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1993 SITE ENVIRONMENTAL REPORT SANDIA NATIONAL LABORATORIES ALBUQUERQUE, NEW MEXICO

T. A. Culp, C. F. Cheng, W. Cox, N. Durand, M. Irwin, A. Jones,
F. Lauffer, M. Lincoln, Y. McClellan, K. Molley, and T. Wolff

7500 Environmental Operations Center
Sandia National Laboratories
Albuquerque, NM 87185

MASTER

ABSTRACT

This 1993 report contains monitoring data from routine radiological and nonradiological environmental surveillance activities. Summaries of significant environmental compliance programs in progress, such as National Environmental Policy Act documentation, environmental permits, environmental restoration, and various waste management programs for Sandia National Laboratories in Albuquerque, New Mexico, are included. The maximum offsite dose impact was calculated to be 0.0016 millirem. The total population within a 50-mile (80 kilometer) radius of Sandia National Laboratories/New Mexico received an estimated collective dose of 0.027 person-rem during 1993 from the laboratories' operations. As in the previous year, the 1993 operations at Sandia National Laboratories/New Mexico had no discernible impact on the general public or on the environment. This report is prepared for the U.S. Department of Energy in compliance with DOE Order 5400.1.

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NOTES TO THE READER

If you have comments or questions about this report, or need further information, contact:

Sandia National Laboratories
Media Relations Dept.
MS 0167
P.O. Box 5800
Albuquerque, NM 87185
(505) 844-4207 or
(505) 844-2282

The organizational structure in use by the Environmental Operations Center (7500) at the time of this document's production is shown below:

7500	Environmental Operations Center
7511	Compliance and Quality Control Department
7512	Administrative and Information Support Department
7572	Generator Interface Department
7573	Waste Management and Regulatory Projects Department
7574	Water Quality Department
7575	Air Quality Department
7576	Pollution Prevention Department
7577	Waste Operations Department
7582	Environmental Restoration I Department
7583	Environmental Restoration II Department
7584	Environmental Restoration III Department
7585	Environmental Restoration IV Department

DISCLAIMER

EXECUTIVE SUMMARY

Sandia National Laboratories/New Mexico (SNL/NM) is located southeast of Albuquerque, NM, on Kirtland Air Force Base (KAFB). Because radionuclides are potentially released in small quantities from SNL/NM activities to offsite areas, SNL/NM maintains an Environmental Surveillance Program for routine radiological sampling and surveillance. The program includes biannual sampling and analysis of soil, arroyo sediment, vegetation, and surface water. Soil, arroyo sediment, and vegetation are analyzed for tritium (H-3) and by gamma spectroscopy; soil and arroyo sediment are also monitored for uranium (U). Also, gross alpha, gross beta, gamma spectroscopy, U and H-3 analyses are performed for water samples. Environmental thermoluminescent dosimeters are used to measure gamma radiation. These samples and analyses are performed at SNL/NM onsite, perimeter, and community locations. The majority of the onsite radionuclide concentrations measured in 1993 were consistent with historical values and also consistent with community values measured in 1993 and in previous years. Perimeter radionuclide concentrations were also found to be consistent with historical values and consistent with community values. The Environmental Surveillance Program was enhanced in 1993 with the addition of the analysis of soil and arroyo sediment for metals. The data generated from this analysis is included in this report.

A total of eight facilities at SNL/NM reported releases of airborne quantities of radionuclides during 1993. A total of 3.2 curies (Ci) of argon-41, 0.62 Ci of nitrogen-13, 0.012 Ci of oxygen-15, and 1.9 of H-3 were released as result of SNL/NM activities in 1993. The National Emission Standards for Hazardous Air Pollutants (NESHAP) maximally exposed individual was determined to be located at the Kirtland Underground Munitions Storage Complex facility onsite. The maximum effective dose equivalent calculated to this location was 0.0016 millirems per year (mrem/yr), or 0.016 percent of the 10 mrem/yr dose limit specified in NESHAP and in DOE orders. The total population dose for the 50-mi radius surrounding SNL/NM was calculated to be 0.027 person-rem during 1993 from SNL/NM operations, whereas it received greater than 57,000 person-rem from natural background radiation (see Chapter 5.0).

Groundwater Monitoring: The SNL/NM Environmental Restoration (ER) Department conducts groundwater monitoring programs at the SNL/NM Chemical Waste Landfill (CWL), SNL/NM Mixed Waste Landfill (MWL), Technical Area II (TA-II), and the Liquid Waste Disposal System (LWDS) and for the Sitewide Hydrogeologic Characterization Project. Site-specific groundwater sampling activities are conducted at the CWL and MWL to satisfy the reporting requirements of Title 40, Code of Federal Regulations, Part 265.94; base-wide groundwater sampling is mandated by U.S. Department of Energy (DOE) Order 5400.1. Monthly water-level measurements are also made as part of an ongoing effort to supplement monitoring activities of the SNL/NM ER program.

As of December 1993, the SNL/NM groundwater monitoring network consisted of 43 wells and 3 springs. Twenty-six of the wells are owned by SNL/NM, 14 by KAFB, 2 by the State of New Mexico, and 1 by the DOE. In 1993, water levels in 35 wells and 2 springs were measured, access permitting, on a monthly basis. Sixteen to 17 wells and all three springs were sampled quarterly in 1993 as part of the SNL/NM Groundwater Surveillance Project. These include South Fence

Road Wells from the Sitewide Hydrogeologic Characterization Project. Five wells at the CWL were sampled on a quarterly basis, and four wells at the MWL were sampled on a quarterly basis, in accordance with site-specific sampling programs. In addition, groundwater samples were collected at new monitoring wells installed at TA-II and LWDS.

Quarterly basewide groundwater sampling (April, July, September, and December 1993) was conducted to provide baseline groundwater characteristics and groundwater contamination detection monitoring.

Groundwater sampling at the CWL was conducted in accordance with Appendix G of the CWL closure plan which includes annual sampling for all Appendix IX parameters and quarterly sampling for Appendix IX volatile organic compounds and total metals. Annual sampling for assessment monitoring at the CWL occurred in February 1993; quarterly sampling took place in May, August, and November 1993. At the request of the New Mexico Environment Department, additional monitoring for total and dissolved chromium occurred at monitoring well CWL-BW3.

Groundwater monitoring was conducted at the MWL in accordance with Resource Conservation and Recovery Act (RCRA) regulations functioning as "applicable or relevant and appropriate requirements" (ARAR). Sampling was conducted at the MWL during January, April, and November 1993. No analytes were detected at levels above U.S. Environmental Protection Agency (EPA) maximum contaminant levels (MCL) or DOE derived concentration guides (DCGs).

Two new monitoring wells were completed and sampled at TA-II in 1993. The soils and groundwater were found to be nonhazardous and nonradioactive.

Groundwater monitoring activities were conducted at the LWDS in accordance with RCRA regulations as ARAR. Background sampling was conducted at the LWDS during June and November 1993. No analytes were detected at levels above EPA MCLs or DOE DCGs. As of the fall of 1993, four additional wells were installed along the South Fence Road as part of the Sitewide Hydrogeologic Characterization Project.

Other Compliance Activities

National Environmental Policy Act of 1969 (NEPA)

During 1993, SNL/NM NEPA compliance activities focused on:

- Fulfilling commitments made in the Final Action Plan to Tiger Team
- Continuing with the development of baseline information
- Developing the NEPA program

NEPA compliance activities increased, and policies and procedures were developed to ensure environmental values are considered as part of the review of SNL/NM's proposed actions. One finding of no significant impact (FONSI) was issued in 1993: Environmental Assessment for the Radioactive and Mixed Waste Management Facility.

During 1993, there were 14 environmental assessments under development for DOE facilities at SNL/NM or for proposed actions involving SNL/NM research activities.

With the Secretary of Energy's National Environmental Policy Act Notice of February 5, 1990, SNL/NM has increased its emphasis on NEPA reviews. The DOE's commitment to (1) infusing environmental values into DOE decision making and (2) disclosing federal activities through the NEPA process has resulted in a large increase in the number of Environmental Assessments that are being written to cover SNL/NM proposed actions.

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ABBREVIATIONS

International System of Units Prefixes

Exponent	Prefix	Symbol	Exponent	Prefix	Symbol
10^{6}	mega	M	10^{-9}	nano	n
10^{3}	kilo	K	10^{-12}	pico	p
10^{-3}	milli	m	10^{-15}	femto	f
10^{-6}	micro	μ	10^{-18}	atto	a

Units

ac	acre	L	liter
cf	cubic feet	lb	pound
°C	Celsius degree	lb/yr	pounds per year
cm	centimeter	lps	liters per second
cm/yr	centimeters per year	m	meter
°F	Fahrenheit degree	m^2	square meter
fbgs	feet below ground surface	MBtu/hr	mega-British thermal units per hour
ft	foot	m/s	meters per second
ft^2	square foot	mg/L	milligrams per liter
ft^3	cubic foot	mi	mile
g	gram	mi^2	square mile
gal	gallon	mi/hr	miles per hour
gpd	gallons per day	min	minute
gpm	gallons per minute	mL	milliliter
hr	hour	ppb	parts per billion
ha	hectare	ppm	parts per million
in.	inch	qt	quart
in./yr	inches per year	s	second
J	Joule	yd^2	square yard
kg	kilogram	yr	year
km	kilometer	% moisture	weight percent of water
km^2	square kilometer		

Symbols

>	greater than	P	statistical probability
≥	greater than or equal to	S	standard deviation
<	less than	$s_{\bar{x}}$	standard error of the mean
≤	less than or equal to		
~	approximately		
$\bar{x}$	mean value		

ABBREVIATIONS (Continued)

Abbreviations for Referenced Nuclides and Components

Al	aluminum
Am-241	americium-241
Ar	argon
Ar-41	argon-41
As	arsenic
Ba	barium
Be	beryllium
C-13	carbon-13
Ca	calcium
Cd	cadmium
Cs	cesium
Cs-137	cesium-137
Cr	chromium
Co	cobalt
Co-60	cobalt-60
Cu	copper
D	deuterium
DU	depleted uranium
I-129	iodine-129
Fe	iron
Fe-55	iron-55
Kr	krypton
Kr-85	krypton-85
Kr-85m	krypton-85m
Kr-87	krypton-87
Kr-88	krypton-88
Pb	lead
Pb-212	lead-212
Mg	magnesium
Mn	manganese
Hg	mercury
U_{nat}	natural uranium
Ni	nickel
N-13	nitrogen-13
N-15	nitrogen-15
O-15	oxygen-15
O-18	oxygen-18
Pu	plutonium
Pu-241	plutonium-241
Po-210	polonium-210
K	potassium
K-40	potassium-40
Ra-226	radium-226
Ra-228	radium-228
Rb-88	rubidium-88
Se	selenium
Ag	silver
Na	sodium
Sr-90	strontium-90
S	sulphur
Th	thorium
U	uranium
U_{tot}	total uranium
HTO	tritiated water vapor
HT	tritiated hydrogen
H-3	tritium
U	uranium
U-238	uranium-238
V	vanadium
Xe	xenon
Xe-133	xenon-133
Xe-135	xenon-135
Xe-135m	xenon-135m
Zn	zinc

Radioactivity Measurements

EDE	effective dose equivalent
μg/g	micrograms per gram
μg/L	micrograms per liter
μCi	microcurie
μCi/MJ	microcuries per megajoule
Ci	curie (unit of radioactivity)
mg/L	milligrams per liter
mR	milliroentgen (unit of radiation exposure)
mrem	millirem (unit of radiation dose)
mrem/yr	millirems per year
person-rem	radiation dose to population (also man-rem)

ABBREVIATIONS
(Continued)

pCi/L	picocuries per liter
pCi/mL	picocuries per milliliter
R	roentgen (unit of radiation exposure)
rem	roentgen equivalent man (amount of ionizing radiation required to produce the same biological effect as 1 R of high-penetration X-rays)
Sv	sievert (unit of radiation dosage, ~8.38 R)

Acronyms

ACM	asbestos-containing material
ACRR	Annular Core Research Reactor
ADM	Action Description Memorandum
ADS	Activity Data Sheet
AIP	Agreement-in-Principle
AIRFA	American Indian Religious Freedom Act
AL/KAO	Albuquerque/Kirtland Area Office
ALARA	as low as reasonably achievable
ANSI	American National Standards Institute
AQCR	Air Quality Control Regulation
AR	averaged replicate
ARAR	applicable or relevant and appropriate requirements
ARPA	Archaeological Resources Protection Act
AT&T	American Telephone and Telegraph
CA	Corrective Action
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CAM	continuous air monitor
CDX	countermeasures demonstration experiment
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERF	Civil Engineer Research Facility
CFC	chlorofluorocarbon
CFR	Code of Federal Regulations
CO	carbon monoxide
CO_2	carbon dioxide
CV	coefficient of variation
CWA	Clean Water Act
CWL	Chemical Waste Landfill
CX	categorial exclusion
CY	calendar year
DCG	derived concentration guide
DNA	Defense Nuclear Agency
DOC	U.S. Department of Commerce
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOE/AL	U.S. Department of Energy Albuquerque Operations Office

ABBREVIATIONS
(Continued)

Acronyms

DOE/KAO	U.S. Department of Energy Kirtland Area Office
DOE/NV	U.S. Department of Energy Nevada Operations Office
DOT	U.S. Department of Transportation
DP	Discharge Plan
EA	Environmental Assessment
ECF	Explosives Components Facility
ECL	Environmental Checklist
EDE	effective dose equivalent
EG&G	Edgerton, Germeshausen & Grier Corporation
EIS	Environmental Impact Statement
EIS/EIR	Environmental Impact Statement/Environmental Impact Review
EIS/ODIS	Effluent Information System/Onsite Discharge Information System
EMP	Environmental Monitoring Plan
ENCOTEC	Environmental Control Technology Corporation
EO	Executive Order
EOC	Environmental Operations Center
EOD	explosive ordnance detonation
EORC	Environmental Operations Records Center
EPA	U.S. Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
EPD	Environmental Programs Departments
ER	Environmental Restoration
ESA	Endangered Species Act
ES&H	Environment, Safety and Health
FFC	Federal Facility Compliance Act
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FONSI	Finding of No Significant Impact
FR	Federal Register
FY	fiscal year
GC	gas chromatography
Ge	germanium
GFAA	graphite furnace atomic absorption
H_2S	hydrogen sulfide
HC	hydrocarbon
HCF	Hot Cell Facility
HCFC	hydrochlorofluorocarbon
HE	high explosives
HEPA	high-efficiency particulates in air
HF	hydrofluoric acid
HIIIA	HERMES-III Accelerator
HNO_3	nitric acid
H_2S	hydrogen sulfide
HSWA	Hazardous and Solid Waste Amendments
HWDMS	Hazardous Waste Data Management System
HWMF	Hazardous Waste Management Facility
IC	Industrial Classification

ABBREVIATIONS
(Continued)

Acronyms

ICP	inductively coupled plasma
IDP	Integrated Demonstration Program
IEEE	Institute of Electrical and Electronics Engineers
IT	International Technology Corporation
IT/AS	International Technology Corporation, Analytical Services
ITRI	Inhalation Toxicology Research Institute
JIT	Just-in-Time
KAFB	Kirtland Air Force Base
KTF	Kauai Test Facility
KUMSC	Kirtland Underground Munitions Storage Complex
LANL	Los Alamos National Laboratory
LATA	Los Alamos Technical Associates
LDR	Land Disposal Restriction
Li	lithium
LiF	lithium fluoride
LECS	Liquid Effluent Control System
LIHE	light initiated high explosives
LIWG	Line Implementation Working Group
LLW	low-level radioactive waste
LWDS	Liquid Waste Disposal System
MAC	maximum allowable concentration
MAP	Mitigation Action Plan
MCA	multichannel analyzer
MCL	maximum contaminant levels
MCLG	maximum contaminant level goals
MDL	minimum detection level
mho	unit of conductance
MinNet	Waste Minimization Network
MO	mobile office
MOU	Memorandum of Understanding
MS	mass spectrometry
MSDS	Material Safety Data Sheet
MTF	memo-to-file
MW	mixed waste
MWL	Mixed Waste Landfill
N	normal
NaF	sodium fluoride
NBS	National Bureau of Standards
NAAQS	National Ambient Air Quality Standards
NCC	National Climatic Centers
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NGTF	Neutron Generator Test Facility
NHPA	National Historic Preservation Act

ABBREVIATIONS
(Continued)

Acronyms

NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards (formerly NBS)
NM	New Mexico
NMED	New Mexico Environment Department
NMHWMR	New Mexico Hazardous Waste Management Regulations
NMWQA	New Mexico Water Quality Authority
NMWQCC	New Mexico Water Quality Control Commission
NMWQR	New Mexico Water Quality Regulations
NO_2	nitrogen dioxide
NO_x	oxides of nitrogen
NOAA	National Oceanographic and Atmospheric Administration
NOD	Notice of Deficiency
NOI	Notice of Intent
NON	Notification of Noncompliance
NOV	Notice of Violation
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NPN	nitrate plus nitrite
NRC	National Response Center
NSPS	New Source Performance Standards
NTS	Nevada Test Site
NTU	nephelometric turbidity unit
O_3	ozone
ODS	ozone-depleting substance
OEL	Occupational Exposure Limit
OSHA	Occupational Safety and Health Administration
OSI	onsite investigation
OU	operable unit
PA	Preliminary Assessment
PA/SI	Preliminary Assessment/Site Inspection
PBFA-II	Particle Beam Fusion Accelerator-II
PCB	polychlorinated biphenyl
PDL	Process Development Laboratory
PDWR	Primary Drinking Water Regulations
PEIS	Programmatic Environmental Impact Statement
pH	hydrogen ion concentration (a measure of acidity)
PM	particulate matter
PM-10	respirable particulate matter
PMRF	Pacific Missile Range Facility
POTW	publicly-owned treatment works
PP	pollution prevention
PSD	Prevention of Significant Deterioration
PWA	Process Waste Assessment
QA	quality assurance
QAP	Quality Assessment Program
QC	quality control
R&D	research and development

ABBREVIATIONS (Continued)

Acronyms

RAM	radiological air monitor
RCRA	Resource Conservation and Recovery Act
REECo	Reynolds Electrical and Engineering Company
RMAL	Rocky Mountain Analytical Laboratory
RMWMF	Radioactive and Mixed Waste Management Facility
ROD	Record of Decision
RQ	reportable quantity
RSI	RCRA Site Investigation
SARA	Superfund Amendments and Reauthorization Act
SASN	silver acetylide-silver nitrate
SC	special-case waste
SC-COM	special case - commercially held, U.S. Department of Energy-owned materials
SC-GTCC	special case - U.S. Department of Energy comparable greater-than-Class-C (waste)
SC-HLI	special case - high-level incidental (waste)
SC-PAL	special case - performance assessment limiting (waste)
SC-TRU	special case - noncertifiable, nontransportable TRU (waste)
SC-US	special case - uncertified or uncharacterized (waste)
SDF	Strategic Defense Facility
SDI	Strategic Defense Initiative
SDIO	Strategic Defense Initiative Organization
SDWA	Safe Drinking Water Act
SFR	South Fence Road
SIC	Standard Industrial Classification
SMERF	Smoke Emission Reduction Facility
SMO	(Environmental) Sample Management Office
SNL	Sandia National Laboratories
SNL/NM	Sandia National Laboratories/New Mexico
SO_2	sulfur dioxide
SOP	Standard Operating Procedure
SPCC	Spill Prevention Control and Countermeasure
SPR	Sandia Pulsed Reactor
STARS	Strategic Targeting System
STL	Simulation Technology Laboratory
SVOC	semivolatile organic compound
SWHC	Sitewide Hydrogeologic Characterization Project
SWMU	Solid Waste Management Unit
TA	Technical Area
TAL	target analyte list
TCA	1,1,1-trichloroethane
TCE	trichloroethylene
TCL	target compound list
TCLP	toxicity characteristics leaching procedure
TCS	Technical Support Center
TDS	total dissolved solids

ABBREVIATIONS
(Concluded)

Acronyms

TLD	thermoluminescent dosimeter
TOC	total organic carbon
TOX	total organic halogen
TPH	total petroleum hydrocarbons
TRI	toxic chemical release
TRU	transuranic
TSCA	Toxic Substances Control Act
TSDF	treatment, storage, and disposal facility
TSP	total suspended particulates
TSS	total suspended solids
TTCE	tetrachloroethane
TTF	Thermal Treatment Facility
TTO	total toxic organics
TTR	Tonopah Test Range
USAF	U.S. Air Force
USC	United States Code
USEC	U.S. Enrichment Corporation
USGS	U.S. Geological Survey
USNRC	U.S. Nuclear Regulatory Commission
UST	underground storage tank
VOC	volatile organic compound
WAC	waste acceptance criteria
WIPP	Waste Isolation Pilot Plant
WIPPWAC	Waste Isolation Pilot Program Waste Acceptance Criteria
WMin	waste minimization
WMin/PP	Waste Minimization/Pollution Prevention
WMOA	Waste Minimization Opportunities Assessment

1.0 INTRODUCTION

1.1 SITE OPERATION

Sandia National Laboratories/New Mexico (SNL/NM) is operated by Sandia Corporation, a prime contractor of the U.S. Department of Energy (DOE). Sandia Corporation is a subsidiary of Martin Marietta Corporation. The major responsibilities are national security and energy projects (ERDA 1977). SNL/NM's mission includes the weaponization of nuclear explosives and the designing of arming, fusing, and firing systems used in nuclear bombs and warheads. Safety, reliability, and survivability of weapon systems receive primary emphasis.

Other projects include nuclear reactor safety studies for the U.S. Nuclear Regulatory Commission (USNRC), development of safe transport and storage systems for special nuclear materials including plutonium (Pu) and uranium (U), radioactive waste disposal techniques and site studies, pulsed power research, thermonuclear fusion research, solar energy research, environmental technologies research, and fossil fuel and geothermal energy research.

1.2 LOCATION AND POPULATION

SNL/NM is located in Bernalillo County at the foot of the Manzano Mountains adjacent to Albuquerque, NM (Figure 1-1). At their nearest points, SNL/NM facilities are 2-1/2 miles (mi) (4.0 kilometers [km]) south of Interstate 40 and approximately 6.5 mi (10.5 km) east of downtown Albuquerque. The facilities are surrounded by Kirtland Air Force Base (KAFB) East, with co-use agreements on some U.S. Air Force (USAF) property. An area of the Manzano Mountains east of KAFB has been withdrawn from the U.S. Forest Service for the exclusive use of the Air Force and the DOE.

The laboratory consists of five technical areas and several remote test areas situated in the eastern half of the 118-square-mile (mi^2) (190-square-kilometer [km^2]) KAFB military reservation. KAFB is located on two broad mesas bisected by the Tijeras Arroyo, an east/west canyon. These mesas are bound by the Manzano Mountains (Cibola National Forest) to the east and the Rio Grande to the west. Elevations range from 4,921 feet (ft) (1,500 meters [m]) at the Rio Grande to 10,680 ft (3,255 m) at Sandia Crest, which is in the Sandia Mountains adjacent to Albuquerque. KAFB is at a mean elevation of 5384 ft (1630 m).

The largest population center in Bernalillo County, and also the closest population center to KAFB, is Albuquerque, located slightly north of the base. The 1990 census figures show an Albuquerque population of 384,736 (U.S. Department of Commerce [DOC], Bureau of the Census, 1991). The Isleta Indian Pueblo, which borders KAFB on the south, is the next nearest population center with a 1980 census of 1872. An estimated total population of 578,313 people live within a 50-mi (80-km) radius of KAFB (DOC 1991). This includes permanent residents of KAFB living in the KAFB housing areas.

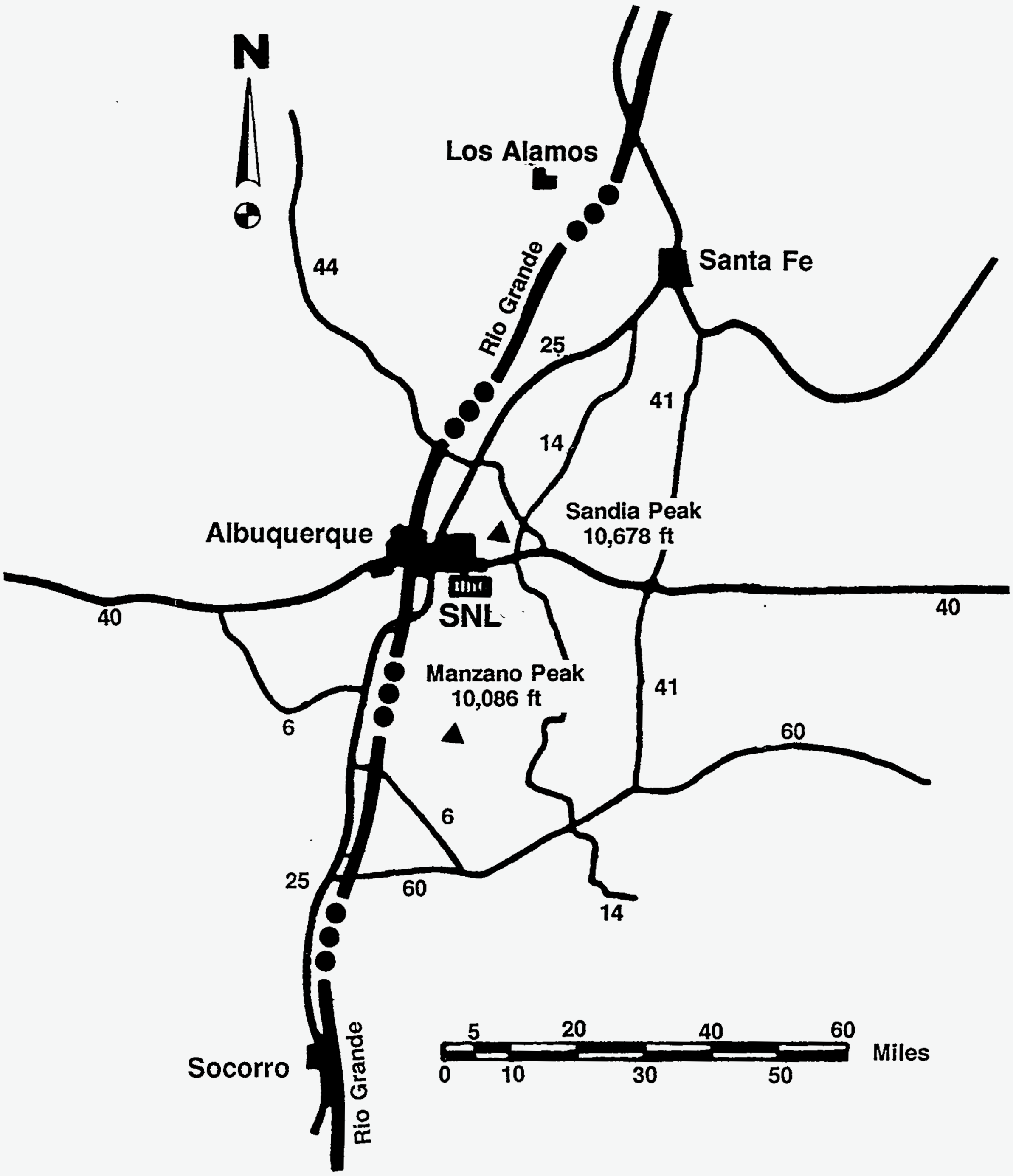

Figure 1-1. Albuquerque Site Regional Setting

1.3 CLIMATE AND METEOROLOGY

The Albuquerque-Belen Basin is characterized by low precipitation; wide temperature extremes; frequent, drying winds; heavy rain showers, usually short in duration and often with erosive effects; and erratic, seasonal distribution of precipitation. Albuquerque air temperatures are characteristic of high-altitude, dry continental climates. Daytime temperatures during the winter average about 50 degrees Fahrenheit (°F) (10 degrees Celsius [°C]), and summer daytime temperatures average <90°F (32°C), except in July, when the maximum reaches 93°F (34°C) (see Appendix A, Table A-1). The average annual precipitation is 8.2 inches (in.) (21 centimeters [cm]); half of this precipitation occurs from July through September in the form of brief thundershowers. Winter months are typically dry with <2.0 in. (5 cm) of precipitation normally recorded. The average annual relative humidity is ~43 percent (see Appendix A, Table A-2). Strong winds, often accompanied by blowing dust, occur mostly in late winter and early spring.

Table 1-1 summarizes meteorological data taken from the Albuquerque International Airport in 1993. The 30-year (yr) annual average precipitation is 8.0 in. (20.6 cm) (see Appendix A, Table A-1).

Table 1-1. Summary Meteorological Data for the Albuquerque Area in 1993

	Temperature (°C)			Precipitation (cm)	Wind (m/s)		
Month	Mean	High	Low		Mean	Maximum	Direction
January	4.3	15.6	-9.4	2.39	2.6	20.1	E
February	5.8	18.9	-6.7	4.62	3.1	22.8	SW
March	9.3	24.4	-8.9	0.56	3.4	19.2	SW
April	13.9	30.0	-2.2	T	3.2	23.3	W
May	18.7	33.9	1.7	0.51	3.7	21.5	S
June	23.9	37.8	8.3	1.12	3.7	30.0	NW
July	26.6	37.8	15.0	0.58	3.4	21.9	NE
August	24.2	36.1	13.9	7.75	3.1	24.1	N
September	20.6	32.2	6.7	1.24	3.6	25.0	NW
October	13.4	30.6	-3.9	1.63	3.8	19.7	E
November	6.3	20.6	-7.2	2.46	3.7	24.6	W
December	2.9	16.1	-10.6	0.08	3.4	21.0	W

1.4 GEOLOGY

The Albuquerque Basin is a north/south-trending basin located within the Rio Grande Rift Zone (Figure 1-2). The uplifted fault blocks of the Sandia and Manzano mountains comprise the eastern basin boundary. The west side of the basin is bounded by the Nacimiento Uplift, the Lucero Uplift, and the Ladron Mountains. During the Miocene and Pliocene, the basin filled with as much as 12,000 ft (3,650 m) of sediments eroded from the surrounding highlands. This sequence, the Santa Fe Group, thins toward the edge of the basin where it is truncated at the bounding uplifts. Santa Fe Group sediments are overlain in places by the Pliocene Ortiz gravel and Rio Grande fluvial deposits and are interbedded with Tertiary and Quaternary basalts and pyroclastics. Basin-fill alluvial fans of the Santa Fe Group consist of channel, debris flow, flood-plain, and interlayered eolian deposits. Grain sizes range from clay to boulders with moderately well developed stratification and some graded bedding. Bed thickness varies from inches to feet and most of the bedding is thought to be lenticular with limited areal extent, although buried channels can extend downdip (westward) for long distances.

The geology underlying the eastern section of KAFB includes major faulting (Figure 1-3). The younger (Tertiary age) Hubbell Springs and Sandia faults are north/south-trending, down-to-the-west, en echelon faults (Lozinsky et al. 1991; Woodward 1982; Kelley and Northrop 1975). The Hubbell Springs fault extends northward from Socorro County, NM, to the southern portion of KAFB. The Sandia fault is thought to be the primary boundary between the Sandia Mountains uplift and the main Albuquerque basin, and may actually be an extension of the Hubbell Springs fault (Kelly 1977). The Tijeras fault is a scissors-type fault of Precambrian origin with left-lateral offset that appears to be downthrown to the southeast near the Four Hills area of KAFB as a result of Cenozoic movement (Kelley and Northrop 1975) and is assumed to be the boundary between the Sandia and Manzano uplifts. The Tijeras, Sandia, and Hubbell Springs faults probably converge near the Chemical Waste Landfill (CWL) at SNL/NM Technical Area III (TA-III).

1.5 HYDROLOGY

1.5.1 Groundwater Hydrology

The fault complex separates the regional aquifer system into a deeper zone west of the faults and a relatively shallower zone east of the faults. The depth to groundwater underlying SNL/NM facilities varies from ~50 to ~100 ft (15 to 30 m) east of the faults and from ~380 to ~500 ft (116 to 153 m) west of the faults. The hydrogeology east of the faults is poorly understood because there are few wells and the geology between the faults and the canyons of the Manzanita Mountains is complex. Most of the water supply and the majority of the monitoring wells east of the faults are located in fractured bedrock with modest yields. Groundwater typically flows out of the canyons and westward toward the fault complex. Titus (1963), in describing flow across the Ojuelos fault in Valencia County, goes so far as to say, "As water moves across the fault into the more permeable rocks of the Santa Fe, it cascades abruptly to the lower level within a short distance." On KAFB, a change in the water surface elevation of over 700 ft (213 m) has been observed in a 2-mi (3-km) distance (from Explosive Ordnance Detonation [EOD] Hill west to the CWL),

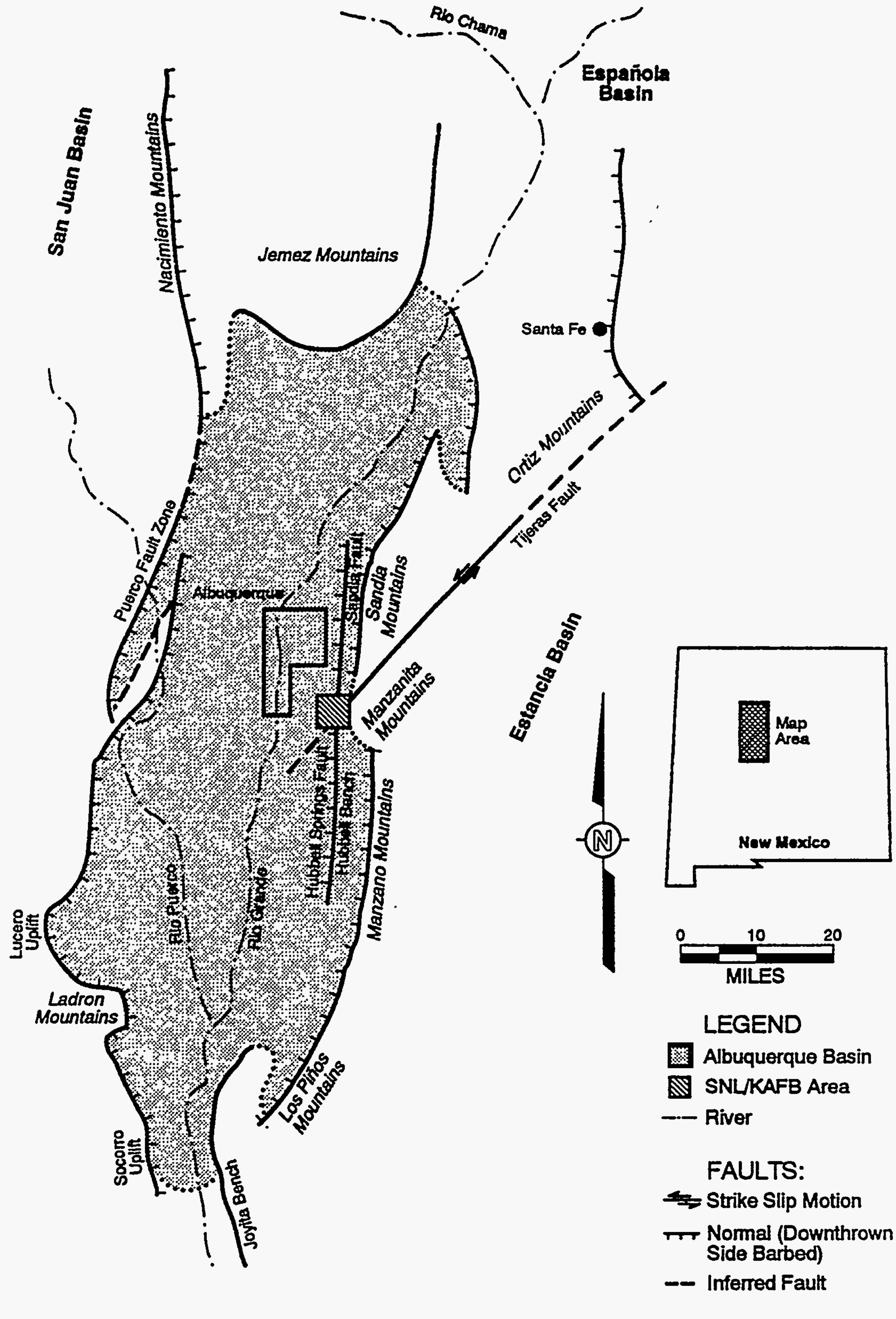

Figure 1-2. Albuquerque Basin of North Central New Mexico (Kelley and Northrup 1975)

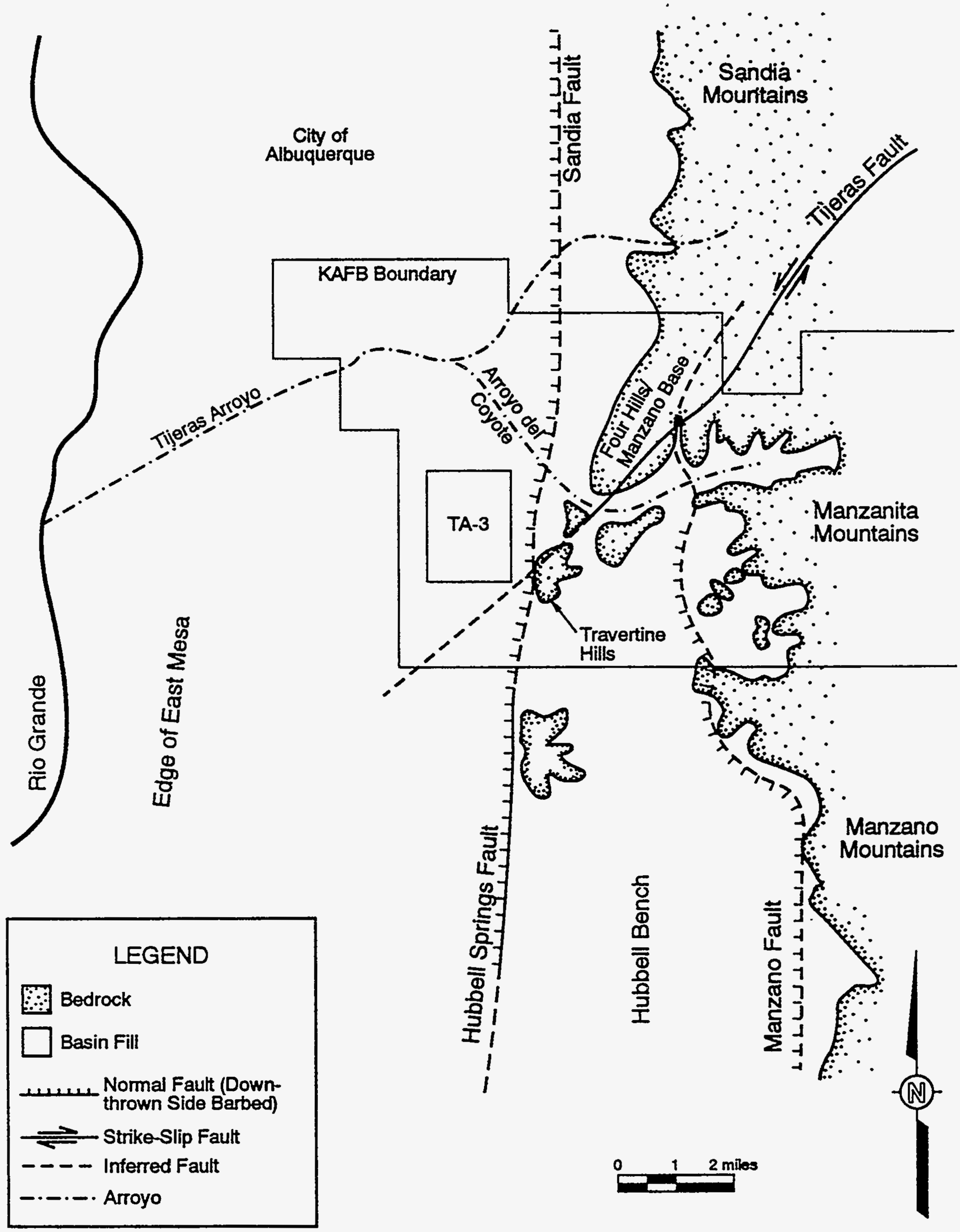

Figure 1-3. Generalized Geology in the Vicinity of Sandia National Laboratories/New Mexico and Kirtland Air Force Base. Areas of bedrock outcrop, major drainages, faults, and landforms are indicated (Grant 1982).

resulting in a hydraulic gradient of ~0.07. West of the faults, the hydraulic gradient decreases to ~0.005 and the depth to bedrock increases rapidly. The apparent direction of groundwater flow is generally westward (toward the Rio Grande) but trends more northward as one approaches the KAFB pumping wells. Although the impact of the KAFB wells (and nearby City of Albuquerque wells) is shown by the fluctuations in monitoring well water levels at the KAFB Sanitary Lagoons, the radial extent of the cone of depression is not clear at this time.

1.5.2 Surface-Water Hydrology

The major surface hydrologic feature in central New Mexico is the Rio Grande, which flows north to south through Albuquerque and lies ~6 mi (10 km) west of KAFB. Rio Grande water is primarily used for irrigation of agricultural crops. There are no continuously running streams on SNL/NM property, although there are two perennial springs (Coyote and Sol se Mete) on KAFB and one (Hubbell Springs) on Isleta Pueblo south of KAFB. The two primary surface channels at SNL/NM are Tijeras Arroyo and the smaller Arroyo del Coyote (Figure 1-3). Arroyo del Coyote joins Tijeras Arroyo ~1 mi (2 km) west of the Tijeras Arroyo Golf Course; both flow intermittently during heavy summer thundershowers. Tijeras Arroyo (above the confluence with Arroyo del Coyote) drains ~80 mi^2 (208 km^2); Arroyo del Coyote (above the confluence with Tijeras Arroyo) drains ~27 mi^2 (70 km^2) (U.S. Army Corps of Engineers 1979). Neither drainage is viewed as a significant flood hazard, and any impact on groundwater resources from flooding would likely be minimal. All active SNL/NM facilities are located well outside the 500-yr floodplain described by the U.S. Army Corps of Engineers (1979) for both arroyos. The extent of infiltration (and potential groundwater recharge) in the primary surface channels is currently unknown.

1.6 BIOLOGY

The semidesert Southwest climate produces low surface-water availability, resulting in many species of drought-resistant flora such as grasses and cacti (ERDA 1977). The mesa vegetation on KAFB, consisting of grasses and shrubs, is illustrated in Figure 1-4. Figure 1-5 shows juniper trees and cacti that are present at the higher elevations bordering the mountains east of KAFB. Russian thistle (tumbleweeds) proliferate in mechanically disturbed areas. The City of Albuquerque, adjacent to KAFB, has flora typically found in urban environments.

1.7 TECHNICAL AREAS

SNL/NM consists of five technical areas and several additional test areas (Figure 1-6). Each area has its own distinctive operations. The following paragraphs describe the activities in each area and summarize potential sources for radioactive and nonradioactive effluent releases.

TA-I (Figure 1-7) has the largest employee population (~5000). This area is dedicated primarily to three activities: the design, research, and development of weapon systems; limited production of weapon system components; and energy programs. TA-I also includes the main library and offices, laboratories, and shops used by administrative and technical staff. Generally, the only potential radioactive releases in TA-I are tritium (H-3) from two laboratory

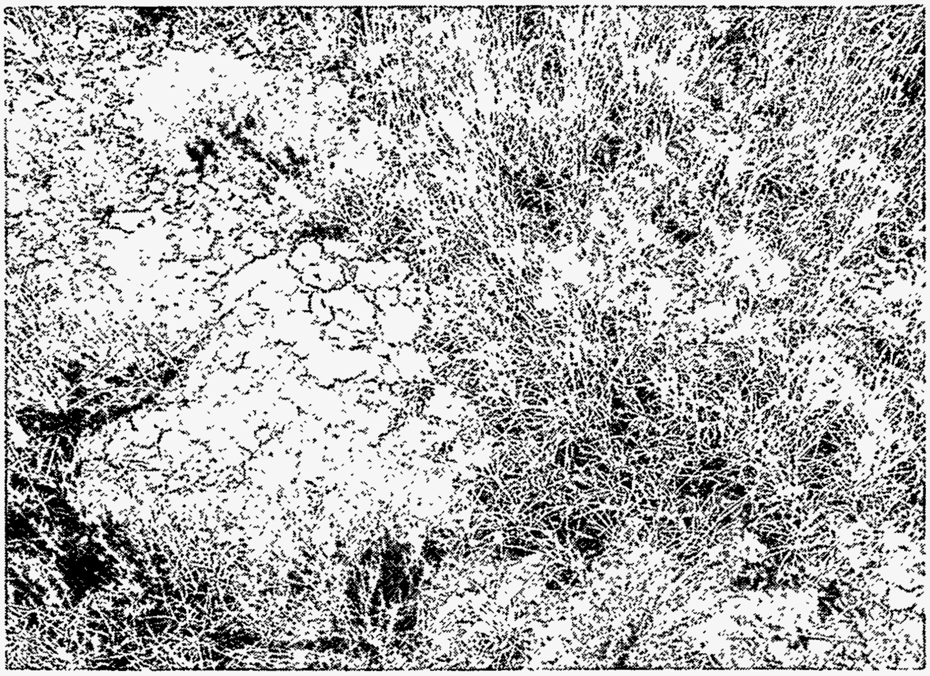

Figure 1-4. Mesa Vegetation

Figure 1-5. Manzano Foothills Vegetation

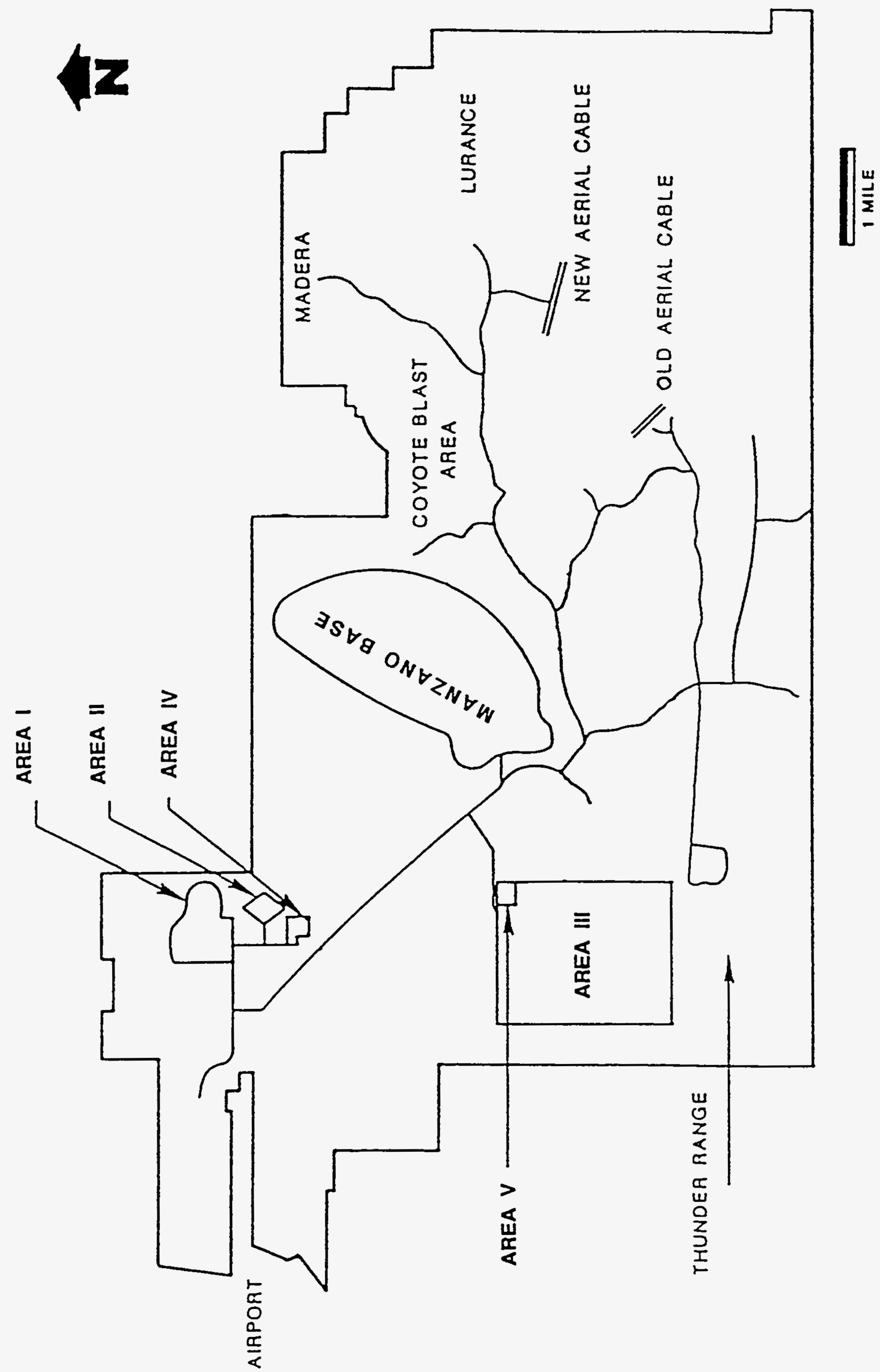

Figure 1-6. Sandia National Laboratories/New Mexico Technical Areas I through V and Remote Areas

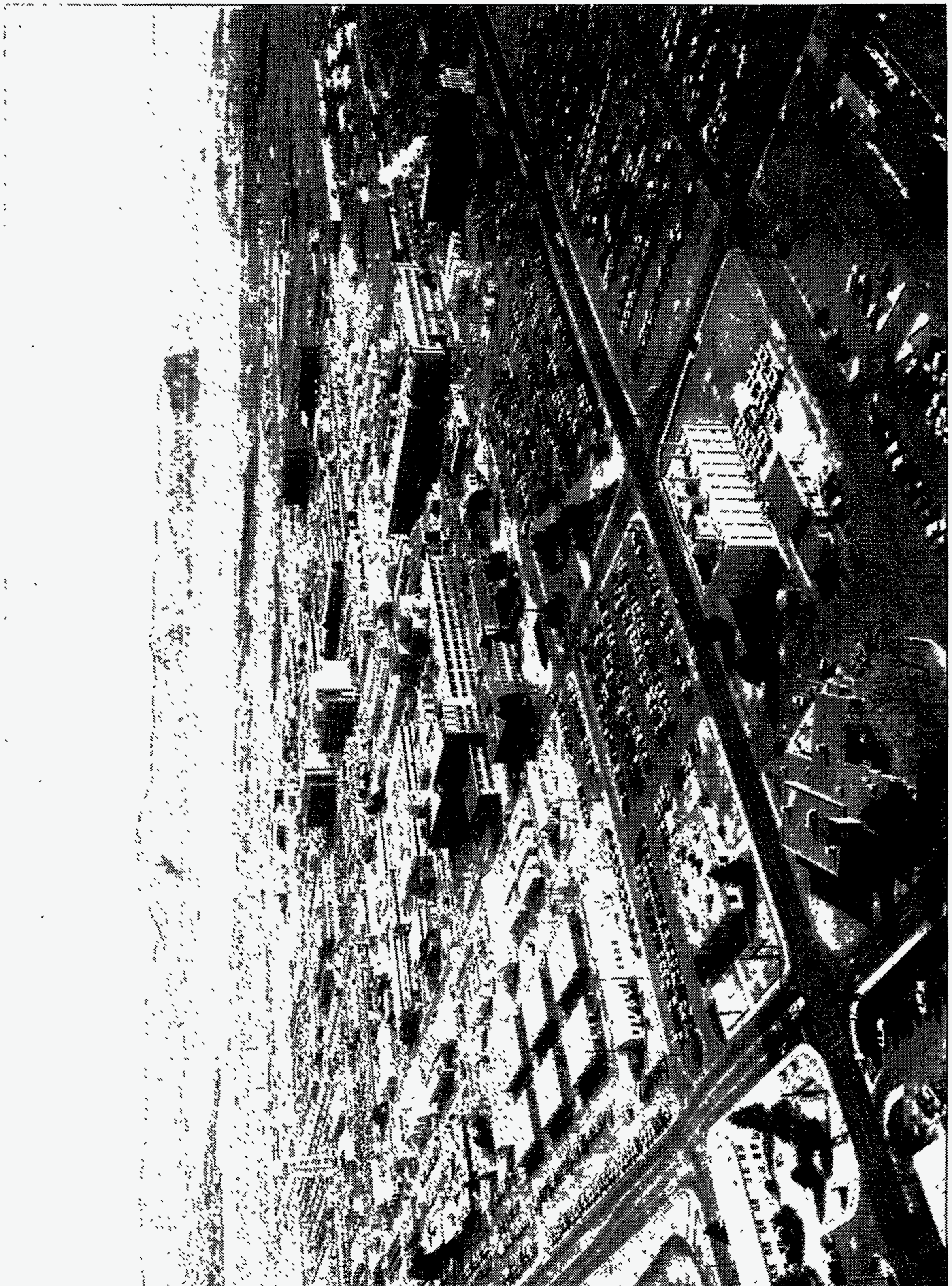

Figure 1-7. Technical Area I (looking east from the intersection of Wyoming and Gibson boulevards)

sources and activation products (such as argon-41 [Ar-41], nitrogen-13 [N-13], and oxygen-15 [O-15]) from two small accelerators. Only small quantities of activation products are released from these stacks annually. Potential sources for nonradioactive effluents include the paint shops, process development laboratory, emergency diesel generator plant, solvent spray booth, foundry, and steam plant.

TA-II (the diamond-shaped area in Figure 1-8) is a small area used for explosive testing. Microcurie (μCi) amounts of H-3 may be released each year from component testing. Techniques for measuring fractures in geologic strata are developed at this facility. Also located in TA-II are an inactive low-level radioactive waste (LLW) disposal site, a small radioactive material decontamination and storage facility (Building 906), and a storage facility designed to temporarily hold polychlorinated biphenyl (PCB)-contaminated materials to be transported to an EPA-licensed disposal facility. The inactive LLW disposal site has not been used for over 20 yr. A new facility, the Explosive Components Facility (ECF), is planned to replace TA-II. This facility will integrate many of the existing TA-II activities, as well as some remote testing activities currently performed in other test areas.

TA-III (Figure 1-9) is located adjacent to and south of TA-V, 5 mi (8 km) south of TA-I. It is comprised of 20 test facilities which include extensive environmental test facilities (such as sled tracks, centrifuges, and a radiant heat facility). No radioactive effluents are released through normal operations in the area with the exception of small quantities of depleted uranium associated with sled track testing. Other facilities in TA-III include a paper incinerator, an inactive LLW and mixed waste (MW) disposal site, and a melting and solidification laboratory. The inactive radioactive waste disposal site in TA-III consists of two adjoining fenced areas that occupy ~1.5 acres (ac) (~0.6 hectares [ha]) (SNL 1989). One area was used for LLW disposal in seven shallow trenches. The second area was used for disposal of classified LLW in 37 pits. LLW consisted primarily of H-3-contaminated materials. Three additional pits located in the classified waste disposal area were used exclusively for natural and depleted uranium (DU) waste disposal. The site is currently used as an interim storage facility for radioactive and MW.

An inactive hazardous-waste disposal and storage site is also located near the southern boundary of TA-III. This facility has not been used for disposal of hazardous wastes since November 7, 1985. It was used as an interim hazardous waste storage area from 1985 to 1988. A closure plan and post-closure permit application were prepared in May 1988. The newer hazardous waste repackaging and storage building, located south of TA-I, has been in use since 1988.

TA-IV (Figure 1-8) consists of several inertial-confinement fusion research and pulsed-power research facilities. One large accelerator, the Particle Beam Fusion Accelerator-II (PBFA-II), was completed in 1985. A large accelerator facility, the Simulation Technology Laboratory (STL), houses seven pulsed-power accelerators: HERMES-III, RLA, TROLL, STF, SPEED, HYDRAMITE, and PROTO II. Several of these accelerators have been transferred from TA-V. HERMES-III became operational in 1988. Another accelerator facility, SATURN, was completed in 1987. During 1993, radioactive emissions from TA-IV were short-lived radionuclides, primarily N-13 and O-15.

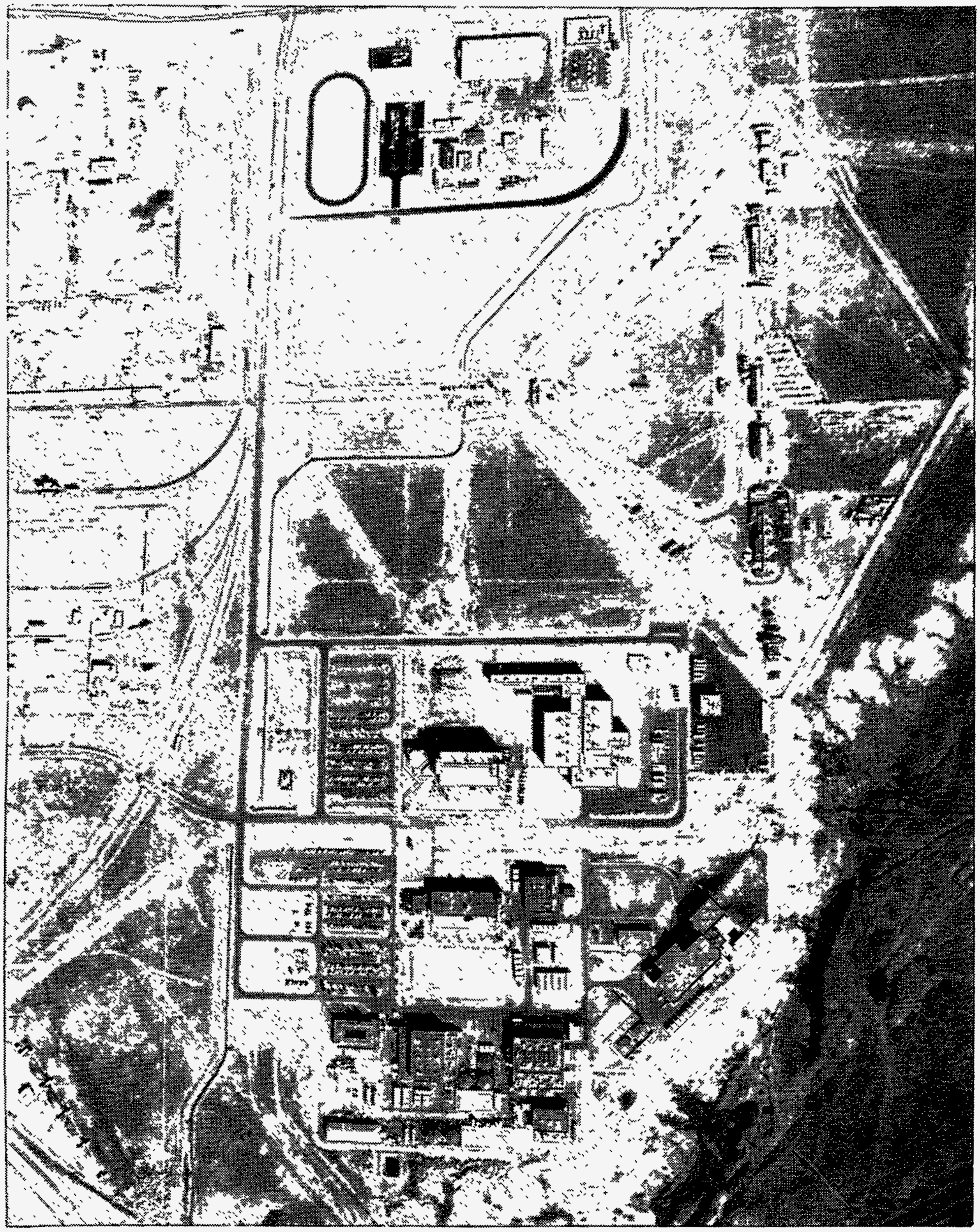

Figure 1-8. View of Technical Areas II and IV

Figure 1-9. Technical Area V and a Portion of Technical Area III (looking toward the southeast with the solar tower in the distance)

TA-V (Figure 1-9) houses two research reactors in two reactor facilities, an intense gamma irradiation facility (using cobalt-60 [Co-60] and cesium-137 [Cs-137]), and a hot cell facility.

The two research reactor facilities in TA-V are small and quite dissimilar: the Sandia Pulsed Reactor (SPR) is an unreflected, unmoderated assembly of enriched U; the Annular Core Research Reactor (ACRR) consists of an annular core of 226 fuel elements in an open water tank. Both the SPR and ACRR air exhaust systems are equipped with particulate effluent samplers. The ACRR also has a continuous gaseous effluent monitor. The only airborne releases are air activation products from reactor operations primarily composed of Ar-41 and xenon-133 (Xe-133). The reported amount of Ar-41, released from both reactor areas, was computed from reactor operating parameters.

1.8 REMOTE TEST AREAS

SNL/NM also has test areas outside the five technical areas. These areas are located south of TA-III and in canyons on the west side of the Manzano Mountains. Coyote Canyon and Thunder Range are two examples of such areas. In these remote areas, wild animals, including snakes, deer, coyotes, and owls, are often present. Figure 1-10 shows the Main Burn Site located in the Coyote Canyon remote area.

DU was used in the past for explosive testing in these remote areas. The test areas were surveyed following each test, and contaminated materials were collected and disposed of in accordance with DOE requirements. Environmental monitoring is done as necessary. Operations in these areas are administratively controlled to avoid U contamination to public areas beyond the confines of KAFB.

Figure 1-10. Main Burn Site at the Entrance of Coyote Canyon (looking west)

2.0 COMPLIANCE SUMMARY

2.1 COMPLIANCE REGULATIONS

Comprehensive Environmental Response Compensation and Liability Act (CERCLA): CERCLA and the Superfund Amendments and Reauthorization Act (SARA) define certain assessment activities and reporting requirements for all federal facilities. As required, CERCLA Section 103(c) (DOE 1989a) notifications were provided to the U.S. Environmental Protection Agency (EPA). Based on the Preliminary Assessment/Site Inspection (PA/SI) performed in 1988 and required by SARA 120(c), the EPA has determined that none of the Sandia National Laboratories/New Mexico (SNL/NM) inactive waste sites qualifies for the EPA list of high priority cleanups (i.e., none of the sites are on EPA's National Priorities List [NPL]). With respect to the SNL/NM inactive waste sites that are on Kirtland Air Force Base (KAFB), no other CERCLA or SARA activities are required. On October 1, 1992, SNL/NM submitted a National Pollutant Discharge Elimination System (NPDES) permit application for its storm water discharges.

In 1993, one reportable quantity release was reported. It was caused by a spill of waste material generated by a paint stripping operation on the roof of Building 807, Technical Area I (TA-I). The waste material (copper dust mixed with lead paint dust) was found on the roof and on the ground where the container bags were stored.

Resource Conservation and Recovery Act (RCRA), Environmental Restoration (ER) Project: The potential release sites identified by the ER Project for facilities at SNL/NM will be evaluated and corrected as required by RCRA 3004(u). Corrective actions (CAs) for releases from Solid Waste Management Units (SWMUs) are a part of the Hazardous and Solid Waste Amendments (HSWA) module RCRA Part B permit, issued August 26, 1993.

SNL/NM has an inactive Chemical Waste Landfill (CWL) that was issued an interim status in 1985. A closure plan was developed for this site following the requirements described in RCRA 40 CFR Part 265. Due to the discovery of trichloroethylene (TCE) at levels slightly above the EPA's drinking water standard in groundwater 500 feet beneath the site, a corrective action plan for remediation of the volatile organic compounds (VOCs) was incorporated into the closure plan, entitled "The Chemical Waste Landfill Closure Plan and Post-Closure Permit Application" (SNL 1991a). This plan was approved by the New Mexico Environment Department (NMED) in May 1993.

Regulatory interactions that have occurred at this site since granting of the interim status and initiation of the closure process can be summarized as follows:

1. In May 1988, NMED issued a groundwater monitoring compliance order which was followed by a compliance agreement in December 1989. In general, the compliance order required revisions to the supply plan and further groundwater characterization work.

2. In September 1992, NMED issued a Notice of Violation (NOV) to SNL/NM indicating that the CWL Closure Plan failed to meet the requirements

of 40 CFR 265.111 (HWMR-6, Part VI, Section 265.111) with respect to not including more groundwater characterization activities. More specifically, the NMED wanted more wells installed and aquifer tests performed. SNL/NM and the U.S. Department of Energy (DOE) agreed to perform the work.

In January 1990, the State of New Mexico adopted the federal underground storage tank (UST) regulations (40 CFR 280), basing the State's regulations on the age of the USTs rather than depth to groundwater. At present, 40 tanks have been removed, and the 24 remaining USTs are registered with the NMED.

RCRA, Hazardous Waste Management: SNL/NM is a large-quantity generator and a permitted storage and treatment facility managed by the Chemical Waste Management Department. On January 25, 1993, NMED issued a Class 1 modification of the RCRA storage permit for the Hazardous Waste Management Facility (HWMF) primarily to correct typographical errors in the original permit.

Revision 6.0 of the RCRA treatment permit application for the Thermal Treatment Facility (TTF) was submitted to the NMED on March 31, 1993. In response to technical deficiencies of the application, Revision 6.1 was submitted to NMED on June 14, 1993. NMED issued a draft treatment permit for the TTF on November 15, 1993. A final permit will be issued in calendar year (CY) 1994 after public comments are heard and addressed.

NMED performs annual RCRA audits of the SNL HWMF and generator locations throughout SNL facilities. The NMED 1993 audit included NMED enforcement bureau personnel. NMED personnel spent five days auditing in all five technical areas. A Compliance Order was issued on September 8, 1993, listing eight violations. Four violations occurred at generator sites, three occurred at mixed waste (MW) storage areas, and one was found at the HWMF. The causes of the violations included open containers of hazardous waste, labeling errors, incomplete training, incomplete inspection data, and incomplete Land Disposal Restriction (LDR) forms. A civil penalty of $8,842.50 was assessed. Corrective actions began immediately and SNL paid the penalty. NMED was satisfied by the response from SNL and closed out all violations.

RCRA, Mixed Waste Management: The State of New Mexico was granted regulatory authority for MW under RCRA on July 25, 1990. In August 1990, SNL/NM submitted a RCRA Part A permit application for MW to the NMED.

In October 1992, SNL/NM devised a permitting strategy for storage and treatment units that called for a phased submittal of the Part B permit application (i.e., a Part B permit application and two major amendments at specified intervals). The strategy was submitted to NMED in the form of a Letter Agreement. The Part B permit application (the first submittal of the phased submittal) was submitted to NMED on schedule on November 8, 1992. The first amendment was submitted to NMED on schedule August 26, 1993. The second amendment is due to NMED on December 31, 1994. If further waste treatment units are required to meet RCRA LDRs, a third amendment will be considered for submittal by October 6, 1995, to permit these treatment units.

In addition, the SNL/NM Part A permit application was revised to correct errors in the August 1990 Part A permit application, consolidate some storage units, add eight treatment processes, and assure comprehensive coverage of all MW expected to be managed at SNL/NM. Plans call for permitting 17 MW storage units and 13 treatment processes. Twelve units included on the Part A permit application will be closed under interim status.

On December 30, 1992, the EPA, Region VI, issued a "Notification of Noncompliance and Necessity for Conference in Regard to the Land Disposal Restrictions for the United States Department of Energy, Sandia National Laboratories." The Notification of Noncompliance (NON) began the process toward full compliance with the LDRs at SNL/NM through a Federal Facilities Compliance Agreement. The DOE and SNL/NM took all the necessary steps to comply with the NON, beginning with a conference with EPA and NMED on April 26, 1993.

In October 1992, the Federal Facility Compliance (FFC) Act was enacted, amending RCRA. SNL began compiling the inventory that was required to be submitted within 180 days of enactment.

The process of negotiating a Federal Facilities Compliance agreement was cancelled by EPA on June 11, 1993, and replaced by a process developed by DOE for implementation of the October 1992 FFC Act. As part of the requirements of the FFC Act, SNL/NM submitted its MW inventory for the preliminary report required within 180 days of enactment and updated this inventory in November 1993 for the Final Mixed Waste Inventory Report (DOE 1993a). Also, as part of the FFC Act, the Conceptual Site Treatment Plan for SNL/NM MW (SNL 1993a) was submitted to NMED in October 1993.

<u>National Environmental Policy Act of 1969 (NEPA)</u>: Since the issuance of the Secretary of Energy's NEPA Notice (SEN-15-90) of February 5, 1990, the promulgation of DOE's 1992 NEPA rule (10 CFR 1021), and the issuance of the revised DOE NEPA Order 5440.1E (DOE 1992a), the emphasis on NEPA reviews at SNL/NM has increased. DOE's commitment to infusing environmental values into DOE decision making and disclosing Federal activities through the NEPA process has resulted in an increase in the number of NEPA documents being written to cover SNL/NM's proposed actions. During 1993, SNL/NM NEPA compliance activities focused on several items:

- Fulfilling commitments made in the Final Action Plan to Tiger Team (SNL 1992a)
- Developing baseline information
- Developing the NEPA program

In 1993, NEPA compliance activities increased. Policies and procedures were further developed to ensure environmental values are considered as part of the review of SNL/NM proposed actions. A finding of no significant impact (FONSI) was issued after the satisfactory completion of the Environmental Assessment for the Radioactive and Mixed Waste Management Facility. The FONSI was published together with the Environmental Assessment (EA) in a single document (DOE 1991a). The NEPA Program also helped prepare the Environmental Assessment for the Purchase of Russian Low-Enriched Uranium Derived from the Dismantlement of Nuclear Weapons in the Countries of the Former Soviet Union (USEC 1994) for DOE Headquarters.

The NEPA Program was responsible for the publication and distribution of two technical reports in early 1993:

1. "Sandia National Laboratories, New Mexico, Environmental Baseline Update" (SNL 1993b)

2. "Cultural Resources Regulatory Analysis, Area Overview, and Assessment of Previous Department of Energy and Kirtland Air Force Base Inventories for Sandia National Laboratories, New Mexico" (SNL 1993c)

More detailed information about the NEPA program may be found in Section 3.5.

Clean Air Act (CAA): For air quality compliance, SNL/NM is regulated by the new Clean Air Act Amendments (CAAA) standards and local regulations such as Air Quality Control Regulations (AQCR) for Albuquerque and Bernalillo County. SNL/NM periodically applies for open-burn permits (AQCR #3), as well as topsoil disturbance permits (AQCR #8), for the control of airborne particulates. Other regulations such as AQCR #5 for visible air contaminants, AQCR #11 for volatile organic compounds, and AQCR #15 through #18 for emission standards of nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and particulate matter (PM) from oil and gas burning equipment are also applied to SNL/NM on a source-specific basis.

SNL/NM also complies with the National Emission Standards for Hazardous Air Pollutants (NESHAP) for radionuclide air emissions (Subpart H), beryllium (Be) air emissions (Subpart C), and asbestos emissions (Subpart M) (40 CFR 61). Other compliance mandates are found in Titles V and VI of CAAA. Title V of CAAA requires existing major sources/facilities to obtain "Operating Permits" as promulgated in 40 CFR 70 and AQCR #41 (in draft). Title VI intends to protect the stratospheric ozone by limiting the usage of Class I and Class II ozone-depleting substances (ODSs) as promulgated in 40 CFR 82 and AQCR #37.

Various inventories of air emissions were performed during the first quarter of 1994 for CY 1993: criteria pollutants, radionuclide emissions, ozone-depleting substances, and SARA Title III, Section 313, Toxic Chemical Releases. The criteria pollutant inventory will be based on AP-42 emission factors and calculations (EPA 1986a). The SARA Title III, Section 313, Toxic Chemical Releases, NESHAP radionuclides inventories, and associated annual reports will be submitted to the EPA. To date, the 1993 emissions are all in compliance with applicable standards.

During 1993, progress was made in the areas of compliance with NESHAP for radionuclides regarding the quality assurance (QA) plan and confirmatory measurement monitoring for significant sources. The stack monitoring system for the HERMES III accelerator facility was completed for design, installation, and testing in 1993. The evaluation of the existing systems in ACRR and HCF facilities was conducted and final sampling plans are being written for confirmatory monitoring of these two facilities.

Clean Water Act (CWA): SNL/NM has seven wastewater discharge permits from the City of Albuquerque for sanitary sewer discharges and has resolved past minor violations of the permits with the City. Instances in which the monitoring results exceeded regulatory limits are discussed in Section 6.1.2. Two surface impoundments are permitted, and there are 67 septic tanks at SNL/NM (Appendix H), three of which remain active. Most of the septic tanks are registered with NMED. NMED has ruled that several categories of low-volume and/or clean wastewater surface discharges require no discharge plans. On October 1, 1992, SNL/NM submitted an NPDES individual permit application and a Notice of Intent to Discharge (NOI) for its storm water discharges. The individual permit application was for the regulated industrial activities onsite, and the NOI was for the construction of the Explosive Components Facility.

<u>Safe Drinking Water Act of 1974 (SDWA)</u>: The SDWA is the legislative vehicle designed to protect human health by regulating the discharge of nontoxic and toxic pollutants into both groundwater and surface water sources by residential, municipal, and industrial sources. The goal of the Act is to preserve the quality of the nation's groundwater for agricultural and drinking water use.

Individual states are given responsibility by EPA for developing programs and procedures necessary to ensure that the quality of the groundwater meets the standards set by EPA. States set standards for the allowable concentrations of pollutants in surface discharges as well as requirements for pre-notifying, monitoring, and reporting discharges.

Individual states can elect to accept primacy of the regulations only if the state's regulations are stricter than the federal standards. Since New Mexico's regulations must be no less stringent than those set by the EPA, the SDWA standards still apply to SNL/NM.

<u>Toxic Substances Control Act (TSCA)</u>: TSCA, administered by the EPA, requires testing and regulation of chemical substances that enter the environment. At SNL/NM, compliance with TSCA primarily involves regulation of polychlorinated biphenyls (PCBs). All electrical distribution equipment found to contain PCBs in concentrations ≥50 parts per million (ppm) are being either removed from service for disposal or retrofitted to contain <50 ppm PCBs. As of December 31, 1993, 47 electrical distribution items containing ≥50 ppm PCBs were in service; of these, five are ≥500 ppm PCBs. All but a few of the nondistribution electrical items tested were found to be free of PCBs. As of December 31, 1993, 12 of these items contained ≥50 ppm PCBs; of those 12, 6 are ≥500 ppm PCBs. During 1993, approximately 21,000 kilograms (kg) of PCB waste were disposed of.

<u>Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)</u>: EPA-registered pesticides are applied at SNL facilities. These pesticides are applied by an EPA-certified applicator. SNL/NM retains records of the quantities and types of pesticides that are used as well as Material Safety Data Sheets (MSDSs) for each pesticide.

<u>Endangered Species Act (ESA)</u>: The ESA provides for protection of threatened and endangered species of flora and fauna. Where applicable, this act requires consultations with the U.S. Fish and Wildlife Service on listed or proposed species and critical habitats. Consultations are also required with the New Mexico Game and Fish Department and the New Mexico Department of Natural Resources to satisfy State procedures for fauna and flora protection.

Several surveys for threatened, endangered, and sensitive species and habitats were also conducted in 1993 to help fulfill the policy objectives of NEPA and provide information in the environmental consequences that must be addressed in the NEPA process. There are no Federal-listed threatened or endangered species known to occur within KAFB. There are, however, New Mexico-listed endangered plants that occur within KAFB.

Cultural Resources Acts: Cultural resources management at SNL/NM is required under acts such as the National Historic Preservation Act (NHPA), the Archaeological Resources Protection Act (ARPA), and the American Indian Religious Freedom Act (AIRFA). SNL integrates cultural resources management into the NEPA Program. It is DOE's policy that NEPA review is required for all DOE actions potentially affecting the environment; thus, even actions that are categorically excludable are reviewed for impacts on cultural resources, among other things. (See Section 3.5 for further information on NEPA activities.)

Executive Orders: Executive Orders 11988, Floodplain Management, and 11990, Protection of Wetlands, apply to NEPA-related activities and require evaluation of the potential effects of actions taken in floodplains and wetlands. These executive orders are coordinated with other NEPA review requirements at SNL/NM and are both addressed in NEPA documents where relevant to proposed actions.

2.2 CURRENT ISSUES AND ACTIONS

Air Quality Compliance:

AQCR #41 - Operating Permit Program

Proposed regulation AQCR #41, "Operating Permit Program," is the implementation of the CAAA, Title V, "State Operating Permit Program" in Albuquerque/Bernalillo County. Most of SNL/NM operations were "grandfathered," and a permit to operate was not required in the past. The new AQCR #41, which will be promulgated by EPA by November 15, 1994, requires all existing major sources to apply for an operating permit. A major source is defined as a facility which emits or has the potential to emit 100 or more tons per year of any criteria pollutant or 10 tons or more per year of any hazardous air pollutant, or 25 tons or more per year of any combination of such pollutants.

Based on the results of stack testing on the steam plant (Building 605) and the inventory of all stand-by generators and boilers outside the steam plant, SNL/NM will probably be a major source under Title V of CAAA for nitrogen oxides (NO_x). An action plan is being written for compliance with the upcoming "Operating Permit Program" regulation in AQCR #41. Under the proposed AQCR #41, SNL will be given one year from the date of promulgation to submit an application for the required operating permit.

AQCR #37 (40 CFR 82) - Stratospheric Ozone Protection

The regulation requires recovery and recycling of ozone-depleting substances. It also requires certain certification for the equipment used and personnel who performed the tasks. It was identified during 1993 that some equipment used for recycling of refrigerant and technicians performing the tasks had not been certified. Action plans are being written by the line organization to address these noncompliance areas. In addition to the certification program, all associated recordkeeping will be improved.

AQCR #20 - Permit Revision for Emergency Diesel Generators (Building 862)

The current permit (#150) for the emergency generators residing in Building 862 does not adequately address the operational needs of the generator plant. The monthly allowable operating hours (4 hours [hr]) does not allow for routine maintenance of the generators. A request to the City of Albuquerque Air Pollution Control Division for the revision of Permit #150 will be made through the DOE office. A proposal of 120 hr per year (instead of the current 4 hr per month) for each generator will be proposed to the City. In addition, other stand-by generators outside Building 862 that require permits will be included in the revision.

AQCR #24 - Variance for SMERF Testing in Compliance with AQCR #5

The Smoke Emission Reduction Facility (SMERF) had problems in complying with the opacity standard (AQCR #5) for visibility. The facility was designed to be used for burn tests of small objects to reduce the impact to air quality in the area (the smaller objects had been tested in the open-burn fire pools in the past). The City has agreed to allow SNL/NM to submit a request for a 1-year (yr) variance in order to resolve the visibility issue.

<u>Chemical Waste Landfill (CWL)</u>: The State of New Mexico issued an NOV for groundwater monitoring in 1989, and because the CAs could not be completed within the statutory 30-day limit, the state subsequently issued a compliance order on the same matter. A compliance agreement between DOE, SNL/NM, and NMED was signed on January 11, 1990, to close the compliance order. The compliance agreement included (1) revising the CWL Sampling and Analysis Plan (SNL 1990a), (2) installing a fourth downgradient monitor well, and (3) characterizing the uppermost aquifer at the CWL. SNL/NM submitted the final report on May 29, 1991, fulfilling the compliance agreement requirements (SNL 1991b). Resubmission of the closure and postclosure plan for the CWL, which had undergone several revisions, was completed in December 1992 (SNL 1992a, 1993d). The closure plan and postclosure permit application were approved in February 1993. The annual groundwater monitoring report for the CWL was submitted on March 1, 1994 (SNL 1994).

<u>Landfill Disposal Restrictions (LDRs) and Toxicity Characteristic Leaching Procedures (TCLPs)</u>: In 1984, Congress amended RCRA by imposing a schedule for restrictions on the land disposal of hazardous waste. These restrictions are referred to collectively as LDRs. On May 8, 1990, the final LDRs were implemented, forbidding the land disposal of hazardous waste that does not meet prescribed treatment standards. However, due to a nationwide absence of MW treatment and disposal facilities, the EPA granted a National Capacity Variance that delays the implementation of most LDRs for MW until May 1992. The EPA also implemented the TCLPs in 1990. Those analytical procedures and the associated regulatory changes have increased the volume and complexity of RCRA-regulated waste generated by SNL/NM.

Hazardous Waste Fees: During the first quarter of CY 1992, the NMED held public meetings concerning setting fees to oversee hazardous waste programs. The fees were to be payable to NMED, and were to be based on the volume of generated hazardous waste and the number of hazardous waste management units at a facility. The fees were adopted in 1993 and will be imposed for CY 1994.

Mixed Waste Authority: The State of New Mexico was granted regulatory authority for MW under RCRA on July 25, 1990. In August 1990, SNL/NM submitted a RCRA Part A permit application to NMED for the storage and limited treatment of MW (pH neutralization, compaction, solidification, and shredding/baling). In October 1992, a permitting strategy in the form of a Letter Agreement was sent to NMED for submitting the SNL/NM MW Part B permit application. The Part B permit application was submitted to NMED on November 8, 1992, and the first amendment was submitted August 26, 1993. An updated SNL/NM MW Part A permit application was also submitted in August 1993.

Mixed Waste Sampling and Analysis: The Radioactive and Mixed Waste Management Department (7573) has developed a method for sampling and analyzing waste that contains or is suspected of containing radioactive and hazardous components. The method includes participation from the Radiation Protection Operations and Measurements Departments (7714 and 7715) and the Department 7576 Environmental Sample Management Office (SMO). Sampling is requested by the waste generator using a Department 7576 Request for Sampling and Analysis form. Samples are obtained by the Department 7576 sampling team and given to the Radiation Protection Measurements Department for analysis and/or screening prior to shipment to one of two contract analytical laboratories. The analytical results are forwarded to the SMO for verification of completeness and validation.

2.3 ENVIRONMENTAL PERMITS

As part of its commitment to full compliance with all applicable environmental laws and regulations, SNL/NM holds environmental permits which are governed as described below.

2.3.1 Air

The CAA is enforced by NMED and the joint Albuquerque/Bernalillo County Air Quality Control Board. These organizations provide administrative support for the following:

1. National Ambient Air Quality Standards (NAAQS) (40 CFR 50)

2. NESHAP (except for the radionuclide NESHAP, which is managed by the EPA, Region VI) (40 CFR 61)

3. New Source Performance Standards (NSPS), which regulate atmospheric emissions from certain types of facilities

4. Open-burn permits

5. NO_2 emissions from gas-burning equipment

6. Topsoil disturbance permits

2.3.2 Water

1. The CWA is administered through EPA, Region VI. The act encompasses the following regulations:

   - NPDES, including pretreatment effluent guidelines and standards.

   - The NPDES permit system for storm water runoff will require a permit for storm water discharges from certain industrial sources. SNL/NM has several targeted activities.

   - Spill Prevention Control and Countermeasure (SPCC) Plan (Fink and Park 1992).

2. Sanitary sewer regulations, which are based on federal pretreatment standards and are promulgated by the City of Albuquerque

3. Surface and near-surface discharge regulations, which are administered by NMED

4. Groundwater monitoring regulations of RCRA, also administered by NMED

2.3.3 Solid Waste

1. CERCLA regulates inactive waste sites and contains requirements for reporting hazardous material spills to the National Response Center (NRC).

2. RCRA regulates generation, storage, treatment, recycling, transport, and disposal of hazardous, mixed, and nonhazardous solid waste in the following ways:

   - Chemical hazardous waste, which is regulated by RCRA

   - USTs for hazardous substances, which are regulated by RCRA

   - Documented waste minimization programs, which are required by RCRA

   - LDRs and treatment standards for chemical waste, which are applied by RCRA and were fully implemented in 1990

   - Radioactive MW, which is dually regulated by the Atomic Energy Act and RCRA

3. The New Mexico Hazardous Waste Act allows NMED to promulgate regulations no more stringent than federal regulations to manage RCRA hazardous waste. NMED received authority to regulate MW from EPA in July 1990. NMED also received authority to regulate Subpart X Miscellaneous Units from EPA in July 1990.

4. The New Mexico Solid Waste Act allows NMED to promulgate regulations to manage solid waste, such as non-hazardous, asbestos, and sanitary waste.

5. The Toxic Substances Control Act (TSCA) regulates the manufacture, distribution, use, handling, and disposal of certain toxic chemicals and materials, including polychlorinated biphenyls (PCBs) and asbestos.

2.3.4 Summary of the Status of Current Permits and Other Notifications

Table 2-1 lists the current environmental permits issued to SNL/NM and those that are under review by various agencies. Besides these environmental permits, notifications were given to the City of Albuquerque regarding asbestos removal (NESHAP, Subpart M) and Be emission/relocation (NESHAP, Subpart C). Also, several projects were evaluated for exemption and applicability of NESHAP, Subpart H, to facilities in TA-IV and V.

2.4 U.S. DEPARTMENT OF ENERGY TIGER TEAM ASSESSMENT SUMMARY

DOE has established teams of Environment, Safety, and Health (ES&H) experts ("Tiger Teams") to inspect the various DOE laboratories for compliance with federal, state, and local environmental and safety regulations, permit agreements, DOE Orders, best management practices, and internal laboratory requirements. A DOE Tiger Team assessment of the ES&H operations at SNL/NM was conducted from April 15 through May 24, 1991. This assessment was comprehensive, encompassing ES&H disciplines, management, self-assessments, and quality assurance; transportation; and waste management operations.

The Tiger Team audit resulted in a variety of environmentally related findings concerning waste characterization and management, training, and compliance issues for offsite treatment, storage, and disposal facilities (TSDFs); radioactive & mixed waste storage, characterization, and tracking; and other potential noncompliances with DOE Orders. Additionally, there were findings concerning groundwater monitoring, sampling, well/borehole closure, UST management, and ER activities. Some of these findings concerned only best management practices. Other deficiencies noted were in air quality monitoring, surface-water protection, groundwater protection, waste minimization, records management, radiological release control, and NEPA activities. The findings concerning NEPA activities were generally shared with the DOE.

In response to the Tiger Team findings, DOE and SNL/NM prepared an Action Plan. The draft Action Plan provided a formal written response to each of the findings and concerns cited in the Tiger Team report and presented plans, schedules, and costs for correcting the identified deficiencies. The Final Action Plan to Tiger Team was approved on February 28, 1992 (SNL 1992b).

Table 2-1. Summary of the Environmental Permits Issued or in Process

Permit No.	Type[a]	Location	Agency	Expiration Date
2069 A-2	Wastewater	WW001	City of Albuquerque	02/01/97
2069 D-3	Wastewater	WW004	City of Albuquerque	02/01/97
2069 F-2	Wastewater	WW006	City of Albuquerque	02/01/97
2069 G-2	Wastewater	WW007[b]	City of Albuquerque	07/31/94
2069 H-2	Wastewater	WW009[c]	City of Albuquerque	02/01/97
2069 I	Wastewater	WW008	City of Albuquerque	02/01/97
2069 K	Wastewater	WW011[d]	City of Albuquerque	03/31/94
DP-530	Surface Water Discharge	TA-IV Lagoons	State of New Mexico	12/26/94
NM5890110518-1	HW	958, 959 (HWMF)	NMED	08/06/02
NM5890110518	HW	6715 (TTF)	NMED	Interim status
NM5890110518 In process	MW (Part A)	TA-I, III, V, two 6000 Area Igloos, and seven Manzano bunkers	NMED	(first submitted 8/90; revised and resubmitted 11/92)
NM5890110518	MW (Part B)	TA-I, III, V, two 6000 Area Igloos, and seven Manzano bunkers	NMED	In process (first phase submitted 11/92)
NM5890110518	Corrective Action (HSWA)	SNL/NM	EPA Region VI	08/26/02

[a]HW and MW are currently operating under interim status.
[b]WW007 is located at the Microelectronics Development Laboratory.
[c]WW009 is located at the Process Development Laboratory.
[d]WW011 includes TA-III and IV, and the Coyote Area sewer lines.

Many of the original deficiencies have been either completed or resolved through time or other actions. However, some actions have been postponed due to circumstances beyond the control of the finding owner, or the Action Plan has been redesigned to address current needs and situations. All of the findings have been addressed to some degree during CY 1992 and CY 1993. In general, the SNL/NM Environmental Center has maintained steady progress toward the timely completion of the Action Plans.

3.0 ENVIRONMENTAL PROGRAMS INFORMATION

3.1 ENVIRONMENTAL RESTORATION PROJECT

The Environmental Restoration (ER) Project is a phased U.S. Department of Energy (DOE) project to identify, assess, and remediate past spill, release, or disposal sites at all DOE facilities including Sandia National Laboratories/New Mexico (SNL/NM).

The initial identification of sites at the Albuquerque location was completed in 1987. The installation assessment report identified 117 sites that would require further evaluation (DOE 1987). Since completion of the installation assessment report, additional sites have been identified and the number of potential release sites at Albuquerque now totals 219. It is anticipated that a few additional sites may be identified in the future. The 1992 annual environmental monitoring report (Culp et al. 1993) listed 172 potential release sites. Since publication of that report, sites have been added that were identified through review of historical documents, interviews, or field reconnaissance.

The potential release sites identified in the installation assessment report and subsequent evaluations are grouped together within geographic and event-related boundaries. These groups of release sites are called Operable Units (OUs) for budget development and project tracking purposes. Table B-1 in Appendix B lists the ER Program sites and identifies the specific potential release sites that are assigned within an individual OU. Since publication of the 1992 report, the sites have been regrouped to reduce the total number of OUs from 23 to 17.

The grouping of potential release sites will allow the assessment investigator to collect samples efficiently and economically. The geographically derived site groups will also provide an opportunity to collect installation-generic data on a regional basis during a single sampling campaign.

The assessment and remediation of potential release sites identified by the ER Project at SNL/NM are being monitored by the U.S. Environmental Protection Agency (EPA) under the Hazardous and Solid Waste Amendments of 1984 (HSWA) module of the Resource Conservation and Recovery Act (RCRA) Part B Operating Permit. The authority to investigate all Solid Waste Management Units (SWMUs) is granted by Section 3004(u) of RCRA, which requires investigation of all past and present SWMUs with a potential for release of hazardous waste or hazardous constituent(s). Facilities seeking a RCRA permit are required to conduct these assessments and subsequent investigations if a release is found or suspected. During 1993, assessment efforts continued at the following OUs: the Chemical Waste Landfill (CWL), the Mixed Waste Landfill (MWL), Technical Area II (TA-II), TA-III and TA-V, septic tanks and drainfields, the liquid waste disposal system (LWDS), former storage tank sites, Tijeras Arroyo, TA-I, Central Coyote Field, Kauai Test Facility, Tonopah Test Range, Southwest Test Areas, Foothills Test Area, Canyons Test Area, Salton Sea, and remote facilities.

3.2 UNDERGROUND STORAGE TANK MANAGEMENT

Underground storage tanks (USTs) at SNL/NM are managed in accordance with State of New Mexico UST regulations. The New Mexico UST regulatory program has been approved by the EPA, Region VI, in accordance with 40 Code of Federal Regulations (CFR) 281.

SNL/NM's inventory of active USTs was reduced in calendar year (CY) 1993 from six to five. UST 6587-2, a 10,000-gallon (gal) steel unleaded gasoline tank, was permanently closed by removal.

The New Mexico Environment Department (NMED) was notified at least 30 days in advance of the removal of UST 6587-2. An NMED representative was present to inspect the tank, piping, and excavation-zone soils during removal. Soil samples were taken from the excavation-zone in locations identified by the NMED representative and sent to an approved laboratory for analysis as required by NMED UST regulations. Official analytical results indicated no contamination of soil beneath the tank. Visual inspection of the soil surrounding the tank also showed no contamination; however, there was a release detected at the dispenser connected to this tank. A contract for an onsite investigation (OSI) has been placed to determine the extent of contamination. Analytical results were not available for this report.

All of SNL/NM's regulated USTs were upgraded to comply with UST leak-detection regulations that became effective on December 22, 1993.

3.3 SPILL PREVENTION CONTROL AND COUNTERMEASURE PLAN

Spill control activities at SNL/NM are managed using several orchestrated plans and programs. Spill Prevention Control and Countermeasure (SPCC) plans for SNL/NM (Fink and Park 1992), the Tonopah Test Range, and Livermore are augmented at SNL/NM by the *Oil Spill Contingency Plan* (Fink and Park 1993a) and the *Hazardous and Radioactive Materials SPCC Plan* (Fink and Park 1993b).

Oil-spill control activities at SNL/NM are coordinated using the *SPCC Plan* (Fink and Park 1992). This plan was prepared in accordance with 40 CFR 112. The 3-year (yr) rewrite, required by 40 CFR 112, was completed in 1990 and approved by the DOE. The next 3-yr revision is in progress at this time.

Activities for 1993 included the following:

- Annual revision of the *SPCC Plan* (Fink and Park 1992)
- Annual revision of the *Oil Spill Contingency Plan* (required by 40 CFR 112) (Fink and Park 1993a)
- Annual inspection of the regulated facilities for SNL/NM

3.4 WASTE MANAGEMENT PROGRAMS

3.4.1 Hazardous Waste and the Resource Conservation and Recovery Act

All RCRA-regulated wastes generated by SNL/NM (except mixed wastes) are transported off site for disposal at EPA-permitted treatment, storage, and disposal facilities (TSDFs).

Chemical wastes generated by SNL/NM research and development (R&D) activities are collected from generator locations, segregated according to U.S. Department of Transportation (DOT) hazard class, and transported to the RCRA-permitted Hazardous Waste Management Facility (HWMF) for storage. At HWMF, the wastes are consolidated and packaged according to DOT and EPA requirements. Packaged wastes are transported by EPA-permitted carriers to EPA-permitted TSDFs or recyclers for final disposition.

The EPA-permitted commercial transporters used to transport SNL/NM hazardous waste during 1993 are listed in Table 3-1. The permitted TSDFs, recyclers, and the waste treatment methods employed at each facility are listed in Table 3-2.

During CY 1993, 483,606 kilograms (kg) of chemical wastes were managed by SNL/NM's chemical waste management program, including 140,613 kg of RCRA-regulated hazardous waste and 342,993 kg of nonregulated industrial wastes. In CY 1993, a total of 25,263 packages were collected from SNL/NM generators, put into 5,089 containers, and sent to TSDFs and recyclers. The volume of waste processed in CY 1993 decreased 9,172 kg from that reported in CY 1992.

SNL/NM's Thermal Treatment Facility (TTF) is operated under EPA interim status. TTF was constructed to thermally treat residual explosives generated at SNL/NM. In CY 1993, TTF treated 0.2 kg of residual explosive waste.

3.4.2 Radioactive Waste

Onsite disposal of low-level radioactive waste (LLW) at SNL/NM was terminated in December 1988 as a result of a DOE Order. Presently, all newly generated LLW and mixed waste (MW) are stored temporarily aboveground at generator sites or in transportation containers at the inactive TA-III disposal site. During 1993, ~1533 cubic feet (ft^3) of LLW waste and 128 ft^3 of mixed waste were accepted at the TA-III storage site. This waste consisted primarily of fission product and uranium-contaminated waste on a volumetric basis, and tritium (H-3) contaminated waste on an activity basis.

The Radioactive and Mixed Waste Management Facility (RMWMF) was completed in 1990. Due to changes in regulations during construction, some facility upgrades are required before operations can begin. This 6000-square-foot (ft^2) facility will serve as a centralized packaging and storage facility for LLW and LLW-MW that meet the facility waste acceptance criteria (WAC). An Environmental Assessment (EA) was prepared for the RMWMF and submitted to the DOE in 1990, with an approval of a finding of no significant impact (FONSI) received in April 1993. In addition, a Safety Assessment for the RMWMF was submitted to the DOE for review on March 25, 1994 (Seylar 1994). It is projected that the RMWMF will be operational in 1996.

SNL/NM generates ~5 ft^3 of transuranic (TRU) waste per year. Ultimately, the TRU waste generated at SNL/NM will be disposed of at the Waste Isolation Pilot Plant (WIPP). Currently, all TRU waste is packaged and stored at generator-controlled locations.

Table 3-1. EPA-Permitted, Sandia National Laboratories/New Mexico Hazardous Waste Transporters Used in Calendar Year 1993[a]

1. Rinchem Company, Inc.
2. Safety-Kleen Corp.
3. Sandia
4. USPCI
5. Division Transport
6. Custom Environmental Transport
7. Chem Waste

[a]Identification of these companies is not necessarily an endorsement of their services by SNL/NM.

Table 3-2. Waste Disposal Facilities Used by Sandia National Laboratories/New Mexico in Calendar Year 1993[a]

Disposal Facility	Treatment
1. Hydrocarbon Recycles, Inc.	Kiln Fuel/Recycling
2. USPCI (Grassy Mountain, UT)	Stabilization, Encapsulation, and Landfill
3. ENSCO, Inc.	Incineration
4. Rollins Env. Svcs., Inc. (LA)	Incineration
5. Rollins Env. Svcs., Inc. (TX)	Incineration
6. Inmetco	Metals Recycling
7. MERECO	Metals Recycling
8. Chemical Waste Management-OSCO	Kiln Fuel/Recycling
9. BDT, Inc.	Hydrolysis of Reactive Metals
10. Envirosafe	Stabilization, Encapsulation, and Landfill
11. Breslube	Oil Recycling
12. Kirtland Landfill	Non-RCRA/Nonenvironmentally Hazardous Trash
13. USPCI (Lone Mountain, OK)	Stabilization, Encapsulation, and Landfill
14. Kirtland EOD Range	Open Detonation/Open Burn
15. Safety-Kleen	Solvent Recycling
16. Kinsbursky Bros.	Metal Recycling

[a]Identification of these companies is not necessarily an endorsement of their services by SNL/NM.

3.4.3 Mixed Waste

In August 1993, SNL/NM submitted an updated MW Part A and first amendment to the Part B permit application to the NMED. During 1993, the following activities were in place to meet regulatory and statutory requirements as listed for RCRA MWs generated at SNL/NM:

- Sampling and analysis of MW (40 CFR 261)
- Acquisition of additional mixed storage capacity (40 CFR 265)
- Inventory of MW generation and MW in storage (Federal Facility Compliance Act)
- Mixed waste generator training (40 CFR 262 and 265)

In July 1993, NMED inspected the hazardous waste (including MW) at SNL/NM. Five violations involving MW were delineated and are listed below with their associated fines:

• Failure to inspect availability and condition of spill-recovery equipment	$600.00
• Failure to equip storage area with telephone or other communications device	$1,155.00
• Failure to provide required training for one employee by scheduled renewal date	$425.00
• Failure to mark containers with accumulation start dates	$1,417.50
• Failure to mark container with complete accumulation start date	$720.00

DOE Albuquerque Operations Office (DOE/AL) made two appraisals during 1992. One examined the SNL/NM waste operations program and documented ten findings; action plans were prepared by SNL/NM and submitted to the DOE Kirtland Area Office (DOE/KAO) on May 6, 1993. The second reviewed the SNL/NM waste moratorium program that controls the release of hazardous wastes from radiological areas. The appraisal identified seven observations for which action plans were prepared by SNL/NM and submitted to DOE/KAO on May 27, 1993.

3.4.4 Special-Case Waste

In 1993, SNL/NM completed a site-wide inventory of waste including six categories of special-case (SC) waste:

- DOE comparable greater-than-Class-C (SC-GTCC)
- Performance assessment limiting (SC-PAL)
- Uncertified or uncharacterized (SC-US)
- Noncertifiable, nontransportable TRU (SC-TRU)
- High-level, incidental (SC-HLI)
- Commercially held, DOE-owned materials (SC-COM)

No special-case waste was identified.

3.4.5 Polychlorinated Biphenyl Waste

SNL/NM is in the process of phasing out polychlorinated biphenyl (PCB) waste oils and equipment to the greatest extent possible. All electrical distribution equipment (transformers and switches) found to contain PCBs in concentrations ≥50 parts per million (ppm) are being either removed from service for disposal or retrofitted to contain <50 ppm PCBs. As of December 31, 1993, there were 47 electrical distribution items containing ≥50 ppm PCBs in service at SNL/NM. Of these 47, 5 are ≥500 ppm PCBs.

Nondistribution electrical devices, such as capacitors, high-voltage power supplies, and a wide variety of oil-containing equipment, such as vacuum and hydraulic systems, have been checked for PCBs at SNL/NM. All but a few of these items were found to be free of PCBs. The items that do contain PCBs in concentrations ≥2 ppm are on an inventory list and will be properly disposed of when the users no longer need the items for service. As of December 31, 1993, there were 12 non-electrical distribution items containing ≥50 ppm PCBs in service at SNL/NM. Of those 12 items, 6 are ≥500 ppm PCBs. Approximately 21,000 kg of PCB waste were disposed of in 1993.

3.4.6 Nonfacilities Asbestos Waste (Equipment with Asbestos-Containing Material)

SNL/NM Chemical Waste Management Department oversees the storage and disposal of nonfacilities waste and equipment that contains friable asbestos. Approximately 16,300 kg of nonfacilities asbestos waste were disposed of in 1993.

In instances where equipment has asbestos-containing material (ACM) in nonfriable form and the equipment is still useful to SNL/NM, the items will remain in service at their current location, or they will be delivered to property reapplication, at the request of the current owner, for use elsewhere within SNL/NM.

If the asbestos in ACM is in friable form (i.e., if the asbestos fibers can easily be liberated to the environment), creating a health hazard, either the equipment will be properly disposed of or the asbestos will be abated from the equipment. Proper disposal consists of transporting the material to a landfill permitted to accept friable asbestos waste. The abatement option is exercised when the ACM is easily removed from an item and/or when the item is of such size that the landfill option is not a practical alternative. Two ovens and one belt furnace were abated in 1993.

3.4.7 Waste Minimization Program

A formal waste-minimization and pollution-prevention (WMin/PP) awareness program was initiated in 1989 to further comply with EPA regulations and DOE Orders 5400.1, 5400.3, and 5820.2A (DOE 1988a, 1988b, and 1989b) and to meet recent Executive Order (EO) 12856. The latter is an important signal of the fundamental change in Federal-agency environmental accountability and mandates a strong Federal pollution-prevention (PP) program. The SNL/NM pollution-prevention program addresses waste reduction activities for all media (air, water, and solid) for nonhazardous, hazardous, mixed, and radioactive wastes and aims to foster a cradle-to-grave philosophy to conserve resources and make PP part of everyday activities.

Accomplishments in 1993 include the following:

- In a joint effort by Centers 7500 and 6600, and the line organization, over 400 Process Waste Assessments (PWAs) on waste-generating processes were completed. PWAs are descriptions of processes with a focus on multimedia environmental protection. These assessments provide the basis for identifying opportunities to reduce or eliminate wastes, air emissions, and water discharges. Reducing waste streams also reduces input requirements, thereby conserving resources and providing a safer workplace. Other benefits of PWAs include the ability to anticipate Environment, safety, and health (ES&H) requirements during project development, reduced requirements for ad hoc data requests, and enhanced reporting capabilities.

- Using the PWAs, Waste Minimization Opportunities Assessments (WMOAs) were performed on selected processes. The WMOAs, conducted for a half or full day, included a diverse team of individuals drawn from the process, SNL/NM ES&H professionals, and outside consultants. Each WMOA began with a 1- or 2-hour (hr) tour of the process operations, followed by a brainstorming session to generate a variety of waste-minimization ideas. Initially, these ideas were not screened in order to facilitate a creative atmosphere. Toward the end of the WMOA, however, ideas were placed into one of three categories: those implementable immediately with little or no testing, those requiring additional study, testing, or funding, or those not economically or technically feasible. In most cases, process personnel were responsible for implementing ideas or conducting further studies, with assistance from the Waste Minimization (WMin) organization as appropriate. In some cases, however, funding was available from the WMin group to assist with implementation or further study.

- The WMin Program was relocated within the PP Department to establish formal coordination with other environmental groups. The new PP Department provides laboratory-wide support for multimedia WMin/PP. This new department also establishes a focal point for the continued development of a comprehensive tracking and information system that interfaces with safety, health, and risk management systems.

3.5 NATIONAL ENVIRONMENTAL POLICY ACT OF 1969 COMPLIANCE ACTIVITIES AND DOCUMENTATION IN 1993

3.5.1 Background

The National Environmental Policy Act (NEPA), the nation's most comprehensive legislative and public policy statement for environmental protection, applies to all agencies of the Federal government. Executive Orders, DOE Orders, and DOE guidance apply NEPA and NEPA-related activities to SNL/NM.

The Secretary of Energy's February 5, 1990, NEPA Notice (SEN-15-90), with directives intended to bring DOE into full compliance with NEPA, set in motion events that have led toward a major increase in commitment to the principles and practices underlying NEPA. New compliance and guidance procedures are being developed by both DOE and SNL/NM. These new requirements have greatly increased NEPA compliance activities.

On April 24, 1992, DOE published its NEPA regulations in the form of a final rule entitled "National Environmental Policy Act Implementing Procedures" (10 CFR 1021). The final rule includes an expanded list of typical classes of actions that require NEPA review. The new rule revoked DOE's former NEPA guidelines of December 15, 1987.

The final rule, incorporating policy initiatives instituted by the Secretary of Energy, is more specific and detailed than DOE's former NEPA guidelines. In the new rule, DOE adopts NEPA-implementing regulations published by the Council on Environmental Quality (CEQ) as 40 CFR 1500-1508. The CEQ, created by the Executive Office of the President under the authority of NEPA, establishes NEPA regulations used by all Federal agencies.

DOE/AL 5440.1D Supplemental Directive was issued on March 19, 1992 (DOE 1992b). This Order is currently being revised to conform to DOE Order 5440.1E (DOE 1992a) and 10 CFR 1021 regulations. DOE Order 5440.1E was issued on November 10, 1992. This order establishes responsibilities and procedures to implement NEPA in conformance with the new DOE NEPA regulations.

At SNL/NM, the Risk Management/NEPA Department (7258) administers the NEPA Program. The program's responsibilities include the following activities:

- Consulting and training line organization personnel in NEPA compliance
- Coordinating NEPA document preparation
- Maintaining a corporate NEPA document file
- Reviewing and assuring the quality of NEPA documents before their submittal to the DOE

These responsibilities are documented in SNL/NM's NEPA Program Document (PG470110) that was approved in 1991 (SNL 1991c).

3.5.2 NEPA Documents

Although only DOE has authority to decide the appropriate level of NEPA documentation, SNL/NM assists DOE by drafting the appropriate documentation for DOE approval (Figure 3-1). NEPA documents serve as vehicles for assessing potential environmental impacts of proposed Federal actions and disclosing Federal activities. These documents include those described below.

Environmental Checklists (ECLs): ECLs are used to document the use of a categorical exclusion, that is, a category of actions for which neither an Environmental Assessment (EA) nor Environmental Impact Statement (EIS) is normally required.

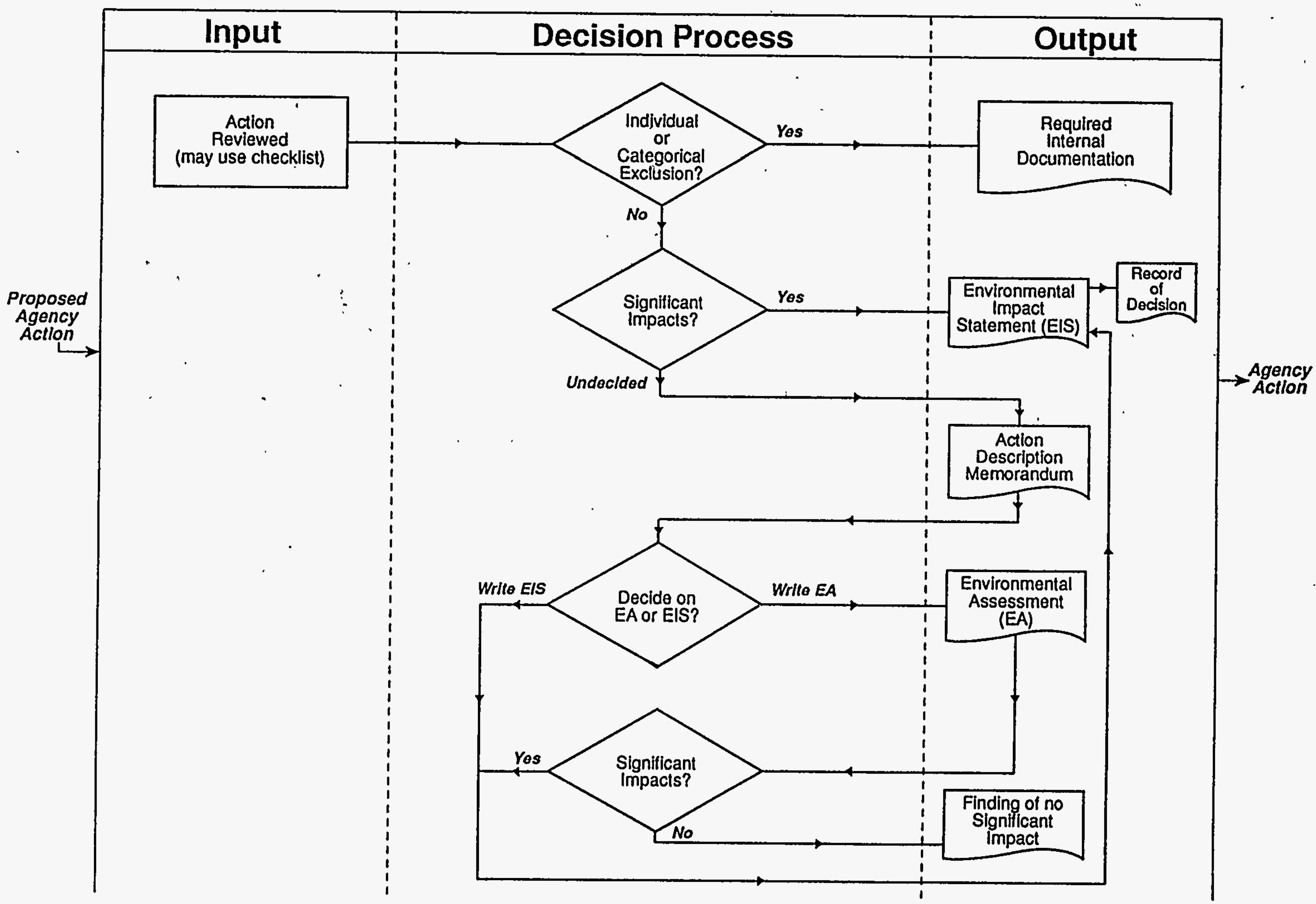

Figure 3-1. Process For Creating and Reviewing U.S. Department of Energy National Environmental Policy Act Documentation

Action Description Memoranda (ADMs): ADMs are documents containing concise descriptions of proposed actions and brief discussions of relevant potential environmental issues. DOE uses ADMs to determine the appropriate level of NEPA documentation for proposed actions. Actions which are not categorically excluded or covered in approved NEPA documents require preparation of EAs or EISs.

At DOE/AL, a combined ECL and ADM, or ECL/ADM, is used for the following purposes:

- Provide a means of reviewing a proposed action to determine if it qualifies for categorical exclusion (CX)
- Help determine the appropriate level of NEPA documentation (EA or EIS) for actions not categorically excluded

Environmental Assessments: EAs are concise public documents intended to provide brief but sufficient evidence and analysis for determining whether to prepare an EIS or a FONSI. EAs are used primarily to evaluate proposals for the possibility of significant impacts; they also aid compliance with NEPA when no EIS is required and facilitate preparation of an EIS when one is necessary. Figure 3-2 is a flowchart of the EA process.

Finding of No Significant Impact (FONSI): An EA can lead to only one of two conclusions: (1) an EIS must be prepared, or (2) the impacts of a proposed action are insignificant. The latter is called a "finding of no significant impact," or FONSI. Many proposals would not qualify for a FONSI without commitments to mitigation measures that render the impacts insignificant.

Environmental Impact Statement: An EIS is a detailed written statement for major Federal actions significantly affecting the quality of the human environment. The EIS process is shown in Figure 3-3.

Mitigation Action Plan (MAP): According to DOE Order 5440.1E (DOE 1992a), an MAP is required where a FONSI would be based in part on a DOE commitment to take certain mitigation actions. The MAP is not intended to address mitigation activities that are normally or routinely undertaken as part of the proposed action. The MAP focuses on actions that are over and above what would routinely occur as part of the proposed action.

Site-Wide NEPA Documents: According to DOE's NEPA rule (10 CFR 1021): "A site-wide NEPA document means a broad scope EIS or EA that is programmatic in nature and identifies and assesses the individual and cumulative impacts of ongoing and reasonable future actions at a DOE site . . . "

3.5.3 1993 Activities

SNL/NM provided information for two documents that are still being prepared:

1. The DOE "Nuclear Weapons Complex Reconfiguration Programmatic Environmental Impact Statement (PEIS)" (DOE 1993b). This PEIS is one of DOE's most important undertakings to be handled in a NEPA document.

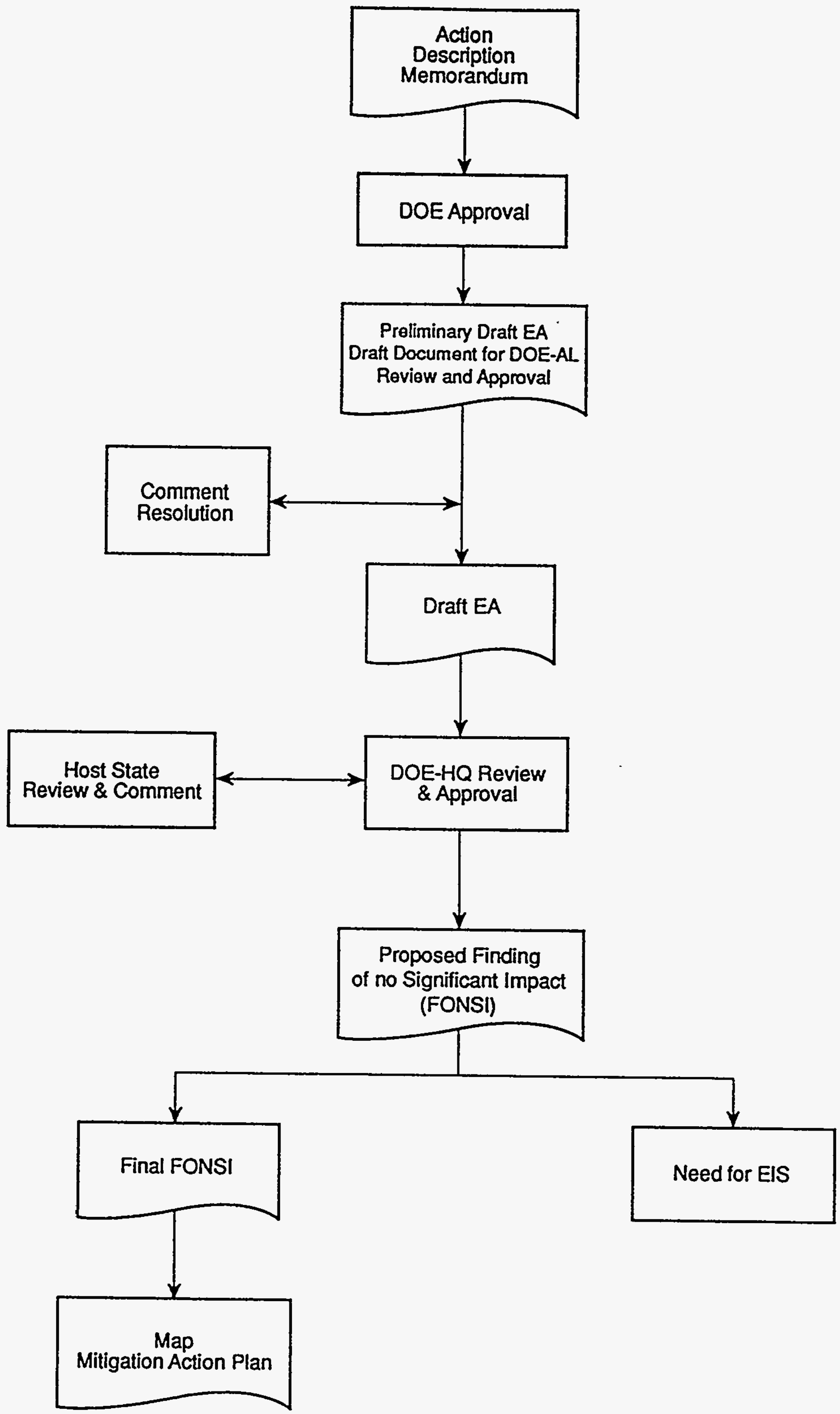

Figure 3-2. Flowchart of the Environmental Assessment Process

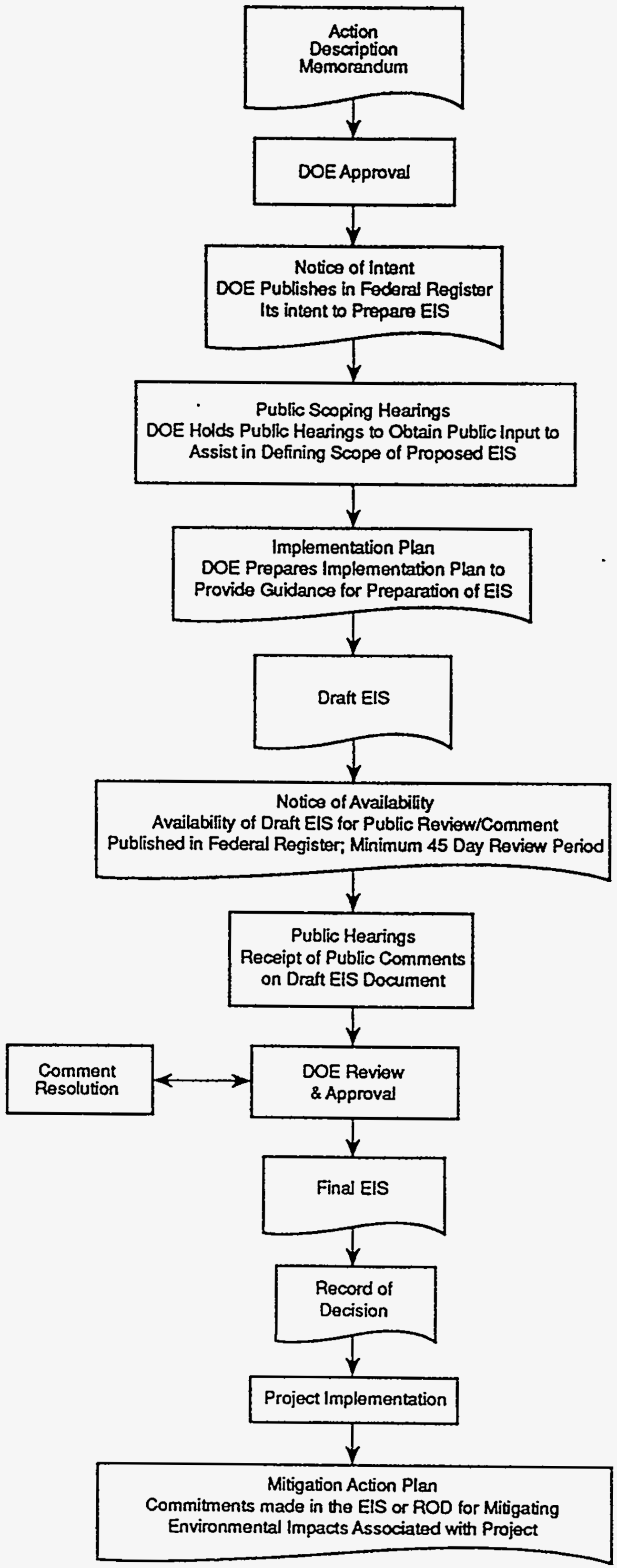

Figure 3-3. Flowchart of the Environmental Impact Statement Process

2. The "Implementation Plan for Environmental Restoration and Waste Management Programmatic Environmental Impact Statement" (DOE 1994a).

The NEPA process deals comprehensively with environmental problems and integrates NEPA requirements with other environmental reviews and required consultations. This helps fulfill the policy objectives of NEPA and provides information on the environmental consequences that must be addressed in NEPA documents.

Several EOs are coordinated with NEPA review requirements and apply to NEPA-related activities. For example, EO 11988, Flood Plain Management, and EO 11990, Protection of Wetlands, contain specific requirements for Federal agencies, and both are addressed in NEPA documents where relevant to proposed actions.

Compliance with environmental laws concerning cultural resources, such as the National Historic Preservation Act (NHPA), helps fulfill the policy objectives of NEPA and provides information on the environmental consequences that must be addressed in the NEPA process. Section 106 of NHPA directs Federal agencies to take into account the effects of their actions on properties included in or eligible for the National Register. In support of NEPA documentation, several archaeological surveys were completed for SNL/NM. No significant cultural resources were located on DOE-owned properties.

The Endangered Species Act provides for protection of threatened and endangered species of flora and fauna. Where applicable, this act requires consultations with the U.S. Fish and Wildlife Service on listed or proposed species and critical habitats. Consultations are also required with the New Mexico Game and Fish Department and the New Mexico Department of Natural Resources to satisfy State procedures for fauna and flora protection.

Several surveys for threatened, endangered, and sensitive species and habitats were also conducted in 1993 to help fulfill the policy objectives of NEPA and provide information on the environmental consequences that must be addressed in the NEPA process. There are no Federal-listed threatened or endangered species known to occur within Kirtland Air Force Base (KAFB). There are, however, New Mexico-listed endangered plants that occur within KAFB.

3.5.4 NEPA Training and Outreach

Professional non-Sandia trainers and Sandia NEPA professionals provide training to Sandians on NEPA processes. The objectives of the training are to enhance efficiency and effectiveness in complying with NEPA.

SNL/NM's ES&H Division, which publishes the "ES&H Training Catalog" (SNL 1993e), offers four NEPA courses, three of which (ENV120, 122, and 124) were offered during 1993:

1. "NEPA Awareness" (ENV120). This is an introduction to NEPA, developed by the NEPA program and Sandia's Training Department and directed toward Sandians not familiar with the law, its implement-

ing regulation, and Sandia's responsibilities as a contractor for DOE.

2. "NEPA Executive Overview" (ENV121). This overview provides basic information on NEPA law and regulations.

3. "NEPA Implementation" (ENV122). This 3-day course details the NEPA process for those developing NEPA documents.

4. "NEPA Writing" (ENV124). This hands-on course provides instruction on correctly writing NEPA documents.

A 1-day in-house NEPA Executive Overview course is being developed jointly by the NEPA Program and the Training Department. It is anticipated that SNL/NM will offer this pilot program in April or May 1994. This course will focus on making NEPA an integral part of the regular recurring planning and management process and will replace the current NEPA Overview course (ENV121).

Two NEPA Compliance Workshops were held in 1993:

1. A NEPA Compliance Guide Workshop for Sandia ES&H coordinators on July 27, 1993

2. A NEPA workshop for the ER Program on October 14, 1993

3.5.5 NEPA Baseline Information

Information gathering to characterize the existing environment on lands used by SNL/NM continued in 1993. The information will be compiled into reports designed to promote uniformity in the quality of baseline information incorporated into SNL/NM NEPA documents. The following two SNL reports were published by the NEPA group in early 1993:

1. "Sandia National Laboratories, New Mexico, Environmental Baseline Update" (SNL 1993b)

2. "Cultural Resources Regulatory Analysis, Area Overview, and Assessment of Previous Department of Energy and Kirtland Air Force Base Inventories for Sandia National Laboratories, New Mexico" (SNL 1993c)

3.5.6 Environmental Assessment Findings of No Significant Impact

One FONSI was issued in 1993 for the EA for the Radioactive and Mixed Waste Management Facility (DOE 1991a). Two other EAs were essentially completed in 1993. The FONSI for the EA for the neutron generator/switch tube prototyping relocation was issued on April 8, 1994 (DOE 1994b). The FONSI for the EA for the Robotic Manufacturing Science and Engineering Laboratory was issued on April 13, 1994 (DOE 1994c).

3.5.7 Miscellaneous NEPA Activities

Consistent with DOE's Supplemental Directive, AL 5440.1D, the NEPA program used NEPA identification numbers in 1993 (DOE 1992b). The new numbers are unique and are assigned by SNL/NM at the earliest appropriate state of a proposed action. The assigned number is to be included on all budget and project/planning, authorization, and control documents.

The NEPA Program supported two NEPA proposed actions involving SNL line organizations in 1993:

1. Katmai Scientific Drilling Projects for which an EIS is being prepared by the Park Service.

2. EA for the U.S. purchase of low-enriched uranium converted from Russian highly-enriched uranium. This EA was prepared at SNL/NM for DOE's Office of Nuclear Energy (USEC 1994). A FONSI was issued in late 1993.

During 1993 there were 14 EAs under development for DOE facilities at SNL/NM or for proposed actions involving SNL/NM research activities. These EAs are listed in Appendix I, Table I-1.

3.6 SUMMARY OF 1993 RELEASE AND ENVIRONMENTAL INCIDENT REPORTS

3.6.1 Summary of Release Reporting

There are four release reporting documents required by organizations external to SNL.

1. Reportable Quantity (RQ) Release Reporting

2. The Radioactive Effluent Information System/Onsite Discharge Information System (EIS/ODIS) Annual Report

3. The National Emission Standards for Hazardous Air Pollutants (NESHAP) for Radionuclides (Subpart H) Annual Report

4. The Superfund Amendment and Reauthorization Act (SARA), Section 313, Toxic Chemical Release Report

Reportable Quantity Reporting: RQ reporting is required by the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) and SARA, Title III. CERCLA requires that any release to the environment in any 24-hr period of any pollutant or hazardous substance in a quantity greater than or equal to the RQ be reported immediately to the National Response Center (NRC). However, if the release is Federally permitted under CERCLA Section 101(10)(H), it is exempted from CERCLA reporting. This reporting exemption also applies to any Federally permitted release under SARA, Title III.

Table 3-3 contains the annual summary of RQ Release Reporting for SNL/NM. In 1993, one release was reported. It was caused by a spill of waste material generated by a paint stripping operation on the roof of Building 807, TA-I.

Table 3-3. Annual Summary of 1993 Reportable Quantity Release Reporting

Date	SNL/NM Location	Material	Quantity (lb)	RQ (lb)	Release To	NRC Number	Report Date
09/07/93	TA-I	Lead	1.0	1.0	Ground	196711	09/08/93

The waste material (copper dust mixed with lead paint dust) was found on the roof and on the ground where the container bags were stored. Non-RQ accidental releases are discussed in Section 3.6.2.

<u>EIS/ODIS Reporting</u>: DOE Order 5400.1 requires that data about radioactive effluent and onsite discharge from the previous year for all planned and unplanned releases must be reported to the Waste Information System Branch of Edgerton, Germeshausen & Grier Corp. (EG&G), Idaho, Inc., by April 1 each year.

The EIS/ODIS report for 1993, submitted on March 14, 1994, covered all routine and nonroutine releases from SNL/NM operations. The TA-V reactors (the Annular Core Research Reactor [ACRR] and the Sandia Pulsed Reactor [SPR]) produced the majority of radioactive air releases. During 1993, SNL/NM released a total of 3.2 curies (Ci) of argon-41 (Ar-41), 1.0 Ci of nitrogen-13 (N-13), 0.51 Ci of oxygen-15 (O-15), 0.41 Ci of rubidium-88 (Rb-88), 0.4 Ci of xenon-135 (Xe-135), 0.36 Ci of krypton-88 (Kr-88), 0.2 Ci of carbon-13 (C-13), 0.18 Ci of xenon-135m (Xe-135m), 0.17 Ci of krypton-87 (Kr-87), 0.14 Ci of krypton-85m (Kr-85m), 0.1 Ci of nitrogen-15 (N-15), and other microcurie (μCi) levels of fission and activation products. All of these releases were within regulatory limits.

Routine sewage discharges from all processes within the technical areas to the City of Albuquerque publicly owned treatment works (POTW) totaled 2.9×10^8 gal. These discharges averaged approximately 3.1 pCi/L gross alpha activity and 11 pCi/L gross beta activity.

<u>NESHAP Reporting</u>: The NESHAP standards of 40 CFR 61, Subpart H, for radionuclides require that an annual report from each DOE site must be submitted to the EPA by June 30 each year. The report includes the calculated maximum offsite dose impacts (effective dose equivalent) to the nearby public receptors and the associated input data for this calculation (40 CFR 61.94[c]). The NESHAP annual report will be submitted to EPA, Region VI, on or before the June 1 due date.

Section 5.5 presents detailed results of the dose assessment for the public due to SNL/NM operations in 1993.

<u>Toxic Chemical Release Reporting</u>: The Toxic Chemical Release (TRI) Report is required by SARA, Title III, Section 313 (40 CFR 372). SARA requires that facilities (within Standard Industrial Classification [SIC] of 20 to 39) report

releases of listed toxic chemicals if the usage quantity is greater than 10,000 pounds per year (lb/yr) for any of the listed chemicals. Although SNL/NM operation is not categorized within the specified SIC code, EO 12856, "Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements," requires Federal facilities meeting established thresholds to submit TRI Reports under the Emergency Planning and Community Right to Know Act (EPCRA). SNL/NM has been filing the TRI Reports with DOE and the EPA since 1991 (for reporting year CY 1990). SNL/NM will report the CY 1993 toxic chemical releases in June 1994.

3.6.2 Summary of Environmental Incident Reporting

There were a total of 26 non-RQ incidents in 1993: nine DOE-reportable occurrences and 17 nonreportable occurrences.

The reportable occurrences varied in size and quantity from <1 gal to many thousands of gallons. Of the nine total occurrences, one was a release of an oil or nonhazardous petroleum product mixed with antifreeze and water. One reportable occurrence involved the release of natural gas. There was one release of <1 gal of mixed acid, two releases of 500-2000 gal of wastewater to the ground surface, three releases of water mixed with low levels of potentially hazardous materials, and one release of cooling water, which contained an additive for corrosion inhibition and descaling.

The nonreportable occurrences varied in size and quantity from a few gallons to several hundred gallons. Of the 17 total nonreportable occurrences, three were releases of oils or nonhazardous petroleum products. Three nonreportable occurrences involved natural gas or propane gas. Four were releases of cooling water containing various additives for corrosion inhibition and descaling. There were also three releases of 100-400 gal of wastewater to the ground surface, and four releases of 100-500 gal of process water to the ground surface.

Of the total 26 reportable and nonreportable occurrences, 22 were liquid releases. Of the 22 liquid releases, 1 was <1 gal of liquid; 1 was >1 gal, but <5 gal; 11 were between 5 gal and 100 gal; and 9 were >100 gal.

4.0 TERRESTRIAL SURVEILLANCE

Sandia National Laboratories/New Mexico (SNL/NM) has maintained environmental radiological surveillance activities since February 1959 (Burnett et al. 1961; Brewer 1973, 1974; Holley 1975; Holley and Simmons 1976; Simmons 1977, 1978, 1979, 1980; Millard 1981; Millard et al. 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989; Hwang et al. 1990, 1991; Culp et al. 1992, 1993). Calendar year (CY) 1993 marked the first year that stable metal surveillance activities were conducted. The objectives of the radiological and stable metal surveillance activities are to detect any potential releases and/or migration of contaminated material related to onsite operations to offsite locations and also to determine potential impacts (if any) of site-related activities to the offsite population and the surrounding environment. These surveillance activities also provide a check on the effectiveness of safety systems in effect at the various technical areas (TAs).

During March and April 1993, Edgerton, Germeshausen & Grier Corporation (EG&G) Energy Measurements Group performed an aerial radiological survey of SNL/NM and the surrounding area. The survey team measured the terrestrial gamma radiation to determine the levels of natural and man-made radiation. The helicopter used in this survey was outfitted with two detector pods and flown at approximately 150-feet (ft) (46 meters [m]) above the survey area. It is anticipated that the results of the aerial gamma survey will be available in 1994. Any pertinent information from this survey will be included in the 1994 Site Environmental Report for SNL/NM.

4.1 SURVEILLANCE LOCATIONS

The Environmental Surveillance Program staff collected soil, arroyo sediments, surface water, and vegetation twice a year: in May and August. The sampling stations are located in three distinct areas: on the SNL/NM site, at the site perimeter, and in the surrounding community. Onsite locations are near areas of known contamination, potential sources of contamination, or in areas where contamination, if present, would be expected to accumulate. The perimeter locations are used to monitor the SNL/NM site boundary for potential site-related contamination migrating to offsite receptors. The community locations represent offsite locations unrelated to SNL/NM activities. Data collected at community locations serve as a reference point to compare to samples collected from SNL/NM site perimeter and onsite locations. Thermoluminescent dosimeters (TLDs) are used to measure ambient levels of gamma radiation. TLDs are also located on site, off site, and in the surrounding community. In the past, no site-related contamination has been found at perimeter or community locations.

Most terrestrial surveillance locations remain essentially the same from year to year (Figures 4-1 and 4-2). Table 4-1 lists the SNL/NM terrestrial surveillance locations and specifies the type of sample collected (vegetation, soil, sediment, or surface water) and the presence of a TLD for each location. There are a total of 64 fixed sampling locations: 32 onsite at SNL/NM; 16 distributed around the site perimeter; and 16 community locations distributed in and around Albuquerque within a 50-mile (mi) (80-kilometer [km]) radius of SNL/NM. New monitoring locations are added as necessary to monitor new facilities and operations, or to supplement existing data. Environmental

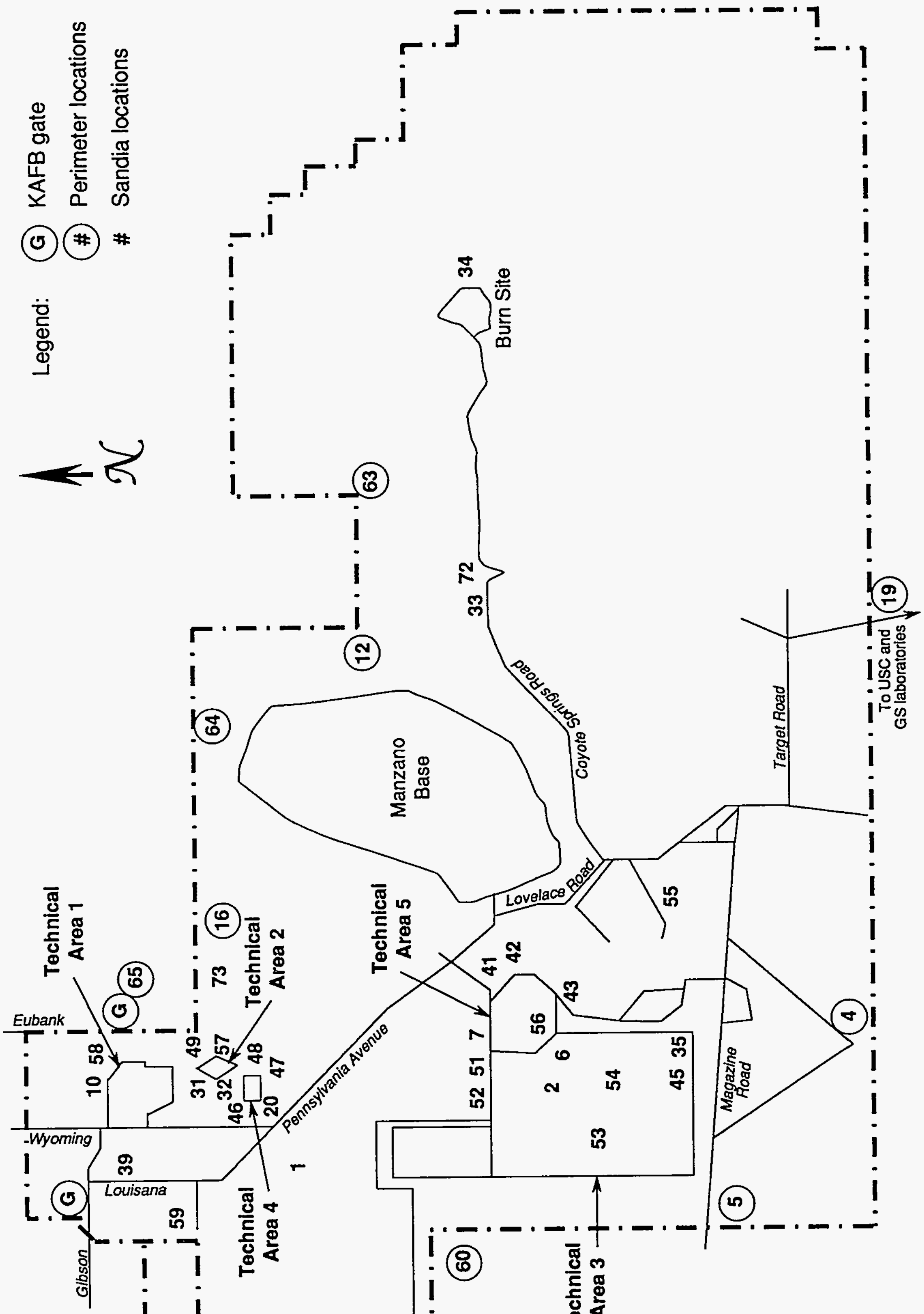

Figure 4-1. Onsite and Perimeter Terrestrial Monitoring Locations

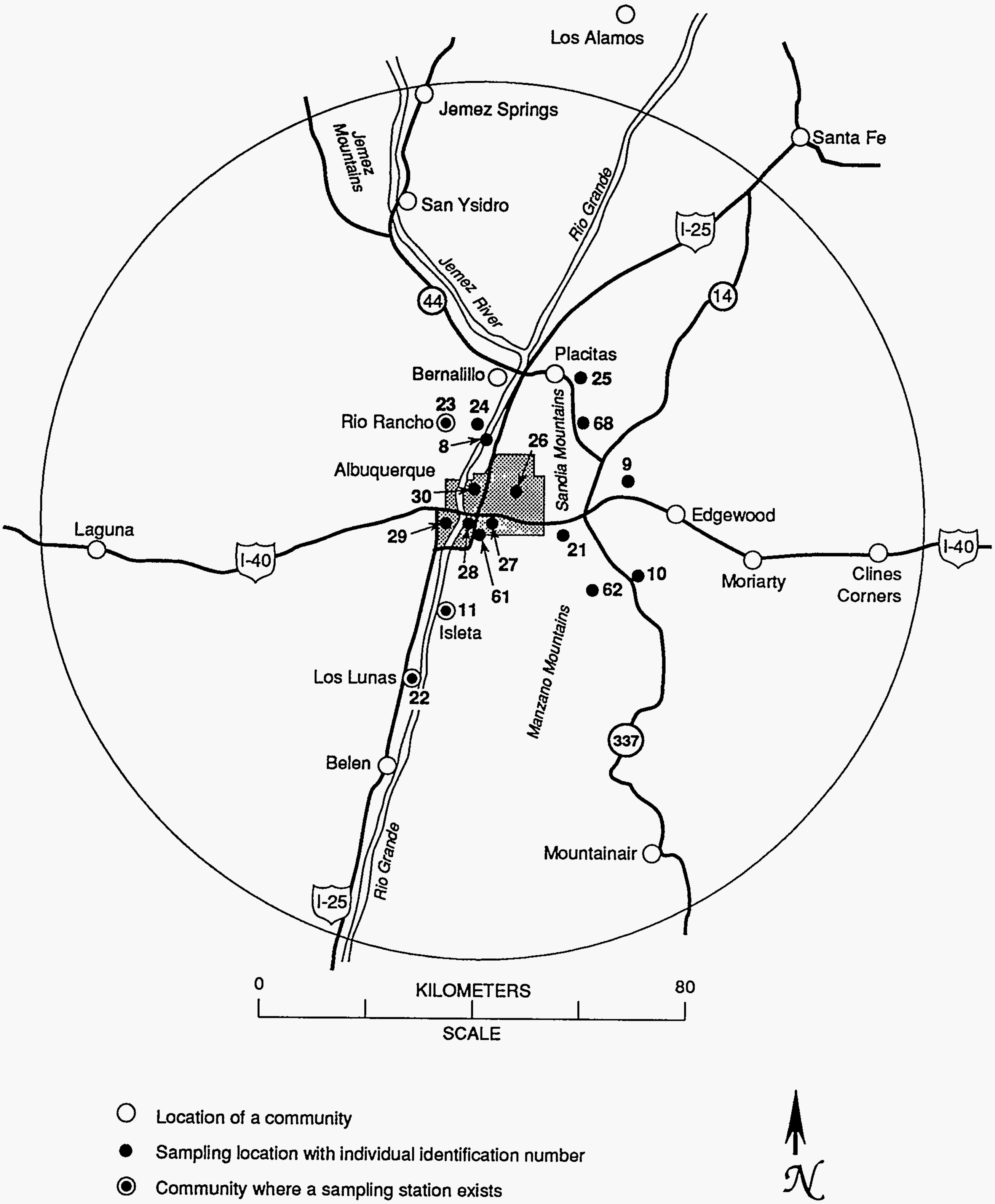

Figure 4-2. Community Terrestrial Monitoring Locations

Table 4-1. Sandia National Laboratories/New Mexico Terrestrial Surveillance Locations and Sample Types

Location Number	Sampling Location	Location Type[a]	Sample Type[b]
1	Pennsylvania Avenue	S	V,S,T
2 NW	Radioactive Waste Disposal Site NW	S	V,S,T
2 NE[c]	Radioactive Waste Disposal Site NE	S	V,S
2 SE	Radioactive Waste Disposal Site SE	S	V,S
2 SW	Radioactive Waste Disposal Site SW	S	V,S
3	Coyote Canyon Control	S	V,S,T
4	Isleta Reservation Gate	P	V,S,T
5	McCormick Gate	P	V,S,T
6	East of Technical Area III, Water Tower	S	V,S,T
7[c]	North of Technical Area V, Arroyo	S	V,S,T
8	Corrales Bridge	C	V,S,W,A
9	Sedillo Hill, I-40, East of Albuquerque	C	V,S
10	Oak Flats	C	V,S,T
11[c]	Isleta Pueblo, Rio Grande	C	V,S,T,W,A
12	NE Perimeter	P	V,S
16	Four Hills	P	V,S,T
18	North Perimeter Road	P	T
19	Seismic Center Gate	P	V,S,T
20	Technical Area IV, SW	S	V,S,T
21	Bernalillo Fire Station 10, Tijeras	C	T
22	Los Lunas Fire Station	C	T
23	Rio Rancho Fire Station, 19th Avenue	C	T
24	Corrales Fire Station	C	T
25	Placitas Fire Station	C	V,S,T
26	ABQ Fire Station 9, Menaul NE	C	T
27	ABQ Fire Station 11, Southern SE	C	T
28	ABQ Fire Station 2, High SE	C	T
29	ABQ Fire Station 7, 47th NW	C	T

[a]Location types: S = Onsite SNL/NM; P = Perimeter of SNL/NM; and C = Community.

[b]Sample types: V = Vegetation, S = Soil, W = Surface Water, A = Sediment, and T = TLD (thermoluminescent dosimeters).

[c]Replicate sampling sites:
- S and V: 2NE, 7, 11, and 53.
- W: 11.
- A: 11 and 73.

Table 4-1. Sandia National Laboratories/New Mexico Terrestrial Surveillance Locations and Sample Types (Continued)

Location Number	Sampling Location	Location Type[a]	Sample Type[b]
30	ABQ[c] Fire Station 6, Griegos NW	C	T
31	Technical Area II Guard Gate	S	T
32S	Technical Area II, Building 935 (South Bay Door)	S	S
32E	Technical Area II, Building 935 (East Personnel Door)	S	S
33	Coyote Spring	S	V,S,W
34	Lurance Canyon	S	V,S
35	Chemical Waste Disposal Site	S	V,S
39	NW DOE Complex	P	T
40	Technical Area I NE by Building 852	P	T
41	Technical Area V, NE Fence	S	V,S,T
42	Technical Area V, E Fence	S	V,S,T
43	Technical Area V, SE Fence	S	V,S,T
45	Technical Area III, RMWMF Site, NW Corner	S	V,S,T
46	Technical Area II, South Corner	S	S,T
47	Tijeras Canyon East of TA-IV	S	T
48	Tijeras Canyon Northeast of TA-IV	S	T
49	Near the ECF Site	S	V,S
51	Ditch, Technical Area V, N	S	V,S
52	Technical Area III, NE/6563	S	V,S
53[c]	Track, Technical Area III, S	S	V,S
54	Technical Area III, 6630	S	V,S
55	Technical Area III, 9939	S	V,S
56	Technical Area V, W/6488	S	V,S
57	Technical Area IV, NE/970	S	V,S
58	N Base Housing	P	V,S
59	Zia Park/SE	P	V,S

[a]Location types: S = Onsite SNL/NM; P = Perimeter of SNL/NM; and C = Community.
[b]Sample types: V = Vegetation, S = Soil, W = Surface Water, A = Sediment, and T = TLD (thermoluminescent dosimeters).
[c]Replicate sampling sites { S and V: 2NE, 7, 11, and 53. W: 11. A: 11 and 73.

Table 4-1. Sandia National Laboratories/New Mexico Terrestrial Surveillance Locations and Sample Types (Concluded)

Location Number	Sampling Location	Location Type[a]	Sample Type[b]
60	Tijeras Arroyo, Old City Prison Farm	P	V,S,A
61	Airport (west end)	P	V,S
62	East Resident	C	V,S
63	No Sweat Boulevard	P	V,S
64	North Manzano	P	V,S
65	Sandia Research Park	P	V,S
66	KUSMC	S	V,S
68	Las Huertas	C	W,A
72	Coyote Arroyo	S	A
73[c]	Tijeras Arroyo	P	A

[a]Location types: S = Onsite SNL/NM; P = Perimeter of SNL/NM; and C = Community.
[b]Sample types: V = Vegetation, S = Soil, W = Surface Water, A = Sediment, and T = TLD (thermoluminescent dosimeters).
[c]Replicate sampling sites { S and V: 2NE, 7, 11, and 53. W: 11. A: 11 and 73.

surveillance locations 72 and 73 were established in 1992 as part of a short-term (2 year [yr]) arroyo sediment sampling network. Location 72 is in Coyote Arroyo near its confluence with Tijeras Arroyo. Location 73 is in Tijeras Arroyo where the arroyo enters the SNL/NM site. In addition, arroyo sediment was sampled at location 60. Location 60 is in the Tijeras Arroyo where it exits the SNL/NM site (see Figure 4-1 and Table 4-1). Although no contamination has been identified at these sites, it has been decided to include locations 72 and 73 as permanent, fixed, sampling locations with arroyo sediment included as a permanently sampled media at these locations and at location 60.

In the past, limited groundwater sampling and analysis has been performed by the Environmental Surveillance Program. Groundwater surveillance locations included ten Kirtland Air Force Base (KAFB) production wells. Groundwater sampling consisted of the sampling of those base production wells which were in operation on the days set aside for the collection of groundwater samples. Within the last year the Environmental Surveillance Program has transferred this function to the Non-Environmental Restoration Groundwater Program where it was consolidated with the site-wide groundwater monitoring efforts (Chapter 7.0).

4.2 SAMPLE COLLECTION AND ANALYSIS

Environmental samples were gathered in accordance with the activity-specific Environment, Safety, and Health (ES&H) Standard Operating Procedure (SOP) entitled "Environmental Sampling Procedure" (SNL 1992c). Native vegetation (grasses unless otherwise noted), soil, sediment, and surface water samples were collected biannually: once early in the growing season (May) and once toward the end of the growing season (August). TLDs were exchanged every calendar quarter. The sampling protocol for soil, sediment, and vegetation was a composite program. Surface water samples were collected by grab sampling. Total surface water (unfiltered), filtered water, and suspended solids (>0.45 μm) were analyzed. Appendix C describes sample collection and analytical procedures. Appendix D lists minimum detection limits for each type of radionuclide analysis.

The radionuclide analysis included laboratory tests on soil, sediment, vegetation, and surface water. Soil, sediment, and vegetation samples were analyzed for tritium (H-3) and by gamma spectroscopy analysis; soil and sediment were also analyzed for total uranium (U_{tot}). Gross alpha, beta, and gamma spectroscopy analyses and U and H-3 analyses are performed on surface water samplings.

The monitoring program was enhanced in 1993 to include the analysis of metals in soil and sediment. Soil and sediment samples were analyzed for 18 elements. The inductively coupled plasma (ICP) method was used to determine metals in samples.

A total of 247 samples were analyzed for H-3, 264 by gamma spectroscopy, and 160 for total U_{tot} in 1993. In addition, 38 water samples or fractions of samples were screened for gross alpha and gross beta. Table C-1 of Appendix C summarizes sampling frequencies and types of analysis for the radioactive environmental monitoring program.

4.3 TERRESTRIAL RADIOLOGICAL SURVEILLANCE RESULTS

Appendix F presents the terrestrial monitoring data for all individual sample stations and sampled media. Calculated summary data tables are discussed in the following paragraphs of this section. Less-than-detection values were set equal to the detection value for statistical calculations. In cases of replicate sampling, only the first sample collected (sample A) was used in summary calculations to avoid skewing summary data toward replicate sample data. In the case of sediment samples, data from individual locations were not pooled to determine descriptive statistics for a given sample location type (i.e., onsite, perimeter, and community); instead, individual samples were compared to one another. Where sediment replicate samples were collected, descriptive statistics were considered the best estimate of the true radionuclide concentration at the sampled station and were used for comparison with other locations.

4.3.1 Vegetation

Tables F-1 and F-2 of Appendix F list concentrations of H-3, potassium-40 (K-40), and percent water in vegetation (grass species unless otherwise noted) for 24 SNL/NM onsite, 12 perimeter, and 6 community sampling locations and any corresponding replicate samples. These locations were sampled twice in 1993. Tables 4-2 and 4-3 summarize the mean ($\overline{x}$), standard deviation (S), and range of values for the three types of sampling locations and two sampling periods. The H-3 concentrations are reported as picocuries per milliliter (pCi/mL) of extracted water.

Tritium concentrations in vegetation collected in May and August from perimeter and community locations appear to be consistent with each other and with previous years' results. The majority of the individually reported H-3 concentrations in vegetation collected from onsite locations are within the range of values for the perimeter and community locations. Where vegetation H-3 concentrations are elevated, soil sampled at the same location is also elevated. These sample locations are near sites known to be contaminated with H-3. These sites are currently undergoing characterization for eventual environmental restoration and are located in areas of restricted access. Monitoring will continue at these locations to identify and measure contaminant migration.

4.3.2 Soil

Tables F-3 and F-4 of Appendix F list concentrations of U_{tot}, H-3, cesium-137 (Cs-137), K-40, and percent water in soil samples for the 28 SNL/NM onsite, 12 perimeter, and 6 community locations and any corresponding replicate samples. These locations were sampled twice in 1993 unless otherwise noted. Table 4-4 summarizes the mean ($\overline{x}$), standard deviation (S), and range of values for the three types of sampling locations and two sampling periods.

Tritium concentrations in soil collected in May and August from perimeter and community locations appear to be consistent with each other and with previous years' results. The majority of the individually reported H-3 concentrations in soil collected from onsite locations fall within the range of values for the perimeter and community locations. Where onsite soil concentrations are elevated with H-3, the sample location is near sites known to be contaminated with H-3. These sites are currently undergoing characterization for eventual environmental restoration and are located in areas of restricted access. Monitoring will continue at these locations to identify and measure contaminant migration.

The Cs-137 concentrations for all location types and sampling periods were consistent with previous years' results and consistent with each other. Concentrations appear to reflect fallout levels of Cs-137 and normal sample variation.

Total uranium concentrations in soil collected in May and August from perimeter and community locations appear to be consistent with each other and with previous years' results. The majority of the individually reported U concentrations in soil collected from onsite locations fall within the range of values for the perimeter and community locations. Where onsite soil

Table 4-2. Mean Concentrations of Tritium in Vegetation Sampled in May 1993

Nuclide	Location	Sample Size	Concentration (pCi/mL) Mean ($\bar{x}$)	Standard Deviation (S)	Range
H-3	SNL	24	0.37	1.8	-0.15 to 8.7
	Perimeter	12	0.00	0.07	-0.12 to 0.10
	Community	6	-0.04	0.05	-0.08 to 0.05
	Total	42			

Table 4-3. Mean Concentrations of Tritium in Vegetation Sampled in August 1993

Nuclide	Location	Sample Size	Concentration (pCi/mL) Mean ($\bar{x}$)	Standard Deviation (s)	Range
H-3	SNL	24	1.4	3.6	-0.18 to 14
	Perimeter	12	-0.05	0.10	-0.19 to 0.13
	Community	6	-0.08	0.05	-0.15 to -0.02
	Total	42			

Table 4-4. Mean Concentrations of Uranium, Cesium-137, and Tritium in Soil Samples Collected in May and August 1993

			Concentration		
Nuclide	Type	Sample Size	Mean ($\bar{x}$)	Standard Deviation (s)	Range
May					
U	SNL	28	1.1	0.7	0.3 to 4.2
(μg/g)	Perimeter	12	0.9	0.2	0.5 to 1.3
	Community	6	1.3	0.6	0.5 to 2.0
Cs-137	SNL	28	0.30	0.35	0.00 to 1.7
(pCi/g)	Perimeter	12	0.47	0.49	0.00 to 1.6
	Community	6	0.47	0.42	0.06 to 1.1
H-3	SNL	28	22	81	-0.14 to 400
(pCi/mL)	Perimeter	12	0.11	0.12	-0.07 to 0.36
	Community	6	0.10	0.15	-0.09 to 0.31
August					
U	SNL	28	1.3	0.5	0.5 to 2.4
(μg/g)	Perimeter	12	1.4	0.5	0.5 to 2.0
	Community	6	2.0	0.7	1.4 to 3.0
Cs-137	SNL	28	0.19	0.16	0.00 to 0.51
(pCi/g)	Perimeter	12	0.27	0.27	0.00 to 0:77
	Community	6	0.16	0.16	0.00 to 0.44
H-3	SNL	28	2.8	7.0	-0.17 to 30
(pCi/mL)	Perimeter	12	-0.01	0.07	-0.11 to 0.15
	Community	6	0.00	0.06	-0.08 to 0.08

concentrations of U are believed to be elevated, the sample location is near a site of known or potential contamination. These sites are currently undergoing characterization of eventual environmental restoration and are located in areas of restricted access. Monitoring will continue at these locations to identify and measure contaminant migration.

4.3.3 Surface Water

Tables F-5 and F-6 of Appendix F list concentrations of gross alpha, gross beta, gross gamma, U_{tot}, and H-3 in surface water for the one SNL/NM onsite and three community locations and any corresponding replicate samples. These locations were sampled twice in 1993. Tables 4-5 and 4-6 summarize mean concentrations of gross alpha, gross beta, gross gamma, U_{tot}, and H-3 for total (unfiltered) water, filtered water, and associated suspended solids in surface water samples.

Station 8 is located on the Rio Grande where the Corrales Bridge goes over the river and is upgradient of both SNL/NM and Albuquerque. Station 11 is located on the Rio Grande at the Isleta Pueblo and is downgradient of both SNL/NM and Albuquerque. Data from samples collected in May 1993 show the upgradient and downgradient locations to be indistinguishable from each other. Suspended solids appear to be elevated in gross alpha and gross beta concentrations compared to data gathered in previous years, but within previously observed range of values.

Data from samples collected in August 1993 show some variation between sample fractions and sampling locations. While some variation does exist, the majority of the data appear to be consistent with previous years results and consistent between the upgradient and downgradient locations. Where variation between sampling locations appears to exist, the upgradient location appears to be elevated in total water gross alpha activity and in total water and filtered water uranium. Some of the variation in sample data may represent normal sample variation or be related to the activities in and around the Rio Grande.

Results from the onsite surface water sample taken from Station 33 (Coyote Spring) are consistent with results from previous years. Results from offsite surface water reference location Station 68 (Las Huertas stream) are also consistent with results from previous years. In general, onsite surface water appears to be higher than the offsite surface water in gross alpha, gross beta, and U total. Other results appear to be comparable to one another.

Differences in activity concentrations in surface water may be due, in part, to random variation in sampling, normal sample variation, and/or environmental factors. Environmental factors may include sediment loading, flow rate, and volume.

Table 4-5. Mean Concentrations of Gross Alpha, Gross Beta, Gamma Spectroscopy[a], Uranium, and Tritium in Surface Water for May 1993

Analysis (units)	Station	Location[b]	Total Water[c] ($\bar{x} \pm s$)	Filtered Water[c] ($\bar{x} \pm s$)	Suspended Solids[c] ($\bar{x} \pm s$)
Gross Alpha (pCi/L)	8	C	6 ± 2	2 ± 1	16 ± 10
	11	C	3 ± 2	1 ± 1	15 ± 8
	33	S	2 ± 13	8 ± 7	-1 ± 7
	68	C	1 ± 2	1 ± 1	9 ± 7
Gross Beta (pCi/L)	8	C	7 ± 2	5 ± 1	21 ± 10
	11	C	6 ± 2	4 ± 1	37 ± 10
	33	S	45 ± 15	35 ± 8	19 ± 10
	68	C	2 ± 2	3 ± 1	6 ± 7
U_{tot} (mg/L)	8	C	<0.005	<0.005	--
	11	C	<0.005	<0.005	--
	33	S	<0.005	0.006	--
	68	C	<0.005	<0.005	--
H-3 (pCi/mL)	8	C	--	-0.15 ± 0.41	--
	11	C	--	-0.12 ± 0.17	--
	33	S	--	-0.06 ± 0.17	--
	68	C	--	-0.14 ± 0.17	--

[a]No values detected above instrument background.
[b]C = Community; S = SNL/NM.
[c]Variability of the radioactive disintegration process (counting error) at the 95-percent confidence level, 1.96 sigma.

Table 4-6. Mean Concentrations of Gross Alpha, Gross Beta, Gamma Spectroscopy[a], Uranium, and Tritium in Surface Water for August 1993

Analysis (units)	Station	Location[b]	Total Water[c] ($\bar{x} \pm s$)	Filtered Water[c] ($\bar{x} \pm s$)	Suspended Solids[c] ($\bar{x} \pm s$)
Gross Alpha (pCi/L)	8	C	14 ± 5	3 ± 2	3. ± 1
	11	C	9 ± 3	3 ± 1	0.3 ± 0.3
	33	S	8 ± 8	20 ± 15	0.3 ± 0.3
	68	C	2 ± 2	2 ± 2	0.3 ± 0.3
Gross Beta (pCi/L)	8	C	15 ± 5	4 ± 2	4 ± 1
	11	C	20 ± 3	6 ± 2	-0.3 ± 0.7
	33	S	23 ± 10	43 ± 19	0.0 ± 0.7
	68	C	2 ± 3	2 ± 2	-0.3 ± 0.7
U_{tot} (mg/L)	8	C	4.0	2.4	<0.005
	11	C	<0.005	<0.005	<0.005
	33	S	0.006	0.006	<0.005
	68	C	<0.005	<0.005	<0.005
H-3 (pCi/mL)	8	C	0.00 ± 0.15	-0.01 ± 0.15	--
	11	C	-0.07 ± 0.15	-0.03 ± 0.15	--
	33	S	0.16 ± 0.16	-0.09 ± 0.15	--
	68	C	-0.02 ± 0.14	0.04 ± 0.14	--

[a]No values detected above instrument background.
[b]C = Community; S = SNL/NM.
[c]Variability of the radioactive disintegration process (counting error) at the 95-percent confidence level, 1.96 sigma.

4.3.4 Sediment

Concentrations of U_{tot}, H-3, and Cs-137 in sediments are reported in Tables F-7 and F-8 of Appendix F and summarized in Table 4-7 for the two Rio Grande sediment stations, one mountain stream sediment station, and three arroyo sediment stations. All stations were sampled twice in 1993.

The U_{tot}, H-3, and Cs-137 concentrations for upgradient SNL/NM perimeter (Station 73), onsite (Station 72), and downgradient SNL/NM perimeter (Station 60) arroyo sediment-monitoring stations are believed to be consistent with each other. Differences in radionuclide concentrations are believed to represent normal sample variation and do not indicate any contaminant loading of the arroyo system due to activities at SNL/NM.

The U_{tot}, H-3, and Cs-137 concentrations in upgradient (Station 8) and downgradient (Station 11) (relative to SNL/NM and Albuquerque) Rio Grande sediment-monitoring stations are believed to be consistent with each other and also consistent with sediment collected from an upgradient mountain stream (Station 68). Differences in radionuclide concentrations are believed to represent normal sample variation.

4.3.5 Environmental Thermoluminescent Dosimeters

Table 4-8 summarizes the annual TLD dose equivalent estimates for the onsite, perimeter, and community locations (listed in Table 4-1). (Table F-9 of Appendix F provides data for individual stations.) These estimates include natural background and facility contributions (if any). The annual external dose equivalent mean for 12 community and 7 perimeter locations was 95.4 millirems per year (mrem/yr) and 94.8 mrem/yr, respectively. The mean of the 15 locations adjacent to onsite facilities was 97.9 mrem/yr. No significant difference in annual dose equivalent estimates (alpha = 0.05) existed between the three location types. Results were also consistent with previous years' results.

4.4 TERRESTRIAL NONRADIOLOGICAL SURVEILLANCE RESULTS

The environmental monitoring program was enhanced to include sampling for total metals. The samples are categorized by site: samples taken on SNL (onsite), samples taken near the SNL perimeter and samples taken in the surrounding community (offsite). Community samples were collected in areas unrelated to SNL activities. Both soil and arroyo sediment samples were analyzed for the following metals: aluminum, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, strontium, titanium, vanadium and zinc. Comparable sets of samples were analyzed from May and August, 1993. The analytical data is presented in Appendix F. Comparison of onsite, perimeter, and offsite samples will help to determine if SNL activities have contributed to the deposition of metals in the past. If SNL activities do contribute to metal deposition, then comparison of samples from the same sites over time will provide information to help monitor SNLs contribution to the increase in metals.

Table 4-7. Concentrations of Uranium, Tritium, and Cesium-137 in Sediment for May and August 1993

Sediment Type	Location Type	Sample Size	Concentrations U (μg/g)	H-3 (pCi/mL)	Cs-137 (pCi/g)
May					
Arroyo	Upgradient	1[a]	0.9	0.06 ± 0.32	0.00 ± 0.04
	SNL	1[a]	1.1	-0.06 ± 0.25	0.00 ± 0.03
	Downgradient	1[a]	1.3	0.12 ± 0.42	0.00 ± 0.04
River/ Stream	Stream	1[a]	1.6	0.07 ± 0.16	0.11 ± 0.05
	Upgradient	1[a]	1.1	-0.06 ± 0.17	0.07 ± 0.05
	Downgradient	3[b]	0.9 ± 0.2	-0.07 ± 0.04	0.01 ± 0.02
August					
Arroyo	Upgradient	3[b]	1.4 ± 0.2	-0.03 ± 0.06	0.00 ± 0.00
	SNL	1[a]	1.4	-0.01 ± 0.27	0.10 ± 0.05
	Downgradient	1[a]	1.7	-0.21 ± 0.41	0.00 ± 0.04
River/ Stream	Stream	1[a]	2.1	-0.01 ± 0.14	0.08 ± 0.03
	Upgradient	1[a]	1.3	-0.03 ± 0.15	0.04 ± 0.05
	Downgradient	3[b]	1.0 ± 0.1	-0.05 ± 0.06	0.01 ± 0.02

[a]Individual value ±95-percent counting error.
[b]Mean ± standard deviation.

Table 4-8. Summary of Thermoluminescent Dosimeter Measurements for 1993[a]

Location	Number of Locations	Annual External Dose Equivalent (mrem/yr)		
		$\bar{x}$	$s_{\bar{x}}$	Range
SNL (S)	15	97.9	5.6	91.5 to 108.7
Perimeter (P)	7	94.8	10.6	82.9 to 114.9
Community (C)	12	95.4	8.5	84.4 to 113.5

[a]Table F-11 of Appendix F lists detailed results.

Soil Samples: Tables F-10, F-11, F-12, and F-13 in Appendix F list the concentrations of metals in soil samples from SNL TAs I, II, and IV, SNL TAs III and V, perimeter, and community sites, respectively, taken in May 1993. Tables F-14, F-15, F-16, and F-17 list the data for the corresponding samples taken in August 1993. The results are summarized in Table 4-9. The onsite data for contiguous TAs I, II, and IV (Group 1) are analyzed separately from the data for contiguous TAs III and V (Group 2).

Statistically, the only concentration means which could be shown to be significantly higher for onsite samples than for offsite samples at the 95% confidence level were for titanium in Group 1 in both May and August. The samples most responsible for the higher mean titanium concentrations were from sampling sites 32E, 32S, and 49 which are in close relative proximity. A salient feature of the data summary in Table 4-9 is the 1,930 ppm mean concentration of lead in the May Group 1 samples. The corresponding mean lead concentration in the August Group 1 samples is also high, at 117 ppm. These high mean concentrations of lead do not show up as statistically significant because the standard deviations for both the onsite and offsite sample populations are relatively large. The high mean lead concentration in the May Group 1 samples is primarily the result of 11,000 ppm in the sample from site 20, and 560 ppm in the sample from site 32E. The lead concentrations in samples taken from these two sites in August were also high, at 260 and 400 ppm respectively. The Site 20 sampling location is in the vicinity of the KAFB skeet shooting range, in the direction of shotgun firing. Of the offsite soil samples, the Site 8 samples had a lead concentration of 100 ppm in May and 80 ppm in August. These were well above the corresponding mean concentrations 25.8 and 18.7 ppm. Site 8 is at the Corrales Bridge about ten kilometers north of the center of Albuquerque at I-25. The concentration means for a number of metals were lower in the onsite samples than in the offsite samples. None of the concentration means were significantly higher for perimeter samples than for offsite samples.

Table 4-9. Summary of Soil Samples

		Metal Concentration Mean (ppm)			
		Onsite Group 1[a]	Onsite Group 2[b]	Perimeter	Offsite
Aluminum	May	7,883	8,680	19,502	11,700
	Aug	8,200	9,510	9,982	11,100
Barium	May	108	77.6	116	165
	Aug	108	92.0	134	160
Beryllium	May	0.5	0.5	0.5	0.600
	Aug	0.5	0.5	1.00	0.589
Cadmium	May	0.733	0.72	0.5	0.5
	Aug	0.750	0.5	1.00	0.522
Calcium	May	31,500	13,580	23,400	29,800
	Aug	38,800	17,400	30,300	29,900
Chromium	May	18.0	17.7	19.2	21.3
	Aug	16.8	19.4	19.9	27.2
Cobalt	May	4.40	3.04	4.80	5.10
	Aug	4.48	3.33	5.40	4.60
Copper	May	16.0	6.72	9.60	11.2
	Aug	11.5	7.21	9.50	9.70
Iron	May	11,200	8,780	12,200	13,400
	Aug	10,400	9,330	12,200	12,200
Lead	May	1,930	8.75	11.2	25.8
	Aug	117	8.50	10.2	18.7
Magnesium	May	3,350	2,445	3,950	3,800
	Aug	3,870	2,640	4,040	3,440
Manganese	May	217	150	261	347
	Aug	215	152	270	311
Nickel	May	7.20	7.05	8.00	10.0
	Aug	7.67	6.70	7.90	9.78
Potassium	May	2,110	2,140	2,630	2,880
	Aug	2,030	2,160	2,350	2,330

[a]Sandia National Laboratories Technical Areas I, II, and IV.
[b]Sandia National Laboratories Technical Areas III and V.
* = Statistically above offsite at the 95% confidence level.

Table 4-9. Summary of Soil Samples (Concluded)

		Metal Concentration Mean (ppm)			
		Onsite Group 1[a]	Onsite Group 2[b]	Perimeter	Offsite
Strontium	May	54.0	29.1	43.1	62.3
	Aug	63.8	40.4	57.1	65.1
Titanium	May	553*	201	352	288
	Aug	508*	262	412	286
Vanadium	May	24.0	15.7	23.1	26.9
	Aug	22.2	19.3	24.3	24.8
Zinc	May	41.0	35.2	40.9	51.9
	Aug	33.8	33.1	45.9	39.8

[a]Sandia National Laboratories Technical Areas I, II, and IV.
[b]Sandia National Laboratories Technical Areas III and V.
* = Statistically above offsite at the 95% confidence level.

Sediment Samples: Tables F-18 and F-19 of Appendix F list the concentrations of metals in sediment from perimeter samples and offsite samples, respectively, taken in May 1993. Tables F-20 and F-21 list the data for the corresponding samples taken in August 1993. The results are summarized in Table 4-10. The concentration means for cobalt, iron, and vanadium in the onsite August samples are higher than those for the offsite samples. The differences in the means are small but statistically significant because the standard deviations for these samples are relatively small. The highest cobalt concentration, 5 ppm, was measured in the sample from Site 60, but this was only slightly above the mean concentration 3.02 ppm for the offsite samples. Since the corresponding differences in concentration means for the May samples are not statistically significant, the August results might be the result of normal sample variability and low concentrations of cobalt in the samples. The same considerations apply to vanadium. The highest concentration of vanadium, 26 ppm was also found in the sample from Site 60, but this was only slightly above the mean of 16.6 for the offsite samples. Future monitoring will help to determine whether the concentrations of cobalt and vanadium are actually higher onsite than offsite and whether they are increasing. It is of interest that the highest concentration of iron was also found in the sample from Site 60. It is possible that the sediment from Site 60 is naturally high in metals. The concentration of iron, of little significance in itself, might act as an indicator of metal deposition by SNL/NM activities.

Table 4-10. Summary of Sediment Samples

		Metal Concentration Mean (ppm)	
		Onsite	Offsite
Aluminum	May	5,630	5,480
	Aug	6,360	5,340
Barium	May	67.7	160
	Aug	133	130
Beryllium	May	0.5	0.5
	Aug	0.5	0.5
Cadmium	May	0.5	0.5
	Aug	0.5	0.5
Calcium	May	40,600	42,400
	Aug	42,000	28,000
Chromium	May	19.3	22.2
	Aug	28.0	35.2
Cobalt	May	3.80	2.90
	Aug	4.28*	3.02
Copper	May	6.37	6.34
	Aug	7.52	5.08
Iron	May	10,100	8,820
	Aug	10,200*	7,620
Lead	May	3.83	5.20
	Aug	7.80	6.10
Magnesium	May	2,860	2,450
	Aug	3,000	2,020
Manganese	May	200	190
	Aug	218	170
Nickel	May	6.70	5.40
	Aug	6.40	6.80
Potassium	May	1,370	1,290
	Aug	1,440	1,250

* = Statistically above offsite at the 95% confidence level

Table 4-10. Summary of Sediment Samples (Concluded)

		Metal Concentration Mean (ppm)	
		Onsite	Offsite
Strontium	May	87.7	73.6
	Aug	73.8	54.4
Titanium	May	546	252
	Aug	716	734
Vanadium	May	21.0	18.4
	Aug	21.2*	16.6
Zinc	May	25.0	62.8
	Aug	25.0	19.6

* = Statistically above offsite at the 95% confidence level

5.0 AIR QUALITY SURVEILLANCE AND EMISSIONS MONITORING

5.1 METEOROLOGICAL MONITORING PROGRAM

A meteorological monitoring program has been implemented at Sandia National Laboratories/New Mexico (SNL/NM). The monitoring program commenced operations on January 3, 1994. This program is integral to compliance with 40 Code of Federal Regulations (CFR) 61, Department of Energy (DOE) Orders 5400.1, 5400.5, and 5500.3, and DOE guidelines outlined in DOE/EH-0173T (DOE 1988a, 1990, 1991b, 1991c). In addition to compliance with the above, the program will also generate data consistent with program guidelines for regulatory modeling applications.

The main objective of the program is to provide data representative of the meteorology at SNL/NM. The program includes a nine-tower meteorological monitoring network which consists of six 10-meter (m) (33-foot [ft]) towers, two 60-m (197-ft) towers, and one 50-m (164-ft) tower. All towers are instrumented at the 3- and 10-m (10- and 33-ft) levels. Instrumentation has also been installed at the top of the taller towers. Tower location and names are portrayed in Figure 5-1.

The meteorological variables measured at all tower levels include wind speed and direction, the standard deviation of the horizontal wind speed (sigma theta), and temperature. Relative humidity is measured at all towers at the 3-m level. There are also two atmospheric pressure sensors and three rain gauges in the meteorological network. Barometric pressure is measured at towers ST6 and A15, while rain gauges are located at SC1, A36, and A15 (Figure 5-1).

Meteorological data collected within the network will be used to: characterize transport and diffusion of actual or potential pollutants, provide emergency response support, support environmental surveillance, perform regulatory air dispersion modeling for permitting applications, perform atmospheric flow modeling over complex terrain, and support laboratory research and engineering design.

The 1994 Site Environmental Report for SNL/NM will include summarized meteorological data, wind roses, and atmospheric stability information for each of the tower sites. In the future, a climatological data base will be developed for comparison to annual data. For 1993, the only available meteorological information is the summarized Albuquerque International Airport data recorded by National Weather Service personnel (Table 1-1).

5.2 AIR QUALITY ENVIRONMENTAL SAMPLING AND SURVEILLANCE

5.2.1 Monitoring Locations

Air quality monitoring equipment has been installed at seven sites (Figures 5-1 and 5-2):

1. Criteria Pollutant Monitoring Station, in Technical Area I (TA-I) east of Building 833 and next to Tower A15

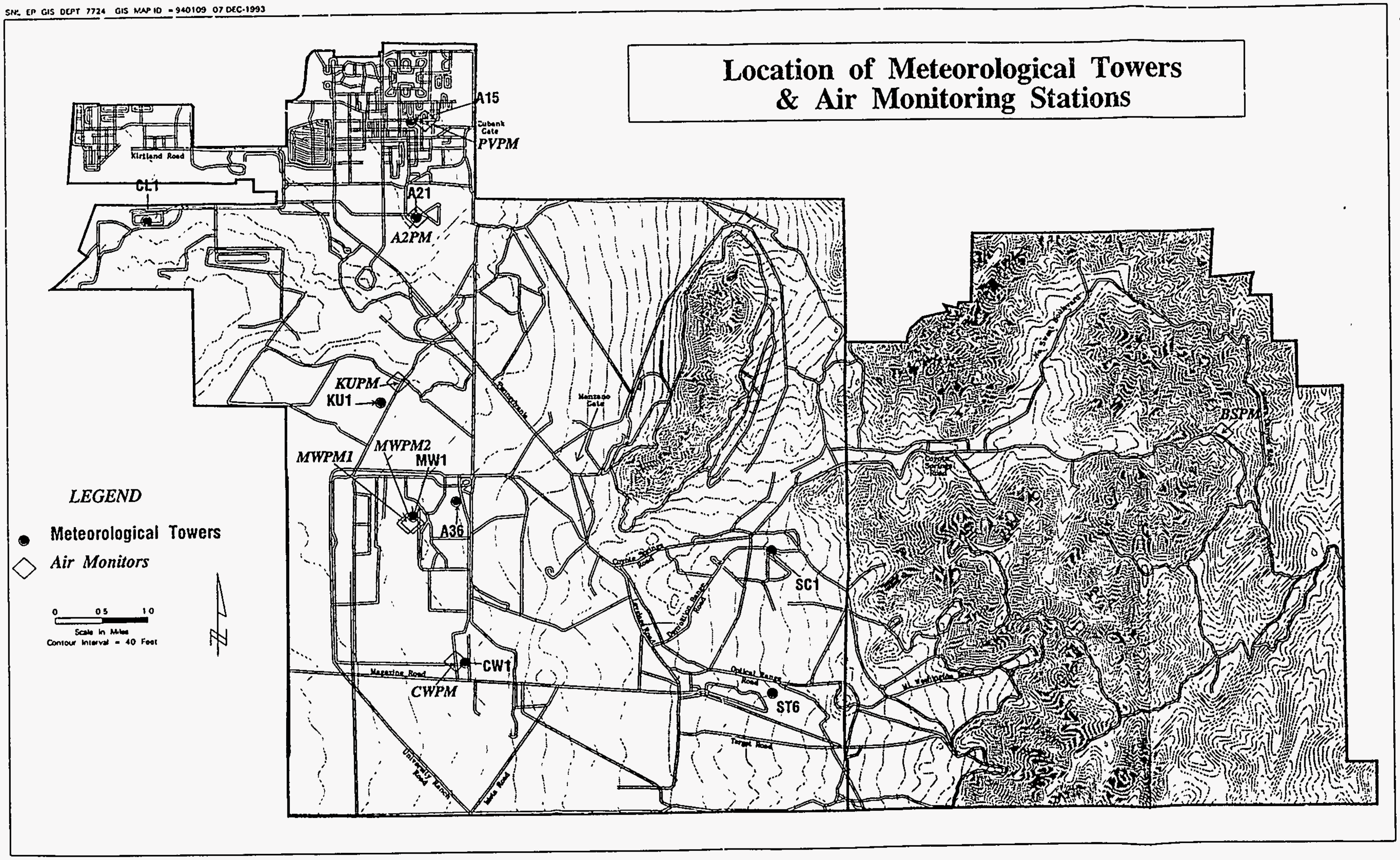

Figure 5-1. Locations of Meteorological Towers and Air Monitoring Stations

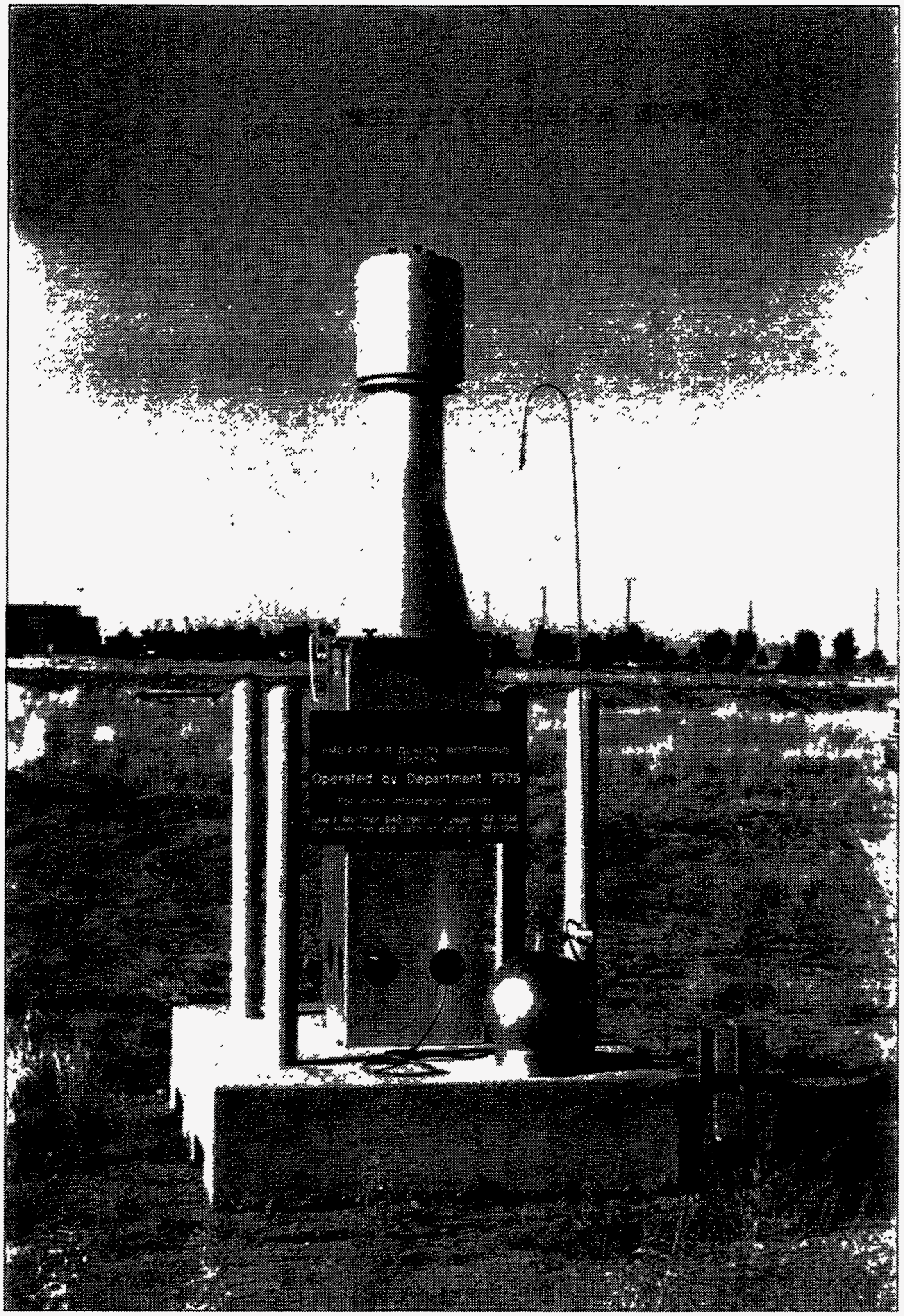

Figure 5-2. PM-10 Monitoring Station

2. PVPM, a respirable particulate matter (PM-10) and volatile organic compound (VOC) monitoring station, south of Building T-33 in TA-I

3. A2PM, a PM-10 and VOC monitoring station, southwest of Building 900, at the entrance to TA-II

4. KUPM, a PM-10 monitoring station, east of Kirtland Underground Munitions Storage Complex (KUMSC) administration building in TA-III

5. MWPM1 and MWPM2, PM-10 (two) and VOC monitoring stations, at the Mixed Waste Landfill (MWL) in TA-III

6. CWPM, a PM-10 and VOC monitoring station at the Chemical Waste Landfill (CWL) in TA-III

7. BSPM, a PM-10 and VOC monitoring station, east of Burn Site in TA-III

Air quality monitoring locations were selected based on factors such as predominant wind direction, traffic patterns, potential for community exposure, potential for windblown dust, or combinations of these and other factors. In addition to these permanent locations, mobile sampling capabilities are also available. A truck equipped with monitoring equipment can respond to accidental releases on an as-needed basis, or for short-term projects (Figure 5-3). A trailer with air sampling equipment is available for more long-term needs.

5.2.2 Sample Collection and Analysis

Since the air quality monitoring program has been operational only since January 3, 1994, no data for calendar year 1993 (CY 93) can be presented in this report. For CY 1994, it is anticipated that the following data will be presented:

- Criteria Pollutant Data: Sulfur dioxide (SO_2), oxides of nitrogen (NO_x), ozone (O_3), carbon monoxide (CO), and airborne lead (Pb)

- PM-10: Respirable airborne particulate matter 10 microns or smaller in diameter

- VOCs: Volatile organic compounds, primarily solvents and fuels

5.3 AIR EMISSIONS RADIOLOGICAL MONITORING

Few facilities within SNL/NM routinely generate radioactive effluents or emissions. These facilities include the accelerators in TA-IV (e.g., the HERMES-III Accelerator and the Particle Beam Fusion Accelerator-II [PBFA-II]), the reactor facilities in TA-V (e.g., the Annular Core Research Reactor [ACRR], Hot Cell Facility [HCF], and Sandia Pulsed Reactor [SPR]), the Neutron Generator Test Facility (NGTF) in TA-II, and small accelerators and tritium (H-3) laboratories in TA-I.

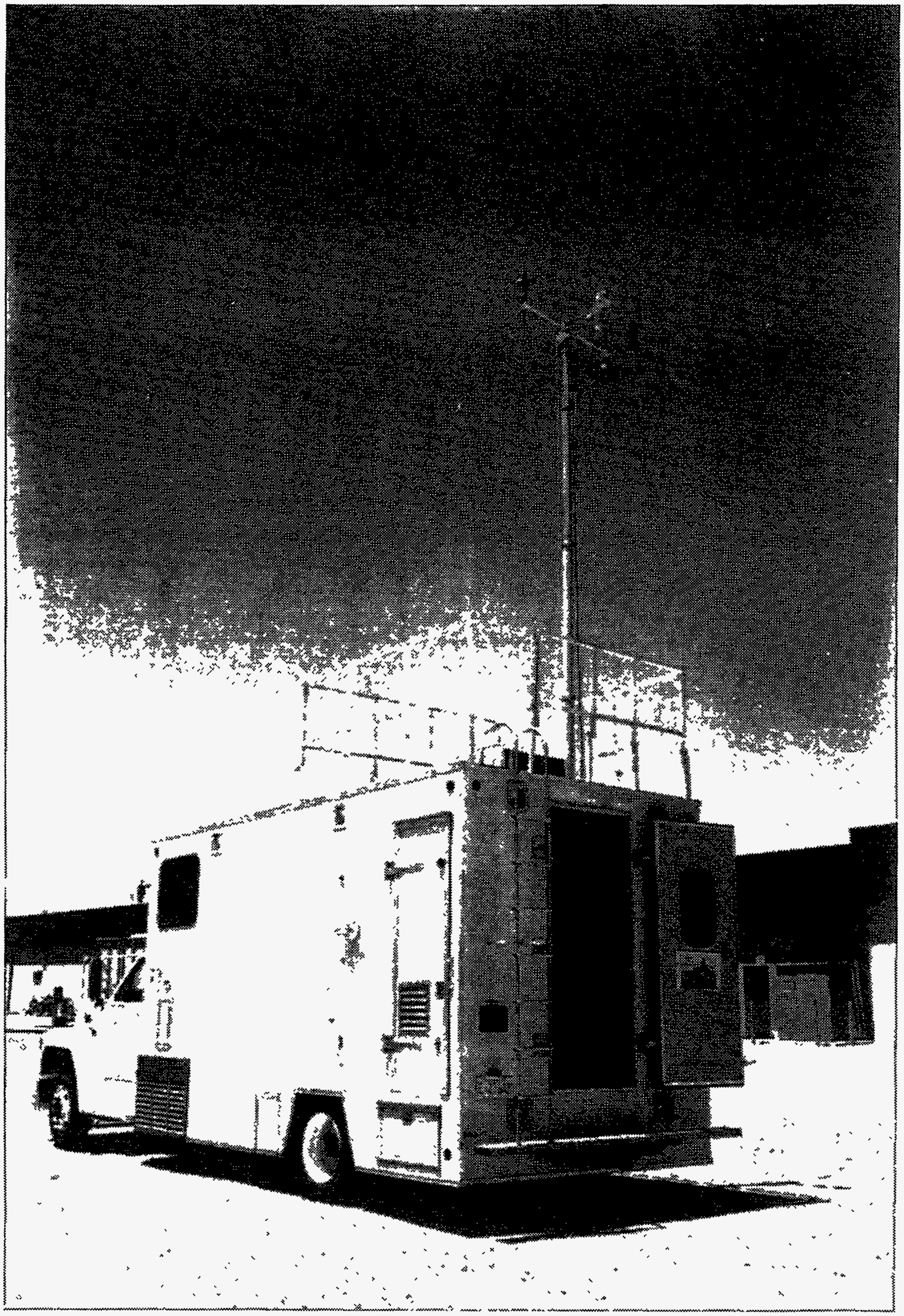

Figure 5-3. Sandia National Laboratories/New Mexico Air Sampling Truck

5.3.1 Radioactive Effluent Monitoring

Calculations indicate that small quantities of H-3, nitrogen-13 (N-13), oxygen-15 (O-15), argon-41 (Ar-41), krypton-85 (Kr-85), and xenon-135 (Xe-135) emissions were released to the atmosphere as a result of SNL/NM 1993 operations. SNL/NM's radionuclide air emissions were so small, they were not measurable with existing monitors at those facilities. Therefore, the radionuclide release data are calculated based on theoretical parameters such as reactor operating power (in megajoules [MJ]) and the conversion factor for the activation products (in microcuries per megajoule [μCi/MJ]) for the generation of noble gases (e.g., Ar-41) from the reactors in TA-V. Figure 5-4 summarizes these annual air emissions from 1978 to 1993.

5.3.2 Technical Area V Reactors

Noble gases and small quantities of H-3 are released from TA-V reactor stacks. High-efficiency particulates in air (HEPA) filters are used to separate particulates from the SPR, ACRR, and HCF exhaust air. Charcoal filters are used to collect noble gases and halogen from the SPR and ACRR stack exhaust air. Gamma scans are performed on the filters to check for specific activities. Particulate or gaseous grab samples are collected periodically or as necessary for specific radionuclide analyses. These sample results have been used as a confirmatory measure to verify the calculated values.

The SPR reactor filter banks consist of a prefilter, a HEPA filter, and a charcoal filter. A radiological air monitor (RAM) is located on the stack exhaust downstream of the filter banks. Grab samples are collected periodically using a low-volume particulate air filter which is analyzed using gamma spectroscopy techniques.

The ACRR reactor filter banks also consist of a prefilter, a HEPA filter, and a charcoal filter. The ACRR has two exhaust stacks. The main-room stack in the high bay is equipped with two continuous air monitors (CAMs), a particulate and a gaseous air monitor, as well as a RAM which is located on the HEPA filter housing. Gamma and beta scans are performed on the filters to determine the gross activity. Particulate or gaseous grab samples are also collected, if necessary, for more detailed analysis (e.g., Ar-41) with a multichannel analyzer (MCA). The second ACRR exhaust stack, the central cavity purge stack, has a particulate CAM as well as a RAM which is located directly on the HEPA filter housing. Grab samples for the MCA analysis can also be collected.

The TA-V HCF filter banks are equipped with a prefilter and HEPA filters. RAMs are located on the filter banks on both the cold exhaust and hot exhaust. Grab samples for particulates can also be collected, if needed for further analyses. These sample results have been used for evaluation of the exhaust filtration system.

5.4 AIR QUALITY RADIOLOGICAL MONITORING RESULTS

Isokinetic sampling equipment has been installed within the main stack of the HCF and the ACRR stack to collect air samples. Both monitoring systems were tested in 1992 for continuous effluent sampling and analyses of gross alpha and beta, noble gases, and iodine. Collection and evaluation of the monitoring

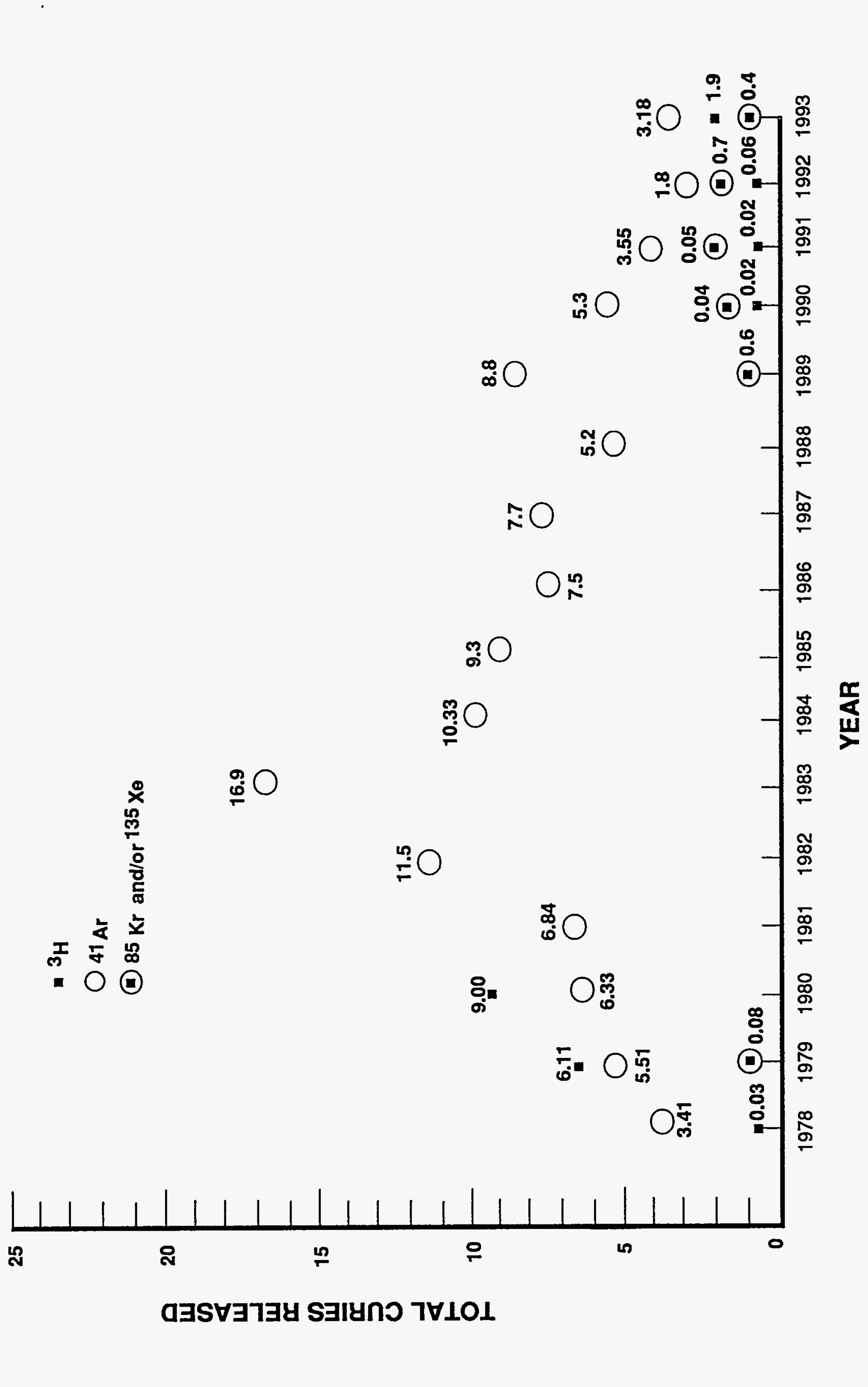

Figure 5-4. Summary of Atmospheric Releases of Argon-41, Tritium, Krypton-85, and Xenon-135 from Sandia National Laboratories/New Mexico Facilities Since 1978. Values reported as less than 1 Ci are not to scale.

system data was continued in 1993. Some modifications to the data analysis software were made to remedy the false-release indications. A process has been initiated to verify the source term and confirm the monitoring system data. It is expected, based on the present information and data, that these facilities will not require continuous stack effluent monitoring. SNL/NM, therefore, plans to use the existing stack monitors for periodic measurements. When the monitoring systems become operational, the results of the continuous air sampling and analyses will be reported.

5.5 ASSESSMENT OF POTENTIAL DOSE TO THE PUBLIC

The U.S. Environmental Protection Agency (EPA) promulgated National Emission Standards for Hazardous Air Pollutants (NESHAP) for radionuclides in December 1989. NESHAP (40 CFR 61, Subpart H) requires radiation dose to be calculated for the maximally exposed individual at a public access location including office, school, or residence. A comprehensive survey of all public access locations on Kirtland Air Force Base (KAFB) was conducted during 1990 to address this new requirement. In addition, a determination has been made that all non-SNL/NM personnel who work or live on KAFB are considered "members of the public" in accordance with the definition in DOE Order 5400.5 (DOE 1990). The 1993 dose assessment was performed for all KAFB receptors including residences, schools, and other locations where non-SNL/NM personnel abide or reside.

All dose calculations presented in this section were performed using the EPA CAP-88 computer code (EPA 1991). The cumulative dose at each receptor location was calculated to be well below the effective dose equivalent (EDE) limit of 10 millirem per year (mrem/yr) for the maximally exposed individual. As indicated in Section 5.3, few facilities within SNL/NM routinely generate radioactive emissions; most of these are located in TA-IV and TA-V. Most of the radioactive releases are air emissions. Therefore, air doses represent the main potential radiological dose impact to offsite locations from routine operations at SNL/NM.

5.5.1 Air Emission Sources

A total of eight facilities at SNL/NM reported releases of airborne quantities of radionuclides during 1993. Seven of the eight sources were point source releases which occurred as stack emissions. The eighth release source was a diffuse area source with a measurable annual release. Table 5-1 summarizes the radionuclides, quantity of release, and release type (point or diffuse) by facility for 1993. Figure 5-5 shows the locations of facilities reporting radionuclide air emissions in 1993. A total of 3.2 Curies (Ci) of Ar-41, 0.62 Ci of N-13, 0.012 Ci of O-15, and 1.9 Ci of H-3 were released into the atmosphere in 1993 as a result of SNL/NM operations. Smaller amounts of additional radionuclides were also released. Many of the radionuclides released are of such short half-lives (e.g., 10 min for N-13, 15 min for rubidium-88 [Rb-88]) that radioactive decay during transport reduces doses at most of the receptor locations considered.

During 1993, there were no new sources or modified sources at SNL/NM.

Table 5-1. Summary of Radionuclide Releases for 1993

Facility	Source Type	Radionuclide	Release (Ci/yr)
ACRR	Point	Ar-41	2.70
		Kr-83m	6.8×10^{-2}
		Kr-85	3.7×10^{-6}
		Kr-85m	0.14
		Kr-87	0.17
		Kr-88	0.36
		Rb-86	1.1×10^{-7}
		Rb-87	1.0×10^{-14}
		Rb-88	0.41
		Rb-89	1.1×10^{-3}
		Xe-131m	5.7×10^{-6}
		Xe-133	2.6×10^{-2}
		Xe-133m	1.3×10^{-3}
		Xe-135	0.40
		Xe-135m	0.18
		Xe-138	1.9×10^{-3}
SPR	Point	Ar-41	0.48
HERMES-III	Point	N-13	0.58
		O-15	5.0×10^{-3}
PBFA-II	Point	N-13	4.2×10^{-2}
		O-15	5.0×10^{-3}
Building 891, TOF Laboratory	Point	H-3	6.0×10^{-5}
Building 884, TANDEM Accelerator	Point	O-15	1.7×10^{-3}
		N-13	9.9×10^{-5}
		F-18	9.4×10^{-6}
		C-11	4.2×10^{-5}
Building 805, Radiation Laboratory	Point	H-3	1.0×10^{-5}
		C-14	2.0×10^{-12}
		N-13	1.0×10^{-8}
		Ar-41	1.0×10^{-9}
		Cm-244	7.0×10^{-11}
		Pb-210	4.0×10^{-13}
		U-238	4.0×10^{-12}
		Pu-239	6.0×10^{-12}
		Am-241	1.0×10^{-11}
MWL	Diffuse	H-3	1.90

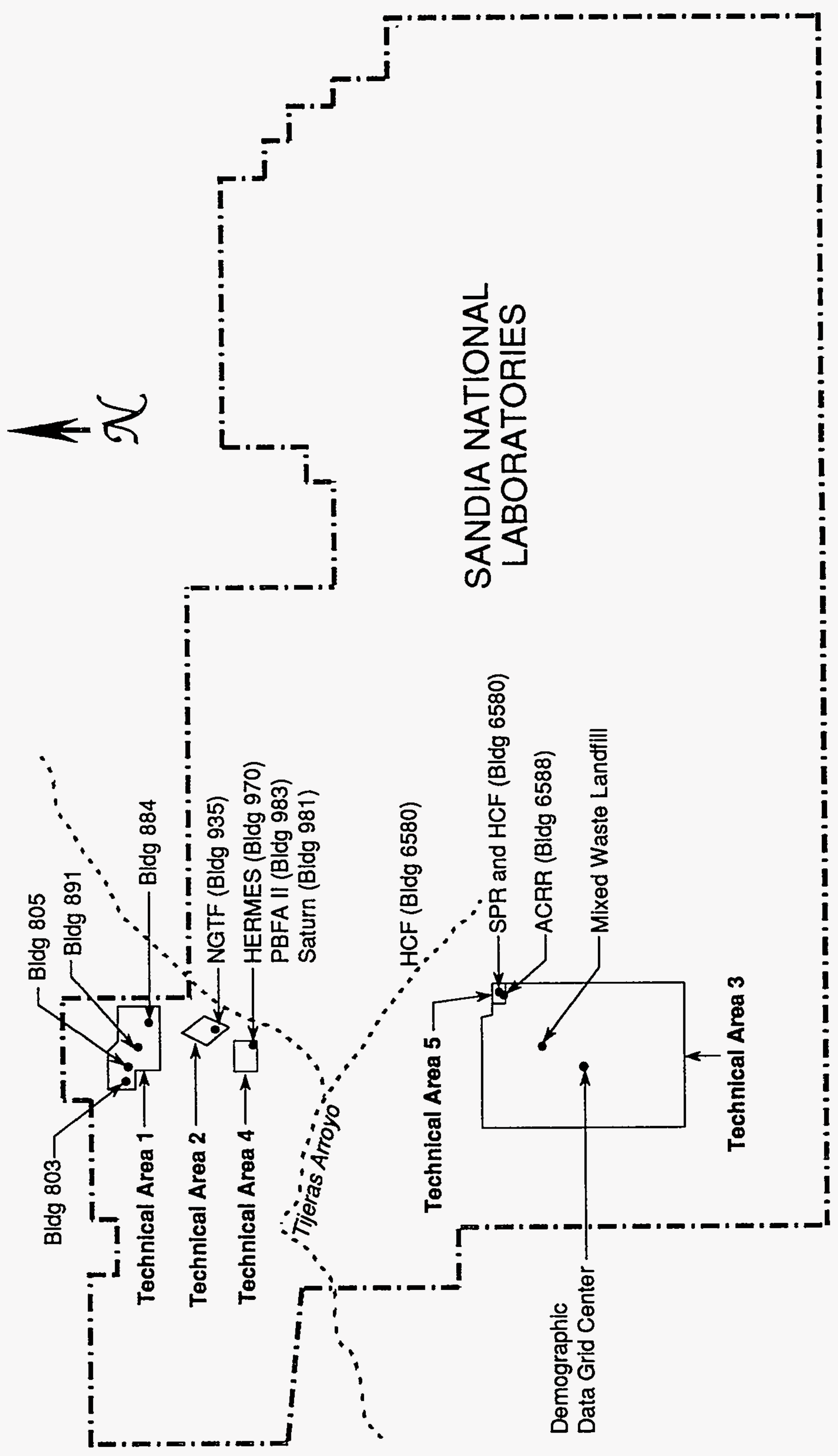

Figure 5-5. Facilities Locations at Sandia National Laboratories/New Mexico

5.5.2 Public Receptors

The population of the five KAFB housing areas is approximately 6600. The nonresidential areas include security offices, guard gates, credit unions, banks, restaurants, the KAFB landfill, golf course, U.S. Army Field Offices at KUMSC, Manzano-area offices, Inhalation Toxicology Research Institute (ITRI), Rinchem, Raytheon/Defense Nuclear Agency (DNA), and other U.S. Air Force and Army research facilities and engineering offices (LATA 1991). The effective dose equivalent (EDE) was calculated for all these public receptors on KAFB in addition to locations outside KAFB boundaries. Using 1990 population census data, population doses were calculated for KAFB residents (6,636) and all other people living within a 50-mile (mi) (81-kilometer [km]) radius of SNL/NM (571,677).

5.5.3 Meteorological Data

The meteorological data used in the dose calculations for SNL/NM were provided by CAP88-PC (EPA 1991). The information was gathered from 1960 through 1964 at the Albuquerque International Airport, an average distance of approximately 3.5 mi (6 km) from the SNL/NM release locations.

5.5.4 Demographic Data

The categories of demographic data include population, beef cattle, dairy cattle, and food crops used for human consumption. These four parameters were calculated for each of the CAP-88 gridded zones (total of 80). In general, demographic data are available by county. The densities for population, beef cattle, dairy cattle, and food crops were calculated as the quotient of the most recent county data and the county land area. For 1993 calculations, 1990 census (U.S. Department of Commerce [DOC], Bureau of the Census, 1991) and 1988 agricultural data were used. These calculations were based on a total of 571,677 people, 32,335 beef cattle, 7,290 dairy cattle, and 2.4×10^8 square meters (m^2) (2.6×10^9 square feet [ft^2]) of food crops from the surrounding nine counties (LATA 1991).

5.5.5 Results of the Dose Assessment

The EDEs for two receptor groups, boundary and KAFB, were calculated for the 1993 releases using the CAP-88 computer code to determine maximum exposure to individuals and to the population within a 50-mi radius.

The nine boundary receptor locations are the Tijeras Arroyo, the City Landfill, the Airport (west end), the Northwest Base Housing (southeast corner), the Eubank Gate, the Northeast Resident, the East Resident, the Isleta Mine, and the West Resident. Table 5-2 presents the 1993 results. The dose at Tijeras Arroyo is consistent with previous years and is the highest (3.5×10^{-4} mrem/yr) of the nine boundary locations. Figure 5-6 shows the nine boundary locations.

Dose calculations were also performed for 14 KAFB receptor locations; the KUMSC, the KAFB Landfill, Raytheon/DNA, Rinchem, the golf course lobby, the golf course maintenance building, the riding club, the Civil Engineer Research Facility (CERF), Lovelace Hospital, Manzano area offices, the Credit Union, North Base housing, Building 887, and Trailer Village. Because of the shorter

Table 5-2. Annual Effective Dose Equivalent (mrem/yr) to Boundary Receptors

Receptor	Radiation Laboratory	TANDEM	TOF Laboratory	ACRR	SPR/CX	HERMES	PBFA-II	Mixed Waste Landfill	Total
Tijeras Arroyo	1.8E-09	4.1E-10	4.7E-09	1.8E-04	1.5E-05	6.5E-07	4.7E-08	1.5E-04	3.5E-04
City Landfill	1.0E-09	8.3E-11	3.7E-09	3.4E-05	3.2E-06	1.2E-07	8.4E-09	4.6E-05	8.3E-05
Airport (west end)	2.7E-09	1.6E-09	5.5E-09	1.4E-04	1.2E-05	5.0E-06	3.6E-07	5.7E-05	2.1E-04
SE Corner of NW Base Housing	1.2E-08	1.2E-08	1.2E-08	1.0E-04	9.0E-06	4.7E-05	3.6E-06	7.5E-05	2.4E-04
Eubank Gate	6.5E-09	1.0E-07	1.5E-08	1.3E-04	1.1E-05	1.4E-05	1.0E-06	7.3E-05	2.3E-04
NE Resident	1.0E-09	2.1E-10	3.7E-09	3.1E-05	3.0E-06	2.8E-07	2.1E-08	3.8E-05	7.2E-05
E Resident	6.8E-10	1.7E-11	3.2E-09	6.3E-06	6.4E-07	1.5E-08	1.1E-09	2.6E-05	3.3E-05
Isleta Gate	7.3E-10	1.9E-11	3.3E-09	1.0E-05	1.0E-06	1.1E-08	7.8E-10	3.3E-05	4.4E-05
W Resident	8.7E-10	3.5E-11	3.5E-09	1.7E-05	1.6E-06	4.0E-08	2.8E-09	3.7E-05	5.6E-05

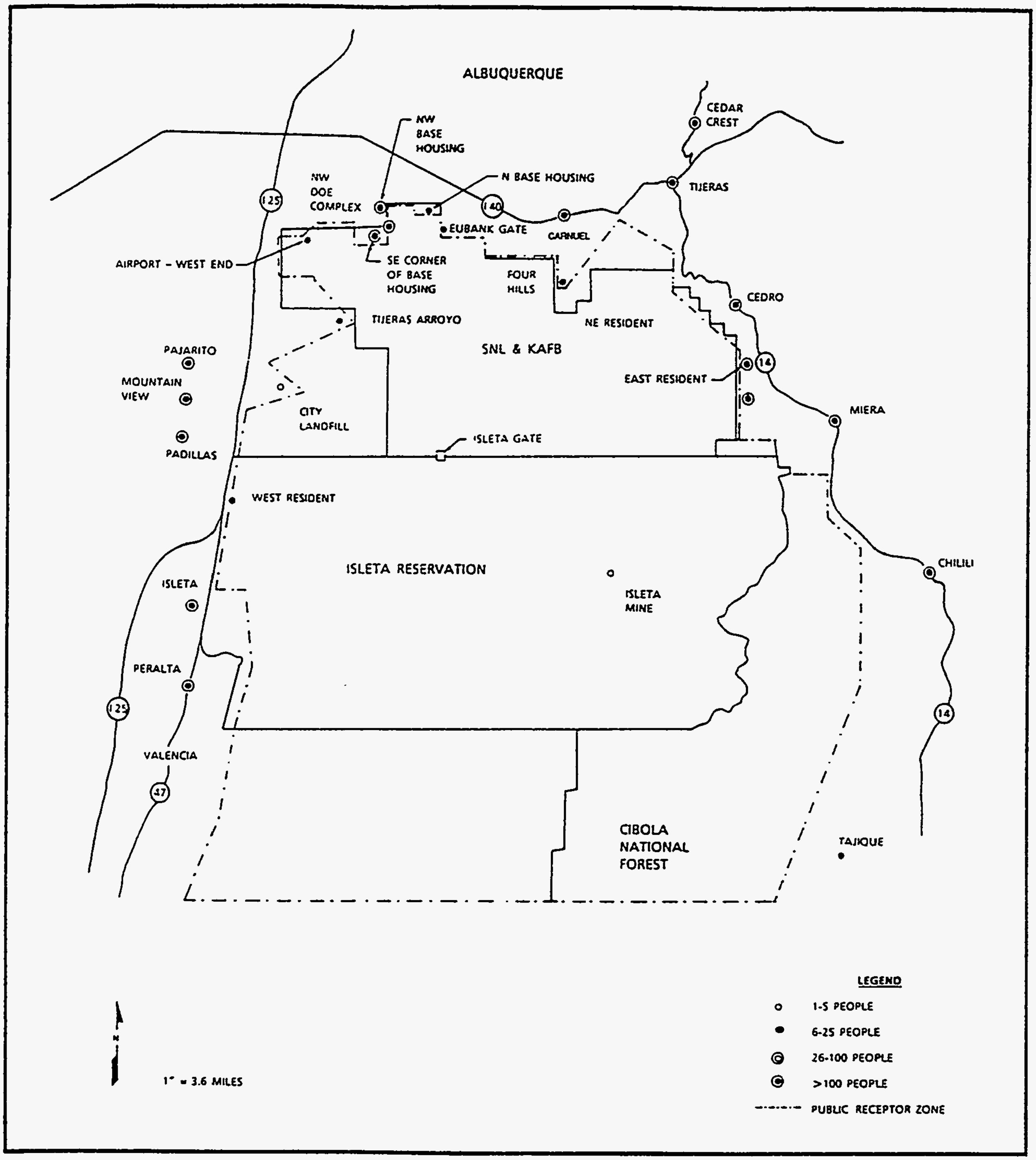

Figure 5-6. Boundary Receptor Locations Around Sandia National Laboratories/New Mexico

distance from the release sources to these KAFB receptors, the doses (Table 5-3) at these receptors are generally higher than those presented in Table 5-2.

The composite dose analysis revealed maximum EDE (based on NESHAP compliance standards) at the KUMSC receptor site, ~5282 ft (~1610 m) northwest of TA-V. The EDE to a maximally exposed individual at the KUMSC was calculated to be 1.6 x 10^{-3} millirem (mrem), due principally to an external air submersion exposure to Ar-41. The Ar-41 dose represents 95 percent of the total EDE. Most of the Ar-41 dose comes from the ACRR and SPR/CX facilities. Several receptor locations are within a factor of 10 of the EDE assessed for the KUMSC receptor location (see Table 5-3).

5.5.6 Population Dose at Kirtland Air Force Base

A population dose was calculated for the KAFB public receptors. There are five major base housing areas on KAFB. A 100-percent occupancy of all the units was assumed, yielding a total KAFB population of 6636. A population dose of 1.2 x 10^{-3} person-rem was estimated for all KAFB housing areas resulting from all SNL/NM 1993 releases. The population dose results from an external exposure via air immersion to Ar-41 and to internal exposure via ingestion of H-3.

5.5.7 Population Dose for the 50-Mile Radius

A population dose was calculated for the 50-mi radius surrounding SNL/NM using a single, common grid analysis for all SNL/NM sources. Because the analysis area is large, the relatively small distances between sources will have minimal impact on the resulting population dose. As stated earlier, the CAP-88 computer code calculated exposure estimates using demographic data based on the 1990 population census and 1988 agricultural census: 571,677 people, 32,335 beef cattle, 7290 dairy cattle, and 2.4 x 10^8 m^2 of food crops from the nine counties included in the study area (EPA 1991, DOC 1991, LATA 1991). The population dose from 1993 SNL/NM operations was calculated to be 0.026 person-rem EDE for the surrounding population (residing outside KAFB). The population dose is the result of an external exposure via air immersion to Ar-41 and to internal exposure via ingestion of H-3.

5.6 SUMMARY OF THE 1993 OFFSITE DOSE IMPACTS

During 1993, the NESHAP maximally exposed individual was determined to be at the KUMSC facility site, approximately 1610 m northwest of SNL/NM TA-V. The maximum EDE at this location was calculated to be 1.6 x 10^{-3} mrem. In addition, a population dose to the public was calculated to be 2.6 x 10^{-2} person-rem to the 571,677 people living within a 50-mi radius of SNL/NM. The population dose to the 6636 residents of KAFB was calculated to be 1.2 x 10^{-3} person-rem. The cumulative dose to the total population, including the KAFB population and the 50-mi-radius population, was 2.7 x 10^{-2} person-rem from all 1993 releases. Table 5-4 summarizes dose impacts.

Table 5-3. Annual Effective Dose Equivalent (mrem/yr) to Kirtland Air Force Base Receptors

Receptor	Radiation Laboratory	TANDEM	TOF Laboratory	ACRR	SPR/CX	HERMES	PBFA-II	Mixed Waste Landfill	Total
KUMSC	2.8E-09	2.7E-09	1.0E-09	1.6E-03	5.9E-05	1.7E-05	1.2E-06	5.5E-05	1.6E-03
KAFB Landfill	4.5E-09	1.9E-08	1.5E-09	2.2E-04	1.8E-05	7.1E-05	5.4E-06	1.8E-05	3.4E-04
Raytheon/DNA	2.0E-08	3.1E-08	6.5E-09	1.6E-04	1.3E-05	1.5E-04	1.3E-05	1.7E-05	3.6E-04
Rinchem	1.7E-08	2.8E-07	5.4E-09	1.6E-04	1.4E-05	1.1E-04	9.9E-06	1.5E-05	3.1E-04
Golf Course Lobby	1.6E-09	2.1E-09	5.6E-10	3.0E-04	2.0E-05	1.0E-05	7.3E-07	1.3E-05	3.5E-04
Golf Course Maintenance Bldg.	1.8E-09	6.9E-09	6.5E-10	5.1E-04	3.2E-05	3.2E-05	2.2E-06	1.1E-05	6.0E-04
Riding Club	1.0E-09	9.3E-10	3.8E-10	6.3E-04	3.5E-05	3.9E-06	2.3E-06	2.0E-05	7.0E-04
CERF	3.5E-10	1.2E-10	1.5E-10	8.2E-05	7.3E-06	2.9E-07	2.8E-07	1.0E-05	1.1E-04
Lovelace	6.8E-10	2.1E-10	2.9E-10	8.3E-05	7.8E-06	2.1E-07	2.1E-08	1.0E-05	1.1E-04
Manzano	6.5E-10	5.4E-10	2.5E-10	2.1E-04	1.4E-05	2.2E-06	1.5E-08	1.5E-05	2.5E-04
Credit Union	4.5E-06	2.2E-07	1.3E-06	9.8E-05	8.6E-06	2.1E-05	1.6E-07	1.2E-05	1.6E-04
North Base Housing	3.1E-08	1.8E-07	9.6E-09	1.0E-04	9.1E-06	1.9E-05	1.4E-06	1.1E-05	1.4E-04
Building 887	2.3E-08	6.7E-06	7.1E-09	1.2E-04	1.0E-05	3.1E-05	2.2E-06	1.2E-05	1.8E-04
Trailer Village	1.6E-08	9.1E-05	5.1E-09	1.4E-04	1.2E-05	2.9E-05	2.0E-06	1.3E-05	2.1E-04

Table 5-4. Summary of Offsite Dose Impacts in Comparison to the National Emission Standards for Hazardous Air Pollutants and to Natural Background Radiation

Parameters	1993 SNL/NM Calculated Dose	NESHAP Standard	Natural Background Radiation in Albuquerque Area
Maximum Effective Dose Equivalent (mrem/yr)	0.0016	10	95[a]
Annual Population Dose[c] (person-rem)	0.027	--[b]	>57,000

[a]Based on the average of community thermoluminescent dosimeter (TLD) values (dose from external penetrating radiation)
[b]-- = Not measured
[c]Dose for the population in 50-mi radius surrounding SNL/NM, including the population on KAFB

5.7 AIR QUALITY MANAGEMENT

5.7.1 Air Quality Regulations

Ambient air quality for SNL/NM is regulated by the Albuquerque/Bernalillo County Air Quality Control Regulations (AQCRs). These include the following:

- Ambient Air Quality Standard (regulates arsenic [As], copper [Cu], zinc [Zn], beryllium [Be], CO, hydrogen sulfide [H_2S], Pb, NO_X, SO_2, total suspended particulates [TSP], hydrocarbons [HC], soiling index, and total reduced sulfur)
- AQCR #3: Open Burning
- AQCR #5: Visible Air Contaminants
- AQCR #8: Airborne Particulate Matter (PM)
- AQCR #11: Volatile Organic Compounds (VOCs)
- AQCRs #15-18: Process Equipment Emissions (NO_x, SO_2, and particulates) for Oil- and Gas-Burning Equipment
- AQCR #19: Breakdown, Abnormal Operating Conditions, or Scheduled Maintenance
- AQCR #20: Authority-to-Construct Permit
- AQCR #21: Permit Fees
- AQCR #22: Registration of Air Contaminant Sources
- AQCR #23: Source Surveillance
- AQCR #24: Variance Procedure
- AQCR #28: Motor Vehicle Inspection

- AQCR #29: Prevention of Significant Deterioration
- AQCR #30: New Source Performance Standards
- AQCR #31: National Emission Standards for Hazardous Air Pollutants (NESHAP) (radionuclides excluded)
- AQCR #37: Stratospheric Ozone Protection

The Air Pollution Control Division of the Albuquerque City Environmental Health Department has established several ambient-air sampling stations throughout the city, including the area near SNL/NM, to monitor TSP, ozone, PM-10, CO, and NO_x. The results were published periodically in the local newspaper. No exceedances of the measured pollutants were observed at the station near SNL/NM in 1993.

5.7.2 Airborne Emissions and Permits

Several sources at SNL/NM emit air pollutants that are regulated by the AQCRs. The emissions from these sources are described below:

- Topsoil Disturbance (AQCR #8): Before disturbing the soil of any area larger than 3/4 acre, SNL/NM or its contractor applies for a Topsoil Disturbance Permit and implements a plan for controlling dust emissions generated by construction activities in accordance with the requirements of AQCR #8, Airborne Particulate Matter. These mitigation measures include watering, phasing of construction, rescheduling of construction during windy periods, limiting vehicle access and vehicle speed, and using dust palliatives where watering is ineffective.

- Open Burning (AQCR #3): The open-burn regulation was revised on June 16, 1992, to include new activities such as the disposal of explosives by burning to avoid the hazards of transport or handling, aboveground detonation of more than 20 pounds (lb) of explosives, and ignition of rocket motors containing more than 20 lb of explosives or more than 4000 lb of fuel. In addition to the scope changes, the City also revised the previous permit basis into two categories: multiple-event permit and single-event permit. The single-event permit was designed to regulate significant impact activities.

  Open-burn permits were obtained from the City of Albuquerque prior to each scheduled regulated test according to the requirement of AQCR #3, Open Burning. A total of 20 multiple- and single-event open burn permits were issued or extended to SNL/NM during 1993 (see Table 5-5).

- Volatile Organic Compounds (AQCR #11): This regulation requires all underground storage (fuel) tanks with annual throughput of 100,000 gal or more of gasoline to implement Stage-I recovery control for VOCs. Only one tank in TA-I requires Stage-I recovery and it has been in compliance with the requirements. During 1992, the Transportation Service Division Procedures Manual was revised to incorporate the requirement of Stage-I recovery in the procedure for receiving fuel (Hindl et al. 1992). The compliance has been demonstrated by the certification stamp and signature of the receiving personnel on the delivery receipt for each shipment and unloading of fuel.

Table 5-5. Summary of 1993 Air Permits

Facility Name	Location	Permit Number	Issue Date	Expiration Date	Regulatory Agency
1. 1993 Open Burn Permits					
Coyote Test Field	9920/9926	0701-92-003	07/01/92	07/01/93	City of Albuquerque
Burn Site	Lurance Canyon	0112-93-002	01/12/93	01/12/94	City of Albuquerque
Burn Site	Lurance Canyon	0202-93-030	02/02/93	12/31/93	City of Albuquerque
Thermal Treatment Facility	Building 6715	0401-93-062	04/01/93	12/31/93	City of Albuquerque
Fire Extinguisher Training Site	9th Street South of TA-I	0507-92-001	05/07/92	05/07/93	City of Albuquerque
Burn Site	Lurance Canyon	0511-92-002	05/11/92	05/11/93	City of Albuquerque
TA-III Rocket Track	Building 6541	0727-93-084	07/27/93	12/31/93	City of Albuquerque
Burn Site	Lurance Canyon	0818-92-008	08/18/92	08/18/93	City of Albuquerque
Burn Site	Lurance Canyon	0819-92-009	08/19/92	08/19/93	City of Albuquerque
Burn Site	Lurance Canyon	0820-92-010	08/20/92	08/20/93	City of Albuquerque
Burn Site	Lurance Canyon	0923-92-011	09/23/92	09/23/93	City of Albuquerque
Burn Site	Lurance Canyon	0924-92-012	09/24/92	09/24/93	City of Albuquerque
Burn Site	Lurance Canyon	0925-92-013	09/25/92	09/25/93	City of Albuquerque
Buildings 9927/9930	Buildings 9927/9930	0925-92-014	09/25/92	09/25/93	City of Albuquerque
Buildings 9927/9966	Buildings 9927/9966	0925-92-015	09/25/92	09/25/93	City of Albuquerque
Buildings 9927/9966	Buildings 9927/9966	0925-92-016	09/25/92	09/25/93	City of Albuquerque
South Thunder Range	Building 9927	0925-92-017	09/25/92	09/25/93	City of Albuquerque
Buildings 9927/9966	Buildings 9927/9966	0925-92-018	09/25/92	09/25/93	City of Albuquerque
South Thunder Range	Building 9927	0925-92-019	09/25/92	09/25/93	City of Albuquerque
North Thunder Range	Building 9927	1001-92-020	10/01/92	09/30/93	City of Albuquerque
2. Other Existing Air Permits					
Wind Shield Fire Test	Lurance Canyon	#196	05/19/88	None	City of Albuquerque
Emergency Generator	TA-1/862	#150	02/13/86	None	City of Albuquerque
PBFA-II	TA-IV	NESHAP	03/23/89	None	EPA, Region VI
SDF (PT2)	TA-IV	NESHAP	07/08/88	None	EPA, Region VI
HERMES III	TA-IV	NESHAP	06/29/88	None	EPA, Region VI

- Steam Boilers and Emergency Diesel Generators (AQCRs #15-#18): SNL/NM currently has five steam boilers with capacities that range from 71.5 to 190.8 mega-British thermal units per hour (MBtu/hr). Because these generators were grandfathered sources, no permits were required or obtained. The four emergency diesel generators in Building 862 are permitted by the City of Albuquerque. There are other emergency generators on-site that may require permits.

5.7.3 Criteria Pollutants Inventory

Five steam boilers were operated by SNL/NM during 1993. The steam plant consumed a total of almost 862 million cubic feet (cf) of natural gas and 2000 gallons (gal) of fuel oil, and produced 621 million lb of steam. Based on the operation data provided by Plant Engineering, emissions of NO_x, CO, SO_2, HC, and TSP were calculated for each boiler. Table 5-6 summarizes the calculated results. Published emission factors in EPA AP-42 for the criteria pollutants were used in the annual emission calculations (EPA 1986a).

SNL/NM also operates an emergency generator plant (Building 862) with four 600-kW standby generators. Based on AP-42 published emission factors and 1993 operation data, the emissions from the emergency generators are summarized in Table 5-7.

Table 5-6. 1993 Criteria Pollutant Inventory (tons per year)

Pollutants/ Source	Steam Generators[a]					
	No. 1	No. 2	No. 3	No. 5	No. 6	Total Emissions
NO_x	9.30	10.22	8.45	70.10	57.01	155.09
CO	2.33	2.56	2.11	5.10	4.15	16.24
TSP	0.91	1.00	0.83	0.64	0.52	3.90
SO_2	0.04	0.04	0.04	0.15	0.06	0.33
TOC	0.39	0.42	0.35	0.22	0.18	1.55

[a]Number 4 boiler was retired and no emissions were generated. Amounts are in tons per year.

Table 5-7. Emergency Generator Emissions Estimates

Pollutants/ Source	Steam Generators[a] (600 kW)				Total Emissions
	No. 1	No. 2	No. 3	No. 4	
1993 Hours of Operation	65.5	65.5	69.5	69.7	--
NO_x[a]	3.50E-01	3.50E-01	3.71E-01	3.72E-01	1.44E+00
CO[a]	1.77E-02	1.77E-02	1.88E-02	1.88E-02	7.30E-02
TSP[b]	5.80E-02	5.80E-02	6.15E-02	6.17E-02	2.39E-01
SO_x[b]	5.41E-02	5.41E-02	5.74E-02	5.76E-02	2.23E-01
HC[b]	6.62E-02	6.62E-02	7.03E-02	7.05E-02	2.73E-01

[a]Based on Kramer & Associates performance tests (Kramer & Associates 1988a, 1988b)
[b]Based on AP-42 Emission Factors for Diesel Industrial Engines (EPA 1986a)

5.7.4 Inventory and Assessment of Hazardous Air Emissions

A Hazardous Chemical Usage Inventory team was formed in October 1993 to develop a streamlined process to collect Lab-wide chemical usage information. The team is composed of members from line organization, the Line Implementation Working Group (LIWG), and Environment, Safety, and Health (ES&H) personnel. Jointly, the team reviewed the regulatory reporting requirements, defined the scope of the inventory, investigated existing databases, and developed an efficient process to carry out the Hazardous Chemical Usage Inventory.

Scope: A two-phase approach was taken in assessing the hazardous air emissions for CY 1993. In the first phase, a laboratory-wide chemical-usage survey was conducted. The chemicals listed for the inventory (along with the reason for their inclusion) encompassed (1) toxic chemicals listed under 40 CFR 372.65 for the purpose of complying with the Superfund Amendments and Reauthorization Act (SARA), Title III (also known as the Emergency Planning and Community Right-to-Know Act [EPCRA]), Section 313; (2) hazardous chemicals listed in NM AQCR #752, Registration of Existing Toxic Air Pollution Sources, for the purpose of identifying and registering existing toxic air-emission points with the New Mexico Environment Department (NMED) to comply with the Agreement in Principle (AIP) between NMED and DOE's Albuquerque Operations Office (DOE/AL); (3) hazardous air pollutants listed in the Clean Air Act Amendments (CAAA), Title III, Section 112, for the purpose of assessing the impact of the CAAA, Title V, State Operating Permit Program; and (4) ozone-depleting substances listed under 40 CFR 82, for the purpose of assessing the impact due to the phase-out of Class I ozone-depleting substances.

In Phase I, CY 92 and CY 93 purchase information from Fisher Scientific Co., SNL/NM chemical Just-in-Time (JIT) supplier, was evaluated to identify materials which contained regulated chemicals. Purchasing information was printed on inventory forms and distributed to all chemical users through vice-president ES&H Coordinators. The chemical users were requested to provide usage data on the chemicals purchased through JIT. They were also asked to provide chemical constituents and usage information on materials that contained regulated chemicals but that were not purchased JIT through Fisher Scientific Co.

Approximately 600 chemical-usage inventory forms were received and the data were keyed into a computer data base. Chemical usages were summarized and two chemicals were selected for assessment based on the amount of laboratory-wide usage and associated activities.

In Phase II, users of the two selected chemicals were requested to calculate air emissions using established EPA guidelines and other methods.

<u>Results</u>: According to the inventory data base, SNL/NM uses a wide variety of materials and chemicals in various processes. A summary of significant chemical usage is shown in Table 5-8.

Table 5-8. Summary of Significant Chemical Usage Laboratory-Wide

CAS	Usage (lb)	Chemical
108883	48,663.18	Toluene
1330207	48,486.58	Xylene
1310732	24,955.89	Sodium hydroxide
7664939	20,431.75	Sulfuric acid
110827	19,444.22	Cyclohexane
7647010	14,868.52	Hydrogen chloride
107211	10,732.40	Ethylene glycol
67641	8,505.08	Acetone
7439896	6,064.60	Iron salts, soluble, as Fe
74986	5,127.63	Propane
76131	4,635.47	Freon 113 (CFC-113)
67561	3,775.91	Methanol (Methyl alcohol)
71432	3,684.20	Benzene
67630	3,643.47	Isopropyl alcohol
100414	3,358.97	Ethylbenzene
7697372	3,031.27	Nitric acid
8052424	2,389.01	Asphalt (petroleum) fumes
75694	2,000.00	Trichlorofluoromethane (CFC-11)
12125018	1,936.65	Ammonium fluoride
110543	1,743.68	n-Hexane
95636	1,710.18	1,2,4-Trimethylbenzene
7664393	1,445.48	Hydrogen fluoride
100425	1,368.31	Styrene
75456	1,135.40	Hydrochlorofluorocarbon-22
7782414	1,133.29	Fluorine

6.0 WATER MONITORING PROGRAMS

6.1 WASTEWATER PROGRAMS

6.1.1 Discharges to Publicly Owned Treatment Works

Sandia National Laboratories/New Mexico (SNL/NM) contains over 15 miles (mi) (24 kilometers [km]) of sewer lines interconnected with those of Kirtland Air Force Base (KAFB). During 1993, SNL/NM had three categorical pretreatment operations and four general wastewater streams discharging to the City of Albuquerque publicly owned treatment works (POTW). For the U.S. Environmental Protection Agency (EPA) categorical discharge limitations, see the list of permits that have 40 Code of Federal Regulations (CFR) designation in Table 6-1.

Table 6-1. Sandia National Laboratories/New Mexico Wastewater Discharge Permits

Permit Number	Station Manhole	Waste Stream Process	Issuing Agency	Permit Expiration
2069A-3	WW001	General	City of Albuquerque/ I.C.-7391[a]	02/01/97
2069D-4	WW004	Metal Finishing	City of Albuquerque/ 40 CFR 433.A15	02/01/97
2069F-3	WW006	General	City of Albuquerque/ I.C.-3674, 3694, and 9711	02/01/97
2069G-2	WW007	Microelectronics Development Laboratory	City of Albuquerque/ 40 CFR 469.A	07/31/94
2069H-3	WW009	Process Development Laboratory	City of Albuquerque/ 40 CFR 433	02/01/97
2069I-2	WW008	General	City of Albuquerque/ I.C.-3674, 3679, and 9711	02/01/97
2069K	WW011	General	City of Albuquerque/ I.C.-3674, 3679, and 9711	03/31/94

[a]I.C. = Industrial classification.

In November 1993, SNL/NM began construction of the Liquid Effluent Control System (LECS) to retain process wastewater for radiological screening prior to disposal into the sanitary sewer. Until the system is completed, SNL/NM will continue to use the two 5,000-gallon (gal) holding tanks in Technical Area V (TA-V). Samples are collected several times weekly as grab samples, then delivered to radiological laboratories for screening analysis. Before sampling, influent flow is switched to the other tank to isolate the active tank's sample volume. Samples are analyzed for gross alpha particle activities, gross beta particle activities, tritium (H-3), and gamma emitters. Comparison samples are collected from tap-water sources in TA-V for background analyses. Every fifth sampling, duplicate samples are collected and shipped to an SNL-contracted laboratory for independent analysis. The sampling results indicate the wastewater discharge from TA-V wastewater holding tanks are below regulatory limits set by the U.S. Nuclear Regulatory Commission (USNRC), the U.S. Department of Energy (DOE), and the State of New Mexico.

SNL/NM's policy prohibits the disposal of radiological material above regulatory levels into the sanitary sewer system. Although radiological analyses for the permitted outfall locations are not permit requirements, results are included to satisfy reporting requirements established by the City of Albuquerque's Sewer Use and Wastewater Control Ordinance, Section 8-9-44.H, which states that all analyses performed in accordance with prescribed procedures established by EPA under provisions contained in 40 CFR 136 shall be reported. Results of radiological sampling are contained in the Wastewater Monitoring Program Quarterly Reports (IT 1993a, 1993b, 1993c, 1994).

Discharges by SNL/NM to the POTW are regulated by the City of Albuquerque Public Works Department, Liquid Waste Division, under the authority of the City's Sewer Use and Wastewater Control Ordinance. The City's ordinance is approved by EPA in accordance with the Clean Water Act (CWA) as amended.

To comply with EPA regulations, the City of Albuquerque has implemented an industrial wastewater pretreatment program. This program requires SNL/NM to obtain permits for wastewater discharges to the City's POTW. These permits specify the required quality of discharges and the frequency of reporting the monitoring results.

Table 6-2 and Figure 6-1 describe the wastewater sampling locations. Table 6-3 summarizes location characteristics. The sampling procedures, permit limits for individual sampling stations, dates of sample collection and sample frequency, analytical methods, and quality control/quality assurance criteria are defined in the *SNL/NM Wastewater Sampling Plan* (Booher 1992). Complete documentation concerning the wastewater sampling program can be found in the Wastewater Monitoring Program Quarterly Reports.

6.1.2 Summary of Monitoring Results

This section describes each permit and addresses those instances in which the monitoring results did not comply with the permit limits described in the Wastewater Monitoring Program Quarterly Reports for 1993.

Table 6-2. Sandia National Laboratories/New Mexico Wastewater Sample Locations

Permit Number	Station Manhole	Average Flow Location(gpd)[a]
2069A-2	WW001 Tijeras Arroyo	South Technical Area IV 28,849
2069D-3	WW004 Building 841 SE	Technical Area I 39,154
2069F-2	WW006	East of KAFB Lagoons514,123
2069G-2	WW007 Building 858 Basement	Technical Area I110,939
2069H-2	WW009 Building 878 Basement	Technical Area I 3,659
2069I	WW008 Tijeras Arroyo	South Technical Area I 25,576
2069K	WW011	Technical Area III 10,000

[a]gpd = gallons per day

Permit 2069A-2: This permit is a general wastewater discharge permit for wastewater discharges from a portion of SNL/NM TA-I.

- Analytical Results: Analytical results from laboratory analyses show all analyte concentrations to be less than permitted requirements.

- Hydrogen ion concentration (pH): No pH excursion of wastewater discharges above the permitted pH limits occurred for greater than 1 hour (hr) during 1993. Dates of pH excursions for 1 hr or less, total time the wastewater pH was out of permit limits, dates of sample collection, and sampling frequencies for each month for Permit 2069A-2 are contained in the Wastewater Monitoring Program Quarterly Reports for 1993 (IT 1993a, 1993b, 1993c, 1994).

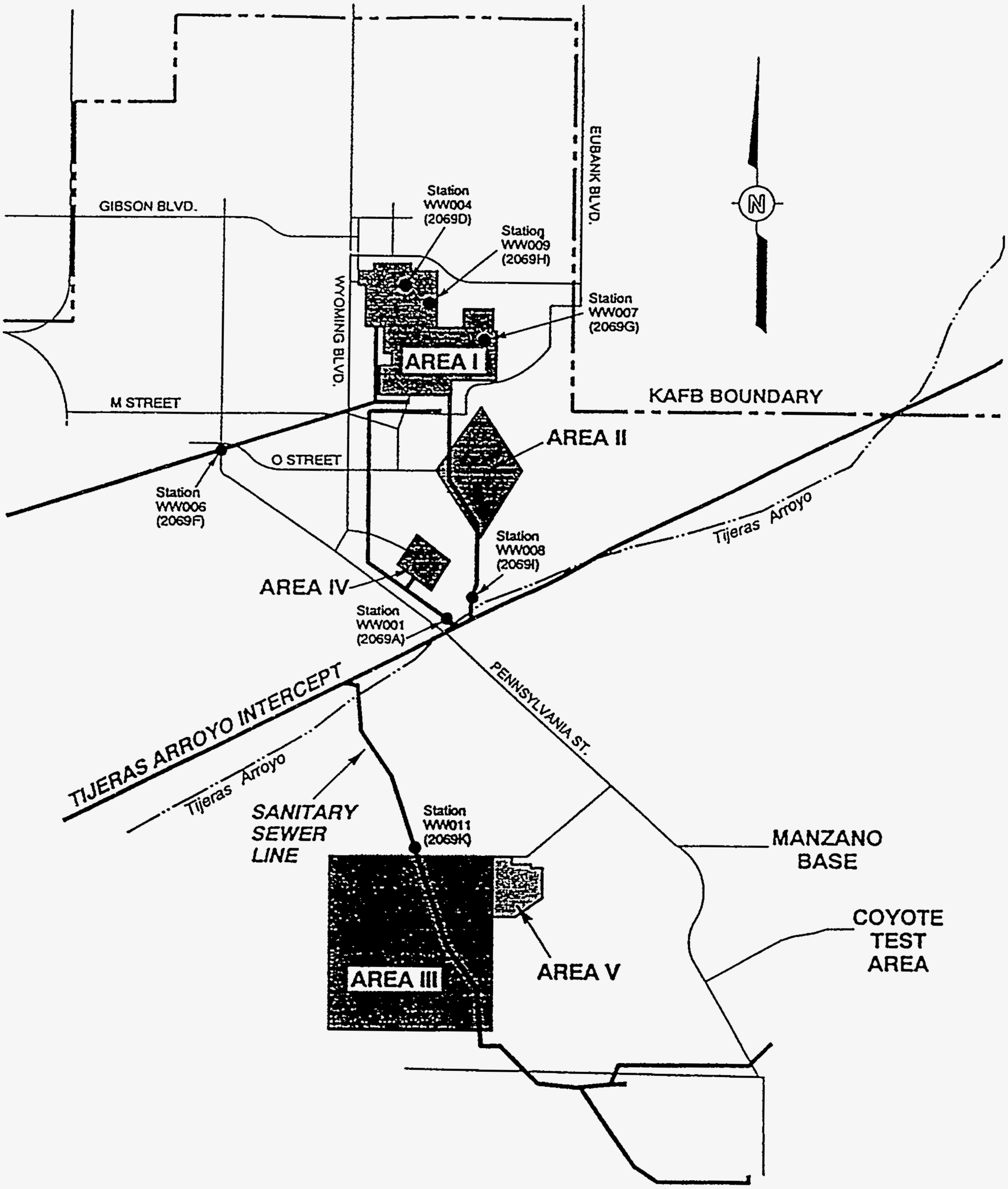

Figure 6-1. Sandia National Laboratories/New Mexico Wastewater Monitoring Station Locations

Table 6-3. Summary of Characteristics for Sandia National Laboratories/New Mexico Wastewater Sampling Stations

Station Number	Flumes	Flow Meter and Sampling Equipment
WW001	3-in. Parshall	Isco 3210 Flow Meter Isco 2700R Sampler Leeds and Northrop pH Analyzer System
WW004	2-in. Parshall	Isco 3210 Flow Meter Isco 2700R Sampler Leeds and Northrop pH Analyzer System
WW006	6-in. Parshall	Isco 3210 Flow Meter Isco 2700R Sampler Leeds and Northrop pH Analyzer System
WW007	45° V-Notch Weir	Isco 3210 Flow Meter Isco 2700R Sampler Leeds and Northrop pH Analyzer System
WW008	6-in. Parshall	Isco 3210 Flow Meter Isco 2700R Sampler Leeds and Northrop pH Analyzer System
WW009	2-in. Parshall	Isco 3210 Flow Meter Isco 2700R Sampler Leeds and Northrop pH Analyzer System
WW011	6-in. Parshall	Isco 3210 Flow Meter Isco 2700R Sampler Leeds and Northrop pH Analyzer System

Permit 2069D-3: This permit covers discharges from the categorical, regulated metal-plating activity in Building 841 of SNL/NM TA-I.

- Analytical Results: Analytical results from laboratory analyses show all analyte concentrations to be less than permitted requirements with the exception of a total toxic organics (TTO) concentration from a sample collected on September 15, 1993. This deviation exceeded permit limit, but caused no impact on the operation of the POTW. The sample concentration and permit limits are summarized in Table 6-4. Corrective actions are documented in the Quarterly Reports for 1993.

- pH: No pH excursion of wastewater discharges above the permitted pH limits occurred for greater than 1 hr during 1993. Dates of pH excursions for 1 hr or less, total time the wastewater pH was out of permit limits, dates of sample collection, and sampling frequencies for each month for Permit 2069D-3 are contained in the Wastewater Monitoring Program Quarterly Reports for 1993.

Table 6-4. Summary of Concentration Violations for Permit 2069D-3, Station WW004, During 1993

Sample Date/Sample Type	Concentration (mg/L)	Permit Limit (mg/L)
September 15, 1993/24-hr Composite	1.3	0.71

Permit 2069F-2: This permit is a general wastewater discharge permit for wastewater discharges from a portion of SNL/NM TA-I and some KAFB facilities.

- Analytical Results: Analytical results from laboratory analyses show all analyte concentrations to be less than permitted requirements.

- pH: No pH excursions of wastewater discharges above the permitted pH limits occurred for greater than 1 hr during 1993. Dates of pH excursions for 1 hr or less, total time the wastewater pH was out of permit limits, dates of sample collection, and sampling frequencies for each month for Permit 2069F-2 are contained in the Wastewater Monitoring Program Quarterly Reports for 1993 (IT 1993a, 1993b, 1993c, 1994).

Permit 2069G-2: This permit covers discharges from categorical, regulated semiconductor production activity in Building 858 of SNL/NM TA-I.

- Analytical Results: Analytical results from laboratory analyses show all analyte concentrations to be less than permitted requirements.

- pH: No pH excursions of wastewater discharges above the permitted pH limits occurred for greater than 1 hr during 1993. Dates of pH excursions for 1 hr or less, total time the wastewater pH was out of permit limits, dates of sample collection, and sampling frequencies for each month for Permit 2069G-2 are contained in the Wastewater Monitoring Program Quarterly Reports for 1993.

Permit 2069H-2: This permit covers discharges from the categorical, regulated, printed circuit activity at the Process Development Laboratory (PDL) in Building 878 of SNL/NM TA-I.

- Analytical Results: Analytical laboratory analyses show all analyte concentrations to be less than permitted requirements with the exception of a copper (Cu) concentration from a sample collected on November 5, 1993. This violation exceeded the permit limit, but caused no impact on the operation of the POTW. The sample concentration and permit limits are summarized in Table 6-5. Corrective actions are documented in the Quarterly Reports for 1993.

- pH: No pH excursions of wastewater discharges above the permitted pH limits occurred for greater than 1 hr during 1993. Dates of pH excursions for 1 hr or less, total time the wastewater pH was out of permit limits, dates of sample collection, and sampling frequencies for each month for Permit 2069H-2 are contained in the Wastewater Monitoring Program Quarterly Reports for 1993.

Table 6-5. Summary of Concentration Violations for Permit 2069H-2, Station WW009, During 1993

Sample Date/Sample Type	Concentration (mg/L)	Permit Limit (mg/L)
November 5, 1993/24-hr Composite (Copper)	3.7	2.960

Permit 2069I: This permit is a general wastewater discharge permit for wastewater discharges from SNL/NM TA-I, TA-II, and TA-IV.

- Analytical Results: Analytical results from laboratory analyses show all analyte concentrations to be less than permitted requirements.

- pH: No pH excursion of wastewater discharges above the permitted pH limits occurred for greater than 1 hr during 1993. Dates of pH excursions for 1 hr or less, total time the wastewater pH was out of permit limits, dates of sample collection, and sampling frequencies for each month for Permit 2069I are contained in the Wastewater Monitoring Program Quarterly Reports for 1993 (IT 1993a, 1993b, 1993c, 1994).

Permit 2069K: This permit is a general wastewater discharge permit for wastewater discharges from SNL/NM TA-III and TA-V.

- Analytical Results: Analytical results from laboratory analyses show all analyte concentrations to be less than permitted requirements with the exception of a cyanide concentration from a sample collected on June 17, 1993. The violation exceeded the permit limit, but caused no impact on the operation of the POTW. The sample concentration and permit limits are summarized in Table 6-6. Corrective actions are documented in the Quarterly Reports for 1993.

- pH: No pH excursions of wastewater discharges above the permitted pH limits occurred for greater than 1 hr during 1993. Dates of pH excursions for 1 hr or less, total time the wastewater pH was out of permit limits, dates of sample collection, and sampling frequencies for each month for Permit 2069K are contained in the Wastewater Monitoring Program Quarterly Reports for 1993.

Table 6-6. Summary of Concentration Violations for Permit 2069K, Station WW011, During 1993

Sample Date/Sample Type	Concentration (mg/L)	Permit Limit (mg/L)
June 17, 1993/24-hr Composite (Cyanide)	6.10	3.8

6.2 STORM WATER PROGRAM

An amendment to the regulations implementing the CWA was promulgated on November 16, 1990, in the Federal Register. This amendment implements Section 402[p] of CWA, which was added by Section 405 of the Water Quality Act of 1987. The implementing regulations are published in 40 CFR 122-124. These enactments require EPA to regulate storm water discharges associated with industrial activities. Industrial activities covered by these new regulations include Standard Industrial Classification (SIC) Codes 21 through 39. SNL/NM has several activities that fall under these SIC codes, including those at the Microelectronics Development Laboratory, the Process Development Laboratory, the Albuquerque Microelectronics Operation, and the plating shops in Building 840.

There are also requirements for permitting specific facility operations: salvage yards, vehicle maintenance yards, construction activities that disturb five or more acres, and hazardous waste treatment, storage, and disposal facilities. SNL/NM has ongoing activities that fall under all these descriptions and others that require SNL/NM to submit a National Pollutant Discharge Elimination System (NPDES) permit application for its storm water discharges.

The permit application was prepared and submitted to EPA, Region VI, on October 1, 1992. The construction activities are being covered by a Notice of Intent to Discharge (NOI) that was also submitted to EPA, Region VI, on October 1, 1992. The permit applications and NOIs will be reviewed and approved by the EPA with State of New Mexico review and concurrence. No formal response has been received.

No storm water sampling was conducted in 1993. A permit application was submitted in 1992 to EPA Region VI. No formal response has been received regarding the permit application. Until the permit application is acted upon, no further sampling is required.

6.3 SURFACE DISCHARGE PROGRAMS

6.3.1 Discharge Plans

All discharges to surface impoundments for SNL/NM are under the authority of the New Mexico Water Quality Control Commission (NMWQCC) Regulations as implemented by the New Mexico Environment Department (NMED) Ground Water Bureau. During 1993, SNL/NM had two active permitted discharge plans from the State of New Mexico: Discharge Plan-530 (DP-530) and DP-771.

DP-530 covers discharges to lagoons I and II from pulsed-power operations in TA-IV. Water that accumulates in the secondary containment area for the Pulsed-Power Development Facilities oil storage tanks is discharged to two surface impoundments (lagoons I and II) outside TA-IV. DP-530 was approved for these discharges in March 1988 and amended in December 1989, November 1992, and June 1993. The approved discharge plan, as amended, requires quarterly measurement of water levels and semiannual sampling and analysis. During 1993, water-level measurements were taken in March, June, August, and December, and sampling was done in March and August. Reports containing water level measurements and monitoring results were submitted in January and July to the NMED Ground Water Bureau. The results are documented in the semiannual reports for DP-530 (SNL 1993f, 1993g).

A second discharge plan, DP-771, was closed on October 1, 1993. DP-771 covered discharges from experiments at the Solar Test Facility. The requirement for surface discharges ended in 1992, and no discharges were made during 1993. NMED approval of DP-771 was received in March 1991 and amended in March 1992. This groundwater discharge plan was submitted by the Solar Detoxification Facility for the discharge of up to 2700 gallons per day (gpd) of process water from solar detoxification experiments. The permit required notification of any experiment modifications to the NMED prior to any water discharge from the modified test. The permit also required quarterly monitoring of listed contaminants for each test at the Solar Detoxification Facility. The results of monitoring are documented in the quarterly reports for DP-771 (Pacheco and Bonaguidi 1993; Pacheco and Copus 1993a, 1993b).

6.3.2 Summary of Analytical Results

This section contains a summary of the DP-530 analytical report of Lagoons I and II.

Total dissolved solids (TDS), chloride, and sulfate were detected in calendar year (CY) 1993 samples from Lagoons I and II at concentrations less than the applicable NMWQCC standards. TDSs were detected in amounts of 519 milligrams per liter (mg/L) for Lagoon I and 480 mg/L for Lagoon II. The NMWQCC standard for TDS is 1000 mg/L. Chloride concentrations in Lagoons I and II were reported at 97.2 mg/L and 125 mg/L, respectively. The NMWQCC standard is 250 mg/L. Sulfates were reported in Lagoons I and II at 10 mg/L and 65 mg/L, respectively. The NMWQCC standard for sulfate is 600 mg/L.

7.0 GROUNDWATER MONITORING

This chapter describes groundwater monitoring activities conducted by the Environmental Operations Center, Organization 7500, at Sandia National Laboratories/New Mexico (SNL/NM) during calendar year 1993 (CY 93). These groundwater monitoring activities are associated with the SNL/NM Environmental Restoration (ER) Project and the Groundwater Surveillance Task. In addition, water level elevations in monitoring wells in the SNL/NM area are measured monthly to establish groundwater flow patterns in the region.

Details of groundwater monitoring activities for CY 93 are discussed in the following sections of this chapter:

Groundwater Surveillance Task (hereinafter referred to as "basewide" groundwater monitoring): Samples were collected from monitoring wells and springs on and adjacent to Kirtland Air Force Base (KAFB) for baseline hydrogeochemical characterization and groundwater contamination detection monitoring. In 1993, basewide sampling occurred in April, July, September, and December. The results of the sampling events are discussed in Section 7.4.2. Water levels were measured each month at 36 wells on KAFB. Water level data are discussed in Section 7.3.

Chemical Waste Landfill (CWL): Annual assessment monitoring took place in February; quarterly assessment sampling was performed in May, August, and November. The results of CWL groundwater monitoring are reported in accordance with the regulatory requirements specified in 40 Code of Federal Regulations (CFR) 265, Subpart F, and the CWL final closure plan (SNL 1992a, 1993d). The results are discussed in Section 7.4.3.

Mixed Waste Landfill (MWL): Semiannual detection groundwater sampling occurred in January, April, and November. The results are discussed in Section 7.4.4.

Technical Area II (TA-II): Two additional monitoring wells were installed and sampled during 1993. Section 7.4.5 provides details.

Liquid Waste Disposal System (LWDS): Two monitoring wells were installed and sampled in CY 93. The results are discussed in Section 7.4.6.

Sitewide Hydrogeologic Characterization Project (SWHC): Four new monitoring wells were installed during 1993; two of the wells were sampled as part of the sitewide activity. The results are discussed in Section 7.4.7. The two other wells were sampled quarterly as part of the basewide sampling program (Section 7.4.2).

7.1 REGULATORY OVERVIEW

The Groundwater Surveillance Task is the implementation of Department of Energy (DOE) Order 5400.1 (DOE 1988a) at SNL/NM. This Order requires SNL/NM to do several things:

1. Obtain data for the purpose of determining baseline conditions of groundwater quality and quantity

2. Demonstrate compliance with and implementation of all applicable regulations and DOE Orders

3. Provide data to permit the early detection of groundwater pollution or contamination

4. Identify existing and potential groundwater contamination sources and maintain surveillance of these sources

5. Provide data upon which decisions can be made concerning land disposal practices and the management and protection of groundwater resources

The purpose of the Groundwater Surveillance Task is to detect any contaminants entering SNL/NM from outside sources and any contaminants leaving SNL/NM with the specific objective of establishing the impact of DOE facilities operations on groundwater quantity and quality.

The CWL currently must meet the interim status Resource Conservation and Recovery Act (RCRA) Groundwater Monitoring Regulations (40 CFR 265, Subpart F). In February 1993, the CWL final closure plan and postclosure permit application (SNL 1992a, 1993d) was approved by all concerned parties. The current groundwater monitoring requirements for this site are discussed in detail in Sections 2.0 and 7.0 of the closure plan. The sampling and analysis plan is provided in Appendix G of the closure plan. During 1993, annual monitoring for Appendix IX parameters occurred in February, and quarterly monitoring for Appendix IX volatile organic compounds (VOCs) and metals occurred in May, August, and November. As required by 40 CFR 265.94.b.2, the results of this sampling effort are provided in Section 7.4.3 of this report.

The MWL is regulated by the U.S. Environmental Protection Agency (EPA) as a solid waste management unit (SWMU) under RCRA. Groundwater monitoring activities at the MWL are in accordance with the requirements of 40 CFR 264, " Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," Subpart F, Section 264.101, " Corrective Action for Solid Waste Management Units."

Groundwater sampling activities at TA-II, LWDS, and SWHC are conducted as part of the site-specific investigations under the Hazardous and Solid Waste Amendments (HSWA) permit for SNL/NM.

7.2 SANDIA NATIONAL LABORATORIES/NEW MEXICO GROUNDWATER MONITORING WELL NETWORK

In CY 93, the following SNL/NM groundwater monitoring activities were performed:

Static water levels were measured in 34 SNL/NM and KAFB wells and 2 springs (including Hubbell Spring on Isleta Indian Pueblo) (Figure 7-1).

The basewide project sampled groundwater from 16 to 17 SNL/NM, KAFB, New Mexico Environment Department (NMED), and DOE wells and 3 springs (including the Isleta Indian Pueblo Hubbell Spring) (Figure 7-1).

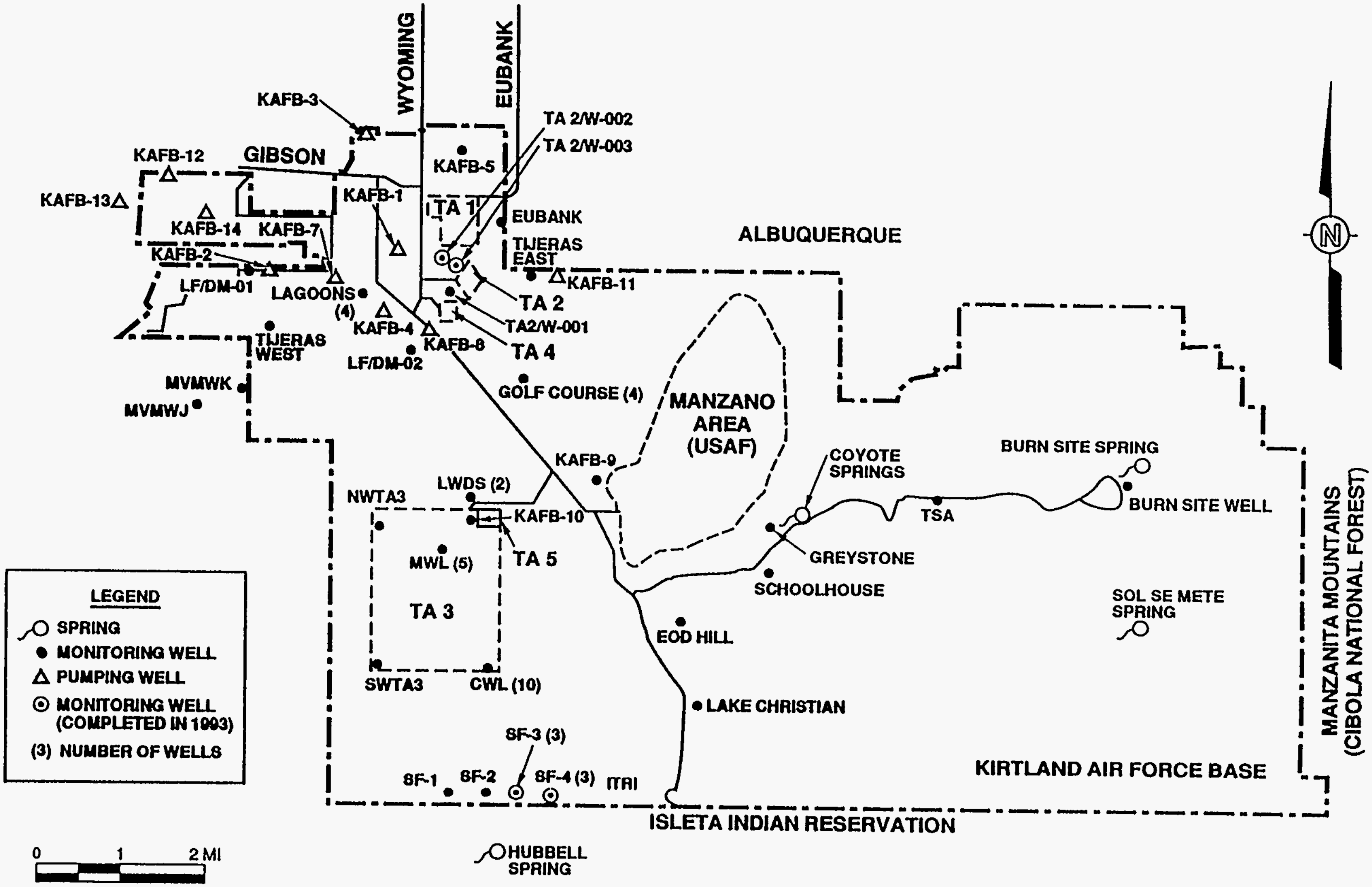

Figure 7-1. Location Map of Sandia National Laboratories and Kirtland Air Force Base Wells and Springs

CWL groundwater monitoring consisted of sampling seven wells (designated "MW") surrounding the landfill and three background wells (designated "BW") (Figure 7-2).

MWL groundwater monitoring consisted of sampling at four wells surrounding the landfill, including one background monitoring well and one monitoring well located inside the landfill (Figure 7-3).

TA-II groundwater samples were collected from one well near the Building 901 septic leachfield and two background monitoring wells in the vicinity of TA-II (Figure 7-4).

LWDS groundwater samples were obtained from two newly installed wells, one adjacent to the LWDS lagoons and the other near the location of the buried LWDS waste line immediately outside TA-V (Figure 7-5).

The SWHC task has installed a series of monitoring wells at four locations along the south fenceline of KAFB. These include a nested pair of wells at SFR-1 (SFR-1D and SFR-1S), SFR-2S, three monitoring wells at SFR-3 (SFR-3, SFR-3T, and SFR-3P), and two monitoring wells at SFR-4 (SFR-4T and SFR-4P) (Figure 7-6).

7.3 WATER LEVEL MEASUREMENTS

Monthly water level measurements were made during 1993 at 34 wells and 2 springs in accordance with SNL/NM procedure PRO 90-02 (Goodrich 1990). Water level elevations were also measured in all CWL and MWL wells prior to each sampling event to ensure that the monitoring well network consisted of at least one upgradient well and three downgradient wells. Seven of the wells and springs included in the program are located east of the faults, with depth to groundwater varying from 0 to 100 feet (ft) (0 to 30 meters [m]); all others are west of the faults, with depths to groundwater up to 500 ft (150 m). Monthly summaries of all depth-to-water measurements and corresponding water surface elevations made at SNL/NM from January through December 1993 are included in "Calendar Year 1993 Annual Groundwater Monitoring Report" (SNL 1994). The water level data collected during 1993 and the subsequent groundwater elevation analyses are discussed in the following sections.

The locations of monitoring wells used for SNL/NM water level measurements are shown in Figure 7-1. Hydrographs constructed from the water-level data are presented as Figures 7-8 through 7-15. Each of these hydrographs has been presented with the same relative vertical scale to facilitate interpretation and comparisons. Wells have been grouped on the hydrographs by their locations. Where data are missing, dashed lines have been used to maintain continuity between adjacent points in the plots. Each of the hydrographs is discussed below.

For comparison with the monitoring well water-level data, the KAFB production well pumping volumes are plotted by month for 1993 in Figure 7-7. There is a seasonal pattern of increased pumpage during the spring and summer months, followed by a significant drop in pumping during the fall and winter.

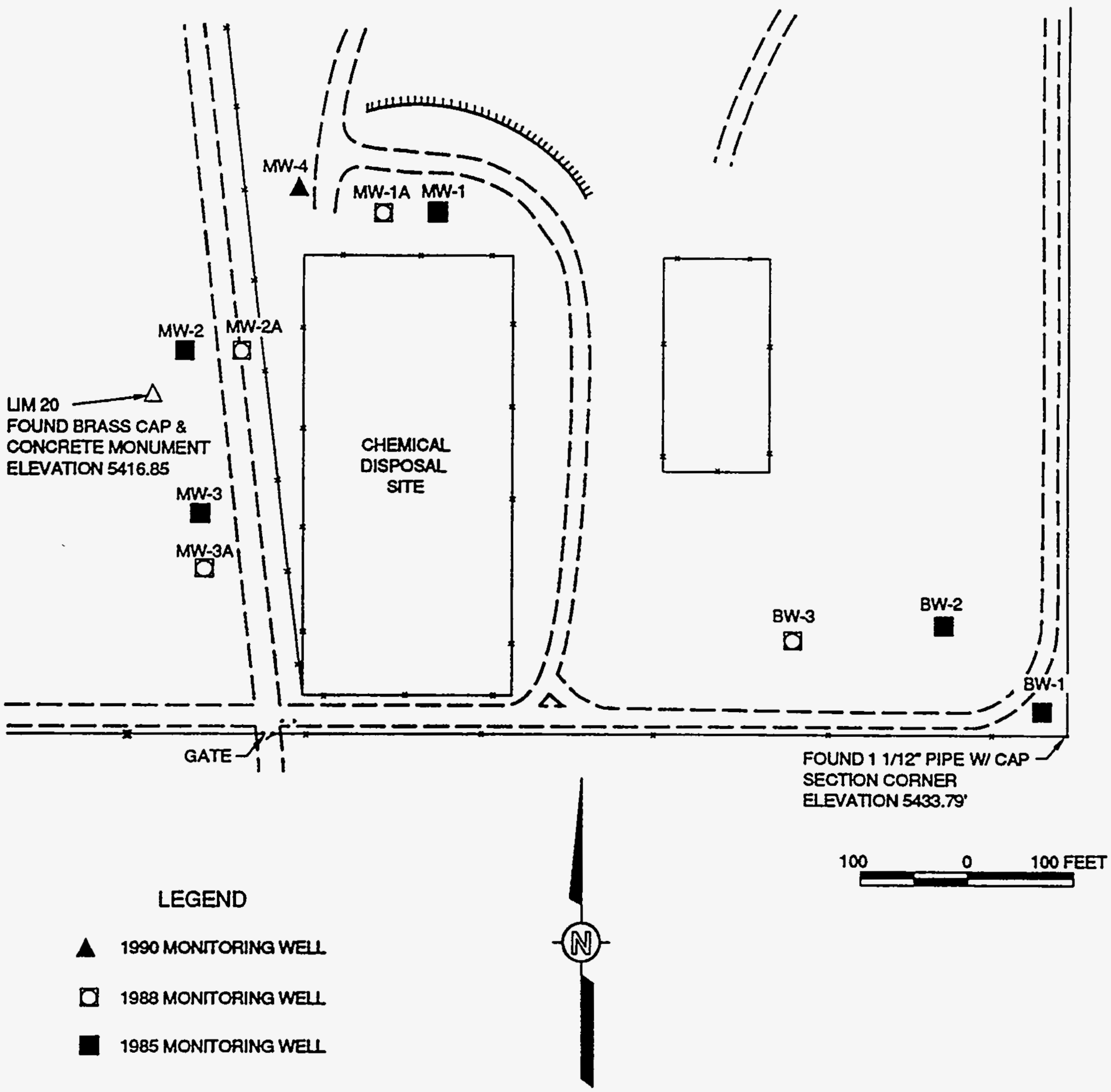

Figure 7-2. Chemical Waste Landfill Monitoring Well Locations

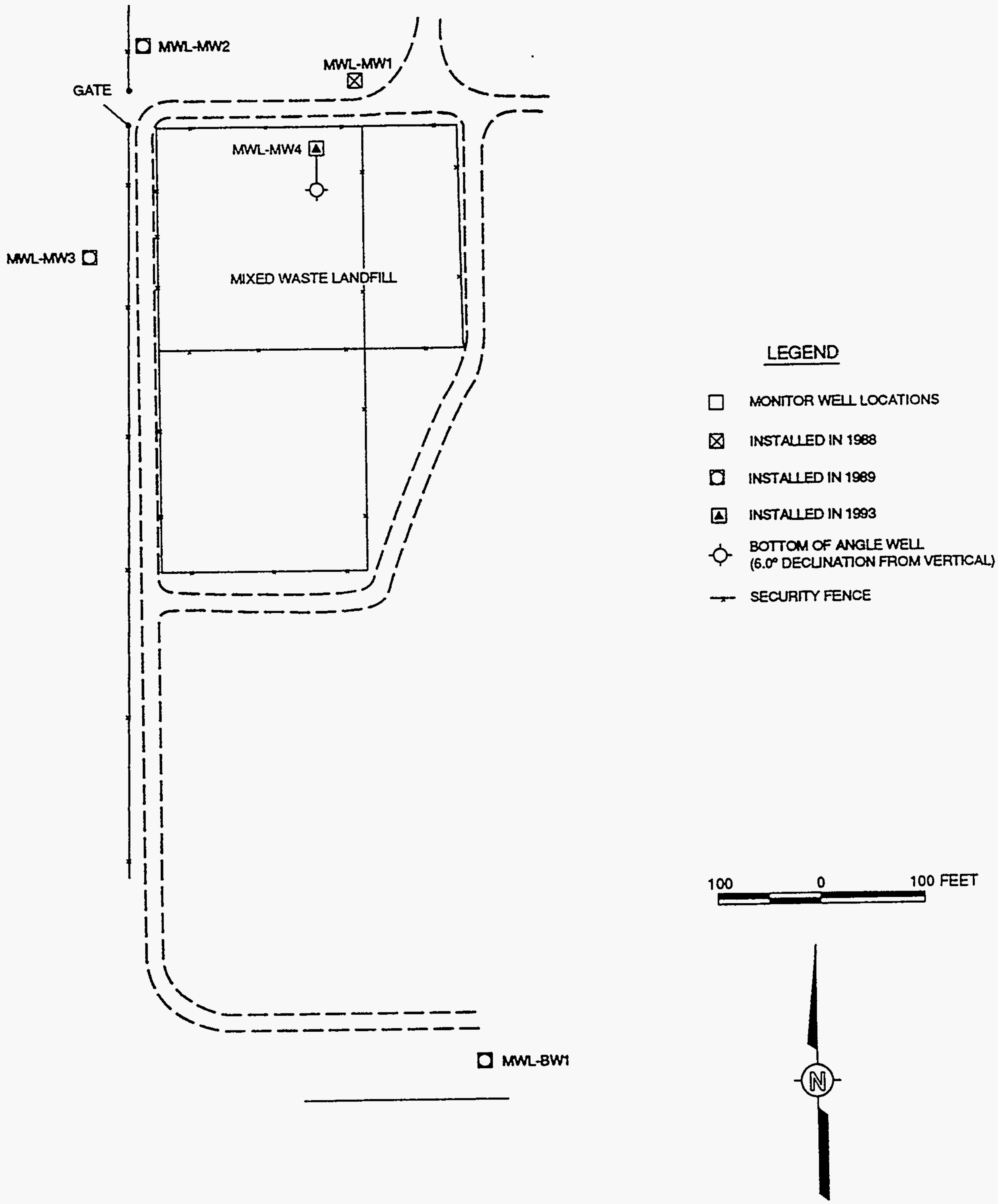

Figure 7-3. Mixed Waste Landfill Monitoring Well Locations

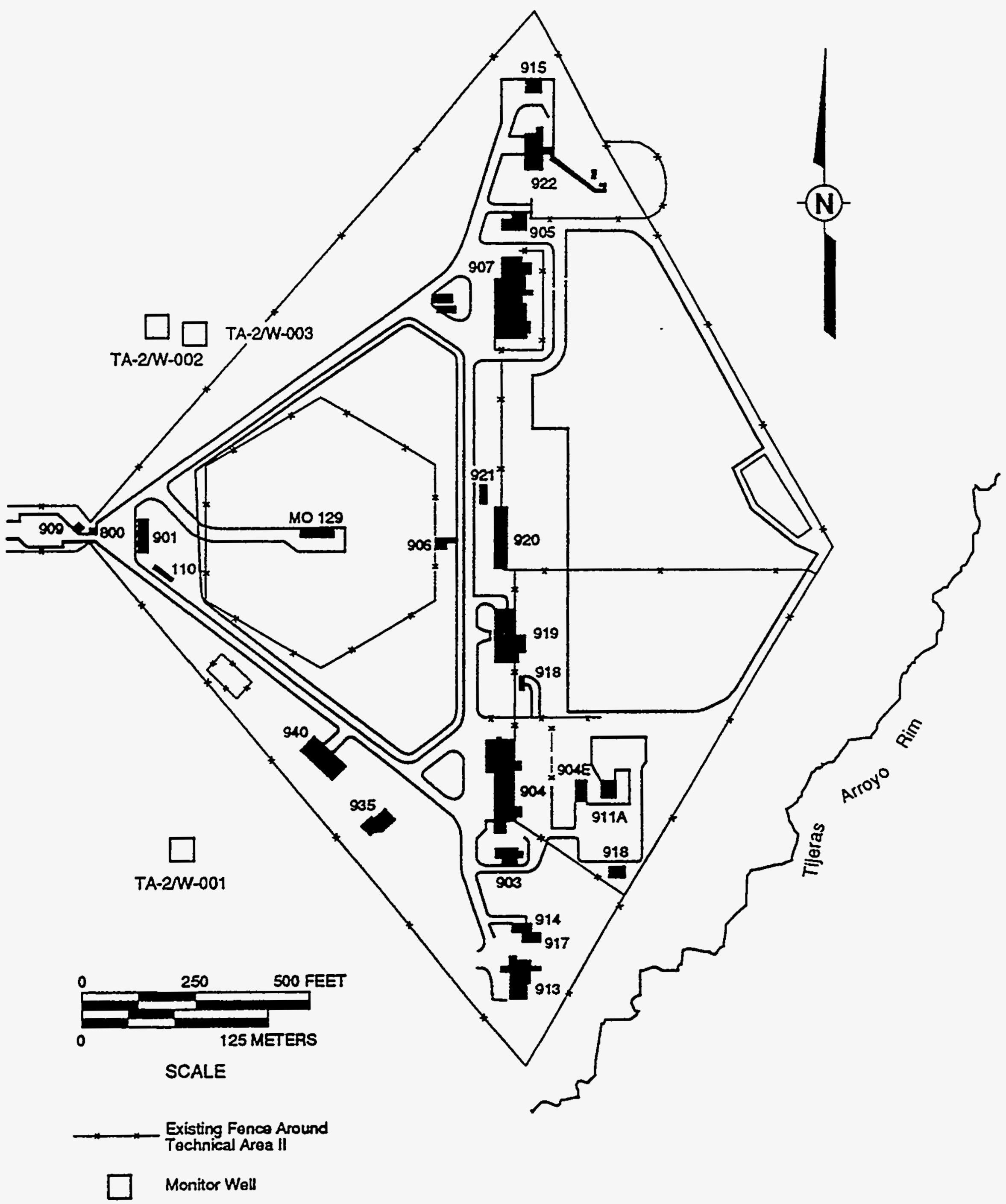

Figure 7-4. Technical Area II Monitoring Well Locations

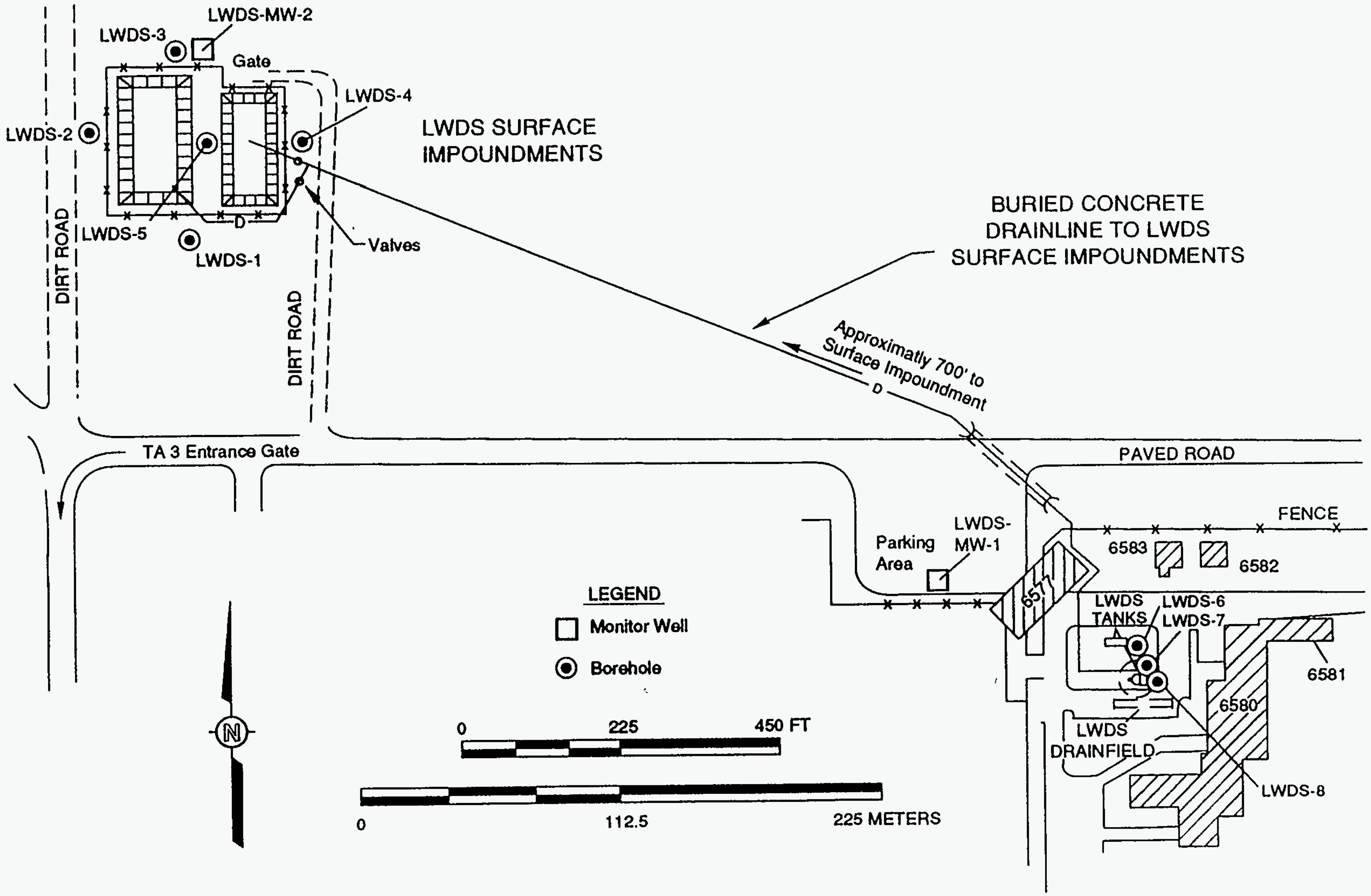

Figure 7-5. Liquid Waste Disposal System Site Borehole and Monitoring Well Locations

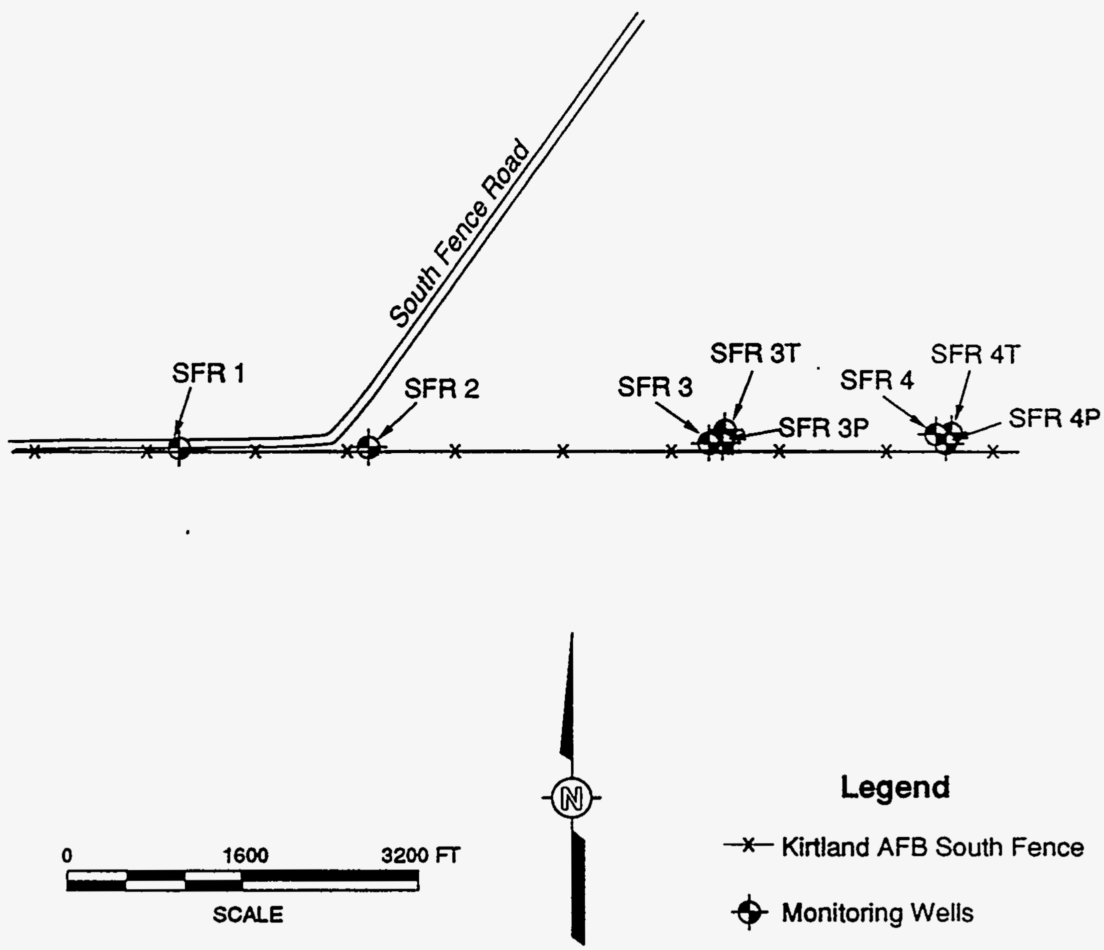

Figure 7-6. South Fence Road Well Locations, Sitewide Hydrogeologic Characterization Project

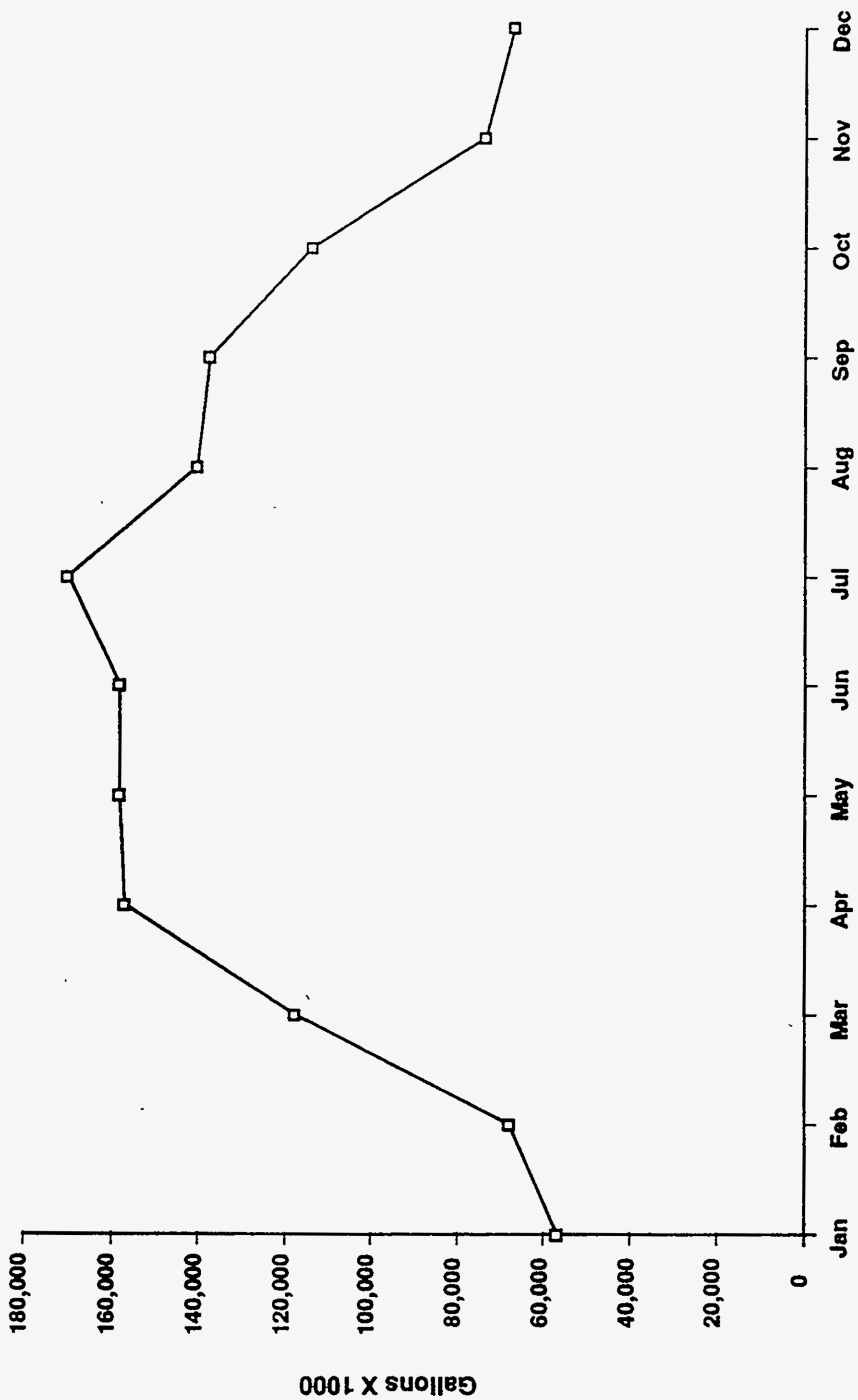

Figure 7-7. Water Pumped by Kirtland Air Force Base Production Wells, 1993

The CWL wells have been divided into two groups: the shallow monitoring well network (Figure 7-8) and the deep monitoring well network (Figure 7-9). The hydrographs of these wells show that the potentiometric surface elevation at the CWL is fairly constant over time, with minor fluctuations. In general, the wells show a slight decline in water levels from March through August or September, followed by a slight rise in the water levels. In four cases (CWL-BW3, CWL-MW1A, CWL-BW2, and CWL-MW2) the water levels exhibit a small isolated rise in February 1993. In addition to the general pattern discussed above, the shallow wells show a pattern of significant water level drop in November 1993, followed by a slight rise in December. The deep wells, on the other hand, show one of the following: (1) a steady rise from August to December (CWL-BW1 and CWL-BW2), (2) a rise from August through November followed by a drop in December (CWL-MW3), (3) a rise from August through October followed by a drop in November and a slight rise in December (CWL-MW4), or (4) a rise from August through September followed by a slow, steady decline through December (CWL-MW2). The shallow well network at the CWL satisfies the requirements of 40 CFR 265.91 in that the wells are located such that CWL-BW3 is hydraulically upgradient, while CWL-MW1A, CWL-MW2A, and CWL-MW3A are hydraulically downgradient from the site (Figure 7-8). Similarly, the network of deep wells are located such that CWL-BW1 and CWL-BW2 are hydraulically upgradient from CWL-MW2, CWL-MW3, and CWL-MW4 (Figure 7-9). The downgradient wells are located at the limit of the waste management facility, where they are capable of immediately detecting any release that may migrate to the aquifer.

The potentiometric surface elevation of the wells at the MWL were measured in January, March, and April 1993. During these three months, the water levels were relatively constant, except for a rise in the water measured in MWL-MW1 from January to April 1993 (Figure 7-10).

The hydrographs for other wells in TA-III are shown in Figure 7-11. The hydrograph for the KAFB-10 well shows a slight dip in water levels during the summer moths, June through August 1993. The hydrograph for the NW-TA3 well exhibits relatively constant water levels throughout the year, with only slight variations. In contrast, the hydrograph for SW-TA3 exhibits a large drop in water level associated with the well being purged dry in early October. Note that there is also a drop in the water level in May 1993, a few weeks after the April 1993 basewide quarterly purging and sampling event. This drop is followed by a rise in June as the well continues to recover. In July, this well was purged and sampled again, resulting in another drop in water level in the August 1993 measurement. This well is characterized by very slow recovery, on the order of three weeks, after being purged. Hence, the hydrograph is depicting variations in water level as a function of proximity to a purging event rather than actual variations in the potentiometric surface in the area.

The hydrographs for the wells located east of the fault complex are shown in Figure 7-12. (Note that the vertical axis of the hydrograph has been split into three sections to fit all four wells on the same figure; however, the vertical axis segments are the same relative scale as the vertical axes of the other hydrographs.)

Each of these wells exhibit relatively flat hydrographs, but with slight declines during the spring and summer months, followed by a rise in water

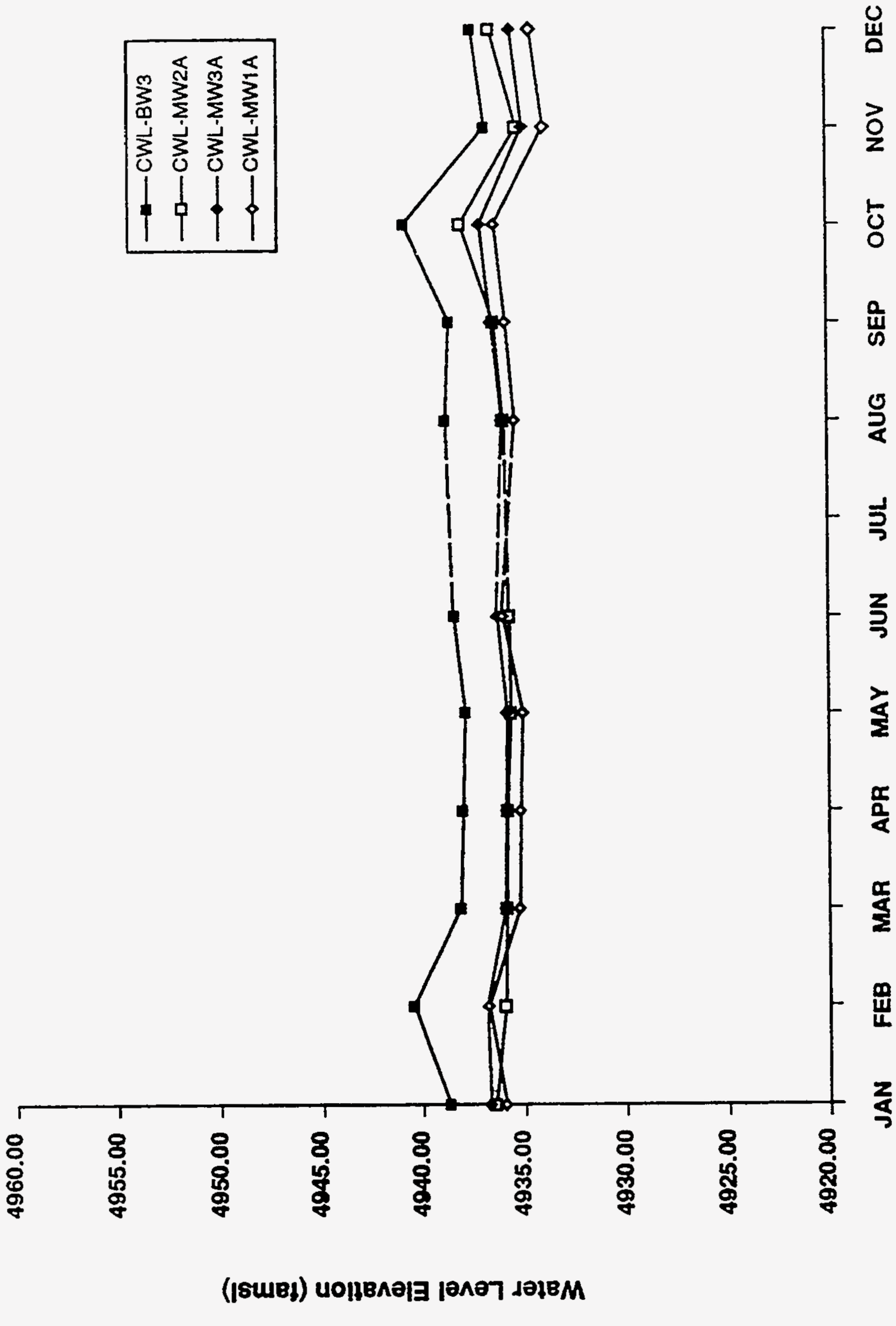

Figure 7-8. Hydrographs for Chemical Waste Landfill Shallow Monitoring Wells, 1993 (dashed lines provide continuity over a gap in data values)

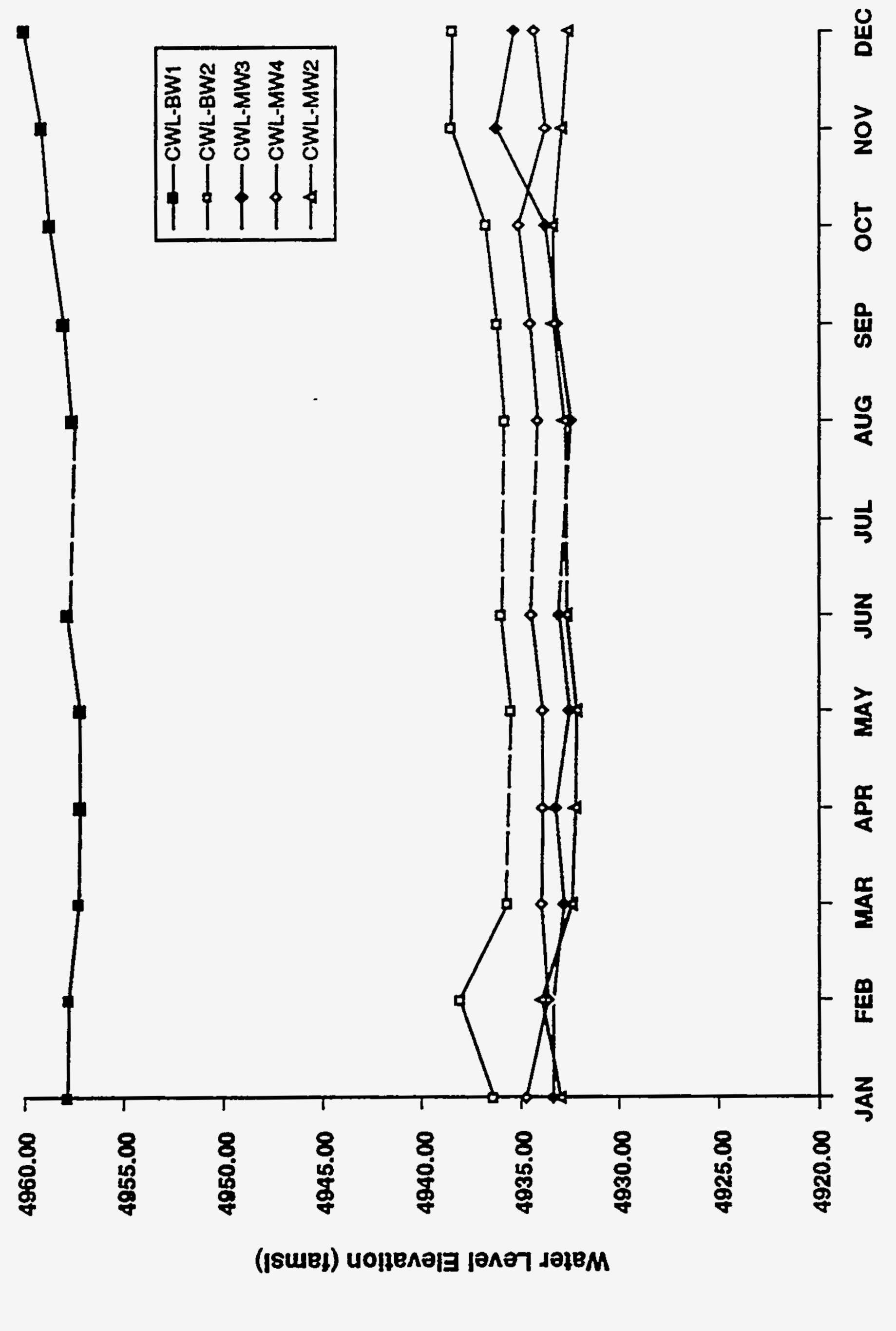

Figure 7-9. Hydrographs for Chemical Waste Landfill Deep Monitoring Wells, 1993 (dashed lines provide continuity over a gap in data values)

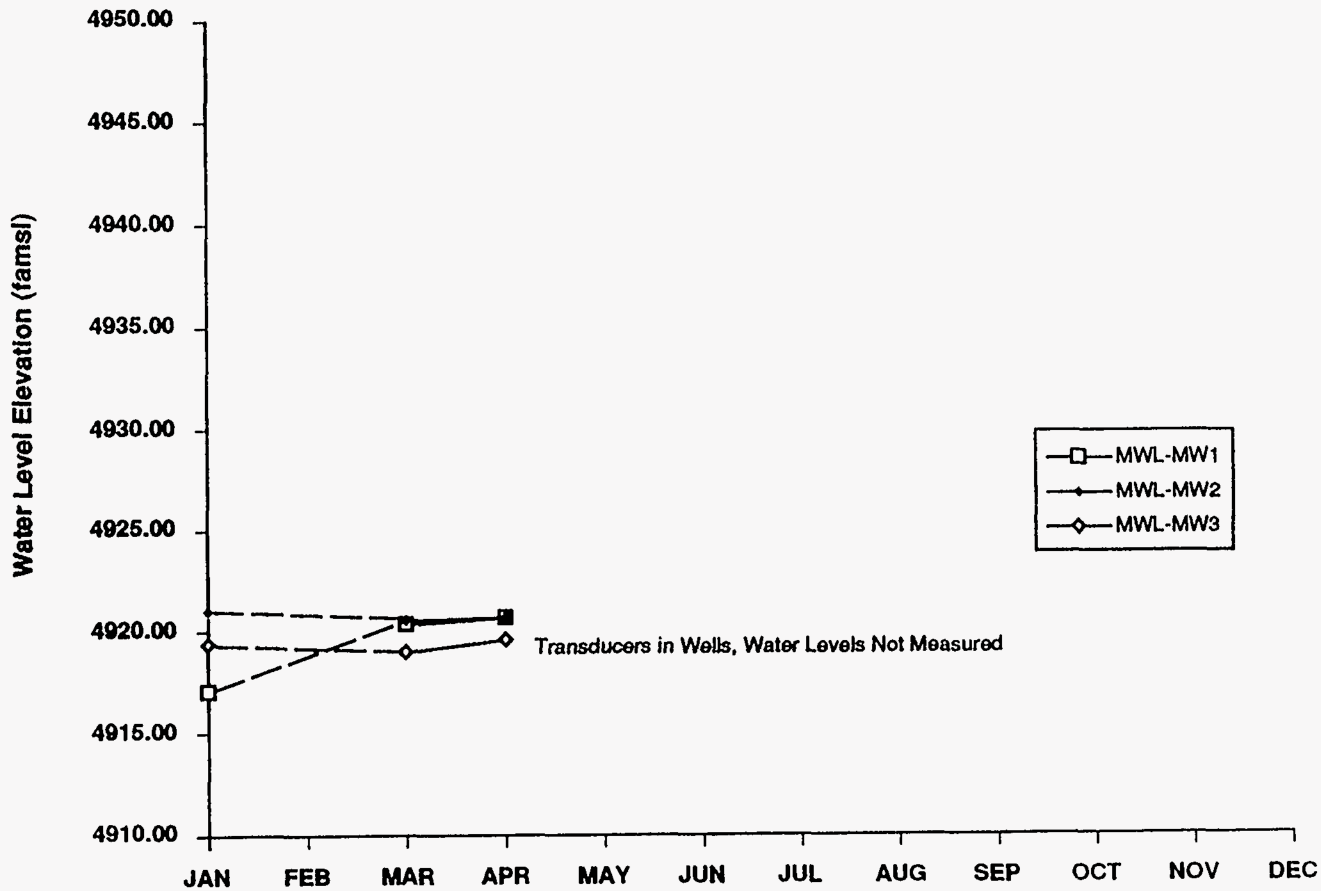

Figure 7-10. Hydrographs for Mixed Waste Landfill Monitoring Wells, 1993 (dashed lines provide continuity over a gap in data values)

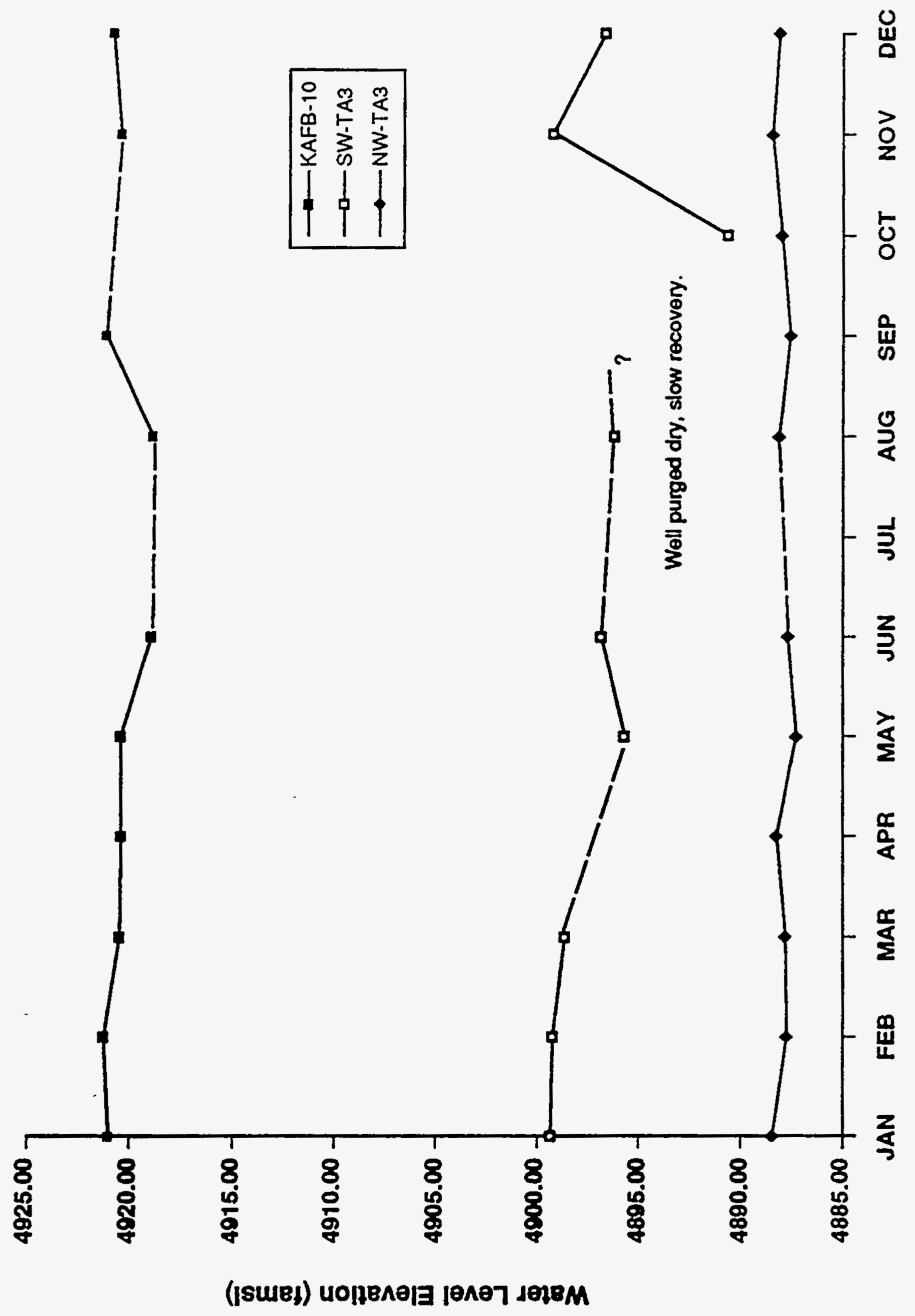

Figure 7-11. Hydrographs for Other Monitoring Wells in Technical Area III, 1993 (dashed lines provide continuity over a gap in data values)

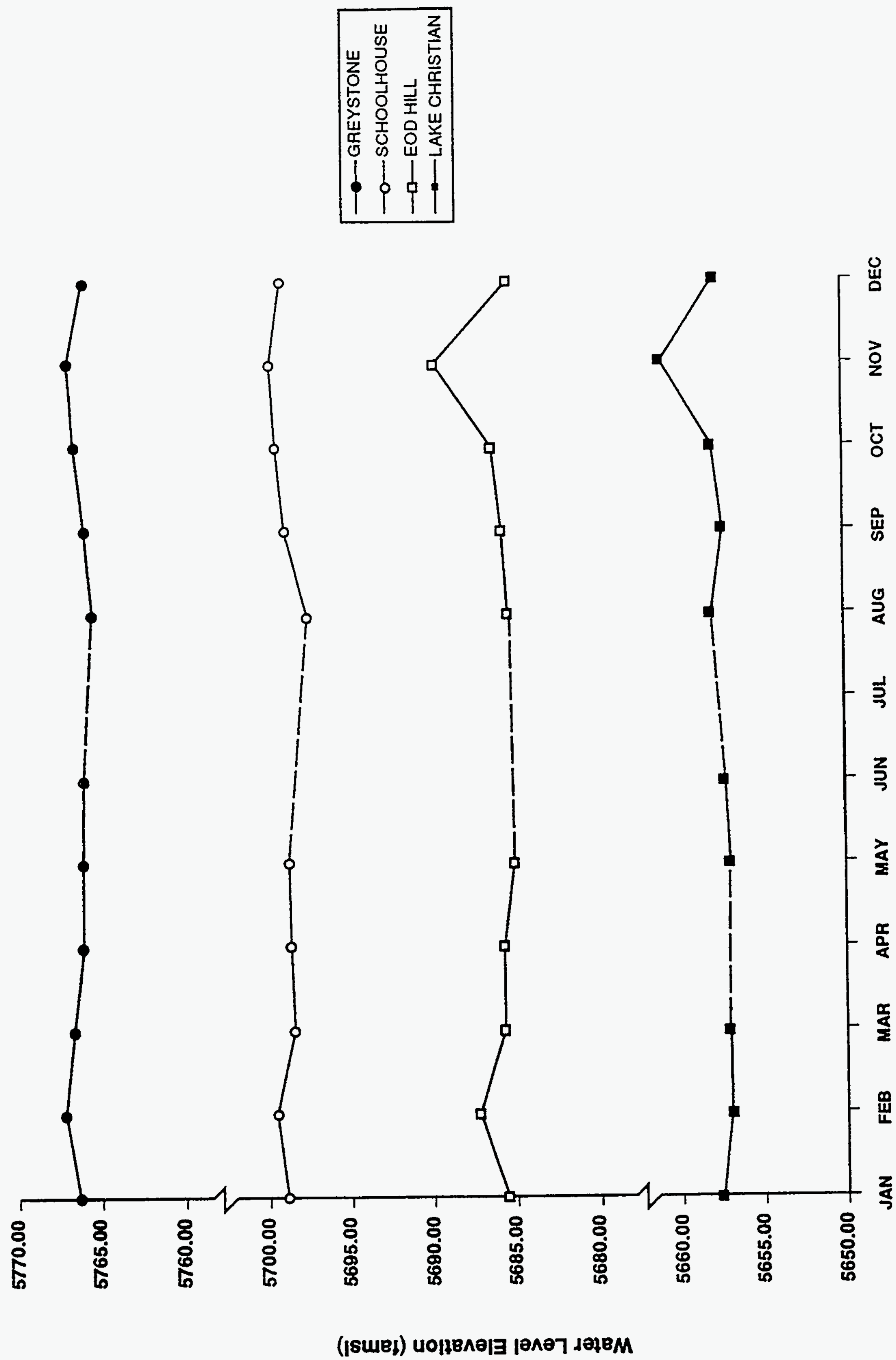

Figure 7-12. Hydrographs for Monitoring Wells East of the Faults, 1993 (dashed lines provide continuity over a gap in data values)

levels that peaks in November. The autumn rise in the water table may reflect recharge associated with the summer precipitation season.

The hydrographs for the KAFB Sanitary Lagoon monitoring wells have been superimposed with the graph of the volumes of water pumped per month from KAFB production wells during 1993 (Figure 7-13).

The KAFB Sanitary Lagoon wells are located close to a number of active KAFB production wells, and there appears to be an inverse correlation between water levels in the Lagoon monitoring wells and the KAFB pumping rates (i.e., the monitoring well water levels decline during periods of increased pumping volume and rise during periods of decreased pumping volume). The pattern of the hydrographs indicates a direct response of the aquifer to pumping in that area.

In Figure 7-14, the hydrographs for all but one well (LF/DM-01) located near Tijeras Arroyo (that is, wells LF/DM-02, MVMW-J, MVMW-K, Tijeras East, and Tijeras West) exhibit subtle declines in water levels from February through May, followed by a slight rise in June, followed by a sharp rise beginning in October, to a peak water-level elevation in November 1993.

The slight decline in March through May may reflect a response to the seasonal increase in KAFB production well pumping, while the sharp rise in October and November may reflect the seasonal drop in KAFB production well pumping volumes at that time. In addition, the October and November rise may be attributable to recharge from summer rains.

However, the LF/DM-01 hydrograph (Figure 7-14) shows a dramatic drop in water-level elevation between February 1993 and August 1993, and an even steeper drop from August to September, returning to a level similar to that of August in October, November, and December. These radical variations are an artifact of a change in the wellhead elevation associated with construction activities along the airfield margin during 1993. They do not represent radical variations in the groundwater level elevations. The water level measurements will be corrected in the future once the new wellhead elevation has been resurveyed.

The Golf Course Well hydrographs show a fairly steady, slow rise in water levels over the spring, summer, and early fall, followed by a drop in November 1993 (Figure 7-15). This pattern of seasonal rise and fall may reflect seasonal irrigation patterns at the golf course. A local groundwater mounding may be occurring during the months of maximum irrigation followed by dissipation of the mound during lower irrigation months.

7.3.1 Direction of Groundwater Flow

To determine the general horizontal hydraulic gradient throughout the SNL/NM-KAFB area, groundwater surface elevations have been measured in all accessible SNL/NM monitoring wells and adjacent KAFB and state of New Mexico monitoring wells on a monthly basis since May 1989. Static water level data from all these monitoring wells (SNL 1994) were used as indicators of the potentiometric surface at various locations. While many of the water levels appear to represent an unconfined water table, the water levels measured in some of the wells indicate confined aquifers. The data points were contoured

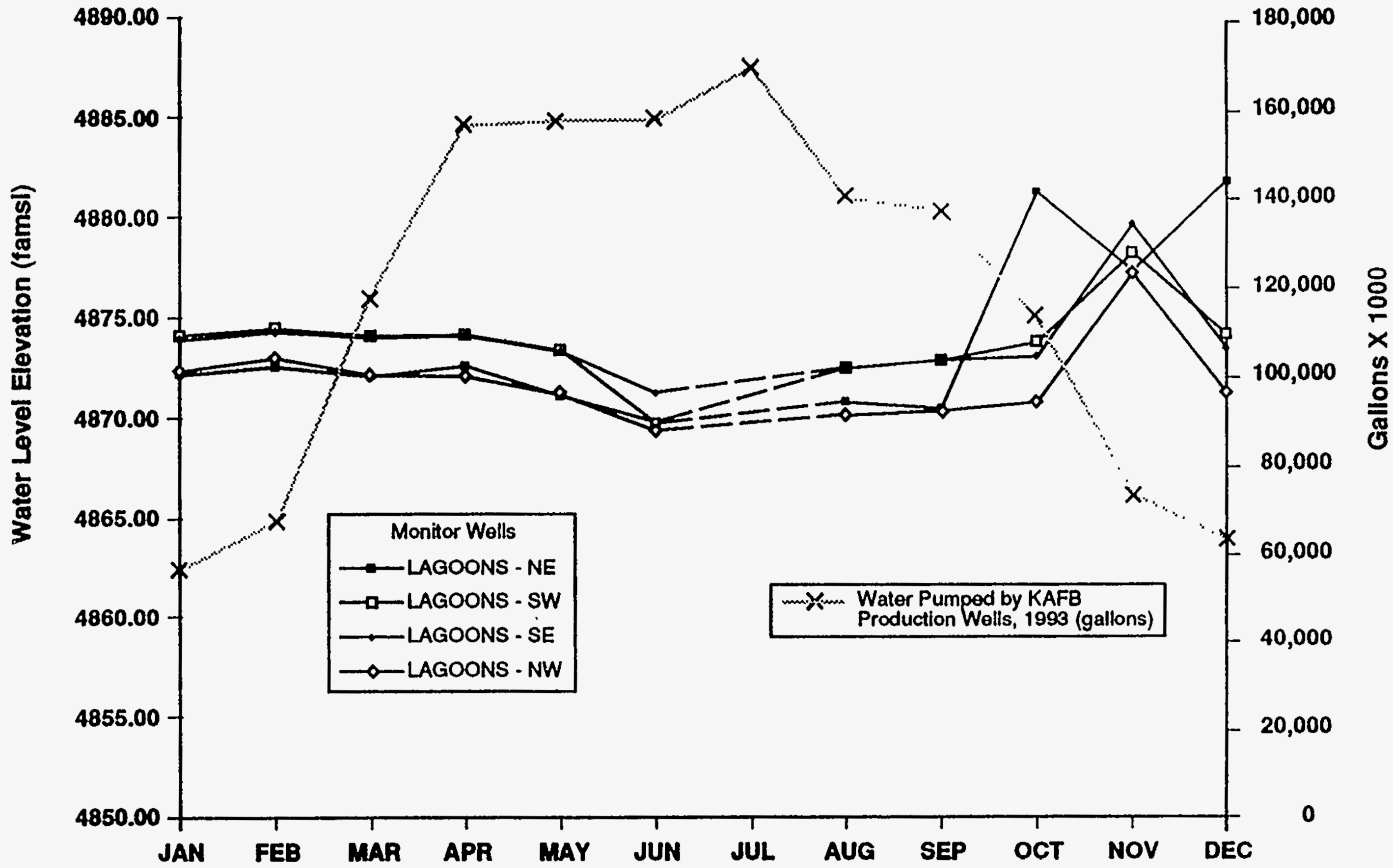

Figure 7-13. Hydrographs for Monitoring Wells at Kirtland Air Force Base Sanitary Lagoons, with Water Pumped by KAFB Production Wells, 1993 (dashed lines provide continuity over a gap in data values)

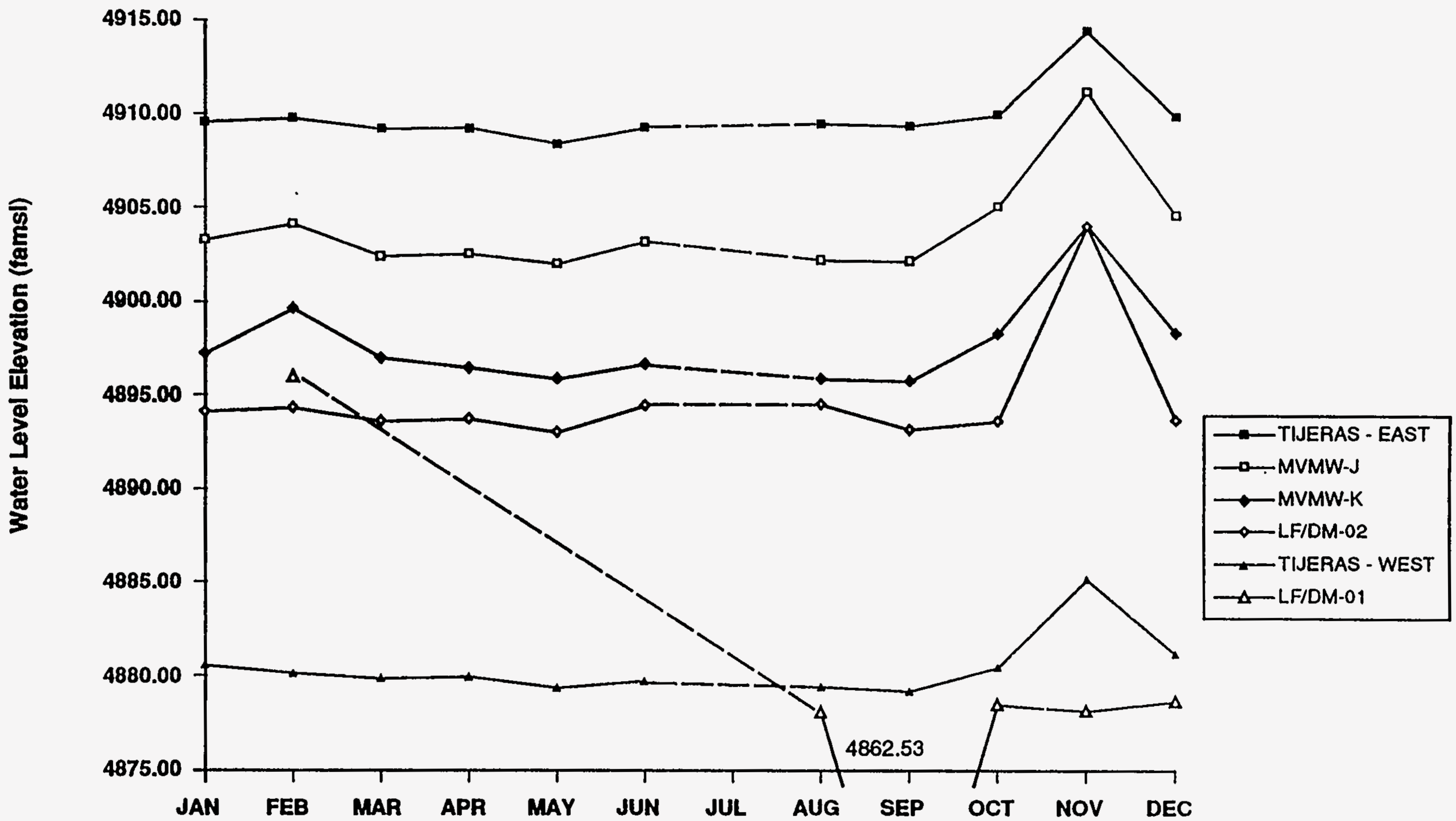

Figure 7-14. Hydrographs for Monitoring Wells Near Tijeras Arroyo, 1993 (dashed lines provide continuity over a gap in data values)

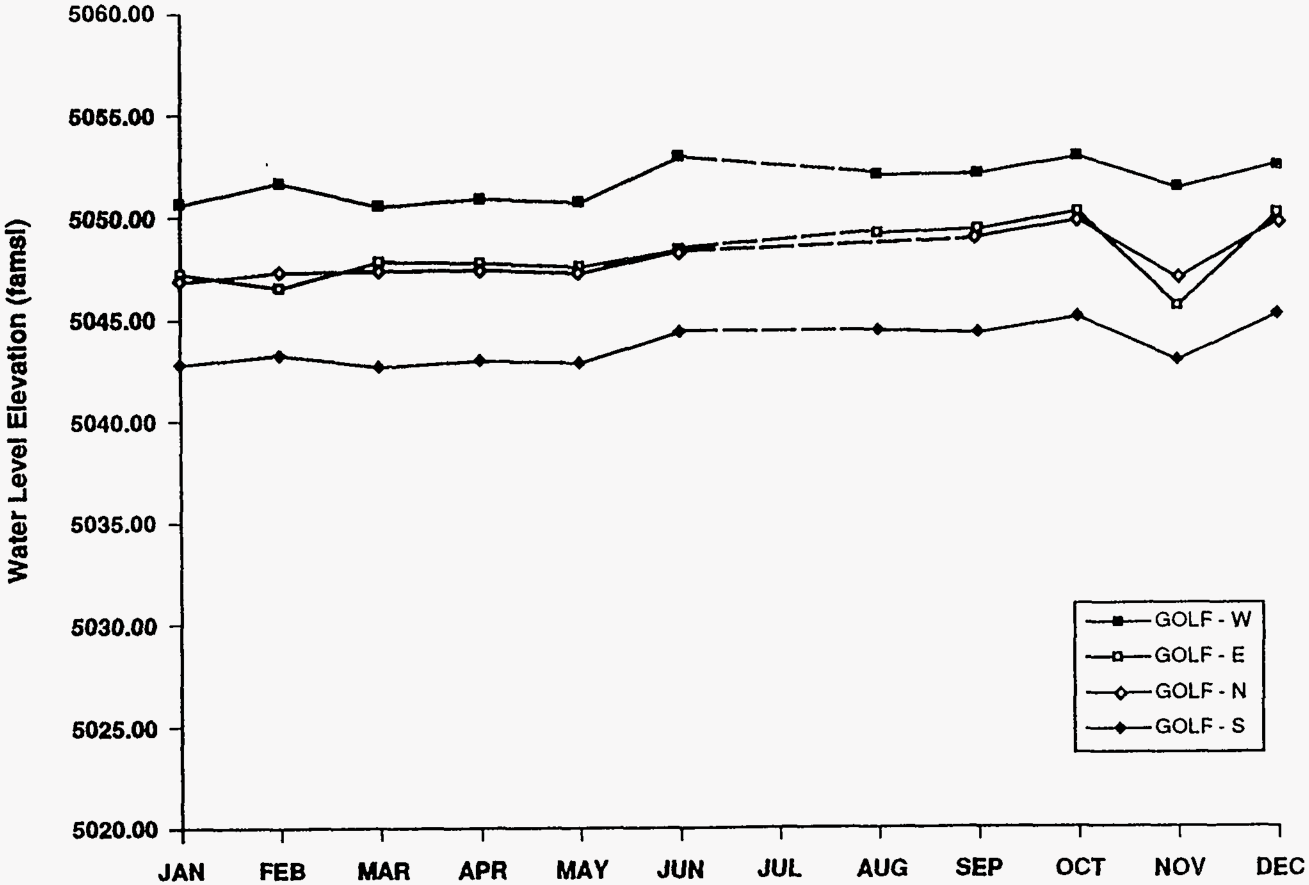

Figure 7-15. Hydrographs for Kirtland Air Force Base Golf Course Monitoring Wells, 1993 (dashed lines provide continuity over a gap in data values)

using SURFER® (Golden Software 1991) to generate the potentiometric surface map of the SNL/NM area (Figure 7-16). The direction of groundwater flow is perpendicular to the equipotential lines. The apparent direction of groundwater flow is generally to the west and northwest.

It is clear that the data set of water level elevations contains several ambiguities, which complicate the interpretation of a potentiometric surface. First, it is possible that some of the water levels in the wells reflect completions in different groundwater zones; therefore, the data set does not represent the elevation of a single groundwater unit. Second, the screens of the wells are of varying lengths. The KAFB production wells are screened over large intervals, usually starting at the water table and extending several hundred feet into the saturated zone. The monitoring wells typically have 20-ft screens placed across the water table. If the groundwater flow is not uniformly horizontal (i.e., vertical gradients exist), then the longer screen lengths do not provide true groundwater table elevation data. They provide the average groundwater potential across the length of the screen, which may differ from a piezometer measurement at the water table surface if vertical gradients are present. The potentiometric surface contour map (Figure 7-16) is the best currently available interpretation of the data, pending further investigation. The Sitewide Hydrogeologic Characterization activities are, in part, investigating these complications of the potentiometric surface data interpretation.

7.3.2 Production Well Pumping

The apparent direction of groundwater flow in the KAFB area currently is west and northwest, in contrast to the southwesterly direction reported by Bjorklund and Maxwell (1961). This difference is probably due to the fact that groundwater pumping by KAFB and nearby City of Albuquerque production wells has had an effect on the hydraulic gradient in the area, creating an apparent cone of depression in the potentiometric surface in the northern portion of KAFB (Figure 7-16). Over 1.4 billion gallons of water were pumped from the KAFB production wells in 1993 (Figure 7-7) (Klimm 1993). About twice as much water is pumped during the summer months, when there is a high water demand, compared to the winter months. Due to a lack of spatial data, the shape and extent of the cone of depression formed by the production wells is not precisely known at this time and is under investigation by SNL/NM and other KAFB tenants.

7.4 GROUNDWATER SAMPLING

The results of groundwater surveillance sampling for the basewide project are presented in "Calendar Year 1993 Annual Groundwater Monitoring Report" (SNL 1994). Sixteen to seventeen wells and three springs across KAFB and SNL/NM were sampled each quarter. This includes two sitewide project wells sampled in April, July, and September and four in December 1993. Details of the quarterly sampling events may be found in the reports on quarterly basewide groundwater monitoring for April, July, September, and December 1993 (IT 1993c, 1993d, 1993e, and 1993f). The results of both annual groundwater quality monitoring and quarterly assessment monitoring conducted at CWL in 1993 are also found in "Calendar Year 1993 Annual Groundwater Monitoring Report" (SNL 1994). Details of the sampling events may be found in the CWL annual

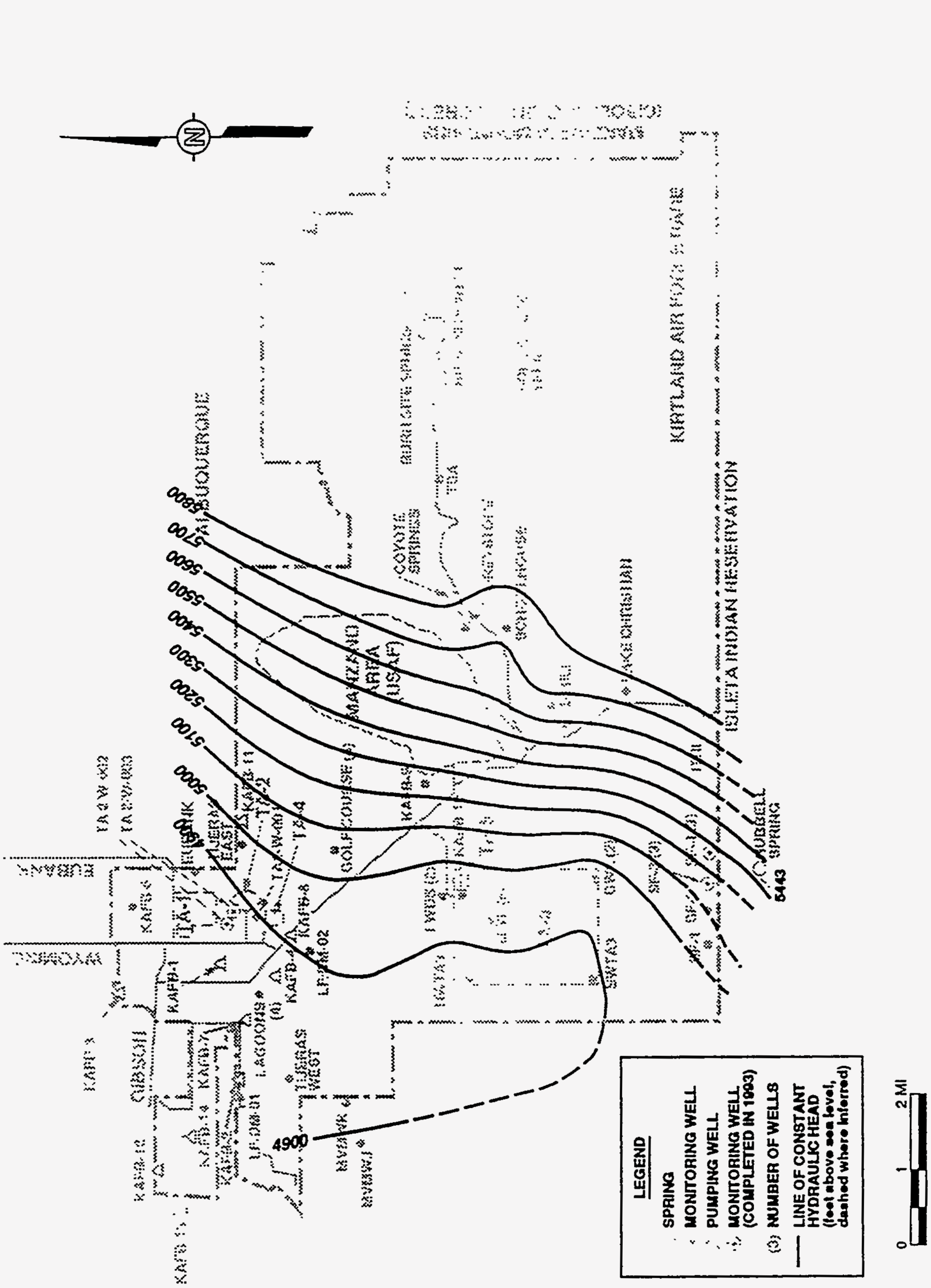

Figure 7-16. Kirtland Air Force Base Potentiometric Surface Map, July 1993 Contours Derived from Monitoring Well Water Levels Only (dashed lines provide continuity over a gap in data values)

groundwater assessment monitoring report (IT 1993g) and in the quarterly groundwater assessment monitoring reports (IT 1993h, 1993i, 1993j).

Groundwater from MWL monitoring wells MWL-BW1, MWL-MW1, MWL-MW2, and MWL-MW3 was sampled in January, April, and November 1993 (SNL 1994). Details of these sampling events may be found in the MWL draft reports on semiannual groundwater sampling (IT 1993k, 1993l).

Groundwater samples were collected from TA-II monitoring wells in November 1992, March 1993, and June 1993, from LWDS-MW1 in November 1993, and from LWDS-MW2 in June 1993 (SNL 1994).

7.4.1 Sampling Procedures and Methods

Samples were collected for the Basewide Groundwater Surveillance Program in 1993 in accordance with the "Sitewide Groundwater Monitoring Program Sampling and Analysis Plan" (SNL 1993h, draft); this plan was also used as guidance for groundwater sampling at TA-II, LWDS, and the sitewide South Fence Road wells. The protocols for collection and analysis of representative groundwater samples at CWL in 1993 are specified in the "Chemical Waste Landfill Final Closure Plan and Post Closure Permit Application," Appendix G, "Sampling and Analysis Plan for Groundwater Assessment Monitoring at the Chemical Waste Landfill, Revision 4" (SNL 1992a). MWL sampling and analysis activities were conducted in accordance with the "Mixed Waste Landfill Sampling and Analysis Plan" (SNL 1990b, draft).

The general procedure for collecting groundwater samples at all areas in 1993 included the following activities:

1. Measuring the groundwater elevation in each well

2. Purging each well of three casing volumes of groundwater (up to a maximum of 100 gallons, with exceptions for low-yield wells, as noted in individual event reports)

3. Collecting the desired groundwater sample and appropriate quality control (QC) samples in specified containers provided by the analytical laboratories with appropriate preservatives as needed

4. Sending the samples to the analytical laboratories for analyses under strict chain-of-custody documentation.

Measurements of field water quality parameters were made during purging to determine stabilization of water quality parameters prior to sample collection so that representative samples could be collected. Specific details pertaining to each groundwater sampling event are described in the individual sampling reports referenced herein. These reports contain summary tables, complete field and laboratory data, QC data, and descriptions of the analytical methods employed by the analytical laboratories.

7.4.2 Sandia National Laboratories/New Mexico Groundwater Surveillance Results

The SNL/NM Groundwater Surveillance Project sampled 16 to 17 wells and 3 springs on a quarterly basis during April, July, September, and December 1993. Analytes detected above acceptable levels may determine the method of disposal of wastewater, which consists of purge water and dilute decontamination solutions. These analytes include any organic compounds detected at or above the minimum detection limits (MDL) (Appendix K, Tables K-1a, b, c, and d) and any other analytes detected at or above maximum contaminant levels (MCL) established by the EPA Primary Drinking Water Regulations (PDWR) in 40 CFR 141.11(b) and maximum contaminant level goals (MCLG) established by EPA PDWR in 40 CFR 141.51(b) (Tables K-2a, b, c, and d).

Prior to and immediately after the sampling of each well or spring, a set of field water quality parameters was measured when adequate water volumes were available. These parameters include pH, temperature, specific conductivity, and turbidity (Tables K-3a, b, c, and d). Detailed discussion of these measurements can be found in the appropriate quarterly reports.

Basewide sampling during 1993 represents a major expansion in the analyte list from previous years. The new analyte list was devised to provide a set of data for groundwater contamination detection monitoring comparable to the analytes investigated for other projects, such as the CWL, MWL, LWDS, and TA-II. Previous to 1993, basewide sampling analytes had been chosen simply to characterize the water quality. For meeting regulatory guidance and for consistency with other projects, the new analyte list follows 40 CFR 265, Subpart F. This new list is representative of parameters for potential contaminants, indicators of potential contamination, and safe drinking water. Because total organic halogens (TOX) analysis may not accurately indicate potential contamination, volatile organic compounds (VOCs) (EPA method 8260) (EPA 1986b) and a library search for other VOCs have been added to the analyte list. In addition, groundwater samples are screened for radionuclides using gamma spectroscopy.

Analytical results from each of the sampling events are presented in "Calendar Year 1993 Annual Groundwater Monitoring Report" (SNL 1994), which contains the results of all analyses except for herbicides and pesticides, which have not been detected in any basewide groundwater sampling events.

<u>Volatile Organic Compounds</u>: Analyses for VOCs and library searches for the four reported quarters detected VOCs which are all common laboratory solvents (e.g., acetone, 2-butanone, carbon tetrachloride, and methylene chloride) (SNL 1994) (Tables K-4a, b, c, and d). The fact that these contaminants are present in QC samples (e.g., trip blanks, equipment blanks, and method blanks) suggests that they were introduced at the laboratory and do not indicate groundwater contamination. The minor concentrations of unknown compounds tentatively identified by the library search also probably represent laboratory contamination (Tables K-5a, b, c, and d).

<u>Inorganic Compounds and Phenolics</u>: The population of basewide sampling sites may be divided into two sample sets (one east of the Hubbell Springs and Sandia faults, the other west of these faults) on the basis of geographic location and water-level elevation at a given site. Burn Site Well, Sol se Mete Springs,

Coyote Spring, Greystone Manor Well, Schoolhouse Well, Explosive Ordnance Detonation (EOD) Hill Well, South Fence Well #1, South Fence Well #2, and Hubbell Spring are either east of or along the fault complex. All of the other wells are west of the faults. East-side wells are typically characterized by relatively low pH, high alkalinity, high concentrations of bromide, chloride, fluoride, and sulfate, and lower nitrate plus nitrite (NPN) concentrations, relative to the west side wells (SNL 1994). Phenolics were not detected in the groundwater regardless of the well or spring location (Tables K-6a, b, c, and d).

<u>Metals</u>: The wells and springs sampled east of the faults typically have higher concentrations of calcium, magnesium, potassium and sodium than the wells west of the faults. This corresponds to the higher alkalinity and ion concentrations for east-side waters discussed above. Some samples contained metals above established MCLs. These include barium concentrations slightly above the MCL of 1.0 milligrams per liter (mg/L) at MVMW-K, Greystone Manor, and Schoolhouse wells; chromium concentrations above the MCL of 0.05 mg/L at CWL-BW2, MWL-BW1, SF-2, and SW-TA3 wells; cadmium concentrations above the MCL of 0.010 mg/L at KAFB-10; and lead concentrations above the MCL of 0.05 mg/L at KAFB-10 (Tables K-7a, b, c, and d).

<u>Coliform Bacteria</u>: Coliform analyses were performed on the samples collected for the April and September 1993 quarters (SNL 1994). The presence of coliform bacteria has been detected in a variety of wells, but fecal coliform has been detected only in Hubbell Spring. This spring is surrounded by a cattle pasture where the presence of fecal coliform is to be expected (Tables K-8a and K-8b).

<u>Radionuclide Screening</u>: Gamma spectroscopy radionuclide screening detected naturally occurring isotopes. These isotopes are not indicators of anthropogenic radioactive contamination (Tables K-9a, b, c, and d).

Groundwater samples collected in September 1993 were analyzed for the following radionuclides: isotopic uranium (U), isotopic thorium (Th), isotopic plutonium (Pu), strontium-90 (Sr-90), radium-226 (Ra-226), radium-228 (Ra-228), gross alpha and gross beta activities (Table K-10). Groundwater samples collected in December 1993 were analyzed for tritium (H-3) (Table K-11).

7.4.3 Chemical Waste Landfill Assessment Monitoring Results

Annual sampling for assessment monitoring at CWL occurred in February 1993; quarterly sampling took place in May, August, and November 1993 (SNL 1994). These sampling events were conducted in accordance with the "Sampling and Analysis Plan for Groundwater Monitoring at the Chemical Waste Landfill, Revision 4" (Appendix G of the CWL closure plan [SNL 1992a]), which includes annual sampling for all Appendix IX parameters and quarterly sampling for Appendix IX VOCs and total metals. At the request of the NMED, additional monitoring for total and dissolved chromium occurred at monitoring well CWL-BW3 and is summarized in the following Metals section. A summary of detected compounds for the February sampling event is presented in Appendix K, Table K-12; for May the detected VOCs are presented in Table K-13; the August results are in Table K-14a for detected VOCs and Table K-14b for metals; and detected compounds for the November sampling are reported in Table K-15.

Volatile Organic Compounds: Appendix IX VOC laboratory analysis of 1993 CWL groundwater samples detected trichloroethylene (TCE) in monitoring wells CWL-MW1A, CWL-MW2A, and CWL-MW3A. TCE was detected in CWL-MW2A duplicate samples in all four quarters of 1993: February (0.005 and 0.006 mg/L), May (0.002 and 0.002 mg/L), August (0.003 and 0.004 mg/L), and November (0.003 and 0.004 mg/L). Duplicate samples were collected from this well because it has the greatest known potential for detectable VOCs, and sampling system precision measurements cannot be made unless detectable quantities of analytes are present in the duplicate sample. TCE was also detected in CWL-MW3A in all four quarters of 1993: February (0.002 mg/L), May (0.002 mg/L), August (0.003 mg/L), and November (0.001 mg/L). TCE was only detected in CWL-MW1A in May (0.001 mg/L) and August (0.007 mg/L). TCE was not detected in any other CWL groundwater sample in 1993.

The reported occurrence of TCE in a greater number of samples in 1993 as compared to previous sampling events is an artifact of the lower analytical MDLs achieved in 1993. Samples prior to 1993 were analyzed with an MDL of 0.005 mg/L, and the 1993 samples were analyzed at the more sensitive detection limit of 0.001 mg/L.

All other VOCs detected in CWL groundwater samples are common laboratory solvents (e.g., acetone, 2-butanone, carbon disulfide, methylene chloride, and toluene). As these compounds were also detected in associated trip blanks, equipment blanks and/or laboratory method blanks, their presence is considered to be a result of laboratory contamination and not an indication of groundwater contamination.

Since concentrations of VOCs in the CWL monitoring wells have not varied significantly during this sampling year, there is no indication that these constituents are migrating away from the site. This conclusion is supported by the conceptual model of limited contaminant transport developed for this site in Section 3.0 of the CWL closure plan (SNL 1992a).

Metals: All groundwater samples collected from CWL monitoring wells during 1993 were analyzed for Appendix IX metals plus iron. Nickel and chromium are the only metals on the list found to exceed the maximum allowable concentration (MAC) limits set by the New Mexico Water Quality Control Commission. Nickel was detected in CWL-BW3 above the MAC of 200 micrograms per liter (µg/L) in May (270 µg/L) and November (240 µg/L). Total chromium analytical results from monitoring well CWL-BW3 exceed the MAC for chromium (50 µg/L) at least once in every quarter. These chromium results are discussed further below.

Total chromium was detected in groundwater samples collected from CWL-BW3 in February 1993 at 53 µg/L. At the request of the NMED, additional samples for total and dissolved chromium were collected from monitoring well CWL-BW3. CWL-BW3 was sampled at differing purge rates using different filtering procedures: filtered and unfiltered samples were collected at both slow and normal purge rates to evaluate the effect of purge rates and turbidity on the metal content of the groundwater. Filtered samples contain only dissolved chromium, whereas unfiltered samples reflect total chromium, including that attributable to particulates as well as the aqueous fraction. Slow purge rates were used in an attempt to minimize the quantity of suspended particulates incorporated into the sample. In May 1993, chromium was detected in the unfiltered, slow-purge sample at 64 μg/L (total chromium); in the filtered, slow-purge sample at 0.62 μg/L (dissolved chromium); and in the unfiltered normal-purge sample at 260 μg/L (total chromium). In August 1993, one sample was taken before purging the well, and consecutive samples were taken the next day after purging the well dry three times in an attempt to minimize the effect of stagnant well water and casing-groundwater interactions on groundwater metal contents. This sampling protocol was requested by NMED, and split samples were collected by NMED each time. Total chromium was detected in an unfiltered slow-purge sample at 46 μg/L; in a low-turbidity, unfiltered sample at 98 μg/L; in an unfiltered sample collected at a low-purge volume of 26 gallons at 49 μg/L; and in a normal-purge (three well volumes), unfiltered sample at 48 μg/L. In November 1993, monitoring well CWL-BW3 was found to contain total chromium at 60 μg/L.

The significant difference in total chromium and dissolved chromium concentrations indicates that the great majority of chromium is associated with particulate matter. A study performed by Stein et al. (1991) suggests that a likely source of particulate chromium is corrosion of stainless steel in well casings, screens, and/or downhole pump components, or naturally occurring sediment. Stainless steel also contains nickel and iron, which were also detected in CWL samples.

7.4.4 Mixed Waste Landfill Monitoring Results

Groundwater monitoring sampling at the MWL took place in January, April, and November 1993 (SNL 1994). Sampling was conducted in accordance with the "Mixed Waste Landfill Sampling and Analysis Plan" (SNL 1990b, draft) or as otherwise requested by the SNL/NM Task Leader. In January, sample fractions were collected for chloride, phenolics, sulfate, total Target Analyte List (TAL) metals, total organic carbon (TOC), TOX, gross alpha activity, gross beta activity, gamma spectrometry, and individual radionuclides. April samples were analyzed for the same parameters, with the addition of nitrate, alkalinity, and dissolved TAL metals. November samples were analyzed for the same parameters as January samples, with the addition of fluoride, NPN, ammonia, alkalinity, total dissolved solids (TDS), pH, specific conductivity, and VOCs (for MWL-MW4 only). Non-radiological analytical results for January, April, and November are reported in Appendix K, Tables K-16a, b, and c, respectively. Radiological analytical data for the same sampling periods are presented in Tables K-17a, b, and c.

<u>Metals</u>: January 1993 metals analyses detected total barium, cadmium, chromium, iron, magnesium, nickel, and zinc. April analyses detected total and dissolved aluminum, barium, chromium, iron, magnesium, manganese, nickel, and zinc. November analyses detected total barium, chromium, iron, lead, magnesium, manganese, nickel, and zinc. All metals were detected at concentrations lower than the EPA MCL. The metals analyses also detected calcium and sodium; however, these compounds are discussed in the following Inorganic Compounds section.

<u>Radionuclides</u>: Groundwater samples collected from MWL wells in 1993 were analyzed for gross alpha and gross beta activities, gamma spectroscopy, and individual radionuclides. Individual radionuclides for January and April 1993 analyses were H-3, Ra-226, Ra-228, americium-241 (Am-241), cesium-137 (Cs-137), iodine-129 (I-129), iron-55 (Fe-55), polonium-210 (Po-210), and Sr-90.

Individual radionuclides for November 1993 analyses were isotopic U, Th, and Pu for all wells, and Sr-90 for MWL-MW4 only.

Gross alpha and gross beta activities were analyzed from January and April 1993 sampling in quadruplicate to enable measurement of statistical variance. Average gross alpha and average gross beta activities did not exceed DOE derived concentration guides (DCGs). Individual radionuclides detected above quantifiable instrument detection limits include Ra-226, Ra-228, Cs-137, I-129, Fe-55, lead-212 (Pb-212), Th-228, uranium-238 (U-238), Am-241, and Sr-90. DOE DCGs were exceeded by individual radionuclides in the following cases: Th-228 (January, MWL-MW1), Pb-212 (January, MWL-MW2), I-129 (April, MWL-BW1), and U-238 (January, MWL-MW2 and BW1).

Organic Compounds: TOX were not measured above detection limits in any sample during any of the sampling events at the MWL in 1993. During the January 1993 sampling, TOC was measured at low levels (0.93 to 1.5 mg/L) in all wells. During the April sampling, TOC was measured at high levels in wells MWL-MW1, MWL-MW2, and MWL-MW3 (13.8 to 23.2 mg/L) and at low levels in the other wells (1.5 to 4.9 mg/L). During the November sampling, no TOC was detected. The likely cause of the high measurements in April samples was a documented laboratory problem with TOC calibration of a new analytical instrument. TOC and TOX were sampled in quadruplicate in January and April 1993 to aid statistical evaluation. No regulatory limits have been established for TOX or TOC. No phenolic compounds or VOCs were detected in any MWL wells during 1993 sampling.

Inorganic Compounds: Major ion and water-chemistry analyses were performed on samples collected during April and November. Total and dissolved calcium and sodium were detected in all samples. Chloride and sulfate were also detected in all samples.

7.4.5 Technical Area II Groundwater Monitoring

By the end of June 1993, three boreholes had been drilled and completed as monitoring wells at TA-II for the SNL/NM ER Project (SNL 1994) (Figure 7-4). The first area investigated is southwest of the TA-II fenceline, at the Building 901 septic-system leachfield, with the installation of monitoring well TA-II/W-001 (also referred to as TA-II/SW-1/320). The second and third monitoring wells were installed northwest of the TA-II fenceline in an area where no contamination was suspected. The monitoring wells installed at this location are TA-II/W-002 and TA-II/W-003 (also referred to as TA-II/NW-1/325 and TA-II/NW-1/598, respectively).

Drilling for TA-II/W-001 began on November 2, 1992. The well was completed in a water-bearing zone at 330 feet below ground surface (fbgs) on November 20, 1992. Groundwater was collected from the open borehole on November 22, 1992, prior to developing and installing the well.

Drilling for TA-II/W-002 began on March 7, 1993, and was completed on March 23, 1993, at a total depth of 330 fbgs. Groundwater samples were collected immediately after well development on March 26, 1993, and were analyzed for VOCs, semivolatile organic compounds (SVOCs), phenolics, inorganics, ion charge balance, TDS, and metals (unfiltered). Groundwater samples were also analyzed for pesticides, high explosives (HE), and cyanide; none of these analytes were detected.

Drilling for TA-II/W-003 began on May 14, 1993, and was completed on June 26, 1993, at a total depth of 650 fbgs. The regional aquifer was apparently encountered in two separate zones (525 to 550 fbgs and 570 to 590 fbgs). The monitoring well was installed on July 7, 1993, with two screened intervals (535 to 555 and 585 to 595 fbgs). Groundwater samples were collected on June 11 and 13, 1993, and analyzed for inorganics, ion charge balance, TDS, and metals (unfiltered). The well was also sampled by NMED in October 1993 for VOCs, SVOCs, metals, radionuclides, and major ions. Preliminary analytical results show no indication of contamination (Betsill 1993).

Groundwater analytical results for these sampling events are summarized for organic compounds in Appendix K, Table K-18, for inorganic compounds in Table K-19, and for total metals in Table K-20.

Additional groundwater samples were collected from these wells in 1993, but analytical results are not available at this time.

7.4.6 Liquid Waste Disposal System Groundwater Monitoring

Groundwater monitoring activities at the LWDS took place in June and November 1993 (SNL 1994). Sampling was conducted in accordance with the "Mixed Waste Landfill Sampling and Analysis Plan" (SNL 1990b, draft) or as otherwise requested by the Task Leader. Details of the sampling events may be found in the groundwater monitoring reports (IT 1993m, 1993n). In June, sample fractions were collected from LWDS MW-2 for VOCs, SVOCs, major cations (calcium, magnesium, sodium, and potassium), major anions (chloride, sulfate, and carbonate), total phosphate, NPN, TDS, total TAL metals, TOC, gross alpha and gross beta activity, gamma spectroscopy, and H-3 (Appendix K, Table K-21a). November samples from LWDS MW-1 include fractions for all June analytes (Table K-21b). In general, analytical results for 1993 LWDS sampling events are comparable to other groundwater sampling results from non-ER site monitoring wells at SNL/NM.

Metals: LWDS MW-2 metals analyses detected total barium (Ba), Fe, magnesium (Mg), potassium (K), selenium (Se), and sodium (Na). LWDS MW-1 analyses detected total arsenic (As), Ba, calcium (Ca), Fe, Mg, manganese (Mn), K, Se, and Na. All metals were detected at concentrations lower than the EPA MCLs.

Radionuclides: In 1993, groundwater samples collected from LWDS wells were analyzed for gross alpha/beta activity, gamma spectroscopy, and H-3. Detected gross alpha and gross beta activity did not exceed DOE DCGs (15 and 30 pCi/L, respectively). H-3 was not measured above the detection limits (360 pCi/L) in either LWDS well.

Organic Compounds: TOC was measured at low levels in LWDS MW-1 (0.94 and 0.93 mg/L) and was not detected in LWDS MW-2 (at an MDL of 0.5 mg/L). Trace amounts of benzene (0.006 mg/L) and TCE (0.006 mg/L) were detected in samples from LWDS MW-1, and common laboratory contaminants were measured below laboratory reporting limits in samples from both wells. No SVOCs were measured above detection limits in samples from either well.

Inorganic Compounds: Chloride, sulfate, and nitrate were detected in samples from both wells. Major ion and water-chemistry analyses were performed on groundwater samples.

7.4.7 Sitewide Hydrogeologic Characterization - South Fence Road Drilling Project

Phase II of the South Fence Road (SFR) drilling project was completed in CY 93 (SNL 1994). This phase included the drilling and completion of three characterization/monitoring wells and one observation well. Two wells are located at the existing SFR-3 location, while the other characterization/ monitoring well and observation well are located at the SFR-4 site.

In addition to the Phase II work, two wells drilled in SFR-Phase I (SFR-2S and SFR-1D) were sampled on May 6, 1993 (Appendix K, Table K-22). MCLs used were primary drinking-water standards unless otherwise noted (NMED 1991). These wells will not be used as public water supply or stock wells. As such, they were not disinfected as is normal for drinking-water supplies. TOC, pesticides, herbicides, total phenolics, and VOCs (except acetone) were not detected above the MDL. Acetone was found in both of the well samples, but was also present in the laboratory method blank, indicating laboratory contamination. As such, the acetone results are not considered valid indicators of groundwater contamination.

The TOX content is measured in parts per billion. The results are indicative only of halogenated organics and cannot be used to quantify concentrations of specific compounds (Nielsen 1991). The levels are low and in the range of other TOX values obtained at SNL/NM.

Parameters such as total alkalinity, Ca, and Mg are indicators of water hardness and do not have associated regulatory standards. The water from both wells has high levels of total alkalinity and Ca, which are consistent with the hardness of the water in the Albuquerque area. Both wells exhibit a neutral pH (~7) which is also indicative of water with a high mineral content.

The levels of chloride, fluoride, NPN, sulfate, Ba, and Mn are all below the primary or secondary MCLs. The Na level for both wells (approximately 77 mg/L) exceeds the secondary (recommended) limit of 20 mg/L for people on sodium-restricted diets, but is insignificant in these wells since they are not to be used as drinking water wells.

Future sampling of these wells will be conducted as part of the SNL/NM Groundwater Surveillance Project.

Results of quarterly sampling of SFR-1 and SFR-2 are provided in the Basewide Groundwater Surveillance Program sections of this report and in the corresponding basewide quarterly reports (IT 1993d, 1993e, 1993f).

8.0 QUALITY ASSURANCE PROGRAMS

8.1 QUALITY ASSURANCE POLICIES AND RESPONSIBILITIES FOR ENVIRONMENTAL PROGRAMS

The Environmental Operations Center (EOC) (Center 7500) has developed and implemented a quality plan that defines a specific approach to ensure that items and services meet the standards set by Sandia National Laboratories, New Mexico (SNL/NM), the Department of Energy (DOE), and applicable regulatory agencies: U.S. Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), and State and local governments. The *EOC Quality Plan* is being written in accordance with guidelines set forth in DOE Order 5700.6C, "Quality Assurance" (DOE 1991b); the *SNL Integrated Quality Program*" (SNL 1993i); and the *ES&H Center 7700 Quality Plan* (SNL, in preparation).

The *EOC Quality Plan* describes quality guidelines and standards for all activities and functions conducted by or for the EOC. This plan stresses prevention of problems by ensuring that (1) requirements are defined in documents such as plans and procedures, (2) requirements are understood through familiarization and training, and (3) all activities necessary for fulfilling the requirements are performed by qualified personnel. There is an ongoing effort to include applicable quality elements from the *EOC Quality Plan* in implementation plans and operating procedures within the departments responsible for hazardous, radioactive, and mixed waste operations, and environmental protection, remediation, and compliance activities. In addition, each EOC employee is responsible for ensuring that all environmentally related activities are performed in accordance with the policies and guidelines set in the *EOC Quality Plan*, which is distributed to all EOC personnel and contractors. A copy is also kept on file in the SNL/NM Environmental Operations Records Center (EORC).

8.2 QUALITY ASSURANCE OF ENVIRONMENTAL SAMPLING AND ANALYSIS

This section summarizes quality assurance (QA) activities related to environmental monitoring, remediation, and waste management programs. Sampling is conducted in accordance with program-specific sampling and analysis plans or work plans, each of which contains relevant QA elements. These documents are prepared and implemented in accordance with the *EOC Quality Plan* and meet appropriate regulatory guidelines for conducting sampling and analysis activities. QA elements for sampling and analysis follow EPA QA guidelines for activities related to environmental management. QA for sampling and analytical activities performed in conjunction with these programs is discussed in the following subsections.

8.2.1 Quality Assurance for Sampling Programs

Quality assurance for sampling activities includes the following items:

- Collection of samples using defined sampling procedures
- Sample collection equipment
- Sample container decontamination
- Sample handling, preservation, and documentation

- Quality control (QC) samples at defined frequencies to estimate sample representativeness and potential contamination acquired during the sampling and handling process

In addition, prior to sample collection, specific procedures are prepared to address the mechanics of the process, the location and frequency of samples to be collected, and proper sample preservation and documentation techniques. Sample collection for all programs is performed by trained personnel only, who must complete an analytical request/chain of custody form for each sample. Each sample is assigned a unique control number and documented with a sample-collection log.

Depending on the type of investigation, project-specific QC samples may include the following: trip, equipment, or field blanks, and environmental replicate samples. QC samples are submitted to contractor laboratories in accordance with project-specific data quality objectives and sampling and analysis plans. Replicate environmental samples are collected and submitted to the laboratory to assess the overall variability (precision) of data associated with a particular sampling location. To assess the quality of the sampling process, blank samples are submitted to document the level of contamination contributed by sampling and handling.

8.2.2 Quality Assurance for Analytical Programs

Most of the chemical analyses of waste and environmental samples collected at SNL/NM during 1993 were performed by independent analytical laboratories. During 1993, these laboratories analyzed over 8000 samples, operating under stringent QA plans that comply with the *EOC Quality Plan* and applicable EPA requirements and guidelines. Before analytical laboratories are selected, contractor laboratories are appraised (preaward audits) in accordance with the *EOC Quality Plan*. These laboratories are then reappraised annually using inspections and audits, which are kept on file in EORC. Table E-1 of Appendix E lists laboratories that provided analytical support to SNL/NM's environmentally related sampling activities during 1993. Information about the quantities and types of samples processed through the EOC Sample Management Office (SMO) are available in the SMO Sample Tracking Data Base ( ).

Analyses employed EPA test procedures wherever possible; otherwise, a suitable validated test procedure was used. Instruments were calibrated in accordance with established procedures and were verified before analysis using certified standard reference materials to ensure the accuracy of data generated.

With each analytical batch of SNL/NM samples, QC samples were concurrently prepared at defined frequencies and analyzed for each analyte of interest to measure analytical accuracy, precision, contamination, and the matrix effect associated with each analytical measurement. For each QC measurement, QC sample results were compared to statistically established control criteria. Analytical data generated, with concurrent QC sample results that were inside established control limits, were considered acceptable. Analytical data generated, with QC sample results that were outside control limits, were considered out of control and corrective action was initiated; reanalysis was performed for all samples in the analytical batch. This process guaranteed the quality of data generated by each analytical laboratory. Results of concurrently analyzed QC sample data were included with each analytical report prepared for SNL/NM. These reports included sample identification numbers; dates of sample collection, preparation, and analysis; analytical-method reference number; analytes, concentration measured, and detection limit; and associated QC control data.

During 1993, over 1,000 QC samples were submitted to monitor overall laboratory performance. Analyses were performed to comply with SNL/NM QA requirements, to meet project-specific data quality objectives, and to monitor and document analytical precision and accuracy. Contractor laboratories operate under strict QA/QC programs. Periodically, they participate in the EPA's programs for blind-audit check sampling to monitor the overall precision and accuracy of analyses routinely performed on SNL/NM samples.

To assess the quality of stable chemistry analyses, double-blind samples were submitted along with routine environmental samples to the contractor laboratories at defined frequencies. These check samples were submitted quarterly based on the frequency and type of samples submitted to assess and document laboratory precision and accuracy. Check samples were prepared by the EPA or Environmental Resource Associates, Arvada, CO, and submitted to the contractor laboratories at frequencies indicated above. All check samples were prepared in batch quantities and subjected to round-robin analyses to verify analyte concentrations. The samples were prepared by spiking concentrated solutions containing various analytes of interest into reagent-grade water, free of analytical interferents or soil, to create check samples at concentration ranges of one to five times the method detection limit. The check samples were prepared in duplicate so analytical precision, as well as accuracy, could be assessed. Check samples submitted to the laboratories consisted of solutions containing trace metals, cyanides, phenolic compounds, and other selected anions, cations, and organic compounds. In addition to aqueous and soil samples, oil samples containing known concentrations of polychlorinated biphenyls (PCBs) were prepared by the EPA and submitted to the laboratories for analysis.

For programs using the EOC SMO (the Wastewater Monitoring, Groundwater Monitoring, Waste Management, and Environmental Restoration programs), results of each set of check sample analyses are available in Quarterly Performance Evaluation Reports. The reports include average percent recoveries for each suite of samples analyzed and the relative range of actual recoveries and relative percent differences for each analyte tested. A corrective-action request was issued for any exceedance of accepted limits. All reports and corrective action responses are maintained in the EORC. The resulting data were used to assess each laboratory's performance using relative percent difference and percent recovery for respective indicators of precision and accuracy. Review of laboratory performance data generated during 1993 indicates that the majority of analytes tested by the SNL/NM analytical laboratories are within EPA (or interlaboratory, round-robin) prescribed control limits.

Tables E-2 through E-4 of Appendix E present results of replicate sampling as part of the Environmental Monitoring Program. Radionuclide analysis results include the mean concentration, standard deviation, and coefficient of variation (CV). The CV is used as a measure of the reproducibility of the data and includes the variation associated with the sampling location and analytical techniques. Replicate samples of water, vegetation, soil, and sediment were collected as a regular part of the Environmental Monitoring Program.

The Environmental Monitoring Program evaluated its contractor laboratory (Accu-Labs Research, Inc.) performance by means of the laboratory's participation in the interlaboratory comparison programs of the EPA Environmental Monitoring Systems Laboratory and the DOE Quality Assessment Program (QAP) (Tables E-5 and E-6 of Appendix E). Results of the EPA Cross-Check program and the DOE QAP are on file in the SNL/NM EORC.

8.2.3 Data Review and Validation

Sample collection, control documentation, and measurement data were reviewed for each sample collected. Analytical data reported by test laboratories were reviewed for laboratory and field precision and accuracy, completeness, representativeness, and comparability with respect to the data-quality objectives of the particular program. Data were reviewed and validated at a minimum of three levels:

1. By the analytical laboratory where the data were validated in accordance with the laboratory's QA plan and standard operating procedures

2. By a knowledgeable member of the SNL/NM SMO staff or contractor who reviewed the analytical reports and corresponding sample collection and control documentation for the following:

   - Compliance with contract requirements
   - SNL/NM QA requirements
   - Documentation completeness
   - Project-specific data quality requirements

3. By the SNL/NM project leader responsible for program objectives and regulatory compliance Records are maintained by EORC in accordance with the requirements of the *EOC Quality Plan*. EORC also maintains all data files related to this report.

8.3 CONTRACTOR QUALITY ASSURANCE OVERVIEW

The SMO has several contractors who provide consulting, waste management and disposal, water sampling and analysis, and other analytical services. These contractors are overseen by contract monitors (with support from the EOC Quality Coordinator) through one of the following mechanisms:

1. Monitored by task (for consulting services) using a project evaluation sheet to evaluate individual projects. Contractors provide monthly reports on the status of progress and budget.

2. Performance checks and annual onsite appraisals as discussed above (for analytical laboratories). Quarterly blind samples, replicates, and blanks are submitted to the laboratories for performance checks. Corrective actions are documented and implemented.

3. Cost-plus-award-fee contract for hazardous waste management and the Environmental Restoration Program. The contract has a 30-percent fixed and 70-percent variable award fee based on quarterly performance evaluations.

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APPENDIX A

METEOROLOGICAL DATA

CONTENTS

Table A-1. Long-Term Historical Data for Albuquerque, New Mexico, 1961 to 1990 (NOAA 1990)

	Temperature		Precipitation	Wind	
	Daily Range (°C)				
Month	Minimum	Maximum	Water Equivalent (cm)	Speed (m/s)	Direction
January	-5.4	8.4	1.04	3.6	N
February	-3.4	11.6	1.02	4.0	N
March	-0.2	15.9	1.32	4.5	SE
April	4.2	21.4	1.02	4.9	S
May	9.2	26.6	1.17	4.7	S
June	14.7	32.6	1.30	4.5	S
July	18.2	33.8	3.30	4.1	SE
August	17.1	31.9	3.84	3.7	SE
September	12.7	28.3	2.16	3.8	SE
October	6.2	22.1	2.18	3.7	SE
November	-0.7	14.0	0.97	3.5	N
December	-4.9	8.9	1.32	3.4	N

Notes:
Temperature and precipitation values are normals recorded for the 1961 to 1990 period. Wind direction is the prevailing direction through 1963. Average wind speeds are reported. The data were collected at the Albuquerque International Airport, elevation 1.62 km. The original measurements have been converted to metric units.

Table A-2. Normals, Means, and Extremes for Albuquerque, New Mexico, 1961 to 1990 (NOAA 1990)

LATITUDE: 35°03'N LONGITUDE: 106°37'W ELEVATION: FT. GRND 5311 BARO 5313 TIME ZONE: MOUNTAIN WBAN: 23050

	(a)	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	YEAR
TEMPERATURE °F:														
Normals														
-Daily Maximum		47.2	52.9	60.7	70.6	79.9	90.6	92.8	89.4	83.0	71.7	57.2	48.0	70.3
-Daily Minimum		22.3	25.9	31.7	39.5	48.6	58.4	64.7	62.8	54.9	43.1	30.7	23.2	42.1
-Monthly		34.8	39.4	46.2	55.1	64.3	74.5	78.8	76.1	69.0	57.4	44.0	35.6	56.2
Extremes														
-Record Highest	51	69	76	85	89	98	105	105	101	100	91	77	72	105
-Year		1971	1986	1971	1989	1951	1980	1980	1979	1979	1979	1975	1958	JUN 1980
-Record Lowest	51	-17	-5	8	19	28	40	52	52	37	25	-7	-7	-17
-Year		1971	1951	1948	1980	1975	1980	1985	1968	1971	1980	1976	1990	JAN 1971
NORMAL DEGREE DAYS:														
Heating (base 65°F)		936	717	583	302	81	0	0	0	12	242	630	911	4414
Cooling (base 65°F)		0	0	0	0	59	285	428	344	132	6	0	0	1254
% OF POSSIBLE SUNSHINE	51	73	73	73	77	79	83	76	75	79	79	77	72	76
MEAN SKY COVER (tenths) Sunrise - Sunset	51	4.8	5.0	5.0	4.6	4.2	3.4	4.5	4.4	3.6	3.5	4.0	4.6	4.3
MEAN NUMBER OF DAYS:														
Sunrise to Sunset														
-Clear	51	13.0	11.2	11.4	12.6	14.4	17.6	12.0	13.5	16.7	17.3	15.2	14.0	168.8
-Partly Cloudy	51	7.7	7.6	9.8	9.5	10.3	8.6	14.3	12.4	7.8	7.7	7.6	7.5	110.9
-Cloudy	51	10.3	9.5	9.7	8.0	6.3	3.8	4.7	5.1	5.5	6.0	7.2	9.5	85.5
Precipitation .01 inches or more	51	4.0	4.0	4.6	3.4	4.4	3.9	8.8	9.5	5.7	4.8	3.4	4.2	60.6
Snow,Ice pellets 1.0 inches or more	51	1.0	1.0	0.7	0.2	0.*	0.0	0.0	0.0	0.0	0.*	0.4	0.9	4.2
Thunderstorms	51	0.1	0.3	0.9	1.6	3.9	5.0	10.9	10.9	4.6	2.3	0.5	0.2	41.4
Heavy Fog Visibility 1/4 mile or less	51	1.1	1.0	0.6	0.2	0.*	0.*	0.1	0.*	0.1	0.4	0.6	1.5	5.6
Temperature °F														
-Maximum														
90° and above	30	0.0	0.0	0.0	0.0	2.6	17.2	23.2	15.9	3.9	0.1	0.0	0.0	62.9
32° and below	30	2.3	0.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.8	5.2
-Minimum														
32° and below	30	29.0	22.8	15.8	4.5	0.2	0.0	0.0	0.0	0.0	2.0	16.1	28.5	118.9
0° and below	30	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.6
AVG. STATION PRESS.(mb)	18	838.9	837.8	835.1	835.8	836.0	838.1	840.4	840.7	840.1	840.0	838.8	839.1	838.4
RELATIVE HUMIDITY (%)														
Hour 05	30	70	65	56	49	48	46	60	66	62	62	65	70	60
Hour 11 (Local Time)	30	51	44	34	26	25	24	34	40	40	38	42	50	37
Hour 17	30	40	33	24	19	18	18	27	30	31	30	36	43	29
Hour 23	30	61	53	43	36	34	33	47	53	52	50	54	61	48
PRECIPITATION (inches):														
Water Equivalent														
-Normal		0.41	0.40	0.52	0.40	0.46	0.51	1.30	1.51	0.85	0.86	0.38	0.52	8.12
-Maximum Monthly	51	1.32	1.42	2.18	1.97	3.07	2.57	3.33	3.30	2.63	3.08	1.45	1.85	3.33
-Year		1978	1948	1973	1942	1941	1986	1968	1967	1988	1972	1940	1959	JUL 1968
-Minimum Monthly	51	T	T	T	T	T	T	0.08	T	T	0.00	0.00	0.00	0.00
-Year		1970	1984	1966	1989	1945	1975	1980	1962	1957	1952	1949	1981	DEC 1981
-Maximum in 24 hrs	51	0.87	0.51	1.11	1.66	1.14	1.64	1.77	1.75	1.92	1.80	0.76	1.35	1.92
-Year		1962	1981	1973	1969	1969	1952	1961	1980	1955	1969	1940	1958	SEP 1955
Snow,Ice pellets														
-Maximum Monthly	51	9.5	10.3	13.9	8.1	1.0	T	T	0.0	T	3.2	9.3	14.7	14.7
-Year		1973	1986	1973	1973	1979	1990	1990		1971	1986	1940	1959	DEC 1959
-Maximum in 24 hrs	51	5.1	6.0	10.7	10.9	1.0	T	T	0.0	T	3.2	5.5	14.2	14.2
-Year		1973	1986	1973	1988	1979	1990	1990		1971	1986	1946	1958	DEC 1958
WIND:														
Mean Speed (mph)	51	8.1	8.9	10.1	11.0	10.6	10.0	9.1	8.3	8.6	8.3	7.9	7.7	9.0
Prevailing Direction through 1963		N	N	SE	S	S	S	SE	SE	SE	SE	N	N	SE
Fastest Obs. 1 Min.														
-Direction (!!)	6	09	09	28	17	28	08	36	27	25	09	27	09	09
-Speed (MPH)	6	52	40	41	46	46	40	52	41	40	32	48	47	52
-Year		1990	1989	1986	1985	1986	1990	1990	1990	1985	1986	1988	1987	JAN 1990
Peak Gust														
-Direction (!!)	7	E	W	NW	E	S	E	N	E	W	NW	W	E	N
-Speed (mph)	7	70	63	66	64	61	67	72	63	61	51	63	71	72
-Date		1990	1984	1986	1990	1987	1986	1990	1989	1985	1986	1988	1987	JUL 1990

Notes:
T = trace amount. Blank entries denote missing/unreported data. "#" indicates a station or instrument relocation. (a) = length of record in years, although individual months may be missing. "0.*" or "*" indicates the value is between 0.0 and 0.05. Normals are based on the 1961-1990 record period. Extremes dates are the most recent occurrence. Wind direction numerals show tens of degrees clockwise from true north. "00" indicates calm. Resultant directions are given to whole degrees.

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APPENDIX B

SANDIA NATIONAL LABORATORIES/NEW MEXICO ENVIRONMENTAL RESTORATION PROGRAM SITES

CONTENTS

Table B-1. Environmental Restoration Program Site List by Activity Data Sheet (ADS)

ADS No.-Operable Unit	Site No.	Site Name	RCRA/RFA No.	Regulatory Driver
1267-Chemical Waste Landfill	74	Chemical Waste Landfill	1,2,3,4,5,6, 7,8,9,20,110	40 CFR 265 Interim Status
1281-Kauai Test Facility	132	Photo Laboratory Discharge	None	CERCLA
	133	Drum Rack Area (Active)	None	CERCLA
	163	Rocket Launcher Pads (Active)	None	CERCLA
1289-Mixed Waste Landfill	76	Mixed Waste Landfill (TA-III)	24,25,26,27,28,29, 30,115,116	RCRA 3004(u)
1295-Septic Tanks and Drainfields	49	Bldg. 9820 Drains	126	RCRA 3004(u)
	101	Explosive Contaminated Sumps, Drains (Bldg. 9926)	None	RCRA 3004(u)
	116	Bldg. 9990 Septic System	79	RCRA 3004(u)
	137	Bldg. 6540/6542 Septic	None	RCRA 3004(u)
	138	Bldg. 6630 Septic System	79	RCRA 3004(u)
	139	Bldg. 9964 Septic System	79	RCRA 3004(u)
	140	Bldg. 9965 Septic System	79	RCRA 3004(u)
	141	Bldg. 9967 Septic System	79	RCRA 3004(u)
	142	Bldg. 9970 Septic System	79	RCRA 3004(u)
	143	Bldg. 9972 Septic System	79	RCRA 3004(u)
	144	Bldg. 9980 Septic System	79	RCRA 3004(u)
	145	Bldg. 9981/9982 Septic Systems	None	RCRA 3004(u)
	146	Bldg. 9920 Drain System	79	RCRA 3004(u)

Table B-1. Environmental Restoration Program Site List by Activity Data Sheet (ADS) (Continued)

ADS No.-Operable Unit	Site No.	Site Name	RCRA/RFA No.	Regulatory Driver
1295-Septic Tanks and Drainfields (Continued)	147	Bldg. 9925 Septic Systems	79	RCRA 3004(u)
	148	Bldg. 9927 Septic System	79	RCRA 3004(u)
	149	Bldg. 9930 Septic System	79	RCRA 3004(u)
	150	Bldg. 9939/9939A Septic Systems	None	RCRA 3004(u)
	151	Bldg. 9940 Septic System	79	RCRA 3004(u)
	152	Bldg. 9950 Septic System	79	RCRA 3004(u)
	153	Bldg. 9956 Septic Systems	79	RCRA 3004(u)
	154	Bldg. 9960 Septic Systems	79	NM UST LAW
	160	Bldg. 9832 Septic System	79	RCRA 3004(u)
	161	Bldg. 6636 Septic System	79	RCRA 3004(u)
1300-Former Underground Storage Tanks	155	Bldg. 6597 25,000 Gallon (TA-V)	None	RCRA 3004(u)/NM UST LAW
	172	Bldg. 888 UST (TA-I)	None	RCRA 3004(u)/NM UST LAW
	173	Bldg. 6525 UST (TA-III)	None	RCRA 3004(u)/NM UST LAW
	174	Bldg. 6581 UST (TA-V)	None	RCRA 3004(u)/NM UST LAW
	175	Bldg. 6588 UST (TA-V)	None	RCRA 3004(u)/NM UST LAW
	176	Bldg. 605 UST (TA-I)	None	RCRA 3004(u)/NM UST LAW
	178	Bldg. 6587 UST (TA-III)	None	RCRA 3004(u)/NM UST LAW
	179	Bldg. 7570 UST	None	RCRA 3004(u)/NM UST LAW

Table B-1. Environmental Restoration Program Site List by Activity Data Sheet (ADS) (Continued)

ADS No.-Operable Unit	Site No.	Site Name	RCRA/RFA No.	Regulatory Driver
1300-Former Underground Storage Tanks (Continued)	180	Bldg. 6503 UST (TA-III)	None	RCRA 3004(u)/NM UST LAW
	181	Bldg. 6500 UST (TA-V)	None	RCRA 3004(u)/NM UST LAW
	211	Bldg. 840 UST (TA-I)	None	RCRA 3004(u)/NM UST LAW
	212	Bldg. 876 UST (TA-I)	None	RCRA 3004(u)/NM UST LAW
	213	Bldg. 880 UST (TA-I)	None	RCRA 3004(u)/NM UST LAW
	214	Bldg. 6505 UST (TA-III)	None	RCRA 3004(u)/NM UST LAW
	215	Bldg. 6536 UST (TA-III)	None	RCRA 3004(u)/NM UST LAW
	216	Bldg. 6596 UST (TA-V)	None	RCRA 3004(u)/NM UST LAW
	217	Bldg. 6630 UST (TA-III)	None	RCRA 3004(u)/NM UST LAW
	218	Bldg. 6720 UST (TA-III)	None	RCRA 3004(u)/NM UST LAW
	219	Tank 7 Burn Site (Lurance Canyon)	None	RCRA 3004(u)/NM UST LAW
	220	Bldg. 9832 UST (Coyote Test Field)	None	RCRA 3004(u)/NM UST LAW
	221	Bldg. 9970 UST (Coyote Test Field)	None	RCRA 3004(u)/NM UST LAW
	222	Igloo Area Bldg. 6018 UST (Tijeras Arroyo)	None	RCRA 3004(u)/NM UST LAW

Table B-1. Environmental Restoration Program Site List by Activity Data Sheet (ADS) (Continued)

ADS No.- Operable Unit	Site No.	Site Name	RCRA/RFA No.	Regulatory Driver
1300-Former Underground Storage Tanks (Continued)	223	Igloo Area Bldg. 6028 UST (Tijeras Arroyo)	None	RCRA 3004(u)/NM UST LAW
1302-Technical Area I	25	Burial Site (South of TA-I)	None	RCRA 3004(u)
	30	PCB Spill (Reclamation Yard)	52,53,54,N	RCRA 3004(u)
	32	Steam Plant Oil Spill (TA-I)	P	RCRA 3004(u)
	33	Motor Pool Oil Spill (TA-I)	Q	RCRA 3004(u)
	41	Bldg. 838 Mercury Spill (TA-I)	O	RCRA 3004(u)
	42	Acid Spill Water Treatment Facility (TA-I)	None	RCRA 3004(u)
	73	Hazardous Waste Repackaging/ Storage (Bldg. 895)	105	RCRA 3004(u)
	96	Storm Drain System (Active)	113	RCRA 3004(u)
	98	Bldg. 863, TCA Photochemical Releases: Silver Catch Boxes	None	RCRA 3004(u)
	104	PCB Spill, Computer Facility	None	RCRA 3004(u)
	186	TCE Dumping South of Bldg. 859	None	RCRA 3004(u)
	187	Septic Tank Piping for POTW (Active)	80	RCRA 3004(u)
	190	Tank Farm for Steam Plant (Active)	None	RCRA 3004(u)
	192	TA-1 Waste Oil Tank	None	RCRA 3004(u)
	226	Acid Waste Line (TA-I)	None	RCRA 3004(u)
1303-Technical Area II	1	Radioactive Waste Landfill (TA-II)	32,33,34,35,36,37	RCRA 3004(u)
	2	Classified Waste Landfill (TA-II)	38,39	RCRA 3004(u)
	3	Chemical Disposal Pit (TA-II)	40	RCRA 3004(u)
	43	Radioactive Material Storage Yard (TA-II) (Active)	57	RCRA 3004(u)

Table B-1. Environmental Restoration Program Site List by Activity Data Sheet (ADS) (Continued)

ADS No.-Operable Unit	Site No.	Site Name	RCRA/RFA No.	Regulatory Driver
1303-Technical Area II (Continued)	44	Decontamination Site and Uranium Calibration Pits (TA-II)	130	RCRA 3004(u)
	48	Bldg. 904 Septic System (TA-II)	79	RCRA 3004(u)
	113	Area II Firing Sites (Active)	None	RCRA 3004(u)
	114	Explosive Burn Pit (TA-II)	None	RCRA 3004(u)
	135	Bldg. 906 Septic System	79	RCRA 3004(u)
	136	Bldg. 907 Septic System	79	RCRA 3004(u)
	159	Bldg. 935 Septic System	79	RCRA 3004(u)
	165	Bldg. 901 Septic System	79	RCRA 3004(u)
	166	Bldg. 919 Septic System	79	RCRA 3004(u)
	167	Bldg. 940 Septic System	79	RCRA 3004(u)
	168	Bldg. 901 UST (TA-II)	None	RCRA 3004(u)/NM UST LAW
	169	Bldg. 910 UST (TA-II)	None	RCRA 3004(u)/NM UST LAW
	170	Bldg. 911 UST (TA-II)	None	RCRA 3004(u)/NM UST LAW
	171	Bldg. 912 UST (TA-II)	None	RCRA 3004(u)/NM UST LAW
1306-Technical Areas III and IV	18	Concrete Pad (Active)	54	RCRA 3004(u)
	26	Burial Site (West of TA-III)	None	RCRA 3004(u)
	31	Electrical Transformer Oil Spill (TA-III)	None	RCRA 3004(u)
	34	Centrifuge Oil Spill (TA-III) (Active)	R	RCRA 3004(u)

Table B-1. Environmental Restoration Program Site List by Activity Data Sheet (ADS) (Continued)

ADS No.-Operable Unit	Site No.	Site Name	RCRA/RFA No.	Regulatory Driver
1306-Technical Areas III and IV (Continued)	35	Vibration Facility Oil Spill (TA-III)	R	RCRA 3004(u)
	36	Oil Spill - HERMES (TA-V)	S	RCRA 3004(u)
	37	PROTO Oil Spill (TA-V) (Active)	T	RCRA 3004(u)
	51	Bldg. 6924 Pad, Tank, Pit	10,11	RCRA 3004(u)
	78	Gas Cylinder Disposal Pit (TA-III)	31	RCRA 3004(u)
	83	Long Sled Track (TA-III) (Active)	I	RCRA 3004(u)
	84	Gun Facilities (TA-III) (Active)	None	RCRA 3004(u)
	100	Bldg. 6620 HE Sump/Drain (TA-III)	84,85	RCRA 3004(u)
	102	Radioactive Disposal (East of TA-III)	None	RCRA 3004(u)
	105	Mercury (Bldg. 6536) (TA-III)	None	RCRA 3004(u)
	107	Explosive Test Area (SE TA-III)	None	RCRA 3004(u)
	111	Bldg. 6715 Sump/Drains (TA-III)	79	RCRA 3004(u)
	188	Bldg. 6597 Aboveground Containment Spill Tank (TA-V)	99	RCRA 3004(u)
	196	Bldg. 6597 Cistern (TA-V)	None	RCRA 3004(u)
	240	Short Sled Track	None	RCRA 3004(u)
	241	Storage Yard	None	RCRA 3004(u)
1307-Liquid Waste Disposal System	4	LWDS Surface Impoundments	18,19	RCRA 3004(u)
	5	LWDS Drainfield (TA-V)	16,17	RCRA 3004(u)
	52	LWDS Holding Tanks (TA-V)	135	RCRA 3004(u)

Table B-1. Environmental Restoration Program Site List by Activity Data Sheet (ADS) (Continued)

ADS No.-Operable Unit	Site No.	Site Name	RCRA/RFA No.	Regulatory Driver
1309-Tijeras Arroyo	7	Gas Cylinder Disposal (Arroyo del Coyote)	44	RCRA 3004(u)
	16	Open Dumps (Arroyo del Coyote)	21,55	RCRA 3004(u)
	23	Disposal Trenches (Near Tijeras Arroyo)	47,48,49	RCRA 3004(u)
	40	Oil Spill (6000 Igloo Area)	W	RCRA 3004(u)
	45	Liquid Discharge (Behind TA-IV)	None	RCRA 3004(u)
	46	Old Acid Waste Line Outfall (Tijeras Arroyo)	112	RCRA 3004(u)
	50	Old Centrifuge Site (TA-II)	None	RCRA 3004(u)
	77	Oil Surface Impoundment (TA-IV) (Active)	12,81,82	RCRA 3004(u)
	227	Bunker 904 Outfall (from TA-II)	None	RCRA 3004(u)
	228	Centrifuge Dump Site	None	RCRA 3004(u)
	229	Storm Drain System Outfall	None	RCRA 3004(u)
	230	Storm Drain System Outfall	None	RCRA 3004(u)
	231	Storm Drain System Outfall	None	RCRA 3004(u)
	232	Storm Drain System Outfall	None	RCRA 3004(u)
	233	Storm Drain System Outfall	None	RCRA 3004(u)
	234	Storm Drain System Outfall	None	RCRA 3004(u)
	235	Storm Drain System Outfall	None	RCRA 3004(u)

Table B-1. Environmental Restoration Program Site List by Activity Data Sheet (ADS) (Continued)

ADS No.- Operable Unit	Site No.	Site Name	RCRA/RFA No.	Regulatory Driver
1332-Foothills Test Area	8	Open Dump (Coyote Canyon Blast Area)	23	RCRA 3004(u)
	15	Trash Pits (Frustration Site)	46	RCRA 3004(u)
	19	TRUPAK Boneyard Storage Area (NW of Old Aerial Cable)	65	RCRA 3004(u)
	27	Bldg 9820 - Animal Disposal Pit (Coyote Springs)	42	RCRA 3004(u)
	28	Mine shafts	None	RCRA 3004(u)
	58	Coyote Canyon Blast Area	136-139	RCRA 3004(u)
	66	Boxcar Site	H	RCRA 3004(u)
	67	Frustration Site	None	RCRA 3004(u)
	82	Old Aerial Cable Site Scrap	66,67	RCRA 3004(u)
	87	Building 9990 (Firing Site)	108,D	RCRA 3004(u)
1333-Canyons Test Area	10	Burial Mounds (Bunker Area North of Pendulum Site)	60,61,62,63	RCRA 3004(u)
	12	Burial Site/Open Dump (Lurance Canyon) (Active)	41	RCRA 3004(u)
	13	Oil Surface Impoundment (Lurance Canyon Burn Site) (Active)	13	RCRA 3004(u)
	59	Pendulum Site	None	RCRA 3004(u)
	60	Bunker Area (North of Pendulum Site)	124	RCRA 3004(u)
	63	Balloon Test Area	E1	RCRA 3004(u)
	64	Gun Site (Madera Canyon)	E2	RCRA 3004(u)
	65	Lurance Canyon Explosive Test Site (Active)	None	RCRA 3004(u)
	72	Operation Beaver Site	None	RCRA 3004(u)
	81	New Aerial Cable Site/Burial Site/Dump/Test Area (Active)	22,50,51,59	RCRA 3004(u)

Table B-1. Environmental Restoration Program Site List by Activity Data Sheet (ADS) (Continued)

ADS No.-Operable Unit	Site No.	Site Name	RCRA/RFA No.	Regulatory Driver
1333-Canyons Test Area (Continued)	92	Pressure Vessel Test Site (Coyote Canyon Blast Area) (Active)	64	RCRA 3004(u)
	93	Madera Canyon Rocket Launcher Pads	E3	RCRA 3004(u)
	94	Lurance Canyon Burn Site (Active)	119	RCRA 3004(u)
	225	AEC Storage Facility/Kirtland AFB	None	RCRA 3004(u)
1334-Central Coyote Test Area	9	Burial Site/Open Dump (Schoolhouse Mesa)	43	RCRA 3004(u)
	11	Radioactive/Explosive Burial Mounds	68,69,70	RCRA 3004(u)
	20	Uranium Burn Site (Schoolhouse Mesa)	None	RCRA 3004(u)
	21	Metal Scrap (Coyote Springs)	73	RCRA 3004(u)
	22	Storage/Burn (West of DEER)	106	RCRA 3004(u)
	47	Doomed Bunker Outfall (South KAFB Boundary)	133,134	RCRA 3004(u)
	57	Workman Site	G	RCRA 3004(u)
	61	Schoolhouse Mesa Test Site	None	RCRA 3004(u)
	62	Graystone Manor Site (Coyote Springs)	None	RCRA 3004(u)
	68	Old Burn Site	111	RCRA 3004(u)
	69	Firing Pits (Near USGS)	None	RCRA 3004(u)
	70	Explosives Test Pit (Water Towers)	127	RCRA 3004(u)
	71	Moonlight Shot Area	F	RCRA 3004(u)
	88	Firing Site (Southwest of Coyote Springs)	J	RCRA 3004(u)
1335-Southwest Test Area	6	Gas Cylinder Disposal Pit (Building 9966)	72,L	RCRA 3004(u)
	14	Burial Site (Bldg. 9920)(Active)	45	RCRA 3004(u)

Table B-1. Environmental Restoration Program Site List by Activity Data Sheet (ADS) (Continued)

ADS No.-Operable Unit	Site No.	Site Name	RCRA/RFA No.	Regulatory Driver
1335-Southwest Test Area (Continued)	17	Scrap Yards/Open Dump (Thunder Range)	74,75,76	RCRA 3004(u)
	38	Oil Spills (Bldg. 9920)	U	RCRA 3004(u)
	39	Oil Spill - Solar Facility (Active)	V	RCRA 3004(u)
	53	Building 9923	None	RCRA 3004(u)
	54	Pickax Site (Thunder Range)	14,15	RCRA 3004(u)
	55	Red Towers Site (Thunder Range)	K	RCRA 3004(u)
	56	Old Thunderwells (Thunder Range)	A	RCRA 3004(u)
	85	Firing Site (Building 9920) (Active)	125	RCRA 3004(u)
	86	Firing Site (Bldg. 9927) (Active)	C	RCRA 3004(u)
	89	Shock Tube Site (Thunder Range) (Active)	56	RCRA 3004(u)
	90	Beryllium Firing Site (Thunder Range) (Active)	B	RCRA 3004(u)
	91	Lead Firing Site (Thunder Range) (Active)	132	RCRA 3004(u)
	103	Scrap Yard (Bldg. 9939)	None	RCRA 3004(u)
	108	Firing Site (Bldg. 9940) (Active)	None	RCRA 3004(u)
	109	Firing Site (Bldg. 9956) (Active)	None	RCRA 3004(u)
	112	Explosive Contaminated Sump (Building 9956) (Active)	None	RCRA 3004(u)
	115	Firing Site (Bldg. 9930) (Active)	None	RCRA 3004(u)
	117	Trenches (Bldg. 9939)	None	RCRA 3004(u)
	191	Equus Red	None	RCRA 3004(u)
	193	Sabotage Test Area (Active)	None	RCRA 3004(u)
	194	General Purpose Heat Source Test Area (Active)	None	RCRA 3004(u)

Table B-1. Environmental Restoration Program Site List by Activity Data Sheet (ADS) (Continued)

ADS No.-Operable Unit	Site No.	Site Name	RCRA/RFA No.	Regulatory Driver
1336-Salton Sea Test Base	157	Salton Sea Test Base	None	CERCLA
1337-Off-Site Areas	156	Pagano Salvage Yard	None	CERCLA - NPL
	164	Edgewood Test Site	None	CERCLA
	177	Holloman AFB Bldg. 882 UST	None	NM UST LAW-Closed
	182	White Sands Missile Range (WSMR) Test Areas	None	CERCLA
	183	LUST Cape Canaveral Old Tank	None	CERCLA
	184	Holloman AFB Bldg. 882-1 Septic System	None	CERCLA
	199	AEC Storage Facility/Fort Hood	None	CERCLA
	200	AEC Storage Facility/Fort Campbell	None	CERCLA
	201	AEC Storage Facility/Barksdale AFB	None	CERCLA
	202	AEC Storage Facility/Loring AFB	None	CERCLA
	203	AEC Storage Facility/Ellsworth AFB	None	CERCLA
	204	AEC Storage Facility/Fairchild AFB	None	CERCLA
	205	AEC Storage Facility/Travis AFB	None	CERCLA
	206	AEC Storage Facility/Westover AFB	None	CERCLA
	207	AEC Storage Facility/Yorktown Naval Weapons Station	None	CERCLA
	208	AEC Storage Facility/Medina	None	CERCLA
	209	AEC Storage Facility/Nellis AFB	None	CERCLA
	210	AEC Storage Facility/Seneca Army Depot	None	CERCLA
	243	Los Lunas Bombing Range, NM	None	CERCLA
	244	Bernardo Test Site, NM	None	CERCLA
	245	New Site	None	CERCLA

Table B-1. Environmental Restoration Program Site List by Activity Data Sheet (ADS) (Continued)

ADS No.-Operable Unit	Site No.	Site Name	RCRA/RFA No.	Regulatory Driver
1337-Off-Site Areas (Continued)	246	New Site	None	CERCLA
	247	New Site	None	CERCLA
	248	New Site	None	CERCLA
	249	New Site	None	CERCLA
	250	New Site	None	CERCLA
	251	New Site	None	CERCLA
	252	New Site	None	CERCLA
1338-Tonopah Test Range	118	Underground Diesel Tank (TTR)	None	CERCLA
	119	Area 3 Landfills (TTR)	None	CERCLA
	120	Fire Training Area (TTR)	None	CERCLA
	121	Waste Oil Sumps, Bldg 360 (TTR)	None	CERCLA
	122	Area 3 Septic Systems (TTR)	None	CERCLA
	123	Photo Shop French Drains (TTR)	None	CERCLA
	124	High Explosive Disposal Area (TTR)	None	CERCLA
	125	Area 9 Landfill (TTR)	None	CERCLA
	126	Mobile Photographic Lab (TTR)	None	CERCLA
	127	Non-Violent Explosive Destruct System (NEDS) (TTR)	None	CERCLA
	128	Antelope Lake (TTR)	None	CERCLA
	134	Heavy Duty Shop Drains	None	CERCLA
	197	Bomblet Pit (TTR)	None	CERCLA

Table B-1. Environmental Restoration Program Site List by Activity Data Sheet (ADS) (Continued)

ADS No.-Operable Unit	Site No.	Site Name	RCRA/RFA No.	Regulatory Driver
1338-Tonopah Test Range (Continued)	198	Dump at Tonopah (TTR)	None	CERCLA
	253	First Gas Station USTs	None	CERCLA
	254	Second Gas Station USTs	None	CERCLA
	255	Septic Tank 33-2	None	CERCLA
	256	Septic Tank 33-3	None	CERCLA
	257	Septic Tank 33-4	None	CERCLA
	258	Septic Tank 33-5	None	CERCLA
	259	Septic Tank 33-6	None	CERCLA
	260	Septic Tank 33-7	None	CERCLA
	261	Septic Tank 33-8	None	CERCLA
	262	Septic Tank 33-9	None	CERCLA
	263	Septic Tank 33-10	None	CERCLA
	264	Septic Tank 33-11	None	CERCLA
	265	Septic Tank 33-12	None	CERCLA
	266	Septic Tank 33-13	None	CERCLA
	267	Leach Field near Bldg. 03-83T	None	CERCLA
	268	Snow Removal Soil Disposal Area	None	CERCLA
	269	UPS Building Drains	None	CERCLA
	270	Depleted Uranium Impact Site	None	CERCLA
	271	Septic Sludge Disposal Pit #1	None	CERCLA
	272	Septic Sludge Disposal Pit #2	None	CERCLA

Table B-1. Environmental Restoration Program Site List by Activity Data Sheet (ADS) (Continued)

ADS No.-Operable Unit	Site No.	Site Name	RCRA/RFA No.	Regulatory Driver
1338-Tonopah Test Range (Continued)	273	Buried DU Artillery Round #1	None	CERCLA
	274	Buried DU Artillery Round #2	None	CERCLA
DOE/AL Resp.-Responsibility of Others	95	Live Fire Range (Central Training Academy)	None	RCRA 3004(u)
DOE/NVO Resp.-Responsibility of Others	129	Cactus Springs (TTR)	None	CERCLA
	130	Roller Coaster Radioactive Decontamination Area (TTR)	None	CERCLA
	131	Roller Coaster Sanitary Sewage System and Lagoons (TTR)	None	CERCLA

Table B-1. Environmental Restoration Program Site List by Activity Data Sheet (ADS) (Concluded)

ADS No.-Operable Unit	Site No.	Site Name	RCRA/RFA No.	Regulatory Driver
KAFB Resp.-Responsibility of Others	24	Landfill and Open Dump (Tijeras Arroyo)	None	RCRA 3004(u)
	80	Current KAFB Landfill	None	RCRA 3004(u)
	158	KAFB Lagoons	None	RCRA 3004(u)
	189	Dry Radioactive Waste Burial, NE Corner of Manzano Base	None	RCRA 3004(u)
N/A-Not a SWMU	75	Thermal Treatment Facility	None	RCRA TSD
	97	Still Photo Lab (Bldg. 802)	None	None
	99	Catch Boxes (TA-I)	114	None
Site Dropped from List-Archival	79	Gas Cylinder Disposal Pit (Thunder Range) (See Archives)	None	None
	106	Explosives-Contaminated Drains (Bldgs. 9939,9960,9965,9967) (See Archives)	None	None
	110	Thunder Range (Miscellaneous) (See Archives)	None	None
	162	Bldg. 9962 Seepage	None	None
	185	Bldg. 863, TA-I (See Archives)	None	None
	195	Experimental Test Pit (See Archives)	None	None
	224	Bldg. 666A and 666B UST (Kauai)	None	None

APPENDIX C

SAMPLE COLLECTION AND ANALYSIS

CONTENTS

C.1 SAMPLE COLLECTION FOR RADIOACTIVE EFFLUENTS

Environmental samples are gathered at Sandia National Laboratories/New Mexico (SNL/NM) in accordance with the activity-specific Environment, Safety and Health (ES&H) Standard Operating Procedure (SOP) entitled "Environmental Sampling Procedure" (SNL 1992). Native vegetation (grasses unless otherwise noted), soil, arroyo sediment, and surface water are collected twice annually: once early in the growing season (May) and once later in the growing season (August). Thermoluminescent dosimeters (TLDs) are exchanged quarterly. Sampling frequencies and types of analyses are shown in Table C-1.

Vegetation: Three adjacent sections, each 3 square yards (yd^2), are marked, and native vegetation and soil samples are composited from within these sections. Because the native desert vegetation is sparse, samples include a mixture of representative grass species unless otherwise noted. The sample mass required for analysis is 0.5 kilogram (kg). If insufficient mass exists within the marked sections, an additional sample is collected from the immediate vicinity. Radionuclide concentrations for vegetation may vary according to species uptake, retention, deposition, and location. Each vegetation sample is cut and blended before radiochemical analysis for tritium (H-3) and gamma spectrum analysis.

Surface Water: Surface water samples are collected in acid-cleaned plastic or glass containers that have been rinsed in distilled water. A 1-liter (L) water sample is acidified immediately after collection for total water radiochemical analysis. A 2-L water sample is filtered through 0.45-micron filter paper to characterize the material in solution. An additional 3-L of water are filtered through 0.45-micron filter paper. The sample retained on the filter paper is used to characterize the suspended particulate matter in the water column.

Soil/Sediment: Soil samples are collected from the same three 3-yd^2 sections as the vegetation samples. Sediment samples are collected from a series of three sections in arroyo bottoms. In both cases, samples are composites of the top 5 centimeters (cm) of material. The 0.5 kg of soil required for analysis is ballmilled and sieved prior to radiochemical analysis.

C.2 RADIOCHEMICAL ANALYSIS

Vegetation: Aliquots of the vegetation samples are taken for each radiochemical analysis. One aliquot of vegetation is air-dried to reach a constant dry mass, then finely ground up and placed in a 500-milliliter (mL) Marinelli beaker for gamma-spectrum analysis. A 70-gram (g) sample (250-mL calibration geometry) is used for each gamma-spectrum analysis. A second (100-g) aliquot of vegetation is heated with cyclohexane in a 1000-mL distillation flask. The resulting water is collected in a Barrett trap and analyzed for H-3 with a liquid scintillation detector using a 1-mL sample volume.

Soil: Soil and sediment samples are analyzed for uranium (U) by leaching a 2-g aliquot with mixed acids (nitric acid [HNO_3]/hydrofluoric acid [HF]) and diluting with water to a 10-mL volume to extract U and other acid-soluble metals. A 0.1-mL aliquot of acid solution is diluted to 10 mL with 2-normal (2N) HNO_3. Fifteen mL of aluminum nitrate and 10 mL of ethyl acetate are added

Table C-1. Sampling Frequencies and Types of Analysis for Radioactive Environmental Monitoring Program

	Sample Media[a]						
				Surface Water			
Parameter	Vegetation May/August	Sediment May/August	Soil May/August	Total May/August	Solution May/August	Filters[b] May/August	TLD[c]
Number of Stations	42/42	6/6	46/46	4/4	4/4	4/4	34
Number of Samples	50/50	8/10	54/54	6/6	6/9	4/7	136
Analysis Performed							
Gross Alpha	--	--	--	12	15	11	--
Gross Beta	--	--	--	12	15	11	--
U_{total}	--	18	108	12	15	7	--
Gamma Spectroscopy	100	18	108	12	15	11	--
Tritium	100	18	108	6	15	--	--
% H_2O	100	18	108	--	--	--	--
ICP 20 Metal Scan	--	18	108	--	--	--	--
Total Number of Analyses	300	90	540	54	75	40	

[a]Includes sample blanks and replicate samples
[b]Filter samples for analysis of suspended solids
[c]TLD = thermoluminescent dosimeter. Samples collected quarterly.
Note that "--" indicates no analysis was performed.

and mixed for 10 minutes (min) to selectively extract U into the organic phase. Three 0.1-mL aliquots are then fused with a sodium fluoride (NaF)/lithium fluoride (LiF) flux and tested by fluorescence.

Percent Moisture: Percent moisture for soil and sediment samples is determined by one of two methods. Either moisture balance is used to provide a direct readout of percent moisture in 10 g of soil, or 10 g of soil is dried at 110 degrees celsius (°C) until a constant dry weight is reached. This weight is then used in calculating percent moisture.

Gamma-Spectrum Analysis: Water, soil, and vegetation samples are analyzed according to American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE) Standard 680-1978 (R1985), "Germanium Semiconductor Detector Gamma-Ray Efficiency Determination Using a Standard Marinelli (Reentrant) Beaker Geometry" (ANSI/IEEE 1978). The samples are analyzed for gamma-emitting radionuclides by placing ~450 g of water or 862 g of soil in 500-mL Marinelli beakers and counting for 1000 min (100 min for soil) using high-efficiency, high-resolution intrinsic germanium (Ge) or Ge(Li) detectors and multichannel analyzers. The 70-g vegetation samples are analyzed in a 250-mL geometry. The detectors are calibrated and checked routinely using either a mixed radionuclide standard obtained from the National Institute of Standards (NIST) or by using a standard for specific radionuclides traceable to the National Bureau of Standards (NBS). The data are analyzed by computer software developed by Canberra Industries.

Surface Water: Surface water samples are further analyzed for gross alpha and gross beta activity by evaporating an aliquot of water (100 mL for alpha analysis, 400 mL for beta analysis) on a 5-cm-diameter stainless-steel planchet and counting for 100 min using a low-background, gas-proportional detector. The detector is calibrated and checked routinely using radionuclide standards traceable to the NBS.

C.3 EXTERNAL PENETRATING RADIATION

TLDs are placed at current locations. The type of TLD phosphor used is LiF in chip form. All dosimeters are placed in open areas over soil substrates 1 meter (m) above ground level. A minimum of five TLDs are placed at each location to get an estimate of the variability in TLD response at that location. TLDs are exchanged on a quarterly basis. A dedicated set of environmental TLDs is maintained for this program.

All TLDs are annealed at 400°C for 1 hour (hr) before field placement. Transit controls are used to document additional exposure received during transit from SNL/NM to field locations. The TLD readout equipment is calibrated by exposing TLDs to 0, 10, 20, 30, and 50 milliroentgen (mR) of cesium-137 (Cs-137) midway through each quarterly field cycle. Ten TLDs are exposed at each level.

Procedures used in the SNL/NM environmental dosimetry program are documented in the dosimetry procedures manual (Thompson 1987, SNL 1994).

C.4 SAMPLE COLLECTION AND ANALYSIS FOR GROUNDWATER SAMPLES

C.4.1 Sample Collection

Sampling protocol is as follows: Water-level measurements are taken using an electric well-sounding instrument. After four to ten well volumes are evacuated from each well, pumping continues until pH, temperature, and conductivity stabilize. The pH is considered stable when three consecutive measurements agree within 0.2 pH units. Temperature is considered stable when three consecutive measurements agree within 0.2°C. Conductivity is considered stable when two consecutive measurements agree within 10 micromhos. All groundwater samples are collected and preserved as described in Table C-2. Organic sample bottles are filled with a restricted water flow to minimize splashing which would volatilize low molecular weight compounds. Volatile aromatic organics are sampled by filling the bottle until a meniscus forms above the lip of the bottle to ensure no headspace. The concern is that the volatile materials will escape into the headspace and result in an erroneous reading. Because of the depth of the groundwater wells, dissolved carbon dioxide volatilizes when the samples are brought to the surface. The evolving carbon dioxide inevitably results in a headspace in the samples. This phenomenon is documented in the field logs. The U.S. Environmental Protection Agency (EPA) is reviewing the significance of headspace in samples containing organics. Specific details on sampling procedures are described in the sampling and analysis plan (SNL 1993).

For analysis, analytical methods described in EPA documents (EPA 1983) are used. If a method is not available in either of the above, an appropriate method from one of the standard references is used.

Inorganic analyses are performed primarily using inductively coupled plasma emission spectrometry (ICP), ion chromatography, and graphite furnace atomic absorption (GFAA). Organic analyses are performed primarily using gas chromatography (GC) and GC/mass spectrometry (GC/MS).

C.4.2 Sources of Error

The purpose of statistical testing for changes in groundwater parameter values over time is to utilize a methodology that can quantitatively show a significant change at a specified level. Identifying a significant change, however, does not in itself confirm that a release from the Chemical Waste Landfill (CWL) has reached the groundwater. One must review the data, the sampling and analytical methods, and the assumptions for the statistical tests to confirm that the statistical change represents a true change.

<u>pH</u>: Because relatively small changes in parameter values may indicate a significant change, the data must reflect similar methods for collection and analysis, including calibration methods and corrections for changes in conditions affecting the measurement.

A review of field data-collection logs reveals that all pH measurements have been made with a field pH instrument. Potential sources of error include temperature, gas exchange, and suspension effects. The meter is calibrated in the field using standard buffer solutions. A potential source of error for the pH

Table C-2. Recommended Analytical Methods, Sample Containers, Preservation Techniques, and Holding Times

Parameter	Method No. (SW-846)[a]	Estimated Method Detection Limit[b]	Container Type[c]	Minimum Volume	Preservation[d]	Maximum Holding Time[d]
<u>Indicator Parameters</u>						
pH	9040	NA	P, G	50 mL	NA	Field measurement
Specific Conductance	Modified 9050	NA	P, G	100 mL	NA	Field measurement
Total Organic Carbon (TOC)	9060	1 mg/L	P, G	4 x 250 mL	Cool to 4°C, HCL or HSO to pH <2	28 days
Total Organic Halogens (TOX)	9020	30 μg/L	G, AG, Teflon-lined cap	4 x 250 mL	Cool to 4°C, HSO to pH <2	28 days
<u>Groundwater Quality Parameters</u>						
Chloride	9250/9251 color EPA 300.0[e] IC	1 mg/L 3 mg/L	P, G	50 mL	None required	28 days
Phenols	9065 4AAP	10 μg/L	G, Teflon-lined cap	500 mL	Cool to 4°C, HSO to pH <4	28 days
Sulfate	9035 color 9036 color 9038 color EPA 300.0[e] IC	10 mg/L 0.5 mg/L 1 mg/L 5 mg/L	P, G	50 mL	Cool to 4°C	28 days
Iron	6010 ICP	0.10 mg/L	P	1000 mL[f]	HNO to pH <2	6 months
Manganese	6010 ICP	0.01 mg/L	P	1000 mL[f]	HNO to pH <2	6 months

[a]U.S. Environmental Protection Agency, 1986, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," Third Edition, EPA 530/SW-846, unless otherwise noted (EPA 1986a). Color = Color metric technique; IC = ion chromatography; ICP = inductively coupled plasma spectroscopy; GFAA = graphite furnace atomic absorption; CVAA = cold vapor atomic absorption; GC = gas chromatography; IS = ion selective probe; and GC/MS = gas chromatography/mass spectrometry.

[b]Method detection limit as listed for specified method. Detection limits listed as mg/L = milligrams per liter; μg/L = micrograms per liter; and pCi/L = picocuries per liter.

[c]Container types: P = linear polyethylene; G = glass; and AG = amber glass.

[d]Preservatives and holding times as specified in EPA-SW-846, Third Edition (EPA 1986a).

[e]U.S. Environmental Protection Agency, 1984, "Methods for Chemical Analysis of Water and Wastewater," EPA-600-84-017 (EPA 1984).

[f]All metals analytes from single sample.

[g]All radionuclide analytes from single container.

[h]All pesticides and herbicides from single set of containers.

Table C-2. Recommended Analytical Methods, Sample Containers, Preservation Techniques, and Holding Times (Continued)

Parameter	Method No. (SW-846)[a]	Estimated Method Detection Limit[b]	Container Type[c]	Minimum Volume	Preservation[d]	Maximum Holding Time[d]
Sodium	6010 ICP	5.0 mg/L	P	1000 mL[f]	HNO to pH <2	6 months
EPA Interim Drinking Water Parameters						
Arsenic	7060 GFAA	0.005 mg/L	P	1000 mL[f]	HNO to pH <2	6 months
Barium	6010 ICP	0.01 mg/L	P	1000 mL[f]	HNO to pH <2	6 months
Cadmium	7131 GFAA 6010 ICP	0.0005 mg/L 0.005 mg/L	P	1000 mL[f]	HNO to pH <2	6 months
Total Chromium	7191 GFAA 6010 ICP	0.001 mg/L 0.01 mg/L	P	1000 mL[f]	HNO to pH <2	6 months
Lead	7421 GFAA	0.005 mg/L	P	1000 mL[f]	HNO to pH <2	6 months
Mercury	7470 CVAA	0.0002 mg/L	P, G	1000 mL[f]	HNO to pH <2	13 days in plastic 38 days in glass
Selenium	7740 GFAA	0.002 mg/L	P	1000 mL[f]	HNO to pH <2	6 months
Silver	EPA 272.2[e] GFAA 6010 ICP	0.0005 mg/L 0.01 mg/L	P Dark, AG	1000 mL[f]	HNO to pH <2	6 months
Gross Alpha	9310	3 pCi/L	P	1 gal	HNO to pH <2	6 months
Gross Beta	9310	4 pCi/L	P	1 gal	HNO to pH <2	6 months

[a]U.S. Environmental Protection Agency, 1986, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," Third Edition, EPA-SW-846, unless otherwise noted (EPA 1986a). Color = Color metric technique; IC = ion chromatography; ICP = inductively coupled plasma spectroscopy; GFAA = graphite furnace atomic absorption; CVAA = cold vapor atomic absorption; GC = gas chromatography; IS = ion selective probe; and GC/MS = gas chromatography/mass spectrometry.
[b]Method detection limit as listed for specified method. Detection limits listed as mg/L = milligrams per liter; µg/L = micrograms per liter; and pCi/L = picocuries per liter.
[c]Container Types: P = linear polyethylene; G = glass; and AG = amber glass.
[d]Preservatives and holding times as specified in EPA-SW-846, Third Edition (EPA 1986a).
[e]U.S. Environmental Protection Agency, 1984, "Methods for Chemical Analysis of Water and Wastewater," EPA-600-84-017 (EPA 1984).
[f]All metals analytes from single sample.
[g]All radionuclide analytes from single container.
[h]All pesticides and herbicides from single set of containers.

Table C-2. Recommended Analytical Methods, Sample Containers, Preservation Techniques, and Holding Times (Continued)

Parameter	Method No. (SW-846)[a]	Estimated Method Detection Limit[b]	Container Type[c]	Minimum Volume	Preservation[d]	Maximum Holding Time[d]
Total Radium	9315	3 pCi/L	P, G	1 gal[g]	HNO to pH <2	6 months
Endrin	8080 GC	0.10 µg/L	AG, Teflon-lined cap	2 x 1000 mL[h]	Cool to 4°C, pH 5-9	7 days to extraction, 40 days after extraction
Lindane (q-BHC)	8080 GC	0.05 µg/L	AG, Teflon-lined cap	2 x 1000 mL[h]	Cool to 4°C, pH 5-9	7 days to extraction, 40 days after extraction
Methoxychlor	8080 GC	0.5 µg/L	AG, Teflon-lined cap	2 x 1000 mL[h]	Cool to 4°C, pH 5-9	7 days to extraction, 40 days after extraction
Toxaphene	8080 GC	1.0 µg/L	AG, Teflon-lined cap	2 x 1000 mL[h]	Cool to 4°C, pH 5-9	7 days to extraction, 40 days after extraction
2,4-D	8150 GC	20 µg/L	AG, Teflon-lined cap	2 x 1000 mL[h]	Cool to 4°C, pH 5-9	7 days to extraction, 40 days after extraction
2,4,5-TP Silvex	8150 GC	10 µg/L	AG, Teflon-lined cap	2 x 1000 mL[h]	Cool to 4°C, pH 5-9	7 days to extraction, 40 days after extraction

[a]U.S. Environmental Protection Agency, 1986, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," Third Edition, EPA-SW-846, unless otherwise noted (EPA 1986a). Color = Color metric technique; IC = ion chromatography; ICP = inductively coupled plasma spectroscopy; GFAA = graphite furnace atomic absorption; CVAA = cold vapor atomic absorption; GC = gas chromatography; IS = ion selective probe; and GC/MS = gas chromatography/mass spectrometry.
[b]Method detection limit as listed for specified method. Detection limits listed as mg/L = milligrams per liter; µg/L = micrograms per liter; and pCi/L = picocuries per liter.
[c]Container Types: P = linear polyethylene; G = glass; and AG = amber glass.
[d]Preservatives and holding times as specified in EPA-SW-846, Third Edition (EPA 1986a).
[e]U.S. Environmental Protection Agency, 1984, "Methods for Chemical Analysis of Water and Wastewater," EPA-600-84-017 (EPA 1984).
[f]All metals analytes from single sample.
[g]All radionuclide analytes from single container.
[h]All pesticides and herbicides from single set of containers.

Table C-2. Recommended Analytical Methods, Sample Containers, Preservation Techniques, and Holding Times (Concluded)

Parameter	Method No. (SW-846)[a]	Estimated Method Detection Limit[b]	Container Type[c]	Minimum Volume	Preservation[d]	Maximum Holding Time[d]
Fluoride	EPA 300.0[e] IC EPA 340.2[e] IS	0.005 mg/L 0.1 mg/L	P	300 mL	None required	28 days
Turbidity	EPA 180.1[e]	<1 NTU	P,G	200 mL	Cool to 4°C	48 hr
Nitrate (as Nitrogen)	EPA 300.0[e] IC EPA 353.2[e] color	0.1 mg/L 0.1 mg/L	P,G P,G	100 mL 100 mL	Cool to 4°C Cool to 4°C, HSO to pH <2	48 hr 28 days
Total Coliform Bacteria	9132	<2 colony/100 mL	P/G (sterilized)	200 mL	Cool to 4°C	6 hr
<u>Supplemental Parameters</u>						
Volatile Organics	8240 GCMS	5-100 µg/L	G,Teflon-lined Septa	3 x 40 mL	Cool to 4°C, 4 drops HCL optional	14 days
Semivolatile Organics	8270 GCMS	10-50 µg/L	AG	2 x 1/2 gal, or 1 x 1 gal	Cool to 4°C	7 days to extraction, 40 days after extraction

[a]U.S. Environmental Protection Agency, 1986, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," Third Edition, EPA-SW-846, unless otherwise noted (EPA 1986a). Color = Color metric technique; IC = ion chromatography; ICP = inductively coupled plasma spectroscopy; GFAA = graphite furnace atomic absorption; CVAA = cold vapor atomic absorption; GC = gas chromatography; IS = ion selective probe; and GC/MS = gas chromatography/mass spectrometry.

[b]Method detection limit as listed for specified method. Detection limits listed as mg/L = milligrams per liter; µg/L = micrograms per liter; and pCi/L = picocuries per liter.

[c]Container Types: P = linear polyethylene; G = glass; and AG = amber glass.

[d]Preservatives and holding times as specified in EPA-SW-846, Third Edition (EPA 1986a).

[e]U.S. Environmental Protection Agency, 1984, "Methods for Chemical Analysis of Water and Wastewater," EPA-600-84-017 (EPA 1984).

[f]All metals analytes from single sample.

[g]All radionuclide analytes from single container.

[h]All pesticides and herbicides from single set of containers.

measurements is thought to result from the calibration procedure when the buffer solutions are at a different temperature than the groundwater being measured. A review of the sensitivity of pH to temperature changes, however, shows that the measurement is somewhat insensitive to temperature changes. Standard buffer solutions in the pH range near 7 will have a variation in pH of 0.02 to 0.03 units over a temperature range of 10° to 50°C. The field measurements of temperature of the solutions measured for pH range from 15° to 30°C.

Because it is impractical to make in situ measurements of groundwater pH, samples must be brought to the surface. Two methods are used to evacuate and sample the wells: (1) pumping with a small-diameter piston pump, and (2) bailing. The potential for gas exchange exists when the groundwater flows into the wellbore and continues until the groundwater sample is measured at the surface. The use of the piston pump to purge and sample wells reduces groundwater contact with the atmosphere. Generally, water is pumped into a sample container, and the pH is measured as soon as practical. Water collected by bailing in the wellbore is generally surged and mixed with the atmosphere existing in the wellbore above the water. The water within the bailer is then removed and placed into a bucket.

Wells MW-1 and BW-1, both 2-inch-diameter wells that do not allow a pump to pass restricted zones within the casing, must be bailed for purging and sampling. The water in wells MW-1 and BW-1 is extremely turbid; therefore, the suspension is allowed to settle for ~15 min before bailing. The loss or gain of certain volatile constituents that participate in controlling the solution pH, such as carbon dioxide (CO_2) and hydrogen sulfide (H_2S), will alter the pH as a time-dependent phenomenon. The absorption of CO_2 into the solution will generate carbonic acid, release hydrogen ions from carbonate-bicarbonate reactions, and cause a decrease in the pH. The equilibrium pH from partial pressure of atmospheric CO_2 is about 5 (Garrels and Christ 1965). Currently, the magnitude of this potential source of error for groundwater is not understood; however, a standard geochemistry textbook reveals a change of 1.5 pH units for a de-aerated alkaline solution allowed to absorb atmospheric constituents (Garrels and Christ 1965).

The effects of mineral suspensions on the results of pH determination are also an important source of error. Carbonate minerals such as calcite (limestone) and aragonite (caliche) hydrolyze in solution, releasing carbonate. The carbonate removes hydrogen ions from the solution, using the same carbonate-bicarbonate reaction noted above, and acts to increase the pH. The equilibrium pH due to calcite is ~9.5 (Garrels and Christ 1965).

The negative charges on the surfaces of clays are also capable of removing hydrogen ions from solutions and increasing the pH. A small laboratory experiment was performed to determine the effect of a clay (found near the water table during the drilling of well MW-1A, 50 feet [ft] to the west of MW-1) on the pH of distilled water. The results showed that the addition of small amounts of the clay would linearly increase the pH from 7.2 to 8.9. Due to the large screen size and the necessity to bail MW-1 for purging and sampling, well MW-1 showed very high turbidity levels.

Specific Conductivity: All data for the specific conductance parameter are found in the field data-collection logs. Temperature differences of 1°C can lead to about a 2-percent difference in the value of specific conductance. These data were not corrected for temperature in the field but were corrected to 25°C prior to reporting.

Statistical Assumptions: The statistical procedure used to test for significant change is specified in the groundwater monitoring regulations. A critical review of the assumptions that support this statistical test must be performed to determine whether the assumptions are upheld. If not, the validity of the conclusion of the statistical test must be questioned.

The Cochran's Approximation to the Behren-Fisher (CABF) t-test method was developed to analyze independent samples with unequal population variances. Because of the inherently high false-positive rate, there was sufficient criticism of this method that the EPA issued a final rule October 11, 1988, amending the statistical tests required for groundwater monitoring (EPA 1988). The rule specifies five other tests, more appropriate to groundwater monitoring than the CABF method, for permitted facilities under 40 Code of Federal Regulations (CFR) 264. EPA concluded that most land disposal facilities would have permits by November 1988 and thus there was no need to modify the interim status regulations of 40 CFR 265.

Two sources have identified potential problems using CABF as a method to detect releases from a hazardous waste management unit. EPA "RCRA Technical Enforcement Guidance Document" discusses t-tests available for facilities under interim status (EPA 1986b). In that document, the authors detail an alternative t-test, the Averaged Replicate (AR) t-test, that is recommended as more appropriate than the CABF t-test method for groundwater monitoring.

The October 1988 final rule on statistical methods for groundwater monitoring points out several reasons for rejecting the CABF t-test method: (1) it is not appropriate for the replicate sampling method required by the regulations, (2) it does not adequately consider the number of comparisons that must be made under the regulations, and (3) it has no control for seasonal variations in parameter values (EPA 1988). Concern arose regarding potential false-positive errors and false-negative errors exceeding reasonable rates for a regulated concern. As a result, four specific statistical tests, not including the CABF or the AR t-tests, and an option for the owner/operator to propose any other test, were issued as a final rule on October 11, 1988. Until SNL/NM certifies closure of the CWL and becomes a permitted facility requiring postclosure monitoring, the statistical tests must remain t-tests as specified in 40 CFR 265 for interim status facilities or by the New Mexico Environment Department (NMED).

C.5 SAMPLE COLLECTION AND ANALYSIS FOR WASTEWATER SAMPLING

Complete documentation for the wastewater sampling program can be found in the Wastewater Monitoring Program Quarterly Reports (IT 1993). These documents describe the methods and procedures used for the samples collected from the sampling locations (see Table 6-2 of Chapter 6).

REFERENCES

ANSI/IEEE 1978: American National Standards Institute/Institute of Electrical and Electronics Engineers, "Germanium Semiconductor Detector Gamma Ray Efficiency Determination Using a Standard Marinelli (Reentrant) Beaker Geometry," ANSI/IEEE Standard 680-1978 (R1985), ANSI, New York, NY.

40 CFR 264, 1980. "Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," including Subpart F, Section 264.101, "Releases for Solid Waste Management Units," as amended June 10, 1994.

40 CFR 265, 1980. "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," as amended December 23, 1991.

EPA 1983: U.S. Environmental Protection Agency, "Methods for Chemical Analysis of Water and Wastes," EPA-600/4-79-020, EPA, Washington, DC (1983).

EPA 1984: U.S. Environmental Protection Agency, "Methods for Chemical Analysis of Water and Waste Water," EPA-600-84-017, EPA, Washington, DC (1984).

EPA 1986a: U.S. Environmental Protection Agency, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Third Edition," EPA-SW-846, EPA, Washington, DC (1986).

EPA 1986b: U.S. Environmental Protection Agency, "RCRA Technical Enforcement Guidance Document (TEGD)," OSWER-9950.1, EPA, Washington, DC (1986).

EPA 1988: U.S. Environmental Protection Agency, "Statistical Methods for Evaluating Ground-Water Monitoring Data From Hazardous Waste Facilities," 53 FR 39720, EPA, Office for Water, Office of Solid Waste (Final Rule October 11, 1988).

Garrels and Christ 1965: Garrels, R. M., and C. L. Christ, *Solutions, Minerals and Equilibria*, New York, NY: Harper and Row (1965).

IT 1993: International Technology Corporation, "Wastewater Monitoring Program Quarterly Reports for 1993" prepared for Sandia National Laboratories, Albuquerque, NM (1993).

SNL 1992: Sandia National Laboratories, "Environmental Sampling Procedure," SP471991, Environmental Protection Department (7725), Sandia National Laboratories, Albuquerque, NM (1992).

SNL 1993: Sandia National Laboratories, "Groundwater Surveillance Program, Sampling and Analysis Plan, March 1993 (Draft)," Sandia National Laboratories, Albuquerque, NM (1993).

SNL 1994: Sandia National Laboratories, "Environmental Dosimetry Processing," Personnel Radiation Dosimetry Program (PRDP)-30-04, Sandia National Laboratories, Albuquerque, NM (April 21, 1994).

Thompson 1987: Thompson, D. J., "Description and Procedures of the Environmental Radiation Dosimetry Program," SAND87-1916, Sandia National Laboratories, Albuquerque, NM (August 1987).

APPENDIX D

MINIMUM DETECTION LIMITS

CONTENTS

Table D-1. Detection Limits for Selected Radiochemical Analysis[a]

Analysis	Sample Media	Sample Minimum Size	Detection Limit	Count Time
H-3	Water	10 mL	0.3 pCi/mL	125 min
	Vegetation	10 mL[b]	0.3 pCi/mL[b]	125 min
	Soil	10 mL[b]	0.3 pCi/mL[b]	125 min
U_{tot}	Water	100 mL	0.002 mg/L	N/A[c]
	Soil	100 g	0.1 μg/g	N/A
Gross Alpha	Water	100 mL	3 pCi/L	100 min
Gross Beta	Water	100 mL	4 pCi/L	100 min
Gamma Spectral[d]	--	--	--	4 hr

[a]ANSI (1989).
[b]Extracted water.
[c]Not applicable.
[d]Detection limit and required sample size vary depending on radionuclide and media of interest.

REFERENCE

ANSI 1989: American National Standards Institute, "Performance Criteria for Radiobioassay," ANSI-N13.30-DRAFT-89, ANSI, New York, NY (1989).

APPENDIX E

QUALITY ASSURANCE DATA

CONTENTS

TABLES Page

Table E-1. Analytical Laboratories Used During 1993

Accu-Labs Research, Inc.
Allied Signal Aerospace Company
Archive Laboratory
Assaigai Analytical Laboratories, Inc.
Environmental Control Technology Corporation (ENCOTEC)
Enseco-Rocky Mountain Analytical Laboratory (RMAL)
Iowa State University
IT Analytical Services, Cincinnati
IT Radiological Sciences Laboratory
Inhalation Toxicology Research Institute (ITRI)
New Jersey Institute of Technology
New Mexico State University
Southern Methodist University
Sandia National Laboratories/New Mexico (SNL/NM)
Daniel B. Stephens & Associates
Texas Bureau of Economic Geology
TMA/Eberline
University of Texas

Table E-2. Determination of Sample Variability in Replicate Samples for Selected Radionuclide Analysis in Soil, Sediment, and Vegetation for May 1993[a,b]

Sample Matrix	Location	Number of Samples	U (µg/g) $\bar{x} \pm s_{\bar{x}}$ (CV)[c]	H-3 (pCi/mL) $\bar{x} \pm s_{\bar{x}}$ (CV)[c]	Cs-137 (pCi/g) $\bar{x} \pm s_{\bar{x}}$ (CV)[c]	K-40 (pCi/g) $\bar{x} \pm s_{\bar{x}}$ (CV)[c]
Soil	2 NE	3	0.7 ± 0.2 (31)	47 ± 12 (25)	0.12 ± 0.03 (0.25)	18 ± 0 (-)[d]
Soil	7	3	0.8 ± 0.2 (20)	0.18 ± 0.11 (61)	0.92 ± 0.16 (17)	18 ± 1 (3)
Soil	11	3	1.0 ± 0.4 (51)	0.00 ± 0.06 (1700)	0.05 ± 0.05 (92)	19 ± 1 (6)
Soil	53	3	1.0 ± 0.2 (20)	0.06 ± 0.02 (27)	0.11 ± 0.03 (27)	17 ± 1 (7)
Sediment	11	3	0.9 ± 0.2 (22)	-0.07 ± 0.04 (57)	0.01 ± 0.02 (200)	19 ± 2 (11)
Vegetation	2 NE	3	--	10 ± 2 (16)	--	6 ± 2 (27)
Vegetation	7	3	--	-0.07 ± 0.03 (44)	--	1 ± 0 (-)[d]
Vegetation	11	3	--	0.03 ± 0.10 (340)	--	20 ± 4 (20)
Vegetation	53	3	--	-0.03 ± 0.06 (210)	--	1 ± 0 (87)

[a]All individual results are listed in Tables F-1, F-3, and F-7 of Appendix F.
[b]Where values are reported as less than detection limit, the detection limit is used in averaging.
[c]Coefficient of Variation (CV) = (Standard deviation ÷ mean) x 100.
[d]All individual values are identical.

Table E-3. Determination of Sample Variability in Replicate Samples for Selected Radionuclide Analysis in Soil, Sediment, and Vegetation for August 1993[a,b]

Sample Matrix	Location	Number of Samples	U(μg/g) $\bar{x} \pm s_{\bar{x}}$ (CV)[c]	H-3 (pCi/mL) $\bar{x} \pm s_{\bar{x}}$ (CV)[c]	Cs-137 (pCi/g) $\bar{x} \pm s_{\bar{x}}$ (CV)[c]	K-40 (pCi/g) $\bar{x} \pm s_{\bar{x}}$ (CV)[c]
Soil	2 NE	3	0.8 ± 0.1 (12)	12 ± 0.6 (4.7)	0.04 ± 0.04 (87)	18 ± 1 (3)
Soil	7	3	0.9 ± 0.1 (11)	-0.05 ± 0.04 (87)	0.52 ± 0.06 (11)	19 ± 0 (-)[d]
Soil	11	3	1.2 ± 0.2 (17)	0.2 ± 0.05 (26)	0.05 ± 0.04 (87)	18 ± 1 (3)
Soil	53	3	1.1 ± 0.2 (20)	-0.01 ± 0.14 (1400)	0.13 ± 0.03 (23)	16 ± 1 (6)
Vegetation	2 NE	3	--	16 ± 2 (13)	--	0.1 ± 0 (-)[d]
Vegetation	7	3	--	0.11 ± 0.02 (22)	--	13 ± 2 (19)
Vegetation	11	3	--	-0.07 ± 0.05 (63)	--	13 ± 2 (12)
Vegetation	53	3	--	0.03 ± 0.08 (300)	--	6.5 ± 1.4 (21)
Sediment	11	3	1.0 ± 0.1 (100)	-0.05 ± 0.06 (120)	0.01 ± 0.02 (200)	19 ± 1 (8)
Sediment	73	3	1.4 ± 0.2 (14)	-0.03 ± 0.06 (200)	0.00 ± 0.0 (-)[d]	25 ± 1 (5)

[a]All individual results are listed in Tables F-2, F-4, and F-8 of Appendix F.
[b]Where values are reported as less than detection limit, the detection limit is used in averaging.
[c]Coefficient of Variation (CV) = (Standard deviation ÷ mean) x 100.
[d]All individual values are identical.

Table E-4. Determination of Sample Variability in Replicate Samples for Selected Radionuclides Analysis in Surface Water for May and August 1993[a]

Water Matrix	Location	Number of Samples	Gross alpha (pCi/L) $\bar{x} \pm s_{\bar{x}}$ (CV)[b]	Gross beta (pCi/L) $\bar{x} \pm s_{\bar{x}}$ (CV)[b]	U_{tot} (mg/L) $\bar{x} \pm s_{\bar{x}}$ (CV)[b]	H-3 (pCi/mL) $\bar{x} \pm s_{\bar{x}}$ (CV)[b]
May 93	11					
Solution		3	2 ± 1 (30)	6 ± 2 (40)	0.005 ± 0.000 (-)[c]	-0.10 ± 0.07 (70)
Total		3	3 ± 0 (-)[c]	7 ± 1 (9)	0.005 ± 0.001 (11)	--
August 93	11					
Solution		3	3 ± 1 (300)	5 ± 1 (20)	0.005 ± 0.0 (-)	0.00 ± 0.03 (-)[d]
Total		3	10 ± 4 (40)	21 ± 4 (20)	0.006 ± 0.001 (20)	-0.02 ± 0.05 (250)
	DI[e]					
Suspended Solids		3	0 ± 0 (-)	0.0 ± 0.0 (-)[c]	0.005 ± 0.0 (-)[c]	--
Total		3	1 ± 0 (-)	1 ± 1 (40)	0.005 ± 0.0 (-)[c]	0.05 ± 0.10 (210)

[a]All individual results are listed in Tables F-5 and F-6 of Appendix F.
[b]Coefficient of Variation (CV) = (Standard deviation ÷ mean) x 100.
[c]All individual values are identical.
[d]Uncalculatable (division by zero).
[e]Deionized water blanks.

Table E-5. 1993 Quality Assurance Results for Selected Radiochemical Analysis Environmental Protection Agency/Accu-Labs Research, Inc., Intercomparison Study, Cross-Check Results[a,b]

Month	EPA Result (pCi/L ± 3 sigma)	Accu-Labs Results (pCi/L ± 2 sigma)	Deviation From Known (sigma)	Grand Average	Deviation from Grand Average
		Gross Alpha in Water			
10/93	20.0 ± 5.0*	18 ± 3; 15 ± 2; 16 ± 3	-1.27	14.08	0.78
07/93	15.0 ± 5.0*	15 ± 2; 16 ± 3; 17 ± 2	0.35	12.06	1.36
04/93	95.0 ± 24.0*	91 ± 4; 89 ± 4; 94 ± 4	-0.26	96.63	-0.38
01/93	34.0 ± 9.0*	**	--	--	--
		Gross Beta in Water			
10/93	15.0 ± 5.0*	14 ± 2; 16 ± 2; 14 ± 2	-0.12	17.01	-0.81
07/93	43.0 ± 6.93*	33 ± 2; 36 ± 2; 36 ± 2	-2.00	37.65	-0.66
04/93	177.0 ± 27.0*	157 ± 4; 154 ± 4; 155 ± 4	-1.39	155.52	-0.01
01/93	44.0 ± 5.0*	**	--	--	--
		Uranium in Water			
07/93	25.3 ± 3.0*	27.8; 26.3; 27.4	1.08	24.91	1.30
04/93	28.9 ± 3.0*	30.1; 29.9; 29.0	0.44	27.64	1.17
02/93	7.6 ± 3.0*	60.8; 61.2; 61.2**	30.87	7.16	31.12
		Tritium in Water			
11/93	7398 ± 740*	7640 ± 280; 7600 ± 280; 7370 ± 280	0.32	7215.65	0.75
06/93	9844 ± 984*	10100 ± 300; 10200 ± 300; 10500 ± 300	-0.78	9591.82	-1.23
06/93	5.0 ± 5.0	6 ± 1; 6 ± 1; 5 ± 1	0.23	--	--
10/93	10.0 ± 5.0	13 ± 1; 13 ± 1; 14 ± 1	1.15	--	--
11/93	40.0 ± 5.0	43 ± 4; 41 ± 4; 43 ± 4	0.81	--	--

[a]Calculations performed by EPA according to "Environmental Radioactivity Laboratory Intercomparison Studies Program, February 1981," EPA 600/4-81-004 (Jarvis and Siu 1981)
[b]Complete results on file in Center 7500 Environmental Records Center.
* = not requested
** = no result

Table E-6. U.S. Department of Energy Operational Safety, Health and Environment Division, Quality Assessment Program (QAP), Accu-Labs Research, Inc., Results

Radionuclide	QAP XXXVIII - 9303 ALR Result	QAP XXXVIII - 9303 EML Result	QAP XXXVIII - 9303 Ratio ALR/EML	QAP XXXIX - 9309 ALR Result	QAP XXXIX - 9309 EML Result	QAP XXXIX - 9309 Ratio ALR/EML
Vegetation (Bq/kg dry)[a]						
Pu-239	0.380 ± 0.122	0.323	1.18	0.79 ± 0.27	0.965	0.82
Pu-239	0.243 ± 0.104	0.323	0.75	**	**	**
Pu-238	1.36 ± 0.10	1.14	1.19	0.42 ± 0.33	0.463	0.91
Am-241	0.216 ± 0.088	0.231	0.94	0.49 ± 0.12	0.465	1.05
Sr-90	205 ± 25	237	0.86	206 ± 17	221	0.93
Cs-137	26.0 ± 1.3	24.6	1.06	105 ± 3	89.2	1.18
K-40	343 ± 14	383	0.90	886 ± 26	842	1.05
Co-60	*	*	*	7.87 ± 1.44	6.45	1.22
Water (Bq/L)[b]						
Pu-239	0.904 ± 0.118	0.828	1.09	0.35 ± 0.05	0.338	1.04
Pu-238	0.463 ± 0.074	0.494	0.94	1.22 ± 0.08	1.14	1.07
U-234	0.137 ± 0.052	0.151	0.91	1.00 ± 0.09	1.06	0.94
U-238	0.139 ± 0.051	0.147	0.95	**	**	**
Am-241	0.330 ± 0.053	0.440	0.75	1.68 ± 0.10	1.39	1.21
Sr-90	1.45 ± 0.14	1.03	1.41	2.54 ± 0.31	2.52	1.01
Cs-137	55.8 ± 2.8	50.8	1.10	85.8 ± 3.9	75.5	1.14
H-3	107 ± 6	97.0	1.10	282 ± 11	270	1.04
Mn-54	110 ± 3	105	1.05	119 ± 5	109	1.09
Co-60	48.6 ± 1.9	45.3	1.07	112 ± 3	99.6	1.12
Cs-134	46.0 ± 2.3	42.4	1.08	57.7 ± 3.2	56.1	1.03
Ce-144	90.8 ± 6.4	83.6	1.09	198 ± 10	173	1.14

[a] Units and results are as reported by DOE QAP. To convert to pCi/g, multiply Bq/kg by 0.37.
[b] Units and results are as reported by DOE QAP. To convert to pCi/L, multiply by 3.7×10^{2}.
* = not requested
** = no result
ALR = Accu-Labs Research
EML = Environmental Measurements Laboratory

Table E-6. U.S. Department of Energy Operational Safety, Health and Environment Division, Quality Assessment Program (QAP), Accu-Labs Research, Inc., Results (Concluded)

	QAP XXXVIII - 9303			QAP XXXIX - 9309		
Radionuclide	ALR Result	EML Result	Ratio ALR/EML	ALR Result	EML Result	Ratio ALR/EML
Soil (Bq/kg)[a]						
Pu-239	17.9 ± 3.82	11.6	1.54	3.29 ± 0.43	1.52	2.16
Pu-239	19.4 ± 3.9	11.6	1.67	**	**	**
U-234	22.9 ± 2.7	37.8	0.61	7.40 ± 0.89	24.8	0.30
U-234	29.8 ± 2.4	37.8	0.79	**	**	**
U-238	24.8 ± 2.7	37.6	0.66	7.11 ± 0.86	25.5	0.28
U-238	30.5 ± 2.4	37.6	0.81	**	**	**
Am-241	5.22 ± 1.98	6.50	0.80	1.18 ± 0.41	0.248	4.76
Sr-90	37.0 ± 6.3	41.7	0.89	5.47 ± 1.30	5.40	1.01
Cs-137	892 ± 9	923	0.97	15.9 ± 1.4	11.4	1.39
K-40	259 ± 13	321	0.81	43.8 ± 12.1	28.6	1.53

[a]Units and results are as reported by DOE QAP. To convert to pCi/g, multiply Bq/kg by 0.37.
[b]Units and results are as reported by DOE QAP. To convert to pCi/L, multiply by 3.7×10^{2}.
* = not requested
** = no result
ALR = Accu-Labs Research
EML = Environmental Measurements Laboratory

REFERENCE

Jarvis and Siu 1981: Jarvis, A. B., and L. Siu, "Environmental Radioactivity Laboratory Intercomparison Studies Program: Fiscal Year 1980-1981," EPA-600/4-81-004, prepared for the EPA by Environmental Monitoring Systems Laboratory, Las Vegas, NV (1981).

APPENDIX F

TERRESTRIAL MONITORING DATA

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Table F-1. Vegetation Sample Analysis, May 1993

Location	Location Type[a]	H-3 (pCi/mL)	H-3 SDEV[b]	H_2O (%)	K-40 (pCi/g)	K-40 SDEV[b]
1	S	-0.03	0.16	49.5	9	3.10
2 NW[c]	S	1.10	0.20	32.6	19	4.00
2 NE A	S	8.70	0.30	24.6	6	2.80
2 NE B	S	10.00	1.00	26.5	4	3.10
2 NE C	S	12.00	1.00	27.4	7	2.90
2 SE	S	0.13	0.16	22.0	5	2.80
2 SW	S	-0.01	0.16	38.9	6	3.60
3	S	0.00	0.17	30.5	2	0.50
4[d]	P	0.10	0.17	20.9	13	1.00
5	P	-0.05	0.17	26.6	0	0.38
6	S	-0.14	0.15	28.0	0	2.10
7 A	S	-0.11	0.17	27.9	1	0.63
7 B	S	-0.06	0.17	27.5	1	0.53
7 C	S	-0.05	0.17	31.6	1	0.51
8	C	-0.04	0.17	34.7	10	3.00
9	C	-0.08	0.16	28.4	25	4.00
10[e]	C	-0.06	0.16	21.7	30	4.00
11 A	C	0.05	0.18	34.9	15	4.00
11 B	C	-0.08	0.17	31.3	22	4.00
11 C	C	0.12	0.18	28.6	22	4.00
12	P	-0.12	0.17	32.2	11	4.00
16	P	0.07	0.20	27.1	7	3.00

[a]Location types: S = SNL/NM, P = Perimeter, C = Community
[b]Variability of the radioactive disintegration process (counting error) at the 95-percent confidence level, 1.96 sigma
[c]Juvenile Snake Weed
[d]Russian Thistle
[e]Alfalfa
[f]Juvenile Yellow Mustard
[g]Clover

Table F-1. Vegetation Sample Analysis, May 1993 (Concluded)

Location	Location Type[a]	H-3 (pCi/mL)	H-3 SDEV[b]	H_2O (%)	K-40 (pCi/g)	K-40 SDEV[b]
19	P	0.06	0.17	38.4	1	0.51
20	S	-0.09	0.16	30.3	6	2.90
25	C	-0.05	0.17	20.9	20	4.00
33	S	-0.01	0.17	27.6	15	4.00
34	S	-0.01	0.17	35.2	1	0.52
35	S	-0.15	0.19	24.4	1	0.48
41	S	0.09	0.15	41.2	14	3.00
42	S	0.08	0.16	40.8	0	2.70
43	S	-0.14	0.15	38.1	12	4.00
45	S	-0.12	0.15	27.2	11	3.00
46	S	-0.07	0.16	25.3	8	2.90
49	S	0.00	0.17	32.0	8	3.10
51	S	0.04	0.17	40.7	1	0.49
52	S	-0.07	0.15	49.0	12	4.00
53 A	S	-0.08	0.34	21.1	1	0.51
53 B	S	-0.03	0.27	26.9	1	0.46
53 C	S	0.03	0.23	27.6	0	0.42
54	S	-0.11	0.15	37.2	12	4.00
55	S	0.00	0.34	27.9	1	0.45
58	P	-0.06	0.17	41.5	2	0.60
59	P	0.02	0.17	41.9	1	0.47
60[f]	P	-0.05	0.16	24.9	18	4.00
61	P	0.01	0.18	32.8	20	4.00
62[g]	C	-0.04	0.16	22.4	20	4.00
63	P	0.09	0.23	22.4	1	0.50
64	P	-0.03	0.17	38.6	3	2.80
65	P	-0.05	0.19	28.1	2	0.40
66	S	-0.01	0.17	51.2	1	0.59

[a]Location types: S = SNL/NM, P = Perimeter, C = Community
[b]Variability of the radioactive disintegration process (counting error) at the 95-percent confidence level, 1.96 sigma
[c]Juvenile Snake Weed
[d]Russian Thistle
[e]Alfalfa
[f]Juvenile Yellow Mustard
[g]Clover

Table F-2. Vegetation Sample Analysis, August 1993

Location	Location Type[a]	H-3 (pCi/mL)	H-3 SDEV[b]	H_2O (%)	K-40 (pCi/g)	K-40 SDEV[b]
1	S	0.05	0.17	32.5	< 0.1	--
2 NE A	S	14.00	1.00	21.0	< 0.1	--
2 NE B	S	18.00	1.00	23.6	< 0.1	--
2 NE C	S	17.00	1.00	33.5	< 0.1	--
2 NW	S	5.20	0.30	28.1	< 0.1	--
2 SE	S	9.20	0.40	22.1	< 0.1	--
2 SW	S	6.20	0.30	21.6	< 0.1	--
3	S	-0.06	0.27	28.3	7.1	2.5
4[c]	P	-0.16	0.16	23.6	50.0	5.0
5	P	-0.19	0.33	20.6	2.6	2.1
6	S	0.07	0.17	41.6	< 0.1	--
7 A[d]	S	0.09	0.17	29.9	9.9	2.8
7 B[d]	S	0.14	0.19	25.3	14.0	3.0
7 C[d]	S	0.11	0.17	32.2	14.0	3.0
8	C	-0.15	0.19	24.7	9.7	2.6
9	C	-0.05	0.22	34.2	5.3	2.7
10	C	-0.13	0.16	22.6	8.6	2.8
11 A	C	-0.02	0.16	38.7	11.0	3.0
11 B	C	-0.10	0.16	51.8	14.0	3.0
11 C	C	-0.10	0.16	40.5	13.0	3.0
12	P	0.07	0.45	18.3	5.5	2.2
16	P	-0.02	0.17	27.6	4.0	2.4
19	P	-0.15	0.16	34.8	5.2	2.6
20	S	0.00	0.27	12.4	5.4	2.3

[a]Location types: S = SNL/NM, P = Perimeter, C = Community
[b]Variability of the radioactive disintegration process (counting error) at the 95-percent confidence level, 1.96 sigma
[c]Russian Thistle/Kochia
[d]Snakeweed
[e]Kochia
[f]Clover

Table F-2. Vegetation Sample Analysis, August 1993 (Concluded)

Location	Location Type[a]	H-3 (pCi/mL)	H-3 SDEV[b]	H_2O (%)	K-40 (pCi/g)	K-40 SDEV[b]
25	C	-0.11	0.16	39.9	8.5	3.0
33	S	0.02	0.17	56.5	13.0	3.0
34	S	-0.03	0.19	28.6	4.2	2.4
35	S	0.08	0.17	43.0	< 0.1	--
41[e]	S	0.02	0.17	47.1	38.0	4.0
42[e]	S	-0.09	0.17	29.2	47.0	5.0
43[e]	S	0.01	0.17	24.3	25.0	4.0
45	S	-0.04	0.17	35.2	< 0.1	--
46[e]	S	-0.06	0.16	41.0	42.0	4.0
49	S	-0.02	0.21	25.6	0.0	1.4
51	S	-0.06	0.17	30.8	4.3	2.4
52	S	0.05	0.17	29.1	< 0.1	--
53 A	S	-0.06	0.17	46.8	7.7	2.4
53 B	S	0.04	0.17	41.8	6.8	2.4
53 C	S	0.10	0.18	53.0	5.0	2.6
54	S	-0.04	0.19	31.0	< 0.1	--
55	S	-0.18	0.19	32.0	12.0	3.0
58	P	0.02	0.17	35.4	32.0	5.0
59	P	-0.02	0.17	35.7	4.4	2.2
60[e]	P	-0.07	0.18	18.6	52.0	5.0
61	P	-0.13	0.15	38.1	5.9	2.8
62[f]	C	-0.04	0.17	26.6	14.0	3.0
63	P	-0.04	0.17	19.8	10.0	3.0
64[d]	P	0.13	0.17	47.9	20.0	4.0
65[d]	P	-0.03	0.17	37.2	15.0	3.0
66[d]	S	0.03	0.17	38.7	14.0	3.0

[a]Location types: S = SNL/NM, P = Perimeter, C = Community
[b]Variability of the radioactive disintegration process (counting error) at the 95-percent confidence level, 1.96 sigma
[c]Russian Thistle/Kochia
[d]Snakeweed
[e]Kochia
[f]Clover

Table F-3. Soil Sample Analysis, May 1993

Location	Location Type[a]	U_{tot} (µg/g)	H-3 (pCi/mL)	H-3 SDEV[b]	H_2O (%)	Cs-137 (pCi/g)	Cs-137 SDEV[b]	K-40 (pCi/g)	K-40 SDEV[b]
1	S	1.0	0.13	0.17	1.4	0.36	0.06	23	1
2 NE A	S	0.9	34.00	1.00	2.2	0.12	0.06	18	1
2 NE B	S	0.5	52.00	1.00	1.9	0.15	0.06	18	1
2 NE C	S	0.6	56.00	1.00	2.2	0.09	0.04	18	1
2 NW	S	0.3	4.40	0.20	1.6	0.16	0.05	17	1
2 SE	S	1.2	3.10	0.20	2.1	0.08	0.04	17	1
2 SW	S	1.5	0.59	0.18	2.0	0.18	0.06	17	1
3	S	0.4	0.02	0.16	3.4	0.55	0.07	19	1
4	P	0.9	0.09	0.16	3.4	0.12	0.05	19	1
5	P	0.5	0.11	0.16	2.8	0.57	0.07	18	1
6	S	4.2	0.06	0.17	2.6	0.70	0.07	18	1
7 A	S	0.8	0.07	0.41	0.8	0.81	0.08	19	1
7 B	S	0.6	0.18	0.21	1.2	0.85	0.08	18	1
7 C	S	0.9	0.29	0.21	1.0	1.10	0.10	18	1
8	C	2.0	0.31	0.18	1.4	0.20	0.05	16	1
9	C	1.2	-0.06	0.16	7.2	0.84	0.07	12	1
10	C	1.6	0.00	0.16	2.6	0.46	0.06	14	1
11 A	C	0.5	-0.07	0.21	0.9	0.06	0.05	20	1
11 B	C	1.4	0.02	0.16	1.4	0.00	0.04	18	1
11 C	C	1.0	0.04	0.16	1.3	0.09	0.04	18	1
12	P	0.9	0.36	0.20	1.1	1.60	0.10	16	1
16	P	1.3	-0.07	0.17	1.3	0.13	0.04	29	1
19	P	0.8	0.20	0.16	4.6	1.00	0.10	20	1
20	S	1.7	-0.14	0.15	1.2	0.60	0.08	18	1
25	C	0.6	-0.01	0.16	2.3	0.17	0.04	17	1
32 E	S	1.6	400.00	10.00	1.2	0.12	0.05	20	1

[a]Location types: S = SNL/NM, P = Perimeter, C = Community
[b]Variability of the radioactive disintegration process (counting error) at the 95-percent confidence level, 1.96 sigma

Table F-3. Soil Sample Analysis, May 1993 (Concluded)

Location	Location Type[a]	U_{tot} (µg/g)	H-3 (pCi/mL)	H-3 SDEV[b]	H_2O (%)	Cs-137 (pCi/g)	Cs-137 SDEV[b]	K-40 (pCi/g)	K-40 SDEV[b]
32 S	S	1.1	170.00	10.00	1.0	0.21	0.05	23	1
33	S	0.9	0.18	0.17	2.6	0.28	0.06	17	1
34	S	0.7	-0.06	0.15	6.7	1.70	0.10	17	1
35	S	0.8	0.07	0.16	1.2	0.22	0.06	20	1
41	S	0.7	-0.01	0.19	2.4	0.15	0.06	16	1
42	S	1.2	0.00	0.17	4.2	0.08	0.05	18	1
43	S	0.4	0.07	0.17	2.9	0.10	0.04	17	1
45	S	0.8	-0.02	0.17	2.8	0.36	0.06	17	1
46	S	0.7	0.31	0.42	0.7	0.51	0.07	17	1
49	S	1.7	0.06	0.23	1.0	0.00	0.38	20	1
51	S	1.1	0.14	0.16	2.4	0.00	0.04	18	1
52	S	1.2	0.08	0.17	3.3	0.11	0.04	18	1
53 A	S	0.8	0.07	0.16	3.4	0.12	0.03	16	1
53 B	S	1.1	0.04	0.15	2.9	0.08	0.05	18	1
53 C	S	1.2	0.06	0.16	3.1	0.14	0.05	18	1
54	S	0.8	0.01	0.17	7.8	0.14	0.05	20	1
55	S	0.5	0.03	0.15	3.2	0.17	0.06	20	1
56	S	0.6	0.26	0.24	1.1	0.00	0.04	20	1
57	S	1.3	-0.04	0.28	0.09	0.06	0.05	21	1
58	P	0.8	0.09	0.16	1.9	0.22	0.06	23	1
59	P	1.0	-0.04	0.15	1.3	0.00	0.04	20	1
60	P	1.3	0.10	0.16	1.0	0.00	0.04	20	1
61	P	0.9	0.22	0.17	1.5	0.00	0.04	17	1
62	C	1.9	-0.09	0.15	4.8	1.10	0.10	15	1
63	P	1.2	0.12	0.16	6.3	0.70	0.08	12	1
64	P	0.9	0.08	0.17	2.1	0.63	0.07	28	1
65	P	0.8	0.03	0.18	1.1	0.66	0.07	20	1
66	S	0.8	0.13	0.16	2.4	0.60	0.10	17	1

[a]Location types: S = SNL/NM, P = Perimeter, C = Community
[b]Variability of the radioactive disintegration process (counting error) at the 95-percent confidence level, 1.96 sigma

Table F-4. Soil Sample Analysis, August 1993

Location	Location Type[a]	U_{tot} (µg/g)	H-3 (pCi/mL)	H-3 SDEV[b]	H_2O (%)	Cs-137 (pCi/g)	Cs-137 SDEV[b]	K-40 (pCi/g)	K-40 SDEV[b]
1	S	1.5	-0.01	0.17	2.1	0.18	0.07	23	1
2 NE A	S	0.9	12.00	1.00	2.8	0.00	0.04	18	1
2 NE B	S	0.8	12.00	1.00	2.3	0.07	0.04	18	1
2 NE C	S	0.7	13.00	1.00	1.7	0.06	0.05	17	1
2 NW	S	1.3	8.3	0.40	1.1	0.32	0.06	17	1
2 SE	S	1.5	2.6	0.20	3.4	0.20	0.06	16	1
2 SW	S	1.0	5.00	0.30	3.8	0.29	0.06	17	1
3	S	1.1	0.02	0.17	3.3	0.41	0.07	21	1
4	P	0.9	0.00	0.17	2.1	0.09	0.04	17	1
5	P	0.5	0.03	0.17	2.5	0.45	0.06	18	1
6	S	1.1	-0.03	0.17	4.3	0.50	0.03	16	1
7 A	S	0.8	0.00	0.17	2.1	0.50	0.08	19	1
7 B	S	1.0	-0.07	0.17	1.7	0.58	0.07	19	1
7 C	S	0.9	-0.07	0.17	1.5	0.47	0.06	19	1
8	C	1.5	0.08	0.41	0.6	0.18	0.06	18	1
9	C	1.9	-0.01	0.15	4.9	0.13	0.05	13	1
10	C	2.7	0.02	0.15	2.4	0.44	0.07	13	1
11 A	C	1.4	-0.08	0.23	0.7	0.00	0.03	18	1
11 B	C	1.0	-0.07	0.14	1.4	0.07	0.04	18	1
11 C	C	1.2	-0.06	0.23	0.6	0.08	0.05	19	1
12	P	0.8	0.05	0.17	1.8	0.65	0.07	15	1
16	P	1.7	-0.08	0.17	1.4	0.12	0.06	28	1
19	P	1.4	-0.11	0.27	0.8	0.07	0.05	20	1
20	S	1.8	0.58	0.69	0.2	0.20	0.05	17	1
25	C	1.6	-0.04	0.14	2.5	0.00	0.04	18	1
32 E	S	2.1	30.00	1.00	0.9	0.16	0.04	20	1
32 S	S	2.0	20.00	1.00	1.9	0.31	0.06	20	1

[a]Location types: S = SNL/NM, P = Perimeter, C = Community
[b]Variability of the radioactive disintegration process (counting error) at the 95-percent confidence level, 1.96 sigma

Table F-4. Soil Sample Analysis, August 1993 (Concluded)

Location	Location Type[a]	U_{tot} (μg/g)	H-3 (pCi/mL)	H-3 SDEV[b]	H_2O (%)	Cs-137 (pCi/g)	Cs-137 SDEV[b]	K-40 (pCi/g)	K-40 SDEV[b]
33	S	1.8	0.43	0.20	1.2	0.09	0.06	26	1
34	S	2.0	-0.03	0.34	0.3	0.51	0.07	16	1
35	S	0.5	0.03	0.17	4.7	0.22	0.05	21	1
41	S	0.9	0.07	0.16	1.3	0.20	0.04	19	1
42	S	1.0	-0.09	0.16	1.9	0.00	0.04	14	1
43	S	1.8	-0.07	0.16	5.0	0.00	0.04	16	1
45	S	1.7	0.12	0.18	6.7	0.29	0.05	20	1
46	S	1.2	0.22	0.27	0.4	0.12	0.05	20	1
49	S	1.4	-0.17	0.21	1.0	0.13	0.05	24	1
51	S	1.1	-0.01	0.16	2.5	0.00	0.03	18	1
52	S	0.9	0.06	0.17	1.4	0.06	0.05	17	1
53 A	S	0.9	-0.03	0.18	1.6	0.10	0.06	16	1
53 B	S	1.3	-0.14	0.15	5.2	0.16	0.05	15	1
53 C	S	1.0	0.14	0.16	3.9	0.13	0.05	17	1
54	S	0.9	-0.16	0.17	6.2	0.23	0.06	18	1
55	S	1.8	-0.05	0.17	3.5	0.15	0.06	16	1
56	S	0.7	-0.04	0.15	4.5	0.12	0.05	17	1
57	S	2.4	-0.03	0.15	1.2	0.00	0.04	22	1
58	P	1.4	0.06	0.17	2.8	0.38	0.06	20	1
59	P	1.0	0.15	0.17	0.9	0.13	0.06	17	1
60	P	1.8	-0.10	0.16	1.7	0.00	0.04	18	1
61	P	1.4	-0.04	0.16	1.3	0.00	0.04	15	1
62	C	3.0	0.03	0.15	2.8	0.20	0.06	12	1
63	P	1.8	-0.01	0.27	0.9	0.09	0.04	17	1
64	P	2.0	-0.01	0.22	0.9	0.52	0.10	27	2
65	P	1.5	-0.03	0.34	0.6	0.77	0.08	19	1
66	S	1.0	0.09	0.23	1.1	0.00	0.04	17	1

[a]Location types: S = SNL/NM, P = Perimeter, C = Community
[b]Variability of the radioactive disintegration process (counting error) at the 95-percent confidence level, 1.96 sigma

Table F-5. Surface Water Sample Analysis, May 1993

Location	Location Type[a]	Gross Alpha (pCi/L)	Gross Alpha SDEV[b]	Gross Beta (pCi/L)	Gross Beta SDEV[b]	Gross Gamma (pCi/L)	U_{tot} (mg/L)	H-3 (pCi/mL)	H-3 SDEV[b]
Number 8	C								
Solution		2	1	5	1	ND[c]	<0.005	-0.15	0.41
Total		6	2	7	2	ND	<0.005	--	--
Suspended Solids		16	10	21	10	ND	--	--	--
Number 68	C								
Solution		1	1	3	1	ND	<0.005	-0.14	0.17
Total		1	2	2	2	ND	<0.005	--	--
Suspended Solids		9	7	6	7	ND	--	--	--
Number 33	S								
Solution		8	7	35	8	ND	0.006	-0.06	0.17
Total		2	13	45	15	ND	<0.005	--	--
Suspended Solids		-1	7	19	10	ND	--	--	--
Number 11A	C								
Solution		1	1	4	1	ND	<0.005	-0.02	0.17
Total		3	2	6	2	ND	<0.005	--	--
Suspended Solids		15	8	37	10	ND	--	--	--
Number 11B	C								
Solution		2	1	9	1	ND	<0.005	-0.15	0.17
Total		3	2	7	2	ND	0.006	--	--
Number 11C	C								
Solution		2	1	6	1	ND	<0.005	-0.12	0.17
Total		3	2	7	2	ND	<0.005	--	--

[a]Location types: C = Community, S = SNL/NM
[b]Variability of the radioactive disintegration process (counting error) at the 95-percent confidence level, 1.96 sigma
[c]ND no gamma-emitting radionuclides detected above instrument background

Table F-6. Surface Water Sample Analysis, August 1993

Location	Location Type[a]	Gross Alpha (pCi/L)	Gross Alpha SDEV[b]	Gross Beta (pCi/L)	Gross Beta SDEV[b]	Gross Gamma (pCi/L)	U_{tot} (mg/L)	H-3 (pCi/mL)	H-3 SDEV[b]
Number 8	C								
Solution		3	2	4	2	ND[c]	2.4	-0.01	0.15
Total		14	5	15	5	ND	4.0	0.00	0.15
Suspended Solids		3	1	4	1	ND	<0.005	--	--
Number 33	S								
Solution		20	15	43	19	ND	0.006	-0.09	0.15
Total		8	8	23	10	ND	0.006	0.16	0.16
Suspended Solids		0.3	0.3	0.0	0.7	ND	<0.005	--	--
Number 68	C								
Filter		0.3	0.3	-0.3	0.7	ND	<0.005	--	--
Solution		2	2	2	2	ND	<0.005	0.04	0.14
Total		2	2	2	3	ND	<0.005	-0.02	0.14
Number 11A	C								
Solution		3	1	6	2	ND	<0.005	-0.03	0.15
Total		9	3	20	3	ND	<0.005	-0.07	0.15
Suspended Solids		0.3	0.3	-0.3	0.7	ND	<0.005	--	--
Number 11B	C								
Solution		2	1	4	1	ND	<0.005	0.03	0.15
Total		7	3	18	3	ND	0.007	-0.02	0.15
Number 11C	C								
Solution		4	1	5	1	ND	<0.005	0.00	0.15
Total		15	4	26	4	ND	<0.005	0.03	0.15
Number W1[d]									
Solution		1	1	1	1	ND	<0.005	-0.01	0.15
Suspended Solids		0	0.3	0	0.7	ND	<0.005	--	--
Number W2[d]									
Solution		1	1	1	1	ND	<0.005	0.16	0.16
Suspended Solids		0	0.3	0	0.3	ND	<0.005	--	--
Number W3[d]									
Solution		1	1	2	1	ND	<0.005	-0.01	0.15
Suspended Solids		0	0.3	1	0.7	ND	<0.005	--	--

[a]Location types: S = SNL/NM, P = Perimeter, C = Community
[b]Variability of the radioactive disintegration process (counting error) at the 95-percent confidence level, 1.96 sigma
[c]ND no gamma-emitting radionuclides detected above instrument background
[d]Blanks prepared with deionized water

Table F-7. Arroyo Sediment Sample Analysis, May 1993

Location	Location Type[a]	U_{tot} (μg/g)	H-3 (pCi/mL)	H-3 SDEV[b]	H_2O (%)	Cs-137 (pCi/g)	Cs-137 SDEV[b]	K-40 (pCi/g)	K-40 SDEV[b]
8	C	1.1	-0.06	0.17	24.4	0.07	0.05	16	1
11 A	C	0.8	-0.1	0.15	15.9	0.00	0.04	17	1
11 B	C	1.1	-0.09	0.15	23.2	0.04	0.05	18	1
11 C	C	0.8	-0.03	0.16	19.5	0.00	0.03	18	1
68	C	1.6	0.07	0.16	18.1	0.11	0.05	12	1
60	P	1.3	0.12	0.42	0.5	0.00	0.04	20	1
73	P	0.9	0.06	0.32	0.6	0.00	0.04	22	1
72	S	1.1	-0.06	0.25	0.8	0.00	0.03	16	1

[a]Location types: C = Community, P = Perimeter, S = SNL/NM
[b]Variability of the radioactive disintegration process (counting error) at the 95-percent confidence level, 1.96 sigma

Table F-8. Arroyo Sediment Sample Analysis, August 1993

Location	Location Type[a]	U_{tot} (µg/g)	H-3 (pCi/mL)	H-3 SDEV[b]	H_2O (%)	Cs-137 (pCi/g)	Cs-137 SDEV[b]	K-40 (pCi/g)	K-40 SDEV[b]
8	C	1.3	-0.03	0.15	13.4	0.04	0.05	17	1
11 A	C	1.0	-0.08	0.14	11.8	0.00	0.03	17	1
11 B	C	1.1	-0.10	0.14	9.5	0.00	0.04	19	1
11 C	C	1.0	0.02	0.14	8.1	0.04	0.03	20	1
68	C	2.1	-0.01	0.14	18.1	0.08	0.03	12	1
60	P	1.7	-0.21	0.41	0.5	0.00	0.04	19	1
73 A	P	1.3	0.00	0.25	0.7	0.00	0.04	24	1
73 B	P	1.4	-0.10	0.14	2.4	0.00	0.04	26	1
73 C	P	1.6	0.02	0.14	1.9	0.00	0.04	26	1
72	S	1.4	-0.01	0.27	0.9	0.10	0.05	17	1

[a]Location types: C = Community, P = Perimeter, S = SNL/NM
[b]Variability of the radioactive disintegration process (counting error) at the 95-percent confidence level, 1.96 sigma

Table F-9. Thermoluminiscent Dosimeter Summary Radiation Exposure Data, 1993

Location	1st Quarter Field Days	1st Quarter Exposure (mR)	2nd Quarter Field Days	2nd Quarter Exposure (mR)	3rd Quarter Field Days	3rd Quarter Exposure (mR)	4th Quarter Field Days	4th Quarter Exposure (mR)	Annual Exposure (mR/yr)
Location Type: Community									
10	90	22.30 ± 1.10	91	24.90 ± 2.30	98	29.90 ± 1.50	84	23.20 ± 4.6	100.3 ± 9.5
11	90	23.70 ± 1.50	91	20.10 ± 3.60	98	21.90 ± 2.30	84	19.80 ± 1.9	85.5 ± 9.3
21	90	26.30 ± 2.00	91	23.30 ± 2.60	98	24.60 ± 4.10	84	23.40 ± 2.5	97.6 ± 11.2
22	90	21.60 ± 2.10	91	20.10 ± 2.30	98	23.10 ± 1.50	84	19.60 ± 2.1	84.4 ± 8.0
23	90	22.40 ± 1.30	91	23.10 ± 2.30	98	22.40 ± 2.80	84	20.40 ± 3.0	88.3 ± 9.4
24	90	27.70 ± 1.10	91	23.20 ± 3.80	98	24.60 ± 2.50	84	22.40 ± 4.3	97.9 ± 11.7
25	90	24.80 ± 4.70	91	21.70 ± 2.10	98	25.30 ± 1.00	84	21.10 ± 2.1	92.9 ± 9.9
26	90	31.10 ± 4.20	91	25.80 ± 2.80	98	30.80 ± 1.30	84	25.80 ± 4.0	113.5 ± 12.3
27	90	25.40 ± 2.80	91	22.40 ± 2.20	98	26.00 ± 1.00	84	24.10 ± 3.5	97.9 ± 9.5
28	90	25.40 ± 1.90	91	24.10 ± 3.90	98	21.40 ± 6.60	84	23.30 ± 1.1	94.2 ± 13.5
29	90	20.40 ± 0.80	91	22.00 ± 4.20	98	24.90 ± 1.40	84	20.00 ± 2.9	87.3 ± 9.3
30	90	27.00 ± 1.80	91	26.20 ± 2.10	98	26.40 ± 2.10	84	24.80 ± 3.6	104.4 ± 9.6
Location Type: Perimeter									
4	90	28.20 ± 3.20	91	20.90 ± 3.90	98	25.30 ± 2.60	84	22.60 ± 2.1	97.0 ± 11.8
5	90	23.7 ± 2.60	91	20.70 ± 1.90	98	22.30 ± 1.50	84	20.50 ± 1.6	87.2 ± 7.6
16	90	27.10 ± 0.90	91	30.30 ± 2.40	98	31.30 ± 2.00	84	26.20 ± 2.9	114.9 ± 8.2
18	90	25.00 ± 2.50	91	23.30 ± 2.10	98	23.60 ± 2.80	84	21.50 ± 2.1	93.4 ± 9.5
19	90	25.20 ± 2.40	91	24.50 ± 2.10	98	27.30 ± 2.90	84	22.90 ± 2.5	99.9 ± 9.9

Table F-9. Thermoluminiscent Dosimeter Summary Radiation Exposure Data, 1993 (Concluded)

	1st Quarter		2nd Quarter		3rd Quarter		4th Quarter		
Location	Field Days	Exposure (mR)	Field Days	Exposure (mR)	Field Days	Exposure (mR)	Field Days	Exposure (mR)	Annual Exposure (mR/yr)
Location Type: Perimeter (Concluded)									
39	90	24.40 ± 1.30	91	20.90 ± 2.80	98	21.60 ± 1.70	84	21.40 ± 3.0	88.3 ± 8.8
40	90	20.90 ± 2.00	91	20.20 ± 2.00	98	22.10 ± 2.50	84	19.70 ± 3.4	82.9 ± 9.9
Location Type: SNL/NM									
1	90	29.20 ± 1.50	91	25.40 ± 3.00	98	28.00 ± 2.70	84	25.00 ± 2.6	107.6 ± 9.8
2	90	25.10 ± 1.10	91	22.50 ± 2.70	98	26.90 ± 1.20	84	21.70 ± 2.4	96.2 ± 7.4
3	90	23.10 ± 1.60	91	24.10 ± 2.80	98	26.20 ± 1.20	84	22.30 ± 4.9	95.7 ± 10.5
6	90	26.90 ± 2.40	91	22.10 ± 2.00	98	23.50 ± 3.80	84	23.40 ± 2.1	95.9 ± 10.3
7	90	23.60 ± 3.70	91	23.80 ± 2.90	98	27.20 ± 2.10	84	24.20 ± 1.1	98.8 ± 9.8
20	90	27.50 ± 2.10	91	23.20 ± 2.40	98	25.90 ± 2.60	84	22.50 ± 3.8	99.1 ± 10.9
31	90	25.10 ± 2.50	91	23.50 ± 3.00	98	26.40 ± 1.00	84	22.40 ± 2.4	97.4 ± 8.9
41	90	23.20 ± 2.30	91	23.10 ± 3.90	98	25.00 ± 2.90	84	22.20 ± 1.8	93.5 ± 10.9
42	90	23.10 ± 1.60	91	22.80 ± 2.00	98	24.50 ± 2.10	84	21.10 ± 1.8	91.5 ± 7.5
43	90	21.20 ± 2.00	91	23.10 ± 2.40	98	25.30 ± 1.70	84	22.70 ± 3.1	92.3 ± 9.2
45A	90	23.30 ± 5.50	91	21.90 ± 2.00	98	25.50 ± 4.40	84	21.10 ± 3.3	91.8 ± 15.2
45B	90	25.70 ± 3.10	91	21.30 ± 2.10	98	25.30 ± 1.20	84	21.50 ± 2.2	93.8 ± 8.6
46	90	27.80 ± 2.90	91	22.90 ± 1.90	98	30.60 ± 1.80	84	24.10 ± 2.3	105.4 ± 8.9
47	90	30.10 ± 3.90	91	24.80 ± 2.90	98	29.90 ± 2.30	84	23.90 ± 3.1	108.7 ± 12.2
48	90	27.10 ± 2.40	91	23.60 ± 2.20	98	25.70 ± 2.70	84	24.60 ± 1.4	101.0 ± 8.7

Table F-10. Concentrations (ppm) of Metals in Onsite Soil Samples (Group 1: Technical Areas I, II, and IV), May 1993

Site: Sample No.:	1 12578	20 12521	32S 9917	32E 9916	49 9915	57 9913
Aluminum	7600	9100	7000	7000	8600	8000
Barium	93	93	82	120	120	140
Beryllium	0.5	0.5	0.5	0.5	0.5	0.5
Cadmium	0.5	1.7	0.5	0.7	0.5	0.5
Calcium	25000	17000	35000	32000	42000	38000
Chromium	16	18	17	25	18	14
Cobalt	4.5	4.5	4.4	3.9	4.9	4.2
Copper	8.9	13	13	47	9.4	7.6
Iron	11000	10000	11000	11000	12000	12000
Lead	11	11000	19	560	8	7
Magnesium	3700	3400	2700	2900	3800	3600
Manganese	250	230	180	190	240	210
Nickel	7	8	6	7	9	6
Potassium	2600	2900	1600	1600	2000	2000
Silica	400	890	85	120	200	240
Silver	0.5	0.6	0.6	0.6	0.5	0.5
Strontium	40	31	46	54	72	80
Titanium	500	490	460	520	640	710
Vanadium	19	21	23	22	28	28
Zinc	36	36	40	72	28	33

Table F-11. Concentrations (ppm) of Metals in Onsite Soil Samples (Group 2: Technical Areas III and V), May 1993

Site:	2NW	2SW	2SE	2NE	2NE	2NE	6	7A	7B	7C	35
Sample No.:	12584	12582	12580	12590	12589	12588	12594	12562	12561	12560	12564
Aluminum	6800	8500	7700	7500	8300	8000	9000	9400	9200	8700	8100
Barium	54	80	74	94	71	71	61	76	75	79	76
Beryllium	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Cadmium	0.5	0.5	0.5	0.5	0.5	4.9	0.5	0.5	0.5	0.5	0.5
Calcium	4400	9600	10000	12000	11000	15000	4300	3000	3200	3200	7300
Chromium	6.7	19	18	21	19	20	24	16	19	18	17
Cobalt	2.3	2.8	2.5	2.7	3	2.7	2.8	3.5	3.5	3.9	2.5
Copper	4	5.7	4.5	5.2	4.7	6	5.8	7.5	7.6	8.6	7
Iron	7400	8600	7200	7400	8900	8500	8600	9900	9700	10000	7900
Lead	7	6	5	6	17	5	10	11	11	16	7
Magnesium	1600	2300	2200	2200	2200	2400	2000	2400	2400	2500	2200
Manganese	120	140	110	120	130	140	130	210	200	220	150
Nickel	4	6	6	5	6	13	6	10	7	8	5
Potassium	1600	2000	1900	2000	2100	2000	2200	2400	2300	2200	2300
Silica	160	170	450	160	160	160	130	330	190	190	290
Silver	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Strontium	16	25	26	30	30	35	15	15	16	15	22
Titanium	170	150	170	160	200	190	170	240	240	190	140
Vanadium	13	15	13	14	16	15	15	16	17	16	14
Zinc	22	27	44	30	32	29	32	31	31	36	44

Table F-11. Concentrations (ppm) of Metals in Onsite Soil Samples (Group 2: Technical Areas III and V), May 1993 (Concluded)

Site:	41	42	43	45	51	52	54	55	56
Sample No.:	12572	12574	12576	12592	12556	12598	12596	12604	9912
Aluminum	9000	8800	9300	9000	7900	13000	10000	8400	7000
Barium	70	73	67	76	94	100	100	91	70
Beryllium	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Cadmium	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Calcium	14000	30000	12000	9600	30000	17000	22000	33000	21000
Chromium	18	14	19	16	17	16	19	14	24
Cobalt	3.2	3.1	3	2.6	2.9	4	3.4	2.9	3.6
Copper	6.4	7.1	6.3	6.4	7	8.6	11	5.7	9.4
Iron	8900	9000	9200	7700	8200	12000	9300	8100	9000
Lead	21	5	5	6	9	7	9	5	7
Magnesium	2500	3000	2500	2300	2700	3400	3000	3000	2100
Manganese	150	150	140	140	130	180	140	150	160
Nickel	6	8	6	7	6	8	10	6	8
Potassium	2300	2400	2400	2300	1700	2600	2000	2700	1400
Silica	140	130	160	210	180	170	160	170	200
Silver	0.5	0.5	0.5	0.5	0.5	0.6	0.9	0.5	0.5
Strontium	25	42	27	24	49	36	41	59	35
Titanium	230	250	220	160	210	230	210	160	340
Vanadium	16	16	18	14	16	20	17	15	18
Zinc	30	28	26	30	30	33	69	26	75

Table F-12. Concentrations (ppm) of Metals in Perimeter Soil Samples, May 1993

Site:	60	4	5	19	63	59	58	61	16	64	12
Sample No.:	12532	12611	12612	12608	12600	12552	12550	12534	12541	12539	12535
Aluminum	9600	8700	7700	11000	12000	9400	11000	7900	12000	12000	14000
Barium	110	110	59	100	140	90	140	190	95	95	150
Beryllium	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Cadmium	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Calcium	22000	32000	12000	8300	64000	10000	38000	40000	7000	8400	16000
Chromium	23	16	27	28	18	13	13	17	20	17	19
Cobalt	4.7	3.2	2.5	6	4.9	3.5	4.7	3.4	6.6	7.3	6.2
Copper	9.1	6.3	5	13	9.8	6.4	13	6	9.5	12	15
Iron	12000	8100	7200	13000	12000	9500	12000	8400	18000	19000	15000
Lead	6	7	7	18	12	8	18	8	9	14	16
Magnesium	3600	2900	1600	4500	4800	3400	4300	3800	4100	6200	4200
Manganese	250	140	140	300	310	200	220	140	330	510	330
Nickel	7	5	5	14	11	7	8	5	8	8	10
Potassium	3200	2500	1800	2700	2700	2600	2600	1900	2900	3200	2800
Strontium	41	54	11	23	97	24	63	110	22	24	4.7
Titanium	350	150	140	270	180	320	450	300	980	450	280
Vanadium	24	16	12	22	20	17	24	25	34	31	29
Zinc	34	24	25	44	42	28	36	26	45	99	46

Table F-13. Concentrations (ppm) of Metals in Offsite Soil Samples, May 1993

Site: / Sample No.:	8 / 9907	25 / 12517	65 / 12548	11A / 12511	11B / 12510	11C / 12509	9 / 12527	10 / 12525	62 / 12523
Aluminum	5600	9600	9500	6400	5800	6300	23000	16000	23000
Barium	180	140	87	180	180	180	240	100	200
Beryllium	0.5	0.5	0.5	0.5	0.5	0.5	0.8	0.5	0.9
Cadmium	0.9	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Calcium	16000	43000	8600	16000	16000	15000	46000	60000	48000
Chromium	18	20	19	17	29	21	24	22	22
Cobalt	3.6	4.2	5.2	3.6	3.6	3.5	8	5.9	8.6
Copper	21	8.7	9.3	5.9	6	5.8	20	8.5	16
lron	16000	9900	12000	9800	9500	9400	20000	15000	19000
Lead	100	30	15	7	7	8	45	10	10
Magnesium	4100	3000	3600	2700	2600	2700	7100	3400	5200
Manganese	250	270	250	280	290	280	470	500	530
Nickel	8	8	7	6	7	6	16	11	21
Potassium	2100	2400	2700	2100	2000	2000	3700	3400	5500
Silica	130	320	160	190	140	160	250	220	380
Silver	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Strontium	68	58	20	49	51	50	75	100	90
Titanium	180	240	410	310	240	270	260	380	300
Vanadium	17	21	23	23	21	21	44	34	38
Zinc	120	54	36	29	26	29	77	35	61

Table F-14. Concentrations (ppm) of Metals in Onsite Soil Samples (Group 1: Technical Areas I, II, and IV), August 1993

Site:	1	20	32S	32E	49	57	46
Sample No.:	9891	13310	13284	13285	13304	13283	13308
Aluminum	7000	9300	6900	8600	9600	7800	10000
Barium	95	93	86	98	120	160	93
Beryllium	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Cadmium	0.5	1.7	0.6	0.7	0.5	0.5	0.5
Calcium	36000	17000	36000	40000	47000	57000	18000
Chromium	15	20	14	21	16	15	19
Cobalt	4.1	5.4	4.4	4.5	4.6	3.9	4.8
Copper	9.4	11	11	15	14	8.7	7.7
Iron	11000	11000	9200	11000	11000	9400	13000
Lead	9	260	12	400	7	11	9
Magnesium	3200	3400	6100	3200	3600	3700	3600
Manganese	210	230	230	220	200	200	250
Nickel	7	10	7	8	6	8	8
Potassium	1700	2600	1900	1900	2300	1800	2800
Silica	0.5	0.5	290	240	120	210	0.5
Silver	110	110	150	160	0.5	160	130
Strontium	59	28	51	67	68	110	32
Titanium	450	430	380	680	550	560	670
Vanadium	22	22	18	23	25	23	26
Zinc	28	35	36	46	27	31	36

Table F-15. Concentrations (ppm) of Metals in Onsite Soil Samples (Group 2: Technical Areas III and V), August 1993

Site:	2NW	2SW	2SE	2NEA	2NEB	2NEC	6	7A	7B	7C
Sample No.:	9889	9887	9885	9883	9882	9881	9877	9853	9852	9851
Aluminum	8100	9500	9300	8200	7700	7700	8700	10000	10000	12000
Barium	67	81	72	68	61	61	68	67	67	69
Beryllium	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Cadmium	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Calcium	4800	7500	7100	2800	2900	2000	4600	12000	2800	8800
Chromium	20	20	22	26	21	20	18	22	21	17
Cobalt	2.8	2.9	2.8	2.9	2.6	2.7	2.9	4.5	4.1	4.3
Copper	5.6	5.6	5.5	5.3	5	4.4	7	7.7	7.3	8.6
Iron	8500	9400	9000	9300	8200	8600	8600	11000	11000	11000
Lead	8	6	6	5	7	10	11	12	10	10
Magnesium	2000	2200	2200	1700	1600	1500	2000	2800	2600	3000
Manganese	140	150	140	160	140	140	140	210	200	210
Nickel	6	5	7	5	5	4	6	8	7	7
Potassium	1900	2100	2100	1800	1800	1700	1900	2400	2400	2700
Silica	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Silver	70	90	80	80	90	80	90	130	120	130
Strontium	18	23	23	16	15	14	17	31	17	28
Titanium	220	240	240	240	240	250	220	380	360	350
Vanadium	17	19	18	19	16	17	16	21	20	21
Zinc	24	26	23	24	21	21	31	32	32	33

Table F-15. Concentrations (ppm) of Metals in Onsite Soil Samples (Group 2: Technical Areas III and V), August 1993 (Concluded)

Site:	35	41	42	43	45	51	52	54	55	56
Sample No.:	9863	9875	9873	9871	9869	9855	9867	9865	897	13292
Aluminum	9000	10000	11000	12000	8000	12000	13000	11000	7400	5600
Barium	76	73	110	93	76	100	120	97	360	55
Beryllium	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Cadmium	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Calcium	8500	12000	69000	22000	9600	21000	22000	20000	96000	13000
Chromium	18	19	17	19	15	21	14	19	14	26
Cobalt	2.8	3.2	4.2	3.8	2.9	4	4.1	3.8	2.8	2.5
Copert	6.8	6.7	7.9	8.1	11	8.4	8.4	9.2	4.7	11
Iron	9100	9400	9500	11000	7900	12000	11000	10000	6300	5800
Lead	9	11	6	6	10	12	8	9	7	7
Magnesium	2300	2500	3800	3000	2200	3200	3600	3000	6000	1600
Manganese	150	150	170	130	140	160	170	150	100	94
Nickel	7	7	8	8	5	8	9	9	7	6
Potassium	2300	2600	2300	2400	2200	2900	2600	2100	1800	1200
Silica	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	210	210
Silver	70	110	110	120	80	140	100	90	0.5	150
Strontium	23	23	86	42	21	41	46	38	260	27
Titanium	190	280	300	290	160	370	250	280	150	240
Vanadium	16	18	22	24	15	25	23	21	25	13
Zinc	34	29	28	25	37	34	42	56	22	88

Table F-16. Concentrations (ppm) of Metals in Perimeter Soil Samples, August 1993

Site:	4	5	12	16	19	58	59	60	61	63	64
Sample No.:	9848	950	13320	13324	901	13330	13328	13302	13299	893	13322
Aluminum	7100	5000	11000	11000	5600	11000	9600	16000	7500	12000	14000
Barium	130	49	110	87	84	140	210	190	200	150	120
Beryllium	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.7	0.5	0.5	0.5
Cadmium	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Calcium	56000	1500	8300	5700	8200	38000	63000	34000	42000	46000	31000
Chromium	19	19	24	19	19	14	18	35	16	19	17
Cobalt	2.7	2.2	6.4	6.1	3.6	4.6	3.8	6.9	3.2	5.5	14
Copper	5.2	3.8	11	8.7	7.3	11	6.3	16	6.2	8.1	21
Iron	6700	5900	12000	15000	8700	12000	9600	16000	6900	12000	29000
Lead	5	8	11	9	8	16	10	9	9	8	19
Magnesium	2800	1300	3900	3900	2100	4300	4100	5400	3600	3600	9400
Manganese	120	130	290	300	170	210	150	400	130	310	760
Nickel	6	6	10	7	8	7	6	12	5	11	9
Potassium	1600	1600	2200	2600	1300	2600	2100	4300	1500	2800	3300
Strontium	86	10	25	20	21	62	100	62	110	89	43
Titanium	150	130	280	860	250	530	440	360	230	300	1000
Vanadium	15	9.8	24	28	16	27	25	31	20	22	49
Zinc	36	57	38	42	40	38	26	53	25	40	110

Table F-17. Concentrations (ppm) of Metals in Offsite Soil Samples, August 1993

Site: Sample No.:	8 13291	9 13282	10 13280	11A 13705	11B 13704	11C 13703	25 13276	65 13326	62 13278
Aluminum	6000	28000	18000	5200	5000	4600	5000	10000	18000
Barium	180	260	110	180	170	160	110	94	180
Beryllium	0.5	1.1	0.6	0.5	0.5	0.5	0.5	0.5	0.6
Cadmium	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.6
Calcium	16000	28000	61000	12000	10000	9100	34000	13000	86000
Chromium	27	34	25	24	31	32	32	16	24
Cobalt	3.1	10	6.1	2.8	2.5	2.7	2.2	4.9	7.1
Copper	23	18	8.4	4.3	4.9	4.3	4.6	8.8	11
Iron	14000	25000	15000	7800	6900	7400	6300	12000	15000
Lead	80	19	11	6	8	7	10	15	12
Magnesium	3600	7800	4000	2000	1900	1700	1700	3700	4600
Manganese	240	510	530	230	230	210	180	240	430
Nickel	9	20	13	5	7	6	6	7	15
Potassium	2300	3300	3300	1600	1600	1400	1400	2600	3500
Silica	280	200	120	230	200	190	70	0.5	180
Silver	320	310	140	0.5	0.5	0.5	0.5	110	180
Strontium	62	61	120	40	34	32	49	28	160
Titanium	180	330	280	280	240	270	180	570	240
Vanadium	15	54	32	18	16	17	14	24	33
Zinc	78	81	38	21	19	19	21	37	44

Table F-18. Concentrations (ppm) of Metals in Perimeter Sediment Samples, May 1993

Site:	60	72	73
Sample No.:	12530	12529	12528
Aluminum	5200	5600	6100
Barium	79	52	72
Beryllium	0.5	0.5	0.5
Cadmium	0.5	0.5	0.5
Calcium	28000	91000	2800
Chromium	22	17	19
Cobalt	4.7	3.1	3.6
Copper	6.3	6.7	6.1
Iron	14000	7400	8800
Lead	6	5	0.5
Magnesium	2400	3500	2700
Manganese	200	190	210
Nickel	7	7	6
Potassium	1400	1100	1600
Strontium	46	170	47
Titanium	730	210	700
Vanadium	30	15	18
Zinc	24	26	25

Table F-19. Concentrations (ppm) of Metals in Offsite Sediment Samples, May 1993

Site:	11A	11B	11C	8	68
Sample No.:	12505	12504	12503	9905	12512
Aluminum	2300	6300	4500	8800	5500
Barium	91	150	130	160	270
Beryllium	0.5	0.5	0.5	0.5	0.5
Cadmium	0.5	0.5	0.5	0.5	0.5
Calcium	5800	17000	11000	18000	160000
Chromium	24	19	30	22	16
Cobalt	1.8	3	2.6	3.8	3.2
Copper	2.8	5.2	11	6.9	5.8
Iron	5000	8500	7600	10000	13000
Lead	3	5	4	3	11
Magnesium	960	2900	1800	3600	3000
Manganese	110	160	140	230	310
Nickel	3	5	6	6	7
Potassium	660	1500	1100	1900	1300
Strontium	18	55	33	72	190
Titanium	180	240	260	230	350
Vanadium	12	18	18	21	23
Zinc	16	27	22	29	220

Table F-20. Concentrations (ppm) of Metals in Perimeter Sediment Samples, August 1993

Site:	60	72	73A	73B	73C
Sample No.:	13300	13313	13297	13268	13267
Aluminum	6400	9100	5300	5800	5200
Barium	110	82	64	61	350
Beryllium	0.5	0.5	0.5	0.5	0.5
Cadmium	0.5	0.5	0.5	0.5	0.5
Calcium	38000	75000	36000	32000	29000
Chromium	24	21	31	34	30
Cobalt	5	4.2	3.8	4.4	4
Copper	8.4	9.7	7.1	6.2	6.2
Iron	13000	10000	8100	11000	9100
Lead	6	17	5	5	6
Magnesium	3100	4400	2800	2500	2200
Manganese	260	240	200	200	190
Nickel	6	8	5	7	6
Potassium	1500	1800	1100	1500	1300
Strontium	61	140	56	54	58
Titanium	840	260	620	950	910
Vanadium	26	22	17	22	19
Zinc	28	31	21	25	20

Table F-21. Concentrations (ppm) of Metals in Offsite Sediment Samples, August 1993

Site:	8	11A	11B	11C	68
Sample No.:	13289	13699	13698	13697	13271
Aluminum	6300	4300	3600	3400	9100
Barium	140	140	120	110	140
Beryllium	0.5	0.5	0.5	0.5	0.5
Cadmium	0.5	0.5	0.5	0.5	0.5
Calcium	1300	7000	6000	5600	120000
Chromium	41	45	38	31	21
Cobalt	3	2.6	2.5	2.2	4.8
Copper	7	4	3.7	3.3	7.4
Iron	8000	7200	7100	6100	9700
Lead	7	6	0.5	7	10
Magnesium	2400	1400	1200	1200	3900
Manganese	180	140	120	120	290
Nickel	5	6	5	6	12
Potassium	1400	1200	1000	940	1700
Strontium	48	28	24	22	150
Titanium	240	260	2770	230	170
Vanadium	18	16	17	14	18
Zinc	22	16	15	14	31

APPENDIX G

ENVIRONMENTAL REGULATIONS AND STANDARDS

CONTENTS

G.1 INTRODUCTION

Radiation-protection standards for the public have been established by the U.S. Department of Energy (DOE) to protect public health. This is accomplished by limiting radiation doses (resulting from DOE operations) received by individuals residing in uncontrolled areas. These standards are based on the risk to members of the public. Environmental monitoring requirements for DOE operations are established in DOE Order 5400.1, "General Environmental Protection Program" (DOE 1988). Radiation protection standards are provided in DOE Order 5400.5, "General Radiation Protection of the Public and the Environment" (DOE 1990). DOE Order 5400.5 limits the annual effective dose equivalent to any member of the public to 100 millirems per year (mrem/yr). This limit is predicated on the dose to the maximally exposed individual in an uncontrolled area from all emission sources and all exposure pathways. DOE Order 5400.5 also contains the derived concentration guide (DCG) for concentrations of radionuclides in water and air that could be continuously consumed or inhaled (365 days/year) and not exceed the DOE primary radiation protection standard of 100 mrem/yr effective dose equivalent (EDE). Table G-1 contains the DCGs pertinent to Sandia National Laboratories/New Mexico (SNL/NM) activities and to this report.

DOE facilities are also required to comply with U.S. Environmental Protection Agency (EPA) standards for radiation protection. On December 15, 1989, the EPA issued its final rule on National Emission Standards for Hazardous Air Pollutants (NESHAP) for radionuclides (EPA 1989). This rule mandates that air emissions from DOE facilities shall not cause any individual of the public to receive in any year an EDE of greater than 10 mrem/year. Table G-2 summarizes the public radiation protection standards that are applicable to DOE facilities. 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).

Table G-3 lists the 40 CFR 265, Subpart F, parameters required for groundwater-monitoring analysis. Table G-4 shows the EPA interim primary drinking-water standards (40 CFR 265, Appendix III) for the groundwater-monitoring parameters.

Table G-1. Derived Concentration Guides (DCGs) For Selected Radionuclides[a]

	Drinking Water		Inhaled Air[b]	
Nuclide	DCG (μCi/L)	f, Value	DCG ($\mu Ci/m^3$)	Solubility Class
H-3 (Water)	2E+00	--	1E-01	--
Cs-137	3E-03	1E+00	4E-04	D
Gross Alpha[a]	15E-06	--	--	--
Gross Beta[c]	3E-05	--	--	--
Total U[d]	6E-04	--	6E-6	--

[a]DOE Order 5400.5, Chapter III (DOE 1990)
[b]DCG for H-3 in air (2E-01) is adjusted for skin absorption
[c]EPA-570/9-76-003 (EPA 1976)
[d]A conversion from μCi/L to pCi/L may be made using 1.3E-6 μCi/μg for U as it exists in drinking water (40 CFR 141)

Table G-2. Radiation Standards for Protection of the Public in the Vicinity of U.S. Department of Energy Facilities for CY 1993

General Dose Limits

All Pathways[a]

The effective dose equivalent for any member of the public from all routine DOE operations[b] (natural background and medical exposures excluded) shall not exceed the values given below:

	Effective Dose Equivalent[c]	
	mrem/yr	(mSv/yr)
Primary limit	100	(1)

Air Pathway[d]	Effective Dose Equivalent	
	mrem/yr	(mSv/yr)
Maximum offsite residence	10	(0.10)

[a]DOE Order 5400.5, Chapters I and II (DOE 1990)
[b]Routine DOE operations means normal planned activities, including remedial actions and naturally occurring radionuclides released by DOE processes and operations.
[c]Effective dose equivalent (EDE) will be expressed in rem (or millirem) with the corresponding value in sievert (or millisievert) in parentheses.
[d]40 CFR 61, Subpart H for radionuclides, National Emission Standard for Hazardous Air Pollutants (NESHAP)

Table G-3. Groundwater Monitoring Parameters Required by 40 CFR 265, Subpart F[a]

Contamination Indicator	Groundwater Quality	Appendix III[b] 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

[a]Resource Conservation and Recovery Act (40 CFR 265)
[b]40 CFR 265, Appendix III

Table G-4. U.S. Environmental Protection Agency Interim Primary Drinking Water Supply Parameters

Parameter	Standard[a]	Units
Arsenic[b]	0.05	mg/L
Barium[b]	1.0	mg/L
Cadmium[b]	0.01	mg/L
Chromium[b]	0.05	mg/L
Lead[b]	0.05	mg/L
Mercury[b]	0.002	mg/L
Selenium[b]	0.01	mg/L
Silver[b]	0.05	mg/L
Fluoride	1.4-2.4	mg/L
Nitrate	10	mg/L
Total Coliform	1/100 mL	cl/100 mL
Turbidity	1 TU	NTU[c]
Radium-226	5 pCi/L	pCi/L
Radium-228	5 pCi/L	pCi/L
Gross Alpha	15 pCi/L	pCi/L
Gross Beta	4 mR/yr	pCi/L
Endrin	0.0002	mg/L
Lindane	0.004	mg/L
Methoxychlor	0.1	mg/L
Toxaphene	0.005	mg/L
2,4-D	0.1	mg/L
2,4,5-TP Silvex	0.01	mg/L

[a] 40 CFR 265, Appendix III
[b] Total metals (unfiltered sample)
[c] NTU = nephelometric turbidity unit

REFERENCES

40 CFR 61, Subpart H for radionuclides. National Emission Standards for Hazardous Air Pollutants (NESHAP).

40 CFR 141, 1975. "National Primary Drinking Water Regulations," as amended January 15, 1992.

40 CFR 265, 1980. "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," as amended December 23, 1991.

DOE 1990: U.S. Department of Energy, Chapter I, "General Radiological Protection of the Public and the Environment;" Chapter II, "Requirements for Radiation Protection of the Public and the Environment;" and Chapter III, "Derived Concentration Guides for Air and Water," DOE Order 5400.5, DOE, Washington, DC (February 1990).

DOE 1988: U.S. Department of Energy, "General Environmental Protection Program," DOE Order 5400.1, DOE, Washington, DC (1988; change 1, June 21, 1990).

EPA 1976: U.S. Environmental Protection Agency, "USEPA National Interim Primary Drinking Water Regulations," EPA-570/9-76-003, EPA, Washington, DC (1976).

Resource Conservation and Recovery Act (RCRA) of 1976. Public Law 94-580, 1976, 90 Statute 2795.

APPENDIX H

SEPTIC TANK REGISTRATION FOR SANDIA NATIONAL LABORATORIES/NEW MEXICO

CONTENTS

Table H-1. Septic Tank Registration for Sandia National Laboratories/New Mexico

Area	Building	Location Description
Technical Area I	898	Optical Maintenance Building
Technical Area I	8895/M0100	Sandia Guard House
Technical Area I	M014/M015	Office/Laboratory
East of Technical Area II	6969, M0118, M0251, and M0252	Robotic Vehicle Range
6000 Igloo Area	6020	Explosives Receiving and Packaging
6000 Igloo Area	6030	Guard Station
Technical Area II	901/902	Systems Analysis Facility
Technical Area II	904	Environmental Testing Laboratory
Technical Area II	906	Safety Chemicals Laboratory
Technical Area II	907	Explosives Application Facility
Technical Area II	913/913A	Component Assembly Building/ Pressure Laboratory and Training Building
Technical Area II	915/922	Explosive Device Laboratories
Technical Area II	914	Equipment for Building 913
Technical Area II	919	Explosive Devices Building
Technical Area II	935	Component Test Facility
Technical Area II	940	Explosive Testing Laboratory
Technical Area III	6584 - East end	Administration for Test Engineering
Technical Area III	6584 - West end	Armory Facility
Technical Area III	6589 and 6600	Guard House and Sensor Test Laboratory
Technical Area III	6501	Nonhazardous Assembly Area
Technical Area III	6620	Hazardous Assembly Building
Technical Area III	6505	Sodium Purification Loop
Technical Area III	6520/6526	Hydraulic Centrifuge Facility
Technical Area III	6523	Pump Building
Technical Area III	6530/6531	Radiant Heat Test Facility
Technical Area III	6536	Thermal/Radiant Heat Testing
Technical Area III	6540/6542	Photometrics
Technical Area III	6560/6562/6563	Vibration Test Facility
Technical Area III	6570/6571	Dynamic Shock Test Facility
Technical Area III	6587	Maintenance and Shop
Technical Area III	6610	Complex Wave Test Facility
Technical Area III	6630	Climatic Test Facility
Technical Area III	6631	Remote Control Building
Technical Area III	6635/6638	Radiography Bunker
Technical Area III	6640	Acoustical Test Facility
Technical Area III	6643	Establishment Type Unknown

Table H-1. Septic Tank Registration for Sandia National Laboratories/New Mexico (Continued)

Area	Building	Location Description
Technical Area III	6650	Vibration Data Control Center
Technical Area III	6710	Air Gun Test Facility
Technical Area III	6715	Explosive Test Facility
Technical Area III	6720	Irradiated Sludge Facility
Technical Area III	6721	Photography/Control for Building 6720
Technical Area III	6730-31/6734-35/MO128	Dynamic Shock Facility
Technical Area III	6741	Control Building for 5000-Foot Sled Track
Technical Area III	6743	Rocket Motor Conditioning Facility
Technical Area III	6750	Small Arms Range/Impact Test Facility
Technical Area III	6920	Mixed Waste Management Facility
Technical Area III	6922	Explosive Test Facility
Technical Area III	T12/T42/T43	N/A
Technical Area III	T52	N/A
Technical Area III	MO231-234	Offices
Technical Area III	MO228-230	Offices
Technical Area III	MO242-245	Offices
Technical Area V	6580/6588/6590-93/ 6596-97	Reactor Facilities and Storage
Technical Area V	6500	Gate House Security Operations Building
Technical Area V	6581-82/MO32/MO57-58	Febetron Building/Emergency Evaluation Center/Offices/ Shock Test Laboratory
Coyote Test Field	9950	Material Test Laboratory
Coyote Test Field	9956	Intermediate Velocity Gun Facility
Coyote Test Field	9965	Remote Control Building for Shock Facility
Coyote Test Field	9967	HE Assembly Building
Coyote Test Field	9970	Antenna Measurement Facility
Coyote Test Field	9972	EMP Studies Facility A
Coyote Test Field	9980	Solar Tower Facility
Coyote Test Field	9981/9982	N/A
Coyote Test Field	Live Fire Range	Live Fire Range
Coyote Test Field	SFER MO127-128/MO130	Small Force Engagement Range
Coyote Test Field	9927	Explosive Test Facility
Coyote Test Field	9930	Explosive Test and Laboratory Building

Table H-1. Septic Tank Registration for Sandia National Laboratories/New Mexico (Concluded)

Area	Building	Location Description
Coyote Test Field	9939/9939A	Evaluation Explosive Facility Control Building
Coyote Test Field	9940	Explosive Test Facility
Coyote Test Field	9925	Coyote Test Field Headquarters
Coyote Test Field	9926/9920	Explosive Test Facility
Coyote Test Field	9960	Explosives Preparation Facility
Coyote Test Field	9990	Earth to Orbit Launching Facility

APPENDIX I

NATIONAL ENVIRONMENTAL POLICY ACT DOCUMENTATION

CONTENTS

Table I-1. 1993 Sandia Environmental Assessments Underway or Approved and Approval Status

Title	DOE Request for EA	Latest EA Sent to DOE	FONSI[a]
Radioactive/Mixed Waste Facility	01/22/90	10/01/90	04/23/93
Lurance Canyon Burn Site	08/11/89		
Construction and Occupancy of Robotic Manufacturing Science Facility	05/03/91	12/10/93	04/13/94
Construction and Occupancy of Radioactive and Mixed Waste Assay Facility	03/25/91		
Coyote Canyon Test Complex	11/10/92		
Sol Se Mete Aerial Cable Facility	03/11/92	10/18/93	
Site-Wide Environmental Assessments for the Environmental Restoration Program	12/03/93		
Atmospheric Radiation Test Program	02/23/92		
Construction and Occupancy of Processing and Environmental Technology Laboratory	03/25/91	01/11/94	
Technical Support Center (GIF)	12/19/90	09/03/93	
Neutron Measurement Laboratory	12/10/90		

[a]FONSI = Finding of No Significant Impact.

Table I-1. 1993 Sandia Environmental Assessments Underway or Approved and Approval Status (Concluded)

Title	DOE Request for EA	EA Sent to DOE	FONSI[a]
Relocation of Neutron Generator and Switch Tube Prototyping	11/10/92	01/26/94	04/08/94
Shipment of Low-Level Waste to the Nevada Test Site	10/15/93		

[a]FONSI = Finding of No Significant Impact.

Table I-2. National Environmental Policy Act Documentation and Approval Status

Title	Memo to DOE	DOE Approval	DOE Request for EA
Sewer Modernization	03/23/92		
5-kV Transmission Line for Buildings 9940, 9960	01/16/92		
Payload and Satellite	12/22/92		
Safeguards Transporter (SGT) Engulfing Fire Tests	01/19/92	01/29/93	
Facilities Shop Building	10/18/92	02/18/93	
Underground Storage Tank Removal at Building 9925	12/03/92	01/28/93	
Environmental Restoration Program	10/08/93		12/09/93
Shipment of Low-Level Waste to the Nevada Test Site	10/22/92		10/15/93
Onsite Evaporative Processing	11/06/92		02/03/93
Motor Pool Rehabilitation	11/11/92	01/28/93	
X-Reactor Phase II	09/04/92	01/12/94	
Continuing Operation of the Existing NSTTF at SNL/NM	09/15/92	01/07/94	
Building 870 Annex Remodeling	08/31/92	09/17/93	
UST Removal at Building 9925	12/03/92	01/28/93	
Facilities Shop Building	10/18/92	02/18/93	
Utility Backbone Project	01/05/93	03/31/93	
Code Modification, Natural Gas System	01/04/93	04/19/93	
PH 3 & 5 Electrical Metering	01/25/93		

Table I-2. National Environmental Policy Act Documentation and Approval Status (Continued)

Title	Memo to DOE	DOE Approval	DOE Request for EA
Decommissioning Bldg. 6650-1	01/27/93		
SAF 1 Test (Ongoing Activity 03/08/93)	01/27/93	03/10/93	
Bldg. 860 Shock Lab Renovation	01/28/93	02/18/93	
Environmental Sample Management Office	01/28/93	03/31/93	
TA-III, Environmental Restoration Landfill Capping Test	02/12/93	04/19/93	
Cased-Explosive Sawing Operation	03/29/93	05/26/93	
Stage Right Development and Demonstration Building	07/09/92	02/12/93	
Transportation Shipping Container Variant (TSCV) Fire Tests	07/10/92		
Install/Operate Weapon Component Waste Disposal Integrated Demonstration (WeDiD) Equipment	02/22/93	05/24/93	
Environmental Checklist for Kiva Pit Modification	03/05/93	05/26/93	
Environmental Checklist Submission For East Mountain Study	03/17/93	04/02/93	
Perimeter Control System, Bldg. 9930	10/26/93	01/04/94	
Interim Storage of Waste in Bldg. 6596	03/24/93	04/05/93	
Propellant Fire Tests	03/17/93	04/19/93	

Table I-2. National Environmental Policy Act Documentation and Approval Status (Continued)

Title	Memo to DOE	DOE Approval	DOE Request for EA
SGT Engulfing Fire Tests	03/29/93	05/24/93	
Administrative Office Building	03/30/93	05/24/93	
WIPP-Salado Two-Phase Flow Laboratory Program	04/07/93	05/19/93	
Thermal Spray Laboratory	04/19/93	05/24/93	
A400 Container Fire Tests	03/05/93	05/24/93	
AT400R Container Radiant Heat Test	04/21/93	05/26/93	
H1224A Container Radiant Heat Test	04/21/93	05/26/93	
Savannah River Container Material Radiant Heat Test	04/21/93	05/26/93	
Install ESM Robot	04/23/93	05/26/93	
Series of Open Pool Fire Tests	04/22/92		
Disposition and Environmental Checklist for Building 9960 (Continuing Activity)	03/24/92	03/24/92	
Move 6300 & 6100 Staff To Lease Space	04/30/93	05/26/93	
Remove Fume Hood System (835/3)	04/29/93	05/26/93	
Install Fume Hood and Add Walls (Bldg. 809, Room 16)	04/29/93	05/26/93	
Chemical Compatibility Tests	04/30/93		
Construct Storage Bldg. near 858	05/07/93	05/28/93	
Environmental Checklist for Electroplating Facility	05/20/93	07/08/93	

Table I-2. National Environmental Policy Act Documentation and Approval Status (Continued)

Title	Memo to DOE	DOE Approval	DOE Request for EA
Electrokinetic Clean-Field Test	05/27/93	08/04/93	
Stars II Test, 06/01/93	05/20/93	05/28/93	
Storm Water Sample Stations	05/25/93	08/04/93	
MAST Radiant Heat Test	05/25/93	09/17/93	
Building 954 Warehouse Addition	06/11/93	09/17/93	
Direct Containment Heating Tests at Containment Technology Test Facility (CTTF)	11/25/92	02/15/93	
Baseline Survey for National Solar Tower Test Facility	09/04/92		
Steam Reforming of Nitrates and Ferrocyanides	08/10/93	10/28/93	
Subsurface Barrier Emplacement Demonstration	06/16/93		
Dish/Stirling Generating System	08/26/93	01/04/94	
Jupiter Project	07/01/93		
KEWD Rocket Sled Test	07/14/93		
Oxidizer Source Term Test	07/19/93	09/24/93	
Operational Change in Lead Management	07/20/93	09/24/93	
Rocket-Accelerated Trolleys on Aerial Cable	07/21/93		
Geotechnology Test Range	12/21/93	03/15/94	
Ground Source Heat Exchanger Tests	08/16/93	01/12/93	

Table I-2. National Environmental Policy Act Documentation and Approval Status (Concluded)

Title	Memo to DOE	DOE Approval	DOE Request for EA
H 1501A Container Test (Continuing Action)	08/09/93	09/03/93	
Install Fence at Bldgs. 834, 844-846	09/09/93		
Operation of Mobile Environmental Monitoring Systems Lab FY94	09/03/93	01/12/94	
Soil Penetrating SAR (at Sensor Test Field)	09/22/93	01/04/94	
SPARTA Rocket ATAF Missile Series	09/16/93	10/28/93	
Asphalt Construction Test Track			
AT-400R Follow-on Fire Tests	09/30/93	01/04/94	
AT-400A Fire Tests	09/30/93	01/04/94	
Transportation Accident-Resistant Containers (TARC) Lateral Impact Test at 10,000 Ft. Track	10/01/93		
Dart Test	10/04/93	01/04/94	
Installation of Water Tank	03/16/93	04/21/93	
Road and Instrumentation Pad	03/16/93	04/21/93	

APPENDIX J

1993 ENVIRONMENTAL COMPLIANCE ACTIVITIES AT THE KAUAI TEST FACILITY

CONTENTS

J.1 INTRODUCTION

Sandia National Laboratories (SNL) operates a rocket preparation and launch facility called the Kauai Test Facility (KTF) at the U.S. Navy's Pacific Missile Range Facility (PMRF), Barking Sands, for the U.S. Department of Energy (DOE). PMRF is located on the west side of the island of Kauai, Hawaii (Figure J-1). KTF is used to launch rockets in support of DOE missions, as well as other U.S. Government projects (DOE 1992).

J.1.1 Facilities and Operations

SNL's KTF is located on the north part of the Navy's PMRF near Nohili Point. Most facilities at KTF were constructed in the early 1960s to support the National Readiness Program. The most recent construction, completed in 1989, added five buildings and a new launch pad to support future DOE and Strategic Defense Initiative (SDI) launches.

KTF has been, and is being, used for testing rocket systems with scientific and technological payloads, advanced development of maneuvering reentry vehicles, scientific studies of atmospheric and exoatmospheric phenomena, and SDI programs. Nuclear devices have never been launched from KTF.

The KTF launcher field was originally designed to accommodate 40 launch pads, but only 15 were constructed. Of these, 12 are inactive, with the launchers removed. Beyond the implementation of portions of the original plan, two additional launch pads have been constructed, Pad 41 at Kokole Point, and Pad 42, the Strategic Targeting System (STARS) launch pad. The launcher field site has a number of permanent facilities used to support rocket operations.

The administrative area of KTF is located in a fenced compound near the North Nohili access road from PMRF. Within the fenced compound, a number of trailers and vans are interconnected with a network of concrete docks and covered walkways. The majority of these temporary facilities are used during operational periods to support field staff at KTF. In the nonoperational periods, they are in standby condition with only dehumidifiers in operation. In addition, there are a small number of permanent buildings, most of which are in use year-round to support and maintain KTF facilities (Helgesen 1990).

J.1.2 Geology and Hydrology

KTF and PMRF are located on the seaward margin of the broad Mana Coastal Plain of Kauai. This plain is composed of alluvium washed from uplands, calcareous and clayey lagoon deposits, sand dunes, and beach rock. The poorly consolidated deposits of the present plain were formed in a shallow lagoon behind an ancient beach ridge. The large wetland was largely filled in and planted with sugar cane by 1936, leaving only some small areas of wetland near Mana, about 10,000 feet (ft) (3048 meters [m]) from KTF.

KTF lies in the rain shadow of Mounts Kawaikini and Waialeale. Annual rainfall is approximately 20 inches per year (in./yr) (51 centimeters per year [cm/yr]). There is no integrated surface drainage on the site. The sand is so permeable

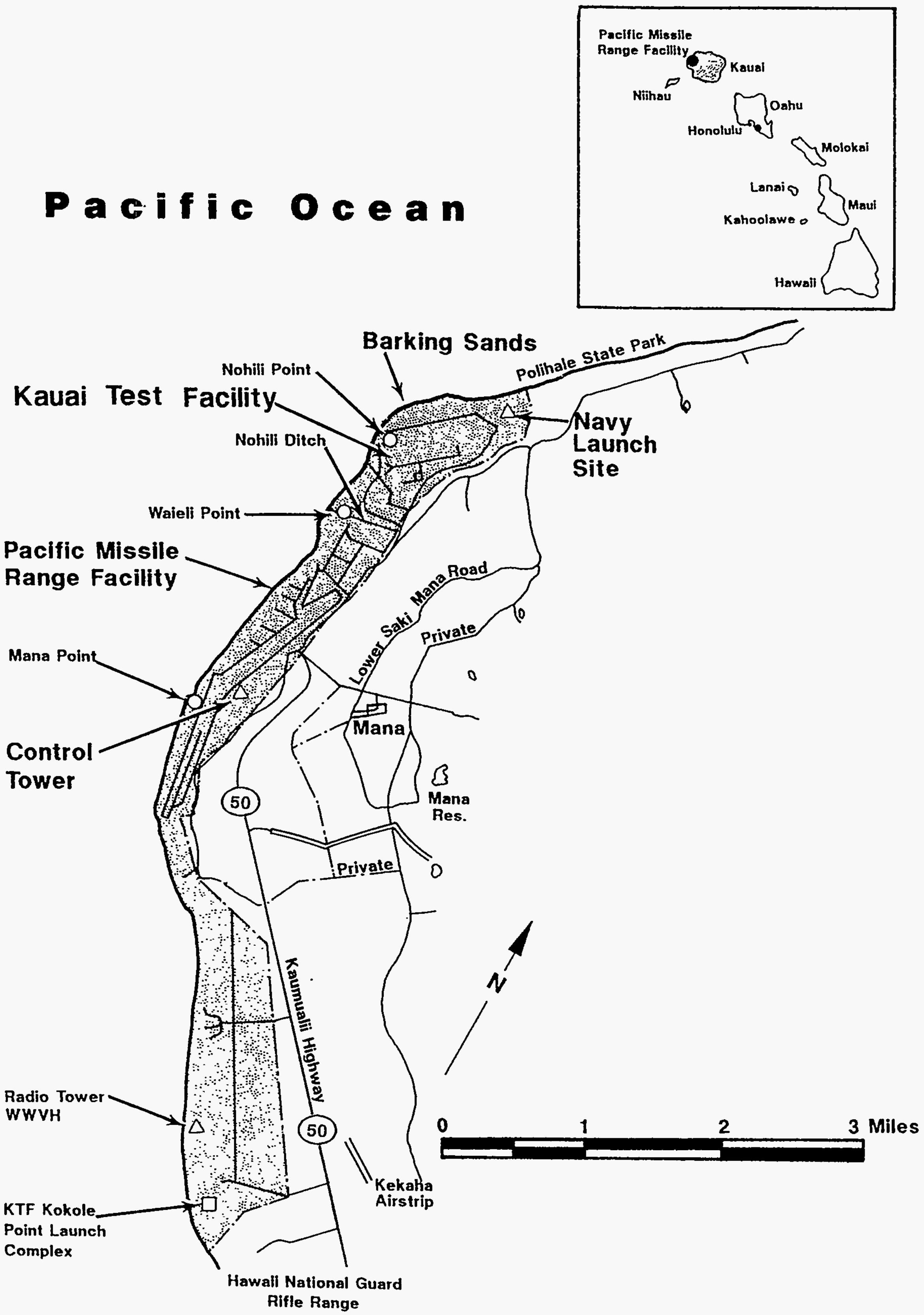

Figure J-1. Map of the Pacific Missile Range Facility (PMRF) and the Adjacent Area. The Kauai Test Facility (KTF) is to the north, near Nohili Point.

and its moisture-holding capacity so low that no drainage pattern has become established on the surface. Rain simply sinks into the sand and disappears.

The Mana Coastal Plain is composed of a wedge of terrestrial and marine sediments overlying a volcanic basement. The basement rock forms an outcrop at the inland edge of the plain; its steep slope is a cliff formed during a former high-stand of the sea. The volcanic basement plunges below the plain at a dip of approximately 5 degrees and continues to the coast, where it is approximately 400 ft (122 m) deep.

The seaward edge of the plain is covered by fossil sand dunes formed when the sea level was lower than it is now. PMRF is located almost entirely on these dunes, which are now no higher than approximately 10 ft (3 m), except to the north of the KTF, where they are ≤100 ft (30 m) high.

The three geological formations (bedrock, alluvium, and dunes) constitute hydraulically connected aquifers. The basement volcanics are highly permeable, containing brackish water floating on seawater. The overlying sediments act as a cap rock because of their low permeability; but though they are saturated, they are not exploitable as an aquifer because of their unfavorable hydraulic characteristics.

The dune sand aquifer, on which PMRF lies, has moderate hydraulic conductivity and reasonable porosity. It consists of a lens of brackish groundwater floating on seawater and is recharged by storm rainfall and seepage from the underlying sediments. The only record of an attempt to exploit this groundwater is of a well drilled for the Navy in 1974, 4 to 5 miles (mi) (6.5 to 8 kilometers [km]) south of the KTF. Drilled to a depth of 42 ft (13 m), the well encountered only fine sand and coral gravel, but when it was tested at 300 gallons per minute (gpm), it contained 2800 milligrams per liter (mg/L) chloride, which is too brackish for plants. This well is not being used (SNL 1986).

J.1.3 Biology and Population

The principal vegetation found on Kauai consists of two introduced shrub species: kiawe, a mesquite, and koahaole, a wild tamarind. Portions of the island are covered with nearly impenetrable thickets of kiawe and koahaole (DOE 1992). The land on which the present KTF facilities lie has been cleared of brush and has a thin cover of grasses and herbs. The sandy soil is barren and appears incapable of supporting agriculture unless it is improved by being mixed with organically rich soil, fertilized extensively, and irrigated.

No mammals or signs of mammals were encountered during a 1986 field survey (SNL 1986). However, it is quite likely that there may be populations of mice and rats. The endangered Hawaiian Hoary Bat (*Lasiurus cinereus semotus*) may also be occasionally found since there are breeding populations elsewhere on Kauai.

Twenty-two species of birds are found on the range, as well as three more just outside the range (SNL 1986). These include 5 species native to Hawaii. There are also several species of waterfowl present during some portion of the year, although they were not seen during the 1986 survey.

Kekah, with a 1980 population of 3300, is the closest population center to KTF. During nonoperational periods, KTF employs 14 permanent onsite personnel. During operational periods when rocket launches are occurring, an additional 50 to 75 persons from the United States mainland are employed (DOE 1992).

J.1.4 Meteorology

Lying in the rain shadow of Mounts Kawaikini and Waialeale, KTF is sheltered from the predominant northeast tradewinds and is one of the driest sections of Kauai. Average annual rainfall at KTF is just over 20 in. (51 cm) and occurrs mostly between October and April. Under normal conditions, winds are generally light and variable; abnormal conditions can result in gusty winds in excess of 30 knots from the south, west, or north. The mean monthly temperature is 70°F, with maximums in the low 90s and minimums in the mid-50s.

J.2 SIGNIFICANT ENVIRONMENTAL COMPLIANCE ACTIVITIES

J.2.1 National Environmental Policy Act Compliance

For KTF, development of a comprehensive site-wide Environmental Assessment (EA), "Kauai Test Facility Environmental Assessment," was completed in 1992 (DOE 1992). A finding of no significant impact (FONSI) was issued on July 17, 1992.

In completing this EA, several environmental surveys were carried out. Reports included the following:

- A Green Sea Turtle Survey Report: This survey found at least 32 green sea turtles (*Chelonia mydas agassizi*) at up to five locations at KTF. The study concluded that constructing an additional launch pad and conducting further launches similar to those conducted at KTF since 1962 probably will not have any quantifiable effects on green sea turtles residing in waters near KTF (IT 1990a).

- A Botanical Survey Report: This survey identified four major vegetation types at KTF and recommended that vehicles be kept off the beach and dunes. The report recommended moving the entire *Ophioglossum concinnum* colony (a Category 1 proposed endangered fern) to a compatible area within PMRF because of the colony's proximity to a beach access road and its location in a frequently-mowed kiawe/koa-haole vegetation zone (IT 1990b).

- An Ornithological Survey Report: This survey determined relative densities of bird species and identified mammalian species at KTF (IT 1990c).

- A Soil Sampling Report: This sampling was undertaken to delineate the extent and concentration of lead (Pb), aluminum (Al), and beryllium (Be) in the soil at KTF and to determine whether the concentrations threaten human health or the environment. The soil sampling results were used to estimate the potential for future soil contamination or human exposure from use of KTF as a launch facility. Results of the data analysis are contained in an International Technology Corporation report (IT 1990d).

- Archaeological Survey and Sampling: This survey found no significant cultural resources on the surface at KTF, but subsurface testing within one area indicated a potential for subsurface cultural resource materials (Gonzalez and Berryman 1990).

Data from these letter reports were incorporated into the KTF EA.

Two rocket launches from the KTF were executed in 1993; both launches were covered by the KTF EA, published in July 1992 (DOE 1992). The STARS Flight Test Unit 1 (FTU-1) was launched on February 26, 1993. The mission successfully demonstrated the missile's flight worthiness and the capability of range equipment and personnel to safely support this type of missile system. While the primary purpose of this launch was to test the STARS missile system, the missile also deployed a mock warhead, or payload, for research purposes. The successful FTU mission demonstrated the capability of the STARS and the mission readiness of the ranges.

The STARS Mission-One (M-1) was launched on August 25, 1993. This mission was a joint venture between the United States and the United Kingdom. The purpose of the mission was to deliver two payloads at re-entry velocities into the broad ocean area near the Kwajalein Atoll. The information gathered will be applied to the development of a ballistic missile defense system. This mission was a success; all onboard systems functioned nominally and all sensors acquired valid data.

J.2.2 Environmental Permits

Air: There are no Prevention of Significant Deterioration (PSD) or National Emission Standards for Hazardous Air Pollutants (NESHAP) sources for the facility, and no air permits are held either by DOE for KTF or by the U.S. Department of Defense (DOD) for PMRF. However, the two electrical generators at KTF are permitted by the State of Hawaii.

Water: Wastewater is treated on site by a wastewater treatment system consisting of septic tanks and leach fields into brackish water. The limited quantities of sewage released from KTF do not impact any protected water. Periodic drainage of septic tanks is accomplished by State of Hawaii licensed contractors who dispose of wastes according to state regulations. The facility currently holds two permits for the two septic tanks on the site.

Solid Waste: KTF, as a tenant of PMRF, is a conditionally exempt small-quantity hazardous waste generator. Resource Conservation and Recovery Act (RCRA) permits are not required for small-quantity generators. These small quantities of hazardous chemical wastes are disposed of according to the PMRF tenant agreement. PMRF also transports nonhazardous solid waste to the county landfill.

J.2.3 1993 Release Reporting

Reportable Quantity (RQ) information is required by the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) and Superfund Amendments and Reauthorization Act (SARA), Title III. CERCLA requires that any release to the environment in any 24-hour (hr) period of any pollutant or hazardous substance in a quantity ≥RQ be reported immediately to the National Response Center (NRC). However, if the release is "federally permitted" under CERCLA Section 101(10)(H), it is exempted from CERCLA reporting. This reporting exemption also applies to any federally permitted release under SARA, Title III.

There were no RQ releases for KTF in 1993 (Table J-1).

Table J-1. Summary of 1993 Reportable Quantity Release Reporting

Date	Location	Material	Quantity	RQ	Site of Release	NRC No.	Report Date
No RQ releases in 1993.							

J.3 ENVIRONMENTAL MONITORING AND MITIGATION ACTION PLAN

Pursuant to DOE Order 5400.1, "General Environmental Protection Program" (DOE 1988), a "Kauai Test Facility Environmental Monitoring Plan" (EMP) was drafted in September 1991 (IT 1992). This EMP will provide a comprehensive description of planned and ongoing environmental activities at KTF and demonstrate compliance with regulatory requirements imposed by applicable Federal, State, and local agencies. The EMP will also support DOE environmental management decisions for the facility.

The draft Sandia National Laboratories/Kauai Test Facility Environmental Monitoring Plan (IT 1992) addresses activities at KTF, such as rocket launches. Environmental monitoring of the 1993 launches was consistent with requirements of the KTF EA and the STARS EIS. A comprehensive monitoring program, which included air quality, noise, water, soil, vegetation, and marine resources, was conducted for the first STARS launch (FTU-1). This monitoring program was directed and coordinated by the U.S. Army Space and Strategic Defense Command (USASSDC) Environmental Office. All required State and Federal agencies were contacted and sent results. The results concluded that no adverse effects had been caused by the launch and no Federal or State standards were violated.

As described in the STARS EIS, air samples were collected during the first demonstration launch to validate the accuracy of the models and to evaluate compliance with Federal and State standards. Based on the results of the FTU mission, the monitoring program for the STARS M-1 mission was the same except that no air monitoring was performed. The results of the environmental monitoring also produced no adverse effects and no violations of Federal or

State statues. The Kauai Test Facility Mitigation Action Plan (Appendix D of the KTF EA [DOE 1992]) contains mitigation measures that are designed to reduce potential environmental impacts to minor levels.

J.4 OTHER COMPLIANCE ACTIVITIES

J.4.1 Spill Prevention Control and Countermeasure Plan

SNL at KTF takes part in the PMRF Spill Prevention Control and Countermeasure (SPCC) Plan which provides support in the event of a diesel fuel spill from the 10,000-gallon (gal) aboveground fuel tank just outside the compound (U.S. Navy 1991).

KTF has only one underground storage tank (UST) in its inventory (666C). This state-of-the-art UST system was placed in service in August 1991 and is registered with the State of Hawaii as a DOE-owned SNL UST system.

J.4.2 Toxic Substances Control Act

Under the Toxic Substances Control Act (TSCA), oil-containing electrical and mechanical equipment and hydraulic-fluid-containing systems must be assumed to be polychlorinated biphenyl (PCB) containing systems unless sampling and analysis show otherwise. The transformers on the KTF site have been tested and are free of PCBs.

REFERENCES

Comprehensive Environmental Reponse, Compensation, and Liability Act (CERCLA) of 1980, as amended. Title 40 U.S.C. 9601.

DOE 1988: U.S. Department of Energy, "General Environmental Protection Program," DOE Order 5400.1, DOE, Washington, DC (1988; change 1, June 21, 1990).

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

Gonzalez and Berryman 1990: Gonzalez, T., and J. Berryman, "Archaeological Survey and Testing, Department of Energy, Kauai Test Facility," prepared for Sandia National Laboratories, Albuquerque, NM (1990).

Helgesen 1990: Helgesen, R. F., "Safety Assessment for the Kauai Test Facility at Barking Sands, Kauai," SAND89-2548, Sandia National Laboratories, NM (1990).

IT 1990a: International Technology Corporation, "A Survey of the Green Sea Turtle Population Fronting the Kauai Test Facility, Pacific Missile Range, Barking Sands, Kauai: An Analysis of Potential Impacts with Implementation of the Strategic Defense Initiative" (1990).

IT 1990b: International Technology Corporation, "Botanical Survey of the Kauai Test Facility Site, Barking Sands, Kauai, Hawaii," prepared for Sandia National Laboratories, Albuquerque, NM (1990).

IT 1990c: International Technology Corporation, "Ornithological Survey Report of the Kauai Test Facility Site, Barking Sands, Kauai, Hawaii," prepared for Sandia National Laboratories, Albuquerque, NM (1990).

IT 1990d: International Technology Corporation, "Soil Sampling Program for Sandia National Laboratories, Kauai Test Facility, Kauai, Hawaii," prepared for Sandia National Laboratories, Albuquerque, NM (1990).

IT 1992: International Technology Corporation, "Sandia National Laboratories Kauai Test Facility Environmental Monitoring Plan," prepared for Sandia National Laboratories, Albuquerque, NM (1992).

SNL 1986: Sandia National Laboratories, "Environmental Report, Proposed IRBS Facilities, Kauai Test Facility," prepared by Sandia National Laboratories, Albuquerque, NM, for the DOE (1986).

Superfund Amendments and Reauthorization Act (SARA) of 1986. Title III, Section 313, "Toxic Chemical Release Reporting."

Toxic Substances Control Act (TSCA) of 1976. U.S.C. §2601 et seq.

U.S. Navy 1991: U.S. Navy, "Spill Prevention Control and Countermeasure Plan, Pacific Missile Range Facility," Pacific Division, Naval Facilities Engineering Command, Pearl Harbor, HI (February 1991).

APPENDIX K

GROUNDWATER MONITORING DATA

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CONTENTS
(Continued)

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(Concluded)

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Table K-1a.

Summary of Volatile Organic Compound Data for
Environmental Samples Exceeding MDL[a]
SNL/NM Basewide Groundwater Surveillance, April 1993

Well or Spring	Wastewater Container No.	Sample No.	Parameter	Value (mg/L)	MCL[b] (mg/L)	MDL[a] (mg/L)
Burn Site Well	No wastewater generated	BSW0012073	Methylene chloride	0.006 B[c]	NE[d]	0.005
Coyote Spring	No wastewater generated	CYS0012074	Methylene chloride	0.006 B	NE	0.005
EOD Hill Well (duplicate)	No wastewater generated	HIL0012129	Acetone	0.046	NE	0.010
Greystone Manor Well	No wastewater generated	GSM0012078	Methylene chloride	0.005 B	NE	0.005
Hubbell Spring	No wastewater generated	HBL0012079	Methylene chloride	0.006 B	NE	0.005
KAFB-10 Well	No wastewater generated	K100012080	Acetone	0.011 B	NE	0.010
Sol se Mete Spring	No wastewater generated	SSM0012088	Methylene chloride	0.005 B	NE	0.005
SW-TA3 Well	No wastewater generated	SW30012089	Methylene chloride	0.006 B	NE	0.005

[a]MDL = Minimum method detection limit obtained for nondetected parameters.
[b]MCL = Maximum contaminant levels established by the U.S. Environmental Protection Agency (EPA) Primary Drinking Water Regulations (PDWR) in 40 CFR 141.11(b).
[c]B = Compound detected in method blank.
[d]NE = MCL not established for this constituent.

Table K-1b.

Summary of Volatile Organic Compound Data for Environmental Samples Exceeding MDL[a]
SNL/NM Basewide Groundwater Surveillance, July 1993

Well or Spring	Wastewater Container No.	Sample No.	Parameter	Value (mg/L)	MCL[b] (mg/L)	MDL[a] (mg/L)
MVMW-J Well	No wastewater generated	MVJ0012964	Acetone	0.012	NE[c]	0.010
			Trimethyl silanol	0.011	NE	NA[d]
			Unknown	0.009	NE	NA
			Unknown	0.014	NE	NA
MVMW-K Well	No wastewater generated	MVK0012965	Trimethyl silanol	0.008	NE	NA
			Unknown alkane C_8 - C_{12}	0.006	NE	NA
			Unknown alkane C_8 - C_{12}	0.016	NE	NA
MVMW-K Well (duplicate)	No wastewater generated	MVX0012966	Trimethyl silanol	0.018	NE	NA
			Unknown alkane C_8 - C_{12}	0.008	NE	NA
Burn Site Well	No wastewater generated	BSW0012953	Trimethyl silanol	0.010	NE	NA
Coyote Spring	No wastewater generated	CYS0012954	Trimethyl silanol	0.009	NE	NA
SW-TA3 Well	No wastewater generated	SW30012971	Unknown	0.006	NE	NA

[a]MDL = Minimum method detection limit obtained for nondetected parameters.
[b]MCL = Maximum contaminant levels established by the U.S. Environmental Protection Agency (EPA) Primary Drinking Water Regulations (PDWR) in 40 CFR 141.11(b).
[c]NE = MCL not established for this constituent.
[d]NA = Method detection limit not applicable to estimated concentrations of tentatively identified compounds from the library search.

Table K-1c.

Summary of Volatile Organic Compound Data for Environmental Samples Exceeding MDL[a]
SNL/NM Basewide Groundwater Surveillance, September 1993

Well or Spring	Wastewater Container No.	Sample No.	Parameter	Value (mg/L)	MCL[b] (mg/L)	MDL[a] (mg/L)
EOD Hill Well	EOD092893-1 EOD092893-2 EOD092893-3	EOD013478	Acetone	0.017	NE[c]	0.010
SW-TA3 Well	No wastewater generated	SW3013483	Carbon tetrachloride	0.012	NE	0.005

[a]MDL = Minimum method detection limit obtained for nondetected parameters.
[b]MCL = Maximum contaminant levels established by the U.S. Environmental Protection Agency (EPA) Primary Drinking Water Regulations (PDWR) in 40 CFR 141.11(b).
[c]NE = MCL not established for this constituent.

Table K-1d.

Summary of Volatile Organic Compound Data for Environmental Samples Exceeding MDL[a]
SNL/NM Basewide Groundwater Surveillance, December 1993

Well or Spring	Wastewater Container No.	Sample No.	Parameter	Value (mg/L)	MCL[b] (mg/L)	MDL[a] (mg/L)
EOD Hill Well, EOD Hill Well (duplicate)	EOD122093-1 EOD122093-2 EOD122993-3	EOD014323 EOD014324	Acetone	0.012 0.013	NE[c]	0.010

[a]MDL = Minimum method detection limit obtained for nondetected parameters.
[b]MCL = Maximum contaminant levels established by the U.S. Environmental Protection Agency (EPA) Primary Drinking Water Regulations (PDWR) in 40 CFR 141.62(b).
[c]NE = MCL not established for this constituent.

Table K-2a.

Summary of Environmental Samples With Data Exceeding MCL[a]
SNL/NM Basewide Groundwater Surveillance, April 1993

Well or Spring	Wastewater Container No.	Sample No.	Parameter	Value	MCL[a]
CWL-BW2	EQR042693-1	CB20012075	Chromium	0.25 mg/L	0.05 mg/L
KAFB-10 Well	No wastewater generated	K100012080	Cadmium	0.017 mg/L	0.010 mg/L
SW-TA3 Well	No wastewater generated	SW30012089	Chromium	0.05 mg/L	0.05 mg/L

[a]MCL= Maximum contaminant levels established by the U.S. Environmental Protection Agency (EPA) Primary Drinking Water Regulations (PDWR) in 40 CFR 141.11(b).

Table K-2b.

Summary of Environmental Samples With Data Exceeding MCL[a]
SNL/NM Basewide Groundwater Surveillance, July 1993

Well or Spring	Wastewater Container No.	Sample No.	Parameter	Value	MCL[a]
Coyote Spring	No wastewater generated	CYS0012954	Fluoride	15.0 mg/L	MCLG[b] 4 mg/L
Golf Course South Well	GCS072793-1 GCS072793-2	GCS0012958	Nitrate plus Nitrite	20 mg/L	10 mg/L
MVMW-J Well	No wastewater generated	MVJ0012964	Nitrate plus Nitrite	13 mg/L	10 mg/L
MVMW-K Well	No wastewater generated	MVK0012965	Nitrate plus Nitrite	20 mg/L	10 mg/L
MVMW-K Well (duplicate)	No wastewater generated	MVX0012966	Nitrate plus Nitrite	23 mg/L	10 mg/L
Greystone Manor Well	No wastewater generated	GSM0012959	Barium	1.1 mg/L	1.0 mg/L
CWL-BW2	No wastewater generated	CB20012955	Chromium	0.39 mg/L	0.05 mg/L
MWL-BW1	No wastewater generated	MB10012967	Chromium	0.06 mg/L	0.05 mg/L
South Fence Well #2	EQR072693-1	SFR013256	Chromium	0.26 mg/L	0.05 mg/L

[a]MCL= Maximum contaminant levels established by the U.S. Environmental Protection Agency (EPA) Primary Drinking Water Regulations (PDWR) in 40 CFR 141.11(b).
[b]MCLG = Maximum contaminant level goal established by the EPA PDWR in 40 CFR 141.51(b).

Table K-2c.

Summary of Environmental Samples With Data Exceeding MCL[a]
SNL/NM Basewide Groundwater Surveillance, September 1993

Well or Spring	Wastewater Container No.	Sample No.	Parameter	Value	MCL[a]
Golf Course South Well	GCS100693-1 GCS100693-2 GCS100693-3	GCS013470	Nitrate plus nitrite	19 mg/L	10 mg/L
MVMW-J Well	MVMW-J,K091493-1	MVJ013484	Nitrate plus nitrite	14 mg/L	10 mg/L
MVMW-K Well	MVMW-J,K091493-1	MVK013485	Nitrate plus nitrite	11 mg/L	10 mg/L
MVMW-K Well	MVMW-J,K091493-1	MVK013485	Barium	1.2 mg/L	1.0 mg/L
Greystone Manor Well	GSM090993-1	GRYS013487	Barium	1.3 mg/L	1.0 mg/L
Schoolhouse Well	SCH091393-1	SCLH013486	Barium	1.1 mg/L	1.0 mg/L
KAFB-10 Well	No wastewaster generated	K10013480	Cadmium	0.87 mg/L	0.010 mg/L
KAFB-10 Well	No wastewaster generated	K10013480	Lead	0.92 mg/L	0.05 mg/L
South Fence Well #2	SF2092193-1	SF2013482	Chromium	1.6 mg/L	0.05 mg/L
SW-TA3 Well	No wastewaster generated	SW3013483	Chromium	0.12 mg/L	0.05 mg/L

[a]MCL= Maximum contaminant levels established by the U.S. Environmental Protection Agency (EPA) Primary Drinking Water Regulations (PDWR) in 40 CFR 141.11(b).

Table K-2d.

Summary of Environmental Samples With Data Exceeding MCL[a]
SNL/NM Basewide Groundwater Surveillance, December 1993

Well or Spring	Wastewater Container No.	Sample No.	Parameter	Value	MCL[a]
CWL-BW2 Well	CWL-BW2112993-1 CWL-BW2112993-2 Decon 112993	CLB2014098	Chromium	0.26 mg/L	0.1 mg/L
Golf Course South Well	GCS0014003-1 GCS0014003-2 GCS0014003-3	GCS0014003	Nitrate + nitrite	20 mg/L	10.0 mg/L
KAFB-10 Well	No wastewater generated	K100013940	Cadmium Lead	0.029 mg/L 0.23 mg/L	0.005 mg/L 0.05 mg/L
MVMW-J Well	No wastewater generated	MVJ0013938	Nitrate + nitrite Barium	13 mg/L 2.2 mg/L	10.0 mg/L 2.0 mg/L
MVMW-K Well	No wastewater generated	MVK0013942	Barium	2.1 mg/L	2.0 mg/L
MVMW-K Well	No wastewater generated	MVK0013942	Nitrate + nitrite	20 mg/L	10.0 mg/L
MVMW-K Well (duplicate)	No wastewater generated	MVK0013943	Nitrate + nitrite	17 mg/L	10.0 mg/L

[a]MCL = Maximum contaminant levels established by the U.S. Environmental Protection Agency (EPA) Primary Drinking Water Regulations (PDWR) in 40 CFR 141.62(b).

Table K-3a.

Summary of Field Water Quality Measurements
SNL/NM Basewide Groundwater Surveillance, April 1993

Site	Sampled by:	Measurements Taken:	pH[a]	Temp, °C	SC[b]
Burn Site Well	Dedicated Pump	Before Sample	6.57	17.0	868
			6.77	16.8	837
		After Sample	6.89	16.7	890
Coyote Spring	Dipper	During Sample	6.22	12.1	2960
			5.91	12.1	3060
			5.88	12.2	3020
			5.92	12.1	3010
CWL-BW2	Portable Pump	Before Sample	7.15	21.6	1175
			7.14	21.6	1177
			7.13	21.8	1173
		After Sample	7.14	21.9	1172
EOD Hill Well	Portable Pump	Before Sample	6.02	18.1	3700
			6.04	18.1	3700
			6.04	18.1	3600
		After Sample	6.05	18.0	3500
Golf Course South Well	Portable Pump	Before Sample	7.55	20.2	691
			7.57	20.2	691
			7.58	20.3	691
		After Sample	NM[c]	NM	NM
Greystone Manor Well	Bailer	During Sample	7.06	15.8	864
			7.09	15.3	969
			7.11	15.6	951
			7.35	15.6	1054
Hubbell Spring	Dipper	During Sample	6.70	12.0	881
			6.48	12.1	903
			6.69	12.9	894
KAFB-10 Well	Bailer	During Sample	7.51	20.2	632
			8.19	20.2	635
LF/DM-01 Well	Portable Pump	NS[d]	NM	NM	NM
LF/DM-02 Well	Portable Pump	Before Sample	7.34	20.7	554
			7.35	20.3	560
			7.37	20.3	557
		After Sample	7.41	20.9	566
MVMW-J Well	Bailer	During Sample	7.80	18.3	359
			7.75	18.3	376
			7.82	18.8	382
			NM[c]	NM	NM
MVMW-K Well	Bailer	During Sample	8.02	20.1	787
			8.07	19.7	620
			8.11	20.3	556
			8.08	21.4	483

Refer to footnotes at end of table.

Table K-3a. (Concluded)

Summary of Field Water Quality Measurements
SNL/NM Basewide Groundwater Surveillance, April 1993

Site	Sampled by:	Measurements Taken:	pH[a]	Temp, °C	SC[b]
MWL-BW1	Dedicated Pump	Before Sample	7.70	20.7	670
			7.58	20.8	672
			7.56	20.7	672
		After Sample	7.55	20.5	675
NW-TA3 Well	Portable Pump	Before Sample	7.63	21.0	548
			7.64	20.9	547
			7.63	20.9	547
		After Sample	7.59	21.1	547
Schoolhouse Well	Portable Pump	Before Sample	6.88	16.8	1358
			6.86	16.8	1366
			6.87	16.8	1362
		After Sample	6.82	17.0	1366
Sol se Mete Spring	Dipper	During Sample	6.18	8.9	702
			5.48	9.0	730
South Fence Well #1	Portable Pump	Before Sample	6.80	20.1	1347
			6.80	20.2	1348
			6.80	20.2	1348
		After Sample	6.81	20.2	1347
South Fence Well #2	Portable Pump	Before Sample	6.99	17.7	1199
			7.00	17.8	1203
			7.01	17.9	1207
		After Sample	7.08	18.2	1224
SW-TA3 Well	Bailer	During Sample[e]	8.01	20.6	626
			8.61	19.4	631
			8.76	21.4	635
			8.82	20.0	629
Tijeras East Well	Portable Pump	Before Sample	7.43	20.1	592
			7.53	19.9	591
			7.51	20.0	591
		After Sample	7.56	20.6	591

[a]Measured in standard pH units.
[b]SC = Specific Conductivity, measured in μmho/cm.
[c]NM = Not measured.
[d]NS = Not sampled this quarter.
[e]Insufficient water volume was available to obtain water quality measurements after sampling.

Table K-3b.

Summary of Field Water Quality Measurements
SNL/NM Basewide Groundwater Surveillance, July 1993

Site	Sampled by:	Measurements Taken:	pH[a]	Temp, °C	SC[b]
Burn Site Well	Dedicated Pump	Before Sample	5.84	18.4	1020
Coyote Spring	Dipper	During Sample	5.72	17.9	3060
CWL-BW2	Portable Pump	Before Sample	6.81	20.8	1025
			6.76	20.8	1026
			6.76	20.9	1026
			6.80	21.3	1027
EOD Hill Well	Portable Pump	Before Sample	6.17	19.6	4500
			6.17	19.4	4530
			6.17	19.3	4530
		After Sample	6.18	19.7	4470
Golf Course South Well	Portable Pump	Before Sample	7.42	20.7	692
			7.42	20.7	692
			7.41	20.8	692
		After Sample	7.43	21.3	691
Greystone Manor Well	Bailer	Before Sample	6.10	18.0	920
			6.47	17.3	1000
			6.77	18.4	990
		After Sample	5.97	17.3	1020
Hubbell Spring	Dipper	During Sample	6.20	19.8	940
KAFB-10 Well	Bailer	NS[c]	NM[d]	NM	NM
LF/DM-01 Well	Portable Pump	Before Sample	7.92	20.2	286
			7.94	20.1	286
			7.94	20.1	287
		After Sample	7.98	20.6	285
LF/DM-02 Well	Portable Pump	Before Sample	7.42	22.1	569
			7.46	22.1	570
			7.45	22.1	570
		After Sample	7.32	23.7	555
MVMW-J Well	Bailer	Before Sample	6.67	22.0	300
			6.64	21.5	300
			6.62	21.6	300
		After Sample	6.78	22.8	300
MVMW-K Well	Bailer	Before Sample	6.97	20.9	310
			7.03	20.8	310
			7.10	20.9	280
			7.03	21.2	300
MWL-BW1	Dedicated Pump	Before Sample	7.51	20.2	670
			7.52	20.3	670
			7.51	20.3	675
		After Sample	7.59	21.0	630
NW-TA3 Well	Portable Pump	Before Sample	7.31	20.7	545
			7.38	20.7	546
			7.40	20.7	545
Schoolhouse Well	Portable Pump	Before Sample	6.72	19.5	1347
			6.72	19.5	1347
			6.72	19.6	1347
Sol se Mete Spring	Dipper	NM	NM	NM	NM

Refer to footnotes at end of table.

Table K-3b. (Concluded)

Summary of Field Water Quality Measurements
SNL/NM Basewide Groundwater Surveillance, July 1993

Site	Sampled by:	Measurements Taken:	pH[a]	Temp, °C	SC[b]
South Fence Well #1	Portable Pump	Before Sample	6.55	20.4	1339
			6.54	20.5	1339
			6.53	20.6	1340
		After Sample	6.60	22.2	1334
South Fence Well #2	Portable Pump	Before Sample	7.49	19.9	1159
			7.49	19.8	1160
			7.49	20.0	1159
SW-TA3 Well	Bailer	During Sample[e]	6.66	23.0	600
			6.49	22.4	350
Tijeras East Well	Portable Pump	Before Sample	7.25	21.3	591
			7.25	21.4	587
			7.26	21.2	591
		After Sample	7.26	23.8	592

[a]Measured in standard pH units.
[b]SC = Specific conductivity, measured in μmho/cm.
[c]NS = Not sampled this quarter.
[d]NM = Not measured.
[e]Insufficient water volume was available to obtain water quality measurements after sampling.

Table K-3c.

Summary of Field Water Quality Measurements
SNL/NM Basewide Groundwater Surveillance, September 1993

Site	Sampled by:	Measurements Taken:	pH[a]	Temp, °C	SC[b]
Burn Site Well	Dedicated Pump	Before Sample	6.79	17.8	938
		After Sample	7.15	18.3	912
Coyote Spring	Dipper	Before Sample	6.00	16.4	1000
CWL-BW2	Portable Pump	Before Sample	6.84	21.5	1226
			6.83	21.8	1234
			6.83	21.9	1238
		After Sample	6.82	25.3	1252
EOD Hill Well	Portable Pump	Before Sample	6.10	18.9	NM[c]
			6.05	18.8	
			6.14	18.7	
		After Sample	6.15	19.0	
Golf Course South Well	Portable Pump	Before Sample	7.43	20.1	694
			7.43	20.4	695
			7.39	20.4	693
		After Sample	7.37	20.9	693
Greystone Manor Well	Bailer	Before Sample	7.28	17.3	996
			7.04	17.4	982
			7.09	17.5	987
		After Sample	7.22	17.6	1038
Hubbell Spring	Dipper	Before Sample	7.46	19.4	882
		After Sample	7.71	18.2	887
KAFB-10 Well	Bailer	Before Sample	7.65	21.2	726
		After Sample	7.90	21.9	686
LF/DM-01 Well	Portable Pump	Before Sample	7.76	20.8	286
			7.76	20.8	287
			7.76	20.7	287
		After Sample	7.76	22.6	284
LF/DM-02 Well	Portable Pump	Before Sample	7.43	22.0	565
			7.43	22.2	564
			7.43	22.2	564
		After Sample	7.43	22.2	560
MVMW-J Well	Bailer	Before Sample	7.89	19.5	399
			7.92	19.6	402
			7.87	19.8	394
		After Sample	7.74	20.3	388
MVMW-K Well	Bailer	Before Sample	7.80	18.6	479
			7.79	18.8	417
			7.79	19.1	383
		After Sample	7.88	19.2	382
MWL-BW1	Dedicated Pump	NS[d]	NS	NS	NS

Refer to footnotes at end of table.

Table K-3c. (Concluded)

Summary of Field Water Quality Measurements
SNL/NM Basewide Groundwater Surveillance, September 1993

Site	Sampled by:	Measurements Taken:	pH[a]	Temp, °C	SC[b]
NW-TA3 Well	Portable Pump	Before Sample	7.53	21.2	546
			7.54	22.0	543
			7.52	21.4	546
		After Sample	7.51	22.7	543
Schoolhouse Well	Bailer	Before Sample	6.92	16.7	1247
			6.98	16.8	1212
			6.95	16.7	1234
		After Sample	6.94	17.1	1264
Sol se Mete Spring	Dipper	Before Sample	6.93	13.9	715
		After Sample	7.34	13.9	688
South Fence Well #1	Portable Pump	Before Sample	6.70	19.4	1328
			6.70	19.5	1328
			6.70	19.5	1328
		After Sample	6.68	20.1	1324
South Fence Well #2	Bailer	Before Sample	7.15	18.7	1166
			7.12	18.5	1183
			7.10	18.8	1174
		After Sample	7.14	18.9	1219
SW-TA3 Well	Bailer	Before Sample[e]	7.73	21.8	604
Tijeras East Well	Portable Pump	Before Sample	7.43	16.7	589
			7.44	16.9	589
			7.44	17.3	589
		After Sample	7.42	17.4	591

[a]Measured in standard pH units.
[b]SC = Specific Conductivity, measured in μmho/cm.
[c]NM = Not measured, too variable to measure.
[d]NS = Not sampled this quarter.
[e]Insufficient water volume was available to obtain water quality measurements after sampling.

Table K-3d.

Summary of Field Water Quality Measurements
SNL/NM Basewide Groundwater Surveillance, December 1993

Site	Sampled by:	Measurements Taken:	pH[a]	Temp, °C	SC[b]	Turbidity[c]
Burn Site Well	Dedicated Pump	During sampling	7.34	15.5	914	2.87
			7.39	15.4	910	2.39
			7.35	15.6	901	1.42
Coyote Spring	Dipper	During sampling	6.14	16.5	3600[d]	8.13
			6.17	16.4	3630	8.00
			6.20	16.5	3560	9.49
CWL-BW2 Well	Portable Pump	Before sampling	6.94	19.9	1233	33.5
			6.97	19.9	1236	29.3
			6.89	19.9	1237	28.6
		After sampling	6.89	19.5	1242	23.0
EOD Hill Well	Portable Pump	Before sampling	6.13	15.2	4590[d]	4.89
			6.14	15.1	4590	4.92
			6.14	15.1	4590	4.50
		After sampling	6.09	11.6	4270	5.57
Golf Course South Well	Portable Pump	Before sampling	7.46	18.5	697	0.15
			7.46	18.6	697	0.12
			7.46	18.6	697	0.12
		After sampling	7.43	18.1	697	0.09
Greystone Manor Well	Bailer	Before sampling	7.17	15.5	895	137
			7.20	15.4	896	141
			7.26	15.6	889	137
		After sampling	7.18	15.4	897	117
Hubbell Spring	Dipper	During sampling	7.27	16.7	939	1.36
			7.38	16.8	937	0.61
			7.63	16.6	917	0.56
KAFB-10 Well	Bailer	During sampling	7.59	17.0	697	25.2
			7.66	17.3	673	19.8
			7.61	17.4	663	30.2
			7.58	17.4	659	26.4
LF/DM-01 Well	Portable Pump	Before sampling	7.92	18.1	286	0.87
			7.93	18.2	286	0.88
			7.93	18.1	286	0.50
		After sampling	7.93	17.4	287	0.86
LF/DM-02 Well	Portable Pump	Before sampling	7.31	18.8	569	4.30
			7.30	18.9	572	4.29
			7.31	18.9	573	4.30
		After sampling	7.32	18.1	571	4.31
MVMW-J Well	Bailer	Before sampling	7.85	16.2[e]	429[e]	31.1
			7.90	16.3	412	34.1
			7.89	16.8	408	28.4
		After sampling	7.86	17.0	406	34.7

Refer to footnotes at end of table.

Table K-3d. (Concluded)

Summary of Field Water Quality Measurements
SNL/NM Basewide Groundwater Surveillance, December 1993

Site	Sampled by:	Measurements Taken:	pH[a]	Temp, °C	SC[b]	Turbidity[c]
MVMW-K Well	Bailer	Before sampling	7.76	17.8	640	49.6
			7.78	17.7	631	51.4
			7.80	17.8	642	63.2
		After sampling	7.76	18.1	680	90.8
MWL-BW1 Well	Dedicated Pump	Before sampling	7.67	17.8	680	0.83
			7.63	18.8	677	0.57
			7.52	19.9	678	0.64
		After sampling	7.46	19.6	678	0.57
NW-TA3 Well	Portable Pump	Before sampling	7.48	18.3	547	0.22
			7.48	18.1	550	0.28
			7.48	18.2	547	0.22
		After sampling	7.46	19.6	546	0.49
Schoolhouse Well	Portable Pump	Before sampling	6.76	15.2	1359	5.31
			6.76	15.1	1360	6.62
			6.75	15.1	1360	5.92
		After sampling	6.76	12.1	1372	6.16
Sol se Mete Spring	Dipper	Before sampling	7.48	NM[f]	0.612	3.18
			7.50	NM	0.611	1.05
		After sampling	7.50	NM	0.612	1.17
South Fence Well #1	Portable Pump	Before sampling	6.70	18.1	1349	0.24
			6.69	18.1	1349	0.25
			6.70	18.2	1348	0.18
		After sampling	6.69	17.4	1349	0.54
South Fence Well #2	Portable Pump	Before sampling	6.96	16.7	1195[e]	2.12
			6.95	16.8	1203	2.65
			6.93	16.8	1213	3.58
		After sampling	6.91	15.8	1214	3.56
South Fence Well #3T	Portable Pump	Before sampling	7.52	16.2[e]	387	0.93
			7.53	15.1	390	0.43
			7.53	15.0	396	0.56
		After sampling	7.45	13.9	396	0.76
South Fence Well #3P	Portable Pump	Before sampling	6.94	16.0[e]	1275	117
			6.93	15.9	1272	71.7
			6.93	16.0	1271	71.5
		After sampling	6.92	11.7	1281	57.1
SW-TA3 Well[g]	Bailer	During sampling	7.84	17.8	573	3.53
			8.15	14.7	733	6.71
Tijeras East Well	Portable Pump	Before sampling	7.24	18.6	593	0.27
			7.23	18.5	593	0.48
			7.22	18.6	593	0.16
		After sampling	7.24	18.0	584	0.41

[a]Measured in standard pH units.
[b]SC = Specific conductivity, measured in μmho/cm.
[c]Turbidity values are not stability measurements.
[d]SC values questionable due to effervescence of water.
[e]Field measurement parameters not stabilized as defined in Section 2.5.1 of "Groundwater Protection Program Quarterly Groundwater Surveillance Report," April 1993, Sandia National Laboratories/New Mexico and "Sitewide Groundwater Monitoring Program Sampling and Analysis Plan," Groundwater Monitoring Program, Department 7723, Sandia National Laboratories, Albuquerque, New Mexico.
[f]NM = Not measured.
[g]Insufficient water volume was available to obtain stability measurements after sampling.

Table K-4a.

Summary of Analytical Results for Detected Organic Compounds
SNL/NM Basewide Groundwater Surveillance, April 1993

		Volatile Organic Compounds					
Analyte		Acetone	2-Butanone	Carbon Tetrachloride	Methylene Chloride	TOC[a]	TOX[b]
MDL[c]		0.010 mg/L	0.010 mg/L	0.005 mg/L	0.005 mg/L	0.5 mg/L	5 μg/L
MCL[d]		NE[e]	NE	NE	NE	NE	NE
Site	Sample #	All results in mg/L except TOX (μg/L)					
Burn Site Well	BSW0012073	ND[f]	0.002 J[g]	ND	0.006 B[i]	0.7	8
Coyote Spring	CYS0012074	ND	0.002 J	ND	0.006 B	ND	18
CWL-BW2	CB20012075	ND	ND	ND	ND	ND	11
EOD Hill Well	EOD0012076	ND	0.003 J	ND	ND	1.0	15
EOD Hill Well (duplicate)	HIL0012129	0.046	ND	ND	ND	1.1	34
Golf Course South Well	GCS0012077	ND	ND	ND	ND	ND	ND
Greystone Manor Well	GSM0012078	ND	ND	ND	0.005 B	0.8	9
Hubbell Spring	HBL0012079	ND	ND	ND	0.006 B	ND	5
KAFB-10 Well	K100012080	0.011 B	0.002 J	ND	0.002 J B	3.7	13
LF/DM-1 Well	NS[h]	NS	NS	NS	NS	NS	NS
LF/DM-2 Well	LF20012082	0.004 J	0.002 J	ND	ND	ND	ND
MVMW-J Well	MVJ0012083	0.007 J B	0.001 J	ND	0.001 J B	0.5	ND
MVMW-K Well	MVK0012084	0.006 J B	0.001 J	ND	0.001 J B	0.7	29
MWL-BW1	MB10012085	0.004 J	0.002 J B	ND	ND	NA[j]	NA
MWL-BW1	SNLA012176	NA	NA	NA	NA	2.15[k]	ND[l]
MWL-BW1 (duplicate)	SNLA012177	NA	NA	NA	NA	2.10[m]	ND[n]
NW-TA3 Well	NW30012086	ND	ND	ND	ND	ND	ND
Schoolhouse Well	SCH0012087	ND	ND	ND	ND	ND	13
Sol se Mete Spring	SSM0012088	ND	ND	ND	0.005 B	2.6	14
South Fence Well #1	SF10012138	0.004 J B	ND	ND	ND	ND	ND
South Fence Well #2	SF20012137	0.009 J	ND	ND	ND	ND	29
SW-TA3 Well	SW30012089	0.006 J	0.002 J	ND	0.006 B	ND	14
Tijeras East Well	TJE0012090	ND	ND	ND	ND	ND	ND

Refer to footnotes at end of table.

Table K-4a. (Concluded)

Summary of Analytical Results for Detected Organic Compounds
SNL/NM Basewide Groundwater Surveillance, April 1993

Analyte		Acetone (Volatile Organic Compounds)	2-Butanone (Volatile Organic Compounds)	Carbon Tetrachloride (Volatile Organic Compounds)	Methylene Chloride (Volatile Organic Compounds)	TOC[a]	TOX[b]
MDL[c]		0.010 mg/L	0.010 mg/L	0.005 mg/L	0.005 mg/L	0.5 mg/L	5 µg/L
MCL[d]		NE[e]	NE	NE	NE	NE	NE
Site	**Sample #**	All results in mg/L except TOX (µg/L)					
Trip Blank - CYS, HBL, SSM, BSW, GSM, SW3	TB00012127	ND	ND	ND	**0.006 B**	NA	NA
Trip Blank - K10, MVJ, MVK	TB00012128	**0.014 B**	ND	ND	**0.002 J B**	NA	NA
Trip Blank - SCH, EB1	TB00012132	ND	ND	ND	ND	NA	NA
Equipment Blank	EB00012133	ND	ND	ND	ND	ND	ND
Trip Blank - CB2, MB1, GCS, NW3	TB00012134	ND	**0.002 J B**	ND	ND	NA	NA
Trip Blank - EOD, HIL	TB00012135	ND	ND	ND	ND	NA	NA

[a]TOC = Total organic carbon.
[b]TOX = Total organic halides.
[c]MDL = Minimum method detection limit obtained for nondetected parameters.
[d]MCL = Maximum contaminant levels established by the U.S. Environmental Protection Agency (EPA) Primary Drinking Water Regulations (PDWR) in 40 CFR 141.11(b).
[e]NE = Not established.
[f]ND = Not detected at MDL indicated.
[g]J = Estimated value less than method detection limit.
[h]NS = Not sampled this quarter.
[i]B = Compound detected in method blank.
[j]NA = Not analyzed.
[k]Sample number SNLA012176, average of four values (2.2, 2.8, 2.1, 1.5).
[l]Sample number SNLA012176, average of four ND values (detection limit of 30 µg/L).
[m]Sample number SNLA012177, average of four values (2.4, 2.7, 1.5, 1.8).
[n]Sample number SNLA012177, average of three ND and one J value (15.2) (detection limit of 30 µg/L).

Table K-4b.

Summary of Analytical Results for Detected Organic Compounds
SNL/NM Basewide Groundwater Surveillance, July 1993

Analyte		Volatile Organic Compounds					
		Acetone	2-Butanone	Carbon Tetrachloride	Methylene Chloride	TOC[a]	TOX[b]
MDL[c]		0.010 mg/L	0.010 mg/L	0.005 mg/L	0.005 mg/L	0.5 mg/L	5 µg/l
MCL[d]		NE[e]	NE	NE	NE	NE	NE
Site	Sample #	All results in mg/L except TOX (µg/L)					
Burn Site Well	BSW0012953	ND[f]	ND	ND	0.001 J[g] B[h]	1.0	14
Coyote Spring	CYS0012954	ND	ND	ND	0.001 J B	1.2	52
CWL-BW2 Well	CB20012955	ND	ND	ND	ND	ND	21
EOD Hill Well	EOD0012956	ND	ND	ND	ND	0.6	32
EOD Hill Well (duplicate)	HIL0012957	ND	ND	ND	ND	2.0	39
Golf Course South Well	GCS0012958	ND	ND	ND	ND	ND	7
Greystone Manor Well	GSM0012959	ND	ND	ND	ND	0.8	28
Hubbell Spring	HBL0012960	ND	ND	ND	0.001 J B	ND	6
KAFB-10 Well	NS[i]	NS	NS	NS	NS	NS	NS
LF/DM-1 Well	LF10012962	ND	ND	ND	ND	4	8
LF/DM-2 Well	LF20012963	ND	ND	ND	ND	ND	ND
MVMW-J Well	MVJ0012964	0.012	ND	ND	ND	0.6	6
MVMW-K Well	MVK0012965	0.004 J	ND	ND	ND	0.7	7
MVMW-K Well (duplicate)	MVX0012966	ND	ND	ND	ND	ND	23
MWL-BW1	MB10012967	ND	ND	ND	0.004 J B	ND	7
NW-TA3 Well	NW30012968	ND	ND	ND	ND	1.1	12
Schoolhouse Well	SCH0012969	ND	ND	ND	ND	ND	37
Sol se Mete Spring	SSM0012970	ND	ND	ND	0.002 J B	2.8	20
South Fence Well #1	SFR10013500	ND	ND	ND	ND	4.4	61
South Fence Well #2	SFR013256	ND	ND	ND	ND	ND	22
SW-TA3 Well	SW30012971	ND	ND	ND	ND	0.6	32
Tijeras East Well	TJE0012972	ND	ND	ND	ND	ND	8
Equipment Blank #1	EB10012973	ND	ND	ND	ND	ND	ND
Equipment Blank #2	EB20012974	ND	ND	ND	ND	ND	ND
Trip Blank - CYS,BSW	TB10012976	ND	ND	ND	0.002 J B	NA[j]	NA
Trip Blank - GSM,HBL	TB20012977	ND	ND	ND	0.002 J B	NA	NA
Trip Blank - MVJ,SW3	TB30012978	ND	ND	ND	0.002 J B	NA	NA
Trip Blank - MVK,MVX	TB40012979	ND	ND	ND	ND	NA	NA

Refer to footnote at end of table.

Table K-4b. (Concluded)

Summary of Analytical Results for Detected Organic Compounds
SNL/NM Basewide Groundwater Surveillance, July 1993

Analyte		Volatile Organic Compounds					
		Acetone	2-Butanone	Carbon Tetrachloride	Methylene Chloride	TOC[a]	TOX[b]
MDL[c]		0.010 mg/L	0.010 mg/L	0.005 mg/L	0.005 mg/L		
MCL[d]		NE[e]	NE	NE	NE		
Site	Sample #	All results in mg/L except TOX (μg/L)					
Trip Blank - CB2,MB1	TB50012980	ND	ND	ND	0.003 J B	NA	NA
Trip Blank - SSM	TB60012981	ND	ND	ND	0.002 J B	NA	NA
Trip Blank - EB1	TB70012982	ND	ND	ND	0.002 J B	NA	NA
Trip Blank - NW3	TB80012983	ND	ND	ND	ND	NA	NA
Trip Blank - TJE	TB0012972	ND	ND	ND	ND	NA	NA
Trip Blank - SCH,SFR,EOD,HIL,EB2	TB00012976	ND	ND	ND	0.006 B	NA	NA
Trip Blank - GCS,LF2	TB0013257	ND	ND	ND	ND	NA	NA
Trip Blank - SFR1	TB0013499	ND	ND	ND	ND	NA	NA
Trip Blank - LF1	TB0013498	ND	ND	ND	0.002 J	NA	NA

[a]TOC = Total organic carbon.
[b]TOX = Total organic halides.
[c]MDL = Minimum method detection limit obtained for nondetected parameters.
[d]MCL = *Maximum contaminant* levels established by the U.S. Environmental Protection Agency (EPA) Primary Drinking Water Regulations (PDWR) in 40 CFR 141.11(b).
[e]NE = Not established.
[f]ND = Not detected at MDL indicated.
[g]J = Estimated value less than method detection limit.
[h]B = Compound detected in method blank.
[i]NS = Not sampled this quarter.
[j]NA = Not analyzed.

Table K-4c.

Summary of Analytical Results for Detected Organic Compounds
SNL/NM Basewide Groundwater Surveillance, September 1993

		Volatile Organic Compounds					
Analyte		Acetone	2-Butanone	Carbon Tetrachloride	Methylene Chloride	TOC[a]	TOX[b]
MDL[c]		0.010 mg/L	0.010 mg/L	0.005 mg/L	0.005 mg/L	0.5 mg/L	5 μg/L
MCL[d]		NE[e]	NE	NE	NE	NE	NE
Site	Sample #	All results in mg/L except TOX (μg/L)					
Burn Site Well	SNLA013491	ND	ND	ND	ND	0.8	ND
Coyote Spring	COYS013490	ND	ND	ND	ND	1.1	12
CWL-BW2	CB2013474	ND	ND	ND	ND	ND	7
EOD Hill Well	EOD013478	0.017	ND	ND	ND	1.1	130
EOD Hill Well (duplicate)	DOE013477	ND	ND	ND	0.001 J[g]	1.2	26
Golf Course South Well	GCS013470	ND	ND	ND	0.001 J	ND	ND
Greystone Manor Well	GRYS013487	ND	ND	ND	ND	0.5	7
Hubbell Spring	HUBS013488	ND	ND	ND	ND	ND	ND
KAFB-10 Well	K10013480	0.009 J	ND	ND	ND	2.2	12
LF/DM-1 Well	LF10013476	ND	ND	ND	ND	ND	ND
LF/DM-2 Well	LF2013471	ND	ND	ND	ND	ND	ND
MVMW-J Well	MVJ013484	ND	ND	ND	ND	ND	ND
MVMW-K Well	MVK013485	ND	ND	ND	ND	ND	8
MWL-BW1	NS[h]	NS	NS	NS	NS	NS	NS
NW-TA3 Well	NW3013479	ND	ND	ND	ND	ND	6
Schoolhouse Well	SCLH013486	ND	ND	ND	ND	ND	10
Sol se Mete Spring	SSMS013489	ND	ND	ND	ND	2.8	12
South Fence Well #1	SF1013473	ND	ND	ND	ND	ND	9
South Fence Well #2	SF2013482	ND	ND	ND	ND	ND	32
SW-TA3 Well	SW3013483	ND	ND	0.012	0.001 J	0.8	15
Tijeras East Well	TJE013469	ND	ND	0.001 J	0.001 J	ND	ND

Refer to footnotes at end of table.

Table K-4c. (Concluded)

Summary of Analytical Results for Detected Organic Compounds
SNL/NM Basewide Groundwater Surveillance, September 1993

		Volatile Organic Compounds					
Analyte		Acetone	2-Butanone	Carbon Tetrachloride	Methylene Chloride	TOC[a]	TOX[b]
MDL[c]		0.010 mg/L	0.010 mg/L	0.005 mg/L	0.005 mg/L	0.5 mg/L	5 μg/L
MCL[d]		NE[e]	NE	NE	NE	NE	NE
Site	Sample #	All results in mg/L except TOX (μg/L)					
Bailer Equipment Blank	EBB013481	ND	ND	0.010	0.001 J	ND	ND
Pump Equipment Blank #1	EBP013475	ND	ND	ND	ND	ND	14
Pump Equipment Blank #2	EB013472	ND	ND	ND	ND	ND	ND
Trip Blank - BSW	SNLA013491	ND	ND	ND	ND	NA	NA
Trip Blank - CB2	CB2013474	ND	ND	ND	0.001 J	NA	NA
Trip Blank - CYS, SSM	COYS013490	ND	ND	ND	ND	NA	NA
Trip Blank - EOD & Dup.	EOD013478	ND	ND	ND	0.001 J	NA	NA
Trip Blank - GCS	GCS013470	ND	ND	ND	0.001 J	NA	NA
Trip Blank - GSM	GRYS013487	ND	ND	ND	0.002 J	NA	NA
Trip Blank - HBL	HUBS013488	ND	ND	ND	ND	NA	NA
Trip Blank - K10	K10013480	ND	ND	ND	ND	NA	NA
Trip Blank - LF1, EBP1	EBP013475	ND	ND	ND	ND	NA	NA
Trip Blank - LF2	LF2013471	ND	ND	ND	ND	NA	NA
Trip Blank - MVJ	MVJ013484	ND	ND	ND	ND	NA	NA
Trip Blank - MVK	MVK013485	ND	ND	ND	ND	NA	NA
Trip Blank - NW3	NW3013479	ND	ND	ND	0.001 J	NA	NA
Trip Blank - SF1	SF1013473	ND	ND	ND	ND	NA	NA
Trip Blank - SF2, EBB	SF2013482	ND	ND	0.012	0.001 J	NA	NA
Trip Blank - SCH	SCLH013486	0.010	ND	ND	ND	NA	NA
Trip Blank - SW3	SW3013483	ND	ND	ND	0.001 J	NA	NA
Trip Blank - TJE	TJE013469	ND	ND	ND	0.002 J	NA	NA

[a]TOC = Total organic carbon.
[b]TOX = Total organic halides.
[c]MDL = Minimum method detection limit obtained for nondetected parameters.
[d]MCL = Maximum contaminant levels established by the U.S. Environmental Protection Agency (EPA) Primary Drinking Water Regulations (PDWR) in 40 CFR 141.11(b).
[e]NE = MCL not established.
[f]ND = Not detected at MDL indicated.
[g]J = Estimated value less than method detection limit.
[h]NS = Not sampled this quarter.

Table K-4d.

Summary of Analytical Results for Detected Organic Compounds
SNL/NM Basewide Groundwater Surveillance, December 1993

		Volatile Organic Compounds			
Analyte		Acetone	Methylene chloride	TOC[a]	TOX[b]
MDL[c]		0.010 mg/L	0.005 mg/L	0.5 mg/L	5 μg/L
MCL[d]		NE[e]	NE	NE	NE
Site	Sample #	All results in mg/L except TOX(μg/L)			
Burn Site Well	BSW013939	0.005 J[g]	ND[f]	0.8	23
Coyote Spring	CYS013842	ND	ND	1.2	140
CWL-BW2 Well	CLB2014098	ND	ND	ND	33
EOD Hill Well	EOD014323	0.012	ND	2.2	140
EOD Hill Well (duplicate)	HIL014324	0.013	ND	1.7	110
Golf Course South Well	GCS014003	ND	0.001 J B[h]	ND	6
Greystone Manor Well	GSM013923	ND	0.001 J	0.5	15
Hubbell Spring	HBL013798	ND	ND	ND	10
KAFB-10 Well	K10013940	ND	ND	2.4	42
LF/DM-1 Well	LF1014322	ND	ND	ND	7
MVMW-J Well	MVJ013938	ND	ND	ND	6
MVMW-K Well	MVK013942	ND	ND	0.6	38
MVMW-K Well (duplicate)	MVK013943	ND	ND	0.9	40
NW-TA3 Well	NWT3014100	ND	ND	ND	8
Schoolhouse Well	SCH014054	ND	ND	ND	18
Sol se Mete Spring	SSM013921	0.007 J	0.001 J B	3.3	12
South Fence Well #1	SFR1014105	ND	ND	ND	89
South Fence Well #2	SFR2014103	ND	ND	ND	14
South Fence Well #3P	SFP014326	ND	ND	ND	16
South Fence Well #3T	SFT014325	ND	ND	ND	12
SW-TA3 Well	SWT3014102	ND	ND	0.8	5
Tijeras East Well	TJE014106	ND	0.001 J B	ND	ND

Refer to footnotes at end of table.

Table K-4d. (Concluded)

Summary of Analytical Results for Detected Organic Compounds
SNL/NM Basewide Groundwater Surveillance, December 1993

Analyte		Volatile Organic Compounds: Acetone	Volatile Organic Compounds: Methylene Chloride	TOC[a]	TOX[b]
MDL[c]		0.010 mg/L	0.005 mg/L	0.5 mg/L	5 μg/L
MCL[d]		NE	NE	NE	NE
Site	**Sample #**	All results in mg/L except TOX (μg/L)			
Equipment Blank #1 (pump)	EB1014099	ND	ND	ND	ND
Equipment Blank #2 (pump)	EB2014104	ND	ND	ND	ND
Equipment Blank #3 (pump)	EB3014321	ND	0.002 J B	ND	ND
Equipment Blank #4 (bailer)	K10013941	ND	0.001 J	ND	44
Trip Blank—SSM	SSM013921	0.006 J	0.002 J	ND	ND
Trip Blank—K10	K10013940	0.004 J	ND	ND	ND
Trip Blank—SF1	SFR1014105	ND	0.001 J B	ND	ND

[a]TOC = Total organic carbon.
[b]TOX = Total organic halides.
[c]MDL = Minimum detection limit obtained for nondetected parameters.
[d]MCL = Maximum contaminant level established by the U.S. Environmental Protection Agency (EPA) Primary Drinking Water Regulations (PDWR) in 40 CFR 141.11(b).
[e]NE = MCL not established.
[f]ND = Not detected at MDL indicated.
[g]J = Estimated concentration value.
[h]B = Compound detected in laboratory blank.

Table K-5a.

Summary of Results of Library Search for Volatile Organic Compounds
SNL/NM Basewide Groundwater Surveillance, April 1993

Site	Sample #	Tentatively Identified Compound	Estimated Concentration, mg/L
Burn Site Well	BSW0012073	Unknown alkyl benzene isomer Unknown alkyl benzene isomer Unknown alkyl benzene isomer	0.006 0.012 0.011
Coyote Spring	CYS0012074	No compounds detected	NA[a]
CWL-BW2	CB20012075	No compounds detected	NA
EOD Hill Well	EOD0012076	No compounds detected	NA
EOD Hill Well (duplicate)	HIL0012129	No compounds detected	NA
Golf Course South Well	GCS0012077	Unknown compound detected	0.008
Greystone Manor Well	GSM0012078	Tetrahydro-Furan	0.17
Hubbell Spring	HBL0012079	Trimethyl silanol	0.005
KAFB-10 Well	K100012080	No compounds detected	NA
LF/DM-1 Well	NS[b]	NS	NS
LF/DM-2 Well	LF20012082	Library search not performed or reported	NA
MVMW-J Well	MVJ0012083	No compounds detected	NA
MVMW-K Well	MVK0012084	No compounds detected	NA
MWL-BW1	MB10012085	No compounds detected	NA
NW-TA3 Well	NW30012086	Unknown compound detected	0.006
Schoolhouse Well	SCH0012087	Unknown compound detected	0.032
Sol se Mete Spring	SSM0012088	No compounds detected	NA
South Fence Well #1	SF10012138	Library search not performed or reported	NA
South Fence Well #2	SF20012137	Library search not performed or reported	NA
SW-TA3 Well	SW30012089	No compound detected	NA
Tijeras East Well	TJE0012090	Library search not performed or reported	NA
Trip Blank - CYS, HBL, SSM, BSW, GSM, SW3	TB00012127	No compounds detected	NA
Trip Blank - K10, MVJ, MVK	TB00012128	No compounds detected	NA
Trip Blank - SCH, EB1	TB00012132	No compounds detected	NA
Trip Blank - CB2, MB1, GCS, NW3	TB00012134	No compounds detected	NA

Refer to footnotes at end of table.

Table K-5a. (Concluded)

Summary of Results of Library Search for Volatile Organic Compounds
SNL/NM Basewide Groundwater Surveillance, April 1993

Site	Sample #	Tentatively Identified Compound	Estimated Concentration, mg/L
Trip Blank - EOD, HIL	TB00012135	No compounds detected	NA
Trip Blank - TJE, LF2	TB00012136	Library search not performed or reported	NA
Trip Blank - EB2, SF1, SF2	TB00012149	Library search not performed or reported	NA
Equipment Blank	EB00012133	**Unknown compound detected**	**0.020**
Equipment Blank	EB20012140	Library search not performed or reported	NA

[a]NA = Not applicable.
[b]NS = Not sampled this quarter.

Table K-5b.

Summary of Results of Library Search for Volatile Organic Compounds
SNL/NM Basewide Groundwater Surveillance, July 1993

Site	Sample #	Tentatively Identified Compound	Estimated Concentration, mg/L
Burn Site Well	BSW0012953	**Trimethyl silanol**	**0.010**
Coyote Spring	CYS0012954	**Trimethyl silanol**	**0.009**
CWL-BW2	CB20012955	Library search not performed or reported	NA[a]
EOD Hill Well	EOD0012956	No compounds detected	NA
EOD Hill Well (duplicate)	HIL0012957	No compounds detected	NA
Golf Course South Well	GCS0012958	No compounds detected	NA
Greystone Manor Well	GSM0012959	Library search not performed or reported	NA
Hubbell Spring	HBL0012960	Library search not performed or reported	NA
KAFB-10 Well	NS[b]	NA	NA
LF/DM-1 Well	LF10012962	No compounds detected	NA
LF/DM-2 Well	LF20012963	No compounds detected	NA
MVMW-J Well	MVJ0012964	Trimethyl silanol Unknown Compound Detected Unknown Compound Detected	0.011 0.009 0.014
MVMW-K Well	MVK0012965	Trimethyl silanol Unknown Alkane C_8 - C_{12} Unknown Alkane C_8 - C_{12}	0.008 0.006 0.016
MVMW-K Well (duplicate)	MVX0012966	Trimethyl silanol Unknown Alkane C_8 - C_{12}	0.018 0.008
MWL-BW1	MB10012967	Library search not performed or reported	NA
NW-TA3 Well	NW30012968	No compounds detected	NA
Schoolhouse Well	SCH0012969	No compounds detected	NA
Sol se Mete Spring	SSM0012970	Library search not performed or reported	NA
South Fence Well #1	SFR10013500	No compounds detected	NA
South Fence Well #2	SFR013256	No compounds detected	NA
SW-TA3 Well	SW30012971	Unknown Compound Detected	0.006
Tijeras East Well	TJE0012972	No compounds detected	NA

Refer to footnotes at end of table.

Table K-5b. (Concluded)

Summary of Results of Library Search for Volatile Organic Compounds
SNL/NM Basewide Groundwater Surveillance, July 1993

Site	Sample #	Tentatively Identified Compound	Estimated Concentration, mg/L
Equipment Blank #1	EB10012973	No compounds detected	NA
Equipment Blank #2	EB20012974	Library search not performed or reported	NA
Trip Blank - CYS,BSW	TB10012976	Unknown Compound Detected Unknown Compound Detected	0.013 0.014
Trip Blank - GSM,HBL	TB20012977	Library search not performed or reported	NA
Trip Blank - MVJ,SW3	TB30012978	No compounds detected	NA
Trip Blank - MVK,MVX	TB40012979	Unknown Compound Detected	0.006
Trip Blank - CB2,MB1	TB50012980	Library search not performed or reported	NA
Trip Blank - SSM	TB60012981	Library search not performed or reported	NA
Trip Blank - EB1	TB70012982	No compounds detected	NA
Trip Blank - NW3	TB80012983	Library search not performed or reported	NA
Trip Blank - TJE	TB0012972	Library search not performed or reported	NA
Trip Blank - SCH,SFR,EOD,HIL,EB2	TB00012976	Library search not performed or reported	NA
Trip Blank - GCS,LF2	TB0013257	Library search not performed or reported	NA
Trip Blank - SFR1	TB0013499	Library search not performed or reported	NA
Trip Blank - LF1	TB0013498	Library search not performed or reported	NA

[a]NA = Not applicable.
[b]NS = Not sampled this quarter.

Table K-5c.

Summary of Results of Library Search for Volatile Organic Compounds
SNL/NM Basewide Groundwater Surveillance, September 1993

Site	Sample #	Tentatively Identified Compound	Estimated Concentration, mg/L
Burn Site Well	SNLA013491	No compounds detected	NA[a]
Coyote Spring	COYS013490	No compounds detected	NA
CWL-BW2	CB2013474	No compounds detected	NA
EOD Hill Well	EOD013478	No compounds detected	NA
EOD Hill Well (duplicate)	DOE013477	No compounds detected	NA
Golf Course South Well	GCS013470	No compounds detected	NA
Greystone Manor Well	GRYS013487	No compounds detected	NA
Hubbell Spring	HUBS013488	No compounds detected	NA
KAFB-10 Well	K10013480	No compounds detected	NA
LF/DM-1 Well	LF10013476	No compounds detected	NA
LF/DM-2 Well	LF2013471	No compounds detected	NA
MVMW-J Well	MVJ013484	No compounds detected	NA
MVMW-K Well	MVK013485	No compounds detected	NA
MWL-BW1	NS[b]	NA	NA
NW-TA3 Well	NW3013479	No compounds detected	NA
Schoolhouse Well	SCLH013486	No compounds detected	NA
Sol se Mete Spring	SSMS013489	Library search not performed or reported	NA
South Fence Well #1	SF1013473	No compounds detected	NA
South Fence Well #2	SF2013482	No compounds detected	NA
SW-TA3 Well	SW3013483	No compounds detected	NA
Tijeras East Well	TJE013469	No compounds detected	NA

Refer to footnotes at end of table.

Table K-5c. (Concluded)

Summary of Results of Library Search for Volatile Organic Compounds
SNL/NM Basewide Groundwater Surveillance, September 1993

Site	Sample #	Tentatively Identified Compound	Estimated Concentration, mg/L
Bailer Equipment Blank	EBB013481	No compounds detected	NA
Pump Equipment Blank #1	EBP013475	No compounds detected	NA
Pump Equipment Blank #2	EB013472	No compounds detected	NA
Trip Blank - BSW	SNLA013491	Library search not performed or reported	NA
Trip Blank - CB2	CB2013474	Library search not performed or reported	NA
Trip Blank - CYS, SSM	COYS013490	Library search not performed or reported	NA
Trip Blank - EOD & Dup.	EOD013478	Library search not performed or reported	NA
Trip Blank - GCS	GCS013470	Library search not performed or reported	NA
Trip Blank - GSM	GRYS013487	Library search not performed or reported	NA
Trip Blank - HBL	HUBS013488	Library search not performed or reported	NA
Trip Blank - K10	K10013480	Library search not performed or reported	NA
Trip Blank - LF1, EBP1	EBP013475	Library search not performed or reported	NA
Trip Blank - LF2	LF2013471	Library search not performed or reported	NA
Trip Blank - MVJ	MVJ013484	Unknown compound detected Unknown compound detected	0.008 0.007
Trip Blank - MVK	MVK013485	Library search not performed or reported	NA
Trip Blank - NW3	NW3013479	Library search not performed or reported	NA
Trip Blank - SCH	SCLH013486	Library search not performed or reported	NA
Trip Blank - SF1	SF1013473	Library search not performed or reported	NA
Trip Blank - SF2, EBB	SF2013482	Library search not performed or reported	NA
Trip Blank - SW3	SW3013483	Library search not performed or reported	NA
Trip Blank - TJE	TJE013469	Library search not performed or reported	NA

[a]NA = Not applicable.
[b]NS = Not sampled this quarter.

Table K-5d.

Summary of Results of Library Search for Volatile Organic Compounds, SNL/NM Basewide Groundwater Surveillance, December 1993

Site	Sample #	Tentatively Identified Compound	Estimated Concentration, mg/L
Burn Site Well	BSW013939	Trimethyl Silanol	0.006
Coyote Spring	CYS013842	No compound detected	NA[a]
CWL-BW2 Well	CLB2014098	No compound detected	NA
EOD Hill Well	EOD014323	No compound detected	NA
EOD Hill Well (duplicate)	HIL014324	No compound detected	NA
Golf Course South Well	GCS014003	Chlorodifluoromethane	0.017
Greystone Manor Well	GSM013923	Tetrahydrofuran	0.009
Hubbell Spring	HBL013798	No compound detected	NA
KAFB-10 Well	K10013940	No compound detected	NA
LF/DM1 Well	LF1014322	No compound detected	NA
LF/DM2 Well	LF2014320	No compound detected	NA
MVMW-J Well	MVJ013938	No compound detected	NA
MVMW-K Well	MVK013942	No compound detected	NA
MVMW-K Well (duplicate)	MVK013943	No compound detected	NA
MWL-BW1 Well	MWBW1014101	No compound detected	NA
NW-TA3 Well	NWT3014100	No compound detected	NA
Schoolhouse Well	SCH014054	Chlorodifluoromethane	0.016
Sol Se Mete Spring	SSM013921	No compound detected	NA
South Fence Well #1	SFR1014105	Chlorodifluoromethane	0.014
South Fence Well #2	SFR2014103	No compound detected	NA
South Fence Well #3P	SFP014326	No compound detected	NA
South Fence Well #3T	SFT014325	No compound detected	NA
SW-TA3 Well	SWT3014102	No compound detected	NA
Tijeras East Well	TJE014106	Chlorodifluoromethane	0.016
Equipment Blank #1 (pump)	EB1014099	No compound detected	NA
Equipment Blank #2 (pump)	EB2014104	No compound detected	NA
Equipment Blank #3 (pump)	EB3014321	Chlorodifluoromethane	0.015
Equipment Blank #4 (bailer)	K10013941	Chlorodifluoromethane Unknown Compound	0.024 0.012

[a]NA = Not applicable.

Table K-6a.

Summary of Analytical Results for Inorganic Compounds and Phenolics
SNL/NM Basewide Groundwater Surveillance, April 1993

Analyte		Alkalinity	Bromide	Chloride	Fluoride	NPN	pH	Phenolics	Sulfate
MDL[a], units		10 mg/L	0.10 mg/L	2.0 mg/L	0.1 mg/L	0.05 mg/L	S.U.[b]	0.05 mg/L	50 mg/L
MCL[c]		NE[d]	NE	NE	4 mg/L[e]	10 mg/L	NE	NE	NE
Site	Sample #	All results in mg/L, except pH (standard pH units)							
Burn Site Well	BSW0012073	230/256^	0.71	52	1.0	1.0	7.2	ND[f]	130
Coyote Spring	CYS0012074	860/943^	1.7	420	1.4	1.3	6.2	ND	92
CWL-BW2 Well	CB20012075	160/363^	0.20	17	0.5	6.4	7.8	ND	60
EOD Hill Well	EOD0012076	2000/1925^	1.6	410	1.6	ND	6.5	ND	110
EOD Hill Well (duplicate)	HIL0012129	2000/1925^	1.6	400	1.7	ND	6.5	ND	110
Golf Course South Well	GCS0012077	130/132^	0.61	44	0.6	•21	7.7	ND	59
Greystone Manor Well	GSM0012078	340/280^	0.46	80	0.7	5.5	7.6	ND	38
Hubbell Spring	HBL0012079	190/192^	0.36	35	0.9	0.75	7.8	ND	220
KAFB-10 Well	K100012080	120/NA[h]	0.31	81	1.2	0.40	8.1	ND	44
LF/DM-1 Well	NS[g]	NS	NS	NS	NS	NS	NS	NS	NS
LF/DM-2 Well	LF20012082	160/157^	0.21	15	0.3	4.0	7.7	ND	74
MVMW-J Well	MVJ0012083	100/145^	0.12	9.1	0.4	0.56	7.3	ND	25
MVMW-K Well	MVK0012084	110/169^	0.16	12	0.4	1.4	7.4	ND	29
MWL-BW1	MB10012085	230/256^	0.23	29	0.9	5.7	7.6	NA	46
MWL-BW1	SNLA012176	NA[h]	NA	27.6	NA	5.4[i]	NA	ND	46.7
MWL-BW1 (duplicate)	SNLA012177	NA	NA	27.9	NA	5.5[i]	NA	ND	46.7
NW-TA3 Well	NW30012086	360/155^	0.64	130	1.7	1.5	7.2	ND	73
Schoolhouse Well	SCH0012087	400/402^	0.71	150	1.4	3.9	7.1	ND	60
Sol se Mete Spring	SSM0012088	240/256-288^	0.40	25	0.4	1.2	7.9	ND	68
South Fence Well #1	SF10012138	420/407^	0.67	130	1.7	0.95	6.9	ND	67
South Fence Well #2	SF20012137	330/316^	0.68	130	1.8	0.96	7.0	ND	71
SW-TA3 Well	SW30012089	210/207^	0.23	32	1.4	3.7	8.2	ND	46
Tijeras East Well	TJE0012090	180/183^	0.17	11	0.3	2.8	7.7	ND	76

[a]MDL = Minimum method detection limit obtained for nondetected parameters.
[b]S.U. = Standard pH units.
[c]MCL = Maximum contaminant levels established by the U.S. Environmental Protection Agency (EPA) Primary Drinking Water Regulations (PDWR) in 40 CFR 141.11(b).
[d]NE = MCL not established.
[e]Maximum contaminant level goal established by the EPA PDWR in 40 CFR 141.51(b) (MCLG).
[f]ND = Not detected at MDL indicated.
[g]NS = Not sampled this quarter.
[h]NA = Not analyzed.
[i]Nitrate (as N).
•Indicates value above the MCL.
^Indicates on-site titration.

Table K-6b.

Summary of Analytical Results for Inorganic Compounds and Phenolics
SNL/NM Basewide Groundwater Surveillance, July 1993

Analyte		Alkalinity	Bromide	Chloride	Fluoride	NPN	pH	Phenolics	Sulfate
MDL[a], units		10 mg/L	0.10 mg/L	2.0 mg/L	0.1 mg/L	0.5 mg/L	S.U.[b]	0.05 mg/L	20 mg/L
MCL[c]		NE[d]	NE	NE	4 mg/L[e]	10 mg/L	NE	NE	NE
Site	Sample #	All results in mg/L, except pH (standard pH units)							
Burn Site Well	BSW0012953	200/228^	0.72	59	0.9	1.0	6.9	ND[f]	ND
Coyote Spring	CYS0012954	780/823^	1.6	410	*15.0	1.2	6.2	ND	10
CWL-BW2	CB20012955	350/352^	0.67	130	1.7	5.4	7.4	ND	56
EOD Hill Well	EOD0012956	2000/1598^	1.4	420	1.5	ND	6.5	ND	110
EOD Hill Well (duplicate)	HIL0012957	2000/1598^	1.6	410	1.5	ND	6.5	ND	110
Golf Course South Well	GCS0012958	130/NA[g]	0.60	45	0.4	*20	7.7	ND	60
Greystone Manor Well	GSM0012959	310/NA	0.44	83	0.7	5.0	7.6	ND	47
Hubbell Spring	HBL0012960	180/238^	0.35	34	0.9	0.74	7.8	ND	180
KAFB-10 Well	NS[h]	NS	NS	NS	NS	NS	NS	NS	NS
LF/DM-1 Well	LF10012962	96/40^	ND	6.3	0.5	0.45	8.0	ND	27
LF/DM-2 Well	LF20012963	160/782^	0.18	16	0.4	4.3	7.8	ND	79
MVMW-J Well	MVJ0012964	89/85^	ND	8.3	0.4	*13	7.6	ND	24
MVMW-K Well	MVK0012965	93/93^	0.15	11	0.5	*20	7.3	ND	33
MVMW-K Well (duplicate)	MVX0012966	97/NA	0.14	9.8	0.5	*23	7.5	ND	30
MWL-BW1	MB10012967	210/215^	0.26	29	0.9	1.6	8.0	ND	47
NW-TA3 Well	NW30012968	150/NA	0.21	16	0.4	6.4	8.1	ND	56
Schoolhouse Well	SCH0012969	380/391^	0.68	150	1.4	4.6	7.4	ND	54
Sol se Mete Spring	SSM0012970	220/216^	0.42	27	0.4	1.3	7.8	ND	60
South Fence Well #1	SFR10013500	410/NA	0.63	130	1.7	0.9	7.1	ND	70
South Fence Well #2	SFR013256	300/NA	0.67	130	2.0	0.9	7.8	ND	68
SW-TA3 Well	SW30012971	180/206^	0.2	31	1.4	3.6	8.2	ND	51
Tijeras East Well	TJE0012972	170/230^	0.16	12	0.3	2.9	7.7	ND	75

[a]MDL = Minimum method detection limit obtained for nondetected parameters.
[b]S.U. = Standard pH units.
[c]MCL = Maximum contaminant levels established by the U.S. Environmental Protection Agency (EPA) Primary Drinking Water Regulations (PDWR) in 40 CFR 141.11(b).
[d]NE = MCL not established.
[e]Maximum Contaminant Level Goal established by the EPA PDWR in 40 CFR 141.51(b) (MCLG).
[f]ND = Not detected at MDL indicated.
[g]NA = Not analyzed.
[h]NS = Not sampled this quarter.
^Indicates on-site titration value.
*Indicates value above the MCL.

Table K-6c.

Summary of Analytical Results for Inorganic Compounds and Phenolics
SNL/NM Basewide Groundwater Surveillance, September 1993

Analyte		Alkalinity	Bromide	Chloride	Fluoride	NPN	pH	Phenolics	Sulfate
MDL[a], units		10 mg/L	0.10 mg/L	2.0 mg/L	0.1 mg/L	0.05 mg/L	S.U.[b]	0.05 mg/L	20 mg/L
MCL[c]		NE[d]	NE	NE	4 mg/L[e]	10 mg/L	NE	NE	NE
Site	Sample #	All results in mg/L, except pH (standard pH units)							
Burn Site Well	SNLA013491	200/198^	0.8	60	1.2	3.7	7.3	ND[f]	140
Coyote Spring	COYS013490	1000/911^	2.0	510	2.2	0.64	6.3	ND	100
CWL-BW2	CB2013474	360/411^	0.66	120	1.9	1.5	7.3	ND	72
EOD Hill Well	EOD013478	2000/1790^	1.4	400	2.5	ND	6.4	ND	120
EOD Hill Well (duplicate)	DOE013477	2000/1790^	1.5	360	2.6	ND	6.5	ND	120
Golf Course South Well	GCS013470	140/117^	0.60	44	0.4	*19	7.6	ND	55
Greystone Manor Well	GRYS013487	310/358^	0.48	88	0.7	4.8	6.6	ND	45
Hubbell Spring	HUBS013488	170/178^	0.4	34	1.0	0.69	7.2	ND	190
KAFB-10 Well	K10013480	70/217^	0.30	120	1.3	2.3	7.6	NS	46
LF/DM-1 Well	LF10013476	110/103^	ND	6.6	0.5	ND	7.0	ND	26
LF/DM-2 Well	LF2013471	170/138^	0.18	16	0.4	4.1	7.8	ND	66
MVMW-J Well	MVJ013484	100/140^	0.1	7.5	0.3	*14	7.6	ND	30
MVMW-K Well	MVK013485	100/134^	ND	9.2	0.4	*11	6.5	ND	31
MWL-BW1	NS[g]	NS	NS	NS	NS	NS	NS	NS	NS
NW-TA3 Well	NW3013479	160/153^	0.21	17	0.4	6.2	7.6	ND	75
Schoolhouse Well	SCLH013486	360/268^	0.67	140	1.4	3.3	7.0	ND	61
Sol se Mete Spring	SSMS013489	220/225^	0.4	27	0.5	1.2	7.3	ND	65
South Fence Well #1	SF1013473	450/507^	0.65	130	1.7	0.96	7.1	ND	71
South Fence Well #2	SF2013482	370/348^	0.70	140	1.9	0.96	7.0	ND	62
SW-TA3 Well	SW3013483	200/166^	0.30	32	1.4	3.7	8.3	ND	50
Tijeras East Well	TJE013469	190/209^	0.19	13	0.3	3.1	7.5	ND	85

[a]MDL = Minimum method detection limit obtained for nondetected parameters.
[b]S.U. = Standard pH units.
[c]MCL= Maximum contaminant levels established by the U.S. Environmental Protection Agency (EPA) Primary Drinking Water Regulations (PDWR) in 40 CFR 141.11(b).
[d]NE = MCL not established.
[e]Maximum contaminant level goal established by the EPA PDWR in 40 CFR 141.51(b) (MCLG).
[f]ND = Not detected at MDL indicated.
[g]NS = Not sampled this quarter.
*Indicates value above the MCL.
^Indicates on-site titration value.

Table K-6d.

Summary of Analytical Results for Inorganic Compounds and Phenolics
SNL/NM Basewide Groundwater Surveillance, December 1993

Analyte		Alkalinity	Bromide	Chloride	Fluoride	NPN	pH	Phenolics	Sulfate
MDL[a], units		10 mg/L	0.05 mg/L	2.0 mg/L	0.1 mg/L	0.05 mg/L	S.U.[b]	0.05 mg/L	5 mg/L
MCL[c]		NE[d]	NE	NE	4 mg/L	10 mg/L	NE	NE	NE
Site	Sample #		All results in mg/L, except pH (standard pH units)						
Burn Site Well	BSW013939	220/197^	0.70 (0.10)	53	1.0	2.7 (0.20)	7.5	ND[e]	150 (10)
Coyote Spring	CYS013842	1000/956^	2.0 (0.10)	530 (20)	2.3 (2.0)	0.40 (0.20)	6.4	ND	130 (100)
CWL-BW2 Well	CLB2014098	340/301^	0.66 (0.10)	130 (4.0)	1.8	1.5	7.5	ND	78 (10)
EOD Hill Well	EOD014323	2000/1917^	1.5 (1.0)	420 (40)	1.8 (1.0)	ND	6.3	ND	120 (100)
EOD Hill Well (duplicate)	HIL014324	2000	1.7 (1.0)	420 (40)	2.0 (1.0)	ND	6.3	ND	120 (100)
Golf Course South Well	GCS014003	130/96^	0.59 (0.10)	43	0.4	**20** (0.5)	7.7	ND	62 (50)
Greystone Manor Well	GSM013923	300/279^	0.50 (0.10)	84	0.7	5.0 (0.20)	7.8	ND	44 (10)
Hubbell Spring	HBL013798	180/165^	0.30 (0.10)	32	0.9	0.70 (0.20)	7.9	ND	220 (100)
KAFB-10 Well	K10013940	50/65^	0.30 (0.10)	130	1.3	0.80 (0.20)	8.1	ND	48 (1.0)
LF/DM-1 Well	LF1014322	98/98^	ND (0.10)	6.0	0.5	ND	7.9	ND	27 (5)
LF/DM-2 Well	LF2014320	160/146^	0.20	16	0.32	4.0 (0.5)	7.5	ND	78 (10)
MVMW-J Well	MVJ013938	95/97^	0.10 (0.10)	8.9	0.4	**13** (2.0)	7.9	ND	27 (10)
MVMW-K Well	MVK013942	88/92^	0.10 (0.10)	10	0.4	**20** (2.0)	8.1	ND	30 (10)
MVMW-K Well (duplicate)	MVK013943	99	0.10 (0.10)	9.6	0.4	**17** (2.0)	8.0	ND	30 (10)
MWL-BW1 Well	MWBW1014101	230/173^	0.23 (0.10)	28	0.9	5.6 (0.2)	7.5	ND	45
NW-TA3 Well	NWT3014100	150/157^	0.24 (0.10)	17	0.4 (0.10)	6.3 (0.2)	7.6 (0.2)	ND	60 (10)
Schoolhouse Well	SCH014054	390/330^	0.72	150 (4.0)	1.4	3.5 (0.5)	6.9	ND	62 (10)

Table K-6d. (Concluded)

Summary of Analytical Results for Inorganic Compounds and Phenolics
SNL/NM Basewide Groundwater Surveillance, December 1993

Analyte		Alkalinity	Bromide	Chloride	Fluoride	NPN	pH	Phenolics	Sulfate
MDL[a], units		10 mg/L	0.05 mg/L	2.0 mg/L	0.1 mg/L	0.05 mg/L	S.U.[b]	0.05 mg/L	5 mg/L
MCL[c]		NE[d]	NE	NE	4 mg/L	10 mg/L	NE	NE	NE
Site	Sample #	All results in mg/L, except pH (standard pH units)							
South Fence Well #1	SFR1014105	430/325^	0.65 (0.10)	140 (20)	1.9	0.87	6.7	ND	70 (50)
South Fence Well #2	SFR2014103	340/260^	0.67 (0.10)	140 (20)	2.0	0.89	7.1	ND	74 (50)
South Fence Well #3P	SFP014326	330/319^	0.70 (0.10)	130 (40)	1.9	0.90 (0.20)	7.1	ND	99 (10)
South Fence Well #3T	SFT014325	22/16^	0.55 (0.10)	47	1.6 (0.2)	ND	7.6	ND	2200 (500)
Sol se Mete Spring	SSM013921	230	0.4 (0.10)	26	0.4	1.2	7.7	ND	78 (10)
SW-TA3 Well	SWT3014102	190/150^	0.25 (0.10)	30	1.5	3.7 (0.20)	8.2	ND	48
Tijeras East Well	TJE014106	180/139^	0.17 (0.10)	14	0.3	2.7 (0.20)	7.3	ND	81 (50)
Equipment Blank #1 (pump)	EB1014099	NM[f]	ND (0.10)	ND	ND	ND	7.1	ND	ND
Equipment Blank #2 (pump)	EB2014104	NM	ND (0.10)	ND	ND	ND	7.2	ND	ND
Equipment Blank #3 (pump)	EB3014321	NM	ND	ND	ND	ND (0.5)	6.3	ND	ND
Equipment Blank #4 (bailer)	K10013941	NM	ND (0.10)	ND	ND	ND (0.20)	7.1	ND	ND

[a]MDL = Minimum method detection limit obtained for nondetected parameters. Higher actual detection limits are listed in parentheses with individual analyses.
[b]S.U. = Standard pH units.
[c]MCL = Maximum contaminant levels established by the U.S. Environmental Protection Agency (EPA) Primary Drinking Water Regulations (PDWR) in 40 CFR 141.11 (b).
[d]NE = MCL not established.
[e]ND = Not detected at MDL indicated.
[f]NM = Not measured.
^ Indicates on-site titration value.
NOTE: Values in bold exceed associated MCL.

Table K-7a.

Summary of Analytical Results for Total Metals
SNL/NM Basewide Groundwater Surveillance, April 1993

Analyte	Arsenic	Barium	Cadmium	Calcium	Chromium	Iron	Lead	Magnesium	Manganese	Mercury	Potassium	Selenium	Silver	Sodium
MDL[a] (mg/L)	0.002	0.02	0.005	0.20	0.02	0.02	0.04	0.20	0.005	0.0002	0.20	0.002	0.01	0.20
MCL[b] (mg/L)	0.05	1.0	0.010	NE[c]	0.05	NE	0.05	NE	NE	0.002	NE	0.01	0.05	NE
Site								All results in mg/L.						
Burn Site Well	ND[d]	0.05	ND	86	ND	0.02	ND	39	ND	ND	4.2	0.002	ND	24
Coyote Spring	0.004	0.03	ND	240	ND	0.18	ND	50	0.97	ND	24	ND	ND	330
CWL-BW2	ND	0.06	ND	120	*0.25	4.4	ND	29	0.037	ND	6.3	ND	ND	85
EOD Hill Well	0.005	0.23	ND	550	ND	20	ND	101	0.76	ND	37	ND	ND	410
EOD Hill Well (duplicate)	0.005	0.23	ND	530	ND	19	ND	99	0.74	ND	37	ND	ND	410
Golf Course South Well	ND	0.17	ND	87	ND	ND	ND	15	ND	ND	2.2	0.006	ND	20
Greystone Manor Well	ND	0.97	ND	99	ND	18	ND	23	0.16	ND	5.9	0.002	ND	64
Hubbell Spring	0.004	0.03	ND	74	ND	ND	ND	32	ND	ND	1.4	0.004	ND	54
KAFB-10 Well	0.007	0.14	*0.017	29	ND	3.3	*0.17	9.3	0.086	ND	6.0	ND	ND	65
LF/DM-1 Well	NS[e]	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
LF/DM-2 Well	ND	0.05	ND	71	ND	0.03	ND	13	ND	ND	2.3	ND	ND	24
MVMW-J Well	0.003	0.21	ND	44	ND	2.7	ND	5.9	0.10	ND	2.8	ND	ND	20
MVMW-K Well	0.002	0.16	ND	53	ND	1.7	ND	5.9	0.045	ND	2.5	ND	ND	23
MWL-BW1	ND	0.073	ND	46.6	ND	0.055	ND	17.9	0.0098	ND	2.7	ND	ND	46.9
MWL-BW1 (duplicate)	0.0011	0.075	ND	47.8	ND	0.14	ND	18.3	0.022	ND	2.9	ND	ND	47.4
NW-TA3 Well	ND	0.07	ND	56	ND	ND	ND	15	ND	ND	43	ND	ND	22

Refer to footnotes at end of table.

Table K-7a. (Concluded)

Summary of Analytical Results for Total Metals
SNL/NM Basewide Groundwater Surveillance, April 1993

Analyte	Arsenic	Barium	Cadmium	Calcium	Chromium	Iron	Lead	Magnesium	Manganese	Mercury	Potassium	Selenium	Silver	Sodium
MDL[a] (mg/L)	0.002	0.02	0.005	0.20	0.02	0.02	0.04	0.20	0.005	0.0002	0.20	0.002	0.01	0.20
MCL[b] (mg/L)	0.05	1.0	0.010	NE	0.05	NE	0.05	NE	NE	0.002	NE	0.01	0.05	NE
Site	All results in mg/L.													
Schoolhouse Well	ND	0.10	ND	140	ND	2.2	ND	25	0.057	ND	6.1	ND	ND	92
Sol se Mete	0.003	0.07	ND	96	ND	ND	ND	17	ND	0.001	1.6	0.005	ND	11
South Fence Well #1	ND	0.07	ND	148	ND	0.78	ND	35	0.016	ND	7.2	ND	ND	78
South Fence Well #2	ND	0.04	ND	125	ND	0.13	ND	34	0.008	ND	7.3	ND	ND	77
SW-TA3	ND	0.07	ND	37	*0.05	1.0	ND	10	0.020	ND	4.8	ND	ND	69
Tijeras East Well	ND	0.03	ND	77	ND	0.10	ND	11	ND	ND	1.8	ND	ND	27

[a]MDL = Minimum method detection limit obtained for nondetected parameters.
[b]MCL = Maximum contaminant levels established by the U.S. Environmental Protection Agency (EPA) Primary Drinking Water Regulations (PDWR) in 40 CFR 141.11(b).
[c]NE = MCL not established.
[d]ND = Not detected at MDL indicated.
[e]NS = Not sampled this quarter.
* indicates value above the MCL.

Table K-7b.

Summary of Analytical Results for Total Metals
SNL/NM Basewide Groundwater Surveillance, July 1993

Analyte	Arsenic	Barium	Cadmium	Calcium	Chromium	Iron	Lead	Magnesium	Manganese	Mercury	Potassium	Selenium	Silver	Sodium
MDL[a] (mg/L)	0.002	0.02	0.005	0.20	0.02	0.02	0.04	0.20	0.005	0.0002	0.20	0.002	0.01	0.20
MCL[b] (mg/L)	0.05	1.0	0.010	NE[c]	0.05	NE	0.05	NE	NE	0.002	NE	0.01	0.05	NE
Site	All results in mg/L.													
Burn Site Well	ND[d]	0.05	ND	100	ND	ND	ND	38	ND	ND	3.8	0.004	ND	ND
Coyote Spring	0.0051	0.02	ND	250	ND	0.22	ND	52	0.91	ND	24	ND	ND	340
CWL-BW2	ND	0.07	ND	140	*0.39	5.3	ND	32	0.059	ND	6.5	ND	ND	82
EOD Hill Well	0.014	0.20	ND	570	ND	18	ND	110	0.79	ND	40	ND	ND	440
EOD Hill Well (duplicate)	0.014	0.20	ND	550	ND	19	ND	110	0.78	ND	40	ND	ND	430
Golf Course South Well	ND	0.18	ND	83	ND	ND	ND	16	ND	ND	2.4	0.005	ND	20
Greystone Manor Well	ND	*1.1	ND	120	ND	41	ND	25	0.34	ND	6.1	ND	ND	65
Hubbell Spring	0.004	0.03	ND	82	ND	ND	ND	32	ND	ND	1.6	0.003	ND	57
KAFB-10 Well	NS[e]	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
LF/DM-1 Well	ND	0.11	ND	32	ND	0.04	ND	5.1	0.005	ND	2.3	ND	ND	19
LF/DM-2 Well	ND	0.04	ND	71	ND	0.02	ND	13	ND	ND	2.3	ND	ND	24
MVMW-J Well	0.003	0.21	ND	52	ND	2.2	ND	6.0	0.10	ND	3.1	ND	ND	20
MVMW-K Well	ND	0.16	ND	57	ND	1.5	ND	6.0	0.05	ND	2.6	ND	ND	23
MVMW-K Well (duplicate)	ND	0.16	ND	58	ND	0.61	ND	5.8	0.040	ND	2.5	ND	ND	23

Refer to footnotes at end of table.

Table K-7b. (Concluded)

Summary of Analytical Results for Total Metals
SNL/NM Basewide Groundwater Surveillance, July 1993

Analyte	Arsenic	Barium	Cadmium	Calcium	Chromium	Iron	Lead	Magnesium	Manganese	Mercury	Potassium	Selenium	Silver	Sodium
MDL[a] (mg/L)	0.002	0.02	0.005	0.20	0.02	0.02	0.04	0.20	0.005	0.0002	0.20	0.002	0.01	0.20
MCL[b] (mg/L)	0.05	1.0	0.010	NE[c]	0.05	NE	0.05	NE	NE	0.002	NE	0.01	0.05	NE
Site	All results in mg/L.													
MWL-BW1	ND	0.09	ND	57	*0.06	24	ND	20	0.008	ND	3.2	0.002	ND	51
NW-TA3 Well	ND	0.08	ND	63	ND	0.66	ND	16	0.013	ND	4.7	ND	ND	22
Schoolhouse Well	ND	0.12	ND	160	ND	0.32	ND	27	0.021	ND	6.7	ND	ND	95
Sol se Mete Spring	0.003	0.07	ND	110	ND	0.04	ND	17	ND	ND	1.7	0.005	ND	11
South Fence #1 Well	ND	0.08	ND	160	ND	ND	ND	37	ND	ND	7.3	ND	ND	80
South Fence #2 Well	ND	0.08	ND	120	*0.26	1.5	ND	33	0.11	ND	6.9	ND	ND	78
SW-TA3 Well	ND	0.08	ND	44	0.05	1.5	ND	11	0.028	ND	5.2	ND	ND	69
Tijeras East Well	ND	0.03	ND	78	ND	0.02	ND	11	ND	ND	1.8	ND	ND	28
Equipment Blank #1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.49
Equipment Blank #2	ND	ND	ND	0.65	0.05	0.42	ND	ND	ND	ND	ND	ND	ND	0.35

[a]MDL = Minimum method detection limit obtained for nondetected parameters.
[b]MCL = Maximum contaminant levels established by the U.S. Environmental Protection Agency (EPA) Primary Drinking Water Regulations (PDWR) in 40 CFR 141.11(b).
[c]NE = MCL not established.
[d]ND = Not detected at MDL indicated.
[e]NS = Not sampled this quarter.
* indicates value above the MCL.

Table K-7c.

Summary of Analytical Results for Total Metals
SNL/NM Basewide Groundwater Surveillance, September 1993

Analyte	Arsenic	Barium	Cadmium	Calcium	Chromium	Iron	Lead	Magnesium	Manganese	Mercury	Potassium	Selenium	Silver	Sodium
MDL[a] (mg/L)	0.002	0.02	0.005	0.20	0.02	0.02	0.04	0.20	0.005	0.0002	0.20	0.002	0.01	0.20
MCL[b] (mg/L)	0.05	1.0	0.010	NE[c]	0.05	NE	0.05	NE	NE	0.002	NE	0.01	0.05	NE
Site	All results in mg/L.													
Burn Site Well	ND[d]	0.05	ND	96	ND	0.04	ND	38	ND	ND	3.7	0.005	ND	26
Coyote Spring	0.005	0.03	ND	250	ND	0.30	ND	57	1.1	ND	26	ND	ND	370
CWL-BW2	ND	0.07	ND	126	ND	0.37	ND	28	0.007	ND	6.3	ND	ND	85
EOD Hill Well	0.017	0.16	ND	530	ND	17	ND	105	0.76	ND	39	ND	ND	420
EOD Hill Well (duplicate)	0.017	0.16	ND	520	ND	17	ND	105	0.76	ND	39	ND	ND	420
Golf Course South Well	ND	0.18	ND	89	ND	ND	ND	16	ND	ND	2.6	0.005	ND	22
Greystone Manor Well	ND	***1.3**	ND	106	ND	21	ND	24	0.20	ND	6.5	ND	ND	69
Hubbell Spring	0.003	0.03	ND	77	ND	ND	ND	32	ND	ND	1.4	0.004	ND	56
KAFB-10 Well	ND	0.21	***0.87**	38	ND	3.3	***0.92**	12	0.058	ND	6.8	ND	ND	77
LF/DM-1 Well	ND	0.11	ND	32	ND	ND	ND	4.9	ND	ND	2.0	ND	ND	18
LF/DM-2 Well	ND	0.05	ND	70	ND	ND	ND	13	ND	ND	2.5	ND	ND	24
MVMW-J Well	0.002	0.23	ND	54	ND	3.5	ND	6.3	0.15	ND	3.0	ND	ND	20
MVMW-K Well	0.002	***1.2**	ND	54	ND	3.5	ND	5.8	0.14	ND	3.9	ND	ND	25
MWL-BW1	NS[e]	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
NW-TA3 Well	ND	0.07	ND	61	ND	0.09	ND	15	ND	ND	4.4	ND	ND	22
Schoolhouse Well	0.005	***1.1**	ND	137	ND	23	0.04	25	0.15	ND	7.4	ND	ND	92
Sol se Mete Spring	0.002	0.07	ND	100	ND	ND	ND	17	ND	ND	1.6	0.005	ND	11
South Fence Well #1	ND	0.07	ND	150	ND	ND	ND	35	ND	ND	7.2	ND	ND	77

Refer to footnotes at end of table.

Table K-7c. (Concluded)

Summary of Analytical Results for Total Metals
SNL/NM Basewide Groundwater Surveillance, September 1993

Analyte	Arsenic	Barium	Cadmium	Calcium	Chromium	Iron	Lead	Magnesium	Manganese	Mercury	Potassium	Selenium	Silver	Sodium
MDL[a](mg/L)	0.002	0.02	0.005	0.20	0.02	0.02	0.04	0.20	0.005	0.0002	0.20	0.002	0.01	0.20
MCL[b](mg/L)	0.05	1.0	0.010	NE[c]	0.05	NE	0.05	NE	NE	0.002	NE	0.01	0.05	NE
Site	All results in mg/L.													
South Fence Well #2	0.006	0.11	ND	130	*1.6	11	ND	33	0.11	ND	7.0	ND	ND	76
SW-TA3 Well	0.002	ND	ND	50	*0.12	3.4	0.042	12	0.076	ND	5.7	0.003	ND	67
Tijeras East Well	ND	0.03	ND	77	ND	0.02	ND	10	ND	ND	1.6	0.003	ND	25
Bailer Equipment Blank	ND	ND	ND	ND	ND	0.03	ND	ND	ND	ND	ND	ND	ND	0.42
Pump Equipment Blank #1	ND	ND	ND	0.23	ND	0.05	ND	ND	ND	ND	ND	ND	ND	0.26
Pump Equipment Blank #2	ND	ND	ND	ND	ND	0.03	ND	ND	ND	ND	ND	ND	ND	0.25

[a]MDL = Minimum method detection limit obtained for nondetected parameters.
[b]MCL = Maximum contaminant levels established by the U.S. Environmental Protection Agency (EPA) Primary Drinking Water Regulations (PDWR) in 40 CFR 141.11(b).
[c]NE = MCL not established.
[d]ND = Not detected at MDL indicated.
[e]NS = Not sampled this quarter.
*Indicates value above the MCL.

Table K-7d.

Summary of Analytical Results for Total Metals
SNL/NM Basewide Groundwater Surveillance, December 1993

Analyte	Arsenic	Barium	Cadmium	Calcium	Chromium	Iron	Lead	Magnesium	Manganese	Mercury	Potassium	Selenium	Silicon	Silver	Sodium
MDL[a] (mg/L)	0.002	0.02	0.005	0.20	0.02	0.02	0.04	0.20	0.005	0.0002	0.20	0.002	0.20	0.01	0.20
MCL[b] (mg/L)	0.05	2.0	0.005	NE[c]	0.10	NE	0.05	NE	NE	0.002	NE	0.05	NE	NE	NE
Site	All results in mg/L.														
Burn Site Well	ND[d]	0.05	ND	110	ND	0.11	ND	39	ND	ND	3.8	ND	4.7	ND	25
Coyote Spring	0.006 (0.005)	0.04	ND	270	ND	0.90	ND	61	1.4	ND	28	ND	8.4	ND	200 2.0
CWL-BW2 Well	ND	0.06	ND	120	*0.26	4.6	ND	29	0.044	ND	6.6	ND	NA[e]	ND	84
EOD Hill Well	0.030 (0.005)	0.17	ND	550 (2.0)	ND	18	ND	110	0.78	ND	39	ND	23	ND	420 (2.0)
EOD Hill Well (duplicate)	0.030 (0.010)	0.17	ND	580 (2.0)	ND	18	ND	110	0.79	ND	40	ND	24	ND	440 (2.0)
Golf Course South Well	ND	0.19	ND	88	ND	ND	ND	17	ND	ND	2.4	0.005	13	ND	21
Greystone Manor Well	ND	0.09	ND	110	ND	3.5	ND	25	0.13	ND	4.6	ND	13	ND	64
Hubbell Spring	0.003	0.03	ND	85	ND	ND	ND	33	ND	ND	1.2	0.003	14	ND	57
KAFB-10 Well	ND	0.14	*0.029	27	ND	1.6	*0.23	11	0.033	ND	6.0	ND	1.5	ND	70
LF/DM-1 Well	ND	0.11	ND	30	ND	0.03	ND	4.7	ND	ND	2.1	ND	17	ND	18
LF/DM-2 Well	ND	0.05	ND	66	ND	0.12	ND	12	ND	ND	2.1	ND	14	ND	22
MVMW-J Well	ND	*2.2	ND	47	ND	1.3	ND	5.5	0.044	ND	5.8	ND	24	ND	27
MVMW-K Well	ND	*2.1	ND	59	ND	2.4	ND	6.5	0.071	ND	5.0	ND	19	ND	29
MVMW-K Well (duplicate)	ND	1.7	ND	53	ND	1.6	ND	5.8	0.047	ND	4.3	0.003	18	ND	27
MWL-BW1 Well	ND	0.08	ND	55	ND	0.03	ND	20	ND	NS[f]	3.3	ND	NA	ND	52
NW-TA3 Well	ND	0.07	ND	60	ND	ND	ND	15	ND	ND	4.4	ND	NA	ND	21
Schoolhouse Well	ND	0.11	ND	140	ND	1.6	ND	25	0.054	ND	6.0	ND	9.6	ND	90

Refer to footnotes at end of table.

Table K-7d. (Concluded)

Summary of Analytical Results for Total Metals
SNL/NM Basewide Groundwater Surveillance, December 1993

Analyte	Arsenic	Barium	Cadmium	Calcium	Chromium	Iron	Lead	Magnesium	Manganese	Mercury	Potassium	Selenium	Silicon	Silver	Sodium
MDL[a] (mg/L)	0.002	0.02	0.005	0.20	0.02	0.02	0.04	0.20	0.005	0.0002	0.20	0.002	0.20	0.01	0.20
MCL[b] (mg/L)	0.05	2.0	0.005	NE[c]	0.10	NE	0.05	NE	NE	0.002	NE	0.05	NE	NE	NE
Site	All results in mg/L.														
Sol se Mete Spring	ND	0.07	ND	100	ND	ND	ND	17	ND	ND	1.6	0.004	8.8	ND	11
South Fence Well #1	ND	0.07	ND	150	ND	ND	ND	35	ND	ND	7.1	ND	1.6	ND	77
South Fence Well #2	0.006	0.06	ND	120	0.03	0.40	ND	33	ND	ND	6.7	ND	14	ND	74
South Fence Well #3P	0.007	0.07	ND	120	0.09	3.6	ND	29	0.11	ND	5.0	ND	15	ND	92 (2.0)
South Fence Well #3T	0.002	ND	ND	450	ND	0.02	ND	41	0.17	ND	5.3	ND	5.3	ND	500 (2.0)
SW-TA3 Well	ND	0.08	ND	41	0.07	1.6	ND	11	0.026	ND	5.3	ND	NA	ND	61
Tijeras East Well	ND	0.04	ND	80	ND	0.02	ND	11	ND	ND	1.8	ND	12	ND	27
Equipment Blank #1 (pump)	ND	NA	ND	ND	NA	ND	ND	NA	ND	ND	NA	ND	NA	ND	0.23
Equipment Blank #2 (pump)	ND	NA	ND	ND	NA	ND	ND	NA	ND	ND	NA	ND	NA	ND	0.38
Equipment Blank #3 (pump)	ND	NA	ND	ND	NA	ND	ND	NA	ND	ND	NA	ND	NA	ND	ND
Equipment Blank #4 (bailer)	ND	NA	ND	ND	NA	ND	ND	NA	ND	ND	NA	ND	NA	ND	0.20

[a]MDL = Minimum method detection limit obtained for nondetected parameters.
[b]MCL = Maximum contaminant levels established by the U.S. Environmental Protection Agency (EPA) Primary Drinking Water Regulations (PDWR) in 40 CFR 141.11(b).
[c]NE = MCL not established.
[d]ND = Not detected at MDL indicated.
[e]NA = Not analyzed.
[f]NS = Not sampled.
• Indicates value above the MCL.

Table K-8a.

Summary of Analytical Results for Coliform Bacteria
SNL/NM Basewide Groundwater Surveillance, April 1993

Sample Site	Sample Number	Total Coliform Bacteria	Fecal Coliform Bacteria
Burn Site Well	BSW0012073	A[a]	A
Coyote Spring	CYS0012074	4 col/100 mL[b]	A
CWL-BW2	CB20012075	A	A
EOD Hill Well	EOD0012076	A	A
EOD Hill Well (duplicate)	HIL0012179	7 col/100 mL[b]	A
Golf Course South Well	GCS0012077	A	A
Greystone Manor Well	GSM0012078	A	A
Hubbell Spring	HBL0012079	**Present**[c]	**Present**
KAFB-10 Well	K100012080	A	A
LF/DM-01 Well	Not Sampled	Not Sampled	Not Sampled
LF/DM-02 Well	LF20012082	A	A
MVMW-J Well	MVJ0012083	A	A
MVMW-K Well	MVK0012084	A	A
MWL-BW1	MB10012085	A	A
NW-TA3 Well	NW30012086	A	A
Schoolhouse Well	SCH0012087	A	A
Sol se Mete Spring	SSM0012088	A	A
South Fence Well #1	SF10012138	**Present**	A
South Fence Well #2	SF20012137	**Present**	A
SW-TA3 Well	SW30012089	A	A
Tijeras East Well	TJE0012090	A	A

[a]A- = Absent.
[b]4 and 7 are the number of colonies counted per 100 mL.
[c]Present = Bacteria present, but no specific count specified.

Table K-8b.

Summary of Analytical Results for Coliform Bacteria
SNL/NM Basewide Groundwater Surveillance, September 1993

Sample Site	Sample Number	Total Coliform Bacteria	Fecal Coliform Bacteria
Burn Site Well	SNLA013491	A[a]	A
Coyote Spring	COYS013490	**Present**[b]	A
CWL-BW2	CB2013474	A	A
EOD Hill	EOD013478	A	A
EOD Hill duplicate	DOE013477	**Present**	A
Golf Course South	GCS013470	**Present**	A
Greystone Manor	GRYS013487	**Present**	A
Hubbell Spring	HUBS013488	**Present**	**Present**
KAFB-10	K10013480	A	A
LF/DM-01	LF10013476	**Present**	A
LF/DM-02	LF2013471	**Present**	A
MVMW-J	MVJ013484	**Present**	A
MVMW-K	MVK013485	**Present**	A
MWL-BW1	Not Sampled	Not Sampled	Not Sampled
NW-TA3	NW3013479	**Present**	A
Schoolhouse	SCLH013486	A	A
Sol se Mete Spring	SSMS013489	**Present**	A
South Fence Well #1	SF1013473	**Present**	A
South Fence Well #2	SF2013482	Rejected[c]	Rejected
SW-TA3	SW3013483	A	A
Tijeras East	TJE013469	**Present**	A
Bailer Equipment Blank	EBB013481	A	A
Pump Equipment Blank #1	EBP013475	**Present**	A
Pump Equipment Blank #2	EB013472	**Present**	A

[a]A = Absent.
[b]Present = Bacteria present, but no specific count specified.
[c]Sample rejected by laboratory because of confluent bacteria growth; coliform determination could not be made.

Table K-9a.

Summary of Results of Unfiltered Radionuclide Screen
SNL/NM Basewide Groundwater Surveillance, April 1993

Sample Site	Wastewater Container No.	Sample No.	Detected Radionuclides[a]						
			Hg-203	Ra-226	Pb-214	Sr-85	Cd-109	Am-243	Be-7
Coyote Spring	No wastewater generated	CYS0012074		3.35E-02[b] (2.85E-02)[c]	3.29 E-02 (2.73E-02)				
Golf Course South Well	GCS042993-1	GCS0012077					4.60 E-01 (3.5E-01)	6.92 E-01 (7.20E-01)	
Hubbell Spring	No wastewater generated	HBL0012079		5.86 E-02 (4.90E-02)	9.17 E-02 (5.92E-02)				
KAFB-10 Well	No wastewater generated	K100012080							1.58 E-01 (1.47E-01)
MVMW-J Well	No wastewater generated	MVJ0012083					8.55 E-01 (5.35E-01)		
MVMW-K Well	No wastewater generated	MVK0012084				7.05 E-03 (8.24E-03)			
South Fence Well #1	EQR050693-1	SF10012138	1.28E-01 (6.85E-02)						

[a]Radionuclides found in concentrations greater than analytical detection limit.
[b]All values are activities in picocuries per milliliter (pCi/mL).
[c]Value in parentheses is the 2-sigma error value in pCi/mL.

Table K-9b.

Summary of Results of Unfiltered Radionuclide Screen
SNL/NM Basewide Groundwater Surveillance, July 1993

			Detected Radionuclides[a]	
Sample Site	Wastewater Container No.	Sample No.	K-40	Th-230
Coyote Spring	No wastewater generated	CYS0012954		7.74E+00[b] (7.91E+00)[c]
Golf Course South Well	GCS072793-1 GCS072793-2	GCS0012958	2.51E-01 (2.72E-01)	
Schoolhouse Well'	SCH072493-1	SCH0012969	3.64E-01 (3.02E-01)	
South Fence Well #1	SFR1072993-1	SFR10013500		6.82E+00 (8.04E+00)

[a]Radionuclides found in concentrations greater than the analytical detection limit.
[b]All values are activities in picocuries per milliliter (pCi/mL).
[c]Value in parentheses is the 2-sigma error value in pCi/mL.

Table K-9c.

Summary of Results of Unfiltered Radionuclide Screen SNL/NM Basewide Groundwater Surveillance, September 1993

Sample Site	Wastewater Container No.	Sample No.	Detected Radionuclides[a]								
			Ba-140	Bi-207	Bi-214	K-40	Na-24	Pb-212	Pb-214	Ra-226	Th-228
Burn Site Well	No wastewater generated	SNLA013491				2.40E-01[b] (2.94E-01)[c]					
CWL-BW2	CWL-BW2093093-1 CWL-BW2093093-2	CB2013474		3.23E-02 (2.53E-02)		2.61E-01 (3.47E-01)				6.26E-02 (4.51E-02)	
Golf Course South Well	GCS100693-1 GCS100693-2 GCS100693-3	GCS013470				2.34E-01 (2.88E-01)					
Greystone Manor Well	GSM090993-1	GRYS013487			4.98E-02 (4.36E-02)					4.76E-02 (4.17E-02)	
Hubbell Spring	No wastewater generated	HUBS013488			1.88E-01 (6.04E-02)				1.65E-01 (6.27E-02)	1.80E-01 (5.78E-02)	
LF/DM-02 Well	LFDM2100593-1 LFDM2100593-2	LF2013471			8.21E-02 (5.27E-02)	3.67E-01 (2.96E-01)				7.85E-02 (5.04E-02)	
MVMW-J Well	MVMW-J,K091493-1	MVJ013484			8.06E-02 (5.60E-02)					7.71E-02 (5.36E-02)	
MVMW-K Well	MVMW-J,K091493-1	MVK013485				2.80E-01 (3.13E-01)					
NW-TA3 Well	NWTA3092793-1 NWTA3092793-2	NW3013479			2.06E-01 (6.35E-02)			5.82E-02 (4.45E-02)	2.19E-01 (5.18E-02)	1.97E-01 (6.07E-02)	5.79E-02 (4.43E-02)
Schoolhouse Well	SCH091393-1	SCLH013486			7.02E-02 (4.72E-02)					6.71E-02 (4.51E-02)	
Sol se Mete Spring	No wastewater generated	SSMS013489								1.00E-01 (5.02E-02)	
South Fence Well #1	SFR1100493-1 SFR1100493-2	SF1013473				2.88E-01 (3.51E-01)				4.40E-02 (3.79E-02)	

Refer to footnotes at end of table.

Table K-9c. (Concluded)

Summary of Results of Unfiltered Radionuclide Screen
SNL/NM Basewide Groundwater Surveillance, September 1993

Sample Site	Wastewater Container No.	Sample No.	Detected Radionuclides[a]								
			Ba-140	Bi-207	Bi-214	K-40	Na-24	Pb-212	Pb-214	Ra-226	Th-228
Tijeras East Well	TJE100793-1 TJE100793-2	TJE013469				5.89E-01 (3.24E-01)				8.64E-02 (5.50E-02)	
Pump Equipment Blank #1	EOD092893-3	EBP013475					3.89E-02 (3.64E-02)				
Pump Equipment Blank #2	SFR1100493-2	EB013472	1.11E-01 (8.05E-02)								

[a]Radionuclides found in concentrations greater than analytical detection limits.
[b]All values are activities in picocuries per milliliter (pCi/mL).
[c]Value in parentheses is the 2-sigma error value in pCi/mL.

Table K-9d.

Summary of Results of Unfiltered Radionuclide Screen
SNL/NM Basewide Groundwater Surveillance, December 1993

Sample Site	Wastewater Container No.	Sample No.	Detected Radionuclides[a]					
			Be-7	Bi-214	K-40	Pb-210	Pb-214	Ra-226
CWL-BW2 Well	CWLBW2113093-1 CWLBW2113093-2 CWLBW2113093-3	CLB2014098			3.99E-01[b] (3.51E-01)[c]			
Golf Course South Well	GCS12993-1	GCS014003		1.73E-01 (5.39E-02)		1.16E+00 (1.10E+00)	1.48E-01 (5.49E-02)	1.65E-01 (5.15E-02)
LF/DM-01 Well	LF1121593-1 LF1121593-2 LF1121593-3	LF1014322	1.15E-01 (1.23E-01)					
MWL-BW1 Well	MWLBW112193-1	MWBW1014101						9.77E-02 (5.20E-02)
NW-TA3 Well	NWTA3113093-1 NWTA3113093-2	NWT3014100						5.06E-02 (4.57E-02)
Sol se Mete Spring	No wastewater generated	SSM013921			3.01E-01 (2.09E-01)			
South Fence Well #1	SFR1/12-7/13-1 SFR1/12-7/13-2 SFR1/12-7/13-3	SFR1014105						9.81E-02 (4.68E-02)
South Fence Well #3P	SFP122293-1 Decon 122193	SFP014326						2.62E-02 (2.07E-02)
Tijeras East Well	TJE12893-1 TJE12893-2 TJE12893-3	TJE014106		1.95E-01 (5.15E-02)			2.23E-01 (6.16E-02)	1.86E-01 (4.93E-02)
Equipment Blank #1 (pump)	CWLB02113093-2	EB1014099		7.68E-02 (5.17E-02)				7.35E-02 (4.95E-02)

[a]All other radionuclides screened were not detected at these sites; at all other sites no radionuclides were detected. See Table 10c for a complete list of the radionuclides screened.
[b]All values are activities in picocuries per milliliter (pCi/mL).
[c]Value in parentheses is the measurement uncertainty in pCi/mL.

Table K-10.

Summary of Results for Radionuclide Surveillance Data, September 1993
(values in pCi/L)

		Burn Site Well	Coyote Spring	Sol se Mete Spring	Hubbell Spring	Greystone Well	Schoolhouse Well	MVMW-K Well	MVMW-J Well
	Sample No.	BSW 013491-11	COYS 013490-11	SSMS 013489-11	HUBS 013488-11	GRYS 013487-11	SCLH 013486-11	MVK 013485-11	MVJ1 03484-11
Gross Measurements	Gross Alpha	4.9±3.0[a]	9.8±5.2	5.3±2.7	8.4±4.3	11±4.8	42±12	7.1±3.2	13±4.9
	Gross Beta	5.3±2.7[a]	21±4.5	4.4±2.3[a]	1.6±2.3[a]	7.7±2.9	32±6.1	9.7±2.8	13±3.4
Isotopic Analyses	Pu-238	U(0.057)	U(0.020)[a]	U(0.11)	0.28±0.14	U(0.043)	0.049±0.034[a]	U(0.042)[a]	0.059±0.040[a]
	Pu-239/240	U(0.049)	U(0.045)	U(0.12)	U(0.13)[a]	U(0.037)	U(0.040)	0.055±0.038[a]	U(0.051)
	U-233/234	3.9±0.45	11±1.2	3.6±0.43	7.0±0.78	4.2±0.52	8.2±0.87	1.2±0.22	0.87±0.19
	U-235	0.097±0.046	0.089±0.046	0.058±0.038	0.073±0.044	0.034±0.03[a]	0.14±0.06	0.036±0.032[a]	0.040±0.036[a]
	U-238	1.1±0.19	2.3±0.31	1.3±0.21	1.8±0.27	1.1±0.20	2.2±0.30	0.83±0.17	0.63±0.16
	Th-230	0.034±0.03	U(0.032)	U(0.10)	U(0.14)	0.11±0.052	0.028±0.032[a]	0.61±0.15	0.43±0.13
	Th-232	U(0.018)[a]	0.016±0.018[a]	U(0.038)	U(0.16)	0.079±0.048	0.028±0.032[a]	0.46±0.13	0.58±0.15
	Sr-90	U(2.2)	U(1.4)	U(1.7)	U(3.2)	U(2.1)	U(6.5)	U(3.1)	U(3.2)
	Ra-228	4.3±3.6[a]	U(4.5)[a]	U(2.3)	U(5.1)	U(2.4)[a]	U(2.5)	U(3.0)	U(3.1)
	Ra-226	U(0.21)	U(0.19)	U(0.25)	U(0.15)	U(0.25)	0.36±0.17	0.47±0.19	0.55±0.14
Gamma Spectrometry	Co-60	U(27)	U(27)	U(26)	U(26)	U(24)	U(23)	U(28)	U(27)
	Cs-137	U(21)	U(25)	U(22)	U(22)	U(22)	U(23)	U(24)	U(21)
	K-40	U(470)[a]	U(720)	U(690)	U(690)	U(680)	U(710)	U(750)	U(760)
	Ra-226	U(49)	U(41)	U(44)	U(49)	U(37)	U(43)	U(47)	U(39)
	Ra-228	U(110)	U(99)	U(110)	U(100)	U(85)	U(100)	U(99)	U(100)

Refer to footnotes at end of table.

Table K-10. (Continued)

Summary of Results for Radionuclide Surveillance Data, September 1993
(values in pCi/L)

		South Fence Well #2	Equipment Blank #1	KAFB-10 Well	NW-TA3 Well	EOD Hill Well	EOD Hill Well (duplicate)	Equipment Blank #2	LF/DM-01 Well
	Sample No.	SF2 013482-11	EBBS 013481-11	K10 013480-11	NW3 013479-11	EOD 013478-11	DOE 013477-11	EBPO 01347-11	LF10 013476-11
Gross Measurements	Gross Alpha	36 ± 11	U(1.1)	4.2 ± 3.1[a]	3.7 ± 2.1	38 ± 12	34 ± 12	U(1.5)	1.9 ± 1.6
	Gross Beta	20 ± 4.4	U(3.8)	8.1 ± 3.0	8.1 ± 2.8	44 ± 7.8	41 ± 7.5	U(3.7)	U(4.0)
Isotopic Analyses	Pu-238	0.080 ± 0.040	U(0.021)[a]	U(0.074)	U(0.056)	U(0.058)[a]	U(0.060)[a]	U(0.064)	U(0.031)
	Pu-239/240	U(0.044)	0.012 ± .012[a]	U(0.038)	U(0.047)[a]	U(0.017)	U(0.23)	U(0.042)	U(0.068)
	U-233/234	19 ± 2.0	U(0.045)	0.72 ± 0.16	3.1 ± 0.42	81 ± 7.5	83 ± 8.8	U(0.054)	0.68 ± 0.14
	U-235	0.26 ± 0.092	U(0.038)	U(0.020)[a]	0.035 ± 0.032[a]	0.37 ± 0.10	0.45 ± 0.18	(U0.054)	0.017 ± 0.020[a]
	U-238	5.0 ± 0.62	U(0.052)	0.23 ± 0.084	1.2 ± 0.22	8.9 ± 0.93	8.6 ± 1.2	U(0.082)	0.33 ± 0.092
	Th-230	0.13 ± 0.078	U(0.075)	0.033 ± 0.026[a]	0.019 ± 0.020[a]	U(0.19)[a]	U(0.021)[a]	U(0.038)	U(0.031)[a]
	Th-232	0.17 ± 0.088	U(0.055)	U(0.030)[a]	U(0.029)	U(0.019)	U(0.046)	U(0.014)[a]	U(0.014)
	Sr-90	U(2.8)	U(1.6)	U(1.9)	U(1.9)	U(1.6)[a]	U(2.1)	U(1.7)	U(1.8)
	Ra-228	U(6.6)	U(1.5)	0.91 ± 0.57[a]	1.8 ± 0.74	4.0 ± 0.97	3.3 ± 1.0	U(1.0)	U(0.85)
	Ra-226	0.20 ± .10[a]	U(0.14)	0.30 ± 0.051[b]	0.19 ± 0.048[b]	3.7 ± 0.54[b]	3.5 ± 0.49[b]	0.23 ± 0.068[b]	0.17 ± 0.038[b]
Gamma Spectrometry	Co-60	U(24)	U(24)	U(26)	U(25)	U(21)	U(25)	U(22)	U(237)
	Cs-137	U(23)	U(24)	U(26)	U(23)	U(21)	U(23)	U(24)	U(251)
	K-40	U(740)[a]	U(760)	U(620)	U(670)	U(650)	U(680)	U(660)	U(640)
	Ra-226	U(49)	U(51)	U(47)	U(44)	U(49)	U(51)	U(39)	U(5139)
	Ra-228	U(90)	U(92)	U(96)	U(94)	U(93)	U(100)	U(100)	U(100)
	67 KeV					43 ± 27			

Refer to footnotes at end of table.

Table K-10. (Concluded)

Summary of Results for Radionuclide Surveillance Data, September 1993
(values in pCi/L)

		CWL-BW2 Well	South Fence Well #1	Equipment Blank #2	LF/DM-02 Well	Golf Course South Well	Tijeras East Well
	Sample No.	CB2 013474-11	SF1 013473-11	EB2 013472-11	LF2 013471-11	GCS 013470-11	TJE 013469-11
Gross Measurements	Gross Alpha	17±6.1	20±6.8	U(1.5)	5.9±3.0	3.1±2.1[a]	4.8±2.4
	Gross Beta	12±3.4	12±3.3	U(3.3)	6.0±2.8	4.7±2.6[a]	U(3.2)
Isotopic Analyses	Pu-238	U(0.32)	0.38±0.12	U(0.020)[a]	U(0.069)	U0.24±0.13[a]	U(0.082)
	Pu-239/240	U(0.098)	U(0.048)	U(0.020)	U(0.026)	U(0.011)	U(0.060)
	U-233/234	14±1.5	16±1.8	U(0.063)[a]	2.4±0.32	2.1±0.35	1.8±0.25
	U-235	0.16±0.064	0.098±0.058	U(0.041)	0.029±0.026[a]	0.050±0.044[a]	0.046±0.032[a]
	U-238	3.5±0.44	4.4±0.58	U(0.063)84	1.2±0.20	0.77±0.19	0.84±0.16
	Th-230	U(0.039)	U(0.029)	U(0.015)[a]	0.023±0.024[a]	U(0.060)	U(0.034)
	Th-232	U(0.013)	U(0.029)	U(0.034)	U(0.016)[a]	U(0.027)	U(0.013)[a]
	Sr-90	U(1.9)	U(1.3)	U(1.5)	U(1.3)	U(2.0)	U(2.1)
	Ra-228	U(0.93)[a]	U(0.89)[a]	U(1.0)	U(0.86)[a]	26±4.3	1.0±0.64[a]
	Ra-226	0.26±0.054[b]	0.19±0.048[b]	0.22±0.050[b]	U(0.050)	0.11±0.043[b]	0.28±0.089[b]
Gamma Spectrometry	Co-60	U(24)	U(23)	U(24)	U(22)	U(22)	U(25)
	Cs-137	U(25)	U(26)	U(24)	U(24)	U(26)	U(23)
	K-40	U(470)	U(670)	U(650)	U(460)	U(650)	U(650)
	Ra-226	U(38)	U(36)	U(43)	U(35)	U(35)	U(41)
	Ra-228 67 KeV	U(100)	U(98)	U(100)	U(97)	U(100)	U(100)

[a]Measurement is within the measurement uncertainty of the minimal detectable activity (MDA).
[b]Parameter detected in laboratory blank.
± indicates the measurement uncertainty of the specified measurement.
U = Isotope not detected; Value in parentheses is the associated MDA.

Table K-11.

Summary of Results of Tritium Analyses,
SNL/NM Basewide Groundwater Surveillance,
December 1993

Site	Sample #	Wastewater Container #	Activity (pCi/L) ± Measurement Uncertainty (pCi/L)	MDA[a] (pCi/L)
Burn Site Well	BSW013939	No wastewater generated	26 ±150 U	250
Coyote Spring	CYS013842	No wastewater generated	−43 ±150 U	250
CWL-BW2 Well	CLB2014098	CWLBW2113093-3 CWLBW2113093-2 CWLBW2113093-1	**370** ±150 B	220
EOD Hill Well	EOD014323	EOD122093-1 EOD122093-2 LF1121593-3	48 ±160 U	260
EOD Hill Well (duplicate)	HIL014324	EOD122093-1 EOD122093-2 LF112593-3	−96 ±150 U	250
Golf Course South Well	GCS014003	GCS12993-1 GCS12993-2 GCS12993-3	**230** ±140 B	210
Greystone Manor Well	GSM013923	No wastewater generated	86 ±160 U	270
Hubbell Spring	HBL013798	No wastewater generated	−19 ±150 U	250
KAFB-10 Well	K10013940	No wastewater generated	56 ±150 U	250
LF/DM-01 Well	LF1014322	LF1121593-1 LF1121593-2 LF1121593-3	82 ±150 U	250
LF/DM-02 Well	LF2014320	LF2121493-1 LF2121493-2 SCH121393-3	180 ±160 U	250
MVMW-J Well	MVJ013938	No wastewater generated	23 ±150 U	250
MVMW-K Well	MVK013942	No wastewater generated	26 ±150 U	250
MVMW-K Well (duplicate)	MVK013943	No wastewater generated	94 ±160 U	260
MWL-BW1 Well	MWBW104101	MWL-BW112193-1	150 ±140 U	210
NW-TA3 Well	NWT3014100	NWTA3113093-1 NWTA3113093-2	110 ±140 U	210
Schoolhouse Well	SCH014054	SCH121393-1 SCH121393-2	**320** ±170	250
Sol se Mete Spring	SSM013921	No wastewater generated	87±150 U	250

Refer to footnotes at end of table.

Table K-11. (Concluded)

Summary of Results of Tritium Analyses,
SNL/NM Basewide Groundwater Surveillance,
December 1993

Site	Sample #	Wastewater Container #	Activity (pCi/L) ± Measurement Uncertainty (pCi/L)	MDA[a] (pCi/L)
South Fence Well #1	SFR1014105	SFR 1/12-7/13-1 SFR 1/12-7/13-2 SFR 1/12-7/13-3	**230** ±140 B	210
South Fence Well #2	SFR2014103	SFR212693-1 SFR212693-2	200 ±140 U	220
South Fence Well #3P	SFP014326	SFP122293-1 Decon 122193	67 ±150 U	250
South Fence Well #3T	SFT014325	SFT122193-1 SFT122193-2 SFT122193-3	−120 ±140 U	250
SW-TA3 Well	SWT3014102	No wastewater generated	190 ±140 U	220
Tijeras East Well	TJE014106	TJE12893-1 TJE12893-2 TJE12893-3	**280** ±140 B	210
Equipment Blank #1 (pump)	EB1014099	CWLB02113093-2	160 ±140 U	210
Equipment Blank #2 (pump)	EB2014104	SFR212693-2	110 ±140 U	210
Equipment Blank #3 (pump)	EB3014321	SCH121393-2	−150 ±140 U	250

[a]MDA = Minimal detectable activity.
U = Measured value is below associated MDA.
B = Tritium was detected in laboratory blank.
NOTE: Values in bold may exceed associated MDA.

Table K-12.

Summary of Detected Compounds
Sandia National Laboratories/New Mexico
Chemical Waste Landfill
February 1993

				Environmental Groundwater Samples						
			Sample No.: Monitor Well ID.:	BW3011668 BW-3	MW1A011665 MW-1A	MW2A011664 MW-2A	MW2B011667 MW-2A Dup.	MW3A011663 MW-3A	MW4011666 MW-4	BW3011669 BW3
Parameter	EPA Method	Detection Limit mg/L	MAC[a] mg/L	All analyses in mg/L						
Barium	6020	2.00	1000	41	65	69	65	63	78	46
Cadmium	6020	0.20	10	0.33	0.29	0.30	0.21	0.27	0.44	0.42
Chromium (total)	6020	0.50	50	27	1.2	22	21	2.8	8.9	53
Cobalt	6020	0.20	50	0.48	0.40	0.73	0.55	0.75	1.5	1.3
Copper	6020	0.20	1000	1.8	0.96	4.8	3.1	0.78	1.5	4.8
Lead	6020	0.20	50	0.28	ND[b]	0.54	ND	ND	0.33	1.3
Nickel	6020	0.50	200	102	43	96	66	67	116	160
Selenium	7741	2.00	50	ND	ND	2.0	ND	ND	ND	2.0
Tin	6020	1.00	NE[c]	6.7	5.5	6.2	6.1	6.4	6.5	ND
Trichloroethene (TCE)	8260	.001	.010	ND	.002	.005	.006	.002	ND	NA[d]
Vanadium	6020	0.50	NE	5.0	1.9	1.6	1.7	1.6	2.0	5.9
Zinc	6020	4.00	10,000	10	24	62	47	7.4	29	38

[a]MAC = Maximum allowable concentration, established by New Mexico Water Quality Control Commission.
[b]ND = Not detected at detection limit indicated.
[c]NE = Not established.
[d]NA = Not analyzed.

Table K-13.

Summary of Detected Volatile Organic Compounds
Sandia National Laboratories/New Mexico
Chemical Waste Landfill
May 1993

			Environmental Groundwater Samples					
		Sample No.:	BW3013538	MW1A013379	MW2A013380	(Duplicate) MW2A013381	MW3A013382	MW4013383
		Well No.:	BW3	MW1A	MW2A	MW2A	MW3A	MW4
		Date Sampled:	8/27/93	8/24/93	8/26/93	8/26/93	8/27/93	8/23/93
Parameter EPA Method 8260 (Appendix IX List)	Detection Limit, mg/L	MAC[a] mg/L	All results in mg/L					
Acetone	.005	NE[b]	0.012 E[c]	ND[d]	0.004 J[e]	ND	0.002 T[f]JM[g]E	ND
Carbon disulfide	.001	NE	ND	0.002 T	ND	ND	ND	0.002 T
Ethylbenzene	.001	.750	ND	ND	ND	0.002	ND	ND
Methylene chloride	.002	.100	0.21 MT	.002 MT	ND	ND	ND	0.002 T
Toluene	.001	.750	0.001	ND	0.006	ND	0.003 ET	ND
Trichloroethene (TCE)	.001	.010	ND	ND	0.002	0.002	0.001 E	ND
Trichlorofluoromethane	.001	NE	0.001	ND	ND	ND	ND	ND

[a]MAC = Maximum allowable concentration, established by New Mexico Water Quality Control Commission.
[b]NE = Not established.
[c]E = Analyte present in equipment blank.
[d]ND = Not detected at detection limit indicated.
[e]J = Analyte present below laboratory detection limit.
[f]T = *Analyte present in trip blank.*
[g]M = Analyte present in method blank.

Table 14a.

Summary of Detected Volatile Organic Compounds
Sandia National Laboratories/New Mexico
Chemical Waste Landfill
August 1993

			Environmental Groundwater Samples					
		Sample No.:	BW3013538	MW1A013379	MW2A013380	(Duplicate) MW2A013381	MW3A013382	MW4013383
		Well No.:	BW3	MW1A	MW2A	MW2A	MW3A	MW4
		Date Sampled:	8/27/93	8/24/93	8/26/93	8/26/93	8/27/93	8/23/93
Parameter EPA Method 8260 (Appendix IX List)	Detection Limit, mg/L	MAC[a] mg/L	All results in mg/L					
2-Butanone (MKE)	0.005	NE[b]	ND[c]	ND	0.003 J[d]	ND	ND	ND
Methylene chloride	0.002	0.100	0.002 E[e]T[f]	0.008 ET	ND	0.001 ET	0.003 ET	0.008 ET
Trichloroethene (TCE)	0.001	0.010	ND	0.007	0.004	0.005	0.003	ND

[a]MAC = Maximum allowable concentration, established by New Mexico Water Quality Control Commission.
[b]NE = Not established.
[c]ND = Not detected at detection limit indicated.
[d]J = Analyte present below laboratory detection limit.
[e]E = Analyte present in equipment blank.
[f]T = Analyte present in trip blank.

Table K-14b.

Summary of Detected Metals
Sandia National Laboratories/New Mexico
Chemical Waste Landfill
August 1993

				Environmental Groundwater Samples				
						(Duplicate)		
			Sample No.:	MW1A013379	MW2A013380	MW2A013381	MW3A013382	MW4013383
			Well No.:	MW1A	MW2A	MW2A	MW3A	MW4
			Date Sampled:	8/24/93	8/26/93	8/26/93	8/27/93	8/23/93
Total Metals	EPA Method	Detection Limit, µg/L	MAC[a] µg/L	All results in µg/L				
Barium	6020	2.00	1000	65	67	67	63	76
Berylium	6020	0.20	NE[b]	0.22	ND[c]	ND	ND	ND
Chromium (total)	6020	0.50	50	1.2 E[d]	9.2 E	8.7 E	1.7 E	1.7 E
Cobalt	6020	0.20	50	ND	0.51	0.63	0.46	0.69
Copper	6020	0.50	1000	1.8 EM[e]	4.4 EM	3.8 EM	2.1 EM	2.6 M
Iron	6010	20	NE	44E	190	170	ND	73
Lead	6020	0.20	50	ND E	0.41	0.51 E	ND	0.27
Nickel	6020	0.50	200	49 E	96 E	100 E	64	48 E
Selenium	7741	2.00	50	2.0	2.3	2.2	2.7	ND
Tin	6020	2.00	NE	3.6 E	3.5 M	3.4	3.3 E	3.7 E
Vanadium	6020	0.50	NE	1.7	1.1	1.1	1.7	1.8
Zinc	6020	4.00	10,000	18 E	37	40	16	11

[a]MAC = Maximum allowable concentration, established by New Mexico Water Quality Control Commission.
[b]NE = Not established.
[c]ND = Not detected at detection limit indicated.
[d]E = Analyte present in equipment blank.
[e]M = Analyte present in method blank.

Table K-15.

Summary of Detected Compounds
Sandia National Laboratories/New Mexico
Chemical Waste Landfill
November 1993

			Environmental Groundwater Samples					
						(Duplicate)		
		Sample No.:	BW3014031	MW1A014032	MW2A014033	MW2A014043	MW3A014034	MW4014035
		Well No.:	BW3	MW1A	MW2A	MW2A	MW3A	MW4
		Date Sampled:	11/19/93	11/17/93	11/19/93	11/19/93	11/18/93	11/22/93
Parameter	Detection Limit, mg/L	MAC[a] mg/L	All results in mg/L					
Barium	2.00	1000	41	59	61	61	58	64
Cadmium	0.20	10	0.37	ND[b]	ND	ND	ND	ND
Chromium (total)	0.50	50	60	0.80E[c]	2.2 E	1.7 E	2.5 E	3.8 E
Cobalt	0.20	50	1.3	0.22	0.27	0.25	0.45	1.1
Copper	0.50	1000	3.7 E	1.3 E	1.9 E	1.9 E	1.5 E	2.4 E
Iron	20	NE[d]	550	23 E	30	70	46 E	66
Nickel	0.50	200	240 E	51 E	57 E	55 E	57 E	75
Tin	1.00	NE	5.7 E	5.7 E	5.5 E	5.6 E	5.9 E	5.6 E
Trichloroethene (TCE)	0.001	0.010	ND	ND	0.003	0.004	0.001	ND
Vanadium	0.50	NE	4.7	2.0	1.8	1.8	2.1	2.9
Zinc	4.00	10,000	52	19 E	32 E	33 E	11	23 E

[a]MAC = Maximum allowable concentration, established by New Mexico Water Quality Control Commission.
[b]ND = Not detected at detection limit indicated.
[c]E = Analyte present in equipment blank
[d]NE = Not established.

Table K-16a.

Summary of the Nonradiological Analytical Results
for the Mixed Waste Landfill
Sandia National Laboratories/New Mexico
January 1993

			Environmental Samples					
		Sample No. SNLA0-	11634	11630	11632	11636	11638	11645
		Well I.D.:	MWL-MW1	MWL-MW2	MWL-MW3	MWL-BW1	MWL-BW1 Dup.	NWTA3
		Sampling Date:	01/19/93	01/18/93	01/19/93	01/20/93	01/20/93	02/02/93
General Inorganics								
Parameter	Analytical Method	Reporting Limit	All results in mg/L					
Chloride	300.0	3.0 mg/L	4.9	5.2	5.4	4.6	4.6	14.8
Phenolics	9065	0.010 mg/L	ND	ND	ND	ND	ND	ND
Sulfate	300.0	5.0 mg/L	22.9	22.5	21.1	23.9	23.8	61.4
Organics								
Total Organic Carbon (TOC), results in mg/L	9060	0.50 mg/L	1.5 1.3 1.4 1.4	1.4 1.2 1.3 1.3	1.2 1.0 1.1 1.0	1.5 1.3 1.1 1.2	0.99 0.94 0.93 0.97	1.4 1.2 1.2 1.2
Total Organic Halogen (TOX) as Cl, results in μg/L	9020	30.0 μg/L	ND 17.9[a] ND ND	ND ND ND ND	9.8[a] 12.4[a] 9.3[a] 7.6[a]	1.8[a] 13.2[a] 0.88[a] 1.7[a]	6.4[a] 3.4[a] 1.5[a] 1.2[a]	5.8[a] 3.0[a] 6.2[a] 5.7[a]

[a]Detected below reporting limit.
ND = Not detected at reporting limit indicated.

Table K-16a. (Continued)

Summary of the Nonradiological Analytical Results
for the Mixed Waste Landfill
Sandia National Laboratories/New Mexico
January 1993

			Environmental Samples					
		Sample No. SNLA0-	11634	11630	11632	11636	11638	11645
		Well I.D.:	MWL-MW1	MWL-MW2	MWL-MW3	MWL-BW1	MWL-BW1 Dup.	NWTA3
		Sampling Date:	01/19/93	01/18/93	01/19/93	01/20/93	01/20/93	02/02/93
Total TAL Metals								
Parameter	Analytical Method	Reporting Limit, mg/L	MCL[a], mg/L	All results in mg/L				
Aluminum	6010	0.10	NL	0.032[b]	ND	0.034[b]	0.044[b]	0.052[b]	0.048[b]
Antimony	6010	0.060	NL	ND	ND	ND	ND	ND	ND
Arsenic	7060	0.0050	0.05	ND	0.0020[b]	0.0021[b]	ND	ND	ND
Barium	6010	0.010	1.0	0.076	0.11	0.097	0.095	0.092	0.077
Beryllium	6010	0.0020	NL	ND	ND	ND	ND	ND	ND
Cadmium	6010	0.0050	0.01	0.0086	0.016	0.029	0.031	0.023	ND
Calcium	6010	0.20	NL	59.1	50.7	48.6	53.9	55.1	62.7
Chromium	6010	0.010	0.05	0.011	0.014	0.026	0.017	0.012	ND
Cobalt	6010	0.010	NL	ND	ND	ND	ND	ND	ND
Copper	6010	0.020	NL	0.014[b]	0.0053[b]	0.015[b]	0.015[b]	0.010[b]	0.011[b]
Iron	6010	0.10	NL	0.090[b]	0.045[b]	0.37	0.058[b]	0.090[b]	0.052[b]
Lead	7421	*0.0050-0.010	0.05	ND	ND	ND	ND	0.0012[b]	ND

[a]MCL = Maximum contaminant level, U.S. EPA Primary Drinking Water Standards.
[b]Detected below reporting limit.
ND = Not detected at reporting limit indicated.
NL = Not listed.

Table K-16a. (Concluded)

Summary of the Nonradiological Analytical Results
for the Mixed Waste Landfill
Sandia National Laboratories/New Mexico

January 1993

			Environmental Samples					
		Sample No. SNLA0-	11634	11630	01632	11636	11638	11645
		Well I.D.:	MWL-MW1	MWL-MW2	MWL-MW3	MWL-BW1	MWL-BW1 Dup.	NWTA3
		Sampling Date:	01/19/93	01/18/93	01/19/93	01/20/93	01/20/93	02/02/93
Total TAL Metals								
Parameter	Analytical Method	Reporting Limit, mg/L	MCL[a], mgL	All results in mg/L				
Magnesium	6010	0.20	NL	18.4	17.6	15.5	19.3	19.4	15.3
Manganese	6010	0.010	NL	0.011	ND	ND	ND	ND	ND
Mercury	7470	0.00020	0.002	ND	ND	ND	ND	ND	ND
Nickel	6010	0.040	NL	0.078	ND	0.026[b]	ND	ND	ND
Potassium	6010	5.0	NL	3.6[b]	4.7[b]	4.2[b]	3.8[b]	3.7[b]	4.4[b]
Selenium	7740	0.0050	0.01	0.0045[b]	0.0038[b]	0.0040[b]	0.0040[b]	0.0043[b]	0.0020[b]
Silver	6010	0.010	0.05	ND	ND	ND	ND	ND	ND
Sodium	6010	5.0	NL	52.7	52.9	54.0	56.5	56.7	23.6
Thallium	7841	0.010-0.050	NL	ND	ND	ND	ND	ND	ND
Vanadium	6010	0.010	NL	0.0076[b]	0.0076[b]	0.0076[b]	0.0087[b]	0.0073[b]	0.0056[b]
Zinc	6010	0.020	NL	ND	0.075	0.074	0.11	0.12	0.026

[a]MCL = maximum contaminant level, U.S. EPA Primary Drinking Water Standards.
[b]Detected below reporting limit.
ND = Not detected at reporting limit indicated.
NL = Not listed.

Table K-16b.

Summary of the Nonradiological Analytical Results
for the Mixed Waste Landfill
Sandia National Laboratories/New Mexico
April 1993

			Environmental Samples					
		Sample No. SNLA0-	12173	12174	12175	12176	12177	12178
		Well I.D.:	MWL-MW1	MWL-MW2	MWL-MW3	MWL-BW1	MWL-BW1 Dup.	MWL-MW4
		Sampling Date:	04/27/93	04/26/93	04/27/93	04/28/93	04/28/93	04/30/93
Parameter	Analytical Method	Reporting Limit	All results in mg/L, except TOX in μg/L					
Chloride	300.0[a]	3.0 mg/L	29.5	31.9	33.4	27.6	27.9	61.2
Phenolics	9065[b]	0.010 mg/L	ND	ND	ND	ND	ND	ND
Sulfate	300.0[a]	5.0 mg/L	43.7	47.3	39.7	46.7	46.7	38.7
Nitrate (as N)	300.0[a]	0.10 mg/L	5.0	4.5	3.7	5.4	5.5	1.1
Alkalinity (mg/L $CaCO_3$)	Field	NA	215.7	207.7	193.4	257.3	NA	231.7
Total Organic Carbon (TOC), results in mg/L	9060[b]	0.50-3.0 mg/L	21.7	15.3	20.2	2.2	2.4	4.4
			21.6	13.8	22.0	2.8	2.7	4.4
			19.6	14.9	23.1	2.1	1.5	4.0
			21.5	14.4	23.2	1.5	1.8	4.9
Total Organic Halogen (TOX) as Cl, results in μg/L	9020[b]	30.0 μg/L	ND	ND	ND	ND	ND	11.3[c]
			14.2[c]	6.4[c]	ND	ND	ND	15.6[c]
			ND	ND	8.7[c]	ND	ND	20.6[c]
			12.5[c]	ND	5.9[c]	ND	15.2[c]	16.6[c]

[a]"Methods for Chemical Analysis of Water and Wastes," U.S. Environmental Protection Agency, EPA-600/4-79-020, 1983.
[b]"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," U.S. Environmental Protection Agency, SW-846, 1986.
[c]Detected below reporting limit.
ND = Not detected at reporting limit indicated.
NA = Not applicable.

Table K-16b. (Continued)

Summary of the Nonradiological Analytical Results
for the Mixed Waste Landfill
Sandia National Laboratories/New Mexico
April 1993

			Sample No. SNLA0- / Well I.D.: / Sampling Date:	Environmental Samples 12173 MWL-MW1 04/27/93	12174 MWL-MW2 04/26/93	12175 MWL-MW3 04/27/93	12176 MWL-BW1 04/28/93	12177 MWL-BW1 Dup. 04/28/93	12178 MWL-MW4 04/30/93
Total TAL Metals									
Parameter	Analytical Method	Reporting Limit, mg/L	MCL[a], mg/L	All results in mg/L					
Aluminum	6010	0.10	NL	0.063[b]	0.057[b]	0.10	0.068[b]	0.14	0.13
Antimony	6010	0.060	NL	ND	ND	ND	ND	ND	ND
Arsenic	7060	0.0050	0.05	ND	0.0010[b]	0.0016[b]	ND	0.0011[b]	0.0040[b]
Barium	6010	0.010	1.0	0.057	0.074	0.074	0.073	0.075	0.082
Beryllium	6010	0.0020	NL	0.0016[b]	ND	ND	ND	ND	ND
Cadmium	6010	0.0050	0.01	ND	ND	ND	ND	ND	ND
Calcium	6010	0.20	NL	51.8	47.1	42.1	46.6	47.8	52.1
Chromium	6010	0.010	0.05	ND	0.016	0.029	ND	ND	ND
Cobalt	6010	0.010	NL	ND	ND	ND	ND	ND	ND
Copper	6010	0.020	NL	ND	0.0031[b]	0.0059[b]	ND	ND	ND
Iron	6010	0.10	NL	ND	ND	0.38	0.055[b]	0.14	0.21
Lead	7421	0.010-0.05	0.05	ND	ND	ND	ND	ND	ND

[a]MCL = Maximum contaminant level, U.S. EPA Primary Drinking Water Standards.
[b]Detected below reporting limit.
ND = Not detected at reporting limit indicated.
NL = Not listed.

Table K-16b. (Continued)

Summary of the Nonradiological Analytical Results
for the Mixed Waste Landfill
Sandia National Laboratories/New Mexico
April 1993

				Environmental Samples					
			Sample No. SNLA0-	12173	12174	02175	12176	12177	12178
			Well I.D.:	MWL-MW1	MWL-MW2	MWL-MW3	MWL-BW1	MWL-BW1 Dup.	MWL-MW4
			Sampling Date:	04/27/93	04/26/93	04/27/93	04/28/93	04/28/93	04/30/93
Total TAL Metals									
Parameter	Analytical Method	Reporting Limit, mg/L	MCL[a], mgL	All results in mg/L					
Magnesium	6010	0.20	NL	17.4	17.1	14.6	17.9	18.3	19.5
Manganese	6010	0.010	NL	0.0095[b]	ND	0.056	0.0098[b]	0.022	0.16
Mercury	7470	0.00020	0.002	ND	ND	ND	ND	ND	ND
Nickel	6010	0.040	NL	0.097[b]	0.014[b]	0.037[b]	0.011[b]	0.016[b]	ND
Potassium	6010	5.0	NL	2.5[b]	3.6[b]	3.1[b]	2.7[b]	2.9[b]	4.3[b]
Selenium	7740	2.5-5.0	0.01	ND	ND	ND	ND	ND	ND
Silver	6010	0.010	0.05	ND	ND	ND	ND	ND	ND
Sodium	6010	5.0	NL	45.7	45.7	45.7	46.9	47.4	46.9
Thallium	7841	0.010	NL	ND	ND	ND	ND	ND	ND
Vanadium	6010	0.010	NL	ND	ND	0.0060[b]	0.0062[b]	0.0047[b]	0.0062[b]
Zinc	6010	0.020	NL	0.011[b]	0.069	0.030	0.033	0.086	0.012[b]

[a]MCL = maximum contaminant level, U.S. EPA Primary Drinking Water Standards.
[b]Detected below reporting limit.
ND = Not detected at reporting limit indicated.
NL = Not listed.

Table K-16b. (Continued)

Summary of the Nonradiological Analytical Results
for the Mixed Waste Landfill
Sandia National Laboratories/New Mexico
April 1993

				Environmental Samples					
			Sample No. SNLAO-	12173	12174	12175	12176	12177	12178
			Well I.D.:	MWL-MW1	MWL-MW2	MWL-MW3	MWL-BW1	MWL-BW1 Dup.	MWL-MW4
			Sampling Date:	04/27/93	04/26/93	04/27/93	04/28/93	04/28/93	04/30/93
Dissolved TAL Metals									
Parameter	Analytical Method	Reporting Limit, mg/L	MCL[a], mg/L	All results in mg/L					
Aluminum	6010	0.10	NL	0.060[b]	0.032[b]	0.051[b]	0.13	0.087[b]	0.041[b]
Antimony	6010	0.060	NL	ND	ND	ND	ND	ND	ND
Arsenic	7060	0.0050	NL	0.0016[b]	0.0012[b]	0.0019[b]	0.0013[b]	0.0010[b]	0.0045[b]
Barium	6010	0.010	NL	0.056	0.078	0.070	0.077	0.075	0.081
Beryllium	6010	0.0020	NL	ND	ND	0.0024	ND	ND	ND
Cadmium	6010	0.0050	NL	ND	ND	ND	ND	ND	ND
Calcium	6010	0.20	NL	50.7	47.0	40.5	48.0	48.5	54.4
Chromium	6010	0.010	NL	ND	0.0077[b]	0.011	ND	ND	ND
Cobalt	6010	0.010	NL	ND	ND	ND	ND	ND	ND
Copper	6010	0.020	NL	0.004[b]	0.0036[b]	0.015[b]	0.0045[b]	ND	ND
Iron	6010	0.10	NL	ND	ND	0.033[b]	0.15	0.12	ND
Lead	7421	0.010-0.050	NL	ND	ND	ND	ND	ND	ND

[a]MCL = *Maximum contaminant* level, U.S. EPA Primary Drinking Water Standards.
[b]Detected below reporting limit.
ND = Not detected at reporting limit indicated.
NL = Not listed.

Table K-16b. (Concluded)

Summary of the Nonradiological Analytical Results
for the Mixed Waste Landfill
Sandia National Laboratories/New Mexico
April 1993

			Sample No. SNLA0- / Well I.D.: / Sampling Date:	Environmental Samples					
				12173 MWL-MW1 04/27/93	12174 MWL-MW2 04/26/93	02175 MWL-MW3 04/27/93	12176 MWL-BW1 04/28/93	12177 MWL-BW1 Dup. 04/28/93	12178 MWL-MW4 04/30/93
Dissolved TAL Metals									
Parameter	Analytical Method	Reporting Limit, mg/L	MCL[a], mgL	All results in mg/L					
Magnesium	6010	0.20	NL	17.3	17.0	14.1	18.8	18.8	20.1
Manganese	6010	0.010	NL	0.012	0.0082[b]	0.050	0.016	0.0097[b]	0.17
Mercury	7470	0.00020	NL	ND	ND	ND	ND	ND	ND
Nickel	6010	0.040	NL	0.094	0.013[b]	0.033[b]	0.012[b]	0.0075[b]	0.0082[b]
Potassium	6010	5.0	NL	2.7[b]	3.6[b]	3.0[b]	2.9[b]	2.8[b]	4.4[b]
Selenium	7740	5.0	NL	ND	ND	ND	ND	ND	ND
Silver	6010	0.010	NL	ND	ND	ND	ND	ND	ND
Sodium	6010	5.0	NL	44.3	45.5	46.0	48.6	48.7	49.0
Thallium	7841	0.010	NL	ND	ND	ND	ND	ND	ND
Vanadium	6010	0.010	NL	ND	0.0059[b]	0.011	0.0044[b]	ND	0.0072[b]
Zinc	6010	0.020	NL	0.0089[b]	ND	0.014	0.045	0.031	ND

[a]MCL = maximum contaminant level, U.S. EPA Primary Drinking Water Standards.
[b]Detected below reporting limit.
ND = Not detected at reporting limit indicated.
NL = Not listed.

Table 16c.

Summary of the Nonradiological Analytical Results
for the Mixed Waste Landfill
Sandia National Laboratories/New Mexico
November 1993

			Sample No. SNLA0- / Well I.D.: / Sampling Date:	14006 / MWL-MW1 / 11/09/93	14007 / MWL-MW2 / 11/08/93	14008 / MWL-MW3 / 11/09/93	14009 / MWL-MW4 / 11/11/93	14010 / MWL-BW1 / 11/10/93	14011 / MWL-BW1 Dup. / 11/10/93
Parameter	Analytical Method	Reporting Limit	MCL[a] mg/L	All results in mg/L, except as noted					
Chloride	300.0[a]	3.0 mg/L	NE	29.1	30.2	32.2	59.1	26.4	26.4
Fluoride	340.2[a]	0.10 mg/L	NE	0.72	1.0	0.83	1.0	0.58	0.64
Phenolics	9065[b]	0.010 mg/L	NE	ND	ND	ND	ND	ND	ND
Sulfate	300.0[a]	5.0 mg/L	NE	41.9	40.5	38.3	34.8	43.5	43.6
Ammonium (as N)	350.1[a]	0.10 mg/L	NE	ND	ND	ND	ND	ND	ND
Nitrate plus nitrite	353.2[a]	1.0 mg/L	NE	5.4	4.9	4.2	1.9	5.9	5.8
Alkalinity (total as $CaCO_3$, pH 4.5)	310.1[a]	5.0 mg/L	NE	211	208	193	218	229	229
Alkalinity (bicarb. as $CaCO_3$, pH 4.5)	310.1[a]	5.0 mg/L	NE	211	208	193	218	229	229
Alkalinity (carb. as $CaCO_3$, pH 8.3)	310.1[a]	5.0 mg/L	NE	ND	ND	ND	ND	ND	ND
Alkalinity (hydrox. as $CaCO_3$)	310.1[a]	5.0 mg/L	NE	ND	ND	ND	ND	ND	ND
Total Organic Carbon (TOC)	9060[b]	1.0 mg/L	NE	ND	ND	ND	ND	ND	ND
Total Organic Halogen (TOX), results in µg/L	9020[b]	30.0 µg/L	NE	7.4[c]	ND	ND	ND	ND	ND

Refer to footnotes at end of table.

Table 16c. (Continued)

Summary of the Nonradiological Analytical Results
for the Mixed Waste Landfill
Sandia National Laboratories/New Mexico
November 1993

			Sample No. SNLA0- / Well I.D.: / Sampling Date:	14006 MWL-MW1 11/09/93	14007 MWL-MW2 11/08/93	14008 MWL-MW3 11/09/93	14009 MWL-MW4 11/11/93	14010 MWL-BW1 11/10/93	14011 MWL-BW1 Dup. 11/10/93
Parameter	Analytical Method	Reporting Limit	MCL[a] mg/L	All results in mg/L, except as noted					
Ion Balance Difference in %	104C[d]	0.1 %	NE	2.44	3.20	-0.15	-2.74	1.11	1.55
Total Anions, results in milliequivalents/L	NA	0.30 meq/L	NE	6.3	6.2	5.9	6.9	6.6	6.6
Total Cations, results in milliequivalents/L	NA	0.10 meq/L	NE	6.6	6.6	5.8	6.5	6.8	6.8
pH	9040[b]	NA	NE	7.8	7.8	8.1	7.6	7.9	7.8
Specific Conductance at 25°C, results in μmhos/cm	120.1[a]	1.0 μmhos/cm	NE	628	575	573	688	639	636
Total Dissolved Solids	160.1[a]	10.0 mg/L	NE	382	372	333	401	388	388
Aluminum	6010	0.10	NE	ND	0.078[b]	ND	ND	ND	ND
Antimony	6010	0.060	NE	ND	ND	ND	ND	ND	ND
Arsenic	7060	0.0050	0.05	ND	ND	0.0015[b]	0.0047[b]	ND	0.0015[b]
Barium	6010	0.010	1.0	0.061	0.11	0.085	0.085	0.081	0.078
Beryllium	6010	0.0020	NE	ND	ND	ND	ND	ND	ND
Cadmium	6010	0.0050	0.01	ND	ND	ND	ND	ND	ND
Calcium	6010	0.20	NE	57.1	51.3	44.2	55.4	54.1	54.7
Chromium	6010	0.010	0.05	0.010	ND	0.010	0.0030[b]	0.011	0.0092[b]

Refer to footnotes at end of table.

Table 16c. (Concluded)

Summary of the Nonradiological Analytical Results
for the Mixed Waste Landfill
Sandia National Laboratories/New Mexico
November 1993

			Sample No. SNLA0- Well I.D.: Sampling Date:	14006 MWL-MW1 11/09/93	14007 MWL-MW2 11/08/93	14008 MWL-MW3 11/09/93	14009 MWL-MW4 11/11/93	14010 MWL-BW1 11/10/93	14011 MWL-BW1 Dup. 11/10/93
Parameter	Analytical Method	Reporting Limit	MCL[a] mg/L	All results in mg/L, except as noted					
Cobalt	6010	0.010	NE	ND	ND	ND	ND	ND	ND
Copper	6010	0.020	NE	0.0053[b]	ND	0.0092[b]	ND	0.0079[b]	0.0036[b]
Iron	6010	0.10	NE	0.22	ND	0.12	0.10	0.054[b]	0.041[b]
Lead	7421	0.010-0.05	0.05	0.018	ND	ND	0.0036[b]	ND	ND
Magnesium	6010	0.20	NE	17.8	18.5	15.9	19.7	19.1	19.3
Manganese	6010	0.010	NE	ND	ND	0.0043[b]	0.040	ND	ND
Mercury	7470	0.00020	0.002	ND	ND	ND	ND	ND	ND
Nickel	6010	0.040	NE	0.095	ND	0.014[b]	ND	ND	ND
Potassium	6010	5.0	NE	3.3[b]	4.8[b]	3.6[b]	4.8[b]	3.6[b]	3.6[b]
Selenium	7740	2.5-5.0	0.01	0.0023[b]	0.0040[b]	0.0023[b]	0.0020[b]	0.0017[b]	0.0017[b]
Silver	6010	0.010	0.05	ND	ND	ND	ND	ND	ND
Sodium	6010	5.0	NE	50.9	55.4	51.5	46.2	56.0	56.2
Thallium	7841	0.010	NE	ND	ND	ND	ND	ND	ND
Vanadium	6010	0.010	NE	0.0063[b]	ND	0.0074[b]	0.0069[b]	0.0071[b]	0.0071[b]
Zinc	6010	0.020	NE	0.016[b]	0.054	0.030	0.0057[b]	0.048	0.040

[a]"Methods for Chemical Analysis of Water and Wastes," U.S. Environmental Protection Agency, EPA-600/4-79-020, 1983.
[b]"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," U.S. Environmental Protection Agency, SW-846, 1986.
[c]Detected below reporting limit.
[d]"Standard Methods for the Examination of Water and Wastewater," 15th ed., American Public Health Association, 1980.
ND = Not detected at reporting limit indicated.
NA = Not applicable
NE = Not established.

Table K-17a.

Summary of the Radiological Analytical Results
for the Mixed Waste Landfill
Sandia National Laboratories/New Mexico
January 1993

Sample No.: Well ID: Sampling Date:	SNLA011635 MWL-MW1 1/19/93					
All results in pCi/L						
Parameter[a]	DCG[b] (pCi/L)	Results (pCi/L)[c]	2 Sigma	Critical Level, Lc	Detection Limit, Ld	Determination Limit, Lq
Gross Alpha	15	10.7	3.8	1.2	3.2	29
Gross Alpha	15	13.9	4.2	0.7	2	26
Gross Alpha	15	10.9	3.8	1.3	3.3	28
Gross Alpha	15	11.7	4	1.4	3.5	30
Average Gross Alpha		11.80	3.95	1.15	3.00	28.25
Gross Beta	30	5.53	2.7	1.9	4	16
Gross Beta	30	6.46	2.98	2.1	4.4	17
Gross Beta	30	5.8	2.63	1.8	3.9	15
Gross Beta	30	4.24	2.67	2	4.2	16
Average Gross Beta		5.51	2.75	1.95	4.13	16.00
Tritium	80000	1	113	93	210	790
Tritium	80000	-74	107	91	190	770
Tritium	80000	-45	109	91	190	780
Tritium	80000	42	111	91	190	770
Average Tritium		-19.00	110.00	91.50	195.00	777.50
Radium-226	4	0.113	0.107	0.046	0.14	2
Radium-228	4	2.13	1.64	1.3	2.6	9.7
Americium-241	1.2	-0.0196	0.0393	0.047	0.15	2.1
Cesium-137	120	17.619	NA	7.6	17.619	107.6
Iodine-129	20	0.33	3.28	2.7	5.7	22
Iron-55	8000	0.072	0.047	37	76	270
Polonium-210	3.2	0	0.557	0.5	1.3	15
Strontium-90	40	-0.2	1	0.8	1.8	7.2
Thorium-228[d]	16	385	364	NG	NG	NG

Refer to footnotes at end of table.

Table K-17a. (Continued)

Summary of the Radiological Analytical Results
for the Mixed Waste Landfill
Sandia National Laboratories/New Mexico
January 1993

Sample No.: Well ID: Sampling Date:	SNLA011631 MWL-MW2 1/18/93					
All results in pCi/L						
Parameter[a]	DCG[b] (pCi/L)	Results[c] (pCi/L)	2 Sigma	Critical Level, Lc	Detection Limit, Ld	Determination Limit, Lq
Gross Alpha	15	11.6	2.5	0.5	1.2	10
Gross Alpha	15	13.4	2.8	0.6	1.5	12
Gross Alpha	15	8.34	2.09	0.6	1.5	11
Gross Alpha	15	7.34	1.98	0.6	1.5	11
Average Gross Alpha		10.17	2.3425	0.575	1.425	11
Gross Beta	30	4.77	2.53	1.8	3.8	15
Gross Beta	30	6.14	2.71	1.9	4	16
Gross Beta	30	6.46	2.76	1.9	4	16
Gross Beta	30	6.16	2.63	1.8	3.8	15
Average Gross Beta		5.8825	2.6575	1.85	3.9	15.5
Tritium	80000	-89	177	150	310	1100
Tritium	80000	-130	175	150	300	1100
Tritium	80000	-159	172	150	300	1100
Tritium	80000	-183	176	150	310	1100
Average Tritium		-140.25	175	150	305	1100
Radium-226	4	0.0919	0.0976	0.045	0.1	2
Radium-228	4	0.07	1.39	1.2	2.4	8.8
Americium-241	1.2	0.02	0.0283	0	0.03	1.1
Cesium-137	120	19.524	NA	8.5	19.5	117
Iodine-129	20	-0.33	3.26	2.7	5.7	22
Iron-55	8000	222	51	29	60	220
Polonium-210	3.2	0.2	1.03	0.8	2.2	21
Strontium-90	40	0.45	1.08	0.87	1.8	7.4
Lead-212[d]	1.2	20.4	18.6	NG	NG	NG
Thorium-234[d]	400	119	165	NG	NG	NG
Uranium-238[d]	24	119	165	NG	NG	NG

Refer to footnotes at end of table.

Table K-17a. (Continued)

Summary of the Radiological Analytical Results
for the Mixed Waste Landfill
Sandia National Laboratories/New Mexico
January 1993

Sample No.:	SNLA011633					
Well ID:	MWL-MW3					
Sampling Date:	1/19/93					
All results in pCi/L						
Parameter[a]	DCG[b] (pCi/L)	Results[c] (pCi/L)	2 Sigma	Critical Level, Lc	Detection Limit, Ld	Determination Limit, Lq
Gross Alpha	15	9.85	2.24	0.6	1.4	11
Gross Alpha	15	8.82	2.09	0.4	1.2	11
Gross Alpha	15	10.3	2.3	0.5	1.3	11
Gross Alpha	15	9.92	2.27	0.6	1.5	11
Average Gross Alpha		9.72	2.23	0.53	1.35	11.00
Gross Beta	30	4.54	2.27	1.6	3.4	13
Gross Beta	30	7.01	2.6	1.7	3.7	14
Gross Beta	30	5.49	2.45	1.7	3.6	14
Gross Beta	30	7.35	2.6	1.7	3.6	14
Average Gross Beta		6.10	2.48	1.68	3.58	13.75
Tritium	80000	-380	183	160	320	1200
Tritium	80000	-354	184	160	320	1200
Tritium	80000	-216	188	160	330	1200
Tritium	80000	-268	187	160	330	1200
Average Tritium		-304.50	185.50	160.00	325.00	1200.00
Radium-226	4	0.178	0.132	0.048	0.151	2.1
Radium-228	4	1.4	2.32	1.9	3.9	14
Americium-241	1.2	0.0316	0.0634	0.038	0.121	1.7
Cesium-137	120	13.889	NA	5.8	13.889	99.8
Iodine-129	20	0.38	3.29	2.7	5.7	22
Iron-55	8000	632	12	53	110	390
Polonium-210	3.2	0.000252	0.000507	0.00031	0.00096	0.013
Strontium-90	40	0.338	0.992	0.8	1.7	6.9
Thorium-234[d]	400	38	166	NG	NG	NG
Uranium-238[d]	24	38	166	NG	NG	NG

Refer to footnotes at end of table.

Table K-17a. (Continued)

Summary of the Radiological Analytical Results
for the Mixed Waste Landfill
Sandia National Laboratories/New Mexico
January 1993

Sample No.: Well ID: Sampling Date:	SNLA011637 MWL-BW1 1/20/93					
	All results in pCi/L					
Parameter[a]	DCG[b] (pCi/L)	Results[c] (pCi/L)	2 Sigma	Critical Level, Lc	Detection Limit, Ld	Determination Limit, Lq
Gross Alpha	15	13	4.1	1.3	3.3	27
Gross Alpha	15	10.4	3.6	1	2.8	28
Gross Alpha	15	10.6	3.5	0.6	1.9	23
Gross Alpha	15	28.1	6.1	0.8	2.4	28
Average Gross Alpha		15.53	4.33	0.93	2.60	26.50
Gross Beta	30	7.45	2.55	1.7	3.5	14
Gross Beta	30	6.95	2.53	1.7	3.5	14
Gross Beta	30	4.56	2.25	1.6	3.3	13
Gross Beta	30	7.03	2.59	1.7	3.6	14
Average Gross Beta		6.50	2.48	1.68	3.48	13.75
Tritium	80000	-80	112	95	200	790
Tritium	80000	-126	111	96	200	810
Tritium	80000	-125	112	96	200	810
Tritium	80000	-180	108	94	200	790
Average Tritium		-127.75	110.75	95.25	200.00	800.00
Radium-226	4	0.133	0.141	0.075	0.21	2.4
Radium-228	4	1.5	2.42	1.9	4	15
Americium-241	1.2	0.0341	0.0209	0	0.0093	0.3
Cesium-137	120	13.446	NA	5.5	13.446	100.7
Iodine-129	20	-1.5	3.22	2.7	5.7	22
Iron-55	8000	69	43	33	69	250
Polonium-210	3.2	0.29	1.02	0.7	2.2	31
Strontium-90	40	0.446	0.95	0.8	1.69	6.6
Potassium-40[d]	280	80.9	157	NG	NG	NG
Thorium-234[d]	400	120	208	NG	NG	NG
Uranium-238[d]	24	120	208	NG	NG	NG

Refer to footnotes at end of table.

Table K-17a. (Concluded)

Summary of the Radiological Analytical Results
for the Mixed Waste Landfill
Sandia National Laboratories/New Mexico
January 1993

Sample No.: Well ID: Sampling Date:	SNLA011639 MWL-BW1 Dup 1/20/93					
	All results in pCi/L					
Parameter[a]	DCG[b] (pCi/L)	Results[c] (pCi/L)	2 Sigma	Critical Level, Lc	Detection Limit, Ld	Determination Limit, Lq
Gross Alpha	15	37.2	5.4	0.5	1.3	11
Gross Alpha	15	6.2	1.82	0.6	1.5	11
Gross Alpha	15	7.57	2.05	0.6	1.5	11
Gross Alpha	15	6.84	1.95	0.7	1.6	11
Average Gross Alpha		14.45	2.81	0.60	1.48	11.00
Gross Beta	30	72.8	8.9	1.9	4	16
Gross Beta	30	5	2.4	1.7	3.5	14
Gross Beta	30	6.06	2.68	1.9	3.9	16
Gross Beta	30	5.25	2.53	1.8	3.8	15
Average Gross Beta		22.28	4.13	1.83	3.80	15.25
Tritium	80000	-33	183	150	310	1100
Tritium	80000	-378	177	150	310	1100
Tritium	80000	-268	176	150	310	1100
Tritium	80000	-370	178	150	310	1100
Average Tritium		-262.25	178.50	150.00	310.00	1100.00
Radium-226	4	0.142	0.078	0.028	0.081	0.9
Radium-228	4	0.09	1.01	0.8	1.7	6
Americium-241	1.2	0.0314	0.016	0	0.0059	0.2
Cesium-137	120	13.317	NA	5.3	13.317	110.9
Iodine-129	20	-1.27	3.23	2.7	5.7	22
Iron-55	8000	0.001	0.047	39	80	290
Polonium-210	3.2	-0.41	1.02	1.11	2.54	14.8
Strontium-90	40	0.01	0.457	0.4	0.78	2.7

[a]Analyses performed by IT Analytical Services, Oak Ridge, Tennessee.
[b]DCG = Derived Concentration Guides, DOE Order 5400.5.
[c]Laboratory results have an uncertainty of ±2 sigma; if the error value exceeds the count value, the result is considered a nondetect and is indicated by a minus sign.
[d]Detected by gamma spectroscopy.
Lc = Critical level = net count rate which must be exceeded before the sample is said to contain any measureable radioactive material.
Ld = Detection limit = the smallest quantity of radioactive material which can be detected with some specified degree of confidence.
Lq = Determination limit = the lowest net count rate which can be detected with a specified relative standard deviation.

Table K-17b.

Summary of the Radiological Analytical Results
for the Mixed Waste Landfill
Sandia National Laboratories/New Mexico
April 1993

	Sample No.:	SNLA012180			
	Well ID:	MWL-MW1			
	Sampling Date:	04/27/93			
		All results in pCi/L			
Parameter[a]	DCG[b] (pCi/L)	Results (pCi/L)[c]	2 Sigma	MDA[d]	Decision Amount, DA[e]
Gross Alpha	15	11	4.4	1.9	1.20
Gross Alpha	15	8.6	3.8	2.5	1.20
Gross Alpha	15	7.8	3.5	2.6	1.05
Gross Alpha	15	9.6	4.1	2.7	1.20
Gross Beta	30	4.5	1.8	2.4	1.21
Gross Beta	30	5.2	1.7	2.0	1.21
Gross Beta	30	5.3	1.7	2.0	1.18
Gross Beta	30	4.8	1.8	2.1	1.21
Tritium	80000	160	230	370	191.62
Tritium	80000	270	240	370	183.29
Tritium	80000	35	220	370	183.29
Tritium	80000	370	240	370	191.62
Radium-226	4	0.40	0.11	0.10	0.05
Radium-228	4	0.71	0.48	0.63	0.28
Americium-241	1.2	0.001	0.016	0.032	0.03
Cesium-137	120	ND	NL	29	18.52
Iodine-129	20	6.3	5.2	8.3	4.80
Iron-55	8000	−5.0	24	37	20.00
Polonium-210	3.2	0.062	0.070	0.062	0.03
Strontium-90	40	5.7	2.7	3.2	1.62

Refer to footnotes at end of table.

Table K-17b. (Continued)

Summary of the Radiological Analytical Results
for the Mixed Waste Landfill
Sandia National Laboratories/New Mexico
April 1993

	Sample No.:	SNLA012181			
	Well ID:	MWL-MW2			
	Sampling Date:	04/26/93			
All results in pCi/L					
Parameter[a]	DCG[b] (pCi/L)	Results[c] (pCi/L)	2 Sigma	MDA[d]	Decision Amount, DA[e]
Gross Alpha	15	12	4.7	2.5	1.20
Gross Alpha	15	13	5.3	4.3	1.05
Gross Alpha	15	19	6.8	3.5	1.40
Gross Alpha	15	10	4.3	3.1	1.20
Gross Beta	30	6.8	2.0	2.1	1.21
Gross Beta	30	7.6	2.0	2.1	1.21
Gross Beta	30	9.9	2.3	2.1	1.21
Gross Beta	30	7.6	2.1	2.3	1.21
Tritium	80000	270	240	370	183.29
Tritium	80000	240	230	370	183.29
Tritium	80000	98	220	370	183.29
Tritium	80000	130	230	370	183.29
Radium-226	4	0.35	0.11	0.12	0.05
Radium-228	4	0.67	0.54	0.76	0.29
Americium-241	1.2	−0.003	0.001	0.022	0.02
Cesium-137	120	ND	NL	27	18.52
Iodine-129	20	7.9	5.6	9.2	5.30
Iron-55	8000	19	28	37	22.38
Polonium-210	3.2	0.029	0.054	0.078	0.02
Strontium-90	40	2.2	1.2	1.6	0.74
Lead-212[f]	120	36	64	100	30.13

Refer to footnotes at end of table.

Table K-17b. (Continued)

Summary of the Radiological Analytical Results
for the Mixed Waste Landfill
Sandia National Laboratories/New Mexico
April 1993

Sample No.:	SNLA012182
Well ID:	MWL-MW3
Sampling Date:	04/27/93

All results in pCi/L

Parameter[a]	DCG[b] (pCi/L)	Results[c] (pCi/L)	2 Sigma	MDA[d]	Decision Amount, DA[e]
Gross Alpha	15	11	4.2	1.6	1.05
Gross Alpha	15	7.1	3.3	2.3	1.05
Gross Alpha	15	6.3	3.2	2.7	1.05
Gross Alpha	15	8.8	3.7	2.3	1.05
Gross Beta	30	4.5	1.8	2.4	1.18
Gross Beta	30	7.4	2.0	2.0	1.18
Gross Beta	30	7.3	2.0	2.0	1.18
Gross Beta	30	7.6	2.0	2.1	1.18
Tritium	80000	280	240	370	191.62
Tritium	80000	−14	220	370	183.29
Tritium	80000	77	220	370	183.29
Tritium	80000	58	220	370	183.29
Radium-226	4	0.34	0.093	0.060	0.04
Radium-228	4	0.55	0.52	0.74	0.28
Americium-241	1.2	0.008	0.016	0.010	0.03
Cesium-137	120	ND	NL	29	18.52
Iodine-129	20	16	6.0	9.1	5.22
Iron-55	8000	5.9	29	37	23.79
Polonium-210	3.2	0.081	0.068	0.016	0.02
Strontium-90	40	2.5	1.2	1.5	0.72
Potassium-40[f]	280	270	510	640	441.05

Refer to footnotes at end of table.

Table K-17b. (Continued)

Summary of the Radiological Analytical Results
for the Mixed Waste Landfill
Sandia National Laboratories/New Mexico
April 1993

Sample No.:	SNLA012183
Well ID:	MWL-BW1
Sampling Date:	04/28/93

All results in pCi/L

Parameter[a]	DCG[b] (pCi/L)	Results[c] (pCi/L)	2 Sigma	MDA[d]	Decision Amount, DA[e]
Gross Alpha	15	5.8	3.4	3.1	1.40
Gross Alpha	15	10	4.5	2.7	1.40
Gross Alpha	15	13	5.4	3.1	1.40
Gross Alpha	15	13	6.1	5.7	1.40
Gross Beta	30	6.3	1.9	2.3	1.21
Gross Beta	30	5.3	1.9	2.3	1.21
Gross Beta	30	6.5	2.0	2.1	1.21
Gross Beta	30	5.9	1.8	2.1	1.21
Tritium	80000	58	220	370	191.62
Tritium	80000	−150	210	370	186.53
Tritium	80000	150	230	370	183.29
Tritium	80000	−20	220	370	191.62
Radium-226	4	0.41	0.12	0.10	0.04
Radium-228	4	0.76	0.58	0.81	0.29
Americium-241	1.2	−0.005	0.001	0.030	0.01
Cesium-137	120	ND	NL	31	18.52
Iodine-129	20	35	8.0	12	6.83
Iron-55	8000	−4.0	38	37	31.86
Polonium-210	3.2	0.026	0.056	0.081	0.03
Strontium-90	40	4.0	1.6	1.8	0.69
Lead-212[f]	120	40	62	98	30.13

Refer to footnotes at end of table.

Table K-17b. (Continued)

Summary of the Radiological Analytical Results
for the Mixed Waste Landfill
Sandia National Laboratories/New Mexico
April 1993

Sample No.:	SNLA012184				
Well ID:	MWL-BW1 Dup				
Sampling Date:	04/28/93				
All results in pCi/L					
Parameter[a]	DCG[b] (pCi/L)	Results[c] (pCi/L)	2 Sigma	MDA[d]	Decision Amount, DA[e]
Gross Alpha	15	12	5.2	3.4	1.40
Gross Alpha	15	12	5.3	4.1	1.40
Gross Alpha	15	9.8	4.4	2.3	1.40
Gross Alpha	15	16	6.1	3.3	1.40
Gross Beta	30	7.9	2.1	2.1	1.21
Gross Beta	30	6.7	2.1	2.3	1.21
Gross Beta	30	6.0	2.0	2.4	1.21
Gross Beta	30	6.8	2.0	2.1	1.21
Tritium	80000	160	230	370	183.29
Tritium	80000	300	240	370	183.29
Tritium	80000	290	220	330	183.29
Tritium	80000	140	210	330	183.29
Radium-226	4	0.37	0.11	0.13	0.04
Radium-228	4	1.0	0.58	0.75	0.29
Americium-241	1.2	0.006	0.012	0.008	0.02
Cesium-137	120	ND	NL	31	18.52
Iodine-129	20	29	7.3	11	6.34
Iron-55	8000	20	140	37	117.47
Polonium-210	3.2	0.073	0.072	0.058	0.02
Strontium-90	40	0.83	1.2	1.9	0.88

Refer to footnotes at end of table.

Table K-17b. (Concluded)

Summary of the Radiological Analytical Results
for the Mixed Waste Landfill
Sandia National Laboratories/New Mexico
April 1993

	Sample No.:	SNLA012185			
	Well ID:	MWL-MW4			
	Sampling Date:	04/30/93			
All results in pCi/L					
Parameter[a]	DCG[b] (pCi/L)	Results[c] (pCi/L)	2 Sigma	MDA[d]	Detection Amount, DA[e]
Gross Alpha	15	8.5	4.4	3.7	1.40
Gross Alpha	15	8.7	4.4	3.5	1.40
Gross Alpha	15	12	5.2	3.5	1.40
Gross Alpha	15	7.2	3.8	2.8	1.68
Gross Beta	30	8.5	2.1	2.0	1.21
Gross Beta	30	6.4	2.0	2.1	1.21
Gross Beta	30	8.9	2.3	2.3	1.21
Gross Beta	30	13	2.6	0.80	1.21
Tritium	80000	280	220	330	191.62
Tritium	80000	160	230	370	186.53
Tritium	80000	180	230	370	186.53
Tritium	80000	88	220	370	186.53
Radium-226	4	0.13	0.10	0.14	0.05
Radium-228	4	1.2	0.62	0.80	0.30
Americium-241	1.2	0.027	0.028	0.008	0.02
Cesium-137	120	ND	NL	28	18.52
Iodine-129	20	12	5.4	8.1	4.67
Iron-55	8000	13	21	37	17.24
Polonium-210	3.2	−0.005	0.042	0.093	0.02
Strontium-90	40	1.9	1.4	2.0	0.98
Potassium-40[f]	280	200	480	650	441.05
Lead-212[f]	120	58	80	130	30.13

[a]Analyses performed by TMA/Eberline, Albuquerque, New Mexico.
[b]DCG = Derived Concentration Guides, DOE Order 5400.5.
[c]Laboratory results have an uncertainty of ± 2 sigma; if the error value exceeds the count value, the result is considered a nondetect and is indicated by a minus sign.
[d]MDA = Minimum detectable activity.
[e]DA = Decision amount = activity that must be exceeded before the sample is said to contain any measurable radioactive material.
[f]Detected by gamma spectroscopy.
ND = Not detected.
NL = Not listed.

Table K-17c.

Summary of the Radiological Analytical Results
for the Mixed Waste Landfill
Sandia National Laboratories/New Mexico
November 1993

	Sample No.: Well ID: Sampling Date:	SNLA014013 MWL-MW1 11/09/93				
All results in pCi/L						
Parameter[a]	DCG[b] (pCi/L)	Results (pCi/L)[c]	2 Sigma	Lc[d]	MDA[e]	DA[f]
Gross Alpha	15	11	4.1	5	2.1	1
Gross Beta	30	5.9	1.8	31	2.2	1
Tritium	80000	-9.0	220	27	360	176
Uranium-233/234	200	6.1	0.82	16	0.085	0.22
Uranium-235	24	0.064	0.064	0	0.085	0.00
Uranium-238	24	3.0	0.49	15	0.085	0.21
Thorium-230	12	-0.008	0.016	0	0.083	0.00
Thorium-232	2	0.013	0.024	0	0.054	0.00
Plutonium-238	1.6	0.011	0.012	4	0.010	0.01
Plutonium-239/240	1.2	-0.007	0.010	3	0.033	0.01
Strontium-90	40	NA	NA	NA	NA	NA
	Sample No.: Well ID: Sampling Date:	SNLA014014 MWL-MW2 11/08/93				
All results in pCi/L						
Parameter[a]	DCG[b] (pCi/L)	Results (pCi/L)[c]	2 Sigma	Lc[d]	MDA[e]	DA[f]
Gross Alpha	15	9.7	3.8	5	2.5	1
Gross Beta	30	5.5	1.8	31	2.1	1
Tritium	80000	120	230	27	360	184
Uranium-233/234	200	5.5	0.74	16	0.080	0.21
Uranium-235	24	0.12	0.082	0	0.036	0.00
Uranium-238	24	2.6	0.44	15	0.095	0.20
Thorium-230	12	0.001	0.026	0	0.090	0.00
Thorium-232	2	0.001	0.026	0	0.090	0.00
Plutonium-238	1.6	-0.004	0.007	0	0.026	0.00
Plutonium-239/240	1.2	0.007	0.018	0	0.033	0.00
Strontium-90	40	NA	NA	NA	NA	NA

Refer to footnotes at end of table.

Table K-17c. (Continued)

Summary of the Radiological Analytical Results
for the Mixed Waste Landfill
Sandia National Laboratories/New Mexico
November 1993

Sample No.:	SNLA014015					
Well ID:	MWL-MW3					
Sampling Date:	11/09/93					
All results in pCi/L						
Parameter[a]	DCG[b] (pCi/L)	Results (pCi/L)[c]	2 Sigma	Lc[d]	MDA[e]	DA[f]
Gross Alpha	15	12	4.3	5	2.4	1
Gross Beta	30	4.3	1.7	31	2.2	1
Tritium	80000	4.9	220	27	360	184
Uranium-233/234	200	5.2	0.65	16	0.079	0.18
Uranium-235	24	0.099	0.066	0	0.030	0.00
Uranium-238	24	2.5	0.39	15	0.079	0.17
Thorium-230	12	0.016	0.022	0	0.036	0.00
Thorium-232	2	0.013	0.022	0	0.043	0.00
Plutonium-238	1.6	0.003	0.010	0	0.022	0.00
Plutonium-239/240	1.2	0.006	0.012	0	0.022	0.00
Strontium-90	40	NA	NA	NA	NA	NA

Sample No.:	SNLA014016					
Well ID:	MWL-MW4					
Sampling Date:	11/11/93					
All results in pCi/L						
Parameter[a]	DCG[b] (pCi/L)	Results (pCi/L)[c]	2 Sigma	Lc[d]	MDA[e]	DA[f]
Gross Alpha	15	9.3	3.9	6	2.4	1
Gross Beta	30	9.7	2.4	27	2.2	1
Tritium	80000	140	160	37	250	126
Uranium-233/234	200	5.4	0.39	21	0.021	0.06
Uranium-235	24	0.13	0.042	0	0.021	0.00
Uranium-238	24	2.4	0.21	20	0.008	0.06
Thorium-230	12	-0.003	0	15	0.032	0.08
Thorium-232	2	0.008	0.016	0	0.032	0.00
Plutonium-238	1.6	0.016	0.022	4	0.036	0.02
Plutonium-239/240	1.2	0.016	0.022	3	0.036	0.01
Strontium-90	40	-0.49	0.56	30	0.99	0.69

Refer to footnotes at end of table.

Table K-17c. (Concluded)

Summary of the Radiological Analytical Results
for the Mixed Waste Landfill
Sandia National Laboratories/New Mexico
November 1993

	Sample No.:	SNLA014017				
	Well ID:	MWL-BW1				
	Sampling Date:	11/10/93				
		All results in pCi/L				
Parameter[a]	DCG[b] (pCi/L)	Results (pCi/L)[c]	2 Sigma	Lc[d]	MDA[e]	DA[f]
Gross Alpha	15	9.7	3.8	5	2.2	1
Gross Beta	30	8.0	2.1	31	2.0	1
Tritium	80000	13	220	27	360	184
Uranium-233/234	200	6.8	0.90	16	0.10	0.22
Uranium-235	24	0.071	0.064	0	0.039	0.00
Uranium-238	24	3.0	0.50	15	0.10	0.21
Thorium-230	12	0.013	0.022	0	0.043	0.00
Thorium-232	2	0.006	0.012	0	0.016	0.00
Plutonium-238	1.6	0.012	0.014	0	0.011	0.00
Plutonium-239/240	1.2	-0.008	0.011	0	0.036	0.00
Strontium-90	40	NA	NA	NA	NA	NA
	Sample No.:	SNLA014018				
	Well ID:	MWL-BW1 Duplicate				
	Sampling Date:	11/10/93				
		All results in pCi/L				
Parameter[a]	DCG[b] (pCi/L)	Results (pCi/L)[c]	2 Sigma	Lc[d]	MDA[e]	DA[f]
Gross Alpha	15	8.7	3.7	5	2.5	1
Gross Beta	30	4.5	1.8	31	2.5	1
Tritium	80000	78	220	27	360	176
Uranium-233/234	200	6.3	0.70	16	0.056	0.15
Uranium-235	24	0.11	0.066	0	0.025	0.00
Uranium-238	24	3.0	0.41	15	0.025	0.14
Thorium-230	12	0.003	0.012	0	0.036	0.00
Thorium-232	2	0	0.001	0	0.016	0.00
Plutonium-238	1.6	0	0.001	0	0.026	0.00
Plutonium-239/240	1.2	0	0.001	0	0.010	0.00
Strontium-90	40	NA	NA	NA	NA	NA

[a]Analyses performed by TMA/Eberline, Albuquerque, New Mexico.
[b]DCG = Derived Concentration Guides, DOE Order 5400.5.
[c]Laboratory results have an uncertainty of ±2 sigma; if the error value exceeds the count value, the result is considered a nondetect and is indicated by a minus sign.
[d]Lc = Critical level = net count rate which must be exceeded before the sample is said to contain any measureable radioactive material.
[e]MDA = Minimum detectable activity.
[f]DA = Decision amount = activity that must be exceeded before the sample is said to contain any measureable radioactive material.
ND = Not detected.
NA = Not analyzed.

Table K-18.

Summary of Analytical Results for Detected Organic Compounds
Sandia National Laboratories/New Mexico
TA-2 Groundwater Monitoring, 1993

Analyte			Volatile Organic Compounds				
			Acetone	2-Butanone	Methylene Chloride	Semivolatile Organic Compounds	Phenolics
		MDL[a]	10 μg/L	10 μg/L	5 μg/L	Varies with compound	0.01 mg/L
Sample Location	Sample Date	Sample #	All results in μg/L				Results in mg/L
TA-2/W-001	11/22/92	ER92003616	14	ND[b]	ND	NA	NA
TA-2/W-002	3/26/93	ER92004632	4.8 B1[c]	ND	1	ND	ND

[a]MDL = Minimum method detection limit obtained for nondetected parameters.
[b]ND = not detected.
[c]B1 = Method blank contained 3.5 mg/L acetone.

Table K-19.

Summary of Analytical Results for Inorganic Compounds
Sandia National Laboratories/New Mexico
TA-2 Groundwater Monitoring, 1993

Analyte			Alkalinity	Chloride	Fluoride	Nitrate Plus Nitrite	Ammonia	Sulfate	Total Phosphorus	pH	Specific Conductance
MDL[a], units			10	2.0	0.1	0.05	0.1	20	0.05		1.0
Sample Location	Sample Date	Sample #	All results in mg/L							Standard pH units, no MDL	µmhos/cm
TA-2/W-001	11/22/92	ER92003616	NA[b]	NA	NA	9.4	NA	NA	0.14	NA	NA
TA-2/W-002	3/26/93	ER92004632	95.7	98.9	0.35	4.1	ND[c]	111	NA	7.8	740
TA-2/W-003	6/11/93	ER92004934	158	14.8	0.42	1.3 (Nitrate)	ND	77.4	NA	7.9	517
TA-2/W-003	6/13/93	ER92004940	153	15.1	0.47	4.6	ND	40.1	NA	7.9	473

[a]MDL = Minimum method detection limit obtained for nondetected parameters.
[b]NA = Not analyzed for.
[c]ND = Not detected at MDL indicated.

Table K-20.

Summary of Analytical Results for Total Metals
Sandia National Laboratories/New Mexico
TA-2 Groundwater Monitoring, 1993

Analyte			Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium
MDL[a]			0.1	0.06	0.01	0.01	0.002	0.01	0.2	0.01
Sampling Location	Sample Date	Sample #	All results in mg/L.							
TA-2/W-002	3/26/93	ER92004632	0.03	ND[c]	ND	0.15	ND	ND	94.0	ND
TA-2/W-003	6/11/93	ER92004934	NA[b]	NA	NA	NA	NA	NA	68.1	NA
TA-2/W-003	6/13/93	ER92004940	NA	NA	NA	NA	NA	NA	60.4	NA
TA-2/W-003	6/24/93	ER92004947	NA	NA	NA	NA	NA	NA	64.0	NA
Analyte			Cobalt	Copper	Iron	Lead	Mercury	Magnesium	Manganese	Nickel
MDL			0.01	0.02	0.1	0.01	0.0002	0.2	0.01	0.04
Sampling Location	Sample Date	Sample #	All results in mg/L.							
TA-2/W-002	3/26/93	ER92004632	ND	0.0033	0.07	ND	ND	13.5	0.17	ND
TA-2/W-003	6/11/93	ER92004934	NA	NA	0.21	NA	NA	11.9	NA	NA
TA-2/W-003	6/13/93	ER92004940	NA	NA	0.21	NA	NA	11.1	NA	NA
TA-2/W-003	6/24/93	ER92004947	NA	NA	0.47	NA	NA	11.8	NA	NA
Analyte			Potassium	Selenium	Silver	Sodium	Thallium	Vanadium	Zinc	
MDL			5	0.01	0.01	5	0.05	0.01	0.02	
Sampling Location	Sample Date	Sample #	All results in mg/L.							
TA-2/W-002	3/26/93	ER92004632	3.1	0.01	ND	22.0	ND	ND	NA	
TA-2/W-003	6/11/93	ER92004934	ND	NA	NA	29.3	NA	NA	NA	
TA-2/W-003	6/13/93	ER92004940	ND	NA	NA	24.2	NA	NA	NA	
TA-2/W-003	6/24/93	ER92004947	5.5	NA	NA	27.6	NA	NA	NA	

Table 21a.

Summary of Analytes Detected in Groundwater Samples
Liquid Waste Disposal Site Monitoring Well MW-2
Sandia National Laboratories/New Mexico
June 24, 1993

		SNLA013024			SNLA013025 (Duplicate)				
	Analyte	Result	Units	Flag	Result	Units	Flag	Detection Limit	
Metals	Barium	0.07	mg/L		0.07	mg/L		0.02	mg/L
	Calcium	47	mg/L		47	mg/L		0.20	mg/L
	Iron	0.24	mg/L		0.22	mg/L		0.02	mg/L
	Magnesium	13	mg/L		13	mg/L		0.20	mg/L
	Potassium	2.6	mg/L		2.6	mg/L		0.20	mg/L
	Selenium	0.002	mg/L		0.002	mg/L		0.002	mg/L
	Sodium	40	mg/L		41	mg/L		0.20	mg/L
General Inorganics	Alkalinity	170	mg/L		170	mg/L		10	mg/L
	Chloride	12	mg/L		12	mg/L		2.0	mg/L
	Nitrate plus nitrite	7.4	mg/L		7.7	mg/L		0.40	mg/L
	Total dissolved solids	160	mg/L		130	mg/L		10	mg/L
	Sulfate	38	mg/L		38	mg/L		5	mg/L
Volatile Organics	Acetone	0.004	mg/L	J[a]	0.003	mg/L	J	0.010	mg/L
	2-Butanone	0.002	mg/L	J	ND[b]	mg/L		0.010	mg/L
	Methylene chloride	0.004	mg/L	J,B[b]	ND	mg/L		0.005	mg/L
Semivolatile Organics	Bis(2-ethylhexyl) phthalate	0.007	mg/L	J	0.007	mg/L	J	0.010	mg/L
Radiologic	Gross alpha	3.8 ± 2.3	1.8[d]	pCi/L	4.6 ± 2.4	1.7[d]	pCi/L		
	Gross beta	3.1 ± 1.6	2.1[d]	pCi/L	2.9 ± 1.7	2.3[d]	pCi/L		

[a]J = Detected below quantitation limit; reported result is an estimated value.
[b]ND = not detected.
[c]B = analyte detected in method blank.
[d]MDA = Minimum detectable activity.

Table K-21b.

Summary of Analytes Detected in Groundwater Samples
Liquid Waste Disposal Site Monitoring Well MW-1
Sandia National Laboratories/New Mexico
November 2 and 3, 1993

		ER92002113			ER92002114 (Duplicate)				
	Analyte	Result	Units	Flag	Result	Units	Flag	Detection Limit	
Metals	Arsenic	0.006	mg/L		0.007	mg/L		0.002	mg/L
	Barium	0.09	mg/L		0.10	mg/L		0.02	mg/L
	Calcium	50	mg/L		51	mg/L		0.20	mg/L
	Chromium	ND[a]	mg/L		0.01	mg/L		0.01	mg/L
	Iron	0.14	mg/L		0.14	mg/L		0.02	mg/L
	Magnesium	15	mg/L		15	mg/L		0.20	mg/L
	Manganese	0.10	mg/L		0.098	mg/L		0.005	mg/L
	Potassium	3.9	mg/L		3.9	mg/L		0.20	mg/L
	Selenium	0.003	mg/L		0.004	mg/L		0.002	mg/L
	Sodium	120	mg/L		120	mg/L		0.20	mg/L
General Inorganics	Alkalinity	260	mg/L		270	mg/L		10	mg/L
	Chloride	72	mg/L		72	mg/L		2.0	mg/L
	Fluoride	1.1	mg/L		1.1	mg/L		0.1	mg/L
	Nitrate plus nitrite	7.3	mg/L		7.2	mg/L		0.05	mg/L
	Total organic carbon	0.94	mg/L		0.93	mg/L		0.5	mg/L
	Phosphorus	2.6	mg/L		3.3	mg/L		0.05	mg/L
	Total dissolved solids	480	mg/L		520	mg/L		10	mg/L
	Sulfate	78	mg/L		77	mg/L		5	mg/L
Volatile Organics	Benzene	ND	mg/L		0.006	mg/L		0.005	mg/L
	total-1,2-Dichloroethene	0.001	mg/L	J[b]	0.001	mg/L	J	0.005	mg/L
	Methylene chloride	0.004	mg/L	J,B[c]	0.004	mg/L	J,B	0.005	mg/L
	Toluene	0.002	mg/L	J	0.002	mg/L	J	0.005	mg/L
	Trichloroethene	0.006	mg/L		ND	mg/L		0.005	mg/L
Radiologic	Gross alpha	14±6.1	4.2	pCi/L	-0.21±0.50	0.93	pCi/L		
	Gross beta	18±3.9	3.0[d]	pCi/L	-1.3±1.2	2.1[d]	pCi/L		
	Total uranium	6.1±0.47	0.50[d]	μg/L	-0.006±0.001	0.50[d]	μg/L		

[a]ND = Not detected
[b]J = Detected below quantitation limit; reported results is an estimated value.
[c]B = Analyte detected in method blank.
[d]MDA = Minimum detectable activity.

Table K-22.

Summary of Analytical Results
Sitewide Hydrogeologic Characterization,
South Fence Wells SFR-1D and SFR-2S
Sandia National Laboratories/New Mexico
May 6, 1993

Parameter, Units	MCL[a]	Well SFR-1D Sample # SF10012138	Well SFR-2S Sample # SF20012137	Equipment Blank Sample # EB20012140
Acetone, mg/L	NE[b]	0.004 J[c]B[d]	0.009 J	ND[e]
Other VOC[f], mg/L	Varies	ND	ND	ND
TOC[g], mg/L		ND	ND	ND
TOX[h], µg/L	NE	ND	29	17
Pesticides, mg/L		ND	ND	ND
Herbicides, mg/L		ND	ND	ND
Total Phenolics, mg/L		ND	ND	ND
Total Coliform Bacteria	Present or absent	Present	Present	NS[i]
Fecal Coliform Bacteria	Present or absent	Absent	Absent	NS
Total Alkalinity, mg/L as $CaCO_3$	NE	420	330	ND
Chloride, mg/L	250 mg/L[j]	130	130	ND
Fluoride, mg/L	4.0 mg/L	1.7	1.8	ND
Nitrate + Nitrite, mg/L	11.0 mg/L	0.95	0.96	ND
pH, Standard Units	NE	6.9	7.0	8.0
Sulfate, mg/L	250 mg/L[j]	67	71	ND
Bromide, mg/L	NE	0.67	0.68	ND
Metals, mg/L:				
Barium	1.0	0.07	0.04	ND
Calcium	NE	148	125	ND
Iron	0.3[j]	0.78	0.13	ND
Magnesium	NE	35	34	ND
Manganese	0.05[j]	0.016	0.008	ND
Potassium	NE	7.2	7.3	0.34
Sodium	20[j]	78	77	ND
Other Metals	various	ND	ND	ND

[a]New Mexico Environment Department Primary Drinking Water Standards, listed where analytes were detected.
[b]NE = Not established.
[c]J = Estimated value below the reported minimum method detection limit.
[d]B = Analyte also detected in the method blank, indicating laboratory contamination.
[e]ND = Not detected above reported method detection limit.
[f]VOC = Volatile organic compounds.
[g]TOC = Total organic carbon.
[h]TOX = Total organic halogens.
[i]NS = Not sampled.
[j]New Mexico Environment Department Secondary Drinking Water Standards—all others listed are Primary Drinking Water Standards.

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