SANDIA REPORT

SAND96–2270 • UC–630
Unlimited Release
Printed September 1996

1995 Site Environmental Report Sandia National Laboratories Albuquerque, New Mexico

Lih-Jenn Shyr, Editor

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

Issued by Sandia National Laboratories, operated for the United States Department of Energy by Sandia Corporation.

Printed in the United States of America. This report has been reproduced directly from the best available copy.

Available to DOE and DOE contractors from
Office of Scientific and Technical Information
PO Box 62
Oak Ridge, TN 37831

Prices available from (615) 576-8401, FTS 626-8401

Available to the public from
National Technical Information Service
US Department of Commerce
5285 Port Royal Rd
Springfield, VA 22161

NTIS price codes
Printed copy: A15
Microfiche copy: A01

SAND96-2270
Unlimited Release
Printed September 1996

Distribution
Category UC-630

1995 SITE ENVIRONMENTAL REPORT
SANDIA NATIONAL LABORATORIES
ALBUQUERQUE, NEW MEXICO

7500 Environmental Operations Center
Sandia National Laboratories
Albuquerque, NM 87185

Lih-Jenn Shyr,[1] Editor
Dianne Duncan,[2] Associate Editor
Dianne Duncan,[2] Technical Editor
Rebecca Sanchez,[3] Technical Word Processor

ABSTRACT

This 1995 report contains data from routine radiological and non-radiological environmental monitoring activities. Summaries of significant environmental compliance programs in progress, such as National Environmental Policy Act documentation, environmental permits, environmental restoration, and various waste management programs at Sandia National Laboratories in Albuquerque, New Mexico, are included. This report is prepared for the U.S. Department of Energy in compliance with DOE Order 5400.1.

[1]Environmental Monitoring and Reporting Department, Sandia National Laboratories
[2]GRAM, Inc.
[3] Infomatrix

CONTRIBUTORS/AUTHORS

Author	Section	
Linda Bayliss	1.5	Regional Geological Overview
	1.6	Hydrology
	7.0*	Groundwater Monitoring & Protection Program
Joe Bonaguidi	3.2	Underground Storage Tank (UST) Management
	3.3	Oil Spill Prevention & Countermeasures Plan
	6.3	Surface Discharge Programs
Vicki Cibicki	2.7	Safe Drinking Water Act (SDWA)
Warren Cox	3.1*	Environmental Restoration Project
	Apx B*	Environmental Restoration Project Sites
Todd Culp	5.3	Air Emissions Radiological Monitoring
	5.4	Assessment of Potential Dose to the Public
	5.5	Summary of the 1995 On-Site & Off-Site Dose Impacts
	Apx F*	Compliance Activities at the Kauai Test Facility
Robyn Davis	3.4.7	Waste Minimization & Pollution Prevention Programs for Hazardous & Radioactive Waste
Regina Deola	1.4	Regional/Local Climate & Meteorology
	5.1	Meteorological Monitoring Program
	5.2	Ambient Air Surveillance Programs
	Apx A	Meteorological Data
Dianne Duncan (Editor)	Executive Summary	
	1.0	Introduction
	1.1	Organization of Report
	1.2	SNL/NM Site Mission & Operations
	1.3	Site Location & Demographics
	1.8	SNL/NM Operational Areas
	2.13	1995 Audits & Appraisals
	2.14	Current Issues & Actions
	3.0	Environmental Programs Information
	3.6	Environmental Monitoring Programs

---
* Co-Authored Section

DISCLAIMER

CONTRIBUTORS/AUTHORS (Continued)

Author	Section	
Nick Durand	8.0,	Quality Assurance
	Appx D	Quality Assurance Data
Charles Fink	2.6*	Clean Water Act (CWA)
	6.2	Stormwater Run-off Program
Debra Garcia	3.1*,	Environmental Restoration Project
	Apx B*	Environmental Restoration Project Sites
Rick Haaker	4.6	Summary of Pathway Analysis Results
Boyd Hamilton	3.4.3	Mixed Waste Issues
Jeff Jerry	2.15*	Summary of Environmental Permits
Adrian Jones	2.6*	Clean Water Act (CWA)
	2.15*	Summary of Environmental Permits
	6.1	Wastewater Programs
Franz Lauffer	1.5	Regional Geological Overview
	1.6	Hydrology
	7.0*	Groundwater Monitoring & Protection Program
	Apx E	Environmental Regulations & Standards
Maureen Lincoln	2.3	Federal Facility Compliance Act (FFCAct)
	2.14.2	Mixed Waste Issues & Actions
	3.4.2	Radioactive Waste Management & Handling
Mike du Mond	2.5	Clean Water Act (CWA) & CAA Amendments (CAAA)
	2.14.1	Air Quality Compliance Issues and Actions
	2.15*	Summary of Environmental Permits
	3.7	Summary of 1995 Release & Environmental ncident Reports
	5.6	Air Quality Managment
Phyllis Peterson	3.4.4	Special Case Waste
JoAnn Pigg	2.9	Federal Insecticide, Fungicide & Rodenticide Act (FIFRA)
Chip Roma	2.2	Resource Conservation & Recovery Act (RCRA)
	3.4.1	SNL/NM Hazardous Waste Management Program
Lih-Jenn Shyr	4.0	Terrestrial Surveillance
	Apx E*	Environmental Regulations & Standards
	Apx F*	Compliance Activities at the Kauai Test Facility
Bill Suderman	3.4.6	The Asbestos Program

CONTRIBUTORS/AUTHORS (Concluded)

Author	Section	
Stanley Edmund	2.16	Tiger Team Summary of Ongoing Actions
Brian Stone	2.1	Comprehensive Environmental Response, Compensation & Liabilitiy Act (CERCLA)
Dave Szklarz	2.8	Toxic Substances Control Act (TSCA)
	3.4.5	The PCB Program
Suzie Showalter	2.17	Summary of Environmental Occurrences
	3.7.2	Environmental Occurrence Reporting
Ted Wolff	1.7	Biology
	2.4	National Environmental Policy Act (NEPA)
	2.10	Endangered Species Act (ESA)
	2.11	Cultural Resources Acts
	2.12	Executive Orders
	3.5	National Environmental Policy Act (NEPA) Compliance Activities & Documentation in 1995
	Apx C,	NEPA Documentation
	Apx F*	Compliance Activities at the Kauai Test Facility

ACKNOWLEDGMENTS

This 1995 report was compiled by the staff of the Environmental Operations Center (7500) of Sandia National Laboratories/New Mexico (SNL/NM).

NOTES TO THE READER

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

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

CONTENTS

CONTENTS (Continued)

CONTENTS (Continued)

CONTENTS (Continued)

CONTENTS (Concluded)

Page

FIGURES

FIGURES (Concluded)

TABLES

TABLES (Concluded)

ABBREVIATIONS

Units of Measure

°C	Celsius degree
cm	centimeter
°F	Fahrenheit degree
famsl	feet above mean sea level
fbgs	feet below ground surface
fbtoc	feet below top of casing
ft	foot
g	gram
gpd	gallons per day
gal	gallon
gpm	gallons per minute
hr	hour
in.	inch
J	Joule
kg	kilogram
km	kilometer
kW	kilowatt
L	liter
lb	pound
sq km	square kilometer
sq mi	square mile
g/m^3	grams per cubic meter
$\mu g/m^3$	micrograms per cubic meter
µm	micron
µg/g	micrograms per gram
mb	millibar
m	meter
m^2	square meter
MBtu	million British thermal units
MJ	megajoule
meq/L	milliequivalents per liter
mi	mile
mph	miles per hour
min	minute
mL	milliliter
ppb	parts per billion
ppbv	parts per billion by volume
ppm	parts per million
s	second
scf	standard cubic feet
yr	year
tpy	tons per year

Radioactivity Measurements

Bq/kg	Becquerel per kilogram
Bq/L	Becquerel per liter
Ci	curie
µCi	microcurie
µCi/MJ	microcuries per megajoule
mR	milliroentgen (unit of radiation exposure)
mrem	millirem (unit of radiation dose)
person-rem	radiation dose to population (also man-rem)
pCi	picocurie
R	roentgen (unit of radiation exposure)
rem	roentgen equivalent man
Sv	sievert (unit of radiation dosage, ~8.38 R)

ABBREVIATIONS (Continued)

Chemical Abbreviations

CO	carbon monoxide
NO_2	nitrogen dioxide
CO_2	carbon dioxide
No_x	nitrogen oxides
O_3	ozone
LiF	lithium fluoride
NaF	sodium fluoride
pH	potenial of hydrogen
SO_2	sulfur dioxide
D	deuterium
HNO_3	nitric acid
H_2S	hydrogen sulfide
TCE	trichloroethylene
TCA	trichloroethane
TTCE	tetrachloroethane
HF	hydrofluoric acid

Elements and Isotopes

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

ABBREVIATIONS (Continued)

Acronyms

ABC/AQCB	Albuquerque-Bernalillo County/Air Quality Control Board
ACRR	Annular Core Research Reactor
ADM	Action Description Memorandum
ADS	Activity Data Sheet
AEA	Atomic Energy Act
AEC	Atomic Energy Commission
AES	Atomic Emission Spectroscopy
AEHD	Albuquerque Environmental Health Department
AIP	Agreement-in-Principle
AIRFA	American Indian Religious Freedom Act
ALARA	as low as reasonably achievable
ALIAS	(an accelerator facility)
ANSI	American National Standards Institute
APCD	Air Pollution Control Division
AQCR	Air Quality Control Regulation
AR	averaged replicate
ARPA	Archaeological Resources Protection Act
BW	background well
CA	Corrective Action
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CAM	continuous air monitor
CAN	Clean Air Network
CAP88-PC	Clean Air Act Assessment Package-1988
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CERF	Civil Engineer Research Facility
CFC	chlorofluorocarbon
CFR	Code of Federal Regulations
CPMS	Criteria Pollutant Monitoring Station
CV	coefficient of variation
CWA	Clean Water Act
CWL	Chemical Waste Landfill
CX	categorial exclusion
CY	calendar year
DCG	derived concentration guide
DNA	Defense Nuclear Agency
DNSFB	Defense Nuclear Facility Safety Board
DOC	U.S. Department of Commerce
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOE/AL	U.S. Department of Energy/Albuquerque Operations Office
DOE/EH	U.S. Department of Energy/Environmental Health
DOE/EPD	U.S. Department of Energy/Environmental Protection Division
DOE/HQ	U.S. Department of Energy/Headquarters
DOE/KAO	U.S. Department of Energy/Kirtland Area Office

ABBREVIATIONS (Continued)

DOE/NV	U.S. Department of Energy/Nevada Operations Office
DOT	U.S. Department of Transportation
DP	Discharge Plan
DQO	data quality objective
DU	depleted uranium
EA	Environmental Assessment
ECF	Explosives Components Facility
ECL	Environmental Checklist
EDE	effective dose equivalent
EG&G	Edgerton, Germeshausen & Grier Corporation
EHS	Extremely Hazardous Substance
EIS	Environmental Impact Statement
EIS/EIR	Environmental Impact Statement/Environmental Impact Review
EIS/ODIS	Effluent Information System/Onsite Discharge Information System
EMFAPS	Exploding Metal Film Annode Plasma Source
EMP	Environmental Monitoring Plan
ENCOTEC	Environmental Control Technology Corporation
ENVC	Environmental Operations Center
EO	Executive Order
EOC	Environmental Operations Center
EOD	Explosive Ordnance Disposal
EORC	Environmental Operations Records Center
EPA	U.S. Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
ER	Environmental Restoration
ESA	Endangered Species Act
ES&H	Environment, Safety, and Health
FFCAct	Federal Facility Compliance Act
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FONSI	Finding of No Significant Impact
FR	Federal Register
FY	fiscal year
GC	gas chromatography
GFAA	graphite furnace atomic absorption
HAP	hazardous air pollutant
HC	hydrocarbon
HCF	Hot Cell Facility
HCFC	hydrochlorofluorocarbon
HDRV	Historical Requests Validation Project
HEPA	high-efficiency particulates in air
HERMES-III	High-Energy Radiation Megavolt Electron Source-III
HLW	high level radioactive waste
HSWA	Hazardous and Solid Waste Amendments (RCRA)
HWMF	Hazardous Waste Management Facility
ICP	inductively coupled plasma (method)
ID	identification
IEEE	Institute of Electrical and Electronics Engineers
IMATRON	(a land mine detector)

ABBREVIATIONS (Continued)

IO	Isolated Occurrences
IRP	Installation Restoration Program (KAFB)
ISS	Interim Storage Site
IT	International Technology Corporation
ITRI	Inhalation Toxicology Research Institute
KAFB	Kirtland Air Force Base
KTF	Kauai Test Facility
KUMSC	Kirtland Underground Munitions Storage Complex
LANL	Los Alamos National Laboratory
LATA	Los Alamos Technical Associates
LCD	laboratory control duplicate
LCS	laboratory control samples
LDR	Land Disposal Restriction
LECS	Liquid Effluent Control System
LIWG	Line Implementation Working Group
LLW	low-level radioactive waste
LLWEA	Low Level Waste Environmental Assessment
LMF	Large-Scale Melt Facility
LWDS	Liquid Waste Disposal System
MAC	maximum allowable concentration
MAP	Mitigation Action Plan
MCL	maximum contaminant level
MEI	maximum exposed individual
MDA	minimum detectable activity
MDL	minimum detection level
MOU	Memorandum of Understanding
MSDS	Material Safety Data Sheet
MSL	Melting and Solidification Laboratory
MW	mixed waste
MWL	Mixed Waste Landfill
N	normal
NA	not analyzed, not applicable, or not available
NAEP	National Association of Environmental Professionals
NAAQS	National Ambient Air Quality Standards
NC	not calculated or not calculable
NCC	National Climatic Centers
ND	analyte Not Detected at the MDL indicated
NE	MCL not established
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NFA	No Further Action
NGTF	Neutron Generator Test Facility
NHPA	National Historic Preservation Act
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards (formerly National Bureau of Standards)
NM	New Mexico
NM	parameter not measured (this quarter)
NMAC	New Mexico Administrative Code
NMAQS	New Mexico Air Quality Standards

ABBREVIATIONS (Continued)

NMED	New Mexico Environment Department
NMEIB	New Mexico Environmental Improvement Board
NMHWMR	New Mexico Hazardous Waste Management Regulations
NMWQA	New Mexico Water Quality Authority
NMWQCC	New Mexico Water Quality Control Commission
NMWQR	New Mexico Water Quality Regulations
NOAA	National Oceanographic and Atmospheric Administration
NOD	Notice of Deficiency
NOI	Notice of Intent (to Discharge)
NON	Notification of Noncompliance
NOV	Notice of Violation
NP	not performed
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NPN	nitrate-plus-nitrite
NRC	National Response Center
USNRC	U.S. Nuclear Regulatory Commission
NRHP	National Register of Historic Properties
NSPS	New Source Performance Standards
NS	not sampled (during this quarter)
NTNC	Non-Transient Non-Community
NTS	Nevada Test Site
NTU	nephelometric turbidity unit
NW3	Northwest TA-3 Well
ODS	ozone depleting substance
OEL	Occupational Exposure Limit
OPOL	Open Pool Burn Site Facility
OSHA	Occupational Safety and Health Administration
OSI	on-site investigation
OU	Operable Unit
PA	Preliminary Assessment
PA/SI	Preliminary Assessment/Site Inspection
PBFA-II	Particle Beam Fusion Accelerator-II
PCB	polychlorinated biphenyl
PDWR	Primary Drinking Water Regulations
PEIS	Programmatic Environmental Impact Statement
PM	particulate matter
PM_{10}	respirable particulate matter (diameter equal to or less than 10 microns)
PMRF	Pacific Missile Range Facility
POM	point of measure
POTW	publicly-owned treatment works
PPOA	Pollution Prevention Opportunity Assessment
PROTO	(an accelerator facility)
PSD	Prevention of Significant Deterioration
PWA	Process Waste Assessment
QA	quality assurance
QAP	Quality Assessment Program
QC	quality control

ABBREVIATIONS (Continued)

R&D	research and development
RAM	radiological air monitor
RCRA	Resource Conservation and Recovery Act
RESRAD	Residual Radioactive (modeling code for dose assessment)
RFI	RCRA Facility Investigation
RHEPP	Repetitive High Energy Pulsed Power
RLA	Recircling Linear Accelerator
RMSEL	Robotic Manufacturing Science and Engineering Laboratory
RMSY	Radioactive Materials Storage Yard
RMWMF	Radioactive and Mixed Waste Management Facility
ROD	Record of Decision
RPD	relative percent difference
RQ	reportable quantity
RSI	RCRA Site Investigation
RWL	Radioactive Waste Landfill
SABRE	Sandia Accelerator Beam Research Experiment
SAF	Soil Amendment Facility
SARA	Superfund Amendments and Reauthorization Act
SATURN	an accelerator facility
SDF	Strategic Defense Facility
SDIO	Strategic Defense Initiative Organization
SDWA	Safe Drinking Water Act
SHPO	State Historic Preservation Officer
SIC	Standard Industrial Classification
SIMS+	Sandia Issues Management System
SMERF	SMoke Emission Reduction Facility
SMO	Sample Management Office
SNL	Sandia National Laboratories
SNL/CA	Sandia National Laboratories/California
SNL/NM	Sandia National Laboratories/New Mexico
SOP	Standard Operating Procedure
SPCC	Spill Prevention Control and Countermeasures (Plan)
SPDES	State Pollutant Discharge Elimination System
SPHINX	(an accelerator facility)
SPR	Sandia Pulsed Reactor
STAR	Stability Array (NESHAP)(decks)
STF	Subsystem Test Facility
STL	Simulation Technology Laboratory
SU	standard units
SVOC	semivolatile organic compound
SWDA	Solid Waste Disposal Act
SWHC	Site-Wide Hydrogeologic Characterization Project
SWISH	Small WInd SHield (facility)
SWMU	Solid Waste Management Unit
TA	Technical Area
TAL	target analyte list
TANDEM	(an accelerator facility)
TCL	target compound list
TCLP	toxicity characteristic leaching procedure
TCS	Technical Support Center

ABBREVIATIONS (Concluded)

TDS	total dissolved solids
TEVES	Thermal Enhanced (soil) Vapor Extraction System
TLD	thermoluminescent dosimeter
TNMHC	total non-methane hydrocarbon
TOC	total organic carbon
TOX	total organic halogen
TPH	total petroleum hydrocarbons
TRI	Toxic Release Inventory
TROLL	(an accelerator facility)
TRS	total reduced sulfur
TRU	transuranic
TSC	Technology Support Center
TSCA	Toxic Substances Control Act
T/S/D	treatment, storage, and disposal (facility)
TSP	total suspended particulates
TSS	total suspended solids
TTF	Thermal Treatment Facility
TTO	total toxic organics
TTR	Tonopah Test Range
TWA	time weighted average
USC	United States Code
USEC	United States Enrichment Corporation
USGS	United States Geological Survey
USNRC	United States Nuclear Regulatory Commission
UST	underground storage tank
VCM	Voluntary Corrective Measure
VOC	volatile organic compound
WAC	waste acceptance criteria
WIPP	Waste Isolation Pilot Plant

Approximate Conversion Factors For Selected Si (Metric) Units

Multiply SI (Metric) Unit	By	To Obtain U.S. Customary Unit
Cubic meters (m^3)	35	Cubic feet (ft^3)
Centimeters (cm)	0.39	Inches (in.)
Meters (m)	3.3	Feet (ft)
Kilometers (km)	0.62	Miles (mi)
Square kilometers (km^2)	0.39	Square miles (mi^2)
Hectares (ha)	2.5	Acres
Liters (L)	0.26	Gallons (gal)
Grams (g)	0.035	Ounces (oz)
Kilograms (kg)	2.2	Pounds (lb)
Micrograms per gram (µg/g)	1	Parts per million (ppm)
Milligrams per liter (mg/L)	1	Parts per million (ppm)
Celsius (°C)	°F = 9/5 °C+ 32	Fahrenheit (°F)

EXECUTIVE SUMMARY

As required by U.S. Department of Energy (DOE) Order 5400.1, this Site Environmental Report has been prepared for Sandia National Laboratories/New Mexico (SNL/NM) to characterize site environmental management performance, confirm compliance with Federal, state, and local environmental standards and requirements, and to identify any areas of non-compliance and corrective actions in progress. The report also serves to highlight environmental successes, audit results, and significant programs and efforts. The annual Site Environmental Report represents a key component of the DOE's effort to keep the public informed about environmental conditions at SNL/NM.

SNL/NM is a managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation. The SNL/NM site is located southeast of Albuquerque, NM, on Kirtland Air Force Base (KAFB). The primary mission of SNL/NM is to conduct research and development activities in the areas of weapon systems, nuclear reactor safety, energy sources, waste management, and environmental cleanup technologies. Some of these activities have the potential to release hazardous materials to the environment. Historically, the releases have been relatively low compared to DOE and EPA standards.

To ensure that SNL/NM operations will not impose undue risk to the public, various environmental management and monitoring programs have been implemented. Major categories of environmental activities include environmental impact studies carried out under the National Environmental Policy Act (NEPA), pollution prevention and waste minimization programs, terrestrial and air monitoring, radioactive and hazardous waste management, and environmental restoration (ER).

The following paragraphs present the major activities, accomplishments, and results of various environmental programs conducted at SNL/NM during calendar year (CY) 1995.

WASTE MANAGEMENT

- *Hazardous (RCRA) Waste* – SNL/NM currently treats and stores hazardous waste on site under a site-wide Resource Conservation and Recovery Act (RCRA) permit. The Hazardous Waste Management Facility (HWMF) serves as the center for handling, packaging, and shipping hazardous waste. In 1995, a total of 91,876 kilograms (kg) of RCRA- regulated waste was generated and shipped off-site. The Hazardous Waste Program was audited by the New Mexico Environment Department (NMED) in July 1995. Four violations were identified which included violations in container management and labeling and one instance of a failure to keep hazardous waste under the control of the waste generator. These were minor problems and all conditions were immediately corrected. A penalty of $3,015.00 was proposed in the Compliance Order. Another audit assessing the Hazardous Waste Management Program was conducted by the EPA in September 1995; eight minor findings were identified. SNL/NM also owns the newly operational Thermal Treatment Facility (TTF) for the treatment of residual explosive waste. In 1995, just 20 pounds (lb) of explosive waste was sent to the TTR for treatment.

- *Radioactive Waste* – All newly generated radioactive waste is stored above ground at waste generator sites. In 1995, SNL/NM generated 13,160 kg of low level waste (LLW), 12,212 kg of mixed waste, and received an additional 5,539 kg of mixed waste from its operations in Livermore (SNL/CA). SNL/NM also accepted 26 drums of transuranic (TRU) waste into SNL-managed storage bunkers at Manzano Base from the Department of Energy's (DOE's) Inhalation Toxicology Research Institute (ITRI). An audit assessing SNL/NM's management of LLW was conducted in March 1995 by DOE/Nevada Operations, Weapons Management Division. Several minor observations were made. A follow-up visit in May noted all observations had been corrected.

- *Mixed Waste Issues* – The Radioactive Mixed Waste Management Facility (RMWMF) which serves as a centralized packaging and temporary storage facility for all LLW and MW became operational in January 1996. Mixed waste is currently a compliance issue as it is in violation of RCRA Section 3004(u) which states that a maximum period of 1 year (yr) is allowed for hazardous waste storage on-site before the waste must undergo treatment to comply with Land Disposal Restrictions. The radioactive component of mixed waste prevents it from being treated as other hazardous waste and there is a national lack of treatment capacity for mixed waste. The Federal Facilities Compliance Act (FFCAct) was passed in October 1992 to address this lack of treatment capacity. SNL/NM is presently actively pursuing treatment methods and storage consolidation to comply with the regulations. A final Site Treatment Plan for Mixed Waste was published in 1995 which includes the use of mobile treatment units to service several DOE/AL sites (SNL 1995f).

- *Industrial Waste* – A total of 542,694 kg of industrial and recycled material was generated in 1995. SNL handles waste and recycled material regulated under the Toxic Substances Control Act (TSCA) which includes primarily asbestos and polychlorinated biphenyl (PCB) contaminated waste. In 1995, approximately 12,400 kg of PCB-contaminated material, consisting mostly of fluorescent light ballasts, was shipped from SNL/NM for disposal or recycling. Asbestos waste (derived from construction materials and various asbestos-containing equipment) totaled 108,510 kg in 1995.

METEOROLOGICAL PROGRAM

Meteorological monitoring specific to the SNL site commenced in 1994. The meteorological network consists of eight towers ranging in height from 10 to 60 meters (m). The towers are instrumented at various levels to record wind speed and direction, standard deviation of horizontal wind speed (sigma theta), temperature, relative humidity, precipitation, and barometric pressure. Meteorological data are primarily used to support National Emission Standards for Hazardous Air Pollutants (NESHAP) compliance and to provide emergency response information in the event of a spill or other hazardous release.

AIR QUALITY COMPLIANCE

- *Title V Requirements* – The new requirements of the Clean Air Act Amendments (CAAA) are implemented by New Mexico Administrative Code – 20 NMAC 11.42. All existing major air emission sources must apply for an operating permit by March 1996. SNL/NM is implementing all new permit requirements before or by the required deadlines.

- *Current issues* – SNL/NM conducts open burn tests in remote test locations. To reduce emissions from these burns the SMoke Emission Reduction Facility (SMERF) and the Small WInd SHield (SWISH) facility were constructed at the Burn Site. Although these facilities greatly reduce smoke that would otherwise be permitted in an open burn, they had difficulty meeting opacity requirements applicable to normal stack emissions. For this reason, SNL/NM applied for and received an exemption form the Albuquerque-Bernalillo County/ Air Quality Control Boards (ABC/AQCB) for research and development fire test facilities.

  SNL/NM is continuing to correct the lack of proper management for ozone depleting substances (ODSs) identified in both the Tiger Team Assessment in 1991, and a recent DOE EH-24 Office of Environmental Assessment audit conducted in 1995. Procedures are being written and revised to address potential non-compliance issues.

- *Non-radiological Air Monitoring* – The objective of the ambient air surveillance program is to establish baseline concentration levels for criteria pollutants which include sulfur dioxide (SO_2), particulate matter (PM), carbon monoxide (CO), ozone (O_3), nitrogen dioxide (NO_2), and lead (Pb). SNL/NM complies with National Ambient Air Quality Standards (NAAQS) and local ambient air standards implemented by New Mexico regulations. The ambient air monitoring network includes one criteria pollutant monitoring station (CPMS), seven particulate matter (PM) monitoring stations, and four volatile organic compound (VOC) monitoring stations. SNL/NM was in full compliance with all air permits and regulations in 1995.

- *NESHAP Compliance* – Radioactive effluent air monitoring indicated that small quantities of tritium, nitrogen-13, oxygen-15, and argon-41 emissions were released to the atmosphere as a result of SNL/NM operations in 1995. The NESHAP calculated maximum exposed individual was determined to be located at the U.S. Air Force (USAF) Kirtland Underground Munitions Storage Complex facility. The effective dose equivalent calculated for this location is 8.5×10^{-4} millirem per year (mrem/yr) or .0085 percent of the 10-mrem/yr dose limit specified in NESHAP and in DOE orders. The total population dose for the 50-mile radius surrounding SNL/NM was calculated to be 1.6×10^{-2} person-rem from SNL/NM operations, whereas by comparison the population received more than 57,000 person-rem from natural background radiation. SNL was in full compliance with NESHAP regulations in 1995. In July 1995, the EPA conducted an informal visit to review all NESHAP sources. No findings or observations were found.

TERRESTRIAL SURVEILLANCE

The objectives of radiological and metal surveillance activities are to detect any potential releases and/or migration of contaminated material related to on-site operations to off-site (community) locations and also to determine potential impacts of site-related activities to the off-site population and the surrounding environment. Radiological and non-radiological surveillance sampling took place at off-site, perimeter, and on-site locations and covers various environmental media including vegetation, soil, sediment, and surface water.

A risk-based statistical approach was used to detect higher-than-background concentrations and to examine whether the data showed an increasing trend over years. For most of the environmental media, only 2 to 5 percent of the sample locations showed either an increasing trend or higher-than-background levels. Approximately 35 percent of the soil sample locations showed an increasing trend for total uranium. Most of these locations showed an increasing trend for the first time and it was likely to be caused by data flucuation. Also, all of these locations had concentrations lower than off-site measurements. SNL/NM surveillance staff plans to monitor these locations on a regular basis.

GROUNDWATER MONITORING

Groundwater monitoring activities reported are those associated with the SNL/NM ER Project and the Groundwater Protection Program. The Groundwater Surveillance Task of the Groundwater Protection Program, performs base-wide groundwater monitoring of well water levels and groundwater quality. Water levels are measured monthly to infer groundwater flow patterns in the region and data are used to define long-term groundwater quantity KAFB. Groundwater quality samples were collected during March 1995 from 16 wells and four springs. In October 1995, the monitoring network was reduced to 32 wells and one spring. In general, the hydrographs indicate that water levels have been declining within the upper units of the Santa Fe Group at rates of between 0.5 to over 3 feet (ft) per year at KAFB. This decline is a result of pumping from City of Albuquerque and KAFB water supply wells.

- *Radionuclides* – Two wells exceeded maximum contaminant levels (MCL) for radionuclides; one well at the Chemical Waste Landfill (CWL) exceeded MCL for radium and one well east of TA-III (Explosive Ordnance Disposal [EOD]) exceeded radium, uranium, and gross alpha measurements.

- Metals and General Chemistry – Several wells exceeded MCLs for antimony, barium, chromium, iron, lead and nickel. The only significant exceedances were for antimony at the EOD well, nickel at well SFR-3P, and lead at well SWTA-3. Three wells also exceeded MCLs for nitrate-plus-nitrite.

WASTEWATER & SURFACE WATER MONITORING

- Wastewater – SNL/NM has six wastewater discharge permits from the City of Albuquerque. There were no violations in wastewater permits in 1995. The City of Albuquerque presented DOE and SNL with five Gold Pretreatment Awards for demonstrating an exceptional level of compliance with wastewater requirements.

- Surface Water – Surface discharges are made to two evaporation lagoons servicing the Pulsed Power Development facilities. Both lagoons are permitted under DP-530. Slight exceedances in total dissolved solids (TDS) and chloride concentrations were noted in one lagoon. The increased concentration was most likely due to a higher than normal evaporation rate.

- Storm Water – The National Pollutant Discharge Elimination System (NPDES) permit for SNL/NM is pending. Currently storm water sampling is conducted at three stations; nine new stations are planned. In 1995, barium and manganese were detected in samples above Federal limits but this was attributed to the naturally high levels of these constituents in local soils. Gross alpha and gross beta also exceeded MCL but again were attributable to the naturally occurring uranium in the decomposing granites of the Sandia and Manzano Mountains.

ENVIRONMENTAL RESTORATION ACTIVITIES

The assessment and remediation of potential release sites (based on past activities) identified by the ER Project at SNL/NM are being monitored by the EPA as provided for by the Hazardous and Solid Waste Amendments of 1984 (HSWA) module of the RCRA Part B operating permit. Based on assessment work completed to date, 92 sites have been proposed to DOE and the EPA for No Further Action (NFA) because no contamination is present or contamination is insignificant and does not warrant further action. In 1995, there were 155 sites listed for further investigation. Assessment efforts continued at several sites and areas, including the Chemical Waste Landfill (CWL), the Mixed Waste Landfill (MWL), the Liquid Waste Disposal System (LWDS), Technical Area II (TA-II), and other areas within Technical Areas I, III, and IV. Voluntary Corrective Actions have been completed at 37 ER sites and 19 more are planned for FY 96. SNL plans to complete remedial actions at the SNL/NM site by the year 2000.

NEPA COMPLIANCE

NEPA activities in 1995 included the completion of three Environmental Assessments (EAs), each of which was issued a Finding of No Significant Impact (FONSI): (1) General Purpose Heat Source Safety Verification Testing, (2) Final EA for the Gamma Irradiation Facility, and (3) EA for the Processing and Environmental Technology Laboratory. Other NEPA activities included additional training for the preparation of NEPA documents and further development of policies and procedures to implement NEPA objectives.

OCCURRENCES & REPORTING

Four occurrences were reported in 1995 which involved three releases and one audit report: (1) 10 gal of hydraulic fluid spilled from a street sweeper (cleaned up with no impact), (2) 1200 gal asphalt spilled from a truck which boiled over (cleaned up and disposed of properly), (3) 150 gal release of a liquid rust inhibitor product to a storm drain (liquid was retrieved before reaching Tijeras Arroyo), and (4) the NMED July 1995 audit finding of four violations in the Hazardous Waste Management Program (all findings were immediately corrected).

Additional reporting requirements are made in compliance with the Superfund Amendments and Reauthorization Act (SARA) Title III. SNL/NM complied with Section 302-303 –Planning Notification, Section 311-312 –MSDS Chemical Inventory reporting, and Section 313 –Toxic Release Inventory (TRI) reporting. Section 304 – Emergency Release Notification was not applicable in 1995, as no releases requiring SARA III reporting occurred.

POLLUTION PREVENTION & WASTE MINIMIZATION

SNL/NM's goal is to minimize all of its waste streams (radioactive, mixed, hazardous, and sanitary) and implement pollution prevention criteria as an integral part of everyday business operations. Accomplishments within the Waste Minimization and Pollution Prevention Programs for 1995 include: (1) development of a defensible and rigorous waste prioritization computer model which will identify areas of opportunity for waste reduction, (2) implementation of 24 Pollution Prevention Opportunity Assessments (PPOAs), and (3) Pollution Prevention Project implementation using "chargeback funds" to finance new waste reducing methods.

1.0 INTRODUCTION

Sandia National Laboratories/ New Mexico (SNL/NM) is committed to protecting the environment and to preserving the health and safety of individuals and the community. As a prime contractor to the U.S. Department of Energy (DOE), SNL/NM manages and conducts its operations in accordance with DOE Orders and goals. Major DOE environmental safeguard requirements applicable to this report are embodied in the following Orders and guidelines:

- DOE Order 5400.1, *General Environmental Protection Program,* (DOE 1988a).
- DOE Order 231.1, *Environment Safety and Health Reporting,* (DOE 1996a -*in final*)
- DOE Order 5400.5, *Radiation Protection of the Public and the Environment* (DOE 1990a).
- DOE/EH-0173T, *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance* (DOE 1991b).

The primary purpose of the annual Site Environmental Report is to present summary environmental data so as to characterize site environmental management performance, confirm compliance with Federal, state, and local environmental standards and requirements, and to identify any areas of non-compliance and corrective actions in progress, as well as to highlight environmental successes and significant programs and efforts. The annual Site Environmental Report represents a key component of the DOE's effort to keep the public informed about environmental conditions at SNL/NM.

SNL/NM strives to operate in full compliance with the letter and spirit of all applicable environmental laws, and environmental safety and health (ES&H) regulations. Laws and regulations are strictly enforced, operating permits are obtained where necessary, and conditions are monitored closely to ensure compliance with all permits and regulations. In the event of a non-compliance situation, SNL/NM tracks the occurrence to see that the situation is corrected as quickly as possible, and if necessary, incorporates changes into policy and/or procedures where needed to prevent a reoccurrence. SNL/NM has infused a strong corporate culture for environmental responsibility and safety which is evident at all levels of operations—from line management to individual workers.

1.1 ORGANIZATION OF REPORT

This report summarizes the environmental protection and compliance activities for the calendar year (CY) 1995. Chapter 1 gives a general introduction to the site including SNL/NM's location, setting, mission, and general operations, particularly those projects which have the potential to impact the environment. Chapter 2 captures essential compliance summary information for CY 1995, and describes the major environmental statutes applicable to SNL/NM, highlighting areas of compliance and/or non-compliance, and current issues and actions. Chapter 3 provides further details about major environmental programs in place at SNL/NM and gives information on environmental performance indicators as well as general trends in environmental management over the last 5 years. Chapter 4 discusses the Terrestrial Surveillance Program designed to sample and analyze various environmental medias (e.g., surface water, vegetation, sediment, and soil) to both measure baseline conditions and to assess impacts, if any, from SNL/NM site operations. Chapter 5 discusses radiological air emission monitoring, ambient air quality monitoring, and the Meteorological Program. Chapter 6 concerns programs for wastewater effluents from sewers, storm water run-off, and surface water discharges. Chapter 7 discusses the Groundwater Protection Program and groundwater monitoring at Environmental Restoration (ER) sites. Finally, Chapter 8 describes the Quality Assurance Program in place at SNL/NM which assures the validity and quality of sampling and monitoring activities in order to meet the compliance goals of the Environmental Protection Agency (EPA), the DOE, and other Federal, state, and local regulations. A separate Site Environmental Report for SNL's Kauai Test Facility (KTF) is contained in Appendix F.

1.2 SNL Site Mission & Operations

SNL operations consists of five separate facilities located in four states: SNL/NM in Albuquerque –the head of operations; two locations in California (SNL/CA) –Livermore and San Jose; the Kauai Test Facility (KTF) located on the U.S. Navy's Pacific Missile Range Facility (PMRF); and operations located on the Tonopah Test Range in Nevada. SNL is managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation.

SNL/NM is one of the nation's national defense laboratories whose original purpose was to supply the nation's needs in national security (both nuclear and non-nuclear) and provide research for new energy sources. Since the end of the Cold War, SNL/NM's mission has greatly expanded to include leading edge research and development (R&D) technologies in electronics, computer systems, robotics, advanced military technology, and arms control and non-proliferation.

Although the nuclear danger is greatly reduced in the wake of the Cold War, the United States still continues to rely on nuclear weapons as a vital military deterrent. Current projects at SNL/NM include the weaponization of nuclear explosives, including the design of arming, fusing, and firing systems used in nuclear weapons, nuclear reactor safety studies for the United States Nuclear Regulatory Commission (USNRC), development of safe transport and storage systems for special nuclear materials including plutonium (Pu) and uranium (U), and radioactive waste site characterization studies and disposal techniques.

SNL/NM also conducts research in pulsed power nuclear reactors, thermonuclear fusion, solar energy, environmental technologies, and fossil fuel and geothermal energy sources. Safely managing nuclear weapons and ensuring the reliability of weapon systems receive primary emphasis at SNL/NM.

1.3 SITE LOCATION & DEMOGRAPHICS

SNL/NM is located in Bernalillo County at the foot of the Manzanita Mountains adjacent to Albuquerque, NM (Figure 1-1). At their nearest points, SNL/NM facilities are 2.5 miles (mi) south of Interstate 40 and approximately 6.5 mi east of downtown Albuquerque. The facilities are located on a portion of the 190 square kilometer (sq km) (118 sq mi) Kirtland Air Force Base (KAFB) military reservation. Additionally, SNL/NM shares a 20,486 acre land withdrawal with KAFB which is used for remote testing activities. This tract of land located on Cibola National Forest land has been withdrawn through agreement with the U.S. Forest Service for the exclusive use of the Air Force and DOE/SNL operations (Figure 1-2).

SNL/NM facilities and project sites are located within five Technical Areas (TAs) and remote test sites on KAFB. The KAFB military reservation is situated on two broad mesas bisected by the Tijeras Arroyo, an east-west drainage which flows to the Rio Grande. These mesas are bound by the Manzanita Mountains on the east and the Rio Grande on the west. Elevations in the area range from 4,921 feet (ft) at the Rio Grande to 10,678 ft at Sandia Crest, the highest point in the Sandia Mountains northeast of KAFB. Mean elevation at the site is 5384 ft.

The population in the Albuquerque and the surrounding area (approximately within a 50-mile radius of KAFB) is contained in all or part of the following nine counties. Primary population areas within the effected radius are shown in parentheses:

(1) Bernalillo County (Albuquerque, KAFB and East Mountain residents);
(2) Sandoval County (Corrales, Rio Rancho, Bernalillo, and several Indian pueblos);
(3) Valencia County (Bosque Farms, Los Lunas and Belen);
(4) Santa Fe County, (Edgewood and Santa Fe suburbs);
(5) Torrance County (Moriarty and small villages east of the Manzano Mountains);
(6) San Miguel County (sparsely populated southwest edge of county);
(7) McKinley County (sparsely populated northwest edge of county);
(8) Cibola County (Laguna Pueblo); and,
(9) Socorro County (includes several small villages on the north edge of county).

Albuquerque, the largest and closest population center to the site, recorded a population of 384,736 in the 1990 census (DOC 1992). Projected estimates from city planners approximate the 1995 population at 414,000. The Isleta Indian Reservation, which borders KAFB on the south, is the next nearest population center (2,953 in the 1990 census). An

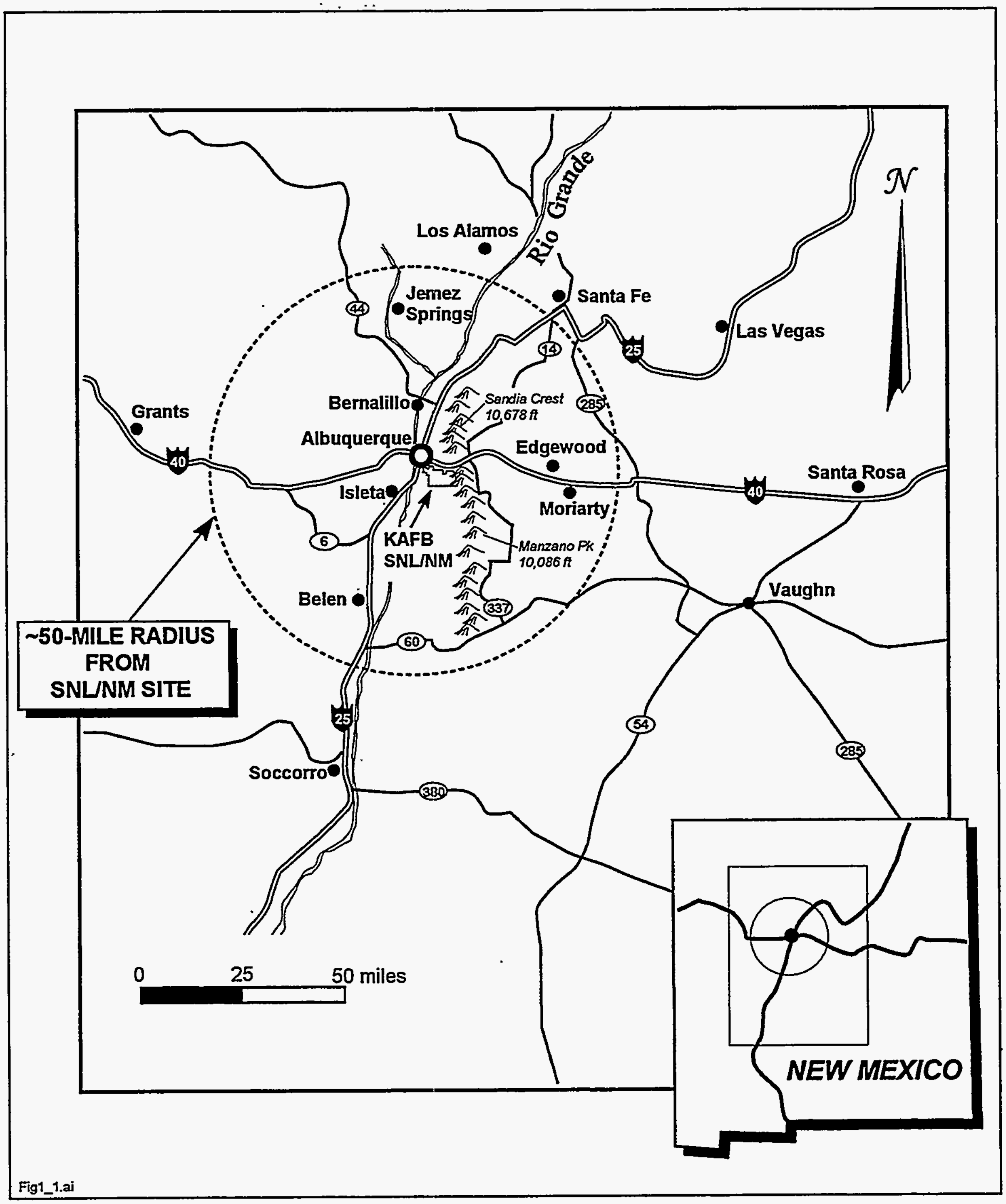

Figure 1-1. Albuquerque site regional setting in the vicinity of SNL/NM facilities.

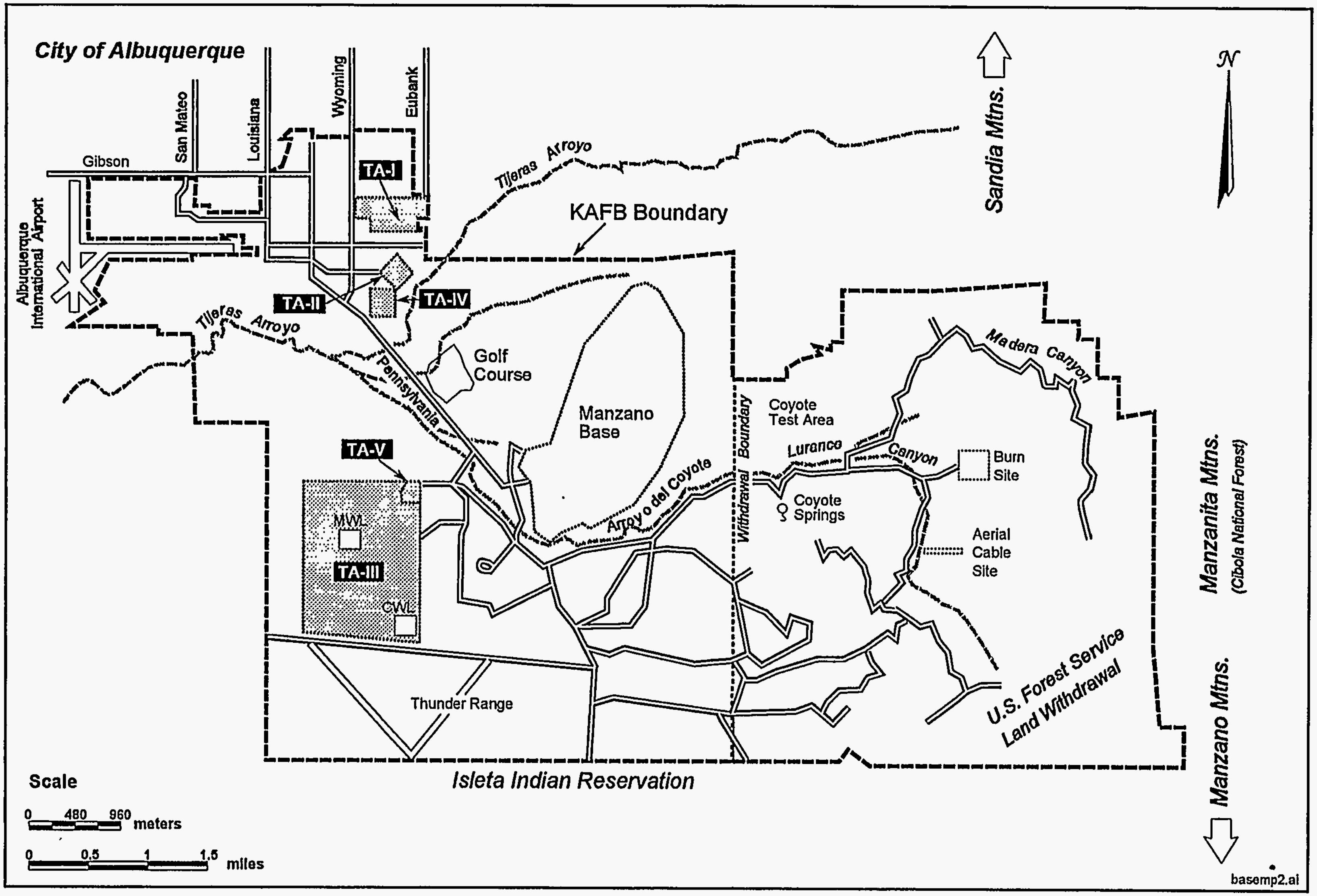

Figure 1-2. SNL/NM and the KAFB site showing Technical Areas I through V, the U.S. Forest Service land withdrawal, and other remote test areas used by SNL/NM.

estimated total population of 583,060 residents live within a 50-mile (80 km) radius of KAFB including the permanent residents living on KAFB (estimated at 6,477). Population is used for dose assessment calculations as described in Section 5.4.

1.4 REGIONAL/LOCAL CLIMATE & METEOROLOGY

The Albuquerque Basin, in which SNL/NM is located, is approximately 30 mi wide and 100 mi long (Figure 1-3). The meteorological conditions in this regional area are greatly influenced by an impressive 13 mile-long escarpment which forms the west face of the Sandia Mountains. Tijeras Canyon, slightly northeast of KAFB, is the largest canyon pass in the area, and divides the Sandia and Manzanita Mountains. These mountains and canyons significantly influence wind patterns in the regional area and across the SNL/NM site; canyons tend to channel or funnel wind, whereas mountains create upslope-downslope diurnal wind flows. The strongest winds, often accompanied by blowing dust, occur mostly in late winter and early spring.

Albuquerque area temperatures are characteristic of high-altitude, dry continental climates; winter daytime temperatures average approximately 50 degrees Fahrenheit (°F) with night-time temperatures often reaching into the low teens. Summer daytime temperatures generally do not exceed 90 °F, except in July, when the maximum reaches an average of 93 °F (see Appendix A, Table A-1).

The regional area is characterized by low precipitation (average 8.2 inches [in.] per year), occurring primarily as brief, but heavy seasonal rain showers. About half of this precipitation falls in the late summer from July through September, the primary season for rainfall in the southwest region of the United States. The dry sparsely vegetated high desert topography is particularly susceptible to erosive arroyo channeling and flash flood run-off conditions that can result. Winter months are typically very dry with less than 2.0 in. of precipitation normally recorded. The average annual relative humidity is approximately 43 percent (Appendix A, Table A-1).

The atmospheric state variables of temperature, relative humidity, and rainfall, in general, do not vary dramatically across a climatic regime. However, topographically induced wind flows do vary within the same climatic regime and can be enhanced or negated by synoptic weather systems that move across the regime. In the past, meteorological data were collected from the Albuquerque Airport which is adjacent to KAFB and shares the main runway. This data however, was not fully representative of the site conditions at SNL/NM. Site specific monitoring at SNL/NM began in 1994. Meteorological data are used in determining compliance with Federal regulations for radionuclide air emissions, and are also used in emergency response management. SNL/NM's meteorological monitoring program consists of eight towers strategically located to best record the spatial and elevation meteorological variations. These towers, ranging from 10 – 60 meters (m)

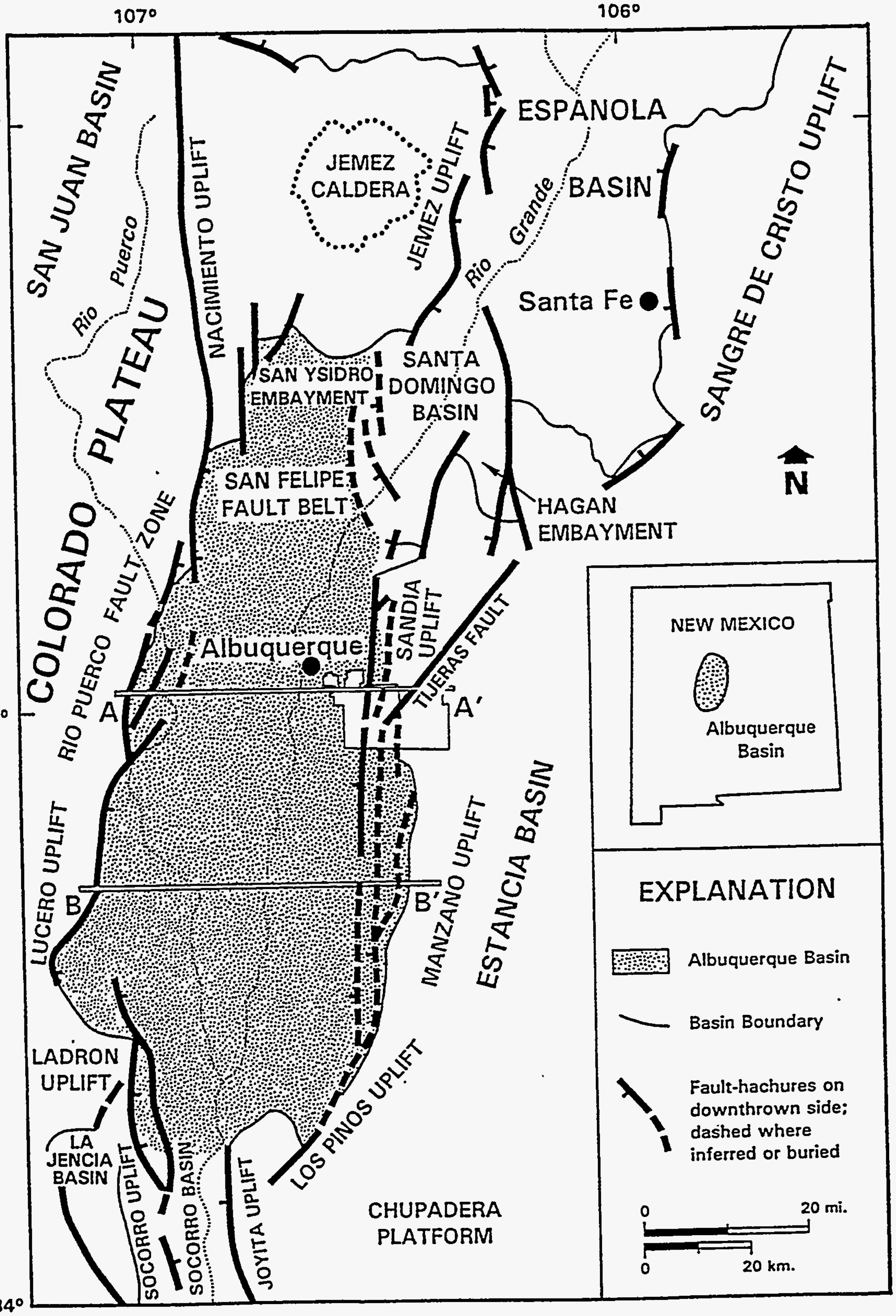

Figure 1-3. Generalized regional tectonic map of the Albuquerque Basin.

high, with various instruments at specific intervals, collect data on temperature, wind velocity, relative humidity, precipitation and atmospheric pressure. Table 5.1 contains site specific meteorological data collected by the tower network in 1995.

1.5 Regional Geologic Overview

SNL/NM and KAFB are located along the eastern margin of the Albuquerque Basin, a major structural feature of the central Rio Grande Rift (Figure 1-3). The site is located west of the Manzano and Manzanita Mountains on the alluvial fan complex that flanks the mountain front. The north-trending Albuquerque Basin underwent subsidence and northwest-southeast extension, beginning 30 to 40 million years ago, with minor activity continuing to the present time (Woodward 1982, Lozinsky 1994). The basin is divided into two half grabens bordered by major faults as shown by cross sections in Figure 1-4. Approximately 30,000 ft of vertical displacement and 5 mi. of extension have occurred within the Albuquerque Basin. Beginning during the Miocene, approximately 20 million years ago, the basin filled with as much as 12,000 ft of sediment, eroded from the surrounding highlands, and from river deposits of the ancestral Rio Grande. These basin fill deposits consist mostly of the Galisteo Formation overlain by several thousand feet of a sedimentary sequence collectively known as the Santa Fe Group.

The SNL/NM site is located in a structurally complex terrain with a number of major regional faults intersecting the area (Figure 1-5). The Sandia Fault is probably the primary frontal fault that forms the eastern border of the Albuquerque Basin and may actually be the northern extension of the Hubbell Springs Fault (Kelly 1977). The Tijeras Fault cuts diagonally across KAFB along the east side of the Four Hills/Manzano Base area. The area east of the Tijeras Fault complex is characterized by fractured and faulted bedrock with a thin alluvium cover. Bedrock units include Precambrian basement rock (granite, quartzite, and meta-rhyolite), Paleozoic Madera Formation (limestone), and Tertiary Abo and Yeso Formations (primarily sandstone, siltstones, and limestones). The area west of the faults consist of Santa Fe Group deposits.

1.6 Hydrology

The major surface hydrologic feature in central New Mexico is the Rio Grande, which flows southward through Albuquerque, and lies approximately 6 mi west of the SNL/NM site. Water from the Rio Grande is primarily used for agricultural irrigation. The major surface drainages on the SNL/KAFB site are the Tijeras Arroyo, the Arroyo del Coyote, and an unnamed drainage south of Arroyo del Coyote. Except for two short reaches of channel with intermittent flow, these drainages are all ephemeral (flows only due to rainfall) on-site. Arroyo del Coyote joins Tijeras Arroyo approximately 2 mi upstream from the point where Tijeras Arroyo leaves KAFB. The unnamed arroyo to the south of

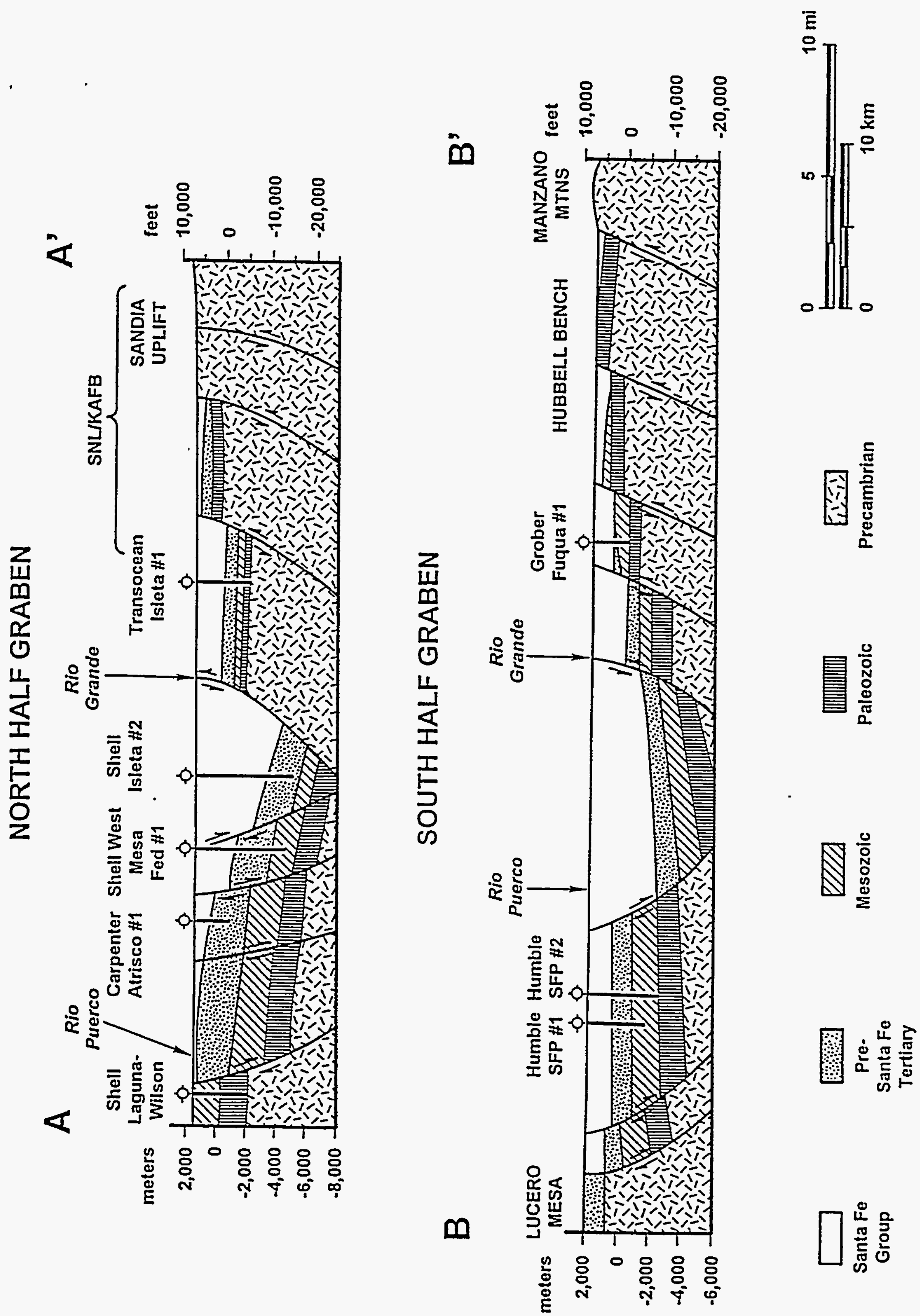

Figure 1-4. Generalized regional cross sections through the Albuquerque Basin.

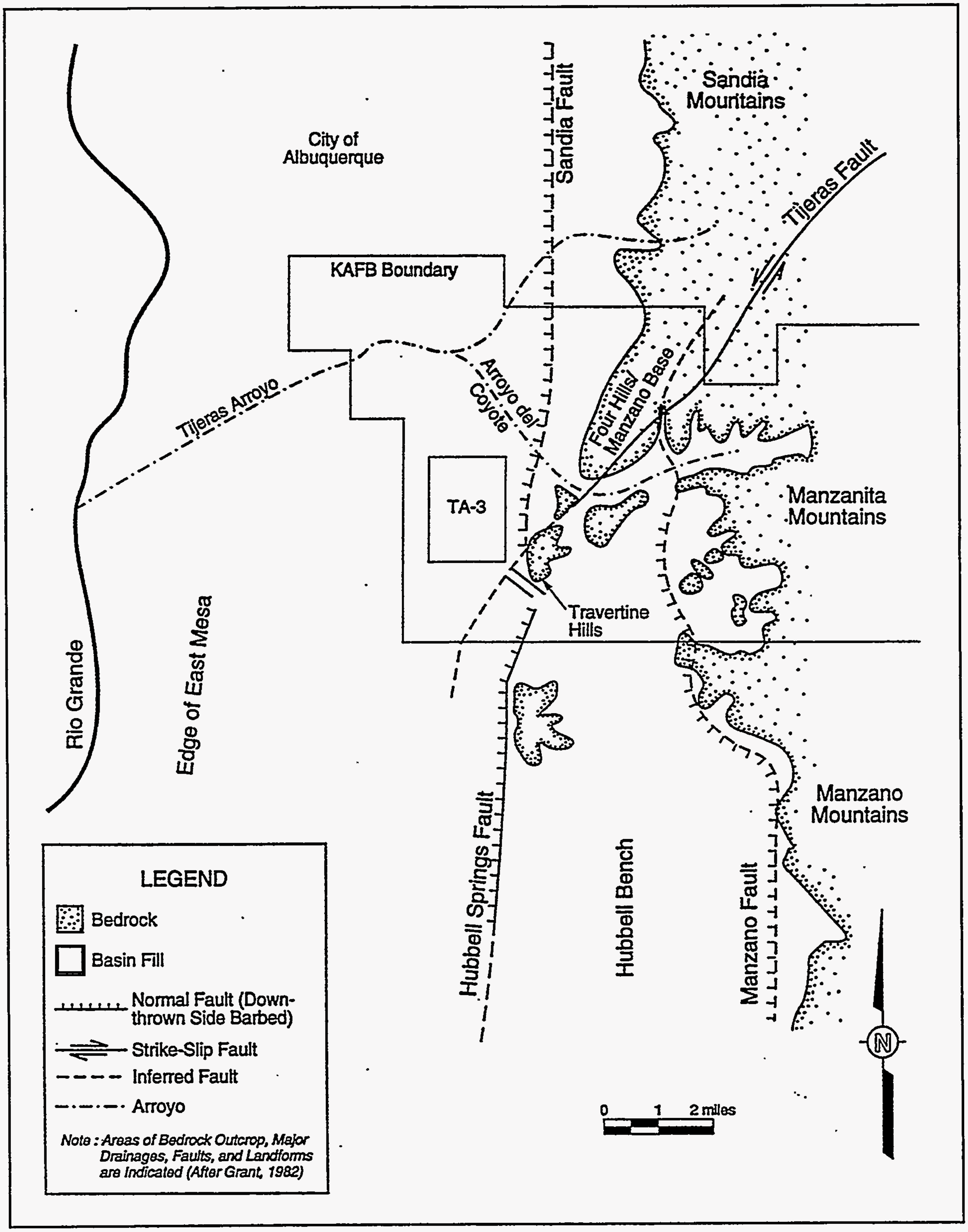

Figure 1-5. Generalized geology in the vicinity of SNL/NM and KAFB.

Arroyo del Coyote disappears in the vicinity of TA-III. Two perennial springs, Coyote Springs and Sol se Mete Spring, are present on KAFB. Hubbell Spring, which is also perennial, is located immediately south of the KAFB boundary on the Isleta Indian Reservation.

Run-off and arroyo flow occur most commonly during the rainfall season from July through September. The snow in the Manzano Mountains can produce local run-off, although this rarely reaches the lower portions of the arroyos or the Rio Grande. There are no drainages that are a significant flood hazard. All active SNL/NM facilities are located outside the 500-year floodplain as described by the U.S. Army Corps of Engineers (1979) for both arroyos.

The vadose (or unsaturated) zone is an important part of the hydrologic system at SNL/KAFB because, as in most semi-arid climates, the vadose zone thickness is quite large. This means that most contaminants released near the ground surface must travel a long distance before reaching the groundwater system. On the west side of the fault zone complex (where most SNL facilities are located) the vadose zone ranges from 300 – 500 ft thick. East of the fault complex, the thickness of the vadose zone can range from 100 – 50 ft thick.

Groundwater is the primary water supply source for the Albuquerque area. The primary water-yielding zones are within the upper unit, and to a lesser degree the middle unit, of the Santa Fe Group. During the period of basin filling, the Albuquerque Basin received alluvial sediments from the adjacent highlands and fluvial sediments from northern New Mexico and Colorado. Most of the City of Albuquerque's water supply wells are located on the east side of the Rio Grande and west of the eastern extent of the ancestral river channel deposits. The highest yield wells are screened in the sediments associated with the ancestral river channel.

Prior to extensive development beginning in the 1950's, the direction of groundwater flow was primarily to the southwest in the vicinity of Albuquerque and KAFB. As a result of pumping, the water table in the regional Santa Fe Group aquifer has dropped by as much as 140 ft (Thorn 1993). Groundwater presently flows from KAFB north-northwest towards the City of Albuquerque well fields.

On KAFB, the fault complex separates the regional aquifer system into a deeper zone west of the faults and a relatively shallower zone east of the faults. The depth to groundwater underlying SNL/NM facilities varies from approximately 50 – 100 ft east of the faults and from approximately 380 – 500 ft west of the faults. The hydrogeology east of the faults is poorly understood, because there are few wells, and the geology between the faults and the canyons of the Manzanita Mountains is complex. The water supply, in the majority of the monitoring wells east of the fault complex, is of modest yield. The wells are screened in fractured bedrock or shallow alluvium. Groundwater typically flows out of the canyons and westward toward the fault complex. On KAFB, the water surface elevation drops over 700 ft within a 2-mile distance, from Explosive Ordnance Disposal (EOD) Hill west to the Chemical Waste Landfill (CWL) in TA-III (Figure 1-2). West of the faults, the depth to bedrock increases dramatically and the hydraulic gradient flattens to approximately 0.005. Immediately west of the fault complex, groundwater flow is to the west and then trends northward as the gradient is influenced by the significant pumping of KAFB and City of Albuquerque water supply wells.

In the western portion of KAFB, in the vicinity of TA-II, a shallower groundwater zone is evident. The depth to this local water table is approximately 320 ft, (whereas the depth to the regional aquifer is 525 ft below ground surface). The gradient in the shallow zone is to the southeast, contrary to the regional gradient which locally slopes to the north-northwest. The source of recharge for the shallow zone has yet to be determined but may be associated with Tijeras Arroyo infiltration. A similar shallow groundwater zone exists to the southeast of the present location of Tijeras Arroyo in the vicinity of the KAFB Golf Course. The existence of these shallow groundwater zones is of significance to the potential migration of contaminants introduced into the subsurface.

1.7 BIOLOGY

The SNL site vicinity is located at the junction of four major North American physiographic and biotic provinces: the Great Basin, the Rocky Mountains, the Great Plains, and the Chihuahuan Desert. The biotic communities, or biomes, within SNL/NM and KAFB exhibit influences from each of these provinces, with the Great Basin influence generally dominating.

The semi-desert southwest climate produces low surface water availability, resulting in many species of drought-resistant flora such as cacti and certain species of grasses (ERDA 1977). Figure 1-6 shows typical mesa vegetation on KAFB, consisting of mostly desert grasses and shrubs. Figure 1-7 shows juniper trees and cacti typical at the higher elevations bordering the Manzanita 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 landscaped environments, which for Albuquerque, includes plants specifically selected to endure moderate extremes in temperature (Zone 6).

The wildlife communities at KAFB are typical of the equivalent woodland and grassland habitat types in central New Mexico (IT and Consensus Planning 1993). The most sensitive habitat types on SNL/KAFB are the wetlands (very restricted in area) in the vicinity of springs which provide an important source of water to wild animals in the area.

Figure 1-6. Typical mesa vegetation of desert grasses and shrubs found on the KAFB/SNL site.

Figure 1-7. Typical vegetation of cacti, pinion, and other drought-tolerant flora found in the Manzanita Mountain foothills.

1.8 SNL/NM OPERATIONAL AREAS

The majority of SNL/NM's operations are conducted within controlled access boundaries in its five technical areas. Additionally, SNL/NM operates at several test areas on KAFB property. Each technical area has its own distinctive operations as briefly described in the following paragraphs including summaries of potential sources for radioactive and non-radioactive effluent releases.

Technical Area I (TA-I) – operations are dedicated primarily to three activities: the design, research, and development of weapons systems; limited production of weapon system components; and energy research programs. TA-I facilities include the main administrative offices, technical library, research and development laboratories, and assembly/manufacturing areas. Potential sources for non-radioactive effluents include paint shops, the process development laboratory, the emergency diesel generator plant, solvent spray booths, the foundry, and the steam plant. In 1995 there were five facilities in TA-I which generated radioactive releases: (1) the Metal Tritide Shelf-Life Laboratory, (2) the TANDEM accelerator, (3) the Calibration Laboratory, and (4) (5) two Radiation Laboratories in Buildings (Bldgs.) 827 and 805. Currently, there are 12 Environmental Restoration (ER) sites undergoing investigations in TA-I.

Technical Area II (TA-II) – is used to test explosive components and to develop techniques for measuring fractures in geologic strata. Radiological releases include microcurie (μCi) amounts of tritium which may be released each year from testing at the Neutron Generator Test Facility (NGTF). Other potential sources for radiological releases are from the Radioactive Waste Landfill (RWL) —a low-level radioactive waste (LLW) disposal site, the Radioactive Materials Storage Yard (RMSY) —a small radioactive material decontamination and storage facility (Bldg. 906), and the Classified Waste Landfill. There is also a storage facility designed to temporarily hold polychlorinated biphenyl (PCB) contaminated materials until they can be transported to an EPA-licensed disposal facility. The RWL and the Classified Waste Landfill are scheduled to undergo remediation in the near future.

Technical Area III (TA-III) – facilities include extensive engineering design test facilities such as sled tracks, centrifuges, and a radiant heat facility. Other facilities in TA-III include a paper destructor (Hammermill), several inactive landfills used for chemical, mixed, and low level radioactive wastes (currently listed as ER sites), the Large-Scale Melt Facility (LMF), the Melting and Solidification Laboratory (MSL), and the Solar Tower Facility. The inactive Chemical Waste Landfill (CWL), closed in 1988, is currently undergoing ER investigation. The CWL was used for disposal of chemical waste from 1962 to 1985 (SNL 1992a). Other ER sites in TA-III include the Mixed Waste Landfill (MWL), which was also closed in 1988. The MWL is divided into two areas enclosed by fences. One area was used in the past for LLW disposal and consists of seven shallow trenches. The second area was used for disposal of classified LLW and contains 37 pits. LLW consisted primarily of tritium-contaminated materials. Three pits located in the classified waste disposal area were used exclusively for natural and depleted uranium waste disposal. Currently, the Radioactive and Mixed Waste Management Facility (RMWMF) in TA-III serves as a central processing facility for packaging and storage of LLW and MW. Two facilities in TA-III released radioactive air emissions in 1995: (1) the Chemical Processing Laboratory (Bldg. 6600) and (2) the MWL.

Technical Area IV (TA-IV) – consists of several inertial-confinement fusion research, pulsed-power, and accelerator research facilities. The Particle Beam Fusion Accelerator-II (PBFA-II) and the High Energy Radiation Megavolt Electron Source-III (HERMES-III) are currently listed as NESHAP sources. The HERMES-III emits a measurable source of primarily short-lived air activation products –nitrogen-13 and oxygen-15. Two other potential radiological sources which may become operational in the near future are the SATURN accelerator and the Sandia Accelerator Beam Research Experiment (SABRE). Other accelerators in TA-IV, (non-operational) include the Repetitive High Energy Pulsed Power (RHEPP-I and RHEPP II) accelerators, the High Power Microwave Lab, TROLL, ALIAS, PROTO-II, and SPHINX. Pulsed power and other facilities include IMATRON (an x-ray device used in land mine detection research), the Subsystem Test Facility (STF), and the Exploding Metal Film Annode Plasma Source (EMFAPS).

Technical Area V (TA-V) – contains two research reactor facilities and a Hot Cell Facility (HCF). Two facilities reported radioactive air emission releases in 1995: (1) the Sandia Pulsed Reactor (SPR) (an unreflected, unmoderated assembly of enriched uranium); and (2) the Annular Core Research Reactor (ACRR) (an annular core of 226 fuel elements in an open water tank). Both the SPR and ACRR air exhaust systems are equipped with radiation particulate effluent monitors. The airborne releases generally are the result of activation of air molecules producing mostly argon-41. There is also an Intense Gamma Irradiation facility (uses cobalt-60 and cesium-137). ER sites in this area include the Liquid Waste Disposal System (LWDS) facility and its associated tanks and drainfields.

Remote Test Areas – are located south of TA-III (e.g., Thunder Range) and within the canyons and foothills of the Land Withdrawal (e.g., Lurance and Coyote Canyons). These areas are used for explosive ordnance testing, rocket firing experiments, and open-burn thermal tests. Permanent facilities in these remote areas include sled tracks, aerial cables, the Small WInd SHield (SWISH) facility, the Smoke Emission Reduction Facility (SMERF) and the Open Pool Burn Site Facility (OPOL). Non-radioactive releases from testing in these areas include combustion products, and lead. No radioactive releases are currently produced on any of the remote tests; however, depleted uranium has been spread over limited areas during past experimental activities (such as during explosive testing). These locations were surveyed following each test, and contaminated material was collected and disposed of in accordance with DOE Orders. Environmental monitoring is performed at regular intervals to monitor any contaminants migrating from the site. Operations in these areas are strictly controlled for access to avoid exposure to any contaminant that may be present.

This page intentionally blank.

2.0 COMPLIANCE SUMMARY

SNL/NM complies with Federal, state, and local environmental laws, regulations, and statutes, and specific rulings contained in Executive Orders (EOs). As a prime contractor to DOE, SNL/NM conducts its operations under the guidance contained in DOE Orders. This chapter summarizes compliance with the major environmental laws and statutes applicable to SNL/NM operations. A summary of ongoing issues and actions, unplanned releases, occurrences, and the results of external assessments are discussed at the end of the chapter.

2.1 COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION & LIABILITY ACT (CERCLA)

CERCLA, 1980, as amended, also commonly known as "Superfund," defines certain assessment activities and reporting requirements for inactive waste sites for all Federal facilities. Notifications as specified in DOE Order 5400.4, *CERCLA Act Requirements* (DOE 1989a) were not required by CERCLA Section 103(c) to the Environmental Protection Agency (EPA) during 1995. Based on the Preliminary Assessment/Site Inspection (PA/SI) performed in 1988, as required by the Superfund Amendments & Reauthorization Act (SARA) Section 120(c), the EPA has determined that none of SNL/NM's inactive waste sites qualifies for EPA's National Priority List (NPL) (a list of high-priority clean-ups nation-wide). Therefore, with respect to SNL/NM's inactive waste sites, no CERCLA or SARA activities are required. Other CERCLA and SARA reporting requirements (i.e., Reportable Quantity [RQ] reporting) are discussed in the following subsection under SARA Title III, which includes reporting requirements designated by the Emergency Planning and Community Right-to-Know Act (EPCRA). RQs are defined as the amount of any extremely hazardous substance listed in CERCLA or in EPCRA's list of Extremely Hazardous Substances (EHSs), in quantities greater than or equal to the given reportable quantities.

No RQ releases under CERCLA or SARA Title III occurred in 1995.

2.1.1 Superfund Amendments & Reauthorization Act (SARA) Title III

The Superfund Amendments and Reauthorization Act (SARA) of 1986 amended CERCLA, the Solid Waste Disposal Act (SWDA), and the Internal Revenue Code, as well as providing some free-standing provisions. Among the free standing provisions is SARA Title III, also known as the "Emergency Planning and Community Right-to-Know Act of 1986" (EPCRA). EPCRA applies to all facilities in which there is present a threshold amount of extremely dangerous substances equal to or greater than the threshold planning quantity, or in specifically designated amounts as determined by the local community. Additionally, EO 12856, "Federal Compliance with Right-to-Know Laws and Pollution Prevention," signed by President Clinton on August 3, 1993, directed all Federal agencies to comply with EPCRA.

The major sections of EPCRA (Sections 302-303, 304, 311-312, and 313) are described below and summarized in Table 2-1.

- **Planning Notification - EPCRA, Sections 302–303 (40 CFR 355)** requires facilities who have extremely hazardous substances above threshold planning quantities, to notify state and local emergency response committees and carry out other facility notification responsibilities necessary for the development and implementation of state and local emergency response plans.

- **Emergency Release Notification - EPCRA, Section 304 (40 CFR 355)** requires a release notification in the event of any release of an EHS, or CERCLA hazardous substance (over the reportable quantity), other than those releases which are specifically "Federally permitted." (SNL/NM had no reportable releases in 1995).

- **MSDS/Chemical Inventory - EPCRA, Sections 311–312 (40 CFR 370)** contains two major reporting requirements. First, an inventory report listing all hazardous chemicals on a facility site (above threshold levels), must be submitted annually to the state and local emergency response groups and fire departments. Second, it requires Material Safety Data Sheet (MSDS) reporting. This gives pertinent information on each hazardous chemical present at a facility site, so that it is readily available to assist emergency responders with general hazard information.

- **Toxic Release Inventory (TRI) - EPCRA Section 313 (40 CFR 372)** requires facilities that use more than a threshold amount of an EHS, to file Toxic Chemical Release forms every year detailing the amount and species of chemicals used for the prior calendar year. This information is used by the EPA to create a national inventory of toxic chemical emissions occurring as the result of normal industrial operations (i.e., excluding accidental releases).

Table 2-1. SNL/NM reporting activities in 1995 with respect to SARA Title III compliance.

SARA, Title III (EPCRA)	Regulation Section Description	SNL Reporting		
		Yes	No	Not Required
EPCRA 302 - 303	Planning Notification	✓		
EPCRA 304	Emergency Release Notification			✓*
EPCRA 311-312	MSDS/Chemical Inventory	✓		
EPCRA 313	Toxic Release Inventory (TRI) Reporting	✓		

*Note: SNL/NM had no releases to report in 1995.

2.2 RESOURCE CONSERVATION & RECOVERY ACT (RCRA)

The following subsections provide a brief overview to RCRA law and describe the status of SNL/NM's compliance with various RCRA requirements and DOE Order 5820.2a *Radioactive Waste Management* (DOE 1988b).

2.2.1 RCRA Framework, Authority & Permits

RCRA was signed into law in 1976 as amendments to the Solid Waste Disposal Act (SWDA). The regulations that implement RCRA law, as amended, for the Hazardous Waste Program are now codified in the regulations as 40 CFR 260–268, 270–272, and 279.

The RCRA regulatory framework is a "cradle to grave" process which requires detailed reporting for all aspects of hazardous waste handling. Facilities that generate, treat, store, or dispose of hazardous waste must obtain a RCRA operating permit from the EPA or designated state authority. Hazardous waste generators who store waste on-site for more than 90 days must obtain a treatment, storage, and disposal (T/S/D) RCRA operating permit. As part of the permit process, RCRA also requires owners to show a documented waste minimization program which will reduce the volume and/or quantity and toxicity of their waste.

RCRA regulations also state that hazardous waste cannot be stored on-site for more than one year before it must undergo treatment for proper disposal. Despite best efforts, many facilities will remain out of compliance due to there being no available treatment for certain types of waste, such as mixed waste (MW) (containing hazardous and radioactive components). The Federal Facility Compliance Act (FFCAct) further amended RCRA in 1992, and addressed the problem of the lack of treatment technologies for MW. Currently the DOE and the EPA are negotiating on appropriate treatment and handling of MW (see Section 2.3.1).

RCRA regulates all forms of solid waste, both hazardous and non-hazardous. "Subtitle C" of RCRA addresses the Hazardous Waste Program; "Subtitle D" addresses non-hazardous municipal solid waste; and "Subtitle I" addresses underground storage tanks (USTs) which contain hazardous materials or petroleum products.

New Mexico Authority for RCRA

Most states, including New Mexico, have been authorized by the EPA to enforce the Hazardous Waste Management Program (Subtitle C) under RCRA regulations. This authority was given to New Mexico on January 25, 1985, and is carried out by the New Mexico Environment Department (NMED). On July 25, 1990, the State of New Mexico was also granted regulatory authority under RCRA for MW management (which enforces RCRA regulations on only the hazardous component of the waste).

RCRA "Subtitle I" Underground Storage Tanks (USTs)

Underground storage tanks (USTs) for containment of hazardous materials or petroleum products are regulated by RCRA (see Section 3.2). In July of 1990, the State of New Mexico adopted the Federal UST regulations, 40 CFR 280, Underground Storage Tanks. Regulations are based both on the age of the UST and depth to groundwater. These criteria (or any obvious indication of a leak), set the basis for determining removal and/or replacement actions for all USTs in New Mexico. The Federal government approved state authority in accordance with 40 CFR 281, Approval of State UST Programs.

2.2.2 RCRA Implementation at SNL/NM

SNL/NM Hazardous Waste Management

SNL/NM is classified as a large-quantity generator under EPA Identification number NM-5890110518. The Hazardous Waste Operations Department operates the Hazardous Waste Management Facility (HWMF) under a RCRA operating permit. This facility is responsible for receiving, packaging, storing, and shipping hazardous waste to off-site T/S/D facilities. SNL/NM shipped 91,876 kg of regulated hazardous waste in 1995. The HWMF does not accept radioactive, mixed, or explosive waste.

SNL/NM currently stores and treats hazardous waste on-site and has obtained a site-wide RCRA storage and treatment operating permit. (Some specific sites, such as the Chemical Waste Landfill [CWL], are under interim status while they undergo corrective actions).

Thermal Treatment Facility (TTF): The TTF was issued a RCRA treatment permit on December 4, 1994, by the NMED. This permit allows thermal treatment of residual explosives generated at SNL/NM and primarily addresses treatment of waste classification code D003 and waste contaminated with D001, D011, F003, and F005.

Mixed Waste (MW) Management: Radioactive mixed waste is dually regulated by RCRA and the Atomic Energy Act (AEA) of 1954. The Atomic Energy Commission (AEC), formed under the AEA, has delegated this authority to the DOE. SNL/NM generated 12,212 kg of mixed waste in 1995 and received 5,539 kg of mixed waste from the SNL/CA site in Livermore. One off-site shipment of mixed waste from SNL/NM occurred in 1995.

The Environmental Restoration (ER) Project & RCRA

The potential release sites identified by the ER Project Department for facilities at SNL/NM are being evaluated and corrected as required by the HSWA module to RCRA, Section 3004(u). Corrective Actions (CAs) for continuing releases from Solid Waste Management Units (SWMUs), whether active or inactive, are stipulated in the requirements for the RCRA Part B permit, issued by NMED on August 26, 1993. (Refer to Section 3.1 for further information on the ER Project.) A complete list of ER sites at SNL/NM are listed in Appendix B.

SNL Underground Storage Tank (UST) Management

As of December 1995, 51 tanks have been removed from the ground since 1988. No inactive USTs remain to be addressed. There are currently seven USTs buried on the SNL/NM site: five active tanks are registered with the NMED; two were closed by stabilization and abandonment in place (following UST Bureau rules) due to their proximity to other structures. (See Section 3.2 for further details on the UST Program.)

Part A & B Permits for Mixed Waste

In August 1990, SNL/NM submitted a RCRA Part A interim status permit application for MW storage. This permit application was revised in November 1992 to: (1) correct errors in the initial permit application, (2) consolidate particular storage units, (3) add eight treatment processes, and (4) assure comprehensive coverage for all MW expected to be managed at SNL/NM. Plans for permitting nine MW storage units and four initial treatment processes are listed in the permit. The remaining units included on the Part A permit application will be closed under interim status or administratively withdrawn. The permit was revised and resubmitted again in January 1995. See Section 2.14.2 for a discussion of current issues and actions on permitting MW.

2.2.3 RCRA Compliance Status

The NMED performs annual RCRA audits of the HWMF and generator locations throughout the SNL/NM site. On July 24 -28th, 1995, the NMED conducted a compliance inspection audit of approximately 500 generator locations including all permitted storage sites. Four violations resulted in a Compliance Order which was issued on October 26, 1995. The types of violations included an open container of hazardous waste, failure to properly label a container, an incorrect start date on a container, and a failure to keep hazardous waste under the control of the generator. All violations were corrected immediately and procedures were subsequently developed to prevent a reoccurrence. A civil penalty of $3,015.00 was proposed in the Compliance Order.

Past Audit Performance

Hazardous waste management performance resulting in only four minor violations in 1995, was a noteworthy improvement over audit results from the past three years; the 1994 audit resulted in 17 violations in which SNL/NM was assessed $9,240 in penalties; eight violations in 1993, and 18 violations in 1992. (There were only two violations in 1991).

2.3 FEDERAL FACILITY COMPLIANCE ACT (FFCAct)

On October 6, 1992, the Federal Facility Compliance Act (FFCAct) was passed into law, amending RCRA and addressing DOE compliance with the Land Disposal Restrictions (LDRs) for the storage of MW. The FFCAct reinforces the authority of the EPA to impose penalties regarding RCRA violations upon other Federal agencies. The Act addresses the lack of MW treatment capacity and requires that DOE facilities develop plans to treat MW to the standards of the LDRs.

2.3.1 Development of a Mixed Waste Treatment Plan

On December 30, 1992, the EPA, Region VI, issued a "Notification of Non-compliance (NON) and Necessity for Conference in Regard to the LDRs for the U.S. DOE, SNL/NM." This NON was issued for storage of MW in violation of RCRA Section 3004(j), which allows only one year for storage before LDR treatment must be performed. The DOE and SNL/NM took all the necessary steps to comply with the NON, beginning with a conference with EPA and NMED on April 26, 1993. Because of the radioactive characteristics of MW, there have been no treatment facilities available in the United States for LDR treatment. The FFCAct amendments to RCRA specifically address the issues related to this lack of treatment capacity.

The NON began the process toward full compliance with the LDRs at SNL/NM through a Federal Facility Compliance Agreement. However, the process of negotiating the agreement was canceled by EPA on June 11, 1993, and replaced by a process developed by DOE for implementation of the FFCAct. As required by the FFCAct, SNL/NM submitted its mixed waste inventory for the preliminary report (required within 180 days of enactment) and updated the inventory in November 1993 published in the *Final Mixed Waste Inventory Report* (DOE 1993d).

As required by the FFCAct, SNL/NM began developing a plan for the treatment of MW. In October, 1993, SNL/NM submitted to NMED an initial report outlining the treatment plans: *Conceptual Site Treatment Plan for Mixed Waste* (SNL 1993a). A subsequent *Draft Site Treatment Plan* (SNL 1994i) was submitted in August 1994. This draft addressed treatment plans for the MW inventory listed in the *Final Mixed Waste Inventory Report* (i.e., only through December 1992). Additional inventory that accumulated through September 1994 is addressed in the *Proposed Site Treatment Plan for Mixed Waste* (SNL 1995c) which was submitted to the NMED for approval on March 31, 1995. The *Proposed Site Treatment Plan for Mixed Waste* identifies preferred treatment options in accordance with the DOE/AL's *Mixed Waste Treatment Plan* (DOE 1994e)) including recommendations made by the DOE Options Analysis Team. SNL/NM's mixed waste treatment plan relies heavily on the use of mobile treatment units being designed and built at other DOE/AL sites. These units will travel to various DOE/AL facility sites and treat the mixed waste on-site. This approach was accepted by the NMED and is integrated into the final *Site Treatment Plan for Mixed Waste* (SNL 1995f), now enforceable under the Compliance Order that was issued on October 6, 1995 by NMED.

2.4 NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)

The National Environmental Policy Act (NEPA) of 1969, as amended, is the basic national charter for protection of the environment which applies to all Federal facilities. The Act establishes policy, sets goals, and provides the means for carrying out the policy. Because SNL/NM is a Federal facility, its activities must comply with the requirements of NEPA. Essentially, these requirements can be summarized by the twin NEPA objectives for DOE: (1) consider the environmental impacts of actions proposed by SNL/NM, and (2) provide opportunities for public review of these impacts before decisions to precede are made with proposed projects/actions.

2.4.1 Recent NEPA Initiatives for DOE Facilities

Several DOE policy directives and other NEPA initiatives issued over the last several years have increased the emphasis on NEPA compliance at SNL/NM. These directives and initiatives include:

- **The Secretary of Energy's NEPA Notice (SEN-15-90) of February 5, 1990 (DOE 1990c)** which set in motion a number of NEPA initiatives designed to enhance NEPA compliance at DOE facilities including the promulgation of the 1992 DOE NEPA rule (10 CFR 1021).

- **DOE's 1992 NEPA Rule (10 CFR 1021)** was mandated to assist DOE operations in complying with both NEPA and the President's Council on Environmental Quality (CEQ) Regulations.

- **The June 1994** ***Secretary's Policy Statement on the National Environmental Policy Act*** **(DOE 1994a)** is intended to "streamline" the NEPA Process, minimize cost and time expended on document preparation, emphasize teamwork, and make the NEPA process more useful to decision makers and the public.

- **The new DOE NEPA Order approved September 11, 1995,** ***National Environmental Policy Act Compliance Program*** **(DOE 1992a)** established DOE's internal requirements and responsibilities for implementing NEPA.

DOE's commitment to infusing environmental values into decision making and disclosing Federal activities through the NEPA process has resulted in an increase in the number of NEPA documents being written to address SNL/NM's proposed actions. During 1995, SNL/NM NEPA compliance activities focused on developing the NEPA program and baseline information and fulfilling the commitments made in the *Final Action Plan to Tiger Team* (SNL 1992b). (See Section 2.16).

2.4.2 NEPA Compliance Activities in 1995

NEPA compliance activities during 1995 increased at SNL/NM. Policies and procedures were further developed to ensure environmental values are considered as part of the review of SNL/NM proposed actions. A comprehensive NEPA guide to assist organizations within SNL/NM in maintaining NEPA compliance was published in August 1995 (SNL 1995d).

Findings of No Significant Impact (FONSIs) were issued after the satisfactory completion of the following three Environmental Assessments (EAs) at SNL/NM:

- *General-Purpose Heat Source Safety Verification Testing* (DOE 1995a), FONSI issued February 15, 1995.

- *Final Environmental Assessment for the Gamma Irradiation Facility* (DOE 1995d), FONSI issued on November 15, 1995.

- *Environmental Assessment for the Processing and Environmental Technology Laboratory* (DOE 1995e), FONSI issued on December 18, 1995.

Section 3.5 gives further information about the NEPA program.

2.5 CLEAN AIR ACT (CAA) & CAA AMENDMENTS (CAAA) OF 1990

Federal clean air legislation, first enacted in 1955, and modified in 1963, was completely rewritten as the Clean Air Act (CAA) of 1970. Major revisions and additions to the Act were made by the Clean Air Act Amendments (CAAA) of 1977. As described below, the Act was also greatly modified in 1990. The objectives of the CAA are to protect and enhance the quality of the nation's air and thereby protect public health and the environment.

The EPA is responsible for describing and regulating air pollutants from stationary and moving sources, as well as setting ambient air quality standards. Additionally, the EPA must describe the characteristics and potential health effects of "criteria pollutants" known to be hazardous to human health which include sulfur dioxide (SO_2), particulate matter (PM), carbon monoxide (CO), ozone (O_3), nitrogen dioxide (NO_2), and lead (Pb). For these criteria pollutants, the CAA gives the EPA authority in the following areas:

- Sets ambient air quality standards including motor vehicle emissions.
- Requires states to submit plans for protection and improvement of air quality.
- Institutes a program to prevent the nation's air from deteriorating below standards.
- Establishes a program for controlling hazardous air pollutants.

2.5.1 1995 Air Quality Compliance Status

The EPA has designated radionuclides as hazardous air pollutants (HAPs), and airborne emissions of radionuclides from DOE facilities are subject to 40 CFR 61, National Emission Standards for Hazardous Air Pollutants (NESHAP). NESHAP includes both dose limit calculations and compliance with monitoring procedures. SNL/NM was in full compliance with NESHAP and all other applicable air quality requirements in 1995.

Air Quality Regulations - Local and EPA

SNL/NM operations are regulated by the CAA, CAAA, ambient air quality standards, and local regulations administered jointly by the City of Albuquerque and Bernalillo County. On October 11, 1995, the Albuquerque-Bernalillo County/Air Quality Control Board (ABC/AQCB) completed the recodification of Board Regulations 1 through 43, and placed them into the New Mexico Administrative Code (NMAC) in Title 20 "Environmental Protection," Chapter 11, ABC/AQCB. (The recodification did not alter the technical content from the previous year.)

SNL/NM periodically submits air quality permit applications through DOE to the City of Albuquerque. These include permits for modifications or new construction (20 NMAC 11.41, "Authority-to-Construct"), HAP or minor source operations (20 NMAC 11.40, "Source Registration"), open burn permits for the Burn Site (20 NMAC 11.21, "Open Burning"), and surface (soil) disturbance permits for construction sites and ER activities (20 NMAC 11.20, "Airborne Particulate Matter"). Refer to Table 2.4 for a list of air permits held by SNL/NM.

Other regulations apply to SNL/NM on a source-specific basis such as the SMoke Emission Reduction Facility (SMERF) (20 NMAC 11.05, "Visible Air Contaminants"), contaminated soil remediation (20 NMAC 11.65, "Volatile Organic Compounds"), and emission standards for NO_2, PM, and SO_2 from gas-burning and oil-burning equipment (20 NMAC 11.67, "Equipment, Emissions, Limitations"). Refer to Section 2.14.1 for current issues and actions regarding air quality compliance status.

Titles within the CAAA including Title III "Hazardous Air Pollutants," Title V "Operating Permits," and Title VI "Stratospheric Ozone and Global Climate Protection," contain other compliance mandates. Under Title III, an inventory of hazardous chemical usage was conducted early in 1996 for CY 1995. The inventoried chemicals included radionuclides, ozone depleting substances (ODSs), and the SARA Toxic Chemical List. A Toxic Release Inventory (TRI), NESHAP notification for radionuclides, and associated annual reports were submitted to the EPA through DOE.

Title V of the CAAA requires existing major sources to obtain operating permits as promulgated in 40 CFR 70, State Operating Permit Programs and 20 NMAC 11.42, "Operating Permits." Title VI protects the stratospheric ozone by limiting the use of Class I and Class II ODSs as promulgated in 40 CFR 82, Protection of Stratospheric Ozone and 20 NMAC 11.23, "Stratospheric Ozone Protection." SNL/NM also complies with 20 NMAC 11.64, "Emission Standards for Hazardous Air Pollutants," 40 CFR 61, NESHAP, Subpart C — "National Emission Standard for Beryllium (Be);" Subpart H — "National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities;" and Subpart M — "National Emission Standard for Asbestos."

Table 2-2 lists some of the air quality requirements that fall under the CAAA and the relationship between the Federal and local regulations. The City of Albuquerque Environmental Health Department has been delegated the authority to administer the Federal regulations by the EPA. The City regulations are therefore at least as strict as those mandated by the EPA. The authority in Bernalillo County would only default to the State of New Mexico if the city fails to act.

Table 2-2. Relationship between Federal and local regulations.

AGENCY	U.S. Congress	U.S. EPA	ABC/AQCB	
STATUTE	CAAA	CFR	20 NMAC 11	Title
CITATION	Title I	40 CFR 93	Parts 3 and 4	Conformity
	Title III	40 CFR 61	Part 64	NESHAP
	Title V	40 CFR 70	Part 42	Operating Permit
	Title VI	40 CFR 82	Part 23	Ozone Protection

2.6 Clean Water Act (CWA)

The Clean Water Act sets forth goals to protect U.S. waters by controlling discharged pollutants. The CWA also provides for the National Pollutant Discharge Elimination System (NPDES) permit program and the Spill Prevention Control and Countermeasures (SPCC) Plan (Section 3.3). The EPA and the NMED are both responsible for compliance oversight of SNL/NM operations with regard to the CWA. The City of Albuquerque administers sanitary sewer discharge permits based on Federal pretreatment standards; NMED administers both surface/near-surface discharge regulations and RCRA groundwater monitoring regulations. Two surface impoundment evaporation lagoons require a NMED approved discharge plan. The discharge plan was approved by NMED in 1995.

In 1995, the City of Albuquerque Industrial Pretreatment Program presented the DOE and SNL/NM with five Gold Pretreatment Awards. These awards are given to permit holders that demonstrate an exceptional level of compliance with the requirements of their wastewater discharge permits in recognition of their accomplishments.

National Pollutant Discharge Elimination System (NPDES)

Storm water run-off from SNL/NM property, (e.g., industrial activity sites) requires a permit to discharge into U.S. waters, which, as applicable to SNL/NM, includes the Tijeras Arroyo. There are currently 22 activities at SNL/NM which are classified as primary industrial activities. Sixteen of these activities require storm water discharge monitoring. On October 1, 1992, SNL/NM submitted an NPDES permit application for its storm water discharges to the EPA Region VI; the permit is pending approval.

Construction sites that disturb more than 5 acres of soil are also required to obtain a storm water run-off discharge permit. SNL/NM presently has surface disturbance permits at three sites. No significant discrepancies were noted in 1995.

Results from tests on 1995 storm water run-off samples showed no analytes indicating the presence of volatile organic compounds (VOCs), semi-VOCs, organo-chlorinated pesticides, PCBs, and/or constituents from explosive testings. Barium and manganese above state and Federal limits and exceedences of gross alpha and beta EPA standards were detected but attributed to natural soil conditions (refer to Section 6.3.3 for discussion).

A State Pollutant Discharge Elimination System (SPDES) permit required in some states, is not required in New Mexico.

2.7 SAFE DRINKING WATER ACT (SDWA)

The Safe Drinking Water Act (SDWA), which has set National Primary Drinking Water Standards, is designed to protect human health by regulating the discharge of nontoxic and toxic pollutants into both groundwater and surface water sources from residential, municipal, and industrial discharges. The goal of the Act is to preserve the quality of the nation's water supply. Individual states have been delegated responsibility by the EPA for developing programs and procedures necessary to ensure that the quality of the water supply meets EPA standards. States set standards for the maximum allowable concentrations of pollutants and requirements for monitoring and reporting. Individual states can elect to accept primacy of the regulations only if the state's regulations are stricter than the Federal standards. Since New Mexico's regulations are not stricter than those set by the EPA, the Federal standards apply.

KAFB provides the majority of potable water used by SNL/NM from its production wells and therefore is responsible for compliance with the National Primary Drinking Water Standards. KAFB samples for trihalomethanes, coliforms, VOCs, gross alpha and gross beta radioactivity, and other specifically listed inorganic chemicals.

SNL/NM also complies with the National Primary Drinking Water Standards for its remote site water delivery system, which supplies water to the test areas in Coyote Canyon and the 6000 Igloo Complex. This system has been classified as a Non-Transient, Non-Community (NTNC) water system. The NMED has approved the SNL/NM sampling plan for this NTNC system. SNL/NM samples for coliform, lead and copper determinations.

2.8 TOXIC SUBSTANCES CONTROL ACT (TSCA)

The Toxic Substances Control Act (TSCA) of 1976, as amended and administered by the EPA, regulates the manufacture, distribution, use, handling, and disposal of certain toxic chemicals and materials, including polychlorinated biphenyls (PCBs) and asbestos. It also requires testing and regulation of all new chemical substances, as well as regulation of some currently existing substances known or suspected to have harmful health and environmental effects. At SNL/NM, compliance with TSCA primarily involves regulation of PCBs and asbestos as well as the import and export of specifically listed chemicals. In the event of waste containing both a TSCA substance and a RCRA regulated hazardous substance, the stricter regulation will apply.

There were no instances of non-compliance with the TSCA regulation in 1995.

The PCB Program: As of December 31, 1995, there were eight non-electrical-distribution items and 37 electrical distribution items remaining in service that have PCB concentrations over 50 ppm. Three of these items contain greater than or equal to 500 ppm. One non-electrical and three electrical pieces of equipment were removed in 1995; this was an 8 percent decrease in PCB equipment as compared to 1994. During 1995, approximately 12,400 kg of PCB waste were shipped from SNL/NM for disposal and recycling. Most of the PCB waste shipped in 1995 was comprised of recyclable PCB-containing fluorescent light ballasts. Further information on the PCB Program can be found in Section 3.4.5.

The Asbestos Program: The Non-Facilities Asbestos Program at SNL/NM handles the collection, packaging, storage, and disposal of all non-facilities asbestos waste (e.g., gloves, fume hoods, and ovens) under the requirements set forth by TSCA. The Facilities Asbestos Program focuses mainly on structure abatement and includes primarily removing floor tiles and insulation. Approximately 108,510 kg of non-facilities and facilities asbestos waste were disposed of in 1995. Further information on the Asbestos Program can be found in Section 3.4.6.

2.9 FEDERAL INSECTICIDE FUNGICIDE & RODENTICIDE ACT (FIFRA)

The Federal Insecticide Fungicide & Rodenticide Act (FIFRA) controls the distribution and application of pesticides, for a variety of plant, rodent, fungus, virus, and bacteria pests as designated by the EPA. EPA-registered pesticides are applied with EPA-certified applicators at all SNL facilities. SNL/NM retains records of the quantities and types of pesticides that are used as well as providing the Material Safety Data Sheets (MSDSs) for each pesticide used or stored on-site. SNL/NM also strives to reduce its use of all hazardous chemicals including pesticides, or to use alternate products where available, which have less impact on the environment. Groundwater quality is sampled throughout the site as part of the Groundwater Protection Program (Chapter 7). Among the parameters tested are herbicides and chlorinated pesticides; none were detected in SNL/NM site wells. No violations with regard to FIFRA occurred in 1995.

2.10 ENDANGERED SPECIES ACT (ESA)

The Endangered Species Act (ESA) provides for the protection of threatened and endangered species of flora and fauna. Prior to beginning any construction, ground-disturbing, and/or other proposed action potentially affecting sensitive species that may be present at the project location (listed or proposed species and critical habitats), SNL/NM representatives (through DOE) must confer with the following state agencies: (1) the U.S. Fish and Wildlife Service, (2) the New Mexico Game and Fish Department, and/or (3) the New Mexico Energy, Minerals and Natural Resources Department. For proposed projects located on U.S. Forest Service withdrawal lands, SNL/NM, through DOE, confers with the U.S. Forest Service before commencing any activities. If DOE or SNL/NM determines that a potential presence of a listed or proposed species, or habitat, exists within the project area, a biological assessment will be prepared. Correspondence with the appropriate agencies and mitigation measures, when appropriate, are included in Environmental Assessments (EAs) or Environmental Impact Statements (EISs) in accordance with NEPA compliance. In some cases, mitigation action plans are required.

Several surveys for threatened, endangered, and sensitive species and habitats were conducted in 1995 to help fulfill the policy objectives of NEPA and provide information on the environmental consequences that must be addressed in the NEPA process. The surveys looked not only for the presence of particular species but also for their critical habitats.

While there are no Federally listed endangered, threatened, or proposed listed species known to occur within KAFB boundaries, or on withdrawal lands used by SNL/NM, three candidate species for Federal listing do occur. These are the grama grass cactus (*Pediocactus papyracanthis*), the Texas horned lizard (*Phrynosoma cornutum)* and the loggerhead shrike (*Lanius ludovicianus*). Additionally, there are three State-listed endangered cacti occurring within the boundaries of KAFB. These are the grama grass cactus, Wright's pincushion cactus (*Mammillaria wrightii*), and the visnagita cactus (*Neolloydia intertexta*). Some Federally listed endangered species that occur in Bernalillo County, such as the bald eagle (*Heliaeetus leucocephalus*), may also be transients within the boundaries of KAFB.

2.11 CULTURAL RESOURCES ACTS

Cultural resources management at SNL/NM is required under acts such as the National Historic Preservation Act (NHPA), the Archaeological Resources Protection Act (ARPA), and the American Indian Religious Freedom Act (AIRFA). Several surveys for cultural resources were conducted in 1995 to help fulfill the policy objectives of NEPA and provide information on the environmental consequences that must be addressed in the NEPA process. SNL/NM integrates cultural resources management into the NEPA program. It is DOE's policy that NEPA review is required for all DOE actions potentially affecting the environment; thus, even actions that are classified as categorical exclusions are reviewed for impacts on cultural resources. (See Section 3.5 for further information on NEPA activities.)

Between July and November 1990, all Technical Areas within SNL/NM were surveyed and/or assessed for the presence of potentially eligible National Register of Historic Properties (NRHP) sites (Hoagland 1990 [a - d] and Lord 1990). Additionally, a large block of land within the KAFB land withdrawal (U.S. Forest Service land) was inventoried including areas along ridges and within portions of Lurance, Madera, and Sol se Mete Canyons. These inventories resulted in the survey, resurvey, and/or assessment of 17.4 sq km (4,275 acres) and the documentation or redocumentation of 40 cultural resource sites.

The only potentially significant cultural resources located were documented in the 5.9 sq km (1,447-acre) Burn Survey (Hoagland 1991a). During this project, 33 archaeological sites and 88 isolated occurrences (IO) were located on withdrawal lands in and around Lurance and Sol se Mete Canyons. Twenty three of the sites were thought to be potentially significant and it was determined that activities should be avoided in the vicinity of these sites according to the State Historic Preservation Officer (SHPO) (Hoagland 1991a).

During 1994, Butler Service Group, Inc., completed a comprehensive cultural resources survey and review of 9.9 sq km (2,445.4 acres) for the SNL/NM's Environmental Restoration Project (Hoagland and Dello-Russo 1995). The project involved the survey or resurvey of 6.6 sq km (1,635.8 acres) of land and the compilation of data from previous surveys of 3.3 sq km (809.6 acres).

The survey and records review resulted in the documentation of 31 new sites, 39 previously recorded sites, 128 IOs, and one potential historic district (TA-II). Of these sites, 29 of the prehistoric sites, 15 of the historic sites, 13 of the historic/prehistoric sites, and one site of unknown temporal affiliation are thought to be eligible or potentially eligible for nomination to the NRHP. Only one site within TA-II, which is potentially eligible for nomination to the

NRHP as a historic district, has been recorded on DOE-owned lands. All other cultural resources sites have been located on leased or withdrawn lands.

2.12 Executive Orders

SNL/NM complies with Executive Orders 11988, *Floodplain Management* and 11990, *Protection of Wetlands*. These Orders apply to NEPA-related activities and require evaluation of the potential effects of SNL/NM actions taken in floodplains and wetlands. These Executive Orders are coordinated with other NEPA review requirements at SNL/NM and both are addressed in NEPA documents where relevant to proposed actions. There are very limited areas on KAFB (springs) which are wetlands. The SNL/NM boundaries of the 100-year flood plain occurs along the arroyos and is shown in Figure 3-6 of document number SAND92-7339 (IT and Consensus Planning 1993).

2.13 1995 Audits & Appraisals

SNL/NM operations are routinely subjected to audits by external regulatory agencies as well as internal self assessments and inspections by DOE. Table 2-3 lists the external appraisals of various SNL/NM environmental programs that occurred in 1995.

An earlier audit from December 1994, performed by DOE's Office of Environmental Audit (DOE/EH-24), resulted in seven findings, which have not yet been closed; the expected date of closure for these findings is December 1996. The following excerpts from the audit describe these findings.

1) SNL/NM DOE/Kirtland Area Office (DOE/KAO) and DOE/Albuquerque Operations Office (DOE/AL) have not fully implemented environmental protection programs for waste minimization, pollution prevention, and for lead management to ensure the protection of the environment in accordance with DOE objectives.

2) SNL/NM and DOE/KAO have not implemented all elements of an environmental ALARA program for comprehensive evaluations of SNL/NM activities and facilities as required by DOE 5400.5 (DOE 1990a).

3) SNL/NM, DOE/KAO, and DOE/AL have not developed fully documented programs, plans, and procedures as required by DOE 5400.1 (DOE 1988a) and DOE 5480.19 (DOE 1990b).

4) SNL/NM does not have a complete and comprehensive set of formal procedures for managing and implementing the site's Management Plan for

Ozone Depleting Substances (ODS) (SNL 1993i) and the requirements of 40 CFR 82.

5) SNL/NM, DOE/KAO, and DOE/AL do not have integrated, effective mechanisms to evaluate, track, and where needed, improve the environmental programs of SNL/NM.

6) SNL/NM, DOE/KAO, and DOE/AL do not have sufficient procedures and resources in place to ensure that all potentially significant environmental risks of projects and actions at SNL/NM are identified and assessed.

7) SNL/NM has not fully implemented a comprehensive environmental training program that ensures that personnel with environmental responsibility have been adequately trained.

SNL is currently actively pursuing required actions to close out these findings.

The DOE/EH-24 audit also reported commendations indicating that there had been significant progress since the Tiger Team Assessment in 1991, noting that in 1991 SNL/NM had very few procedures for the conduct of environmental protection activities, and that by 1994 environmental programs were, for the most part, in place. Other strengths pointed out in the DOE/EH-24 audit was SNL/NM's excellent regulatory tracking system that provides timely identification of laws, regulations, and DOE Orders to line organizations within SNL's divisions.

Another audit conducted in September 1995 by the EPA to assess SNL/NM's compliance with RCRA regulations, reported a successful program. The auditor described SNL/NM's Hazardous Waste Program as "excellent," with very few issues to resolve. The EPA has not yet requested a Corrective Action Plan for eight minor findings noted during the audit.

2.14 Current Issues & Actions

The following subsections highlight ongoing issues and actions of concern or interest to SNL/NM for 1995.

2.14.1 Air Quality Compliance Issues & Actions

This section lists only those regulations that are currently undergoing actions or issues. Refer to Table 2-4 for a complete list of environmental permits for air quality.

Table 2-3. Audits and appraisals conducted by external agencies in 1995.

Appraising Agency	Title	Begin	End	Summary
• DOE/Nevada Operations Office, Weapons Mgt. Div.	Technical Audit LLW, SNL/NM (Audit #WMD A-95-05)	3/13/95	3/17/95	Observations were noted and a correction plan formulated.
• DOE/Nevada Operations Office, Weapons Mgt. Div.	Follow-up Surveillance of the LLW Program, SNL/NM	5/22/95	5/26/95	Follow-up visit noted all observations had been corrected.
• Environmental Protection Agency	Air Quality - Environmental Protection, SNL/NM	7/11/95	7/11/95	Informal visit from the EPA to review radionuclide emission sources listed in the NESHAP report, (accelerators in TA-IV, nuclear generator testing in TA-II, and small sources in TA-I.) No observations/findings found.
• NMED Audit	Hazardous Waste Management Performance Audit	7/24/95	7/28/95	Inspection of 500 generator locations and the HWMF. Four violations (immediately corrected) resulted in a proposed $3,015 fine.
• Environmental Protection Agency	Resource Conservation Recovery Act (RCRA) Audit, SNL/NM	9/11/95	9/14/95	Program specific EPA Region VI audit involving Hazardous Waste Program. Reviewed line organization satellite waste areas, the HWMF, and the MW Management Facilities. Included reviews of hazardous waste generators, hazardous waste container storage areas, and documentation (manifest shipping documents). Eight minor findings found. Corrective Action Plan not yet requested by EPA.
• Lockheed Martin	Lockheed Martin Corp. Audit	9/11/95	9/22/95	Reviewed compliance with all environmental requirements and systems for environmental programs. Eight minor violations noted.

Table 2-4. Summary of environmental permits and registrations in effect during 1995 (Continues).

Permit Type and/or Facility Name	Location/Building	Permit Number	Issue Date	Expiration Date	Regulatory Agency
Water					
1. WASTEWATER DISCHARGE PERMITS					
• General	WW001 station manhole at Tijeras Arroyo, south of TA-IV	2069 A-3	(NA)	02/01/97	City of Albuquerque
• General	WW006 station manhole, east of KAFB sanitary Lagoons	2069 F-3	(NA)	02/01/97	City of Albuquerque
• Microelectronics Development Laboratory (MDL)	WW007 station manhole, TA-I/Bldg. 858	2069 G-3	(NA)	Permit extended by the City	City of Albuquerque
• Advanced Manufacturing Process Laboratory	WW009 station manhole, TA-I/Bldg. 878	2069 H-3	(NA)	02/01/97	City of Albuquerque
• General	WW008 station manhole at Tijeras Arroyo, south of TA-II	2069 I-2	(NA)	02/01/97	City of Albuquerque
• General	WW011 station manhole, north of TA-III (includes TA-III, TA-V, and Coyote Test Area sewer lines)	2069 K-2	(NA)	Permit extended by the City	City of Albuquerque
• NPDES Permit	Storm water discharges	Pending	Submitted on 10/1/92	Pending	EPA

Table 2-4. Summary of environmental permits and registrations in effect during 1995 (Continued).

Permit Type and/or Facility Name	Location/Building	Permit Number	Issue Date	Expiration Date	Regulatory Agency
2. SURFACE WATER DISCHARGE PERMITS					
• Pulsed Power Development Facilities	TA-IV, Lagoons I and II	DP-530	(NA)	2-24-2000	State of New Mexico
RCRA					
1. HAZARDOUS WASTE PERMITS					
• Hazardous Waste Management Facility (HWMF)	TA-II/Bldgs. 958 and 959	NM5890110518-1	7/31/92	08/06/2002	NMED
• Thermal Treatment Facilty (TTF)	TA-III/Bldg. 6715	NM5890110518-2	12/4/94	12/4/2004	NMED
• Electrokenetic (RD&D)	TA-III	NM5890110518-RDD3	7/18/95	8/17/96	NMED
• RCRA - HWSA- Module	SNL/NM Site	NM5890110518-1	8/26/93	9/20/2002	NMED
2. MIXED WASTE PERMITS					
• *MW (Part A), in process	RMWMF Bldg. 6596 7 manzano bunkers, interim storage site (TA-III)	NM5890110518	Interim status (first submitted 8/90; revised and resubmitted 11/92; revised and resubmitted 01/95		NMED
• *MW (Part B)	RMWMF, Bldg. 6596, 7 manzano bunkers	NM5890110518	Interim status submitted 11/92; (Phase I) 08/93 (Phase II) and Revised 01/95		NMED
• Chemical Waste Landfill (RD & D)	TA-III, CWL	NM5890110518-3	6/26/94	6/26/95	NMED

*HW and MW are currently operating under interim status.

Table 2-4. Summary of environmental permits and registrations in effect during 1995 (Continued).

Permit Type and Facility Name	Location/Building	Permit Number	Issue Date	Expiration Date	Regulatory Agency
AIR					
1. OPEN BURN PERMITS					
• FE Train Site	Off 9th Street76-OB-1-1995	04/01/95	04/01/95	03/30/96	
• 10,000 Ft Track	TA-III	76-OB-3-1995	06/06/95	05/01/96	City of Albuquerque
• Burn Site	Lurance Canyon	76-OB-5-1995	08/10/95	06/30/96	City of Albuquerque
• Burn Site	Lurance Canyon	0503-94-038	05/03/94	04/30/95	City of Albuquerque
• Burn Site	Lurance Canyon	0503-94-039	05/03/94	06/30/95	City of Albuquerque
• Burn Site	Lurance Canyon	95-004-S	01/17/95	12/31/95	City of Albuquerque
• Burn Site	Lurance Canyon	95-003-S	01/17/95	12/31/95	City of Albuquerque
• Burn Site	Lurance Canyon	76-OB-6-1995	09/15/95	09/30/95	City of Albuquerque
• Thermal Treatment Facility	Bldg. 6715	95-001-M	01/01/95	12/31/95	City of Albuquerque
• Burn Site	Lurance Canyon	76-OB-4-1995	06/08/95	05/01/96	City of Albuquerque
2. AIR PERMITS & REGISTRATIONS					
• Hammermill (paper destructor)	TA-III,/Bldg. 6583	#144	08/28/85	Biennial update	City of Albuquerque
• Solvent Spray Cleaning	TA-IV/ Bldg. 983	#147	10/20/85	12/15/92	City of Albuquerque
• Emergency Generators	TA-I/ Bldg. 862	#150	12/13/86	Biennial update	City of Albuquerque
• Wind Shielded Fire Test (SMERF)	Lurance Canyon	#196	05/19/88	Registration	City of Albuquerque
• Thermal Enhanced Vapor Extraction System	TA-III, CWL Facility	#370	10/11/94	Biennial update	
• Neutron Generator Manufacturing	TA-III/ CWL Facility	#374	09/23/94	Registration†	City of Albuquerque
• Particle Beam Fusion Accelerator	A-IV/Bldg. 983	NESHAP	03/23/89	Approval††	EPA, Region VI
• Strategic Defense Facility	TA-IV/Bldg. 970	NESHAP	07/08/88	Approval††	EPA, Region VI
• High Energy Radiation Megavolt Eectron Source (HERMES-III)	TA-IV/Bldg. 970	NESHAP	06/29/88	Approval††	EPA, Region VI
• Radioactive & Mixed Waste Mgt. Facility	TA-III/Bldg. 6920	Pending	Submitted**	Registration†	City of Albuquerque
• Neutron Generator Recertification	TA-II/Bldg. 919	Pending	Submitted**	Registration†	City of Albuquerque
• Hot Cell Facility	TA-V/Bldg. 6580	NESHAP	11/28/95	Approval††	EPA, Region VI
• Radioactive Waste Landfill	TA-II	NESHAP	12/12/95	Approval††	EPA, Region VI
• Standby Diesel Generators (4)	TA-I, Bldg. 862	#150	2/13/86	Registration†	City of Albuquerque

Table 2-4. Summary of environmental permits and registrations in effect during 1995 (Concluded).

Permit Type and/or Facility Name	Location/Building	Permit Number	Issue Date	Expiration Date	Regulatory Agency
Air					
• NG Recertification Project	TA-II, Bldg. 919	Pending	Submitted**	Registration†	City of Albuquerque
• Isotope Production Facility	TA-V, Bldg. 6588	Pending	Submitted**	Registration†	City of Albuquerque
• Soil Vapor Extraction	TA-III, CWLF	Pending	Submitted**	Registration†	City of Albuquerque
• Electrokinetics	TA-III, CWLF	Pending	Submitted**	Registration†	City of Albuquerque
Radioactive Waste Landfill (RWL)	TA-II, RWL	Pending	Submitted**	Registration†	City of Albuquerque

†Registration = Certificate, no permit required.
††Approval = EPA does not issue a permit.
**Submitted = Awaiting agency review.

20 NMAC 11.05 "Visible Air Contaminants" concerns the visible emissions from the SMoke Emission Reduction Facility (SMERF) and the Small WInd SHielded (SWISH) facility at the Burn Site. The SMERF had difficulty in meeting the 20 percent opacity standard of the regulation. The facility was designed to and successfully reduces the air quality impact of smaller test objects that otherwise would be subjected to the open pool fire tests. SNL/NM, on behalf of the DOE, petitioned the ABC/AQCB to grant an exemption from the opacity requirements for research and development fire test facilities.

The exemption in the regulation became effective on December 1, 1995, and the Albuquerque Environmental Health Department (AEHD) granted the facility specific exemption in their letter dated January 17, 1996.

20 NMAC 11.07 "Variance Procedure" covered the SMERF while opacity reductions were attempted. The ABC/AQCB had granted SNL/NM a one-year variance that expired August 9, 1995, to resolve the opacity issue.

20 NMAC 11.23 "Stratospheric Ozone Protection" requires the recovery and recycling of ODSs. It also requires certifying the recovery and recycling equipment used and training the personnel who operate it. The DOE EH-24 Office of Environmental Audit conducted an audit in FY 1995 and revealed that SNL/NM did not have an adequate corporate-wide plan to address ODS management (see Section 2.13). Procedures are being written and revised by the affected line organizations to address any potential non-compliance issues. In addition to the certification program, all associated documentation and record keeping will be improved during FY 1996.

20 NMAC 11.41 "Authority-to-Construct" covered the four standby diesel generators in Bldg. 862. The current permit (#150) did not adequately address the operational hour needs of the facility because the monthly allowable operating hours per generator of four hours did not allow for electrical outages beyond routine maintenance of the generators. A modification to the permit application was made through the DOE office to the City of Albuquerque's Air Pollution Control Division (APCD) on February 16, 1995, proposing 480 hr/yr for all four generators. However, a later operating permit requesting 500 hr/yr bypassed the need for this modification.

20 NMAC 11.42 "Operating Permits" is the implementation of the CAAA, Title V State Operating Permit Program, in Albuquerque/Bernalillo County. The permit took effect on March 13, 1995 and requires all existing major sources to apply for an operating permit within 1 year (by March 13, 1996). A major source is defined as a facility that emits, or has the potential to emit, 100 or more tons per year (tpy) of any criteria pollutant, 10 or more tpy of any Hazardous Air Pollutant (HAP), or 25 or more tpy of any combination of HAPs. Based on the actual emissions from the steam plant in Bldg. 605 and the inventory of all boilers, heaters, and standby generators, SNL/NM is a major source for nitrogen oxides (NO_x) and has the potential to emit more than 100 tpy of carbon monoxide (CO). A "Permitting and Registration Settlement Agreement" was negotiated between the City of Albuquerque and the DOE for those SNL/NM sources that may have required an "Authority-to-Construct" permit prior to, or a certificate of registration subsequent to, construction. The information for the source's references in the agreement will be incorporated into the operating permit application that is being prepared and will be submitted by the required deadline.

2.14.2 Mixed Waste Issues & Actions

The FFCAct amendments to RCRA specifically address the Land Disposal Restriction (LDR) treatment of mixed waste. As a result of the FFCAct, the DOE submitted plans to the NMED for treatment of SNL/NM's mixed waste. These plans are now enforceable under a Compliance Order from the NMED for the LDR treatment of the hazardous components of mixed waste that is currently in violation of RCRA Section 3004(j), which allows storage for a maximum of 1 year before waste must undergo LDR treatment.

A brief chronological summary of the permit process is as follows:

- In **August 1990**, SNL/NM submitted a RCRA Part A permit application to NMED for the storage of mixed waste.
- In **October 1992**, a permitting strategy in the form of a Letter Agreement was sent to NMED for submitting the SNL/NM mixed waste Part B permit application.
- On **November 8, 1992**, the Part B permit application was submitted to NMED.
- In **August 1993** , the Part A application was amended to include limited treatment of mixed waste (pH neutralization, compaction, solidification, and shredding/baling).
- On **August 26, 1993**, the first amendment to the Part B permit application was submitted.
- On **January 1995**, a second amendment to the Part B permit application was sent to NMED.
- A third amendment in **December 1996** will include the initial treatments needed to implement the final *Site Treatment Plan* (SNL 1995f) as are required by the Compliance Order. In the future, other amendments are expected to include proposed treatment technologies identified in the *Site Treatment Plan*, but as yet are not well enough developed for adequate detail to be provided in a permit application.

2.15 Summary of Environmental Permits

As part of its commitment to full compliance with all applicable environmental laws and regulations, SNL/NM holds, or has applied for, all applicable environmental permits for radioactive and hazardous waste management, air emissions, and wastewater discharges. Table 2-4 lists all environmental permits and registrations that were in effect in 1995 including permits that are pending and under review by various agencies (e.g., the Radioactive Waste Landfill [RWL] and the yet to be built, Isotope Production Facility). Besides these environmental permits, notifications were given to the City of Albuquerque regarding asbestos removal activities regulated under 40 CFR 61 (NESHAP) Subpart M "National Emission Standards for the Removal of Asbestos." Also several projects in TA-II and TA-V were evaluated for applicability of 40 CFR 61 Subpart H, which concerns radionuclide releases.

2.16 Tiger Team Summary of Ongoing Actions

An initiative by the Secretary of Energy in 1989 to conduct rigorous health and safety appraisals at DOE facilities formulated what became known as "Tiger Teams." DOE established Tiger Teams of Environmental, Safety, and Health (ES&H) experts to inspect the various DOE owned and/or operated laboratories for compliance with Federal, state, and local environmental and safety regulations, permits, agreements, DOE Orders, best management practices, and internal SNL/NM requirements. A DOE Tiger Team conducted an assessment of the ES&H operations at SNL/NM from April 15 to May 24, 1991. Corrective actions (CAs) to address the Tiger Team findings continued in 1995.

The Tiger Team audit identified 382 findings concerning issues such as waste characterization and management, training, and compliance issues for off-site treatment, storage, and disposal (T/S/D) facilities; radioactive and mixed waste storage, characterization, and tracking; and other potential non-compliances with DOE Orders. Additionally, there were findings concerning groundwater monitoring, sampling, well/borehole closure, UST management, and ER activities. Other deficiencies noted were in air quality monitoring, surface water protection, groundwater protection, waste minimization programs, records management, radiological release control, and NEPA activities.

In response to the Tiger Team findings, DOE and SNL prepared an action plan. The draft action plan provided a formal written response to each finding cited in the Tiger Team report and presented plans, schedules, and estimated costs for correcting identified deficiencies. The *Final Action Plan to Tiger Team* was approved on February 28, 1992 (SNL 1992b). The *Consolidated Final Action Plan to Tiger Team* (SNL 1992c), which combined the SNL/NM and SNL/CA findings, was approved on October 1, 1992. This is the plan currently being followed by SNL/NM.

The status of all Tiger Team Action Plan CAs are monitored and tracked in the Sandia Issues Management System (SIMS+) database, managed by the Appraisal Management Department. CA status may be any one of the following:

- Open — CA is on schedule or is not yet due
- Behind Schedule — CA is behind schedule
- In Review — CA is in review by the Appraisal Management Department
- Complete — CA has been reviewed and determined to be complete
- Closed — CA has been verified as complete and a "Certificate of Completion" has been signed by DOE or their delegate
- Re-Opened — CA has been re-opened either by SNL/NM or DOE

Completion of a CA requires that the owner accomplish the necessary activities to ensure that the deficiencies identified in the corresponding finding have been satisfactorily addressed. This does not necessarily require that each individual milestone contained in the *Consolidated Final Action Plan to Tiger Team* be addressed. However, any deviations from the plan are reviewed by the Appraisal Management Department to ensure that the CA taken is appropriate to satisfy the intent of the finding.

Closure of a CA requires that there be sufficient evidence to verify that the CA was indeed accomplished and that the CA taken adequately addresses the intent of the finding. The Appraisal Management Department has been delegated authority from DOE to close out all Tiger Team Findings.

The summary status of CAs for each year since the Tiger Team assessment is detailed in Table 2-5.

Table 2-5. Status of Corrective Actions resulting from 1991 Tiger Team Audit.

YEAR	Completed	Closed	Open
1991	0	0	382
1992	50	3	332
1993	43	29	289
1994	42	60	247
1995	94	114	153
TOTAL	229	206	153

2.17 SUMMARY OF ENVIRONMENTAL OCCURRENCES

In 1995, there were four environmental occurrences that because of their volume and/or ingredients were reported to DOE and the State of New Mexico. (See Section 3.7.2.)

Three of the four occurrences involved unplanned releases which were immediately corrected and resulted in no fines:

- 10-gal release of hydraulic oil to the street
- 1200-gal spill of asphalt emulsion to the ground
- 150 gal of liquid rust inhibitor product (Nalco 2827) released into a storm water sewer

The fourth occurrence resulted from an NMED audit which identified four minor violations in the SNL/NM Hazardous Waste Management Program (Section 2.2.3). The audit result was listed as an occurrence because it resulted in a proposed fine ($3,015) and was reported to the State of New Mexico.

This page intentionally blank.

3.0 Environmental Programs Information

SNL/NM has developed a variety of environmental programs to implement or go beyond the basic requirements contained in Federal, state, and local statutes, laws, and regulations. These programs are also driven by the strict standards set by DOE Orders, such as DOE Order 5400.1, *General Environmental Protection*, and DOE Order 5400.5, *Radiation Protection of the Public and the Environment*. The programs that have been implemented at SNL/NM address ongoing environmental concerns and issues and work to improve the quality of the environment by reducing air emissions, liquid effluents, and waste production wherever possible. SNL/NM is also actively involved in remediating areas of past contamination and is committed to reaching DOE's strategic plan goals to remediate all areas of past releases within the DOE complex through the complex-wide Environmental Restoration (ER) Program.

This chapter describes the environmental program activities conducted at SNL/NM in 1995. These programs include monitoring air emissions and the ambient air quality, sewage effluents and other wastewater discharges, and the management of hazardous and radioactive waste streams. An environmental program has also been established to monitor the accumulation, if any, of radiological and non-radiological contaminants in the environment through extensive terrestrial surveillance of soil, vegetation, and water from on-site, perimeter, and off-site locations. Terrestrial monitoring establishes the baseline conditions in off-site areas and provides a comparison for parameter values taken from on-site and perimeter locations. SNL/NM has also established programs to specifically respond to any accidental releases or other environmental incidences that may occur, to identify areas of potential contamination from past activities, and to reduce waste or contamination from on-going activities. The pollution prevention program targets projects which can make significant waste reductions by basic changes in processes or the use of innovative pollution prevention methods including adding equipment upgrades which can reduce the use of hazardous chemicals. The program also actively encourages increased recycling efforts. Environmental progress at SNL/NM is tracked through performance measures and indicators including annual summaries, such as this report, which highlight trends in environmental management.

3.1 Environmental Restoration Project

The Environmental Restoration (ER) Project is a phased DOE project to identify, assess, and remediate all contaminated DOE-owned or operated facilities which have past spill, release, and disposal sites. DOE initiated its first five year ER plan in 1989. The plan has since been replaced by the *1995 Baseline Environmental Management Report* which provides cost estimates, tentative schedules, and projected activities to complete the Environmental Management Program (DOE 1995b). This is the DOE's most comprehensive effort, to date, to develop a clearer picture of the waste incurred from years of nuclear weapons related work. A DOE projection estimates that all ER activities will be essentially complete by approximately the year 2070. The completion of ER remediation at SNL/NM is projected to be completed by the year 2000.

Remedial action of an ER site begins with the identification of potentially contaminated sites (based on past activities), followed by a preliminary assessment and inspection. Many sites will be determined to need No Further Action (NFA) due to no contamination present or very small amounts not exceeding regulatory action levels. Once a site has been identified as requiring remediation, it will undergo a comprehensive site characterization, followed by an analysis of cleanup alternatives, a selection of the best alternative, and ultimately, remedial action.

The initial identification of sites at SNL/NM was completed in 1987. The installation assessment report (DOE 1987), which was a part of the comprehensive Environmental Assessment and Response Program, identified 117 sites requiring further evaluation. Since completion of that report, additional potential release sites have been identified reaching a maximum of 183 in 1994 (SNL 1994b). Based on assessment work completed to date, 92 sites have been proposed to the DOE and the EPA for NFA. Currently there are 155 ER sites listed at SNL/NM. Table 3-1 list the total number of ER sites on record for each year since 1987.

The potential release sites identified in the installation assessment report and subsequent evaluations are grouped together within geographic and event-related boundaries. These groups of release sites are called operable units (OUs) for budget development and project tracking purposes. Appendix B list the SNL/NM ER Project Sites and identifies the specific potential release sites that are assigned within an individual Operable Unit.

The assessment and remediation of potential sites identified by DOE's ER Project at SNL/NM are being monitored by the EPA as provided for by the Hazardous and Solid Waste Amendments Act of 1984 (HSWA) module the RCRA Part B Operating Permit. Section 3004(u) of RCRA, "Continuing Releases at Permitted Facilities," requires investigation of all past and present Solid Waste Management Units (SWMUs) which includes any facility which has collected, stored, processed, and disposed of refuse, sludge, garbage, or other discarded materials, and has a potential for release of hazardous waste or hazardous constituents. During 1995, ER assessment efforts continued at the following SNL/NM specific sites and/or general areas:

- Chemical Waste Landfill (TA-III)
- Mixed Waste Landfill (TA-III)
- Technical Area I
- Technical Area II
- Technical Area III
- Septic tanks & drainfields
- Liquid Waste Disposal System (LWDS)
- Storage tank sites (former)
- Tijeras Arroyo
- Central Coyote Field

- Technical Area IV
- Foothills test areas
- Southwest test areas
- Canyons test areas
- Other remote test facilities

A current ER site requiring RCRA corrective action is the inactive Chemical Waste Landfill (CWL). Trichloroethylene (TCE), a volatile organic compound (VOC), at concentrations slightly above the EPA's drinking water standard, was discovered in the groundwater 500 ft beneath the site. The CWL is currently under RCRA interim status issued by the NMED in 1985. A closure plan, *The Chemical Waste Landfill Final Closure Plan and Postclosure Permit Application* (SNL 1992a), has been developed for the CWL site which follows the interim status standards described in 40 CFR 265. The closure plan incorporates a corrective action plan for remediation with respect to the TCE and was approved by the NMED in May 1993.

Voluntary Corrective Measures (VCMs) have been completed at 37 ER sites and 19 more VCMs are planned for FY 1996.

Table 3-1. Total number of ER sites at SNL/NM on record each year since 1987.

TRENDS: Annual Listing of ER Sites

Year	# of sites	
1987 -	**117 sites**	Identified in initial Installation Assessment Report
1990 -	**150 sites**	(Mostly septic tanks/drainfields)
1991 -	**151 sites**	--
1992 -	**172 sites**	--
1993 -	**219 sites**	--
1994 -	**183 sites**	(Many proposed for NFA)
1995 -	**155 sites**	--

3.2 UNDERGROUND STORAGE TANK MANAGEMENT

Underground storage tanks (USTs) at SNL/NM are managed in accordance with State of New Mexico UST regulations which adopted Federal standards in July 1990. The New Mexico UST regulatory program has been approved by the EPA, Region VI, in accordance with 40 CFR 281, Approval of State Underground Storage Tank Programs. 40 CFR 280, Underground Storage Tanks, is the implementation of "Subtitle I" of the

Hazardous and Solid Waste Amendments (HSWA) of 1984 which regulates hazardous waste and petroleum products contained in USTs.

A UST, as defined by the New Mexico regulations, is any tank or combination of tanks and its associated piping, which are used to contain an accumulation of regulated substances, and which has a tank/piping volume ten percent or more beneath the surface of the ground. The state regulations are based on both the age of the UST as well as the depth to groundwater. SNL/NM currently owns five active USTs registered with the NMED, which are used exclusively for petroleum product storage. Inventories in the tanks are strictly monitored by SNL/NM to identify any potential leaks. There were no releases to the environment (e.g., spills or leaks) from any of SNL/NM's five active tanks in 1995.

Since 1988, 51 USTs have been removed from the ground. In 1993, the number of active tanks decreased from seven to the current five. Currently, there are seven USTs in the ground, five which are active and two of which were closed by abandonment in place. In these two cases, removal was not a practical method due to their proximity to other structures. The tanks were filled with an inert material for stabilization, (an accepted industry practice allowed in the UST regulations) and the closure was approved by the UST Bureau. No other inactive tanks remain to be addressed at SNL/NM.

Table 3-2 lists the number of active tanks since 1990. The five active USTs are in three separate locations and have a combined volume of 73,370 gal. Two of these USTs are used for oil storage at Bldg. 888; another two are used for motorpool fuel storage at Bldg. 876; and the fifth tank is used for emergency generator fuel storage at Bldg. 862. Of these tanks, only the UST located at Bldg. 862 meets the new 1998 requirements for spill, overfill and corrosion standards. The remaining tanks are scheduled to be removed or upgraded by December 1998. The two USTs at the motorpool have been tentatively scheduled for removal.

Table 3-2. Active USTs since 1990.

TRENDS: in UST Management

Year	# tanks
1990 -	33
1991 -	16
1992 -	6
1993 -	5
1994 -	5
1995 -	5

3.3 OIL SPILL PREVENTION & COUNTERMEASURES PLAN

The plan to mitigate potential risks in the event of a spill or accidental release of a hazardous material is documented in the *Spill Prevention Control and Countermeasures (SPCC) Plan* (CDM 1990, 1993). The plan identifies oil storage requirements and secondary containments around transformer pads and oil tanks and was prepared in accordance with 40 CFR 112, Oil Pollution Prevention. Oil spill control and countermeasures activities are coordinated using the SPCC Plan. Investigation, sampling, and evaluation of all spills and leaks of potentially hazardous material are conducted by SNL/NM in the event of any unplanned release. Under authority of 40 CFR 112, a report for all releases to the ground or surface waters not specifically permitted must be reported to the EPA. A mandatory 3-year review of the SPCC Plan for SNL/NM was completed in 1992 and 1995.

The total volume of oil stored on site at SNL/NM for 1995 (excluding USTs) was just over 5.5 x 10^6 gal. The annual SPCC Oil Storage Facilities inspection reports for the over 900 SNL/NM locations storing oil are on file in the Environmental Operations Record Center (EORC).

3.4 HAZARDOUS & RADIOACTIVE WASTE MANAGEMENT PROGRAMS

Hazardous and radioactive waste management at SNL/NM includes the safe handling, packaging, storing, treatment, and shipment of waste generated at the SNL/NM site and/or accepted from off-site sources. The following sections include summary descriptions of the SNL/NM management of (1) Resource Conservation and Recovery Act (RCRA)-regulated hazardous waste, (2) mixed, low-level, and transuranic (TRU) radioactive wastes, and (3) Toxic Substance Control Act-regulated polychlorinated biphenyl (PCB) and asbestos waste.

3.4.1 SNL/NM Hazardous Waste Management Program

RCRA was signed into law on October 21, 1976, as amendments to the Solid Waste Disposal Act (SWDA) of 1965. Further amendments made to RCRA in 1984, entitled the Hazardous and Solid Waste Amendments (HSWA), provide a set of criteria for Land Disposal Restrictions (LDRs) of hazardous waste. These provisions were fully implemented on May 8, 1980, making it unlawful to dispose untreated waste to the ground (with the exception of a "No Migration Variance" made on a case-by-case basis by the EPA). All hazardous waste must meet strict treatment standards to reduce the toxicity, volume, and/or likelihood of migration from a disposal site before it can be disposed of to land.

Chemical wastes generated by SNL/NM R&D activities are collected from generator locations, segregated according to U.S. Department of Transportation (DOT) classes, and transported to the Hazardous Waste Management Facility (HWMF) on-site. The EPA Identification number for SNL/NM, as required for all generators handling, storing, and shipping hazardous waste, is NM-5890110518. At the HWMF, the wastes are consolidated and packaged for later transport to other EPA-permitted treatment, storage, and disposal (T/S/D) facilities or to recycling facilities.

In 1995, a total of 33,273 items were collected from SNL/NM generators, packaged into 3,549 containers, and shipped off-site to permitted T/S/D facilities and recyclers. The quantity for RCRA hazardous waste processed in 1995 increased from that reported in 1994; however, the total quantity of industrial solid waste decreased. During 1995, a total of 634,570 kg of waste was managed by SNL/NM's Hazardous Waste Operations Department: 91,876 kg of RCRA-regulated hazardous materials, and 542,694 kg of solid industrial waste and recycled materials. The quantity differences compared to previous years were influenced by ER clean-up activities and SNL/NM's expanded recycling effort. Table 3-3 lists the total hazardous and industrial wastes generated at SNL/NM since 1990. Table 3-4 lists the permitted commercial carriers used in 1995 by SNL/NM to transport hazardous waste. Table 3-5 lists the permitted disposal sites used by SNL/NM and the treatment methods employed at each facility, and Table 3-6 lists the recycling companies used by SNL/NM.

Thermal Treatment Facility (TTF)

The TTF was designed to thermally treat residual explosive waste generated during research and development experimental operations. The TTF was initially built in the 1960s and operated under RCRA interim status until it became fully permitted by the NMED in November 1994. Waste treatment resumed in 1995, with the treatment of approximately 20 lb of residual explosive wastes.

3.4.2 Radioactive Waste Management & Handling

Radioactive waste falls into four major categories:

- **High-Level Waste (HLW) -** typically contains highly radioactive short-lived fission products as well as other long-lived isotopes. Most DOE HLW comes from plutonium production activities.

- **Transuranic (TRU) Waste -** without regard for source or form, waste that is contaminated with alpha-emitting transuranium radionuclides with half-lives greater than 20 years and concentrations greater than 100 curies per gram (Ci/g) at the time of assay. In some cases, it may be determined that other alpha contaminated wastes, particular to a specific site, must be managed as transuranic waste.

- **Mixed Waste (MW)** - is waste that contains both RCRA-regulated hazardous constituents and radioactive materials.

- **Low-Level Waste (LLW)** - comprises most all other radioactive wastes that are not classified under the above three categories. Most LLW contains small amounts of radioactivity within a large volume of material.

Currently SNL/NM generates only LLW or low-level/mixed waste primarily containing contaminated personal protective gear, lab debris, accelerator-activated material, and fission products. Presently, all newly generated LLW and LLW/MW waste are stored temporarily aboveground at SNL/NM waste generator sites in the TA-V High

Table 3-3. Total weight per year of hazardous and industrial waste generated at SNL/NM.

TRENDS: Hazardous & Industrial Waste Management

Year	Waste Categories Generated
1990 -	209,468 kg RCRA hazardous 141,380 kg industrial 350,847 kg of total chemical waste
1991 -	293,583 kg RCRA hazardous 553,511 kg industrial 847,094 kg total chemical waste
1992 -	147,392 kg RCRA hazardous 345,386 kg industrial 492,778 kg total chemical waste
1993 -	140,613 kg RCRA hazardous waste 342,993 kg industrial 483,606 kg total chemical waste
1994 -	86,369 kg RCRA hazardous 605,324 kg industrial & recycled material 691,693 kg total chemical & recycled waste
1995 -	91,876 kg RCRA hazardous waste 542,694 kg industrial & recycled material 634,570 kg total chemical & recycled waste

Table 3-4. Commercial carriers of hazardous waste used by SNL/NM in 1995.

Hazardous Waste Transport Companies
• Rinchem Company, Inc.
• Custom Environmental Transport
• USPCI/Willis Trucking
• Sandia National Laboratories (Transportation Dept.)
• Safety Kleen
• Matlock Trucking
• Evergreen
• MCT

Table 3-5. Permitted disposal site facilities used by SNL/NM in 1995.

Disposal Companies	Disposal Method
• Rollins Environmental Services, Inc. (TX)	• Incineration
• Rollins Environmental Services, Inc. (LA)	• Incineration
• ENSCO	• Incineration
• NSSI	• Incineration
• Treatment One, Inc.	• Incineration
• USPCI/Laidlaw	• Stabilization/Landfill
• Kirtland Air Force Base	• Open detonation
• Rio Rancho Landfill	• Landfill
• ECDC, Inc.	• Landfill

Table 3-6. Recycling facilities used by SNL/NM in 1995.

Recycling Companies	Recycled Material
• Salesco	• Light Ballasts/Capacitors
• Kinsburski Brothers, Inc.	• Lead acid batteries
• Safety Kleen, Inc.	• Solvents
• Evergreen Oil, Inc.	• Used Oil
• Lighting Resources, Inc.	• Light ballasts/Capacitors
• Englehard, Inc.	• Precious Metals
• TAB Manufacturing	• Lead
• Hydrocarbon Recyclers, Inc.	• Oil

Bay Waste Storage Facility (Bldg. 6596) and in transportation containers located at the Interim Storage Site (ISS) within the area of the inactive mixed waste landfill (MWL). During 1995, 13,160 kg (1839 ft^3) of LLW waste and 12,212 kg (506 ft^3) of MW were generated by SNL/NM and accepted into on-site storage facilities. The waste consists of material primarily contaminated with tritium, uranium isotopes, and mixed fission products. Table 3-7 lists the quantities of radioactive waste categories generated by SNL/NM since 1990.

On-site disposal of LLW was terminated in December 1988 by order of the DOE. The sites of past radioactive waste disposal such as the RWL and the MWL are currently under ER management.

Receipt of off-site MW

In addition to SNL/NM-generated MW mentioned above, 392 ft^3 (5,539 kg) of MW inventory was received from SNL/CA operations in Livermore. This consolidation of waste from SNL sites allows SNL to process waste under one Site Treatment Plan which facilitates the implementation of the requirements stated in the Federal Facility Compliance Act (FFCAct).

TRU Waste Handling

SNL/NM did not generate TRU waste in 1995. However, 26 drums of TRU waste from DOE's Inhalation Toxicology Research Institute (ITRI) on KAFB was accepted into SNL/NM-managed storage bunkers at the Manzano Base. This consolidation of TRU waste allowed the DOE to reduce its waste management costs by eliminating the need for redundant radioactive waste storage facilities. Ultimately, the TRU waste generated at SNL/NM in the past (approximately 35 ft^3) and the new ITRI waste will be permanently disposed of at the Waste Isolation Pilot Plant (WIPP) which is designed specifically for TRU waste. Currently, TRU waste generated from past SNL/NM projects is being stored at waste generator facilities.

Radioactive Mixed Waste Management Facility (RMWMF)

The RMWMF was originally completed in 1990; however, due to changes in regulations during construction, some facility upgrades were required before operations could begin in January 1996. This 6000 sq ft facility serves as a centralized packaging and temporary storage facility for all LLW and MW that meets waste acceptance criteria (WAC). An Environmental Assessment (EA), as required by NEPA, was prepared for the RMWMF and submitted to DOE in 1990. The DOE issued a Finding of No Significant Impact (FONSI) in April 1993, and the facility's operation plan was fully approved. The RMWMF was added to the current list of facilities capable of emitting radiological air emissions and will be subject to National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations.

3.4.3 Mixed Waste Issues

Currently, all LLW and MW generated at SNL/NM is being stored at waste generator sites or in the transportation containers located at the MWL. SNL/NM is facilitating the proper transportation and disposal of its MW and LLW inventory by incorporating the two waste streams under one EA. This is being accomplished by modifying the existing low level waste EA (LLWEA) to include MW; the modification is expected to be completed by August 1996. The waste will be shipped to selected permitted sites for permanent disposal by Envirocare of Utah.

Treatability Studies

Two treatability studies were performed in 1995 to identify additional technologies potentially available to SNL/NM and DOE for MW treatment using several waste technologies. These are based on either stabilizing the waste through silica-based solidification agents (used to solidify mixtures of organic aqueous liquids) and/or thermal inertion technologies for explosive waste (used to thermally decompose, deactivate or render inert the explosive components of MW).

Table 3-7. Quantities of radioactive waste generated at SNL/NM since 1990.

TRENDS: Radioactive Waste Generation at SNL/NM

Year	LLW (ft^3)	MW (ft^3)	TRU (ft^3)
1990 -	~1600 (total)	n/a	n/a
1991 -	~3300 (total)	n/a	~5
1992 -	~1086 (total)	n/a	~5
1993 -	~1533	128	~5
1994 -	~1886	59	0
1995 -	~1839	506	0

Historical Disposal Requests Validation (HDRV) Project

In June of 1995, a comprehensive characterization process was started as a means of updating historical disposal requests for radioactive and MW. Packages and drums of MW were opened and inspected to characterize the contents and separate the waste into treatability groups. The data collected during the HDRV Project will be used to validate wastes identified in the final *Site Treatment Plan for Mixed Waste* (SNL 1995f) to ensure the implementation of adequate treatment technologies. The sorting of MW is expected to be completed by September 1996.

FFCAct Requirements

The FFCAct requires the DOE to submit a Site Treatment Plan for developing MW treatment capacities and technologies to treat all of SNL/NM facility MW pursuant to RCRA Section (m). The Site Treatment Plan under development is intended to fulfill the requirements of the FFCAct and establish an enforceable framework to allow the DOE and SNL/NM to achieve full compliance with LDRs under the New Mexico Hazardous Waste Act and RCRA.

3.4.4 Special Case Waste

In 1993, SNL/NM completed a site-wide inventory of waste including special case waste. No special case waste was identified during that inventory and none has been identified since.

With the issuance of DOE Order 5820.2a (DOE 1988b), DOE enacted a comprehensive plan for managing radioactive waste at all DOE facilities. The three major categories of radioactive waste identified in the Order are HLW, LLW, and TRU waste. It is recognized, however, that not all radioactive wastes fit the criteria of these three major radioactive waste types. Although special case waste may have the attributes of one or more of these waste types, it defies clear categorization due to additional characteristics which prevent it from being managed as typical waste. Six categories of special case waste and potential waste materials have been defined.

3.4.5 The PCB Program

The Toxic Substances Control Act (TSCA) regulates the manufacture, distribution, use, handling, and disposal of specific toxic chemical and materials including polychlorinated biphenals (PCBs). Most of the provisions in the regulation apply to transformers, capacitors, and switches with PCB concentrations above 50 ppm. According to EPA definition, oils and equipment with less than 50 ppm are classified as "non-PCB." Other substances that may contain PCBs include dielectric fluids, contaminated solvents, hydraulic oils, waste oils, heat transfer liquids, certain lubricants and paints, and casting wax. SNL/NM has been in the process of phasing out PCB-containing materials to the greatest extent possible. The complete removal and disposal of this equipment is estimated to take 2 to 4 years.

The PCB program at SNL/NM is on an overall decreasing activity trend as the total number of PCB-containing items at SNL/NM approaches zero. The SNL/NM PCB Program generates an annual report (Szklarz 1995) by July 1, as required by the TSCA. The next report, covering all activities within the program during 1995, is due out by July 1, 1996.

3.4.6 The Asbestos Program

Asbestos is defined as a hazardous air pollutant under NESHAP and is also regulated under TSCA. Because of its fibrous and fire retardant properties, it has been used extensively in construction and industrial materials for insulation (e.g., above ceilings and around pipes and tanks). It can also be found used in heat-resistant surface materials, fireproofing, lab equipment, and floor tiles.

SNL/NM has two Asbestos Abatement programs: the Facilities Asbestos Program focuses mainly on removing asbestos building materials; the Non-facilities Asbestos Program removes asbestos-containing equipment (gloves, fume hoods, ovens, etc.). The SNL/NM Waste Operations Department oversees the storage, transportation, and disposal of facilities and nonfacilities asbestos. Proper disposal consists of transporting the material to a landfill permitted to accept friable asbestos waste.

SNL/NM policy on asbestos use is dependent on whether the applied use poses a significant health risk to workers or not; asbestos material in friable form and not contained creates a health hazard if asbestos particles can be inhaled. SNL/NM will remove friable asbestos in structures and/or equipment for disposal. If the asbestos-contaminated item cannot be disposed of, or the abatement of the item cannot be sufficiently and practically performed, it may be necessary for the entire piece of equipment or construction component to be removed for disposal. In instances where equipment has asbestos-containing material in a non-friable form and inhalation of asbestos particles is not a risk factor, providing the equipment is still useful, it will remain in service or will be redistributed through the property reapplication program.

3.4.7 Waste Minimization & Pollution Prevention Programs for Hazardous & Radioactive Waste

A formal waste-minimization and pollution prevention awareness program for hazardous and radioactive waste was initiated by SNL/NM in 1989 in compliance with EPA regulations and EO 12856, DOE Orders 5400.1, 5400.3, and 5820.2a (DOE 1988a, 1989b, 1988b). EO 12856, *Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements*, strongly mandates the government's priority focus on waste minimization and pollution prevention, and signals an important and fundamental change in government policy requiring full environmental accountability for all of its Federal agencies.

SNL/NM's goal is to minimize all of its waste streams (radioactive, mixed, hazardous, and sanitary) and make pollution prevention an integral part of everyday business operations. Accomplishments within the Waste Minimization and Pollution Prevention Programs for 1995 highlight the following three accomplishments:

(1) **Waste Prioritization Model:** This computer model tracks SNL/NM organizations based on parameters such as types of waste streams produced, quantities of chemicals used, and pollution prevention opportunities existing within each activity. The waste prioritization model will develop and apply a rigorous, defensible method for identifying and prioritizing SNL/NM hazardous and radioactive waste generators for possible pollution prevention actions. The model will be used to generate a list of priority waste generators who will receive Pollution Prevention Opportunity Assessments (PPOAs) in 1996.

(2) **Pollution Prevention Opportunity Assessments (PPOAs):** The Pollution Reduction Group, formed in 1994, was designed to help SNL/NM's line organizations reduce or eliminate waste through PPOAs. These assessments include gathering information on the waste-producing processes, evaluating that process for all pollution prevention opportunities, and identifing alternatives, if available, to facilitate and implement a waste reducing alternative process. Throughout CY 1995, 24 PPOAs were conducted. Four examples demonstrating pollution saving measures were accomplished at the following facilities: (1) the microelectronics development lab, (2) the photovoltaic fabrication laboratory (reduced potassium hydroxide waste), (3) the steam heating plant (recycled a larger volume of process water), and (4) the repetitive pulsed power facilities (extended the service time on millions of gallons of oil and other liquids used in research). Additionally, a prototype system was initiated which would effectively reduce large quantities of wastewater produced by over 250 evaporative coolers throughout SNL/NM. This is a significant savings since the wastewater which becomes saturated in ions must be treated as hazardous waste.

(3) **Pollution Prevention Project Implementation:** To encourage waste minimization, "chargeback funds" are acquired by a fee charged to waste generators based on their waste quantity and type. These funds are in turn used to implement some of the waste reducing opportunities identified during the PPOAs. In 1995, chargeback funds were used on projects including: (1) a new oil filter system to extend the life of motor oil in service vehicles, (2) a microbial parts washer to eliminate solvent use, (3) digital cameras to eliminate photochemical waste, and (4) a refrigerant recovery system to eliminate or reduce the release of ozone-depleting substances (ODS) to the environment.

Another category of pollution saving measures includes those implemented by the "Return on Investment Projects." This is a SNL/NM pollution prevention tactic in which certain activities are fitted with pollution prevention measures designed to return the initial cost of investment within 2 years or less. Fourteen proposals were submitted to

DOE Headquarters (DOE/HQ) for consideration for this type of funding. DOE funded five activities, which were implemented in 1995. The following describes the innovations and waste reductions achieved:

- **"Snail Bullet Trap" for lead waste:** Projectile testing at SNL/NM previously produced up to 380 kg per year of lead-contaminated target material (the total quantity of the matrix material and embedded lead). The old bullet trap targets were replaced with a conical "snail" bullet trap which catches the bullet without the need for as much of the shock-absorbing matrix material. Lead-contaminated waste has been reduced to few kilograms per year. Implementation cost: $13,500.

- **Smaller potassium baths:** Several 13.2-liter (L) potassium baths, used in the manufacturing of photovoltaic wafers for solar cell research, were replaced with more efficient 7-L baths, thereby reducing potassium hydroxide waste by 150 kg per year. Implementation cost: $15,000.

- **Printer replacement:** Installation of two high-quality printers eliminated the need for wet photochemical processing reducing photochemical waste by 175 gal per year. Implementation cost: $25,000.

- **Microfiche replacement:** CD-ROM computer system replaced the Datagraphix XC system used for microfiche reducing photochemical waste and associated cleaning materials by 72.5 gal per year. Implementation cost: $13,000.

- **Oil monitors:** Installation of liquid contamination monitors allowed oil to be changed on a conditional rather than scheduled basis at the SNL/NM service fleet, reducing oil waste by 600 gal per year. Implementation cost: $13,000.

Earth Day 1995

On April 21, 1995, SNL/NM held its second annual celebration of Earth Day (now in its 25th year). The festival theme was "Environmental Responsibility: Making it Happen." Over 50 demonstrations and displays showcasing SNL, DOE, and KAFB waste minimization and environment-friendly technologies and achievements were on display. Environmental information included displays on conservation, recycling, using environmentally safe products, and drought-tolerant landscaping hints. Despite rainy weather, an estimated 3,000 people attended the event and over 50 volunteers donated their time for festival planning and production. SNL/NM's Earth Day 95 Festival received the Sandia President's Gold Award for excellence in production and planning.

3.5 NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) COMPLIANCE ACTIVITIES & DOCUMENTATION IN 1995

NEPA law declares broad mandates for all Federal agencies and requires detailed statements on all activities which may significantly affect the environment. The Council on Environmental Quality (CEQ), created by the Executive Office of the President under the authority of NEPA, establishes NEPA regulations used by all Federal agencies and serves to advise, review, and investigate NEPA-related actions. The NEPA-implementing regulations are found in 40 CFR 1500-1508.

On April 24, 1992, DOE published its NEPA regulations as a final rule entitled National Environmental Policy Act Implementing Procedures (10 CFR 1021). In the new rule, DOE promulgated its own strict requirements, incorporating all applicable NEPA-implementing regulations. The CEQ was consulted on the rule and determined that the regulation conformed with NEPA and the CEQ regulations, and presented no objections to its promulgation. DOE Order 451.1 (DOE 1995c), issued on September 11, 1995, establishes responsibilities and procedures to implement NEPA in conformance with the new DOE NEPA regulations.

NEPA Administration at SNL/NM

At SNL/NM, the Risk Management & NEPA Department administers the NEPA program. The program's responsibilities include consulting and training line organization personnel in NEPA compliance, coordinating NEPA document preparation, and reviewing and assuring the quality of NEPA documents before submittal to the DOE.

Although only DOE has authority to decide the appropriate level of NEPA documentation, SNL/NM assists DOE by drafting the proposed documentation for DOE approval. NEPA documents serve as vehicles for assessing potential environmental impacts of proposed Federal actions and for disclosing Federal activities. The process for creating and reviewing DOE NEPA documents is shown in Figure 3-1.

Acts & Regulations Related to NEPA Compliance

Several Executive Orders and other environmental laws and regulations are coordinated with NEPA review requirements and apply directly to NEPA related activities. These related acts and Executive Orders, such as EO 11988, EO 11990, the Cultural Resources Act, and the Endangered Species Act, can be referenced in Chapter 2.

3.5.1 1995 NEPA Activities

SNL/NM provided information, including baseline data, for two programmatic Environmental Impact Statements (EISs) that are being prepared by DOE/HQ.

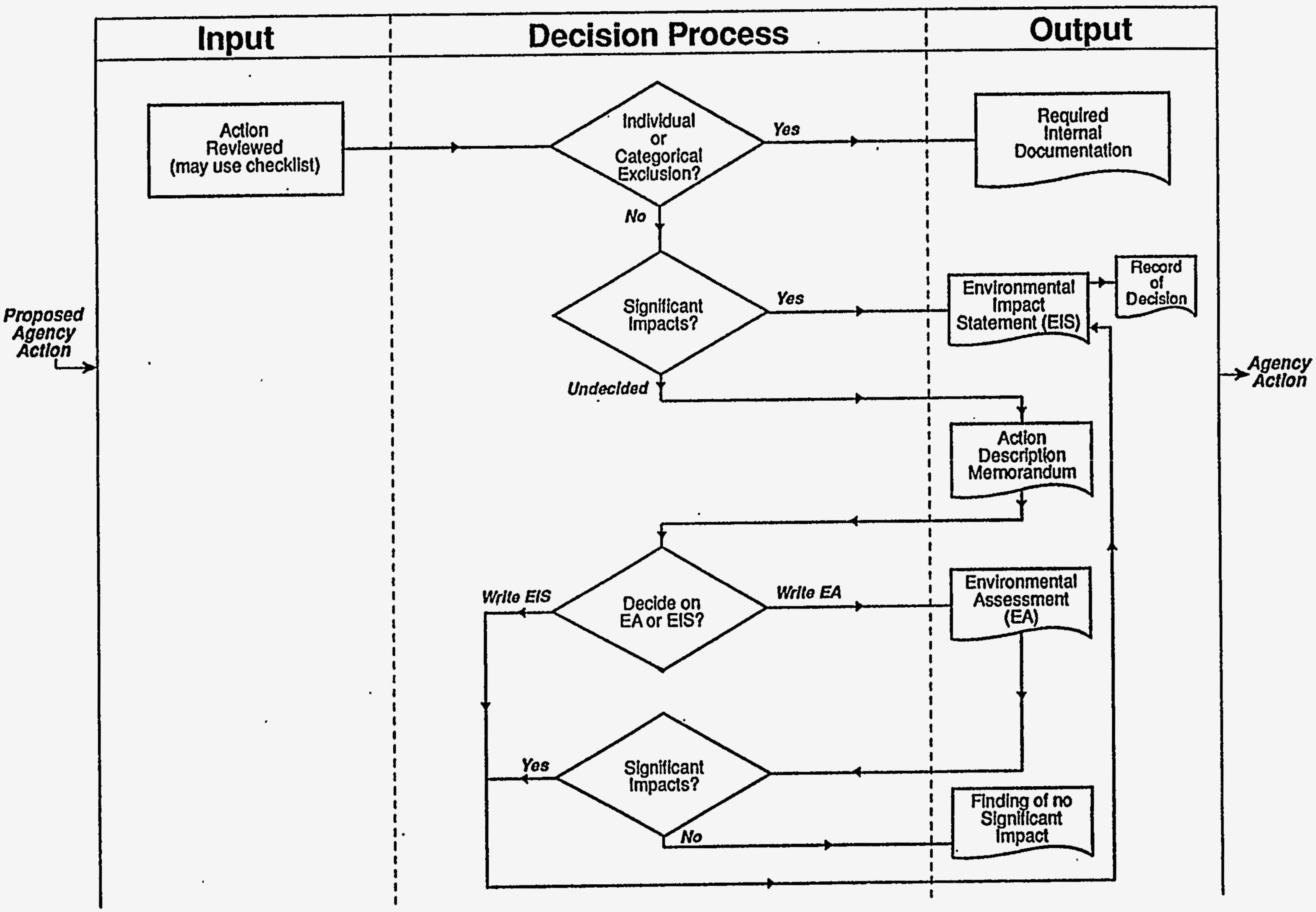

Figure 3-1. Flow chart for NEPA documentation.

- The draft *Programmatic Environmental Impact Statement for Stockpile Stewardship and Management (SSM PEIS) (DOE/EIS 0236)*: Proposal for the SSM Program which is designed to ensure the safety and reliability of the nuclear weapons stockpile without the need for underground nuclear testing (DOE 1996b, in preparation).

- The draft *Waste Management Programmatic Environmental Impact Statement* (DOE/EIS-0200-D): A programmatic EIS for managing the treatment, storage, and disposal of radioactive and hazardous waste (DOE 1995f).

NEPA Tracking for SNL/NM Activities

In 1995, 108 proposed actions were assigned NEPA identification (ID) numbers and were submitted to DOE/KAO for review and action determination. The NEPA ID number is assigned at the earliest appropriate stage, generally at the time the action is determined to warrant preparation of a NEPA Environmental Checklist (DOE 1992a).

During 1995 there were 13 EAs under development for DOE facilities at SNL/NM for proposed actions involving SNL/NM research activities.

3.5.2 NEPA Training & Outreach

Professional non-SNL trainers and SNL NEPA specialists train SNL/NM employees on NEPA processes to enhance efficiency and effectiveness in complying with NEPA. These courses are designed to provide line managers and staff with the basic information and skills to facilitate the cooperative effort needed to more effectively prepare NEPA documents. In the longer term, the time and effort invested in this training can pay dividends in shorter review periods as DOE makes determinations about SNL projects. Achieving this result facilitates the work of both the SNL line and the NEPA department.

3.5.3 NEPA Baseline Information

Information gathering to characterize the existing environment on lands used by SNL/NM continued in 1995. The term "environmental baseline" refers to the existing physical, biological, and socio-economic environment before it is altered (significantly or not) by the proposed action in the NEPA context. The baseline is a compendium of information that provides a framework for describing the affected environment as required for EISs and other NEPA-related environmental documents.

3.6 ENVIRONMENTAL MONITORING PROGRAMS

Environmental monitoring at SNL/NM began in 1959. Its principal objective was to monitor radioactive effluent and associated environmental impacts resulting from SNL/NM operations. Since then, it has greatly expanded and now includes extensive monitoring of both radioactive and non-radioactive effluents, including air emissions, wastewater discharges and storm water run-off. Monitoring of the ambient environment is also performed regularly to establish baseline presence and/or migration of contaminants in the environment.

SNL/NM's environmental monitoring falls into two categories. The first category includes direct effluent monitoring activities such as air quality samples taken directly from air emission stacks, vents and diffuse sources, or wastewater samples taken directly from sewer lines, storm drains, and lagoons. The second monitoring category is ambient environmental surveillance which includes collecting samples of media within the general environment to detect the presence and/or migration of various pollutants or elements of concern that will facilitate characterization of the background conditions at a local site or within a broader region. This type of monitoring includes groundwater monitoring, terrestrial surveillance, and ambient air monitoring. Samples are collected from on-site, perimeter, and off-site locations for air, surface water, groundwater, biota, and by monitoring external gamma radiation with thermoluminescent dosimeters (TLDs). SNL/NM has also established its own meteorological monitoring program to measure wind speed and direction, temperature, humidity, precipitation, and barometric pressure at various locations throughout the site.

SNL/NM radiological air emissions are far below the EPA standard of 10 millirem (mrem) per year for total releases from all NESHAP sources emanating from a site. Information and results from these programs are detailed in subsequent chapters of this report. Table 3-8 summarizes the radiological effective dose equivalent (EDE) calculated for NESHAP compliance since 1990. Table 3-9 specifies the primary radionuclide species released in air emissions from SNL/NM over the same time frame

3.7 SUMMARY OF 1995 RELEASES & ENVIRONMENTAL INCIDENT REPORTS

This section briefly describes the reporting requirements necessary for all non-routine releases of pollution or hazardous substances. Release information may be used to evaluate facility operation compliance, waste handling programs, and emergency response programs.

Table 3-8. Radiological dose assessments calculated from SNL/NM activities since 1990.

*TRENDS: Radiological Off-site Dose Assessments**		
	Off-Site Max Collective Dose (mrem/yr) (EDE)	**Annual Population Dose (person-rem) (EDE)**
1990 -	0.002 mrem/yr	0.82 person-rem/yr
1991 -	0.0013 mrem/yr	0.52 person-rem/yr
1992 -	0.0034 mrem/yr	0.019 person-rem/yr
1993 -	0.0016 mrem/yr	0.027 person-rem/yr
1994 -	0.00015 mrem/yr	0.012 person-rem/yr
1995 -	0.00017 mrem/yr	0.016 person-rem/yr

*Doses are estimated from maximum exposure assumptions and therefore represent potential not actual doses. EPA standard specifies not greater than 10 mrem/yr from all generator contributions at one site.

Table 3-9. Air releases for specific radionuclides emitted from SNL/NM facilities.

TRENDS: Total SNL/NM Releases of Primary Radionuclides in Air Emissions (Ci/yr)					
Year	**Argon-41**	**Nitrogen-13**	**Oxygen -15**	**Tritium (H-3)**	**Krypton-85 or Xenon-135**
1990	5.3	n/a	n/a	0.02	0.04
1991	3.55	n/a	n/a	0.02	0.05
1992	1.8	n/a	n/a	0.06	0.7
1993	3.18	n/a	n/a	1.9	0.4
1994	2.6	2.4	0.037	0.29	-
1995	4.7	n/a	n/a	0.29	1.4 (Xe-135)

3.7.1 Summary of Release Reporting

The following five release reporting documents are required by organizations other than SNL/NM.

- **Reportable Quantity (RQ) Accidental Release Reporting:** RQ release reporting is required by the CERCLA and SARA, Title III. CERCLA requires that any release to the environment, in any 24-hour period of any pollutant or hazardous substance in a quantity greater than or equal to the RQ, must be reported immediately to the National Response Center (NRC) at telephone number (800) 424-8802. However, if the release is "Federally permitted" under CERCLA Section 101(10)H, it is exempted from CERCLA reporting. This reporting exemption also applies to any "Federally permitted" release under SARA, Title III. In 1995, no release exceeding the RQ was reported at SNL/NM.

- **Radioactive Effluent Information System/Onsite Discharge Information System (EIS/ODIS) Annual Report:** DOE Order 5400.1 requires that data about radioactive effluent and on-site discharges from the previous year for all planned and unplanned releases must be reported to the Waste Information System Branch of Edgerton, Germeshausen, and Greer Corporation (EG&G), Idaho, Inc., by April 1 each year (DOE 1988a). The EIS/ODIS report for 1995, submitted in 1996, covered all routine and non-routine releases from SNL/NM operations.

- **National Emission Standards for Hazardous Air Pollutants (NESHAP) for Radionuclides Other than Radon from Department of Energy Facilities (Subpart H) Annual Report:** The NESHAP standards of 40 CFR 61, Subpart H, require that an annual report from each DOE site must be submitted to the EPA by June 30 each year. The report includes the calculated effective dose equivalent in millirems per year for both the maximum exposed individual (MEI) and the local population. Section 5.4 presents results of the dose assessment for the public from SNL/NM operations in 1995.

- **Emergency Planning and Community Right-to-Know Act (EPCRA), Section 313, Toxic Release Inventory (TRI):** The TRI Report is required by 40 CFR 372, EPCRA, for facilities that have a Standard Industrial Classification (SIC) code from 20 through 39 and that use listed toxic chemicals in quantities greater than ten thousand pounds per year (>10,000 lbs/yr) for any of the listed chemicals. Executive Order (EO) 12856 *Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements*, requires Federal facilities meeting reporting thresholds to submit TRI reports under EPCRA. SNL/NM has been filing TRI reports with DOE and the EPA since 1991 (for reporting year 1990). SNL/NM submitted its CY 1995 TRI to DOE in May 1996.

- **20 NMAC 11.90 "Administration, Enforcement, Inspection:"** On December 12, 1994, the Thermally Enhanced Vapor Extraction System (TEVES) at the Chemical Waste Landfill (CWL) emitted untreated vapors for one hour. On December 13, 1994, the DOE notified the City of Albuquerque of the release under 20 NMAC 11.90 (formerly Air Quality Control Regulation # 19). In a letter to the City dated December 21, 1994, the DOE reported that a non-compliance, in fact, did not occur. The City requested a discussion meeting in their letter dated January 5, 1995. The DOE transmitted information and set the meeting date in their letter dated January 25, 1995. A meeting was held with the City of Albuquerque on January 31, 1995, to field questions about the TEVES incident.

3.7.2 Environmental Occurrence Reporting

In 1995, there were four environmental occurrences that because of their volume and/or ingredients were reported to DOE as required by DOE Order 5000.3b *Occurrence Reporting and Processing of Operations Information* (DOE 1993c), and DOE 231.1, *Environmental Safety and Health Reporting* (DOE 1996a, in final preparation). Two of these occurrences were reportable to the State of New Mexico as required by New Mexico Hazardous Waste Management Regulations.

Of the total four occurrences for 1995, three were liquid releases; two were over 10 gal, and one was over 1000 gal.

The four occurrences are summarized as follows:

1) **Oil spill:** Approximately 10 gal of hydraulic oil was released to a road surface from a street sweeper. The spill was cleaned up and there were no associated fines.

Table 3-10. Environmental occurrences reported since 1990 at SNL.

TRENDS: Environmental Occurrences at SNL/NM

The trend over the last five years shows significant improvement in the reduced number of environmental occurrences:

year	# occurrences	Reportable Quantities
1990 -	**46 occurrences**	(3 RQ)
1991 -	**32 occurrences**	
1992 -	**29 occurrences**	
1993 -	**26 occurrences**	(9 RQ)
1994 -	**15 occurrences**	
1995 -	**4 occurrences**	(1 RQ)

2) **Asphalt Spill:** An asphalt truck inadvertently released 1200 gal of polymer modified anionic asphalt emulsion to the ground in TA-III when the asphalt became overheated and boiled over the top of the containment tank of the truck. The asphalt flowed across an open field into a storm water drainage ditch. The asphalt emulsion was allowed to solidify and then was collected and disposed of properly. There were no associated fines. This occurrence was reported to the State of New Mexico due to the large volume.

3) **Chemical release:** 150 gal of liquid rust inhibitor product was improperly disposed of into a storm sewer. The liquid was retrieved from the drain before it reached Tijeras Arroyo. Mitigation included conducting a meeting with the SNL/NM contractor involved, and updating the SNL Standard Specifications # 01065 specifying the prohibition of any material other than rainwater, being put into the storm water drain system. This was reportable to the state under the New Mexico Hazardous Waste Management Regulations. There were no associated fines.

4) **Environmental Occurrence - NMED Audit finding:** There were four violations involving improper container management and labeling as a result of the NMED audit of the Hazardous and Radioactive Waste Management Program (see Section 2.2.3). Total fines of $3,015 were proposed.

4.0 Terrestrial Surveillance

Surveillance monitoring at regular intervals allows SNL/NM to detect the possible migration of contaminated material to off-site (community) locations and also to determine potential impacts (if any) of site-related activities to the off-site population and the surrounding environment. Surveillance monitoring includes sampling of soil, vegetation, limited waters (e.g., rivers, streams, springs), and sediment samples.

SNL/NM has performed environmental radiological surveillance sampling since 1959. Non-radiological surveillance sampling began in May 1993, which marked the first year that metals analysis was performed. Terrestrial surveillance also determines the background levels of radionuclides and metals present in community (off-site) areas, which are used as a baseline for data comparison.

4.1 Sampling Locations

The Environmental Surveillance Program staff collected soil, arroyo/stream and river sediment, surface water, and vegetation samples in May and August 1995. The sampling stations are located in three distinct areas: on the SNL/NM site (on-site), at the site perimeter, and in the surrounding community (off-site). On-site sampling locations are near areas of known contamination or potential sources of contamination, or are in areas where contamination, if present, would be expected to accumulate. The perimeter locations are used to monitor the SNL/NM boundaries for migration of potential SNL/NM site-related contamination to off-site receptors. The community locations are off-site and unrelated to SNL/NM activities. Data collected at off-site locations serve as a background reference for comparison with samples collected from SNL/NM perimeter and on-site locations. Thermoluminescent dosimeters (TLDs) that are used to measure ambient levels of external gamma radiation are also located on-site, around the perimeter, and off-site.

Figure 4-1 shows the sample locations on-site and around the perimeter of KAFB. Figure 4-2 shows off-site sampling locations. Table 4-1 lists the SNL/NM terrestrial surveillance locations, specifies the types of samples collected at each location, and indicates which locations contain TLD stations. There are a total of 73 fixed sampling locations: 40 on-site (at SNL/NM), 17 distributed around the site perimeter, and 16 off-site in and around Albuquerque within a 50-mile (80 km) radius of SNL/NM. Over the past years, new monitoring locations have been added, as necessary, to monitor new facilities and operations or to supplement existing data. Seven new locations (74 through 80), for example, were added this year based on a study of existing environmental restoration (ER) sites and present sampling locations. This study was conducted to

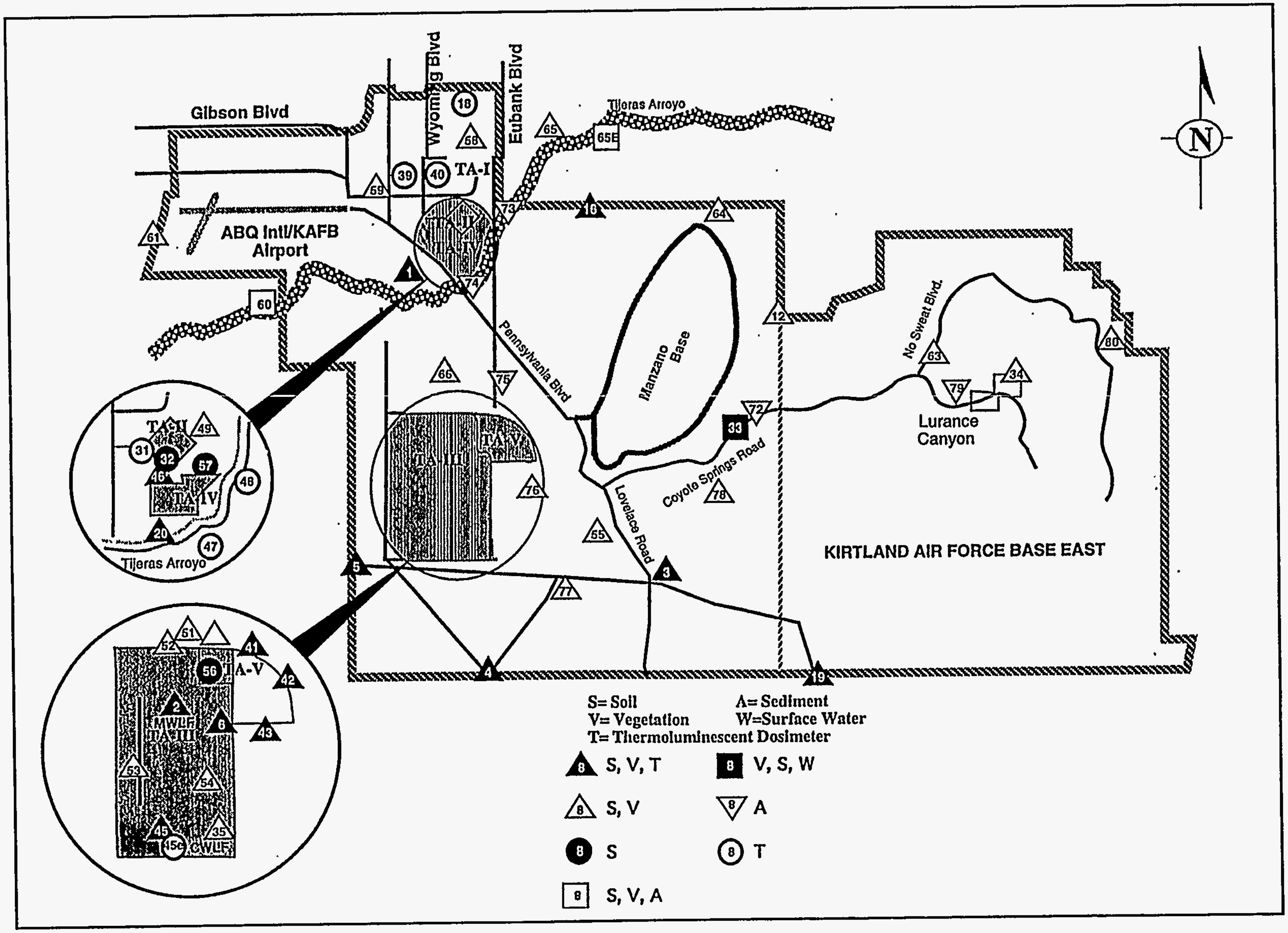

Figure 4-1. On-site and perimeter monitoring locations

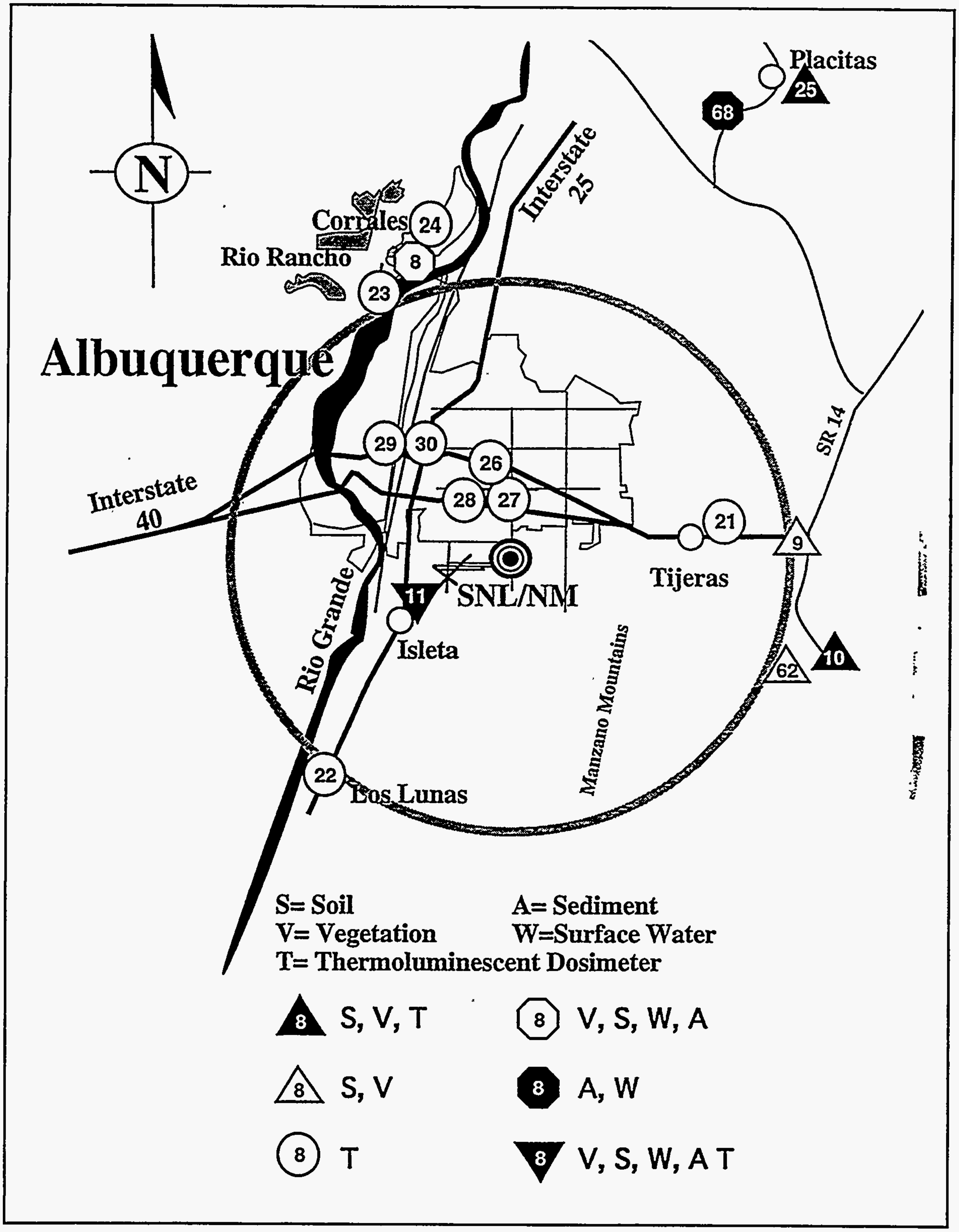

Figure 4-2. Off-site terrestrial monitoring locations.

Table 4-1. SNL/NM terrestrial surveillance locations and sample types.

Location Number	Sampling Location	Location Type*	Sample Type†
1	Pennsylvania Avenue	S	V,S,T
2NW	Mixed Waste Landfill	S	V,S,T
2NE‡	Mixed Waste Landfill	S	V,S
2SE	Mixed Waste Landfill	S	V,S
2SW	Mixed Waste Landfill	S	V,S
3	Coyote Canyon Control	S	V,S,T
4	Isleta Reservation Gate	P	V,S,T
5	McCormick Gate	P	V,S,T
6	Technical Area III, east of water tower	S	V,S,T
7‡	North of Technical Area V, arroyo	S	V,S,T
8	Corrales Bridge (upgradient of Rio Grande)	C	V,S,W,A
9	Sedillo Hill, I-40, east of Albuquerque	C	V,S
10	Oak Flats	C	V,S,T
11‡	Isleta Pueblo, Rio Grande (downgradient)	C	V,S,T,W,A
12	NE Perimeter	P	V,S
16	Four Hills	P	V,S,T
18	North Perimeter Road	P	T
19	Seismic Center Gate	P	V,S,T
20	Technical Area IV, SW	S	V,S,T
21	Bernalillo Fire Station 10, Tijeras	C	T
22	Los Lunas Fire Station	C	T
23	Rio Rancho Fire Station, 19th Avenue	C	T
24	Corrales Fire Station	C	T
25	Placitas Fire Station	C	V,S,T
26	Albuquerque Fire Station 9, Menaul NE	C	T
27	Albuquerque Fire Station 11, Southern SE	C	T
28	Albuquerque Fire Station 2, High SE	C	T
29	Albuquerque Fire Station 7, 47th NW	C	T

Note: NW = northwest; NE = northeast; SE = southeast; SW = southwest.
*Location types: S = on-site SNL/NM; P = perimeter of SNL/NM; and C = community (off-site).
†Sample types: V = vegetation, S = soil, W = surface water, A = sediment, and T = TLD (thermoluminescent dosimeter).

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

Table 4-1. SNL/NM terrestrial surveillance locations and sample types (Continued).

Location Number	Sampling Location	Location Type*	Sample Type†
30	Albuquerque‡ Fire Station 6, Griegos NW	C	T
31	Technical Area II Guard Gate	S	T
32S	Technical Area II, Building 935 (south bay door)	S	S
32E	Technical Area II, Building 935 (east personnel door)	S	S
33	Coyote Spring	S	V,S,W
34	Lurance Canyon (Burn Site)	S	V,S
35	Chemical Waste Disposal Site	S	V,S
39	NW U.S. Department of Energy 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, east fence	S	V,S,T
43	Technical Area V, SE fence	S	V,S,T
45	Technical Area III, Radioactive and Mixed Waste Management Facility Site, NW corner	S	V,S,T
45E	Technical Area III, Radioactive and Mixed Waste Management Facility Site, east fence	S	T
46	Technical Area II, south corner	S	V,S,T
47	Tijeras Canyon east of TA-IV	S	T
48	Tijeras Canyon NE of TA-IV	S	T
49	Near the Explosives Components Facility Site	S	V,S
51	Technical Area V, north of culvert	S	V,S
52	Technical Area III, NE of Buildings 6716/6717	S	V,S
53‡	Technical Area III, south of Long Sled Track	S	V,S
54	Technical Area III, Building 6630	S	V,S
55	Large-Scale Melt Facility, Building 9939	S	V,S
56	Technical Area V, west Building 6588	S	S
57	Technical Area IV, NE of Building 970	S	S

Note: NW = northwest; NE = northeast; SE = southeast; SW = southwest.
*Location types: S = on-site SNL/NM; P = perimeter of SNL/NM; and C = community (off-site).
†Sample types: V = vegetation, S = soil, W = surface water, A = sediment, and T = TLD (thermoluminescent dosimeter).

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

Table 4-1. SNL/NM terrestrial surveillance locations and sample types (Concluded).

Location Number	Sampling Location	Location Type*	Sample Type†
58	North Base housing	P	V,S
59	Zia Park/SE	P	V,S
60	Tijeras Arroyo (downgradient)	P	V,S,A
61	Albuquerque International Sunport (west end)	P	V,S
62	East resident	C	V,S
63	No Sweat Boulevard	P	V,S
64	North Manzano	P	V,S
65	Sandia Research Park	P	V,S
65E	Tijeras Arroyo East (upgradient 1)	P	V,S,A
66	Kirtland Underground Munitions Storage Complex	S	V,S
68	Las Huertas	C	W,A
72	Arroyo del Coyote (mid-arroyo)	S	A
73‡	Tijeras Arroyo (upgradient 2)	P	A
74	Technical Area IV, Tijeras Arroyo mid-stream	S	A
75	Arroyo del Coyote (downgradient)	S	A
76	North Thunder Range	S	V,S
77	South Thunder Range	S	V,S
78	School House Mesa	S	V,S
79	Arroyo del Coyote (upgradient)	S	A
80	Maderas Canyon	P	V,S

73 total

Note: NW = northwest; NE = northeast; SE = southeast; SW = southwest.

*Location types: S = on-site SNL/NM; P = perimeter of SNL/NM; and C = community (off-site).

†Sample types: V = vegetation, S = soil, W = surface water, A = sediment, and T = TLD (thermoluminescent dosimeter).

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

determine optimum positions for the new sampling locations relative to topographical features (i.e., drainage basins), wind directions, and the locations of other sampling points in the vicinity of particular ER sites (Shyr and Thelen 1995).

4.2 Sample Collection & Analysis

Environmental samples were collected and analyzed in accordance with the Quality Assurance Project Plan (SNL 1994d) and the Field Operating Procedure for Terrestrial Surveillance (SNL 1994j). Native vegetation (usually grasses because of their fast growing cycle), soil, sediment, and surface-water samples were collected biannually — once early in the growing season (May) and once toward the end of the growing season (August). TLDs were exchanged every calendar quarter (January, April, July, and October). Surface-water samples were collected by grab sampling. Unfiltered surface water (Total Water), filtered surface water, and suspended solids (sediments > 0.45 micron [μm]) were analyzed for radiological and non-radiological constituents. Table 4-2 shows the sampling matrix for the types of analysis performed on each type of media.

Table 4-2. Terrestrial surveillance sampling and analysis matrix.

Matrix	Gross Alpha	Gross Beta	Gamma Spec	ICP-20 Metals	Tritium	Total Uranium	Percent H_20
Soil			✓	✓	✓	✓	✓
Sediment			✓	✓	✓	✓	✓
Vegetation			✓		✓		✓
Filtered H_20	✓	✓	✓	✓	✓	✓	
Unfiltered H_20	✓	✓	✓	✓	✓	✓	
Water Filters	✓	✓	✓	✓		✓	

4.3 Statistical Analysis Methodology & Trend Analysis

To meet the objectives of the terrestrial surveillance program (i.e., determine contaminant presence/migration), data from on-site and perimeter locations over the last 5 years (August 1991 through August 1995) were compared to those from community locations to identify locations with concentrations higher than background. (Data from 1991 to the present were selected, since during this time period the same analytical laboratory was used and therefore provided consistent analytical procedures [Shyr and Skipper 1995]). In addition, data from soil and vegetation samples gathered over the last 5 years were analyzed by location to determine if a trend (either increasing or decreasing) was observed. Results of both analyses were then combined to determine how a location should be categorized (i.e., "Category 1" to "Category 4") for further investigation (Table 4-3).

Table 4-3. Analysis categories.

Category Type	Higher than Off-site?	Trend Increasing?	Priority for further investigation
Category 1	Yes	Yes	1st priority
Category 2	Yes	No	2nd priority
Category 3	No	Yes	3rd priority
Category 4	No	No	No concern.

Only those locations listed under Categories 1, 2, or 3 were discussed in the data analysis report. This analysis identified locations with abnormal concentrations based on statistical procedures and the results were further compared to Federal/state regulation limits and U.S. Soil average concentrations.

Data from surface water and sediment samples were analyzed using the same approach with additional comparisons between upgradient and downgradient river and arroyo samples to determine contribution from SNL/NM and/or Albuquerque and the surrounding areas.

4.4 TERRESTRIAL RADIOLOGICAL SURVEILLANCE RESULTS

The following subsections summarize the results of the statistical analyses described above and site-specific discussions. Analysis details and the actual data are described in the *1995 Environmental Surveillance Data Analysis Report* (Shyr et al. 1996).

4.4.1 Vegetation Results - Radiological

Table 4-4 presents the summary statistics for tritium (H-3) concentrations in vegetation samples taken in May and August of 1995. H-3 concentrations in vegetation at on-site locations are skewed toward smaller values as indicated by the small median compared to the mean. Location 63 showed an unusually high H-3 concentration (16 picocuries per milliliter [pCi/mL]) in the May 1994 sampling and was considered in the *1994 SNL/NM Site Environmental Report* (SNL 1995e) as a possible measurement error based on historical data. The 1995 data did not show an elevated concentration. The environmental surveillance staff will continue to monitor this location for reoccurrences.

There were no Category 1 or Category 3 locations observed for H-3 concentrations at either perimeter or on-site locations. The only Category 2 location was 2NE, which reported a higher than background H-3 level, but no increasing trend. The elevated H-3 concentration at this location was the primary cause of the higher mean for the on-site H-3 concentrations (Table 4-4).

4.4.2 Soil Results - Radiological

Table 4-5 presents the summary statistics for uranium-total (U_{tot}), cesium-137 (Cs-137), and H-3 concentrations in soil samples taken in May and August of 1995. Concentrations of H-3 in soil from on-site locations are skewed toward smaller values as indicated by the small median compared to the mean.

Cesium-137 - Last year an increasing trend was detected for Cs-137 at on-site location 6 in TA-III. However, with the 1995 data, that trend was no longer noted at this location (Figure 4-3).

Uranium - The background (off-site) U_{tot} concentrations showed a larger variation among locations and showed a higher mean concentration level than did on-site and perimeter locations. This trend has been observed consistently over the years and most of the high U_{tot} values were associated with locations on the east side of the city, near the mountain areas, where the rock formation may contribute to the high U_{tot} values (Shyr et al. 1996). Last year, increasing trends were detected for U_{tot} at locations 20, 46, and 64, (SNL 1995e). However, with the addition of the 1995 data, the increasing U_{tot} trends were no longer detected (Figure 4-4).

Table 4-4. Summary statistics for concentrations of tritium in vegetation, May and August 1995.

				Raw Data			
Radionuclide	**Units**	**Location Type**	**# of Samples**	**Median**	**Mean**	**Standard Deviation**	**Range**
<u>**May, 1995**</u>							
Tritium	pCi/mL	SNL/NM	27	0.09	0.39	1.20	-0.05 to 6.40
		Perimeter	14	0.01	0.08	0.19	-0.06 to 0.63
		Off-site	6	0.07	0.06	0.03	0.00 to 0.10
<u>**August, 1995**</u>							
Tritium	pCi/mL	SNL/NM	27	0.06	0.70	2.47	-0.26 to 13.00
		Perimeter	13	-0.03	0.13	0.35	-0.14 to 1.10
		Off-site	6	0.14	0.19	0.13	0.10 to 0.45

Note: pCi/mL = pico curies per milliliter. (Perimeter location 65 was not sampled during the August 1995 sampling period due to construction activities).

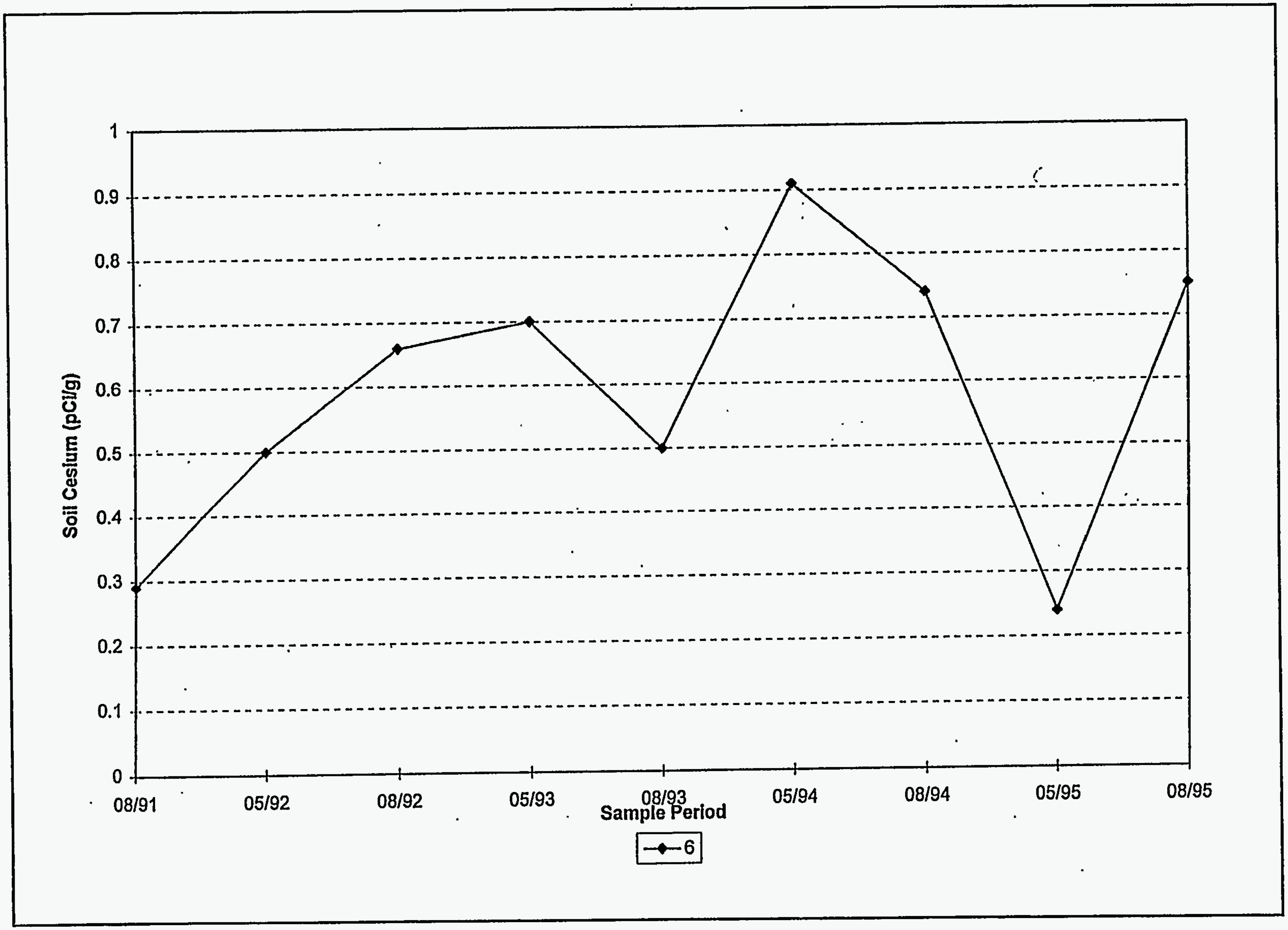

Figure 4-3. SNL/NM soil location where increasing trend for cesium-137 was observed in 1994, but no trend observed with addition of 1995 data.

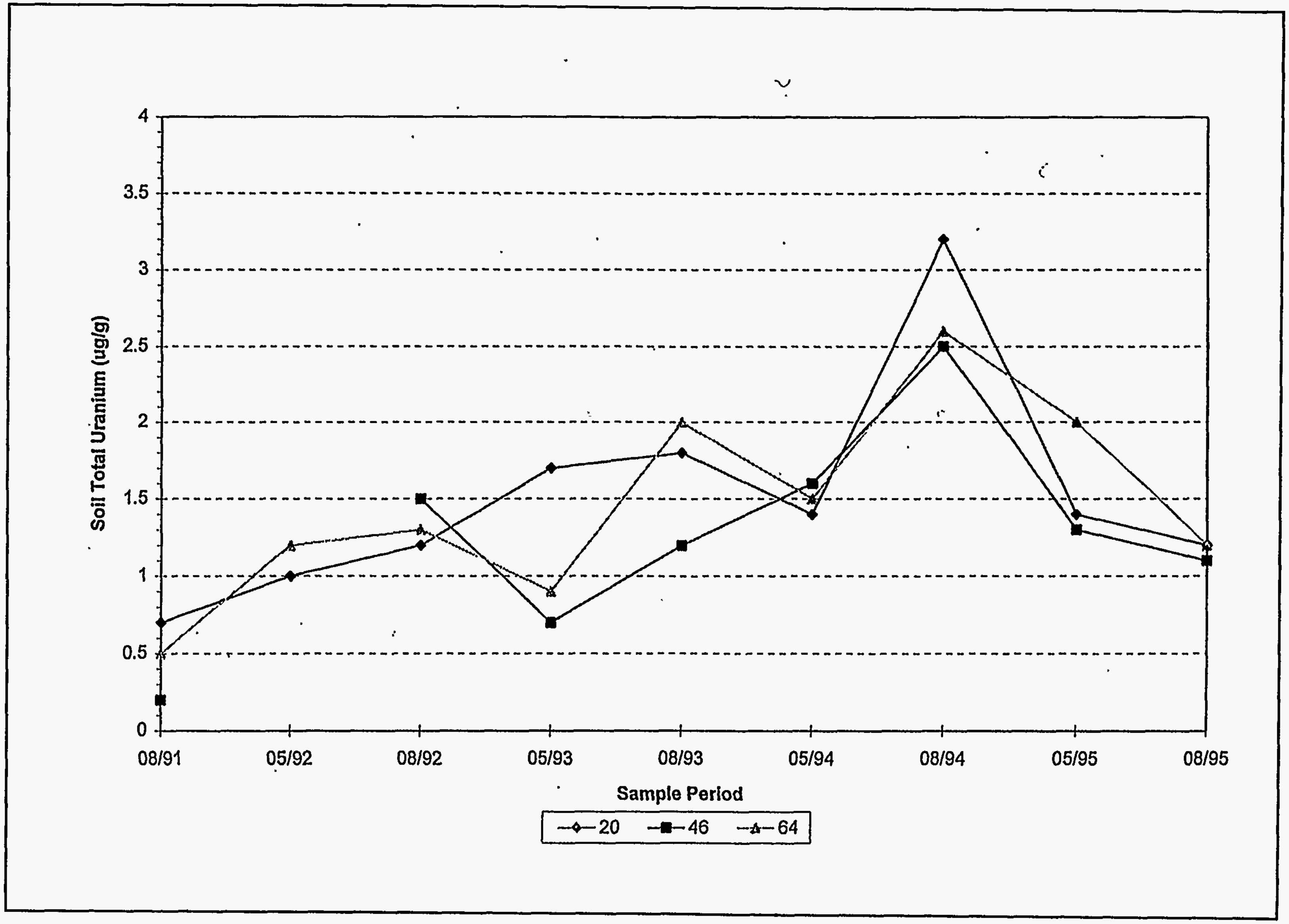

Figure 4-4. On-site and perimeter soil locations where increasing trend for total uranium was observed in 1994, but no trend observed with addition of 1995 data.

Tritium - The value of 2300 pCi/mL for H-3 in the soil sample taken at location 32S during May 1995 had an impact on the statistics for on-site locations, as indicated by the adjusted statistics when the value is excluded. Location 32S is within the controlled area of TA-II and has shown an elevated H-3 concentration in past years.

Table 4-6 shows the results of the statistical analysis for Cs-137, H-3, and U_{tot} concentrations.

Table 4-6 Discussion

Cs-137 - An increasing trend was observed for the first time in 1995 for two on-site locations, 2NW and 45; however, the concentrations were not higher than background levels. Monitoring on these locations will continue. The Cs-137 concentrations at on-site location 34 and perimeter locations 12 and 64 were higher than the background values, but no increasing trend was detected. The Cs-137 concentrations at locations 34, 12, and 64 ranged from 0.4 to 1.9 pCi/g over the past 5 years (Shyr et al. 1996). Even though these values were higher than those from off-site locations, they were still within the range of background Cs-137 concentrations in the vicinity of Albuquerque (Hostak 1995). The SNL/NM surveillance staff plans to investigate if the variation in background values was the only reason for the elevated concentrations.

H-3 - No trends were detected at perimeter locations and there were no detected differences from background levels. Three on-site locations, 33, 43, and 46, showed an increasing trend for the first time, although the concentrations were not higher than the background values. Monitoring of these locations will continue. Three on-site locations, 2NE, 32E, and 32S, showed higher concentrations than background. These locations are associated with identified ER sites in controlled areas. The major exposure pathway for H-3 is through food/crop intake (RSIC 1994) which is not a possible exposure scenario at these controlled locations. These elevated concentrations will be addressed by the ER Project and the facility owners.

Uranium-total - There were no on-site and perimeter locations that showed higher concentrations of U_{tot} as compared to off-site (background) values. However, a number of locations showed an increasing trend (Table 4-6). Among these were samples from locations 3, 49, 51, and 55, which showed an increasing trend for the first time (Figure 4-5). On-site locations, 1, 32S, 42, 43, and 66, have shown an increasing trend for two consecutive years, 1994 and 1995 (Figure 4-6), even though the 1995 concentrations were declining. Out of the six perimeter locations, only one location, 58, showed an increasing trend for two consecutive years (Figure 4-7).

For all three radionuclides (Cs-137, U_{tot}, and H-3), no location was classified as a Category 1.

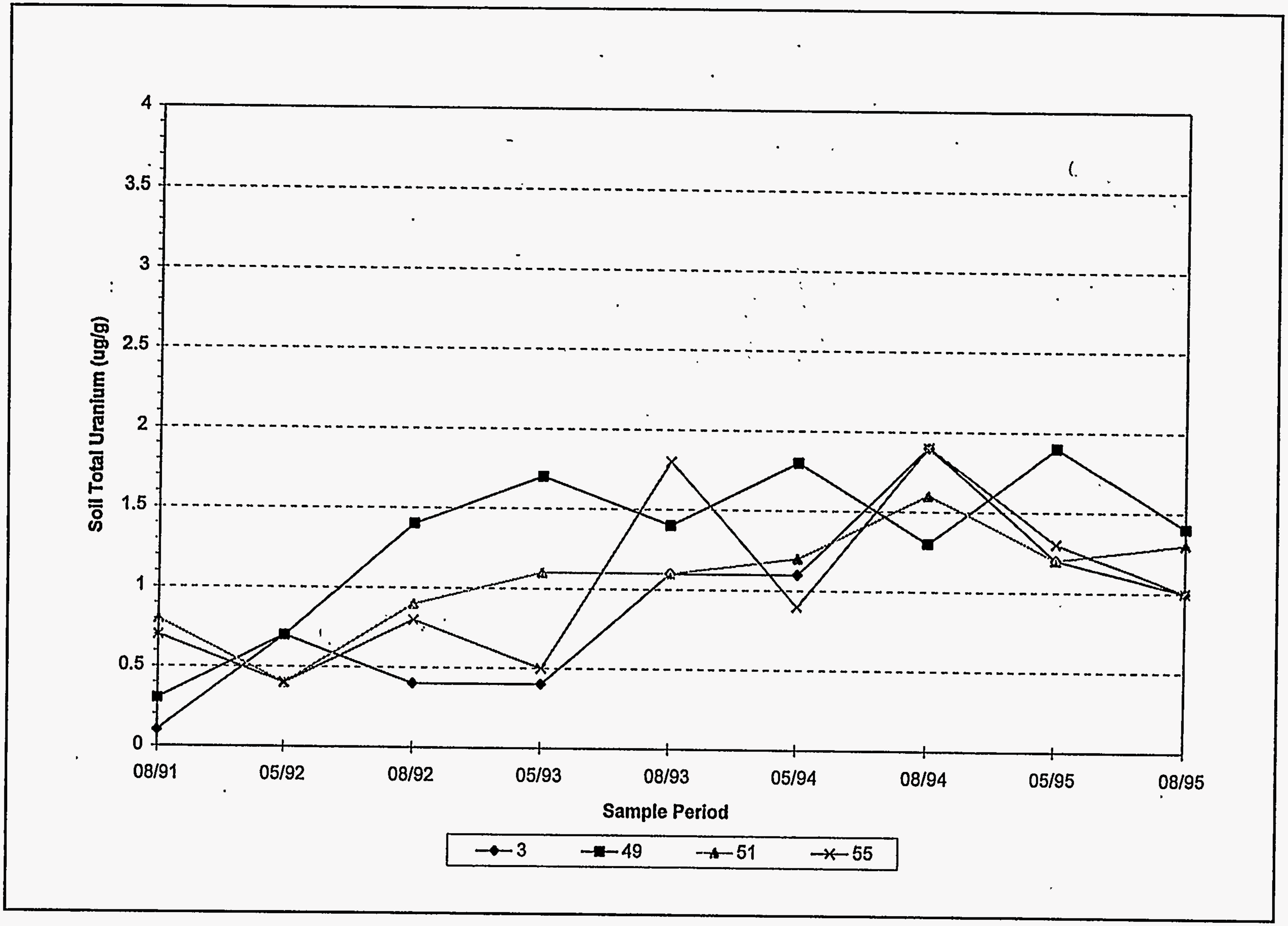

Figure 4-5. SNL/NM soil locations with increasing total uranium concentrations for the first time.

Table 4-5. Summary statistics for concentrations for soil radionuclides, May and August 1995.

Radionuclide	Units	Location Type	# of Samples	Raw Data Median	Mean	Standard Deviation	Range
May, 1995							
Uranium-total	ug/g	SNL/NM	31	1.20	1.33	0.51	0.63 to 2.60
		Perimeter	14	1.70	1.68	0.44	0.92 to 2.50
		Off-site	6	2.40	2.42	0.74	1.60 to 3.70
Cesium-137	pCi/g	SNL/NM	26	0.23	0.37	0.32	0.07 to 1.40
		Perimeter	13	0.20	0.42	0.35	0.04 to 1.20
		Off-site	6	0.31	0.31	0.23	0.04 to 0.58
Tritium (oxide)	pCi/mL	SNL/NM	31	0.24	82.25	406.54	-0.01 to2300.00
			30	0.23	11.06	39.95	-0.01 to200.00*
		Perimeter	14	0.12	0.19	0.22	-0.06 to 0.74
		Off-site	6	0.14	0.24	0.31	0.05 to 0.86
August, 1995							
Uranium-total	ug/g	SNL/NM	31	1.10	1.14	0.22	0.86 to 1.60
		Perimeter	13	1.20	1.25	0.30	0.73 to 1.90
		Off-site	6	2.05	2.08	0.71	1.40 to 3.40
Cesium-137	pCi/g	SNL/NM	28	0.31	0.39	0.30	0.06 to 1.00
		Perimeter	11	0.41	0.50	0.45	0.05 to 1.30
		Off-site	5	0.26	0.34	0.23	0.08 to 0.60
Tritium (oxide)	pCi/mL	SNL/NM	31	0.18	9.85	38.50	-0.03 to200.00
		Perimeter	13	0.08	0.77	2.36	-0.09 to 8.60
		Off-site	6	0.16	0.22	0.18	0.02 to 0.52

Note: µg/g = micrograms per gram; pCi/g = picocuries per gram; pCi/mL = picocuries per milliliter
*The adjusted statistics indicates the impact of the value of 2300 pCi/mL measured at location 32S during May 1995. The sample size for U_{tot} and H-3 was one less in August because perimeter location 65 was not sampled for the August 1995 sampling period due to construction activities. Cesium-137 sample sizes reflect only the results reported by the lab (i.e., Cs-137 was not detected in samples from several locations).

Table 4-6. Analysis categories for Cs-137, H-3, and U_{tot} concentrations.

Radionuclide	Category	On-Site Location No.	Perimeter Locations No.
Cs-137	*Category 1*	-	-
	Category 2	34	12, 64
	Category 3	2NW, 45	-
H-3	*Category 1*	-	-
	Category 2	2NE, 32E, 32S	-
	Category 3	33, 43, 46	-
U_{tot}	*Category 1*	-	-
	Category 2	-	-
	Category 3	1, 3, 32S, 42, 43, 49, 51, 55, 66	4, 5, 12, 19, 58, 60

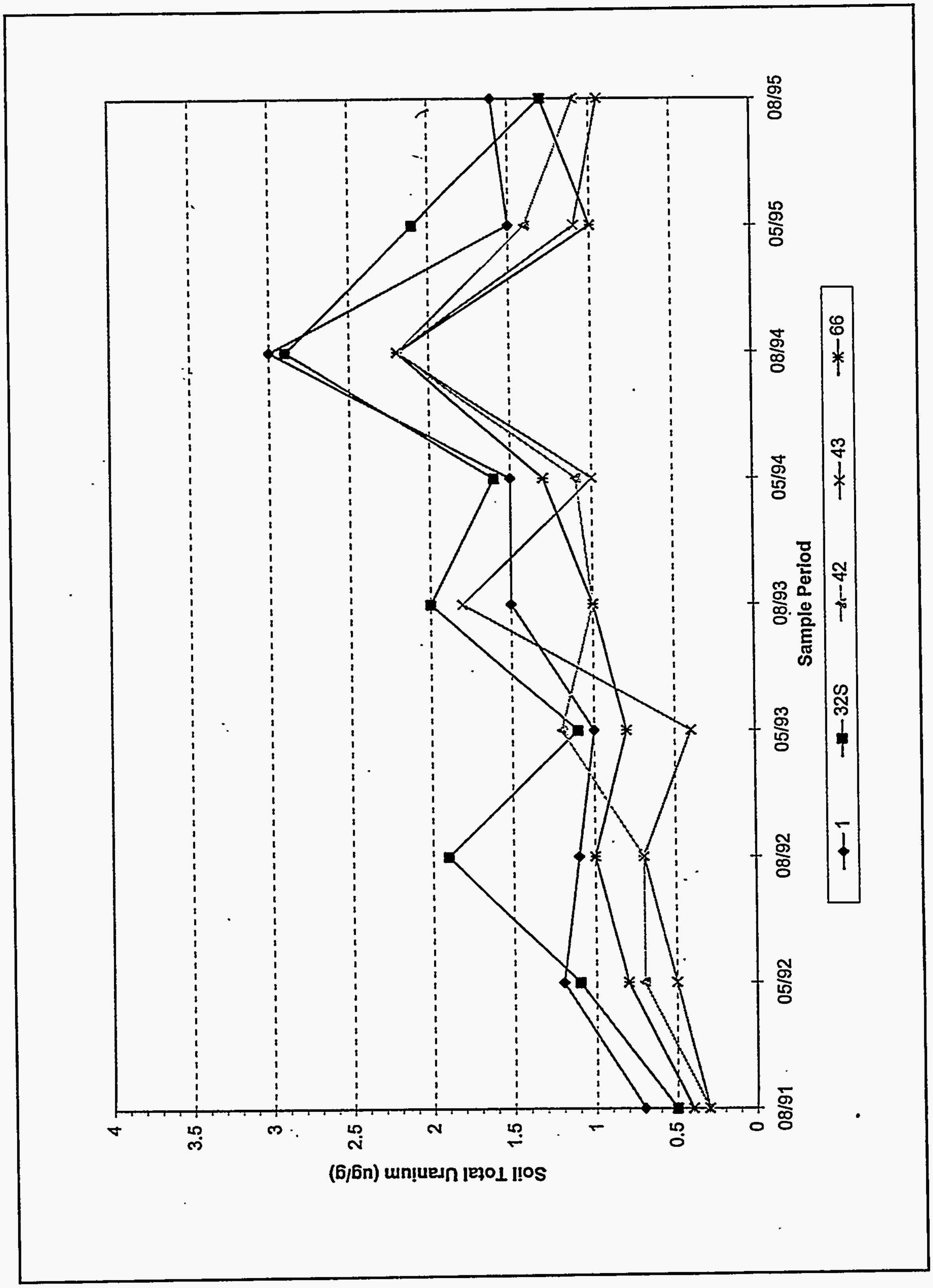

Figure 4-6. SNL/NM soil locations with increasing total uranium concentrations for two consecutive years (1994 and 1995).

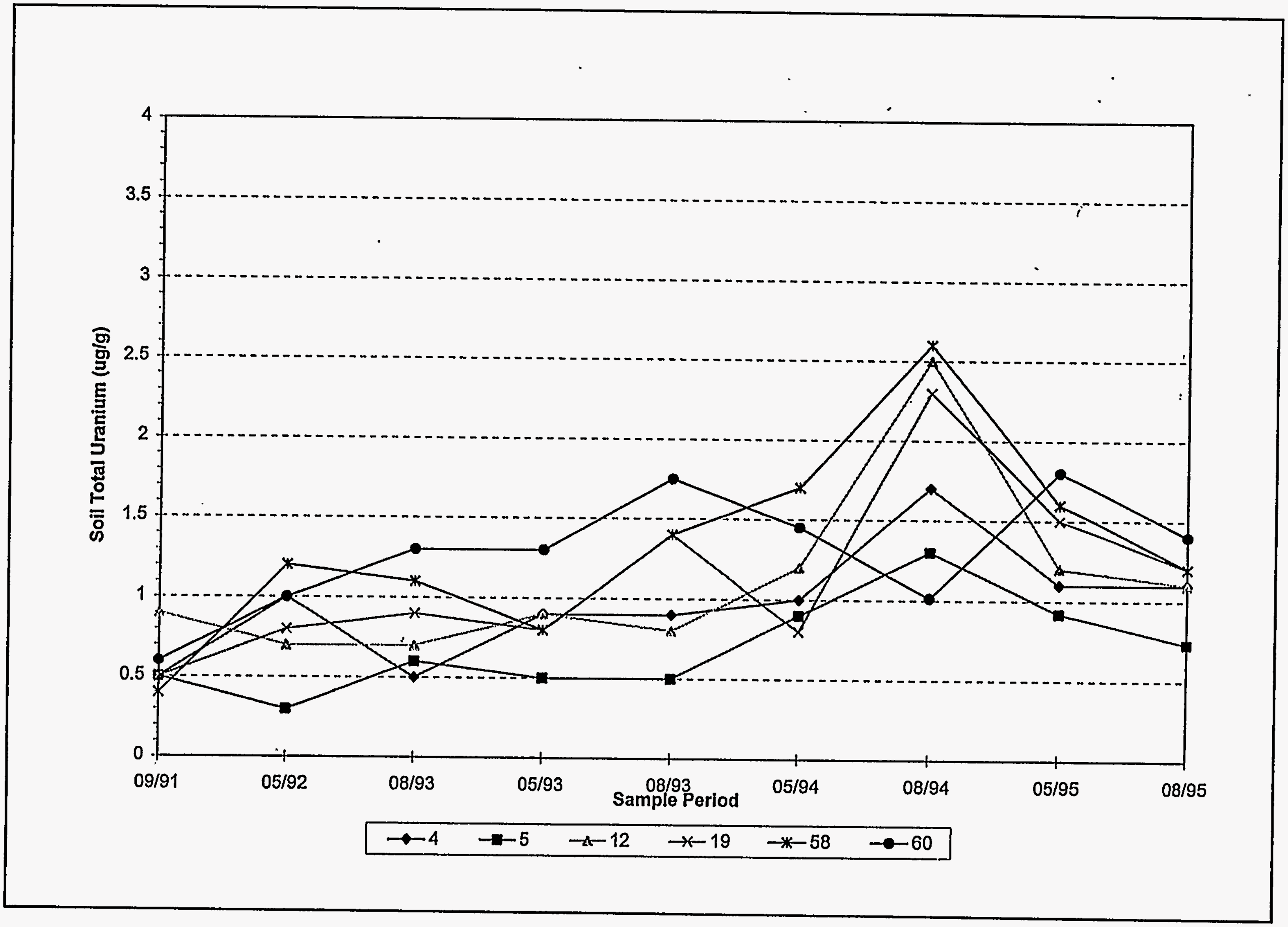

Figure 4-7. Perimeter soil locations showing increasing total uranium concentrations over time. Location 4, 5, 12, 19, and 60 showed no trend previously.

As seen in Figures 4-3 to 4-7, a trend can be observed for a particular location due to one value higher than usually seen and/or data fluctuations as a result of variations in sampling conditions and analysis. Therefore, locations that continue to show an increasing trend for two consecutive years should receive a higher priority for further investigation. If a trend has been observed in the past, but does not show a trend for the current year or the following year, it will not be further discussed in subsequent reports.

4.4.3 Sediment Results - Radiological

Table 4-7 summarizes the data for sediment samples taken from the Rio Grande, Las Huertas Creek, and on-site arroyos in May and August of 1995. Trend analyses for Cs-137, U_{tot}, and H-3 were performed for all locations using data from 1991 to 1995. No trend was detected at any location and on-site and perimeter concentrations were not statistically different from off-site values. In addition to this analysis, data from upgradient and downgradient samples taken from the following locations were compared to determine potential contribution from SNL/NM and/or Albuquerque and the surrounding areas.

Tijeras Arroyo - Location 73 is on the site perimeter by TA-II where the Tijeras Arroyo intersects SNL/NM property. Location 60, also taken from the arroyo, is downgradient from TA-1, II, and IV. Data from 1991 through 1995 showed there was no statistically significant difference between upgradient and downgradient radionuclide concentrations (Shyr et al. 1996).

Rio Grande - Location 8 is off-site at the Corrales Bridge, just north of Abuquerque. This location is upgradient of both SNL/NM and the city, although it is located downgradient of Corrales Village and Rio Rancho, two outlying suburbs. Downgradient samples were taken from the Rio Grande at location 11, on the Isleta Pueblo Indian Reservation, south of Albuquerque. No statistically significant difference in isotope concentrations were detected based on data from the past 5 years.

Arroyo del Coyote - Since locations 79 and 75, upgradient and downgradient of Arroyo del Coyote, are new locations added in 1995, a trend analysis cannot be performed at this time. The upgradient, mid-arroyo, and downgradient concentrations did not appear to be very different; a statistical analysis will be performed when more data become available.

4.4.4 Surface Water Results - Radiological

Tables 4-8 and 4-9 summarize the data for surface water taken from three off-site locations 8, 11, and 68, and one on-site location 33 in May and August 1995. No trend was detected for any location based on the data collected from the past 5 years. Location 33 was the only Category 2 location, as discussed below.

Table 4-7. Concentrations of sediment radionuclides, May and August 1995.

Sediment Type	Loc No.	Location Type	Total Uranium (µg/g)	Tritium (pCi/mL)	Cesium-137 (pCi/g)
<u>May, 1995</u>					
Arroyo del Coyote	79	Upgradient	2.50	0.11	0.05
	72	Mid-arroyo	1.70	0.20	0.08
	75	Downgradient	1.30	0.30	NR
Tijeras Arroyo	65E	Upgradient1	2.30	0.25	0.19
	73	Upgradient2	2.10	0.00	NR
	74	Mid-arroyo	1.80	0.12	NR
	60	Downgradient	1.80	-0.04	0.08
River/Stream	8	River upgradient	1.11	0.04	0.19
	68	Stream	0.97	0.03	0.04
	11	River downgradient	0.97	0.18	0.09
<u>August, 1995</u>					
Arroyo del Coyote	79	Upgradient	1.60	-0.06	0.12
	72	Mid-arroyo	1.20	-0.07	0.05
	75	Downgradient	1.20	0.20	NR
Tijeras Arroyo	65E	Upgradient1	1.30	0.11	NR
	73	Upgradient2	1.60	0.12	NR
	74	Mid-arroyo	1.30	0.11	NR
	60	Downgradient	1.40	0.52	0.05
River/Stream	8	River upgradient	1.20	0.10	0.15
	68	Stream	2.00	0.12	0.07
	11	River downgradient	0.73	0.08	0.07

Note: µg/g = micrograms per gram; pCi/mL = pico curies per milliliter; pCi/g = pico curies per gram; NR = cesium-137 concentrations were not detected at these locations. Location 65E is a new location for data collection in 1995. Both locations 75 and 79 are new locations in 1995 and no comparison of data over years was made.

Table 4-8. Concentrations of surface water radionuclides, May 1995.

Analysis (Units)	Location Type	Loc No.	Total Water	Filtered Water	Suspended Solids
Gross Alpha (pCi/L)	River upgradient	8	1	1	-3.24
	River downgradient	11	2	1	-0.59
	On-site	33	16	32	-3.53
	Stream	68	-1	0	-0.59
Gross Beta (pCi/L)	River upgradient	8	4	3	-1.18
	River downgradient	11	6	3	1.18
	On-site	33	44	66	-7.35
	Stream	68	-1	1	-0.29
Uranium-total (mg/L)	River upgradient	8	0.0018	0.0016	0.0002
	River downgradient	11	0.0019	0.0017	0.0001
	On-site	33	0.0052	0.0062	*0.0000
	Stream	68	0.0011	0.0012	0.0001
Tritium (pCi/mL)	River upgradient	8	-0.03	0.03	NA
	River downgradient	11	0.06	-0.10	NA
	On-site	33	-0.02	0.02	NA
	Stream	68	0.02	0.01	NA

Note: pCi/L = picocuries per liter; mg/L = milligrams per liter; pCi/mL = picocuries per milliliter; NA = filters were not analyzed for tritium. * Numerical rounding result.

Uranium-total - Using the 1991 to 1995 data set, on-site location 33 at Coyote Spring showed statistically higher concentrations for U_{tot} than off-site results, and was therefore classified as Category 2 for Total Water, Filtered Water, and Suspended Solids. The concentrations of U_{tot} in water (~0.005mg/L) at this location were approximately 25 percent of the maximum Federal standard for drinking water (0.02 mg/L).

Gross Alpha - Concentrations over the past 5 years at on-site location 33 were also higher than off-site values for suspended solids and were therefore classified as Category 2 for Suspended Solids. The 1995 gross alpha activities at location 33 were higher than the off-site locations, and exceeded the Federal drinking water standard (15 pCi/L).

Location 33 is on-site and has been controlled for access. It has also been posted as "Not a Source for Drinking Water."

Gross Beta and H-3 - Based on data from the past 5 years, gross beta and H-3 from location 33 did not show concentrations that were statistically significant from the background concentrations. Location 8 is on the Rio Grande upgradient of SNL/NM and Albuquerque; location 11 is downgradient. In addition to the trend analysis, data from upgradient and downgradient samples taken from the Rio Grande were compared to determine potential contributions from Albuquerque and the surrounding areas. The results showed there was no statistically significant difference between the upgradient and downgradient locations (Shyr et al. 1996).

Table 4-9. Concentrations of surface water radionuclides, August 1995.

Analysis (Units)	Location Type	Loc No.	Total Water	Filtered Water	Suspended Solids
Gross Alpha (pCi/L)	River upgradient	8	2	3	0.29
	River downgradient	11	2	1	0
	On-site	33	38	28	-0.09
	Stream	68	NR	NR	NR
Gross Beta (pCi/L)	River upgradient	8	5	7	0.29
	River downgradient	11	8	5	0.88
	On-site	33	51	28	-0.29
	Stream	68	NR	NR	NR
Uranium, total (mg/L)	River upgradient	8	0.0019	0.0018	*
	River downgradient	11	0.0019	0.0018	0.0001
	On-site	33	0.0059	0.0060	0.0000
	Stream	68	NR	NR	NR
Tritium (pCi/mL)	River upgradient	8	0.11	0	NA
	River downgradient	11	0.04	0	NA
	On-site	33	-0.13	0.02	NA
	Stream	68	NR	NR	NA

Note: pCi/L = picocuries per liter; mg/L = milligrams per liter; pCi/mL = picocuries per milliliter; NA = filters were not analyzed for tritium. NR = No sample was taken at location 68 because the stream bed was dried up. * Sample was not analyzed for U_{tot}.

4.4.5 Environmental Thermoluminescent Dosimeters (TLD) Results

Table 4-10 summarizes the 1995 annual dose equivalent estimates for the on-site, perimeter, and off-site locations. These estimates include total external gamma readings from both natural background (e.g., cosmic rays) and man-made sources (e.g., facility contributions, if any). One datum point was excluded from the summary statistics

Table 4-10. Summary of thermoluminescent dosimeter measurements for 1995.

Location	Number of Locations	Annual External Dose Equivalent (mrem/year) Mean	Standard Deviation	Range
On-site- SNL/NM (S)	14	99.74	4.07	93.10 - 107.70
Perimeter (P)	7	98.51	11.60	88.50 - 120.02
Off-site- Community (C)	11	97.86	8.28	89.10 - 114.20

because the TLD from one off-site location (24) was not recovered during the fourth quarter in 1995. Because the mean, the standard deviation, and the range were similar for on-site, perimeter, and off-site locations, the individual sites were not compared to the mean of the off-site locations which is the approach used for all other radiological data. Instead, the means of the three location groups were compared to detect any difference using a one-way analysis of variance (Shyr et al. 1996). It appears that for the 13 years worth of data (1983 - 1995), on-site locations are slightly higher than background locations. There is no statistical difference between readings taken at perimeter locations and background readings taken at community locations.

In addition to the comparison of means for the three location types, TLD data from 1983 to 1995 were analyzed to detect any trend (Shyr et al. 1996). TLD measurements from on-site, perimeter, and off-site locations have been consistent over the past 13 years, although on-site locations were approximately 9 percent higher than perimeter and off-site locations during the period from 1986 through 1989 (Figure 4-8). No trend was detected.

4.5 TERRESTRIAL NON-RADIOLOGICAL RESULTS

Beginning in 1993, the scope of the terrestrial surveillance program was broadened to include sample analysis for metals in soil. Samples were analyzed for the following 20 metals:

aluminum (Al)	barium (Ba)	beryllium (Be)
cadmium (Cd)	calcium (Ca)	chromium (Cr)

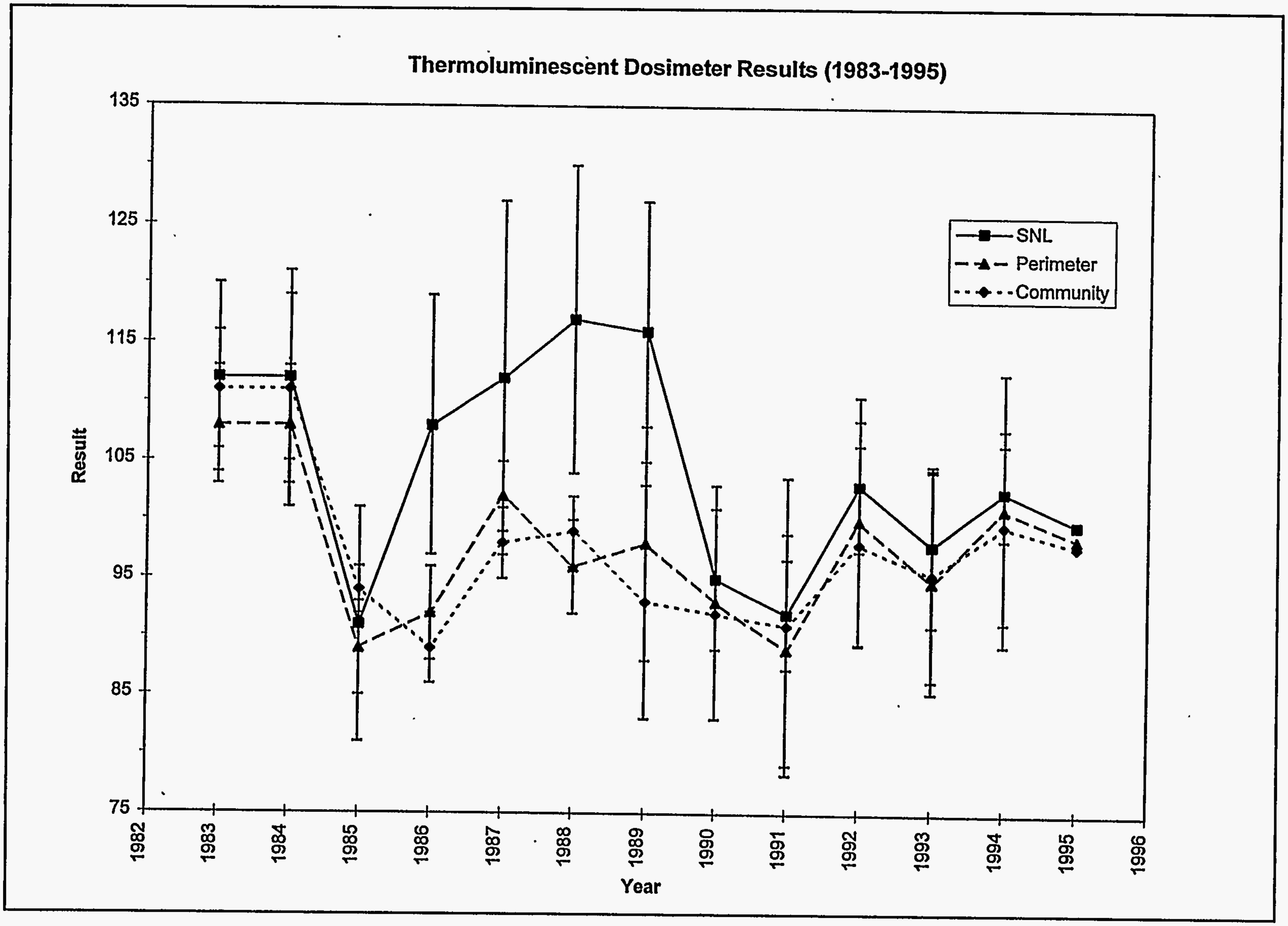

Figure 4-8. Mean thermoluminescent dosimeter (TLD) dose estimate by year.

cobalt (Co)	copper (Cu)	iron (Fe)
lead (Pb)	magnesium (Mg)	manganese (Mn)
nickel (Ni)	potassium (K)	silicon (Si)
silver (Ag)	strontium (Sr)	titanium (Ti)
vanadium (V)	zinc (Zn)	

As was done for radiological results, a trend comparison was performed to determine if concentrations were increasing for any on-site/perimeter location over the past several years. Next, metal concentrations from these locations were compared to community (background) concentrations. The same classification scheme used for radiological comparisons (Categories 1-4) was used for non-radiological results.

All soil and sediment samples were analyzed by EPA method 6010 A, "Inductively Coupled Plasma-Atomic Emission Spectroscopy (ICP-AES)." Samples were first prepared using EPA method 3050 A, which does not allow for complete dissolution and only provides a measure of the concentration of metals in soil that can be leached and remained dissolved in the digestion solution (Shyr et al. 1996).

There are numerous soil types on KAFB (USDA 1977) and composition and mineralogical differences among these different soil types are to be expected. Funding has not been available to match on-site, perimeter, and off-site sampling locations by soil type.

Aluminum, calcium, iron, magnesium, potassium, and silicon occur in abundance within the soil as naturally occurring components in the crystal structure of minerals (e.g., calcite, feldpars, quartz, and clays). They have a low health impact and no primary drinking water standards or RCRA toxicity characteristics have been established for these metals. For these reasons, the above metals are not discussed further within the context of this report. The data for individual sample locations are reported in the *1995 Environmental Surveillance Data Analysis Report* (Shyr et al. 1996).

4.5.1 Soil Results - Metals

Tables 4-11 and 4-12 provide summary statistics of soil samples. Qualitatively, on-site concentrations for all the metals except lead and titanium were lower than off-site values which also showed relatively larger variations among locations. Table 4-13 lists the categorization for metal analysis for on-site and perimeter locations. Only those metals that were classified as Category 1, Category 2, or Category 3 are listed. However, there were no Category 1 locations for any metals.

Table 4-11. Summary statistics for metal concentrations in soil, May 1995.

Metal	Units	Description	Count	Median	Mean	Stand Dev.	Range
Barium	mg/kg	SNL/NM	31	90.00	96.03	25.28	68 to 170
	mg/kg	Perimeter	14	103.00	113.21	35.26	64 to 190
	mg/kg	Off-site	6	170.00	163.33	44.12	110 to 230
Beryllium	mg/kg	SNL/NM	31	0.50*	0.55	0.14	0.5 to 1.1
	mg/kg	Perimeter	14	0.50*	0.53	0.07	0.5 to 0.7
	mg/kg	Off-site	6	0.65	0.62	0.10	0.5 to 0.7
Cadmium	mg/kg	SNL/NM	31	0.50*	0.59	0.30	0.5 to 1.9
	mg/kg	Perimeter	14	0.50*	0.50	0.00	0.5 to 0.5
	mg/kg	Off-site	6	0.50*	0.50	0.00	0.5 to 0.5
Chromium	mg/kg	SNL/NM	31	30.00	28.44	12.87	4.7 to 60
	mg/kg	Perimeter	14	20.50	23.57	8.35	12 to 39
	mg/kg	Off-site	6	28.50	28.50	9.09	17 to 42
Cobalt	mg/kg	SNL/NM	31	3.60	3.86	0.88	2.6 to 5.9
	mg/kg	Perimeter	14	4.85	5.13	1.99	2.6 to 8.8
	mg/kg	Off-site	6	5.75	5.45	2.34	2.4 to 8.7
Copper	mg/kg	SNL/NM	31	9.10	9.51	2.87	5.4 to 18
	mg/kg	Perimeter	14	11.00	10.74	3.35	5.2 to 18
	mg/kg	Off-site	6	14.00	17.15	10.96	5.9 to 33
Lead	mg/kg	SNL/NM	31	13.00	463.19	2512.33	5 to14000**
	mg/kg	Perimeter	14	11.00	12.71	4.01	8 to 19
	mg/kg	Off-site	6	14.00	21.83	20.88	5 to 62
Manganese	mg/kg	SNL/NM	31	170.00	182.90	50.41	110 to 320
	mg/kg	Perimeter	14	275.00	276.43	130.36	120 to 570
	mg/kg	Off-site	6	350.00	373.33	158.07	190 to 560
Nickel	mg/kg	SNL/NM	31	8.00	8.35	2.33	4 to 15
	mg/kg	Perimeter	14	8.50	8.29	2.67	4 to 12
	mg/kg	Off-site	6	11.50	11.00	6.00	4 to 20
Silver	mg/kg	SNL/NM	31	0.50*	0.51	0.02	0.5 to 0.6
	mg/kg	Perimeter	14	0.50*	0.53	0.07	0.5 to 0.7
	mg/kg	Off-site	6	0.50*	0.50	0.00	0.5 to 0.5
Strontium	mg/kg	SNL/NM	31	26.00	37.90	29.11	14 to 140
	mg/kg	Perimeter	14	35.50	60.21	71.73	12 to 290
	mg/kg	Off-site	6	75.50	86.00	51.53	33 to 180

Table 4-11. Summary statistics for metal concentrations in soil, May 1995 (Concluded).

Metal	Units	Description	Count	Median	Mean	Stand Dev.	Range
Titanium	mg/kg	SNL/NM	31	210.00	233.87	82.69	100 to 470
	mg/kg	Perimeter	14	240.00	271.43	147.80	100 to 560
	mg/kg	Off-site	6	104.50	111.50	23.81	82 to 140
Vanadium	mg/kg	SNL/NM	31	15.00	16.19	4.21	11 to 29
	mg/kg	Perimeter	14	17.00	18.71	6.22	9.9 to 32
	mg/kg	Off-site	6	22.50	20.17	6.18	12 to 27
Zinc	mg/kg	SNL/NM	31	31.00	33.94	10.87	20 to 72
	mg/kg	Perimeter	14	37.50	40.79	17.11	20 to 78
	mg/kg	Off-site	6	45.50	43.00	11.76	24 to 57

Note: * Analytical laboratory reported results at detection limit because results fell below the detection limit.
** The high lead concentration (14,000 ppm) at location 20 had a significant impact on the mean value. The mean for SNL/NM would be 11.97 if location 20 was excluded from analysis.

Table 4-12. Summary statistics for metal concentrations in soil, August 1995.

Metal	Units	Description	Count	Median	Mean	Stand Dev.	Range		
Barium	mg/kg	SNL/NM	31	79.00	87.90	25.45	58	to	160
	mg/kg	Perimeter	13	115.00	122.08	35.35	56	to	190
	mg/kg	Off-site	6	165.00	161.67	40.70	110	to	210
Beryllium	mg/kg	SNL/NM	31	0.50*	0.53	0.10	0.5	to	1.0
	mg/kg	Perimeter	13	0.50*	0.56	0.09	0.5	to	0.7
	mg/kg	Off-site	6	0.75	0.70	0.17	0.5	to	0.9
Cadmium	mg/kg	SNL/NM	31	0.50*	0.59	0.30	0.5	to	1.9
	mg/kg	Perimeter	13	0.50*	0.51	0.03	0.5	to	0.6
	mg/kg	Off-site	6	0.50*	0.50	0.00	0.5	to	0.5
Chromium	mg/kg	SNL/NM	31	15.00	16.06	3.36	8	to	23
	mg/kg	Perimeter	13	18.50	19.00	4.26	14	to	30
	mg/kg	Off-site	6	22.00	22.67	3.14	19	to	28
Cobalt	mg/kg	SNL/NM	31	3.95	4.24	0.95	2.9	to	6.4
	mg/kg	Perimeter	13	5.60	5.48	1.83	2.7	to	8.0
	mg/kg	Off-site	6	5.65	5.47	2.12	2.9	to	8.1
Copper	mg/kg	SNL/NM	31	8.00	8.74	2.24	6	to	13
	mg/kg	Perimeter	13	10.50	10.92	4.27	5	to	21
	mg/kg	Off-site	6	12.00	11.67	5.47	5	to	20
Lead	mg/kg	SNL/NM	31	11.00	18.32	41.21	7	to	240
	mg/kg	Perimeter	13	12.50	13.46	4.12	7	to	23
	mg/kg	Off-site	6	13.00	15.17	8.70	7	to	32
Manganese	mg/kg	SNL/NM	31	170.00	190.00	52.85	120	to	320
	mg/kg	Perimeter	13	290.00	287.69	137.00	130	to	590
	mg/kg	Off-site	6	395.00	370.00	124.58	200	to	500
Nickel	mg/kg	SNL/NM	31	7.00	8.16	2.25	6	to	15
	mg/kg	Perimeter	13	8.50	9.23	3.14	4	to	13
	mg/kg	Off-site	6	10.50	11.00	5.40	4	to	19
Silver	mg/kg	SNL/NM	31	0.50*	0.52	0.06	0.5	to	0.8
	mg/kg	Perimeter	13	0.50*	0.52	0.06	0.5	to	0.7
	mg/kg	Off-site	6	0.50*	0.50	0.00	0.5	to	0.5
Strontium	mg/kg	SNL/NM	31	25.50	36.42	29.95	13	to	150
	mg/kg	Perimeter	13	45.00	53.92	45.99	10	to	180
	mg/kg	Off-site	6	68.50	71.17	22.46	40	to	99

Table 4-12. Summary statistics for metal concentrations in soil, August 1995 (Concluded).

Metal	Units	Description	Count	Median	Mean	Stand Dev	Range		
Titanium	mg/kg	SNL/NM	31	140.00	191.10	126.60	58	to	460
	mg/kg	Perimeter	13	255.00	267.69	196.42	51	to	820
	mg/kg	Off-site	6	230.00	208.33	64.94	120	to	280
Vanadium	mg/kg	SNL/NM	31	17.50	18.65	5.33	12	to	29
	mg/kg	Perimeter	13	23.50	23.54	6.39	10	to	37
	mg/kg	Off-site	6	32.00	28.83	9.28	15	to	39
Zinc	mg/kg	SNL/NM	31	32.00	33.71	12.29	21	to	75
	mg/kg	Perimeter	13	40.50	41.46	15.50	20	to	74
	mg/kg	Off-site	6	39.00	37.17	11.62	23	to	51

Note: * Analytical laboratory reported results at detection limit because results fell below the detection limit.

Table 4-13 Discussion

Cadmium - Concentrations at location 20 were above the background concentration levels, but no trend was detected. The current concentration levels of cadmium (~2 ppm) were about an order of magnitude lower than the concentration that would show RCRA toxicity characteristics (Shyr et al. 1996). It should be noted that cadmium was below the detection limit for most locations. When a metal concentration was below the detection limit, the result was recorded by the analytical laboratory as at the detection limit. As a result, any deviation from the detection limit was detected as statistically significant. This example demonstrated the need of a closer examination of the data for an appropriate interpretation of "statistically significant" results.

Cobalt - An increasing trend for cobalt at on-site location 35 was observed, however, the concentration levels for cobalt are below background concentration levels. Monitoring at this location will continue. Perimeter location 64 was noted for having cobalt concentrations (along with manganese and zinc) above the background concentrations, but no trend was present. The maximum concentration level of cobalt (14 ppm) was at least two orders of magnitude lower than the proposed RCRA action limit (4800 ppm), and was within the range of U.S. Surface Soil background cobalt concentrations (3-50 ppm).

Table 4-13. Locations with metal concentrations classified by category. Note: barium, beryllium, nickel, silver, vanadium, strontium, and chromium did not occur in Category 1,2, or 3.

Radionuclide	Category	On-Site Location No.	Perimeter Locations No.
Cadmium	*Category 1*	-	-
	Category 2	20	-
	Category 3	-	-
Cobalt	*Category 1*	-	-
	Category 2	-	64
	Category 3	35	-
Copper	*Category 1*	-	-
	Category 2	-	-
	Category 3	2SE	-
Lead	*Category 1*	-	-
	Category 2	20	-
	Category 3	55	-
Manganese	*Category 1*	-	-
	Category 2	-	64
	Category 3	-	-
Titanium	*Category 1*	-	-
	Category 2	-	16
	Category 3	-	-
Zinc	*Category 1*	-	-
	Category 2	-	64
	Category 3	-	-

Copper - On-site location 2SE was the only location observed to have an increasing trend for copper concentrations, however, concentration levels were not statistically different from the background values: monitoring at this location will continue.

Lead - On-site location 55 showed an increasing trend for lead concentration, but was less than the background concentration levels. Monitoring at this location will continue. On-site location 20 had concentration levels greater than the community average over

Location 20 is adjacent to the skeet shooting range on KAFB. The higher concentrations of lead at this location are most likely due to the presence of lead shot within the sample. If that is the case, the high soil lead values might not meet the RCRA lead toxicity characteristics. Soils from this location may be analyzed by EPA method 1311, "Toxic Compound Leaching Procedure," to determine whether the lead value exceeds the maximum concentration specified in 40 CFR 261.24, Table 1.

Manganese and Zinc - Perimeter location 64 showed concentration levels for manganese and zinc above the community level, but did not show an increasing trend. The maximum concentrations for manganese and zinc at location 64, were 760 ppm and 110 ppm, respectively. Although these concentrations were higher than the community values, they were still within the range of U.S. Surface Soil background levels which is 20-3000 ppm for manganese, and 13-300 ppm for zinc (CRC 1992). The zinc concentration, 110 ppm, was at least two orders of magnitude lower than the proposed RCRA Subpart S action level –23,000 ppm; however, the manganese concentration, 760 ppm, was higher than the RCRA action level –400 ppm. Both manganese and zinc are considered non-carcinogenic. Monitoring at this location will continue.

Titanium - Concentrations were statistically higher at perimeter location 16 when compared to background concentrations. There was no increasing trend for titanium concentrations at this location or any other location. Although location 16 showed titanium concentrations higher than background, the concentrations were still in the range of U.S. Surface Soil concentrations (50–1000 ppm).

4.5.2 Sediment Results - Metals

Table 4-14 summarizes the data for sediment samples taken from the Rio Grande, Las Huertas Creek, and two arroyos in May and August of 1995. Trend analysis and comparison to off-site (background) locations was performed for all locations using data from 1993 to 1995. There were no Category 1 locations observed for sediment samples. Perimeter location 60 showed titanium concentrations above the off-site (background) values and was classified as Category 2. Perimeter location 73 had an increasing trend for lead concentration and was classified as Category 3. No other metal concentrations were observed as Category 2 or Category 3.

Location 73 is in the Tijeras Arroyo on the east side of KAFB where it enters the site perimeter; location 60 is at the perimeter on the west side of KAFB where the Tijeras

Table 4-14. Concentrations of metal in sediments. Samples, from May and August 1995.

Sediment Type	Location Description	Loc No.	Ba	Be	Cd	Cr	Co	Cu	Pb	Mn	Ni	Ag	Ti	V	Zn
								(mg/kg or ppm)							
May, 1995															
Tijeras Arroyo	Upgradient 1	65E	44.00	0.50	0.50	61.00	4.60	9.10	6.00	170.00	6.00	0.50	860.00	16.00	22.00
Tijeras Arroyo	Upgradient 2	73	55.00	0.50	0.50	20.00	4.60	8.00	7.00	200.00	4.00	0.50	500.00	13.00	26.00
Tijeras Arroyo	Mid-arroyo	74	140.00	0.50	0.50	34.00	5.30	7.30	10.00	220.00	6.00	0.50	660.00	30.00	26.00
Tijeras Arroyo	Downgradient	60	110.00	0.50	0.50	19.00	4.20	8.00	9.00	230.00	6.00	0.50	450.00	16.00	29.00
Arroyo del Coyote	Upgradient	79	89.00	0.50	0.50	42.00	2.80	7.60	7.00	250.00	10.00	0.50	59.00	13.00	28.00
Arroyo del Coyote	On-site	72	120.00	0.50	0.50	47.00	4.90	12.00	16.00	270.00	10.00	0.50	230.00	22.00	34.00
Arroyo del Coyote	Downgradient	75	39.00	0.50	0.50	30.00	4.10	8.20	5.00	190.00	8.00	0.50	430.00	15.00	22.00
River/Stream	River upgradient	8	200.00	0.50	0.50	36.00	3.60	8.30	7.00	180.00	5.00	0.50	160.00	15.00	25.00
River/Stream	Stream	68	350.00	0.50	0.50	28.00	2.80	5.70	8.00	410.00	9.00	0.50	160.00	13.00	29.00
River/Stream	River downgradient	11	180.00	0.50	0.50	56.00	3.50	7.30	7.00	250.00	7.00	0.50	140.00	19.00	26.00
August, 1995															
Tijeras Arroyo	Upgradient 1	65E	53.00	0.50	0.50	28.00	4.10	7.00	7.00	220.00	5.00	0.50	920.00	18.00	26.00
Tijeras Arroyo	Upgradient 2	73	47.00	0.50	0.60	21.00	5.10	8.00	7.00	200.00	4.00	0.50	620.00	18.00	25.00
Tijeras Arroyo	Mid-arroyo	74	190.00	0.50	0.50	20.00	5.80	11.00	10.00	260.00	7.00	0.60	650.00	28.00	34.00
Tijeras Arroyo	Downgradient	60	93.00	0.50	0.50	26.00	4.80	8.00	7.00	220.00	7.00	0.50	740.00	24.00	26.00
Arroyo del Coyote	Upgradient	79	100.00	0.50	0.60	14.00	2.90	6.00	7.00	290.00	8.00	0.50	44.00	13.00	31.00
Arroyo del Coyote	On-site	72	74.00	0.50	0.50	18.00	4.50	10.00	10.00	240.00	9.00	0.50	170.00	20.00	33.00
Arroyo del Coyote	Downgradient	75	38.00	0.50	0.50	20.00	4.40	9.00	5.00	200.00	7.00	0.50	440.00	20.00	22.00
River/Stream	River upgradient	8	160.00	0.50	0.50	33.00	4.40	11.00	31.00	260.00	8.00	0.50	260.00	21.00	36.00
River/Stream	Stream	68	180.00	0.70	0.50	36.00	5.30	10.00	12.00	330.00	12.00	0.50	340.00	28.00	35.00
River/Stream	River downgradient	11	180.00	0.50	0.50	22.00	3.10	6.00	6.00	170.00	5.00	0.50	190.00	19.00	25.00

Arroyo leaves the KAFB boundary, downgradient from SNL/NM. Data from 1993 to 1995 were used to determine if there was any statistically significant differences between upgradient and downgradient metal concentrations in the Tijeras Arroyo; the results showed no statistically significant difference (Shyr et al. 1996). Location 8 is on the Rio Grande upgradient of SNL/NM and Albuquerque; location 11 is on the river downgradient from the site. No statistically significant difference was detected based on the past 3 years of data.

4.5.3 Surface Water Results - Metals

Tables 4-15 and 4-16 summarize the data for surface water taken from three off-site locations, 8, 11, and 68, and one on-site location 33, in May and August 1995. Only 2 years of data (1994 and 1995) from surface waters were used for metal concentration analysis because the 1993 water samples were not analyzed for metals. Using the data from the past 2 years, no trend was detected.

Table 4-15. Concentrations of surface water metals, May 1995.

Analysis (Units)	Location Type	Loc No.	Total Water	Filtered Water	Suspended Solids
Barium (mg/L)	River upgradient	8	0.08	0.06	0.016
	River downgradient	11	0.09	0.06	0.014
	On-site	33	0.05	0.05	0.003
	Stream	68	0.12	0.09	0.013
Beryllium (mg/L)	River upgradient	8	0.005	0.005	0.000
	River downgradient	11	0.005	0.005	0.000
	On-site	33	0.006	0.005	0.000
	Stream	68	0.005	0.005	0.000
Cadmium (mg/L)	River upgradient	8	0.005*	0.005*	0.001
	River downgradient	11	0.005*	0.005*	0.000
	On-site	33	0.005*	0.005*	0.000
	Stream	68	0.005*	0.005*	0.001
Chromium (mg/L)	River upgradient	8	0.005*	0.005*	0.001
	River downgradient	11	0.005*	0.005*	0.001
	On-site	33	0.005*	0.005*	0.000
	Stream	68	0.005*	0.005*	0.001
Cobalt (mg/L)	River upgradient	8	0.005*	0.005*	0.010
	River downgradient	11	0.005*	0.005*	0.007
	On-site	33	0.007	0.009	0.003
	Stream	68	0.005*	0.005*	0.006
Copper (mg/L)	River upgradient	8	0.005	0.005	0.003
	River downgradient	11	0.005	0.005	0.002
	On-site	33	0.005	0.005	0.001
	Stream	68	0.005	0.005	0.002

Table 4-15. Concentrations of surface water metals, May 1995 (Concluded).

Analysis (Units)	Location Type	Loc No.	Total Water	Filtered Water	Suspended Solids
Lead (mg/L)	River upgradient	8	0.05*	0.05*	0.003*
	River downgradient	11	0.05*	0.05*	0.003*
	On-site	33	0.05*	0.05*	0.003*
	Stream	68	0.05*	0.05*	0.003*
Manganese (mg/L)	River upgradient	8	0.083	0.005*	0.053
	River downgradient	11	0.120	0.005*	0.047
	On-site	33	1.200	1.300	0.002
	Stream	68	0.043	0.005*	0.022
Nickel (mg/L)	River upgradient	8	0.02	0.02	0.001
	River downgradient	11	0.02	0.02	0.001
	On-site	33	0.03	0.04	0.001
	Stream	68	0.02	0.02	0.001
Silver (mg/L)	River upgradient	8	0.005*	0.005*	0.000*
	River downgradient	11	0.005*	0.005*	0.000*
	On-site	33	0.005*	0.005*	0.000*
	Stream	68	0.005*	0.005*	0.000*
Strontium (mg/L)	River upgradient	8	0.27	0.27	NA
	River downgradient	11	0.27	0.26	NA
	On-site	33	1.30	1.30	NA
	Stream	68	0.17	0.16	NA
Titanium (mg/L)	River upgradient	8	0.05	0.01*	NA
	River downgradient	11	0.07	0.01*	NA
	On-site	33	0.01	0.01*	NA
	Stream	68	0.05	0.01*	NA
Vanadium (mg/L)	River upgradient	8	0.006	0.005*	0.003
	River downgradient	11	0.009	0.005*	0.002
	On-site	33	0.005*	0.005*	0.000
	Stream	68	0.005*	0.005*	0.001
Zinc (mg/L)	River upgradient	8	0.010	0.005*	0.010
	River downgradient	11	0.013	0.005*	0.005
	On-site	33	0.051	0.056	0.001
	Stream	68	0.008	0.005*	0.004

Note: pCi/L = picocuries per liter; mg/L = milligrams per liter; pCi/mL = picocuries per milliliter; NA = filters were not analyzed for tritium. *Analytical laboratory reported results at detection limit because results fell below the detection limit.

Table 4-16. Concentrations of surface water metals, August 1995.

Analysis (Units)	Location Type	Loc No.	Total Water	Filtered Water	Suspended Solids
Barium	River upgradient	8	0.08	0.07	0.019
(mg/L)	River downgradient	11	0.08	0.07	0.016
	On-site	33	0.05	0.05	0.006
	Stream	68	NR	NR	NR
Beryllium	River upgradient	8	0.005	0.005	0.001
(mg/L)	River downgradient	11	0.005	0.005	0.001
	On-site	33	0.005	0.005	0.001
	Stream	68	NR	NR	NR
Cadmium	River upgradient	8	0.005*	0.005*	0.001
(mg/L)	River downgradient	11	0.005*	0.005*	0.001
	On-site	33	0.005*	0.005*	0.001
	Stream	68	NR	NR	NR
Chromium	River upgradient	8	0.005*	0.005*	0.001
(mg/L)	River downgradient	11	0.005*	0.005*	0.002
	On-site	33	0.005*	0.005*	0.001
	Stream	68	NR	NR	NR
Cobalt	River upgradient	8	0.005*	0.005*	0.001*
(mg/L)	River downgradient	11	0.005*	0.005*	0.001*
	On-site	33	0.007	0.007	0.001*
	Stream	68	NR	NR	NR
Copper	River upgradient	8	0.005	0.005	0.004
(mg/L)	River downgradient	11	0.005	0.005	0.004
	On-site	33	0.006	0.005	0.002
	Stream	68	NR	NR	NR
Lead	River upgradient	8	0.05*	0.05*	0.006*
(mg/L)	River downgradient	11	0.05*	0.05*	0.006*
	On-site	33	0.05*	0.05*	0.006*
	Stream	68	NR	NR	NR

Table 4-16. Concentrations of surface water metals, August 1995 (Concluded).

Analysis (Units)	Location Type	Loc No.	Total Water	Filtered Water	Suspended Solids
Manganese (mg/L)	River upgradient	8	0.075	0.005*	0.118
	River downgradient	11	0.058	0.009	0.076
	On-site	33	1.300	1.200	0.004
	Stream	68	NR	NR	NR
Nickel (mg/L)	River upgradient	8	0.02	0.02	0.002*
	River downgradient	11	0.02	0.02	0.002*
	On-site	33	0.02	0.02	0.002*
	Stream	68	NR	NR	NR
Silver (mg/L)	River upgradient	8	0.005*	0.005*	0.001*
	River downgradient	11	0.005*	0.005*	0.001*
	On-site	33	0.005*	0.005*	0.001*
	Stream	68	NR	NR	NR
Strontium (mg/L)	River upgradient	8	0.28	0.28	NA
	River downgradient	11	0.29	0.29	NA
	On-site	33	1.30	1.30	NA
	Stream	68	NR	NR	NA
Titanium (mg/L)	River upgradient	8	0.02	0.01*	NA
	River downgradient	11	0.02	0.01*	NA
	On-site	33	0.01*	0.01*	NA
	Stream	68	NR	NR	NA
Vanadium (mg/L)	River upgradient	8	0.005*	0.005*	0.002
	River downgradient	11	0.007	0.005*	0.002
	On-site	33	0.005*	0.005*	0.001
	Stream	68	NR	NR	NR
Zinc (mg/L)	River upgradient	8	0.005*	0.006	0.013
	River downgradient	11	0.007	0.006	0.011
	On-site	33	0.052	0.052	0.004
	Stream	68	NR	NR	NR

Note: pCi/L = picocuries per liter; mg/L = milligrams per liter; pCi/mL = picocuries per milliliter; NR = No results for location 68 in August 1995 because stream bed was dried up. *Analytical laboratory reported results at detection limit because results fell below the detection limit.

On-site location 33 at Coyote Springs was a Category 3 location with a few metal concentrations higher than the background (Table 4-17). The maximum concentration of strontium in water (1.4 mg/L) at location 33 was an order of magnitude lower than the RCRA proposed action level (21 mg/L). The maximum concentration of manganese in water (1.3 mg/L) at location 33 exceeded all Federal and state drinking water standards which range from 0.05 to 0.2 mg/L. This location is on-site and had controlled access and was posted as "Not a Drinking Water Source."

Table 4-17. Metals concentrations at on-site location 33 that were above off-site concentrations.

Metal	Total Water	Filtered Water	Suspended Solids
Manganese	✓	✓	-
Strontium	✓	✓	-

Data from 1994 and 1995 were used to determine whether there was a statistically significant difference between upgradient and downgradient metal concentrations in the Rio Grande. Location 8 is at the river upgradient of SNL/NM and Albuquerque; location 11 is downgradient, south of Albuquerque. The results showed no statistically significant difference (Shyr et al. 1996).

4.6 SUMMARY of PATHWAY ANALYSIS RESULTS

An analysis (Shyr and Haaker 1995) was performed during 1995 to identify pathways that may result in a dose to the public that are comparable to the dose reported for the most exposed individual (MEI) in Section 5.4.5 of this report. The dose to the MEI reported in Section 5.4.5 pertains only to air emissions from NESHAP permitted sources, and was calculated using an EPA prescribed model Clean Air Act Assessment Package - 1988 (CAP-88) (EPA 1991). In the analysis, the following pathways and receptors are considered:

- Doses that are not considered by CAP-88, but are related to accumulation of radionuclides deposited in soil from NESHAP permitted air emissions from facilities, such as doses from re-suspension, groundwater contamination, and storm water run-off.

- Dose to a worker at the City of Albuquerque Soil Amendment Facility (SAF) during year 21 of land farming operations. Evaluating the dose received during the twenty-first year of operation takes into account possible accumulation in the environment.

- Dose to a farmer using composted wastewater treatment sludge[1], as an annual soil amendment, during year 50 of use. Evaluating the dose received during the fiftieth year of operation takes into account possible accumulation in the environment.

- Dose resulting from the use of water from the Rio Grande for food crop irrigation down stream of the outfall from the City of Albuquerque Wastewater Treatment Plant.

- Ambient air concentrations of depleted uranium due to re-suspension from surface contaminated lands, based on isotopic data.[2]

A summary of this analysis is provided below.

1. **Non-CAP-88 Pathways:** The CAP-88 computer code (EPA 1991) was used to estimate the maximal annual radioactive material deposition rates based on 1994 NESHAP emissions data. From this result, estimates of concentrations in other environmental media were derived. The concentrations and resulting doses from re-suspension, groundwater contamination, and storm water run-off were very insignificant compared to the pathways for which CAP-88 calculates a dose to the MEI. CAP-88 considers doses due to ingestion, inhalation of airborne contaminants (other than re-suspended airborne contaminants) immersion in a radioactive plume, and settled radioactivity onto the ground surface.

   The concentrations that would build up in the soil over 50 years of emissions was estimated taking into account accumulation, uniform mixing within the upper 15 cm (6 in.) of soil, and radioactive decay. The estimated added-radioactivity concentrations in soil after 50 years were very low for all isotopes. The largest amount of added radioactivity was estimated to be 0.0008 pCi/g from tritium. The next largest amount of added radioactivity was estimated as (2×10^{13}) pCi/g from rubidium-86 (Rb-86). The amount of added radioactivity that could be present in run-off rainwater also was insignificant; the concentrations tended to be approximately one billion times smaller than the derived concentration guide (DCG) values established for water by DOE Order 5400.5. The radionuclide concentrations that would be present in re-suspended dust also were insignificant, even when the dust loading was conservatively assumed to be 0.1 milligrams per cubic meter (mg/m^3). The estimated airborne concentrations were about 1.0×10^{15} times smaller than the corresponding air DCG values. There would be no affect on ground water because of the low amounts of radioactive material per square meter

[1] Hereafter, simply referred to as compost or composted sludge.

[2] CAP-88 does not include doses from re-suspension of particles in air.

square meter that would accumulate over a period of 50 years from NESHAP permitted sources.

2. **The Soil Amendment Facility (SAF):** Doses to a worker at the City of Albuquerque SAF were estimated based on a site visit, and data provided by the City's consulting health physicist. A recent gamma spectroscopy analysis on a dried sludge sample indicated the presence of Cs-137 (0.03 pCi/g); Co-60 was not actually detected but was reported as "less than" 0.012 pCi/g [footnote[3]]. No other radioactive materials were detected in the sludge other than naturally occurring radioactive materials which might be expected in ordinary tap water. Cs-137 and Co-60 in the sludge could have come from one or many points in the city. However, these values provide a means to place an upper bound estimate on the dose received by a worker at the SAF from SNL-added radioactivity.

   RESRAD (RSIC 1994) an environmental radiation dosimetry computer code used extensively by NRC and DOE facilities, was used to compute doses taking into account exposure factors obtained from interviews with City of Albuquerque SAF supervisory staff. To allow for the possibility of accumulation in the areas land-farmed, the dose estimate represents the dose received by workers during the 21st year of operation of the SAF. It is assumed that the radionuclide concentration of the sludge remains constant for the next 21 years (Table 4-18). The estimated radiation dose received by a SAF worker from Cs-137 would be comparable to that received by the NESHAP most exposed individual, 0.001 millirems per year (mrem/yr). The dose received from Co-60 is estimated to be less than 0.0009 mrem/yr.

3. **Local Farmer:** An upper bound estimate of the dose to a hypothetical farmer from SNL activities was estimated from the dry sludge gamma spectroscopy data provided by the City of Albuquerque's consulting health physicist. Wastewater

Table 4-18. Soil activity after 21 years, estimated dose to workers on the 21st year of land-farming at SAF and estimated dose conversion factors.

Isotope	Dose on 21st year (mrem)	Soil Activity After 21 years (pCi/g)	Dose Conversion Factor for Soil, (mrem/yr ÷ pCi/g)
Co-60	<0.00089	<0.00094	0.95
Cs-137	0.001	0.00564	0.18

[3] Personal communication with Mark Miller, City of Albuquerque Liquid Waste Division, March 8, 1996.

treatment sludge is mixed with animal bedding straw or other cellulose rich wastes and composted at the City of Albuquerque SAF. The composted product is sold through nurseries as a soil conditioner. This material is assumed to contain one-half of the concentration of Cs-137 or Co-60 as the waste water treatment sludge. To allow for the possibility of accumulation in the areas farmed, it is assumed that the compost is applied annually for 50 years at a density of 1 kilogram per square meter per year (kg/m^2/yr). The annual dose to the hypothetical farmer, was estimated for the fiftieth year using RESRAD. The concentration in soil was estimated, taking into account the application rate, uniform mixing into the upper 15 cm (6 in.) of soil, a physical removal constant of 2 percent per year, and radioactive decay. One-half of the individual's meat, milk and vegetables were assumed to be raised in the amended soil. In addition, the individual was assumed to receive direct gamma radiation from the amended soil for 10 hours per week. The radiation dose received by the hypothetical farmer due to Cs-137 or Co-60 would be about one fourth the amount estimated for the SAF worker as shown in Table 4-19.

4. **River Irrigation:** A detailed analysis of the irrigation pathway was not performed. Instead, the importance of this pathway relative to composting was evaluated. Soil amendment with composted sludge at a rate of 1 kg/m^2 would add 65 picocuries per square meter (pCi/m^2) per year to soil for each pCi/L of added radioactivity discharged from SNL, if all of the material were precipitated from the wastewater effluent. If none of the radioactive material were removed from wastewater, and SNL discharges contained 1 pCi/L of added radioactivity, then river water below the treatment plant outfall would contain about 0.001 pCi/L of added radioactivity. Irrigation at a rate of 1000 liters per year per square meter (L/yr /m^2) would add 1 pCi/m^2 per year to soil. Based on these assumptions, irrigation with Rio Grande water causes about 2 percent of the dose that would result using composted sludge as a soil conditioner.

Table 4-19. Estimated soil concentrations resulting from use of compost as soil amendment for 50 years at the rate of 1 kg/m^2/yr) and the estimated dose conversion factors for a long-term agricultural user of compost derived from wastewater treatment sludge.

Isotope	Dose on 50th year, mrem	Soil Activity pCi/g	Dose Conversion Factor for soil (mrem/y) ÷ (pCi/g)
Co-60	<0.0002	<0.00018	1.16
Cs-137	0.00049	0.0014	0.35

5. **ER Site Fugitive Dust:** The potential dose from the re-suspension of depleted uranium from surface contaminated lands (ER sites) on KAFB was evaluated. Depleted uranium is the principal radiological surface soil contaminant at SNL. During 1995, air samples were collected and composited by season and location. The locations selected included TA-II, the Kirtland Underground Munitions Storage Complex (KUMSC) and the chemical waste landfill (CWL). The resulting 12 composite samples were analyzed by alpha spectroscopy. For each sample, the ratio of U-234/U238 was 1.0, within experimental error, as would be expected for naturally occurring uranium. In addition, Th-230 and Ra-226, were also present on the air filters in approximately the concentrations expected for natural uranium. To summarize, isotopic air sample data on seasonal composite samples supports the conclusion that the airborne uranium detected during PM_{10} air sampling (airborne particulate matter $\leq$10 microns (µm) is naturally occurring and is not due to SNL-added radioactivity to the environment.

In summary, it appears that the most important pathway for radiation exposure of the public to SNL-added radioactivity to the environment is due to atmospheric releases from sources regulated under NESHAP regulations, which for 1995 was 8.5×10^{-4} mrem/yr. The dose to a worker at the City's SAF, from traces of Cs-137 present in wastewater treatment sludge, may approach 0.001 mrem/yr after 21 years of land-farming assuming emission rates remain constant. This value is comparable to the dose calculated from SNL/NM NESHAP emissions. However, it is uncertain just how much of the Cs-137 present at the SAF is due to SNL wastewater emissions. Even when allowing for accumulation over 50 years, the dose to a farmer from composting is unlikely to exceed 8.5×10^{-4} mrem per year based on Cs-137 concentrations reported in waste water treatment sludge. It is evident that the doses due to accessory pathways related to NESHAP emissions (re-suspension, groundwater contamination, and storm water run-off) would be many orders of magnitude smaller than the dose of 8.5×10^{-4} mrem/yr already assigned to the most exposed individual (MEI). Finally, during 1995 the dose to the public, due to re-suspension of depleted uranium from surface contaminated ER sites is insignificant, as no indications of depleted uranium have been detected on air sample composites analyzed by alpha spectroscopy.

5.0 Air Quality Surveillance & Emissions Monitoring

Air quality at SNL/NM is assessed for both radiological and non-radiological pollutants by direct monitoring of air emissions (e.g., stacks, vents, and diffuse sources) and surveillance of the ambient air. SNL/NM complies with local, state, and Federal regulations in accordance with the goals of the Clean Air Act (CAA) and Clean Air Act Amendments (CAAA).

5.1 Meteorological Monitoring Program

The Meteorological Monitoring Program at SNL/NM commenced operations on January 3, 1994. This program is integral to compliance with 40 CFR 61—National Emission Standards for Hazardous Air Pollutants (NESHAP), DOE Orders 5400.1 (DOE 1988a), 5400.5 (DOE 1990a), and 5500.3 (DOE 1991a), and DOE guidelines (DOE 1991b). Meteorological data generated is consistent with program guidelines for regulatory modeling applications. The meteorological monitoring program is one of two programs that constitutes the Clean Air Network (CAN). The other half of the CAN is the Ambient Air Surveillance Program which is discussed in Section 5.2.

The main objective of the program is to provide data representative of the meteorology at SNL/NM for dose calculations, as required (see Section 5.4.3). The data are also available for use in emergency response in the event of an unplanned release of any hazardous material. The program includes an eight-tower meteorological monitoring network which consists of six 10-meter (m) towers, one 60-meter tower, and one 50-meter tower. All towers are instrumented at the 3-meter and 10-meter levels. Instrumentation has also been installed at the top of the two taller towers. Figure 5-1 shows the tower locations.

The meteorological variables measured at all tower levels include wind speed and direction, the standard deviation of the horizontal wind speed (sigma theta), and temperature. Relative humidity is measured at all towers at the 3-meter level. There are also two atmospheric pressure sensors and three rain gauges in the meteorological network; barometric pressure is measured at towers A21 and A36, and rain gauges are located at SC1, A36, and A21.

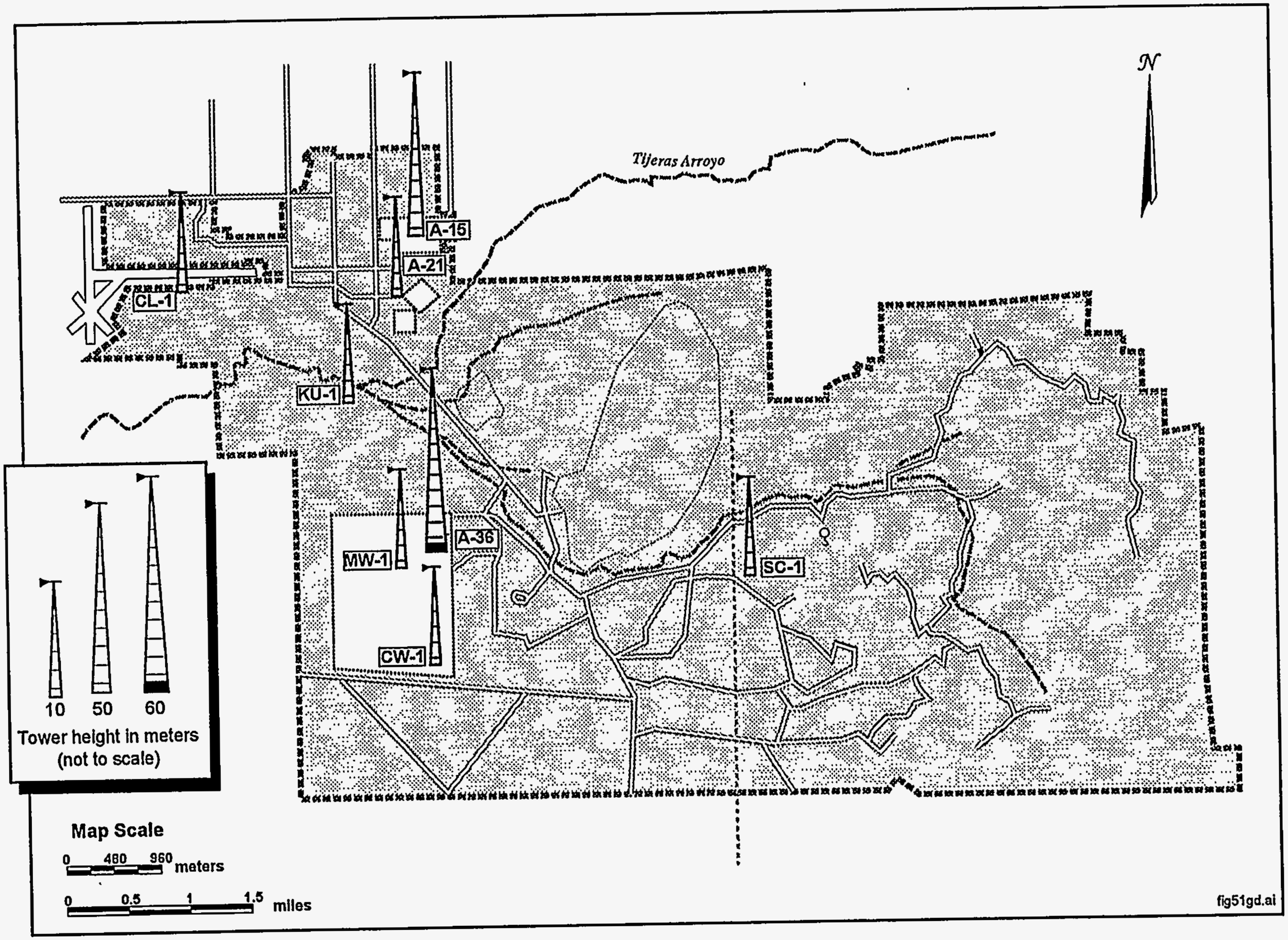

Figure 5-1. Meteorological monitoring station locations on the SNL/NM-KAFB site. Eight towers were in operation in 1995.

5.1.1 Meteorological Monitoring Results

Due to its central geographic position and the availability of data at all three of its instrument levels (3-m, 10-m, and 60-m), the A36 meteorological tower has been designated as the official tower to describe general meteorology at the SNL/NM site. The A15 tower (50-m), although closer to the most populous part of SNL/NM, shows microscale urbanization effects not seen at the rest of the meteorological tower sites. Table 5-1 lists the annual climatic summary developed with information from tower A36. Figure 5-2 portrays some statistics for other network locations.

In general, the annual statistics for each of the towers are similar; however, daily meteorology at each site, which can effect transport and dispersion of pollutants, varies considerably across the network. For example, daily average wind speeds varied up to 3.4 meters per second (m/s) while wind direction variability can differ up to 180 degrees during certain times of the day. Another example of the variability can be seen by looking at the daily maximum wind speeds. Maximum wind speeds across SNL/NM vary routinely during the thunderstorm season. Maximum wind speeds recorded during a thunderstorm in September 1995 ranged between 19.65 and 30.05 m/s.

Temperature extremes for 1995 ranged from -10.3 °C to 38.7 °C across the network. Precipitation was less than the climatic normal for the area, ranging from 14.27 centimeters (cm) to 19.71 cm. The maximum variability in rainfall between stations (when all three stations accumulated precipitation) occurred when a 1.60-cm difference was recorded during a September thunderstorm.

Wind Roses

Figure 5-3 portrays annual wind roses for three locations across SNL/NM. A wind rose is a graphical presentation of wind speed and direction frequency distribution. Wind direction is the true bearing when facing the wind (the direction from which the wind is blowing). As shown in the figures, wind directions and speeds vary considerably across the SNL/NM site. The annual wind frequency distribution for tower A15 shows a different pattern, with the greatest direction frequency from the east. The annual frequency distribution data mask the diurnal pattern of wind flow common through many areas of the SNL/NM site. Figure 5-4 shows the day and night wind frequency distributions for the A36 tower.

In general, areas closer to the mountains or canyons experience greater frequency of winds coming from the easterly directions (northeast through southeast) at night. Daytime wind patterns are not as pronounced but generally flow toward the mountains or channel into the canyons. In most areas, the nighttime wind direction frequency produces the maximum annual direction frequency.

Table 5-1. Annual climatic summary (1995) from Tower A36.

Month*	Average Temperature (°C)	Maximum Temperature (°C)	Average Temperature (°C)	Minimum RH (%)	Average Wind (m/s)	Maximum Wind (m/s)	Average Rain (cm)	Maximum 24-hr (cm)	Pressure (mb)
1995									
Jan	3.28	13.41	-7.35	60.10	3.05	18.05	1.32	0.99	837.9
Feb (98.9%)	9.04	20.65	-2.86	47.28	3.50	19.65	1.50	1.14	837.9
Mar	9.55	24.96	-4.46	44.18	4.12	22.05	0.53	0.23	834.5
Apr	11.39	25.87	-1.77	37.48	4.23	21.25	1.17	0.56	831.2
May (77.7%)	16.35	29.33	4.95	34.06	4.79	24.45	0.41	0.18	829.6
Jun (99.0%)	22.46	34.64	7.80	28.04	4.54	26.85	0.05	0.05	831.6
Jul (97.4%0	25.54	38.41	11.49	28.75	3.77	22.85	2.41	2.36	833.9
Aug	24.82	35.95	15.65	48.05	3.36	18.85	3.02	1.42	833.1
Sept	20.14	34.07	3.45	48.50	3.57	19.65	4.45	1.73	835.6
Oct	15.66	26.75	-0.43	27.53	3.10	20.45	0.00	0.00	835.8
Nov	10.40	22.48	-4.67	42.79	3.11	23.65	0.23	0.13	838.8
Dec (99.4%)	5.22	19.49	-9.74	50.28	2.67	26.85	0.18	0.10	838.2
Annual Averages	14.49			41.42	3.65	22.05	15.27		834.8
Annual Extremes		38.41	-9.74			26.85		2.36	

Note: °C = Celsius degree; RH = relative humidity; m/s = meters per second; cm = centimeter; mb = millibars.

*Monthly data recovery is 100% except where noted in parentheses.

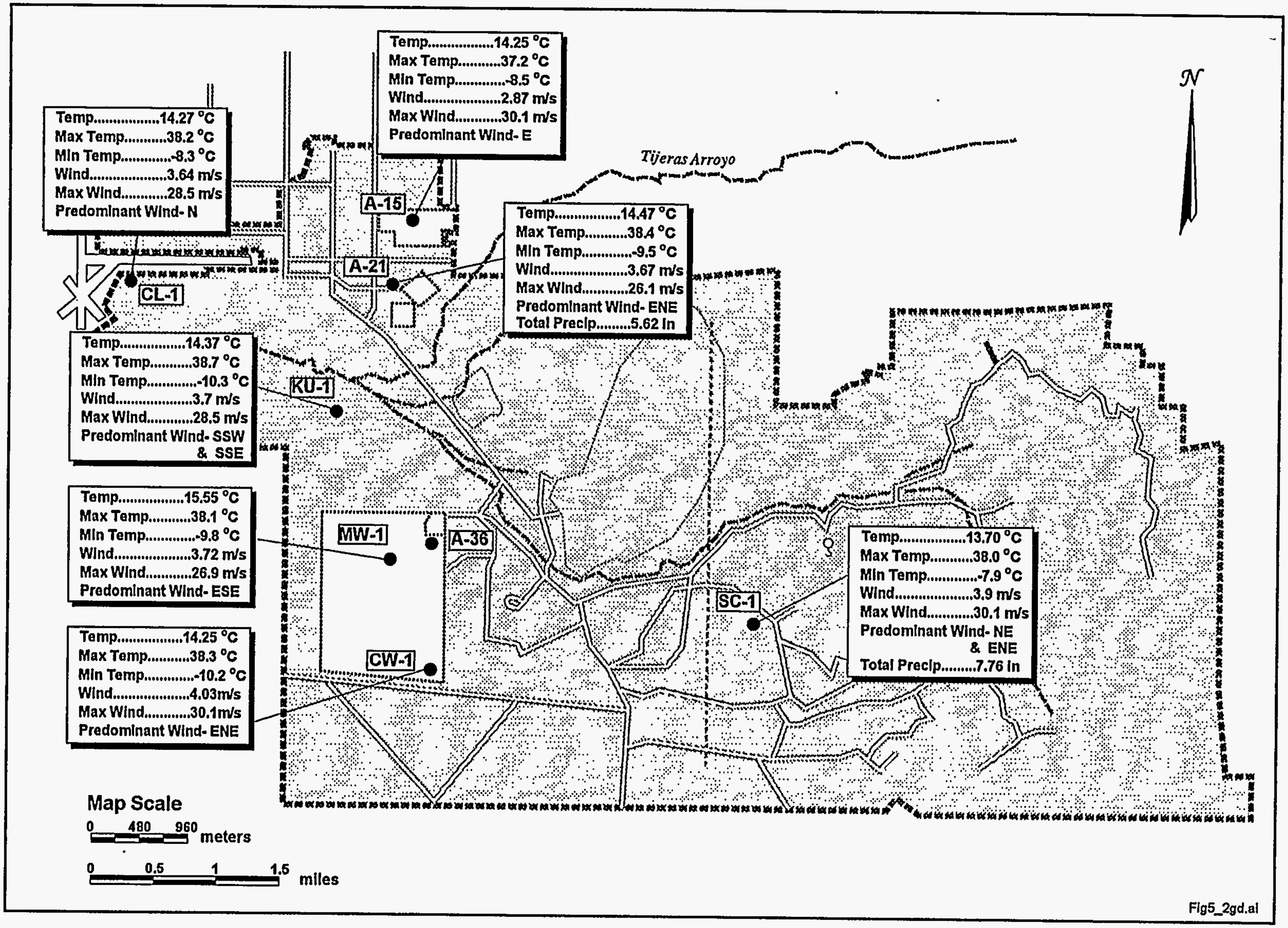

Figure 5-2. Summary of selected climatological information across the CAN.

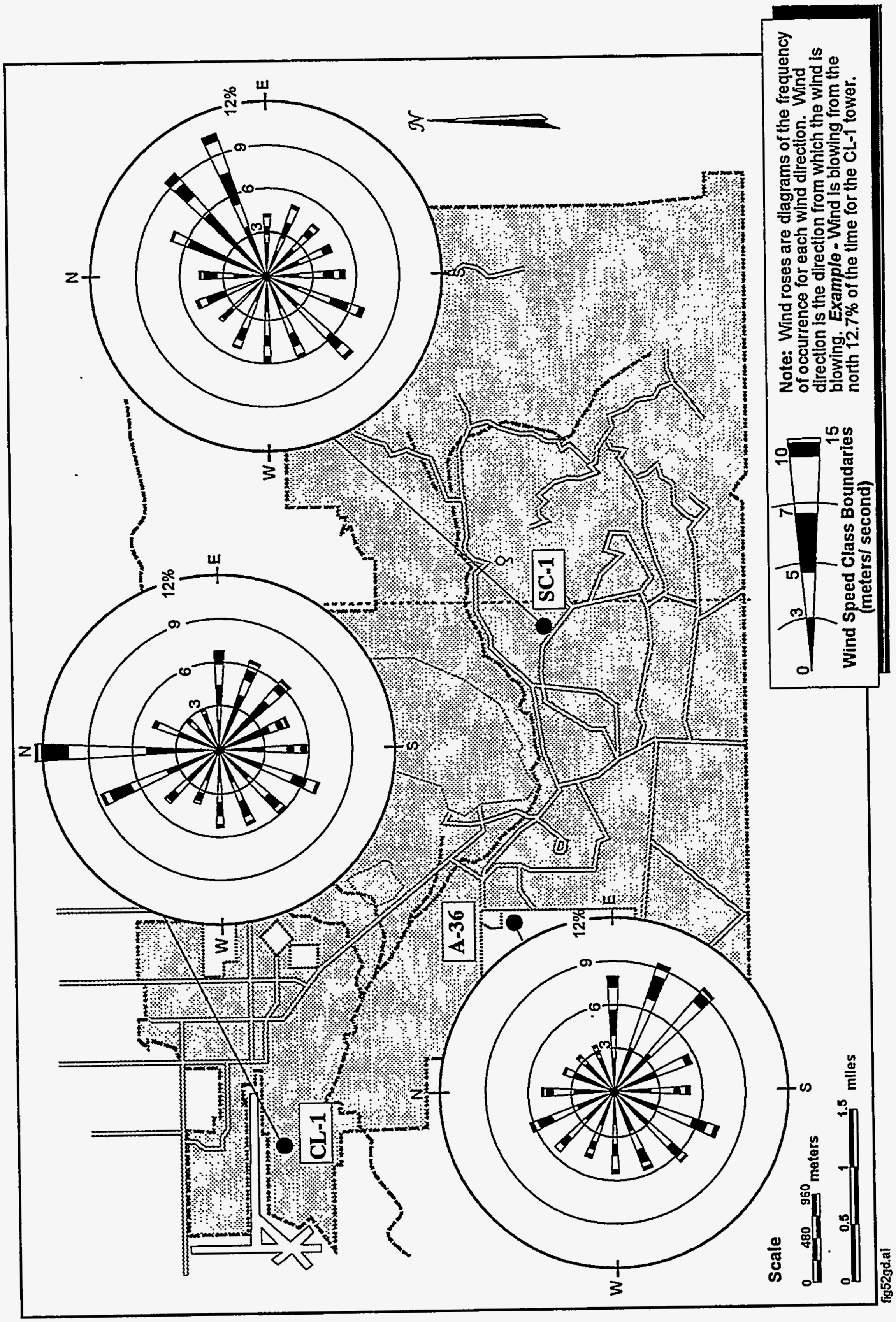

Figure 5-3. Annual wind roses for towers Cl-1, A-36, and SC-1.

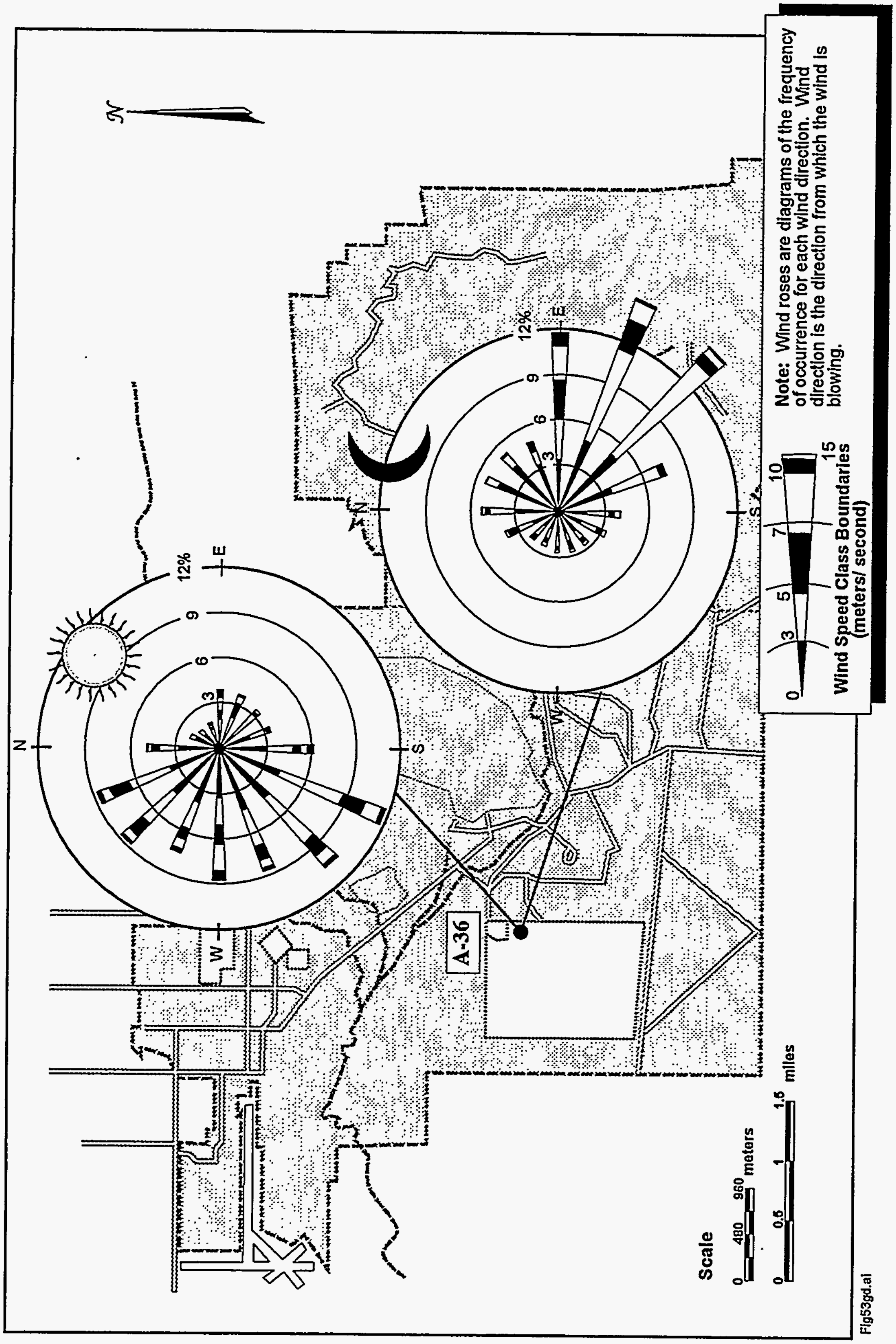

Figure 5-4. Annual wind roses for daytime and nighttime wind frequency at the A-36 tower.

A comparison of the A15 tower wind-speed data with the rest of the network towers reveals the effects buildings have on wind speed. The A15 tower average monthly wind speed was consistently the lowest recorded across the network. The greatest frequency of calm conditions were recorded at this site, but the highest monthly maximum winds were also found at the A15 location due to winds channeling down from Tijeras Canyon.

Uses for Meteorological Data

Meteorological data are used in atmospheric dispersion modeling. Pasquill-Gifford stability classes are calculated for use in the atmospheric dispersion estimates. Stability classes for tower data were calculated using the sigma theta technique (EPA 1987), which categorizes the stability class as a function of standard deviation of horizontal wind direction and mean horizontal wind speed. Stability classes range from extremely unstable (A) to moderately stable (F). These classes are used in modeling to estimate how much a plume will spread over time and space. In general, the more stable the atmosphere is, the less potential for plume spread, creating higher plume concentrations. Table 5-2 shows the percentage occurrence of stability classes at A36. When wind speeds are greater than 6.0 m/s, the stability class defaults to D regardless of the sigma theta value. The wind speed distribution is the major cause of the high percentage of D stability classes.

Table 5-2. Tower A36 stability class frequency distribution.

Stability Class	Atmospheric Description	Percent Occurrence
A	Extremely Unstable	12.6 %
B	Unstable	8.1%
C	Slightly unstable	9.7%
D	Neutral	43.2%
E	Slightly stable	18.3%
F	Moderately stable	8.0%

Note: Stability class variability across the network was generally within 5% of tower A36 class values except for two notable locations. At SC1 moderately stable conditions (F) occurred 18.2% of the time. At A15 stability varied markedly from extremely unstable (A), neutral (D), and moderately stable (F) conditions. The class percentage occurrences for A15 were, 20.1%, 26.7% and 21.6%, respectively. Dispersion of pollutants will vary between A36 and A15 both in modeled and actual scenarios based on the wind and stability variations between the two sites.

5.2 AMBIENT AIR SURVEILLANCE PROGRAM

The current ambient air surveillance program at SNL/NM commenced operations January 3, 1994. The ambient air surveillance program is one of two programs that constitute the Clean Air Network (CAN). This program is integral to compliance with 40 CFR 50, National Ambient Air Quality Standards (NAAQS), DOE Orders 5400.1 and 5400.5, and follows DOE guidelines outlined in DOE/EH-0173T (DOE 1991b). The program also follows 40 CFR 58, Ambient Air Quality Surveillance to ensure that data meet the requirements dictated for state monitoring programs.

The main objective of SNL/NM's ambient air surveillance program is the collection of data to establish background concentration levels for pollutants of concern, show compliance with the NAAQS and local ambient air quality standards, and evaluate effects of laboratory emissions on the public and the environment. The network includes one criteria pollutant monitoring station (CPMS), seven particulate matter (PM) monitoring stations, and four volatile organic compound (VOC) monitoring locations. An eighth PM monitor is collocated at station PVPM. Figure 5-5 shows ambient air monitoring station locations. The CPMS is used to perform continuous monitoring of sulfur dioxide (SO_2), carbon monoxide (CO), nitrous oxides (NO_X) and ozone (O_3). The PM monitors collect data on matter with a diameter equal to or less than 10 microns (PM_{10}). The PM_{10} sampling schedule is consistent with the National Air Sampling Program. The sampling frequency for the PM monitors is a 24-hour sample, starting and ending at midnight, every sixth day. VOCs are sampled once a month for a 24-hour period.

5.2.1 Ambient Air Monitoring Results

Criteria Pollutants

The automated CPMS system compiles gaseous criteria pollutant information in hourly averages. Data recovery for 1995 was 94.8 percent. Table 5-3 lists the state, and Federal air quality standards and monitored results. Federal annual standards cannot be violated, but short-term standards may be exceeded once a year. State standards represent objectives to preserve air resources, and may be exceeded due to meteorological conditions, for short periods of time. This was the case in late October 1995, when state standards were exceeded three times over a 36-hour period.

Particulate Matter - PM_{10}

PM_{10} concentrations were low except for several sampling days in June when dry, windy weather aided the production of airborne dust. A comparison of PM monitoring locations showed the highest 24-hr particulate loading occurred at station MWPME, during a time of increased activity on the dirt road just west of the sampling station.

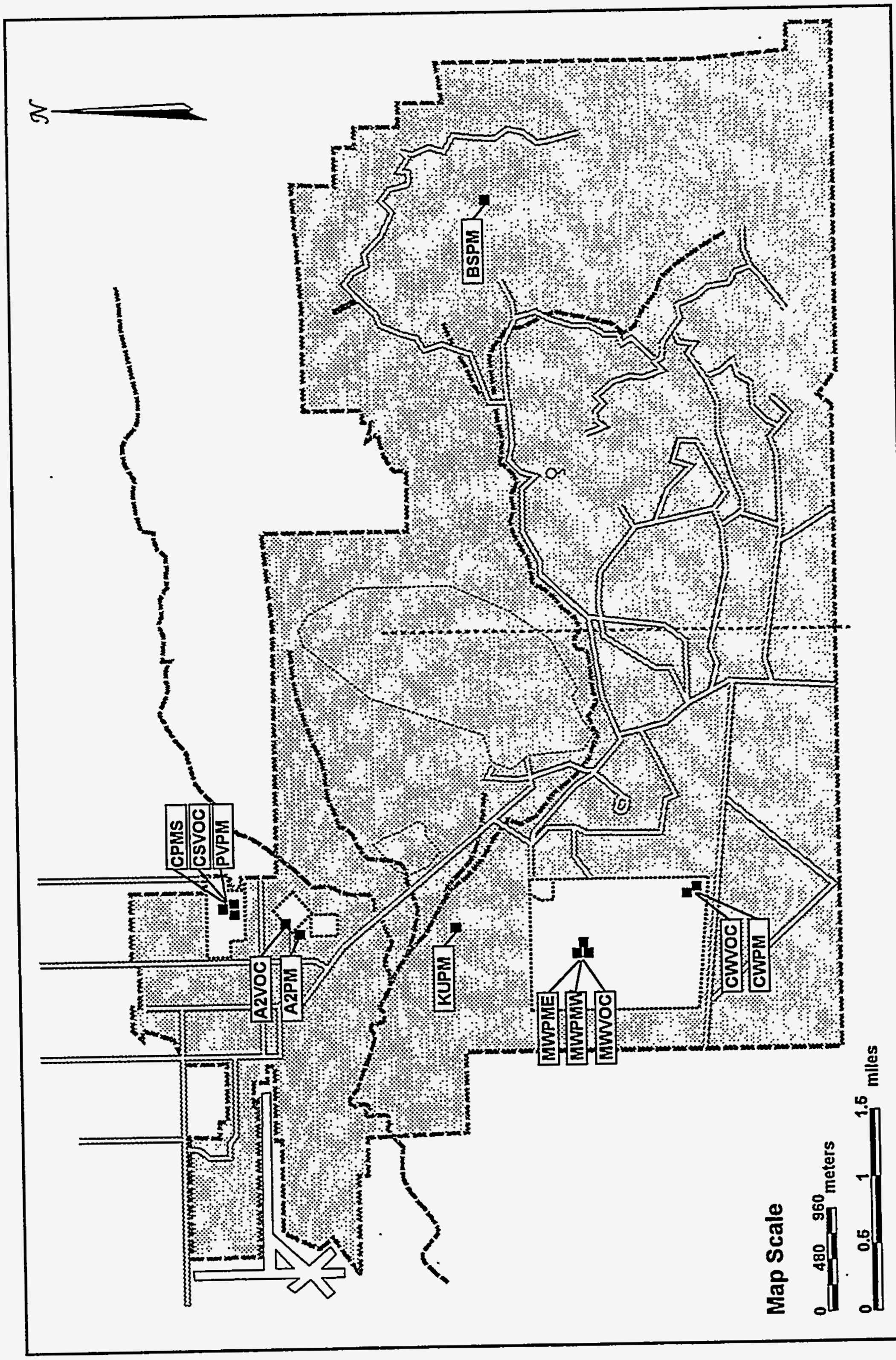

Figure 5-5. Ambient air monitoring station locations on the SNL/NM-KAFB site.

Table 5-3. Criteria pollutant standards and SNL/NM monitoring results.

Pollutant	Averaging Time	Unit	NMAQS†	NAAQS‡	Measured Concentrations
Carbon Monoxide	1 hour	ppm	13.1	35	15.25
	8 hours	ppm	8.7	9	4.80
	Annual	ppm			0.80
Nitrogen Dioxide	24 hours	ppm	0.10		0.033
	Annual	ppm	0.05		0.013
Nitrogen Oxides	Annual	ppm		0.053	0.023
Sulfur Dioxide	3 hours	ppm		0.50	0.031
	24 hours	ppm	0.10	0.14§	0.003
	Annual	ppm	0.02	0.03§	0.002
Ozone (photo chemical oxidants)	1 hour	ppm	(0.06)	0.12	0.093
PM_{10}	24 hours	$\mu g/m^3$	150	150	89*
	Annual	$\mu g/m^3$	60	50	19.49*
Total Suspended Particulates	7 days	$\mu g/m^3$	110		NA
	30 days	$\mu g/m^3$	90		NA
Lead (heavy metals)	30 days	$\mu g/m^3$	(10)		0.0058
	Any quarter	$\mu g/m^3$		1.5	0.0023

Note: ppm = parts per million; PM_{10} = particulate matter (diameter equal to or less than 10 microns); $\mu g/m^3$ micrograms per cubic meter; NA = not available.

*At the MWPME site.

†NMAQS = New Mexico Air Quality Standards.

‡NAAQS = National Ambient Air Quality Standards.

§Standards are defined in $\mu g/m^3$ and converted.

The PM_{10} filters were grouped into monthly composites for the analyses listed in Table 5-4. Analyses are conducted by an off-site laboratory which uses EPA approved analytical methods. Monthly composites varied from four to six filters per month throughout 1995, dependent upon the sampling schedule.

Table 5-4. PM_{10} sample analyses conducted in 1995.

Site	ICP-20 Metals	Total Uranium	Gamma Spec	Gross Alpha	Gross Beta	Lead
PVPM1	✓		✓	✓	✓	
PVPM2	✓		✓	✓	✓	
CPMS						✓
A2PM	✓		✓	✓	✓	
KUPM	✓	✓	✓	✓	✓	
MWPME	✓	✓	✓	✓	✓	
MWPMW	✓	✓	✓	✓	✓	
CWPM	✓		✓	✓	✓	

Note: PM_{10} = particulate matter (diameter equal to or less than 10 microns);
ICP = Inductively Coupled Plasma (method).

Figure 5-6 depicts the average concentrations of metals in micrograms per cubic meter (ug/m^3) for each sampling location. As can be seen from the figure, most metals were found in trace amounts. The figure includes eight metals for which results were reported at the analytical detection limit. (In metals analysis, if an analyte is below the analytical method detection limit, the result is reported as *at the detection limit.*) The metals at the detection limits were: arsenic (As), beryllium (Be), cadmium (Cd), cobalt (Co), molybdenum (Mo), nickel (Ni), selenium (Se), and titanium (Ti). This represents approximately 35 percent of the analytical results. Occasionally, Silver (Ag) was detected at levels just above the detection limits. Metals such as aluminum (Al), sodium (Na), calcium (Ca), iron (Fe), potassium (K), magnesium (Mg), and silica (Si) constituted the bulk of the particulate matter collected on the filters; these are also the metal constituents found in common minerals for soils on the site.

Figure 5-7 presents the radiochemistry screening results in picocuries per cubic meter (pCi/m^3) of the particulate matter (except U is measured in micrograms per cubic meter [ug/m^3]). As can been seen from both Figure 5-6 and 5-7, concentrations seem consistent across the whole network. An analysis of variance was performed on the data to determine if concentrations of any analyte were statistically and significantly different for any site.

Results indicated that out of all the analytes, only copper (Cu) showed a significant difference between sites. Copper results were higher at A2PM and KUPM (not apparent

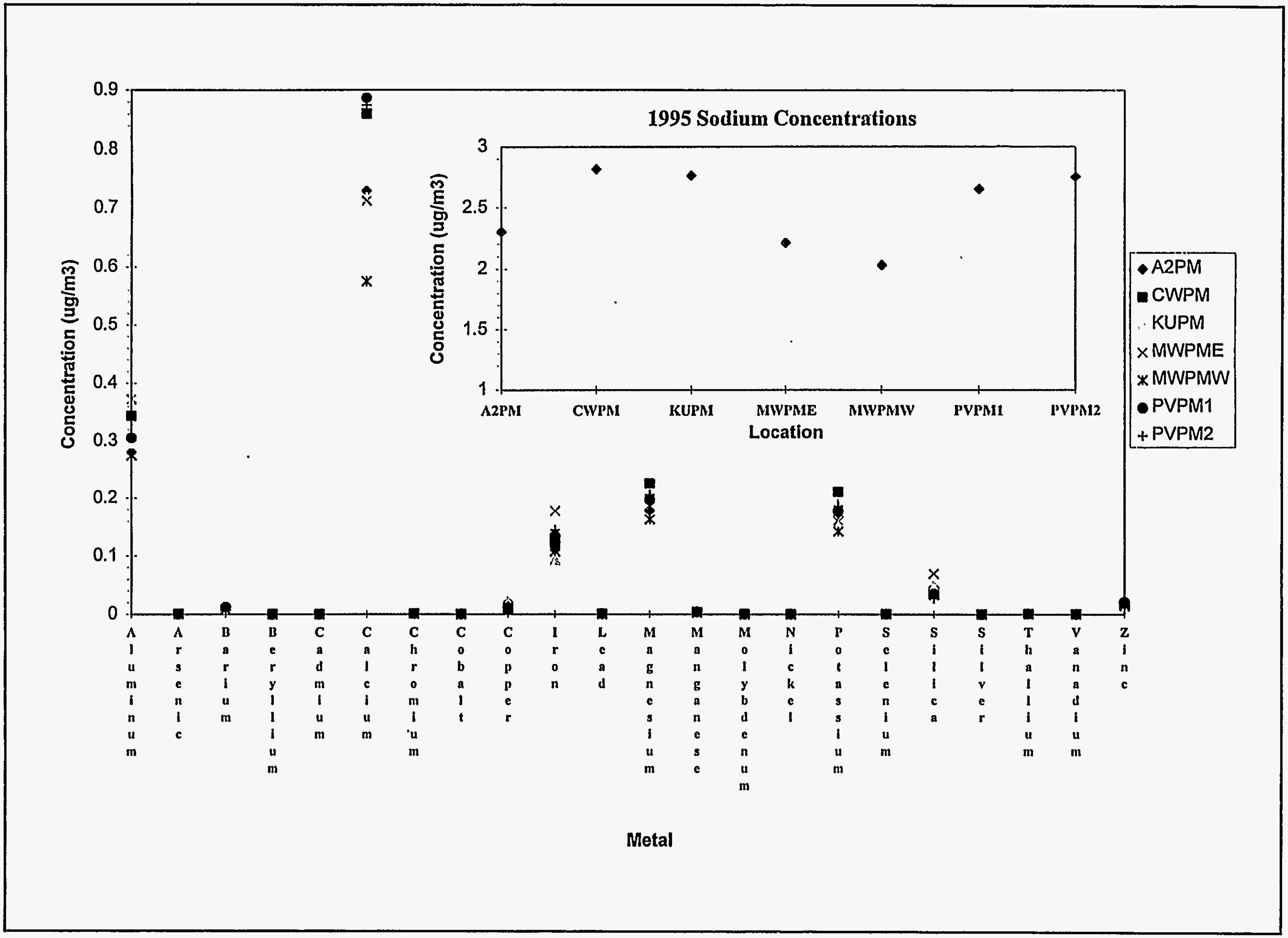

Figure 5-6. PM_{10} concentrations for metals.

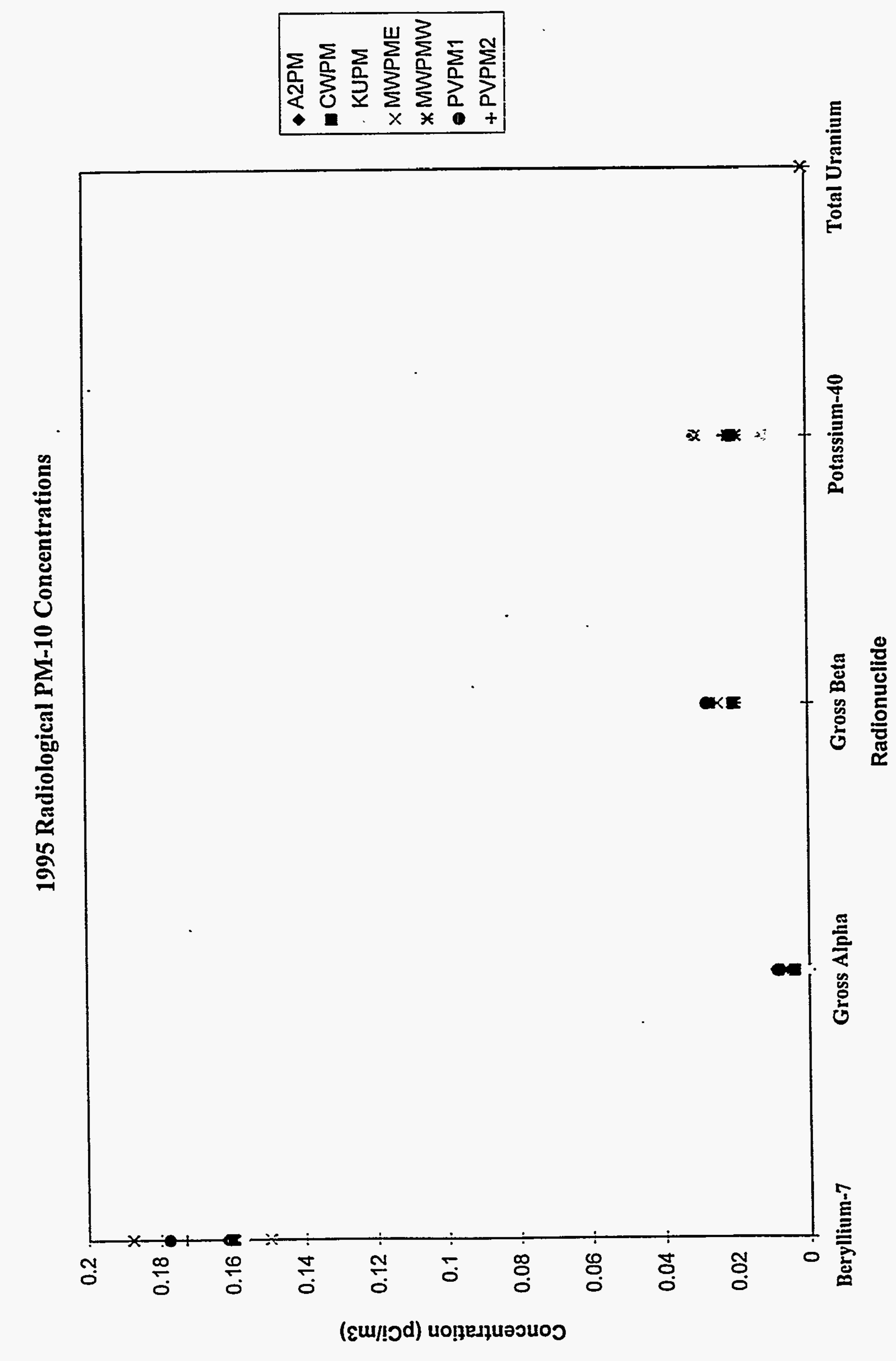

Figure 5-7. PM_{10} concentrations for radionuclides.

from Figure 5-6). Concentrations at these two sites, 0.0196 and 0.0213 ug/m^3 respectively, were 1.7 to 1.8 times higher than the average for the other sites (0.0114 ug/m^3). Soil analysis results from the report *Background Concentrations of Constituents of Concern to SNL/NM Environmental Restoration Program* (IT 1996) indicate that the highest concentrations of copper found at SNL/NM are found in soils in close proximity to these two sampling locations; soils in the geochemically derived Tijeras Area Group (north central portion of KAFB). Meteorological data show that winds at the PM_{10} sampling locations can come from this higher copper source region. The PM_{10} analytical results are generally consistent with metals found in soil analyses at SNL/NM.

Volatile Organic Compounds

Data recovery for the 1995 VOC sampling program was 96 percent. Two samples were invalidated due to canister vacuums reaching ambient pressure conditions, thereby making the volume of air sampled unknown. VOC samples were analyzed for 25 species of VOCs and total non-methane hydrocarbons (TNMHC). Table 5-5 lists the number of valid samples taken and the number of detections or "hits" of the specific compound. Only the analytes that were found are listed in the Table.

It can be inferred from Table 5-5 that samples taken at the CPMS generally exhibit a greater percentage of "hits" than the other sites. The CPMS site is in the northern part of Technical Area I (TA-I), near a busy intersection and across the street from the motor pool where vehicle maintenance is performed. Due to the activity in the area, this site should generally have a greater frequency and quantity of trace concentrations of pollutants. Figure 5-8 shows the annual average concentrations in parts per billion by volume (ppbv) of the hits recorded in Table 5-5. As can be seen from incorporating Table 5-5 results into the figure, some values are averages of only one to three occurrences, while other results are based on a much greater frequency of occurrence. This fact must be taken into account while interpreting results in VOC concentrations across the SNL/NM site.

Table 5-6 lists the average of TNMHC for the four sites. In general, concentrations of most VOCs are low. However, two average concentrations found at the Mixed Waste Landfill (MWL) are further discussed below and need additional explanation, as they seem inconsistent with other results. Figure 5-8 shows the average concentration of 1,1,1,Trichloroethane (1,1,1-TCA) as 53.30 ppbv. Concentrations of 1,1,1-TCA had not been detected at the MWL until April 1995 and increased steadily for several months after exploratory drilling for landfill characterization around the periphery of the landfill was conducted during May. While concentrations of this compound averaged over two orders of magnitude higher than other sampling locations, the maximum concentration recorded over a 24-hour period was 0.242 parts per million (ppm) (242 parts per billion [ppb]). The published time weighted average (TWA) for this compound is 350 ppm. The TWA is the time-weighted average concentration for a normal 8-hour workday and a 40-hour workweek, to which nearly all workers may be repeatedly exposed, without adverse effects. While the TWA is not a standard, it is used here as a reference to show

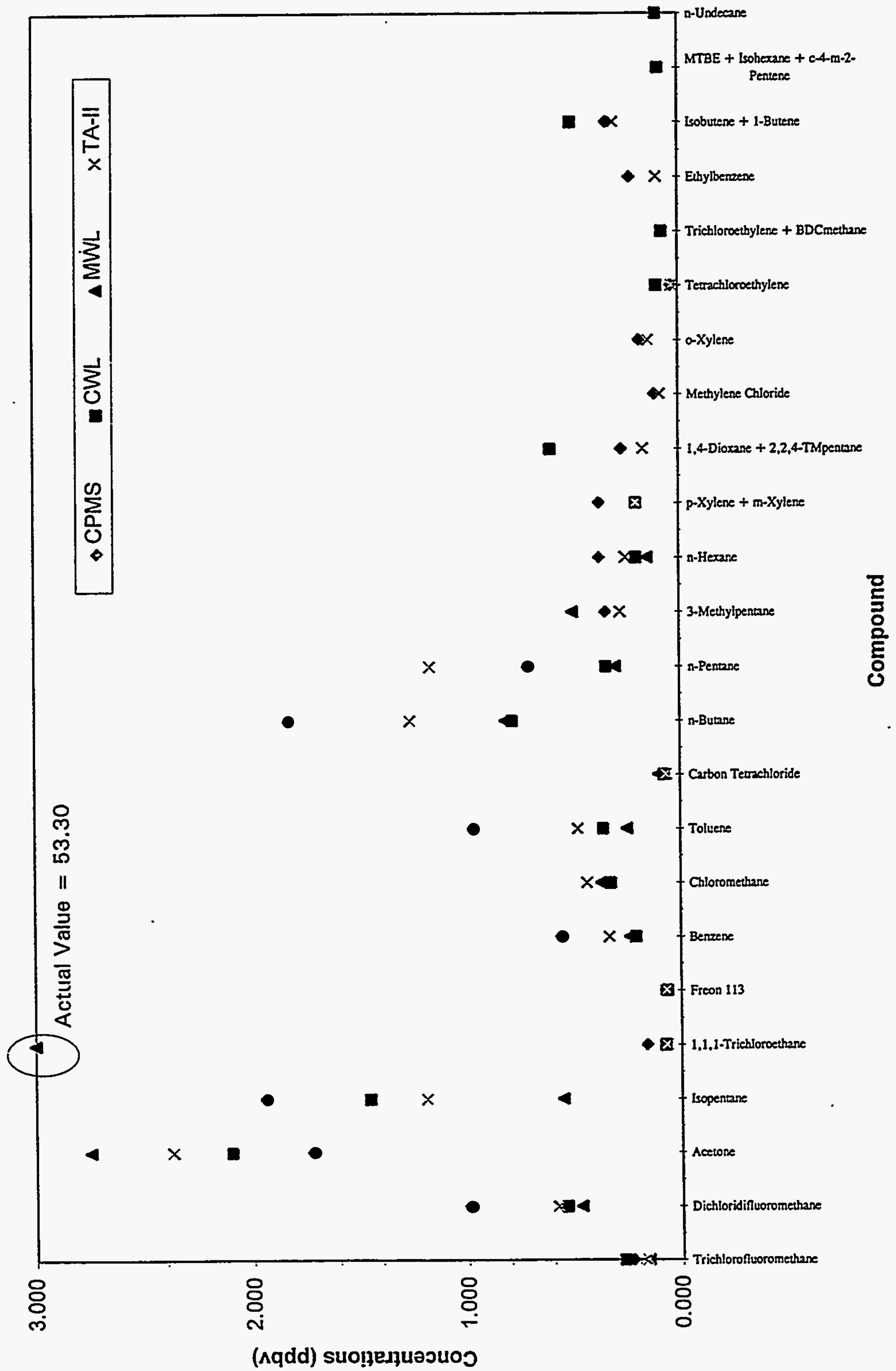

Figure 5-8. VOC concentrations.

Table 5-5. Frequency of VOCs observed at SNL/NM sampling locations.

VOC Compounds	CPMS (12 samples)	TA-II (12 samples)	MWL (12 samples)	CWL (11 samples)
	Number of samples showing VOC detections			
TNMHC	12	12	12	11
Trichlorofluoromethane	12	12	12	11
Dichloridifluoromethane	12	12	11	10
Acetone	12	11	11	9
Isopentane	12	10	9	9
1,1,1-Trichloroethane	11	9	9	10
Freon 113	11	9	10	8
Benzene	12	9	8	6
Chloromethane	11	8	7	8
Toluene	12	10	6	5
Carbon Tetrachloride	11	10	1	10
n-Butane	10	8	7	6
n-Pentane	11	6	5	7
3-Methylpentane	9	4	1	
n-Hexane	7	4	2	1
p-Xylene + m-Xylene	7	3		1
1,4-Dioxane + 2,2,4-TMpentane	6	3		1
Methylene Chloride	6	2		
o-Xylene	6	2		
Tetrachloroethylene	3	3		1
Trichloroethylene + BDCmethane				6
Ethylbenzene	4	1		
Isobutene + 1-Butene	3	1		1
MTBE + Isohexane + c-4-m-2-Pentene				1
n-Undecane				1

Note: For example, out of 12 samples in a batch, the maximum number of detections would be one per every sample, or 12 "hits." Only analytes found are recorded as hits.

Table 5-6 Average total non-methane hydrocarbon (TNMHC) results for 1995.

Sampling Location	Average TNMHC (ppbv)
CPMS	13.67
TA-II	9.60
MWL	25.15
CWL	5.00

Note: ppbv = parts per billion by volume

the magnitude of what can be considered a safe concentration. The highest TNMHC average occurred at the MWL because the TNMHC is a count of all carbon in the sample.

5.3 Air Emissions Radiological Monitoring

Several facilities within SNL/NM routinely generate radioactive air emissions subject to NESHAP regulations. A total of 12 facilities at SNL/NM reported airborne releases of radionuclides in 1995. Eleven of the 12 sources were point source releases which occurred as stack or vent emissions. The twelfth release source was a diffuse source with a measurable annual release. Table 5-7 summarizes the radionuclides, quantity of release, and release type (point or diffuse) by facility for 1995.

5.3.1 Radioactive Effluent Air Monitoring

Calculations and operational measurements indicate that small quantities of tritium (H-3), xenon-135 (Xe-135), and argon-41 (Ar-41) emissions were released to the atmosphere along with additional, less significant, radionuclides as a result of SNL/NM 1995 operations. Ar-41 was released from the Annular Core Research Reactor (ACRR) and the Sandia Pulsed Reactor-II (SPR-II) in TA-V as a result of neutron activation of stable naturally occurring Ar-40. The High-Energy Radiation Megavolt Electron Source-III (HERMES-III) accelerator, and Particle Beam Fusion Accelerator-II (PBFA-II) accelerator in TA-IV released small amounts of nitrogen-13 (N-13)and oxygen-15 (O-15) during routine operations as a result of x-ray activation of air. H-3 was measured in both 1992 and 1993 at the MWL in TA-III (Radian 1994). Figure 5-9 summarizes the annual air emissions from 1978 to 1995 for several radionuclides of interest.

Table 5-7. Summary of radionuclide releases from 12 sources in 1995.

Facility/Location	Source Type	Est./Measured Radionuclide	Release (Ci/yr)
• **Annular Core Research Reactor (ACRR)** TA-V, Bldg. 6588	*Point Source*	H-3 (Tritium)	2.0×10^{-5}
		Ar-41	3.0
		Krypton-83m	1.6×10^{-2}
		Krypton-85	3.3×10^{-5}
		Krypton-85m	1.2×10^{-1}
		Krypton-87	1.4×10^{-3}
		Krypton-88	1.0×10^{-1}
		Rubidium-86	8.0×10^{-7}
		Rubidium-87	8.1×10^{-14}
		Rubidium-88	4.1×10^{-4}
		Xenon-131m	5.7×10^{-5}
		Xenon-133	2.4×10^{-1}
		Xenon-133m	1.1×10^{-2}
		Xenon-135	1.4
		Xenon-135m	2.8×10^{-4}
		Xenon-138	1.4×10^{-14}
• **Calibration Laboratory** TA-I, Bldg. 869	*Point Source*	Tritium	3.7×10^{-5}
• **Chemical Processing Laboratory** TA-III, Bldg. 6600	*Point Source*	Sodium-22	2.4×10^{-12}
		Americium-241	1.0×10^{-13}
		Uranium-232	1.0×10^{-13}
		Plutonium-241	1.0×10^{-13}
• **High-Energy Radioactive Megavolt Electron Source-III (HERMES-III)** TA-IV, Bldg. 970	*Point Source*	Nitrogen-13	5.5×10^{-4}
		Oxygen-15	5.5×10^{-5}
• **Neutron Generator Test Facility** TA-II, Bldg. 935	*Point Source*	Tritium	2.8×10^{-4}
• **Metal Tritide Shelf-Life Laboratory** TA-I, Bldg. 891	*Point Source*	Tritium	5.0×10^{-9}
• **Sandia Pulsed Reactor (SPR)** TA-V, Bldg. 6591	*Point Source*	Argon-41	1.7

Table 5-7. Summary of radionuclide releases from 12 sources in 1995 (Concluded).

Facility/Location	Source Type	Est./Measured Radionuclide	Release (Ci/yr)
• **Particle Beam Fusion Accelerator-II (PBFA-II),** TA-IV, Bldg. 983	*Point Source*	Nitrogen-13	4.2×10^{-2}
		Oxygen-15	5.0×10^{-3}
• **TANDEM** TA-I, Bldg. 884	*Point Source*	Carbon-11	8.8×10^{-6}
		Oxygen-14	5.3×10^{-8}
		Oxygen-15	3.5×10^{-4}
		Nitrogen-13	2.1×10^{-5}
		Fluorine-17	1.3×10^{-6}
		Fluorine-18	$2. \times 10^{-6}$
• **Radiation Laboratory** TA-I, Bldg. 805	*Point Source*	Tritium	1.0×10^{-5}
• **Radiation Laboratory** TA-1, Bldg. 827		Tritium	1.0×10^{-5}
		Nitrogen-16	2.0×10^{-7}
		Nitrogen-17	1.0×10^{-8}
		Argon-41	1.0×10^{-9}
		Carbon-14	2.0×10^{-12}
• **Mixed Waste Landfill (MWL)** TA-III	*Diffuse Source*	Tritium	2.9×10^{-1}

Note: Ci/yr = curies per year.
The "m" after isotopes indicates metastable.

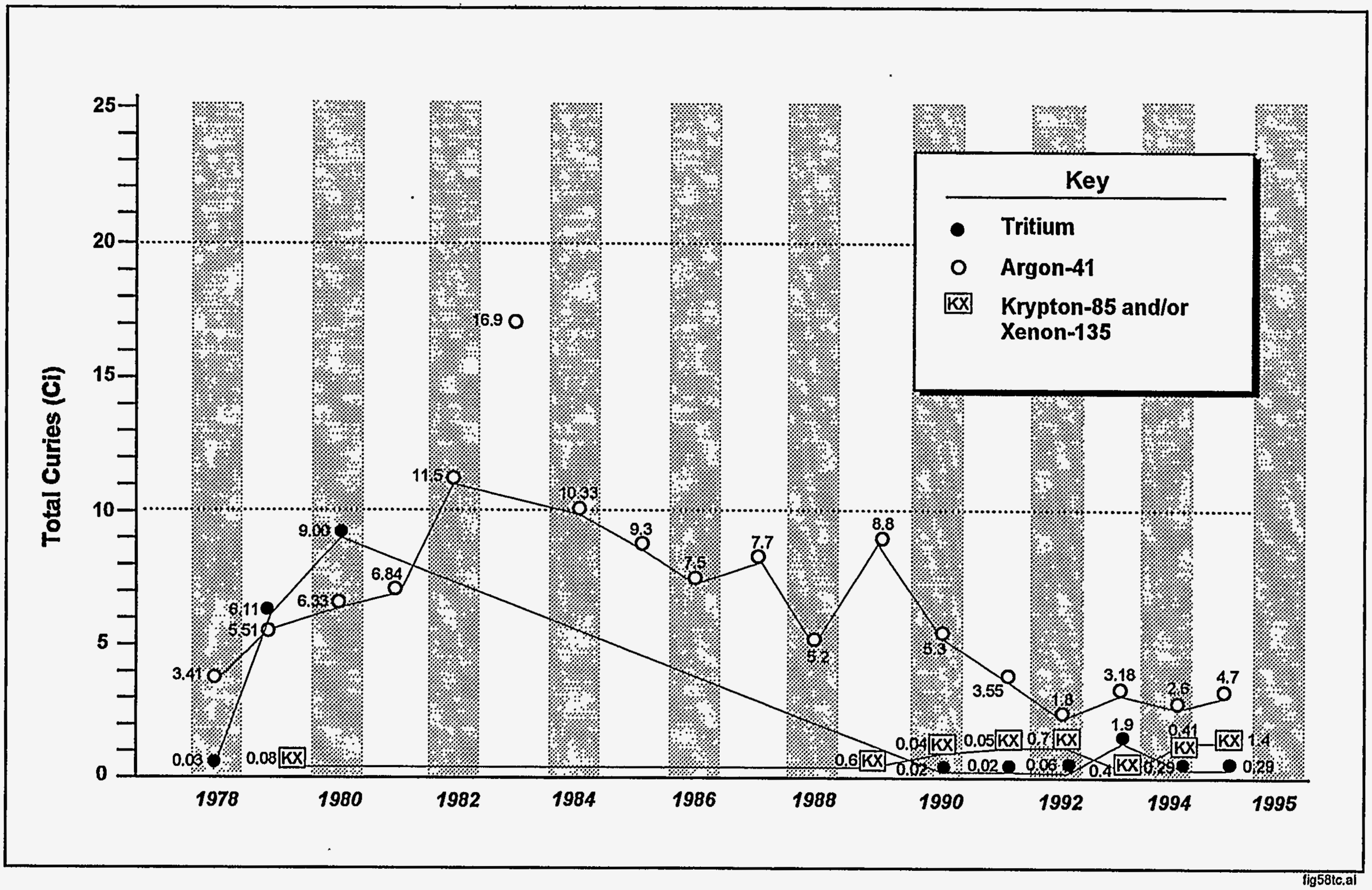

Figure 5-9. Summary of atmospheric releases of most prevalent airborne radionuclides from SNL/NM facilities reported since 1978. Values reported as less than 1 curie are not to scale.

5.3.2 Technical Area V Facilities

TA-V had three listed NESHAP facilities in 1995; two of them reported releases in 1995.

The Sandia Pulsed Reactor (SPR) released Ar-41 from its exhaust stack which is equipped with a pre-filter, a high-efficiency particulates in air (HEPA) filter, and a charcoal filter. A radiological air monitor (RAM) is located on the stack exhaust downstream of the filter banks. Gamma/beta surveys are routinely performed on the filters to determine dose rates. If necessary, gaseous grab samples and particulate samples can be collected, for a more detailed gamma spectral analysis.

The ACRR released primarily Ar-41 as a result of reactor operations. The ACRR has two exhaust stacks: one stack exhausts the room air in the high bay, and the second stack, (the central cavity purge system), evacuates the reactor's experimental cavity. There are three RAMs that sample the cavity purge stack, high bay room air, and the reactor pool for beta emissions. The exhaust system is equipped with pre-filters, HEPA filters, and charcoal filters. Gamma/beta surveys are routinely performed on the filters to determine dose rates. Also, gaseous grab samples and particulate samples can be collected, if necessary, for a more detailed gamma spectral analysis. An air monitoring system installed in the cavity purge stack has the capability to monitor gross alpha, gross beta, radioactive iodine, and Ar-41.

The Hot Cell Facility (HCF) stack contains filter banks equipped with a prefilter and HEPA filters. RAMs are located on the filter banks on both the cold exhaust and hot exhaust. An air monitoring system installed in the HCF exhaust stack has the capability to monitor gross alpha, gross beta, and radioactive gas (iodine and krypton). Gaseous grab samples and particulate samples can be collected, if necessary, and analyzed using gamma spectroscopy. The HCF performed no operations in 1995, and, therefore, had no radionuclide releases to report.

5.3.3 Technical Area IV Facilities

Two reactor facilities in TA-IV reported releases; the HERMES-III gamma-ray simulator and the PBFA-II both produced the radioactive gases N-13 and O-15 as a result of the photo activation of the surrounding air. The HERMES-III stack is equipped with an air monitoring system capable of monitoring the reactor's gas emissions.

5.3.4 Air Sampling For Reactor Facilities

Compressed air samples and particulate samples were taken in 1995 at the ACRR, SPR-III, and HCF as part of the confirmatory source measurements required by NESHAP regulations (40 CFR 61). NESHAP regulations require continuous monitoring for an effective dose equivalent (EDE) for any facility that produces greater than or equal to 0.1 millirem per year (mrem/yr), and periodic monitoring for an EDE less than 0.1 mrem/yr. Based on the confirmatory measurements taken at all three facilities, the EDE was

Based on the confirmatory measurements taken at all three facilities, the EDE was calculated to be less than the 0.1-mrem/yr limit (SNL 1994e). Periodic monitoring, therefore, will be performed at the SPR-III, ACRR, and HCF. Although not required, the ACRR and HCF are each equipped with a continuous stack monitor as a best management practice and will be used to provide periodic measurement data for each of these facilities. Compressed gas sampling and particulate sampling will be performed periodically for monitoring at SPR. Compressed gas sampling will be performed annually to confirm the periodic measurements for all three facilities (SPR-III, ACRR, and HCF). The results of the periodic and confirmatory measurements were used to report the annual emissions.

The HERMES-III source terms were also confirmed for NESHAP compliance in 1995. HERMES-III is equipped with a continuous stack monitor as a best management practice. The source terms were confirmed by comparing the stack monitor measurements and the confirmatory measurements. The EDE was calculated to be much less than 0.1 mrem/yr (Culp 1994); therefore, only periodic monitoring is required for HERMES-III. Periodic measurements taken using the stack monitor will be confirmed by gamma spectroscopy measurements to provide results for use in future release reports.

All results from reactor facility sampling can be found in the *NESHAP Annual Report for CY 1995* (SNL 1996b).

5.4 ASSESSMENT OF POTENTIAL DOSE TO THE PUBLIC

The U.S. Environmental Protection Agency (EPA) promulgated NESHAP (40 CFR 61, Subpart H) for radionuclides in December 1989, which requires the radiation dose to be calculated for the maximum exposed individual (MEI) at a public access location including an office, school, or residence. A comprehensive survey of all public access locations on KAFB was conducted in 1990 to address this requirement, and review of all locations is conducted annually. In addition, a determination was made that all non-SNL/NM personnel who work or live on KAFB are considered "members of the public" as defined by DOE Order 5400.5 (DOE 1990a) and are therefore receptors for the purpose of dose assessment. The 1995 dose assessment was performed for KAFB receptors including residences, businesses, and other locations where non-SNL/NM personnel abide or reside. All dose calculation results presented in this section were obtained using the EPA Clean Air Act Assessment Package (CAP88-PC) computer code (EPA 1991).

5.4.1 Radionuclide Air Emission Sources

Table 5-7 summarizes the radionuclides, quantity of release, and release type (point or diffuse) by facility for 1995. Figure 5-10 shows the locations of the 12 facilities reporting radionuclide air emissions in 1995. A total of 4.7 curies (Ci) of Ar-41, 1.4 Ci of

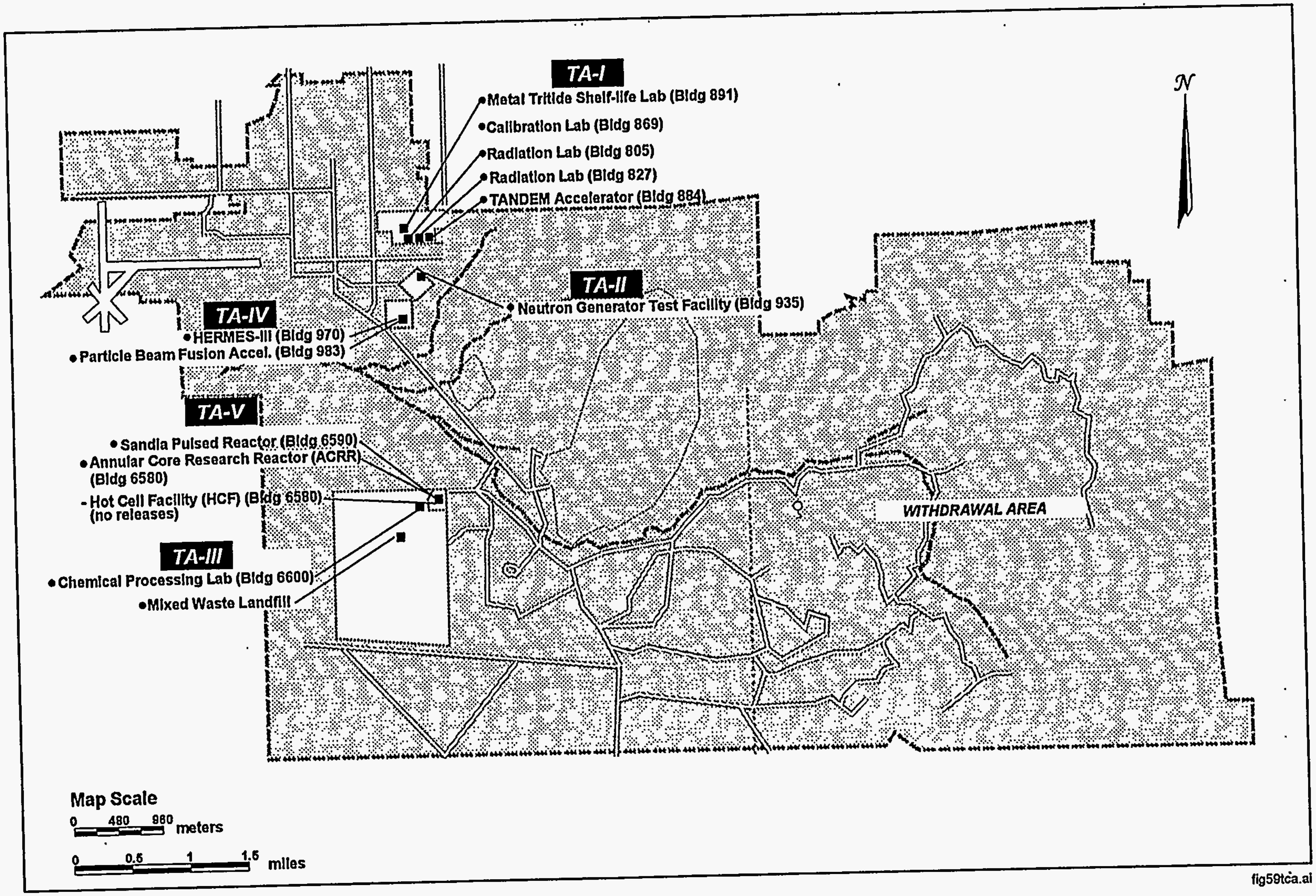

Figure 5-10. Locations of the 12 facilities at SNL/NM that reported radionuclide releases in 1995.

Xe-135, and 0.29 Ci of H-3 were released into the atmosphere in 1995 as a result of SNL/NM operations. Smaller amounts of additional radionuclides were also released. Many of the radionuclides released are of such short half-lives (e.g., 10 min for nitrogen-13, 15 min for rubidium-88) that radioactive decay during transport reduces doses at most of the receptor locations considered. See Table 3-8 and 3-9 for a summary of radionuclide air emissions from SNL/NM over the past six years.

5.4.2 Public Receptors

The nonresidential and residential areas of KAFB include security offices, guard posts, base housing areas, schools, banks, recreational facilities, restaurants, the KAFB landfill, a golf course, the U.S. Army Field Offices at Kirtland Underground Munitions Storage Complex (KUMSC), Manzano-area offices, the 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 EDE was calculated for public receptors on KAFB in addition to locations outside KAFB boundaries. Using 1990 population census data, population doses were calculated for KAFB residents and all other people living within an 80-kilometer (50-mile) radius of SNL/NM.

5.4.3 Meteorological Data Used in NESHAP Calculations

Meteorological data used in 1995 for the dose assessment were obtained from meteorological stations located near the emission sources at SNL/NM. These site-specific data consist of approximately 35,000 meteorological observations of wind direction, wind speed, and stability class (inferred from wind and solar insolation data), and form a normalized distribution from which all wind and stability frequency of occurrence data are derived. The 1995 SNL/NM meteorological station data were used to create Stability Array (STAR) data files which were incorporated into the CAP88-PC computer code for the dose assessment. Other meteorological data from the on-site stations used in the CAP88-PC code include average annual precipitation and temperature.

5.4.4 Demographic Data

The categories of demographic data include population, beef cattle, dairy cattle, and food crops used for human consumption. These four parameters were calculated for each of the CAP88-PC gridded zones (a total of 80). In general, demographic data are available by county. The densities for population, beef and dairy cattle, and food crops were calculated as the quotient of the most recent county data and the county land area. For 1995 calculations, 1990 census (DOC 1992) and 1988 agricultural data were used. These calculations were based on a total of 583,060 people, 32,335 beef cattle, 7,290 dairy cattle, and 2.4×10^8 m^2 of food crops from the surrounding nine counties (LATA 1991). The population of the four KAFB housing areas is estimated to be approximately 6477.

5.4.5 Results of the Dose Assessment

A calculation of the maximum exposed member of the public is required annually under the NESHAP regulation, 40 CFR 61, Subpart H. The regulation requires that the cumulative EDE of exposure from all site-wide radionuclide releases not exceed 10.0 mrem/yr.

SNL/NM releases occurred from 12 different sources located in all five technical areas. As a result, many different receptor locations were evaluated as suspected locations of maximum exposure. In all, 27 receptor locations were evaluated. These locations are in either off-site or on-site areas where members of the public are known to abide or reside. The off-site and on-site SNL/NM receptors are listed in Tables 5-8 and 5-9, respectively. Receptor locations are discussed in the *NESHAP Annual Report for calender year 1995, Sandia National Laboratories, New Mexico* (SNL 1996b)

The dose contributions from each of the radionuclide sources were combined to yield an overall cumulative dose for the MEI. Twelve independent release sources, consisting of 11 point sources and a single diffuse source, were determined to contribute to the MEI dose in 1995. Release amounts from individual facilities at SNL/NM were determined from either calculations based on measured stack parameters or from worst-case calculations based on process knowledge (Table 5-7).

The dose assessment results showed that the MEI for on-site exposure would be located at KUMSC, north of the ACRR in TA-V. The EDE to the MEI was calculated to be 8.5×10^{-4} mrem/yr. This dose results primarily from exposure to Ar-41 released from the ACRR and the SPR-II. This cumulative MEI dose of 8.5×10^{-4} mrem/yr is well below the NESHAP dose standard of 10.0 millirems per year from all facility sources. Individual doses to off-site and on-site SNL/NM receptors are presented in Tables 5-8 and 5-9, respectively.

5.4.6 Population Dose at Kirtland Air Force Base

A population dose resulting from exposure to all SNL/NM routine radiological emissions was calculated for KAFB residents. Because there are only a few residential neighborhoods on KAFB, the KAFB population dose was determined based on the maximum individual dose calculated for each of the four KAFB housing compounds.

A 100 percent occupancy rate was conservatively assumed for all housing units, yielding a total KAFB population of 6477. The population dose for each KAFB housing unit was calculated as the product of the housing unit population and the maximum housing unit individual dose (calculated by the CAP88-PC code). The housing unit population dose

Table 5-8. Annual effective dose equivalent to off-site receptors.

Receptor	Source-Specific Effective Dose Equivalents (mrem/yr)						
	Radiation Lab (Bldg. 805)	Radiation Lab (Bldg. 827)	Calibration Lab (Bldg. 869)	TANDEM (Bldg. 884)	Metal Tritide Lab (Bldg. 891)	NGTF (Bldg. 935)	Chemical Processing Lab (Bldg. 6600)
NE Resident	6.7E-10	9.8E-10	3.0E-09	2.3E-11	1.2E-13	9.6E-09	1.1E-12
USGS Seismic Center	6.7E-10	9.8E-10	3.0E-09	1.5E-11	1.2E-13	9.5E-09	7.4E-13
Four Hills	7.2E-10	1.0E-09	3.2E-09	3.7E-10	1.3E-13	1.1E-08	2.3E-12
Eubank Gate Area	9.3E-10	1.5E-09	4.4E-09	2.0E-08	1.8E-13	1.5E-08	2.3E-12
Albuquerque City Offices	7.9E-10	1.1E-09	3.4E-09	1.1E-10	1.5E-13	1.2E-08	3.7E-12
Tijeras Arroyo	8.0E-10	1.1E-09	3.5E-09	1.3E-10	1.5E-13	1.1E-08	5.3E-12
Isleta Bingo	6.9E-10	9.9E-10	3.1E-09	7.9E-12	1.3E-13	9.7E-09	7.7E-13
East Resident	6.6E-10	9.6E-10	3.0E-09	2.0E-12	1.2E-13	9.4E-09	4.3E-13

Receptor	Source-Specific Effective Dose Equivalents (mrem/yr)					Total Effective Dose Equivalent (mrem/yr)
	MWL	HERMES III (Bldg. 970)	PBFA II (Bldg. 983)	ACRR (Bldg. 6588)	SPR (Bldg. 6590)	
NE Resident	4.5E-06	2.6E-10	2.1E-08	2.3E-05	9.8E-06	3.7E-05
USGS Seismic Center	4.4E-06	4.1E-11	3.1E-09	1.3E-05	5.8E-06	2.3E-05
Four Hills	4.8E-06	2.6E-09	2.3E-07	5.1E-05	2.2E-05	7.8E-05
Eubank Gate Area	4.8E-06	1.1E-08	1.0E-06	4.7E-05	2.0E-05	7.3E-05
Albuquerque City Offices	6.3E-06	2.8E-09	5.7E-08	7.5E-05	3.4E-05	1.2E-04
Tijeras Arroyo	7.3E-06	4.1E-09	1.3E-07	1.1E-04	4.9E-05	1.7E-04
Isleta Bingo	4.5E-06	1.9E-11	1.4E-09	1.1E-05	4.8E-06	2.0E-05
East Resident	4.2E-06	7.2E-11	5.6E-10	5.1E-06	2.2E-06	1.2E-05

Table 5-9. Annual effective dose equivalent to on-site receptors (Continues).

Receptor	Source-Specific Effective Dose Equivalents (mrem/yr)						
	Radiation Lab (Bldg. 805)	Radiation Lab (Bldg. 827)	Calibration Lab (Bldg. 869)	TANDEM (Bldg. 884)	Metal Tritide Lab (Bldg. 891)	NGTF (Bldg. 935)	Chemical Processing Lab (Bldg. 6600)
ITRI/Lovelace	3.7E-11	3.8E-11	1.4E-10	2.3E-11	1.2E-14	2.9E-10	1.4E-12
Civil Engineering Research Facility	4.2E-11	4.4E-11	1.6E-10	3.1E-11	1.3E-14	3.5E-10	1.5E-12
Coyote Canyon Control Center	4.3E-11	4.5E-11	1.7E-10	3.3E-11	1.3E-14	3.6E-10	1.4E-12
Manzano Offices	4.8E-11	5.3E-11	1.9E-10	1.4E-10	1.3E-14	6.6E-10	4.4E-12
Riding Club	1.0E-10	1.2E-10	4.3E-10	2.4E-10	2.6E-14	1.2E-09	8.3E-12
KUMSC	1.4E-10	1.5E-10	5.7E-10	3.0E-10	3.0E-14	2.1E-09	3.7E-11
Golf Course Clubhouse	1.4E-10	1.7E-10	6.1E-10	5.0E-10	3.1E-14	2.1E-09	1.1E-11
Golf Course Maintenance Area	1.9E-10	2.4E-10	8.6E-10	1.0E-09	3.7E-14	3.7E-09	6.9E-12
KAFB Landfill	2.1E-10	5.4E-10	1.1E-09	5.7E-09	3.3E-14	8.7E-09	3.8E-12
Raytheon/DNA Facility	7.6E-10	1.2E-09	4.2E-09	8.7E-09	4.6E-14	9.2E-08	3.4E-12
Airport (Bldg. 760)	4.2E-10	3.6E-10	1.4E-09	1.5E-09	8.5E-14	4.4E-09	2.6E-12
Airport East	4.2E-10	3.1E-10	1.2E-09	2.3E-09	7.0E-14	3.4E-09	2.1E-12
U.S. Army Bldg. 20706	3.1E-09	3.3E-09	1.4E-08	4.5E-08	1.0E-13	1.5E-08	2.7E-12
Sandia Credit Union	3.1E-08	3.1E-09	1.2E-08	8.0E-08	1.4E-13	9.8E-09	2.2E-12
Maxwell Housing	1.5E-10	1.3E-10	4.9E-10	4.0E-10	3.8E-14	1.6E-09	2.5E-12
Zia Park Housing	1.4E-09	7.0E-10	2.9E-09	9.0E-09	1.4E-13	6.4E-09	2.3E-12
Pershing Park Housing	4.1E-10	2.8E-10	1.1E-09	2.7E-09	4.2E-14	3.4E-09	1.6E-12
Loop Housing	1.9E-09	7.6E-10	2.8E-09	1.4E-08	6.9E-14	5.4E-09	1.9E-12
Air Force Bldg. 24499	2.6E-10	2.7E-10	8.5E-10	1.1E-08	5.2E-14	3.8E-09	1.9E-12

Table 5-9. Annual effective dose equivalent to on-site receptors (Concluded).

Receptor	Source-Specific Effective Dose Equivalents (mrem/yr)					Total Effective Dose Equivalent (mrem/yr)
	MWL	HERMES III (Bldg. 970)	PBFA II (Bldg. 983)	ACRR (Bldg. 6588)	SPR (Bldg. 6590)	
ITRI/Lovelace	4.6E-07	1.2E-10	9.3E-09	3.4E-05	1.6E-05	5.0E-05
Civil Engineering Research Facility	5.6E-07	2.1E-10	1.6E-08	3.6E-05	1.6E-05	5.3E-05
Coyote Canyon Control Center	5.6E-07	1.6E-10	1.7E-08	3.7E-05	1.6E-05	5.4E-05
Manzano Offices	1.1E-06	1.0E-09	8.1E-08	1.2E-04	5.1E-05	1.7E-04
Riding Club	2.1E-06	2.2E-09	2.6E-07	2.9E-04	1.0E-04	3.9E-04
KUMSC	4.0E-06	5.8E-09	4.0E-07	6.0E-04	2.5E-04	8.5E-04
Golf Course Clubhouse	1.9E-06	9.1E-09	7.0E-07	2.5E-04	9.8E-05	3.5E-04
Golf Course Maintenance Area	1.5E-06	1.6E-08	1.8E-06	1.7E-04	6.3E-05	2.4E-04
KAFB Landfill	9.7E-07	3.8E-08	4.3E-06	8.8E-05	3.5E-05	1.3E-04
Raytheon/DNA Facility	9.5E-07	1.5E-07	1.4E-05	8.0E-05	3.5E-05	1.3E-04
Airport (Bldg. 760)	1.1E-06	9.6E-09	2.6E-07	9.9E-05	2.5E-05	1.3E-04
Airport East	8.7E-07	6.2E-09	4.6E-07	4.4E-05	2.0E-05	6.5E-05
U.S. Army Bldg. 20706	7.6E-07	3.0E-08	2.4E-06	6.0E-05	2.7E-05	9.0E-05
Sandia Credit Union	6.8E-07	1.6E-08	1.3E-06	5.2E-05	2.3E-05	7.7E-05
Maxwell Housing	9.2E-07	1.7E-09	1.3E-07	5.3E-05	2.4E-05	7.8E-05
Zia Park Housing	9.5E-07	1.1E-08	7.7E-07	5.1E-05	2.3E-05	7.6E-05
Pershing Park Housing	5.1E-07	4.2E-09	3.3E-07	3.7E-05	1.4E-05	5.2E-05
Loop Housing	5.9E-07	8.1E-09	6.7E-07	4.1E-05	1.7E-05	5.9E-05
Air Force Bldg. 24499	5.9E-07	8.1E-09	7.3E-07	4.3E-05	1.8E-05	6.2E-05

results were then summed to obtain a composite KAFB population dose. An annual composite population dose of 4.5 x 10^{-4} person-rem was estimated for KAFB. This population dose results primarily from exposure to Ar-41.

5.4.7 Population & MEI Dose for the 50-Mile (80-km) Radius

A population dose was calculated for the 50-mile (80 km) radius surrounding SNL/NM using a single, common grid analysis for all SNL/NM sources. Because the analysis area is large, the relatively small distances between radionuclide sources have a minimal impact on the resulting population dose. As stated earlier, the CAP88-PC computer code calculated exposure estimates using demographic data based on the 1990 population census and 1988 agricultural census. The population dose from 1995 SNL/NM operations was calculated to be 0.016 person-rem EDE for the regional population. The population dose primarily results from exposure to Ar-41. The off-site MEI dose was calculated to be 1.7 x 10^{-4} mrem/yr.

5.5 SUMMARY OF THE 1995 ON-SITE & OFF-SITE DOSE IMPACTS

During 1995, the NESHAP MEI was determined to be at the KUMSC site, north of SNL/NM TA-V. The maximum EDE at this on-site location was calculated to be 8.5 x 10^{-4} mrem. The maximum off-site EDE was calculated to be 1.7 x 10^{-4} mrem at the Tijeras Arroyo location which is approximately 5500 m southwest of TA-I and 4800 m west-northwest of TA-V. A population dose to the public was calculated to be 0.016 person-rem to the 583,060 people living within a 50-mile radius of SNL/NM. The population dose to the 6477 residents of KAFB was calculated to be 4.5 x 10^{-4} person-rem. Table 5-10 summarizes the dose impacts.

5.6 AIR QUALITY MANAGEMENT

The following sections list local air quality regulations and discuss the specific regulations which apply to operations at SNL/NM. Local laws implement Federal standards for criteria pollutants. Radionuclide emissions and other hazardous air pollutants are administered by the EPA under NESHAP regulations 40 CFR 61.

5.6.1 Air Quality Regulations

Air quality for SNL/NM is governed by regulations promulgated by both the Albuquerque-Bernalillo County/Air Quality Control Board (ABC/AQCB) and the Federal government under 40 CFR 58, Subchapter C, "Air Programs." On October 11,

Table 5-10. Summary of on-site and off-site dose impacts in comparison to the National Emission Standards for Hazardous Air Pollutants (NESHAP) and to natural background radiation.

Parameters	1995 SNL/NM Calculated Dose	NESHAP Standard	Natural Background radiation in the Albuquerque area
On-Site Maximum Effective Dose Equivalent (mrem/yr)	8.5×10^{-4}	10	95*
Off-Site Maximum Effective Dose Equivalent (mrem/yr)	1.7×10^{-4}	10	95*
Population Dose‡ (person-rem)	1.6×10^{-2}	----†	>57,000
Kirtland Air Force Base Population Dose ‡‡ (person-rem)	4.5×10^{-4}	----†	>57,000

Note: mrem/yr = millirem per year; person-rem = radiation dose to population (also man-rem).

*Based on the average community thermoluminescent dosimeter (TLD) values (doses from external penetrating radiation).

†No standard available. .

‡Dose for the population in 50-mi (80 km) radius surrounding SNL/NM

‡‡Dose for the KAFB population of 6,477 residents.

**Tijeras Arroyo where exits SNL/NM boundary.

1995, the ABC/AQCB completed the recodification of Board Regulations 1 through 43. Regulations 1 through 43 were placed into the New Mexico Administrative Code (NMAC) in Title 20, Environmental Protection, Chapter 11 ABC/AQCB. Current air quality issues and actions may be found in Section 2.14.1.

The applicable Federal regulations are:

- **40 CFR 52** Approval and Promulgation of Implementation Plans
- **40 CFR 58** Ambient Air Quality Surveillance
- **40 CFR 60** New Source Performance Standards

- **40 CFR 61** National Emission Standards for Hazardous Air Pollutants
- **40 CFR 63** NESHAP for Source Categories
- **40 CFR 70** State Operating Permit Programs
- **40 CFR 80** Regulation of Fuels and Fuel Additives
- **40 CFR 82** Protection of Stratospheric Ozone
- **40 CFR 93** Determining Conformity of Federal Actions to State or Federal Implementation Plans

The recodified ABC/AQC regulations include the following:

- **20 NMAC 11.01** "General Provisions," regulates arsenic (As), copper (Cu), zinc (Zn), beryllium (Be), carbon monoxide (CO), hydrogen sulfide (H_2S), lead (Pb), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), total suspended particulates (TSP), hydrocarbons (HC), photochemical oxidants, soiling index, and total reduced sulfur (TRS).
- **20 NMAC 11.02** "Permit Fees"
- **20 NMAC 11.03** "Transportation Conformity"
- **20 NMAC 11.04** "General Conformity"
- **20 NMAC 11.05** "Visible Air Contaminants"
- **20 NMAC 11.06** "Emergency Action Plan"

- **20 NMAC 11.07** "Variance Procedure"
- **20 NMAC 11.20** "Airborne Particulate Matter"
- **20 NMAC 11.21** "Open Burning"
- **20 NMAC 11.22** "Woodburning"
- **20 NMAC 11.23** "Stratospheric Ozone Protection"

- **20 NMAC 11.40** "Source Registration"
- **20 NMAC 11.41** "Authority-to-Construct"
- **20 NMAC 11.42** "Operating Permits"
- **20 NMAC 11.43** "Stack Height Requirements"
- **20 NMAC 11.44** "Emissions Trading"

- **20 NMAC 11.60** "Permitting in Nonattainment Areas"
- **20 NMAC 11.61** "Prevention of Significant Deterioration"
- **20 NMAC 11.62** "Acid Rain"
- **20 NMAC 11.63** "New Source Performance Standards"
- **20 NMAC 11.64** "Emission Standards for Hazardous Air Pollutants"

- **20 NMAC 11.65** "Volatile Organic Compounds"
- **20 NMAC 11.66** "Process Equipment"
- **20 NMAC 11.67** "Equipment, Emissions, Limitations"
- **20 NMAC 11.68** "Incinerators and Crematories"

- **20 NMAC 11.69** "Pathological Waste Destructors"
- **20 NMAC 11.90** "Administration, Enforcement, Inspection"
- **20 NMAC 11.100** "Motor Vehicle Inspection — Decentralized."

The Albuquerque Environmental Health Department's (AEHD) Air Pollution Control Division (APCD) has ambient-air sampling stations established throughout the city, including sites near SNL/NM, to monitor TSP, ozone (O_3), particulate matter with a diameter equal to or less than ten microns (PM_{10}), CO, and oxides of nitrogen (NO_x). Sampling results are published periodically in local newspapers. No exceedances of these measured pollutants were observed at off-site stations near SNL/NM in 1995.

5.6.2 Airborne Emissions & Permits

Various sources at SNL/NM emit air pollutants and are regulated by the above regulations. Those regulations having specific impact to SNL/NM are described below:

20 NMAC 11.20 "Airborne Particulate Matter"

Before disturbing, moving, placing, or removing the soil of any area larger than ¾ acre (32,670 ft^2); SNL/NM, through DOE or its contractor, must apply for a topsoil disturbance permit and implement a plan for controlling dust emissions generated by construction activities in accordance with the requirements of 20 NMAC 11.20. These mitigation measures could include limiting vehicle access and speed, phasing construction, rescheduling construction around windy periods, watering, or using dust palliatives where watering is ineffective. A permit is also required before demolishing any building containing over 75,000 ft^3 of space.

20 NMAC 11.21 "Open Burning"

The open-burning regulation covers activities such as the disposal of explosives by burning to avoid the hazards of transport or handling, above ground detonation of more than 20 lbs (>20 lbs) of explosives, single-event research and development activities of 2000 gal or more of liquid fuel, and ignition of rocket motors containing more than 4000 lbs of fuel. In addition, the regulation differentiates the permit basis into two categories: multiple-event or single-event. The single-event permit was designed to regulate activities having significant impact. Open-burn permits were obtained from the City of Albuquerque for each scheduled regulated burn or test according to 20 NMAC 11.21. A total of ten multiple- and single-event permits were issued or extended to SNL/NM during 1995 as listed in Table 2-4.

20 NMAC 11.40 "Source Registration"

The SMoke Emission Reduction Facility (SMERF) in Lurance Canyon is registered by the City of Albuquerque under Certificate #196, and the Neutron Generator

Manufacturing Facility in TA-I Bldg. 870 is registered under Certificate #374. All other registrations listed in Table 2-4 are awaiting agency review.

20 NMAC 11.41 "Authority-to-Construct"

The hammermill in TA-III Bldg. 6583 is permitted by the City of Albuquerque under Permit #144, and the four standby diesel generators in TA-I, Bldg. 862, are permitted under Permit #150. All other permits listed in Table 2-4 are either awaiting agency review, are EPA approved, or have expired.

20 NMAC 11.65 "Volatile Organic Compounds"

As quoted in the regulation, "No person shall unload gasoline into any underground storage tank with a capacity of three thousand gallons (3000 gal) or more unless such tank is equipped with an approved vapor loss control system." Only one 12,000-gal tank in TA-1 is greater than 3,000 gal, and it is equipped with a Stage-I vapor loss control system. This tank is scheduled for removal by 1998.

20 NMAC 11.67 "Equipment, Emissions, Limitations"

SNL/NM has five steam boilers with rated heat capacities ranging from 94 to 235 million British thermal units per hour (MBtu/hr). Because this regulation governs oil burning equipment having a rated heat input greater than 250 MBtu or gas burning equipment greater than 1,000,000 MBtu, it does not apply to SNL/NM.

5.6.3 Criteria Pollutants

During 1995, all five boilers at the steam plant were operated. The steam plant consumed a total of 752,329,365 standard cubic feet of natural gas. SNL/NM also operates an emergency generator plant in Bldg. 862 with 4600-kilowatt (kW) standby generators. Criteria pollutant emissions from the steam plant and the standby generators were not calculated for 1995 but should be reported in conjunction with fuel usage for the future operating permit compliance update.

5.6.4 Inventory & Assessment of Hazardous Air Pollutants

SNL/NM has conducted an inventory of hazardous chemical usage since 1993. Computer-generated usage reports are created for each calendar year from an inventory of purchased material and Material Safety Data Sheets (MSDSs). Line organizations are then polled to verify these computer-generated reports. Table 5-11 presents the results of the 1995 inventory.

Table 5-11. Summary of significant laboratory-wide chemical usage.

Chemical	Chemical Abstract System (CAS) Number	Usage (lb)
Sulfuric Acid	7664-93-9	28,555
Hydrogen chloride	7647-01-0	37,578
Acetone	67-64-1	6,838
Isopropyl alcohol	67-63-0	3,308
Nitric acid	7697-37-2	3,270
Methanol (methyl alcohol)	67-56-1	2,627
Ethylene glycol	107-21-1	3,319
Hydrogen fluoride	7664-39-3	3,283
Napthalene	91-20-3	1,002
Phosphoric acid	7664-38-2	1,224

This page intentionally blank.

6.0 SEWER, SURFACE DISCHARGE, & STORM WATER MONITORING PROGRAMS

Wastewater sewer effluent, surface water discharges, and storm water run-off at SNL/NM are monitored for both radioactive and non-radioactive pollutants to ensure compliance with all applicable permits.

6.1 SEWER WASTEWATER PROGRAM

SNL/NM maintains and monitors discharges to the City of Albuquerque's (COAs) sewer system. There are over 15 mi of sanitary sewer lines that are interconnected with those of KAFB. During 1995, SNL/NM had two categorical pretreatment operations and four general wastewater streams discharging to the COA sanitary sewer system where SNL/NM's wastewater effluent is treated at the POTW. Table 6-1 includes a list of current wastewater discharge permits and station characteristics. Figure 6-1 shows the wastewater sampling locations.

The sampling procedures, permit limits for individual sampling stations, dates of sample collection and sample frequency, analytical methods, and quality control/quality assurance criteria are documented in the *SNL/NM Wastewater Sampling and Analysis Plan* (Booher 1992). Complete documentation concerning the wastewater sampling program can be found in the Wastewater Monitoring Program Monthly Reports.

6.1.1 Sewer System Regulations

Discharges by SNL/NM to the publicly owned treatment works (POTW) are regulated by the COA Public Works Department, Liquid Waste Division, under the authority of the City's Sewer Use and Wastewater Control Ordinance. The City's National Pollutant Discharge Elimination System (NPDES) permit is issued by the EPA in accordance with the Clean Water Act (CWA) as amended. The current COA permit expires in 1998.

To comply with EPA regulations, the COA has implemented an industrial wastewater pretreatment program. This program requires SNL/NM to obtain permits for wastewater discharges to the City's POTW. These permits specify the required quality of discharges and the frequency of reporting the monitoring results. SNL/NM is required to submit semiannual reports for the first half of the calendar year (January to June) by July 31st of each year; and the second half (July to December) by January 31st of the following year.

Radiological Screening

During 1995, the Liquid Effluent Control System (LECS) in TA-V was fully operational and used to retain process wastewater for radiological screening prior to discharge to the sanitary sewer. SNL/NM segregates the process effluent from the routine sanitary effluent generated in TA-V by directing the sanitary effluent flow to the sanitary sewer system and collecting the process effluent in the LECS for analysis prior to discharge. The sanitary effluent and any discharges from the LECS flow through monitoring station WW011 (Permit Number 2069K-2). The system consists of three tanks used for diverting process water flow. Before sampling, the influent flow is switched to one active tank to isolate the sample volume. Representative samples are collected from the isolated tank and delivered to radiological laboratories for screening analysis. Samples are analyzed for gross alpha and gross beta activities, tritium (H-3), and gamma emitters. Duplicate samples are collected periodically and shipped to a contracted laboratory for independent analysis. The sampling results indicate the wastewater discharges from the LECS are below regulatory limits set by the U.S. Nuclear Regulatory Commission (USNRC), the DOE, and the State of New Mexico.

SNL/NM's policy prohibits the disposal of radiological material above regulatory levels into the sanitary sewer system. Although performing radiological analyses for the permitted outfall locations is not required by the permits, analytical results are included to satisfy reporting requirements established by the COA "Sewer Use and Wastewater Control Ordinance," Section 8-9-44.H, which states that all analyses performed in accordance with prescribed procedures established by the EPA under provisions contained in 40 CFR 136 shall be reported. Results of radiological sampling are contained in the Wastewater Monitoring Program Monthly Reports. These reports are on file at SNL/NM's 7500 Environmental Operations Record Center.

6.1.2 Summary of Monitoring Results

The 1995 wastewater permit results are documented in the *Wastewater Monitoring Program Semiannual Reports for 1995* (SNL 1996c). No chemical or radiological parameter was found to exceed its respective permit concentration limit and all monitoring data demonstrated that the effluent discharged from SNL/NM was in compliance with the facility's wastewater discharge permits. Only one permit came close to— but did not exceed—a permit limit. The 1995 compliance results with wastewater discharge permits at SNL/NM are listed below.

- **Permit 2069A-3.** No violations occurred.
- **Permit 2069F-3.** No violations occurred.

Table 6-1. SNL/NM wastewater discharge permits, sampling locations, and station characteristics.

Permit Number	Station Manhole Number*	Location	Average Flow (gpd)	Waste Stream Process	Issuing Agency	Flumes
2069A-3	WW001	South of TA-IV Tijeras Arroyo	91,721	General	City of Albuquerque, I.C. 7391	3-inch Parshall
2069F-3	WW006	East of KAFB Sanitary lagoons	385,747	General	City of Albuquerque, I.C. 3674, 3694, 9711	6-inch Parshall
2069G-3	WW007	TA-I Bldg. 858 basement	144,722	Microelectronics Development Laboratory	City of Albuquerque, 40 CFR 469.A	45°V-Notch Weir
2069H-3	WW009	TA-I Bldg. 878 Basement	2,082	Advanced Manufacturing Process Laboratory (AMPL)	City of Albuquerque, 40 CFR 433	2-inch Parshall
2069I-2	WW008	South of TA-II Tijeras Arroyo	393,426	General	City of Albuquerque, I.C. 3674, 3679, 9711	6-inch Parshall
2069K-2	WW011	North of TA-III (includes TA-III, TA-V, and Coyote Test Area sewer lines)	54,798	General	City of Albuquerque, I.C. 3674, 3679, 9711	6-inch Parshall

Note: I.C. = Industrial classification; gpd = gallons per day.

*At each station there is an Isco 3210 flow meter, an Isco 2700R sampler, and a Leeds and Northrop pH analyzer system.

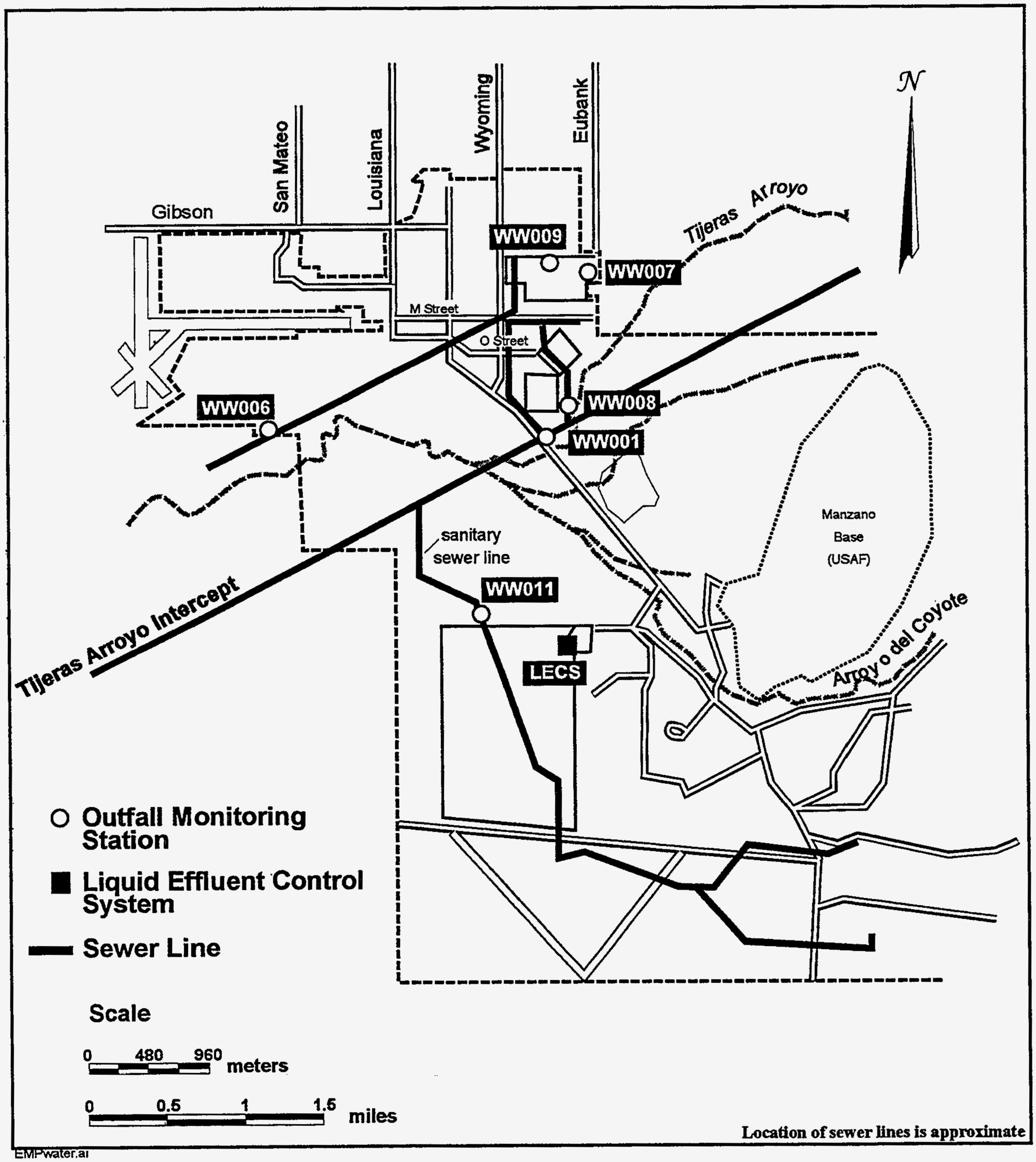

Figure 6-1. SNL/NM's wastewater monitoring station locations.

- **Permit 2069G-3.** No violations occurred.
- **Permit 2069H-3.** No violations occurred.
- **Permit 2069I-2.** No violations occurred.
- **Permit 2069K-2.** No violations occurred, however, on February 21, 1995, acid releases came close to exceeding limits. Exceedences in permitted pH levels (below 5.0) are not allowed to occur for more than 1 hr continuously or for a total monthly cumulative time greater than 7 hr and 26 min. Monitoring levels were recorded for a pH excursion below the 5.0 pH limit which occurred for 6 hr and 46 min at outfall location WW011 (Permit 2069K). This was 40 min under the monthly cumulative excursion allowed. The excursion was tracked to DOE's Inhalation Toxicology Research Institute's (ITRI's) wastewater monitoring station and was not directly attributable to SNL/NM's activities.

6.2 Surface Discharge Programs

All discharges to surface impoundments at SNL/NM are under the authority of the New Mexico Water Quality Control Commission (NMWQCC). Regulations are implemented by the New Mexico Environment Department's (NMED's) Ground Water Bureau.

6.2.1 Pulsed Power Evaporation Lagoons

Pulsed power operations use large volumes of oil (millions of gallons) during experimental runs. The oil is stored and recycled for use at the facility's oil tank farm which is equipped with secondary containments for spill prevention control. The containments can collect large volumes of storm water and therefore require periodic pumping. Additionally, water accumulates in several indoor floor containment trenches (e.g., from condensation, cleaning, etc.) and also must be pumped out. Surface discharges of this relatively clean water are made to lined surface impoundment lagoons for collection and evaporation. Possible contaminants that may be present in the water are trace amounts of oil, acetone, and/or other solvents. All visible oil is skimmed before discharge to the lagoons.

Two lagoons, serving several Pulsed Power Development Facilities in Tech Area IV, required permits in 1995. Lagoon I is 50 by 70 ft in surface area, and 11 ft deep with a 137,500-gal capacity. Lagoon II is approximately 40 by 70 ft in area (trapezoidal shape), and 8 ft deep with a 127,000-gal capacity. NMED Discharge Plan DP-530 permits discharges to both Lagoon I and Lagoon II. The permit was first issued in March 1988 and last amended in June 1993, before it expired in December 1994. A renewal for DP-530 was submitted to the NMED on September 26, 1994. Prior to reissue of the permit, the NMED placed a public notice in the Albuquerque Journal newspaper on December 27, 1994, requesting public comment through January 26, 1995. The new Discharge Plan was approved for another 5 years, and will expire on February 24, 2000. The plan currently requires semiannual sampling and analysis of water quality and routine measurements of water levels.

6.2.2 Summary of Analytical Results

Samples from lagoons are collected according to the *Sampling and Analysis Plan for the Pulsed Power Development Facilities, Bldgs. 981/983 and 970, Lagoons I and II* (SNL 1994k). Water level measurements were taken in March, June, and December of 1995; water quality samples were taken in June and December of 1995.

The NMWQCC lagoon-water standards measure total dissolved solids (TDS), chloride, sulfates, and other chemical species as designated in the plan. SNL/NM also performs an analysis for calcium, sodium, magnesium, potassium, calcium carbonate, and VOCs. Samples taken in June 1995 from Lagoon II exceeded the New Mexico water quality standards for TDS by 40 milligrams per liter (mg/L) –the maximum standard is 1,000 mg/L. Lagoon II also slightly exceeded the NMWQCC maximum chloride concentration allowed by 38 mg/L –the maximum standard is 250 mg/L. Both exceedences were minor and recorded in the DP-530 semiannual report (SNL 1995g). The increase in concentration of these two constituents is most likely due to a high rate of evaporation.

DP-530 allows for a maximum capacity of 75 percent to prevent possible run-over due to additional rainfall. The highest levels recorded for Lagoons I and II were 43 and 37 percent of total capacity, respectively. The lowest levels recorded for both lagoons were in December with a low of 12 and 8 percent of total capacity, respectively, during December.

6.3 Storm Water Run-off Program

Storm water not absorbed directly into the ground, is transported as run-off from streets, parking lots, buildings, industrial or waste sites, and other areas of potential contamination before discharging to a storm drain system. The EPA regulates storm water as a "point source discharge" and defines the "point" as the location where the storm drainage system empties (discharges) into "waters of the United States." At SNL/NM, this point of discharge is defined as the point where storm water discharges to the Tijeras Arroyo or leaves SNL/NM property.

SNL/NM meets the EPA criteria requiring storm water permitting and has established a Storm Water Program. Tijeras Arroyo drains through SNL/NM property and collects various run-off point and non-point sources before emptying into the Rio Grande. Twenty-two activities at SNL/NM are classified as a primary industrial activity as defined in the SIC Codes listed in Appendix A of 40 CFR 122; storm water discharge monitoring is required for 16 of these activities.

SNL/NM practices cognizant spill prevention and response procedures to prevent any pollutants from coming into contact with storm water and thereby being transported to the storm drain system. Only rainfall or other atmospheric precipitation is allowed to be discharged to the storm water drainage system. Storm water that has been collected in a secondary containment may be discarded to the storm drain system only if it has not been contaminated and proper records have been maintained.

6.3.1 Storm Water Regulations

The Storm Water Program at SNL/NM is the implementation of 40 CFR 121 to 125 which requires certain industrial and waste handling activities to obtain a permit for the discharge of storm water run-off. Permit conditions require the permit holder to implement a program for pollution prevention and to monitor storm water run-off to determine if pollution control measures are effective.

Amendments to the Federal Clean Water Act in 1987 (40 CFR 122) required that affected sites obtain a NPDES permit for storm water run-off to any municipal storm drain system and/or storm water discharges from industrial sites. The criteria set by the EPA which mandate storm water run-off permitting includes all facilities which have been classified under a set of Standard Industrial Classification (SIC) codes for particular industrial activities (codes 20 through 39), and which discharge storm water run-off either to a municipal storm system or directly to U.S. surface waters. SNL/NM submitted an application on October 1, 1992, to the EPA, Region VI, for a storm water discharge permit. This application lists the four primary SIC classifications at SNL/NM as: National Security (9711); Commercial Physical Biological Research (8731); Semi-conductors and Related Devices (3674); and Electronic Components (3679). The permit is currently pending approval.

Construction sites that disturb more than 5 acres of soil are also required to obtain a storm water discharge permit. Sandia presently has soil disturbance permits at three sites: (1) The Explosive Components Facility (ECF) which is due to be closed once vegetation is reestablished at the site, (2) the Technology Support Center (TSC), scheduled for completion in 1996, and (3) the Robotics Manufacturing Science and Engineering Laboratory (RMSEL), also scheduled for completion in 1996. Construction permits do not require analytical monitoring; however, sites receive weekly visual inspections for apparent problems with storm water pollution control systems. No significant discrepancies were noted in 1995 at permitted sites.

6.3.2 SNL Storm Water Monitoring Stations

SNL/NM presently has three monitoring and sampling stations (Stations 2, 4, and 5) which automatically collect storm water run-off after a rain of sufficient intensity and duration (Figure 6-2). Station 2 monitors storm water run-off that enters SNL/NM property from a KAFB housing area to the north of TA-I. Station 4 monitors run-off from the salvage (reapplication) yard located at the west end of TA-II. Station 5, which collects run-off from the majority of SNL/NM's industrial activity, monitors run-off from the eastern two thirds of TA-I, TA-II, and most of TA-V.

Storm water sampling at SNL/NM occurs during the rainy season from April through September. Typically, samples are taken from each station annually and are analyzed to determine compliance with the NPDES permit (pending). The automatic sampling systems are programmed to collect water during the first 30 min of atmospheric precipitation; after which a flow-weighted composite sample is collected over the duration of the rainfall event. The samples are analyzed by the test methods using guidelines prescribed in 40 CFR 136. The analytes are determined by the type of industrial activity upstream of the discharge point.

The rainfall in 1995 was sparse (34 percent below normal), and the reduced run-off hindered the sampling effort. Only three of the planned six samples were collected for 1995: one from Station 2, and two from Station 4. Station 5 had insufficient run-off to allow sample collection.

6.3.3 Sampling Results

Tests on the 1995 samples were analyzed for volatile organic compounds, (VOCs), semi-VOCs, organo-chlorinated pesticides, polychlorinated biphenyls (PCBs), and constituents from explosive testings. None of these pollutants were detected (Station 2 and 4 reporting).

Barium and manganese above state and Federal limits were detected but attributed to natural soil conditions for the following reasons: the standards are based on dissolved concentrations in water (filtered water samples); however, tests for storm water run-off are performed on unfiltered samples (dissolved and suspended particles). Since both barium and manganese occur in soils found in the Albuquerque area as discussed in *Background Concentrations of Constituents of Concern to Sandia National Laboratories/New Mexico Environmental Restoration Project* (IT 1996), it is likely that samples with suspended solids may contribute significantly to the total barium and manganese readings.

Gross alpha and gross beta also exceeded the EPA maximum contaminant levels (MCL). The decomposed granite from the Sandia and Manzano Mountains contain trace radionuclides which cause the soils in this area to have higher than normal emissions of

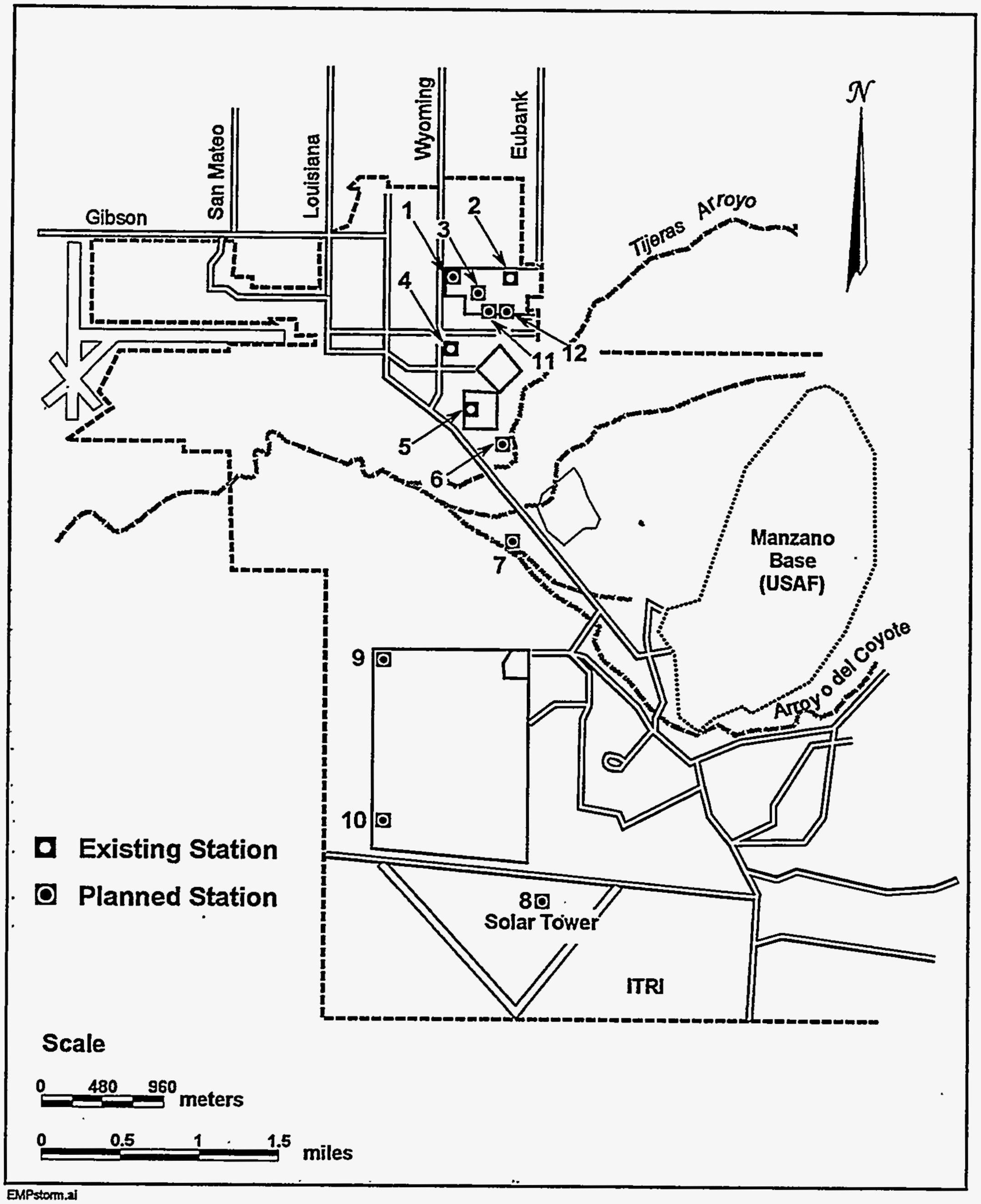

Figure 6-2. Storm water monitoring station locations.

alpha and beta. The most widely distributed radionuclides which occur in more than 95 percent of the samples taken are potassium-40, strontium-90, and uranium-238. Details of this analysis can be found in the report on background constituents (IT 1996). Complete results of the 1995 storm water sampling program can be referenced in the *Results of 1995 Storm Water Sampling* (SNL 1995h).

6.3.4 Storm Sewer Clean-up Actions

Two incidences involving storm drain contamination occurred in 1995:

- A spill reportable to the NMED occurred on October 4, 1995. Approximately 100 gal of Nalco 2827, a rust inhibitor product, was inadvertently dumped into a storm drain system. The mixture flowed approximately 600 ft before forming a small pool at the end of the storm sewer. The contaminant was pumped out and the area was cleaned before the liquid reached the Tijeras Arroyo. All manholes connected to the sump were inspected for additional pooling of the contaminant.

- A 1200-gal liquid release of a polymer-modified anionic asphalt emulsion flowed into a storm drain ditch on December 20, 1995. The spill occurred in TA-III (just outside the TA-V gate) when an asphalt truck inadvertently released asphalt to the ground after the contents overheated and boiled over. The asphalt was allowed to solidify and was later removed and disposed of properly. This occurrence was reported to the State of New Mexico due to the large volume of the spill.

7.0 GROUNDWATER MONITORING & PROTECTION PROGRAMS

This chapter describes the groundwater monitoring activities conducted at SNL/NM during 1995. Groundwater monitoring activities reported are those associated with two programs at SNL/NM: the Groundwater Protection Program and the Environmental Restoration (ER) Project. The Groundwater Protection Program operates the Groundwater Surveillance Task which performs site-wide water quality and water level measurements. Water level data are used to define long-term trends in groundwater quantity at KAFB. The specific objective of the task is to establish the impact, if any, of DOE facilities' operations on groundwater quantity and quality. The function of this task is to detect any contaminants entering SNL/NM from outside sources and any contaminants leaving SNL/NM. Data collected are used in baseline hydrogeochemical characterization and groundwater contamination detection monitoring. The ER project is concerned with water quality and flow in the vicinity of contaminated areas. Some ER wells are also shared by monitoring performed under the Groundwater Surveillance Task. Groundwater monitoring activities for 1995 were associated with the following activities and areas:

- **Groundwater Surveillance Task** – (Groundwater Protection Program task group).
- **Site-Wide Hydrogeologic Characterization (SWHC)** (ER Project task group).
- **Chemical Waste Landfill (CWL)** – (ER Project task group).
- **Mixed Waste Landfill (MWL)** – (ER Project task group).
- **Technical Area II (TA-II)** – (ER Project task group).
- **Technical Area V (TA-V) including Liquid Waste Disposal System (LWDS)** – (ER Project task group).

7.1 REGULATORY REQUIREMENTS FOR GROUNDWATER MONITORING ACTIVITIES

The Groundwater Protection Program implements requirements found in DOE Order 5400.1, *General Environmental Protection Program* and DOE Order 5400.5, *Radiation*

Protection of the Public and the Environment. SNL/NM complies with New Mexico water quality standards found in 20 NMAC 7.1 "Drinking Water" and 20 NMAC 6.2 "Groundwater and Surface Water Protection." Federal regulations also drive the program including 40 CFR 141, National Primary Drinking Water Regulations. The ER project follows monitoring criteria set in Resouce Conservation and Recovery Act (RCRA) as specified in the following ER areas:

(1) **The Chemical Waste Landfill (CWL)** currently must meet the interim status provided under RCRA Groundwater Monitoring Regulations (40 CFR 265, Subpart F). In February 1993, the CWL final closure plan and post-closure permit application was approved by all concerned parties (SNL 1992a and 1993f). The current groundwater monitoring requirements for this site are discussed in detail in Sections 2.0 and 7.0 of the closure plan. The sampling and analysis plan is provided in Appendix G of the closure plan.

(2) **The Mixed Waste Landfill (MWL)** is regulated by the EPA as a solid waste management unit (SWMU) under RCRA. Groundwater monitoring activities at the MWL are in accordance with the requirements of 40 CFR 264, Subpart F, Section 264.101, "Corrective Action for Solid Waste Management Units."

(3) **Groundwater sampling activities at TA-II and the TA-V** are conducted as part of the site-specific investigations under the Hazardous and Solid Waste Amendments (HSWA) permit for SNL/NM. The HSWA require that the RCRA process for investigating operating disposal facilities be applied to non-operating facilities. That is, investigations shall be carried out at the facilities using the RCRA facility investigation (RFI) process. Accordingly, RFI activities have been conducted at TA-V and at TA-II, in accordance with RFI work plans that are awaiting EPA approval. These preliminary activities have been designed to determine the amount and extent of any potential contamination in anticipation of formal RFI activities.

7.2 SNL/NM GROUNDWATER MONITORING OVERVIEW

As part of the Groundwater Surveillance Task, groundwater quality samples were collected during March 1995 from 16 wells and four springs owned by SNL/NM, KAFB, and the New Mexico Environment Department (NMED) (Figure 7-1). In addition, static water levels were measured on a monthly basis in 37 SNL/NM and KAFB wells and two springs (including Hubbell Spring located on the Isleta Indian Reservation). In October 1995, the network was reduced to 32 wells and one spring (Figure 7-2). Table 7-1 summarized the frequency of smampling and the number of wells sampled during each monitoring event. The following paragraphs give a brief overview of the activities performed by the Groundwater Surveillance Task and the ER Program.

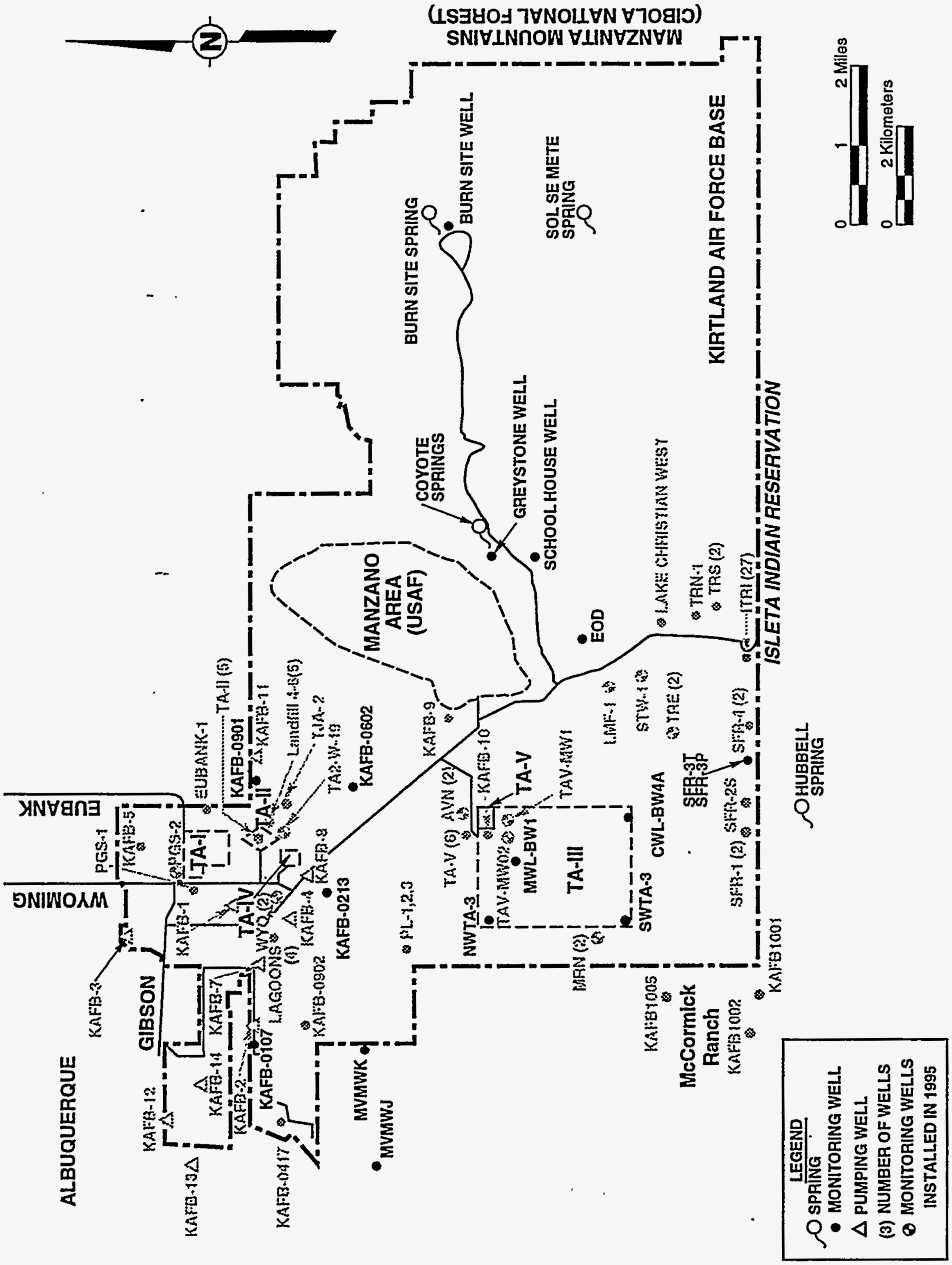

Figure 7-1. Wells and springs water quality sampled by the Groundwater Surveillance Task (shown in bold).

Table 7-1. Sampling frequency for groundwater quality monitoring and number of wells and springs sampled during each period.

	Groundwater Surveillance	Chemical Waste Landfill	Mixed Waste Landfill	Technical Area V	Technical Area II
January					
February		9			
March	20		1	2	
April			3		
May		9			
June				2	3
July					1
August		9			
September				2	3
October			4		
November		9			1
December				6	

Chemical Waste Landfill: Groundwater monitoring was performed at nine monitor wells surrounding the landfill, including two background wells (Figure 7-3). Annual monitoring (February) was performed using water quality parameters specified in RCRA regulations (40 CFR 264 Appendix IX); quarterly monitoring for VOCs (Appendix IX) and metals occurred in May, August, and November.

Mixed Waste Landfill: Groundwater monitoring was performed at five monitor wells in the vicinity of the MWL, including one background monitor well and one monitor well located inside the landfill (Figure 7-4). Semiannual detection groundwater sampling took place at the MWL during April and October 1995.

TA-II wells: Groundwater was sampled at three monitor wells in June and September of 1995: one well in the vicinity of the Bldg. 901 septic leachfield, one background monitoring well, and one well west of Bldg. 906 (Figure 7-5). These wells are completed in a shallow water-bearing zone approximately 200 ft in elevation above the Santa Fe Group regional aquifer groundwater. In addition, one monitor well screened at 585 – 595 ft below ground surface in the regional aquifer, was sampled in July 1995. A new monitor well was installed in 1995 and was sampled in November before, during, and after well development. This well is located in the Tijeras Arroyo floodplain south of the main TA-II site.

TA-V wells: The bulk of TA-V groundwater quality monitoring was performed at two monitor wells (Figure 7-6). One well (LWDS-MW2) is located adjacent to the Liquid Waste Disposal System (LWDS) lagoons and the other well (LWDS-MW1) is adjacent to the buried LWDS waste line immediately outside TA-V. These wells were sampled in

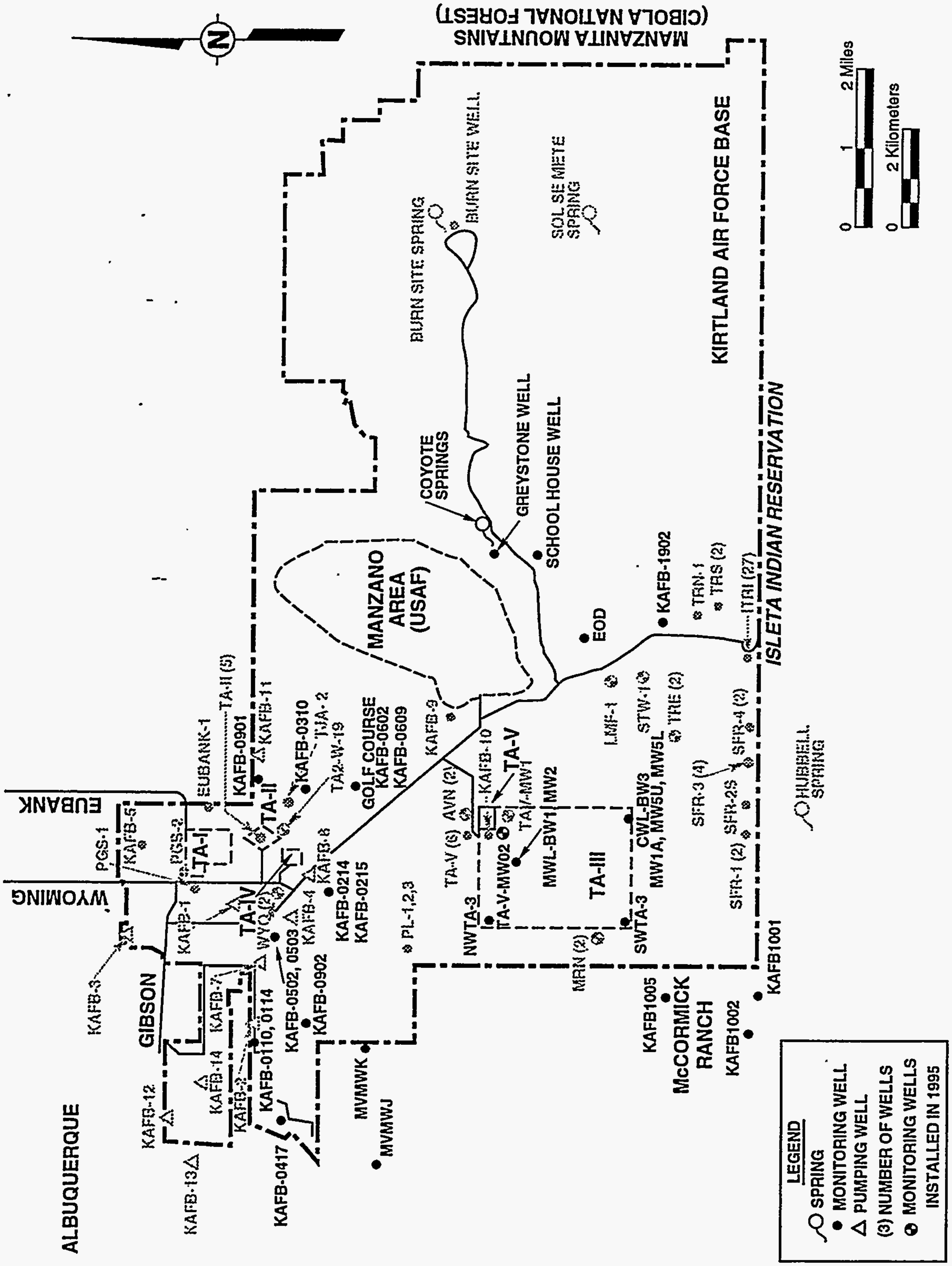

Figure 7-2. Wells and springs measured for static water levels by the Groundwater Surveillance Task (shown in bold).

March, June, and September of 1995. Four additional wells were added to TA-V in 1995. These wells are located in the immediate vicinity of the TA-V seepage pits, downgradient and outside the boundary fence, and northeast of TA-V. The wells in TA-V, (including the four new ones), were also sampled in December 1995, but the results are not yet available for inclusion in this report. However, analytical results from December of 1994 for TA-V that were not available for inclusion in the '94 calendar report, are summarized in this report.

Site-Wide Hydrogeologic Characterization (SWHC): The SWHC task of the ER Project has installed 28 characterization wells at 11 locations on KAFB during the past several years (Figure 7-7). In June 1995, monthy water level measurements were initiated. No routine groundwater quality sampling of these wells occurred through the SWHC task in 1995. Many of the locations have well pairs with one well completed at the water table and the other completed lower in the aquifer.

7.3 WATER LEVEL MEASUREMENTS & TRENDS

Water level data are collected to define regional groundwater flow directions. The data are used to develop the potentiometric surface maps from which gradients can be established and the flow directions determined. During 1995, a detailed analysis was completed of the SNL/NM and the KAFB monitor wells, and a revised SNL/NM groundwater surveillance network was recommended to provide more representative water level data, especially of the upper unit of the Santa Fe Group regional aquifer system. Through September 1995, water levels were measured by the Groundwater Surveillance Task on a monthly basis at 37 wells and 2 springs. Beginning in October 1995, the new groundwater surveillance network was initiated and water level data were collected from the 32 monitor wells and one spring as shown in Figure 7-2.

In addition to the water levels collected by the Groundwater Surveillance Task, the SWHC task performs monthly or quarterly water level measurements from wells associated with the ER project. Wells under the HSWA jurisdiction include sites in TA-II, TA-III, and TA-V. Groundwater level data are also available from the Inhalation Toxicology Research Institute (ITRI) and the KAFB Installation Restoration Program. These data are discussed only briefly. These additional sources of groundwater level data are used along with data collected by the Groundwater Surveillance Task to provide potentiometric surface maps for the SNL/KAFB groundwater system.

Production Well Pumping & General Water Level Trends

Several SNL/NM ER sites are situated relatively close to KAFB and COA water supply wells. The dynamics of the flow regime in these areas are important for the accurate prediction of flow and transport of potential contaminants. Figure 7-8 shows the

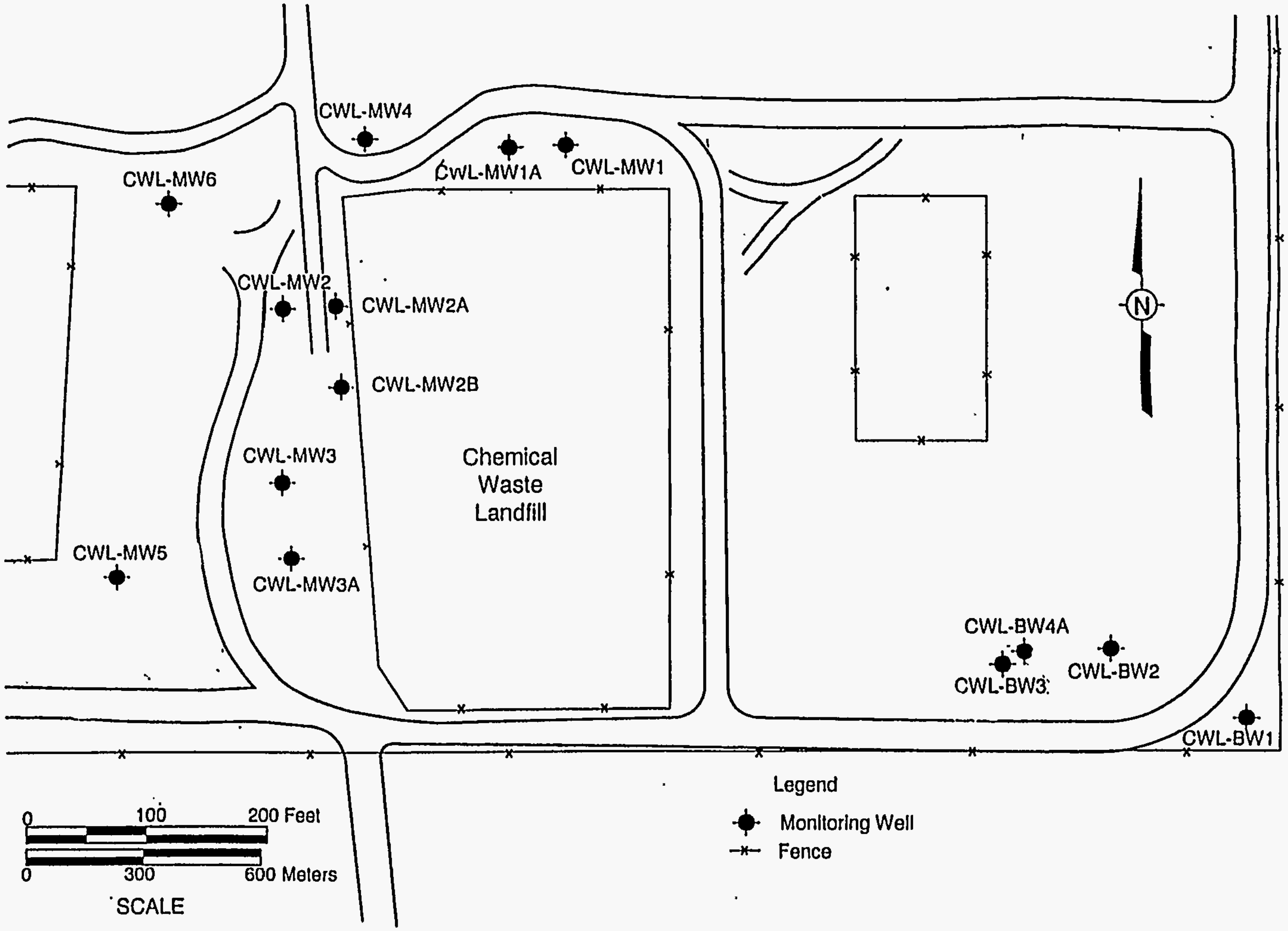

Figure 7-3. Chemical Waste Landfill monitor well locations.

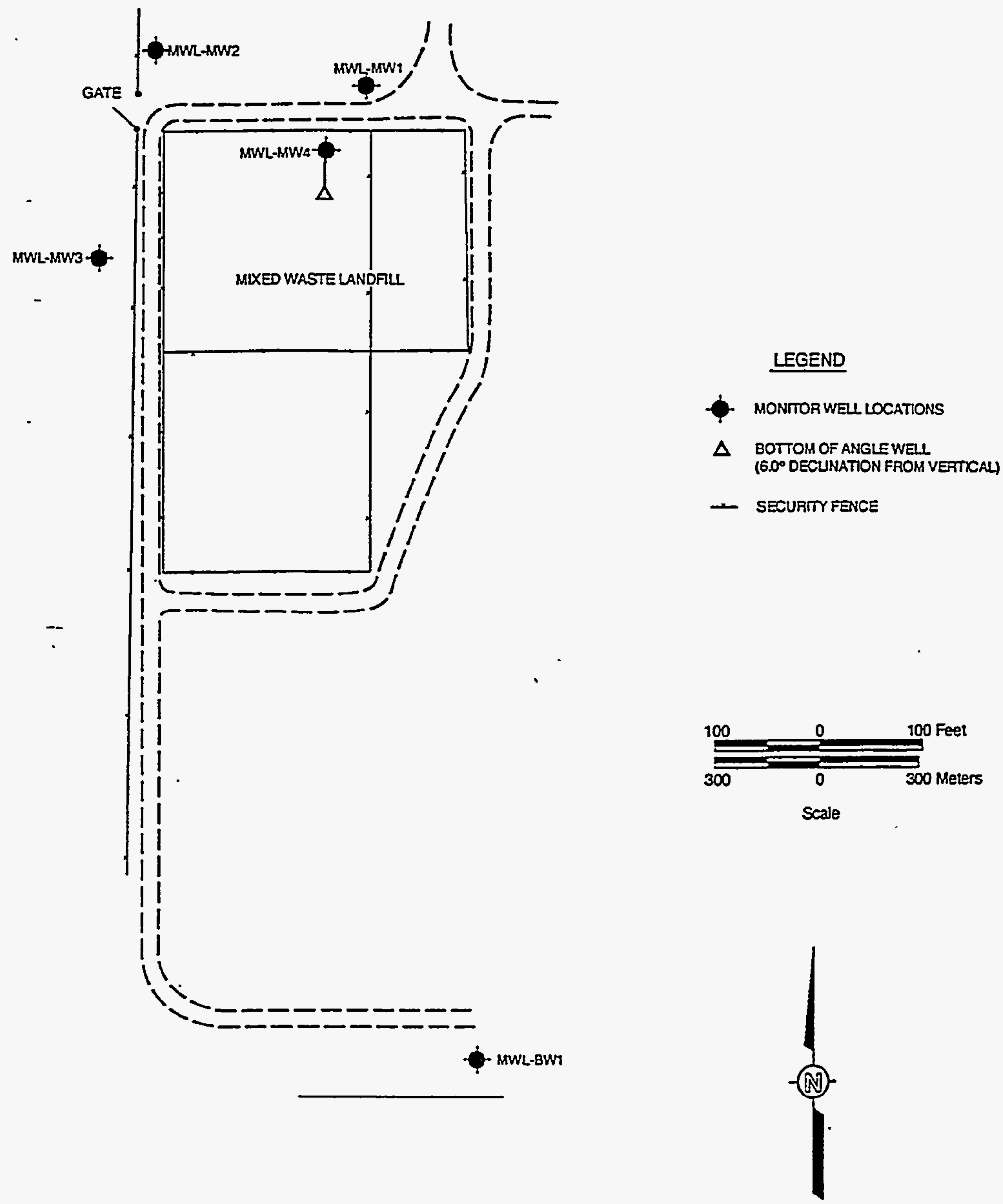

Figure 7-4. Mixed Waste Landfill (MWL) monitor well locations

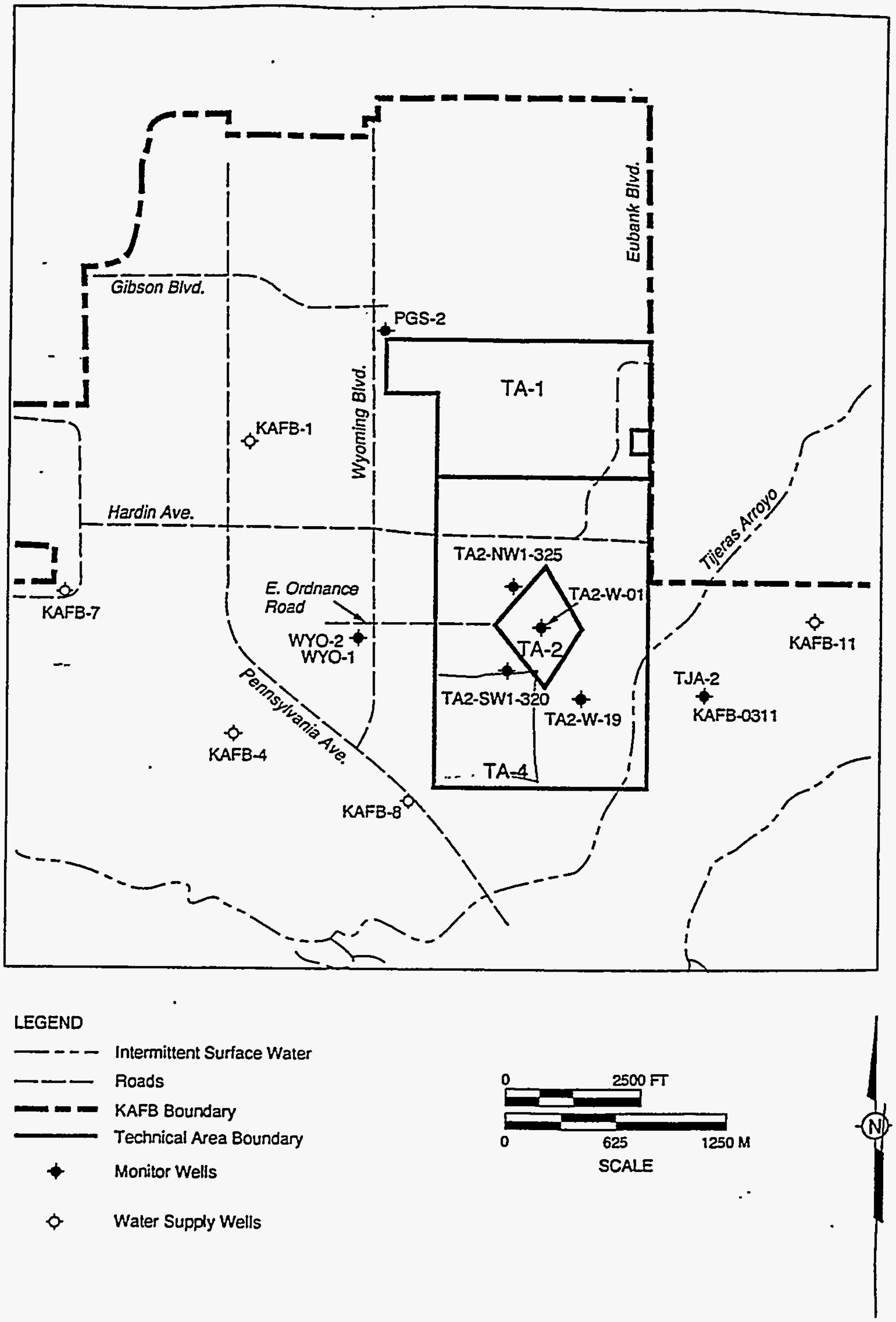

Figure 7-5. Technical Area II (TA-II) monitor well locations.

total monthly production of groundwater from KAFB water supply wells for 1995. Over one billion gallons were pumped from KAFB water supply wells in 1995. As Figure 7-8 shows, water use from these wells is generally highest in the summer months and lowest in the winter months. As a result of above-average precipitation during the spring months of 1995 followed by below-average precipitation during the summer months, the typical pattern of groundwater production was somewhat altered.

Pumping from the KAFB water supply wells results in both seasonal and daily water level fluctuations in monitoring wells located north of Tijeras Arroyo. After an increase in pumping through March, production dropped in April and May, then increased significantly for the months of June through October. The KAFB water supply wells pump significantly more water in the summer months than in the winter months (Figure 7-8). The seasonal effects of pumping are evident in water level fluctuations in monitoring wells that are located north of the Tijeras Arroyo (e.g., KAFB Sewage Lagoon wells). Monitoring wells south of the Tijeras Arroyo do not show significant seasonal fluctuations in water levels but still show long-term declines of up to 2 ft per year. Additionally, many of the COA's water supply wells are located along the northern boundary of KAFB. These well fields pump considerably more than the KAFB wells. However, their effect on seasonal fluctuations in groundwater levels at KAFB is not known at this time.

In general, the hydrographs indicate that water levels have been declining within the upper units of the Santa Fe Group at rates of between 0.5 to over 3 ft per year at KAFB. This decline is a result of pumping from COA and KAFB water supply wells. Most of these water supply wells produce from coarser-grained sediments of the upper and middle units of the Santa Fe Group.

East of the Tijeras fault, water levels in wells do not appear to be affected by the water level declines within the Santa Fe Group regional aquifer system. There are no water supply wells in this area that produce from aquifers east of the fault complex. Because of the proximity to recharge sources (mountain fronts) in the region east of the fault complex, water levels primarily fluctuate as a result of recharge from precipitation run-off and the water usage.

The following subsections discuss the water levels measured within particular areas in 1995 and water level trends that were observed over the last several years for all monitoring wells at SNL/KAFB. Hydrographs for selected wells are presented to illustrate the trends.

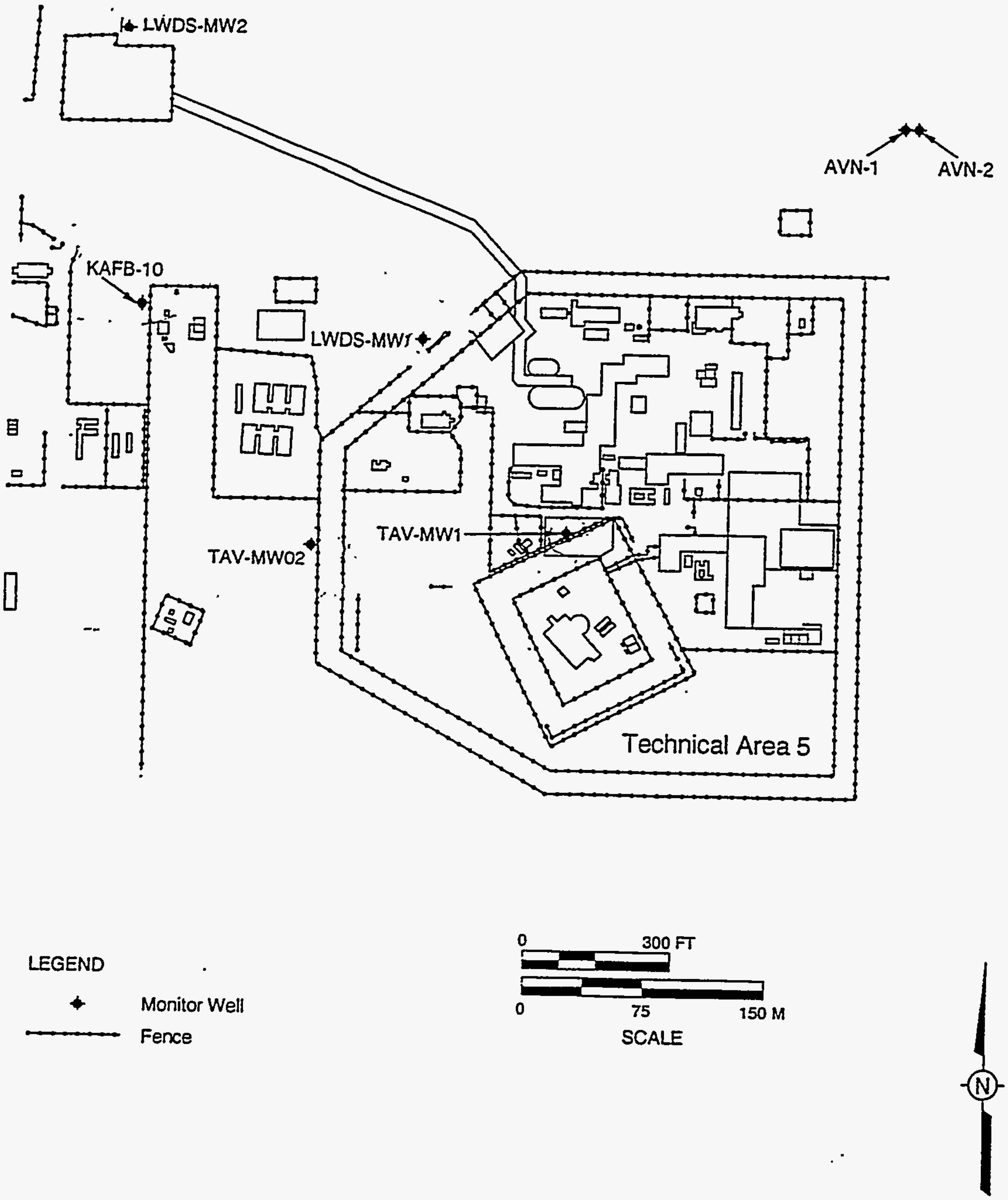

Figure 7-6. Technical Area V (TA-V) monitor well locations.

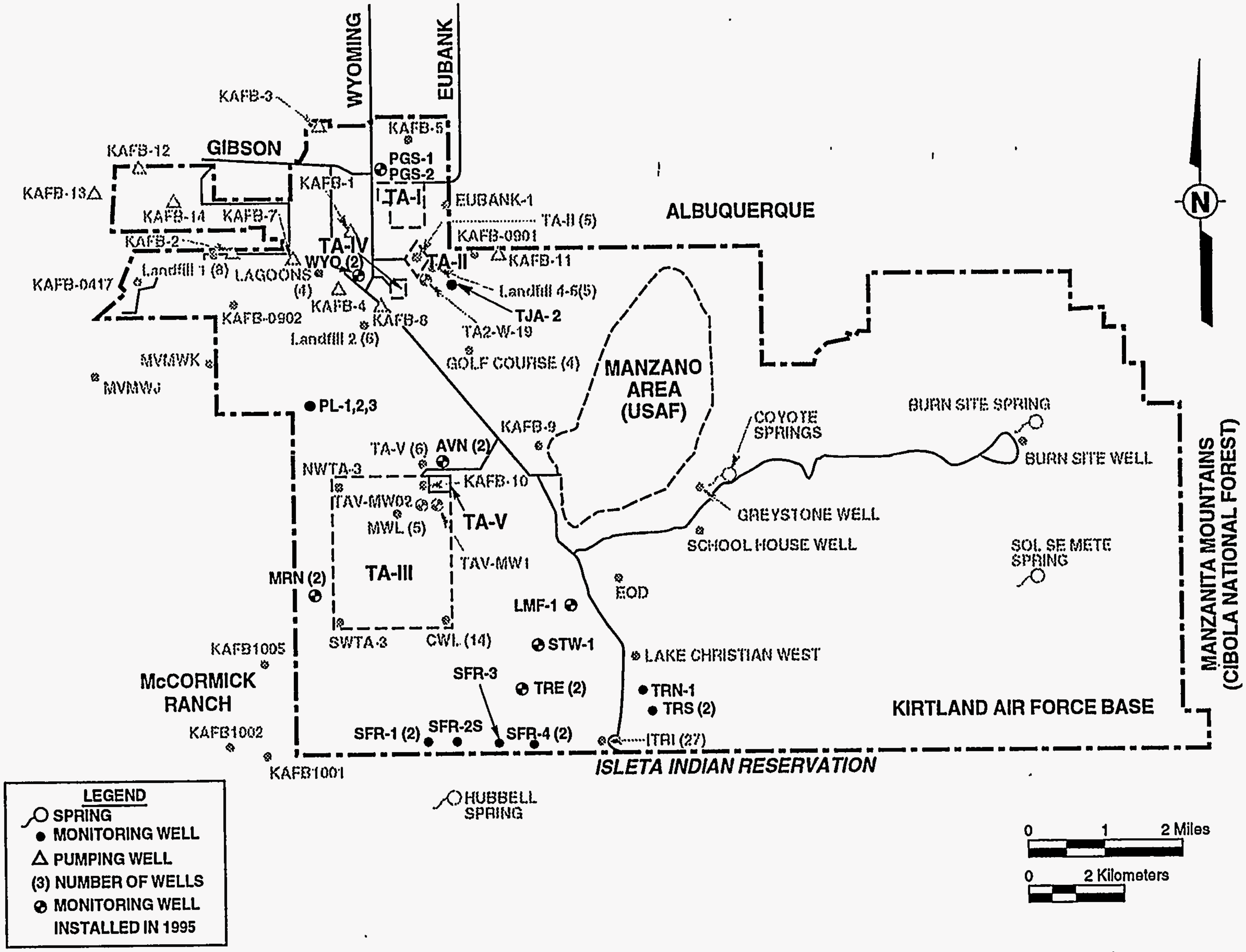

Figure 7-7. Location Map of SNL/NM Sitewide Hydrogeologic Characterization Wells (Shown in bold).

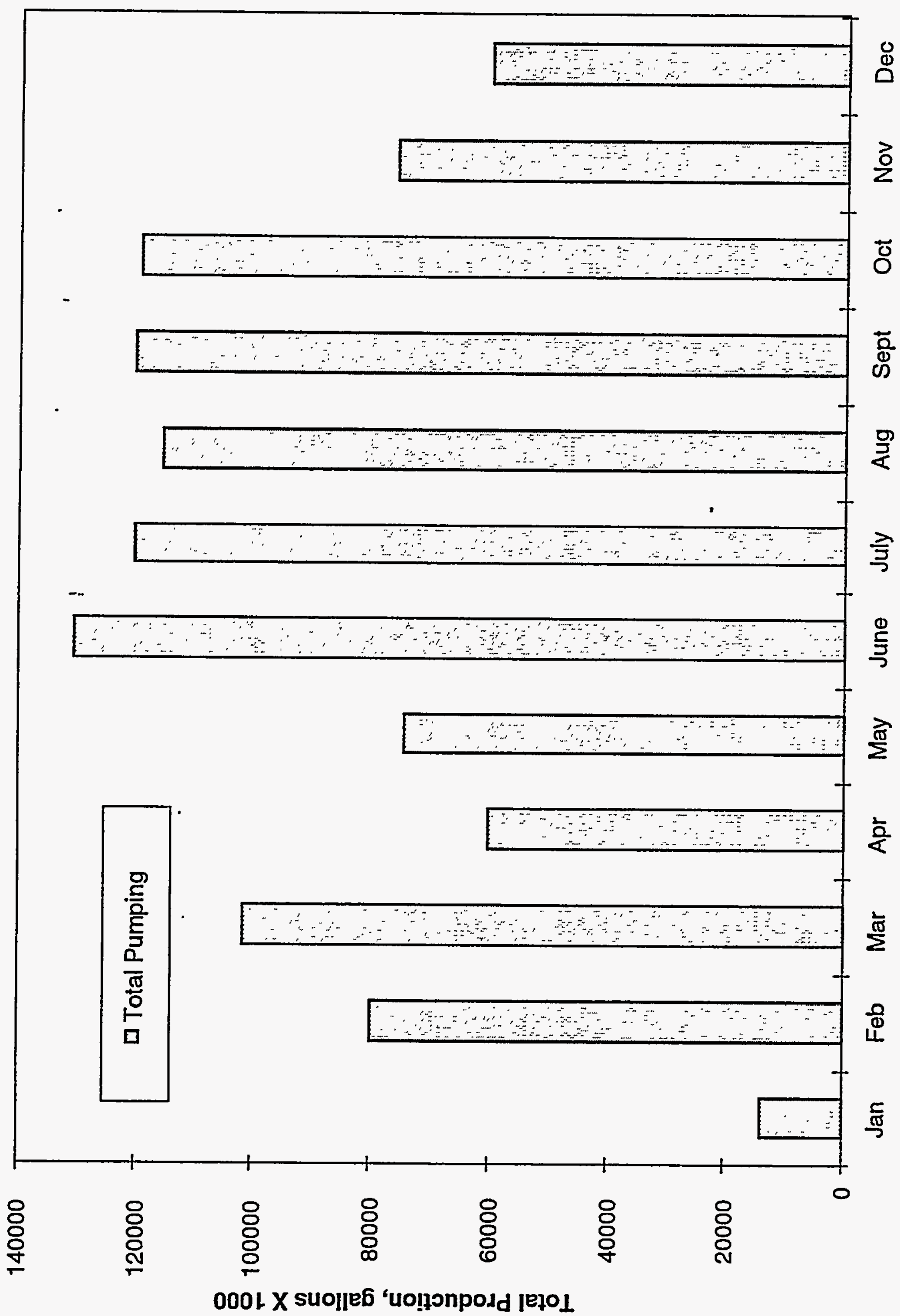

Figure 7-8. Groundwater Pumped by KAFB Production Wells, 1995.

7.3.1 Chemical Waste Landfill Wells - Water Levels

Water levels were measured in 12 wells (Figure 7-3) at the CWL through August of 1995. Four CWL monitor wells (CWL-MW1A, CWL-BW3, CWL-MW5U, and CWL-MW5L) were selected for monthly surveillance in the groundwater surveillance network beginning in October of 1995. Additional water level measurements (from at least one hydraulically up-gradient well and three hydraulically down-gradient wells from the CWL facility) are made during water quality sampling to satisfy the requirements of 40 CFR 265.91.

Water levels in the CWL wells generally decreased throughout the year at an average rate of 1.4 ft (0.43 m) per year, higher than the average decline of 0.85 ft per year as averaged over the past 10 years (Figure 7-9). Generally, the water levels in the CWL wells screened at the water table are higher than those in nearby deep wells. This indicates a downward vertical gradient. Several monitoring wells were installed as nested wells with one relatively shallow well and one relatively deep well. Water levels from CWL-MW5U (shallow well) and CWL-MW5L (deep well) and from CWL-MW6U and CWL-MW6L indicate a downward vertical gradient of 0.06 ft per foot. Vertical gradients at the CWL occur because fine-grained alluvial fan deposits overlie coarse-grained fluvial deposits. Preferential flow in response to water supply pumping to the north occurs within these fluvial deposits, creating downward vertical flow within the alluvial fan deposits.

7.3.2 Mixed Waste Landfill Wells - Water Levels

Based on the limited water level measurements taken at the MWL, it appeared that water levels declined at a rate of approximately 1.0 ft (0.30 m) per year in 1995. The rate of decline over the past seven years is approximately 0.8 ft per year (Figure 7-10). Vertical gradients at the MWL are expected to be approximately the same as at the CWL.

7.3.3 Other Technical Area III & Vicinity Wells - Water Levels

With the exception of SWTA-3, wells located west of the CWL and MWL showed significantly higher rates of water level declines (2 –3 ft per year). These wells are completed in coarser-grained fluvial deposits with characteristically higher hydraulic conductivity than the alluvial fan deposits found at the CWL and MWL.

Nested wells were installed west (MRN-1,2) and northwest (PL-1,2,3) of TA-III by the SWHC task. Monthly water level measurements of these wells have been collected by the SWHC task since June of 1995. These water level data suggest that groundwater levels west of TA-III are declining at slightly greater than 2 ft per year. Vertical gradients

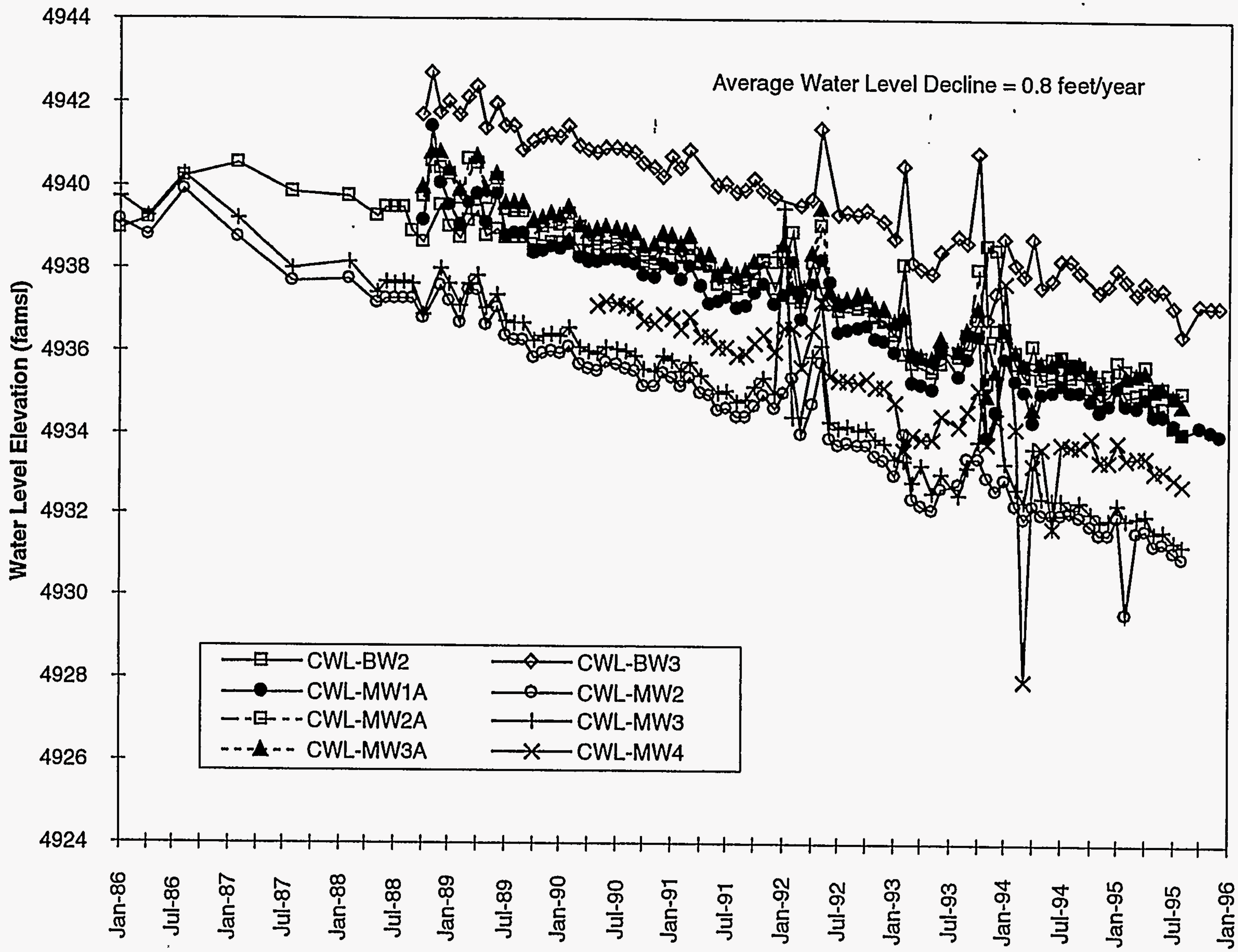

Figure 7-9. Hydrograph for Chemical Waste Landfill monitor wells, 1986-1995.

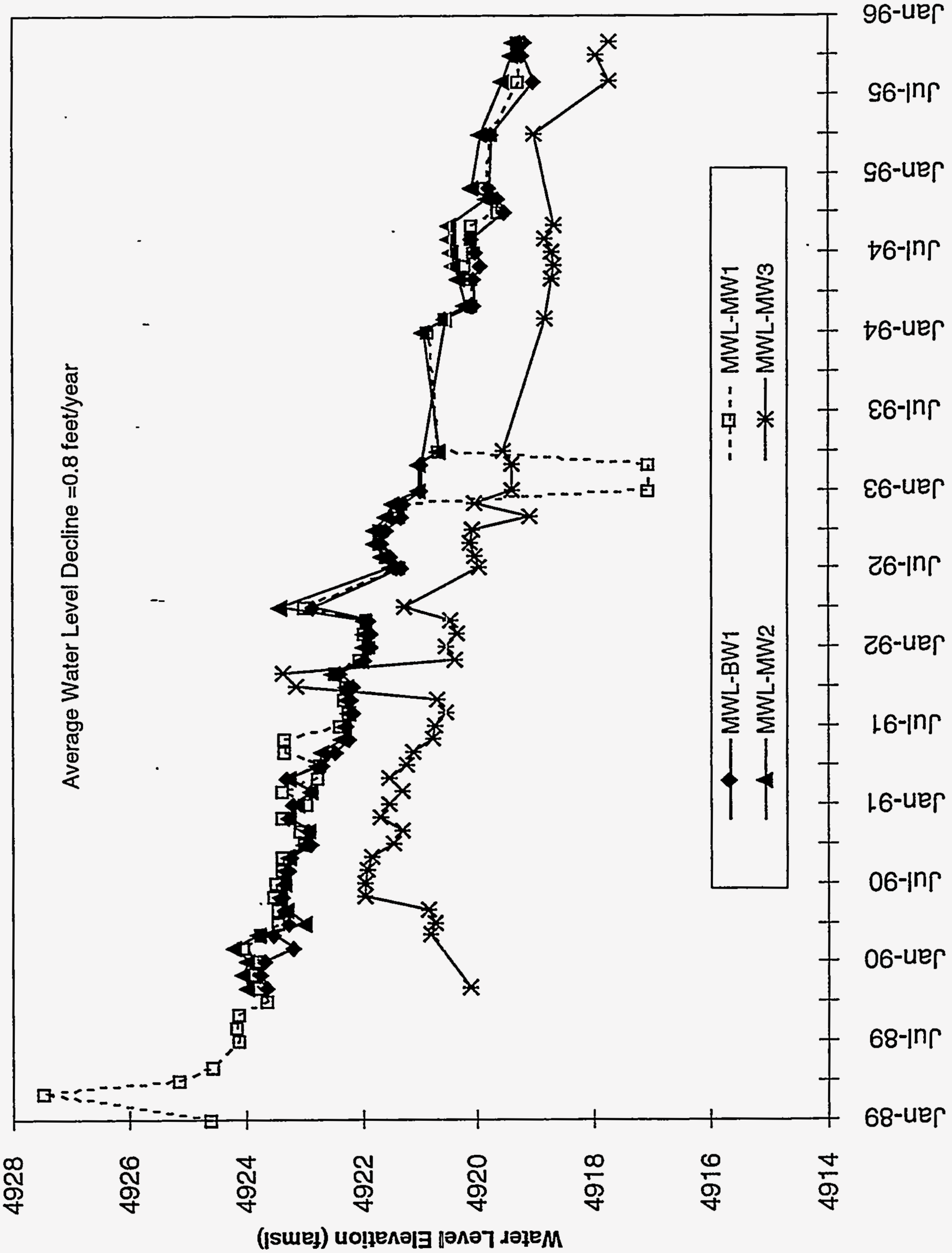

Figure 7-10. Hydrograph for Mixed Waste Landfill monitor wells, 1989-1995.

appear to be insignificant at the MRN and PL locations. This is in contrast to the CWL and the MWL, where vertical gradients are 0.06 ft per foot or greater.

Additionally, three KAFB monitor wells located outside the southwestern boundary of KAFB at the McCormick Ranch Test Range, have been added to the groundwater surveillance network to provide better coverage in this area. The McCormick Ranch monitor wells are declining at approximately 1.5 – 2 ft per year.

7.3.4 Technical Area V Wells - Water Levels

Six monitor wells (Figure 7-6) and one abandoned water supply well (KAFB-10) are located at TA-V. Water levels were measured monthly in KAFB-10 until September 1995. Because of its long screen length, however, this well was not considered to be representative of the uppermost water level and was replaced in the current groundwater surveillance network with TAV-MW02. Water levels collected from TA-V wells show a fairly steady decline in water levels, ranging from 0.5 to 1.9 ft per year. LWDS-MW1 and KAFB-10 have the longest record of measurement and show similar declines of approximately 1.4 ft per year. This rate of decline is the same as that observed at the CWL and slightly higher than that at the MWL. A downward vertical hydraulic gradient of 0.02 was calculated for TA-V from monitoring wells AVN-1 and AVN-2 (vertical separation of 75 ft).

7.3.5 Site-Wide Hydrogeologic Characterization Monitor Well - Water Levels

Wells located along the South Fence Road were installed by the SWHC task to assess the effects that regional faults traversing KAFB have on groundwater flow. Only the SFR-4 wells showed significant water level changes since June, when the SWHC task water level measurements began. SFR-4P was developed in March 1995 and has a very slow recovery rate. More data need to be collected for a meaningful evaluation of the water level trends in these wells, including the relation of any trends to aquifer types and fault contact interactions.

Monitor wells were installed by the SWHC task in late 1995 to assess the fault zone (STW-1, TRE-1, TRE-2, and LMF-1 [see Figure 7-7]). These wells have insufficient water level data for analysis of trends due to the short time since their installation.

7.3.6 KAFB Sewage Lagoon Wells - Water Levels

The four monitor wells at the KAFB sewage lagoons are located close to two active KAFB production wells (KAFB-4 and KAFB-7). Water levels in previous years have shown an inverse correlation with production well pumping rates (i.e., the monitoring well water levels decline during periods of increased production well pumping and rise during periods of decreased pumping). This indicates a direct response of the regional

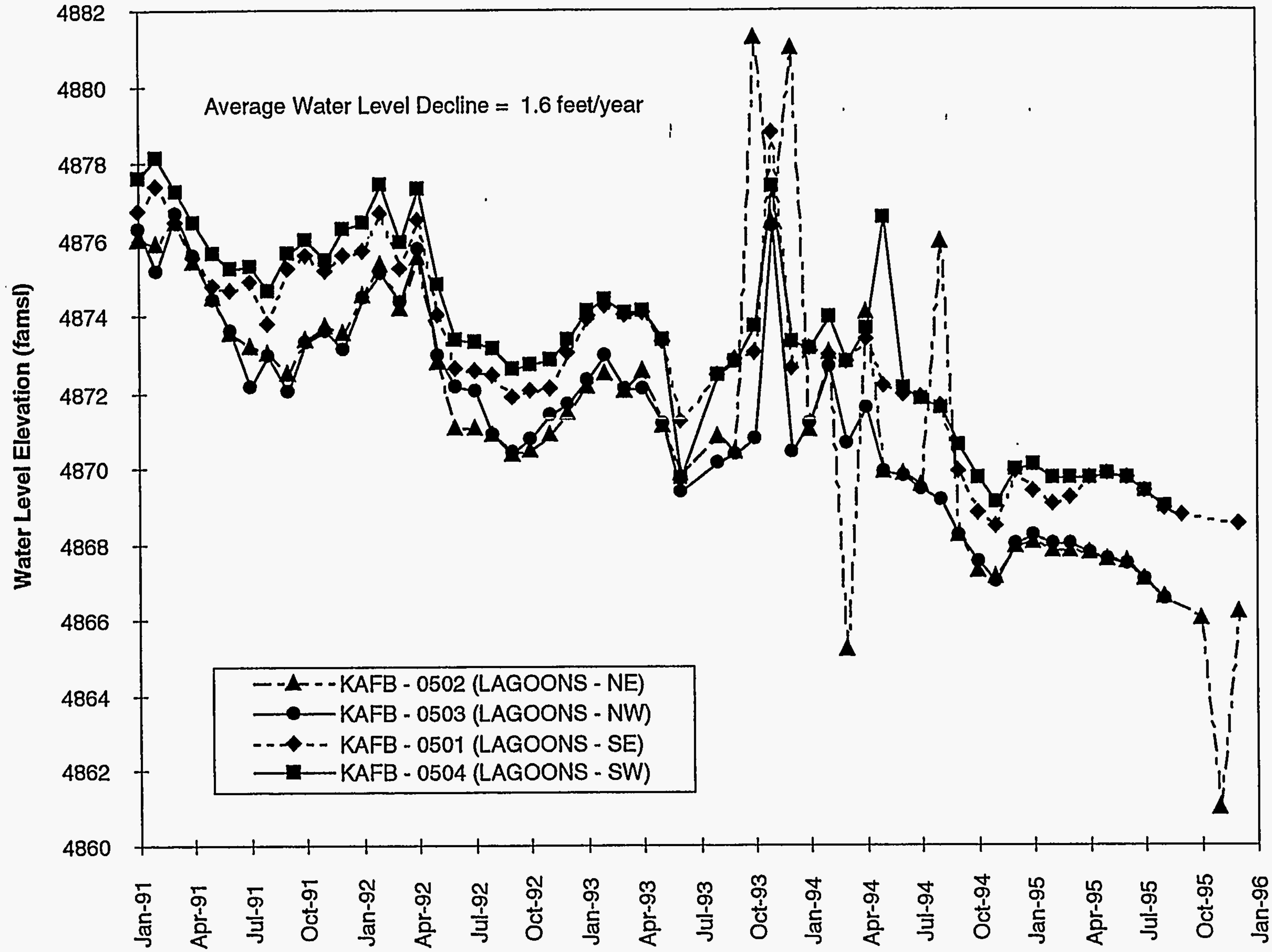

Figure 7-11. Hydrograph for KAFB Sanitary Lagoon monitor wells KAFB-0501, KAFB-0502, KAFB 0503, and KAFB-0504, 1991-1995.

aquifer to pumping in that area. The hydrograph in Figure 7-11 shows seasonal water level fluctuations as a result of pumping from nearby production wells. While it is most probable that the southern Lagoon wells respond to pumping from KAFB-4 and the northern Lagoon wells respond to pumping from KAFB-7, other nearby production wells (KAFB-1 and KAFB-3) may also influence water level fluctuations in these monitoring wells. Superimposed on the seasonal water level fluctuations is the basin-wide decline of the regional aquifer. In the area of the KAFB sewage lagoons, this decline appears to be approximately 2.6 ft per year (Figure 7-11).

7.3.7 Tijeras Arroyo Wells - Water Levels

Wells are located near the Tijeras Arroyo (KAFB-0107 [also called LF/DM-01], KAFB-0213 [also called LF/DM-02], MVMWJ, MVMWK, KAFB-0901 [also called Tijeras East], and KAFB-0902 [also called Tijeras West]). The data from these wells generally show steady water level declines ranging from 3 ft per year in the western portion of the Tijeras Arroyo to 1 ft per year at KAFB-0901 (Tijeras East). Both KAFB-0902 (Tijeras West) and KAFB-0107 (LF/DM-01) show fluctuations in their water levels that appear to be in response to production pumping, most likely from either KAFB-2 or KAFB-14.

7.3.8 Tijeras Arroyo Golf Course Wells -Water Levels

The Tijeras Arroyo Golf Course wells continued to show a fairly steady rise in water levels for 1995 as seen by the hydrograph in Figure 7-12. Water levels are rising at between 1.2 and 2.3 ft per year for 1995. This is consistent with the average rate of water level rises of between 1.5 and 2.7 ft per year for the past 5 years. Currently, it is unknown why water levels are increasing in these wells and why there is variation in rates among the different Golf Course wells. Although one possible source is artificial recharge from the Tijeras Arroyo Golf Course; recharge may also be occurring from potential sources to the northwest. Groundwater is first encountered beneath the Tijeras Arroyo Golf Course and TA-II at approximately 150 ft above the regional groundwater surface. This relatively shallow groundwater is either a perched zone, multiple perched zones, or a local rise on the regional aquifer system. Section 7-4 discusses the shallow groundwater zone in the Tijeras Arroyo area.

7.3.9 Technical Area II Wells - Water Levels

TA-II has four monitor wells that are screened within a shallow water-bearing zone encountered at a depth of approximately 300 ft below ground surface. It is most probable that the shallow water-bearing zone in this area represents one or multiple perched zone(s) present beneath TA-II and its vicinity: however, the nature and extent of the perched zones have not been determined.

Additionally, one monitoring well has been screened in the regional aquifer at TA-II. The depth to the regional aquifer at TA-II is approximately 540 ft below ground surface.

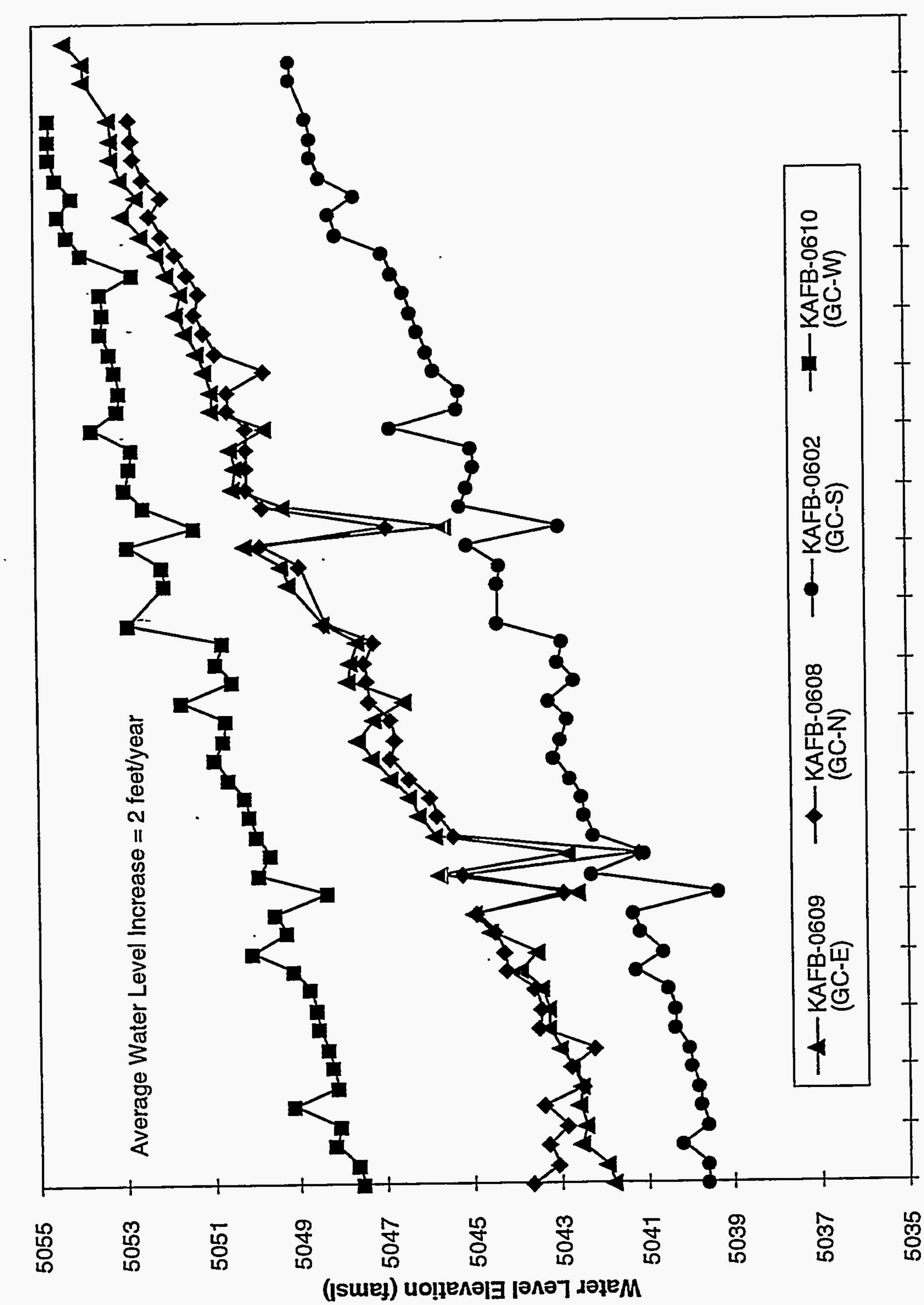

Figure 7-12. Hydrograph for Golf Course Wells KAFB-0609, KAFB-0608, KAFB-0602 and KAFB-0610, 1991-1995.

The SWHC task installed several monitoring wells in the vicinity of TA-II both within the shallow water-bearing zone and in the regional aquifer: TJA-2 (shallow), WYO-1 (regional), and WYO-2 (shallow) (shown on Figure 7-5).

Water level data for TA-II and the vicinity are sparse for 1995. The range of water level fluctuations for wells screened within the shallow water-bearing zone at and in the vicinity of TA-II is generally less than 1 ft in each well (Figure 7-13). Currently, there are insufficient data to determine whether water levels are increasing in the perched zone wells, as they are at the Tijeras Arroyo Golf Course. Water levels generally appear to have decreased in the TA-II shallow wells since 1994; however, inconsistent fluctuations and the lack of data from the first three quarters of 1995 make it difficult to adequately assess water level trends. Section 7.3 presents a discussion of the apparent flow direction for groundwater in both the regional and shallow water-bearing zones.

Water levels have fluctuated at TA2-NW1-595 (a regional aquifer monitor well) more than 5 ft within the span of a month. Comparison of pumping from nearby production wells with transducer data from this well indicate that TA2-NW1-595 is within the capture zone of water production well KAFB-11 located to the east of TA-II.

7.3.10 East of the Fault Zone Complex Wells - Water Levels

Water levels in wells located east of the fault complex (Figure 1-3) show distinctly different trends than those wells completed in the Santa Fe Group regional aquifer west of the fault complex. In general, the east wells do not show the water level declines associated with the regional aquifer. Water levels in the School House Well increased slightly until May, and then decreased through October by more than 0.5 ft. The EOD well showed slight increases in water levels until May with the exception of a lower level in April, and then rose slightly the remainder of the year. Both the School House Well and the EOD well are completed in fractured bedrock but are in different formations (Precambrian granite and Madera limestone, respectively) which may account for the differences in their behavior.

The Greystone Well showed decreases through August of approximately 1.8 ft, with increasing water levels thereafter. This well is screened in a shallow alluvial aquifer that may receive most of its recharge from direct precipitation and so is subject to a higher magnitude in water level variations. Greystone Well for the past 6 years shows high variability. In general, water levels are highest during winter months and lowest during summer months. The Lake Christian West Well declined steadily through 1995 with only one slight increase in August, followed by additional water level decline. This well is also in a shallow alluvial aquifer that is probably larger both laterally and vertically than that at the Greystone Well. This would result in more stable water levels over time.

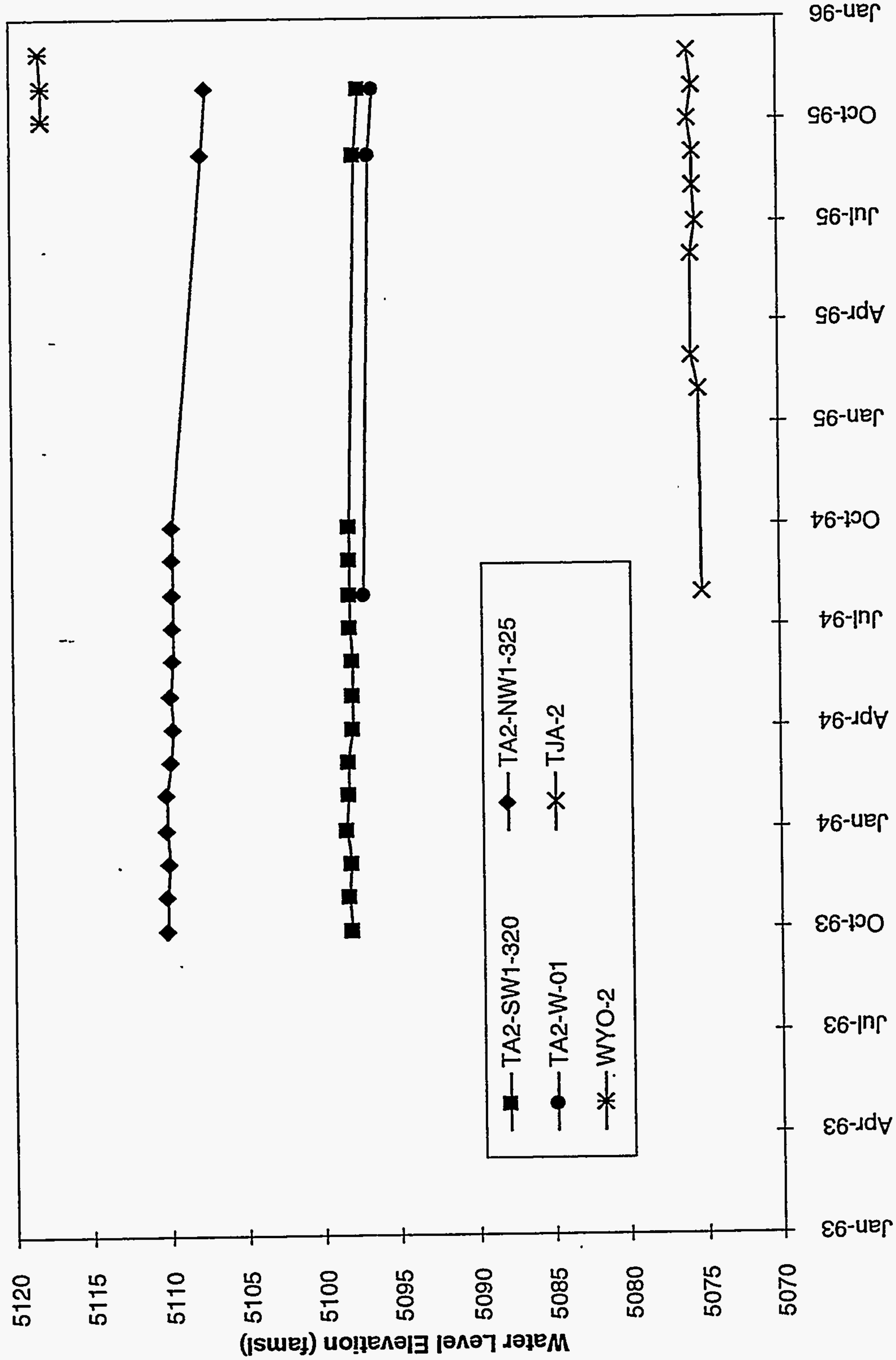

Figure 7-13. Hydrograph For TA-2 Perched Zone Monitor Wells, 1993-1995.

7.4 POTENTIOMETRIC SURFACE

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

A potentiometric surface map was constructed using static water level data from October and November of 1995. The potentiometric surface map shown in Figure 7-14 is representative of the uppermost water surface of the regional aquifer systems. Wells used to construct the 1995 potentiometric surface map are, for the most part, screened across the water table. (Only KAFB-5 and wells located east of the fault complex are not screened in this manner.)

Within the upper unit of the Santa Fe Group regional aquifer system, west of the fault complex, the apparent direction of groundwater flow is west and northwest. This is in contrast to the southwesterly direction reported by Bjorklund and Maxwell (1961). This change in flow direction is a result of groundwater pumping by KAFB and nearby COA water production wells. Pumping from these well fields has created a groundwater surface north-south trending ellipsoidal depression along the western and northern boundaries of KAFB. This depression, extending as far south as the Isleta Pueblo, is probably the result of preferential flow through highly hydraulically conductive ancestral Rio Grande deposits that are the primary aquifer material in this area. Potentiometric contours on the northern portion of KAFB indicate primarily northern flow direction. Pumping from water production wells can change the local hydraulic gradient and the groundwater flow direction on a seasonal basis.

Groundwater is more than 700 ft higher east of the Tijeras Fault zone (Figure 7-14). East of the fault complex, groundwater flow direction and hydraulic gradient is controlled by topography and aquifer lithology. The hydraulic gradients are higher within saturated fractured bedrock than in more conductive alluvial aquifers. Groundwater in this area generally flows southwest through Lurance Canyon and west and northwest across the fault zone.

A shallow water-bearing zone exists in the vicinity of the Tijeras Arroyo Golf Course and TA-II (Figure 7-15). This area appears to represent a perched aquifer but in the vicinity of the Tijeras Arroyo Golf Course, it is possibly a local rise in the regional aquifer in this area. The equipotential contours are drawn only for the known extent of this shallow groundwater zone and the lateral extent of the zone is currently under investigation. The direction of groundwater flow in this zone appears to be to the south-southeast, which is

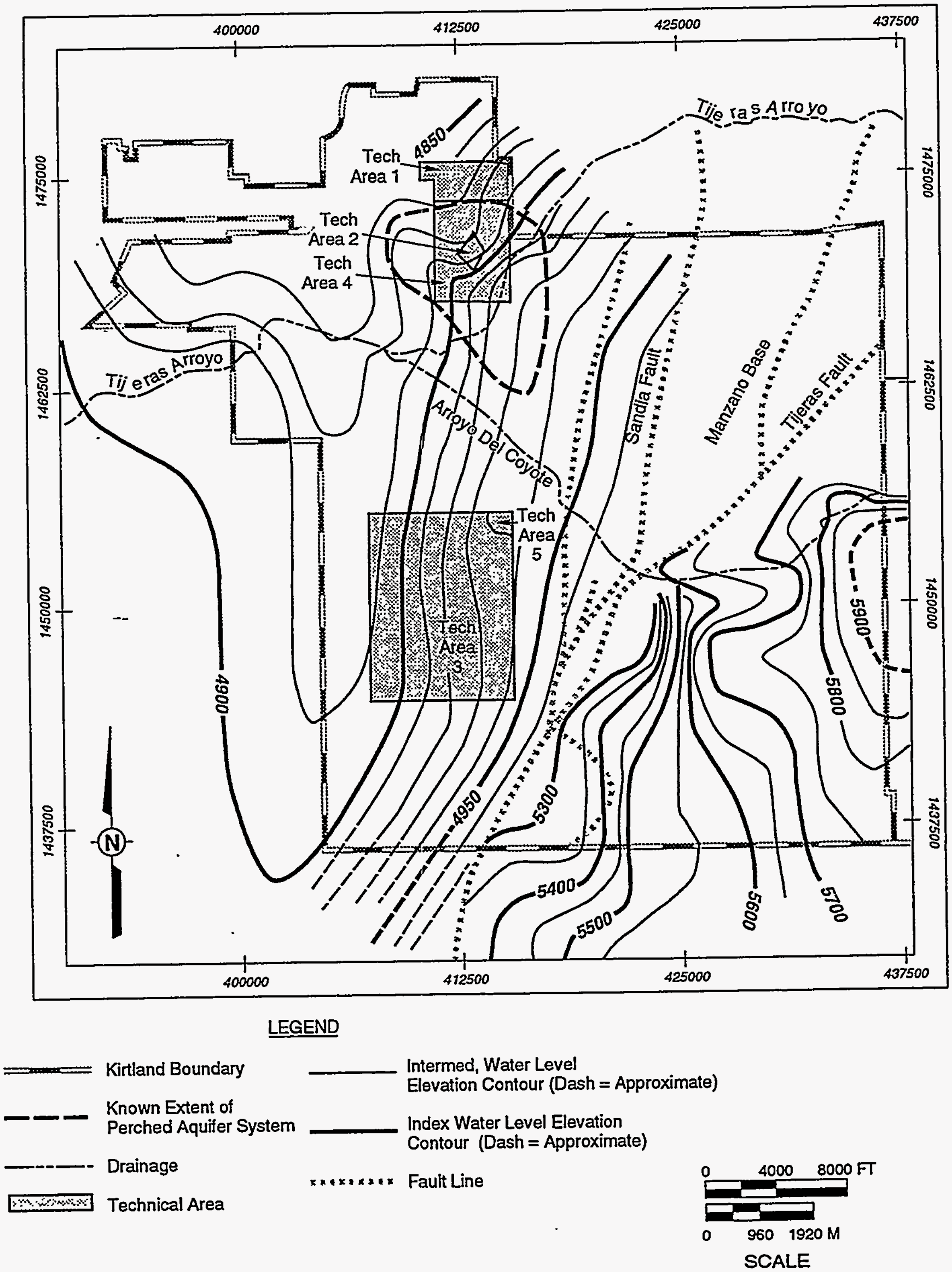

Figure 7-14. Potentiometric surface for the regional groundwater system at SNL/KAFB, October 1995.

counter to groundwater flow in the regional aquifer. The hydraulic gradient appears to be about 0.01 ft per foot.

Figure 7-16 shows a summary map of the groundwater declines in feet per year in the regional aquifer for the KAFB area. These declines are based upon monitor well data discussed in Section 7.3. In general, water levels are declining at 0.5 to 3.0 ft per year on KAFB. Water level declines within the fluvial deposits of the ancestral Rio Grande are much greater than within the alluvial fan deposits.

7.5 GROUNDWATER QUALITY

Groundwater monitoring activities conducted by SNL/NM during 1995 included water quality sampling at the CWL, MWL, TA-V, and TA-II monitor wells on periodic schedules (Table 7-1). Chemical analyses were conducted in accordance with EPA-approved methods (e.g., SW-846) (EPA 1986) by laboratories under contract to SNL/NM and by SNL/NM's on-site laboratories. The following subsections describe the sampling, procedures, parameters, and analytical results for each of the project areas.

7.5.1 Sampling Procedures & Methods

The general procedure for the collection of groundwater samples at all areas in 1995 included:

- Measuring the groundwater level in each well.
- Purging each well of three casing volumes of groundwater up to a maximum of 100 gal (with exceptions for low-yield wells, as noted in individual event reports).
- Collecting the groundwater sample and appropriate quality control (QC) samples in specified containers provided by the analytical laboratories with appropriate preservatives as needed.
- Sending the samples to the analytical laboratories for analyses under chain-of-custody documentation.

Measurements of water quality parameters were made during purging to determine effectiveness of purging as demonstrated by the stability of the measured parameters. This was performed in order to ensure collection of representative samples. Specific

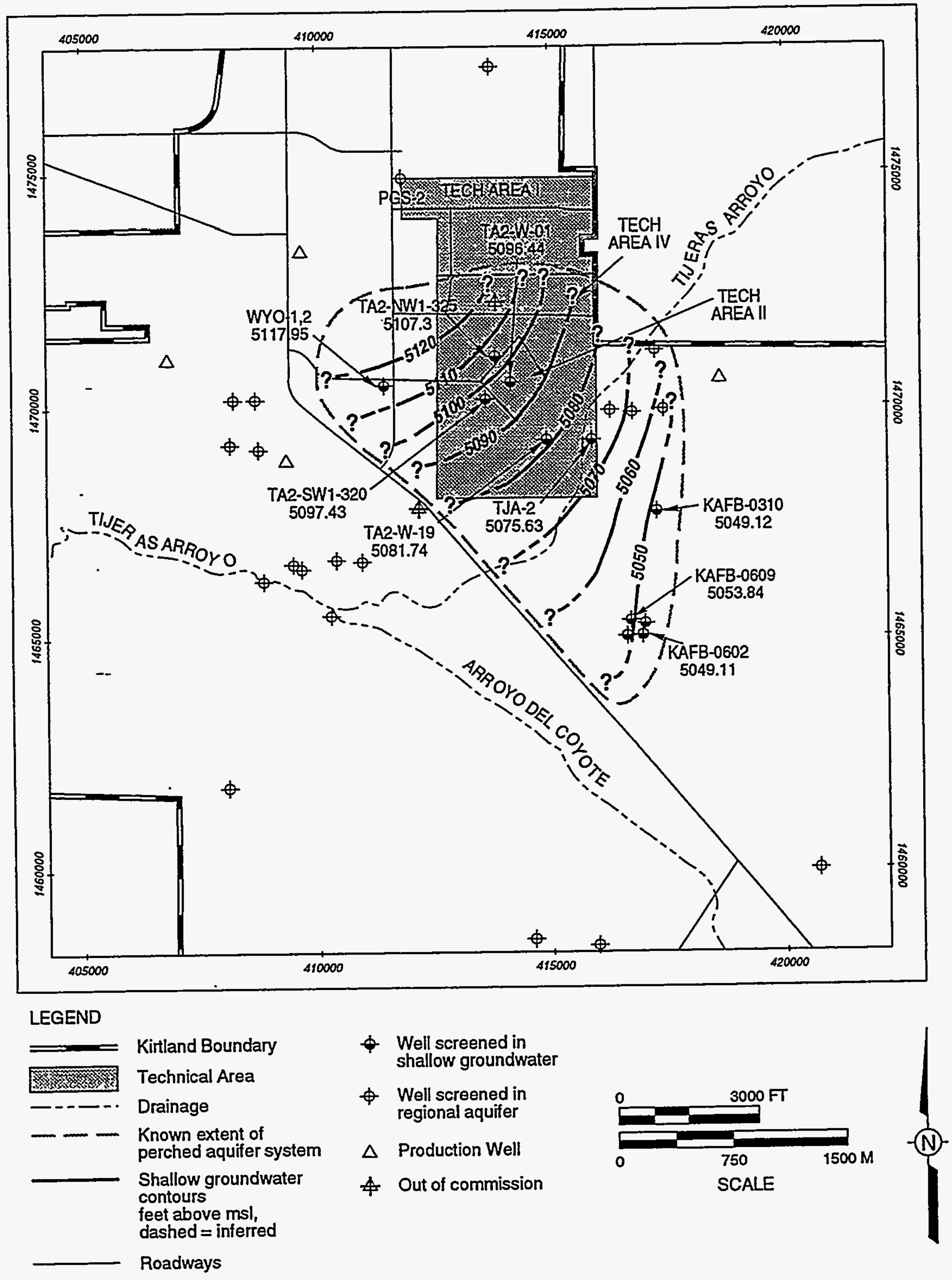

Figure 7-15. Poteniometric surface map for the perched aquifer system in the vicinity of Tijeras Arroyo, Fall 1995.

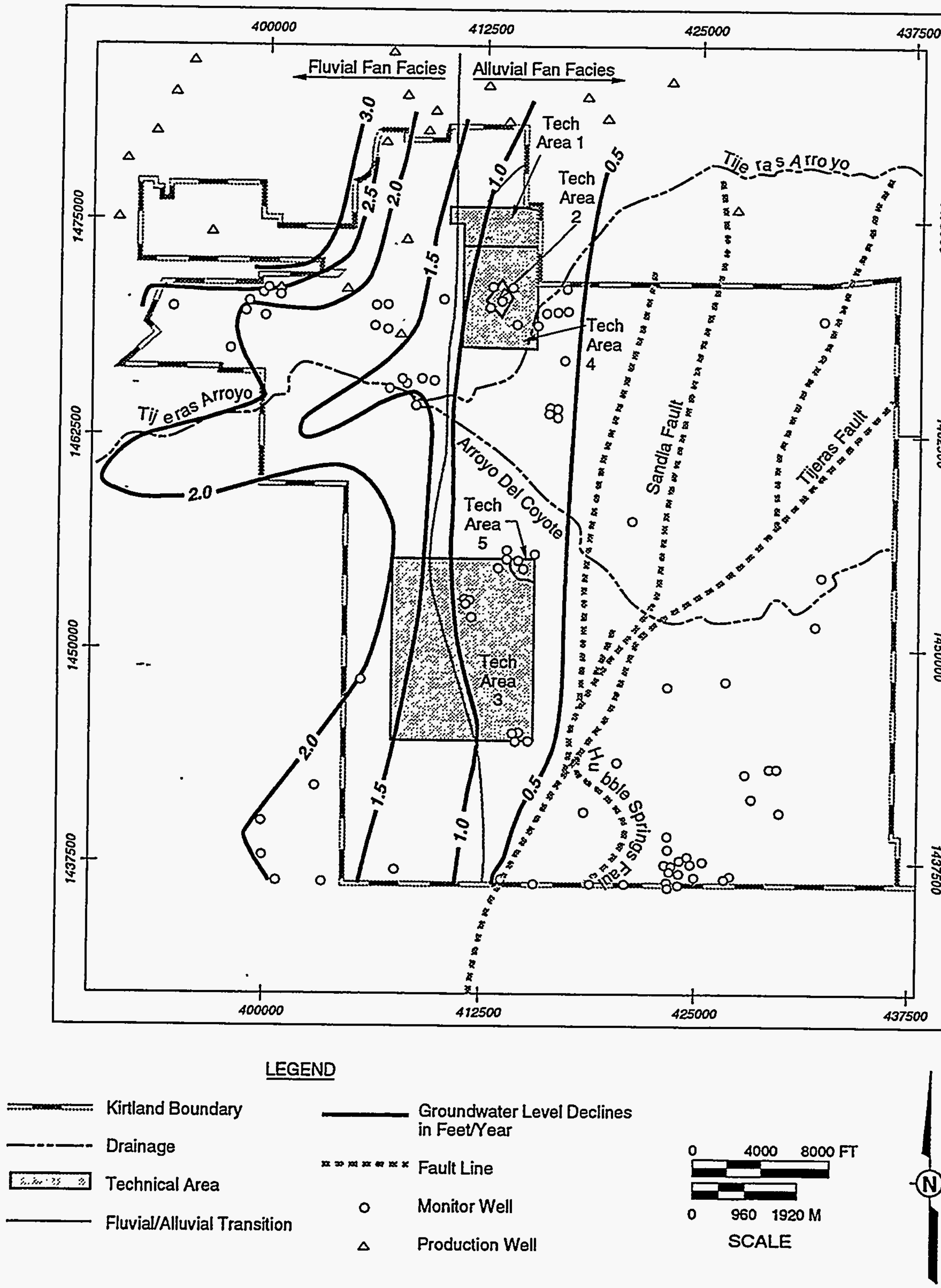

Figure 7-16. Average annual water level elevation decline in the Santa Fe Group regional aquifer system.

details pertaining to each groundwater sampling event are described in the individual sampling reports which contain summary tables, complete field and laboratory data, QC data, and descriptions of the analytical methods employed by the analytical laboratories. These reports are referenced under each project section.

Detailed protocols for the collection and analysis of groundwater samples for Groundwater Surveillance Task monitoring are provided in the *Groundwater Monitoring Program Sampling and Analysis Plan* (SNL 1993g). The protocols for the collection and analysis of representative groundwater samples are specified in the following reports:

- **CWL Wells**

Chemical Waste Landfill Final Closure Plan and Post Closure Permit Application, Appendix G, Sampling and Analysis Plan for Groundwater Assessment Monitoring at the Chemical Waste Landfill, Revision 4 (SNL 1992a).

- **MWL Wells**

Mixed Waste Landfill Sampling and Analysis Plan (SNL 1994g).

- **TA-V Wells**

TA-V Groundwater Sampling and Analysis Plan (SNL 1995j).

- **TA-II Wells**

Site-Specific Sampling and Analysis Plan, TA-II Groundwater Monitoring (SNL 1994h).

7.5.2 Groundwater Quality Analysis

Due to the amount of data generated by the analyses, only those numerical values exceeding the maximum concentration levels (MCL) of the National Primary Drinking Water Regulations (40 CFR Part 141), the maximum allowable concentration (MAC) in groundwater as defined by the New Mexico Water Quality Control Commission (NMWQCC) (20 NMAC 6.2), and DOE guidelines for radioactive constituents are discussed in this section (i.e., all other values are below the identified standards). References are provided where complete data for each activity are reported.
The Groundwater Surveillance Task measured water quality parameters and collected water samples for laboratory analyses from 16 wells and four springs across KAFB in March through April of 1995 (Figure 7-1). The results of the analyses of the samples collected during this event were used to characterize the regional groundwater system and provide contaminant detection monitoring. Details and results of this annual sampling activity are documented in the *Groundwater Protection Program, Groundwater Surveillance Report, March 1995* (SNL 1995i).

Groundwater surveillance during 1995 was guided by RCRA regulations, 40 CFR 265, Subpart F, in the selection of parameters and analytes. The list of parameters and analytes is representative of potential contaminants, indicators of potential contamination, and safe drinking water parameters. Because total organic halogens (TOX) analysis, which include volatile organic compounds (VOCs), may not accurately indicate potential contamination, additional VOCs were added to the analyte list including VOCs determined by EPA Method 8260, and VOCs chosen from material gathered from other documents through a library search. Analyses for antimony, beryllium, and thallium were requested first in 1995 to obtain data for comparison with MCL for Primary Drinking Water Standards, as administered by the State of New Mexico (20 NMAC 7.1). During the March sampling event, groundwater was sampled for background characterization of selected radionuclides consisting of gross alpha and gross beta activity, isotopic analyses for uranium, thorium, radium, strontium-90, and tritium analysis. Groundwater samples were also screened for gamma-emitting radionuclides.

7.5.3 Quality Control (QC) Samples

Duplicate samples for QC were collected during 1995 groundwater surveillance sampling of selected wells concurrent with environmental samples. In general, relative percent difference (RPD) calculations are within acceptable limits. Ion-charge-balance calculations for QC were requested from the analytical laboratory for all groundwater samples in 1995; RPD calculations are within acceptable limits. Ion-charge-balance calculations were conducted for all groundwater samples; results were within acceptable limits.

7.5.4 Non-radiological Parameters for Groundwater Quality Samples

<u>VOCs</u>

The VOCs detected above MCLs were all common laboratory solvents used to clean glassware (e.g., acetone, 2-butanone, toluene, and methylene chloride). The fact that these contaminants were present in QC samples (e.g., trip blanks, equipment blanks, and method blanks) suggests that they were introduced at the laboratory and do not indicate groundwater contamination.

<u>Inorganic Compounds</u>

Groundwater surveillance sampling sites may be divided into two groups on the basis of their geographic locations— east or west of the fault complex. Wells considered to be east of the faults or along the line of the fault complex include: Burn Site Well, Sol Se Mete Spring, Coyote Springs, Greystone Well, School House Well, EOD Well, South Fence Road wells, and Hubbell Spring wells. All of the other wells are considered to be west of the faults. The east-side wells are typically characterized by relatively low pH, high alkalinity, high concentrations of bromide, chloride, fluoride, and sulfate, and lower nitrate plus nitrite (as nitrogen) (NPN) concentrations relative to the west-side wells. Table 7-2 provides a summary of concentration values for those wells exceeding MCLs or MACs.

Table 7-2. Summary of groundwater surveillance sampling results for non-radioactive analytes above MCLs or MACs.

Analyte	Location (Well or Spring)	Analysis Result	Maximum Contaminant Level (MCL)[A]	Maximum Allowable Concentration (MAC)[B]	Sampling Date
GENERAL CHEM					
Fluoride	Coyote Springs	2.0 mg/L	4.0 mg/L	1.6 mg/L	3/10/95
	SFR-3P	2.0 mg/L			3/27/95
Nitrate plus Nitrite (as N)	Burn Site Well	16 mg/L	10 mg/L	10 mg/L	3/20/95
	MVMWJ	15 mg/L			3/8/95
	KAFB-0602 (Golf Course-S)	19 mg/L			3/15/95
METALS					
Antimony	EOD	50 µg/L	6 µg/L	NA	3/16/95
Barium	Burn Site Spring	4.5 mg/L	2 mg/L	1 mg/L	3/20/95
	MVMWJ	1.6 mg/L			3/8/95
	MVMWK	1.4 mg/L			3/8/95
Chromium	SFR-3P	60 µg/L	100 µg/L	50 µg/L	3/27/95
	SWTA-3	80 µg/L			3/7/95
Iron	EOD	17 mg/L	NA	1.0 mg/L	3/16/95
	Greystone Well	2.2 mg/L			3/9/95
	MVMWJ	3.7 mg/L			3/8/95
	MVMWK	4.1 mg/L			3/8/95
	School House Well	1.5 mg/L			3/21/95
	SWTA-3	1.9 mg/L	(note) [C]	(note) [C]	3/7/95
Lead	SWTA-3	50 µg/L	15 µg/L	50 µg/L	3/7/95
Nickel	SFR-3P	410 µg/L	100 µg/L	200 µg/L	3/27/95

Note:
mg/L = Milligrams per liter.
µg/L = Micrograms per liter.
NA = Not applicable.
MVMW = Mountain View Monitoring Well (NMED)
CWL-BW = Chemical Waste Landfill Background Well.
[A]MCL = Maximum contaminant levels established by the U.S. Environmental Protection Agency (EPA) Primary Drinking Water Regulations (PDWR) in 40 CFR 141.11 (b) and subsequent amendments.
[B]MAC = Maximum allowable concentrations established by the New Mexico Water Quality Control Commission in New Mexico Administrative Code, "Environmental Protection, Water Quality, Ground and Surface Water Protection," Title 20, Chapter 6, Part 2.
[C]No MCL is established for lead in drinking water. The EPA drinking water action level is 0.015 mg/L, and that value is treated as an MCL for this report.

Metals

The wells and springs sampled east of the faults typically have higher concentrations of calcium, magnesium, potassium and sodium than the wells west of the faults. This corresponds to the higher alkalinity and ion concentrations for east-side waters as discussed above. For antimony, beryllium, thallium, and lead, the laboratory quantitation or reporting limits exceeded the MCLs for several analyses. In these instances the sample results were reported as "not detected" and assessment of the sample constituent concentrations relative to the MCLs cannot be made. Metals analysis results exceeding MCLs and MACs are reported in Table 7-2.

7.5.5 Radionuclide Parameters & for Groundwater Quality Analysis

All tritium concentrations were less than the DOE guideline and the EPA MCL of 20,000 picocuries per liter (pCi/L). Tritium was reported above the minimum detectable activity (MDA) in 10 samples. Gross alpha activity, uranium 233/234, radium-228, and the combined activities of radium-228 and radium-226 exceeded the respective DOE guidelines and MCLs in the sample from the EOD well. Results for CWL-BW4A showed radium-228 and the combined activities of radium-228 and radium-226 exceeding the DOE guidelines and MCLs (Table 7-3).

Table 7-3. Summary of sampling results for radionuclides above MCLs or DOE guidelines.

Radionuclide	Well Location	Analysis Result	MCL	DOE Guidelines
Gross Alpha	EOD	110 pCi/L	15 pCi/L	15 pCi/L
Uranium 233/234	EOD	81 ± 8.5 pCi/L	20 pCi/L	20 pCi/L
Radium-228	CWL-BW4A	4.7 ± 1.5 pCi/L	4.0 pCi/L	4.0 pCi/L
	EOD	4.5 ± 0.89 pCi/L		
Radium-228+226	EOD	7.8 ± 1.4 pCi/L	5.0 pCi/L	5.0 pCi/L
	CWL-BW4A	5.3 ± 1.6 pCi/L		

Note:
pCi/L = Picocuries per liter.
EOD = Explosive Ordnance Disposal.
CWL-BW = Chemical Waste Landfill Background Well.
MCL = Maximum contaminant levels established by the U.S. Environmental Protection Agency (EPA) Primary Drinking Water Regulations (PDWR) in 40 CFR 141.11 (b) and subsequent amendments.
Gross alpha values include radon and uranium contributions. MCL and DOE guideline for gross alpha activity is 15 pCi/L after subtracting uranium and radon contributions. The isotopic radon activity was not determined.
Radium-228 plus radium-226 activity is determined by combining the results of the radium-228 and radium-226 analyses. Combined error is determined by taking the square root of the sum of the errors squared. MCL and DOE guidelines are for the combined activities of radium-228 and radium-226.

All radionuclides detected in groundwater samples are naturally-occurring isotopes and their presence does not indicate man-made radioactive contamination. Based upon results of the gamma screen only, several samples indicate activity concentrations exceeding established MCLs (Table 7-4). The radioisotopic analyses results, however, do not confirm the reported gamma spectroscopy isotopic activities. The MCL of 1.6×10^{-2} pCi/mL for radium-224 was exceeded in samples from five locations.

7.5.6 Chemical Waste Landfill Assessment Monitoring Results

SNL/NM performed annual groundwater sampling for assessment monitoring at the CWL in February 1995 and quarterly assessment sampling in May, August, and November 1995 (Figure 7-3). All sampling events were completed in accordance with procedures outlined in Appendix G of the CWL Closure Plan, *Sampling and Analysis Plan for Groundwater Assessment Monitoring at the Chemical Waste Landfill, Revision 4.0* (SNL 1992a). Only those results exceeding EPA MCLs, NMWQCC MACs, and DOE Guidelines are discussed in this section. Detailed results of the analysis of the samples and field measurements of water quality parameters are reported in quarterly reports (IT 1995a, IT 1995b, IT 1995c, and IT 1995d).

Table 7-4. Summary of groundwater surveillance sampling results for gamma-emitting radioactive analytes above MCLs or DOE guidelines.

Analyte	Location (Well or Spring)	Analysis Result	Maximum Contaminant Level (MCL)	DOE Guideline	Sampling Date
Radium-224	CWL-BW4A	0.509 pCi/mL	0.016 pCi/mL	0.016 pCi/mL	2/21/95
	Greystone Well	0.648 pCi/mL			3/9/95
	Hubbell Spring	0.434 pCi/mL			3/17/95
	MVMWJ	0.307 pCi/mL			3/8/95
	KAFB-0901 (Tijeras East)	0.691 pCi/mL			3/23/95
Thorium-234	Greystone Well	0.557 pCi/mL	0.400 pCi/mL	0.400 pCi/mL	3/9/95
	Sol Se Mete Spring	0.802 pCi/mL			3/9/95
	SWTA-3	0.704 pCi/mL			3/7/95

Note:
pCi/mL = Picocuries per milliliter.
KAFB = Kirtland Air Force Base.
MVMW = Mountain View Monitoring Well (NMED)
CWL-BW = Chemical Waste Landfill Background Well.
MCL = Maximum contaminant levels established by the EPA Primary Drinking Water Regulations (PDWR) in 40 CFR 141.11 (b) and subsequent amendments.

VOC Analyses

All volatile organic compounds (VOCs) detected during CY95 were at concentrations below the applicable State of New Mexico MACs, where established. Trichloroethylene (TCE) and mthylene chloride were above EPA's MCL for drinking water as shown in Table 7-5.

Additional VOCs detected at or above laboratory quantitation limits in 1995 CWL groundwater samples include acetone, bromoform, dibromochloromethane, 1,1-dichloroethene, methylene chloride, tetrachloroethene, toluene, 1,1,1-trichloroethane, and trichlorofluoromethane. Three species which are common laboratory solvents used in cleaning containers were also detected in trace amounts (acetone, methylene chloride, and toluene) in the trip blanks, equipment blanks, and/or laboratory method blanks. Their presence is considered to be the result of laboratory contamination—not an indication of groundwater contamination. All of these VOCs were present at concentrations below the applicable MACs, where established. In some samples, methylene chloride and trichloroethene sample concentrations exceeded the drinking water MCLs.

As concentrations of VOCs in the CWL monitoring wells have not varied significantly during the 1995 sampling year, there is no indication that these constituents are migrating away from the site. This conclusion is supported by the conceptual model of limited contaminant transport developed for this site in Chapter 3.0 of the CWL closure plan (SNL 1992a), and the ground-water assessment results presented in the *CWL Ground Water Assessment Report* (SNL 1995k).

Metals Analyses

All groundwater samples collected from CWL monitoring wells during 1995 were analyzed for 40 CFR 265 Appendix IX metals. Total iron was analyzed during the May, August, and November sampling events. Those analytes exceeding MACs are based on total analyses. (MAC values are based on dissolved fractions only compared to MCLs which are based on totals). Chromium, iron, and nickel were the only metals on the list to exceed the applicable MAC, where established.

Chromium was detected at concentrations above the MAC of 50 µg/L in groundwater samples collected from CWL-BW3 and CWL-MW2A.

Nickel was detected at concentrations above the MAC of 200 µg/L in groundwater samples from CWL-BW3, CWL-MW2A, and CWL-MW4.

Iron was detected at concentrations above the MAC of 1,000 µg/L in groundwater samples from CWL-BW3 and CWL-MW2A.

Table 7-6 summarizes detected metals from samples collected during 1995 groundwater sampling at the CWL that were above the MAC or MCL.

Table 7-5. Summary of chemical waste landfill sampling results for VOCs above MCLs or MACs.

Analyte	Well Location	Analysis Result	Maximum Contaminant Level (MCL)	Maximum Allowable Concentration (MAC)	Sampling Date
Methylene Chloride	CWL-BW4A	7 µg/L B	5.0 µg/L	100 µg/L	8/28/95
	CWL-MW1A	7 µg/L B	"	"	11/15/95
	CWL-MW5U	8 µg/L B	"	"	11/13/95
	CWL-MW6U	6 µg/L B	"	"	5/22/95
	CWL-MW6U	8 µg/L B	"	"	11/13/95
Trichloroethene	CWL-MW2A	12 µg/L	5.0 µg/L	100 µg/L	2/23/95
	CWL-MW2A	11 µg/L	"	"	2/23/95
	CWL-MW2A	5 µg/L	"	"	5/30/95
	CWL-MW2A	18 µg/L	"	"	8/29/95
	CWL-MW2A	17 µg/L	"	"	8/29/95
	CWL-MW5L	5.7 µg/L	"	"	8/16/95
	CWL-MW5L	16 µg/L	"	"	11/12/95
	CWL-MW6L	13 µg/L	"	"	5/9/95
	CWL-MW6L	9.0 µg/L	"	"	8/16/95
	CWL-MW6L	13 µg/L B	"	"	11/12/95

Note:
µg/L = Micrograms per liter.
B = Compound also detected in a laboratory or field blank sample.
CWL-BW = Chemical Waste Landfill Background Well.
CWL-MW = Chemical Waste Landfill Monitoring Well.
MCL = Maximum contaminant levels established by the U.S. Environmental Protection Agency (EPA) Primary Drinking Water Regulations (PDWR) in 40 CFR 141.11 (b) and subsequent amendments.
MAC = Maximum allowable concentrations established by the New Mexico Water Quality Control Commission in New Mexico Administrative Code, "Environmental Protection, Water Quality, Ground and Surface Water Protection," Title 20, Chapter 6, Part 2.

Table 7-6. Summary of CWL sampling results for metals above MCLs or MACs.

Analyte	Location (Well or Spring)	Analysis Result	Maximum Contaminant Level (MCL)[A]	Maximum Allowable Concentration (MAC)[B]	Sampling Date
Chromium	CWL-BW3	0.10 mg/L	0.10 mg/L	0.05 mg/L	2/21/95
	CWL-BW3	0.12 mg/L	"	"	8/28/95
	CWL-BW3	0.29 mg/L	"	"	11/20/95
	CWL-MW2A	0.11 mg/L	"	"	8/29/95
	CWL-MW2A	0.49 mg/L	"	"	11/16/95
	CWL-MW2A	0.65 mg/L	"	"	11/16/95
Iron	CWL-BW3	1.5 mg/L	NA	1.0 mg/L	8/28/95
	CWL-BW3	3.8 mg/L	"	"	11/20/95
	CWL-MW2A	1.5 mg/L	"	"	5/30/95
	CWL-MW2A	1.4 mg/L			5/30/95
	CWL-MW2A	3.0 mg/L			11/16/95
	CWL-MW2A	1.7 mg/L			11/16/95
	CWL-MW2BU	48.0 mg/L			2/27/95
	CWL-5L	2.1 mg/L			2/14/95
	CWL-6L	3.3 mg/L			2/14/95
Nickel	CWL-BW3	0.63 mg/L	0.10 mg/L	0.20 mg/L	2/21/95
	CWL-BW3	0.33 mg/L			5/24/95
	CWL-BW3	0.40 mg/L			8/28/95
	CWL-BW3	0.39 mg/L			11/20/95
	CWL-BW3	0.26 mg/L			11/20/95
	CWL-MW2A	0.22 mg/L			5/30/95
	CWL-MW2A	0.50 mg/L			8/29/95
	CWL-MW2A	0.43 mg/L			8/29/95
	CWL-MW2A	0.23 mg/L			11/16/95
	CWL-MW2A	0.27 mg/L			11/16/95
	CWL-MW3A	0.14 mg/L			5/31/95
	CWL-MW4	0.12 mg/L			2/29/95
	CWL-MW4	0.44 mg/L			5/10/95
	CWL-MW4	0.29 mg/L			8/22/95
	CWL-MW4	0.33 mg/L			11/13/95

Note:
µg/L = Micrograms per liter.
NA = Not applicable.
CWL-BW = Chemical Waste Landfill Background Well.
CWL-MW = Chemical Waste Landfill Monitoring Well.
[A]MCL = Maximum contaminant levels established by the U.S. Environmental Protection Agency (EPA) Primary Drinking Water Regulations (PDWR) in 40 CFR 141.11 (b) and subsequent amendments.
[B]MAC = Maximum allowable concentrations established by the New Mexico Water Quality Control Commission in New Mexico Administrative Code, "Environmental Protection, Water Quality, Ground and Surface Water Protection," Title 20, Chapter 6, Part 2.

7.5.7 Additional Water Quality Analyses

Additional chemistry parameters analyzed during 1995 included total alkalinity, cations, chloride, total cyanide, dioxins and furans, fluoride, herbicides, chlorinated pesticides and polychlorinated biphenyls (PCB), semi-volatile organic compounds, sulfate, total sulfide, and total dissolved solids. Table 7-7 summarizes detected analytes from samples collected during 1995 groundwater sampling at the CWL that were above the MAC or MCL.

Fluoride was the only parameter to exceed the applicable MAC, where established. Fluoride was detected at or above the MAC of 1.6 mg/L in CWL-BW3, CWL-BW4A, CWL-MW1A, CWL-MW2A, CWL-MW2BL, CWL-MW3A, and CWL-MW5L.

Table 7-7. Summary of CWL sampling results for supplemental analyses above MCLs or MACs.

Analyte	Well Location	Analysis Result	Maximum Contaminant Level (MCL)[A]	Maximum Allowable Concentration (MAC)[B]	Sampling Date
Fluoride	CWL-BW3	1.8 mg/L	4.0 mg/L	1.6 mg/L	2/21/95
	CWL-BW3	1.9 mg/L	"	"	8/28/95
	CWL-BW4A	1.8 mg/L	"	"	2/21/95
	CWL-BW4A	1.7 mg/L	"	"	8/28/95
	CWL-MW1A	1.8 mg/L	"	"	2/24/95
	CWL-MW1A	1.7 mg/L			8/24/95
	CWL-MW2A	1.7 mg/L			2/23/95
	CWL-MW2A	1.6 mg/L			8/29/95
	CWL-MW2BL	1.6 mg/L			2/15/95
	CWL-MW2BL	1.5 mg/L			8/23/95
	CWL-MW3A	1.7 mg/L			2/16/95
	CWL-MW5L	1.7 mg/L			2/14/95

Note:
mg/L = Milligrams per liter.
CWL-BW = Chemical Waste Landfill Background Well.
CWL-MW = Chemical Waste Landfill Monitoring Well.
[A]MCL = Maximum contaminant levels established by the U.S. Environmental Protection Agency (EPA) Primary Drinking Water Regulations (PDWR) in 40 CFR 141.11 (b) and subsequent amendments.
[B]MAC = Maximum allowable concentrations established by the New Mexico Water Quality Control Commission in New Mexico Administrative Code, "Environmental Protection, Water Quality, Ground and Surface Water Protection," Title 20, Chapter 6, Part 2.

7.5.8 Mixed Waste Landfill (MWL) Monitoring

Semiannual groundwater sampling from MWL monitoring wells was conducted in April and October 1995 (Figure 7-4). Details of the sampling events are in the MWL reports on semiannual groundwater sampling (IT 1995e and IT 1995f). No contaminants of concern were detected in groundwater at the MWL in concentrations above background levels or in concentrations exceeding EPA drinking water standards. Nickel was the only exceedence reported (October 1995) (Table 7-8), slightly exceeding the MCL of 100 µg/L. No other Target Analyte List (TAL) metal was detected in concentrations that exceeded the EPA MCLs. No TAL metals or radionuclides were detected in groundwater above background levels. No Appendix IX organic contaminants, except the common laboratory contaminants of methylene chloride and bis(2-ethylhexyl)phthalate, were detected at levels above their quantitation limits.

Table 7-8. Summary of mixed waste landfill sampling results for non-radioactive analytes above MCLs or MACs.

Analyte	Well Location	Analysis Result	Maximum Contaminant Level (MCL)[A]	Maximum Allowable Concentration (MAC)[B]	Sampling Date
Nickel	MWL-MW1	120 µg/L	100 µg/L	200 µg/L	4/19/95
	MWL-MW1	107 µg/L			10/20/95

Note:
µg/L = Micrograms per liter.
MWL-MW = Mixed Waste Landfill Monitoring Well.
[A]MCL = Maximum contaminant levels established by the U.S. Environmental Protection Agency (EPA) Primary Drinking Water Regulations (PDWR) in 40 CFR 141.11 (b) and subsequent amendments.
[B]MAC = Maximum allowable concentrations established by the New Mexico Water Quality Control Commission in New Mexico Administrative Code, "Environmental Protection, Water Quality, Ground and Surface Water Protection," Title 20, Chapter 6, Part 2.

7.5.9 TA-V Groundwater Monitoring

Quarterly groundwater sampling events for TA-V occurred in December 1994, and in March, June, and September 1995. The December 1994 and March, June, and September 1995 sampling and analysis documentation are filed at the SNL/NM Environmental Operations Records Center. The September 1995 samples were not analyzed for metals. No TAL metals or radionuclides were detected in concentrations that exceeded the EPA MCLs in LWDS-MW1 or LWDS-MW2. Nitrate plus nitrite (as N) (NPN) ranged from 8.8 mg/L to 9.8 mg/L in LWDS-MW1, and from 1.57 mg/L to 13 mg/L in LWDS-MW2. TCE was detected in LWDS-MW1 during the December 1994 and March and June 1995 sampling events at concentrations ranging from 14 to 17 µg/L (Table 7-9). TCE was detected in a duplicate sample collected during the September 1995 sampling event at a concentration of 9.18 µg/L. Except for the common laboratory contaminant methylene chloride, no other organic compounds were detected at levels above their quantitation limits.

Four additional monitor wells AVN-1, AVN-2, TAV-MW1, and TAV-MW02 were installed around the TA-V vicinity during 1995. Initial samples in these undeveloped wells showed sporadic detections of acetone and toluene. However, subsequent sampling after the development of these monitor wells in September 1995 was conducted for VOCs by EPA Methods 8010 and 8020 and for NPN by EPA Method 353.1. No VOCs were detected above the reporting limits in monitor wells AVN-1, AVN-2, or TAV-MW02. TCE was identified in the sample collected from well TAV-MW1. The concentration was below the quantitation limit and was estimated at 1.44 µg/L. The results for nitrate plus nitrite (NPN) for each well are: 7.92 mg/L in well AVN-1; 7.36 mg/L in well AVN-2; 2.86 mg/L in well TAV-MW1; and 6.2 mg/L in well TAV-MW02. Groundwater samples collected from these four wells were only analyzed for VOCs and NPN for a preliminary assessment of the groundwater quality. The wells were sampled in December 1995 and were analyzed for a more comprehensive list of compounds including metals, radionuclides, VOCs, and wet chemistry parameters. No values exceeded MCLs, MACs, or DOE guidelines.

Table 7-9. Summary of Technical Area V sampling results for non-radioactive analytes above MCLs or MACs.

Analyte	Well Location	Analysis Result	Maximum Contaminant Level (MCL)[A]	Maximum Allowable Concentration (MAC)[B]	Sampling Date
Trichloroethene	LWDS-MW1	14 µg/L	5.0 µg/L	100µg/L	12/8/94
	LWDS-MW1	17 µg/L			3/2/95
	LWDS-MW1	15 µg/L			6/14/95

Note:
µg/L = Micrograms per liter.
LWDS-MW = Liquid Waste Disposal System Monitoring Well.
[A]MCL = Maximum contaminant levels established by the U.S. EPA Primary Drinking Water Regulations (PDWR) in 40 CFR 141.11 (b) and subsequent amendments.
[B]MAC = Maximum allowable concentrations established by the New Mexico Water Quality Control Commission in New Mexico Administrative Code, "Environmental Protection, Water Quality, Ground and Surface Water Protection," Title 20, Chapter 6, Part 2.

7.5.10 Technical Area II Groundwater Monitoring

Groundwater sampling was conducted in TA-II during June, July, September, and November. Wells TA2-SW1-320, TA2-NW1-325, and TA2-W-01 were sampled in June and November. TA2-NW1-596 was sampled in November. A new well, TA2-W-19, was completed in November and sampled the same month.

Organics

Organic contaminants of concern detected above MCLs or the proposed RCRA Subpart S action levels (FR, July 27, 1990) included bis(2-ethylhexyl)phthalate at concentrations of up to 23 µg/L at TA2-SW1-320, 13 µg/L at TA2-NW1-325, and 9.3 µg/L at TA2-W-01 in June 1995 (action level of 3 µg/L), TCE at concentrations of up to 8.1 µg/L at TA2-W-19 in November 1995 (MCL and action level of 5 µg/L). Groundwater samples from all TA-II monitoring wells except TA2-NW1-595 have had detectable concentrations of TCE, although only the concentrations from TA2-W-19 have exceeded the MCL and action level to date. TCE was detected in concentrations of up to 3.9 µg/L in TA2-SW1-320, 0.6 µg/L in TA2-NW1-325, and 1.9 µg/L in TA2-W-01—all in August 1995. 1,1-dichloroethene was reported in a duplicate sample from TA2-SW1-320 at concentrations of 2.2 µg/L in June 1995, below the MCL and action level of 7µg/L. 1,1-dichloroethane was detected at concentrations of up to 1.6 µg/L from groundwater samples collected from TA2-W-19 in November 1995 compared to an action level of 4,000 µg/L. Cis-1,2-dichloroethene was detected at concentrations of up to 2.1 µg/L from groundwater samples collected from TA2-W-19 in November 1995 compared to an MCL of 70 µg/L and an action level of 80 µg/L. Toluene was detected at concentrations of 1.5 µg/L in groundwater samples collected from TA2-NW1-595 in July 1995 compared to an MCL and action level of 1000 µg/L .

Inorganics

Inorganics detected above either their respective MCLs or action levels included nitrate and beryllium. NPN (as N) was detected at concentrations of up to 26 mg/L in June 1995 and 26 mg/L in September 1995 at TA2-SW1-320 compared to an MCL and action level of 10 mg/L. Beryllium was detected at an estimated concentration of 0.000163 mg/L at TA2-SW1-320 in June 1995 compared to an MCL of 0.004 mg/L and an action level of 0.000008 mg/L.

Non-enforceable secondary MCLs that were exceeded included aluminum (concentrations of up to 0.36 mg/L in June 1995 and concentrations of up to 0.31 mg/L in September 1995 at TA2-SW1-320; and 0.67 mg/L in July 1995 at TA2-NW1-595) compared to a secondary standard of 0.05 to 0.2 mg/L—and iron (concentrations of up to

0.50 mg/L in June 1995 and 0.39 mg/L in September 1995 at TA2-SW1-320; and 1.1 mg/L in July 1995 at TA2-NW1-595) compared to a secondary standard of 0.3 mg/L.

Radionuclides

No groundwater samples collected at TA-II for radionuclide analyses exceeded their respective MCL or DOE guideline activity levels.

Table 7-10. Summary of Technical Area II sampling results for non-radioactive analytes above MCLs or MACs.

Analyte	Well Location	Analysis Result	Maximum Contaminant Level (MCL)[A]	Maximum Allowable Concentration (MAC)[B]	Sampling Date
Trichloroethene (TCE)	TA2-W-19	8.1 µg/L	5.0 µg/L	100µg/L	11/29/95
bis(2-ethylhexyl)phthalate	TA2-SW1-320 TAD-NW1-325 TA2-W-01	23 µg/L 13 µg/L 9.3 µg/L			
Nitrate plus Nitrite (as N)	TA2-SW1-320	26 mg/L	10 mg/L	10 mg/L	6/20/95
	TA2-SW1-320	26 mg/L			9/27/95

Note:
µg/L = Micrograms per liter.
mg/L = Milligrams per liter.
TA2 = Technical Area II.
MCL = Maximum contaminant levels established by the U.S. Environmental Protection Agency (EPA) Primary Drinking Water Regulations (PDWR) in 40 CFR 141.11 (b) and subsequent amendments.
MAC = Maximum allowable concentrations established by the New Mexico Water Quality Control Commission in New Mexico Administrative Code, "Environmental Protection, Water Quality, Ground and Surface Water Protection," Title 20, Chapter 6, Part 2.

8.0 QUALITY ASSURANCE

SNL/NM is committed to providing quality work for sampling and anaysis procedures to ensure the validity and accuracy of all monitoring data. The Sample Management Office (SMO) Quality Assurance (QA) Program covers all aspects of sampling for monitoring and surveillance for both non-radiological and radiological pollutants.

The Environmental Operations Center (7500) has developed the following two plans that describe the connection between project and program initiation, execution, and assessment, and established SNL/NM practices.

- *7500 Quality Assurance Plan (QAP),* QAP 96-01 (SNL 1996d)
- *7500 Quality Assurance Management Plan (QAMP),* PLA-9614 (SNL 1996a)

The 7500 QAP provides the basic QA structure for most Environmental Operations Center functions. Attachments give a "level of rigor" checklist and a mapping to DOE Order 5700.6c, *Quality Assurance* (DOE 1991b).

The 7500 QAMP is used when a higher degree of QA rigor is needed and is a general plan designed to meet the requirements of modern rigorous standards, such as NQA-1, ISO 14000, and ANSI/ASQC E-4. The QAMP identifies basic elements consolidating comparable requirements contained in these other QA documents. The QAMP serves two basic purposes. The first allows the user to understand and evaluate what 7500 products and services are (identifying basic elements that can be used to build or provide these services). The second serves to identify the basic mandantory regulatory requirements, guidance, and other standards that specify quality assurance management elements. The QAMP serves as a roadmap to direct users to QA documents and sections relevant to their work or interest.

These plans stress prevention of problems by ensuring that: (1) requirements are defined in documents such as plans and procedures, (2) requirements are understood through familiarization and training, and (3) activities necessary for fulfilling the requirements are performed by qualified personnel. Each Environmental Operations Center employee and contractor is responsible for ensuring that all environmentally related activities are performed according to applicable policies and practices set in the 7500 Quality Plans.

8.1 QUALITY ASSURANCE OF ENVIRONMENTAL SAMPLING & ANALYSIS

This section summarizes QA activities related to sampling and analysis procedures in environmental monitoring and surveillance, environmental remediation, and waste management programs. Sampling is conducted in accordance with program-specific sampling and analysis plans or work plans, each of which contains relevant QA elements. These documents are prepared and implemented in accordance with the *SMO Quality Plan* (SNL 1996f) and meet appropriate regulatory guidelines for conducting sampling and analysis activities. QA elements for sampling and analysis follow EPA QA guidelines for activities related to environmental management. QA for sampling and analytical activities performed in support of these programs is discussed in the following subsections.

8.1.1 Quality Assurance for Sampling Programs

Quality assurance is integrated into the following sampling activities:

- The collection of samples using defined sampling procedures applicable to each program.
- The use of EPA-approved sample collection equipment.
- The selection of appropriate sample container decontamination procedures.
- The handling of samples, their preservation, labeling, and event documentation procedures.
- The collection of quality control (QC) samples at defined frequencies to estimate sample representativeness and potential contamination acquired during the sampling and handling process.

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

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

The overall adherance and compliance of any sampling and analysis activity is the responsibility of the particular project. The sample management office (SMO) provides guidance and support for field activities only. The SMO is responsible for adherance to quality only at the point of sample relinquishment by the field team into the custody of the SMO.

8.1.2 Quality Assurance for Analytical Programs

Analytical Laboratories

Independent analytical laboratories performed most of the chemical analyses of waste and environmental samples collected at SNL/NM in 1995. These laboratories analyzed over 8000 samples, operating under stringent QA plans that comply with the *SMO Quality Plan* and applicable EPA requirements and guidelines. Before analytical laboratories are selected, contractor laboratories are appraised in pre-award audits in accordance with the *SMO Quality Plan*. The selected laboratories are then reappraised annually using inspections and audits, which are filed in the Environmental Operations Record Center (EORC). Table D-1 of Appendix D lists laboratories that provided analytical support to SNL/NM's environmentally related sampling activities in 1995. Information about the quantities and types of samples processed through the ENVC SMO are available in the SMO Sample Tracking Analytical Results (STAR) database.

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

Accuracy & Precision

With each SNL/NM samples batch, QC samples were concurrently prepared at defined frequencies and analyzed for each constituent of interest to measure analytical accuracy, precision, contamination, and the matrix effect associated with each analytical measurement.

For each QC measurement, QC sample results were compared to statistically established control criteria. Analytical results generated concurrent with QC sample results that were within established control limits were considered acceptable. Analytical results generated concurrent with QC sample results that exceeded control limits were considered out of control and corrective action was initiated; reanalysis was performed for all samples in the analytical batch. This process guaranteed the quality of data generated by each analytical laboratory. Results of concurrently analyzed QC sample data were included with each analytical report prepared for SNL/NM which contained sample identification numbers—dates of sample collection, preparation, and analysis; analytical-method reference number—analytes, concentration measured, and detection limit; and associated QC control data.

Performance Audits & QC checks

During 1995, 2828 QC samples were submitted to monitor overall contract laboratory performance. Analyses were performed to comply with SNL/NM QA requirements, project-specific DQOs, and to monitor and document analytical precision and accuracy. The SMO processed 4402 samples for Environmental Monitoring projects with 407 total Quality Assurance/Quality Control (QA/QC) samples submitted specifically in support of those activities. Contractor laboratories operate under strict QA/QC programs which include periodic participation in the EPA's programs for blind-audit check sampling to monitor the overall precision and accuracy of analyses routinely performed on SNL/NM samples.

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

Replicate Sampling Results

Results of each set of check sample analyses are in Quarterly Performance Evaluation Reports SMO sends reports-to-file, and to the laboratories; these include average percent recoveries for each suite of samples analyzed, the relative range of actual recoveries, and relative percent differences for each analyte tested. A corrective action request was issued for any exceedance of accepted limits. All reports and corrective action responses are filed in the EORC. The resulting data were used to assess each contract laboratory's performance using relative percent difference and percent recovery for respective indicators of precision and accuracy. Review of laboratory performance data generated in 1995 indicated that the majority of analytes tested by the SNL/NM analytical laboratories are within EPA (or interlaboratory, round-robin) prescribed control limits.

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

The Environmental Monitoring Program evaluated its contractor laboratory performance by means of the laboratory's participation in the interlaboratory comparison programs of the EPA Environmental Monitoring Systems Laboratory and the DOE Quality Assessment Program (QAP). Appendix D (Tables D-5 and D-6) shows results of the EPA Cross-Check program and the DOE QAP.

8.1.3 Data Review,Validation, & Records Management

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

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

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

    - Contract requirements.
    - SNL/NM QA requirements.
    - Documentation completeness requirements.

3. By the SNL/NM project leader responsible for program objectives and regulatory compliance.

    - Project-specific data quality requirements.

Records are maintained on file by the EORC. ENVC also maintains all data files related to this Site Environmental report.

8.2 CONTRACTOR QUALITY ASSURANCE OVERVIEW

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

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

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

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

9.0 References

Bjorklund and Maxwell 1961: Bjorklund, L. J. and Maxwell, B. W., 1961, *Availability of Groundwater in the Albuquerque Area, Bernalillo and Sandoval Counties, New Mexico.* New Mexico State Engineer Technical Report 21, 117p.

Booher 1992: Booher, W., *Sandia National Laboratories/New Mexico Wastewater Sampling and Analysis Plan*, Plan 92-06, Rev. 2. Sandia National Laboratories, Albuquerque, NM (June 1996).

CDM 1993: CDM Federal Programs Corporation, *Spill Prevention Control and Countermeasure (SPCC) Plan for Sandia National Laboratories, New Mexico*, Plan 90-11, Revision 1. CDM Federal Programs Corporation, Albuquerque, NM (January 1993).

CDM 1990: CDM Federal Programs Corporation, *Spill Prevention Control and Countermeasure (SPCC) Plan for Sandia National Laboratories, New Mexico*, Plan 90-11. CDM Federal Programs Corporation, Albuquerque, NM (November 1990).

CRC 1992: Chemical Rubber Company, *Trace Elements in Soil and Plants*, 2nd. Ed. CRC Press, Inc., Boca Raton, Florida (1992).

Culp 1994: Culp, T., SNL/NM Air Quality Department memorandum to F. Ghanbari, *HERMES CAP88 Modeling Results.* Sandia National Laboratories, Albuquerque, NM (October 31, 1994).

DOC 1992: U.S. Department of Commerce, Bureau of the Census, *1990 United States Census--Preliminary Report.* DOC, U.S. Government Printing Office, Washington, DC (1992).

DOE 1996a: see Orders section.

DOE 1996b: U.S. Department of Energy, *Programmatic Environmental Impact Statement for Stockpile Stewardship and Management (SSM PEIS)*, (Draft) DOE/EIS 0236. DOE, Washington, DC (February 1996).

DOE 1995a: U.S. Department of Energy/Albuquerque Field Office (DOE/AFO), *General Purpose Heat Source Safety Verification Testing*, DOE/EA-1025. DOE/AFO, Albuquerque, NM (February 15, 1995).

DOE 1995b: U.S. Department of Energy, *Estimating the Cold War Mortgage - 1995 Baseline Environmental Management Report*, Volume I - III, DOE/EM-0232. U.S. DOE., Office of Environmental Management, Washington DC (March 1995).

DOE 1995c: see Orders section.

DOE 1995d: U.S. Department of Energy, *Draft Environmental Assessment for the Gamma Irradiation Facility at SNL/NM, Albuquerque, New Mexico*, DOE/EA-0973. U.S. DOE/KAO, Albuquerque, NM (September 1995).

DOE 1995e: U.S. Department of Energy, *Environmental Assessment for the Processing and Environmental Technology Laboratory,* DOE/EA-0945. U.S. DOE/AL, Albuquerque, NM (September 1995).

DOE 1995f: U.S. Department of Energy, *Draft Waste Management Programmatic EIS for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste,* DOE/EIS-0200-D, Volume I - IV. U.S. DOE., Office of Environmental Management, Washington DC (August 1995).

DOE 1994a: U.S. Department of Energy, *Secretary's Policy Statement on the National Environmental Policy Act.* DOE, Washington, DC (June 1994).

DOE 1994b: U.S. Department of Energy/Albuquerque Field Office (DOE/AFO), *Neutron Generator/Switch Tube (NG/ST) Prototyping Relocation Environmental Assessment,* DOE/EA-0885. DOE/AFO, Albuquerque, NM (April 8, 1994).

DOE 1994c: U.S. Department of Energy/Albuquerque Field Office (DOE/AFO), *Environmental Assessment for the Robotic Manufacturing Science and Engineering Laboratory (RMSEL)*, DOE/EA-0879. DOE/AFO, Albuquerque, NM (April 13, 1994).

DOE 1994d: U.S. Department of Energy, *Implementation Plan for Environmental Restoration and Waste Management Programmatic EIS*, DOE/EIS-0200. U.S. DOE, ER and Waste Management Program, Washington DC (January 1994).

DOE 1994e: U.S. Department of Energy/Albuquerque Operations Office, *Mixed Waste Treatment Plan.* DOE/AL, Albuquerque, NM (March 1994).

DOE 1994f: U.S. Department of Energy, *Restoration and Waste Management Programmatic Environmental Impact Statement,* DOE/EIS-0200. DOE, Office of Environmental Restoration and Waste Management, Washington, DC (January 1994).

DOE 1993a: U.S. Department of Energy, *U.S. DOE Interim Mixed Waste Inventory Report Waste Streams Treatment Capacities and Technologies,* DOE/NBM-1100, Volumes 1 through 6. DOE, Washington, DC (April 1993).

DOE 1993b: U.S. Department of Energy, *Nuclear Weapons Complex Reconfiguration Programmatic Environmental Impact Statement (PEIS),* DOE/EIS-0161. DOE, Washington, DC (1993).

DOE 1993c: see Orders section.

DOE 1993d: U.S. Department of Energy, *U.S. DOE Final Mixed Waste Inventory Report Waste Streams Treatment Capacities and Technologies.* DOE, Washington DC (1993).

DOE 1992a: see Orders section.

DOE 1992b: see Orders section.

DOE 1991a: see Orders section.

DOE 1991b: U.S. Department of Energy, *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*, DOE/EH-0173T. DOE, Assistant Secretary for Environment, Safety and Health, Washington, DC (January 1991).

DOE 1991c: see Orders section.

DOE 1990a: see Orders section.

DOE 1990b: see Orders section.

DOE 1990c: U.S. Department of Energy, *The Secretary of Energy; NEPA Notice (SEN-15-90)*. DOE, Washington, DC (Feb. 5, 1990).

DOE 1989a: see Orders section.

DOE 1989b: see Orders section.

DOE 1988a: see Orders section.

DOE 1988b: see Orders section.

DOE 1987: U.S. Department of Energy/Albuquerque Operations Office (DOE/AL), *Comprehensive Environmental Assessment and Response Program Phase 1: Installation Assessment*, draft DOE/AL, Environment, Safety and Health Division, Albuquerque, NM (September 1987).

EG&G 1994: Edgerton, Germeschausen & Grier Corp., *An Aerial Radiological Survey of the Sandia National Laboratories and Surrounding Area I,* EG&G 11265-1030; UC-702. (June 1994).

EPA 1993: U.S. Environmental Protection Agency, *Emission Factors for Diesel Industrial Engines*, AP-42. EPA (1993).

EPA 1991: U.S. Environmental Protection Agency, *CAP-88, Clean Air Act Assessment Package*, Radiation Shielding Information Center, CCC-542. Oak Ridge, TN (1991).

EPA 1987: U.S. Environmental Protection Agency, *On-Site Meteorological Program Guidance for Regulatory Modeling Applications.* EPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711 (June 1987).

EPA 1986: U.S. Environmental Protection Agency, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Third Edition*, EPASW-846, 2nd ed. EPA, Washington, DC (1986).

ERDA 1977: U.S. Energy Research and Development Administration, *Environmental Impact Assessment, Sandia National Laboratories, Albuquerque, New Mexico*, EIA/MA 77-1. ERDA (1977).

Fink and Park 1993a: Fink, C., and E. Park, *Oil Spill Contingency Plan*, Plan 90-11, Revision 1. Sandia National Laboratories, Albuquerque, NM (February 1993).

Fink and Park 1993b: Fink, C., and E. Park, *Hazardous and Radioactive Materials Spill Prevention Control and Countermeasure Plan*, draft. Sandia National Laboratories, Albuquerque, NM (1993).

Fink and Park 1992: Fink, C., and E. Park, *Spill Prevention Control and Countermeasure Plan*, Plan 90-11, Revision 1. Sandia National Laboratories, Albuquerque, NM (December 14, 1992).

Grant 1982: Grant, P. R., Jr., "Geothermal Potential in the Albuquerque Area, New Mexico," in *Guidebook – New Mexico Geological Society*, Vol. 33, pp. 325 through 331 (1982).

Gutman and Silver 1994: Gutman, W. M., and R. J. Silver, *Air Quality Investigations of the Sandia National Laboratories Sol se Mete Aerial Cable Facility*, SAND93-7094. Sandia National Laboratories, Albuquerque, NM (December 1994).

Hindl et al. 1992: Hindl, S., J. L. Davis, R. E. Barton, and W. A. Rose, *1992 Transportation Service Division Procedures Manual.* Sandia National Laboratories, Albuquerque, NM (March 27, 1992).

Hoagland 1990a: Hoagland, S.R., *A Cultural Resources Survey and Review for Sandia National Laboratories, Area I, North of O Street, Kirtland Air Force Base, New Mexico*, CGI Report 8067Z. Chambers Group Inc., Albuquerque, NM (1990).

Hoagland 1990b: Hoagland, S.R., *A Cultural Resources Survey and Review for Sandia National Laboratories, Area I, South of O Street, Kirtland Air Force Base, New Mexico*, CGI Report 8067AB. Chambers Group Inc., Albuquerque, NM (1990).

Hoagland 1990c: Hoagland, S.R., *A Cultural Resources Survey and Review for Sandia National Laboratories, Area II, Kirtland Air Force Base, New Mexico*, CGI Report 8067AC. Chambers Group Inc., Albuquerque, NM (1990).

Hoagland 1990d: Hoagland, S.R., *A Cultural Resources Survey and Review for Sandia National Laboratories, Area IV, Kirtland Air Force Base, New Mexico*, CGI Report 8067AD. Chambers Group Inc., Albuquerque, NM (1990).

Hoagland 1991a: Hoagland, S.R., *A Cultural Resources Survey Conducted in the Vicinity of the Sandia National Laboratories Burn Site, KAFB, NM*, CGI Project # 8067AF.CR. Chambers Group Inc., Albuquerque, NM.

Hoagland and Dello-Russo 1995: Hoagland and Dello-Russo, *Cultural Resource Investigation for Sandia National Laboratories/New Mexico Environmental Restoration Program, Kirtland Air Force Base, New Mexico.* Service Group Inc., Albuquerque, NM (1995).

Hostak 1995: Hostak J.M, *Characterization of Environmental Radiation and Radioactivity Near Albuquerque New Mexico*, NMED/DOE/AIP-95/3. Sandia National Laboratories, Albuquerque, NM (1995).

IT 1996: IT Corporation, *Background Concentrations of Constituents of Concern to the Sandia National Laboratories, New Mexico Environmental Restoration Program and the Kirtland Air Force Base Installation Restoration Program.* IT Corporation (January 1996).

IT 1995a: IT Corporation (IT), *Report on Quarterly Chemical Waste Landfill Groundwater Assessment Monitoring and Closure Progress Report, February 1995.* IT, prepared for the Environmental Restoration Department , Sandia National Laboratories, Albuquerque, NM (1995)

IT 1995b: IT Corporation (IT), *Report on Quarterly Chemical Waste Landfill Groundwater Assessment Monitoring and Closure Progress Report, May 1995.* IT, prepared for the Environmental Restoration Department , Sandia National Laboratories, Albuquerque, NM (1995)

IT 1995c: IT Corporation (IT), *Report on Quarterly Chemical Waste Landfill Groundwater Assessment Monitoring and Closure Progress Report, August 1995.* IT, prepared for the Environmental Restoration Department , Sandia National Laboratories, Albuquerque, NM (1995)

IT 1995d: IT Corporation (IT), *Report on Quarterly Chemical Waste Landfill Groundwater Assessment Monitoring and Closure Progress Report, November 1995.* IT, prepared for the Environmental Restoration Department , Sandia National Laboratories, Albuquerque, NM (1995)

IT 1995e: IT Corporation (IT), 1995a, *Report on Semiannual Groundwater Sampling at the Mixed Waste Landfill.* IT, prepared for the Environmental Restoration Department , Sandia National Laboratories, Albuquerque, NM (1995)

IT 1995f: IT Corporation (IT), *Report on Semiannual Groundwater Sampling at the Mixed Waste Landfill.* IT, prepared for the Environmental Restoration Department , Sandia National Laboratories, Albuquerque, NM (1995)

IT 1994a: IT Corporation, *Former Underground Storage Tank 6587 Onsite Investigation, Technical Area III, Sandia National Laboratories/New Mexico.* IT, Albuquerque, NM (March 1994).

IT 1994b: IT Corporation, *Sandia National Laboratories Wastewater Monitoring Program Quarterly Report, November 1993 - January 1994.* IT, prepared for Sandia National Laboratories, Albuquerque, NM (1994).

IT 1994c: IT Corporation, *Report on Quarterly Basewide Groundwater Monitoring, December 1993,* draft. IT, prepared for the Groundwater Protection Program, Sandia National Laboratories, Albuquerque, NM (1994).

IT 1994d: IT Corporation, *Report on Quarterly Basewide Groundwater Monitoring, March 1994,* draft. IT, prepared for the Groundwater Protection Program, Sandia National Laboratories, Albuquerque, NM (1994).

IT 1994e: IT Corporation, *Report on Quarterly Basewide Groundwater Monitoring, June 1994,* draft. IT, prepared for the Groundwater Protection Program, Sandia National Laboratories, Albuquerque, NM (1994).

IT 1994f: IT Corporation, *Report on Quarterly Basewide Groundwater Monitoring, September 1994.* IT, draft, prepared for the Groundwater Protection Program, Sandia National Laboratories, Albuquerque, NM (1994).

IT 1994g: IT Corporation, *Report on Annual Groundwater Assessment Monitoring at the Chemical Waste Landfill, Sandia National Laboratories/New Mexico, February 1994.* IT, prepared for the Environmental Restoration Project, Sandia National Laboratories, Albuquerque, NM (1994).

IT 1994h: IT Corporation, *Report on Quarterly Groundwater Assessment Monitoring at the Chemical Waste Landfill, Sandia National Laboratories/New Mexico, May 1994.* IT, prepared for the Environmental Restoration Project, Sandia National Laboratories, Albuquerque, NM (1994).

IT 1994i: IT Corporation, *Report on Quarterly Groundwater Assessment Monitoring at the Chemical Waste Landfill, Sandia National Laboratories/New Mexico, August 1994.* IT, prepared for the Environmental Restoration Project, Sandia National Laboratories, Albuquerque, NM (1994).

IT 1994j: IT Corporation, *Report on Quarterly Groundwater Assessment Monitoring at the Chemical Waste Landfill, Sandia National Laboratories/New Mexico, November 1994.* IT, prepared for the Environmental Restoration Project, Sandia National Laboratories, Albuquerque, NM (1994).

IT 1994k: IT Corporation, *Report on Semiannual Groundwater Sampling at the Mixed Waste Landfill, Sandia National Laboratories/New Mexico, March Through May 1994.* IT, prepared for the Environmental Restoration Project, Sandia National Laboratories, Albuquerque, NM (1994).

IT 1994l: IT Corporation, *Report on Semiannual Groundwater Sampling at the Mixed Waste Landfill, Sandia National Laboratories/New Mexico, October, 1994.* IT, prepared for the Environmental Restoration Project, Sandia National Laboratories, Albuquerque, NM (1994).

IT 1994m: IT Corporation, *Analytical Results for Liquid Waste Disposal Site.* IT, prepared for the Environmental Restoration Project, Sandia National Laboratories, Albuquerque, NM (1994).

IT and Consensus 1993: IT Corporation and Consensus Planning, Inc./Zephyr Design, *Sandia National Laboratories, New Mexico Environmental Baseline Update*, SAND92-7339. IT, prepared for Planning Sandia National Laboratories, Albuquerque, NM (1993).

Kelley 1977: Kelley, V. C., *Geology of Albuquerque Basin, New Mexico*, Memoir 33. New Mexico Bureau of Mines and Mineral Resources, Socorro, NM (1977).

Kelley and Northrup 1975: Kelley, V. C., and S. A. Northrup, *Geology of Sandia Mountains and Vicinity, New Mexico*, Memoir 29. New Mexico Bureau of Mines and Mineral Resources, Socorro, NM (1975).

LATA 1991: Los Alamos Technical Associates, *AIRDOS-EPA Data Upgrade and Dose Calculations for SNL, Albuquerque.* LATA, Los Alamos, NM (1991).

Lord K. J. 1990: Lord, K. J., *A Cultural Resources Review of Sandia National Laboratories TA-V, Kirtland Air Force Base, New Mexico*, (CRA-90-020) November 30, 1990.

Lozinsky 1994: Lozinsky, R. P., "Cenozoic Stratigraphy, Sandstone Petrology, and Depositional History of the Albuquerque Basin, Central New Mexico," in *Basin of the Rio Grande Rift: Structure, Stratigraphy, and Tectonic Setting*, Geol. Soc. America Special Paper 291, pp. 73-81 (1994).

Lozinsky et al. 1991: Lozinsky, R. P., J. W. Hawley, and D. W. Lowe, "Geologic Overview and Pliocene-Quaternary History of the Albuquerque Basin, Central New Mexico," in *Field Guide to Geologic Excursions in New Mexico and Adjacent Areas of Texas and Colorado*, Bulletin 37, B. Julian and J. Zidek, editors, New Mexico Bureau of Mines and Mineral Resources, Socorro, NM (1991).

Matise et al. 1994: Matise, B. K., W. M. Gutman, R. A. Cunniff, R. J. Silver, and W. E. Stepp, *Noise and Vibration Investigations of the Sandia National Laboratories Sol se Mete Aerial Cable Facility*, SAND93-7095. Sandia National Laboratories, Albuquerque, NM (November 1994).

NAEP 1994: Wolff, T. A., and P. Hansen, *Use of Comprehensive NEPA Documents to Reduce Program Risk, in Proceedings of the 1994 National Association of Environmental Professionals (NAEP), Global Strategies for Environmental Issues.* New Orleans, LA, (June 12-15, 1994).

NMED 1991: New Mexico Environmental Department, *Water Supply Regulations*, as Appended Through April 16, 1991. New Mexico Environment Department, Santa Fe, NM (1991).

NMWQR 1991: New Mexico Water Quality Regulations, *New Mexico Water Quality Control Commission Regulations* (1967, as amended through August 17, 1991).

Radian 1994: Radian Corporation, *Measurement of Tritium and VOC Fluxes from Mixed Waste Landfill at Sandia National Laboratories, New Mexico.* Radian Corporation (May 24, 1994).

RSIC 1994: Radiation Shielding Information Center, *RESRAD 5.05 Code System to Implement Residual Radioactive Material Guidelines*, CCC-552. RSIC, Oak Ridge, TN (1994).

SEN-15-90: see DOE 1990c.

Seylar 1994: Seylar, R. F., *Draft Safety Assessment, Radioactive and Mixed Waste Management Facility, Sandia National Laboratories, New Mexico.* Sandia National Laboratories, Albuquerque, NM (March 15, 1994).

Shyr and Thelen 1995: Shyr, L. J., C. Thelen, *Environmental Surveillance Site Evaluation with Respect to the Environmental Restorations Sites.* Sandia National Laboratories, Albuquerque, NM (1995).

Shyr and Haaker 1995: Shyr, L. J., and R. Haaker, *Potential Radiation Dose to the Public due to Sandia National Laboratories Emissions*. Sandia National Laboratories, Albuquerque, NM (1995).

Shyr and McClellan 1995: Shyr, L.-J., and Y. McClellan, *Data from Terrestrial Surveillance in CY94*, Sandia National Laboratories, Albuquerque, NM (1995).

Shyr and Skipper 1995: Shyr, L.-J. and B. Skipper, *1994 Environmental Surveillance Data Analysis.* Sandia National Laboratories, Albuquerque, NM (March 1995).

Shyr et al. 1996: Shyr, L. J., R. Haaker, and H. Herrera, *1995 Environmental Surveillance Data Analysis* Report, SAND96xxxx, in preparation. Sandia National Laboratories, Albuquerque, NM (1995).

SNL 1996a: Sandia National Laboratories *7500 Quality Assurance Management Plan (QAMP)*, PLA 96-14. Sandia National Laboratories, Albuquerque, NM (1996).

SNL 1996b: Sandia National Laboratories (3 reports in one): (1) *NESHAP Annual Report for 1995,* (2) *Supplemental Dose Assessment Data for SNL/NM*, 1995, (3) *Radiological Dose Calculations NESHAP Compliance SNL/NM, 1995*. Sandia National Laboratories, Albuquerque, NM (1996).

SNL 1996c: Sandia National Laboratories, *Wastewater Monitoring Program Semiannual Reports for 1995*. Sandia National Laboratories, Albuquerque, NM (1995).

SNL 1996d: Sandia National Laboratories, *7500 Quality Assurance Plan QAP*, QAP 96-01. Sandia National Laboratories, Albuquerque, NM (1996).

SNL 1996e Sandia National Laboratories, *Groundwater Protection Program, Ground Water Surveillance Report* (in preparation). Sandia National Laboratories, Albuquerque, NM (1996).

SNL 1996f: Sandia National Laboratories, *Sample Manangement Office (SMO) Quality Plan.* Sandia National Laboratories, Albuquerque, NM (January 1996).

SNL 1995a: Sandia National Laboratories, *Sampling and Analysis Plan for Characterization of Waste From Septic System Sampling Project, Sandia National Laboratories, New Mexico*, PLA 95-16, Revision 00. Sandia National Laboratories, Albuquerque, NM (May 10, 1995).

SNL 1995b: Sandia National Laboratories, *Groundwater Protection Program Calendar Year 1994 Annual Groundwater Monitoring Report, Sandia National Laboratories/New Mexico.* Sandia National Laboratories, Albuquerque, NM (March 1, 1995).

SNL 1995c: Sandia National Laboratories, *Proposed Site Treatment Plan for Mixed Waste, Sandia National Laboratories, New Mexico,* Sandia National Laboratories, Albuquerque, NM (March 31, 1995).

SNL 1995d: Sandia National Laboratories, *NEPA Guide*. Sandia National Laboratories, Albuquerque, NM (August 1995).

SNL 1995e: Sandia National Laboratories, *Site Environmental Report*, SAND95-1953. Sandia National Laboratories, Albuquerque, NM (1995).

SNL 1995f: Sandia National Laboratories, *Site Treatment Plan for Mixed Waste, Sandia National Laboratories, New Mexico*, (in preparation). Sandia National Laboratories, Albuquerque, NM (1995). (Enforced Oct. 6, 1995)

SNL 1995g: Sandia National Laboratories, *Semiannual DP-530 report for Pulsed Power Facility*. Sandia National Laboratories, Albuquerque, NM (December 7, 1995).

SNL 1995h: Sandia National Laboratories, *Results of 1995 Storm Water Sampling*. Sandia National Laboratories, Albuquerque, NM (1995).

SNL 1995i: Sandia National Laboratories, *Groundwater Protection Program, March 1995, Groundwater Surveillance Report*. Sandia National Laboratories, Albuquerque, NM (1995).

SNL 1995j: Sandia National Laboratories, TA-V G*roundwater Sampling and Analysis Plan.* Sandia National Laboratories, Albuquerque, NM (1995).

SNL 1995k: Sandia National Laboratories, *Chemical Waste Landfill Groundwater Assessment Report*. Sandia National Laboratories, Albuquerque, NM (1995).

SNL 1994a: Sandia National Laboratories, *Internal, Independent ES&H Appraisal #94-I-004 Environmental Programmatic Compliance Appraisal*, draft report. Sandia National Laboratories, Albuquerque, NM (1994).

SNL 1994b: Sandia National Laboratories, *Program Implementation Plan for Albuquerque Potential Release Sites.* Sandia National Laboratories, Albuquerque, NM (February 1994 draft).

SNL 1994c: Sandia National Laboratories, *Sandia National Laboratories Pollution Prevention Plan.* Sandia National Laboratories, Albuquerque, NM (May 1994).

SNL 1994d: Sandia National Laboratories, *Quality Assurance Project Plan for Terrestrial Surveillance at Sandia National Laboratories, New Mexico*, QUA94-04, Revision 0. Sandia National Laboratories, Albuquerque, NM (December 1, 1994).

SNL 1994e: Sandia National Laboratories, *NESHAP Radionuclide Compliance Project Summary Report for SNL/NM (HERMES III, HCF, ACRR, SPR III)*, SAND94-2291. Sandia National Laboratories, Albuquerque, NM (1994).

SNL 1994f: Sandia National Laboratories, *Measurement of Ground-Water Level*, Field Operating Procedure (FOP) 95-02, Revision 0. Sandia National Laboratories, Albuquerque, NM (1994).

SNL 1994g: Sandia National Laboratories, *Sampling and Analysis Plan for Groundwater Detection Monitoring at the Mixed Waste Landfill*, draft, Rev. 1.0. Environmental Restoration Project, Sandia National Laboratories, Albuquerque, NM (1994).

SNL 1994h: Sandia National Laboratories, *Site-Specific Sampling and Analysis Plan, TA-II Groundwater Monitoring..* Environmental Restoration Project, Sandia National Laboratories, Albuquerque, NM (1994).

SNL 1994i: Sandia National Laboratories, *Draft Site Treatment Plan for Mixed Waste.* Sandia National Laboratories, NM (August 1994).

SNL 1994j: Sandia National Laboratories, *Terrestrial Surveillance Operating Procedures*, FOP 95-03. Sandia National Laboratories, Albuquerque, NM (1994).

SNL 1994k: Sandia National Laboratories, *SAP for Pulsed Power Development Facilities Building 981, 983, and 970 for Lagoons I and II.* Sandia National Laboratories, Albuquerque, NM (July 7, 1994).

SNL 1993a: Sandia National Laboratories, *Conceptual Site Treatment Plan for Mixed Waste, Sandia National Laboratories, New Mexico*, Revision 1 (October 15, 1993). Sandia National Laboratories, Albuquerque, NM (1993).

SNL 1993b: Sandia National Laboratories, *Environment, Safety and Health Training Catalog*, MN471010. Sandia National Laboratories, Albuquerque, NM (March 1993).

SNL 1993c: Sandia National Laboratories, *SNL/NM ER Program Quality Assurance Project Plan (QAPP).* Sandia National Laboratories, Albuquerque, NM (March 26, 1993).

SNL 1993d: Sandia National Laboratories, *New Mexico Environment Department Discharge Plan DP-530 Lagoon Discharge Report, Sandia National Laboratories, Albuquerque, Pulsed Power Development Facilities, Technical Area IV, January 1993 through June 1993.* Submitted by Sandia National Laboratories, Albuquerque, NM, to the New Mexico Environment Department (1993).

SNL 1993e: Sandia National Laboratories, *State of New Mexico Environment Department Discharge Plan DP-530 Lagoon Discharge Report, Sandia National Laboratories, New Mexico, Pulsed Power Development Facilities, Technical Area IV*, prepared for Second Semiannual, CY 1993. Sandia National Laboratories, Albuquerque, NM (December 1993).

SNL 1993f: Sandia National Laboratories, *Chemical Waste Landfill Final Closure Plan Approval.* Sandia National Laboratories, Albuquerque, NM (February 22, 1993).

SNL 1993g: Sandia National Laboratories, *Sitewide Groundwater Monitoring Program Sampling and Analysis Plan*, draft. Groundwater Monitoring Program, Environmental Restoration Department, Sandia National Laboratories, Albuquerque, NM (1993).

SNL 1993h: Sandia National Laboratories, *Sandia National Laboratories' Integrated Quality Program*, SAND93-0891. Sandia National Laboratories, Albuquerque, NM (1993).

SNL 1993i: Sandia National Laboratories, *Sandia National Laboratories Real Property Ozone Depleting substances (ODS) Management Plan and New Mexico Implementation Plan.* Sandia National Laboratories, Albuquerque, NM (August 31, 1993).

SNL 1992a: Sandia National Laboratories, *Sampling and Analysis Plan for Groundwater Assessment Monitoring at the Chemical Waste Landfill..* Revision 4.0, Appendix G in Sandia National Laboratories, New Mexico, 1992c, *Chemical Waste Landfill Final Closure Plan and Postclosure Permit Application*, Volume 2C, Appendices. Environmental Restoration Program, Sandia National Laboratories, Albuquerque, NM (1992) (Approved in May 1993).

SNL 1992b: Sandia National Laboratories, *Final Action Plan to Tiger Team*, SAND92-0120. Sandia National Laboratories, Albuquerque, NM (1992).

SNL 1992c: Sandia National Laboratories, *Consolidated Final Action Plan to Tiger Team*, SAND92-2035. Sandia National Laboratories, Albuquerque, NM (October 1, 1992).

SNL 1989: Sandia National Laboratories, *Site Development Plan.* Sandia National Laboratories, Albuquerque, NM (1989).

Szklarz 1995: Szklarz, D. D., *PCB Annual Document Log 1994.* Sandia National Laboratories, Albuquerque, NM (May 10, 1995).

Sullivan 1994: Sullivan, R. M., *Biological Investigations of the Sandia National Laboratories Sol se Mete Aerial Cable Facility*, SAND93-7093. Sandia National Laboratories, Albuquerque, NM (October 1994).

Sullivan and Knight 1994: Sullivan, R. M., and P. J. Knight, *Biological Surveys for the Sandia National Laboratories Coyote Canyon Complex Kirtland Air Force Base Albuquerque, New Mexico*, SAND93-7089. Sandia National Laboratories, Albuquerque, NM (June 1994).

Thorne 1993: Thorn, C.R., P. McAda, and J.M. Kernodle, *Geohydrologic Framework Hydrologic Conditions in the Albuquerque Basin, Central New Mexico*, Water Resources Investigation Report 93-4149. U.S. Geological Survey, Albuquerque, NM (1993).

Titus 1963: Titus, F. B., *Geology and Ground-Water Conditions in Eastern Valencia County, New Mexico*, Ground-Water Report No. 7. State Bureau of Mines and Mineral Resources, New Mexico Institute of Mining and Technology, Socorro, NM (1963).

U.S. ACE 1979 U.S. Army Corps of Engineers, *Special Flood Hazard Information, Tijeras Arroyo and Arroyo del Coyote, Kirtland AFB, New Mexico.* U.S. Army Corps of Engineers Albuquerque District, Albuquerque, NM (1979).

USDA 1977: U.S. Department of Agriculture (USDA), *Soil Survey of Bernalillo County and Parts of Sandoval and Valencia Counties, New Mexico.* Soil Conservation Service, U.S. Department of the Interior, Bureau of Indian Affairs and Bureau of Land Management (1977).

Woodward 1982: Woodward, L. A., "Tectonic Framework of Albuquerque Country," *in Albuquerque Country II, Guidebook – 33rd New Mexico Geological Society*, Field Conference (1982).

ACTS

American Indian Religious Freedom Act (AIRFA) of 1978, as amended.

Archaeological Resources Protection Act (ARPA) of 1979, as amended.

Atomic Energy Act of 1954, as amended.

Clean Air Act (CAA) of 1955, as amended. Title 42 U.S.C. 7401.

Clean Water Act (CWA) of 1948, (Federal Water Pollution Control Act), as amended. Title 33 U.S.C. 1251.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended. Title 40 U.S.C. 9601.

Emergency Planning and Community Right to Know Act (EPCRA) of 1986 (Enacted by Public Law 99-499, October 17, 1986; 42 U.S.C. 11001 et seq.).

Federal Facility Compliance Act (FFCA) of 1992. Public Law 102-386.

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as amended. Title 7 U.S.C. 136.

National Environmental Policy Act (NEPA) of 1969, as amended. Title 42 U.S.C. 4321.

National Historic Preservation Act of 1966, as amended, Section 106, Advisory Council on Historic Preservation Comment on Federal Undertakings (16 U.S.C. 470f).

New Mexico Hazardous Waste Act, 1978. New Mexico Statute Amendment §74-4-1 through 74-4-12, 1978, amended as laws 1983, Chapter 302.

New Mexico Solid Waste Act, Article 9; Enacted by Laws of 1990, Chapter 99; Amended by Laws of 1991, Chapters 185, 194.

Resource Conservation and Recovery Act (RCRA) of 1976. Public Law 94-580, 1976, 90 Statute 2795.

Superfund Amendments and Reauthorization Act (SARA) of 1986. Title III, Section 313, "Toxic Chemical Release Reporting."

Safe Drinking Water Act (SDWA).

Toxic Substances Control Act (TSCA) of 1976. U.S.C. §2601 et seq.

Water Quality Act of 1987. Public Law 100-4, 1987, 100 Statute 7.

CODE OF FEDERAL REGULATIONS

10 CFR 834. *Radiation Protection of the Public and the Environment.*

10 CFR 835, 1995. *Occupational Radiation Protection*, January 1, 1995.

10 CFR 1021, 1992. *National Environmental Policy Act Implementing Procedures*, as revised April 24, 1992.

40 CFR 50, 1971. *National Primary and Secondary Ambient Air Quality Standards.*

40 CFR 52. *Approved and Promulgation of Implementation Plans.*

40 CFR 58, 1994. *Ambient Air Quality Surveillance*, as revised July 1, 1994.

40 CFR 60. *New Source Performance Standards.*

40 CFR 61, 1973. *National Emission Standards for Hazardous Air Pollutants (NESHAP)*, including 1985, Subpart H. *National Emission Standards for Emissions of Radionuclide Other Than Radon From Department of Energy Facilities*, as amended.

40 CFR 63. Halogenated Solvent Cleaner (NESHAP for Source Categories).

40 CFR 70, 1993. *State Operating Permit Programs.*

40 CFR 80. *Regulation of Fuels and Fuel Additives.*

40 CFR 82, 1988. *Protection of Stratospheric Ozone.*

40 CFR 93. *Determining Conformity of Federal Actions to State or Federal Implementation Plans.*

40 CFR 112, 1973. *Oil Pollution Prevention*, as amended March 26, 1976.

40 CFR 121,1979 *Certification of Activities Requiring a Federal License of Permit.*

40 CFR 122, 1980. *EPA Administered Permit Programs: The National Pollutant Discharge Elimination System*, as amended November 5, 1991.

40 CFR 123, 1980. *State Program Requirements*, as amended November 16, 1990.

40 CFR 124, 1980. *Procedures for Decision Making*, as amended November 16, 1990.

40 CFR 125,1979 *Criteria and Standards.*

40 CFR 136, 1973. *Guidelines Establishing Test Procedures for the Analysis of Pollutants*, as amended August 15, 1990.

CODE OF FEDERAL REGULATIONS (Concluded)

40 CFR 141, 1975. January 15, 1992.	*National Primary Drinking Water Regulations*, as amended.
40 CFR 260	*Hazardous Waste Management System: General.*
40 CFR 261, 1980 January 2, 1992.	*Identification and Listing of Hazardous Waste*, as amended.
40 CFR 262, 1980	*Standards Applicable to Generators of Hazardous Waste*, as amended.
40 CFR 263,	*Standards Applicable to Transporters of Hazardous Waste.*
40 CFR 264, 1980.	*Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities*, including Subpart F, Section 264.101, "Releases for Solid Waste Management Units," as amended June 10, 1994.
40 CFR 265, 1980.	*Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities*, as amended December 23, 1991.
40 CFR 266,	*Standards for the Management of Specific Hazardous Waste and Specific Types of Hazardous Waste Management Facilities.*
40 CFR 267,	[RESERVED]
40 CFR 268, 1986.	*Land Disposal Restrictions*, as amended August 19, 1991.
40 CFR 270	*EPA Administered Permit Programs: The Hazardous Waste Permit Program.*
40 CFR 271	*Requirements for Authorization of State Hazardous Waste Programs.*
40 CFR 272	*Approved State Hazardous Waste Management Programs.*
40 CFR 279	*Standards for the Management of Used Oil.*
40 CFR 280, 1985.	*Underground Storage Tanks*, as amended December 23, 1991.
40 CFR 281, 1988.	*Approval of State Underground Storage Tank Programs*, as amended.
40 CFR 372, 1988.	*Toxic Chemical Release Reporting: Community Right-to-Know*, as amended.
40 CFR 413, 1981.	*Electroplating Point Source Category*, as amended.
40 CFR 433, 1983.	*Metal Finishing Point Source Category*, as amended.
40 CFR 469, 1983.	*Electrical and Electronic Components Point Source Category.*
40 CFR 1500 through 1508, 1978.	Chapter V, *Council on Environmental Quality.*
40 CFR 355	(EPCRA) *Emergency Planning and Notification.*
40 CFR 370	(EPCRA) *Hazardous Chemical Reporting: Community Right-to-Know.*
FR July 27, 1990:	Federal Register, *Corrective Action for Solid Waste Management Unit (SWMU) at Hazardous Waste Management Facilities.* EPA, Proposed Rule, Vol. 55, No. 145, July 27, 1990, p. 30798.

DOE ORDERS

DOE 1996a: *Environmental Safety & Health Reporting*. U.S. Department of Energy, DOE Order 231.1. DOE, Washington, DC (in Final, 1996).

DOE 1995c: U.S. Department of Energy, *National Environmental Policy Act Compliance Program*, DOE Order 451.1. DOE, Washington, DC (September 11, 1995).

DOE 1993c: U.S. Department of Energy, *Occurrence Reporting and Processing of Operations Information*, DOE Order 5000.3B. DOE, Washington, DC (1993, change 1 July 2, 1993).

DOE 1992a: U.S. Department of Energy, *NEPA Compliance Program*, DOE Order 5440.1E. DOE, Washington, DC (1992).

DOE 1992b: U.S. Department of Energy/Albuquerque Operations Office (DOE/AL), *Department of Energy Albuquerque Field Office National Environmental Policy Act Compliance Program*, Supplemental Directive AL 5440.1D. DOE/AL, Albuquerque, NM (1992).

DOE 1991a: U.S. Department of Energy, *Planning and Preparedness for Operational Emergencies*, DOE Order 5500.3A. DOE, Washington, DC (1991, change 1, February 27, 1992).

DOE 1991c: U.S. Department of Energy, *Quality Assurance*, DOE Order 5700.6C. DOE, Washington, DC (August 21, 1991).

DOE 1990a: U.S. Department of Energy, Chapter I, *General Radiological Protection of the Public and the Environment*; Chapter II, *Requirements for Radiation Protection of the Public and the Environment*; and Chapter III, *Derived Concentration Guides for Air and Water*, DOE Order 5400.5, DOE. Washington, DC (February 8, 1990, change 2, January 7, 1993).

DOE 1990b: U.S. Department of Energy, *Conduct of Operations Requirements for DOE Facilities*, DOE Order 5480.19. DOE, Washington, DC (1990, change 1, May 18, 1992).

DOE 1989a: U.S. Department of Energy, *Comprehensive Environmental Response Compensation and Liability Act Requirements,* DOE Order 5400.4, DOE, Washington, DC (1989).

DOE 1989b: U.S. Department of Energy, *Hazardous and Radioactive Mixed Waste Program*, DOE Order 5400.3. DOE, Washington, DC (1989).

DOE 1988a: U.S. Department of Energy, *General Environmental Protection Program*, DOE Order 5400.1. DOE, Washington, DC (1988, change 1, June 21, 1990).

DOE 1988b: U.S. Department of Energy, *Radioactive Waste Management*, DOE Order 5820.2A. DOE, Washington, DC (1988).

DOE ORDERS (Concluded)

Executive Order 11988: *Floodplain Management* (Signed May 24, 1977; 42 FR 26951, 3 CFR, 1977 Comp., p. 117; Amended by Executive Order 12148, July 20, 1979; 44 FR 43239, 3 CFR, 1979 Comp., p. 412).

Executive Order 11990: *Protection of Wetlands* (Signed May 24, 1977; 42 FR 26961, 3 CFR, 1977 Comp., p. 121).

Executive Order 12856: *Federal Compliance With Right-to-Know Laws and Pollution Prevention Requirements* (Signed August 3, 1993; 58 FR 41981, August 6, 1993).

Executive Order 12780: *Federal Agency Recycling and the Council on Federal Recycling and Procurement Policy.* (Signed October 31, 1991; 56 FR 56289, November 4, 1991).

Executive Order 12873: *Federal Acquisition, Recycling and Waste Prevention.* (Signed October 20, 1993; 58 FR 54911, October 22, 1993; amended 6y EO 12995, March 25, 1996; 61 FR 13645, March 28, 1996).

APPENDIX A

METEOROLOGICAL DATA

This page intentionally blank.

CONTENTS

TABLES | Page

Table A-1. Normals, Means, and Extremes for Albuquerque, New Mexico, 1961 to 1990 (NOAA 1990)

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

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

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

REFERENCE

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

This page intentionally blank.

APPENDIX B

SANDIA NATIONAL LABORATORIES/NEW MEXICO ENVIRONMENTAL RESTORATION PROJECT SITES

This page intentionally blank.

CONTENTS

Table B-1. Environmental Restoration Project Sites by Activity Data Sheet (ADS) Number

ADS No.-Operable Unit	Site No.	Site Name	RCRA/RFA No.	Regulatory Driver
1267-Chemical Waste Landfill	74	Chemical Waste Landfill	1-9,20,110	40 CFR 265 Interim Status
1281-Kauai Test Facility	132	Photo Lab Discharge	None	CERCLA
	133	Drum Rack Area	None	CERCLA
	163	Rocket Launcher Pads	None	CERCLA
1289-Mixed Waste Landfill	76	Mixed Waste Landfill (TA-III)	24,25,26,27,28, 29,30,115,116	RCRA 3004(u)
1295-Septic Tanks and Drainfields	49	Bldg. 9820 Drains	126	RCRA 3004(u)
	101	Explosive Contaminated Sumps, Drains (Bldg 9926)	None	RCRA 3004(u)
	116	Building 9990 Septic System	79	RCRA 3004(u)
	137	Bldg. 6540/6542 Septic System	None	RCRA 3004(u)
	138	Bldg. 6630 Septic System	79	RCRA 3004(u)
	140	Bldg. 9965 Septic System	79	RCRA 3004(u)
	141	Bldg. 9967 Septic System	79	RCRA 3004(u)
	142	Bldg. 9970 Septic System	79	RCRA 3004(u)
	143	Bldg. 9972 Septic System	79	RCRA 3004(u)
	144	Bldg. 9980 Septic System	79	RCRA 3004(u)
	145	Bldg. 9981/9982 Septic Systems	None	RCRA 3004(u)
	146	Bldg. 9920 Drain System	79	RCRA 3004(u)
	147	Bldg. 9925 Septic Systems	79	RCRA 3004(u)
	148	Bldg. 9927 Septic System	79	RCRA 3004(u)

Table B-1. Environmental Restoration Project Sites by Activity Data Sheet (ADS) Number (Continued)

ADS No.- Operable Unit	Site No.	Site Name	RCRA/RFA No.	Regulatory Driver
1295-Septic Tanks and Drainfields (Concluded)	149	Bldg. 9930 Septic System	79	RCRA 3004(u)
	150	Bldg. 9939/9939A Septic Systems	None	RCRA 3004(u)
	151	Bldg. 9940 Septic System	79	RCRA 3004(u)
	152	Bldg. 9950 Septic System	79	RCRA 3004(u)
	153	Bldg. 9956 Septic Systems	79	RCRA 3004(u)
	154	Bldg. 9960 Septic Systems	79	NM UST LAW
	160	Bldg. 9832 Septic System	79	RCRA 3004(u)
	161	Bldg. 6636 Septic System	79	RCRA 3004(u)
Tech Area I	30	PCB Spill (Reclamation Yard)	52,53,54,N	RCRA 3004(u)
	33	Motor Pool Oil Spill	Q	RCRA 3004(u)
	42	Acid Spill Water Treatment Facility (TA-I)	None	RCRA 3004(u)
	96	Storm Drain System	113	RCRA 3004(u)
	98	Bldg. 863 TCA Photochemical Releases	None	RCRA 3004(u)
	186	Building 859 TCE Disposal	None	RCRA 3004(u)
	187	TA-I Sanitary Sewer Lines	80	RCRA 3004(u)
	190	Steam Plant Tank Farm	None	RCRA 3004(u)
	192	TA I Waste Oil Tank	None	RCRA 3004(u)
	211	Bldg. 840 Former UST 840-1 (TA-I)	None	RCRA 3004(u)/NM UST LAW
	226	Old Acid Waste Line	None	RCRA 3004(u)
	276	Building 829X Sump	None	RCRA 3004(u)

Table B-1. Environmental Restoration Project Sites by Activity Data Sheet (ADS) Number (Continued)

ADS No.- Operable Unit	Site No.	Site Name	RCRA/RFA No.	Regulatory Driver
1303-Tech Area II	1	Radioactive Waste Landfill & Chemical Disposal Pits	32,33,34,35,36,37	RCRA 3004(u)
	2	Classified Waste Landfill (TA-II)	38,39	RCRA 3004(u)
	3	Chemical Disposal Pit (TA-II)	40	RCRA 3004(u)
	43	Radioactive Material Storage Yard (TA-II)	57	RCRA 3004(u)
	44	Decontamination Site & Uranium Calibration Pits (TA-II)	130	RCRA 3004(u)
	48	Bldg. 904 Septic System (TA-II)	79	RCRA 3004(u)
	113	Area II Firing Sites	None	RCRA 3004(u)
	114	Explosive Burn Pit (Area II)	None	RCRA 3004(u)
	135	Bldg. 906 Septic System	79	RCRA 3004(u)
	136	Bldg. 907 Septic System	79	RCRA 3004(u)
	159	Bldg. 935 Septic System	79	RCRA 3004(u)
	165	Bldg. 901 Septic System	79	RCRA 3004(u)
	166	Bldg. 919 Septic System	79	RCRA 3004(u)
	167	Bldg. 940 Septic System	79	RCRA 3004(u)
Tech Area III & V	18	Concrete Pad	54	RCRA 3004(u)
	26	Burial Site (West of TA-III)	None	RCRA 3004(u)
	31	Electrical Transformer Oil Spill (TA-III)	None	RCRA 3004(u)
	34	Centrifuge Oil Spill (TA-III)	R	RCRA 3004(u)
	35	Vibration Facility Oil Spill (TA-III)	R	RCRA 3004(u)
	36	Oil Spill - HERMES (TA-V)	S	RCRA 3004(u)
	37	PROTO Oil Spill (TA-V)	T	RCRA 3004(u)

Table B-1. Environmental Restoration Project Sites by Activity Data Sheet (ADS) Number (Continued)

ADS No.-Operable Unit	Site No.	Site Name	RCRA/RFA No.	Regulatory Driver
Tech Area III & V (Concluded)	51	Building 6924 Pad, Tank, Pit	10, 11	RCRA 3004(u)
	78	Gas Cylinder Disposal Pit (TA-III)	31	RCRA 3004(u)
	83	Long Sled Track (TA-III)	I	RCRA 3004(u)
	84	Gun Facilities (TA-III)	None	RCRA 3004(u)
	100	Building 6620 HE Sump/Drain (TA-III)	84,85	RCRA 3004(u)
	102	Radioactive Disposal (East of TA-III)	None	RCRA 3004(u)
	107	Explosive Test Area (Southeast TA-III)	None	RCRA 3004(u)
	111	Building 6715 Sump/Drains (TA-III)	79	RCRA 3004(u)
	196	Bldg 6597 Cistern (TA-V)	None	RCRA 3004(u)
	240	Short Sled Track	None	RCRA 3004(u)
	241	Storage Yard	None	RCRA 3004(u)
	275	TA-V Seepage Pits	None	RCRA 3004(u)
1307-Liquid Waste Disposal System	4	LWDS Surface Impoundments	18,19	RCRA 3004(u)
	5	LWDS Drainfield (TA-V)	16,17	RCRA 3004(u)
	52	LWDS Holding Tanks (TA-V)	135	RCRA 3004(u)
1309-Tijeras Arroyo	7	Gas Cylinder Disposal (Arroyo del Coyote)	44	RCRA 3004(u)
	16	Open Dumps (Arroyo del Coyote)	21,55	RCRA 3004(u)
	23	Disposal Trenches (Near Tijeras Arroyo)	47,48,49	RCRA 3004(u)
	40	Oil Spill (6000 Igloo Area)	W	RCRA 3004(u)
	45	Liquid Discharge (Behind TA-IV)	None	RCRA 3004(u)
	46	Old Acid Waste Line Outfall (Tijeras Arroyo)	112	RCRA 3004(u)
	50	Old Centrifuge Site (Tijeras Arroyo)	None	RCRA 3004(u)
	77	Oil Surface Impoundment (Tijeras Arroyo)	12,81,82	RCRA 3004(u)

Table B-1. Environmental Restoration Project Sites by Activity Data Sheet (ADS) Number (Continued)

ADS No.-Operable Unit	Site No.	Site Name	RCRA/RFA No.	Regulatory Driver
1309-Tijeras Arroyo (Concluded)	227	Bunker 904 Outfall (Tijeras Arroyo)	None	RCRA 3004(u)
	228	Centrifuge Dump Site	None	RCRA 3004(u)
	229	Storm Drain System Outfall	None	RCRA 3004(u)
	230	Storm Drain System Outfall	None	RCRA 3004(u)
	231	Storm Drain System Outfall	None	RCRA 3004(u)
	232	Storm Drain System Outfall	None	RCRA 3004(u)
	233	Storm Drain System Outfall	None	RCRA 3004(u)
	234	Storm Drain System Outfall	None	RCRA 3004(u)
	235	Storm Drain System Outfall	None	RCRA 3004(u)
1332 -Foothills Test Area	8	Open Dump (Coyote Canyon Blast Area)	23	RCRA 3004(u)
	15	Trash Pits (Frustration Site)	46	RCRA 3004(u)
	19	TRUPAK Boneyard Storage Area (NW End of Old Aerial Cable)	65	RCRA 3004(u)
	27	Bldg 9820 - Animal Disposal Pit (Coyote Springs)	42	RCRA 3004(u)
	28B	Mine shafts	None	RCRA 3004(u)
	28C	Mine shafts		
	28D	Mine shafts		
	28E	Mine shafts		
	28F	Mine shafts		
	28G	Mine shafts		
	28H	Mine shafts		
	28I	Mine shafts		
	28J	Mine shafts		
	58	Coyote Canyon Blast Area	136,137,138,139	RCRA 3004(u)
	66	Boxcar Site	H	RCRA 3004(u)

Table B-1. Environmental Restoration Project Sites by Activity Data Sheet (ADS) Number (Continued)

ADS No.- Operable Unit	Site No.	Site Name	RCRA/RFA No.	Regulatory Driver
1332 -Foothills Test Area (Continued)	67	Frustration Site	None	RCRA 3004(u)
	82	Old Aerial Cable Site Scrap	66,67	RCRA 3004(u)
	87	Building 9990 Firing Site	108, D	RCRA 3004(u)
	333	Canyons Test Area 10 Burial Mounds (Bunker Area North of Pendulum Site)	60,61,62,63	RCRA 3004(u)
	12A	Burial Site/Open Dump: Open Dump (Lurance Canyon)	41	RCRA 3004(u)
	12B	Burial Site/Open Dump: Buried Debris in Graded Area	41	RCRA 3004(u)
	13	Oil Surface Impoundment (Lurance Canyon Burn Site)	13	RCRA 3004(u)
	59	Pendulum Site	None	RCRA 3004(u)
	60	Bunker Area (North of Pendulum Site)	124	RCRA 3004(u)
	63A	Balloon Test Area: PDSP Site	E1	RCRA 3004(u)
	63B	Balloon Test Area: Balloon/Helicopter Site	E1	RCRA 3004(u)
	64	Gun Site (Madera Canyon)	E2	RCRA 3004(u)
	65A	Lurance Canyon Explosive Test Site: Small Debris Mound	None	RCRA 3004(u)
	65B	Lurance Canyon Explosive Test Site: Primary Detonation Area	None	RCRA 3004(u)
	65C	Lurance Canyon Explosive Test Site: Secondary Detonation Area	None	RCRA 3004(u)
	65D	Lurance Canyon Explosive Test Site: Near Field Dispersion Area	None	RCRA 3004(u)

Table B-1. Environmental Restoration Project Sites by Activity Data Sheet (ADS) Number (Continued)

ADS No.-Operable Unit	Site No.	Site Name	RCRA/RFA No.	Regulatory Driver
1332 -Foothills Test Area (Continued)	65E	Lurance Canyon Explosive Test Site: Far Field Dispersion Area	None	RCRA 3004(u)
	65F	Lurance Canyon Explosive Test Site: Tabs Test Area	None	RCRA 3004(u)
	72	Operation Beaver Site	None	RCRA 3004(u)
	81A	New Aerial Cable Site: Catcher Box/Sled Track	22,50,51,59	RCRA 3004(u)
	81B	New Aerial Cable Site: Impact Pad	22,50,51,59	RCRA 3004(u)
	81C	New Aerial Cable Site: Former Burial Location	22,50,51,59	RCRA 3004(u)
	81D	New Aerial Cable Site: Northern Cable Area	22,50,51,59	RCRA 3004(u)
	81E	New Aerial Cable Site: Gun Impact Area	22,50,51,59	RCRA 3004(u)
	81F	New Aerial Cable Site: Scrap Yard	22,50,51,59	RCRA 3004(u)
	92	Pressure Vessel Test Site (Coyote Canyon Blast Area)	64	RCRA 3004(u)
	93A	Madera Canyon Rocket Launcher Pad A	E3	RCRA 3004(u)
	93B	Madera Canyon Rocket Launcher Pad B	E3	RCRA 3004(u)
	93C	Madera Canyon Rocket Launcher Pad C	E3	RCRA 3004(u)
	94A	Lurance Canyon Burn Site: Above-Ground Tanks	119	RCRA 3004(u)
	94B	Lurance Canyon Burn Site: Debris/Soil Mound Area	119	RCRA 3004(u)
	94C	Lurance Canyon Burn Site: Bomb Burner Area and Discharge Line	119	RCRA 3004(u)

Table B-1. Environmental Restoration Project Sites by Activity Data Sheet (ADS) Number (Continued)

ADS No.- Operable Unit	Site No.	Site Name	RCRA/RFA No.	Regulatory Driver
1332 -Foothills Test Area (Concluded)	94D	Lurance Canyon Burn Site: Bomb Burner Discharge Pit	119	RCRA 3004(u)
	94E	Lurance Canyon Burn Site: Small Surface Impoundment	119	RCRA 3004(u)
	94F	Lurance Canyon Burn Site: LAARC Discharge Pit	119	RCRA 3004(u)
	94G	Lurance Canyon Burn Site: Scrap Yard	119	RCRA 3004(u)
	225	AEC Storage Facility/Kirtland AFB	None	RCRA 3004(u)
	236	Pit East of Balloon Site	None	
	237	Rocket Launch Rail	None	
	238	Rocket Launch Rail Impact Area	None	
	239	Impact Area 155mm and Rockets	None	
	1334	Central Coyote Test Area 9 Burial Site/Open Dump (Schoolhouse Mesa)	43	RCRA 3004(u)
	11	Explosive Burial Mounds	68,69,70	RCRA 3004(u)
	21	Metal Scrap (Coyote Springs)	73	RCRA 3004(u)
	22	Storage/Burn (West of DEER)	106	RCRA 3004(u)
	57A	Workman Site: Firing Site	G	RCRA 3004(u)
	57B	Workman Site: Target Area	G	RCRA 3004(u)
	61A	Schoolhouse Mesa Test Site: Blast Area	None	RCRA 3004(u)
	61B	Schoolhouse Mesa Test Site: Cratering Area	None	RCRA 3004(u)
	61C	Schoolhouse Mesa Test Site: Schoolhouse Bldg	None	RCRA 3004(u)
	68	Old Burn Site	111	RCRA 3004(u)
	70	Explosives Test Pit (Water Towers)	127	RCRA 3004(u)
	71	Moonlight Shot Area	F	RCRA 3004(u)
	88B	Firing Site: Instrumentation Pole	J	RCRA 3004(u)

Table B-1. Environmental Restoration Project Sites by Activity Data Sheet (ADS) Number (Continued)

ADS No.- Operable Unit	Site No.	Site Name	RCRA/RFA No.	Regulatory Driver
1335-Southwest Test Area	6	Gas Cylinder Disposal Pit (Building 9966)	72, L	RCRA 3004(u)
	6A	Gas Cylinder Disposal Pit	None	RCRA 3004(u)
	14	Burial Site (Bldg. 9920)	45	RCRA 3004(u)
	17	Scrap Yards/Open Dump (Thunder Range)	74,75,76	RCRA 3004(u)
	38	Oil Spills (Bldg. 9920)	U	RCRA 3004(u)
	39	Oil Spill - Solar Facility	V	RCRA 3004(u)
	53	Building 9923 Storage Igloo	None	RCRA 3004(u)
	54	Pickax Site (Thunder Range)	14,15	RCRA 3004(u)
	55	Red Towers Site (Thunder Range)	K	RCRA 3004(u)
	56	Old Thunderwells (Thunder Range)	A	RCRA 3004(u)
	85	Firing Site (Building 9920)	125	RCRA 3004(u)
	86	Firing Site (Bldg. 9927)	C	RCRA 3004(u)
	89	Shock Tube Site (Thunder Range)	56	RCRA 3004(u)
	90	Beryllium Firing Site (Thunder Range)	B	RCRA 3004(u)
	91	Lead Firing Site (Thunder Range)	132	RCRA 3004(u)
	103	Scrap Yard (Bldg. 9939)	None	RCRA 3004(u)
	108	Firing Site (Bldg. 9940)	None	RCRA 3004(u)
	109	Firing Site (Bldg. 9956)	None	RCRA 3004(u)
	112	Explosive Contaminated Sump (Building 9956)	None	RCRA 3004(u)
	115	Firing Site (Bldg. 9930)	None	RCRA 3004(u)
	117	Trenches (Bldg. 9939)	None	RCRA 3004(u)
	191	Equus Red	None	RCRA 3004(u)
	193	Sabotage Test Area	None	RCRA 3004(u)
	194	General Purpose Heat Source Test Area	None	RCRA 3004(u)

Table B-1. Environmental Restoration Project Sites by Activity Data Sheet (ADS) Number (Continued)

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

Table B-1. Environmental Restoration Project Sites by Activity Data Sheet (ADS) Number (Continued)

ADS No.- Operable Unit	Site No.	Site Name	RCRA/RFA No.	Regulatory Driver
1337-Off-Site Areas (Concluded)	247	[New Site Name]	None	CERCLA
	248	[New Site Name]	None	CERCLA
	249	[New Site Name]	None	CERCLA
	250	[New Site Name]	None	CERCLA
	251	[New Site Name]	None	CERCLA
	252	[New Site Name]	None	CERCLA
Archival ARCHIVE - Sites Dropped from List	20	Schoolhouse Mesa Burn Site	None	RCRA 3004(u)
	25	Burial Site (South of TA-I)	None	RCRA 3004(u)
	32	Steam Plant Oil Spill (TA-I)	P	RCRA 3004(u)
	41	Building 838 Mercury Spill (TA-I)	O	RCRA 3004(u)
	47	Unmanned Seismic Observatory	133,134	RCRA 3004(u)
	62	Greystone Manor Site	None	RCRA 3004(u)
	69	Old Borrow Pit	None	RCRA 3004(u)
	73	Bldg 895 Hazardous Waste Repackaging/Storage	105	RCRA 3004(u)
	79	Gas Cylinder Disposal Pit (Thunder Range)	None	None
	88A	Firing Site: Ranchhouse	J	RCRA 3004(u)
	104	PCB Spill, Computer Facility	None	RCRA 3004(u)
	105	Mercury (Bldg 6536) (TA-III)	None	RCRA 3004(u)
	106	Explosives-Contaminated Drains (Bldgs 9939,9960,9965,9967) (See Archives)	None	None
	110	Thunder Range (Miscellaneous) (See Archives)	None	None
	139	Bldg. 9964 Septic System	79	RCRA 3004(u)
	155	Bldg. 6597 25,000 Gallon (TA-V)	None	RCRA 3004(u)/NM UST LAW
	162	Bldg. 9962 Seepage	None	None

Table B-1. Environmental Restoration Project Sites by Activity Data Sheet (ADS) Number (Continued)

ADS No.- Operable Unit	Site No.	Site Name	RCRA/RFA No.	Regulatory Driver
Archival ARCHIVE - Sites Dropped from List (Continued)	168	Bldg. 901 UST (TA-II)	None	RCRA 3004(u)/NM UST LAW
	169	Bldg. 910 UST (TA-II)	None	RCRA 3004(u)/NM UST LAW
	170	Bldg. 911 UST (TA-II)	one	RCRA 3004(u)/NM UST LAW
	171	Bldg. 912 UST (TA-II)	None	RCRA 3004(u)/NM UST LAW
	172	Bldg. 888 UST (TA-I)	None	RCRA 3004(u)/NM UST LAW
	173	Bldg. 6525 UST (TA-III)	None	RCRA 3004(u)/NM UST LAW
	174	Bldg. 6581 UST (TA-IV)	None	RCRA 3004(u)/NM UST LAW
	175	Bldg. 6588 UST (TA-IV)	None	RCRA 3004(u)/NM UST LAW
	176	Bldg. 605 UST (TA-I)	None	RCRA 3004(u)/NM UST LAW
	178	Bldg. 6587 UST (TA-III)	None	RCRA 3004(u)/NM UST LAW
	179	Bldg. 7570 UST	None	RCRA 3004(u)/NM UST LAW
	180	Bldg. 6503 UST (TA-III)	None	RCRA 3004(u)/NM UST LAW
	181	Bldg. 6500 UST (TA-V)	None	RCRA 3004(u)/NM UST LAW
	185	Bldg 863 (TA-I)	None	None
	188	Bldg. 6597 Above Ground Containment Spill Tank, (TA-V)	99	RCRA 3004(u)
	195	Experimental Test Pit	None	None
	212	Bldg. 876 UST (TA-I)	None	RCRA 3004(u)/NM UST LAW
	213	Bldg. 880 UST (TA-I)	None	RCRA 3004(u)/NM UST LAW
	214	Bldg. 6505 UST (TA-III)	None	RCRA 3004(u)/NM UST LAW
	215	Bldg. 6536 UST (TA-III)	None	RCRA 3004(u)/NM UST LAW
	216	Bldg. 6596 UST (TA-V)	None	RCRA 3004(u)/NM UST LAW
	217	Bldg. 6630 UST (TA-III)	None	RCRA 3004(u)/NM UST LAW
	218	Bldg. 6720 UST (TA-III)	None	RCRA 3004(u)/NM UST LAW
	219	Tank 7 Burn Site (Lurance Canyon)	None	RCRA 3004(u)/NM UST LAW
	220	Bldg. 9832 UST (Coyote Test Field)	None	RCRA 3004(u)/NM UST LAW

Table B-1. Environmental Restoration Project Sites by Activity Data Sheet (ADS) Number (Continued)

ADS No.- Operable Unit	Site No.	Site Name	RCRA/RFA No.	Regulatory Driver
Archival ARCHIVE - Sites Dropped from List (Concluded)	221	Bldg. 9970 UST (Coyote Test Field)	None	RCRA 3004(u)/NM UST LAW
	222	Igloo Area Bldg 6018 UST (Tijeras Arroyo)	None	RCRA 3004(u)/NM UST LAW
	223	Igloo Area Bldg 6028 UST (Tijeras Arroyo)	None	RCRA 3004(u)/NM UST LAW
	224	Bldg 666A & 666B UST (Kauai)	None	None
	242	Sabotage Test Box (Thunder Range)	None	None
DOE/AL RESP Sites under Responsibility of Others (DOE Albuquerque Operations)	95	Live Fire Range (Central Training Academy)	None	RCRA 3004(u)
DOE/NVO Resp Sites under Responsibility of Others (DOE Nevada Operations)	118	Underground Diesel Tank (TTR)	None	CERCLA
	119	Area 3 Landfills (TTR)	None	CERCLA
	120	Fire Training Area (TTR)	None	CERCLA
	121	Waste Oil Sumps, Bldg 360 (TTR)	None	CERCLA
	122	Area 3 Septic Systems (TTR)	None	CERCLA
	123	Photo Shop French Drains (TTR)	None	CERCLA
	124	High Explosive Disposal Area (TTR)	None	CERCLA
	125	Area 9 Landfill (TTR)	None	CERCLA
	126	Mobile Photographic Lab (TTR)	None	CERCLA
	127	Non-Violent Explosive Destruct System (NEDS) (TTR)	None	CERCLA
	128	Antelope Lake (TTR)	None	CERCLA
	129	Cactus Springs (TTR)	None	CERCLA
	130	Roller Coaster Radioactive Decontamination Area (TTR)	None	CERCLA

Table B-1. Environmental Restoration Project Sites by Activity Data Sheet (ADS) Number (Continued)

ADS No.- Operable Unit	Site No.	Site Name	RCRA/RFA No.	Regulatory Driver
DOE/NVO Resp Sites under Responsibility of Others (DOE Nevada Operations) (Concluded)	131	Roller Coaster Sanitary Sewage System and Lagoons (TTR)	None	CERCLA
	134	Heavy Duty Shop Drains	None	CERCLA
	197	Bomblet Pit (TTR)	None	CERCLA
	198	Dump at Tonopah (TTR)	None	CERCLA
	253	First Gas Station USTs	None	CERCLA
	254	Second Gas Station USTs	None	CERCLA
	255	Septic Tank 33-2	None	CERCLA
	256	Septic Tank 33-3	None	CERCLA
	257	Septic Tank 33-4	None	CERCLA
	258	Septic Tank 33-5	None	CERCLA
	259	Septic Tank 33-6	None	CERCLA
	260	Septic Tank 33-7	None	CERCLA
	261	Septic Tank 33-8	None	CERCLA
	262	Septic Tank 33-9	None	CERCLA
	263	Septic Tank 33-10	None	CERCLA
	264	Septic Tank 33-11	None	CERCLA
	265	Septic Tank 33-12	None	CERCLA
	266	Septic Tank 33-13	None	CERCLA
	267	Leachfield Near Bldg 03-83T	None	CERCLA
	268	Snow Removal Soil Disposal Area	None	CERCLA
	270	Depleted Uranium Impact Site	None	CERCLA
	271	Septic Sludge Disposal Pit #1	None	CERCLA
	272	Septic Sludge Disposal Pit #2	None	CERCLA
	273	Buried DU Artillery Round #1	None	CERCLA
	274	Buried DU Artillery Round #2	None	CERCLA

Table B-1. Environmental Restoration Project Sites by Activity Data Sheet (ADS) Number (Concluded)

ADS No.-Operable Unit	Site No.	Site Name	RCRA/RFA No.	Regulatory Driver
KAFB Resp	24	Landfill and Open Dump (Tijeras Arroyo)	None	RCRA 3004(u)
Sites under Responsibility of	29	Old KAFB Landfills	None	RCRA 3004(u)
Others (Kirtland Air Force Base)	80	Current KAFB Landfill	None	RCRA 3004(u)
	158	KAFB Lagoons	None	RCRA 3004(u)
Not a SWMU	189	Dry Radioactive Waste Burial, NE Corner of Manzano Base	None	RCRA 3004(u)
Not Applicable - (not a Solid Waste Management Unit)	75	Thermal Treatment Facility	None	RCRA TSD
	97	Still Photo Lab (Bldg 802)	None	None
	99	Catch Boxes (TA-I)	114	None

APPENDIX C

NATIONAL ENVIRONMENTAL POLICY ACT DOCUMENTATION

This page intentionally blank.

CONTENTS

Table C-1. 1995 SNL/NM Environmental Assessments (EAS) Status.

Title	DOE Request for EA	Latest EA Sent to DOE	FONSI
Lurance Canyon Burn Site	08/11/89		
Construction and Occupancy of Radioactive and Mixed Waste Assay Facility	03/25/91		
Coyote Canyon Test Complex	11/10/92		
Sol se Mete Aerial Cable Facility	03/11/92	10/18/93	
Site-Wide Environmental Assessments for the Environmental Restoration Project	12/03/93	12/19/95	
Atmospheric Radiation Test Program	02/23/92		
Construction and Occupancy of Processing and Environmental Technology Laboratory	03/25/91	11/16/94	12/18/95
Technical Support Center (GIF)	12/19/90	12/06/94	11/15/95
Neutron Measurement Laboratory	12/10/90		
Transportation of low-level Waste to Offsite Disposal Facilities	10/15/93	09/14/94	
Jupiter Accelerator Facility		06/00/94	
General Purpose Heat Source Radioisotope Thermoelectric Generator Safety Verification Testing 10,000-ft Sled Track Facility	08/31/94	01/16/95	02/13/95

Note: FONSI = Finding of No Significant Impact.

Table C-1. 1995 SNL/NM Environmental Assessments (EAs) Status (Concluded).

Title	DOE Request for EA	Latest EA Sent to DOE	FONSI
Radiopharmaceutical Program, Medical Isotope Production Program (Molybdenum 99)	11/15/94	06/00/95 *	
EA for Operations, Upgrades and Modifications in SNL/NM Technical Area IV	11/18/49	07/27/95	
Joint Computational Engineering Laboratory	09/05/95		
Storm Drains, Sanitary Sewers and Domestic Water Systems Modernization Project	09/25/95		
Microelectronics Development Laboratory	12/21/95		

* EA Determination was to prepare an Environmental Impact Statement (EIS)

Note: FONSI = Finding of No Significant Impact.

Table C-2. National Environmental Policy Act documentation (Environmental Checklists/Action Description Memoranda) and approval status (Continues).

Title	Memo to DOE	DOE Approval	DOE Request for Environmental Assessment
Voluntary Corrective Action, ER Project, Former Underground Storage Tank (UST) 9970-1	03/07/94	03/06/95	
Absolute Time Firing Device for Mines	05/26/94	06/26/95	
Removal of Surface Radioactive Contamination VCA Technical Area III	06/28/94	09/22/95	
United States Strategic Command (USSTRACOM) Commander in Chief(CINC) Mobile Alternate Headquarters	09/08/94	02/16/95	
Protective Sample Container Development	10/03/94	01/08/95	
Glass Cutter for Sniper Support	09/21/94	06/26/95	
Modifications to Building 6596 East	09/27/94	02/03/95	
Subsurface Gas Flowmeter	10/11/94	01/12/95	
Development of Focus Ion Beam Capabilities	10/17/94	08/30/95	
Video Technology Laboratory	11/08/94	07/28/95	
Physical Separation of Neutron Generators	11/08/94	01/26/95	
Characterization Activities Environmental Restoration	11/15/94	05/17/95	
Water Infiltration Test South of Technical Area IV	11/29/94	03/16/95	
Site-Wide Hydrogeological Characterization Surface Trenches	11/23/94	03/16/95	
Decontamination of Buildings 828, 834, and 846	11/17/94	02/16/95	
Radiant Heat Tests CY95	11/18/94	01/26/95	
Particle Beam Fusion Accelerator Project	11/18/94	07/27/95	07/27/95
Air Force Technical Application Center (AFTAC) Space Operations Support	11/18/94	03/06/95	

Table C-2. National Environmental Policy Act documentation (Environmental Checklists/Action Description Memoranda) and Approval Status (Continued).

Title	Memo to DOE	DOE Approval	DOE Request for Environmental Assessment
Surface Radiation Voluntary Corrective Measures (VCM) Sites 55, 175, 103, 117, 119, and 193	12/01/94	01/26/95	
DNA Robust Microelectronics Radiation Harness	12/12/94	01/26/95	
Spectroscopic Excitation and Classification of Trace Elements	12/13/94	01/26/95	
Dielectric Sensor Development	12/14/94	01/26/95	
Ultra-Violet (UV) Spectroscopic Detection and Identification (ID) of Food Pathogens	12/15/94	01/26/95	
Warning-Sensor	12/19/94	02/03/95	
Ground-Based Non-Nuclear Kill	12/21/94	02/03/95	
SERDP/CAMPEP Project in Suspension Rheology Lab (FY95-98)	01/18/95	04/20/95	
Low Cost, Adverse Weather, Precision Strike Demonstration	01/17/95	05/23/95	
Navy Kinetic Energy Weapon Leathality Program	01/10/95	02/03/95	
VCM for Radioactive Waste Landfill Site #1 & #2 , TA II	01/13/95	11/07/95	
Power Systems Moderization Subproject C	01/16/95	03/02/95	
Hot Cell Facilitiy Decontamination	01/17/95	07/28/95	
VCM for ER Sites 27, 108, 14/85 57, 16, &228	01/23/95	03/06/95	
VCM Tech Area II ER Site #114	01/24/95	03/06/95	

Table C-2. National Environmental Policy Act documentation (Environmental Checklists/Action Description Memoranda) and approval status (Concluded).

Title	Memo to DOE	DOE Approval	DOE Request for Environmental Assessment
Removal of Surface Radiation (VCM) ER Sites 10/60, 87SE, 94(12,65,88,61)	01/27/95	03/06/95	
Russian Pit Containers	01/27/95	03/16/95	
Cooperative Joint Range Development	02/07/95	03/16/95	
Chemical/Biological (CB) Aerosol Mitigation Expertiments	02/06/95	03/16/95	
NDS Augmentation Payload (NAP)	02/13/95	04/20/95	
Extended Tracking & Control Experiments	02/13/95	03/16/95	
Propellant Disposal Risk Assessment SWISH Demonstration	02/17/95	06/10/95	
TAI - ADS 1302 RCRA Faciltiy Investigation Work Plan	02/15/95	03/16/95	
Environmental Restoration Project Inspectation and Excavation ER Site 6, Gas Cylinder Disposal Pit	02/21/95	03/16/95	
Geothermal Heat Pump Development and Testing	03/02/95	04/10/95	
Operation of Site 9930 (CY95-97)	03/01/95	06/26/95	
Optical Detonator Fault Study	03/03/95	04/10/95	
Preliminary Investigations ER Project, Tijeras Arroyo ADS 13	03/13/95	04/06/95	

Table C-2. National Environmental Policy Act documentation (Environmental Checklists/Action Description Memoranda) and approval status (Continued).

Title	Memo to DOE	DOE Approval	DOE Request for Environmental Assessment
Historical Radioactive & Mixed Waste Disposal Project	03/16/95	04/20/95	
NFA Sampling at ER Site 88	03/15/95	04/06/95	
ER Site 66 Confirmatory Sampling	03/15/95	04/06/95	
VCM at ER Site 57B	03/15/95	04/06/95	
VCM at ER Site 47	03/16/95	04/06/95	
VCM at ER Site 22	03/16/95	04/06/95	
ER Site 1355-Gas Cylinder Disposal Pit	03/16/95	04/06/95	
Site-Wide Hydrologic Characterization	04/12/95	06/26/95	
Waste Transfer Station	04/13/95	04/20/95	
UMTRA-Durango Toe Drain	04/10/95	05/17/95	
USSPACECOM Mobile Consolidated Command Center (MCCC)	04/10/95	05/17/95	
Development of P-MOSFAT Gamma Ray Detector	04/13/95	05/17/95	
Cafeteria Expansion	04/13/95	04/20/95	
Renewable Energy Geothermal Ground Loop Test Field at PSSL	04/19/95	05/17/95	
VCM at Site 21	04/14/95	05/17/95	
Explosive Testing of Security Vaults at the 10,000 Foot Track	04/19/95	05/17/95	
Hayfield Multi-Chip Module Qualification	05/09/95	06/10/95	

Table C-2. National Environmental Policy Act documentation (Environmental Checklists/Action Description Memoranda) and approval status (Continued).

Title	Memo to DOE	DOE Approval	DOE Request for Environmental Assessment
Site-Wide Hydrogeological Arroyo Del Coyote Additional Wells	05/30/95	06/10/95	
ARM/Tropical Western Pacific Activities	05/26/95	07/28/95	
SNTP Decontamination and Decommissioning Project	06/22/95	09/08/95	
Behavior of Explosives Under Pentrating Environments	06/06/95	07/12/95	
Geophysical Surveys for Ground Water Characterizations	06/08/95	07/12/95	
Centrifuge Laboratory Operations FY95-97	06/12/95	07/27/95	
Equipment Storage Tank at ACRR	06/12/95	07/27/95	
Low Cost Plastic Packaging	06/21/95	07/12/95	
Water Cooled Calorimeter Tests	07/14/95	08/30/95	
SONOS Development	06/28/95	08/09/95	
CN0179 Temporary Unit for Storage	06/29/95	07/12/95	
Site-Wide Hydrological Arroyo Del Coyote Additional Boreholes	07/01/95		
Mass Properties Laboratory Operations Area I, FY95-97	07/11/95	07/27/95	
Oxider Source Term Experiments, SNL/NM FY95-97	07/13/95	07/28/95	
WES Baseline Sampling FY95	07/14/95	07/19/95	

Table C-2. National Environmental Policy Act documentation (Environmental Checklists/Action Description Memoranda) and approval status (Continued).

Title	Memo to DOE	DOE Approval	DOE Request for Environmental Assessment
Electromagnetic Induction Tunnel Detection	07/25/95	08/30/95	
Tomahawk Program Support	07/27/95	08/30/95	
Storm Drains, Sanitary Sewers, and Domestic Water Systems Modefications	07/27/95	09/27/95	09/27/95
Joint Computatunial Engineering Laboratory	07/27/95	09/05/95	09/05/95
Component Irradiation Project, TA-V	07/31/95	09/08/95	
USCAR Low Emissions Partnership	08/03/95	09/30/95	
Centrifuge Testing of Nuller and DUC Antenna Systems	08/03/95	09/30/95	
Removal of Septage Wastes and Closure of SNL/NM Septic Tanks	09/05/95		
Site Characterization for the Septic Tanks and Drainfields Project ADS 1295	09/05/95		
Additional ACRR Fuel Storage Rack	09/07/95	09/22/95	
ACRR Transporter Upgrade and Cask Fabrication	09/07/95	09/27/95	
ACRR Core and Tank Reconfiguration	09/07/95	09/28/95	
Protype Electrooptical Device Design, and Development	09/14/95	10/02/95	
Advanced Manufacturing Protyping Facility	09/26/95		
High Power Electromagnetics Department (9323) Activities	09/15/95	11/14/95	
Thermionics In-Situ Temperture Measurement Apparatus	09/18/95	10/02/95	

Table C-2. National Environmental Policy Act documentation (Environmental Checklists/Action Description Memoranda) and approval status (Continued).

Title	Memo to DOE	DOE Approval	DOE Request for Environmental Assessment
Building 860, NDE (Non-Destructive Evaluation) Laboratory	09/18/95	12/04/95	
Area III, X-Ray Facility	09/18/95	12/04/95	
Project Moonbeam	09/19/95	09/22/95	
Moly 99 Chemical Extraction Experiments	10/03/95	11/14/95	
Transporation of Depleated Uranium to MSC in Oak Ridge TN.	10/16/95	12/19/95	
Modifications to RMSEL	10/30/95	11/07/95	
Rock Mechanics Processes, Org.6100, Building 849, FY96-97	11/07/95	11/14/95	
Computer Aided Advance Ceramic Component Manufacturing	11/06/95	11/14/95	
System Certification and Validation Test Center	11/20/95	12/21/95	
Operation of Microelectronics Development Laboratory (MDL)	11/12/95	12/21/95	12/21/95
Facilities Shop Building	11/13/95	12/04/95	
Plugging and Abandonment of KAFB - 10	11/16/95	12/04/95	
Project Activities in the Systems Assessment and Research Center	12/07/95	12/13/95	
SSF Support and Services	11/28/95	12/20/95	
VCM at ER Site 11	11/21/95		

Table C-2. National Environmental Policy Act documentation (Environmental Checklists/Action Description Memoranda) and approval status (Concluded).

Title	Memo to DOE	DOE Approval	DOE Request for Environmental Assessment
Casing Patch	11/21/95	12/04/95	
Countermrasures Verification	12/08/95	12/20/95	
Excavate ER Site #1 Landfill	12/08/95		
Construction of Temporary Unit	12/11/95		
Track Robotic System Development	12/11/95	12/20/95	
Border Warning/Intrusion Detection System	12/20/95		
Sensor Fused Weapons Parachute Tests	12/12/95	12/20/95	
Cooperative Engagement Capability Experiment	12/22/95		
Capacitance Source for Orbital Weld Machine	12/18/95	12/20/95	
Vertical-Cavity Surface Emitting Laser Development	12/18/95	12/20/95	
East Mountain Education Project	12/19/95		
AABL Support	12/20/95		

REFERENCES

National Environmental Policy Act (NEPA) of 1969, as amended. Title 42 U.S.C. 4321.

10 CFR 1021, 1992. "National Environmental Policy Act Implementing Procedures," as revised April 24, 1992.

APPENDIX D

QUALITY ASSURANCE DATA

This page intentionally blank.

CONTENTS

TABLES Page

Table D-1. Analytical laboratories used by SNL/NM in 1995.

Accu-Labs Research, Inc.
Environmental Control Technilocy Corp. (ENCOTEC)
Quanterra - Denver, CO
Quanterra - St. Louis, MO
General Engineering Laboratory
Sandia National Laboratories/New Mexico (SNL/NM)
Lockheed Analytical Services
Core Labs - Cooper,
Core Labs. - Denver, CO

Table D-2. Sample variability in replicate water samples and blanks, 1995.

Description	Loc No.	Analyte	Units	Count	Average	Std Dev.	CV
May 1995							
Filtered Water	11	Gross Alpha	pCi/L	3	0.67	0.58	86.60
Total Water	11	Gross Alpha	pCi/L	3	1.33	0.58	43.30
Blank		Gross Alpha	pCi/L	3	0.00	0.00	*
Filtered Water	11	Gross Beta	pCi/L	3	3.67	0.58	15.75
Total Water	11	Gross Beta	pCi/L	3	6.33	0.58	9.12
Blank		Gross Beta	pCi/L	3	0.33	0.58	173.21
Filtered Water	11	Tritium	pCi/L	3	-0.0433	0.0603	-139.10
Total Water	11	Tritium	pCi/L	3	0.0267	0.0416	156.12
Blank		Tritium	pCi/L	3	-0.0367	0.0513	-139.95
Filtered Water	11	Uranium	mg/L	3	0.0017	0.0001	3.46
Total Water	11	Uranium	mg/L	3	0.0019	0.0001	2.99
Blank		Uranium	mg/L	3	-0.0001	0.0000	0.00
August 1995							
Filtered Water	11	Gross Alpha	pCi/L	3	2.00	1.00	50.00
Total Water	11	Gross Alpha	pCi/L	3	2.00	1.00	50.00
Blank		Gross Alpha	pCi/L	2	0.50	0.71	141.42
Filtered Water	11	Gross Beta	pCi/L	3	6.00	1.00	16.67
Total Water	11	Gross Beta	pCi/L	3	8.00	2.00	25.00
Blank		Gross Beta	pCi/L	2	1.00	0.00	0.00
Filtered Water	11	Tritium	pCi/L	3	0.0733	0.0473	64.44
Total Water	11	Tritium	pCi/L	3	0.0967	0.0513	53.09
Blank		Tritium	pCi/L	2	0.1050	0.0495	47.14
Filtered Water	11	Uranium	mg/L	3	0.0018	0.0001	3.27
Total Water	11	Uranium	mg/L	3	0.0018	0.0001	6.30
Blank		Uranium	mg/L	2	-0.0001	0.0000	0.00

Note: * Division by zero (0), During August sampling period, there were only 2 water blanks computed by current analytical laboratory.

Table D-3. Sample variability in replicate vegetation samples, 1995.

Matrix	Analyte	Units	Loc No.	Count	Average	Std Dev.	CV
May1995							
Vegetation	Beryllium-7	pCi/g	11	3	2.90	0.89	30.65
		pCi/g	2NE	3	6.70	1.23	18.34
		pCi/g	53	3	6.83	1.11	16.19
		pCi/g	7	3	8.23	3.66	44.40
Vegetation	Potassium-40	pCi/g	11	3	13.33	2.08	15.61
		pCi/g	2NE	3	4.80	1.45	30.26
		pCi/g	53	3	3.30	0.70	21.21
		pCi/g	7	3	6.10	4.55	74.60
Vegetation	Tritium	pCi/mL	11	3	0.05	0.02	32.73
		pCi/mL	2NE	3	5.13	1.55	30.26
		pCi/mL	53	3	0.00	0.02	458.26
		pCi/mL	7	3	0.14	0.04	30.46
August 1995							
Vegetation	Beryllium-7	pCi/g	11	3	3.80	1.06	27.85
		pCi/g	2NE	3	5.60	0.56	9.94
		pCi/g	53	3	5.53	0.47	8.54
		pCi/g	7	3	5.33	0.75	14.07
Vegetation	Potassium-40	pCi/g	11	3	9.37	0.85	9.08
		pCi/g	2NE	3	4.50	1.11	24.75
		pCi/g	53	3	5.70	0.52	9.12
		pCi/g	7	3	4.93	1.25	25.34
Vegetation	Tritium	pCi/mL	11	3	0.16	0.06	39.36
		pCi/mL	2NE	3	11.40	1.97	17.28
		pCi/mL	53	3	0.15	0.10	63.60
		pCi/mL	7	3	0.04	0.04	90.14

Note: pCi/g = pico curies per gram; pCi/mL = pico curies per milliliter

Table D-4. Sample variability in replicate soil and sediment samples, 1995 (Continues).

Matrix	Analyte	Units	Loc No.	Count	Average	Std Dev.	CV
May 1995							
Soil	Cesium-137	pCi/g	7	3	0.73	0.08	10.70
Soil		pCi/g	53	3	0.12	0.05	43.14
Soil		pCi/g	11	3	0.08	0.02	18.33
Soil		pCi/g	2NE	3	0.20	0.03	12.80
Sediment		pCi/g	73	3	0.08	0.04	49.38
Sediment		pCi/g	11	3	0.06	0.03	50.76
Soil	Potassium-40	pCi/g	7	3	18.33	0.58	3.15
Soil		pCi/g	53	3	16.33	0.58	3.53
Soil		pCi/g	11	3	17.33	1.15	6.66
Soil		pCi/g	2NE	3	16.00	1.00	6.25
Sediment		pCi/g	11	3	17.00	2.00	11.76
Sediment		pCi/g	73	3	18.00	1.00	5.56
Soil	Tritium	pCi/mL	11	3	0.34	0.45	130.53
Soil		pCi/mL	2NE	3	23.67	1.15	4.88
Soil		pCi/mL	7	3	0.28	0.12	42.86
Soil		pCi/mL	53	3	0.22	0.15	68.51
Sediment		pCi/mL	11	3	0.06	0.03	39.74
Sediment		pCi/mL	73	3	0.16	0.27	173.21
Soil	Total Uranium	ug/g	11	3	1.53	0.12	7.53
Soil		ug/g	53	3	0.91	0.51	56.37
Soil		ug/g	7	3	1.20	0.10	8.33
Soil		ug/g	2NE	3	0.77	0.07	9.16
Sediment		ug/g	73	3	2.67	0.55	20.65
Sediment		ug/g	11	3	1.67	0.23	13.86

Table D-4. Sample variability in replicate soil and sediment samples, 1995 (Concluded).

Matrix	Analyte	Units	Loc.No.	Count	Average	Std Dev.	CV
August 1995							
Soil	Cesium-137	pCi/g	2NE	3	0.19	0.01	6.19
Soil		pCi/g	7	3	0.45	0.14	30.03
Soil		pCi/g	53	3	0.13	0.02	15.38
Soil		pCi/g	11	3	0.07	0.02	22.91
Sediment		pCi/g	73	3	0.06	0.03	53.91
Sediment		pCi/g	11	3	0.06	0.02	36.74
Soil	Potassium-40	pCi/g	53	3	17.67	0.58	3.27
Soil		pCi/g	11	3	19.33	1.53	7.90
Soil		pCi/g	2NE	3	15.67	0.58	3.69
Soil		pCi/g	7	3	18.67	0.58	3.09
Sediment		pCi/g	73	3	20.00	1.00	5.00
Sediment		pCi/g	11	3	17.00	1.00	5.88
Soil	Tritium	pCi/mL	11	3	0.07	0.06	83.32
Soil		pCi/mL	2NE	3	129.00	66.96	51.90
Soil		pCi/mL	53	3	0.16	0.06	35.87
Soil		pCi/mL	7	3	0.11	0.07	57.41
Sediment		pCi/mL	73	3	0.09	0.04	48.43
Sediment		pCi/mL	11	3	0.15	0.03	17.16
Soil	Total Uranium	ug/g	11	3	1.37	0.06	4.22
Soil		ug/g	2NE	3	0.99	0.11	11.09
Soil		ug/g	53	3	1.17	0.21	17.84
Soil		ug/g	7	3	1.13	0.06	5.09
Sediment		ug/g	73	3	1.47	0.12	7.87
Sediment		ug/g	11	3	1.47	0.15	10.41

Note: pCi/g = pico curies per gram; pCi/mL = pico curies per milliliter; ug/g = micro grams per gram;

Table D-5. 1995 Quality Assurance results for selected radiochemical analysis environmental protection agency/Accu-Labs Research, Inc. Intercomparison Study, cross-check results.

Month	EPA Result (pCi/L ± 3 sigma)	Accu-Labs Results (pCi/L ± 2 sigma)	Deviation From Known (sigma)	Grand Average	Deviation from Grand Average
		Gross Alpha in Water			
10/1995		40 ± 5; 39 ± 5; 38 ± 5			
7/1995	27.5 ± 6.9	27 ± 4; 31 ± 5; 28 ± 4	0.29	19.75	2.24
4/1995 (Blind)	47.5 ± 11.9	46 ± 5; 49 ± 5; 44 ± 5	-0.13	50.90	-0.63
1/1995	5.0 ± 5.0	6 ± 2; 6 ± 2; 5 ± 2	0.23	5.68	0.00
		Gross Beta in Water			
10/1995		24 ± 3; 27 ± 3; 24 ± 3			
7/1995	19.4 ± 5.0	25 ± 3; 24 ± 3; 21 ± 3	1.29	21.67	0.51
4/1995 (Blind)	86.6 ± 10.0	77 ± 5; 83 ± 5; 88 ± 5	-0.68	86.93	-0.73
1/1995	5.0 ± 5.0	7 ± 2; 6 ± 2; 6 ± 2	0.46	6.62	-0.10
		Uranium in Water			
9/1995	30.5 ± 3.0	30.9; 30.4; 31.1	0.17		
6/1995	15.2 ± 3.0	16.1; 15.6; 15.5	0.31	14.62	0.64
4/1995 (Blind)	10.0 ± 3.0	10.7; 10.2; 10.3	0.23	9.93	0.27
2/1995	25.5 ± 3.0	20.8; 20.9; 20.6	-2.73	24.74	-2.29
		Tritium in Water and Urine			
8/1995	4872 ± 487	4500 ± 310; 4770 ± 310; 4800 ± 310	-0.65	4788.09	-0.35
3/1995	7435 ± 744	7390 ± 360; 7820 ± 360; 7800± 360	0.55	7299.15	0.86

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

Radionuclide	QAP XXXIX - 9309 ALR Result	EML Result	Ratio ALR/EML
Vegetation (Bq/kg)*			
Pu-239	0.71 ± 0.12	0.98 ± 0.115	0.72
Pu-238	§	§	§
U-238	‡	‡	‡
Am-241	0.40 ± 0.20	0.534 ± 0.04	0.75
Sr-90	355 ± 33	587 ± 36.3	0.61
Cs-137	92.5 ± 3.1	97.2 ± 1.93	0.95
H-3	‡	‡	‡
K-40	267 ± 14.6	352 ± 8.16	0.76
Co-60	5.5 ± 0.6	9.17 ± 0.257	0.60
Water (Bq/L)			
Pu-239	0.400 ± 0.100	0.272 ± 0.033	1.47
Pu-238	1.400 ± 0.200	1.410 ± 0.096	0.99
U-234	0.400 ± 0.100	0.306 ± 0.003	1.31
U-238	0.400 ± 0.100	0.311 ± 0.016	1.29
Am-241	1.500 ± 0.200	1.950 ± 0.084	0.77
Sr-90	1.800 ± 0.500	2.000 ± 0.040	0.90
Cs-137	89.900 ± 7.400	75.200 ± 0.642	1.20
H-3	145.000 ± 11.400	168.000± 35.000	0.86
Mn-54	52.200 ± 4.400	44.900 ± 0.726	1.16
Co-60	219.000 ± 16.600	196.000 ± 1.410	1.12
Cs-134	§	§	§
Cs-144	§	§	§

Note: ALR = Accu-Labs Research; EML = Environmental Measurements Laboratory.

*Units and results are as reported by DOE QAP. To convert to picocuries per gram (pCi/g), multiply Becquerels per kilogram (Bq/kg) by 0.37.

†Units and results are as reported by DOE QAP. To convert to picocuries per liter (pCi/L), multiply by Becquerels per liter (Bq/L) 3.7 x 10.

‡‡= not requested.

§ = no result.

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

Radionuclide	QAP XXXIX - 9309		
	ALR Result	EML Result	Ratio ALR/EML
Soil (Bq/kg)*			
Pu-239	5.700 ± 2.200	5.170 ± 0.070	1.10
U-234	20.500 ± 4.100	29.500 ± 2.320	0.70
U-238	17.300 ± 3.700	30.400 ± 2.080	0.57
Am-241	1.700 ± 0.600	1.760 ± 0.113	0.97
Sr-90	12.400 ± 3.000	7.810 ± 0.280	1.59
Cs-137	236.000 ± 6.700	207.000 ± 1.120	1.14
H-3	‡	‡	‡
K-40	339.000 ± 20.700	377.000 ± 16.400	0.90

Note: ALR = Accu-Labs Research; EML = Environmental Measurements Laboratory.
*Units and results are as reported by DOE QAP. To convert to picocuries per gram (pCi/g), multiply Becquerels per kilogram (Bq/kg) by 0.37.
†Units and results are as reported by DOE QAP. To convert to picocuries per liter (pCi/L), multiply by Becquerels per liter (Bq/L) 3.7 x 10.
‡ = not requested.
§ = no result.

This page intentionally blank.

APPENDIX E

ENVIRONMENTAL REGULATIONS & STANDARDS

This page intentionally blank.

CONTENTS

E.1 INTRODUCTION

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

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

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

Table E-1. Derived Concentration Guides (DCGs) For Selected Radionuclides.*

	Drinking Water		Inhaled Air[†]	
Nuclide	DCG (µCi/L)	f_1 Value	DCG (µCi/m^3)	Solubility Class
Tritium (water)	2E+00	--	1E-01	--
Cesium-137	3E-03	1E+00	4E-04	D
Gross Alpha*	15E-06	--	--	--
Gross Beta	3E-05	--	--	--
Uranium§, total	6E-04	--	6E-6	--

Note: µCi/L = microcuries per liter; µCi/m^3 = microcuries per cubic meter.
*DOE Order 5400.5, Chapter III (DOE 1990).
†DCG for tritium in air (2×10^{-1}) is adjusted for skin absorption.
‡EPA-570/9-76-003 (EPA 1976).
§A conversion from picocuries per liter (pCi/L) to micrograms per liter (µg/L) may be made using 1.3×10^{-6} picocuries per microgram (pCi/ g) for uranium as it exists in drinking water (40 CFR 141).

Table E-2. Radiation standards for protection of the public in the vicinity of U.S. Department of Energy facilities.

General Dose Limits

All Pathways*

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

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

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

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

Table E-3. Groundwater Monitoring parameters required by 40 CFR 265, Subpart F.*

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

*Resource Conservation and Recovery Act (40 CFR 265).
†40 CFR 265, Appendix III.

Table E-4. U.S. Environmental Protection Agency Interim Primary Drinking-Water Supply parameters.

Parameter	Standard*	Units
Arsenic†	0.05	mg/L
Barium†	1.0	mg/L
Cadmium†	0.01	mg/L
Chromium†	0.05	mg/L
Lead†	0.05	mg/L
Mercury†	0.002	mg/L
Selenium†	0.01	mg/L
Silver†	0.05	mg/L
Fluoride	1.4-2.4	mg/L
Nitrate	10	mg/L
Total Coliform	1/100 mL	cl/100 mL
Turbidity	1 TU	NTU
Radium-226	5 pCi/L	pCi/L
Radium-228	5 pCi/L	pCi/L
Gross Alpha	15 pCi/L	pCi/L
Gross Beta	4 mR/yr	mR/yr
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

Note: mg/L = milligrams per liter; mL = milliliters; NTU = nephelometric turbidity unit; pCi/L = picocuries per liter; mR/yr = milliroentgens per year.
*40 CFR 265, Appendix III.
†Total metals (unfiltered sample).

REFERENCES

DOE 1988: U.S. Department of Energy, "General Environmental Protection Program," DOE Order 5400.1, DOE, Washington, DC (1988; change 1, June 21, 1990).

DOE 1990: U.S. Department of Energy, Chapter I, "General Radiological Protection of the Public and the Environment;" Chapter II, "Requirements for Radiation Protection of the Public and the Environment;" and Chapter III, "Derived Concentration Guides for Air and Water," DOE Order 5400.5, DOE, Washington, DC (February 1990).

EPA 1976: U.S. Environmental Protection Agency, "U.S. EPA National Interim Primary Drinking Water Regulations," EPA-570/9-76-003, EPA, Washington, DC (1976).

Resource Conservation and Recovery Act (RCRA) of 1976. Public Law 94-580, 1976, 90 Statute 2795.

10 CFR 1021, 1992. "National Environmental Policy Act Implementing Procedures," as revised April 24, 1992.

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

40 CFR 141, 1975. "National Primary Drinking Water Regulations," as amended January 15, 1992.

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

This page intentionally blank.

APPENDIX F

1995 ENVIRONMENTAL COMPLIANCE ACTIVITIES AT THE KAUAI TEST FACILITY

This page intentionally blank.

CONTENTS

FIGURES

TABLES

ABREVIATIONS

BMDO	Ballistic Missile Defense Organization
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
EA	Environmental Assessment
EIS	Environmental Implementation Statement
EORC	Environmental Operations Record Center
EMP	Environmental Monitoring Plan
EPA	U.S. Environmental Protection Agency
EPCRA	Emergency Planning & Community Right-to-Know Act
ER	Environmental Restoration
ES&H	Environment, Safety, and Health
ET&CE	Extended Tracking & Control Experiment
FONSI	finding of no significant impact
FTU	Flight Test Unit
ICP	inductively coupled plasma (method)
IT	International Technology (Corp.)
KTF	Kauai Test Facility
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NRC	National Response Center
NSPS	New Source Performance Standards
PCB	polychlorinated biphenyl
PMRF	Pacific Missile Range Facility
PSD	Prevention of Significant Deterrioration
PTO	Permit-to-Operate
RCRA	Resource Conservation & Recovery Act
RQ	reportable quantity
SARA	Superfund Amendments and Reauthorization Act
SDI	Strategic Defense Initiative
SEA	site evaluation accomplished
SI	site inspection
SNL	Sandia National Laboratories
SNL/NM	Sandia National Laboratories/New Mexico
SOP	standard operating procedure
SPCC	Spill Prevention Control and Countermeasure Plan
STARS	Strategic Targeting System
TAL	target analyte list
TCLP	toxicity characteristic leaching procedure
TSCA	Toxic Substances Control Act
USASSDC	U.S. Army Space and Strategic Defense Command
UST	underground storage tank
VOC	volatile organic compound

Units & Chemical Abbreviations

mi	mile
m	meter
ft	feet
min	minute
gal	gallon
yr	year
in.	inch
mg	milligram
L	liter
°F	degrees Fahrenheit
ppm	parts per million
lb	pounds
pCi	picocurie
g	gram
µg	microgram
kg	kilogram

ELEMENTS

Ag	silver
Al	aluminum
Ba	barium
Be	beryllium
Ca	calcium
Co	cobalt
Cr	chromium
Cs-137	cesium-137
Cu	copper
Fe	iron
K	potassium
Mg	magnesium
Ni	nickel
Pb	lead
Si	silicon
Sr	strontium
Ti	titanium
U	uranium
Va	vanadium
Zn	zinc

Sandia National Laboratories (SNL) operates a rocket preparation and launch facility called the Kauai Test Facility (KTF) at the U.S. Navy's Pacific Missile Range Facility (PMRF), Barking Sands, for the U.S. Department of Energy (DOE). PMRF is located on the west side of the island of Kauai, Hawaii (Figure F-1). KTF is used to launch rockets in support of DOE missions, as well as other U.S. government projects (DOE 1992).

F.1 FACILITIES & OPERATIONS

SNL's KTF is located on the north end of the PMRF near Nohili Point. The first facilities at KTF were constructed in the early 1960s to support the National Readiness Program. The most recent construction, completed in 1994, added four buildings to support DOE and Strategic Defense Initiative (SDI) launches.

KTF is used for testing rocket systems with scientific and technological payloads, advanced development of maneuvering reentry vehicles, scientific studies of atmospheric and exoatmospheric phenomena, and SDI programs. Nuclear devices have never been launched from KTF.

The KTF launcher field was originally designed to accommodate 40 launch pads, but only 15 were constructed. Of these, 11 have had their launchers removed. Beyond the implementation of portions of the original plan, two additional launch pads have been constructed: Pad 41 at Kokole Point, and Pad 42, the Strategic Targeting System (STARS) launch pad. The launcher field site has a number of permanent facilities used to support rocket operations and is configured to meet programmatic needs.

The administrative area of KTF, known as the Main Compound, is located in a fenced area near the North Nohili access road from PMRF. Within the fenced compound, a number of trailers and vans are interconnected with a network of concrete docks and covered walkways. The majority of these temporary facilities are used during operational periods to support the field staff at KTF. During non-operational periods, general maintenance continues and dehumidifiers remain in operation. Additionally, there are a number of permanent buildings, most of which are in use year-round to support and maintain KTF facilities (Helgesen 1990).

F.2 AREA POPULATION

The closest population center, Kekaha (population 3300), is 8 miles (mi) from KTF. KTF employs 14 permanent on-site personnel; two are employed by SNL and the rest are SNL

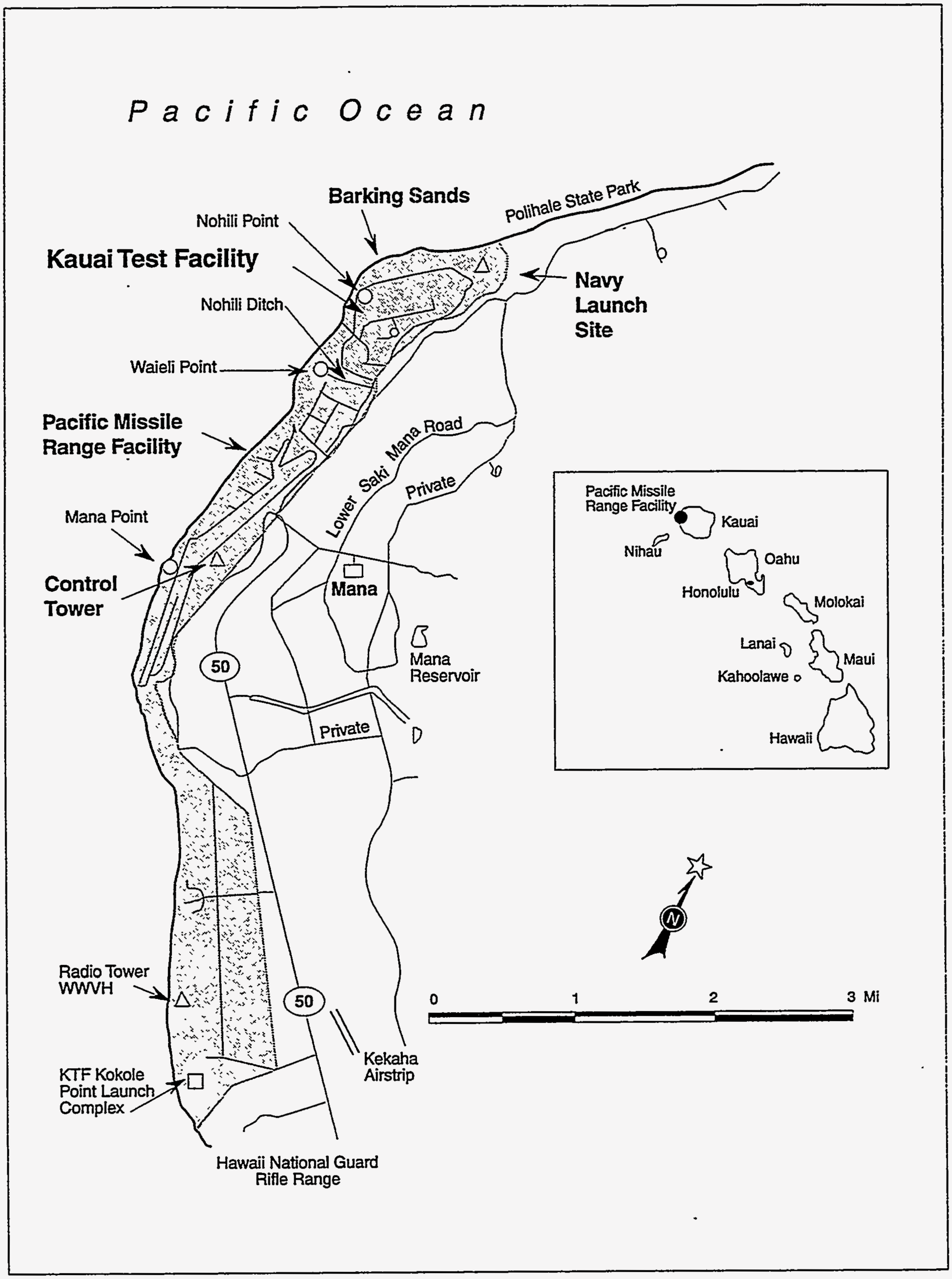

Figure F-1. Map of the Pacific Missile Range Facility (PMRF) and the adjacent area. The Kauai Test Facility (KTF) is to the north, near Nohili Point.

contractors. During operational periods when rocket launches occur, an additional 50 to 130 persons from the United States mainland are employed at KTF (DOE 1992).

F.3 GEOLOGY & HYDROLOGY

Geology

KTF and PMRF are located on the seaward margin of the broad Mana Coastal Plain of Kauai. This plain is composed of alluvium washed down from higher elevations, 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 barrier beach ridge. Most of the larger wetland areas on the island were drained and planted with sugar cane by 1936, leaving only some small areas of wetland near Mana, about 10,000 feet (ft) south of KTF.

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 cliff slope formed in the geologic past when sea levels were higher. The volcanic basement plunges below the plain at a dip of approximately 5 degrees and continues to the coast, where it is approximately 400 ft below the surface.

The seaward edge of the plain on the west side is covered by ancient sand dunes which formed when the sea level was lower than present conditions. PMRF is located almost entirely on these dunes, which are now no higher than approximately 10 ft. To the north of KTF, these dunes are up to 100 ft high.

Hydrology

The KTF area is located in one of the driest areas on the island with very little rainfall (~20 in/yr). Rain usually sinks into the sand and disappears, though during hard rains surface run-off is visible after the soil becomes saturated. However, there is no integrated surface 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.

Three types of geologic features (volcanic bedrock, alluvium, and sand dunes) constitute the hydraulically connected aquifers in area of the site. The basement volcanics are highly permeable, containing brackish water floating on seawater. The overlying sediments act as a cap rock due to their low permeability; but although they are saturated, they are not exploitable as an aquifer because of their unfavorable hydraulic characteristics and water quality.

The sand dune aquifer (on which PMRF overlies) has moderate hydraulic conductivity and fair porosity. It consists of a lens of brackish groundwater floating on seawater and is recharged by storm rainfall and seepage from the underlying sediments. The only record of an attempt to exploit this groundwater is of a well drilled for the Navy in 1974, 4 to

5 mi south of KTF. Drilled to a depth of 42 ft, the well encountered only fine sand and coral gravel and was tested at 300 gallons per minute (gal/min). However, it contained 2800 milligrams per liter (mg/L) of chloride, which is too brackish for agriculture use. This well is currently not being used (SNL 1986).

F.4 BIOLOGY

The principal vegetation found on Kauai consists of two introduced shrub species: kiawe, a mesquite; and koahaole, a wild tamarind. Portions of the island are covered with nearly impenetrable thickets of these two plant species (DOE 1992). The land on which the present KTF facilities lie has been cleared of brush and has a thin cover of grasses and herbs. The sandy soil in the site area 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 likely that there may be rodent populations. The endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*) may also be occasionally found since there are breeding populations elsewhere on Kauai. A total of 22 species of birds are found on the range, as well as three more species just outside the range (SNL 1986). These include five species native to Hawaii. There are also several species of waterfowl present during some seasons of the year, although they were not seen during the 1986 survey.

F.5 METEOROLOGY

Lying in the rain shadow of Mount Kawaikini and Mount Waialeale, KTF is sheltered from the predominant northeast tradewinds and is one of the driest sections of Kauai. Average annual rainfall at KTF is just over 20 in. and occurs mostly between October and April. Under normal conditions, winds are generally light and variable, although abnormal conditions can result in gusty winds in excess of 30 knots from the south, west, or north. The mean monthly temperature is 70 °F, with maximums in the low 90s and minimums in the mid-50s.

F.6 ENVIRONMENTAL COMPLIANCE ACTIVITIES

F.6.1 National Environmental Policy Act (NEPA) Compliance

In accordance with the National Environmental Policy Act (NEPA), a comprehensive site-wide Environmental Assessment (EA), *Kauai Test Facility Environmental Assessment*, was completed for KTF in 1992 (DOE 1992). A finding of no significant impact (FONSI) was issued on July 17, 1992.

In completing this EA, several environmental surveys were carried out. Reports included the following:

- **Green Sea Turtle Survey Report** – This survey found at least 32 green sea turtles (*Chelonia mydas agassizi*) in five locations at KTF. The study concluded that constructing an additional launch pad and conducting further launches similar to those conducted at KTF since 1962 probably will not have any quantifiable negative effects on green sea turtles inhabiting waters near KTF (IT 1990a).

- **Botanical Survey Report** – This survey identified four major vegetation types at KTF and recommended that vehicles be kept off the beach and dunes. The report recommended moving the entire *Ophioglossum concinnum* colony (a Category 1[a] proposed endangered fern) to a compatible area within PMRF because of the colony's proximity to a beach access road and its location in a frequently-mowed kiawe/koahaole vegetation zone (IT 1990b).

- **Ornithological and Mammal Survey Report** – This survey determined relative population densities of bird species and identified mammalian species at KTF (IT 1990c).

- **Soil Sampling Report** – Sampling was undertaken to delineate the extent and concentration of lead (Pb), aluminum (Al), and beryllium (Be) in the soil at KTF and to determine whether the concentrations pose a risk to human health or the environment. The soil sampling results were used to estimate the potential for future soil contamination or human exposure from use of KTF as a launch facility (IT 1990d).

- **Archaeological Survey and Sampling** – No significant cultural resources were found on the surface at KTF, but subsurface testing within one area indicated a potential for subsurface cultural resource materials (Gonzalez and Berryman 1990).

Two STRYPI IX sounding rockets were launched from KTF in 1995. These launches were performed under the "Uwbralla" administration of the KTF site-wide EA, published

[a] Category 1 is a species for which biologic vulnerability exists to the point of support of proposal to list as endangered or threatened.

in July 1992 (DOE 1992). The experiment, called the “Extended Tracking and Control Experiment” (ET&CE), sponsored by Ballistic Missile Defense Organization (BMDO), demonstrated the increasing capability of the Navy's fleet defense systems to perform “Theater Missile Defense” functions. The mission was a success; all on-board systems functioned as designed and all sensors acquired valid data. The two rockets were launched on June 26 and June 29 respectively.

F.6.2 Environmental Permits

Air Permits

Currently there are no facilities at KTF which require permits or compliance with the “New Source Performance Standards (NSPS),” “Prevention of Significant Deterioration (PSD),” or the National Emission Standards for Hazardous Air Pollutants (NESHAP). Within PMRF no federal air emission permits are held either by DOE for KTF, or by the U.S. Department of Defense (DoD) for PMRF. However, the two electrical generators at KTF are permitted for operation by the State of Hawaii under “Permit-to-Operate” (PTO) No. P-737-1591.

Waste Water Permits

Sanitary waste is treated on-site by a wastewater treatment system consisting of three septic tanks and one leach pit in brackish water. The limited quantities of sewage released from KTF do not impact any protected water. Periodic drainage of septic tanks is accomplished by State of Hawaii licensed contractors who dispose of wastes according to state procedures. The KTF facility currently has three septic tanks on-site which do not require permits from the State.

Solid Waste Permits

In 1994, KTF became permitted as a "small quantity hazardous waste generator" under EPA Permit Number HI0000363309. However, the volume of waste generated still qualified the KTF for conditionally exempt status.

F.6.3 1995 Release Reporting

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

There were no RQ releases for KTF in 1995.

F.6.4 Environmental Restoration Project Activities

In regard to site remediation at KTF, no ER activities are planned. The site inspection (SI) report generated in 1994 was submitted to EPA in May 1995 and recommended that the EPA apply a "site evaluation accomplished" (SEA) designation to KTF. No additional assessment or sampling was done at the KTF site.

F.7 ENVIRONMENTAL SURVEILLANCE

F.7.1 1994 Limited Soil Sampling

In July 1994, staff from the SNL Air Quality Department Environmental Surveillance Program (now the Environmental Monitoring & Reporting Department) collected a limited number of soil samples at KTF. The program objectives are to detect any potential releases and/or migration of contaminated material related to on-site operations to off-site locations, and to determine potential impacts (if any) of site-related activities to the off-site population and the surrounding environment.

The specific objective of the 1994 sampling was to provide limited baseline data for the radiological and non-radiological metal concentrations in the soil at KTF and in the soil around KTF. Due to limited resources, the sampling locations, the number of samples, and analyses performed were prioritized based on the following: (1) sampling areas where, if present, contamination would be expected to accumulate; (2) sampling areas where, if present, contamination would pose the greatest potential impact to workers and the environment; and (3) an analysis strategy that would provide a wide range of information.

Soil samples were collected off-site and on-site. Off-site sampling provided data that represent areas unaffected or unrelated to site activities. Results for samples collected from on-site locations were compared to the off-site data to assess the potential impact (if any) of site activities. All on-site samples were taken from unrestricted access locations on KTF.

F.7.2 Sample Collection & Analysis

Soil samples were gathered in accordance with the activity-specific Environment, Safety, and Health (ES&H) standard operating procedure (SOP) entitled *Environmental Sampling Procedure* (SNL 1992). All samples were analyzed for inductively coupled plasma (ICP) standard 20 metals, gross alpha, and gross beta, and by gamma spectroscopy. Only the gamma spectroscopy results for cesium-137 (Cs-137) are reported herein. The list of radionuclide results reported by gamma spectroscopy is lengthy and therefore, the complete list of results can be referenced and are on file in the Environmental Operations Record Center (EORC) at SNL/New Mexico (SNL/NM). All results have been reviewed.

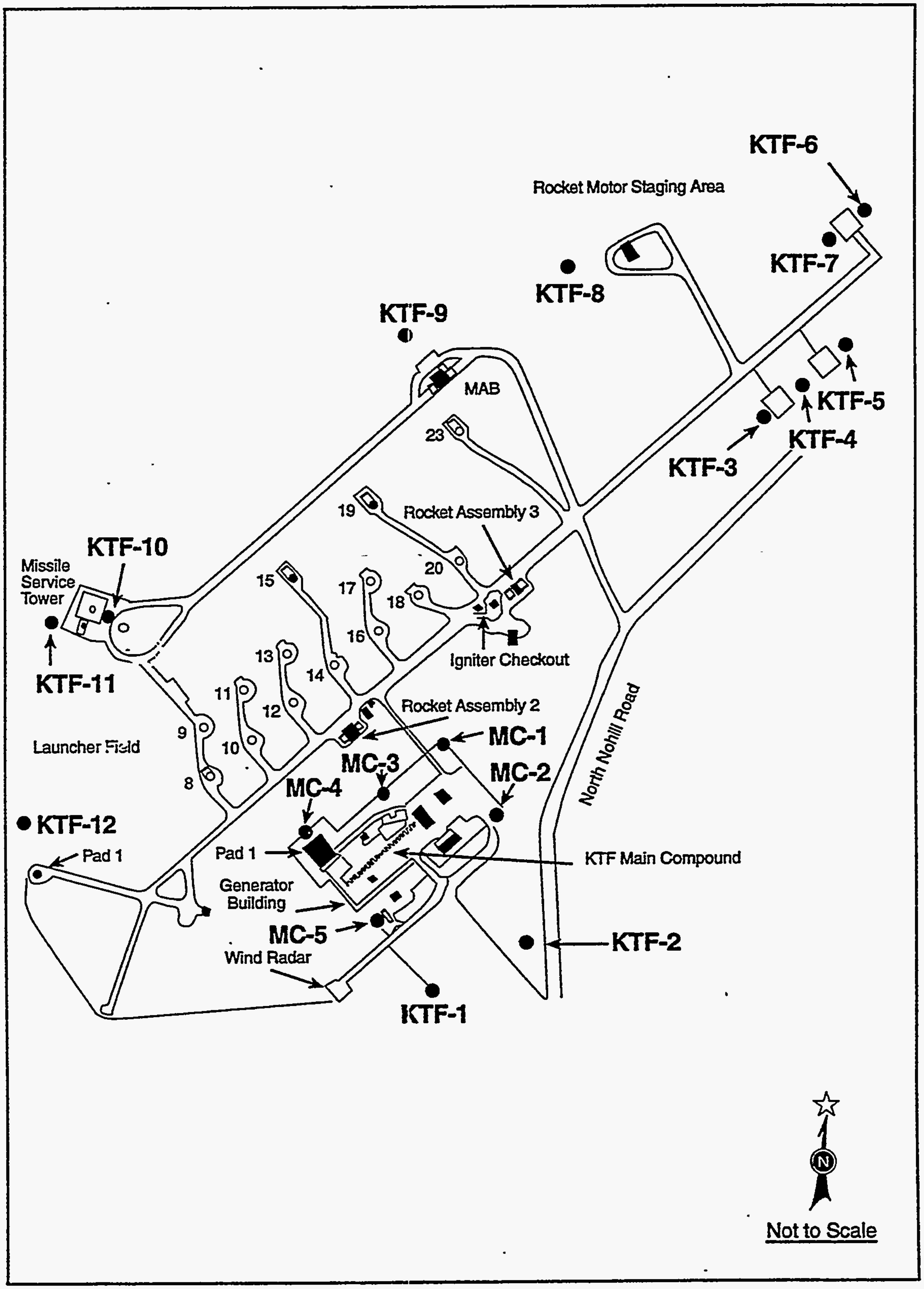

Figure F-2. Soil sampling locations at the Main Compound and around the Kauai Test Facility.

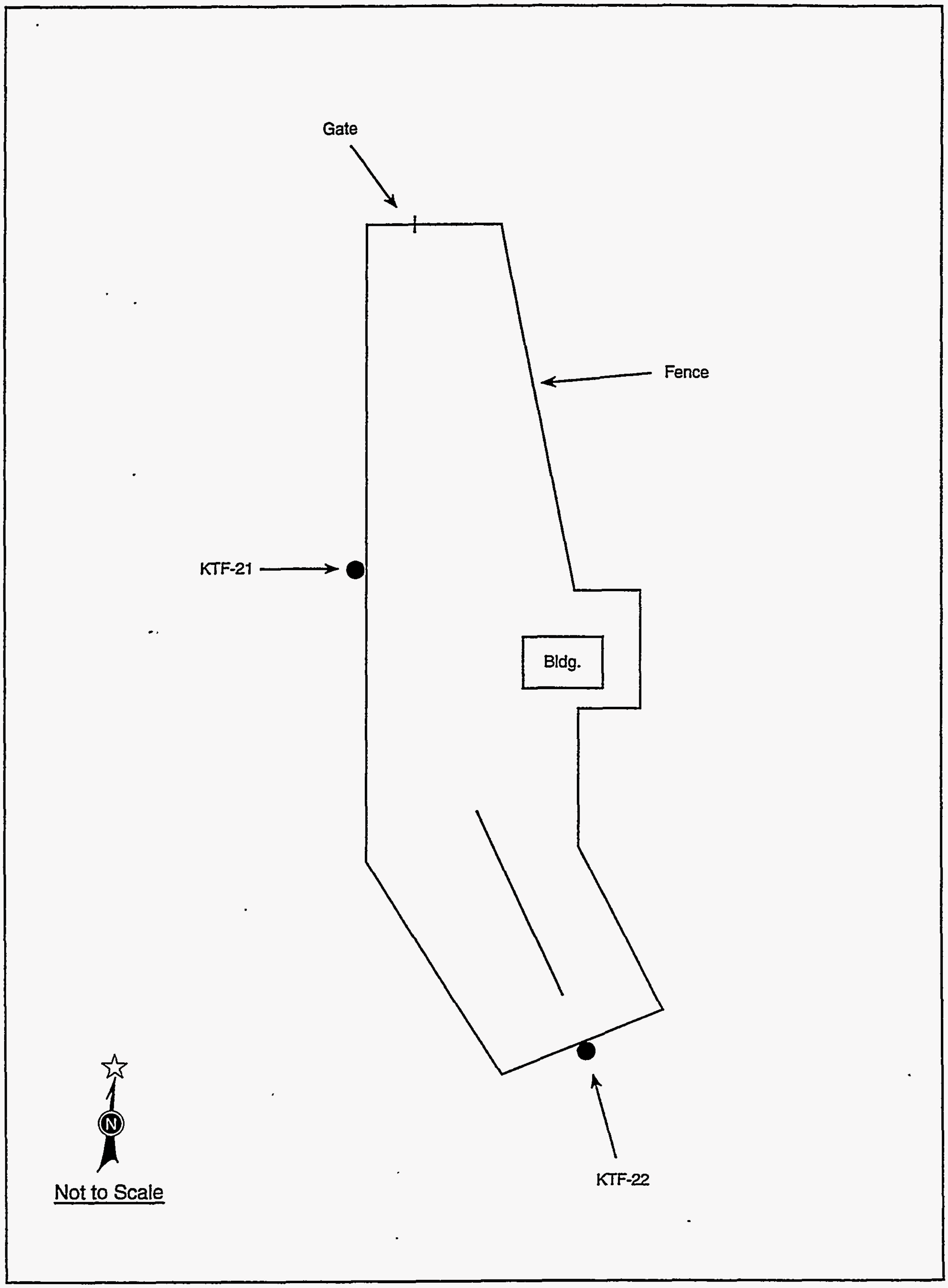

Figure F-3. Sampling locations at the Kokole Point Launch Complex.

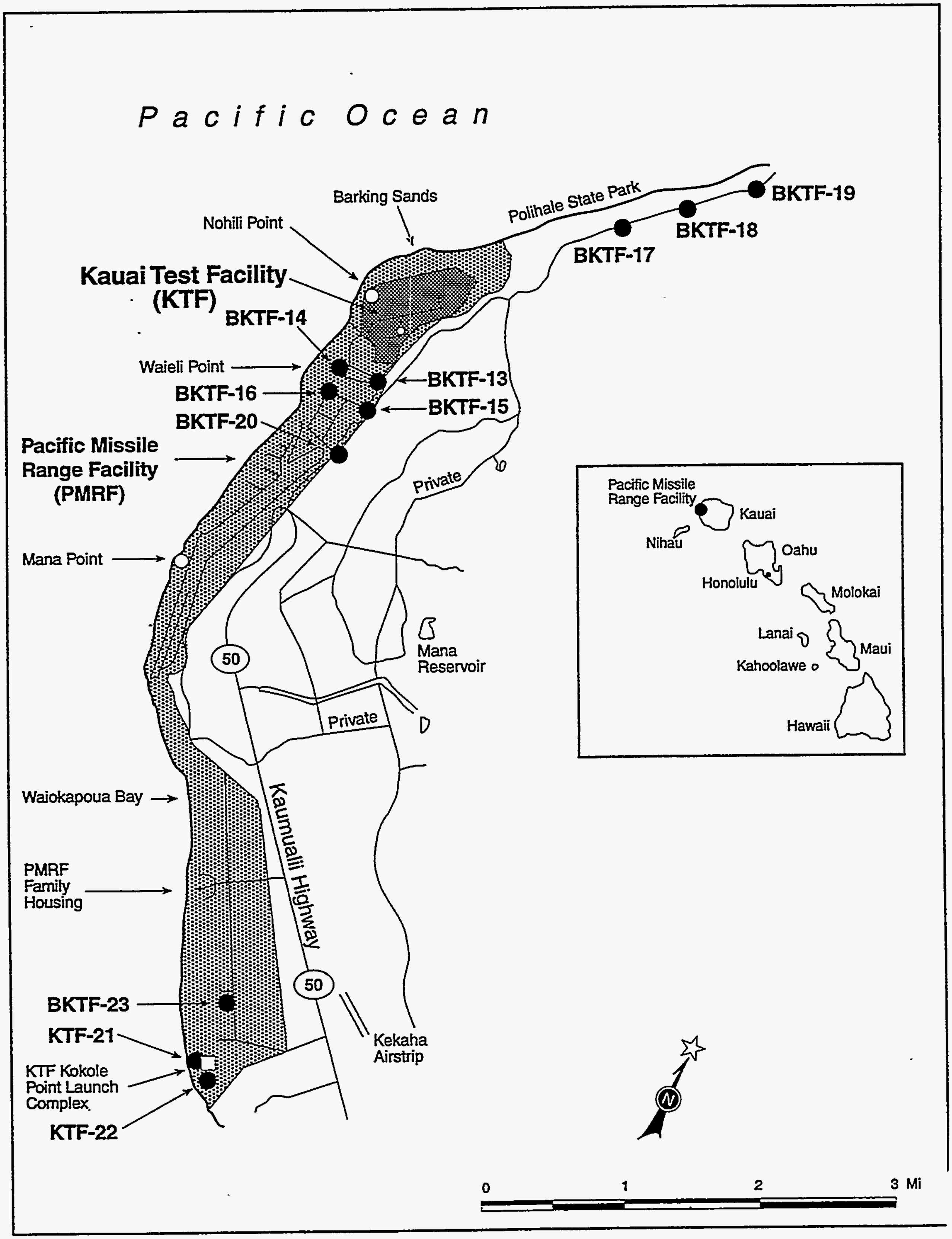

Figure F-4. Off-site soil sampling locations.

Soil samples were collected (including replicate samples) at the KTF Main Compound, along the security fence around the compound perimeter (Figure F-2), and various areas at KTF including the Kokole Point Launch Complex (Figure F-3). A total of nine off-site soil sampling locations were selected (Figure F-4). Much of the area around the Barking Sands Missile Range is agricultural; the soil in the agricultural areas differs from the very sandy soils found on KTF. Therefore, off-site sampling locations only include areas with soils similar to those found at KTF.

F.7.3 Results of Soil Sampling

A preliminary data characterization along with the data for individual locations was presented in last year's report (SNL 1995). The data were further analyzed in the analysis to provide a planning basis for future sampling activities. The on-site and off-site radionuclide concentrations were similar (Table F-1) and there was no statistically significant difference (Shyr et al. 1996). This is consistent with the process knowledge that operations conducted at KTF did not involve the use of radiological materials. But the sampling provides a baseline for natural radiologic background conditions occurring at the site.

Among the metals being analyzed—aluminum (Al), calcium (Ca), iron (Fe), magnesium (Mg), potassium (K), and silicon (Si)—occur naturally in soil in high concentrations and have low health impact. Also, there are no primary drinking water standards or Resource Conservation & Recovery Act (RCRA) toxicity characteristics established for these metals. Due to these reasons, the above metals are not discussed further within the context of this report. As shown in Table F-2, on-site and off-site samples showed similar statistics for metal concentrations except for zinc (Zn) and lead (Pb). Statistically, zinc was the only metal showing concentration values higher in on-site locations than those from off-site (Shyr et al. 1996).

Metal concentrations from on-site locations were also compared to those from off-site locations to show if any individual on-site locations had elevated concentrations as that might be the result of past operations. Table F-3 shows locations with metal concentrations higher than two standard deviations (95% confidence interval) of the off-site mean and the maximum off-site values. Since the comparison was only based on one datum point for each location, discussion of small differences may not be warranted considering the potential uncertainties associated with a small sample size. Thus, only locations with concentrations much higher than the off-site maximum (greater than 200 percent difference) are discussed. Zinc was elevated at locations KTF-1, KTF-21, KTF-22, MC-1, MC-2, MC-3, and MC-4. Geographically, KTF-1 and MC-1, MC-2, MC-3, and MC-4 are around the KTF Main Compound (Figure F-2), while KTF-21 and KTF-22 are at the Kokole Point Launch Complex (Figure F-4). Concentrations for zinc at these locations were outside the range of U.S. Surface Soil concentrations (13-300 ppm), but even the maximum concentration, 3100 ppm, was only about 10 percent of the proposed RCRA action level (23,000 ppm).

Lead was elevated at two locations, KTF-2 and MC-2 (Figure F-2), and are in close proximity. Lead is an expected pollutant emission during the launch of some rocket systems. For example, about 1.5 pounds (lb) of Pb was released during a launch in 1994 (SNL 1995). The Pb concentration at KTF-2 (35 ppm) was within the range of U.S. Surface Soil concentrations (10-70 ppm) and was about 30 percent of the RCRA toxicity characteristic leaching procedure (TCLP) toxicity level (100 ppm) for hazardous waste classification. However, the Pb concentration at MC-2, 110 ppm, was higher than the maximum U.S. Surface Soil concentration and might exhibit the RCRA TCLP toxicity characteristics. Since this estimate was based on only one sample from this location and the lead soil concentration for cleanup has not been well defined, immediate action is not warranted. It was indicated in the KTF EA (DOE 1992) that if KTF is decommissioned in the future, samples will be collected to determine whether Pb is present in soils at a level requiring remediation.

F.8 ENVIRONMENTAL MONITORING & MITIGATION ACTION PLAN

Pursuant to DOE Order 5400.1, *General Environmental Protection Program* (DOE 1988), a *Kauai Test Facility Environmental Monitoring Plan* (EMP) was published in 1992 (IT 1992). This EMP provides a description of planned and ongoing environmental activities at KTF and demonstrates compliance with regulatory requirements imposed by applicable federal, state, and local agencies. The EMP also supports DOE environmental management decisions for the facility.

The EMP addressed activities such as rocket launches at KTF. Environmental monitoring of the 1994 STARS M-2 launch was consistent with requirements of the KTF EA and the STARS Environmental Impact Statement (EIS) (DoD 1992). A comprehensive monitoring program, similar in scope to the one implemented for the first STARS launch Flight Test Unit (FTU-1) on February 26, 1993, was conducted for the STARS M-2 except that noise monitoring was not performed.

As described in the STARS EIS, air samples were collected during the first demonstration launch, FTU-1, to validate the accuracy of the models used in the EIS and to evaluate compliance with federal and state standards. The instrumented monitoring program for the M-2 launch, which included air quality, water, vegetation, and marine resources, was directed and coordinated by the U.S. Army Space and Strategic Defense Command (USASSDC) Environmental Office. All required state and federal agencies were first contacted and later provided with the results. The results showed that no adverse effects were caused by the launch and no federal or state standards were violated (DoD 1994). The Kauai Test Facility Mitigation Action Plan (Appendix D of the KTF EA [DOE 1992]) contains mitigation measures that are designed to reduce the potential environmental impacts.

F.9 Other Compliance Activities

F.9.1 Spill Prevention Control & Countermeasure Plan

SNL. at KTF, takes part in the PMRF *Spill Prevention Control and Countermeasure (SPCC) Plan* which provides support in the event of a diesel fuel spill from the 10,000-gal above-ground fuel tank inside the Main Compound (U.S. Navy 1991).

KTF has only one underground storage tank (UST) in its inventory (# 666C). This state-of-the-art UST system was placed in service in August 1991 and is registered with the State of Hawaii as a DOE-owned SNL UST system.

F.9.2 Toxic Substances Control Act

Under the Toxic Substances Control Act (TSCA), the oil contained in all electrical and/or mechanical equipment, and all hydraulic fluid-containing systems must be assumed to contain polychlorinated biphenyls (PCBs) unless sampling and analysis prove otherwise. The transformers on the KTF site have been tested and are free of PCBs.

F.9.3 Other Reporting Activities

According to EPA requirements, two reports were submitted to the State of Hawaii: (1) the annual emmisions report submitted February 9, 1995 and (2) the report addressing the Emergency Planning and Community Right-to-Know Act (EPCRA), Sections 311 and 312, submitted February 22.

Table F-1. Summary statistics for concentrations of radionuclides, Kauai Test Facility, July 1994.

Radionuclide	Units	Location Type	Count	Median	Average	Std Dev	Range
CS-137	pCi/g	Off-Site	3	0.14	0.17	0.14	0.05 to 0.32
CS-137	pCi/g	On-Site	9	0.06	0.07	0.04	0.03 to 0.14
Gross Alpha	pCi/g	Off-Site	9	0.00	0.00	3.16	-3.00 to 7.00
Gross Alpha	pCi/g	On-Site	19	2.00	1.42	2.36	-4.00 to 5.00
Gross Beta	pCi/g	Off-Site	9	1.00	1.67	3.04	-4.00 to 5.00
Gross Beta	pCi/g	On-Site	19	2.00	1.32	2.50	-4.00 to 7.00
K-40	pCi/g	Off-Site	4	0.20	0.23	0.17	0.08 to 0.43
K-40	pCi/g	On-Site	10	0.55	0.77	0.66	0.15 to 2.40
U_{tot}	ug/g	Off-Site	9	1.50	1.60	0.41	1.20 to 2.30
U_{tot}	ug/g	On-Site	19	1.40	1.48	0.31	1.10 to 2.30

Note: pCi/g = pico curies per gram; ug/g = micro grams per gram

Table F-2. Summary statistics for concentrations of metals, Kauai Test Facility, July 1994.

Metal	Units	Location Type	Count	Median	Average	Std Dev	Range
Barium	mg/kg	Off-Site	9	10.00	13.78	14.66	5.00 to 52.00
Barium	mg/kg	On-Site	19	8.00	10.32	6.64	6.00 to 31.00
Beryllium	mg/kg	Off-Site	9	0.50	0.50	0.00	0.50 to 0.50
Beryllium	mg/kg	On-Site	19	0.50	0.50	0.00	0.50 to 0.50
Cadmium	mg/kg	Off-Site	9	1.50	1.57	1.27	0.50 to 4.20
Cadmium	mg/kg	On-Site	19	0.50	0.67	0.47	0.50 to 2.40
Chromium	mg/kg	Off-Site	9	40.00	43.67	21.66	12.00 to 86.00
Chromium	mg/kg	On-Site	19	39.00	43.21	24.72	14.00 to 93.00
Cobalt	mg/kg	Off-Site	9	9.80	12.69	8.68	2.10 to 30.00
Cobalt	mg/kg	On-Site	19	13.00	14.25	9.41	2.40 to 32.00
Copper	mg/kg	Off-Site	9	8.50	9.60	6.44	2.20 to 20.00
Copper	mg/kg	On-Site	19	13.00	13.14	6.37	3.30 to 27.00
Lead	mg/kg	Off-Site	9	5.00	5.00	0.00	5.00 to 5.00
Lead	mg/kg	On-Site	19	5.00	12.11	24.68	5.00 to 110.00
Manganese	mg/kg	Off-Site	9	180.00	255.33	150.70	88.00 to 520.00
Manganese	mg/kg	On-Site	19	250.00	256.26	118.07	80.00 to 450.00
Nickel	mg/kg	Off-Site	9	130.00	168.56	154.88	21.00 to 520.00
Nickel	mg/kg	On-Site	19	140.00	166.68	133.30	22.00 to 440.00
Silver	mg/kg	Off-Site	9	0.50	0.50	0.00	0.50 to 0.50
Silver	mg/kg	On-Site	19	0.50	0.50	0.00	0.50 to 0.50
Strontium	mg/kg	Off-Site	9	2400.00	2411.11	252.21	2000.00 to 2800.00
Strontium	mg/kg	On-Site	19	2600.00	2463.16	444.99	1600.00 to 3100.00
Titanium	mg/kg	Off-Site	9	440.00	443.33	245.51	120.00 to 910.00
Titanium	mg/kg	On-Site	19	530.00	465.79	177.93	140.00 to 690.00
Vanadium	mg/kg	Off-Site	9	18.00	17.34	7.82	7.20 to 27.00
Vanadium	mg/kg	On-Site	19	21.00	18.88	6.66	6.70 to 29.00
Zinc	mg/kg	Off-Site	9	24.00	20.67	9.53	10.00 to 35.00
Zinc	mg/kg	On-Site	19	35.00	249.84	424.70	17.00 to 1500.00

Note: mg/kg = milligrams per kilogram

Table F-3. KTF on-site locations with concentrations higher than two standard deviations of off-site mean and outside the off-site range.

Location	Analyte (Total)	Units	Result	Off-Site Max	% Difference*
KTF-1	Zinc	mg/kg	110	35	214.29
KTF-2	Chromium	mg/kg	93	86	8.14
KTF-2	Cobalt	mg/kg	32	30	6.67
KTF-2	Iron	mg/kg	26000	22000	18.18
KTF-2	Lead	mg/kg	35	5	600.00
KTF-2	Magnesium	mg/kg	54000	52000	3.85
KTF-2	Zinc	mg/kg	64	35	82.86
KTF-3	Chromium	mg/kg	92	86	6.98
KTF-3	Cobalt	mg/kg	32	30	6.67
KTF-3	Iron	mg/kg	26000	22000	18.18
KTF-3	Magnesium	mg/kg	58000	52000	11.54
KTF-3	Silica	mg/kg	2900	1900	52.63
KTF-4	Iron	mg/kg	24000	22000	9.09
KTF-5	Copper	mg/kg	27	20	35.00
KTF-5	Silica	mg/kg	2200	1900	15.79
KTF-8	Silica	mg/kg	2500	1900	31.58
KTF-9	Silica	mg/kg	3000	1900	57.89
KTF-10A	Zinc	mg/kg	53	35	51.43
KTF-12	Copper	mg/kg	26	20	30.00
KTF-21	Zinc	mg/kg	1200	35	3328.57
KTF-22	Zinc	mg/kg	1500	35	4185.71
MC-1	Zinc	mg/kg	290	35	728.57
MC-2	Lead	mg/kg	110	5	2100.00
MC-2	Zinc	mg/kg	390	35	1014.29
MC-3	Strontium	mg/kg	3100	2800	10.71
MC-3	Zinc	mg/kg	660	35	1785.71
MC-4	Zinc	mg/kg	210	35	500.00
MC-5	Strontium	mg/kg	3100	2800	10.71

* % Difference = [(Result - Off-Site Maximum) / Off-Site Maximum]*100

REFERENCES

DoD 1994: U.S. Department of Defense, *Ambient Air Quality Assessment No. 43-21-N3DD-94, Strategic Target System, Operational and Deployment Experiments Simulator Missile Launch, Pacific Missile Range Facility, Kauai Test Facility, Barking Sands, Kauai, Hawaii, 6-25 July 1994.* U.S. Army Environmental Hygiene Agency, Department of Defense.

DoD 1992: *Final Environmental Impact Statement for the Strategic Target System,* Volumes I through III. U.S. Army Strategic Defense Command, Department of Defense, May 1992.

DOE 1988: U.S. Department of Energy, *General Environmental Protection Program,* DOE Order 5400.1. DOE, Washington, DC (1988; change 1, June 21, 1990).

DOE 1992: U.S. Department of Energy Albuquerque Operations Office (DOE/AL), *Kauai Test Facility Environmental Assessment*, DOE/EA-0492. DOE/AL, Albuquerque, NM, 1992.

Gonzalez and Berryman 1990: T. Gonzalez, and J. Berryman, *Archaeological Survey and Testing, Department of Energy, Kauai Test Facility.* Prepared for Sandia National Laboratories, Albuquerque, NM, 1990.

Helgesen 1990: R. F. Helgesen, *Safety Assessment for the Kauai Test Facility at Barking Sands, Kauai,* SAND89-2548. Sandia National Laboratories, Albuquerque, NM, 1990.

IT 1990a: IT Corporation, *A Survey of the Green Sea Turtle Population Fronting the Kauai Test Facility, Pacific Missile Range, Barking Sands, Kauai: An Analysis of Potential Impacts with Implementation of the Strategic Defense Initiative.* IT Corp., prepared for Sandia National Laboratories, Albuquerque, NM, 1990.

IT 1990b: IT Corporation, *Botanical Survey of the Kauai Test Facility Site, Barking Sands, Kauai, Hawaii.* IT Corp., prepared for Sandia National Laboratories, Albuquerque, NM, 1990.

IT 1990c: IT Corporation, *Ornithological Survey Report of the Kauai Test Facility Site, Barking Sands, Kauai, Hawaii.* IT Corp., prepared for Sandia National Laboratories, Albuquerque, NM, (1990).

IT 1990d: IT Corporation, *Soil Sampling Program for Sandia National Laboratories, Kauai Test Facility, Kauai, Hawaii.* IT Corp., prepared for Sandia National Laboratories, Albuquerque, NM, 1990.

IT 1992: IT Corporation, *Sandia National Laboratories Kauai Test Facility Environmental Monitoring Plan.* IT Corp., prepared for Sandia National Laboratories, Albuquerque, NM, 1992.

SNL 1986: Sandia National Laboratories, *Environmental Report, Proposed IRBS Facilities, Kauai Test Facility.* Sandia National Laboratories, Albuquerque, NM, for the DOE, 1986.

SNL 1992: Sandia National Laboratories, *Environmental Sampling Procedure*, SP471991. Sandia National Laboratories, Albuquerque, NM, November 19, 1992.

U.S. Navy 1991: U.S. Navy, *Spill Prevention Control and Countermeasure Plan, Pacific Missile Range Facility.* Pacific Division, Naval Facilities Engineering Command, Pearl Harbor, HI, February 1991.

SNL 1995: *1994 SNL/NM Site Environmental Report,* SAND95-1953. Sandia National Laboratories, Albuquerque, NM.

Shyr et al., 1996: L. J. Shyr, R. Haaker, and H. Herrera, *1995 Terrestrial Surveillance Data Analysis Report for the SNL/NM and KTF Sites, SAND96___,* in preparation. Sandia National Laboratories, Albuqueruqe, NM.

REGULATIONS

Superfund Amendments and Reauthorization Act (SARA) of 1986. Title III, Section 313, "Toxic Chemical Release Reporting."

Toxic Substances Control Act (TSCA) of 1976. U.S.C. §2601 et seq.
Comprehensive Environmental Reponse, Compensation and Liability Act (CERCLA) of 1980, as amended. Title 40 U.S.C. 9601.

This page intentionally blank.

UNLIMITED RELEASE DISTRIBUTION

U.S. Department of Energy (80)
Kirtland Area Office (KAO)
Environment, Safety, Health, and
 Compliance Branch
P.O. Box 5400
Albuquerque, NM 87185

U.S. Department of Energy/HQ, (3)
 Office of Environmental Policy
 and Assistance (EH-41)
1000 Independence Ave. SW
Washington, DC 20585

U.S. Department of Energy/HQ, (2)
 Office of Research, Development and
 Testing Facilities (DP-13)
1000 Independence Ave. SW
Washington, DC 20585

U.S. Department of Energy/HQ, (1)
 Office of Environmental
 Oversight (EM-22)
1000 Independence Ave. SW
Washington, DC 20585

U.S. Department of Energy/HQ, (2)
 Office of Southwestern Area
 Programs (EM-45)
1000 Independence Ave. SW

U.S. Department of Energy (3)
 Albuquerque Operations Office, EPD
P.O. Box 5400
Albuquerque, NM 87185-5400

New Mexico Environment Department (1)
c/o DOE-KAO-ESHCB
P.O. Box 5400
Albuquerque, NM 87185-5400

Albuquerque City Environmental
 Services (1)
400 Marquette Ave. NW
Albuquerque, NM 87117
Captain Robert C. Viramontes (1)
2000 Wyoming Blvd.
377 ABW/EMP
KAFB, NM 87117-5606

Director (1)
Inhalation Toxicology Research Institute
P.O. Box 5800
Albuquerque, NM 87185

Environmental Protection Agency (1)
Headquarters Office
401 M Street, SW
Washington, DC 20460

Environmental Protection Agency (1)
Region VI Office
1445 Ross Ave.
Dallas, TX 75202-2733

SANDIA NATIONAL LABORATORIES,
INTERNAL DISTRIBUTION

1	(MS 0141)	C. B. Hall, 11300
1	(MS 0141)	E. D. Krauss, 11300
1	(MS 0141)	R. J. Park, 11300
1	(MS 0167)	K. Kuhlmann, 12621
1	(MS 0167)	A. Stotts, 12630
1	(MS 0315)	R. G. Hay, 2419
1	(MS 0354)	P. D. Yourick, 7311
1	(MS 0361)	G. E. Chavez, 7002
1	(MS 0369)	T. A. Lovato, 7522
1	(MS 0407)	S. A. Edmund, 15106
1	(MS 0407)	D. P. Finnegan, 15106
1	(MS 0658)	C. Nelson, 9819-1
1	(MS 0806)	R. L. Davis, 8920
1	(MS 0862)	J. Lewis, 7001
5	(MS 0899)	Technical Library, 4414
1	(MS 1035)	J. G. Yeager, 7572
1	(MS 1036)	S. Showalter, 7523
1	(MS 1037)	A. O. Bendure, 7523
1	(MS 1037)	T. A. Wolff, 7523
1	(MS 1054)	W. D. Burnett, 7701
1	(MS 1054)	J. C. Pigg, 7514
1	(MS 1067)	A. N. Blackwell, 7000
1	(MS 1094)	V. R. Cibicki, 7712
1	(MS 1094)	E. H. Forbes, 7525
1	(MS 1095)	D. J. Thompson, 7713
1	(MS 1117)	C. M. Roma, 7577
1	(MS 1117)	W. J. Suderman, 7577
1	(MS 1117)	D. D. Szklarz, 7577
1	(MS 1132)	D. L. Stermer, 7584
1	(MS 1147)	W. B. Cox, 7581
1	(MS 1147)	F. B. Nimick, 7582
1	(MS 1149)	J. Jerry, 7577
1	(MS 1304)	B. K. Hamilton, 7511
1	(MS 1304)	S. J. Ward, 7511
1	(MS 1307)	B. A. Botsford, 7577
1	(MS 1307)	P. K. Peterson, 7577
1	(MS 1309)	D. Garcia, 7512
1	(MS 1309)	A. Maese, 7512
35	(MS 1309)	Records Center and 7500 Library, 7512
1	(MS 0854)	L. S. Bayliss, 7575
1	(MS 0854)	J. M. Bonaguidi, 7575
1	(MS 0854)	T. A. Culp, 7575
1	(MS 0854)	R. A. Deola, 7575
1	(MS 0854)	M. L. du Mond, 7575
1	(MS 0854)	D. K. Duncan, 7575
1	(MS 0854)	C. H. Fink, 7575

1	(MS 0854)	R. Haaker, 7575
1	(MS 0854)	H. A. Hwang, 7575
1	(MS 0854)	A. K. Jones, 7575
1	(MS 0854)	F. C. Lauffer, 7575
7	(MS 0854)	R. V. Sanchez, 7575
1	(MS 0854)	L. J. Shyr, 7575
1	(MS 0854)	B. M. Stone, 7575
1	(MS 1314)	E. D. Conway, 7571
1	(MS 1314)	J. R. Guth, 7502
1	(MS 1314)	M. J. Lincoln, 7571
1	(MS 1315)	T. E. Blejwas, 7500
1	(MS 1315)	R. W. xRohde, 7501
1	(MS 1331)	N. A. Durand, 7513
1	(MS 1331)	W. L. Jenkins, 7513
1	(MS 9018)	Central Technical Files, 8523-2
1	(MS 9221)	G. L. West, 8421
2	(MS 0619)	Review and Approval Desk, 12630 For DOE/OST1