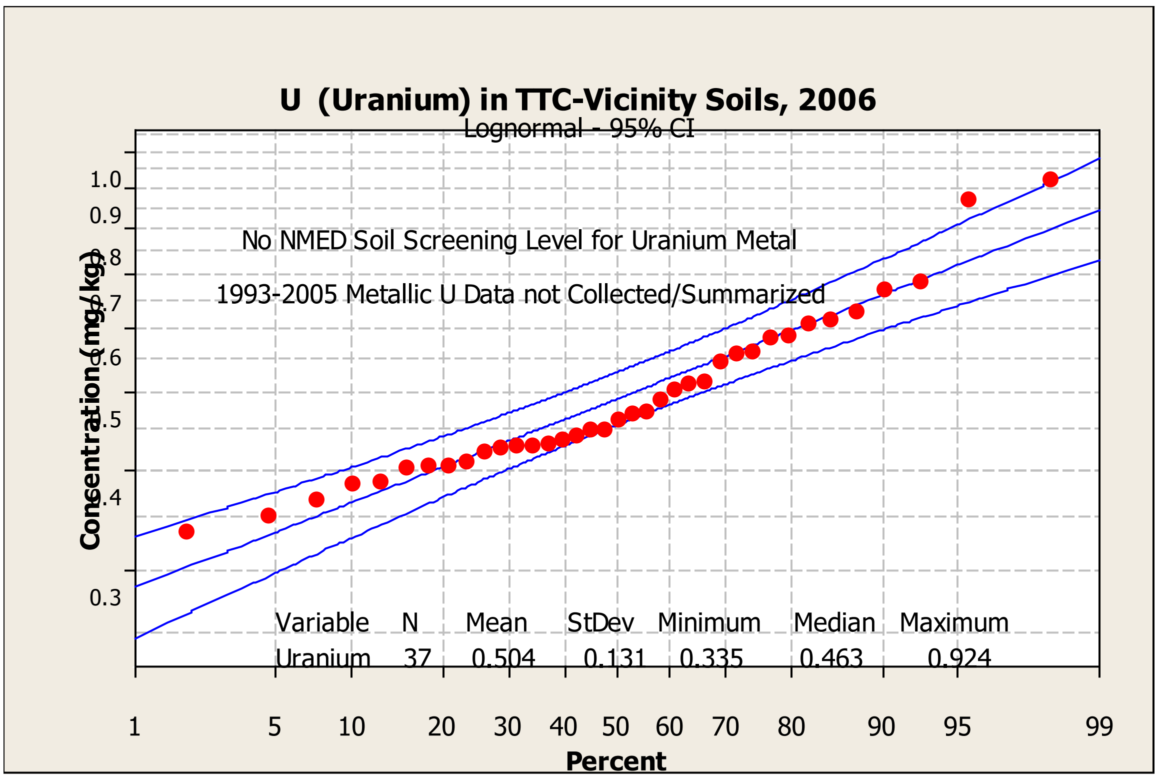

Sb (Antimony) from "background" SNL/NM 1993-2005
Lognormal - 95% CI
NMED Industrial Soil Screening Level = 92, Residential = 30
Variable N Mean StDev Median
Sb 660 2.36 2.29 0.62
Concentration (mg/kg)
10.00
1.00
0.10
0.1 1 5 10 20 30 40 50 60 70 80 90 95 99
Percent

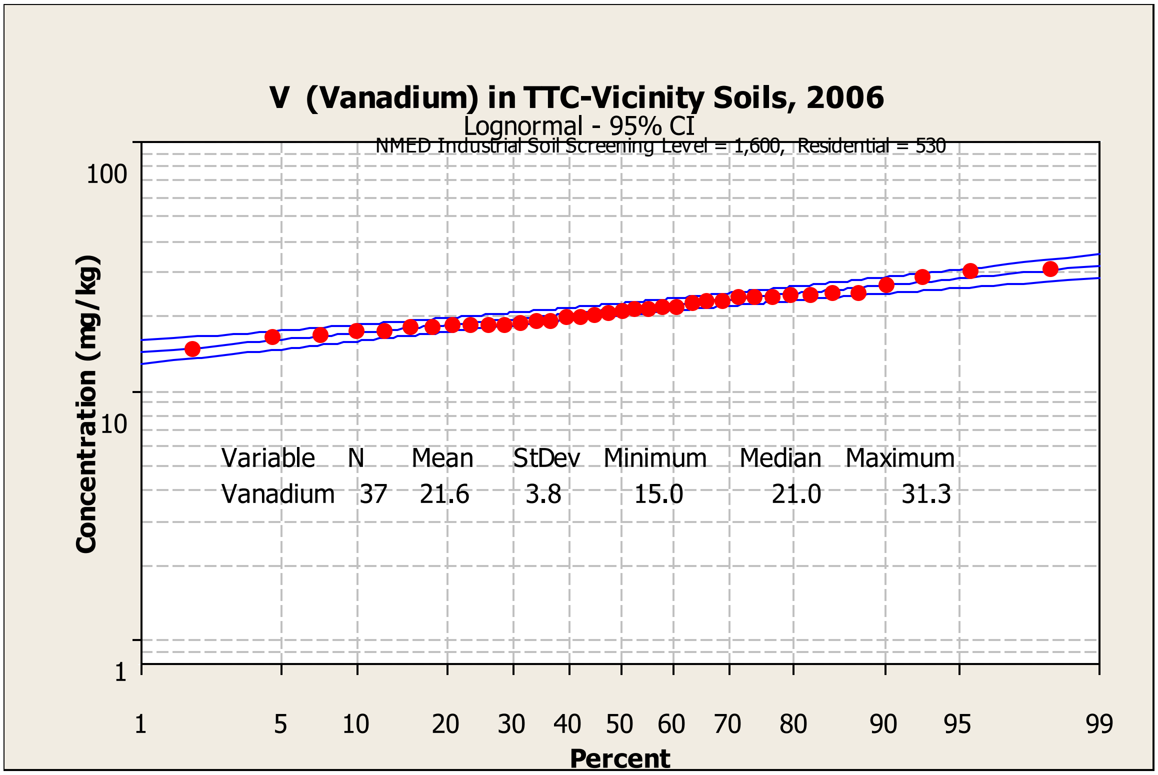

(Se) Selenium in TTC-Vicinity Soils, 2006
Lognormal - 95% CI
NMED Industrial Soil Screeninhg Level = 1,200, Residential = 380
Laboratory reported "U" (No detects)
Variable N Mean StDev Minimum Median Maximum
Selenium 37 0.61 0.07 0.57 0.59 0.97
Concentration (mg/kg)
10.0
1.0
0.1
1
5
10
20
30
40
50
60
70
80
90
95
99
Percent


Se (Selenium) in SNL/NM Soils 1993-2005
Lognormal - 95% CI
NMED Industial Screening Level = 1200, Residential = 380
Mean = 2.59
S.D. = 2.63
Geometric Mean (Median) = 0.73
Geometric S.D. = 6.8
N = 681
UTL = 7.2
Concentration (mg/kg)
10.0
1.0
0.1
1
5
10
20
30
40
50
60
70
80
90
95
99
Percent

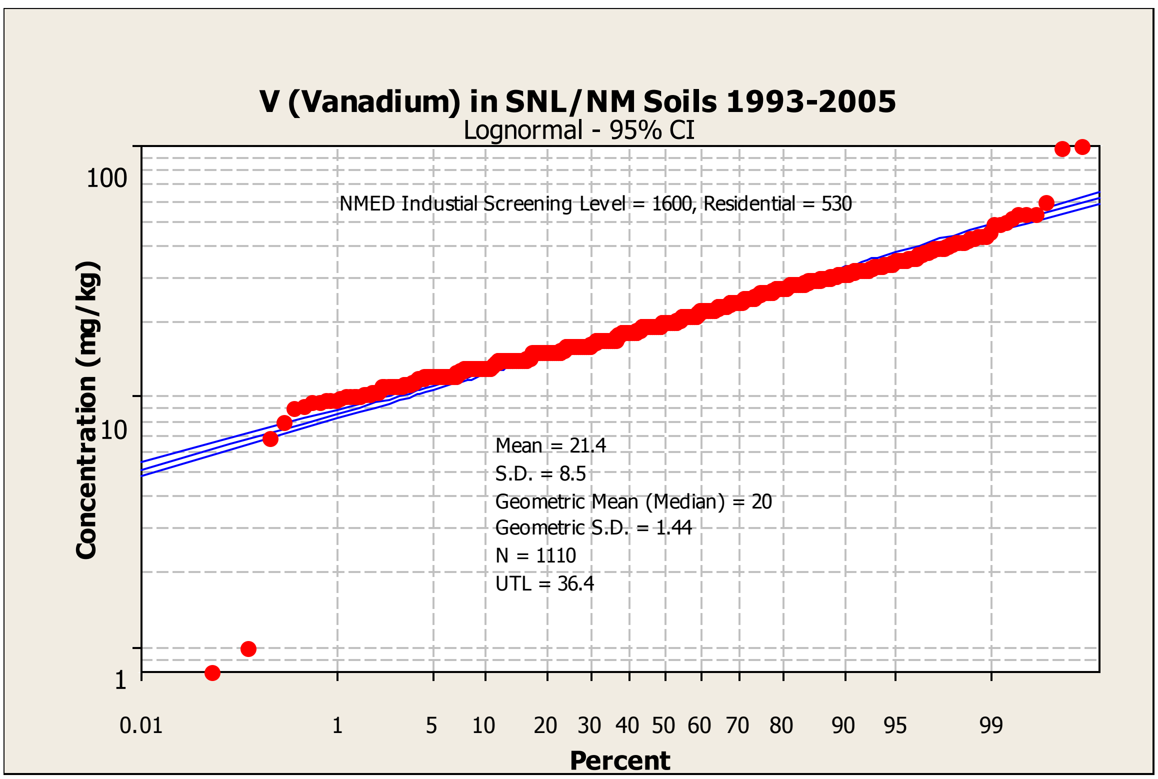

Tl (Thallium) in TTC-Vicinity Soils, 2006
Lognormal - 95% CI
NMED Industrial Soil Screening Level = 18, Residential = 6
Variable N Mean StDev Minimum Median Maximum
Thallium 37 0.49 0.01 0.48 0.49 0.50
Concentration (mg/kg)
1000.0
100.0
10.0
1.0
0.1
1
5
10
20
30
40
50
60
70
80
90
95
99
Percent


Tl (Thallium) in SNL/NM Soils 1993-2005
Lognormal - 95% CI
NMED Industial Screening Level = 18, Residential = 6
Mean = 7.16
S.D. = 10.64
Geometric Mean (Median) = 2.36
Geometric S.D. = 5.5
N = 707
UTL = 25.9
Concentratin (mg/kg)
1000.0
100.0
10.0
1.0
0.1
0.01
1
5
10
20
30
40
50
60
70
80
90
95
99
Percent

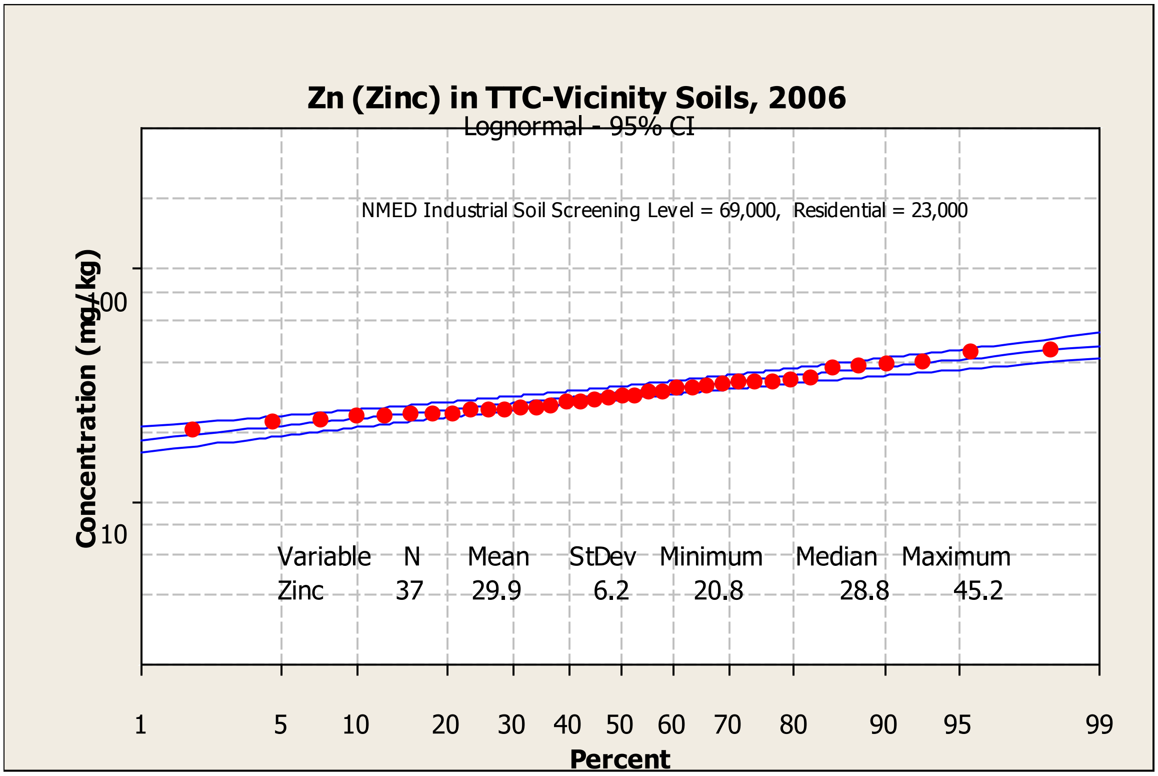

U (Uranium) in TTC-Vicinity Soils, 2006
Lognormal - 95% CI
No NMED Soil Screening Level for Uranium Metal
1993-2005 Metallic U Data not Collected/Summarized
Concentration (mg/kg)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
Variable N Mean StDev Minimum Median Maximum
Uranium 37 0.504 0.131 0.335 0.463 0.924
1
5
10
20
30
40
50
60
70
80
90
95
99
Percent



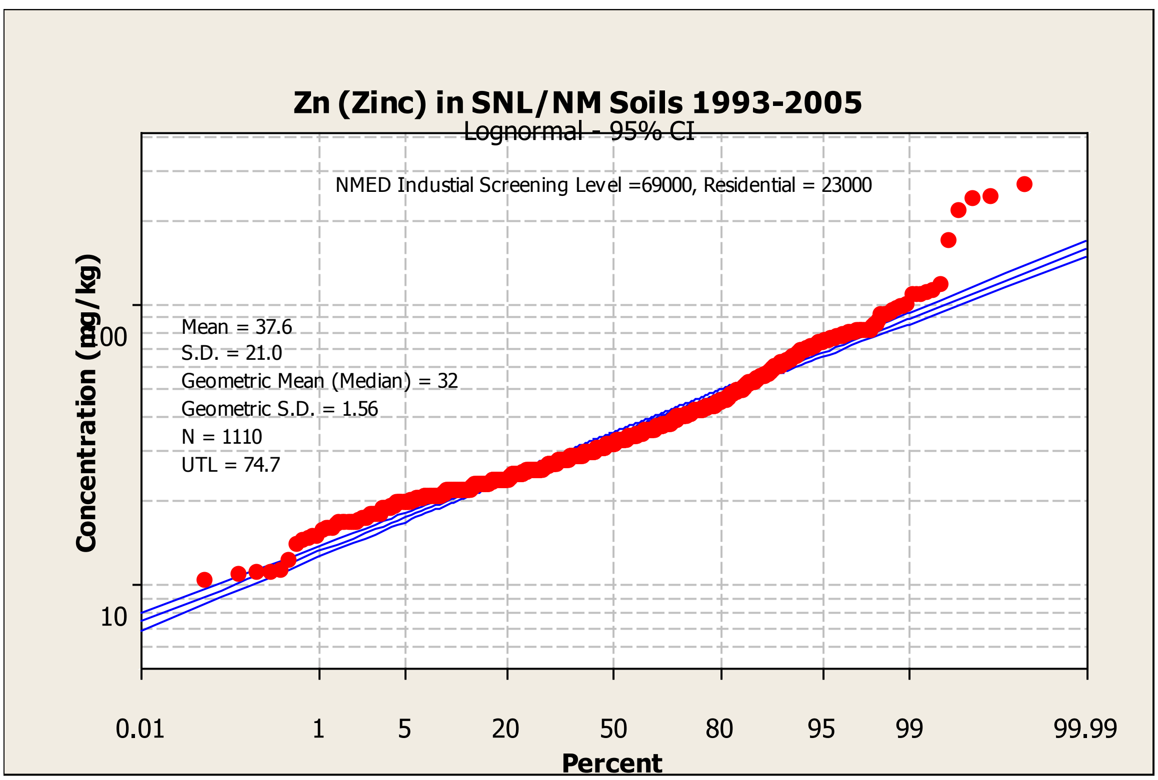
V (Vanadium) in TTC-Vicinity Soils, 2006
Lognormal - 95% CI
NMED Industrial Soil Screening Level = 1,600, Residential = 530
Concentration (mg/kg)
100
10
1
Variable N Mean StDev Minimum Median Maximum
Vanadium 37 21.6 3.8 15.0 21.0 31.3
1 5 10 20 30 40 50 60 70 80 90 95 99
Percent



V (Vanadium) in SNL/NM Soils 1993-2005
Lognormal - 95% CI
NMED Industial Screening Level = 1600, Residential = 530
Concentration (mg/kg)
100
10
1
Mean = 21.4
S.D. = 8.5
Geometric Mean (Median) = 20
Geometric S.D. = 1.44
N = 1110
UTL = 36.4
0.01 1 5 10 20 30 40 50 60 70 80 90 95 99
Percent



Zn (Zinc) in TTC-Vicinity Soils, 2006
Lognormal - 95% CI
NMED Industrial Soil Screening Level = 69,000, Residential = 23,000
Concentration (mg/kg)
100
10
Variable N Mean StDev Minimum Median Maximum
Zinc 37 29.9 6.2 20.8 28.8 45.2
1 5 10 20 30 40 50 60 70 80 90 95 99
Percent



Zn (Zinc) in SNL/NM Soils 1993-2005
Lognormal - 95% CI
NMED Industial Screening Level =69000, Residential = 23000
Mean = 37.6
S.D. = 21.0
Geometric Mean (Median) = 32
Geometric S.D. = 1.56
N = 1110
UTL = 74.7
Concentration (mg/kg)
100
10
0.01 1 5 20 50 80 95 99 99.99
Percent

Distribution

1	MS1042	Mark Miller	10333
1	MS1042	Danielle Nieto	10333
1	MS0184	Karen Agogino	10730
1	MS0184	Susan Lacy	10730
2	MS9018	Central Technical Files	8944
2	MS0899	Technical Library	4536

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APPENDIX E

1993–2005 SNL Metals in Soil Summary

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Unlimited Release
Printed March 2006

Chemical Analyses of Soil Samples Collected from the Sandia National Laboratories, New Mexico Environs, 1993–2005

Mark L. Miller, Regina A. Deola, Heidi M. Herrera, and Hans D. Oldewage

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Chemical Analyses of Soil Samples Collected from the Sandia National Laboratories, New Mexico Environs, 1993–2005

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Abstract

From 1993 through 2005, the Environmental Management Department of Sandia National Laboratories in Albuquerque, New Mexico (SNL/NM), has collected soil and sediment samples at numerous locations on-site, on the perimeter, and off-site for the purpose of determining potential impacts to the environs from operations at the Laboratories. These samples were submitted to an analytical laboratory for metal-in-soil analyses. Intercomparisons of these results were then made to determine if there was any statistical difference between on-site, perimeter, and off-site samples, or if there were year-to-year increasing or decreasing trends which indicated that further investigation may be warranted. This work provided the SNL Environmental Management Department with a sound baseline data reference against which to assess potential current operational impacts or to compare future operational impacts. In addition, it demonstrates the commitment that the Laboratories have to go beyond mere compliance to achieve excellence in its operations. This data is presented in graphical format with narrative commentaries on particular items of interest.

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Introduction

In order to establish a baseline for trace metals that exist in the soils of Sandia National Laboratories, New Mexico (SNL/NM), from 1993 through 2005, the Environmental Management Department at SNL/NM collected soil and sediment samples at numerous locations on-site, on the perimeter, and off-site for the purpose of determining potential impacts to the environs from operations at the Laboratories. The locations are shown in Figures 1 and 2, and tabulated in Tables 1, 2, and 3. Samples were submitted to an analytical laboratory for metal-in-soil analyses (target analyte list [TAL] metals). Similar to the soil samples, sediment samples were also collected at several locations. Sediment samples sometimes can be used to determine if aggregation or concentration of contaminants in runoff can help identify trends earlier, or if they otherwise may go undetected completely. These locations are also indicated in the Tables and Figures as well and are not plotted separately.

These soil and sediment results were compared to determine if there was any statistical difference between on-site, perimeter, and off-site samples, or if there were year-to-year increasing or decreasing trends which indicated that further investigation may be warranted to ascertain the cause of the observed anomaly (Shyr, Haaker, and Herrera 1998). In some cases, the ratio between two or more elements can be used to determine if the observed concentrations are natural or anthropogenic (Hooper 2004). When more than one distribution is observed in these plots, the data are assumed to be heterogeneous (i.e., a separate source is associated with each distribution) (McLish 1994). Comparisons of these soil and sediment samples were made by media, location, and constituent following each sampling campaign, but the summary data has been pooled in this report to save space. This work provided the SNL Environmental Management Department with a sound baseline data reference against which to compare future operational impacts. In addition, it demonstrates the commitment that the Laboratories have to go beyond mere compliance, but to also achieve excellence in its operations. This data is presented in graphical format, with narrative commentaries on particular items of interest.

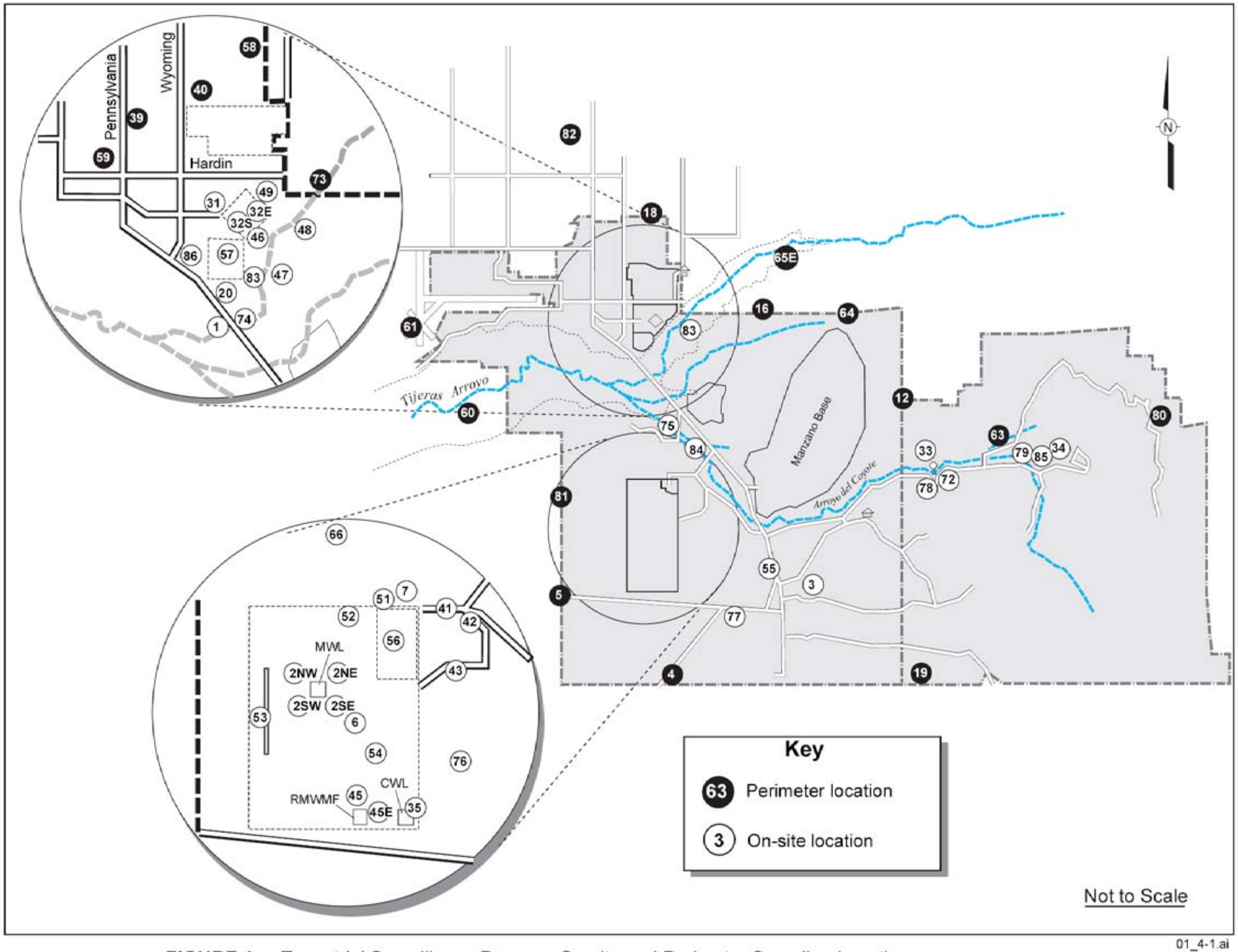

FIGURE 1. Terrestrial Surveillance Program On-site and Perimeter Sampling Locations
On-site locations are within areas of SNL/NM operations. Perimeter locations are located both on and off KAFB property.

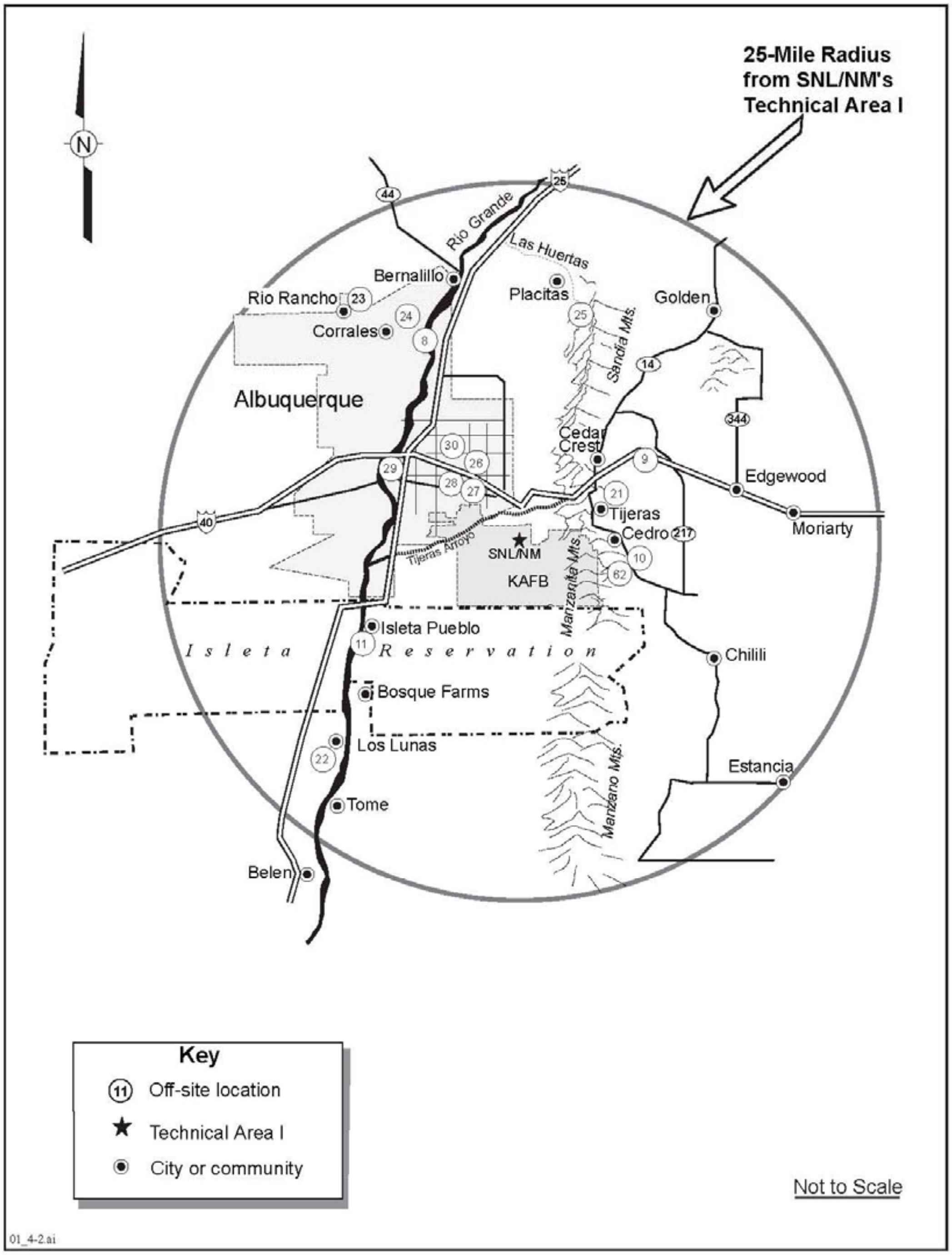

FIGURE 2. Terrestrial Surveillance Program Off-site Sampling Locations

TABLE 1. On-site Terrestrial Surveillance Locations and Sample Types

Location Number	Sampling Location	Soil	Sediment
1	Pennsylvania Ave.	X	
2NW	Mixed Waste Landfill (MWL) (northwest)	X	
2NE	MWL (northeast)	X	
2SE	MWL (southeast)	X	
2SW	MWL (southwest)	X	
3	Coyote Canyon Control	X	
6	Tech Area (TA) III (east of water tower)	X	
7	Unnamed Arroyo (north of TA-V)	X	
20	TA-IV (southwest) (KAFB Skeet Range)	X	
32S	TA-II, Bldg. 935 (south bay door)	X	
33	Coyote Springs	X	
34	Lurance Canyon Burn Site	X	
35	Chemical Waste Landfill (CWL)	X	
41	TA-V (northeast fence)	X	
42	TA-V (east fence)	X	
43	TA-V (southeast fence)	X	
45	Radioactive and Mixed Waste Management Facility (RMWMF), TA-III (northwest corner)	X	
46	TA-II (south corner)	X	
49	Near the Explosive Components Facility (ECF)	X	
51	TA-V (north of culvert)	X	
52	TA-III, northeast of Bldgs. 6716 and 6717	X	
53	TA-III south of long sled track	X	
54	TA-III, Bldg. 6630	X	
55	Large Melt Facility (LMF), Bldg. 9939	X	
56	TA-V, Bldg. 6588 (west corner)	X	X
57	TA-IV, Bldg. 970 (northeast corner)	X	
66	KAFB Facility	X	
76	Thunder Range (north)	X	
77	Thunder Range (south)	X	
78	School House Mesa	X	
79	Arroyo del Coyote (up-gradient)		X
83	Tijeras Arroyo GW Well		X
84	Storm Water Monitoring Point (SWMP)-10		X
85	Arroyo del Coyote Cable Site		X

TABLE 2. Perimeter Terrestrial Surveillance Locations and Sample Types

	Sampling Location	Soil	Sediment
4	Isleta Reservation Gate	X	
5	McCormick Gate	X	
12	Northeast Perimeter	X	
16	Four Hills	X	
19	USGS Seismic Center Gate	X	
58	North KAFB Housing	X	
59	Zia Park (southeast)	X	
60	Tijeras Arroyo (down-gradient)	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
80	Madera Canyon	X	
81	KAFB West Fence	X	
82	Commissary	X	

TABLE 3. Off-site Terrestrial Surveillance Locations and Sample Types

Location Number	Sampling Location	Soil	Sediment
8	Rio Grande, Corrales Bridge (up-gradient)	X	X
9	Sedillo Hill, I-40 (east of Albuquerque)	X	
10	Oak Flats	X	
11	Rio Grande, Isleta Pueblo (down-gradient)	X	X
25	Placitas Fire Station	X	
62	East resident	X	

Results of the soil and sediment samples were evaluated using probability plotting, which provided a visual representation of the entire data set for all locations and for all times sampled. If the results were similar, or fit a linear distribution when plotted on logarithmic or log-probability scales, then the results were attributable to natural origin. Summary statistics for each element was imbedded in each plot. If any samples indicated concentrations greater than expected from the rest of the sample distribution, further evaluation was conducted to determine if SNL/NM facility operations were possibly responsible for the observed result. Table 4 provides various reference values for metals-in-soil. Applicable NMED Screening Levels (if available) for Industrial and Residential use are indicated on the graphs.

Appendix A contains a detailed description of the mechanics of log-normal plotting. Appendix B contains the plots of the soil/sediment data, sorted alphabetically by analyte name. Associated with each plot presented are the summary statistics for each analyte.

Table 4. Various Reference Values for Metals-in-Soil

	NM Soil Concentrations[1]		NMED Soil Screening Levels[2]		US Soil Concentrations[3]	
Analyte	**Lower Limit**	**Upper Limit**	**Residential**	**Industrial**	**Lower Limit**	**Upper Limit**
Aluminum	5000	100000	74000	100000	4500	100000
Antimony	0.2	1.3	30	92	0.25	0.6
Arsenic	2.5	19	4	17	1	93
Barium	230	1800	5200	15000	20	1500
Beryllium	1	2.3	150	440	0.04	2.54
Cadmium	ND	11	70	190	0.41	0.57
Calcium	600	320000	n/a	n/a	n/a	n/a
Chromium	7.6	42	230	660	7	1500
Cobalt	2.1	11	4500	13000	3	50
Copper	2.1	30	2800	8500	3	300
Iron	1000	100000	23000	69000	5000	50000
Lead	7.8	21	400	1000	10	70
Magnesium	300	100000	n/a	n/a	n/a	n/a
Manganese	30	5000	7800	14000	20	3000
Mercury	0.01	0.06	7	20	0.02	1.5
Molybdenum	1	6.5	380	1200	0.8	3.3
Nickel	2.8	19	1500	4400	5	150
Potassium	1900	63000	n/a	n/a	n/a	n/a
Selenium	0.2	0.8	380	1200	0.1	4
Silica (Silicon)	150000	440000	n/a	n/a	24000	368000
Silver	0.5	5	380	1200	0.2	3.2
Sodium	500	100000	n/a	n/a	n/a	n/a
Strontium	88	440	37000	89000	7	1000
Thallium	n/a	n/a	6	18	0.02	2.8
Titanium	910	4000	n/a	n/a	20	1000
Vanadium	15	94	530	1600	0.7	98
Zinc	18	84	23000	69000	13	300

ND = not detectable
n/a = not available
(1) Dragun, James, A. Chiasson, *Elements in North American Soils*, 1991, Hazardous Materials Control Resources Institute, (Used San Juan Basin, A Horizon to determine values).
(2) NMED Soil Screening Levels (SSL), New Mexico Environmental Department Hazardous Waste Bureau and Ground Water Quality Bureau Voluntary Remediation Program, *Technical Background Document for Development of Soil Screening Levels*, NMED 2000
(3) US Soil Surface Concentrations
Kabata-Pendias, A., Pendias, H., CRC, *Trace Elements in Soils and Plants*, 2nd Edition, 1992

Summary

Soil and sediment samples have been collected from 1993 through 2005 at SNL/NM as one means of monitoring for the potential effects on the environment of facility operations at the Laboratories. The year-to-year results of this sampling effort are reported in the Annual Site Environmental Report (ASER, SNL 2005a). With the exception of a few locations, the data indicate that SNL/NM operations have made no significant impact to existing concentration of TAL metal in surface soil or sediment.

The only significant exception was noted at sampling location #20, immediately west of Technical Area IV (TA-IV). Here, elevated levels of As, Sb and Pb were detected. As it turns out, the As, Sb and Pb did not originate from SNL/NM operations, but coincidentally from the nearby Skeet Range operated by the Kirtland Air Force Base (KAFB) for many years. The Skeet Range has now been remediated and is no longer used (Montgomery-Watson 2001). The New Mexico Environment Department determined that this remediation was sufficient for No Further Action (Lundstrom 2003). Furthermore, comprehensive analysis of the data collected from this location corroborates that the low levels of residual As, Sb, and Pb at this location present no future risk to human health or the environment (SNL 2005b).

Appendix A - Data Analysis

The data in this report is presented in the form of log-normal probability plots. Such plots are useful tools for conveniently cataloguing and evaluating large amounts of data, as well as providing a first approximation of the similarity (or differences) of the data. The basis for using log-normal plotting is experience which has shown that large quantities of environmental data (many similar analyte/media combinations) yield a straight line when plotted on a log-probability or logarithmic scale (Miller 1977). The presumption of log-normal distribution is never a bad presumption and is never worse than the presumption of arithmetic-normal (Michels 1971). Because the data is represented graphically, the mean, standard deviation, expected upper limits, and any abnormalities can be readily determined visually (Waite 1975).

Characteristics of special importance in the use of log-normal plots are linearity (denoting data from a common population), standard geometric deviation ($\sigma_{g,}$ an indicator of variability or range), and geometric mean (X_g). The usit of slope in a log-normal plot involves a logarithmic increment. Thus, the standard deviation is a multiplier of the geometric mean (Michels 1971).The values for σ_g and X_g can be obtained from the graphs by the ratio of the 84%/50% intercepts and the 50% intercepts, respectively (Miller 1977). Linearity of the graph implies that any potential SNL/NM contribution to the observed concentration is indistinguishable from regional levels of the element. Anomalous results (potentially attributable to SNL/NM operations) must necessarily occur at a higher concentration than would be expected from regional distributions. For convenience, summary statistics for each element was imbedded in each plot. Included in this list is the Upper Tolerance Limit (UTL), which is defined as:

$$95^{th}\ \text{UTL} = \bar{X} + K*S$$

Where UTL = Upper Tolerance Limit
X = Sample Arithmetic Mean
S = Sample Standard Deviation
K = One-sided normal tolerance factor

Values for K are commonly determined from tables such as those provided by Lieberman (Leiberman 1958). A typical value of K equal to 1.763 was assigned, which is for sample size of n = 500. The sample size for each element ranged from 500-1100. This UTL can be used to estimate a level above which a sample result may not be attributable to naturally occurring "background" levels of the element.

Whenever a particular results appears elevated (on the log-normal plot) compared to the expected concentration based on the population comprised of all the other locations, further investigation to determine if SNL/NM operations are potentially responsible may include (but should not be limited to) the following:

- What is the geographical location of the sample? Is there a detectable pattern to the anomalous observation or is the sample from an area in close proximity to a facility which has the potential for release of the analyte or contaminant?
- Does the location of the sample(s) show elevated levels for other analytes or for the results obtained from the same location in previous years?
- If several locations appear to be elevated, is there a particular year that had the elevated results? How did these compare to perimeter or off-site sample results?

As can be observed in many of the graphs, data at the lower end of the range frequently "falls off" in a manner that suggests that these results do not belong in the distribution being plotted, or are otherwise anomalous. However, in almost all instances, these results represent reported values that were at the extreme lower limit of the analytical method employed at the time of analysis. This is not atypical, since the plotted values do not include the analytical uncertainty or method detection level (MDL) for a given result. Also, the MDL changes (frequently becomes better) over time as the state-of-the-art for analytical science improves, and the aggregated data may include data that actually has a range of MDLs, which only becomes an artifact if the given analyte's concentration is near the MDL. In several of the plots, many of the same reported values appear as a "flat line". These values are typically the "less than" values reported by the laboratory when the analyte was not otherwise detected.

Appendix B contains the plots of the soil/sediment data, sorted alphabetically by analyte name. Any noteworthy anomalies in the plots are discussed by notes within the given plot. Associated with each plot presented in Appendix B are the summary statistics and NMED Screening Levels for each analyte.

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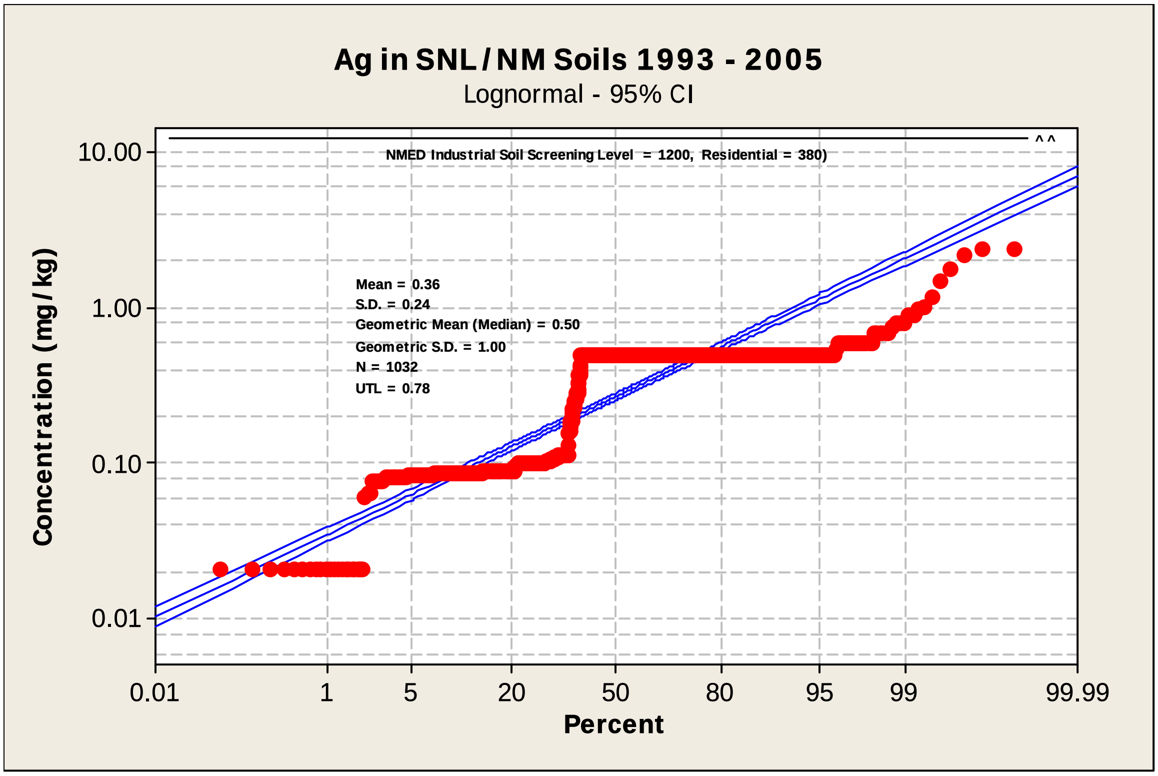
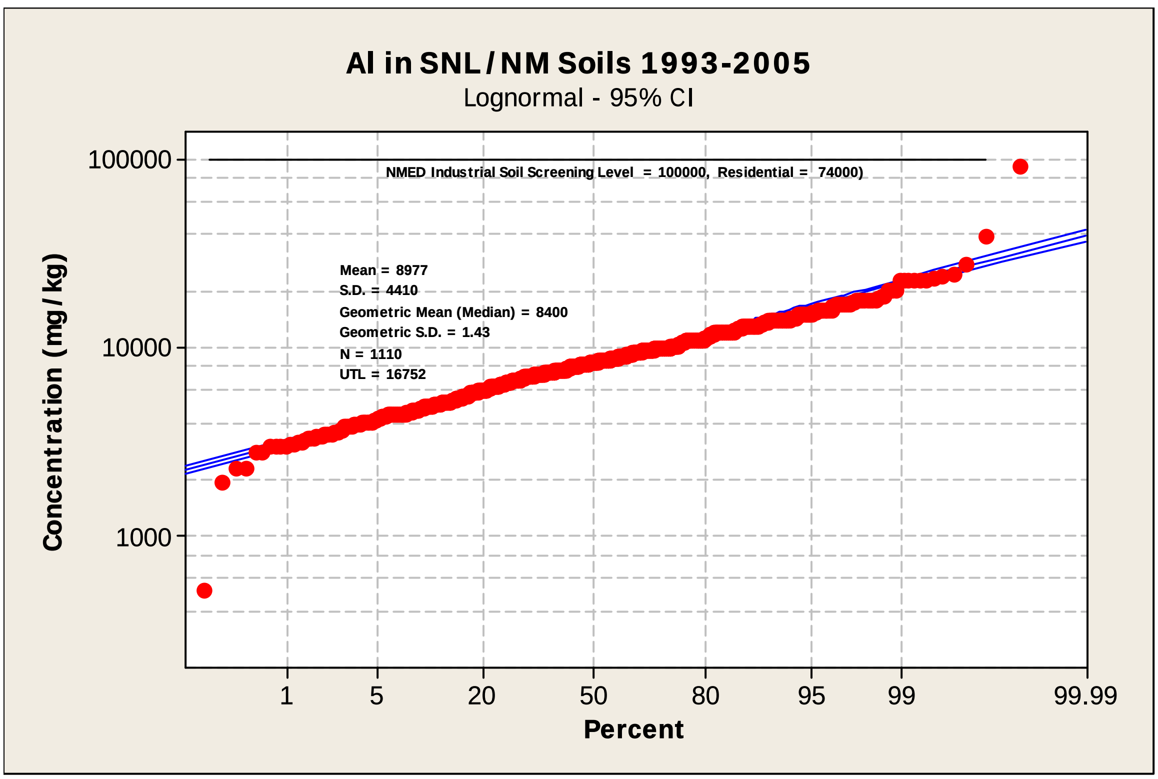
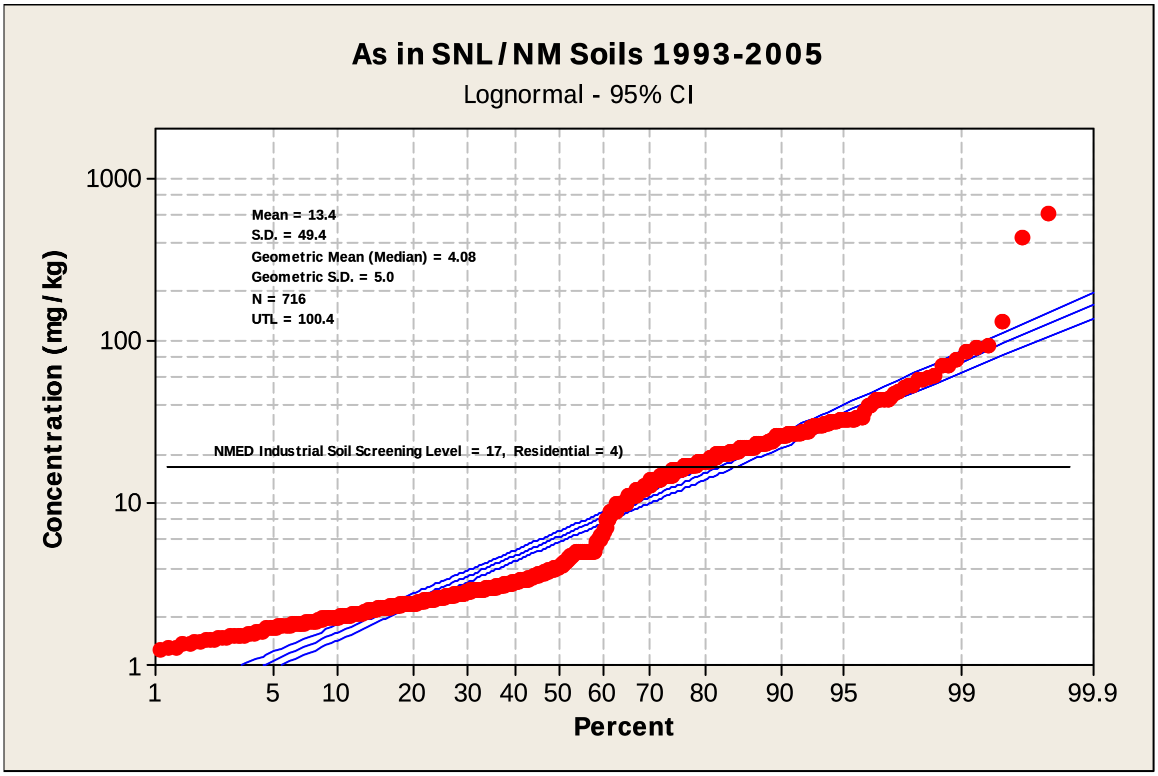
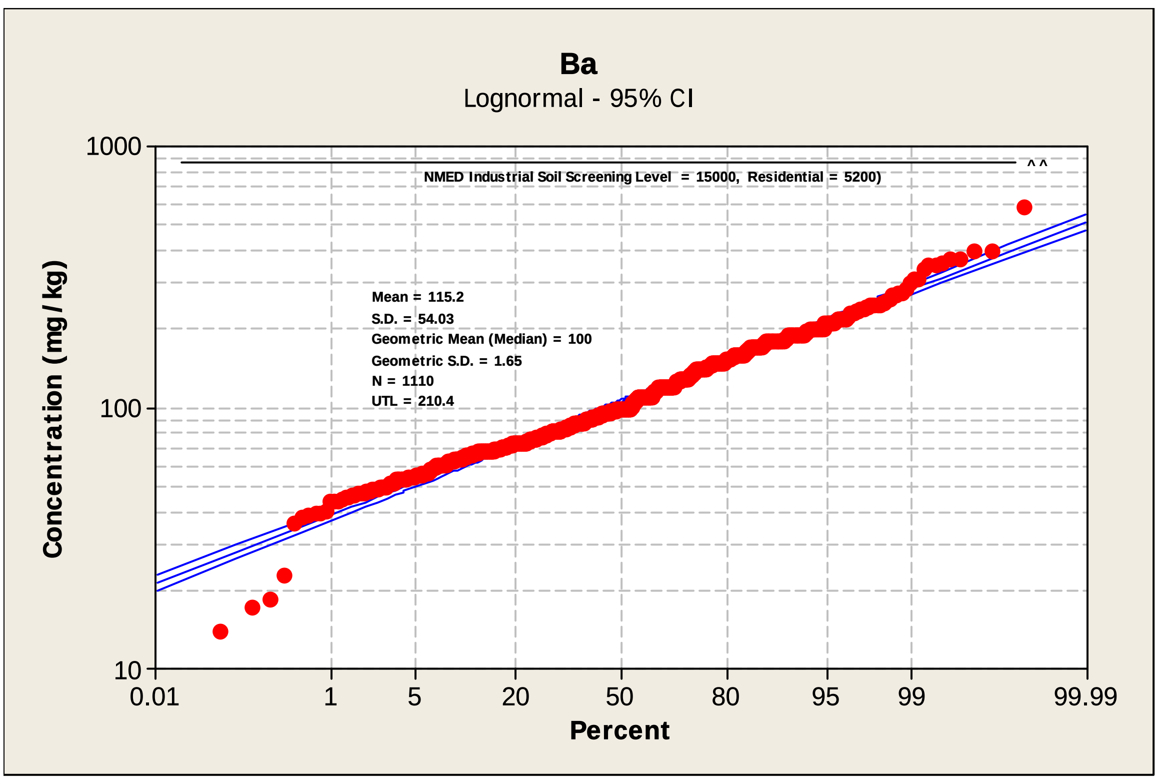
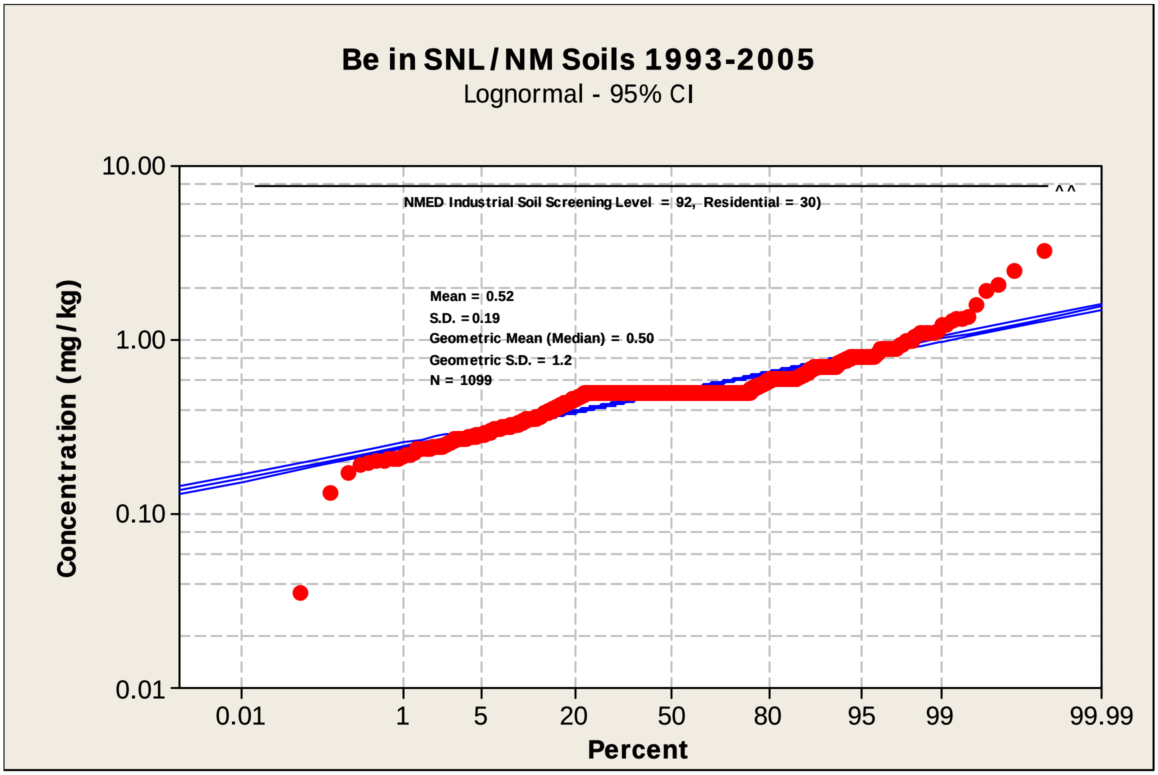
Appendix B – TAL Metals in Soil in the SNL/NM Environs

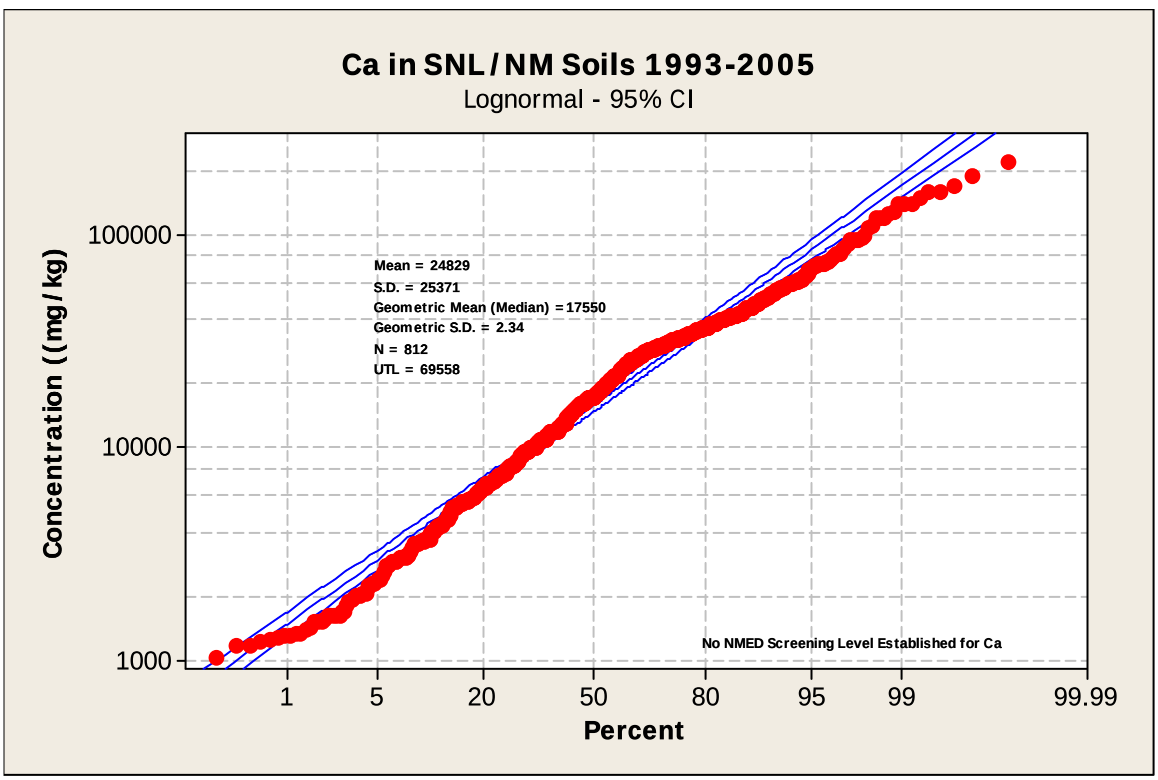


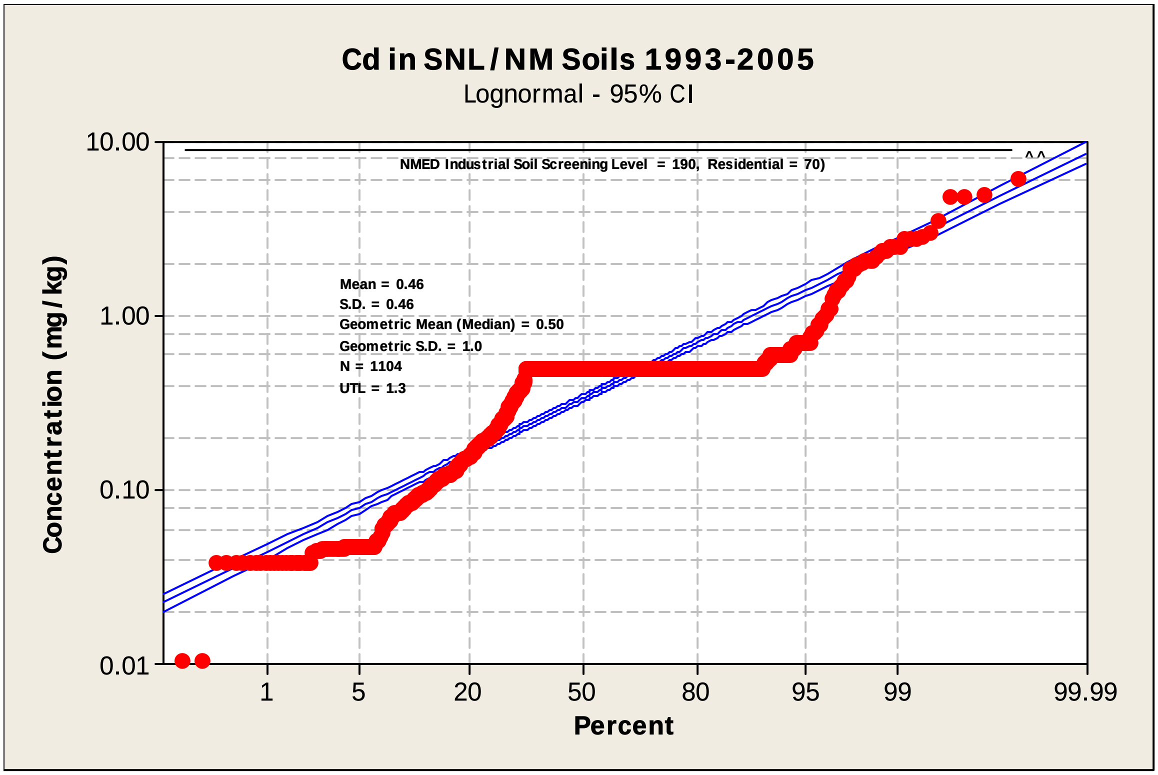


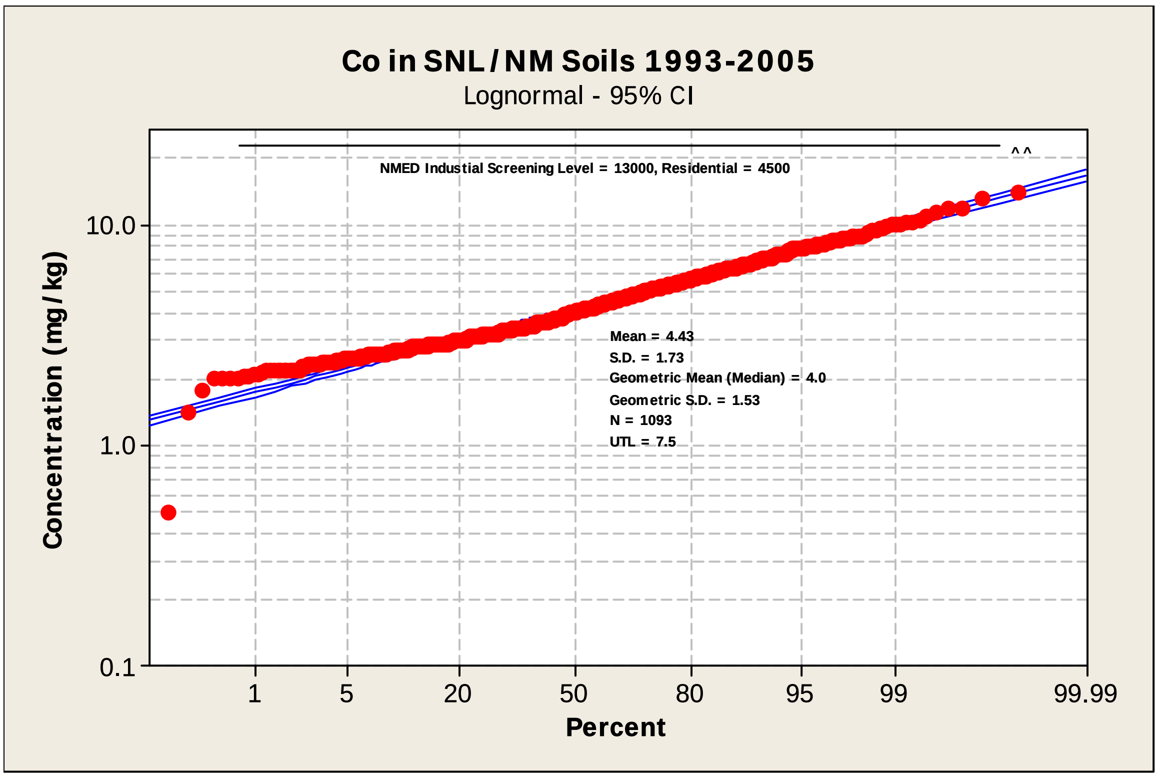

As in SNL / NM Soils 1993-2005
Lognormal - 95% CI
Mean = 13.4
S.D. = 49.4
Geometric Mean (Median) = 4.08
Geometric S.D. = 5.0
N = 716
UTL = 100.4
NMED Industrial Soil Screening Level = 17, Residential = 4)
Concentration (mg / kg)
1000
100
10
1
1
5
10
20
30
40
50
60
70
80
90
95
99
99.9
Percent

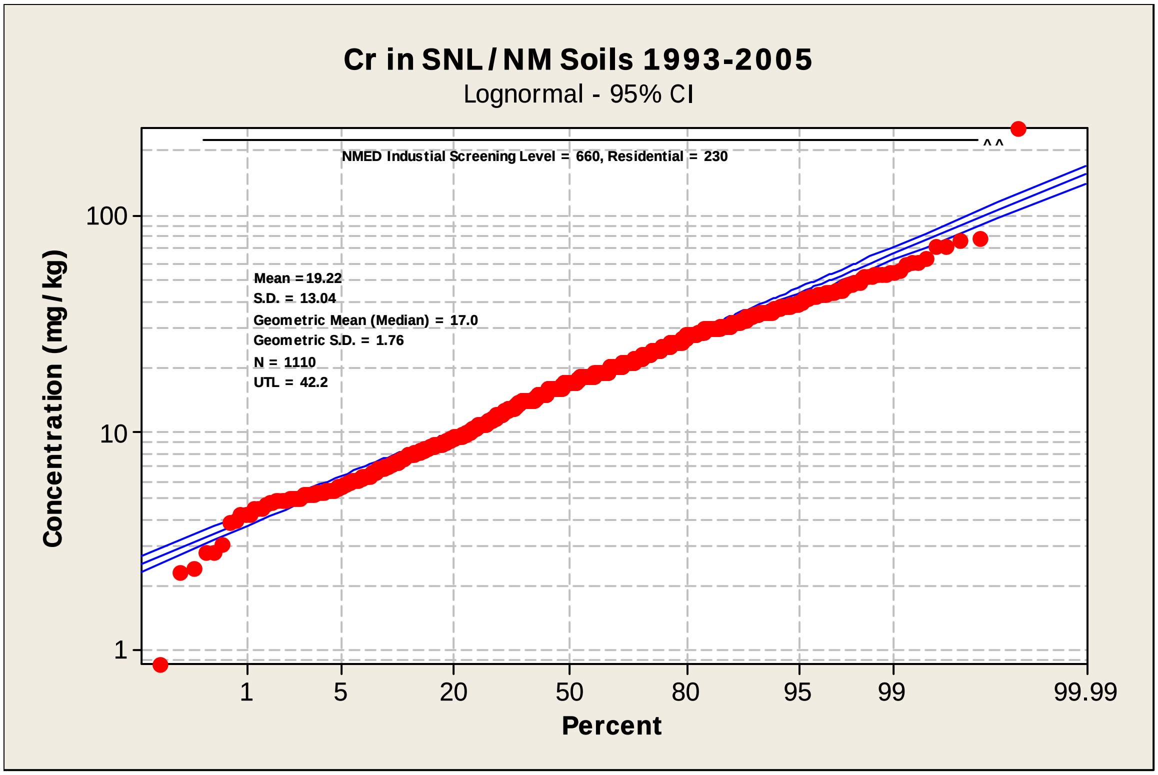

Ba
Lognormal - 95% CI
NMED Industrial Soil Screening Level = 15000, Residential = 5200)
^^
Mean = 115.2
S.D. = 54.03
Geometric Mean (Median) = 100
Geometric S.D. = 1.65
N = 1110
UTL = 210.4
Concentration (mg / kg)
1000
100
10
0.01
1
5
20
50
80
95
99
99.99
Percent

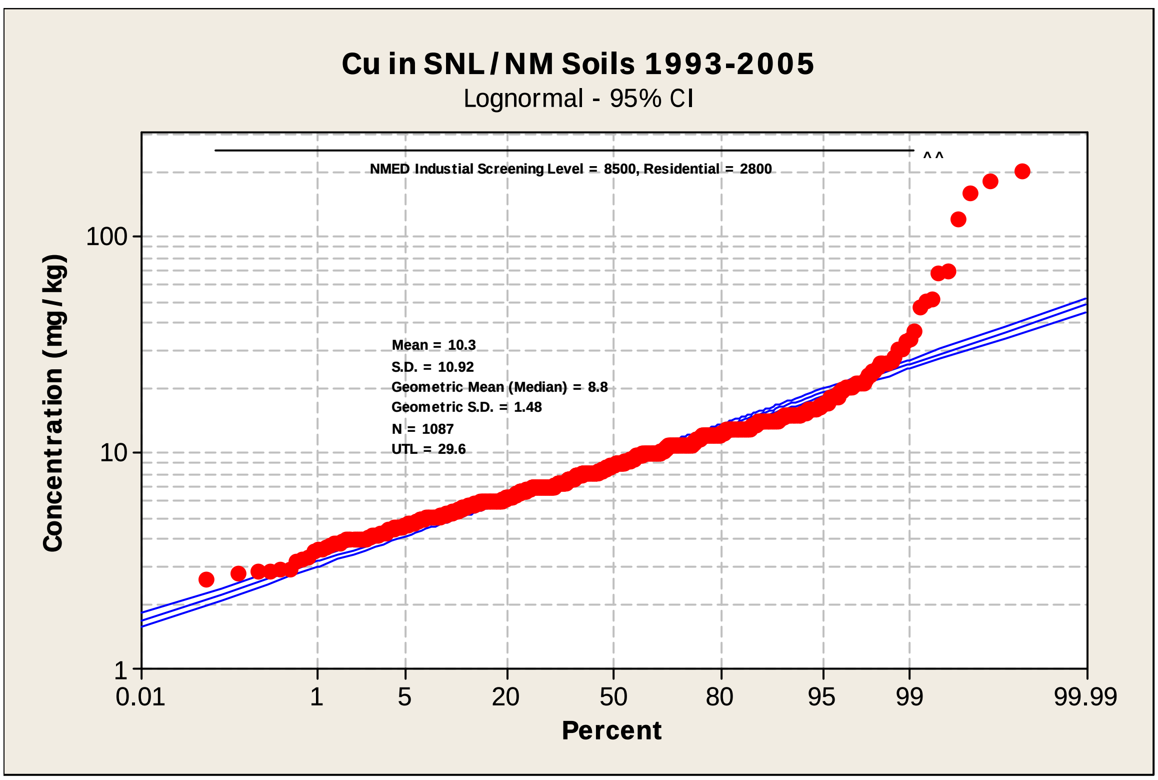

Be in SNL / NM Soils 1993-2005
Lognormal - 95% CI
NMED Industrial Soil Screening Level = 92, Residential = 30)
^^
Mean = 0.52
S.D. = 0.19
Geometric Mean (Median) = 0.50
Geometric S.D. = 1.2
N = 1099
Concentration (mg/kg)
10.00
1.00
0.10
0.01
0.01
1
5
20
50
80
95
99
99.99
Percent

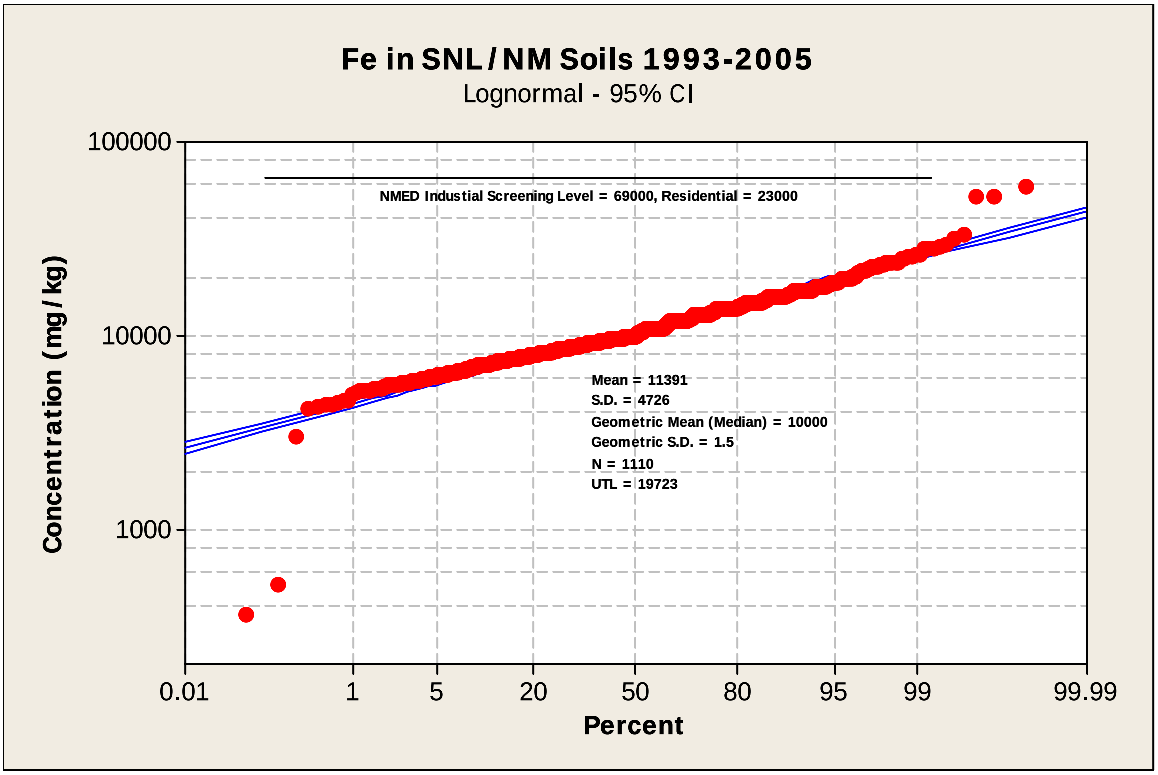

Ca in SNL / NM Soils 1993-2005
Lognormal - 95% CI
Mean = 24829
S.D. = 25371
Geometric Mean (Median) = 17550
Geometric S.D. = 2.34
N = 812
UTL = 69558
No NMED Screening Level Established for Ca
Concentration ((mg/kg)
100000
10000
1000
1
5
20
50
80
95
99
99.99
Percent

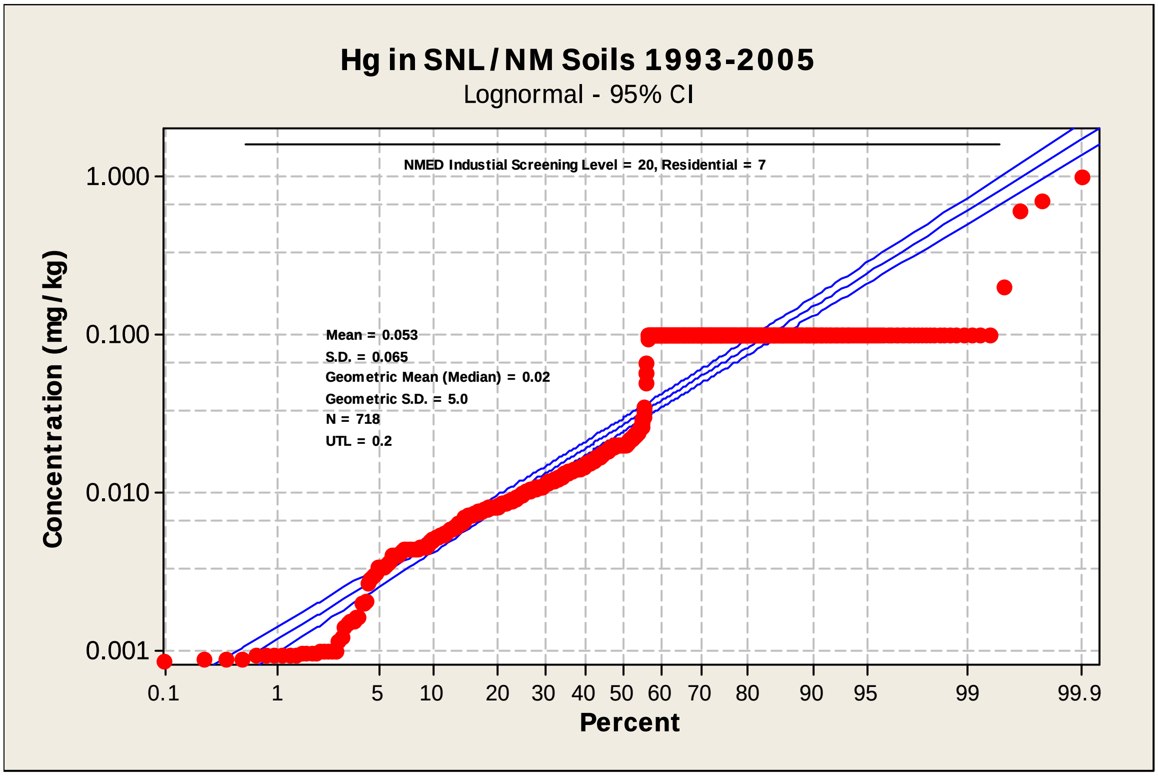

Cd in SNL / NM Soils 1993-2005
Lognormal - 95% CI
NMED Industrial Soil Screening Level = 190, Residential = 70)
Mean = 0.46
S.D. = 0.46
Geometric Mean (Median) = 0.50
Geometric S.D. = 1.0
N = 1104
UTL = 1.3
Concentration (mg/kg)
Percent
10.00
1.00
0.10
0.01
1
5
20
50
80
95
99
99.99

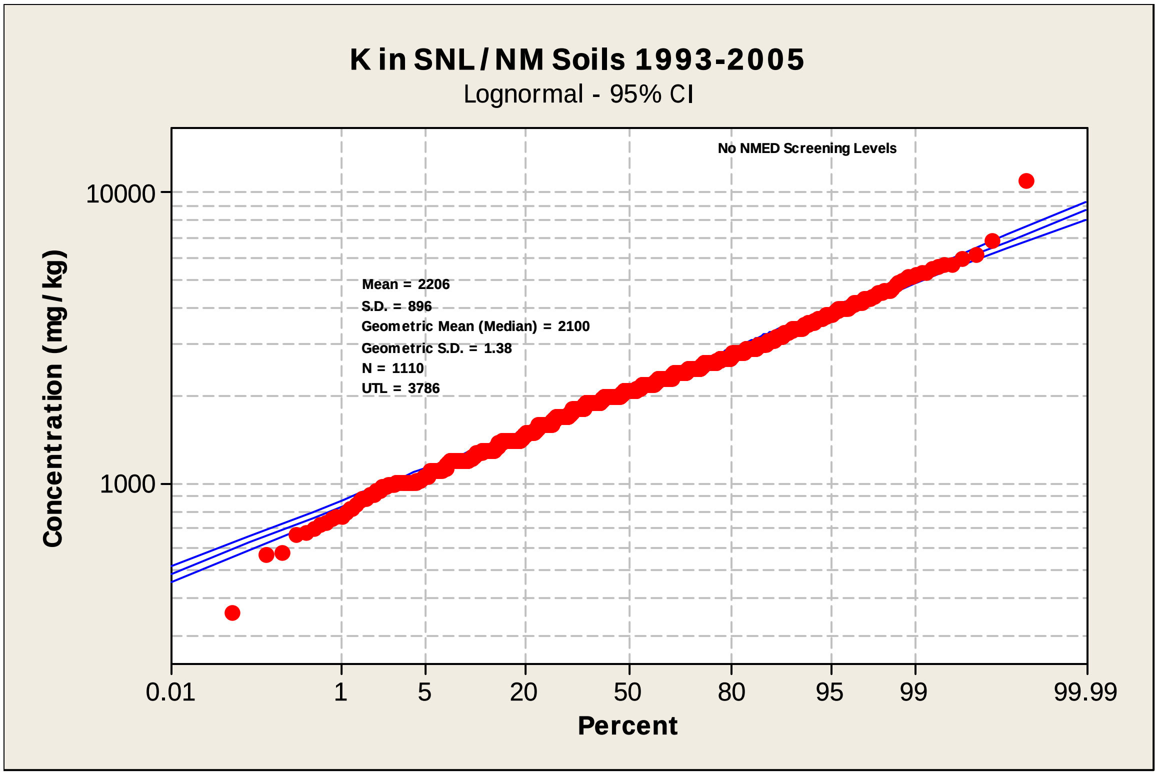

Co in SNL / NM Soils 1993-2005
Lognormal - 95% CI
NMED Industial Screening Level = 13000, Residential = 4500
Mean = 4.43
S.D. = 1.73
Geometric Mean (Median) = 4.0
Geometric S.D. = 1.53
N = 1093
UTL = 7.5
Concentration (mg/kg)
Percent
10.0
1.0
0.1
1
5
20
50
80
95
99
99.99

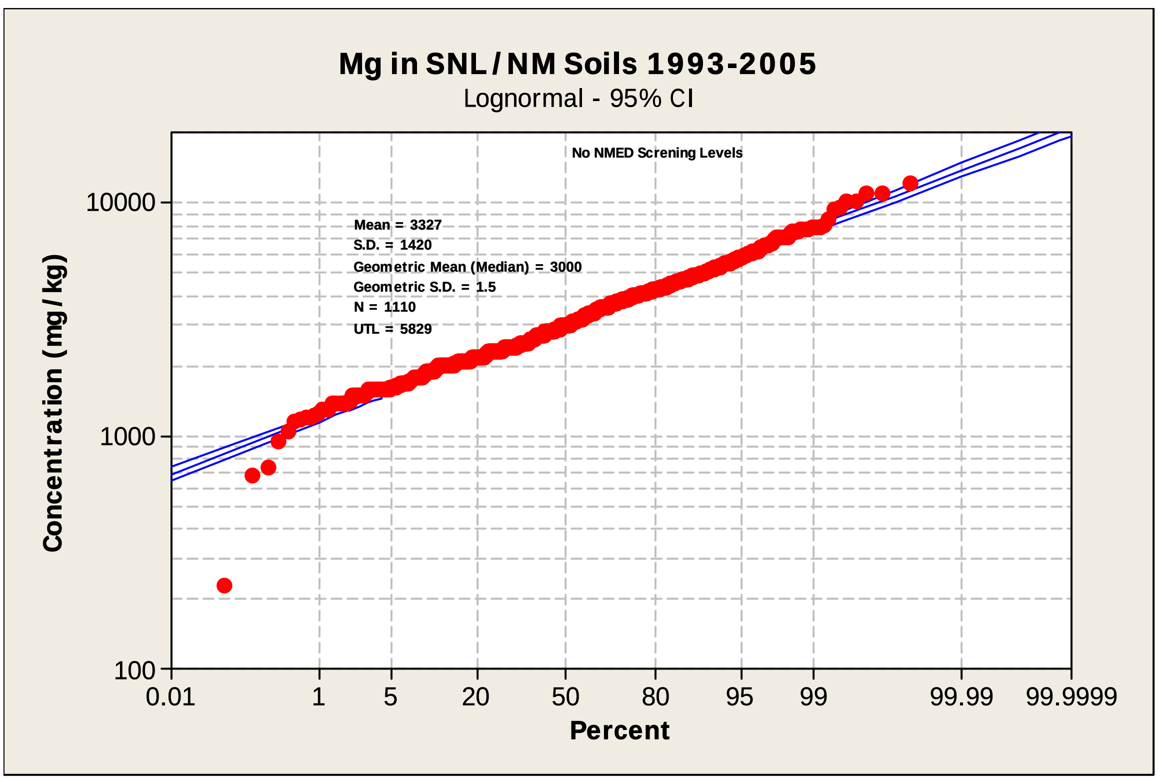

Cr in SNL / NM Soils 1993-2005
Lognormal - 95% CI
NMED Industial Screening Level = 660, Residential = 230
Mean = 19.22
S.D. = 13.04
Geometric Mean (Median) = 17.0
Geometric S.D. = 1.76
N = 1110
UTL = 42.2
Concentration (mg / kg)
Percent
100
10
1
1
5
20
50
80
95
99
99.99

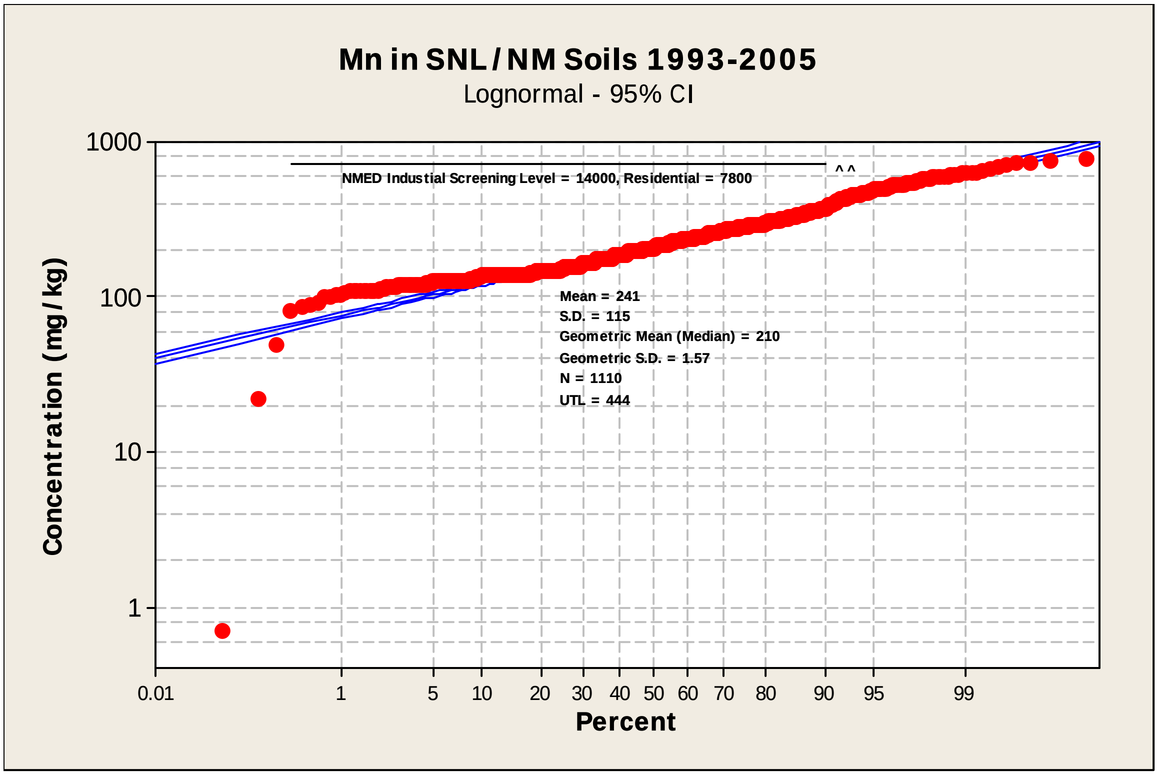

Cu in SNL / NM Soils 1993-2005
Lognormal - 95% CI
NMED Industial Screening Level = 8500, Residential = 2800
Mean = 10.3
S.D. = 10.92
Geometric Mean (Median) = 8.8
Geometric S.D. = 1.48
N = 1087
UTL = 29.6
Concentration (mg / kg)
Percent
100
10
1
0.01
1
5
20
50
80
95
99
99.99

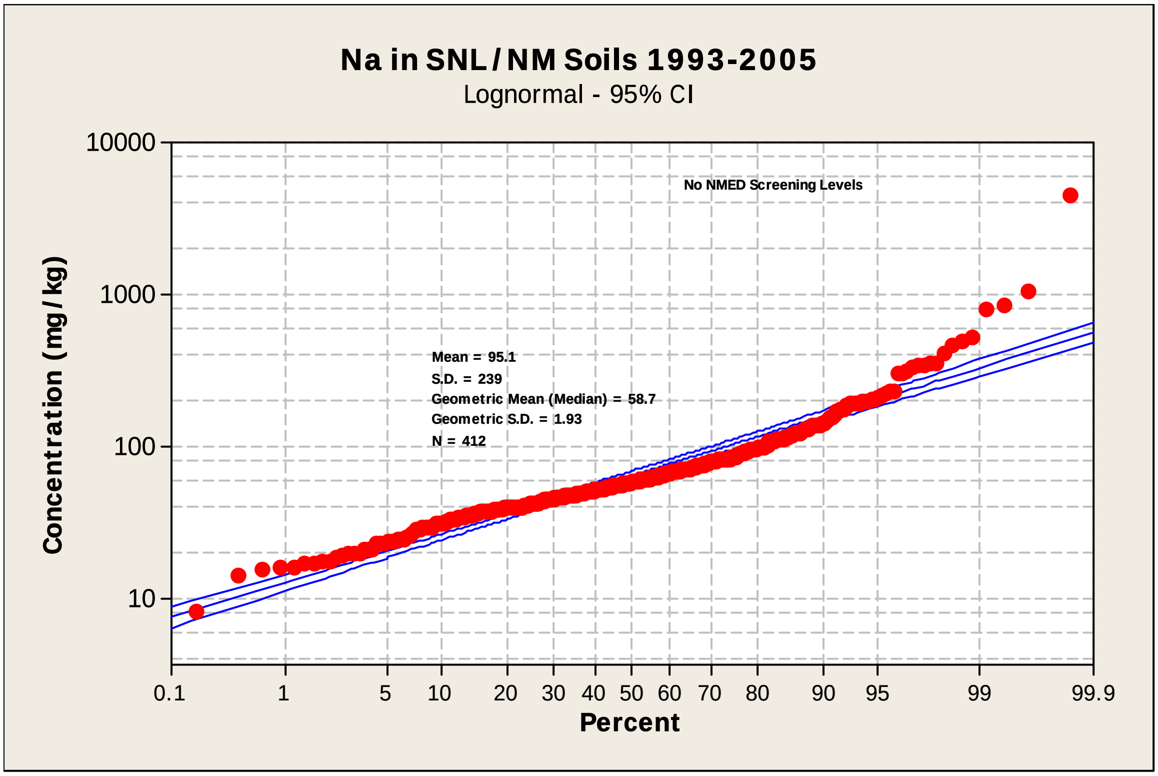

Fe in SNL/NM Soils 1993-2005
Lognormal - 95% CI
Concentration (mg/kg)
100000
10000
1000
NMED Industial Screening Level = 69000, Residential = 23000
Mean = 11391
S.D. = 4726
Geometric Mean (Median) = 10000
Geometric S.D. = 1.5
N = 1110
UTL = 19723
0.01
1
5
20
50
80
95
99
99.99
Percent

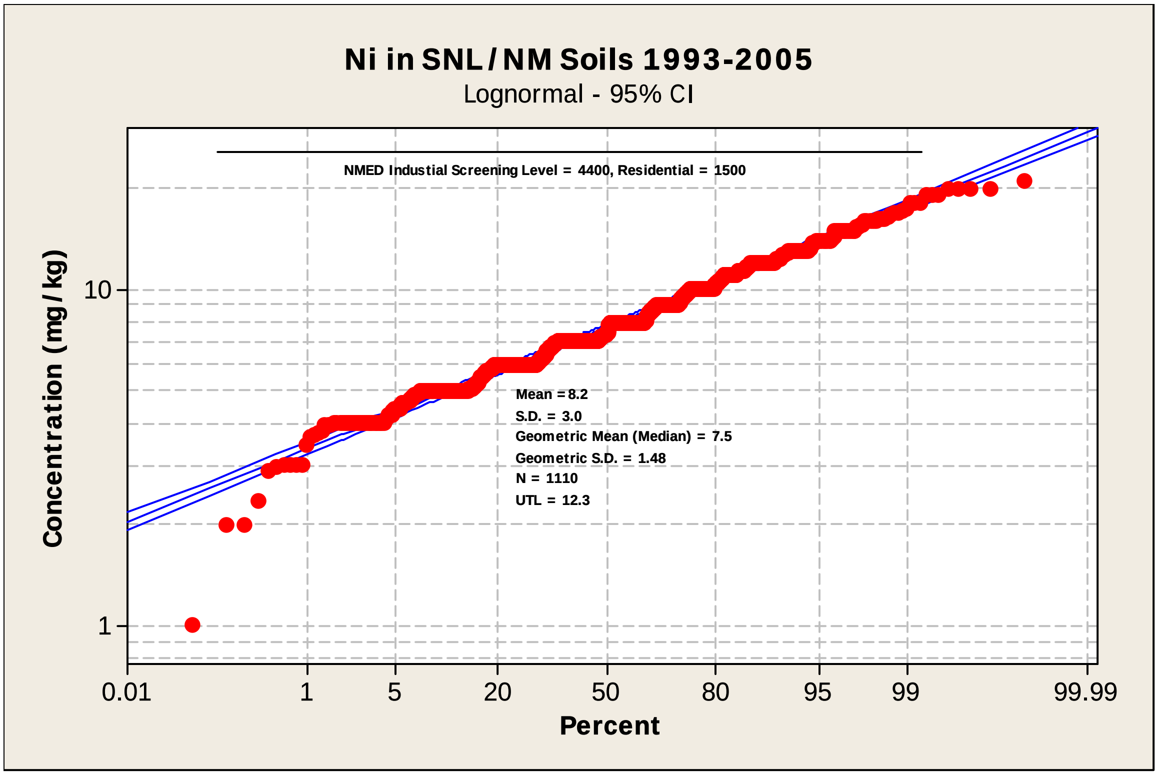

Hg in SNL/NM Soils 1993-2005
Lognormal - 95% CI
Concentration (mg/kg)
1.000
0.100
0.010
0.001
NMED Industial Screening Level = 20, Residential = 7
Mean = 0.053
S.D. = 0.065
Geometric Mean (Median) = 0.02
Geometric S.D. = 5.0
N = 718
UTL = 0.2
0.1
1
5
10
20
30
40
50
60
70
80
90
95
99
99.9
Percent


K in SNL / NM Soils 1993-2005
Lognormal - 95% CI
No NMED Screening Levels
Mean = 2206
S.D. = 896
Geometric Mean (Median) = 2100
Geometric S.D. = 1.38
N = 1110
UTL = 3786
Concentration (mg / kg)
10000
1000
0.01
1
5
20
50
80
95
99
99.99
Percent

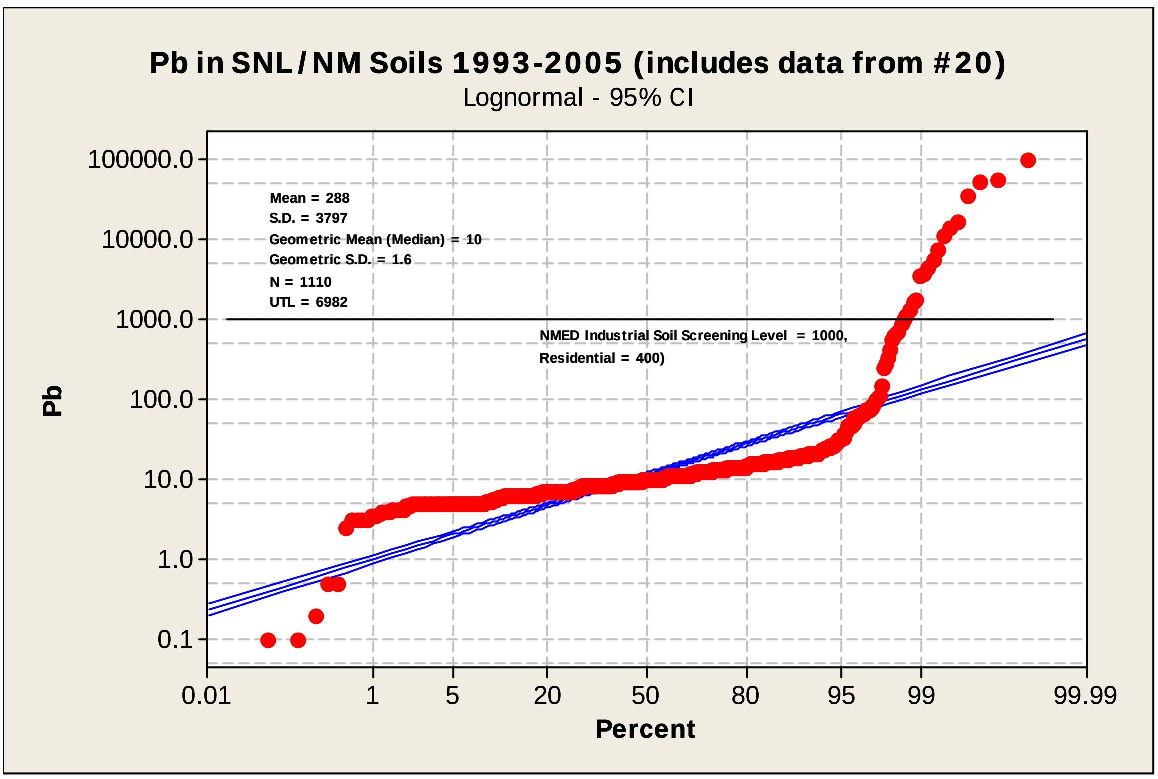

Mg in SNL / NM Soils 1993-2005
Lognormal - 95% CI
No NMED Screning Levels
Mean = 3327
S.D. = 1420
Geometric Mean (Median) = 3000
Geometric S.D. = 1.5
N = 1110
UTL = 5829
Concentration (mg / kg)
10000
1000
100
0.01
1
5
20
50
80
95
99
99.99
99.9999
Percent


Mn in SNL / NM Soils 1993-2005
Lognormal - 95% CI
NMED Industial Screening Level = 14000, Residential = 7800
^ ^
Mean = 241
S.D. = 115
Geometric Mean (Median) = 210
Geometric S.D. = 1.57
N = 1110
UTL = 444
Concentration (mg / kg)
1000
100
10
1
Percent
0.01
1
5
10
20
30
40
50
60
70
80
90
95
99

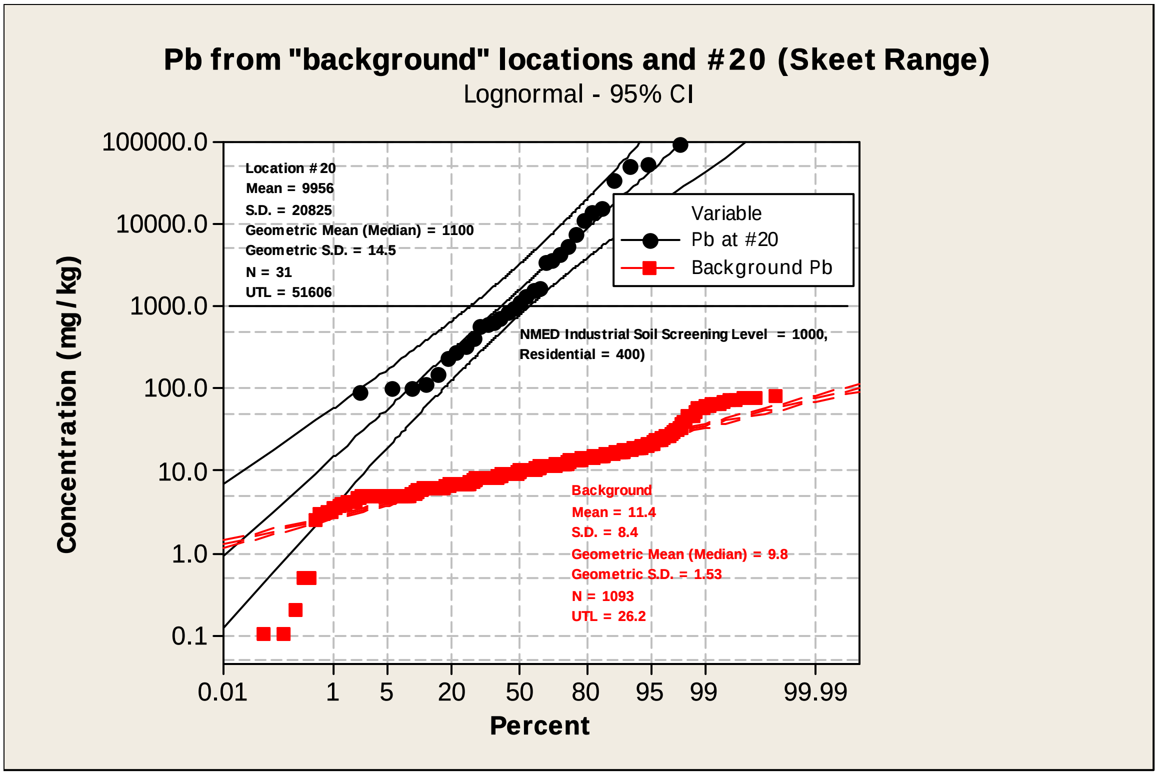

Na in SNL / NM Soils 1993-2005
Lognormal - 95% CI
No NMED Screening Levels
Mean = 95.1
S.D. = 239
Geometric Mean (Median) = 58.7
Geometric S.D. = 1.93
N = 412
Concentration (mg / kg)
10000
1000
100
10
Percent
0.1
1
5
10
20
30
40
50
60
70
80
90
95
99
99.9



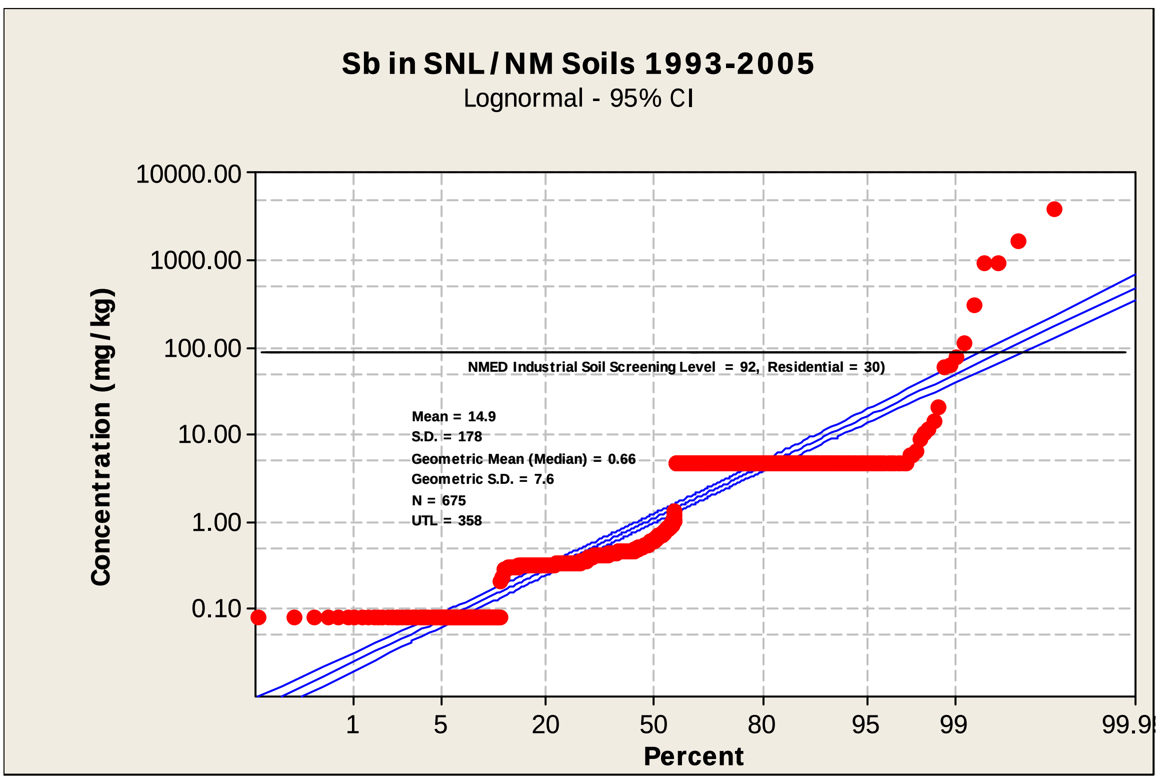
Ni in SNL/NM Soils 1993-2005
Lognormal - 95% CI
NMED Industial Screening Level = 4400, Residential = 1500
Mean = 8.2
S.D. = 3.0
Geometric Mean (Median) = 7.5
Geometric S.D. = 1.48
N = 1110
UTL = 12.3
Concentration (mg/kg)
10
1
0.01
1
5
20
50
80
95
99
99.99
Percent



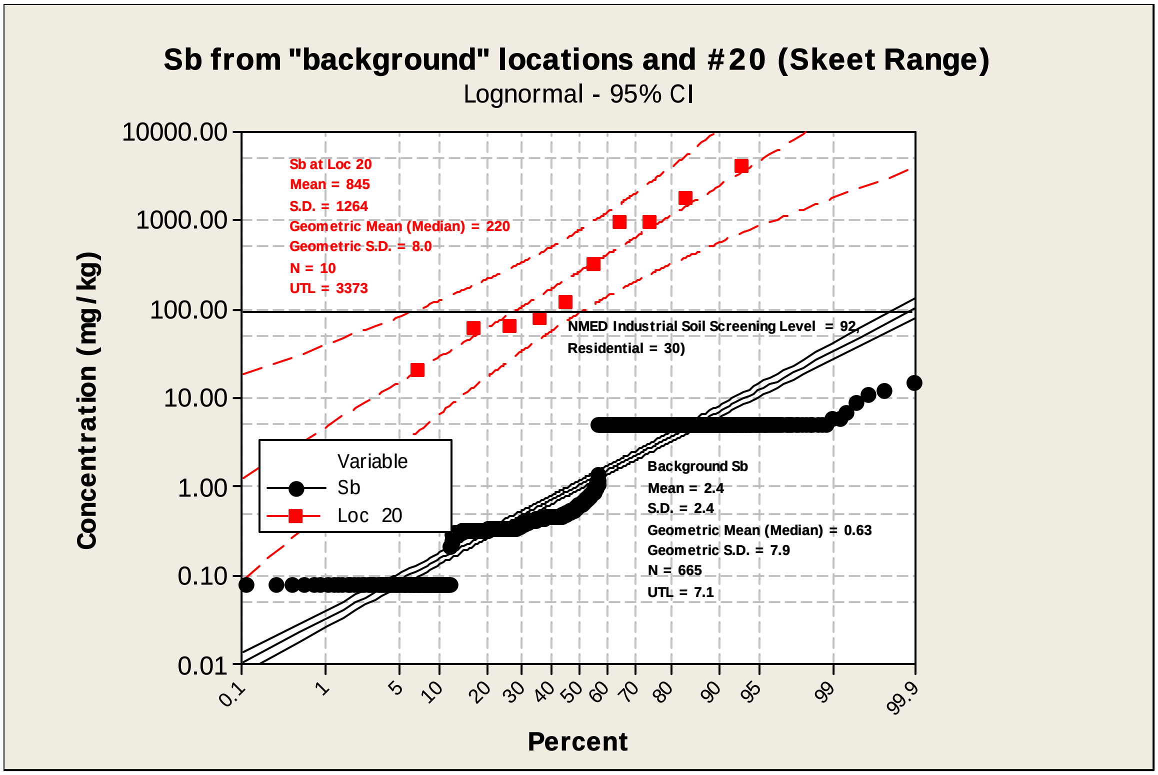
Pb in SNL/NM Soils 1993-2005 (includes data from #20)
Lognormal - 95% CI
Mean = 288
S.D. = 3797
Geometric Mean (Median) = 10
Geometric S.D. = 1.6
N = 1110
UTL = 6982
NMED Industrial Soil Screening Level = 1000,
Residential = 400)
Pb
100000.0
10000.0
1000.0
100.0
10.0
1.0
0.1
0.01
1
5
20
50
80
95
99
99.99
Percent

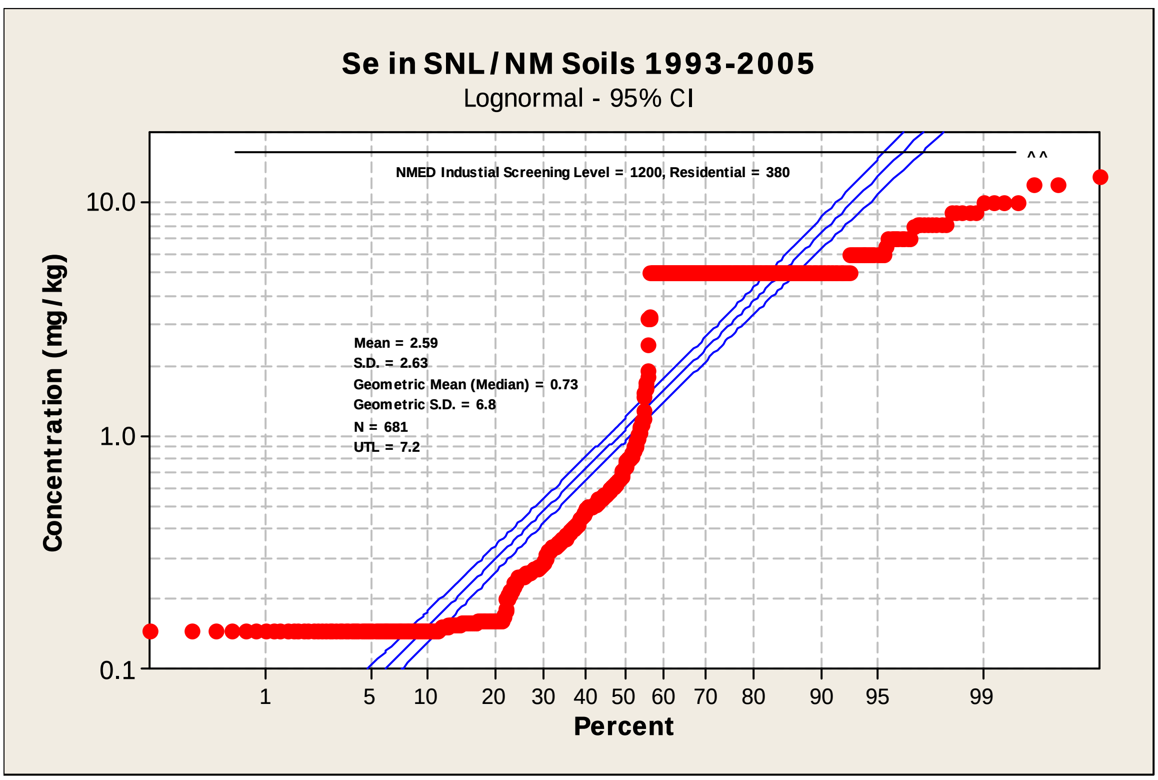


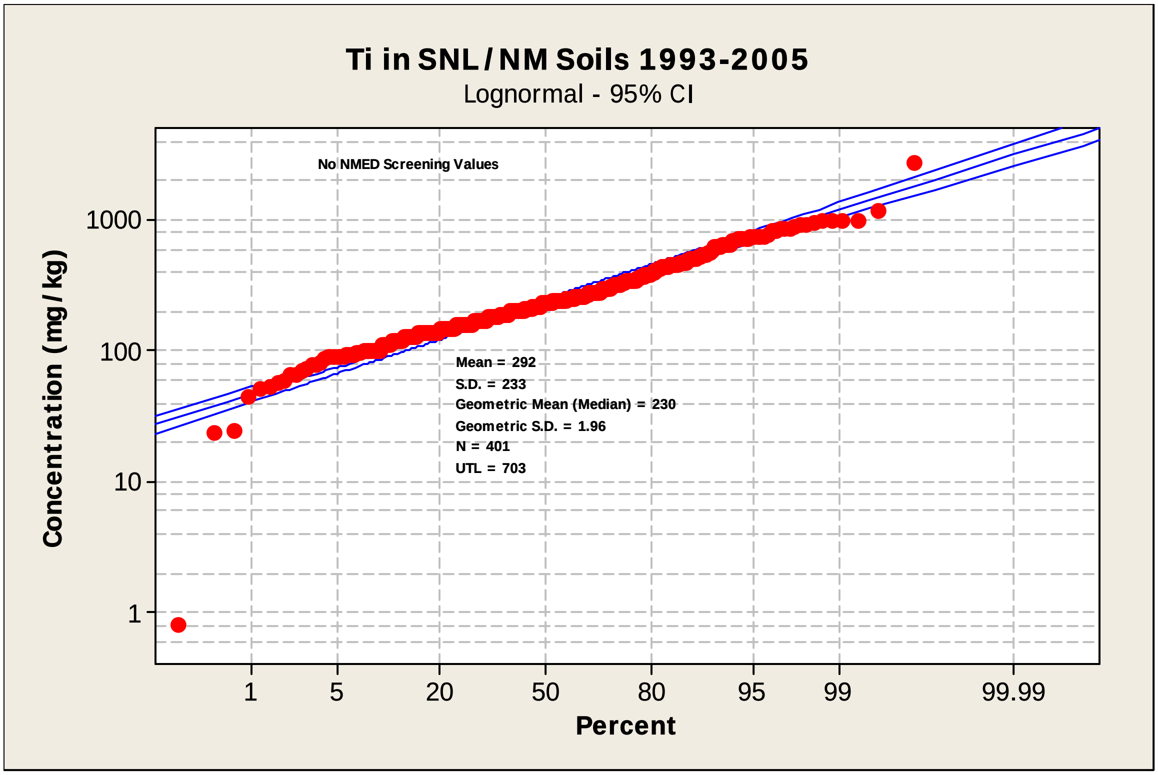
Pb from "background" locations and #20 (Skeet Range)
Lognormal - 95% CI
Concentration (mg/kg)
100000.0
10000.0
1000.0
100.0
10.0
1.0
0.1
Location #20
Mean = 9956
S.D. = 20825
Geometric Mean (Median) = 1100
Geometric S.D. = 14.5
N = 31
UTL = 51606
Variable
Pb at #20
Background Pb
NMED Industrial Soil Screening Level = 1000, Residential = 400)
Background
Mean = 11.4
S.D. = 8.4
Geometric Mean (Median) = 9.8
Geometric S.D. = 1.53
N = 1093
UTL = 26.2
0.01
1
5
20
50
80
95
99
99.99
Percent

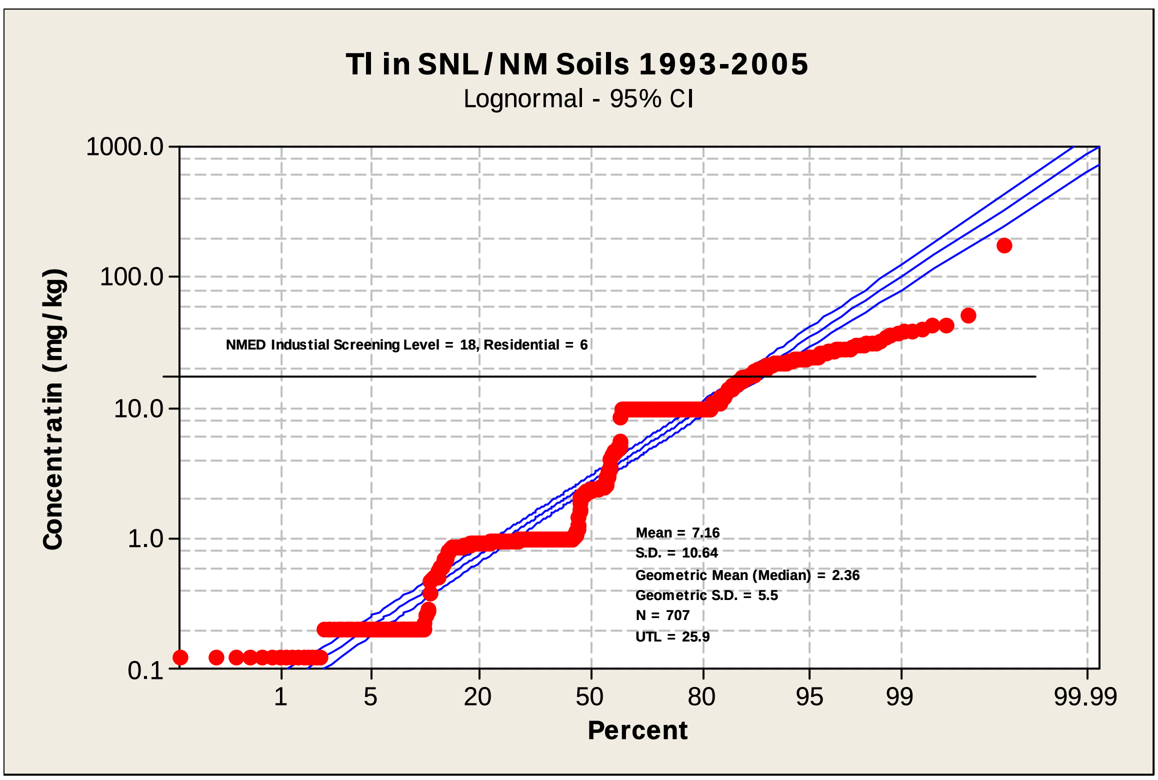


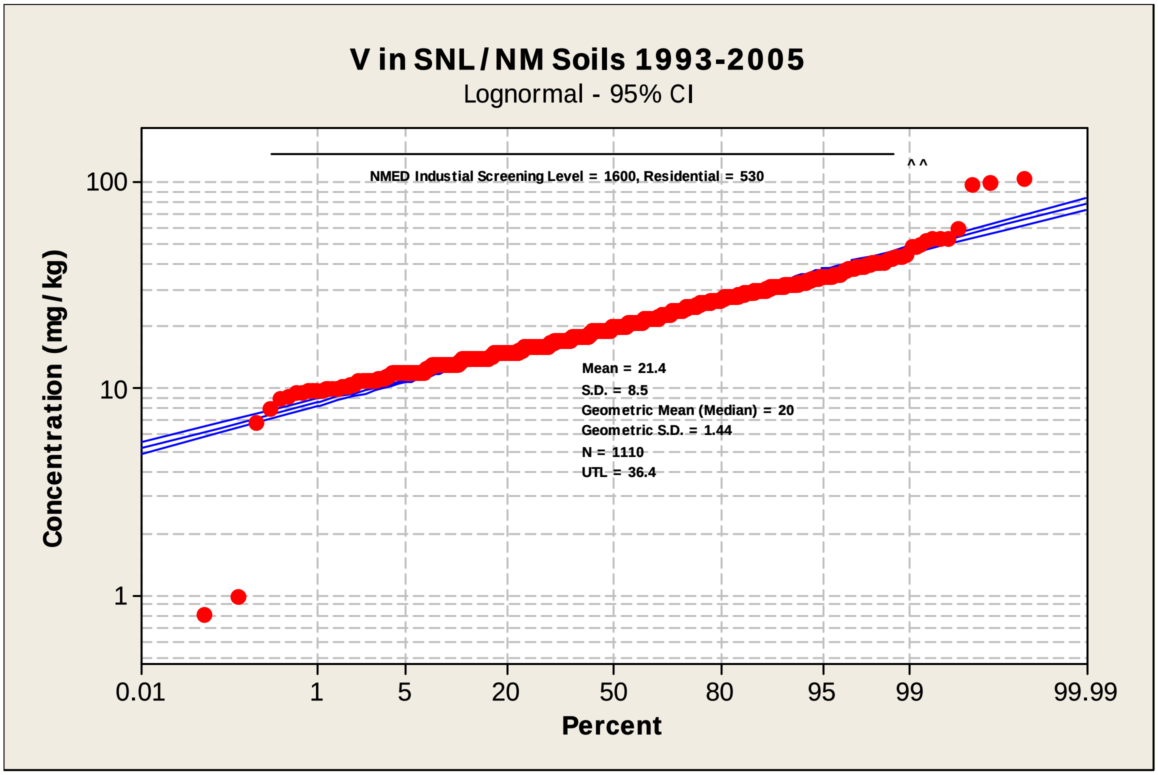
Sb in SNL/NM Soils 1993-2005
Lognormal - 95% CI
Concentration (mg/kg)
10000.00
1000.00
100.00
10.00
1.00
0.10
NMED Industrial Soil Screening Level = 92, Residential = 30)
Mean = 14.9
S.D. = 178
Geometric Mean (Median) = 0.66
Geometric S.D. = 7.6
N = 675
UTL = 358
1
5
20
50
80
95
99
Percent

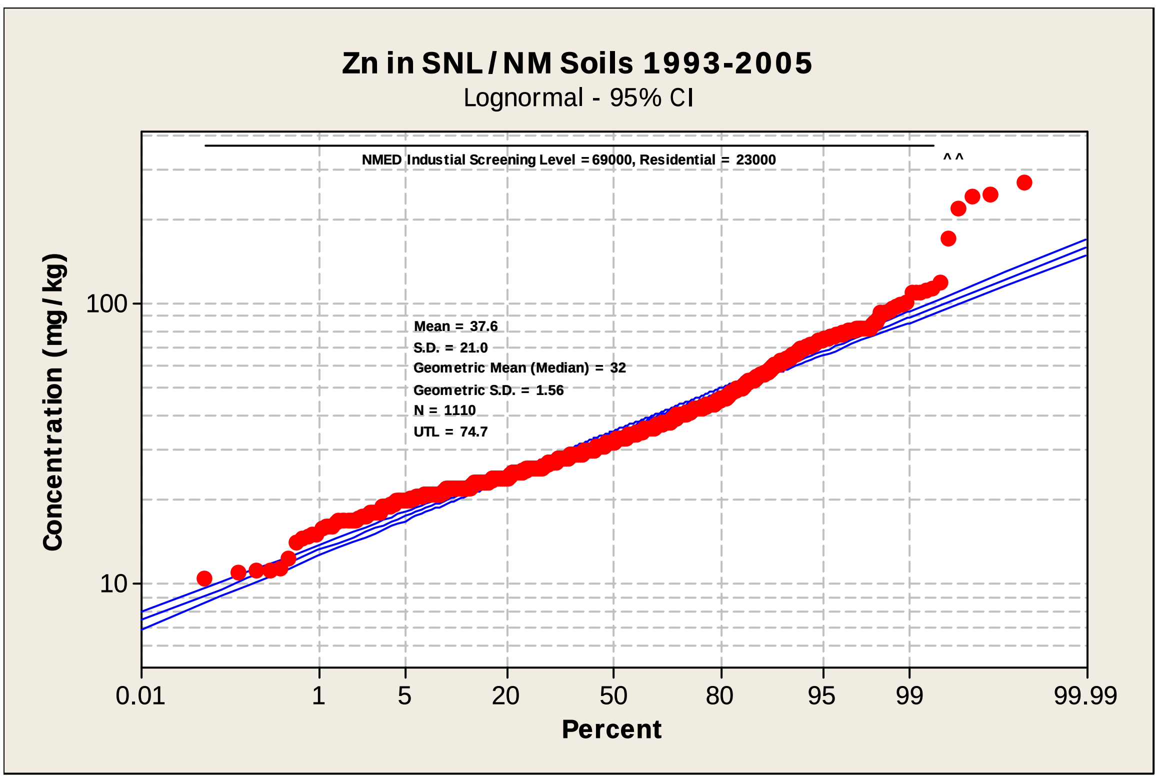

Sb from "background" locations and #20 (Skeet Range)
Lognormal - 95% CI
Sb at Loc 20
Mean = 845
S.D. = 1264
Geometric Mean (Median) = 220
Geometric S.D. = 8.0
N = 10
UTL = 3373
NMED Industrial Soil Screening Level = 92,
Residential = 30)
Variable
Sb
Loc 20
Background Sb
Mean = 2.4
S.D. = 2.4
Geometric Mean (Median) = 0.63
Geometric S.D. = 7.9
N = 665
UTL = 7.1
Concentration (mg/kg)
10000.00
1000.00
100.00
10.00
1.00
0.10
0.01
0.1
1
5
10
20
30
40
50
60
70
80
90
95
99
99.9
Percent


Se in SNL/NM Soils 1993-2005
Lognormal - 95% CI
NMED Industial Screening Level = 1200, Residential = 380
Mean = 2.59
S.D. = 2.63
Geometric Mean (Median) = 0.73
Geometric S.D. = 6.8
N = 681
UTL = 7.2
Concentration (mg/kg)
10.0
1.0
0.1
1
5
10
20
30
40
50
60
70
80
90
95
99
Percent


Ti in SNL / NM Soils 1993-2005
Lognormal - 95% CI
No NMED Screening Values
Mean = 292
S.D. = 233
Geometric Mean (Median) = 230
Geometric S.D. = 1.96
N = 401
UTL = 703
Concentration (mg / kg)
1000
100
10
1
1
5
20
50
80
95
99
99.99
Percent


Tl in SNL / NM Soils 1993-2005
Lognormal - 95% CI
NMED Industial Screening Level = 18, Residential = 6
Mean = 7.16
S.D. = 10.64
Geometric Mean (Median) = 2.36
Geometric S.D. = 5.5
N = 707
UTL = 25.9
Concentratin (mg / kg)
1000.0
100.0
10.0
1.0
0.1
1
5
20
50
80
95
99
99.99
Percent


V in SNL / NM Soils 1993-2005
Lognormal - 95% CI
NMED Industial Screening Level = 1600, Residential = 530
Mean = 21.4
S.D. = 8.5
Geometric Mean (Median) = 20
Geometric S.D. = 1.44
N = 1110
UTL = 36.4
Concentration (mg / kg)
100
10
1
0.01
1
5
20
50
80
95
99
99.99
Percent


Zn in SNL / NM Soils 1993-2005
Lognormal - 95% CI
NMED Industial Screening Level = 69000, Residential = 23000
Mean = 37.6
S.D. = 21.0
Geometric Mean (Median) = 32
Geometric S.D. = 1.56
N = 1110
UTL = 74.7
Concentration (mg / kg)
100
10
0.01
1
5
20
50
80
95
99
99.99
Percent

Distribution

1	MS1042	Mark Miller	10331
1	MS1042	Regina Deola	10331
1	MS0890	Heidi Herrera	10312
1	MS0491	Hans Oldewage	123451
1	MS0184	Karen Agogino	SSO
1	MS0184	Susan Lacy	SSO
2	MS9018	Central Technical Files	8945-1
2	MS0899	Technical Library	4536

APPENDIX F
SPARTAN POST-BURN SAMPLING REPORT 11/15/2006

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SANDIA REPORT

SAND2007-4559P
Unlimited Release
July 2007

Spartan Post-Burn Sampling Report November 2006

Mark A. Miller

Prepared by
Sandia National Laboratories
Albuquerque, New Mexico 87185 and Livermore, California 94550

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Spartan Post-Burn Sampling Report
11/15/2006

Several weeks before the Spartan Rocket Motor burn, background soil samples were collected along radials that fell along the most likely wind directions predicted for the burn area. The analyte of concern was aluminum (Al) because it was one of the major constituents in the rocket fuel. If any deposition was to occur (which itself was not considered to be likely), then Al in soil would be the best indicator. The directions were obtained fron SNL meteorologist, Regina Deola. This sampling strategy is depicted in Figures 1 and 2 below.

Figure 1. Spartan Pre-burn Predicted Wind Direction

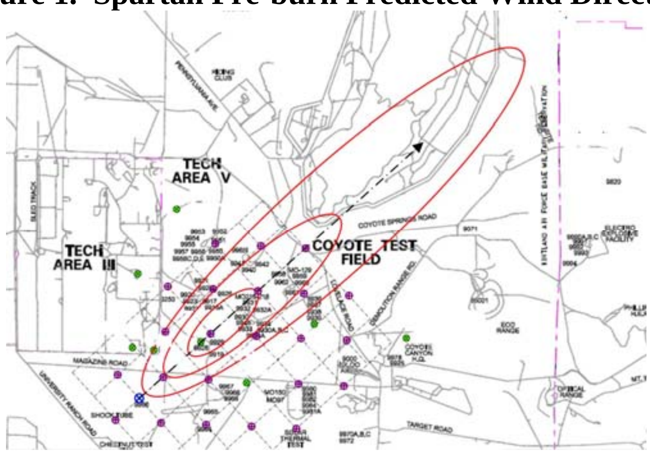
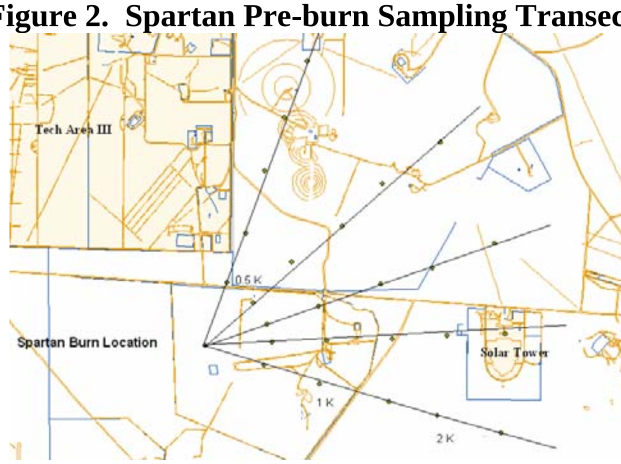
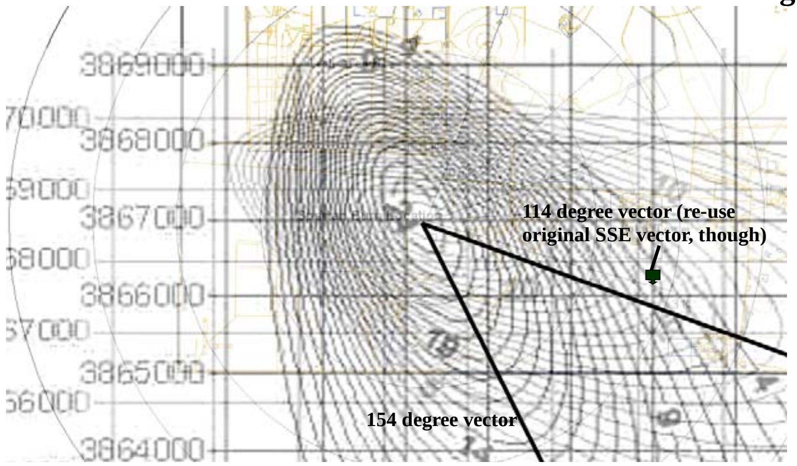


Figure 2. Spartan Pre-burn Sampling Transects



Because the actual winds trended toward the ESE at the time of the burn, samples were collected at several additional/new post-burn samples on the transect along the centerline of the elevated plume plume, as shown below in Figure 3. The "dimmer" plume shown below indicates the surface winds, whereas the winds higher aloft (where the "puff" actually went) were about 40 degrees more to the ESE (the darker plume, shown below). Thus, we will collect post-burn samples every 500 meters out to 2.5 kilometers along a transect along the nominal centerline and post-burn samples along the most clockwise transect where we collected pre-burn samples (slightly CCW of the 114 degree vector, shown below).

Figure 3. Transects Added to Account for Actual Winds During Burn



As Regina Deola points out, it is worth noting that the scalar average of the winds collected by the SODAR for the boundary layer through approximately 600 feet AGL is 293.7 at approximately 5.3 knots, which is very close to the 6000 foot MSL winds of 295 and 7 knots. In addition, the winds aloft, through the rest of the plume layer, are more from the Northwest and North-Northwest. The end result of this would be about a 40 degree offset of the plume center line towards the south as the plume rises above 600 feet AGL, which should be within the first kilometer of the plume trace. That offset would match visual observations of the plume, which went well south of the Solar Tower.

While the depositional accumulation of aluminum oxide was extremely low, this alteration of the plume configuration was used for confirmatory soil sampling. The most robust sampling to prove the point of minimal environmental impact was to collect confirmatory samples along two vectors, one at the modeled centerline and one shifting the centerline 40 degrees to the south from the source. The vectors from the source location would be towards the compass directions of 114 (use original pre-burn transect for this one) and 154.

After the burn event and subsequent sampling, the samples to sent to the laboratory for Aluminum metal analysis for analysis by ICP-MS were:

- 6 samples from the pre-burn set collected along the most north-trending transect (0, 0.5, 1, 1.5, 2, 2.5 km) (these were designated the "background" samples)
- 10 samples from the 2 most clockwise pre-burn transects (0.5, 1, 1.5, 2, 2.5 km these were samples along the most likely predicted plume direction)
- 6 samples from the post-burn transect along the elevated plume centerline (154 degree transect) (0, 0.5, 1, 1.5, 2, 2.5 km)
- 5 samples from the most clockwise pre-burn transect (~ the 114 degree ground-level plume transect (0.5, 1, 1.5, 2, 2.5 km)

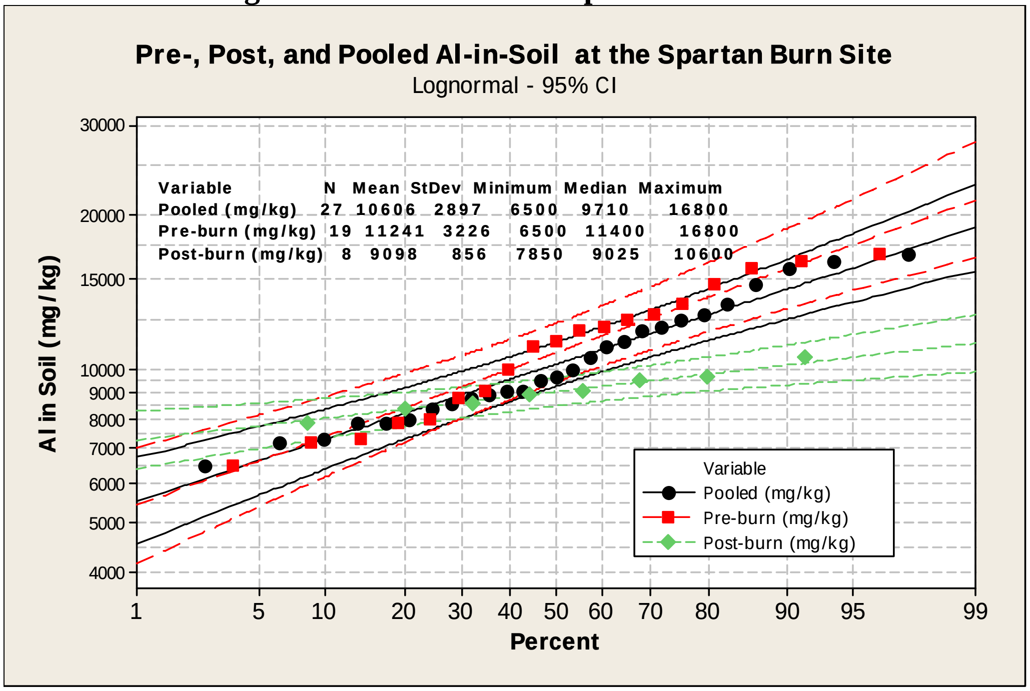
Total = 27 samples.

The resultant data are shown in Table 1 and Figure 4 below.

Table 1. Pre-, and Post-burn Soil Samples at the Spartan Burn Area

Sample Location	Sample Date	Matrix	Analyte	Result	Unit Of Measure
SB 1-1	6/29/2006	SOIL	Aluminum	15800	mg/kg
SB 4-1	6/29/2006	SOIL	Aluminum	11100	mg/kg
SB 4-3	6/29/2006	SOIL	Aluminum	7200	mg/kg
SB 4-4	6/29/2006	SOIL	Aluminum	13400	mg/kg
SB 4-5	6/29/2006	SOIL	Aluminum	7860	mg/kg
SB 5-1	6/29/2006	SOIL	Aluminum	10000	mg/kg
SB-BP	6/29/2006	SOIL	Aluminum	12800	mg/kg
SB 4-2	7/3/2006	SOIL	Aluminum	8020	mg/kg
SB 5-2	7/3/2006	SOIL	Aluminum	14700	mg/kg
SB 5-3	7/3/2006	SOIL	Aluminum	9100	mg/kg
SB 5-4	7/3/2006	SOIL	Aluminum	11900	mg/kg
SB 5-5	7/3/2006	SOIL	Aluminum	12100	mg/kg
SB 1-2	7/5/2006	SOIL	Aluminum	12500	mg/kg
SB 1-3	7/5/2006	SOIL	Aluminum	16800	mg/kg
SB 1-4	7/5/2006	SOIL	Aluminum	8770	mg/kg
SB 1-5	7/5/2006	SOIL	Aluminum	7330	mg/kg
SB 5-1	7/9/2006	SOIL	Aluminum	11400	mg/kg
SB 5-2	7/9/2006	SOIL	Aluminum	16300	mg/kg
SB 5-3	7/9/2006	SOIL	Aluminum	6500	mg/kg
SB 5-4	10/9/2006	SOIL	Aluminum	8970	mg/kg
SB 5-5	10/9/2006	SOIL	Aluminum	9080	mg/kg
SB 6-1	10/9/2006	SOIL	Aluminum	10600	mg/kg
SB 6-2	10/9/2006	SOIL	Aluminum	9550	mg/kg
SB 6-3	10/9/2006	SOIL	Aluminum	7850	mg/kg
SB 6-4	10/9/2006	SOIL	Aluminum	8630	mg/kg
SB 6-5	10/9/2006	SOIL	Aluminum	9710	mg/kg
SB-BP	10/9/2006	SOIL	Aluminum	8390	mg/kg

Figure 4. Al in Soil at the Spartan Burn Site



Upon examination of the data seen in Table 1 and Figure 4 above, it can be concluded that <u>no measurable impact</u> to the environment occurred during of the Spartan Rocket Motor burn event.

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