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1990 Environmental Monitoring Report Sandia National Laboratories, Albuquerque, New Mexico

S. Hwang, G. Yeager, T. Wolff, A. Parsons, M. Goodrich, D. Dionne,
C. Massey, B. Schwartz, J. Fish, D. Thompson

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1990 ENVIRONMENTAL MONITORING REPORT SANDIA NATIONAL LABORATORIES, ALBUQUERQUE, NEW MEXICO

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ABSTRACT

This 1990 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 (NEPA) documentation, environmental permits, environmental restoration, and various waste management programs for Sandia National Laboratories in Albuquerque (SNL, Albuquerque) are included. The maximum offsite dose impact was calculated to be 2.0×10^{-3} mrem. The total 50-mile population received a collective dose of 0.82 person-rem during 1990 from SNL, Albuquerque, operations. As in the previous year, the 1990 SNL operations had no adverse 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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This report was compiled by the staff of the Environment, Safety and Health Directorate (7700) of Sandia National Laboratories, Albuquerque. The Ecology and Environment staff (E/E) assisted in the environmental sample collection. G. Chavez and T. Roybal of Division 7722, R. Helgese, L. Marlman, and K. Molley of Division 7721, and R. Knowton, M. Irwin, and S. Purvis of Division 7723 assisted in providing information for waste management and Clean Water Act compliance assessments. M. Pope of Los Alamos Technical Associates (LATA) performed the radiological offsite dose assessment. K. Horak, N. Fleming, and B. Bailey White of Creative Computer Services (CCS) provided statistical analysis, data management, report coordination, and editorial review services for all authors. W. Booker of International Technology Corporation (IT) provided the quality assurance results for nonradiological analyses.

NOTE TO THE READER

The SNL organization numbers of the authors and supporting staff changed effective August 1, 1991. The former organization numbers were used within the text since the report was initiated prior to the organization change. For reference to the new organization numbers, see the following list:

<u>From</u>	<u>To</u>
3200	7700
3201	7701
3210	7710
3211	7711
3212	7712
3213	7713
3214	7714
3215	7715
3216	7716
3217	7717
3220	7720
3221	7721
3222	7722
3223	7723
7513	2713
7523	2723

N. R. Ortiz

Director

Environment, Safety and Health

Sandia National Laboratories

Albuquerque, New Mexico, 87185

date: July 17, 1991

to: RECIPIENTS OF SAND91-0592 OR SAND91-0593

from:
Nestor R. Ortiz, 3200

subject: 1990 Environmental Monitoring Reports, Sandia National Laboratories, Albuquerque, New Mexico (SAND91-0592) and Tonopah Test Range, Nevada (SAND91-0593)

Enclosed is a copy of the subject reports for Sandia National Laboratories at Albuquerque (SAND91-0592) or at Tonopah Test Range (SAND91-0593) prepared for the Department of Energy (DOE). The purpose of the reports is to present summaries of the 1990 environmental monitoring data. This data demonstrates the performance of the site environmental management and confirms the success of the continuing efforts to achieve compliance with the environmental standards and requirements.

This report is prepared and published annually for distribution to local, State, and Federal agencies; the Congress; the public; and the news media. To the best of my knowledge, this report accurately summarizes and discusses the results of the 1990 environmental monitoring program for the Sandia National Laboratories at Albuquerque (SAND91-0592), or at Tonopah Test Range (SAND91-0593).

Also enclosed is an addendum summarizing significant changes to our compliance status, current issues and actions, and conformance to environmental permit requirements for the period January 1 through May 31, 1991.

If you have any questions or desire additional information, please contact Ms. Su Hwang of our Environmental Impact and Restoration Division at (505) 846-8821.

NRO:3200:lmg
(91-0152)

Enclosures:

1. SAND91-0592: 1990 Env. Monitoring Report, Albuquerque, NM
2. SAND91-0593: 1990 Env. Monitoring Report, TTR, Nevada
3. Compliance Summary for January thru May 1991

ADDENDUM
COMPLIANCE SELF-ASSESSMENT
U.S. DEPARTMENT OF ENERGY
SANDIA NATIONAL LABORATORIES, ALBUQUERQUE

Background

Sandia National Laboratories, Albuquerque (SNL, Albuquerque) must operate in compliance with environmental and other requirements established by a number of federal and state statutes and regulations, executive orders, U.S. Department of Energy (DOE) orders, and a state compliance order. The following paragraphs summarize SNL, Albuquerque's compliance status for the period of January 1 through May 31, 1991, as an addendum to the 1990 Environmental Compliance Activities (Chapter 3) of the report. DOE Headquarters (DOE/HQ) sent a Tiger Team to appraise SNL, Albuquerque's Environment, Safety, and Health (ES&H) functions in 1991. The draft findings report was received at the end of May. SNL, Albuquerque, was requested to submit a draft action plan in July.

Comprehensive Environmental Response Compensation and Liability Act (CERCLA)/Superfund Amendment and Reauthorization Act (SARA)

Reportable Quantity (RQ) Release--Reportable quantities of lead were released to the air as a result of the following rocket tests: Two RQ releases involved NIKE rocket tests at SNL, Albuquerque, and two RQ releases at the Kauai Test Facility (KTF) involved one NIKE and one Terrier rocket test. These RQ releases were reported to the National Response Center during this period.

Toxic Chemical Release (SARA III, Section 313)--SNL, Albuquerque, completed the 1990 SARA III, Section 313, Release Report. It was submitted to the DOE in June 1991. One chemical, hydrochloric acid, qualifies for reporting.

Clean Air Act (CAA)

The Clean Air Act Amendments of 1990 list 189 substances as hazardous air pollutants (Title III, Air Toxics). As required by the CAA, the U.S. Environmental Protection Agency (EPA) will soon establish emission standards for these pollutants.

The City of Albuquerque requested SNL, Albuquerque, to conduct an inventory of these 189 substances for their use and potential air emissions. A preliminary inventory report for SNL, Albuquerque, was submitted to the City in April. SNL, Albuquerque, has used 107 chemicals out of the 189 listed. Among the 107 used, only 30 of them are used in amounts exceeding 100 lb/yr and only 12 of them are used in amounts exceeding 1000 lb/yr.

Clean Water Act (CWA)

Wastewater Program--SNL, Albuquerque, has nine active permits including seven wastewater discharge permits from the City of Albuquerque and two discharge permits for surface impoundments from the New Mexico Environmental Improvement Division (NMED). On February 19, 1991, a CWA notification under 40 CFR 403 was given to the City, the NMED, and the EPA on hazardous waste discharged to the publicly-owned treatment works (POTW). Wastewater Discharge Permits 2069 C and 2069 E were deactivated on April 19, 1991. No wastewater discharge permit was required for the Explosive Components Facility (Permit Application 2069 J). Wastewater Discharge Permit 2069 K for the Technical Area III, V, and Coyote Test Field sewer line was issued from the City on April 26, 1991. Corrective construction for the Microelectronics Development Laboratory was completed and Wastewater Discharge Permit 2069 G is now in full compliance. Quarterly reporting has been in compliance.

Spill Prevention--Some of SNL, Albuquerque's aboveground storage tanks for oil and petroleum products lack spill containment. These tanks are generally small and contain less than 5 percent of the total oil storage on the site. In the revised Spill Prevention Control and Countermeasure (SPCC) Plan, spill control mechanisms are being recommended for all outside storage of oil and inside storage of over 60 gallons in any one device. These recommendations will be implemented in the near future.

Storm Water--A storm water program has been written and an action plan for permit preparation is in place. CDM Federal Program Corporation is providing technical support on permit application preparations and the application is expected to be complete by November 15, 1991. SNL, Albuquerque, is in the process of determining the locations of the regulated facilities and the appropriate locations for sampling and analysis.

National Environmental Policy Act (NEPA)

SNL, Albuquerque, obtains required surveys on a case-by-case basis for historical and archaeological protection, as required by the Historical Preservation Act, for inclusion in NEPA documents. SNL, Albuquerque, contracts to have new surveys conducted as needed and is working with the DOE to reach an agreement with the New Mexico State Historical Preservation Officer on historical preservation for DOE-owned lands. SNL, Albuquerque, also complies with the Endangered Species Act (ESA) on a case-by-case basis. The DOE must comply with the ESA when planning federal actions. The key provision of the ESA for federal activities is Section 7, Consultation. Under Section 7 of the ESA, federal agencies must consult with the U.S. Fish and Wildlife Service to ensure that any agency actions are "not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species." SNL, Albuquerque, also consults with State of New Mexico Department of Fish and Game, and Department of Natural Resources officials.

KTF Sitewide Environmental Assessment (EA)--The KTF EA was delivered to DOE/KAO on April 5, 1991. The EA was transmitted by DOE/AL/EPD on April 15, 1991 to R. L. Dintaman, DP-20 Team Leader for SNL, DP-26.1, HQ. The DOE/AL stated in their cover letter (Attachment 1): "We believe, in consideration of the comprehensive analysis provided, that a Finding of No Significant Impact (FONSI) is supportable."

KTF EA for the Strypi/Lace Rocket--SNL drafted an EA and a FONSI for the Strypi/Lace rocket launch at the KTF in Hawaii. Staff at DOE/HQ and DOE/AL, and at SNL completed and coordinated this EA within 6 weeks in order to permit the Strypi/Lace rocket to be launched within severe test schedule constraints. The FONSI was issued on March 6, 1991.

Resource Conservation and Recovery Act (RCRA)

Radioactive and Mixed Wastes Compliance--In the last quarter of calendar year 1990, after technical review of SNL's RCRA Part B Permit Application, the NMED issued a Notice of Deficiency (NOD) for technical deficiencies in the application. In April

1991, SNL/DOE/AL/KAO submitted a revised Part A and Part B Permit Application to the NMED. It is expected that the operating permit for the Hazardous Waste Management Facility will be granted during calendar year 1991.

Underground Storage Tanks (USTs)--USTs 6500-1 and 6503-1 were removed in January 1991. Analytical results from soil samples were greater than 100 ppm and site investigation by soil borings was conducted. UST 888-3 was isolated, cleaned, and abandoned in place.

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ABBREVIATIONS

International System Prefixes

<u>Exponent</u>	<u>Prefix</u>	<u>Symbol</u>	<u>Exponent</u>	<u>Prefix</u>	<u>Symbol</u>
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

°C	Celsius degree	lb	pound
cm	centimeter	lps	liters per second
ft.	feet	m	meter
g	gram	mi	mile
gal	gallon	min	minute
gpd	gallons per day	ml	milliliter
gpm	gallons per min	ppm	parts per million
hr	hour	psi	pounds per square inch
ha	10,000 square meters	qt	quart
in.	inch	s	second
J	Joule	TPY	tons per year
kg	kilogram	yr	year
km	kilometers	% moisture	weight percent of water
L	liter		

Symbols

α	alpha particle	$\bar{x}$	mean value
β	beta particle	P	statistical probability
γ	gamma particle	s	standard deviation
<	greater than	$s_{\bar{x}}$	standard error of the mean
>	less than	σ	statistical variance
~	approximately		

Nuclide Symbols for Frequently Referenced Nuclides and Components

Ar	argon	Pu	plutonium
²⁴¹ Am	americium-241	²⁴¹ Pu	plutonium-241
Be	beryllium	S	sulphur
Cs	cesium	U	uranium
Co	cobalt	²³⁸ U	uranium-238 (principal component of depleted uranium [DU])
³ H	tritium	U _{nat}	natural uranium
HT	tritiated hydrogen	U _{tot}	total uranium
HTO	tritiated water vapor	Xe	xenon
K	potassium		
Kr	krypton		
PCB	polychlorinated biphenyl		

ABBREVIATIONS (Continued)

Radioactivity Measurements

Ci	curie (unit of radioactivity)
mR	milliroentgen (unit of radiation exposure)
mrem	millirem (unit of radiation dose)
person-rem	radiation dose to population (also man-rem)
pCi/l	picocuries/liter
R	roentgen (unit of radiation dosage)
rem	r(oentgen) e(quivalent) m(an) (amount of ionizing radiation required to produce the same biological effect as 1R of high-penetration X-rays)
Sv	sievert (unit of radiation dosage, ~8.38 R)

Water Quality Measurements and Abbreviations

AMSL	above mean sea level
Cl	chloride ion
CN	cyanide
CN _{amenable}	cyanide amenable to chlorination
CN _T	cyanide, total
F	filtered water
K-sat	saturated hydraulic conductivity
MCL	maximum contaminant level
mho	unit of conductance
NAPL	nonaqueous phase liquid
NTU	nephelometric turbidity unit
pH	hydrogen ion concentration, a measure of acidity
S	suspended solids
SP.Cond	specific conductivity (mho/l)
SWL	depth to water below measuring point
T	unfiltered water
TCA	1,1,1-trichloroethane
TCE	trichlorethylene
TDS	total dissolved solids
TOC	total organic carbon
TOX	total organic halogen
TR	trace
TTCE	tetrachloroethene
TTO	total toxic organics
VOC	volatile organic compound
WLEL	water level elevation above mean sea level

Acronyms

ACRR	Annular Core Research Reactor
ADM	Action Description Memorandum
ALARA	as low as reasonably achievable
AMO	Albuquerque Microelectronics Operations

ABBREVIATIONS (Continued)

Acronyms

ANSI/IEEE	American National Standards Institute/Institute of Electrical and Electronic Engineers
AQCR	Air Quality Control Regulations
AR	averaged replicate
ARARs	Applicable or Relevant and Appropriate Requirements
AT&T	American Telephone & Telegraph
CAA	Clean Air Act
CAM	continous air monitor
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CERF	Civil Engineer Research Facility
CFR	Code of Federal Regulations
CNSAC	Center for National Security and Arms Control
CVAA	cold vapor atomic absorption
CWA	Clean Water Act
CWL	chemical waste landfill
DCP	direct current plasma
DCG	derived concentration guide
DNA	Defense Nuclear Agency
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOE/AL	DOE Albuquerque Operations Office
DOE/NVO	DOE Nevada Operations Office
DOT	U.S. Department of Transportation
EA	Environmental Assessment
EC	Environmental Checklist
ECF	Explosive Components Facility
EDE	effective dose equivalent
EIS	Environmental Impact Statement
EIS/ODIS	Effluent Information System/On-Site Discharge Information System
Encotec	Environmental Control Technology Corporation
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
ES&H	Environment, Safety and Health
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FONSI	Finding of No Significant Impact
GC	gas chromatography
GFAA	graphite furnace atomic adsorption
GPP	General Plant Projects
HCF	Hot Cell Facility
HEPA	high-efficiency particulates in air
HIIIA	HERMES-III Accelerator
HWMF	Hazardous Waste Management Facility
IC	ion chromatography
ICP	inductive coupled plasma

ABBREVIATIONS (Continued)

Acronyms

IMRL	Integrated Materials Research Laboratory
IT	International Technology Corporation
IT/AS	International Technology Corporation, Analytical Services
ITRI	Inhalation Toxicology Research Institute
IS	ion selective probe
KAFB	Kirtland Air Force Base
LANL	Los Alamos National Laboratory
LATA	Los Alamos Technical Associates
LDR	Land Disposal Restriction
LLW	low-level radioactive waste
MCA	multichannel analyzer
MDL	minimum detection level
MS	mass spectrometry
MSDS	Material Safety Data Sheet
MTF	memo-to-file
MW	mixed waste
MWL	mixed waste landfill
NAAQS	National Ambient Air Quality Standards
NBS	National Bureau of Standards
NCC	National Climatic Center
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NIST	National Institute of Standards (formerly NBS)
NMED	New Mexico Environmental Improvement Division
NMWQA	New Mexico Water Quality Authority
NMWQCC	new Mexico Water Quality Control Commission
NOAA	National Oceanographic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRC	National Response Center
NSPS	New Source Performance Standards
NTS	Nevada Test Site
OBP	Open Burning Permit
OEL	Occupational Exposure Limit
OSHA	Occupational Safety and Health Administration
PA	Preliminary Assessment
PBFA-II	Particle Beam Fusion Accelerator-II
PDL	Process Development Laboratory
PETL	Processing and Environmental Technology Laboratory
PMRF	Pacific Missile Range Facility
POTW	publicly-owned treatment works
QA	quality assurance
QC	quality control
R&D	research and development
RAM	Radiological Air Monitor

ABBREVIATIONS (Concluded)

Acronyms

RCRA	Resource Conservation and Recovery Act
REEC	Reynold Electric and Engineering Company
RMWMF	Radioactive and Mixed Waste Management Facility
RPD	relative percent difference
RQ	reportable quantity
RTC	Reactor Technology Center
SARA	Superfund Amendment and Reauthorization Act
SC	Special-Case
SC-COM	special case - commercially held, DOE-owned materials
SC-GTCC	special case - DOE 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
SFER	Small Force Engagement Range
SIC	Standard Industrial Classification
SNL	Sandia National Laboratories
SOP	Standard Operating Procedure
SPCC	Spill Prevention Control and Countermeasure
SPR	Sandia Pulsed Reactor
STL	Simulation Technology Laboratory
SWMU	Solid Waste Management Unit
TCLP	toxicity characteristics leaching procedure
TLD	thermoluminescent dosimeter
TRU	transuranic
TSCA	Toxic Substances Control Act
TSDF	Treatment Storage and Disposal Facility
UST	underground storage tank
USGS	United States Geological Survey
WIPP	Waste Isolation Pilot Plant
WIPPWAC	Waste Isolation Pilot Program Waste Acceptance Criteria
XRF	X-ray fluorescence

CHAPTER 1

EXECUTIVE SUMMARY

1.1 Assessment of Radiological Impact for the Public

SNL, Albuquerque, is located southeast of Albuquerque on Kirtland Air Force Base (KAFB). Because radionuclides are potentially released in small quantities from its research activities to offsite areas, SNL, Albuquerque, has maintained an environmental monitoring program for radiological sampling and surveillance. The program includes annual sampling and analysis for tritium (^3H), gross alpha (α) and beta (β), total uranium (U_{tot}), and isotopic gamma (γ) in surface water, groundwater, soil, and vegetation. These samplings and analyses are performed around Albuquerque at SNL, perimeter, and community locations. Most levels measured in 1990 were consistent with the local background values measured in previous years.

A total of 5.3 Ci of argon-41 (^{41}Ar), 0.4 Ci of krypton-85 (^{85}Kr), approximately 0.2 Ci each of nitrogen-13 (^{13}N) and oxygen-15 (^{15}O) and 0.02 Ci of ^3H were released as a result of SNL, Albuquerque, operations in 1990. The maximum effective dose equivalent calculated for an offsite residence is 2.0×10^{-3} mrem, or 0.02 percent of the 10 mrem/yr dose limit specified in the National Emission Standards for Hazardous Air Pollutants (NESHAP) and DOE orders (see Appendix G, Table G-1). The total Albuquerque population received a collective dose of 0.82 person-rem during 1990 from SNL, Albuquerque, operations, whereas it received >57,000 person-rem from natural background radiation (see Chapter 5).

1.2 Overview of 1990 Monitoring Results

Radiological Monitoring

Most of the 1990 radiological monitoring results were consistent with the results of the previous years, and all were well below the DOE-derived concentration guides (DCGs) specified in DOE Order 5400.5, "Radiological Protection of the Public and the Environment," issued in February 1990.

In 1990, external penetrating radiation doses for the Albuquerque community area averaged 93 mrem/yr as measured by the SNL, Albuquerque, environment thermoluminescent dosimeter (TLD) monitoring system. This is the natural background radiation dose rate for the region, attributable to terrestrial and cosmic radiation. There was no statistically significant difference among the three group locations (SNL, Albuquerque; perimeter; and community) in the 1990 TLD results (see Chapter 5).

Nonradiological Monitoring

Wastewater--Discharges by SNL, Albuquerque, to publicly-owned treatment works (POTW) are regulated by the City of Albuquerque. At the end of 1990, SNL, Albuquerque, operated under eight wastewater discharge permits issued

by the City. Two of the eight permits were obtained during 1990. Detailed results are listed in Chapter 6 and in Appendix F. The 1990 wastewater monitoring results were within the permit conditions except for a few cases of fluoride and pH violations. The corrective actions were taken immediately after the problems were identified.

The annual 24-hr composite sampling for all parameters specified in the City permits was conducted during June 1990. The results were all less than the concentration limits established by the permits. The results are summarized in Appendix C.

Surface Water--Nonsanitary discharges to surface impoundments are under the authority of the State of New Mexico. A Discharge Plan (DP-530) covering two lagoons in Technical Area IV was amended in December 1989 by the State. Quarterly water-level measurements and semiannual analysis were all within the parameters and concentration limits specified in DP-530. Semiannual reports that include the surface-water sampling and analyses were submitted to the New Mexico Environmental Improvement Division (NMED) Ground Water Bureau. No organic compounds were detected in the lagoon samples in 1990.

Air Quality--Air quality, except for radionuclide emissions, is regulated by the City of Albuquerque. Ambient air monitoring throughout the City is conducted by the Air Pollution Control Division of the City. SNL, Albuquerque, does not maintain any ambient air samplers on the site. A preliminary inventory of air emissions was conducted during 1990 for ten hazardous air pollutants (see Chapter 6). Only nine of the one hundred sources surveyed show significant emissions at the stack level and thus require modeling calculations. However, the results of the modeling show that none of these nine sources have any significant impact to the ambient air concentration. Therefore, none of the existing sources would require an air quality permit from the City.

Groundwater Monitoring

The groundwater surface elevation was evaluated by measuring the water level at monitor wells throughout the SNL, Albuquerque, area. Sixteen wells were added to the SNL, Albuquerque, water-level monitoring network during 1990. One new monitor well was installed to obtain a detailed lithologic log and samples, and to obtain an additional site for groundwater sampling and better definition of the potentiometric surface at the chemical waste landfill (CWL).

The apparent groundwater flow direction at the CWL is to the northwest. Potentiometric surface contour maps indicate that the CWL groundwater monitoring network satisfies the requirements of 40 CFR 265.91.

Semiannual sampling for groundwater contamination indicator parameters began in March 1990, in anticipation of closure, following the conclusion of background monitoring in January 1990. The March 1990 sampling discovered trichlorethylene (TCE) in the CWL monitor well MW-2A. Subsequent resampling in April and May 1990 confirmed the presence of TCE and 1,1,1-trichloroethane (TCA), and confirmed instances of statistically

significant changes from background values of indicator parameters (pH, specific conductivity [SP.Cond], and turbidity). Background values for water quality at MW-4 were established in June 1990, and were found to be consistent with background water quality determined at the other CWL monitor wells. Quarterly assessment sampling events in August and December 1990 detected TCE in two of the four downgradient monitor wells. An assessment plan for quarterly sampling was devised and is being implemented to further characterize the extent of contamination and continue to determine aquifer properties at the CWL.

The apparent groundwater flow direction across Technical Area III is to the west-northwest. Potentiometric surface contour maps indicate that the groundwater monitoring network at the mixed waste landfill (MWL) may satisfy the requirements of 40 CFR 265.91. SNL, Albuquerque, is writing a work plan to address the adequacy of the monitor well network.

Background sampling was conducted in September 1990 to establish initial values for all groundwater quality parameters and primary drinking-water standards. No parameters were detected in concentrations exceeding drinking-water standards, except noncoliform bacteria. Turbidity values were slightly elevated in all the MWL monitor wells, with 6.5 nephelometric turbidity units (NTUs) the highest value noted (see Chapter 7).

1.3 Other Compliance Activities

National Environmental Policy Act of 1969 (NEPA)--During 1990, SNL's NEPA compliance activities increased. New guidance procedures were initiated. The number of Action Description Memoranda (ADMs) increased by 100 percent, two EAs were completed, and seven Environmental Assessments (EAs) were under preparation for submittal to the DOE. (For further details, see Chapter 4.)

Resource Conservation and Recovery Act RCRA--The RCRA Part B permit application is currently being revised to address issues identified in the Notice of Deficiency issued by the NMED in late 1989. Part B modifications were submitted to the NMED in April 1991. A revised Part A permit application for hazardous waste was prepared and submitted to the NMED to include new toxicity characteristics leaching procedures (TCLPs). An interim status permit was prepared for mixed waste (MW) storage and submitted to the DOE on February 9, 1990. (For further details, see Chapter 3.)

Low-Level Radioactive Waste (LLW) and MW Disposal--SNL, Albuquerque, submitted an application to the Nevada Test Site (NTS) for disposal of both LLW and MW in 1990. The application was reviewed by the DOE Nevada Operations Office (DOE/NVO) and is currently being revised by SNL, Albuquerque. (For further details, see Chapter 4.)

Permit/Notification

Table 3-1 and Table 6-11 list the current environmental permits issued to SNL, Albuquerque, and those that are in the process of being reviewed by

various agencies. In addition to these environmental permits, notifications were made to the City of Albuquerque regarding asbestos removal (NESHAP, Subpart M) and beryllium (Be) emission/relocation (NESHAP, Subpart C). Also, several projects were evaluated for exemption and applicability of NESHAP, Subpart H, to facilities in Technical Areas IV (see Chapter 5) and V. In 1990, 13 additional septic tanks were registered with the NMED, as required by the State of New Mexico discharge regulations. (For further details, see Chapters 3 and 6.)

CHAPTER 2

INTRODUCTION

2.1 Site Operation

SNL, Albuquerque, is operated by Sandia Corporation, a prime contractor of the DOE. Sandia Corporation, which is a subsidiary of AT&T Technologies, Incorporated, provides service to the U.S. Government on a nonprofit, no-fee, and no-loss basis. The major responsibilities are national security and energy projects (ERDA, 1977). Its 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; 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; vertical axis wind turbine research; and fossil fuel and geothermal energy research.

2.2 Location and Population

SNL, Albuquerque, is located in Bernalillo County at the foot of the Manzano Mountains adjacent to Albuquerque, New Mexico. At their nearest points, SNL facilities are 2-1/2 mi south of Interstate 40 and approximately 6-1/2 mi east of downtown Albuquerque (Figure 2-1). The facilities are surrounded by Kirtland Air Force Base (KAFB) East, with co-use agreements on some U.S. Air Force property. An area of the Manzano Mountains east of KAFB has been withdrawn from the 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 190-km² 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 River to the west. Elevations range from 1500 m at the Rio Grande River to 3255 m at Sandia Crest, which is in the Sandia Mountains adjacent to Albuquerque. KAFB is at a mean elevation of 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, 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 an 80-km radius of KAFB (U.S. Department of Commerce, Bureau of the Census, 1991). This includes permanent residents of KAFB living in the KAFB housing areas.

Figure 2-1. Albuquerque Site Regional Setting

2.3 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 10°C, and summer daytime temperatures average less than 32°C, except in July, when the maximum reaches 34°C (see Appendix A, Table A-1). The average annual precipitation is 21 cm; half of this precipitation occurs from July through September in the form of brief thundershowers. Winter months are typically dry with <5 cm of precipitation normally recorded. The average annual relative humidity is approximately 43 percent (Appendix A, Table A-2). Strong winds often accompanied by blowing dust occur mostly in late winter and early spring. The wind speed reaches 13.3 m/s for less than 48 days each year. Prevailing surface winds on KAFB are from the east (Figure 2-2) (Olson et al., 1970).

Table 2-1 summarizes meteorological data for 1990. The 30-yr annual average precipitation is 20.6 cm (see Appendix A, Table A-1).

2.4 Geology

Research into the literature on the geology of the area (e.g., Lozinsky, 1988; Anderholm, 1988; Kelley, 1977; Kelley and Northrup, 1975; Bjorklund and Maxwell, 1961; and many others) has yielded much information on the Albuquerque-Belen Basin. It is one of the north/south-trending line of basins that make up the Rio Grande Rift zone. The Rio Grande River enters the basin on the north near White Rock Canyon and flows down the middle of the basin to where it is joined by the Rio Salado at the south end. On the east and west, the basin is bounded by uplifted fault blocks. The Sandia, Manzanita, and Manzano Mountains are uplifted on the eastern boundary. The west side of the basin is bounded by the Lucero Uplift with the Ladrón Mountains along the south, but there is little relief along the Nacimiento Uplift on the northwest side of the basin. During the Miocene and Pliocene, the basin filled with up to 3600 m of sediments eroded from the surrounding highlands. This sequence, called the Santa Fe Group, thins towards the edge of the basin and is truncated at the bounding uplifts. The 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 channels, debris flows, flood plain deposits, and aeolian deposits. These sediments range from clay to boulders. Stratification can be moderately well developed, and some graded bedding may occur. Beds vary in thickness from a few centimeters to several meters. Most of the bedding is lenticular, with limited areal extent, although channel beds can extend downdip (westward) for long distances. Caliche deposits are commonly formed on exposed surfaces. Sediment samples collected are composed of unconsolidated and semiconsolidated cobbles, sands, and gravels with inclusions of silty and clayey lenses intermixed with sand.

Figure 2-2. Annual Surface Wind Speed and Direction, SNL Technical Area I

Table 2-1. Summary Meteorological Data for the Albuquerque Area in 1990

Month	<u>Temperatures (°C)</u>		<u>Precipitation</u>	<u>Wind</u>	
	Daily Range Min	Max	(cm) Water Equivalent	Speed m/s	Direction
January	-5.6	8.4	0.53	4.0	N
February	-3.3	10.5	1.24	4.2	SE
March	1.9	16.4	1.04	4.4	W
April	6.7	21.4	4.34	4.9	S
May	9.7	25.4	1.14	5.4	SW
June	17.3	34.8	0.69	4.5	S
July	17.7	32.1	5.99	4.4	E
August	16.2	35.8	4.55	3.8	SE
September	15.0	28.2	2.44	3.8	E
October	6.4	22.8	0.38	3.5	W
November	0.0	14.4	2.18	3.9	E
December	-6.6	6.6	1.50	3.7	NW

The geology underlying the eastern section of KAFB is separated by major faulting. The Hubbell Springs and Sandia faults are postulated to be a set of north/south-trending, down-to-the-west, *en eschelon* blocks (SAIC, 1985; Machette, 1982; Grant, 1981; Kelley, 1977; and Kelley, 1961). The Tijeras Fault, while it is mostly downthrown to the west too, is slightly different in that it appears to be downthrown to the east near KAFB (Kelley and Northrup, 1975). The Hubbell Springs Fault has been described as one of the most remarkable faults in the Rio Grande Rift (Grant, 1981). It is unbroken for over 56 km and runs nearly due north from Socorro County, New Mexico, to somewhere near the southern portion of KAFB. The Hubbell Bench (south of KAFB) is one of the most easily recognizable fault scarps in the basin with offsets of 5 to 30 m (Machette, 1982). The Sandia Fault is thought to parallel the Hubbell Springs Fault north of KAFB and the City of Albuquerque but bears west along the western side of Four Hills (Manzano Base) in the KAFB area. It is thought to be the primary boundary between the Sandia Uplift and the main Albuquerque Basin graben (Kelley, 1977). The Tijeras Fault is assumed to be the boundary between the Sandia and Manzano uplifts. Strike slippage is thought to consist of southwesterly movement of the northern block. The fault starts at least as far north as Madrid, New Mexico, and has been traced southwesterly through Tijeras Canyon and along the eastern side of Four Hills.

Very few data are available to describe the soils at SNL, Albuquerque. The most recent Site Development Plan (SNL, 1989) describes the soils in the region as "a surface layer of brown, gravelly, fine, sandy loam, underlain by a subsoil of brown, sandy, clay loam, and a substratum of gravelly sand loam." This very general description may not represent SNL site-specific soils. Hacker (1977) describes two general soil classes probably found in the SNL, Albuquerque, area. The Mature.-Wink soils are well-drained, loamy soils associated with level to moderately sloping piedmonts. They are characterized by a surface layer of brown, fine, sandy loam, underlain by a brown, sandy, clay loam and a substratum of pinkish, gray-white, sandy loam. The Tijeras-Embudo soils are well-drained, loamy and gravelly soils usually found with level to moderately sloping alluvial fans. These soils are typically composed of a surface layer of brown, gravelly, fine, sandy loam, and underlain by a subsoil of brown, sandy, clay loam and a substratum of pale brown, calcareous, very gravelly, loamy sand.

SNL, Albuquerque, Division 3223 personnel recently began mapping the soils exposed by excavations for a new sanitary sewer line at SNL, Albuquerque. This project is aiding in the understanding of the geology, geomorphology, and soil distribution in the SNL, Albuquerque, region. Excavations began north of SNL, Albuquerque, Technical Area III in August 1990 and continued southward and eastward through Technical Area III and on to the Inhalation Toxicology Research Institute (ITRI) and the solar tower. The total length of the main sewer line and lateral branches is over 15 km; the depth of the trench varied from just over 1 m to approximately 3 m. At present, the last 3 km of excavations are under way in the southeast portion of Technical Area III and east of Technical Area III. Samples are collected to represent vertical sections along the trench at intervals determined by the degree of lateral variation observed. Further testing in the near future will include analysis to better characterize the permeability of samples. A grain-size analysis laboratory is being set up in Building 6540 to analyze the sewer trench samples as well as future SNL, Albuquerque, drilling or excavation samples. Efforts are being made to collect some undisturbed samples to be impregnated for thin section preparation or used for direct permeability measurements. SNL, Albuquerque, is planning, assuming sufficient funding is provided, to map all the soils and surficial geology within the SNL, Albuquerque, property on KAFB.

2.5 Hydrology

Groundwater Hydrology

The faults described in Section 2.4 separate the regional water table into a somewhat deep region west of the fault complex and a much shallower region on the east. The depth to saturated groundwater underlying SNL, Albuquerque, facilities varies from 15 to 30 m east of the faults and from 115 to 150 m west of the faults. Most SNL, Albuquerque, facilities are located west of the fault system in the area of deeper groundwater. Virtually no information exists about the hydraulic properties of the vadose zone. The cores taken from well MW-4 were analyzed to determine the saturated hydraulic conductivity (K-sat) and moisture retention characteristics. Reported values of K-sat ranged from 4.1E-06 to 3.8E-3 cm/s;

literature values of K-sat for sediments similar to those in the Albuquerque-Belen Basin average about $4.0\text{E-}04$ cm/s (Carsel and Parrish, 1988). Detailed information on other hydraulic parameters and moisture retention characteristics is reported in DBS&A, Inc. (1990).

Because the monitor well network at SNL, Albuquerque, is limited in size and space (Appendix F, Figure F-1), there is uncertainty about the apparent direction of groundwater flow in the region. However, based on available data, the apparent direction of groundwater flow west of the fault complex is generally to the north and northwest (Appendix F, Figure F-2). This is substantially different from the southwesterly direction of groundwater flow reported by Bjorklund and Maxwell (1961). These differences are most likely due to the influence of KAFB production wells. Albuquerque (including KAFB) obtains all of its drinking water from groundwater. Economic growth in the last 30 yr, resulting in increased pumping from KAFB and the City of Albuquerque's deep municipal supply wells, has significantly altered the saturated groundwater flow direction in the vicinity of SNL, Albuquerque. Pumping data from KAFB wells for 1990 are listed by Schelor (1990). Two details are apparent from these data: (1) there is a seasonal variation in pumping rates at KAFB with the peak occurring in July, and (2) wells 7, 11, and 4 were the biggest producers during 1990. Further analyses will be performed on these data.

The hydrogeology east of the fault systems is poorly understood because there are few monitor wells and the geology between the fault systems and the canyons of the Manzanita Mountains is very complex. The direction of groundwater flow would typically be out of the canyons and westward toward (perpendicular to) the fault system. SNL, Albuquerque, is currently studying the flow in the vicinity of the fault complex. A surface microgravity survey is planned to delineate the location of the fault blocks. Initially, that survey will cover a 1.1-km (0.5-mi) wide band extending from an SNL monitor well westward to the chemical waste landfill (CWL) (4.4 km [2 mi]). This well is known as the EOD well because of its proximity to the Explosives, Ordnance, and Demolition Range. Once the information on fault location is known, the installation of 3 or 4 wells is planned, each in a different block between the EOD well and the CWL. One of the holes may be angled to intercept the boundary between two blocks. Field tests can be performed to help determine the nature of this boundary and its impact on regional flow.

Surface Water Hydrology

The major surface hydrologic feature in central New Mexico is the Rio Grande River, which flows north-to-south through Albuquerque, and lies ~8 km (3.6 mi) west of KAFB. Rio Grande water is primarily used for irrigation of agricultural crops. There are no continuously running streams on SNL, Albuquerque, property, although there are two perennial springs (Coyote and Sol Se Mete) on KAFB. The two primary surface channels at SNL, Albuquerque, are Tijeras Arroyo and the smaller Arroyo del Coyote. Arroyo del Coyote joins into Tijeras Arroyo ~1.6 km (0.7 mi) west of the Tijeras Arroyo Golf Course; both flow intermittently during heavy thunder-showers. Tijeras Arroyo (above the confluence with Arroyo del Coyote)

drains ~210 km² while Arroyo del Coyote (above the confluence with Tijeras Arroyo) drains ~71 km² (15 mi²) (U.S. Army Corps of Engineers, 1979).

2.6 Biology

The semidesert Southwest climate combines with the low water availability to produce many species of drought-resistant flora such as cacti (ERDA, 1977). The mesa vegetation on KAFB, consisting of grasses and shrubs, is illustrated in Figure 2-3. Figure 2-4 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.

2.7 Technical Areas

SNL, Albuquerque, consists of five technical areas and several additional test areas (Figure 2-5). Each area has its own distinctive operations. The following is a brief description of the activities in each area and a summary of potential sources for radioactive and nonradioactive effluent releases.

Technical Area I

Technical Area I (Figure 2-6) has the largest employee population, approximately 5000. This area is dedicated primarily to the design, research, and development of weapon systems; limited production of weapon system components; and energy programs. It also includes laboratories and shops used by administrative and technical staff. Generally, the only potential radioactive releases in Technical Area I are tritium (³H) from two laboratory sources and activation products (such as argon-41 [⁴¹Ar], nitrogen-13 [¹³N], and oxygen-15 [¹⁵O]) from two small accelerators. Only small quantities of activation products were released from these stacks in 1990. Potential sources for nonradioactive effluents include the paint shops, toxic machine shop, process development laboratory, emergency diesel generator plant, solvent spray booth, foundry, and steam plant.

Technical Area II

Technical Area II (the diamond-shaped area in Figure 2-7) is a small area used for explosive testing. Microcurie amounts of ³H may be released each year from component testing. Techniques for measuring fractures in geologic strata are developed at this facility. Also located in Technical Area II are an inactive low-level 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 for Technical Area II. This facility will integrate many of the existing Technical Area II activities as well as some remote testing activities currently performed in other test areas.

Figure 2-3. Mesa Vegetation

Figure 2-4. Manzano Foothills Vegetation

Figure 2-5. SNL, Albuquerque, Technical Areas (I-V) and Remote Areas

Figure 2-6. Technical Area I (looking east from the intersection of Wyoming and Gibson boulevards)

Figure 2-7. Top-Down View of Technical Areas II and IV

Technical Area III

Technical Area III (Figure 2-8) is located adjacent to and south of Technical Area V, and 8 km south of Technical Area 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. During 1990, there was a total of three NIKE motor tests that released 3.73 lb of lead per test at the sled-track area. Other facilities in Technical Area III include a paper incinerator, an inactive LLW and mixed waste (MW) disposal site, a large melt facility, a melting and solidification laboratory, and a solar tower facility.

The inactive radioactive waste disposal site in Technical Area III consists of two adjoining fenced areas that occupy approximately 0.6 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. The LLW consisted primarily of tritium-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 scheduled for closure by 1992. It is currently used as an interim storage facility for radioactive and MW. LLW will be stored at a new radioactive and MW storage facility which is scheduled for completion and use in fiscal year 1992. This new facility is located at the southern end of Technical Area III adjacent to the inactive chemical disposal site.

An inactive hazardous waste disposal and storage site is located near the southern boundary of Technical Area 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 was prepared in May 1988 for the no-longer-used hazardous waste disposal site. A new hazardous waste repackaging and storage building, located south of Technical Area I, has been in use since 1988.

Technical Area IV

Technical Area IV (Figure 2-7) 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. Gaseous tritium effluents (primarily tritiated hydrogen [HT]) will be released from fusion research efforts starting 1991. A large accelerator facility, the Simulation Technology Laboratory (STL), houses seven pulsed power accelerators: HERMES-III, RLA, TROLL, STF, SPEED, HYDRAMITE, and in 1989, PROTO II. Several of these accelerators have been transferred from Technical Area V. HERMES-III became operational in 1988. Another accelerator facility, SATURN, was also completed in 1987. A major research facility, the Strategic Defense Facility (SDF), is under construction and will be operational by 1990. During 1990, radioactive emissions from this facility were short-lived radionuclides, primarily ^{13}N and ^{15}O .

Technical Area V

Technical Area V (Figure 2-8) houses a large electron beam accelerator, two research reactors in two reactor facilities, an intense gamma (γ) irradiation facility (using cobalt-60 [^{60}Co] and cesium-137 [^{137}Cs]), and a hot cell facility. The large accelerator is HERMES-II.

The two research reactor facilities in Technical Area V are quite dissimilar: the Sandia Pulsed Reactor (SPR) is an unreflected, unmoderated assembly of enriched U; the Annular Core Research Reactor (ACRR) is 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 ^{41}Ar and xenon-133 (^{133}Xe). The reported amount of ^{41}Ar , released from both reactor areas, was computed from reactor operating parameters.

Remote Test Areas

SNL, Albuquerque, also has test areas outside of the five technical areas. These areas are located south of Technical Area 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 2-9 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 2-8. Technical Area V and Portion of Technical Area III (looking toward the southeast with the solar tower in the distance)

Figure 2-9. Main Burn Site at the Entrance of Coyote Canyon (looking west)

CHAPTER 3

COMPLIANCE SUMMARY

The environmental compliance activities at SNL, Albuquerque, are administered by the Environmental Programs Department, 3220. The department consists of three divisions: 3221, Hazardous Waste and Wastewater Division; 3222, Radioactive and Mixed Waste Division; and 3223, Environmental Impact and Restoration Division. This chapter summarizes all significant environmental compliance activities that occurred during 1990.

3.1 Compliance Status

Background

SNL, Albuquerque, must operate in compliance with environmental requirements established by federal and state statutes and regulations, executive orders, the DOE, and a State of New Mexico compliance order. SNL, Albuquerque, has been issued environmental permits in compliance with air emissions, water discharge, and solid waste disposal regulations. Compliance is enforced by the EPA, the State of New Mexico Environmental Improvement Division (NMED), Bernalillo County, and the City of Albuquerque (Section 3.3). The following summarizes the compliance status of SNL, Albuquerque, with the major environmental statutes.

Clean Air Act (CAA)--From the Albuquerque/Bernalillo County Air Quality Control Board, SNL, Albuquerque, periodically receives open-burning permits as well as topsoil disturbance permits for the control of airborne particulates during construction projects. SNL, Albuquerque, also complies with the National Emissions Standards for Hazardous Air Pollutants (NESHAP) for radionuclide air emissions (Subpart H), beryllium (Be) air emissions (Subpart C), and asbestos emissions (Subpart M). NESHAP radionuclide permits were obtained from EPA Region VI for three facilities located in Technical Area IV. SNL, Albuquerque, is committed to compliance with NESHAP for radiation and believes it will be able to verify compliance after a memo of understanding (MOU) between the EPA and DOE is signed which will clarify compliance requirements.

Clean Water Act (CWA)--SNL, Albuquerque, has eight wastewater discharge permits from the City of Albuquerque for sanitary sewer discharges and has resolved past minor violations of the permits with the City. Two surface impoundments are permitted and seventy-eight septic tanks are registered with the NMED. The NMED has ruled that several categories of low-volume and/or clean wastewater surface discharges require no discharge plans.

On April 18, 1990, a compliance schedule to correct pH and fluoride violations at the Microelectronics Development Laboratory (Permit 2069 G) was submitted to the City of Albuquerque. The corrective construction started on September 4, 1990 and was not complete by the end of 1990.

Comprehensive Environmental Response Compensation and Liability Act (CERCLA)--SNL, Albuquerque, negotiated with the other potentially responsible party involved in an offsite National Priorities List (NPL) location to reimburse the EPA for completed remedial actions. SNL, Albuquerque, has not been nominated for the NPL and does not expect to be in the future. Thus, all Environmental Restoration (ER) Program activities will be directed by a Resource Conservation and Recovery Act (RCRA) Corrective Action permit provision.

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)--EPA-registered pesticides are applied at SNL facilities. These pesticides are applied by an EPA-certified applicator. SNL, Albuquerque, retains records of the quantities and the types of pesticides that are used. Material Safety Data Sheets (MSDSs) are kept on each pesticide applied.

National Environmental Policy Act of 1969 (NEPA)--SNL, Albuquerque, is committed to the principles and practices underlying the NEPA. During 1990, SNL's NEPA compliance activities increased. New guidance procedures were initiated. The number of Action Description Memoranda (ADMs) increased by 100 percent and five environmental assessments (EAs) are under preparation for submittal to the DOE.

Resource Conservation and Recovery Act (RCRA)--SNL, Albuquerque, has an inactive chemical waste landfill (CWL) that is permitted under interim status. Minor RCRA violations from the 1990 annual RCRA inspection were resolved with the NMED. The RCRA Part B permit application is currently being revised to address issues identified in the Notice of Deficiency issued by NMED in late 1989. Part B modifications were submitted to the NMED in April 1991. A revised Part A permit application for hazardous waste was prepared and submitted to the NMED to include new toxicity characteristics leaching procedures (TCLPs). An interim status permit application was prepared for mixed waste (MW) storage and submitted to the state in August 1990.

In July 1990, the State of New Mexico adopted the Federal Underground Storage Tank (UST) regulations (40 CFR Part 280), basing the State's regulations on the age of the USTs rather than depth to groundwater. Eleven USTs went into noncompliance with the regulation change. By the end of 1990, ten of the eleven USTs were in compliance and the removal of the eleventh UST was in design. At present, 33 remaining underground storage tanks (USTs) are registered with the NMED.

A groundwater monitoring compliance order was issued by the State of New Mexico in May 1988. A compliance agreement between the State, the DOE, and SNL concerning actions to close out the compliance order was completed on December 29, 1989, and signed on January 11, 1990. The compliance agreement activities include: (1) revising the Sampling and Analysis Plan, (2) installing an additional monitor well, and (3) performing aquifer characterization. The first two activities were completed in 1990, and an aquifer test was conducted in early 1991. SNL is currently working on the final report which describes the aquifer characterization results.

The potential release sites identified by the ER Program will be evaluated and corrected as required by the RCRA 3004(u). Corrective Action for releases from Solid Waste Management Units (SWMUs) will be a part of the final RCRA Part B permit.

3.2 Current Issues and Actions

Mixed Waste Authority (RCRA)--In July 1990, the State of New Mexico received authority to regulate mixed waste (MW). Subsequently, SNL, Albuquerque submitted a Part A permit application for MW storage and treatment to the DOE. The DOE then submitted the Part A application to the NMED.

Chemical Waste Landfill (CWL)--The State of New Mexico issued a Notice of Violation for groundwater monitoring in 1989, and because the corrective actions 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 the DOE, SNL, and the NMED was signed on January 11, 1990, to close the compliance order. The compliance agreement includes (1) revising the Sampling and Analysis Plan, (2) installing a fourth downgradient monitoring well, and (3) characterizing the uppermost aquifer at the CWL. SNL, Albuquerque, is currently working toward fulfilling the compliance agreement requirements. The first two activities were completed in 1990. An annual groundwater monitoring report for the MWL was submitted on March 1, 1991. Resubmission of closure and postclosure of the CWL (May 1988) was completed in December 1990.

Low-Level Radioactive Waste (LLW) and Mixed Waste (MW) Disposal--SNL, Albuquerque, submitted an application to the Nevada Test Site (NTS) for disposal of both low-level radioactive waste (LLW) and MW in 1990. The application was reviewed by the DOE Nevada Operations Office (DOE/NVO) and is currently being revised by SNL, Albuquerque. Upon review and approval, all radioactive waste sent to the NTS must meet the waste acceptance criteria set forth in NVO-325, "Nevada Test Site Defense Waste Acceptance Criteria, Certification, and Transfer Requirements."

Land Disposal Restrictions (LDR)--In 1984, Congress amended the RCRA by imposing a schedule for restrictions on the land disposal of hazardous waste. These restrictions are referred to collectively as land disposal restrictions (LDRs). On May 8, 1990, the final LDRs were implemented, forbidding the land disposal of hazardous waste that does not meet prescribed treatment standards. The DOE has submitted a 2-yr national capacity variance for MW. The EPA also implemented the TCLPs in 1990. This analytical procedure and the associated regulatory changes are likely to increase the volume of RCRA-regulated waste generated by SNL, Albuquerque.

3.3 Environmental Permits

As part of its commitment to full compliance with all applicable environmental laws and regulations, SNL, Albuquerque, holds environmental permits which are governed by the following:

A. Air

The Clean Air Act (CAA) is enforced by the NMED and the joint Albuquerque/Bernalillo County Air Quality Control Board. They regulate the following:

1. National Ambient Air Quality Standards (NAAQS).
2. NESHAP, except for the radionuclide NESHAP, which is administrated by EPA Region VI (Dallas).
3. New Source Performance Standards (NSPS), which regulate atmospheric emissions from certain types of facilities.
4. Open Burning Permits.
5. Nitrogen dioxide emissions from gas-burning equipment.
6. Topsoil Disturbance Permits.

B. Water

1. The Clean Water Act (CWA) is administered through EPA Region VI. The act encompasses the following regulations:
 - a. National Pollutant Discharge Elimination System (NPDES), including pretreatment effluent guidelines and standards.
 - b. NPDES permit system for storm water runoff, which will require a permit for storm water discharges from industrial point sources.
 - c. Spill Prevention Control and Countermeasure (SPCC) Plan.
2. Sanitary sewer regulations are based on federal pretreatment standards and promulgated by the City of Albuquerque.
3. Surface and near-surface discharge regulations are administered by the NMED.
4. Groundwater monitoring regulations of the RCRA are also administered by the NMED.

C. Solid Waste

1. The Federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) regulates inactive waste sites and contains requirements for reporting hazardous material spills to the National Response Center (NRC).

2. The RCRA regulates generation, storage, treatment, recycling, transport, and disposal of hazardous and nonhazardous solid waste.
 - a. Chemical hazardous waste is regulated by the RCRA.
 - b. USTs for hazardous substances are regulated by the RCRA.
 - c. Documented waste minimization programs are required by the RCRA.
 - d. Land disposal restrictions and treatment standards for chemical waste applied by the RCRA, were fully implemented in 1990.
 - e. Radioactive MW is dually regulated by the Atomic Energy Act and RCRA.
3. The New Mexico Hazardous Waste Act allows the NMED to promulgate regulations equivalent to or more stringent than federal regulations to manage RCRA hazardous waste. The NMED received authority to regulate MW from the EPA in July 1990.
4. The New Mexico Solid Waste Management Regulations are equivalent to RCRA regulations in governing hazardous 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.

Summary of the Status of Current Permits and Other Notifications

Table 3-1 and Table 6-11 list the current environmental permits issued to SNL, Albuquerque, and those that are in the process of being reviewed by various agencies. Besides these environmental permits, notifications were made 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 Technical Areas IV and V. In 1990, 13 additional septic tanks were registered with the NMED, as required by the State of New Mexico discharge regulations.

Table 3-1. Summary of the Environmental Permits Issued or in Process

Permit No.	Type	Location	Agency	Expiration Date
2069 A	Wastewater	WW001	City of Albuquerque	09/30/93
2069 C-3	Wastewater	WW003	City of Albuquerque	09/30/93
2069 D-3	Wastewater	WW004	City of Albuquerque	09/30/93
2069 E-2	Wastewater	WW005a	City of Albuquerque	06/30/93
2069 F-2	Wastewater	WW006	City of Albuquerque	09/30/93
2069 G	Wastewater	WW007b	City of Albuquerque	07/31/91
2069 H	Wastewater	WW009c	City of Albuquerque	09/30/93
2069 I	Wastewater	WW008	City of Albuquerque	09/30/93
2069 J	Wastewater	WW010d	City of Albuquerque	In process
2069 K	Wastewater	WW011e	City of Albuquerque	In process
DP-530	Wastewater	Area IV Lagoons	State of New Mexico	03/08/93
NM5890110518	HW	958, 959	NMED (EPA)	In process

aWW005 is located at the Albuquerque Microelectronics Operation.
bWW007 is located at the Microelectronics Development Laboratory.
cWW009 is located at the Process Development Laboratory.
dWW010 is for the Explosives Component Facility (ECF).
eWW011 is for Technical Areas III and IV, and the Coyote Area sewer lines.

CHAPTER 4

ENVIRONMENTAL PROGRAMS INFORMATION

4.1 Environmental Restoration (ER) Program

The ER Program is a phased DOE program to identify, assess, and correct past spill, release, or disposal sites at all DOE Albuquerque Operations Office (DOE/AL) facilities including SNL, Albuquerque. 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/AL, 1987). After completion of the Installation Assessment, additional sites have been identified, and the number of potential release sites at Albuquerque now totals 150. The majority of the new sites identified were septic tanks and drainfields that may have received nondomestic wastes. It is anticipated that a few additional sites may be identified in the future.

The individual potential release sites identified in the Installation Assessment and subsequent evaluations are grouped together within geographic and event-related boundaries. These groups of release sites are called ADSs for budget development and program tracking purposes. Table B-1 identifies the specific potential release sites that are assigned within an individual task. Figure 4-1 shows a map with the approximate locations of the groups of sites assigned within each task.

The grouping of potential release sites will allow the assessment investigations to collect samples efficiently and cost effectively. The geographically derived 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 Program will be monitored by the New Mexico Environmental Improvement Division (NMED) as a requirement of the Resource Conservation and Recovery Act (RCRA) waste management operating permit. The authority to investigate all Solid Waste Management Units (SWMUs) is directed by Section 3004(u) of the Solid Waste Disposal Act (SWDA), which requires investigating all past and present SWMUs which may have a potential for release of hazardous constituent(s). Facilities seeking a RCRA permit are required to conduct these assessments and subsequent investigations if a release is found or suspected. Since the permit is expected to be issued in 1991, the ER Program began utilizing the guidance for RCRA Corrective Action evaluations. During 1990, assessment efforts continued at the chemical waste landfill (CWL) (ADS 1268), the mixed waste landfill (MWL) (ADS 1289), Technical Area II (ADS 1303), and Technical Areas III and V (1306A). One new groundwater monitor well was installed at the chemical waste landfill (see Chapter 7).

Figure 4-1. Task Map for Sandia National Laboratories, Albuquerque

4.2 Underground Storage Tanks (UST) Management and Spill Prevention Control Plan

4.2.1 UST Management

USTs at SNL, Albuquerque, are managed in accordance with the State of New Mexico UST Regulation. The New Mexico UST Regulation has been approved by the EPA in accordance with 40 CFR 281.

Precision tightness tests were performed on six USTs. USTs 9980-1 and 9925-1 were tested because they were identified to be in an area with groundwater <100 ft deep. USTs 888-4 and 888-5 were tested as a result of an inventory discrepancy. USTs 6587-2 and 6587-3 were tested because these tanks had been installed before 1965 and were required to have release detection. The method of release detection used on these two tanks was a combined method of precision tightness testing and inventory control. All USTs tested tight (leak rate less than 0.1 gal/hr), except for UST 6587-3, which was removed. Precision tightness tests are summarized in Appendix H, Table H-1.

Pressurized piping leak detection was added to USTs 876-2 and 876-3. The pressurized piping for USTs 6597-2, -3, -4, -5, -6, -7, and -8 was moved from underground to aboveground. A portion of the piping under a road was replaced with double contained pipe and sumps on both sides of the road.

Fifteen USTs were permanently closed by removal. The NMED was notified at least 30 days in advance of each removal. A NMED representative was present at each removal. Soil samples were taken from each removed UST excavation. The removed USTs and soil sample analytical results are listed in Appendix H, Table H-2. Releases determined by soil sample analytical results greater than 100 ppm were reported immediately to the NMED. Additional site assessments were performed by boring for USTs 6581-2, 6525-1, 6588-1, and 7570-1. The site assessments are summarized in Appendix H, Table H-3. The site assessments were accepted and no further remediation was required by the NMED.

Eight USTs that were incorrectly registered were deregistered in 1990. The deregistered USTs are listed in Appendix H, Table H-4. Thirty-three USTs were registered at the end of 1990, including four USTs that were previously unregistered. The registered USTs are listed in Appendix H, Table H-5.

4.2.2 Spill Prevention Control and Countermeasure (SPCC) Plan

Oil spill control activities at SNL, Albuquerque, are coordinated by the SPCC Plan. This plan was prepared in accordance with 40 CFR 112. The 3-yr review and rewrite of the SPCC Plan, completed in 1990, was sent to the DOE for approval.

Design and construction activities for 1990 included:

- Procured and distributed secondary containment pallets.

- Increased regulated storage units from 98 to 725 during the 3-yr update of the SPCC Plan.
- Initiated projects for the upgrade of 42 Priority I sites.
- Incorporated a more complete definition of the term "facility" into the updated SPCC Plan.

4.3 Waste Management Programs

4.3.1 Hazardous Waste and the Resource Conservation and Recovery Act (RCRA)

All RCRA-regulated wastes generated by SNL, Albuquerque, are transported offsite for disposal at EPA-permitted Treatment, Storage, and Disposal Facilities (TSDFs). The CWL, located in Technical Area III, was used for onsite disposal from 1962 through November 1985. A RCRA Closure Plan for the facility was submitted to the NMED in May 1988. Negotiations with the NMED on the closure continued during 1990. This landfill is no longer used for disposal of hazardous chemicals.

Chemical wastes generated by SNL, Albuquerque, research and development (R&D) activities are collected from generator locations, segregated according to the DOT hazard class, and transported to the Hazardous Waste Management Facility (HWMF) for storage. Packaged wastes are transported by EPA-permitted carriers to EPA-permitted TSDFs for disposal.

The EPA-permitted commercial transporters used to transport SNL hazardous waste during 1990 are listed in Table 4-1. The permitted TSDFs used for disposal of SNL hazardous wastes, along with the waste treatment methods employed at each facility, are listed in Table 4-2.

During calendar year 1990, 350,847 kg of chemical wastes were managed by SNL's hazardous waste management program, including 209,468 kg of RCRA-regulated hazardous waste and 141,380 kg of nonregulated industrial wastes. A total of 53,390 packages were collected from SNL generators in calendar year 1990, put into 6981 containers, and sent to TSDFs. The two-fold increase over the volume of chemical waste managed in calendar year 1989 was the result of a continuing laboratory-wide Environment, Safety and Health (ES&H) compliance improvement initiative conducted at SNL, Albuquerque, during calendar year 1990. As part of the ES&H initiative, a second orphan chemical program was conducted to identify any improperly stored and labeled chemicals stored outside at SNL, Albuquerque.

Permitting Activities

In 1990, the NMED conducted two formal hearings on the RCRA Permit B application by SNL, Albuquerque.

Table 4-1. SNL, Albuquerque, Hazardous Waste Transporters Used in CY90^a

-
1. ENSCO, Inc.
 2. Hazmat Environmental Group, Inc.
 3. Rinchem Company, Inc.
 4. Safety-Kleen Corp.
 5. Star Motor Freight Lines, Inc.
 6. Delta Environmental
 7. Custom Environmental Transport
 8. DART Trucking
 9. Technical Transporters, Inc.
 10. Mesa Oil
 11. Exide Corporation
-

^aIdentification of these companies is not necessarily an endorsement of their services by SNL, Albuquerque.

Table 4-2. SNL, Albuquerque, Waste Disposal Facilities Used in CY90^a

Disposal Facility	Treatment
1. BDT, Inc.	- Hydrolysis of Reactive Metals
2. Chemical Waste Management, Inc.	- Encapsulation, Landfill
3. Conservation Services, Inc.	- Non-RCRA Waste Landfill
4. ENSCO, Inc.	- Incineration
5. Hydrocarbon Recyclers, Inc.	- Recycling
6. Rollins Env. Svcs., Inc. (TX)	- Incineration
7. Rollins Env. Svcs., Inc. (LA)	- Incineration
8. Safety-Kleen Corp.	- Recycling
9. USPCI (Grassy Mt., VT)	- Treatment, Encapsulation, Landfill
10. Mesa Oil	- Recycling
11. RSR Corporation	- Recycling

^aIdentification of these companies is not necessarily an endorsement of their services by SNL.

4.3.2 Radioactive Waste

Onsite disposal of low-level waste (LLW) was terminated in December 1988 at SNL, Albuquerque, by order of the DOE. Presently, all newly generated LLW and mixed waste (MW) are being temporarily stored at generator sites or aboveground in transportation containers at the inactive Technical Area III disposal site. Approximately 1600 ft³ of waste was accepted at the Technical Area III storage site during 1990. The waste consisted primarily of fission product and uranium (U)-contaminated waste on a volumetric basis, and tritium (³H)-contaminated waste on an activity basis.

Base construction of the Radioactive and Mixed Waste Management Facility (RMWMF) was completed in 1990. This 6000-ft² facility will serve as a centralized packaging and storage facility for LLW and MW meeting the facility waste acceptance criteria (WAC) generated at SNL, Albuquerque. An Environmental Assessment (EA) was prepared for the RMWMF and submitted to the DOE in 1990, along with a request for approval of a Finding of No Significant Impact (FONSI). In addition, work commenced on a Safety Analysis Report for the RMWMF. Applications were also submitted for the offsite disposal of LLW and MW at the Nevada Test Site (NTS).

Ultimately, the transuranic (TRU) waste generated at SNL, Albuquerque, will be disposed of at the Waste Isolation Pilot Plant (WIPP). Currently, all generated TRU waste is packaged and stored at generator-controlled locations.

4.3.3 Mixed Waste

SNL, Albuquerque, has submitted a Part A permit application for MW storage and treatment to the DOE/AL for submittal by the DOE/AL to the State of New Mexico. Also, programs are currently being developed to meet the characterization requirements of the following regulations: RCRA Part 261 and Part 265, for MW storage; RCRA Part 268, restrictions on land disposal; DOE Order 5820.2A; and NVO-325, waste acceptance criteria for proper disposition of defense LLW and MW at the NTS. TRU (including mixed TRU) waste packaging and certification procedures are being developed to meet the Waste Isolation Pilot Program Waste Acceptance Criteria (WIPP WAC).

4.3.4 Special-Case (SC) Waste

SNL, Albuquerque, will perform a site-wide inventory of 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)

The scope of this identification and characterization effort is significantly larger than previous efforts to identify similar types of

wastes, which consisted mainly of identifying SC-GTCC wastes. The current scope includes existing and potential wastes in the above six SC waste categories and will provide information necessary for EPA permits. Potential waste is included because these wastes must be disposed of in the short-term future and may require development of special management and disposal strategies. Potential SC waste includes materials which are not now waste but may be declared waste (and meet the special-case criteria) in the future. Information on potential waste will be used to assist in long-term management planning.

4.3.5 Polychlorinated Biphenyl (PCB) Waste

SNL, Albuquerque, is in the process of phasing out PCB oils and equipment to the greatest extent possible. All electrical distribution equipment (transformers, capacitors, switches, etc.) found to contain PCBs in concentrations of ≥ 50 ppm have been either removed from service for disposal or retrofitted to contain < 50 ppm PCBs. According to the EPA definition, oils and equipment containing < 50 ppm PCBs are "non-PCB."

Nondistribution electrical devices, such as 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, Albuquerque. All but a few of these items were found to be free of PCBs. The items that do contain PCBs in concentrations ≥ 50 ppm are on an inventory list. The users of these items receive instructions on proper PCB disposal when the items are taken out of service.

4.3.6 Waste Minimization Program

A formal waste minimization and pollution prevention awareness program was initiated in 1989 to comply with both EPA regulations and DOE Order 5820.2A. It addresses nonhazardous, hazardous, mixed, and radioactive wastes.

A Waste Minimization Network (MinNet) was formed with representation from all waste-generating organizations. A major activity of the MinNet representatives will be development of Process Waste Assessments (PWAs) on which Waste Minimization Opportunity Assessments (WMOAs) will be based.

Preliminary guidance for the PWAs, based on DOE and EPA guidance, has been distributed to the MinNet representatives. Several prototype PWAs are currently under way. The guidance will be modified if any problems are identified in the prototyping.

The MinNet schedule calls for preliminary PWAs to be completed for all routine waste-generating operations by the end of fiscal year (FY) 1992. In addition, WMOAs will be complete for the top 25 percent of the waste streams by the same time.

In 1990, SNL's Hazardous Waste and Wastewater Division, 3221, conducted a Laboratory-wide Chemical Waste Procedures Training Program. Approximately 2000 employees of waste generators were trained in 1990.

The Chemical Exchange Program was started by Division 3221 in August 1989. The purpose of the program was preventing fresh, uncontaminated chemicals from being disposed of as chemical waste. This reduces the amount of new chemicals purchased by SNL and avoids costly disposal.

Since its inception, the Chemical Exchange Program has saved SNL an average of \$3388 per month. The most popular items are common solvents such as acetone, methanol, propanol, and toluene.

A plan to expand the program to "out-of-house" organizations, such as other government agencies and universities, is currently being studied. The potential liabilities of expansion are under consideration by the SNL Legal Department staff.

4.4 National Environmental Policy Act of 1969 (NEPA) Compliance Activities and Documentation in 1990

Background

The NEPA, the nation's most comprehensive legislative and public policy statement for environmental protection, applies to all agencies of the federal government. Executive and DOE orders, and DOE guidance apply NEPA and NEPA-related activities to SNL.

The Council on Environmental Quality (CEQ), created by the Executive Office of the President under the authority of NEPA, established regulations that were formally adopted by the DOE in August 1979. DOE NEPA guidelines were last published in full in the Federal Register on December 15, 1987. On November 2, 1990, the DOE proposed to revise its existing rule of 10 CFR 1021, entitled "Compliance with the National Environmental Policy Act." The proposed rule incorporates certain policy initiatives instituted by the Secretary of Energy.

Although only the DOE has authority to decide the appropriate level of NEPA documentation, SNL, Albuquerque, assists the DOE by drafting appropriate documentation--Environmental Checklists (ECs), Action Description Memoranda (ADMs), and Environmental Assessments (EAs) for DOE approval.

NEPA documents serve as vehicles for assessing potential environmental impacts of proposed federal actions and disclosing federal activities.

At SNL, Albuquerque, Division 3223 of the Environmental Programs Department carries out various NEPA-related activities, including consulting and training line organization personnel in NEPA compliance, coordinating document preparation, maintaining a corporate NEPA document file, and reviewing NEPA documents before their submittal to the DOE. These responsibilities are documented in the Sandia National Laboratories National Environmental Policy Act (NEPA) Program (PG470110).

1990 Activities

A second staff member was assigned fulltime to assist in maintaining NEPA compliance.

Following the Secretary of Energy's February 5, 1990, National Environmental Policy Act Notice (SEN-15-90) with directives intended to bring the DOE into full compliance with NEPA, an ES&H Bulletin was issued to all SNL employees to enhance understanding of SNL NEPA compliance responsibilities. Subsequently, several group meetings which included visits to remote sites--Livermore, California and Tonopah, Nevada--were held to better communicate SNL's NEPA responsibilities and to enhance NEPA compliance.

The SNL National Environmental Policy Act (NEPA) Program (PG470110) was completed in 1990 and approved in early 1991.

SNL worked with the DOE/AL to propose input for the DOE NEPA rulemaking. SNL also provided information to the DOE Office of Environmental Restoration and Waste Management for the "Environmental Restoration and Waste Management Programmatic Environmental Impact Statement."

SNL provided information on historic preservation to the DOE for compilation in a New Mexico Archaeological Council Section 196 Compliance Handbook. Several archaeological surveys were completed for SNL, Albuquerque, and the Tonopah Test Range (TTR).

A baseline environmental report, "Revision of Species Inventory Checklists for Sandia National Laboratories, Albuquerque, Bernalillo County, New Mexico," SAND90-7098, was published in October 1990.

Environmental Checklists (ECs)

ECs are used to document the use of a categorical exclusion (a category of actions for which neither an EA nor Environmental Impact Statement [EIS] is normally required).

Action Description Memoranda (ADMs)

ADMs are documents containing concise descriptions of proposed actions and brief discussions of relevant potential environmental issues. The DOE uses ADMs to determine the appropriate level of NEPA documentation for proposed actions.

In the past, ADMs were also used to document categorical exclusions and to support memo-to-file (MTF) reviews.

The MTF, established in 1980, was a unique DOE mechanism to justify not preparing EAs on clearly insignificant actions that, because of DOE's limited experience, had not yet been added to the DOE published list of categorical exclusions. The MTF system to exclude actions that are clearly insignificant but not specifically categorically excluded from detailed

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

Environmental Assessments (EAs)

An EA is a concise public document intended to provide, in brief, sufficient evidence and analysis for determining whether to prepare an EIS or a FONSI. The EA also aids in the compliance with NEPA when no EIS is required and facilitates preparation of an EIS when one is necessary.

Figure 4-2 describes the sequence for creating and reviewing NEPA documents.

EAs completed in 1990:

- The Integrated Materials Research Laboratory (IMRL)
- The Radioactive and Mixed Waste Management Facility (RMWMF)

EAs are now under way for these facilities:

- The Kauai Test Facility (KTF)
- The Explosives Components Facility (ECF)
- The Kauai Test Facility Two Experiment Rocket Campaign
- The Processing and Environmental Technology Laboratory (PETL)
- The Reactor Technology Center (RTC)
- The Modification and Operation of the Neutron Measurements Laboratory
- The Mine Detection by Energetic Photons

1990 continued the trend of a major increase in commitment to the principles and practices underlying the NEPA. New compliance and guidance procedures were developed and the number of assessment documents submitted to the DOE increased by more than 100 percent for the second year in a row.

Major construction projects that received NEPA approval were the IMRL and the Center for National Security and Arms Control (CNSAC).

The IMRL is intended to provide space for basic research in new electronic and structural materials, and applied research in new devices, components, and systems in a highly integrated environment. A FONSI was issued for the IMRL in January 1991.

The CNSAC will serve as a focus for national security, verification, and arms control activities. A MTF was issued for the CNSAC in October 1990.

The 91 ECs, ADMs, and EAs written or approved in 1990 and their approval status are listed in Appendix I.

Figure 4-2. Sequence for Creating and Reviewing NEPA Documents

4.5 Environmental Monitoring Programs

The Environmental Monitoring Program at SNL, Albuquerque, administered by the Environmental Programs Department, 3220, ensures compliance with pertinent environmental monitoring requirements. The Environmental Monitoring Program at SNL, Albuquerque, began in 1959. Its principal objective is to monitor radioactive effluents and associated environmental impacts resulting from SNL, Albuquerque, operations. The program has expanded greatly to encompass nonradioactive effluents monitoring, hazardous and radioactive waste site monitoring, and other environmental compliance activities. The growth of the program is in response to new environmental regulations as well as expanded SNL, Albuquerque, research programs.

The current environmental monitoring and compliance activities at SNL, Albuquerque, are described and documented in this report as required by DOE Order 5400.1, "General Environmental Protection Program." New programs which have been initiated within the past 3 yr include a remedial action program (Section 4.1), a groundwater monitoring program (Chapter 7), a greatly expanded wastewater sampling program (Section 6.1), a UST removal program (Section 4.2.1), and an improved spill prevention program (Section 4.2.2).

The radiological monitoring programs, which consist of environmental surveillance of soil, vegetation, surface water and well water, and external radiation measurements by thermoluminescent dosimeters (TLDs), are summarized in Chapter 5. The sampling locations are reviewed and modified, if necessary, each year to reflect any operational changes. The number of sampling stations increased significantly in 1990 to include more perimeter and community locations (see Section 5.2).

The nonradiological monitoring programs, including those for wastewater monitoring, groundwater monitoring, and selected air quality monitoring, are summarized in Chapters 6 and 7. The nonradiological monitoring results were submitted to regulatory agencies (e.g., State of New Mexico or City of Albuquerque) in accordance with the regulations and permit requirements.

4.6 Summary of 1990 Release and Environmental Incidence Reporting

Reporting Requirements

The four types of external release reporting requirements are (1) the Reportable Quantity (RQ) Release Reporting, (2) the Radioactive Effluent Information System/Onsite Discharge Information System (EIS/ODIS) Annual Report, (3) the NESHAP for Radionuclides (Subpart H) Annual Report, and (4) the Superfund Amendment and Reauthorization Act (SARA), Section 313, Toxic Chemical Release Report.

RQ Reporting

RQ reporting is required by the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) and the SARA, Title III. It

requires that any release to the environment in any 24-hr period of any pollutant or hazardous substance in a quantity that was equal to or greater than the RQ be reported to the National Response Center (NRC) immediately. However, if the release is "Federally permitted" under CERCLA Section 101(10)(H), it is exempted from CERCLA reporting. This reporting exemption also applied to any federally-permitted release under the SARA, Title III.

The Annual Summary of 1990 RQ Release Reporting for SNL, Albuquerque, is listed in Table 4-3. Most releases were caused by routine testing utilizing NIKE rocket motors, which contain lead acetate as part of the propellant. These tests were conducted under the approval of an ADM dated June 5, 1986. Other accidental releases are discussed individually in the Summary of 1990 Environmental Incidence Reporting in this section.

EIS/ODIS Reporting

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

The EIS/ODIS report for 1990 was submitted to the Waste Information System Branch, EG&G Idaho, Inc., in March 1991. It covered all routine and nonroutine releases from SNL, Albuquerque, operations. The Technical Area V reactors (the Annular Core Research Reactor [ACRR] and the Sandia Pulsed Reactor [SPR]) produced the major radioactive air releases. For 1990, SNL, Albuquerque, released a total of 5.3 Ci of argon-41 (^{41}Ar), 0.4 Ci of krypton-85 (^{85}Kr), ~0.2 Ci each of nitrogen-13 (^{13}N) and oxygen-15 (^{15}O), and 0.02 Ci of ^3H and other μCi levels of fission products. All of these releases were within regulatory limits.

National Emission Standards for Hazardous Air Pollutants (NESHAP) Reporting

The NESHAP Standards of 40 CFR 61, Subpart H, for radionuclides requires that an annual report from each DOE site must be submitted to the EPA by June 1 each year. The report should include the calculated maximum offsite dose impacts (effective dose equivalent) to the public and the associated input data for this calculation (40 CFR 61.94[c]).

The NESHAP Standards for radionuclides have been revised and promulgated on December 15, 1989. The annual report required under 40 CFR 61.94 for calendar year 1990 was made in accordance with the new standards and will be submitted to DOE and the EPA in June 1991.

The dose assessment for public exposure due to SNL, Albuquerque, operations in 1990 is discussed in detail in Section 5.3.

Toxic Chemical Release Reporting

The Toxic Chemical Release Report is required by the SARA, Title III, Section 313 (40 CFR 372). The SARA requires that facilities (within Standard Industrial Code [SIC] of 2239) report releases of listed toxic

Table 4-3. Annual Summary of 1990 Reportable Quantity (RQ) Release Reporting

Date	SNL, Albuquerque, Location	Material	Quantity	RQ	Release To	NRC Number	Report Date
05/30/90	Solar Tower	Sodium metal	12 lb	10 lb	Ground	24515	05/31/90
06/20/90	Thunder Range	Propellant	125-150 lb	100 lb	Ground	27863	06/22/90
06/27/90	Sled Track	Lead	3.73 lb	1.0 lb	Air	29216	07/03/90
06/29/90	Sled Track	Lead	3.73 lb	1.0 lb	Air	29215	07/03/90
07/27/90	Building 887	PCB	<6 lb	1.0 lb	Concrete Floor	33061	07/31/90
08/08/90	Sled Track	Lead	3.73 lb	1.0 lb	Air	34626	08/09/90

chemicals if the usage quantity is greater than 10,000 lb/yr for any of the listed chemicals. Although SNL, Albuquerque, operation is not categorized within the specified SIC code, it will report the toxic chemical releases to the DOE and EPA in June 1991.

Environmental Incidence Reporting

For calender year 1990, there was a total of 46 environmental incidents reported. Five environmental incident numbers were reserved but not used because a release did not occur. The unused environmental incident numbers are 90-012, 90-013, 90-014, 90-015, and 90-018.

Of the 46 environmental incidents reported, only 3 were reportable quantities.

- Environmental incident 90-025, which occurred on May 30, 1990, released about 10 to 12 gal of sodium (Na) metal but probably less. This incident was reported to the National Response Center, the local Emergency Planning Committee, and the State Emergency Response Commission on May 30, 1990.
- On June 20, 1990, environmental incident 90-030 involved the release of 125 to 150 lb of propellant to the environment. The incident was reported to the National Response Center on June 21, 1990. The propellant was burned. All burning was performed under the authorization of an emergency RCRA treatment permit.
- The third reportable environmental incident, 90-036, involved 1 to 2 qt of transformer oil with >500 ppm PCBs. The incident occurred on July 27, 1990, and was reported to the National Response Center on July 28, 1990.

CHAPTER 5

RADIOLOGICAL MONITORING

SNL, Albuquerque, has maintained an environmental radiological monitoring program since February 1959 (Burnett et al., 1961; Brewer, 1973 and 1974; Holley, 1975; Holley and Simmons, 1976; Simmons, 1977, 1978, 1979, and 1980; Millard, 1981; Millard et al., 1982, 1983, 1984, 1985, 1986, 1987, 1988, and 1989; and Hwang et al., 1990). The objectives of this surveillance program are to detect any potential releases and/or migration of radioactive material from SNL, Albuquerque, operations and to determine the resulting population exposures above normal background radiation levels. The radiological monitoring program also provides a check on the effectiveness of reactor radiological safety systems that are in effect at Technical Area V. Radioactive effluent discharges to the environment will be kept at as low as reasonably achievable (ALARA) levels by developing an ALARA program in accordance with DOE Order 5400.5 for environmental protection. Soil, vegetation, and water are monitored for radionuclides, primarily cesium-137 (^{137}Cs) and tritium (^3H). Gross alpha (α) and beta (β) screening analysis is performed on water samples. Soil samples are also analyzed for uranium (U). Sampling locations have been updated for the past 2 yr to include more boundary site and new operation facility locations.

In addition to the above elements of the radiological surveillance program, another program was begun in 1981 which uses thermoluminescent dosimeters (TLDs) to measure ambient levels of external penetrating radiation around each major facility. Before a facility's contribution to a population dose can be calculated (in the event of an unplanned release), a good estimate of ambient background with its inherent variability must be available. This can be achieved by setting up TLD stations around a new facility, such as the Radioactive and Mixed Waste Management Facility (RMWMF), before its operation. Natural background radiation levels are affected by many environmental factors, including ground cover and seasonal variations in precipitation and temperature.

5.1 Radioactive Effluent Monitoring

Few facilities within SNL, Albuquerque, routinely generate radioactive effluents or emissions. These facilities include the accelerators in Technical Area IV (e.g., HERMES-III Accelerator [HIIIA] and Particle Beam Fusion Accelerator-II [PBFA-II]), the reactor facilities in Technical Area V (e.g., the Annular Core Research Reactor [ACRR], Hot Cell Facility [HCF], and Sandia Pulsed Reactor [SPR]), and the Neutron Generator Test Facility in Technical Area II. Most of these releases are air emissions. A small quantity of radioactivity was released as liquid effluent from the ACRR cooling tank in the past.

Small quantities of ^3H , nitrogen-13 (^{13}N), oxygen-15 (^{15}O), argon-41 (^{41}Ar), krypton-85 (^{85}Kr), iodine-129 (^{129}I), and xenon-133 (^{133}Xe) emissions have been released to the atmosphere as a result of SNL, Albuquerque, operations. Because SNL's air emissions are so small, they are not measurable, and the release data are calculated based on theoretical parameters such as reactor operating power (in MJ) and the conversion factor for the activation products (in $\mu\text{Ci}/\text{MJ}$) for the generation of noble gases (e.g., ^{41}Ar) from the reactors in Technical Area V. Figure 5-1 summarizes these annual air emissions from 1975 to 1990.

Technical Area V Reactors

Noble gases and small quantities of ^3H and I gases are released from Technical Area V reactor stacks. High-efficiency particulate air (HEPA) filters are used to filter out 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 (γ) scans are performed for the filters to check for specific activities. Particulate or gaseous grab samples are collected periodically or as necessary for specific radionuclide analyses. These results were used as a confirmatory measure to verify the calculated values by theory.

The SPR reactor filter banks consist of a prefilter, HEPA filter, and 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 for γ -emitting particulates using a multichannel analyzer (MCA).

The ACRR reactor filter banks also consist of a prefilter, HEPA filter, and 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 (i.e., ^{41}Ar) with a 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 Area 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 results have been used for evaluation of the exhaust filtration system.

The isokinetic sampling equipment was installed and calibrated within the main stack of the HCF and the ACRR stack to collect air samples. Both of these air samplers became operational in 1991. Continuous effluent sampling and analyses are performed for gross α and β , noble gases, and I. These monitoring results will be reported in future environmental monitoring reports.

Figure 5-1. Summary of Atmospheric Releases of ^{41}Ar , ^3H , ^{85}Kr , and ^{133}Xe
From SNL, Albuquerque, Facilities Since 1975

5.2 Environmental Sampling and Surveillance

Monitoring Locations

Except for the addition of new stations, most of the environmental surveillance locations remain essentially the same from year to year (Figures 5-2 and 5-3). The selection of these sampling locations was based on all potential releases, past contamination areas, and other potential impacts to the offsite residents and the surrounding environment. New monitoring locations are added as necessary to monitor new facilities and operations. During 1990, a total of 14 new stations were added to the environmental surveillance network. Three new TLD stations, located at the north, east, and south radiation control fence lines surrounding Technical Area V, were added in 1987. Additional TLD stations were placed in Technical Area IV in 1988 to monitor radiation levels at the new facilities in Technical Area IV. Two new TLD stations were added in 1990 at the Radioactive and Mixed Waste Management Facility (RMWMF) in Technical Area III to collect background data before the new facility becomes operational. Groundwater samples for radiological analysis are collected from base wells in use at the time of sample collection, and the sampled wells may differ from one year to the next.

Table 5-1 lists the SNL, Albuquerque, environmental monitoring locations and specifies the type of sample collected (vegetation, water, and soil) or the presence of a TLD station for each location. There are a total of 65 sampling locations. Thirty-eight locations (labelled as S) are on the site at SNL, Albuquerque, twelve are on the KAFB boundaries (labelled as P), and fifteen are community or background sites (labelled as C), distributed in and around Albuquerque within an 80-km radius of SNL, Albuquerque. Water monitoring locations include ten KAFB wells and three surface water locations.

New 1990 sampling locations are stations 12, 45, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, and 62. Location 45 is at the RMWMF. This station will provide base line data for comparison with future data when the facility is operational. Station 62 is a community site near the eastern boundary of KAFB. Stations 51 through 57 are vegetation and soil sampling sites in Technical Areas III, IV, and V. The remaining stations (12 and 58 through 61) are perimeter locations for vegetation and soil sampling. Station 12 is at the northeastern boundary near the Manzano mountains, station 58 is at the North Base Housing complex, and station 59 is located at Zia Park at the southeastern corner of the housing area. All are nearby areas of population density on KAFB. Station 60, at the extreme western end of the base near Tijeras Arroyo, and station 61, at the western end of the Albuquerque International Airport, are remote perimeter stations.

Sample Collection and Analysis

Samples are gathered and stored in accordance with methods described in USDOE/EP-0023 (DOE, 1981). These procedures have been documented in an environmental monitoring manual (Millard, 1986) and sampling procedure (Procedure 90-07). Native vegetation (mostly grasses), soil, and water

Figure 5-2. Environmental Monitoring Locations in Technical Areas I-V and Kirtland Air Force Base (KAFB)

Figure 5-3. Community Monitoring Locations in the Albuquerque Area

Table 5-1. SNL, Albuquerque, Environmental Monitoring Locations and Sample Types for Radioactive Surveillance

Location Number	Location	Sample Description ^a	Type ^b
1	Pennsylvania Avenue	S	V, S, T
2 NW	Radioactive Waste Disposal Site NW	S	V, S, T
2 NE	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 ^c	McCormick Gate	P	V, S, T
6 ^c	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
9	Sedillo Hill, I-40, East of Albuquerque	C	V, S
10	Oak Flats	C	V, S, T
11	Isleta Pueblo, Rio Grande	C	V, S, T, W
12	NE Perimeter	P	V, S
13	Base Well 1	S	W
14	Base Well 2 (Not running)	S	W
15	Base Well 7	S	W
16 ^c	Four Hills	P	V, S, T
17	Base Well 14	S	W
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 ^d 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

^aS = SNL, Albuquerque; P = Perimeter of SNL, Albuquerque; and
C = Community.

^bV = Vegetation, S = Soil, W = Water, and T = TLD (thermoluminescent dosimeters).

^cTriplicate sampling sites: { 5, 6, 7, 16, and 60 for V and S.
32 for S only.
33 for W only.

^dABQ = Albuquerque.

Table 5-1. SNL, Albuquerque, Environmental Monitoring Locations and Sample Types for Radioactive Surveillance (Continued)

Location Number	Location	Sample Description ^a	Type ^b
30	ABQ ^d Fire Station 6, Griegos NW	C	T
31	Technical Area II Guard Gate	S	T
32 ^c	Technical Area II, Building 935	S	S
33 ^c	Coyote Spring	S	V,S,W
34	Lurance Canyon	S	V,S
35	Chemical Waste Disposal Site	S	V,S
36	Base Well 4 (Not running)	S	W
37	Base Well 8 (Not running)	S	W
38	Base Well Lift Station to Manzano (Not running)	S	W
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
44	Base Well 12	S	W
45	Technical Area III, RMWMF Site, NW Corner	S	V,S,T
46	Technical Area II, South Corner	S	T
47	Tijeras Canyon East of AIV	S	T
48	Tijeras Canyon Northeast of AIV	S	T
49	Near the proposed ECF Site	S	V,S
50	Base Well 11	S	W
51	Ditch, Technical Area V, N	S	V,S
52	Technical Area III, NE/6563	S	V,S
53	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

^aS = SNL, Albuquerque; P = Perimeter of SNL, Albuquerque; and
C = Community.

^bV = Vegetation, S = Soil, W = Water, and T = TLD (thermoluminescent dosimeters).

^cTriplicate sampling sites: { 5, 6, 7, 16, and 60 for V and S.
32 for S only.
33 for W only.

^dABQ = Albuquerque.

Table 5-1. SNL, Albuquerque, Environmental Monitoring Locations and Sample Types for Radioactive Surveillance (Concluded)

Location Number	Location	Sample Description ^a	Type ^b
60 ^c	Tijeras Arroyo	P	V,S
61	Airport (west end)	P	V,S
62	East Resident	C	V,S

^aS = SNL, Albuquerque; P = Perimeter of SNL, Albuquerque; and C = Community.

^bV = Vegetation, S = Soil, W = Water, and T = TLD (thermoluminescent dosimeters).

^cTriplicate sampling sites: { 5, 6, 7, 16, and 60 for V and S.
32 for S only.
33 for W only.

^dABQ = Albuquerque.

samples are collected annually at the end of the growing season. The analytical procedures are described in Appendix C. Detection limits for each type of radiochemical analysis are included in Appendix D. The 1990 samples were analyzed by International Technology Corporation Analytical Services (IT/AS) at Oak Ridge, Tennessee.

A total of 102 samples was submitted for ³H and γ spectrometry analysis in 1990. Fifty-three samples were analyzed for U. Twenty-eight water and filter samples were screened for gross α and β . Sampling frequencies are summarized in Table C-1.

Monitoring Results

Appendix F lists the monitoring results for all sample locations. Calculated summary data tables are included and discussed in the following paragraphs. Minimum detection level (MDL) values were set equal to the MDL in the calculation of mean ($\bar{x}$) values.

Vegetation

Table F-1 of Appendix F gives concentrations of ³H, ¹³⁷Cs, and potassium-40 (⁴⁰K) in vegetation (primarily grass species) for 28 SNL, Albuquerque, samples; 15 perimeter samples; and 6 community samples. Table 5-2 compares the mean concentrations and respective standard deviations, as well as ranges, for ³H and ¹³⁷Cs in vegetation for the three types of sampling locations. The ¹³⁷Cs concentrations ranged from <MDL values to 0.225 pCi/g. Twelve samples had above MDL ¹³⁷Cs. The ³H concentrations,

Table 5-2. Mean Concentrations of ^3H and ^{137}Cs in Vegetation

Nuclide	Location	Sample Size	Concentration		
			Mean ($\bar{x}$)	Standard Deviation (s)	Range
^3H (pCi/ml)	SNL	28	5.93	3.36	1.00 to 14.40
	Perimeter	15	6.94	8.20	2.40 to 35.90
	Community	6	4.21	0.44	3.80 to 4.93
	Total	49	6.03	7.00	1.00 to 35.90
^{137}Cs (pCi/g)	SNL	28	0.03	0.04	MDL ^a to 0.11
	Perimeter	14	<0.08	--	MDL to 0.06
	Community	6	<0.23	--	MDL to 0.23
	Total	48	0.02	0.04	MDL to 0.23

^aMDL = minimum detection level.

reported as pCi/ml of extracted water, ranged from <MDL to 14.4 pCi/ml. The reported ^{137}Cs concentrations (Table 5-2) are consistent with fallout levels. The ^{137}Cs concentrations at the three locations were not significantly different. The reported ^3H concentrations fall within the range of background ^3H levels for this area, except station 4 at the Isleta Reservation Gate and station 33 at Coyote Spring. Because soil and water levels of ^3H are not elevated at these locations, we are investigating the analytical methods used for these vegetation samples.

Soil

Concentrations of U, ^{137}Cs , and ^3H in soil samples are reported in Appendix F, Table F-2 for 32 SNL, Albuquerque, samples; 15 perimeter samples; and 6 community samples. Table 5-3 summarizes the mean concentrations, respective standard deviations, and range of values for radionuclides in each of the three types of sampling locations.

The U concentrations in soil ranged from 1.1 to 4.7 $\mu\text{g/g}$ and are consistent with natural background levels. Differences between locations were not statistically significant. The ^{137}Cs concentrations ranged from 0.02 to 0.96 pCi/g and appear to reflect fallout levels of ^{137}Cs . The ^3H concentrations ranged from <1.7 to 4.34 pCi/ml. Concentration differences between locations were not statistically significant.

Table 5-3. Mean Concentrations of U, ^{137}Cs , and ^3H in Soil Samples

Nuclide	Location	Sample Size	Concentration		
			Mean ($\bar{x}$)	Standard Deviation (s)	Range
U ($\mu\text{g/g}$)	SNL	31	2.8	0.9	1.2 to 4.66
	Perimeter	15	2.4	0.9	1.08 to 4.38
	Community	<u>6</u>	<u>3.3</u>	<u>0.7</u>	<u>1.9 to 3.97</u>
	Total	52	2.7	0.99	1.08 to 4.66
^{137}Cs (pCi/g)	SNL	31	0.27	0.17	0.028 to 0.59
	Perimeter	15	0.23	0.19	0.02 to 0.69
	Community	<u>6</u>	<u>0.42</u>	<u>0.35</u>	<u>0.06 to 0.96</u>
	Total	52	0.27	0.21	0.02 to 0.96
^3H (pCi/ml)	SNL	31	<1.96	--	<1.7 to 4.34
	Perimeter	15	<2.25	--	<1.7 to 4.1
	Community	<u>6</u>	<u><2.15</u>	<u>--</u>	<u><2.0 to <2.3</u>
	Total	52	<2.2	--	<1.7 to 4.34

Water

Concentrations of gross α , β , ^{137}Cs , ^3H , and U in water are reported for all sample locations in Appendix F, Tables F-3 and F-4, for both total (unfiltered) water (T) as well as filtered water (F) and associated suspended solids (S). Table F-3 lists concentrations in surface waters while Table F-4 lists concentrations in groundwater. Tables 5-4 and 5-5 summarize the water sampling results for both well and surface water locations.

Gross α , ^3H , and ^{137}Cs concentrations in water were all less than MDL values and are consistent with background levels and results of previous years.

TLD

Table 5-6 gives the summary of annual TLD dose estimates for the SNL, Albuquerque, perimeter, and community locations noted in Table 5-1. Data for individual stations are in Appendix F, Table F-5. These estimates include natural background plus facility contributions (if any). The mean annual doses for 12 community and 7 perimeter (SNL, Albuquerque, boundary)

Table 5-4. Mean Concentrations of Gross α , Gross β , U, ^{137}Cs , and ^3H in Surface Water (Streams)^a

Analysis (Units)	Total Water $\bar{x} \pm s^b$	Filtered Water $\bar{x} \pm s^b$	Suspended Solids $\bar{x} \pm s^b$
Gross α (10^{-9} $\mu\text{Ci/ml}$)	8.65 ± 2.49	<20.8	<1.0
Gross β (10^{-9} $\mu\text{Ci/ml}$)	22.1 ± 10.9	21.8 ± 13.1	0.65 ± 0.53
U (10^{-3} $\mu\text{g/ml}$)	7.27 ± 2.10	6.61 ± 2.06	c
^{137}Cs (10^{-9} $\mu\text{Ci/ml}$)	<0.01	<0.01	c
^3H (10^{-6} $\mu\text{Ci/ml}$)	<0.45	<0.45	c

^aSummary data for three surface water locations. Individual values are in Appendix F, Table F-3.

^bStandard deviation (s) values were not calculated for gross α , ^{137}Cs , and ^3H because the results are less than detection levels.

^cThe analysis was not performed for this sample medium (suspended solids).

locations were 92 mrem and 93 mrem, respectively. The mean annual dose at locations adjacent to onsite facilities was 95 mrem/yr. The mean annual external penetrating radiation dose for all location types was 93 mrem/yr, which is not statistically different from the values of perimeter and community locations (Table 5-6).

There was no significant difference between the three location types in annual dose estimates. The onsite annual dose estimate is higher than the perimeter and offsite area estimates primarily because of measurements taken at station 48. Station 48, on the radiation control fence northeast of Technical Area IV, collected significantly higher values than the other SNL, Albuquerque, locations. These higher values can be attributed to controlled outdoor operations from the HERMES-III accelerator in Technical Area IV. The mean annual dose from all other 14 onsite locations averaged 93 ± 6 mrem/yr.

5.3 Potential Dose Assessment for the Public

The EPA promulgated new revised National Emission Standards for Hazardous Air Pollutants (NESHAP) standards for radionuclides in December 1989. The

Table 5-5. Mean Concentrations of Gross α , Gross β , U, ^{137}Cs , and ^3H in Groundwater (Base Wells)^a

Analysis (Units)	Total Water $\bar{x} \pm s^b$	Filtered Water $\bar{x} \pm s^b$	Suspended Solids $\bar{x} \pm s^b$
Gross α (10^{-9} $\mu\text{Ci/ml}$)	<4.27	<6.15	<1.04
Gross β (10^{-9} $\mu\text{Ci/ml}$)	3.59 ± 0.76	4.5 ± 1.1	3.59 ± 0.90
U (10^{-3} $\mu\text{g/ml}$)	2.85 ± 1.35	2.8 ± 1.2	--
^{137}Cs (10^{-9} $\mu\text{Ci/ml}$)	<0.01	<0.01	--
^3H (10^{-6} $\mu\text{Ci/ml}$)	<0.45	<0.45	--

^aSummary data for five well water locations. Individual values are in Appendix F, Table F-4.

^bStandard deviation S values were not calculated for ^{137}Cs , ^3H , and gross α because the results are less than detection levels.

Table 5-6. Summary of TLD Measurements^a

Location	Sample Size	Mean Annual External Dose (mrem/yr)		
		$\bar{x}$	$s_{\bar{x}}$	Range
SNL (S)	15	95	11	82 to 130 ^b
Perimeter (P)	7	93	10	84 to 115
Community (C)	<u>12</u>	<u>92</u>	<u>10</u>	<u>77 to 113</u>
Total	34	93	11	77 to 130

^aDetailed results are listed in Appendix F, Table F-5.

^bResult of HERMES III outdoor shots at TLD station 48.

new standard (40 CFR Part 61, Subpart H) requires that a radiation dose be calculated for the maximally exposed individual actually located at a public access location including an office, school, or residence. The new standard redirects the maximally exposed location to where a member of the public actually lives or works as opposed to where an individual could possibly reside. Therefore, a comprehensive survey of all public access locations on KAFB was conducted during 1990 to address this new requirement. In addition, a determination has been made that all non-SNL personnel who work or live on KAFB are considered "members of the public" in accordance with the definition in DOE Order 5400.5 (published February 1990). Thus, the 1990 dose assessment was performed for all KAFB residences, schools, and other locations where non-SNL personnel work.

All dose calculations presented in this section were performed by using EPA-authorized AIRDOS-PC or AIRDOS-EPA computer codes. The results were compared with the new effective dose equivalent (EDE) limit of 10 mrem/yr for the maximally exposed individual. As indicated in Section 5.1, few facilities within SNL, Albuquerque, routinely generate radioactive emissions. Most of these facilities are located in Technical Areas IV and V, and most of the radioactive releases are air emissions. Therefore, air doses represent the main radiological dose impact to offsite locations from routine operations at SNL, Albuquerque.

Release Sources

A number of small releases of radiological material from various sources occurred at the SNL, Albuquerque, facility during 1990. Figure 5-4 depicts the locations of facilities at SNL, Albuquerque. Table 5-7 summarizes the kinds and quantities of radionuclides released during 1990. The more significant releases included 4.65 Ci of ^{41}Ar from the ACRR, 0.65 Ci of ^{41}Ar from the SPR, 0.4 Ci of ^{85}Kr , 0.02 Ci of ^3H , and 10 μCi of ^{129}I from the HCF. Releases of ^{13}N and ^{15}O from the HIIIA and (to a lesser extent) from the PBFA-II, while potentially significant, were of such short half-lives (10 min for ^{13}N and 2 min for ^{15}O) that decay during plume transport greatly reduced doses at most of the receptor locations considered. The other facility that released radiological material during 1990 was Division 2561 (Building 935) with an annual release of 160 μCi of ^3H . Releases from Technical Area I, including Buildings 803 and 805, were microcurie ranges of activation gases with very short half-lives and were not included in the calculation. The Large Melt Facility (Building 9935) had no release during 1990. The Robotic Facility (RF) and RMWMF (Building 6920) are new projects and have not become operational.

Two projects were evaluated during 1990 as a new source and a modification source. The new source is the SATURN project, located in Building 981, Technical Area IV. The experiment started on October 29, 1990 and ended November 9, 1990. The total amount of ^3H released was 4.75 μCi over the 10-day experiment (Spielman, 1990). The second project was the modification of HIIIA operations using depleted uranium (DU) as target material. The modified experiments produced small quantities of ^{41}Ar (0.016 Ci/yr) and other noble gases such as Kr, Xe, and I (in the microcurie range). The justification for exemption was documented in a memo-to-file (Hwang, 1990).

Figure 5-4. Facilities Locations at SNL, Albuquerque

Table 5-7. Summary of Radionuclide Releases for 1990

Facility	Radionuclide	Release (Ci/yr)
1. ACRR (Building 6588)	^{41}Ar	4.65
2. HCF (Building 6580)	^{41}Ar	6.0×10^{-4}
	^3H	0.02
	^{85}Kr	0.4
	^{129}I	1.0×10^{-5}
3. HIIIA (Building 970) and PBFA-II (Building 983)	^{13}N	0.16
	^{15}O	0.15
4. Division 2561 (Building 935)	^3H	1.6×10^{-4}
5. SPR/CX (Building 6590)	^{41}Ar	0.65

Public Receptors

As discussed earlier, the public receptor locations were updated in 1990 to include all non-SNL, Albuquerque, locations on KAFB. The new survey showed that there is an approximate population of 6600 residents in five KAFB housing areas. The nonresidential areas surveyed include the security offices, guard gates, credit unions, banks, restaurants, the KAFB landfill, golf course, KUMSC (U.S. Army Field Offices), 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 maximally exposed individual dose was calculated for all these public receptors on KAFB in addition to other locations outside the KAFB boundaries. The population doses were calculated for the KAFB residence (6636) and all other people living within a 50-mi radius of SNL, Albuquerque (571,677) from the 1990 population census data.

Meteorological Data

The meteorological data used in the dose calculations for SNL, Albuquerque, are from the Albuquerque International Airport, an average distance of approximately 3.5 mi from the SNL, Albuquerque, release locations. The joint frequency wind distribution is a 5-yr average, provided by the National Climatic Center (NCC) in Ashville, South Carolina. The Pasquill

stability class analysis was performed using the STAR Program provided by the NCC. The period of record is from 1960 to 1964 inclusive for Albuquerque, New Mexico. All of these meteorological data were updated in March 1990 before the final dose calculation was performed.

Demographic Data

The calculation of demographic data includes population, beef cattle, dairy cattle, and food crops used for human consumption. These four parameters were calculated for each of the AIRDOS-EPA gridded zones (total of 80). In general, demographic data is available by county, and the densities for population, beef cattle, dairy cattle, and food crops are calculated as the quotient of the most recent county data and the county land area. For 1990 calculations, the census (U.S. Department of Commerce, Bureau of the Census, 1991) and the 1988 agricultural data were utilized. These calculations were based on a total of 571,677 people, 32,335 beef cattle, 7290 dairy cattle, and $2.4 \times 10^8 \text{ m}^2$ of food crops from the surrounding 9 counties (LATA, 1991).

Results of the Dose Assessment

The EDEs for three receptor groups were calculated for the 1990 releases. The three groups are historical, boundary, and KAFB receptors. The seven historical locations (including the Northwest Base Housing, Four Hills, North Base Housing, DOE Complex, Mountain View, Tijeras, and Isleta Gate) have been calculated for the past year using the previously authorized AIRDOS codes. The 1990 results for these historical locations are presented in Table 5-8 for comparison purposes. Individual source contribution (from each of the five sources) as well as the total composite EDE are both presented. As shown in past calculations, the dose at Isleta Gate is again the highest impacted location among the seven historic locations.

The nine boundary locations including the Tijeras Arroyo, City Landfill, airport (west end), Northwest Base Housing (southeast corner), Eubank Gate, Northeast Resident, East Resident, Isleta Mine, and West Resident were calculated in a 1989 report by using the previously authorized AIRDOS codes. The new 1990 results are presented in Table 5-9 for comparison with the previous results. The dose at Tijeras Arroyo, consistent with the 1989 result, is the highest among the nine boundary locations. The nine boundary locations are demonstrated in Figure 5-5.

The dose calculations were also performed for 11 KAFB receptor locations including the KUMSC, KAFB Landfill, Raytheon/DNA, RINCHEM, golf shop, golf maintenance, riding club, Civil Engineer Research Facility (CERF), ITRI, Manzano area offices and SNL, Albuquerque, Technical Area I. Due to the shorter distance to the release sources for these KAFB receptors, the resulted doses (Table 5-10) are generally higher than those presented in Tables 5-8 and 5-9.

Table 5-8. Annual Effective Dose Equivalents (EDEs) to Historical Receptors

Public Receptor	Effective Dose Equivalent (mrem)					Total
	ACRR	SPR	HCF	HERMES IIIA	Division 2561	
1. Northwest Base Housing	9.8×10^{-5}	9.7×10^{-6}	1.5×10^{-6}	2.9×10^{-6}	7.2×10^{-8}	1.1×10^{-4}
2. Four Hills	6.9×10^{-5}	7.0×10^{-6}	1.1×10^{-6}	1.1×10^{-6}	1.7×10^{-8}	7.8×10^{-5}
3. North Base Housing	1.4×10^{-4}	1.3×10^{-5}	2.0×10^{-6}	7.7×10^{-6}	9.3×10^{-8}	2.4×10^{-4}
4. DOE Complex	1.8×10^{-4}	1.1×10^{-5}	1.6×10^{-6}	8.3×10^{-6}	9.3×10^{-8}	2.0×10^{-4}
5. Mountain View	2.3×10^{-5}	2.5×10^{-6}	5.9×10^{-7}	2.0×10^{-8}	2.9×10^{-9}	2.6×10^{-5}
6. Tijeras	1.0×10^{-5}	1.2×10^{-6}	3.7×10^{-7}	9.7×10^{-9}	1.9×10^{-9}	1.2×10^{-5}
7. Isleta Gate	2.4×10^{-4}	2.4×10^{-5}	3.4×10^{-6}	1.5×10^{-7}	1.1×10^{-8}	2.7×10^{-4}

Table 5-9. Annual Effective Dose Equivalents (EDEs) to Boundary Rec-ptor Locations

Public Receptor	Effective Dose Equivalent (mrem)					Division 2561	Total
	ACRR	SPR/CX	HCF	HERMES IIIA			
Tijeras Arroyo	2.3 x 10 ⁻⁴	2.1 x 10 ⁻⁵	2.5 x 10 ⁻⁶	2.2 x 10 ⁻⁷	1.9 x 10 ⁻⁸	2.5 x 10 ⁻⁴	
City Landfill	4.1 x 10 ⁻⁵	4.3 x 10 ⁻⁶	8.1 x 10 ⁻⁷	4.5 x 10 ⁻⁸	7.9 x 10 ⁻⁹	4.6 x 10 ⁻⁵	
Airport (west end)	1.7 x 10 ⁻⁴	1.7 x 10 ⁻⁵	2.5 x 10 ⁻⁶	1.6 x 10 ⁻⁶	3.7 x 10 ⁻⁸	1.9 x 10 ⁻⁴	
Southeast Corner of Northwest Base Housing	1.3 x 10 ⁻⁴	1.2 x 10 ⁻⁵	1.6 x 10 ⁻⁶	1.4 x 10 ⁻⁵	1.2 x 10 ⁻⁷	1.6 x 10 ⁻⁴	
Eubank Gate	1.6 x 10 ⁻⁴	1.5 x 10 ⁻⁵	2.1 x 10 ⁻⁶	4.4 x 10 ⁻⁶	4.8 x 10 ⁻⁸	1.8 x 10 ⁻⁴	
Northeast Resident	3.8 x 10 ⁻⁵	4.1 x 10 ⁻⁶	7.3 x 10 ⁻⁷	1.1 x 10 ⁻⁷	6.0 x 10 ⁻⁹	4.3 x 10 ⁻⁵	
East Resident	7.5 x 10 ⁻⁶	8.7 x 10 ⁻⁷	2.8 x 10 ⁻⁷	5.7 x 10 ⁻⁹	2.5 x 10 ⁻⁹	8.7 x 10 ⁻⁶	
Isleta Mine	1.2 x 10 ⁻⁵	1.4 x 10 ⁻⁶	4.2 x 10 ⁻⁷	4.3 x 10 ⁻⁹	3.1 x 10 ⁻⁹	1.4 x 10 ⁻⁵	
West Resident	2.1 x 10 ⁻⁵	2.2 x 10 ⁻⁶	5.0 x 10 ⁻⁷	1.7 x 10 ⁻⁸	5.3 x 10 ⁻⁹	2.4 x 10 ⁻⁵

Figure 5-5. Boundary Receptor Locations Around SNL, Albuquerque

Table 5-10. Annual Effective Dose Equivalents (EDEs) to KAFB Receptor Locations

NESHAP Receptor	Effective Dose Equivalent (mrem)					Division 2561	Total
	ACRR	SPR/CX	HCF	HERMES- IIIA			
KUMSC (U.S. Army Field Offices)	2.0 x 10 ⁻³	8.1 x 10 ⁻⁵	4.9 x 10 ⁻⁶	2.9 x 10 ⁻⁶	2.8 x 10 ⁻⁸	2.1 x 10 ⁻³	
KAFB Landfill	6.3 x 10 ⁻⁴	4.4 x 10 ⁻⁵	4.1 x 10 ⁻⁶	2.1 x 10 ⁻⁵	1.8 x 10 ⁻⁷	7.0 x 10 ⁻⁴	
Raytheon/DNA	2.0 x 10 ⁻⁴	1.7 x 10 ⁻⁵	1.8 x 10 ⁻⁶	5.0 x 10 ⁻⁵	2.5 x 10 ⁻⁷	2.7 x 10 ⁻⁴	
RINCHEM	2.0 x 10 ⁻⁴	1.7 x 10 ⁻⁵	1.8 x 10 ⁻⁶	3.3 x 10 ⁻⁵	6.9 x 10 ⁻⁷	2.5 x 10 ⁻⁴	
Golf Shop	3.0 x 10 ⁻⁴	2.8 x 10 ⁻⁵	2.9 x 10 ⁻⁶	1.0 x 10 ⁻⁵	5.2 x 10 ⁻⁸	3.4 x 10 ⁻⁴	
Golf Maintenance Area	6.3 x 10 ⁻⁴	4.4 x 10 ⁻⁵	4.1 x 10 ⁻⁶	1.0 x 10 ⁻⁵	5.2 x 10 ⁻⁸	6.8 x 10 ⁻⁴	
Riding Club	6.9 x 10 ⁻⁴	4.4 x 10 ⁻⁵	5.0 x 10 ⁻⁶	1.0 x 10 ⁻⁵	5.2 x 10 ⁻⁸	7.5 x 10 ⁻⁴	
CERF (USAF)	1.0 x 10 ⁻⁴	9.9 x 10 ⁻⁶	1.2 x 10 ⁻⁶	1.0 x 10 ⁻⁵	5.2 x 10 ⁻⁸	1.2 x 10 ⁻⁴	
Lovelace Research Center	1.0 x 10 ⁻⁴	1.1 x 10 ⁻⁵	1.4 x 10 ⁻⁶	1.0 x 10 ⁻⁵	5.2 x 10 ⁻⁸	1.2 x 10 ⁻⁴	
Manzano Offices	3.0 x 10 ⁻⁴	2.3 x 10 ⁻⁵	2.3 x 10 ⁻⁶	8.4 x 10 ⁻⁷	9.9 x 10 ⁻⁹	3.2 x 10 ⁻⁴	
SNL, Albuquerque, Technical Area I	2.0 x 10 ⁻⁴	1.7 x 10 ⁻⁵	1.8 x 10 ⁻⁶	3.3 x 10 ⁻⁵	6.9 x 10 ⁻⁷	2.5 x 10 ⁻⁴	

The composite dose analysis found a maximum exposure location for the NESHAP compliance at the KUMSC receptor site, located approximately 1610 m northwest of SNL, Albuquerque, Technical Area V. The EDE to the maximally exposed individual at the KUMSC was calculated to be 2.1×10^{-3} mrem due principally to an external air submersion exposure to ^{41}Ar . The ^{41}Ar dose represents 95 percent of the total EDE. Most of the ^{41}Ar dose (95.6 percent) 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 5-10).

Population Dose at KAFB

A population dose was calculated for the KAFB public receptors. There are five major base housing areas on the KAFB. Table 5-11 presents the distances and direction of the base housing compounds from the ACRR, SPR, and HCF facilities and the associated population distribution. A 100-percent occupancy of all the units was assumed yielding a total KAFB population of 6636.

Table 5-12 summarizes the EDE and population exposure to the KAFB receptors. The analysis found a maximum individual exposure at the Northwest Base Housing receptor (Area D). An EDE of 1.32×10^{-4} mrem/yr was calculated for this location primarily as a result of ^{41}Ar air submersion. The composite population dose of 7.9×10^{-1} mrem EDE was calculated for all KAFB housing areas resulting from all SNL 1990 releases.

Population Dose for the 50-mi Radius

A population dose was calculated for the 50-mi radius surrounding SNL, Albuquerque, using a single, common grid analysis for all SNL, Albuquerque, sources. Because the analysis area is so large, the relatively small distances between sources will have a minimal impact on the resulting population dose. The AIRDOS-EPA computer code was again used for exposure estimates. Demographic data based on 1990 population data and 1988 agricultural data were employed. These calculations were based on a total of 571,677 people, 32,335 beef cattle, 7290 dairy cattle, and 2.4×10^8 m² of food crops from the 9 counties included in the study area. The population dose was calculated to be 2.6×10^{-2} man-rem EDE for the surrounding population residing outside of KAFB from 1990 SNL, Albuquerque, operations. This dose results from an external exposure (air submersion) to ^{41}Ar (96 percent) and ingestion of ^{129}I (2.3 percent).

5.4 Summary of the 1990 Offsite Dose Impacts

During 1990, the NESHAP maximally exposed individual was determined to be at the KUMSC facility site, approximately 1610 m northwest of SNL, Albuquerque, Technical Area V. The maximum EDE at this location was calculated to be 2.0×10^{-3} mrem. In addition, a population dose to the public was calculated to be 2.6×10^{-2} man-rem to the 571,677 people living within a 50-mi radius of SNL, Albuquerque. The population dose to the 6636 residents of KAFB was calculated to be 0.79 man-rem. The population dose at KAFB is disproportionately greater than the dose to the much larger

Table 5-11. Residential Population Distribution at KAFB

Residential Area Receptor	AIRDOS-EPA Sector	Distance from ACRR/SPR/HCF (km)	Population
Base Housing North (Area A)	NNW	7.36	831
Base Housing North (Area B)	N	7.05	1475
Base Housing Northwest (Area C)	NNW	6.44	1960
Base Housing Northwest (Area D)	NNW	6.38	250
Base Housing Northwest (Area E)	NW	9.04	<u>1816</u>
Total			6636

Table 5-12. Annual Population Dose to KAFB Residents

Public Receptor	Individual Effective Dose Equivalent (mrem)	Population Dose (man-rem)
Base Housing North (Area A)	1.02×10^{-4}	8.5×10^{-2}
Base Housing North (Area B)	1.26×10^{-4}	1.9×10^{-1}
Base Housing Northwest (Area C)	1.30×10^{-4}	2.6×10^{-1}
Base Housing Northwest (Area D)	1.32×10^{-4}	3.3×10^{-2}
Base Housing Northwest (Area E)	1.21×10^{-4}	<u>2.2×10^{-1}</u>
Total		7.9×10^{-1}

regional population because of the close proximity to the SNL, Albuquerque, release locations. The cumulative total population dose, including the KAFB population and the 50-mi-radius population, was 0.82 man-rem from all 1990 releases. The results are summarized in Table 5-13.

Table 5-13. Summary of Offsite Dose Impacts in Comparison to NESHAP Standards and Natural Background Radiation

Parameters	1990 SNL, Albuquerque, Calculated Dose	NESHAP Standard	Natural Background Radiation in Albuquerque Area
Maximum Effective Dose Equivalent (mrem/yr)	0.002	10	93 ^a
Annual Population Dose ^b (person-rem)	0.82	--	>57,000

^aBased on the average of community TLD values (dose from external penetrating radiation).

^bDose over the population in 50-mi radius surrounding SNL, Albuquerque, including the population on KAFB.

CHAPTER 6

NONRADIOLOGICAL MONITORING

6.1 Wastewater, Storm Water, and Surface Discharge Programs

6.1.1 Wastewater Programs

Discharges to Publicly-Owned Treatment Works (POTW)

SNL, Albuquerque, contains over 15 mi of sewer lines interconnected with those of Kirtland Air Force Base (KAFB). SNL, Albuquerque, has five categorical pretreatment operations and three general wastewater streams discharging to the City of Albuquerque's POTW.

Discharges by SNL, Albuquerque, to POTW are regulated by the City's 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 the EPA in accordance with the Clean Water Act (CWA) (as amended).

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

In early 1990, SNL, Albuquerque, operated six wastewater discharge permits issued by the City of Albuquerque. Permit 2069I was granted to SNL, Albuquerque, on March 26, 1990. Permit 2069H became effective on September 4, 1990. Five of the eight permits contained provisions for meeting categorical limits established by the EPA. The permits in Table 6-1 that have 40 CFR designation in the "Issuing Agency" column contain EPA categorical discharge limitations.

Further details concerning the wastewater sampling program are found in Appendices B, C, D, E, and F. Tables 6-2 and 6-3 and Figure 6-1 describe the wastewater sampling locations and brief characteristics of each. Appendix C (Tables C-2 through C-8) describes sampling procedures and permit limits for individual sampling stations. Tables C-9 through C-16 summarize total monthly pH excursions which exceed specified permit pH limits, dates of sample collection, and sampling frequency. Table D-2 of Appendix D provides analytical methods, quality control (QC) acceptance criteria, and detection limits for individual parameters. Appendix E briefly describes the wastewater sampling QA data. Appendix F (Tables F-7 through F-14) provides the analyses results of wastewater samples.

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Table 6-1. SNL, Albuquerque, Wastewater Discharge Permits

Permit Number	Station Manhole	Waste Stream Process	Issuing Agency	Permit Expiration
2069A-2	WW001	General	City of Albuquerque/ I.C. -7391 ^a	9/30/93
2069C-3	WW003	Electroplating/ Printed Circuit Board	City of Albuquerque/ 40 CFR 413.84	9/30/93
2069D-2	WW004	Metal Finishing	City of Albuquerque/ 40 CFR 433.A15	9/30/93
2069E-2	WW005	Electronics	City of Albuquerque/ 40 CFR 469.A	9/30/93
2069F-2	WW006	General	City of Albuquerque/ I.C.-3674, 3694, and 9711	9/30/93
2069G	WW007	Microelectronics Development Laboratory	City of Albuquerque/ 40 CFR 469.A	9/30/93
2069H	WW009	Process Development Laboratory	City of Albuquerque/ 40 CFR 433	9/30/93
2069I	WW008	General	City of Albuquerque/ I.C.-3674, 3679, and 9711	9/30/93

^aI.C. = Industrial Classification.

Table 6-2. SNL, Albuquerque, Wastewater Sample Locations

Permit Number	Station Manhole	Location	Average Flow (gpd) ^a
2069A	WW001	South Technical Area IV Tijeras Arroyo	28,849
2069C	WW003	Technical Area I Building 841 SW	15,000 ^b
2069D	WW004	Technical Area I Building 841 SE	39,154
2069E	WW005	Technical Area I Building 870 SW	91,476
2069F	WW006	East of KAFB Lagoons	514,123
2069G	WW007	Technical Area I Building 858 Basement	110,939
2069H	WW009	Technical Area I Building 878 Basement	3,659
2069I	WW008	South Technical Area I Tijeras Arroyo	25,576

^agpd = Gallons/day.^bEstimated.

Table 6-3. Summary of Characteristics for SNL, Albuquerque,
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
WW003	None	Isco 2700 Sampler
WW004	2-in. Parshall	Isco 3210 Flow Meter Isco 2700R Sampler Leeds and Northrop pH Analyzer System
WW005	3-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

Figure 6-1. Wastewater Discharge Sampling Locations

Compliance Summary

This section addresses those instances in which the monitoring results did not comply with the permit limits described in Appendix C, Tables C-4 through C-18.

Permit 2069A--Permit 2069A is a general wastewater discharge permit for wastewater discharges from a portion of Technical Area I, SNL, Albuquerque.

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 1990. Dates of pH excursions for 1 hr or less, total time for pH out of permit limits, dates of sample collection, and sampling frequencies for each month for Permit 2069A are summarized in Appendix C, Table C-9.

Permit 2069C--Permit 2069C covers discharges from the categorical, regulated, printed circuit activity in Building 841, Technical Area I, SNL, Albuquerque.

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 1990. Dates of pH excursions for 1 hr or less, total time for pH out of permit limits, dates of sample collection, and sampling frequencies for each month for Permit 2069C are summarized in Appendix C, Table C-10.

Permit 2069D--Permit 2069D covers discharges from the categorical regulated metal-plating activity in Building 841, Technical Area I, SNL, Albuquerque.

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 1990. Dates of pH excursions for 1 hr or less, total time for pH out of permit limits, dates of sample collection, and sampling frequencies for each month for Permit 2069D are summarized in Appendix C, Table C-11.

Permit 2069E--Permit 2069E covers discharges from the categorical regulated semiconductor production activity conducted by Allied Signal Corporation,

Albuquerque Microelectronics Operations (AMO) in Building 870, Technical Area I, SNL, Albuquerque.

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 1990, with the exception of two times in November. These violations are tabulated in Table 6-4. Dates of pH excursions, total time for pH out of permit limits, dates of sample collection, and sampling frequencies for each month for Permit 2069E are summarized in, Appendix C, Table C-12.

Table 6-4. Summary of pH Violations for Permit 2069E,
Station WW005, During 1990

Date	pH Limit/ pH Value	Duration (hr)	Monthly Total (hr)
November 20	<5/5.0	2.5	3.0
November 24	<5/5.0	2.0	4.5

Permit 2069F--Permit 2069F is a general wastewater discharge permit for wastewater discharges from a portion of Technical Area I, SNL, Albuquerque, and some KAFB facilities.

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

pH

pH excursions of wastewater discharges above the permitted pH limits for greater than 1 hr occurred in May and August of 1990. These violations are tabulated in Table 6-5. Dates of pH excursions, total time for pH out of permit limits, dates of sample collection, and sampling frequencies for each month for Permit 2069F are summarized in Appendix C, Table C-13.

Table 6-5. Summary of pH Violations for Permit 2069F,
Station WW006, During 1990

Date	pH Limit/ pH Value	Duration (hr)	Monthly Total (hr)
May 25	<5/5.0	3.0	3.0
August 10	<5/4.9	1.0	
11	<5/4.6	1.5	
12	<5/3.0	9.0	
13	<5/4.8	2.0	14.0

Permit 2069G--Permit 2069G covers discharges from the categorical, regulated, semiconductor production activity in Building 858, Technical Area I, SNL, Albuquerque.

Analytical Results:

Fluoride

Fluoride concentrations exceeded specified permit values seven times during 1990. Dates of collection, sample types, sample concentration, and permit limit values are summarized in Table 6-6.

Table 6-6. Summary of Fluoride Violations for Permit 2069G,
Station WW007, During 1990

Sample Date/Type	Concentration (mg/l)	Permit Limit (mg/l)
February 13, 1990: 24 hr	91.0	45
15, 1990: 24 hr	74.0	45
16, 1990: 24 hr	90.0	45
17, 1990: 24 hr	98.0	45
February: 4-Day Average	66.0	30
March 29, 1990: 24 hr	60.0	45
August 16, 1990: 24 hr	64.0	45
December 11, 1990: 24 hr	75.0	45

February was the only month in which the 4-day composite limit was exceeded. The cause of excess fluoride was determined to be from discharges of certain processes. It was determined that strict administrative controls and additional pretreatment were necessary to prevent further violations. Modifications and upgrades to the pretreatment system have been installed at Building 858 to the minimum detectable level (MDL) with completion at the end of 1990. No other constituents were found to exceed the permitted analyte concentrations limits.

pH

The pH limits were changed from 5 and 11 to 6 and 9 on March 26, 1990. Because equipment in place was designed for the previous pH limits of 5 and 11, numerous violations occurred at this time. To reduce the reporting of pH excursions, pH limit reporting values were changed to 5 and 11 until modifications to pH neutralization equipment could be installed. pH violations which exceeded permit limits for 1 hr are summarized in Table 6-7. Dates of pH excursions, total excursion times for permit specified pH limits, dates of sample collection, and sampling frequencies for each month for Permit 2069G are summarized in Appendix C, Table C-14.

Table 6-7. Summary of pH Violations for Permit 2069G, Station WW007, During 1990

Date	pH Limit/ pH Value	Duration (hr)	Monthly Total (hr)
October 28	<6/3.5	4.0	12.33
November 10	<6/3.5	2.2	
12	<6/5.7	5.25	
13	<6/5.8	1.75	17.83

Permit 2069H--Permit 2069H covers discharges from the categorical, regulated, printed circuit activity at the Process Development Laboratory (PDL) in Building 878, Technical Area I, SNL, Albuquerque.

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

pH

Operations for Permit 2069H did not begin until December 1990 when continuous pH and flow monitoring, and a sampling program were

initiated. No pH excursion of wastewater discharges above the permitted pH limits occurred for greater than 1 hr in December 1990. Dates of pH excursions for less than 1 hr, total time for pH out of permit limits, dates of sample collection, and sampling frequencies for each month for Permit 2069H are summarized in Appendix C, Table C-15.

Permit 2069I--Permit 2069I is a general wastewater discharge permit for wastewater discharges from Technical Areas I, II, and IV, SNL, Albuquerque.

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 during 1990. Dates for pH excursions for 1 hr or less, total time for pH out of permit limits, dates of sample collection, and sampling frequencies for each month for Permit 2069I are summarized in Appendix C, Table C-16.

Annual Sampling

Annual sampling for all parameters is specified in wastewater discharge permits of SNL, Albuquerque (Appendix C, Tables C-4 through C-8). Annual 24-hr composite sampling specified in wastewater discharge permits was conducted in June 1990. Sample collection was performed by International Technology Corporation (IT) personnel. The analytical results for all analytes were less than the concentration limits set by the wastewater discharge permits. Results for annual sampling are included in Appendix C, Tables C-17 and C-18.

Discharge to Septic Systems

In New Mexico, discharge from septic systems is regulated by the Liquid Waste Disposal Regulations and the New Mexico Water Quality Control Commission Regulations. These regulations are administered by the New Mexico Environmental Improvement Division (NMED).

On May 9, 1989, registration forms for a total of 65 septic systems were sent to the NMED in two separate letters. Eight additional septic systems were registered by letter, dated July 5, 1990. The registered septic systems are listed in Appendix H, Table H-6.

6.1.2 Storm Water Program

An amendment to the regulations enforcing the CWA was promulgated on November 16, 1990, in the Federal Register. This amendment implements Section 402[p] of the CWA added by Section 405 of the Water Quality Act of 1987. This amendment modified 40 CFR Parts 122 through 124. This modification requires the EPA to regulate storm water discharges associated with industrial activities. Industrial activities covered by these new

regulations included Standard Industrial Classification (SIC) Codes 21 through 39. SNL, Albuquerque, has several activities that may fall under these SIC codes. These include the Microelectronics Development Laboratory, Process Development Laboratory, Albuquerque Microelectronics Operation, and the plating shops in Building 840.

There are also requirements for permitting of new construction activities that disturb 5 acres or more and for permitting of hazardous waste management facilities. SNL has ongoing construction activities that exceed this limit and a hazardous waste management facility (HWMF) that probably will require National Pollutant Discharge Elimination System permit applications. In New Mexico, these permits will be reviewed and approved by the EPA with State of New Mexico review and concurrence.

6.1.3 Surface Discharge Programs

Nonsanitary discharges to surface impoundments for SNL, Albuquerque, are under the authority of the New Mexico Water Quality Control Commission (NMWQCC) Regulations as implemented by the NMED Ground Water Bureau.

Storm water from oil storage tank areas and building basements associated with the SNL, Albuquerque, Pulsed Power Development Facilities in Technical Area IV are collected in two lagoons. Discharge Plan DP-530 was approved for these discharges in March 1988 and amended in December 1989. The approved discharge plan, as amended, requires quarterly measurement of water levels and semiannual sampling and analysis. See Table 6-8 for a description of the parameters and sample concentration limits specified in Discharge Plan DP-530. During 1990, water-level measurements were taken in January, April, July, and October. Sampling was done in January and July. Reports containing water-level measurements and monitoring results were submitted in January and July to the NMED Ground Water Bureau. See Tables 6-9 and 6-10 for water-level measurements and analytical results.

Discharge Plan DP-530 does not list any limits for sample parameters. Total dissolved solids (TDS) and chloride ion (Cl^-) exceeded the New Mexico State Water Quality Control Commission Standard on several occasions as a result of ion concentration by evaporation in lined Lagoon I. Lagoon II has no liner. No organic compounds were detected in the lagoon samples in 1990.

6.2 Air Quality Management

6.2.1 Air Quality Regulations

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

- Ambient Air Quality Standard (regulates As, Cu, Zn, Be, CO, HS, Pb, NO_x , SO_2 , total suspended particulates [TSP], hydrocarbons, soiling index, and total reduced sulfur)
- AQCR 3: Open Burning

Table 6-8. Sampling Parameters Specified by Discharge Plan DP-530 and New Mexico Water Quality Control Commission Standards

Parameter	New Mexico Water Quality Control Commission Standard
Purgeable and Extractable Organics per NMWQCC Regulations	Sections 1-101.UU and 3-103.A
Total Dissolved Solids	1000 mg/l
<u>Major Anions</u>	
Chloride	250 mg/l
Sulfate	600 mg/l
Alkalinity	None specified
<u>Major Cations</u>	
Sodium	None specified
Calcium	None specified
Magnesium	None specified
Potassium	None specified

Table 6-9. 1990 Water Level Measurements for Lagoons I and II, Technical Area IV, SNL, Albuquerque

Date	<u>Lagoon I</u>		<u>Lagoon II</u>	
	Water Level	Volume (gal)	Water Level	Volume (gal)
01/24/90	4 ft 9 in.	127,600	0 ft 0 in.	0
04/04/90	5 ft 2 in.	139,200	1 ft 0 in.	14,960
07/24/90	5 ft 4 in.	142,100	3 ft 0 in.	44,880
10/08/90	3 ft 7 in.	92,800	3 ft 6 in.	59,840

Table 6-10. 1990 Major Cations, Anions, and TDS for Lagoons I and II, Technical Area IV, SNL, Albuquerque^a

NMWQCC Standard	TDS ^b 1000	Cl ⁻ 250	SO ₄ ⁻² 600	Alkalinity ^c	Na ⁺	Ca ⁺²	Mg ⁺²	K ⁺
<u>Sampling Period:</u>								
<u>Lagoon I</u>								
01/90	1200	610	46	180	365	49	19	29
07/90	1060	470	5.4	160	314	35	17	26
<u>Lagoon II</u>								
01/90	d	d	d	d	d	d	d	d
07/90	250	12	40	110	26	38	7.9	4.4

^aAll results are in mg/l unless otherwise noted.

^bTDS = Total Dissolved Solids.

^cThere are no listed standards for the alkalinity, Na⁺, Ca⁺², Mg⁺², and K⁺ compounds in either Section 3-103 or I-101.UU of the NMWQCC Regulations.

^dLagoon II was dry during the indicated sampling period. No samples were taken for analysis.

- AQCR 5: Visible Air Contaminants
- AQCR 8: Airborne Particulate Matter (PM)
- AQCR 11: Volatile Organic Compounds (VOCs)
- AQCR 15 to 18: Process equipment emissions (NO_x, SO₂, and particulates) for oil- and gas-burning equipment
- AQCR 20: Authority-to-Construct Permit
- AQCR 22: Registration of Air Contaminant Sources
- AQCR 29: Prevention of Significant Deterioration
- AQCR 30: New Source Performance Standards
- AQCR 31: National Emission Standards for Hazardous Air Pollutants (NESHAP) (radionuclides excluded)

The Air Pollution Control Division under the Albuquerque City Environmental Health Department has set up several ambient air sampling stations throughout the city, including the area near SNL, Albuquerque, to monitor TSP, ozone, PM, CO, and NO_x. The results were published periodically in the local newspaper.

6.2.2 Airborne Emissions and Permits

Several sources at SNL, Albuquerque, emit air pollutants that are regulated by the AQCR. The emissions from these sources are described below:

- Topsoil Disturbance (AQCR 8)

Before disturbing the soil, SNL, Albuquerque, or its contractor will apply for a Topsoil Disturbance Permit and implement 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, limitations on vehicle access and vehicle speed, and use of dust palliatives where watering is ineffective.

- Open Burning (AQCR 3)

Open Burn permits were obtained from the City of Albuquerque prior to each scheduled burn test according to the requirement of AQCR 3 (Open Burning). A total of 12 new multiuse Open Burn permits were issued, and five of the permits were extended, to SNL, Albuquerque, during 1990 (see Table 6-11).

- Beryllium (Be) Machining Operation (AQCR 31)

The toxic machine shop (Building 869) operation is regulated by AQCR 31 (NESHAP) standard for Be. Except for the period of January 16-17, when the exhaust system was tested for Be stack emission by an offsite contractor, there has been no routine machining operation during calendar year 1990. During the test period, various sets of representative Be-containing metals were processed in the toxic machine shop. The results were reported to the Air Pollution Division, City of Albuquerque, in February 1990. The results are at least three orders of magnitude smaller compared to the NESHAP standard for Be (9.2×10^{-4} lb/hr or 10 gm/24 hr) specified in 40 CFR 61.32. The City of Albuquerque has evaluated the results and determined that the toxic machine shop was in compliance with the NESHAP standard and relocation of the shop will not result in any significant increases in Be emission because SNL, Albuquerque, does not anticipate any change in operation. However, the relocation of the toxic shop did not occur during 1990 as originally planned because of the asbestos removal project being conducted at the proposed location.

- Steam Generators (AQCR 15-18)

SNL, Albuquerque, currently has five steam generators with boiler capacities that range from 71.5 to 190.8 MBtu/hr. All these generators were grandfathered sources, hence no permits were obtained or required. The City of Albuquerque determined that the

Table 6-11. 1990 Open Burning Permits

ADM Number	Title	Approval Date	Expiration Date	Comments
90-46	Open Pool Fire Test of a Fire Extinguisher System for Air Force	In process		
90-37	H1556 Shipping Container Pool Fire Tests	In process		
90-33	H1501 Shipping Container Pool Fire Tests	11/14/90	10/01/91	
90-31	Four Additional TRUPACT-II Pool Fire Tests and Application for OBP	12/19/90	09/30/91	
90-30	H838 Shipping Container Burn Tests	In process		
90-07	Proposed Fire Extinguisher Training Site	12/04/90	12/31/90	Extension approved (verbal)
90-06	Series of Wood Crib Fire Tests of Explosive Components for Shipping Containers	08/03/90	12/31/90	Extension approved 12/04/90 Extension expires 12/31/91
89-24	Open Burning Permit for Operation of the SNL Thermal TRE	01/09/90	12/31/90	Extension approved 12/19/90 Extension expires 12/30/91
89-20	Burn Permit Application for a Rocket Motor Static Firing Test	03/27/90	12/31/90	

Table 6-11. 1990 Open Burning Permits (Concluded)

ADM Number	Title	Approval Date	Expiration Date	Comments
89-14	10/89 Liquid Fuel Test Facilities, Test Site 9920	03/29/90	07/31/90	
89-11	Open Pool Tests of an SST Trailer Wall Section SNL, Albuquerque	03/27/90	09/28/91	Extension approved 12/19/90 Extension expires 12/30/91
89-09	Wood Crib Fire Tests of Explosive Components for Allied Signal	07/17/89	09/30/90	
89-07	Wood Crib Fire Test of the W82 Rec. System			
89-02	Open Pool Fire Tests on The On-Site Container	03/26/90	03/31/90	Extension approved 3/26/90 Extension expires 03/31/91
88-11	Wood Crib Fire Tests of Explosive Components for General Electric	03/15/89	09/30/90	
88-03	Wood Crib Fire Tests Components of Shipping Containers for Monsanto/Mound	01/06/89	09/30/90	

modernization of the steam plant is not considered to be a modification of the plant.

The modernization of the steam-producing facility at SNL, Albuquerque, will be carried out in the next few years. The more efficient controls of the new plant will result in a decrease of average contaminant emissions. The 1989 emissions were reported in the calendar year 1990 criteria pollutants inventory to the City of Albuquerque.

6.2.3 Criteria Pollutants Inventory

Seven point-source emission inventories for six steam generator boilers and four identical emergency diesel power generators were conducted in 1990 for criteria pollutant emissions. The calculated emission data were reported for NO_x, SO₂, TSP, CO, and hydrocarbon (HC). Most of the operating schedules were intermittent. Specifically, the diesel generators were operating for 4 hr each month. The inventory results are shown in Table 6-12.

6.2.4 Preliminary Assessment of Hazardous Air Emissions

A preliminary assessment of hazardous air emissions was conducted during calendar year 1990 for ten chemicals used in Technical Area I. This inventory was designed to assess major sources within Technical Area I for their emission impact to the environment and for their compliance status. A total of 27 divisions within directorates 1100, 1800, and 7400 and 12 major buildings were surveyed for the usage and potential emissions of the following chemicals:

- Benzene
- Carbon Tetrachloride (CCl₄)
- Chlorinated Benzene
- Chlorofluorocarbon-113 (freon)
- Chloroform
- Methyl Chloroform (1,1,1-trichloroethane [TCA])
- Methylene Chloride (MC)
- Toluene
- Trichloroethylene (TCE)

These contaminants were selected from a listing of substances in 40 CFR 61.01(a) and (b) or the NESHAP list.

The inventory data were collected by inventory form and site visits. All data were managed using a dBase III program. The software used is "Screening Procedures for Estimating the Air Quality Impact of Stationary Source," an EPA-authorized screening model. The model is conservative because it estimates the 1-hr impact of a single source while assuming the worst meteorological condition at any desired downwind distance.

The impact of each source was estimated by comparing the 8-hr average stack emission concentration in mg/m³ to the 1-percent Occupational Exposure

Table 6-12. Criteria Pollutant Inventory (tons per year [TPY])

Pollutants/ Source	Steam Generators						Emergency Diesel Generator	Total Emissions
	#1	#2	#3	#4 ^a	#5	#6		
NOx	0.3307	0.1168	0.4076	0	7.6339	0.5938	0.256	9.3388
SO ₂	0.0014	0.0007	0.0017	0	0.0327	0.0025	0.061	0.1000
TSP	0.0118	0.0058	0.2423	0	0.2726	0.0212	-- ^b	0.5537
CO	0.0827	0.0233	0.1019	0	1.9085	0.1484	0.013	2.2778
HC	0.0061	0.0061	0.0081	0	0.1526	0.0118	--	0.1847

^aNumber 4 boiler was retired and no emissions were generated.

^bNo TSP and HC data were reported for the diesel generator.

Limit (OEL). The 1-percent OEL was deemed to be a "significant level" by the City of Albuquerque. Any source whose hazardous air emissions could result in "significant" ambient concentration requires an air quality permit.

Only nine sources of all sources inventoried were identified as significant at their stack emissions and thus required modeling calculations. However, none of the nine sources had a significant impact to the ambient air. Therefore, none of the sources required any air quality permit. Table 6-13 lists the locations, chemicals/annual emission (in lb/yr), stack emission, 1-percent OEL, and the maximum impacted ambient concentrations for comparison to the 1-percent OEL limit.

The data were also summarized for three major buildings: Building 805 (Chemistry Building), Building 893 (CSRL), and Building 878, the Process Development Laboratory (PDL), and their emissions. These are demonstrated in Figures 6-2, 6-3, and 6-4, respectively.

Although Building 805 uses all ten chemicals, the quantities used were actually very small. Except the 29 lb/yr emission for trichloroethylene, all other emissions for the remaining nine chemicals were less than 10 lb/yr.

Building 893 (CSRL) had emissions for four chemicals: chlorobenzene, chloroform, toluene, and trichloroethylene. Among the four chemicals used, 403 lb/yr of trichloroethylene emission is the most significant.

The stack emissions of the PDL in Building 878 are shown by Figure 6-4. This building had the most significant hazardous air emissions for the ten chemicals surveyed. The top three emissions from the building are 1,1,1-trichloroethane (1097 lb/yr), trichloroethylene (228 lb/yr), and methylene chloride (385 lb/yr).

These data presented in Figures 6-2 through 6-4 clearly demonstrated the overview of stack emissions for each of the three buildings surveyed in Technical Area I. All impacts on the ambient air are insignificant according to the modeling results presented in Table 6-13. A complete laboratory-wide inventory and assessment for all hazardous air pollutants listed in 40 CFR 61.01(a) and (b), and the Superfund Amendments and Reauthorization Act (SARA) Title III, Section 313, "Toxic Chemical Release Reporting," is being conducted during 1991. The report will be submitted to the EPA in June 1991.

Table 6-13. Summary of Major Sources and Results of
EPA Screening Procedures^a

Building Number	Chemical Stack Emission (lb/yr)	Stack Concentrations (mg/m ³)	1-Percent OEL (mg/m ³)	Result of ^a Maximum Ambient (mg/m ³)
893	TCE (403)	15.00	2.700	0.0104
878	TCE (226)	15.00	2.700	0.0102
878	MC (354)	7.00	3.500	0.0047
878	TCA (913)	50.00	19.000	0.0174
805	CCl (<1.5)	7.50	0.300	0.0131
805	MC (<1.2)	6.30	3.500	0.0110
805	Benzene (<0.5)	0.01	0.002	0.0000
805	Benzene (<0.3)	0.10	0.002	0.0005
805	MC (3.5)	21.80	3.500	0.0372

^a"Screening Procedures for Estimating the Air Quality Impact of Stationary Sources" EPA document, EPA-450/4-88-010, August 1988.

Figure 6-2. Summary of Major Emissions for Building 805

Figure 6-3. Summary of Major Emissions for Building 893

Figure 6-4. Summary of Major Emissions for Building 878

CHAPTER 7

GROUNDWATER MONITORING

7.1 Regulatory Overview

Groundwater monitoring is required under DOE Order 5400.1. Monitoring activities at the SNL, Albuquerque, chemical waste landfill (CWL) and mixed waste landfill (MWL) are also required under the Resource Conservation and Recovery Act (RCRA) (40 CFR 265, Subpart F). As defined in 40 CFR 265.91, the regulations require that the waste management facility has a monitor well network consisting of "1) Monitor wells (at least one) installed hydraulically upgradient (i.e., in the direction of increasing static head) from the limit of the waste management area. Their number, locations, and depths must be sufficient to yield groundwater samples that are: i) representative of backgroundwater quality in the uppermost aquifer near the facility; and ii) not affected by the facility; and 2) Monitor wells (at least three) installed hydraulically downgradient (i.e., in the direction of decreasing static head) at the limit of the waste management area. Their number, locations, and depths must ensure that they immediately detect any statistically significant amounts of hazardous waste or hazardous waste constituents that migrate from the waste management area to the uppermost aquifer."

Background groundwater quality conditions at the CWL were determined for all of the current RCRA monitor wells (40 CFR 265.92[c][1]). Background values of the 40 CFR 265, Appendix III drinking-water supply parameters, contamination indicator parameters, and groundwater quality parameters were collected quarterly for 1 yr (December 1988 to January 1990). Each quarter, four replicate samples were collected for the indicator parameters (pH, specific conductivity [SP.Cond], total organic carbon [TOC], and total organic halogen [TOX], and the initial background arithmetic mean and variance were determined by pooling the replicate measurements for the respective parameter concentrations or values in samples obtained from the upgradient well as required by 40 CFR 265.92(c)(2). In addition, the elevation of the groundwater was measured in each monitor well before each of the quarterly samplings as required by 40 CFR 265.92(e). The groundwater surface elevation data were evaluated to confirm that the monitor well network continued to meet the requirements of being composed of at least one upgradient and three downgradient wells as specified in 40 CFR 265.93(f). (For a more detailed discussion of groundwater monitoring activities and results, see SNL, 1991a.)

After establishing background conditions by sampling for indicator parameters quarterly for a year, the interval for groundwater contamination indicator sampling was changed from quarterly to semiannually and the interval for groundwater quality sampling was changed from quarterly to annually as allowed by 40 CFR 265.92(d)(2). On the first semiannual sample collection event, the groundwater monitoring list (40 CFR 264, Appendix IX) parameters were also collected in anticipation of closure requirements and

trichlorethylene (TCE) was discovered in downgradient well MW-2A. Therefore, indicator parameters were resampled in accordance with 40 CFR 265.93(c)(2). In addition, volatile organics were resampled to confirm the presence of the TCE. The May 1990 resampling results confirmed the presence of TCE in the groundwater. Subsequently, an assessment monitoring program was begun in accordance with 40 CFR 265.93(d)(2). The assessment monitoring program includes quarterly monitoring for the constituent of concern (TCE) and annually monitoring for the Appendix IX parameters (SNL, 1990b).

A slightly different regulatory strategy exists with regard to the MWL. DOE Order 5400.4 sets forth the policy that DOE facilities will be "not inconsistent with" all releases in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended, 42 U.S.C. 9601 et seq. and National Oil and Hazardous Substances Pollution Contingency Plan (NCP), regardless of whether the site is on the National Priority List (NPL). The Superfund Amendments and Reauthorization Act (SARA) of 1986 incorporated the concept of Applicable or Relevant and Appropriate Requirements (ARARs) into the CERCLA statute. The ARARs require that a remedial action in which a hazardous substance will remain on the site must attain at least the legally applicable or relevant and appropriate standards, requirements, criteria, or limitations provided by federal environmental law. With this standard in mind, SNL has judged the RCRA Groundwater Monitoring Regulations to fall under the category of an ARAR. SNL does not believe that the requirements of 40 CFR Part 265, Subpart F, are specifically mandated for the MWL, inasmuch as the MWL was never under interim status or permitted before the final disposal of waste at the site in December 1988. Therefore, details pursuant to 40 CFR Part 265, Subpart F, are submitted for information purposes because it is an ARAR, not because it is a mandated requirement.

The groundwater at the MWL was initially sampled in late September 1990. In accordance with the regulations, the background conditions of the groundwater quality were determined for all of the current RCRA monitor wells (40 CFR 265.92[c][1]). Background values of the 40 CFR 265, Appendix III drinking-water supply parameters, contamination indicator parameters, and groundwater quality parameters were collected. Four replicate samples were collected for the indicator parameters (pH, SP.Cond, TOC, and TOX), and the initial background arithmetic mean and variance were determined by pooling the replicate measurements for the respective parameter concentrations or values in samples obtained from the upgradient well as required by 40 CFR 265.92(c)(2). In addition, the elevation of the groundwater was measured in each monitor well before the sampling event as required by 40 CFR 265.92(e). The groundwater surface elevation data were evaluated to determine whether the monitor well network meets the requirements of being composed of at least one upgradient and three downgradient wells as specified in 40 CFR 265.93(f). It cannot be demonstrated that the monitor well network meets this requirement at this time. Therefore, a work plan is currently being produced to address the adequacy of the monitor well network and to present a method to quantitatively address this requirement.

7.2 The SNL, Albuquerque, Groundwater Monitor Well Network

At the outset of this year, 11 groundwater monitor wells were being monitored for water levels monthly. These wells include nine wells at the CWL, one well at the MWL, and well KAFB-10 (Technical Area V). The network has now expanded to 27 wells and one spring (Coyote), and it is being monitored according to an improved and better documented procedure for measuring static water levels (Goodrich, 1990). Of the 27 monitor wells, 6 are new; the others are existing wells whose locations were previously unknown, or they are wells neither owned nor monitored by SNL, Albuquerque (other parties such as Kirtland Air Force Base [KAFB] and the State of New Mexico own these wells). Five of the wells that were not being monitored are now being monitored (plus Coyote Spring). These wells are east of the faults with depths to groundwater varying from 50 to 100 ft; all others are west of the faults with depths to groundwater of ~480 ft. In December 1990, SNL, Albuquerque, began monitoring four additional wells belonging to KAFB: one at the east end of Tijeras Arroyo, one at the west end of Tijeras Arroyo, one at the KAFB golf course, and one at the KAFB sanitary lagoons. These wells, along with the 6 new monitor wells that SNL, Albuquerque, expects to install during 1991, will bring the total to at least 33 wells by the end of 1991. SNL, Albuquerque, maintains a file of all the wells being monitored that includes a complete description of the physical characteristics of the wells (e.g., total depth [TD], screened interval, casing material, filter pack material, geographic coordinates, etc.). SNL, Albuquerque, is focusing on selecting statistically defensible new monitor well locations to reduce uncertainty about the rate and direction of groundwater flow. SNL (1991a) summarizes completely all depth-to-water measurements (and where possible, the corresponding water surface elevation) taken at SNL, Albuquerque, from January through December 1990.

Groundwater monitoring at the CWL (Figure 7-1) has been an operational program since 1985. The monitor well system at the CWL consists of a network of ten groundwater monitor wells (Figure 7-2). Five groundwater monitor wells (MW-1, MW-2, MW-3, BW-1, and BW-2) were installed at the CWL during the summer of 1985 using a mud rotary drilling method. These wells were completed at various vertical depths within the aquifer, with screened intervals ranging from 70 to 460 ft in length. MW-1 is presently unusable for monitoring because it was plugged by a bailer. In 1988, four additional wells (BW-3, MW-1A, MW-2A, and MW-3A) were installed at the CWL using air rotary casing hammer techniques. These four wells have 20-ft screened intervals located such that approximately 15 ft of screen is below the water table. Well MW-4 was completed in May 1990 using hollow-stem auger (0 to 260 ft) and mud rotary (260-TD) techniques. This well also has a 20-ft screened interval with approximately 15 ft of screen below the water table.

A monitor well network was established at the MWL (Figure 7-1) in 1988, when MW-1 was installed. Three additional monitor wells (MW-2, MW-3, and BW-1) were installed between June and September 1989 (Figure 7-3). These wells have 20-ft screened intervals located from 5 ft above the water table to 15 ft below the water table. The monitor wells were not fully developed

Figure 7-1. Location of the CWL and MWL in Technical Area III

Figure 7-2. Locations of Monitoring Wells at the CWL

Figure 7-3. Locations of Monitoring Wells at the MWL

until the summer of 1990 because of the relatively low permeability of the sediments in the upper portion of the aquifer.

7.3 Groundwater Elevation

The potentiometric surface elevation was measured by personnel from International Technology Corporation (IT); SNL, Albuquerque; the U.S. Air Force; and the U.S. Geological Survey (USGS). The water-level data collected during 1990 and the groundwater elevation analyses are presented in the following section. Water-level measurements by IT and SNL, Albuquerque, personnel were obtained in accordance with the instructions contained in SNL Standard Operating Procedure (SOP) 90-02 (Goodrich, 1990).

Water-Level Measurements

Water-level elevations were measured in all wells before each sampling event to assure that the monitor well network consisted of at least one upgradient well and three downgradient wells. To supplement the groundwater elevation data from the CWL and MWL, and determine the general hydraulic gradient throughout the SNL, Albuquerque, area, groundwater surface elevations have been measured monthly in all accessible SNL, Albuquerque, monitor wells and adjacent monitor wells since May 1989. The adjacent monitor wells include two State of New Mexico Environmental Improvement Division (NMED) monitor wells in Tijeras Arroyo, two U.S. Air Force landfill monitor wells south of the KAFB runway, and KAFB wells 9 and 10, located northeast of Technical Area III. The locations of monitor wells and pumping wells used for SNL, Albuquerque, water-level measurements are shown in Appendix F, Figure F-1. Sixteen additional wells were added to the SNL, Albuquerque, measurement network in November and December 1990. These new additions consist of six wells that extend the monitored area considerably to the east within KAFB, four wells surrounding the irrigation water lagoon northeast of the KAFB golf course, four wells surrounding the sewage lagoons at the southeast end of the KAFB east-west runway, one well located in Tijeras Arroyo north of Technical Area III within KAFB, and one well located within Tijeras Arroyo at the western boundary of KAFB. Complete water-level data can be found in SNL, 1991a. See also Appendix F, Table F-16.

Apparent Direction of Groundwater Flow

The rate and direction of groundwater flow through a given media is controlled by the hydraulic gradient and the distribution of the hydraulic conductivity. The hydraulic gradient is determined from measurements of water levels in wells screened near the water table. Water-level data from all of the monitor wells in the SNL, Albuquerque, area (and some KAFB production wells) were used to generate the potentiometric surface elevation contours of the SNL, Albuquerque, area. Assuming that the vertical gradient is negligible (an assumption that is currently under investigation) after adequate recovery time, the production well static water levels are considered to be representative of the elevation of the water table at that location. Because pumping from the production wells significantly affects the hydraulic gradient nearby, it is important to

include the production wells in the SNL, Albuquerque, groundwater surface elevation analysis. As compared to the monitor wells, the KAFB production wells are screened over large intervals starting at the water table. Differences in screen length between wells are not considered to be a problem because the aquifer system is unconfined (again, neglecting vertical gradients). Figure F-2 in Appendix F is a representative contour map of the SNL, Albuquerque, area water surface (from June 1990).

The elevation contours of the potentiometric surface in the southwestern portion of SNL, Albuquerque, in the vicinity of Technical Area III and the CWL, are depicted in Appendix F, Figure F-3. July and December 1990 (summer and winter) were chosen as representative time frames. Data from both of these measuring events indicate that the apparent groundwater flow direction near Technical Area III was to the west-northwest.

The potentiometric surface elevation contours were determined by using water-level data from monitor wells BW-3, MW-1A, MW-2A, MW-3A, NWT3, DM/LF01, DM/LF02, MWL BW-1, KAFB-09, KAFB-10, and MVMWJ. The potentiometric surface at the CWL is fairly constant from one quarter to the next, as depicted in Figures F-4 and F-5 of Appendix F.

Given a homogeneous and isotropic media under steady-state flow conditions, one can assume that the direction of groundwater flow is perpendicular to the potentiometric contour lines. Although the assumption of homogeneity and isotropy is undoubtedly invalid in this complex alluvial environment, potentiometric surface contour maps show that the apparent direction of groundwater flow at the CWL is to the northwest. Moreover, the groundwater monitor well network at the CWL satisfies the requirements of 40 CFR 265.91 in that BW-3 is hydraulically upgradient, and MW-1A, MW-2A, MW-3A, and MW-4 are hydraulically downgradient from the site. The downgradient wells located at the limit of the waste management facility are capable of immediately detecting any release that may migrate to the aquifer.

Production Well Pumping

As previously discussed (Section 2.5), the KAFB production wells greatly affect the hydraulic gradient in the SNL, Albuquerque, area, creating a cone of depression in the groundwater surface elevation in the northern portion of the area. Because of a lack of spatial data, the lateral extent of the cone of depression is unknown. However, it is possible that KAFB production well pumping is the cause of water-level fluctuations observed in the CWL monitor wells. Appendix F, Figure F-6 shows the fluctuations in CWL monitor well water levels observed during 1990. A slight decrease in water level over the year is seen superimposed on the seasonal changes. These qualitative results indicate that the effects of pumping the KAFB production wells may extend as far south as the CWL. Continued monitoring of the potentiometric surface elevation from the expanded well network now in use, combined with statistical comparisons between the KAFB pumping rates and SNL, Albuquerque, monitor well water levels, may resolve whether the observed fluctuations in CWL water levels are predominantly due to withdrawal from KAFB production wells, seasonal fluctuations, or barometric fluctuations.

7.4 Groundwater Sampling

Chemical Waste Landfill

Quarterly background groundwater quality assessment for the CWL monitor wells BW-3, MW-1A, MW-2A, and MW-3A was completed in January 1990 as described by Parsons (1990). Background water quality values at monitor well MW-4 were established by groundwater sampling in June 1990 (IT, 1990a). The results are presented in Appendix F, Table F-17 (see also SNL, 1991a).

The first semiannual contamination indicator sampling at the CWL was performed in March 1990 in compliance with RCRA interim status requirements contained in 40 CFR 265.92. Groundwater monitoring list (40 CFR 264, Appendix IX) parameters were also measured in anticipation of closure requirements (IT, 1990b). A change from detection monitoring to assessment monitoring was required following the discovery of TCE contamination in well MW-2A.

Resampling of the CWL monitor wells in May 1990 accomplished three objectives: (1) groundwater contamination indicator parameters were resampled to allow a second statistical comparison with background data, (2) volatile organic compounds (VOCs) were specifically analyzed to gather additional data about the extent of the TCE contamination, and (3) the May 1990 resampling was considered the first set of data for the new quarterly assessment monitoring. Because of the change from detection monitoring to assessment monitoring at the CWL, contamination indicator parameter statistics for the TOX and TOC were no longer reported after the May 1990 resampling. The indicator parameter statistical results from the March semiannual sampling are provided in Appendix F, Tables F-18 and F-19, and statistical results from the May 1990 resampling are provided in Tables F-20 and F-21 (IT, 1990a and 1990c). The results of assessment monitoring in May, August, and December 1990 are also presented in Appendix F. Details of the August and December 1990 sampling events may be found in the "Report on Quarterly Groundwater Assessment Monitoring at the Chemical Waste Landfill, Sandia National Laboratories, Albuquerque, August 29-September 5" (IT, 1991a) and the "Report on Quarterly Groundwater Assessment Monitoring at the Chemical Waste Landfill, Sandia National Laboratories, Albuquerque, December 4-7, 1990" (IT, 1991b) (see also SNL, 1991a).

Sampling Procedures and Methods for the CWL

The protocol for collection and analysis of representative groundwater samples at the CWL is specified in the CWL sampling and analysis plan (SNL, 1990a). The procedure for the collection of groundwater samples includes (1) monitoring the well-head atmosphere for the occurrence of organic vapors which may indicate the presence of nonaqueous phase liquids (NAPLs), (2) measuring the groundwater elevation and total depth of each well, (3) purging the well of three casing volumes at rates that minimize turbulence during recharge, (4) collecting the desired groundwater sample in specified containers provided by the analytical laboratory, and

(5) sending the samples for analysis to the analytical laboratory under strict chain-of-custody documentation. Specific details pertaining to the initial semiannual contamination detection sampling and to each subsequent quarterly assessment groundwater sampling event are described in the quarterly groundwater sampling reports (IT, 1990a, 1990d, 1991a, and 1991b). These reports contain summary tables, raw field and laboratory data, quality control (QC) data, and descriptions of the analytical methods employed by the analytical laboratories.

Background Monitoring Data Summary for the CWL

The January 1990 sampling event was the fourth complete quarterly sampling event at the CWL, concluding the background monitoring initiated in December 1988. As described by Parsons (1990), the 1989 background monitoring results indicated four instances of contaminants at concentrations or levels in excess of 40 CFR 265, Appendix III drinking-water standards: (1) total chromium (Cr), (2) gross alpha (α) activity, (3) noncoliform bacteria, and (4) turbidity. Total Cr exceeded drinking-water levels during some, but not all, sampling events at BW-3, MW-1A, and MW-2A. Dissolved Cr concentrations measured in filtered samples did not exceed drinking-water standards. The total Cr concentrations detected in groundwater samples were consistent with Cr concentrations measured in core samples from the CWL area, suggesting that suspended particles were the source of total Cr in groundwater samples. Gross α activity at the CWL was found to be consistent with background concentrations of radioisotopes known to occur in the source rocks of the CWL area sediments, with atomic weight distributions suggesting natural origin. High levels of noncoliform bacteria (too numerous to count) prevented measurement of coliform bacteria on several occasions. The presence of noncoliform bacteria appeared to be related to field methods or laboratory procedures. In the absence of excessive noncoliform bacteria, the coliform bacteria concentrations were found to be within drinking-water standards. Turbidity often exceeded the drinking-water standard of 1 nephelometric turbidity unit (NTU), with values typically between 0.5 and 2.5 NTU, except that turbidity in excess of 5 NTU was measured at one well during the first background sampling quarter. Turbidity appeared to be related to high concentrations of total Cr due to suspended particulate matter. Stein et al. (1991) suggest that both the CWL sediments and stainless-steel equipment may be sources of Cr-bearing particles.

Background values for groundwater quality at MW-4 were established by sampling in June 1990 (IT, 1990a). Groundwater quality at MW-4 was found to be consistent with the results from the background assessment at the other CWL monitor wells. Hexane contamination was found in both environmental and equipment blank samples collected from MW-4 with a nondedicated sampling pump, requiring dilution of VOC fractions to the point that the volatile constituents of concern would have been undetectable at the New Mexico Water Quality Authority (NMWQA) maximum contaminant levels. As a result of this problem, decontamination procedures now follow an expanded protocol with an additional deionized water rinse, and hexane is no longer used for decontamination. During background sampling, gross α activity and turbidity were found to be the

only parameters consistently exceeding drinking-water standards that could not be explained as artifacts of decontamination procedures.

Annual Summary of Assessment Monitoring Data for the CWL

A summary of data collected during quarterly assessment monitoring is presented in Appendix F. The assessment monitoring program was developed in response to the detection of TCE in monitor wells at the CWL during the first semiannual sampling event in March 1990. This sampling detected (1) TOX at concentrations of 1 to 5 $\mu\text{g/l}$, below the reporting limit of 30 $\mu\text{g/l}$; (2) TCE in MW-2A at concentrations of 6.7 to 7.3 $\mu\text{g/l}$; and (3) statistically significant changes of indicator parameters relative to background values. The March 1990 sampling found that the pH had decreased significantly in BW-3 and MW-2A, SP.Cond had increased at BW-3, and TOC values had increased at BW-3 and MW-3A.

Resampling of MW-2A in April 1990 and sampling of all the CWL monitor wells in May 1990 confirmed the presence of halogenated organic compounds in MW-2A at concentrations of 15 to 16 $\mu\text{g/l}$ TCE and 7.1 to 8.0 $\mu\text{g/l}$ of 1-1-1, trichloroethane (TCA), and found TCE in MW-3A at a concentration of 0.59 mg/l . TCE and TCA were detected in equipment blanks at 20 percent of the concentrations detected in environmental samples, and some field blanks were found to have similar contamination at ~10 percent of the environmental sample concentrations. It was concluded that the deionized water supply used for decontamination and in blank samples was responsible for the contamination of sample blanks. Steps were taken to acquire a higher-quality source of deionized water for later sampling efforts. Resampling confirmed significant changes from background values for: (1) pH in BW-3, MW-1A, and MW-2A, and (2) the SP.Cond in MW-3. Resampling failed to confirm the changes in the TOC detected in the initial March 1990 semiannual sampling.

Quarterly sampling for assessment monitoring at the CWL took place in May, August, and December 1990. These sampling events were conducted in accordance with the Groundwater Quality Assessment Program for the Sandia Chemical Waste Landfill (SNL, 1990b), which details the groundwater monitor measures being taken to address the problem of TCE contamination in the CWL groundwater.

Quarterly sampling has included measurements of the pH, SP.Cond, and turbidity indicator parameters during purging to guide in the stabilization of water quality during environmental sampling and ensure the collection of representative samples. Because TCE is the primary contaminant of concern at the CWL, quarterly assessment sampling has included laboratory analysis for VOCs in groundwater samples collected using dedicated pumps.

Laboratory results from the quarterly assessment sampling in August 1990 found hexane contamination at levels that required dilution to the point that detection limits for the constituents of concern were in excess of the maximum previously detected concentrations. Acetone contamination from decontamination procedures (attempts to remove residual hexane) was present in the August 1990 assessment monitoring samples collected from dedicated

pumps installed in wells MW-3A and BW-3. In addition, trihalomethanes were detected in field blanks during the assessment monitoring events and were believed to be contaminants in the deionized water used in preparing the blanks.

Laboratory results from the December 1990 quarterly sampling detected TCE in MW-2A at a concentration of 5 $\mu\text{g/l}$ in duplicate groundwater samples and detected TCE in the MW-1A sample at a concentration of 1.1 $\mu\text{g/l}$. Significant results from analyses for TCA, TCE, and tetrachloroethene (TTCE) are summarized in Table F-22 of Appendix F. The analytical results from the December 1990 sampling indicate that the more rigorous decontamination protocol was successful in reducing contamination introduced by the previous decontamination procedure. To further these efforts in preventing future problems with trihalomethanes or other introduced volatile contamination, deionized water used for field blanks will be obtained from the analytical laboratory, and deionized water used during equipment decontamination will be obtained only from lots produced with newly replaced ion exchange columns. Decontamination procedures no longer involve the use of hexanes or acetone.

The work plan for the TCE investigation in the Groundwater Quality Assessment Program for the Sandia Chemical Waste Landfill includes plans for a single well aquifer test with extended pumping from monitor well MW-2A, which began in January 1991. SNL is currently negotiating with the State of New Mexico for a corrective action plan which describes a strategy for assessing and remediating the TCE plume.

Mixed Waste Landfill

Initial sampling for background groundwater quality and drinking-water standards for the MWL monitor wells MWL-BW1, MWL-MW1, MWL-MW2, and MWL-MW3 was completed in September 1990. The results of the sampling are presented in SNL, 1991b. Details of this sampling event may be found in the "Report on Background Groundwater Sampling at the Mixed Waste Landfill, Sandia National Laboratories, Albuquerque, September-October 1990" (IT, 1991c).

Sampling Procedures and Methods for the MWL

The protocol for collection and analysis of representative groundwater samples at the MWL is specified in the draft Mixed Waste Landfill Sampling and Analysis Plan, SNL Groundwater Monitoring Program (SNL, August 1990). The procedure for the collection of groundwater samples includes (1) monitoring the well-head atmosphere for the occurrence of organic vapors that may indicate the presence of NAPLs; (2) measuring the groundwater elevation and total depth of each well; (3) purging the well to dryness, then allowing full recovery; (4) collecting the desired groundwater sample in specified containers provided by the analytical laboratory; and (5) sending the samples for analysis to the analytical laboratory under strict chain-of-custody documentation. Specific details pertaining to the initial background sampling are described in a groundwater sampling report (IT, 1991c); this report contains summary

tables, raw field and laboratory data, QC data, and descriptions of the analytical methods employed by the analytical laboratories.

Background Monitoring Data Summary for the MWL

The September 1990 sampling was conducted to establish background values for groundwater quality parameters and drinking-water standards at the MWL.

Background monitoring detected no contamination indicators at concentrations or levels in excess of RCRA Appendix III drinking-water standards or groundwater quality standards, with the exception of noncoliform bacteria. High levels of noncoliform bacteria (too numerous to count) prevented measurement of coliform bacteria on several occasions. The presence of noncoliform bacteria may be related to field methods or laboratory procedures. In the absence of excessive noncoliform bacteria, the coliform bacteria concentrations were found to be within drinking-water standards.

Turbidity often exceeded the drinking-water standard of 1 NTU, with values between 1.5 and 6.0 NTU. Turbidity appeared to be related to completing development of the wells before background sampling. Turbidity values during previous well development purge events have been measured in the hundreds of NTUs and were consistently lower during the background sampling in September to October 1990. It is believed that turbidity will continue to decrease as the wells develop.

Sampling included measurements of the pH, SP.Cond, and turbidity indicator parameters during purging to guide in the stabilization of water quality during environmental sampling and ensure the collection of representative samples. Two wells, MWL-MW2 and MWL-MW3, are extremely low-yielding. It was found during sampling that indicator parameters did not stabilize until immediately before the wells went dry. Therefore, it was necessary to sample before stabilization to ensure that adequate water volume was available to make up a full sample suite.

7.5 Summary

This report describes the groundwater monitoring activities conducted at SNL, Albuquerque, with emphasis on the CWL, during calendar year 1990. The groundwater surface elevation was evaluated by measuring the water level at monitor wells throughout the SNL, Albuquerque, area. Sixteen wells were added to the SNL, Albuquerque, water-level monitoring network during 1990. One new monitor well was installed to obtain a detailed lithologic log and samples, and to obtain an additional site for groundwater sampling and better definition of the potentiometric surface at the CWL.

The apparent groundwater flow direction at the CWL is to the northwest. Potentiometric surface contour maps indicate that the CWL groundwater monitoring network satisfies the requirements of 40 CFR 265.91. That is, there is one upgradient well (BW-3) and at least three downgradient wells (MW-1A, MW-2A, MW-3A, and MW-4) located so as to detect contaminant migration from the CWL.

Protocol used for the collection and analysis of groundwater samples at the CWL are described in the CWL sampling and analysis plan (SNL, 1990a). Semiannual sampling for groundwater contamination indicator parameters began in March 1990, in anticipation of closure, following the conclusion of background monitoring in January 1990. The March 1990 sampling discovered TCE in the CWL monitor well MW-2A. Subsequent resampling in April and May 1990 confirmed the presence of TCE and TCA, and confirmed instances of statistically significant changes from background values of indicator parameters (pH, SP.Cond, and turbidity). Background values for water quality at MW-4 were established in June 1990 and were found to be consistent with background water quality determined at the other CWL monitor wells. Quarterly assessment sampling events in August and December 1990 detected TCE in two of the four downgradient monitor wells. An assessment plan for quarterly sampling was devised and is being implemented to further characterize the extent of contamination and continue to determine aquifer properties at the CWL.

The apparent groundwater flow direction across Technical Area III is to the west-northwest. Potentiometric surface contour maps indicate that the groundwater monitoring network at the MWL may satisfy the requirements of 40 CFR 265.91. That is, there is one upgradient well (MWL-BW1) and three downgradient wells (MWL-MW1, MWL-MW2, and MWL-MW3). SNL, Albuquerque, is writing a work plan to address the adequacy of the monitor well network.

Sampling and analysis protocol used for the collection and analysis of groundwater samples at the MWL is described in the draft Mixed Waste Landfill Sampling and Analysis Plan (SNL, 1990). Background sampling was conducted in September 1990 to establish initial values for all groundwater quality parameters and primary drinking-water standards. No parameters were detected in concentrations exceeding drinking-water standards, except noncoliform bacteria. Turbidity values were slightly elevated in all the MWL monitor wells, with 6.5 NTU the highest value noted.

CHAPTER 8

QUALITY ASSURANCE PROGRAMS

8.1 Quality Assurance (QA) for Environmental Programs

Policies and Responsibilities

The ES&H Directorate (3200) has the overall responsibility for ensuring the quality of all activities related to environmental protection and compliance. A QA Program Plan was issued in June 1989 to address the policy, activities, and responsibilities of this Directorate for the promotion of quality throughout its operations. It was revised and reissued as the ES&H Directorate 3200 Quality Plan in April 1991.

The Environmental Programs Department (3220), under the direction of the ES&H Directorate (3200), has developed and implemented its own Quality Plan. This Quality Plan defines an approach to ensure that Department 3220's work (items and services) meet or exceed that of SNL, Albuquerque; the DOE (DOE/AL Order 5700.6B); and applicable regulatory (EPA, Occupational Safety and Health Administration [OSHA], state, and local) requirements. The Department 3220 Quality Plan supplements the SNL Corporate Quality Improvement Plan and the SNL ES&H Directorate Quality Plan. A copy of the Department 3220 Quality Plan is distributed to all Department 3220 personnel and contractors and the SNL Department 3220 Records Center maintains a copy on file.

Each employee in Department 3220 is responsible for ensuring that all activities performed by or for Department 3220 are in accordance with the policies and guidelines set in the Directorate 3200 ES&H Quality Plan and the Department 3220 Quality Plan.

New Programs

The Department 3220 Quality Plan, issued in November 1989 and revised in April 1991, is written in accordance with the guidelines set in DOE/AL 5700.6B, "General Operations Quality Assurance"; the SNL Corporate ES&H Quality Assurance Plan; and the ES&H Directorate 3200 Quality Plan.

This comprehensive Quality Plan describes quality guidelines and standards for all activities and functions conducted by or for Directorate 3220. It stresses prevention of problems by ensuring that requirements are defined in documents such as plans and procedures, that the requirements are understood through familiarization and training, and that all activities necessary for fulfilling the requirements are performed by qualified personnel. There is an ongoing effort to include applicable quality elements from the Department 3220 Quality Plan into implementation plans and procedures within Department 3220 for all hazardous, radioactive and mixed waste (MW) operations, and environmental protection, remediation, and compliance activities.

8.2 QA of Environmental Sampling and Analysis

There were various types of informal (unwritten) and formal (written) QA plans that covered the activities of the Environmental Protection Program in the past. All QA-related activities and results are summarized and published every year in this Report. Sampling and analyses plans are prepared in accordance with Department 3220 requirements and meet appropriate regulatory guidelines.

The existing environmental monitoring activities that are under the auspices of the Department 3220 Quality Plan are as follows:

A. Environmental Sampling

Environmental and waste media sampling are conducted and documented in accordance with the Department 3220 Quality Plan and follow applicable EPA guidelines for sample collection. Sample collection is performed by trained personnel only.

B. Radiological Analyses

Environmental samples submitted for radiological analyses were analyzed using validated test procedures. Instrument calibration is verified using certified standard reference materials to ensure the accuracy of data generated.

The analytical laboratory used by SNL, Albuquerque, for radiological analyses of environmental monitoring samples collected during 1990 operates under a documented quality plan. In order to assess the laboratory's ability to provide accurate data, laboratory performance was evaluated through participation in the EPA (Environmental Monitoring Systems Laboratory) and/or DOE (Environmental Measurements Laboratory) interlaboratory comparison programs. Table 8-1 provides results of laboratory performance studies for the laboratory used by SNL, Albuquerque (International Technology Corporation Radiological Sciences Laboratory, Analytical Services [IT/AS]). Performance evaluation sample analyses included gross alpha (α), gross beta (β), cesium-137 (^{137}Cs), tritium (^3H), and uranium (U) determinations in water and filter media. For comparison purposes, EPA reference values and contractor laboratory values are included. Data indicate the accuracy of analyses are acceptable. It should be noted that ^{137}Cs analyses in water are biased high whereas gross α analyses in water are biased low.

In addition to performance evaluation samples, replicate environmental samples were collected and submitted to the laboratory to assess the overall variability (precision) of data associated with a particular sampling location. Table 8-2 lists results of replicate sample analyses, including the average concentration value for each location and the standard error of the

Table 8-1. 1990 Quality Assurance Results for Selected Radiochemical Analysis

Analysis	Units	Sample Type	Date	QA Program	Program Value	IT/AS Oak Ridge ^a	Ratio ^b
Gross α	pCi/l	Water	09/21/90	EPA	10.0	6.67 ± 0.47	0.67
Gross β	pCi/l	Water	09/21/90	EPA	10.0	10.00 ± 0.82	1.00
^3H	pCi/l	Water	10/19/90	EPA	7203.0	7543.33 ± 185.53	1.05
^{137}Cs	pCi/l	Water	10/05/90	EPA	12.0	15.67 ± 1.25	1.31
	pCi/l	Air	08/31/90	EPA	20.0	21.67 ± 0.94	1.08
Total U	pCi/l	Water	07/20/90	EPA	20.8	22.97 ± 0.31	1.10
	pCi/l	Water	11/16/90	EPA	35.5	36.20 ± 2.97	1.02

^aThere is 1 standard deviation (1σ) associated with counting precision.
^bRatio of IT/AS-Oak Ridge to program value.

Table 8-2. Determination of Sample Variability in Replicate Samples for Selected Analysis in Vegetation, Soil, and Surface Water^a

Sample Type	Location	U ($\mu\text{g/g}$) $\bar{x} \pm s_x$ (%v) ^b	¹³⁷ Cs (pCi/g) $\bar{x} \pm s_x$ (%v) ^b	⁴⁰ K (pCi/g) $\bar{x} \pm s_x$ (%v) ^b	³ H (pCi/g) $\bar{x} \pm s_x$ (%v) ^b
Vegetation	5	No analysis	<MDL	<14.00	4.74 $\pm$ 1.27 (27)
	6	No analysis	0.06 $\pm$ 0.04 (71)	No analysis	<MDL
	7	No analysis	0.06 $\pm$ 0.04 (79)	No analysis	11.70 $\pm$ 1.88 (16)
	16	No analysis	0.02 $\pm$ 0.03 (141)	No analysis	15.72 $\pm$ 14.37 (91)
	60	No analysis	<MDL	<57.37	<MDL
Soil	5	1.42 $\pm$ 0.46 (32)	0.39 $\pm$ 0.06 (16)	12.42 $\pm$ 3.70 (30)	<MDL
	6	2.42 $\pm$ 0.49 (20)	0.43 $\pm$ 0.04 (10)	17.60 $\pm$ 2.11 (12)	<MDL
	7	2.92 $\pm$ 0.91 (31)	0.43 $\pm$ 0.08 (19)	17.37 $\pm$ 0.94 (5)	<MDL
	16	3.26 $\pm$ 0.07 (2)	0.07 $\pm$ 0.02 (28)	21.60 $\pm$ 3.63 (17)	<MDL
	32	1.32 $\pm$ 1.01 (77)	0.10 $\pm$ 0.07 (71)	19.25 $\pm$ 0.65 (3)	<MDL
	60	2.36 $\pm$ 0.47 (20)	0.06 $\pm$ 0.03 (45)	15.10 $\pm$ 2.69 (18)	1.37 $\pm$ 1.93 (141)
Water	33	8.49 $\pm$ 0.02 (0)	<1.0		<0.45

^aAll results are listed in Tables F-1, F-2, and F-3 of Appendix F.

^b(%v) = Standard deviation as a percentage.

mean for replicate sample analyses. This estimate includes the variability associated with sampling and analytical errors. Reported values reflect background fallout concentrations. Precision data for ^3H analyses in vegetation exhibits a greater variability compared to the other analytical parameters. This apparent problem is currently being investigated to determine the cause.

Waste samples for analysis of radiological parameters were collected and analyzed in accordance with the draft SNL "Waste Analysis Plan for Radioactive and Mixed Wastes." Samples collected were submitted to IT/AS laboratories for analyses during 1991. Analyses were performed using validated test procedures.

C. Stable Chemistry Analyses

The majority of analyses of waste and environmental samples collected at SNL, Albuquerque, during 1990 were performed by contracted analytical laboratories. The contracted laboratories operate under QA plans which comply with the Department 3220 Quality Plan, and applicable EPA requirements and guidelines. Analyses are performed using EPA test procedures wherever possible or other validated test procedures. Concurrently-analyzed quality control (QC) sample data are provided with each analytical report prepared for SNL, Albuquerque. QC sample requirements vary between programs. Minimal laboratory QC requirements include laboratory control sample analyses using certified standard reference materials to document analytical accuracy and precision, method blank analysis to assess and document analytical interference, and use of surrogate standards for samples analyzed by gas chromatography/mass spectrometry to document sample bias. Additional QC samples may include environmental duplicate samples; field, equipment, and trip blanks; and matrix spike/matrix spike duplicate analyses. Specific QC requirements are described in the individual sampling and analysis plans.

8.3 QA of Data Management

Measurement data received from 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 two levels: (1) by a member of the staff or a contractor, and (2) by the project leader. During 1990, project records were maintained by the appropriate project leaders. Efforts are currently under way to forward records to the Department 3220 Records Center in accordance with the requirements of the Department 3220 Quality Plan (Section 17). The Records Center maintains all data files related to this report.

8.4 QA of Outside Analytical Laboratories

Appraisals of contractor laboratories (preaward audits) are conducted in accordance with Section 4 of the Department 3220 Quality Plan before an analysis laboratory is selected. Annual appraisals (e.g., inspections or audits) are subsequently conducted at the contractor laboratories in accordance with Sections 10 and/or 18 of the Department 3220 Quality Plan. Trip blanks, check samples, and replicates are submitted with the wastewater samples for analyses.

Contractor QA Overview

Department 3220 has several contractors who provide consulting, waste management and disposal, water sampling and analysis, and other analytical services. These contractors are monitored by contract monitors (with support from the Department 3220 Quality Coordinator) through one of the following mechanisms:

- A. Monitored by task (for consulting services)--The project evaluation sheet was developed to evaluate individual projects. The contractors provide monthly reports on the status of progress and budget.
- B. Performance checks and annual onsite appraisals (for analytical laboratories)--Quarterly blind samples, replicates, and blanks are submitted to the laboratories for performance checks. Corrective actions are documented and implemented.
- C. Cost-plus-award-fee contract for hazardous waste management and the Environmental Restoration (ER) Program--The contract has a 30-percent fixed and 70-percent variable award fee based on quarterly performance evaluations.

In October 1988, SNL, Albuquerque, entered into 4-yr contracts with 2 commercial laboratories to provide analytical services to SNL, Albuquerque, in conjunction with the environmental and hazardous waste programs. The laboratories that provided the majority of analytical support to SNL's environmentally-related sampling activities during 1990 were Encotec (Environmental Control Technology Corporation) located in Ann Arbor, Michigan, and Enseco, located in Arvada, Colorado. Other commercial laboratories providing analytical support during 1990 were IT/AS, Assaigai Analytical Laboratories, Inc., and TMA-Eberline. Quantities and types of analyses performed during 1990 are presented in Appendix E, Table E-1.

The contractor laboratories operate under strict QA/QC programs and routinely participate in the EPA's blind audit check sample programs. In addition, contracts with these laboratories stipulate that the laboratories concurrently analyze laboratory QC samples with all analytical batches containing SNL, Albuquerque, samples to monitor laboratory control and include results of these analyses in the analytical report.

To enhance confidence in the quality of data generated by the contractor laboratories, SNL, Albuquerque, has implemented its own laboratory performance program to monitor the contractor laboratories' overall analytical precision and accuracy for analyses routinely performed on SNL, Albuquerque, samples. During 1990, a total of 144 environmental duplicate samples and 111 check samples were submitted to the contractor laboratories at defined frequencies as double-blind samples along with routine environmental samples. Replicate environmental samples were submitted to each laboratory on a monthly or quarterly basis to monitor and document analytical precision. Check samples were submitted to the laboratories on a quarterly basis based on the frequency and type of samples submitted to assess and document laboratory precision and accuracy.

Check samples submitted to the contractor laboratories were prepared by a different outside laboratory or the EPA and submitted to the contractor laboratories at the frequencies indicated above. The check samples used were prepared in batch quantities and subjected to round-robin analyses for verification of check sample analyte concentrations. The samples were prepared by spiking concentrated solutions containing analytes of interest into reagent-grade water free of analytical interferences to create check samples at concentration ranges at one to five times the method detection limit. The check samples were prepared in duplicate so that 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 samples, oil samples prepared by the EPA containing known concentrations of polychlorinated biphenyls (PCBs) were submitted to both laboratories for analysis.

Results of each set of check sample analyses are summarized in Appendix E, Tables E-3 and E-4, respectively. The tables 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. 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 1990 (see Appendix E, Tables E-3 through E-6) indicates that the majority of analytes tested by the SNL, Albuquerque, analytical laboratories are within EPA-prescribed control limits. Analytes identified during 1990 with overall poor accuracy and/or precision performance for the Encotec laboratory were limited to silver (Ag) analysis. Analytes with overall poor accuracy and performance for the Enseco laboratory were limited to total organic halides (TOX) analysis.

During 1990, SNL, Albuquerque, worked with the contracted analytical laboratories, attempting to resolve problem areas identified from previous check sample analyses, i.e., laboratory deficiencies for analytical test procedures. Identified deficiencies of analytical data quality at the Encotec laboratory included poor accuracy for cyanide analyses, and poor accuracy and precision for mercury (Hg) and Ag analyses. Deficiencies

identified for the Enseco laboratory included total organic carbon (TOC), phenolic compounds, and sulfate analyses. Laboratory performance data for the last period check samples submitted suggest Encotec has resolved problems associated with cyanide and Hg analysis; however, recurring problems with Ag analysis remain. Efforts to determine the cause of problems with Ag analysis continue. Enseco laboratory data indicate improved precision and accuracy performance for phenolic compounds, sulfate, and TOC analyses. Efforts to identify causes for poor TOX analysis performance at Enseco during 1990 are under way.

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APPENDIX A
METEOROLOGICAL DATA

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

Month	Temperature		Precipitation Water Equivalent (cm)	Wind	
	<u>Daily Range (°C)</u>			Speed (m/s)	Direction
	Minimum	Maximum			
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

^aNOAA, Local Climatological Data, Annual Summary with Comparative Data, Albuquerque, New Mexico, 1990. 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.

1990 ENVIRONMENTAL MONITORING REPORT,
SANDIA NATIONAL LABORATORIES, ALBUQUERQUE

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

LATITUDE: 35°03'N LONGITUDE: 106°37'W ELEVATION: FT. GRND 5311 BARO 5313 TIME ZONE: MOUNTAIN MBAN: 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	0.4	0.0	0.0	0.0	0.0	0.4	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	0.4	0.4	0.1	0.4	0.1	0.4	0.6	1.5	5.6
Temperature														
-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	30	51	44	34	26	25	24	34	40	40	38	42	50	37
Hour 17 (Local Time)	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	1	1	1	1	1	1	0.08	1	1	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	1	1	0.0	1	3.2	9.3	14.7	14.7
-Year		1973	1986	1973	1973	1979	1990	1990	1	1971	1986	1940	1959	DEC 1959
-Maximum in 24 hrs	51	5.1	6.0	10.7	10.9	1.0	1	1	0.0	1	3.2	5.5	14.2	14.2
-Year		1973	1986	1973	1988	1979	1990	1990	1971	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	1587	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 * = 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.

REFERENCES

National Oceanographic and Atmospheric Administration (NOAA), 1990. "Local Climatological Data, Annual Summary with Comparative Data, Albuquerque, NM, NOAA."

APPENDIX B
SANDIA NATIONAL LABORATORIES, ALBUQUERQUE,
ENVIRONMENTAL RESTORATION PROGRAM SITES

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Table B-1. Sandia National Laboratories, Albuquerque, Environmental Restoration (ER) Program Sites

ER Program Operable Unit	ER Program Site Number	Site Name
ADS 1267, 1268	74	Chemical Waste Landfill
ADS 1289, 1290	76	Mixed Waste Landfill
ADS 1306b (Liquid Waste Disposal)	4 5	Radioactive Surface Impoundment Radioactive Seepage Basin
ADS1306a (Technical Areas III and V)	18 26 31 34 35 36 37 51 52 78 83 84 100 102 105 107 111	Storage and Salvage Yards Burial Site (west fence of TA 3) Electrical Transformer Oil Spill (Phase 5) Centrifuge Oil Spill (Phase 5) Vibration Facility Oil Spill (Phase 5) Oil Spill--HERMES PROTO Oil Spill Building 6924 (pad/tank/pit) Sandia Engineering Reactor Liquid Waste Disposal Gas Cylinder Disposal Pit Sled Tracks Gun Facilities (Technical Area III) Building 6620 HE Sump/Drain Radioactive Disposal Site (E of Technical Area III) Mercury (Building 6536) Explosive Test Area (SE of Technical Area III) Building 6715 Sump/Drains
ADS 1303, 1304 (Technical Area II)	1 2 3 43 44 48 50 113 114 135 136	Radioactive Burial Site Classified Waste Disposal Trenches Chemical Disposal Pit Radioactive Storage Yard Decontamination Site and Uranium Calibration Pits Building 904 Septic System Old Centrifuge Site Technical Area II Firing Sites Explosive Burn Pit Building 906 Septic System Building 907 Septic System

Table B-1. Sandia National Laboratories, Albuquerque, Environmental
Restoration Program Sites (Continued)

ER Program Operable Unit	ER Program Site Number	Site Name
ADS 1303, 1304 (Technical Area II)	159	Building 935 Floor Drains and Septic System
	165	Building 901 Septic System
	166	Building 919 Septic System
	167	Building 940 Septic System
	168	Building 901-1 LUST
	169	Building 910-1 LUST
	170	Building 911-1 LUST
	171	Building 912-1 LUST
ADS 1295, 1294 (Septic Tanks and Drain Fields)	49	Building 9820 Drains
	101	Explosive Contaminated Sumps, Drains
	116	Building 9990 Septic Tank and Drain Fields
	137	Building 6540/6542 Septic Tanks and Leach Field
	138	Building 6630 Septic Tank and Leach Field
	139	Building 9964 Septic Tank Systems
	140	Building 9965 Septic Tank and Seepage Pit
	141	Building 9967 Septic Tank and Seepage Pit
	142	Building 9970 Septic Tank and Seepage Pit
	143	Building 9972 Septic Tank and Leach Field
	144	Building 9980 Septic Tank Systems
	145	Building 9981/9982 Septic Tank and Leach Field
	146	Drain Fields (Building 9920)
	147	Building 9925 Septic Tanks and Leach Field
	148	Building 9927 Septic Tank and Seepage Pit
	149	Building 9930 Septic Tank and Seepage Pit
	150	Building 9939/9939A Septic Tank and Seepage Pit
	151	Building 9940 Septic Tank and Seepage Pit
	152	Building 9950 Septic Tank and Leach Field
	153	Building 9956 Septic Tank and Leach Field
	154	Building 9960 Septic Tank and Seepage Pit
	161	Building 6636 Septic Tank and Leach Field
	155	Building 6597 25,000 Gal
	172	Building 888-4
	173	Building 6525
	174	Building 6581-2
	175	Building 6588-1
	176	Building 605-18
	177	Holloman AFB Building 12-1

Table B-1. Sandia National Laboratories, Albuquerque, Environmental Restoration Program Sites (Continued)

ER Program Operable Unit	ER Program Site Number	Site Name
ADS 1300, 1301 (Leaking Under- ground Storage Tanks)	178	Building 6587-3
	179	Manzano AFB Building 7570-1
	180	Building 6503
	181	Building 6500
ADS 1270, 1271 (Coyote Canyon Blast Area)	8	Open Dump
	58	Coyote Canyon Blast Area
ADS 1308 (Thunder Range)	6	Gas Cylinder Disposal Pit
	17	Scrap Yards/Open Dump
	39	Oil Spill--Solar Facility
	54	Pickax Site
	55	Red Towers Site
	56	Old Thunderwells
	79	Gas Cylinder Disposal
	89	Shock Tube Site
	90	Beryllium Firing Site
	91	Lead Firing Site
	110	Thunder Range--Miscellaneous
ADS 1266 (Central Coyote Test Field)	11	Radioactive/Explosive Burial Mounds
	19	Scrap Yard (NW of old aerial cable)
	22	Storage/Burn Area (W of DEER)
	57	Workman Site (Phase 5)
	66	Boxcar Site
	68	Old Burn Site (Phase 5)
	70	Explosive Test Pit (water towers)
	71	Moonlight Shot Area
	87	Building 9990
	82	Old Aerial Cable Site (scrap yard/dump/test area)
ADS 1288 (Pendulum Area)	10	Burial Mounds
	59	Pendulum Site
	60	Bunker Area
	92	Pressure Vessel Test Site (Coyote Canyon)
ADS 1272 (Coyote Springs Area)	21	Metal Scrap (Coyote Springs)
	27	Building 9820--Animal Disposal Pit
	62	Graystone Manor Site
	88	Firing Site (SW of Coyote Springs)

Table B-1. Sandia National Laboratories, Albuquerque, Environmental
Restoration Program Sites (Continued)

ER Program Operable Unit	ER Program Site Number	Site Name
ADS 1298 (SW Coyote Test Field)	14	Burial Site (Building 9920)
	38	Oil Spill (Building 9920)
	53	Building 9923
	85	Firing Site (Building 9920)
	86	Firing Site (Building 9927)
	103	Scrap Yard (Building 9939)
	106	Building Drains (Buildings 9939, 9960, 9967)
	108	Firing Site (Building 9940)
	109	Firing Site (Building 9956)
	112	Explosive Contaminated Sump (Building 9956)
	115	Firing Site (Building 9930)
	117	Trenches (Building 9939)
ADS 1302 (Technical Area I)	25	Burial Site (S of Technical Area I)
	30	PCB Spill (Reclamation Yard)
	32	Steam Plant Oil Spill (Phase 5)
	33	Motor Pool Oil Spill (Phase 5)
	41	Building 838 Mercury Spill
	42	Acid Spill-Water Treatment Facility
	73	Hazardous Waste Repackaging/Storage
	77	Oil Surface Impoundment (Technical Area IV)
	96	Storm Drain System
	104	PCB Spill (Computer Facility)
ADS 1282 (Lurance Canyon)	185	Building 863, TCA, and Photochemical Releases
	12	Burial Site/Open Dump
	13	Oil Surface Impoundment (Lurance Canyon)
	63	Balloon Test Area
	64	Gun Site (Madera Canyon)
	65	Lurance Canyon Explosive Test Site
	94	Lurance Canyon Burn Site
	81	New Aerial Cable Site (burial site/dump/test area)
ADS 1293 (Schoolhouse Mesa)	93	Madera Canyon Rocket Launcher Pads
	9	Burial Site/Open Dump
	20	Uranium Burn Site
	61	Schoolhouse Mesa Test Site

Table B-1. Sandia National Laboratories, Albuquerque, Environmental Restoration Program Sites (Concluded)

ER Program Operable Unit	ER Program Site Number	Site Name
ADS 1309 (Tijeras Arroyo)	23	Disposal Treches
	24	Landfill/Open Dump
	45	Liquid Discharge (behind Technical Area IV)
	7	Gas Cylinder Disposal (Arroyo del Coyote)
	16	Open Dumps (Arroyo Del Coyote)
	40	Oil Spill (6000 Igloo Area) (Phase 5)
	46	Old Acid Waste Line Outfall
ADS 1297 (South Coyote Test Field)	15	Trash Pits (Frustration Site)
	28	Mine Shafts
	47	Doomed Bunker Outfall
	67	Frustration Site
	69	Firing Pits (near USGS)
	72	Operation Beaver Site

APPENDIX C
SAMPLE COLLECTION AND ANALYSIS

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C.1 Sample Collection for Radioactive Effluents

Samples are gathered and stored in accordance with methods described in DOE/EP-0023 (DOE, 1981). These procedures have been documented in the SNL, Albuquerque, "Environmental Monitoring Manual" (SNL, 1986). Native vegetation, soil, and water samples are collected annually at the end of the growing season. Thermoluminescent dosimeters (TLDs) are exchanged quarterly (Table C-1).

Vegetation

Native vegetation samples are collected in late summer from a 9-m² area at each sampling location. Because the native desert vegetation is sparse, a sample includes a mixture of species, with grass species predominating. Each sample weighs approximately 0.5 kg and consists of stems and leaves representative of the species at each site. Consequently, radionuclide concentrations for vegetation vary due to species uptake, retention, or deposition as well as location. Three samples are collected and composited at each location to ensure an adequate sample size for subsequent analysis. Replicate samples consisting solely of grasses are collected at each of three adjacent sample plots in order to estimate variability due to location. Each vegetation sample is cut and blended before radiochemical analysis for tritium and gamma spectrum analysis.

Water

Water samples are collected in acid-cleaned, plastic containers that have been rinsed in distilled water. Replicate samples of approximately 3.8 L of water are collected at each water sampling location. One sample is acidified immediately to 10 percent by volume with 2N HNO and is used for total water radiochemical analysis.

The second sample is filtered immediately and the water is then acid-treated to prevent plating of any radionuclides on the container walls. A radiochemical analysis for gross alpha (α), gross beta (β), and gamma (γ) spectrum analysis, and uranium (U) and tritium (³H) is then performed on the water and filter samples.

Soil

Soil samples are randomly collected from the same 9-m² quadrant as the vegetation samples. Three 100-cm² samples of the top 5 cm of soil are collected and composited at each station. Each soil sample is dried, ball-milled, and sieved prior to a cesium-137 (¹³⁷Cs) and U analysis. A separate aliquot is used for ³H analysis following EPA-recommended procedures. Replicate (three) samples are collected at three or more locations to determine sample variability.

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

Parameter	Sample Media				
	Vegetation	Soil	Total	Water	TLDs
				Filters ^a Filtrate	
Number of Locations	39	41	8	8	34
Number of Samples	49	53	10	10	130
Sample Frequency	Annual	Annual	Annual	Annual	Quarterly
Analysis Performed					
Gross α	-- ^b	--	X	X ^c	--
Gross β	--	--	X	X ^c	--
U	--	X	X	X	--
Gamma Spectrometry	X	X	X	X	--
Tritium	X	X	X	X	--
% HO	X	X	--	--	
TLD	--	--	--	--	X
Number of Analyses	147	159	50	80	130

^aThese filter samples are for analysis of suspended solids as well as water for selected analysis.

^bNo analysis performed.

^cAn analysis was performed on suspended solids in addition to filtered water (filtrate).

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, finely ground up, and then placed in a 500-ml Marinelli beaker for gamma spectrum analysis. A 70-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 1,000-ml distillation flask, and the water is collected in a Barrett trap. The water collected in the trap is analyzed for ^3H with a liquid scintillation detector using a 1-ml sample volume.

Soil

Soil samples are analyzed for uranium by leaching a 2-g aliquot with mixed acids (HNO_3/HF) and diluting with water to a 10-ml volume to extract uranium and other acid-soluble metals. A 0.1-ml aliquot of acid solution is diluted to 10 ml with 2N HNO_3 . Fifteen milliliters of aluminum nitrate and 10 ml of ethyl acetate are added and mixed for 10 min to selectively extract uranium into the organic phase. Three 0.1-ml aliquots are then fused with an NaF/LiF flux and tested by fluorescence.

Percent Moisture

Percent moisture for soil samples is determined by one of two methods. A moisture balance is used that provides a direct readout of percent moisture in 10 g of soil. The alternative method is to dry 10 g of soil at 110°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, "Standard Techniques for Determination of Germanium Semiconductor Detector Gamma Ray Efficiency Using a Standard Marinelli Beaker Geometry." They are analyzed for gamma-emitting radionuclides by placing approximately 450 g of water, 862 g of soil, or 70 g of vegetation in 500-ml Marinelli beakers and counting for 1,000 min (100 min for soil) by using high-efficiency, high-resolution intrinsic Ge or Ge (Li) detectors and multichannel analyzers. The vegetation samples are analyzed in a 250-ml geometry. The detectors are calibrated and checked routinely by 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 NBS. The data are analyzed by computer software developed by Canberra Industries.

Water

Water samples are further analyzed for gross α and gross β 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 by using a low-background, gas-proportional detector. The detector is calibrated and checked routinely by using radionuclide standards traceable to the NBS.

C.3 External Penetrating Radiation

TLDs are placed at 33 locations. The type of TLD phosphor used is LiF in chip form. All dosimeters are placed in open areas over soil substrates 1 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 hr before field placement. Transit controls are used to document additional exposure received during transit from SNL, Albuquerque, to field locations. The TLD readout equipment is calibrated by exposing TLDs to 0, 10, 20, 30, and 50 mR of ^{137}Cs midway through each quarterly field cycle. Ten TLDs are exposed at each level.

Procedures used in the SNL, Albuquerque, environmental dosimetry program are documented in the "Dosimetry Procedures Manual" (Federal Register, 1988).

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 a chalked tape. 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 phenomena is documented in the field logs. The EPA is reviewing the significance of headspace in samples containing organics.

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

Parameter	Method No. (SW-846) ^a	Estimated Method Limit ^b	Container Type ^c	Minimum Volume	Preservation ^d	Maximum Holding Time
<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

^aU.S. Environmental Protection Agency, 1986, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," Third Edition, EPA-SW-846, unless otherwise noted. 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.

^bMethod 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.

^cP = Linear polyethylene; G = Glass; and AG = Amber glass.

^dPreservatives and holding times as specified in EPA-SW-846, Third Edition.

^eU.S. Environmental Protection Agency, 1984, "Methods for Chemical Analysis of Water and Wastewater," EPA-600-84-017.

^fAll metals analytes from single sample.

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

Parameter	Method No. (SW-846) ^a	Estimated Detection Limit ^b	Container Type ^c	Minimum Volume	Preservation ^d	Maximum Holding Time
Sodium	6010 ICP	5.0 mg/l	P	1000 ml ^f	HNO to pH <2	6 months
<u>EPA Interim Drinking Water Parameters</u>						
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 α	9310	3 pCi/l	P	1 gal ^g	HNO to pH <2	6 months
Gross β	9310	4 pCi/l	P	1 gal ^g	HNO to pH <2	6 months

^aU.S. Environmental Protection Agency, 1986, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," Third Edition, EPA-SW-846, unless otherwise noted. 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.

^bMethod detection limit as listed for specified method. Detection limits listed as mg/l = milligrams per liter; μ g/l = micrograms per liter; and pCi/l = picocuries per liter.

^cP = Linear polyethylene; G = Glass; and AG = Amber glass.

^dPreservatives and holding times as specified in EPA-SW-846, Third Edition.

^eU.S. Environmental Protection Agency, 1984, "Methods for Chemical Analysis of Water and Wastewater," EPA-600-84-017.

^fAll metals analytes from single sample.

^gAll radionuclide analytes from single container.

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
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 extrac- tion
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 extrac- tion
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 extrac- tion
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 extrac- tion
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 extrac- tion
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 extrac- tion

^aU.S. Environmental Protection Agency, 1986, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," Third Edition, EPA-SW-846, unless otherwise noted. 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.

^bMethod 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.

^cP = Linear polyethylene; G = Glass; and AG = Amber glass.

^dPreservatives and holding times as specified in EPA-SW-846, Third Edition.

^eU.S. Environmental Protection Agency, 1984, "Methods for Chemical Analysis of Water and Wastewater," EPA-600-84-017.

^fAll metals analytes from single sample.

^gAll radionuclide analytes from single container.

^hAll pesticide and herbicide analytes 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
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 GC/MS	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 GC/MS	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 ex- traction

^aU.S. Environmental Protection Agency, 1986, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," Third Edition, EPA-SW-846, unless otherwise noted. 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.

^bMethod 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.

^cp = Linear polyethylene; G = Glass; and AG = Amber glass.

^dPreservatives and holding times as specified in EPA-SW-846, Third Edition.

^eU.S. Environmental Protection Agency, 1984, "Methods for Chemical Analysis of Water and Wastewater," EPA-600-84-017.

^fAll metals analytes from single sample.

^gAll radionuclide analytes from single container.

^hAll pesticide and herbicide analytes from single set of containers.

For analysis, analytical methods described in EPA (1982; 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 is 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 and 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 is not in itself a confirmation of a release from the Chemical Waste Landfill (CWL) reaching the groundwater. One must review the data, the sampling and analytical methods, and the assumptions for the statistical tests in order to confirm that the statistical change represents a true change.

pH

Because relatively small changes in parameter values may show 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 the field data collection logs reveals that all pH measurements were made with a field pH instrument. Potential sources of error include temperature, gas exchange, and suspension effects. The meter was calibrated in the field using standard buffer solutions. A potential source of error for the pH measurements was thought to be in the calibration procedure if the buffer solutions were at a different temperature than the groundwater being measured. A review of the sensitivity of pH to temperature changes 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 ranged from 15 to 30°C.

Because it is impractical to make in-situ measurements of the groundwater pH, the sample 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 occurring 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 the well reduces the contact of the groundwater with the atmosphere. Generally, the 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 MW1 and BW1, both 2-in. 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 MW1 and BW1 was extremely turbid; therefore, the suspension was allowed to settle for approximately 15 min before bailing. The loss or gain of certain volatile constituents that participate in controlling the solution pH, such as carbon dioxide (CO₂) and hydrogen sulfide, will alter the pH as a time-dependent phenomenon. The absorption of CO₂ into the solution will generate carbonic acid, release hydrogen ions from carbonate-bicarbonate reactions, and cause a decrease in the pH. The equilibrium pH due to the partial pressure of atmospheric CO₂ 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 deaerated alkaline solution allowed to absorb atmospheric constituents (Garrels and Christ, 1965).

The effects of mineral suspensions on the results of a 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 approximately 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 MW1A, 50 ft to the west of MW1) 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 MW1 for purging and sampling, well MW1 showed very high turbidity levels. During the February 1988 sampling event, a measurement of the turbidity revealed a value of 3,400 nephelometric turbidity unit (NTU) for MW1 and 3,100 for BW1.

Specific Conductivity

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

Statistical Assumptions

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

The CABF 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, that amended the statistical tests required for groundwater monitoring (Federal Register, 1988). The rule specifies five other tests, more appropriate to groundwater monitoring than the CABF method, for permitted facilities under 40 CFR Part 264. The EPA believed that most land disposal facilities would have permits by November 1988 and did not see the need to modify the interim status regulations of 40 CFR Part 265.

Two sources have identified potential problems with using the CABF as a method to detect releases from a hazardous waste management unit. The EPA "Technical Enforcement Guidance Document" discusses t-tests available for facilities under interim status (EPA, 1986). 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 for groundwater monitoring.

The October 1988 Final Rule on statistical methods for groundwater monitoring points out several reasons for rejecting the CABF method: (1) the replicate sampling method required by the regulations is not appropriate for the CABF method, (2) the CABF method does not adequately consider the number of comparisons that must be made under the regulations, and (3) the CABF method has no control for seasonal variations in parameter values (Federal Register, 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, Albuquerque, 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 Part 265 for interim status facilities or by the New Mexico Environmental Improvement Division (NMED).

C.5 Sample Collection and Analysis for Wastewater Sampling

The sampling methods and procedures are detailed in the SNL, Albuquerque, Wastewater Sampling Plan Table C-3. Samples were collected at eight locations (Table 6-2). Methods used for sampling grab and composite samples are listed in Tables C-2 and C-3, respectively. Analytical methods and detection limits are listed in Table D-2 for each parameter. Monitoring requirements for each of the permitted stations may be separated into daily, monthly, and yearly requirements. These requirements are summarized in Appendix C, Table C-3. Details about the parameters to be analyzed and the permit limits for each parameter are contained in Tables C-4 through C-8.

The City of Albuquerque permits require that all parameters listed in Tables C-4 through C-8 be analyzed once each year. Stations WW001, WW004, WW005, WW006, WW007, WW008, and WW009 are monitored continuously for pH and flow. Station WW003 is monitored for pH in each of two grab samples taken during the four sampling days every month. Table C-3 describes the analytical methods used for each SNL, Albuquerque, permitted wastewater sampling station.

Table C-3. Sampling and Analytical Methods, SNL, Albuquerque,
Wastewater Monitoring Stations

Parameter	Wastewater Discharge Permit Number	Sampling Frequency ^a	Sample Collection Method	EPA Analytical Method ^b	Preservative	Holding Time	Container Type ^c
Arsenic	2069A	A	Flow-Composite ^d	206.3/200.7 ^e	HNO ₃ to pH<2	6 months	P, G
	2069C	A	Time-Composite ^f				
	2069D	A	Flow-Composite				
	2069E	M	Flow-Composite				
	2069F	A	Flow-Composite				
	2069G	A	Flow-Composite				
	2069H	M	Flow-Composite				
	2069I	A	Flow-Composite				
Barium	2069A	A	Flow-Composite	208.1/200.7 ^e	HNO ₃ to pH<2	6 months	P, G
	2069C	A	Time-Composite				
	2069D	A	Flow-Composite				
	2069E	A	Flow-Composite				
	2069F	A	Flow-Composite				
	2069G	A	Flow-Composite				
	2069H	A	Flow-Composite				
	2069I	A	Flow-Composite				
Cadmium	2069A	M	Flow-Composite	213.1/200.7 ^e	HNO ₃ to pH<2	6 months	P, G
	2069C	M	Time-Composite				
	2069D	M	Flow-Composite				
	2069E	M	Flow-Composite				
	2069F	M	Flow-Composite				
	2069G	M	Flow-Composite				
	2069H	M	Flow-Composite				
	2069I	M	Flow-Composite				

^aA = Annually; M = Monthly; and C = Continuous monitoring.

^bAlternate EPA-approved analytical methods are listed in 40 CFR Part 136.3, Table 1B.

^cP = Plastic, for metals polyethylene with polypropylene cap; G = Glass; and AG = Amber glass.

^d24-hour flow proportional composite sample collected with an ISCO 2700R sampler interfaced to an ISCO 2400 flow meter. Sample maintained near 4°C during sample collection. Specific sample collection techniques are identified in the draft SNL, Wastewater Sampling Plan (October 1987).

^eU.S. Environmental Protection Agency (EPA), Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March 1983.

^f24-hour time-weighted composite sample collected using an ISCO 2700 portable sampler. Sample collection container iced during sample collection.

Table C-3. Sampling and Analytical Methods, SNL, Albuquerque, Wastewater Monitoring Stations (Continued)

Parameter	Wastewater Discharge Permit Number	Sampling Frequency ^a	Sample Collection Method	EPA Analytical Method ^b	Preservative	Holding Time	Container Type ^c
Total Chromium	2069A	A	Flow-Composite ^d	218.1/200.7 ^e	HNO ₃ to pH<2	6 months	P,G
	2069C	M	Time-Composite ^f				
	2069D	M	Flow-Composite				
	2069E	M	Flow-Composite				
	2069F	A	Flow-Composite				
	2069G	M	Flow-Composite				
	2069H	M	Flow-Composite				
	2069I	A	Flow-Composite				
Copper	2069A	M	Flow-Composite	220.1/200.7 ^e	HNO ₃ to pH<2	6 months	P,G
	2069C	M	Time-Composite				
	2069D	M	Flow-Composite				
	2069E	M	Flow-Composite				
	2069F	M	Flow-Composite				
	2069G	M	Flow-Composite				
	2069H	M	Flow-Composite				
	2069I	M	Flow-Composite				
Total Cyanide	2069A	M	Flow-Composite	335.2/335.3 ^e	Cool to 4°C, NaOH to pH>12 0.68 C ₆ H ₈ O ₆ /L	14 days	P,G
	2069C	M	Time-Composite				
	2069D	M	Flow-Composite				
	2069E	A	Flow-Composite				
	2069F	M	Flow-Composite				
	2069G	A	Flow-Composite				
	2069H	M	Flow-Composite				
	2069I	M	Flow-Composite				

^aA = Annually; M = Monthly; and C = Continuous monitoring.^bAlternate EPA-approved analytical methods are listed in 40 CFR Part 136.3, Table 1B.^cP = Plastic, for metals polyethylene with polypropylene cap; G = Glass; and AG = Amber glass.^d24-hour flow proportional composite sample collected with an ISCO 2700R sampler interfaced to an ISCO 2400 flow meter. Sample maintained near 4°C during sample collection. Specific sample collection techniques are identified in the draft SNL Wastewater Sampling Plan (October 1987).^eU.S. Environmental Protection Agency (EPA), Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March 1983.^f24-hour time-weighted composite sample collected using an ISCO 2700 portable sampler. Sample collection container iced during sample collection.

Table C-3. Sampling and Analytical Methods, SNL, Albuquerque,
Wastewater Monitoring Stations (Continued)

Parameter	Wastewater Discharge Permit Number	Sampling Frequency ^a	Sample Collection Method	EPA Analytical Method ^b	Preservative	Holding Time	Container Type ^c
Fluoride	2069E	M	Flow-Composite ^d	340.2 ^e	None required	28 days	G
	2069G	M	Flow-Composite				
	2069H	M	Flow-Composite				
Lead	2069A	M	Flow-Composite	239.1/200.7 ^e	HNO ₃ to pH<2	6 months	P,G
	2069C	M	Time-Composite ^f				
	2069D	M	Flow-Composite				
	2069E	M	Flow-Composite				
	2069F	M	Flow-Composite				
	2069G	M	Flow-Composite				
	2069H	M	Flow-Composite				
	2069I	M	Flow-Composite				
Manganese	2069A	A	Flow-Composite	243.1/200.7 ^e	HNO ₃ to pH<2	6 months	P,G
	2069C	A	Time-Composite				
	2069D	A	Flow-Composite				
	2069E	A	Flow-Composite				
	2069F	A	Flow-Composite				
	2069G	A	Flow-Composite				
	2069H	A	Flow-Composite				
	2069I	A	Flow-Composite				

^aA = Annually; M = Monthly; and C = Continuous monitoring.

^bAlternate EPA-approved analytical methods are listed in 40 CFR Part 136.3, Table 1B.

^cP = Plastic, for metals polyethylene with polypropylene cap; G = Glass; and AG = Amber glass.

^d24-hour flow proportional composite sample collected with an ISCO 2700R sampler interfaced to an ISCO 2400 flow meter. Sample maintained near 4°C during sample collection. Specific sample collection techniques are identified in the draft SNL, Wastewater Sampling Plan (October 1987).

^eU.S. Environmental Protection Agency (EPA), Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March 1983.

^f24-hour time-weighted composite sample collected using an ISCO 2700 portable sampler. Sample collection container iced during sample collection.

Table C-3. Sampling and Analytical Methods, SNL, Albuquerque, Wastewater Monitoring Stations (Continued)

Parameter	Wastewater Discharge Permit Number	Sampling Frequency ^a	Sample Collection Method	EPA Analytical Method ^b	Preservative	Holding Time	Container Type ^c
Mercury	2069A	A	Flow-Composite ^d	245.1 ^e	HNO ₃ to pH<2	28 days	P,G
	2069C	A	Time-Composite ^f				
	2069D	A	Flow-Composite				
	2069E	A	Flow-Composite				
	2069F	A	Flow-Composite				
	2069G	A	Flow-Composite				
	2069H	A	Flow-Composite				
Nickel	2069I	A	Flow-Composite				
	2069A	A	Flow-Composite	249.1/200.7 ^e	HNO ₃ to pH<2	6 months	P,G
	2069C	M	Time-Composite				
	2069D	M	Flow-Composite				
	2069E	A	Flow-Composite				
	2069F	A	Flow-Composite				
	2069G	M	Flow-Composite				
Oil and Grease	2069H	A	Flow-Composite				
	2069I	M	Flow-Composite				
	2069A	A	Flow-Composite	413.1 ^e	Cool to 4°C, HCl to pH<2	28 days	P,G
	2069C	A	Time-Composite				
	2069D	A	Flow-Composite				
	2069E	A	Flow-Composite				
	2069F	A	Flow-Composite				
	2069G	A	Flow-Composite				
	2069H	A	Flow-Composite				
	2069I	A	Flow-Composite				

^aA = Annually; M = Monthly; and C = Continuous monitoring.^bAlternate EPA-approved analytical methods are listed in 40 CFR Part 136.3, Table 1B.^cP = Plastic, for metals polyethylene with polypropylene cap; G = Glass; and AG = Amber glass.^d24-hour flow proportional composite sample collected with an ISCO 2700R sampler interfaced to an ISCO 2400 flow meter. Sample maintained near 4°C during sample collection. Specific sample collection techniques are identified in the draft SNL, Wastewater Sampling Plan (October 1987).^eU.S. Environmental Protection Agency (EPA), Methods for Chemical Analysis of Water and Wastes, EPA-800/4-79-020, March 1983.^f24-hour time-weighted composite sample collected using an ISCO 2700 portable sampler. Sample collection container iced during sample collection.

Table C-3. Sampling and Analytical Methods, SNL, Albuquerque,
Wastewater Monitoring Stations (Continued)

Parameter	Wastewater Discharge Permit Number	Sampling Frequency ^a	Sample Collection Method	EPA Analytical Method ^b	Preservative	Holding Time	Container Type ^c
pH ⁸	2069A	C	Flow-Composited Time-Composite ^f Flow-Composite Flow-Composite Flow-Composite Flow-Composite Flow-Composite Flow-Composite Flow-Composite	150.1/150.2 ^e	None Required	Analyze Immediately	P,G
	2069C	h					
	2069D	C					
	2069E	C					
	2069F	C					
	2069G	C					
	2069H	C					
	2069I	C					
Phenolics	2069A	A	Flow-Composited Time-Composite ^f Flow-Composite Flow-Composite Flow-Composite Flow-Composite Flow-Composite Flow-Composite	420.1/420.2 ^e	Cool to 4°C, H ₂ SO ₄ to pH<2	28 days	P,G
	2069C	A					
	2069D	A					
	2069E	A					
	2069F	A					
	2069G	A					
	2069H	A					
	2069I	A					
Selenium	2069A	A	Flow-Composite Time-Composite Flow-Composite Flow-Composite Flow-Composite Flow-Composite Flow-Composite Flow-Composite	270.3/200.7 ^e	HNO ₃ to pH<2	6 months	P,G
	2069C	A					
	2069D	A					
	2069E	A					
	2069F	A					
	2069G	A					
	2069H	A					
	2069I	A					

^aA = Annually; M = Monthly; and C = Continuous monitoring.

^bAlternate EPA-approved analytical methods are listed in 40 CFR Part 136.3, Table 1B.

^cP = Plastic, for metals polyethylene with polypropylene cap; G = Glass; and AG = Amber glass.

^d24-hour flow proportional composite sample collected with an ISCO 2700R sampler interfaced to an ISCO 2400 flow meter. Sample maintained near 4°C during sample collection. Specific sample collection techniques are identified in the draft SNL, Wastewater Sampling Plan (October 1987).

^eU.S. Environmental Protection Agency (EPA), Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March 1983.

^f24-hour time-weighted composite sample collected using an ISCO 2700 portable sampler. Sample collection container iced during sample collection.

^gTwo grab samples collected and measured for pH and temperature each day of monthly sample collection.

^hContinuous monitoring with a Leeds and Northrup 200 series pH monitoring system.

Table C-3. Sampling and Analytical Methods, SNL, Albuquerque, Wastewater Monitoring Stations (Continued)

Parameter	Wastewater Discharge Permit Number	Sampling Frequency ^a	Sample Collection Method	EPA Analytical Method ^b	Preservative	Holding Time	Container Type ^c
Silver	2069A	A	Flow-Composited ^d	272.1/200.7 ^e	HNO ₃ to pH<2	6 months	P,G
	2069C	M	Time-Composite ^f				
	2069D	M	Flow-Composite				
	2069E	A	Flow-Composite				
	2069F	A	Flow-Composite				
	2069G	A	Flow-Composite				
	2069H	M	Flow-Composite				
	2069I	A	Flow-Composite				
Temperature	2069A	A	Grab	170.1 ^e	None Required	NA	P,G
	2069C	M	Grab				
	2069D	A	Grab				
	2069E	A	Grab				
	2069F	A	Grab				
	2069G	A	Grab				
	2069H	A	Grab				
	2069I	A	Grab				
Zinc	2069A	M	Flow-Composite	289.1/200.7 ^e	HNO ₃ to pH<2	6 months	P,G
	2069C	M	Time-Composite				
	2069D	M	Flow-Composite				
	2069E	M	Flow-Composite				
	2069F	M	Flow-Composite				
	2069G	M	Flow-Composite				
	2069H	M	Flow-Composite				
	2069I	M	Flow-Composite				

^aA = Annually; M = Monthly; and C = Continuous monitoring.^bAlternate EPA-approved analytical methods are listed in 40 CFR Part 136.3, Table 1B.^cP = Plastic, for metals polyethylene with polypropylene cap; G = Glass; and AG = Amber glass.^d24-hour flow proportional composite sample collected with an ISCO 2700R sampler interfaced to an ISCO 2400 flow meter. Sample maintained near 4°C during sample collection. Specific sample collection techniques are identified in the draft SNL, Wastewater Sampling Plan (October 1987).^eU.S. Environmental Protection Agency (EPA), Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March 1983.^f24-hour time-weighted composite sample collected using an ISCO 2700 portable sampler. Sample collection container iced during sample collection.

Table C-3. Sampling and Analytical Methods, SNL, Albuquerque,
Wastewater Monitoring Stations (Continued)

Parameter	Wastewater Discharge Permit Number	Sampling Frequency ^a	Sample Collection Method	EPA Analytical Method ^b	Preservative	Holding Time	Container Type ^c
<u>Total Toxic Organicsⁱ</u>							
Volatile Compounds	2069A	A	Flow-Composite ^j	624 ^k	Cool to 4°C, 0.008% Na ₂ S ₂ O ₃	14 days	AG, Teflon- faced silicone septa, no headspace
	2069C	A	Time-Composite ^j				
	2069D	A	Flow-Composite ^j				
	2069E	A	Flow-Composite ^j				
	2069F	A	Flow-Composite ^j				
	2069G	A	Flow-Composite				
	2069H	A	Flow-Composite				
	2069I	A	Flow-Composite				
	2069A	A	Flow-Composite				
BNA Extractable Compounds	2069C	A	Time-Composite	625 ^k	Cool to 4°C, 0.008% Na ₂ S ₂ O ₃	7 days ^l	AG, Teflon- lined cap
	2069D	A	Flow-Composite				
	2069E	A	Flow-Composite				
	2069F	A	Flow-Composite				
	2069G	A	Flow-Composite				
	2069H	A	Flow-Composite				
	2069I	A	Flow-Composite				
	2069A	A	Flow-Composite				
	2069C	A	Flow-Composite				

^aA = Annually; M = Monthly; and C = Continuous monitoring.

^bAlternate EPA-approved analytical methods are listed in 40 CFR Part 136.3, Table 1B.

^cP = Plastic, for metals polyethylene with polypropylene cap; G = Glass; and AG = Amber glass.

^d24-hour flow proportional composite sample collected with an ISCO 2700R sampler interfaced to an ISCO 2400 flow meter. Sample maintained near 4°C during sample collection. Specific sample collection techniques are identified in the draft SNL, Wastewater Sampling Plan (October 1987).

^eU.S. Environmental Protection Agency (EPA), Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March 1983.

^f24-hour time-weighted composite sample collected using an ISCO 2700 portable sampler. Sample collection container iced during sample collection.

^gTwo grab samples collected and measured for pH and temperature each day of monthly sample collection.

^hContinuous monitoring with a Leeds and Northrup 200 series pH monitoring system.

ⁱTotal Toxic Organic (TTO) parameters as identified in wastewater discharge permits are contained in the subset of organic analyses methods listed.

^jVolatile organic fraction collected each 12-hour interval during annual sample collection.

^kU.S. Environmental Protection Agency (EPA), Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater, EPA-600/4-82-057, July 1982.

^lHolding time is 40 days after extraction.

Table C-3. Sampling and Analytical Methods, SNL, Albuquerque, Wastewater Monitoring Stations (Concluded)

Parameter	Wastewater Discharge Permit Number	Sampling Frequency ^a	Sample Collection Method	EPA Analytical Method ^b	Preservative	Holding Time	Container Type ^c
Pesticides	2069A	A	Flow-Composite	608k	Cool to 4°C, pH 5-9	7 days ¹	AG, Teflon-lined cap
	2069C	A	Time-Composite				
	2069D	A	Flow-Composite				
	2069E	A	Flow-Composite				
	2069F	A	Flow-Composite				
	2069G	A	Flow-Composite				
	2069H	A	Flow-Composite				
Polychlorinated Biphenyls	2069I	A	Flow-Composite	608k	Cool to 4°C, pH 5-9	7 days ¹	AG, Teflon-lined cap
	2069A	A	Flow-Composite				
	2069C	A	Time-Composite				
	2069D	A	Flow-Composite				
	2069E	A	Flow-Composite				
	2069F	A	Flow-Composite				
	2069G	A	Flow-Composite				
	2069H	A	Flow-Composite				
	2069I	A	Flow-Composite				

^aA = Annually; M = Monthly; and C = Continuous monitoring.

^bAlternate EPA-approved analytical methods are listed in 40 CFR Part 136.3, Table 1B.

CP = Plastic, for metals polyethylene with polypropylene cap; G = Glass; and AG = Amber glass.

^d24-hour flow proportional composite sample collected with an ISCO 2700R sampler interfaced to an ISCO 2400 flow meter. Sample maintained near 4°C during sample collection. Specific sample collection techniques are identified in the draft SNL Wastewater Sampling Plan (October 1987).

^eU.S. Environmental Protection Agency (EPA), Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March 1983.

^f24-hour time-weighted composite sample collected using an ISCO 2700 portable sampler. Sample collection container iced during sample collection.

^gTwo grab samples collected and measured for pH and temperature each day of monthly sample collection.

^hContinuous monitoring with a Leeds and Northrup 200 series pH monitoring system.

ⁱTotal Toxic Organic (TTO) parameters as identified in wastewater discharge permits are contained in the subset of organic analyses methods listed.

^jVolatile organic fraction collected each 12-hour interval during annual sample collection.

^kU.S. Environmental Protection Agency (EPA), Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater, EPA-600/4-82-057, July 1982.

¹Holding time is 40 days after extraction.

Table C-4. Pollutant Concentration Limits, Wastewater Discharge
Permits 2069A, 2069F, and 2069I, Sampling Stations
WW001, WW006, and WW008

Pollutant	4-Day Average	1-Day Average	Grab Maximum
Phenol (ug/l)	1000	2000	4000
Silver (ug/l)	2000	3400	8000
Arsenic (ug/l) ^a	500	800	2000
Barium (ug/l)	5000	7500	20,000
Cadmium (ug/l) ^a	1000	1700	4000
Cyanide (mg/l)	2000	3800	8000
Chromium (ug/l) ^a	5000	8800	20,000
Copper (ug/l) ^a	6000	10,200	24,000
Mercury (ug/l)	20	40	100
Manganese (ug/l)	5000	7500	20,000
Nickel (ug/l) ^a	3000	4700	12,000
Oil and Grease (mg/l)	50	75	150
Lead (ug/l) ^a	800	1200	3200
pH ^b			>5/<11
Selenium (ug/l)	500	800	2000
Temperature °F			<140
Total Metals (ug/l) ^a (Cr+Cu+Ni+Zn)	10,000	15,400	40,000
Total Toxic Organics (ug/l)	2100	3200	5000
Zinc (ug/l) ^a	7000	11,300	28,000

^aAnalyzed in samples collected each month.

^bMonitored continuously.

Table C-5. Pollutant Concentration Limits, Wastewater Discharge
Permit 2069C, Sampling Station WW003

Pollutant	4-Day Average	1-Day Average	Grab Maximum
Phenol (ug/l)	1000	2000	4000
Silver (ug/l) ^a	2000	3400	8000
Arsenic (ug/l)	500	800	2000
Barium (ug/l)	5000	7500	20,000
Cadmium (ug/l) ^a	600	1000	4000
Cyanide (ug/l) ^a	2000	3800	8000
Chromium (ug/l) ^a	5000	8800	20,000
Copper (ug/l) ^a	6000	10,200	24,000
Mercury (ug/l)	20	40	100
Manganese (ug/l)	5000	7500	20,000
Nickel (ug/l) ^a	3000	4700	12,000
Oil and Grease (mg/l)	50	75	150
Lead (ug/l) ^a	600	1000	3200
pH ^b			>5/<11
Selenium (ug/l)	500	800	2000
Temperature °F			<140
Total Metals (ug/l) ^a (Cr+Cu+Ni+Zn)	10,000	15,400	40,000
Total Toxic Organics (ug/l)	2100	2600	5000
Zinc (ug/l) ^a	7000	11,300	28,000

^aAnalyzed in samples collected each month.

^bMeasured in two grab samples, 4 days each month.

Table C-6. Pollutant Concentration Limits, Wastewater Discharge
Permit 2069D, Sampling Station WW004

Pollutant	4-Day Average	1-Day Average	Grab Maximum
Phenol (ug/l)	1000	2000	4000
Silver (ug/l) ^a	440	780	8000
Arsenic (ug/l)	500	800	2000
Barium (ug/l)	5000	7500	20,000
Cadmium (ug/l) ^a	370	990	4000
Cyanide (ug/l) ^a	650	1200	8000
Chromium (ug/l) ^a	4300	6900	20,000
Copper (ug/l) ^a	6000	10,200	24,000
Mercury (ug/l)	20	40	100
Manganese (ug/l)	5000	7500	20,000
Nickel (ug/l) ^a	3000	4700	12,000
Oil and Grease (mg/l)	50	75	150
Lead (ug/l) ^a	800	1200	3200
pH ^b			>5/<11
Selenium (ug/l)	500	800	2000
Temperature °F			<140
Total Metals (ug/l) ^a (Cr+Cu+Ni+Zn)	10,000	15,400	40,000
Total Toxic Organics (ug/l)	2100	2130	5000
Zinc (ug/l) ^a	4200	7500	28,000

^aAnalyzed in samples collected each month.

^bMonitored continuously.

Table C-7. Pollutant Concentration Limits, Wastewater Discharge
Permits 2069E and 2069G, Sampling Stations WW005
and WW007

Pollutant	4-Day Average	1-Day Average	Grab Maximum
Phenol (ug/l)	1000	2000	4000
Silver (ug/l)	2000	3400	8000
Arsenic (ug/l) ^a	500	800	2000
Barium (ug/l)	5000	7500	20,000
Cadmium (ug/l) ^a	1000	1700	4000
Cyanide (ug/l)	2000	3800	8000
Chromium (ug/l) ^a	5000	8800	20,000
Copper (ug/l) ^a	6000	10,200	24,000
Fluoride (ug/l) ^a	30	45	100
Mercury (ug/l)	20	40	100
Manganese (ug/l)	5000	7500	20,000
Nickel (ug/l) ^a	3000	4700	12,000
Oil and Grease (mg/l)	50	75	150
Lead (ug/l) ^a	800	1200	3200
pH ^b			>6/<9
Selenium (ug/l)	500	800	2000
Temperature °F			<140
Total Metals (ug/l) ^a (Cr+Cu+Ni+Zn)	10,000	15,400	40,000
Total Toxic Organics (ug/l)	2100	1305	5000
Zinc (ug/l) ^a	7000	11,300	2800

^aAnalyzed in samples collected each month.

^bMonitored continuously.

Table C-8. Pollutant Concentration Limits, Wastewater Discharge
Permit 2069H, Sampling Station WW009

Pollutant	4-Day Average	1-Day Average	Grab Maximum
Phenol (ug/l)	1000	2000	4000
Silver (ug/l)	110	200	8000
Arsenic (ug/l)	500	800	2000
Barium (ug/l)	5000	7500	20,000
Cadmium (ug/l) ^a	25	40	4000
Cyanide (ug/l) ^a	160	300	8000
Chromium (ug/l)	1100	1700	20,000
Copper (ug/l) ^a	1700	2800	24,000
Mercury (ug/l)	20	40	100
Manganese (ug/l)	5000	7500	20,000
Nickel (ug/l)	750	1250	12,000
Oil and Grease (mg/l)	50	75	150
Lead (ug/l) ^a	300	500	3200
pH ^b			>5/<11
Selenium (ug/l)	500	800	2000
Temperature °F			<140
Total Metals (ug/l) ^a (Cr+Cu+Ni+Zn)	10,000	15,400	40,000
Total Toxic Organics (ug/l)	2100	550	5000
Zinc (ug/l) ^a	1100	1850	28,000

^aAnalyzed in samples collected each month.

^bMonitored continuously.

C.6 Sample Collection and Analysis for Area IV Lagoons

The approved Discharge Plan, DP-530, requires quarterly measurement of the water level in each of the lagoons and semiannual sampling for the water-quality parameters listed in Table 6-8. The New Mexico Quality Control Commission Regulation Standards for these parameters are also shown in Table 6-8.

Samples from the lagoons are collected and preserved in accordance with guidance provided in the "Handbook for Sampling and Sample Preservation of Water and Wastewater" (EPA-600/4-82-029). Organic and inorganic fractions are collected as surface grab samples using a wide-mouthed borosilicate glass jar. Purgeable and extractable organic fractions are aliquotted first. Metal and wet-chemistry fractions are passed through a 0.45-micron cellulose acetate membrane filter before placement into prepreserved sample containers. All samples are iced after collection and during shipment.

Analyses conducted on all samples include (1) priority pollutant analysis for purgeable and base neutrals, (2) major cations and anions, and (3) total dissolved solids (TDS). Analyses are performed in accordance with EPA-recommended analytical procedures for aqueous samples.

Table C-9. Summary of pH Excursions for Permit 2069A, 1990

Month	Summary of Total Monthly pH Excursions ^a		Dates of Sample Collection	Sample Frequency (gal)
	hr <5	@ pH limits: >11		
January	0	0	01/23-26/90	1000
February	0	0	02/06-09/90	1000
March	0	0	03/20-23/90	1000
April	0	0	04/10-13/90	1000
May	0	0	05/22-25/90	1000
June	1.0	0	06/19-22/90	500
July	0.25	0	07/10-13/90	500
August	0	0	08/07-10/90	500
September	0	0	09/11-14/90	500
October	0	0	10/16-19/90	500
November	0	0	11/06-09/90	500
December	0	0	12/04-07/90	500

^aA permit violation is out of pH limits for greater than 1 hr at a time or greater than 7 hr and 26 min per month.

Table C-10. Summary of pH Excursions for Permit 2069C, 1990

Month	Summary of Total Monthly pH Excursions ^a		Dates of Sample Collection	Sample Frequency (min)
	hr <5	@ pH limits: >11		
January	0	0	01/16-19/90	15
February	0	0	02/13-16/90	15
March	0	0	03/20-23/90	15
April	0	0	04/24-27/90	15
May	0	0	05/15-18/90	15
June	0	0	06/12-15/90	15
July	0	0	07/17-20/90	15
August	0.5	0	08/14-17/90	15
September	0	0	09/19-21/90	15
October	0	0	10/23-26/90	15
November	0	0	11/13-16/90	15
December	0	0	12/11-14/90	15

^aA permit violation is out of pH limits for greater than 1 hr at a time or greater than 7 hr and 26 min per month.

Table C-11. Summary of pH Excursions for Permit 2069D, 1990

Month	Summary of Total Monthly pH Excursions ^a		Dates of Sample Collection	Sample Frequency (gal)
	hr <5	@ pH limits: >11		
January	0	0	01/16-19/90	500
February	0	0	02/13-16/90	500
March	0.5	0	03/20-23/90	b
April	0	0	04/24-27/90	500
May	0	0	05/23-27/90	500
June	0.8	0	06/12-15/90	500
July	0.5	0	07/24-27/90	500
August	0	0.2	08/14-17/90	500
September	0.5	0	09/19-21/90	500
October	0.3	0	10/23-26/90	500
November	0.6	0	11/13-16/90	500
December	0	0.25	12/11-14/90	500

^aA permit violation is out of pH limits for greater than 1 hr at a time or greater than 7 hr and 26 min per month.

^bSample collected by the City of Albuquerque.

Table C-12. Summary of pH Excursions for Permit 2069E, 1990

Month	Summary of Total Monthly pH Excursions ^a		Number of Excursions >1 hr	Dates of Sample Collection	Sample Frequency (gal)
	hr <5	@ pH limits: >11			
January	0	0		01/23-26/90	4000
February	0	0		02/06-09/90	4000
March	0.5	0		03/20-23/90	^b
	----- <6	>9 -----			
April	1.25	1.8	0	04/10-13/90	5000
May	0	0		05/22-25/90	2500
June	0.2	0.6		06/19-22/90	2500
July	0.3	2.3	0	07/10-13/90	2500
August	0.3	0.2		08/07-10/90	2500
September	0	0.4		09/11-14/90	2500
October	0.2	0.2		10/16-19/90	2500
November	0	4.5	2	11/06-09/90	2500
December	0	1.5	1	12/04-07/90	2500

^aA permit violation is out of pH limits for greater than 1 hr at a time or greater than 7 hr and 26 min per month.

^bSample collected by the City of Albuquerque.

Table C-13. Summary of pH Excursions for Permit 2069F, 1990

Month	Summary of Total Monthly pH Excursions		Number of Excursions >1 hr	Dates of Sample Collection	Sample Frequency (gal)
	hr <5	@ pH limits: >11			
January	0	0		01/23-26/90	8000
February	0	0		02/06-09/90	8000
March	0.5	0		03/20-23/90	b
April	0	0		04/10-13/90	5000
May	3.0	0	1	05/22-25/90	8000
June	0.25	0.2		06/19-22/90	5000
July	0.5	0.5		07/10-13/90	5000
August	14.0	0.3	2 ^c	08/07-10/90	5000
September	0	0		09/11-14/90	5000
October	0.2	0		10/16-19/90	5000
November	0	0		11/06-09/90	5000
December	0	0		12/04-07/90	5000

^aA permit violation is out of pH limits for greater than 1 hr at a time or greater than 7 hr and 26 min per month.

^bSample collected by the City of Albuquerque.

^cpH violations were due to debris on pH probe.

Table C-14. Summary of pH Excursions for Permit 2069G, 1990

Month	Summary of Total Monthly pH Excursions ^a		Number of Excursions >1 hr	Dates of Sample Collection	Sample Frequency (gal)
	hr <5	@ pH limits: >11			
January	0	0		01/16-19/90	750
February	0	0		02/13-16/90	750
March	0	0		03/27-30/90	^b
April	0	0		04/24-27/90	750
May	0	0		05/15-18/90	750
June	0	4.1	0	06/12-15/90	750
July	0.5	2.6	0	07/17-20/90	1000
August	0	2.2	0	08/14-17/90	1000
September	1.6	0.7	0	09/18-21/90	1000
October	12.7	4.0	3 ^c	10/23-26/90	1000
November	17.8	1.4	5	11/13-16/90	1000
December	5.1	1.5	1	12/11-14/90	1000

^aA permit violation is out of pH limits for greater than 1 hr at a time or greater than 7 hr and 26 min per month.

^bSample collected by the City of Albuquerque.

^cCorrective action to modify pH neutralization under construction.

Table C-15. Summary of pH Excursions for Permit 2069H, 1990

Month	Summary of Total Monthly pH Excursions ^a		Number of Excursions >1 hr	Dates of Sample Collection	Sample Frequency (gal)
	hr <5	@ pH limits: >11			
December	5.25	0	0	12/18-21/90	1000

^aA permit violation is out of pH limits for greater than 1 hr at a time or greater than 7 hr and 26 min per month.

Table C-16. Summary of pH Excursions for Permit 2069I, 1990

Month	Summary of Total Monthly pH Excursions ^a		Number of Excursions >1 hr	Dates of Sample Collection	Sample Frequency (gal)
	hr <5	@ pH limits: >11			
March	NA	NA		NA	^b
April	0	0		04/10-13/90	5000
May	0.6	0		05/22-25/90	5000
June	0	0		06/19-22/90	5000
July	0.25	0		07/10-13/90	5000
August	0	0		08/16-19/90	4000
September	0	0		09/11-14/90	5000
October	0	0		10/16-19/90	5000
November	0	0		11/06-09/90	5000
December	1.0	0		12/04-07/90	5000

^aA permit violation is out of pH limits for greater than 1 hr at a time or greater than 7 hr and 26 min per month.

^bSample collected by the City of Albuquerque.

Table C-17. Results of Analysis for Annual Parameters,
June 1990^a

Permit: Station:	2069A WW001	2069C WW003	2069D WW004	2069E WW005
<u>Parameter</u>				
Inorganics				
Arsenic	u0.002 ^b	u0.002	u0.002	u0.002
Barium	0.53	0.11	0.09	0.09
Cadmium	u0.005	u0.005	u0.005	u0.005
Chromium	0.04	u0.02	0.04	u0.02
Copper	0.09	0.18	0.03	u0.02
Total Cyanide	u0.01	u0.01	u0.01	u0.01
Fluoride	NA ^c	NA	NA	19
Lead	u0.02	u0.02	u0.02	u0.02
Manganese	0.03	0.011	u0.005	u0.005
Mercury	u0.0002	u0.0002	u0.0002	u0.0002
Nickel	u0.02	u0.02	0.03	u0.02
Selenium	0.002	u0.002	u0.002	u0.002
Silver	u0.01	u0.01	u0.01	u0.01
Zinc	0.43	0.05	u0.02	u0.02
Phenolics	u0.05	u0.05	u0.05	u0.05
Grease and Oil	19	6	10	10
Total Toxic Organics	<5.0	<5.0	<5.0	<5.0

^aAll Results in mg/l.^bu = Analyte not detected at method reporting limit listed.^cNA = Not applicable.

Table C-18. Results of Analysis for Annual Parameters,
June 1990^a

Permit: Station:	2069F WW006	2069G WW007	2069I WW008
<u>Parameter</u>			
Inorganics			
Arsenic	u0.002 ^b	u0.002	0.008
Barium	0.11	u0.02	0.13
Cadmium	u0.005	u0.005	u0.005
Chromium	0.02	u0.02	u0.02
Copper	0.04	u0.02	u0.02
Total Cyanide	u0.01	u0.01	u0.01
Fluoride	NA ^c	0.1	0.8
Lead	u0.02	u0.02	u0.02
Manganese	0.009	u0.0002	u0.0002
Mercury	u0.0002	u0.0002	u0.0002
Nickel	u0.02	u0.02	u0.02
Selenium	u0.002	u0.002	0.005
Silver	u0.01	u0.01	u0.01
Zinc	0.05	u0.02	u0.02
Phenolics	u0.05	u0.05	u0.05
Grease and Oil	<4	36	<4
Total Toxic Organics	<5.0	<5.0	<5.0

^aAll Results in mg/l.

^bu - Analyte not detected at method reporting limit listed.

^cNA - Not applicable.

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APPENDIX D

MINIMUM DETECTION LIMITS

AND

ANALYTICAL METHODS

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Table D-1. Radiochemical Analysis Minimum Detection Limits (MDLs)

Analysis	Method	Sample		MDLs ^a		Count Time (min)
		Type	Size	Value	Units	
³ H	Liquid Scintillation	Water	75 ml	0.45	pCi/ml	30 x 3
		Vegetation ^b	20 g ^c	2.74	pCi/ml (wet)	30 x 3
		Soil ^b	20 g ^c	1.69	pCi/g (wet)	30 x 3
U _{tot}	Flourescence Gamma	Water	5 ml	1.5 x 10 ⁻³	μg/ml	Not Applicable 60
		Soil ^b	600-700 g (dry)	1.08	μg/g (dry)	
Gross α	Gas Proportional	Water	60-300 ml	1.68	pCi/ml	60
Gross β	Gas Proportional	Water	60-300 ml	8.3 x 10 ⁻²	pCi/ml	120
¹³⁷ Cs	Gamma Spectral Analysis ^d	Water	900 ml	1.0	pCi/ml	60
		Vegetation ^b	600-700 g (dry)	4.4 x 10 ⁻³	pCi/g (dry)	240
		Soil ^b	600-700 g (dry)	2.8 x 10 ⁻²	pCi/g (dry)	120
⁴⁰ K	Gamma Spectral Analysis ^d	Vegetation ^b	600-700 g (dry)	1.31	pCi/g (dry)	240
		Soil ^b	600-700 g (dry)	7.36	pCi/g (dry)	60

^aThese are typical MDL values at 95-percent confidence level.

^bSoil and vegetation sample size is geometric volume. Sample mass varies from sample to sample. The marinelli water standard is a 450-ml standard. The marinelli soil standard is 890 g.

^cProvided % moisture is ≥50 percent.

^dGamma isotopics were analyzed using a PGT intrinsic/germanium detector.

Table D-2. Analytical Methods, Detection Limits, and Quality Control (QC)
Acceptance Criteria for Analysis of Wastewater Samples

Parameter	Analytical Methods (EPA, 1983)	Detection Limits ($\mu\text{g/l}$)	QC Acceptance Spike Recovery	Criteria Q Recovery
Arsenic	EPA 206.2	5	75-125%	90-110%
Barium	EPA 208.1/200.7	<10/5	75-125%	75-125%
Cadmium	EPA 213.1/200.7	5/5	75-125%	75-125%
Chromium	EPA 218.1/200.7	50/10	75-125%	75-125%
Copper	EPA 220.1/200.7	<10/10	75-125%	75-125%
Cyanide, Total	EPA 335.2	20	75-125%	85-115%
Fluoride	EPA 340.2	100	75-125%	75-125%
Lead	EPA 239.2/200.7	5/50	75-125%	75-125%
Manganese	EPA 243.1	<10/5	75-125%	75-125%
Mercury, Total	EPA 245.1	0.2	75-125%	85-115%
Nickel	EPA 249.1/200.7	10/30	75-125%	75-125%
Oil and Grease	EPA 413.1/413.2	5000/200	75-125%	75-125%
Phenolic Compounds	EPA 420.1	5	75-125%	75-125%
Selenium	EPA 270.2	5	75-125%	75-125%
Silver	EPA 272.1/200.7	<10/10	75-125%	75-125%
Zinc	EPA 289.1/200.7	10/10	75-125%	75-125%

REFERENCES

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

APPENDIX E
QUALITY ASSURANCE DATA

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Table E-1. List of Environmental Samples
Collected During 1990

Type	Number of Samples	Number of Analyses
Groundwater	442	1241
Wastewater	1240	3586
Oils/PCBs (including wipes)	274	274
Hazardous Wastes	178	821
Soil	525	1645
Other	<u>328</u>	<u>1471</u>
Total	2967	9038

Table E-2. List of Laboratories Used During 1990

Assaigai Analytical Laboratories, Incorporated

Environmental Control Technology Corporation (Encotec)

Enseco

International Technology Corporation, Analytical Services (IT/AS),
Radiological Science Laboratories

Table E-3. Summary of Analytical Results for Check Samples Submitted to Ensco/RMAL During 1990

Quarter	First Quarter			Second Quarter			Third Quarter			Fourth Quarter		
	Percent Recovery	Relative Percent Difference		Percent Recovery	Relative Percent Difference		Percent Recovery	Relative Percent Difference		Percent Recovery	Relative Percent Difference	
Parameter												
Alkalinity	NC ^a /NC	NC		102/100	2		--	--		--	--	
Antimony	--	--		--	--		--	--		88/84	--	5
Arsenic	86/98	12		97/100	3		97/100	3		78/88	11	
Barium	88/91	3		105/109	4		94/98	4		--	--	15
Beryllium	--	--		--	--		--	--		82/96	--	0
Cadmium	81/82	1		181/163	11		NC/NC	NC		88/88	10	
Calcium	99/101	2		99/91	9		--	--		156/174	--	--
Chloride	99/98	1		91/90	1		--	--		--	--	6
Chromium	86/82	5		97/100	3		94/87	8		92/96	4	
Cobalt	--	--		--	--		--	--		92/100	8	
Copper	84/77	9		--	--		--	--		--	--	--
Cyanide	--	--		101/97	4		94/94	0		--	--	6
Fluoride	--	--		97/100	3		44/83	47		100/106	6	
Iron	98/96	2		97/94	3		86/95	9		76/90	6	
Lead	77/95	19		--	--		--	--		--	--	--
Magnesium	101/102	1		96/89	8		98/116	16		--	--	4
Manganese	89/88	1		--	--		--	--		94/98	6	
Mercury	99/105	6		73/73	0		97/103	6		98/104	--	6
Molybdenum	--	--		--	--		--	--		--	--	6
Nickel	94/94	0		--	--		--	--		92/98	--	--
Nitrate	19/NC	NC		--	--		--	--		--	--	--
Phenolics	83/90	8		39/47	17		40/53	25		--	--	--
Potassium	100/99	1		91/96	5		--	--		--	--	NC
Selenium	101/114	11		111/99	12		NC/NC	NC		940/NC	--	--
Silver	92/88	5		87/NC	NC		81/81	0		--	--	--
Sodium	99/100	1		99/102	3		--	--		--	--	--
Sulfate	93/93	0		94/92	2		--	--		--	--	--
TOC	--	--		101/101	0		100/100	0		--	--	--
TOX	850/930	9		NC/NC	NC		--	--		--	--	6
Vandium	--	--		--	--		--	--		92/98	--	2
Zinc	89/95	6		--	--		--	--		92/94	--	--

^aNC = Not calculable.

Table E-4. Summary of Analytical Results for Check Samples Submitted to Encotec During 1990

Quarter	First Quarter			Second Quarter			Third Quarter			Fourth Quarter		
	Percent Recovery	Relative Percent Difference		Percent Recovery	Relative Percent Difference		Percent Recovery	Relative Percent Difference		Percent Recovery	Relative Percent Difference	
Alkalinity	97/99	2		96/87	10		--	--		--	--	
Antimony	--	--		--	--		--	--		98/100	--	2
Arsenic	101/110	8		100/92	9		100/100	0		116/101	15	
Barium	99/99	0		103/103	0		101/101	0		--	--	
Beryllium	--	--		--	--		--	--		100/94	6	
Cadmium	98/102	4		86/NC ^a	NC		128/154	17		98/83	18	
Calcium	101/99	2		96/89	8		--	--		108/100	8	
Chloride	97/97	0		94/94	0		--	--		--	--	
Chromium	69/137	50		94/94	0		129/129	0		--	--	
Cobalt	--	--		--	--		--	--		--	--	
Copper	141/141	0		--	--		--	--		98/86	14	
Cyanide	62/NC	NC		84/87	3		86/86	0		98/90	9	
Fluoride	--	--		93/95	2		111/83	34		--	--	
Iron	100/94	6		--	--		--	--		94/96	--	
Lead	106/98	8		83/111	25		136/NC	--		100/88	--	
Magnesium	99/99	0		94/87	8		--	--		80/76	5	
Manganese	99/94	5		--	--		--	--		98/89	10	
Mercury	99/120	18		140/80	75		80/87	8		--	--	
Molybdenum	--	--		--	--		--	--		100/96	4	
Nickel	117/117	0		--	--		--	--		96/92	4	
Nitrate	NC/NC	NC		--	--		--	--		--	--	
Oil and Grease	--	--		87/101	14		25/40	38		--	--	
Phenolics	110/110	0		120/110	9		100/90	11		--	--	
Potassium	94/102	8		94/95	1		--	--		--	--	
Selenium	101/114	11		99/99	0		100/100	0		101/93	9	
Silver	--	--		156/101	54		94/94	0		8/60	87	
Sodium	101/102	1		90/97	7		--	--		--	--	
Sulfate	98/95	3		116/102	14		--	--		--	--	
Titanium	--	--		--	--		--	--		100/90	11	
TOC	--	--		112/112	--		146/146	0		--	--	
TOX	--	--		84/90	7		--	--		--	--	
Zinc	111/111	0		--	--		--	--		98/90	9	

aNC = Not calculable.

Table E-5. Results of Quarterly Performance Evaluation Samples,
Organic Analyses, Encotec

Parameter	Percent Recovery	Relative Percent Difference
1,4-Dichlorobenzene	68/67	1
2,4, 6-Trichlorophenol	94/96	2
2,4-Dichlorophenol	88/82	7
2,4-Dimethylphenol	92/81	14
2,4-Dinitrophenol	95/10	850
2-Chlorophenol	100/95	5
2-Methyl-4,6-Dinitrophenol	87/85	2
2-Nitrophenol	81/77	5
4-Bromophenyl Phenyl Ether	92/90	2
4-Chloro-3-Methylphenol	95/88	8
4-Chlorophenyl Phenyl Ether	88/85	4
4-Nitrophenol	31/NC ^a	NC
Acenaphthene	87/85	2
Anthracene	79/81	2
Benzo Fluoranthene	83/84	1
Benzo Perylene	83/86	3
Benzo Pyrene	78/82	5
Bis(2-Ethyl Hexy)Phthalate	100/100	0
Butyl Benzyl Phthalate	11/12	8
Chrysene	140/140	0
Dibenzo Anthracene	120/140	14
Diethylphthalate	222/NC	NC
Dimethylphthalate	183/NC	NC
Fluoranthene	88/90	2
Fluorene	92/87	6
Hexachlorethane	51/54	6
Napthalene	85/85	0
Nitrobenzene	68/77	12
Pentachlorophenol	80/NC	NC
Phenanthrene	184/NC	NC
Phenol	50/46	9

^aNC = Not calculable.

Table E-6. Results of Quarterly Performance Evaluation Samples,
Organic Analyses, Enseco/RMAL

Parameter	Percent Recovery	Relative Percent Difference
1,4-Dichlorobenzene	48/50	4
2,4, 6-Trichlorophenol	79/75	5
2,4-Dichlorophenol	75/71	6
2,4-Dimethylphenol	73/64	14
2,4-Dinitrophenol	54/77	30
2-Chlorophenol	76/70	9
2-Methyl-4,6-Dinitrophenol	89/83	7
2-Nitrophenol	77/70	10
4-Bromophenyl Phenyl Ether	56/57	2
4-Chloro-3-Methylphenol	84/74	14
4-Chlorophenyl Phenyl Ether	58/61	5
4-Nitrophenol	98/67	46
Acenaphthene	56/55	2
Anthracene	49/57	14
Benzo Fluoranthene	53/52	2
Benzo Perylene	51/48	6
Benzo Pyrene	47/49	4
Bis(2-Ethyl Hexy)Phthalate	53/66	20
Butyl Benzyl Phthalate	10/12	17
Chrysene	58/63	8
Dibenzo Anthracene	40/41	2
Diethylphthalate	NA ^a /NA	NA
Dimethylphthalate	NC ^b /NC	NC
Fluoranthene	52/69	25
Fluorene	60/62	3
Hexachlorethane	33/41	20
Napthalene	61/64	5
Nitrobenzene	68/72	6
Pentachlorophenol	86/80	8
Phenanthrene		
Phenol	77/68	13

^aNA = Not analyzed.^bNC = Not calculable.

REFERENCES

Sandia National Laboratories (SNL), 1988. "Sandia National Laboratories Laboratory Data Quality Evaluation Plan for the Wastewater Monitoring Program," SNL, Albuquerque, NM.

APPENDIX F
ENVIRONMENTAL MONITORING DATA

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Figure F-1. Locations of SNL, Albuquerque, Area Monitoring Wells

Figure F-2. Western Kirtland Air Force Base (KAFB) and SNL, Albuquerque, Technical Area III, With Potentiometric Surface Contours From June 1990

Figure F-3. July 1990 and December 1990 Potentiometric Surface Contours in Southwestern KAFB Around Technical Area III

Figure F-4. Potentiometric Surface Elevation Contours at the Chemical Waste Landfill (CWL), SNL, Albuquerque, Technical Area III, January 17, 1990, March 14, 1990, and July 18, 1990 (contour interval = 0.25 ft, elevation = above mean sea level [AMSL])

Figure F-5. Potentiometric Surface Elevation Contours at the CWL, SNL, Albuquerque, Technical Area III, September 13, 1990, and December 14, 1990 (contour interval = 0.25 ft, elevation = AMSL)

Figure F-6. KAFB Production Well Pumping Totals for 1990
(totals in millions of gallons pumped at month's end)

Table F-1. 1990 Vegetation Sample Analysis

Report No.	Location Type	³ H pCi/ml	³ H SDEV	% HO	¹³⁷ Cs pCi/g	¹³⁷ Cs SDEV	⁴⁰ K pCi/g	⁴⁰ K SDEV
1	S ^a	4.36	2.18	0.626	<0.068	NC ^b	-- ^c	--
2 NW	S	5.22	2.57	0.530	<0.058	NC	--	--
2 SE	S	5.11	2.52	0.541	<0.060	NC	--	--
2 NE	S	<4.4	NC	0.486	0.0667	0.0329	--	--
2 SW	S	11.1	3.10	0.490	<0.042	NC	--	--
3	S	9.4	5.07	0.308	0.0412	0.0328	--	--
4	P ^d	<3.3	22	0.538	<0.055	NC	16.8	2.2
5 A	P	<3.6	NC	0.525	<0.070	NC	14.0	2.3
5 B	P	4.11	2.40	0.578	<0.067	NC	--	--
5 C	P	6.52	2.70	0.515	<0.038	NC	--	--
6 A	S	<4.4	NC	0.422	<0.054	NC	--	--
6 B	S	<4.5	NC	0.408	0.0859	0.0421	--	--
6 C	S	<7.2	NC	0.328	0.0803	0.0442	--	--
7 A	S	11.7	5.30	0.265	0.109	0.041	--	--
7 B	S	<9.4	NC	0.224	<0.049	NC	--	--
7 C	S	14.0	5.20	0.274	0.0594	0.031	--	--
8	C ^e	4.93	2.44	0.560	<0.056	NC	--	--
9	C	<3.8	NC	0.583	<0.099	NC	--	--
10	C	4.69	2.59	0.530	<0.046	NC	--	--
11	C	<3.8	NC	0.570	<0.030	NC	--	--
12	P	<3.7	NC	0.598	<0.080	NC	--	--
16 A	P	35.9	5.7	0.310	0.057	0.034	--	--
16 B	P	7.65	3.26	0.373	<0.058	NC	--	--
16 C	P	<3.6	NC	0.448	<0.030	NC	--	--
19	P	13.9	3.7	0.443	<0.063	NC	--	--
20	S	<5.7	NC	0.371	<0.079	NC	--	--
25	C	4.1	2.14	0.651	0.225	0.059	--	--
33	S	<7.0	33	0.362	<0.056	NC	--	--
34	S	<3.0	NC	0.630	0.109	0.048	13.1	1.9
35	S	<4.3	NC	0.487	<0.044	NC	--	--
41	S	<5.2	NC	0.419	<0.050	NC	--	--
42	S	14.4	3.6	0.350	<0.052	NC	--	--
43	S	<3.0	NC	0.742	<0.076	NC	--	--
45	S	<3.4	NC	0.591	<0.030	NC	--	--

^aS = SNL.^bNC = Not calculable.^c-- = Data was not available.^dP = Perimeter.^eC = Community.

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Table F-1. 1990 Vegetation Sample Analysis (Concluded)

Report No.	Location Type	³ H pCi/ml	³ H SDEV	% HO	¹³⁷ Cs pCi/g	¹³⁷ Cs SDEV	⁴⁰ K pCi/g	⁴⁰ K SDEV
46	S	<4.3	NC	0.497	<0.071	NC	--	--
49	S	<4.6	NC	0.403	0.0539	0.0427	--	--
51	S ^a	<2.8	NC ^b	0.677	<0.067	NC	-- ^c	--
52	S	<10	NC	0.210	0.0962	0.0439	--	--
53	S	<4.2	NC	0.528	<0.045	NC	--	--
54	S	<4.6	NC	0.471	0.0469	0.0331	--	--
55	S	<5.3	NC	0.331	<0.061	NC	--	--
57	S	<2.5	NC	0.877	<0.063	NC	--	--
58	P ^d	<4.3	NC	0.500	<0.069	NC	--	--
59	P	<3.8	NC	0.489	<0.068	NC	--	--
60 A	P	<3.6	NC	0.669	<0.071	NC	60.1	6.8
60 B	P	<3.9	NC	0.652	--	NC	55.7	6.4
60 C	P	<3.8	NC	0.675	<0.055	NC	56.4	6.1
61	P	<2.4	NC	0.788	<0.046	NC	28.5	3.5
62	C ^e	3.93	2.32	0.588	<0.10	NC	--	--

^aS = SNL.

^bNC = Not calculable.

^c-- = Data was not available.

^dP = Perimeter.

^eC = Community.

Table F-2. 1990 Soil Sample Analysis

Report No.	Location Type	U _{tot} μg/g	U _{tot} SDEV	³ H pCi/ml	³ H SDEV	% HO	¹³⁷ Cs pCi/g	¹³⁷ Cs SDEV	⁴⁰ K pCi/g	⁴⁰ K SDEV
1	S	3.47	1.16	<2.3	NC ^a	0.95	0.528	0.069	15.0	1.7
2 NW	S	1.86	1.44	<2.3	NC	8.96	0.213	0.045	16.5	2.5
2 SE	S	3.80	1.50	<1.7	NC	6.14	0.060	0.0278	15.3	2.4
2 NE	S	3.42	1.38	<1.7	NC	6.23	0.232	0.051	16.5	2.6
2 SW	S	3.25	1.60	<1.7	NC	10.66	0.220	0.050	16.2	2.5
3	S	3.57	1.79	1.85	1.07	1.52	0.380	0.067	16.8	2.6
4	P	2.20	1.05	<2.3	NC	4.27	0.249	0.042	17.1	2.0
5 A	P	2.06	1.07	<2.1	NC	2.21	0.350	0.062	16.1	2.5
5 B	P	1.11	0.95	<2.0	NC	2.25	0.350	0.061	7.36	1.22
5 C	P	1.08	0.90	<2.1	NC	2.54	0.483	0.063	13.8	1.6
6 A	S	1.97	1.35	<2.3	NC	6.36	0.398	0.073	20.4	3.1
6 B	S	3.11	1.33	<1.7	NC	6.79	0.396	0.071	17.1	2.7
6 C	S	2.19	1.36	<1.7	NC	5.55	0.490	0.084	15.3	2.4
7 A	S	1.73	1.11	<1.7	NC	1.00	0.458	0.076	17.4	2.6
7 B	S	3.94	1.47	<1.7	NC	0.94	0.317	0.059	18.5	2.9
7 C	S	3.08	1.39	<2.3	NC	0.94	0.505	0.085	16.2	2.5
8	C	3.40	1.37	<2.1	NC	2.15	0.239	0.050	16.5	2.6
9	C	3.84	1.68	<2.3	NC	6.29	0.349	0.067	14.2	2.2
10	C	3.97	1.59	<2.3	NC	8.10	0.836	0.132	14.6	2.3
11	C	1.90	1.26	<2.0	NC	2.26	0.0868	0.0295	15.2	2.3
12	P	4.38	1.69	<2.3	NC	11.45	0.686	0.113	16.8	2.1
16 A	P	3.36	1.35	<2.0	NC	1.06	0.0683	0.0271	25.1	3.7
16 B	P	3.19	1.46	<2.0	NC	0.96	0.103	0.030	23.1	3.4
16 C	P	3.24	1.61	<2.0	NC	0.92	0.0536	0.0294	16.6	2.6
19	P	2.34	1.16	<2.3	NC	1.52	0.380	0.054	19.2	2.1
20	S	2.99	1.38	<1.7	NC	2.66	0.271	0.052	14.9	2.3
25	C	3.37	1.11	<2.1	NC	1.71	0.0642	0.0269	16.6	2.6
32 A	S	2.46	1.16	<1.7	NC	3.02	0.163	0.038	19.9	3.0
32 B	S	1.50	0.89	<1.7	NC	2.94	0.150	0.031	18.6	2.1
33	S	4.29	1.13	<1.7	NC	9.31	0.0534	0.0187	21.6	3.2
34	S	3.03	1.3	<1.7	NC	8.17	0.341	0.055	14.9	1.8
35	S	4.61	1.46	<1.7	NC	1.67	0.593	0.097	17.5	2.7
41	S	1.79	1.13	<1.7	NC	2.27	0.161	0.037	14.0	2.2
42	S	3.59	1.46	<1.7	NC	1.78	0.0681	0.0271	14.3	2.3
43	S	1.95	1.03	<2.3	NC	1.78	0.0572	0.0212	11.5	1.8
45	S	3.10	1.24	<1.7	NC	2.82	0.328	0.060	16.4	2.6

^aNC = Not calculable.

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Table F-2. 1990 Soil Sample Analysis (Concluded)

Report No.	Location Type	U _{tot} $\mu\text{g/g}$	U _{tot} SDEV	³ H pCi/ml	³ H SDEV	% HO	¹³⁷ Cs pCi/g	¹³⁷ Cs SDEV	⁴⁰ K pCi/g	⁴⁰ K SDEV
46	S	2.41	1.14	<2.3	NC	4.18	0.385	0.056	15.5	1.8
49	S	2.86	1.17	4.34	1.21	2.69	0.582	0.073	16.6	1.9
51	S	1.96	0.95	<1.7	NC ^a	0.75	<0.028	NC	14.9	1.7
52	S	1.81	1.02	<1.7	NC	9.28	0.0269	0.0181	16.6	2.6
53	S	4.66	1.30	2.12	1.07	1.62	0.150	0.032	16.0	1.9
54	S	1.20	1.18	<1.7	NC	1.80	0.330	0.600	14.2	2.2
55	S	2.97	1.11	<2.3	NC	0.86	0.367	0.052	18.9	2.1
56	S	2.59	1.21	<1.7	NC	16.92	0.0884	0.0284	14.9	2.3
57	S	1.64	0.95	<2.3	NC	2.43	0.0841	0.0241	15.4	1.8
58	P	2.81	1.45	<2.2	NC	4.82	0.343	0.065	18.6	2.9
59	P	2.50	1.19	<2.3	NC	1.35	0.188	0.035	17.3	1.9
60 A	P	2.62	1.18	<2.0	NC	1.32	0.0839	0.0283	11.3	1.8
60 B	P	1.71	1.00	4.10	1.35	1.34	0.0222	0.0186	16.8	1.9
60 C	P	2.76	1.18	<1.7	NC	0.99	0.0673	0.0265	17.2	2.6
61	P	1.18	0.93	<2.3	NC	4.27	0.0623	0.0212	14.9	1.7
62	C	3.57	1.73	<2.1	NC	9.45	0.963	0.150	16.1	2.0

^aNC = Not calculable.

Table F-3. 1990 Water Sample Analysis: Surface Water

Sample Type	Gross Alpha $\times 10^{-3}$ pCi/ml ^a	Alpha SDEV $\times 10^{-3}$	Gross Beta $\times 10^{-3}$ pCi/ml ^a	Beta SDEV $\times 10^{-3}$	U _{tot} pg/ml	U _{tot} SDEV	³ H pCi/ml	³ H SDEV	¹³⁷ Cs pCi/ml $\times 10^{-2}$	¹³⁷ Cs SDEV $\times 10^{-2}$
<u>Number: 8</u>										
Filter	<1.0	NC ^b	0.72	0.33	-- ^c	--	--	--	--	--
Solution	<4.7	NC	6.18	1.84	3.12	0.32	<0.45	NC	<1.0	NC
Total	7.24	4.17	8.69	2.67	3.63	0.38	<0.45	NC	<1.0	NC
<u>Number: 11</u>										
Filter	<1.0	NC	1.43	0.44	--	--	--	--	--	--
Solution	<6.1	NC	4.23	2.05	3.39	0.35	<0.45	NC	<1.0	NC
Total	12.8	5.3	10.00	3.0	3.89	0.41	<0.45	NC	<1.0	NC
<u>Number: 33-1</u>										
Filter	<1.0	NC	0.62	0.31	--	--	--	--	--	--
Solution	<39.00	NC	24.90	10.90	8.00	0.85	<0.45	NC	<1.0	NC
Total	<26.00	NC	<17.00	NC	8.43	0.88	<0.45	NC	<1.0	NC
<u>Number: 33-2</u>										
Filter	<1.0	NC	1.11	0.40	--	--	--	--	--	--
Solution	<35.00	NC	21.70	11.30	7.80	0.82	<0.45	NC	<1.0	NC
Total	<32.00	NC	37.30	12.20	8.48	0.91	<0.45	NC	<1.0	NC
<u>Number: 33-3</u>										
Filter	<1.0	NC	<0.50	NC	--	--	--	--	--	--
Solution	<25.00	NC	39.80	12.80	8.23	0.87	<0.45	NC	<1.0	NC
Total	<34.00	NC	31.50	11.20	8.55	0.92	<0.45	NC	<1.0	NC

^aValues for all filter samples (F) are pCi/filter.^bNC = Not calculable.^c-- = Analysis not performed on filters.

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Table F-4. 1990 Water Sample Analysis: Well Water

Sample Type	Gross Alpha $\times 10^{-3}$ pCi/ml ^a	Alpha SDEV $\times 10^{-3}$	Gross Beta $\times 10^{-3}$ pCi/ml ^a	Beta SDEV $\times 10^{-3}$	U _{tot} pg/ml	U _{tot} SDEV	³ H pCi/ml	³ H SDEV	¹³⁷ Cs pCi/ml $\times 10^{-2}$	¹³⁷ Cs SDEV $\times 10^{-2}$
<u>Number: 13</u>										
Filter	<1.0	NC ^b	<0.50	NC	-- ^c	--	--	--	--	--
Solution	9.75	4.66	4.03	1.88	2.81	0.29	<0.45	NC	<1.0	NC
Total	5.13	2.54	3.26	2.08	2.75	0.29	<0.45	NC	<1.3	NC
<u>Number: 15</u>										
Filter	<1.0	NC	<0.50	NC	--	--	--	--	--	--
Solution	<4.2	NC	4.52	1.60	1.67	0.18	<0.45	NC	<1.0	NC
Total	<2.8	NC	3.58	1.27	1.64	0.17	<0.45	NC	<1.3	NC
<u>Number: 17</u>										
Filter	<1.0	NC	<0.50	NC	--	--	--	--	--	--
Solution	<3.9	NC	4.64	1.30	3.04	0.32	<0.45	NC	<1.0	NC
Total	3.43	1.70	2.57	1.31	3.12	0.32	<0.45	NC	<1.0	NC
<u>Number: 44</u>										
Filter	<1.2	NC	2.39	1.64	--	--	--	--	--	--
Solution	<5.2	NC	2.88	1.69	1.63	0.17	<0.45	NC	<1.0	NC
Total	<4.4	NC	3.27	1.72	<1.5	NC	<0.45	NC	<1.0	NC
<u>Number: 50</u>										
Filter	<1.0	NC	<0.50	NC	--	--	--	--	--	--
Solution	<7.7	NC	6.42	2.29	4.85	0.51	<0.45	NC	<1.0	NC
Total	<5.6	NC	5.25	2.11	5.25	0.54	<0.45	NC	<1.0	NC

^aValues for all filter samples are pCi/filter.

^bNC = Not calculable.

^c-- = Analysis not performed on filters.

Table F-5. 1990 Thermoluminescent Dosimeter (TLD) Summary Radiation Exposure Data

Report No.	1st Quarter		2nd Quarter		3rd Quarter		4th Quarter		Annual Exposure mR/365d (error) ^a	
	Field Days	Exposure (mR)	Field Days	Exposure (mR)	Field Days	Exposure (mR)	Field Days	Exposure (mR)		
<u>Location Type: Community</u>										
10	89	18.9	90	24.3	92	28.9	93	26.8	99	4
11	89	18.4	90	19.2	92	21.1	93	22.9	82	2
21	89	20.3	90	21.9	92	28.0	93	23.5	94	3
22	89	18.8	90	15.5	92	19.6	93	22.6	77	3
23	89	16.3	90	18.9	92	20.0	93	22.7	78	2
24	89	19.8	90	21.6	92	24.0	93	25.4	91	2
25	89	24.2	90	24.4	b	b	93	28.8	104	11
26	89	25.1	90	26.8	b	b	93	32.1	113	12
27	89	20.5	90	22.5	92	23.6	93	26.8	94	2
28	89	19.3	90	21.1	92	21.3	93	24.7	87	2
29	89	19.3	90	21.0	92	19.4	93	25.1	85	2
30	89	21.5	90	23.5	92	23.9	93	28.5	98	3
<u>Location Type: Perimeter</u>										
4	91	20.5	88	21.9	92	21.0	93	24.4	88	2
5	91	20.3	88	19.1	92	20.9	93	23.4	84	2
16	91	26.7	88	27.7	92	29.6	93	30.3	115	1
18	91	21.5	88	22.6	92	24.6	93	26.3	95	2
19	91	22.6	88	25.3	92	26.3	93	25.5	100	1
39	91	19.5	88	20.1	92	21.6	93	22.6	84	1
40	91	19.1	88	20.0	92	20.6	93	27.1	87	3
<u>Location Type: SNL</u>										
1	91	19.2	88	23.6	92	23.3	93	26.0	92	2
2	91	22.5	88	21.8	92	25.3	93	25.7	96	2
3	91	20.4	88	21.9	92	24.2	c	c	90	10
6	91	20.1	88	21.2	92	20.6	93	26.5	89	3
7	91	23.3	88	22.8	92	24.9	93	27.3	99	2
20	91	23.1	88	23.9	92	22.9	93	25.8	96	1
31	91	21.9	88	20.1	92	24.9	93	26.7	94	3
41	91	20.3	88	20.6	92	23.7	93	24.9	90	2
42	91	20.2	88	19.6	92	21.4	93	24.1	86	2
43	91	16.6	88	19.9	92	21.6	93	23.8	82	3
45 A	c	c	c	c	92	22.6	93	24.3	93	12
45 B	c	c	c	c	92	22.1	93	25.1	93	12
46	91	22.6	88	26.2	92	28.0	93	30.3	107	3
47	91	25.3	88	19.3	92	28.0	93	30.3	103	4
48	91	57.2	88	23.7	92	24.3	93	24.9	130	14

^aEstimate of error at the 95-percent confidence level, includes uncertainty of calibration.^bDevice destroyed; no data available.^cDevice not installed until second quarter of 1990.

Table F-6. 1990 Calculated Dispersion Factors

Facility	Dispersion Factors ^a (χ/Q), s/m ³
ACRR	2.00×10^{-6}
SPR	0.59×10^{-6}
HERMES-III	1.40×10^{-6}
A-I/935	1.90×10^{-3}
HCF	0.22×10^{-6}

^a χ/Q was calculated to the closest receptor of the individual facility.

Table F-7. Summary of 4-Day Averages of Analytical Results for
Wastewater Sampling Station WW001, Permit 2069A, SNL,
Albuquerque (All results in mg/l unless otherwise noted)

Month	Parameter				
	Cd	Cu	CN (Total)	Pb	Zn
January	u0.005 ^a	0.31	u0.01	u0.02	0.48
February	u0.005	0.16	u0.01	u0.02	0.30
March	u0.005	0.15	u0.01	<0.02 ^b	0.45
April	u0.005	0.16	<0.01	u0.02	0.41
May	<0.005	0.06	u0.01	u0.02	0.10
June	u0.005	<0.06	u0.01	u0.02	0.39
July	u0.005	0.05	u0.01	u0.02	0.25
August	u0.005	0.05	u0.01	u0.02	0.38
September	u0.005	0.05	<0.01	u0.02	0.35
October	u0.005	0.18	u0.01	<0.02	0.69
November	u0.005	0.20	u0.01	<0.02	0.77
December	u0.005	0.07	u0.01	u0.02	0.35

^au = Analyte not detected at method reporting limit in all four 24-hr composite samples.

^b< = Analyte not detected at method reporting limit in at least one 24-hr composite sample.

Table F-8. Summary of 4-Day Averages of Analytical Results for
Wastewater Sampling Manhole WW003, Permit 2069C, SNL,
Albuquerque (All results in mg/l unless otherwise noted)

Month	Parameter				
	Cd	Cr	Cu	CN	Pb
January	<0.005 ^a	<0.02	0.61	u0.01 ^b	u0.02
February	u0.005	<0.02	0.70	<0.01	u0.02
March	<0.005	u0.02	0.22	u0.01	u0.02
April	u0.005	u0.02	0.21	u0.01	<0.02
May	u0.005	<0.02	0.40	u0.01	<0.02
June	<0.005	u0.02	0.11	u0.01	<0.02
July	u0.005	u0.02	0.33	u0.01	u0.02
August	u0.005	u0.02	0.14	u0.01	u0.02
September ^c	u0.005	u0.02	2.3	u0.01	u0.02
October	u0.005	<0.04	0.10	u0.01	<0.08
November	u0.005	<0.02	0.19	u0.01	<0.04
December	<0.005	<0.25	0.60	u0.01	0.25

	Parameter			
	Ni	Ag	Zn	Total Metals
January	u0.02	u0.01	0.33	<0.98
February	u0.02	u0.01	0.22	<0.96
March	u0.02	u0.01	0.26	<0.52
April	u0.02	u0.01	0.10	<0.35
May	u0.02	u0.01	<0.29	<0.73
June	u0.02	u0.01	0.06	<0.21
July	u0.02	<0.01	0.43	<0.80
August	u0.02	u0.01	0.45	<0.63
September ^a	u0.02	u0.01	0.08	<2.4
October	u0.02	u0.01	0.32	<0.48
November	u0.02	u0.01	<0.29	<0.52
December	0.25	<0.04	0.60	<1.63

^a< = Analyte not detected at method reporting limit in at least one 24-hr composite sample.

^bu = Analyte not detected at method reporting limit in all four 24-hr composite samples.

^cEquipment malfunction interrupted composite sampling on September 18, 1990 and September 21, 1990.

Table F-9. Summary of 4-Day Averages of Analytical Results for Wastewater Sampling Station WW004, Permit 2069D, SNL, Albuquerque (All results in mg/l unless otherwise noted)

Month	Parameter				
	Cd	Cr	Cu	CN	Pb
January	<0.14 ^a	u0.02 ^b	0.04	<0.28	u0.02
February	<0.008	u0.02	0.03	<0.01	u0.02
March ^c	<0.012	u0.02	<0.05	u0.01	<0.02
April	<0.005	u0.02	0.06	u0.01	u0.02
May	0.04	<0.02	<0.05	u0.01	u0.02
June	u0.005	<0.005	<0.03	u0.01	u0.02
July	0.02	<0.02	<0.04	u0.01	u0.02
August	u0.005	u0.02	<0.03	u0.01	u0.02
September	u0.005	u0.02	u0.02	u0.01	u0.02
October	u0.005	u0.02	<0.02	u0.01	u0.02
November	u0.005	u0.02	u0.02	u0.01	u0.02
December	<0.005	u0.02	<0.03	u0.01	u0.02

	Parameter			
	Ni	Ag	Zn	Total Metals
January	<0.04	<0.01	0.02	<0.12
February	0.08	<0.01	<0.02	<0.15
March ^c	<0.02	u0.01	u0.02	<0.11
April	<0.02	u0.01	u0.02	<0.12
May	u0.02	u0.01	<0.02	<0.11
June	<0.02	u0.01	<0.02	<0.10
July	0.03	u0.01	u0.02	<0.03
August	<0.043	u0.01	<0.02	<0.11
September	<0.02	u0.01	u0.02	<0.08
October	u0.02	u0.01	u0.02	<0.08
November	<0.03	u0.01	u0.02	<0.09
December	u0.02	u0.02	u0.01	<0.09

^a< = Analyte not detected at method reporting limit in at least one 24-hr composite sample.

^bu = Analyte not detected at method reporting limit in all four 24-hr composite samples.

^cWastewater samples collected by the City of Albuquerque March 20-23, 1990.

Table F-10. Summary of 4-Day Averages of Analytical Results for
Wastewater Sampling Station WW005, Permit 2069E, SNL,
Albuquerque (All results in mg/l unless otherwise noted)

Month	Parameter				
	As	Cd	Cr	Cu	F
January	u0.002 ^a	u0.005	u0.02	u0.02	12.3
February	u0.002	u0.005	u0.02	u0.02	11.0
March	u0.002	u0.005	u0.02	<0.02 ^b	1.6
April	u0.002	u0.005	u0.02	0.03	7.1
May	<0.002	u0.005	u0.02	u0.02	7.5
June	u0.002	u0.005	<0.02	<0.03	7.1
July	u0.002	u0.005	u0.02	<0.02	5.7
August	u0.002	u0.005	u0.02	u0.02	5.8
September	u0.002	u0.005	0.70	0.08	<5.0
October	<0.002	u0.005	<0.05	0.08	8.5
November	u0.002	u0.005	u0.02	0.03	0.7
December	<0.002	u0.005	0.06	0.07	0.7

	Parameter			
	Pb	Ni	Zn	Total Metals
January	u0.02	u0.02	0.08	<0.14
February	u0.02	u0.02	0.02	<0.26
March	u0.02	u0.02	<0.17	<0.23
April	u0.02	u0.02	<0.07	<0.14
May	u0.02	u0.02	u0.02	<0.08
June	u0.02	u0.02	<0.09	<0.16
July	u0.02	u0.02	0.17	<0.23
August	u0.02	u0.02	0.30	<0.36
September	u0.02	u0.02	0.37	<1.10
October	<0.02	<0.04	3.40	<3.60
November	u0.02	u0.02	0.58	<0.65
December	u0.02	<0.03	1.5	<1.67

^au = Analyte not detected at method reporting limit in all four 24-hr composite samples.

^b< = Analyte not detected at method reporting limit in at least one 24-hr composite sample.

Table F-11. Summary of 4-Day Averages of Analytical Results for Wastewater Sampling Station WW006, Permit 2069F, SNL, Albuquerque (All results in mg/l unless otherwise noted)

Month	Parameter				
	Cd	Cu	CN	Pb	Zn
January	<0.007 ^a	0.06	u0.01 ^b	u0.02	0.33
February	u0.005	0.07	u0.01	u0.02	0.26
March	<0.005	0.07	u0.01	<0.02	<0.21
April	u0.005	0.08	u0.01	u0.02	0.30
May	<0.007	0.05	u0.01	u0.02	0.06
June	u0.005	<0.04	u0.01	u0.02	<0.11
July	u0.005	0.06	u0.01	u0.02	0.25
August	u0.005	<0.02	u0.01	u0.02	0.33
September	u0.005	0.04	u0.01	u0.02	0.35
October	u0.005	0.04	u0.01	u0.02	0.33
November	u0.005	<0.04	u0.01	u0.02	0.36
December	u0.005	0.06	u0.01	u0.02	0.32

^a< = Analyte not detected at method reporting limit in at least one 24-hr composite sample.

^bu = Analyte not detected at method reporting limit in all four 24-hr composite samples.

Table F-12. Summary of 4-Day Averages of Analytical Results for
Wastewater Sampling Station WW009, Permit 2069G, SNL,
Albuquerque (All results in mg/l unless otherwise noted)

Month	Parameter				
	As	Cd	Cr	Cu	F
January	u0.002 ^a	u0.005	u0.02	u0.02	1.0
February	u0.002	u0.005	u0.02	u0.02	66.0
March	u0.002	u0.005	u0.02	u0.02	16.0
April	u0.002	u0.005	u0.02	<0.14 ^b	6.1
May	<0.002	u0.005	u0.02	<0.02	14.0
June	u0.002	u0.005	u0.02	u0.02	4.8
July	u0.002	u0.005	u0.02	u0.02	9.46
August	u0.002	u0.005	u0.02	u0.02	23.78
September	u0.002	u0.005	u0.02	u0.02	1.10
October	u0.002	u0.005	u0.02	u0.02	10.6
November	u0.002	u0.005	u0.02	u0.02	14.0
December	u0.002	u0.005	u0.02	u0.02	29.4

	Parameter			
	Pb	Ni	Zn	Total Metals
January	u0.02	u0.02	<0.03	<0.09
February	u0.02	u0.02	u0.02	<0.08
March	u0.02	u0.02	u0.02	<0.08
April	u0.02	u0.02	<0.03	<0.21
May	u0.02	u0.02	u0.02	<0.08
June	<0.03	u0.02	u0.02	<0.08
July	u0.02	u0.02	u0.02	<0.08
August	u0.02	u0.02	<0.10	<0.16
September	u0.02	u0.02	u0.02	<0.08
October	u0.02	u0.02	u0.02	<0.08
November	u0.02	u0.02	u0.02	<0.08
December	u0.02	u0.02	u0.02	<0.08

^au = Analyte not detected at method reporting limit in all four 24-hr composite samples.

^b< = Analyte not detected at method reporting limit in at least one 24-hr composite sample.

Table F-13. Summary of 4-Day Averages of Analytical Results for Wastewater Sampling Station WW009, Permit 2069H, SNL, Albuquerque (All results in mg/l unless otherwise noted)

Month	Parameter				
	Cd	Cr	Cu	CN	F
December	u0.005 ^a	u0.02	0.03	u0.01	0.6

Month	Parameter				
	Pb	Ni	Ag	Zn	Total Metals
December	u0.02	u0.02	u0.01	<0.03 ^b	<0.10

^au = Analyte not detected at method reporting limit in all four 24-hr composite samples.

^b< = Analyte not detected at method reporting limit in at least one 24-hr composite sample.

Table F-14. Summary of 4-Day Averages of Analytical Results for
Wastewater Sampling Station WW008, Permit 20691, SNL,
Albuquerque (All results in mg/l unless otherwise noted)

Month	Parameter				
	Cd	Cu	CN	Pb	Zn
April	u0.005 ^a	0.04	<0.02 ^b	<0.02	0.24
May	u0.005	0.06	u0.01	u0.02	<0.03
June	u0.005	<0.02	u0.01	u0.02	<0.09
July	u0.005	<0.02	u0.01	<0.02	<0.08
August	u0.005	u0.02	u0.01	u0.02	0.32
September	u0.005	0.04	<0.01	u0.02	0.37
October	u0.005	<0.02	<0.01	u0.02	0.32
November	u0.005	u0.02	u0.01	u0.02	0.29
December	u0.005	0.05	0.01	u0.02	0.39

^au = Analyte not detected at method reporting limit in all four 24-hr composite samples.

^b< = Analyte not detected at method reporting limit in at least one 24-hr composite sample.

Table F-15. CY90 Sandia Environmental Incident Summary

EIF #	Incident Date	Quantity	Material	RQ ^a	Corrective Action Status
90-001	01/05/90	~800 gal	Ethylene Glycol	No	Closed
90-002	01/09/90	~60 gal	Diala Ax Oil	No	Open
90-003	01/20/90	~20 gal	Mineral Oil	No	Open
90-004	01/29/90	~200 gal	Low-Level Radioactive Water	No	Closed
90-005	02/07/90	~70 gal	JP-4	No	Open
90-006	02/15/90	~500 gal	Green Liquid	No	Open
90-007	02/19/90	~5 gal	Oil, No PCBs	No	Open
90-008	02/27/90	<1 gal	Transmission Fluid	No	Open
90-009	03/02/90	<2 g	Mercury	No	Open
90-010	03/02/90	<5 gal	Unleaded Gasoline	No	Open
90-011	04/09/90	~15 gal	Mineral Spirits	No	Open
90-012	b		N/A	N/A	N/A
90-013	b		N/A	N/A	N/A
90-014	c		N/A	N/A	N/A
90-015	b		N/A	N/A	N/A
90-016	04/05/90		NALCO	No	Open
90-017	04/24/90	2 g	Mercury	No	Open
90-018	b		N/A	N/A	N/A
90-019	04/06/90	<1 gal	Ferric Chloride	No	Open
90-020	04/03/90	150 gal	Diala Ax Oil	No	Closed
90-021	04/12/90	10 gal	Ethylene Glycol/Water	No	Open
90-023	05/04/90	~1000 gal	Green Liquid	No	Open
90-024	05/25/90	~20 gal	Yellow/Green Liquid	No	Closed
90-025	05/30/90	10-12 gal	Sodium Metal	Yes	Closed
90-026	05/26/90	<5 gal	Water/ATS Solution	No	Open
90-027	06/04/90	2000 lb	Molton Salt	No	Closed
90-028	06/11/90	2 gal	Acrylic Paint	No	Closed
90-029	06/12/90	5 gal	Poly Sealer	No	Open

^aRQ = Reportable quantity.^bNo release.^cNotice of intent to discharge.

Table F-15. CY90 Sandia Environmental Incident Summary (Concluded)

EIF #	Incident Date	Quantity	Material	RQ ^a	Corrective Action Status
90-030	06/20/90	125-150 lb	Propellant	Yes	Closed
90-031	06/21/90	4-5 gal	Hydraulic Oil	No	Closed
90-032	06/28/90	100 lb	Freon and Oil	No	Open
90-033	07/03/90	.5 gal	Hydrochloric Acid	No	Open
90-034	07/16/90	10-15 gal	Insulating Oil	No	Closed
90-035	07/16/90	1000 gal	30% Ethylene Glycol and Water	No	Open
90-036	07/27/90	1-2 qt	Oil with PCBs >500 ppm	Yes	Open
90-037	08/07/90	<10 gal	Mineral Oil	No	Closed
90-038	08/10/90	Unknown	Green Liquid	No	Closed
90-039	08/05/90	<1 gal	Air Compressor Oil	No	Open
90-040	08/30/90	Spots	Oil	No	Closed
90-041	09/13/90	3-5 qt	Motor Oil	No	Open
90-042	09/26/90	5 gal	Diesel Fuel	No	Closed
90-043	10/08/90	1 oz	Heater Oil	No	Open
90-044	10/10/90	<1 gal	Lubricating Oil	No	Closed
90-045	10/26/90	<1 gal	Ethylene Glycol	No	Closed
90-046	11/01/90	1 gal	Resin Compound	No	Open
90-047	04/26/90	3 lb	Propellant	No	Closed
90-048	10/31/90	2 gal	Spent Developer	No	Closed
90-049	10/24/90	90 lb	Propellant	No	Open
90-050	11/05/90	None	None	No	Closed
90-051	12/07/90	<4 gal	Hydraulic Oil	No	Open
90-052	11/21/90	2 gal	Sodium Hydroxide	No	Open

^aRQ = Reportable quantity.

Table F-16. Water-Level Elevation Data Collected by SNL During 1990
(Elevations are in Feet Above Mean Sea Level [AMSL])

Well Number:	CWL BW-1	CWL BW-2	CWL BW-3	CWL MW-1A	CWL MW-2
Surveyed Measuring Point Elevation:	5435.28	5433.54	5430.23	5421.49	5418.55
<u>Date Measured</u>					
01/04/90			4941.02	4938.36	
01/17/90	4957.66	4938.61	4941.15	4938.45	4935.90
02/15/90	4957.95	4938.82	4941.39	4938.59	4936.11
02/28/90					
03/14/90	4957.55	4938.42	4940.96	4938.24	4935.68
04/10/90					
04/13/90	4957.53	4938.35	4940.82	4938.13	4935.55
05/14/90	4957.53	4938.29	4940.83	4938.20	4935.51
06/15/90	4957.75	4938.45	4940.96	4938.25	4935.71
07/18/90					
07/19/90	4957.84	4938.54	4940.96	4938.25	4935.65
08/15/90					
08/16/90	4957.84	4938.46	4940.93	4938.18	4935.57
09/04/90				4940.90	
09/13/90	4957.83	4938.31	4940.84	4938.14	4935.48
09/26/90					
10/19/90	4957.55	4938.12	4940.59	4937.90	4935.16
11/12/90					
11/13/90	4957.56	4938.07	4940.49	4937.85	4935.12
12/14/90	4958.02	4938.52	4940.26	4938.16	4935.36
12/17/90					

Table F-16. Water-Level Elevation Data Collected by SNL During 1990
(Elevations are in Feet Above Mean Sea Level [AMSL])
(Continued)

Well Number:	CWL MW-2A	CWL MW-3	CWL MW-3A	CWL MW-4	MWL MW-1
Surveyed Measuring Point Elevation:	5418.67	5418.83	5417.87	5420.33	5381.54
<u>Date Measured</u>					
01/04/90	4938.91		4939.16		
01/17/90	4939.02	4936.34	4939.23		4923.78
02/15/90	4939.31	4936.54	4939.46		4924.02
02/28/90					4923.34
03/14/90	4939.00	4936.10	4939.05		4923.73
04/10/90					4923.34
04/13/90	4938.67	4935.98	4938.89		
05/14/90	4938.69	4935.95	4938.92	4937.08	4923.44
06/15/90	4938.75	4936.09	4938.98	4937.19	4923.49
07/18/90					
07/19/90	4938.72	4936.04	4938.93	4937.12	4923.45
08/15/90					
08/16/90	4938.66	4935.97	4938.87	4937.08	4923.36
09/04/90	4938.33		4938.95		
09/13/90	4938.62	4935.88	4938.84	4937.01	4923.23
09/26/90					4923.15
10/19/90	4938.29	4935.54	4938.50	4936.73	4922.97
11/12/90					
11/13/90	4938.32	4935.51	4938.56	4936.65	4923.03
12/14/90	4938.64	4935.86	4938.82	4936.87	4923.34
12/17/90					

Table F-16. Water-Level Elevation Data Collected by SNL During 1990
 (Elevations are in Feet Above Mean Sea Level [AMSL])
 (Continued)

Well Number:	MWL MW-2	MWL MW-3	MWL BW-1	NW TA-3	SW TA-3
Surveyed Measuring Point Elevation:	5377.26	5381.32	5384.51	5333.81	5320.57
<u>Date Measured</u>					
01/04/90					
01/17/90	4923.94		4923.64	4895.06	4898.84
02/15/90	4924.19			4895.17	4900.67
02/28/90	4924.47		4923.15		
03/14/90	4923.75	4920.82	4923.48	4894.79	
04/10/90	4922.97	4920.72			
04/13/90			4923.25	4894.47	
05/14/90	4923.27	4920.86	4923.30	4894.43	4897.78
06/15/90	4923.38	4921.93	4923.35	4894.35	4893.94
07/18/90					
07/19/90	4923.29	4921.93	4923.31	4894.21	4898.09
08/15/90					
08/16/90	4923.29	4921.92	4923.22	4893.97	4900.52
09/04/90					
09/13/90	4923.23	4921.82	4923.19	4893.95	4901.93
09/26/90	4923.18	4921.75	4923.08		
10/19/90	4922.95	4921.46	4922.84	4893.30	4902.69
11/12/90					
11/13/90	4922.90	4921.31	4922.90	4893.24	4902.98
12/14/90	4923.25	4921.67	4923.24	4893.52	4903.10
12/17/90					

Table F-16. Water-Level Elevation Data Collected by SNL During 1990
(Elevations are in Feet Above Mean Sea Level [AMSL])
(Continued)

Well Number:	KAFB09	KAFB10	LF01	LF02	MVMWJ	MVMWK
Surveyed Measuring Point Elevation:	5498.52	5415.98	5333.22	5294.59	5115.37	5183.38
<u>Date Measured</u>						
01/04/90						
01/07/90	4954.87	4924.80	4895.43	4900.66	4909.60	4903.66
02/15/90	4955.03	4924.80	4895.52	4900.99	4909.61	4903.69
02/28/90						
03/14/90	4954.69	4924.49	4895.07	4900.76	4909.31	4903.38
04/10/90						
04/13/90	4954.69	4924.55	4894.72	4900.24	4909.04	4903.13
05/14/90	4954.62	4924.53	4895.03	4900.10	4908.99	4903.02
06/15/90	4954.90		4894.99	4900.01	4908.87	4902.84
07/16/90	4954.88		4894.53	4899.41	4908.49	4902.35
07/19/90		4924.62				
08/15/90	4954.98		4894.01	4899.00	4908.36	4902.13
08/16/90		4924.47				
09/04/90						
09/13/90	4954.74	4924.37	4893.55	4898.59	4908.24	4901.91
09/26/90						
10/19/90	4954.82	4924.27	4893.32	4898.09	4907.77	4901.46
11/12/90			4893.39	4897.95	4907.57	
11/13/90	4954.66	4923.97				
12/14/90	4954.95	4924.20	4894.04	4898.34	4907.87	4901.76
12/17/90						

Table F-16. Water-Level Elevation Data Collected by SNL During 1990
(Elevations are in Feet Above Mean Sea Level [AMSL])
(Concluded)

Date of Measurement:	Static Water Level (Feet)		
	11/13/90	12/14/90	12/17/90
<u>Well I.D.</u> ^{a,b}			
Greystone Manor	55.30		55.34
Coyote Spring	5.61		5.67
TSA/1	157.68		158.45
Schoolhouse			95.76
EOD/1			142.23
Lake Christian	53.41		53.34
Golf Course East		320.28	
Tijeras East		475.42	
Tijeras West		342.04	
Runway Lagoon NE		485.66	

^aThis table gives static water levels measured in wells not yet surveyed by SNL. The static water levels are measured in feet below top of casing.

^bWell locations are indicated by the open triangle symbols in Figure F-1.

Table F-17. Comparison of Analytical Results From June 1990
Sampling of Monitoring Well MW-4 With 1989-1990
Quarterly CWL Background Sampling Results

Parameter	Date	Detection Limit	BW-3	MW-1A	MW-2A	MW-3A	MW-4
<u>Total Organic Carbon (TOC), mg/L</u>							
	3/89	0.1	0.2	0.5	ND ^a	0.4	
			0.3	0.4	0.1	0.2	
			0.3	0.3	0.1	0.4	
			0.2	0.3	ND	0.3	
	6/89	0.5	ND	ND	ND	ND	
			ND	ND	ND	0.8	
			ND	ND	ND	0.8	
			0.6	ND	0.5	0.8	
	9/89	0.5	0.7	ND	0.6	ND	
			0.7	ND	ND	ND	
			0.7	ND	ND	ND	
			0.7	ND	ND	ND	
	3/90	5.0	3.0	2.0	2.0	2.0	
			2.0	ND	2.0	3.0	
			2.0	ND	5.0	2.0	
			2.0	1.0	2.0	2.0	
	6/90	1.0	-- ^b	--	--	--	4.0
			--	--	--	--	2.4
			--	--	--	--	3.0
			--	--	--	--	2.5
<u>Gross Alpha, pCi/L</u>							
	3/89		15±0	16±0	12±0	14±0	
	6/89		5.7±4.4	15.2±6.0	7.0±4.4	5.3±3.8	
	9/89		15±6	16±6	16±6	12±5	
	6/90						19±7

^aND = Not detected at 0.50 µg/l reporting limit.

^b-- = No measurement taken.

Table F-17. Comparison of Analytical Results From June 1990
Sampling of Monitoring Well MW-4 With 1989-1990
Quarterly CWL Background Sampling Results (Continued)

Parameter	Date	BW-3	MW-1A	MW-2A	MW-3A	MW-4
<u>Gross Beta, pCi/L</u>						
	3/89	0.9±6.4	0.4±6.5	0.0±6.0	0.3±6.3	
	6/89	5.4±6.2	2.4±6.5	3.8±6.1	8.4±6.3	
	9/89	0.6±6.3	6.2±6.8	0.0±6.3	7.0±6.6	
	6/90					0.1±6.7
<u>Radium-226, pCi/L</u>						
	3/89	0.0±0.5	0.0±0.6	0.0±0.5	0.0±1.1	
	6/89	0.2±0.5	1.6±1.1	0.3±0.5	0.1±0.4	
	9/89	0.0±0.7	1.5±0.9	0.5±0.8	0.2±0.4	
	6/90					0.6±0.8
<u>Chloride, mg/L</u>						
	3/89	114	100	99	94	
	6/89	123	104	99	97	
	9/89	129	103	104	99	
	6/90					104
<u>Fluoride, mg/L</u>						
	3/89	1.9	1.6	1.6	1.6	
	6/89	1.5	1.6	1.4	1.5	
	9/89	1.6	1.6	1.4	1.5	
	6/90					1.3
<u>Nitrate, mg/L</u>						
	3/89	1.6	0.9	1.1	1	
	6/89	-- ^b	--	--	--	
	9/89	1.6	1.2	1.3	1.3	
	6/90					0.79

^aND = Not detected at 0.50 µg/l reporting limit.

^b-- = No measurement taken.

Table F-17. Comparison of Analytical Results From June 1990
Sampling of Monitoring Well MW-4 With 1989-1990
Quarterly CWL Background Sampling Results (Continued)

Parameter	Date	BW-3	MW-1A	MW-2A	MW-3A	MW-4
<u>Sulfate, mg/L</u>						
	3/89	106	58	59	63	
	6/89	83	62	59	62	
	9/89	102	61	61	63	
	6/90					62.3
<u>Total Coliform Bacteria, number of colonies</u>						
	3/89	14+	<1	<1	<1	
	6/89	-- ^b	--	--	--	
	9/89	TNTC ^c	<1	<1	<1	
	6/90					TNTC
<u>Total Barium, mg/L</u>						
	3/89	0.049	0.077	0.07	0.051	
	6/89	0.06	0.07	0.07	0.05	
	9/89	0.05	0.07	0.07	0.06	
	3/90	0.042	0.069	0.066	0.052	
	6/90					0.89
<u>Total Zinc, mg/L</u>						
	3/89	--	--	--	--	
	6/89	--	--	--	--	
	9/89	--	--	--	--	
	3/90	0.021	0.048	0.017	0.010	
	6/90					0.067
<u>Dissolved Barium, mg/L</u>						
	3/89	0.047	0.08	0.07	0.054	
	6/89	0.05	0.08	0.07	0.05	
	9/89	0.05	0.07	0.07	0.06	
	6/90					0.093

^aND = Not detected at 0.50 µg/l reporting limit.

^b-- = No measurement taken.

^cTNTC = Too numerous to count.

Table F-17. Comparison of Analytical Results From June 1990
Sampling of Monitoring Well MW-4 With 1989-1990
Quarterly CWL Background Sampling Results (Concluded)

Parameter	Date	BW-3	MW-1A	MW-2A	MW-3A	MW-4
<u>Dissolved Manganese, mg/L</u>						
	3/89	0.018	0.063	0.006	0.014	
	6/89	0.02	0.04	ND<0.01	ND<0.01	
	9/89	0.03	0.01	0.01	ND<0.01	
	6/90					0.2
<u>Dissolved Sodium, mg/L</u>						
	3/89	142	73	74	87	
	6/89	112	74	74	79	
	9/89	137	80	82	81	
	6/90					82.9

^aND = Not detected at 0.50 µg/l reporting limit.

^b-- = No measurement taken.

^cTNTC = Too numerous to count.

Table F-18. Comparison of Calculated t-Values,
March 1990, CWL Semiannual Sampling

Well		pH	Specific Conductance $\mu\text{mho}/\text{cm}@25^{\circ}\text{C}$	Total Organic Halogen (TOX) $\mu\text{g}/\text{L}$	Total Organic Carbon (TOC) mg/L
BW-3	t*	-3.70 ^a	3.2	0.3	5.7 ^a
	t _c	2.95	2.7	3.9	4.5
MW-1A	t*	-2.60	-7.5	0.4	1.3
	t _c	2.95	2.7	2.6	4.5
MW-2A	t*	-3.90 ^a	-8.1	-1	3.2
	t _c	2.95	2.6	2.6	4.5
MW-3A	t*	-2.70	-10.2	-0.9	5.7 ^a
	t _c	2.95	2.6	3.3	4.5

^aFor pH, if the absolute value of t* is greater than or equal to the absolute value of t_c, and for TOC, if t* is greater than or equal to t_c, then a statistically significant change is indicated.

Table F-19. Measured Values and Summary Statistics
for Indicator Parameters, March 1990,
CWL Semiannual Sampling

Well	pH	Specific Conductance $\mu\text{mho}/\text{cm}@25^\circ\text{C}$	Total Organic Halogen (TOX) $\mu\text{g}/\text{L}$	Total Organic Carbon (TOC) mg/L
<u>BW-3</u>	6.96	1206	15	3
	6.96	1203	15	2
	6.96	1198	25.3	2
	<u>6.98</u>	<u>1191</u>	<u>5.8</u>	<u>2</u>
Sum	27.86	4798	61.1	9
n	4	4	4	4
Mean	6.97	1200	15.3	2
Variance	0.00	43	63.5	0
<u>MW-1A</u>	7.07	1041	15	2
	7.08	1041	15	0.5
	7.09	1036	15	0.5
	<u>7.09</u>	<u>1037</u>	<u>15</u>	<u>1</u>
Sum	28.33	4155	60	4
n	4	4	4	4
Mean	7.08	1039	15	1
Variance	0.00	7	0	0.5
<u>MW-2A</u>	6.96	1032	10.2	2
	6.96	1031	11.6	2
	6.94	1029	10.6	5
	<u>6.93</u>	<u>1027</u>	<u>12.2</u>	<u>5</u>
Sum	27.79	4119	44.6	14
n	4	4	4	4
Mean	6.95	1030	11.2	4
Variance	0.00	5	0.8	3
<u>MW-3A</u>	7.08	996	13.8	2
	7.08	998	5.9	3
	7.06	998	8.5	2
	<u>7.06</u>	<u>997</u>	<u>15.1</u>	<u>2</u>
Sum	28.28	3989	43.3	9
n	4	4	4	4
Mean	7.07	997	10.8	2
Variance	0.00	1	18.9	0

Table F-20. Comparison of Calculated t-Values,
May 1990, CWL Resampling

Well		pH	SP. Cond	TOC
BW-3	t ^{*a}	-4.14 ^b	3.0 ^{b,c}	3.5
	t _c ^d	3.00	2.9	4.5
MW-1A	t [*]	-3.80 ^c	-8	-- ^e
	t _c	2.95	3	
MW-2A	t [*]	-4.09 ^c	-8	--
	t _c	2.96	3	
MW-3A	t [*]	-3.22 ^c	-11	1.7
	t _c	2.95	3	2.9
MW-2	t [*]	-5.22 ^c	5 ^c	--
	t _c	2.95	3	
MW-3	t [*]	-6.15 ^c	6 ^c	--
	t _c	2.95	3	
MW-4	t [*]	-2.31	-7	--
	t _c	2.98	3	

^at^{*} = Test t-value.

^bA statistically significant change is indicated. (If t^{*} is greater than or equal to t_c, then a statistically significant change is indicated. In the case of pH, the absolute value of t^{*} is used for comparison.)

^cSpecific conductivity calculation to one decimal place to show detail.

^dt_c = Critical test t-value.

^e-- = No measurement taken.

Table F-21. Measured Values and Summary Statistics for
Indicator Parameters, May 1990, CWL Resampling

Well	pH	SP. Cond	TOC
<u>MW-2</u>	6.82	1225	--
	6.81	1224	
	6.82	1225	
	<u>6.82</u>	<u>1228</u>	
Sum	27.27	4902	
n	4	4	
Mean	6.82	1226	
Variance	0.00	3	
<u>MW-3</u>	6.72	1245	--
	6.72	1247	
	6.73	1244	
	<u>6.73</u>	<u>1244</u>	
Sum	26.97	4980	
n	4	4	
Mean	6.725	1245	
Variance	0.00	2	
<u>MW-4</u>	7.13	1050	--
	7.12	1050	
	7.08	1051	
	<u>7.10</u>	<u>1048</u>	
Sum	28.43	4199	
n	4	4	
Mean	7.11	1050	
Variance	0.00	2	
<u>MW-3</u>	6.90	1214	3.4
	6.90	1207	2.1
	6.94	1193	4.5
	<u>6.95</u>	<u>1186</u>	<u>1.7</u>
Sum	27.69	4800	11.7
n	4	4	4
Mean	6.92	1200	2.93
Variance	0.00	41	1.63

-- = No measurement taken.

Table F-21. Measured Values and Summary Statistics for
Indicator Parameters, May 1990, CWL Resampling
(Concluded)

Well	pH	SP. Cond	TOC
<u>MW-1A</u>	6.96	1031	--
	6.96	1029	
	6.96	1034	
	<u>6.96</u>	<u>1032</u>	
Sum	27.84	4126	
n	4	4	
Mean	6.96	1032	
Variance	0.00	1	
<u>MW-2A</u>	6.91	1032	--
	6.93	1031	
	6.94	1031	
	<u>6.94</u>	<u>1030</u>	
Sum	27.72	4124	
n	4	4	
Mean	6.93	1031	
Variance	0.00	0	
<u>MW-3A</u>	7.02	993	0.79
	7.02	992	0.75
	7.01	993	0.95
	<u>7.02</u>	<u>993</u>	<u>0.83</u>
Sum	28.43	3971	3.32
n	4	4	4
Mean	7.02	993	0.83
Variance	0.08	0	0.01

-- = No measurement taken.

Table F-22. Summary of Analytical Results for Trichloroethane (TCA), Trichloroethylene (TCE), and Tetrachloroethene (TTCE) From CWL Groundwater Samples Collected in 1990

Monitoring Well		Sample Month					
		March	April	May	June	August	December
<u>MW-1A</u>	TCA	ND/5	NS	ND/0.50	NS	ND/25	ND/1.0
	TCE	ND/5	NS	ND/0.50	NS	ND/25	ND/1.0
	TTCE	ND/5	NS	ND/0.50	NS	ND/25	3.4
<u>MW-2A</u>	TCA	ND/5	ND/5	7.1, 8.0	NS	ND/50	ND/1.0
	TCE	7	14, ND/5	15, 16	NS	ND/50	5.0
	TTCE	ND/5	ND/5	ND/0.50	NS	ND/50	ND/1.0
<u>MW-3A</u>	TCA	ND/5	NS	ND/0.50	NS	ND/50	ND/1.0
	TCE	ND/5	NS	0.59	NS	ND/50	ND/1.0
	TTCE	ND/5	NS	ND/0.50	NS	ND/50	ND/1.0
<u>MW-4</u>	TCA	NS	NS	ND/0.50	ND/50	ND/170	ND/1.0
	TCE	NS	NS	ND/0.50	ND/50	ND/170	ND/1.0
	TTCE	NS	NS	ND/0.50	ND/50	ND/170	ND/1.0
<u>MW-2</u>	TCA	NS	NS	ND/0.50	NS	NS	NS
	TCE	NS	NS	ND/0.50	NS	NS	NS
	TTCE	NS	NS	ND/0.50	NS	NS	NS
<u>MW-3</u>	TCA	NS	NS	ND/0.50	NS	NS	NS
	TCE	NS	NS	ND/0.50	NS	NS	NS
	TTCE	NS	NS	ND/0.50	NS	NS	NS
<u>BW-3</u>	TCA	ND/5	NS	ND/0.50	NS	NS	ND/1.0
	TCE	ND/5	NS	ND/0.50	NS	NS	ND/1.0
	TTCE	ND/5	NS	ND/0.50	NS	NS	ND/1.0

- NOTES: 1. All analytical values reported in $\mu\text{g/l}$.
 2. NS = not sampled.
 3. ND = not detected at specified limit (i.e., ND/10).
 4. Duplicate sample results listed separately unless both were identical.

REFERENCES

U.S. Department of Energy (DOE), 1990. "Radiation Protection of the Public and the Environment," DOE Order 5400.5, DOE, February 1990.

APPENDIX G
ENVIRONMENTAL REGULATIONS AND STANDARDS

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Table G-1. Radiation Standards^a for Protection of the Public
in the Vicinity of DOE Facilities for CY90

Dose Limits

All Pathways

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:

	<u>Effective Dose Equivalent^c</u>	
	<u>mrem/yr</u>	<u>(mSv/yr)</u>
Occasional annual exposures	500	(5)
Prolonged period of exposure ^d	100	(1)

No individual organ shall receive a committed effective dose equivalent of 5 rem/year (50 mSv/year) or greater.

Air Pathway

	<u>Effective Dose Equivalent</u>	
	<u>mrem/yr</u>	<u>(mSv/yr)</u>
Maximum off-site residence	10	(0.10)

^aDOE Interim Standards, memorandum, dated August 5, 1985.

^bRoutine DOE operations means normal planned operations and do not include actual, potential accidental, or unplanned releases.

^cEffective dose equivalent will be expressed in rem (or millirem) with the corresponding value in sievert (or millisievert) in parentheses.

^dFor the purposes of these standards, a prolonged exposure will be one that lasts, or is predicted to last, longer than 5 yr.

Table G-2. Derived Concentration Guides (DCG) For Selected Radionuclides^a

Nuclide	<u>Drinking Water</u>		<u>Inhaled Air^b</u>	
	DCG $\mu\text{Ci/L}$	f, Value	DCG $\mu\text{Ci/m}^3$	Solubility Class
³ H (Water)	2E+00	--	1E-01	--
¹³⁷ Cs	3E-03	1E+00	4E-04	D
Gross α^c	15E-06	--	--	--
Gross β^c	3E-05	--	--	--
Total U ^d	6E-04	--	6E-6	--

^aDOE Order 5400.5, Chapter III.

^bDCG for ³H in air (2E-01) is adjusted for skin absorption.

^cEPA-570/9-76-003.

^dOne curie of natural uranium is equivalent to 3000 kg of natural uranium.
A conversion from μg to μCi may be made by multiplying μg by 3.3×10^{-7} .

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

Parameter ^a		
Contamination Indicator	Groundwater Quality	Appendix III Drinking Water Supply
pH	Chloride	Arsenic
Specific Conductivity	Iron	Barium
Total Organic Halogen (TOX)	Manganese	Cadmium
Total Organic Carbon (TOC)	Phenol	Chromium
	Sodium	Fluoride
	Sulfate	Lead
		Mercury
		Nitrate (as N)
		Selenium
		Silver
		Endrin
		Lindane
		Methoxychlor
		Toxaphene
		2,4-D
		2,4,5-TP Silvex
		Radium
		Gross α
		Gross β
		Coliform Bacteria
		Turbidity

^aRCRA (40 CFR 265).

Table G-4. EPA 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	col/100 ml
Turbidity	1 TU	NTU ^c
Radium-226	5 pCi/l	pCi/l
Radium-228	5 pCi/l	pCi/l
Gross α	15 pCi/l	pCi/l
Gross β	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

^a40 CFR 265, Appendix III.

^bTotal metals (unfiltered sample).

^cNTU = nephelometric turbidity unit.

REFERENCES

U.S. Department of Energy (DOE), 1990. "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, February 1990.

U.S. Environmental Protection Agency (EPA), 1990. Title 40, "Protection of the Environment," Part 265, "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," Appendix III, "EPA Interim Primary Drinking Water Standards, EPA, July 1, 1990.

U.S. Environmental Protection Agency (EPA), "USEPA National Interim Primary Drinking Water Regulations," EPA-570/9-76-003, EPA, Washington, D.C.

APPENDIX H
OTHER ENVIRONMENTAL COMPLIANCE RECORDS

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Table H-1. SNL, Albuquerque, Underground Storage Tanks Precision Tightness Testing During 1990

Tank I.D.	Date Tested	Leak Rate (gal/hr)	Pass or Fail ^a
9980-1	03/03/90	-0.024	Pass
9925-1	03/13/90	-0.006	Pass
888-4	08/10/90	0.048	Pass
888-5	08/16/90	0.026	Pass
6587-2	10/19/90	-0.075	Pass
6587-3	10/20/90	-0.219	Fail
	10/24/90	-0.145	Fail

^aFail requires the leak rate to be greater than ± 0.1 gal/hr.

Table H-2. SNL, Albuquerque, Underground Storage Tanks Removed in 1990

Tank I.D.	Contents	Date Removed	Analytical Results ^a
Burnsite-7	JP-4	01/31/90	ND ^b
6630-1	Fuel Oil	02/09/90	116 ppm
605-12	Heat Transfer Oil	05/11/90	31.4 ppm
605-13	Heat Transfer Oil	05/11/90	34.1 ppm, 564 ppm
6581-2	Diesel	05/18/90	ND, 409 ppm
6505-1	Fuel Oil	06/22/90	53 ppm
6525-1	Fuel Oil	06/25/90	3250 ppm
901-1	Gasoline	06/27/90	ND ^c
910-1	Gasoline	06/27/90	5.2 ppm ^c
911-1	Gasoline	06/27/90	ND ^c
912-1	Gasoline	06/27/90	ND ^c
6588-1	Fuel Oil	09/10/90	245 ppm, 462 ppm
7570-1	Fuel Oil	10/15/90	7250 ppm
H-882-1 ^d	Gasoline	10/30/90	2.9 ppm ^e
6587-3	Diesel	11/29/90	8.5 ppm, 12.2 ppm

^aStandard analysis is EPA Method 418.1 - Total Petroleum Hydrocarbons.

^bND = Not Detected.

^cAnalytical method used was EPA Method 8240 - Total Aromatic Hydrocarbons.

^dH-882-1 was located at Holloman Air Force Base, New Mexico.

^eAnalytical method used was EPA Method 8020 - Benzene, Toluene, Ethylbenzene, Xylene.

Table H-3. SNL, Albuquerque, Underground Storage Tanks with Additional Site Investigations by Boring in 1990

Tank/Boring I.D.	Date Investigated	Depth to Groundwater	Boring Depth	Analytical Results ^a
6581-2-E	10/10/90	492 ft	30 ft	10.0 ppm
6581-2-N	10/09/90	492 ft	44.5 ft	9.0 ppm
6582-2-SA	10/10/90	492 ft	20 ft	15.5 ppm
6525-1-E	10/09/90	492 ft	25 ft	21.0 ppm
6525-1-C	10/03/90	492 ft	50 ft	8.2 ppm
6525-1-W	10/03/90	492 ft	25 ft	10.2 ppm
6588-1-C	10/11/90	492 ft	50 ft	8.5 ppm
7570-1-A	11/12/90	Unknown	100 ft ^b	0.6 ppm ^c

^aStandard analysis is EPA Method 418.1 - Total Petroleum Hydrocarbons.

^bBoring was made with an air rotary drill rig.

^cPhotoionization detector reading.

Table H-4. SNL, Albuquerque, Underground Storage Tanks Deregistered During 1990

Tank I.D.	Capacity	Contents	Reason
844-1	150 Gal	Tritiated Water	Not Regulated
867-1	4,000 Gal	Neutralization Tank	Not Regulated
888-1	550 Gal	Spill Tank	Not Regulated
888-2	550 Gal	Spill Tank	Not Regulated
888-6			Did not Exist
983-8	60,000 Gal	Deionized Water	Not Regulated
6580-5	5,000 Gal	Fuel Oil	Same as 6588-1
9925-2	6,000 Gal	Diesel	Removed in 1987

Table H-5. SNL, Albuquerque, Underground Storage Tanks
Registered as of 12/31/90

Tank I.D.	Capacity	Contents	Year Installed
605-7	1,000 Gal	Fuel Oil	1968
605-8	12,000 Gal	Fuel Oil	1956
605-9	12,000 Gal	Fuel Oil	1956
605-10	12,000 Gal	Fuel Oil	1956
605-11	12,000 Gal	Fuel Oil	1956
862-2	9,730 Gal	Diesel	1987
876-1	1,000 Gal	Waste Oil	1950
876-2	12,000 Gal	Gasoline	1985
876-3	12,000 Gal	Diesel	1986
888-3	20,000 Gal	Transformer Oil	1982
888-4	20,000 Gal	Transformer Oil	1982
888-5	20,000 Gal	Transformer Oil	1982
970-1	1,000 Gal	Fuel Oil	1987
970-3	1,000 Gal	Waste Oil	1987
983-9	2,000 Gal	Waste Oil	1985
6028-1	5,000 Gal	Gasoline	1987
6500-1	600 Gal	Fuel Oil	1978
6503-1	600 Gal	Fuel Oil	1960
6587-2	10,000 Gal	Gasoline	1963
6595-1	34,120 Gal	Transformer Oil	1968
6595-2	34,120 Gal	Transformer Oil	1968
6595-3	34,120 Gal	Transformer Oil	1968
6595-4	34,120 Gal	Transformer Oil	1968
6595-5	34,120 Gal	Transformer Oil	1968
6597-2	25,000 Gal	Transformer Oil	1978
6597-3	25,000 Gal	Transformer Oil	1978
6597-4	25,000 Gal	Transformer Oil	1978
6597-5	25,000 Gal	Transformer Oil	1978
6597-6	25,000 Gal	Transformer Oil	1978
6597-7	25,000 Gal	Transformer Oil	1978
6597-8	25,000 Gal	Transformer Oil	1978
9925-1	6,000 Gal	Gasoline	1978
9980-1	6,000 Gal	Fuel Oil	1977

Table H-6. Septic Tank Registration, SNL, Albuquerque

Area	Building	Location Description
Area I	898	Optical Maintenance Building
Area I	8895/MO100	Sandia Guard House
Area I	MO14/MO15	Office/Laboratory
East of Area II	6969, MO118, MO251, and MO252	Robotic Vehicle Range
6000 Igloo Area	6020	Explosives Receiving and Packaging
6000 Igloo Area	6030	Guard Station
Area II	901/902	Systems Analysis Facility
Area II	904	Environmental Testing Laboratory
Area II	906	Safety Chemicals Laboratory
Area II	907	Explosives Application Facility
Area II	913/913A	Component Assembly Building/ Pressure Laboratory and Training Building
Area II	915/922	Explosive Device Laboratories
Area II	914	Equipment for Building 913
Area II	919	Explosive Devices Building
Area II	935	Component Test Facility
Area II	940	Explosive Testing Laboratory
Area III	6584 - East end	Administration for Test Engineering
Area III	6584 - West end	Armory Facility
Area III	6589 and 6600	Guard House and Sensor Test Laboratory
Area III	6501	Nonhazardous Assembly Area
Area III	6620	Hazardous Assembly Building
Area III	6505	Sodium Purification Loop
Area III	6520/6526	Hydraulic Centrifuge Facility
Area III	6523	Pump Building
Area III	6530/6531	Radiant Heat Test Facility
Area III	6536	Thermal/Radiant Heat Testing
Area III	6540/6542	Photometrics
Area III	6560/6562/6563	Vibration Test Facility
Area III	6570/6571	Dynamic Shock Test Facility
Area III	6587	Maintenance and Shop
Area III	6610	Complex Wave Test Facility
Area III	6630	Climatic Test Facility

Table H-6. Septic Tank Registration, SNL, Albuquerque (Continued)

Area	Building	Location Description
Area III	6631	Remote Control Building
Area III	6635/6638	Radiography Bunker
Area III	6640	Acoustical Test Facility
Area III	6643	Establishment Type Unknown
Area III	6650	Vibration Data Control Center
Area III	6710	Air Gun Test Facility
Area III	6715	Explosive Test Facility
Area III	6720	Irradiated Sludge Facility
Area III	6721	Photography/Control for Building 6720
Area III	6730-31/6734-35/M0128	Dynamic Shock Facility
Area III	6741	Control Building for 5000 Foot Sled Track
Area III	6743	Rocket Motor Conditioning Facility
Area III	6750	Small Arms Range/Impact Test Facility
Area III	6920	Mixed Waste Management Facility
Area III	6922	Explosive Test Facility
Area III	T12/T42/T43	N/A
Area III	T-52	N/A
Area III	M0231-234	Offices
Area III	M0228-230	Offices
Area III	M0242-245	Offices
Area V	6580/6588/6590-93/ 6596-97	Reactor Facilities and Storage
Area V	6500	Gate House Security Operations Building
Area V	6591-82/M032/M057-58	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

Table H-6. Septic Tank Registration, SNL, Albuquerque (Concluded)

Area	Building	Location Description
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
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
LIST OF NEPA DOCUMENTATION

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Table I-1. List of NEPA Documentation

1990 Environmental Checklists (CLs), Action Description Memoranda (ADMs), and Environmental Assessments (EAs) and Approval Status			
Title	Memo to DOE	DOE Approval	EA Request
<u>CLs and ADMs</u>			
Communication Duct System Upgrade	09/27/90	12/20/90	
Vital Records Storage Vault	09/27/90	12/20/90	
Rehabilitation of Security Lighting, Area I	09/27/90	12/20/90	
Relocation of 46-kV Line in Area I	11/27/90		
Lighting System for the Live Fire Range at the TTR	11/01/90		
FY91 General Plan Projects (GPP)	09/27/90		
Construction and Occupancy of the Radio- active and Mixed Waste Assay Facility	10/11/90		
Utility Restoration Projects (12 Checklists)	12/21/90		
Building 880 Remodeling	12/18/90		
Remodeling of Evacuation and Conferencing Building 6582	12/07/90		
PCB Transformer Removal	12/03/90		
Open Pool Fire Tests of a Fire Extinguisher System for the Air Force	09/14/90		
Explosives Shipping and Receiving Facility	11/05/90		
Construction and Occupancy of the Processing and Environmental Technology Laboratory (PETL)	10/23/90		

Table I-1. List of NEPA Documentation (Continued)

1990 Environmental Checklists (CLs), Action Description Memoranda (ADMs), and Environmental Assessments (EAs) and Approval Status			
Title	Memo to DOE	DOE Approval	EA Request
Rocket Sled Track for 5000-Foot Aerial Cable Facility	10/08/90		
Quiescent Bottle II Tests	09/10/90		
Demolition of Buildings 824, 829, and 834, Sandia Labs (3 Checklists)	09/07/90		
Office and Chemical Exchange Building Relocation	09/07/90	12/20/90	
H1556 Shipping Container Pool Fire Tests	09/07/90		
Archaeological Survey, and ADM for Proposed Reactor Technology Center	09/06/90		12/19/90
Hydrological Studies DOE Environmental Checklist	08/30/90	01/28/91	
W89 Core Simulation Abnormal Thermal Environment Tests	08/29/90	12/04/90	
H1501 Shipping Container Pool Fire Tests	08/28/90	12/04/90	
Replacing Building 880 Phase I and II Dry-Type Transformers	08/27/90	11/21/90	
Four Additional TRUPACT-II Pool Fire Tests and Application for OBP	08/27/90	12/11/90	
H838 Shipping Container Burn Tests	08/03/90	10/10/90	
Neutron Measurements Laboratory, Building 984	08/07/90		12/10/90
Testing with Pyrotechnic Smoke	07/31/90	12/04/90	
Joint Full Function Testing of the W82/ M785 Artillery Projectile at the TTR	07/30/90		

Table I-1. List of NEPA Documentation (Continued)

1990 Environmental Checklists (CLs), Action Description Memoranda (ADMs), and Environmental Assessments (EAs) and Approval Status			
Title	Memo to DOE	DOE Approval	EA Request
New Production Reactor Transient Fuel Performance Experiments	06/12/90		
Renovation of Old KAFB Commissary	06/25/90	08/13/90	
Laser Kinetics Test Device (KiTE)	06/06/90	12/10/90	
Environmental Checklist for the SRAM-A Battery Tests	06/07/90	06/15/90	
DOE Environmental Checklist and Cultural Resources Review for Proposed Expanded Fenced Area Around MO 242-245	05/25/90	07/09/90	
DOE Environmental Checklist and ADM for the Toxic Machining Facility	05/25/90	10/12/90	
Area I Switch Building (Environmental Checklist)	05/16/90	06/26/90	
Fiber Optic Truck Upgrade (DOE Environmental Checklist)	05/15/90	06/15/90	
Transmission Line and Substation CNSAC 115 kV	05/15/90	06/15/90	
Haul Road and Fill Site (DOE Environmental Checklist)	05/15/90	06/15/90	
Employee Services Building (Environmental Checklist)	05/14/90		
Grading of Path, Robotic Vehicle Range (Environmental Checklist)	05/07/90	06/26/90	
Relocation of MO220/221 RVR (Environmental Checklist)	05/04/90	06/20/90	
Center for National Security and Arms Control	04/13/90	10/26/90	

Table I-1. List of NEPA Documentation (Continued)

1990 Environmental Checklists (CLs), Action Description Memoranda (ADMs), and Environmental Assessments (EAs) and Approval Status			
Title	Memo to DOE	DOE Approval	EA Request
12.47-kV Power Distribution Project	04/12/90	05/23/90	
Triode Driven Induction Cavity Experiment	04/11/90	12/04/90	
Proposed Sewer Line System Within Area III	03/23/90	09/18/90	
Proposed Temporary Rocket Motor Spray Coating Facility	03/23/90	10/12/90	
Proposed Fire Extinguisher Training Site	03/23/90	07/25/90	
Series of Wood Crib Fire Tests of an Explosive Component Shipping Container	03/22/90	07/25/90	
Test and Evaluation of Directional Boring Equipment	03/20/90	07/25/90	
115-kV Transmission Line Project	/ /	02/21/90	
Area II Site and Circulation Modifications	07/07/90	07/13/90	
<u>EAs</u>			
Radioactive and Mixed Waste Management Facility	10/01/90	01/22/90	
Explosive Components Facility	05/09/89		
Integrated Materials Research Laboratory	11/19/90	02/15/90	01/29/90
Lurance Canyon Burn Site	/ /		08/11/89
<u>CLs</u>			
30-Day Notification of Intent to Remove UST (9980-1)	08/14/90	09/20/90	

Table I-1. List of NEPA Documentation (Continued)

1990 Environmental Checklists (CLs), Action Description Memoranda (ADMs), and Environmental Assessments (EAs) and Approval Status			
Title	Memo to DOE	DOE Approval	EA Request
Removal of 1000-Gal Fuel Oil UST From Manzano Base	05/14/90	07/10/90	
Removal of 5000-Gal Fuel Oil UST From SNL Technical Area V	05/14/90	07/10/90	
Removal of 560-Gal Diesel Fuel UST at SNL Technical Area V	05/22/90	09/06/90	
Removal of 5000-Gal Fuel Oil UST From SNL Technical Area V	05/14/90	07/10/90	
Removal of 500-Gal Fuel Oil UST From SNL Technical Area III	05/14/90	07/10/90	
Removal of 300-Gal Fuel Oil UST From SNL Technical Area III	05/14/90	07/10/90	
Removal of 600-Gal Fuel Oil UST at SNLA Technical Area III	05/18/90	07/10/90	
Removal of 600-Gal Fuel Oil UST at SNL Technical Area III	05/18/90	07/10/90	
Removal of 120-Gal Gasoline UST From SNL Technical Area II	05/14/90	07/10/90	
Removal of 120-Gal Gasoline UST From SNL Technical Area II	05/14/90	07/10/90	
Removal of 120-Gal Gasoline UST From SNL Technical Area II	05/14/90	07/10/90	
Removal of 120-Gal Gasoline UST From SNL Technical Area II	05/14/90	07/10/90	
30-Day Notification of Intent to Remove UST	10/16/90		

Table I-1. List of NEPA Documentation (Concluded)

1990 Environmental Checklists (CLs), Action Description Memoranda (ADMs), and Environmental Assessments (EAs) and Approval Status			
Title	Memo to DOE	DOE Approval	EA Request
Removal of 350-Gal Used Oil UST at SNLA Technical Area I	05/29/90	09/06/90	
Removal of 7897-Gal Heat Transfer Oil UST at SNL Technical Area I	05/14/90	07/10/90	
Removal of 5264-Gal Heat Transfer Oil UST at SNL Technical Area I	05/14/90	07/10/90	
Removal of 110-Gal Gasoline UST From Holloman Air Force Base	05/03/90	07/10/90	

APPENDIX J
1990 ENVIRONMENTAL COMPLIANCE ACTIVITIES
AT KAUAI TEST FACILITY

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J.1 Introduction

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 DOE. The PMRF is located on the west side of the island of Kauai, Hawaii (Figure J-1). The KTF is used to launch rockets in support of DOE missions, as well as other U.S. government projects (SNL, 1986).

Facilities and Operations

SNL's KTF is located on the north part (near Nohili Point) of the Navy's PMRF. The majority of the facilities at the 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.

The KTF has been, and is being, used for testing rocket systems with science and technology payloads, advanced development of maneuvering reentry vehicles, scientific studies of atmospheric and exoatmospheric phenomena, and SDI programs. No nuclear devices have ever been launched from KTF.

The KTF launcher field was originally designed to accommodate 40 launch pads, but only 15 pads were constructed. Of these, 12 are presently inactive, with the launchers removed. Since the original plan, two additional launch pads have been constructed, Pad 41 at Kokole Point and Pad 42, the STARS launch pad. The launcher field site has a number of permanent facilities used to support the rocket operations.

The administrative area of the KTF is located in a fenced compound near the North Nohili access road from the 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 the KTF. In the non-operational 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 the KTF facilities (Helgesen, 1990).

Geology and Hydrology

The KTF and PMRF are located on the seaward margin of the broad Mana Coastal Plain of Kauai. The Mana Coastal 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 ft from the KTF.

The KTF lies in the rain shadow of Mounts Kawaikini and Waialeale. The annual rainfall is about 20 in. per year. There is no integrated surface

Figure J-1. Map of the PMRF and the Adjacent Area. The KTF is to the north, near Nohili Point.

drainage on the site. The sand is so permeable 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 about 5 degrees and continues to the coast, where it is about 400 ft deep.

The seaward edge of the plain is covered by fossil sand dunes formed when the sea was lower than it is now. The PMRF is located almost entirely on these dunes, which are now no higher than 10 ft or so, except to the north of the KTF, where they are ≤ 100 ft 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; they are saturated but are not exploitable as an aquifer because of their unfavorable hydraulic characteristics.

The dune sand aquifer, on which the PMRF lies, has a moderate hydraulic conductivity and a reasonable porosity. It consists of a lens of brackish groundwater floating on seawater, and is recharged by storm rainfall and by 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 mi south of the KTF. It was dug to a depth of 42 ft, encountering only fine sand and coral gravel. Tested at 300 gpm, it initially yielded water having 2800 mg/l chloride, which is too brackish for plants. This well is not used (SNL, 1986).

Biology and Population

The principal vegetation found on Kauai consists of two introduced shrub species: kiawe, a mesquite, and koa-haole, a wild tamarind. Portions of the island are covered with nearly impenetrable thickets of kiawe and koa-haole (SNL, 1986). The land on which the present KTF facilities lie has been cleared from 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 found, at least occasionally, as there are breeding populations elsewhere on Kauai.

Twenty-two species of birds were found on the range, as well as three more just outside the range (SNL, 1986). These 25 include five species native

to Hawaii. There are also several species of waterfowl present on the range during some portion of the year, even though they were not seen during the 1986 survey.

The nearest off-base community is the village of Mana (estimated population 30) 10,000 ft to the south. The population at the KTF fluctuates between 10 and 70, depending on mission schedules. The majority of approximately 200 military personnel are stationed at the PMRF.

Meteorology

The KTF lies in the rain shadow of Mounts Kawaikini and Waialeale. This part of the island is sheltered from the predominant northeast tradewinds and as such is one of the driest sections of Kauai. Average rainfall is just over 20 in./yr, mostly occurring 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 directions. 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

NEPA Compliance

Environmental Assessments (EAs) are now under way for the KTF and the KTF Two Experiment Rocket Campaign.

For the KTF, development of a comprehensive site EA continued in 1990. The completed document is scheduled to be submitted to the DOE by June 1991. 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 the KTF. The study concluded that constructing an additional launch pad and conducting further launches similar to those conducted at the KTF since 1962 probably will not have any quantifiable effects on green sea turtles residing in waters near the KTF (IT, 1990a).
- A Botanical Survey Report--This survey identified four major vegetation types at the 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 the 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 the KTF (IT, 1990c).

- A Soil Sampling Report--This sampling was undertaken to delineate the extent and concentration of lead, aluminum, and beryllium in the soil at the 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 contaminations or human exposure from use of the KTF as a launch facility. For results of the data analysis, see IT, 1990d.
- An Archaeological Survey and Sampling--This survey found no significant cultural resources on the surface at the KTF, but subsurface testing within one area indicated a potential for subsurface cultural resource materials (Gonzalez and Berryman, 1990).

Data from these letter reports will be incorporated into the KTF EA.

The 91 KTF Action Description Memoranda (ADMs) and EAs written or approved in 1990 and their approval status are listed in Table J-1.

Table J-1. 1990 KTF NEPA Approval Status

Title	Memo to DOE	DOE Approval Letter
<u>ADMs</u>		
Strypi/Lace Experiment	11/21/90	
Have List Rocket Launches at the KTF	06/27/90	09/06/90
<u>EAs</u>		
Kauai Test Facility		

Environmental Permits

Air

There are no PSD or National Emission Standards for Hazardous Air Pollutants (NESHAP) sources for the facility and no air permits are held either by the DOE for the KTF or by the Department of Defense (DoD) for the PMRF. However, the two electrical generators at the KTF are permitted by the State of Hawaii for air emissions.

Water

Wastewater is treated onsite by a wastewater treatment system consisting of septic tanks and leach fields into brackish water. The limited quantities of sewage released from the 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

The PMRF holds a Resource Conservation and Recovery Act (RCRA) Interim Status Permit for treatment and storage of hazardous waste. The KTF, as a tenant of the PMRF, is a small-quantity hazardous waste generator. These small quantities of hazardous chemical wastes are disposed of according to the PMRF tenant agreement. The PMRF also transports nonhazardous solid waste to the county landfill.

One or two rocket explosions near a launch pad have scattered debris in close proximity to the pads. All debris was collected and disposed of according to the PMRF program.

1990 Release Reporting

All of the 1990 releases from KTF are air emissions of lead (Pb) as results of Terrier Malmute Rocket or NIKE Rocket System tests. The reportable quantity (RQ) for lead is one pound. The release reporting was initially made by KTF staff to the Environmental Programs Department, 3220, at SNL, Albuquerque. The final reporting was then made by SNL, Albuquerque, to the National Response Center (NRC) by telephone reporting and in written reports. Table J-2 lists the 1990 release reports from the KTF.

Table J-2. Summary of 1990 RQ Release Reporting

Date	Location	Material	Quantity	RQ	Site of Release	NRC No.	Report Date
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08/19/90	KTF	Lead	20.4 lb	1.0 lb	Air	36053	08/28/90
08/22/90	KTF	Lead	20.4 lb	1.0 lb	Air	36496	08/29/90
08/25/90	KTF	Lead	20.4 lb	1.0 lb	Air	36928	08/29/90

J.3 Environmental Restoration and Monitoring Program

There is no routine environmental monitoring program for the KTF because of the nature of the operations occurring at the site. However, special sampling and monitoring are done on a case-by-case basis. The

Environmental Restoration (ER) program has performed a Preliminary Assessment (PA) of the KTF to identify sites where past spills or releases might have caused environmental degradation. Two sites were identified, the Drum Rock Area and Photo Laboratory Discharges.

J.4 Other Compliance Activities

Spill Prevention and Control Countermeasure (SPCC) Plan

SNL at KTF is part of the PMRF Spill Prevention and Control Countermeasure (SPCC) Plan which provides support in the event of a diesel fuel spill from the 10,000-gal aboveground fuel tank just outside the compound.

Underground Storage Tanks (USTs)

Underground gasoline tanks in the compound are being replaced with one double-wall fiberglass tank, which, along with the installation, complies with the most recent federal and state regulations.

Diesel fuel, gasoline, and oils such as mechanical oils and hydraulic fluids are stored and used in large quantities at the KTF. The underground fuel tank will be monitored for leakage as required by the RCRA.

Toxic Substances Control Act (TSCA)

Under the 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 shown to be free of PCBs.

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