SANDIA REPORT

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1988 Environmental Monitoring Report Sandia National Laboratories Albuquerque, New Mexico

G. Millard, G. Yeager, J. Phelan, T. Wolff, P. Pei,
D. Dionne, C. Gray, D. Thompson, R. Hamilton

Prepared by
Sandia National Laboratories
Albuquerque, New Mexico 87185 and Livermore, California 94550
for the United States Department of Energy
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1988 ENVIRONMENTAL MONITORING REPORT
SANDIA NATIONAL LABORATORIES
ALBUQUERQUE, NEW MEXICO

Prepared for the U.S. Department of Energy
in Compliance with USDOE Order 5400.1

G. Millard, G. Yeager, J. Phelan, T. Wolff, P. Pei, D. Dionne,
C. Gray, D. Thompson, and R. Hamilton
Environment, Safety, and Health Directorate 3200
Sandia National Laboratories
Albuquerque, NM 87185

ABSTRACT

Sandia National Laboratories (SNL), Albuquerque is located south of Albuquerque on Kirtland Air Force Base. Because radionuclides are potentially released in small quantities from its research activities, SNL, Albuquerque has a continuing environmental monitoring program which analyzes for cesium-137, tritium, uranium, alpha emitters, and beta emitters in water, soil, air, and vegetation. Measured radiation levels in public areas were consistent with local background in 1988. A total of 5.23 curies of argon-41 were released as a result of SNL, Albuquerque operations in 1988. The Albuquerque population received an estimated 0.04 person-rem from airborne radioactive releases, whereas it received greater than 44,500 person-rem from naturally occurring radionuclides. A nonradioactive effluent monitoring program at SNL, Albuquerque includes groundwater, stormwater and sewage monitoring. Results indicate that the groundwater has not been impacted by the chemical waste landfill. Preliminary testing of stormwater showed that no pollutants were above minimum detectable levels. A program to investigate potential remedial action sites has been started.

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SUMMARY ASSESSMENT
ENVIRONMENTAL COMPLIANCE ACTIVITY
U.S. DEPARTMENT OF ENERGY,
SANDIA NATIONAL LABORATORIES, ALBUQUERQUE

BACKGROUND

Sandia National Laboratories, Albuquerque (SNL, Albuquerque) must operate in compliance with environmental and other requirements established by a number of Federal and State statutes and regulations, Executive Orders, U.S. Department of Energy (DOE) and a State Compliance Order. The following paragraphs summarize SNL, Albuquerque's compliance status with major environmental statutes:

Comprehensive Environmental Response Compensation and Liability Act (CERCLA) -- SNL, Albuquerque, has negotiated with the other Potentially Responsible Party, involved in an off-site National Priorities List (NPL) location, to reimburse EPA for completed remedial actions. Sandia, Albuquerque, is not and does not expect to be nominated for the NPL.

Clean Air Act (CAA) -- SNL, Albuquerque, periodically receives open-burning permits from the Albuquerque/Bernalillo County Air Quality Control Board and also has permits from the board for emergency diesel generators and an inactive classified waste incinerator. SNL, Albuquerque, also has a National Emissions Standards for Hazardous Air Pollutants permit from the EPA for radionuclide air emissions.

Clean Water Act (CWA) -- SNL, Albuquerque, has five permits from the City of Albuquerque for pretreatment sanitary sewer discharges and has resolved minor violations with the City. Two surface impoundments are permitted and 65 septic tanks are registered with the State Environmental Improvement Division (EID). Discussions are being held with EID to submit a proposed agreement to cover site-wide nonregulated surface discharges and incorporate effluent limits for cooling water discharges.

Resource Conservation and Recovery Act (RCRA) -- SNL, Albuquerque, has an inactive landfill, a storage facility, and a thermal treatment facility which are all permitted under interim status. Minor RCRA violations have been resolved with the State. A final hazardous waste permit application has been submitted. An interim status permit is being prepared for mixed waste storage. A groundwater monitoring compliance order has been issued by the State and corrective actions have been implemented and an agreement with the State to cover remaining corrective actions is expected in the near future.

CURRENT ISSUES AND ACTIONS

Land Disposal Restrictions (RCRA) -- In 1984, Congress amended RCRA by scheduling restrictions on the storage and land disposal of hazardous wastes. These restrictions are referred to collectively as land disposal restrictions (LDRs). SNL, Albuquerque, believes that LDRs that apply to mixed (radioactive and hazardous) waste require regulatory agreements to ensure compliance.

Mixed Waste Authority (RCRA) -- Even though 53FR37045 clearly declares that New Mexico does not have mixed waste authority and the State has previously rejected DOE permit applications for mixed waste, the State now claims to have independent state authority to regulate mixed waste. SNL, Albuquerque, does not consider itself to be in violation and there is a legitimate dispute concerning whether any violation has occurred. However, as a matter of policy, SNL, Albuquerque, will comply with RCRA requirements for mixed wastes and is preparing an interim status permit for mixed waste.

Groundwater Monitoring (RCRA) -- The State had previously issued a Notice of Violation for groundwater monitoring violations and, since the corrective actions could not be completed within the statutory 30 day limit, subsequently issued a compliance order on the same issue. Most of the corrective actions have been completed and a proposed agreement is near completion to schedule the remaining corrective actions and provide for more specificity for interpretation of groundwater monitoring data.

DOE F 1325.8
(8-89)

United States Government | Department of Energy

memorandum

DATE: JAN 11 1990

REPLY TO ATTN OF: EH-232

SUBJECT: Approval of the Cover Letter to the 1988 Environmental Report

TO: Manager, Albuquerque Operations Office
Manager, Idaho Operations Office

This is to notify you that the cover memorandum with attachment for the 1988 Annual Environmental Report submitted to EH has been approved for distribution. Please ensure that a copy of this memorandum is attached to each distributed copy of the 1988 monitoring report.

Peter N. Brush
Acting Assistant Secretary for
Environment, Safety, and Health

Leo P. Duffy
Director
Office of Environmental Restoration and
Waste Management

Attachment

ACKNOWLEDGMENTS

This report was compiled by the staff of the Environment, Safety, and Health Directorate (3200) of Sandia National Laboratories.

R. Gomez of the Environmental Protection Division (3202) assisted in the environmental sample collection.

K. Gruelich of the Industrial Hygiene Division assisted with the sample analysis.

T. Simmons and H. Abbott of the Health Physics Division (3212) provided the effluent release data.

V. Montoya of the Environmental Protection Division (3202) assisted with data preparation.

IT Corp. provided the groundwater data.

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ABBREVIATIONS

Acronyms

ACRR	Annular Core Research Reactor
ADM	Action Description Memorandum
ANSI	American National Standards Institute
AQCR	Air Quality Control Regulation
ATC	Authority to Construct
CAA	Clean Air Act
CEARP	Comprehensive Environmental Assessment and Response Program
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CLP	Contractor Laboratory Program
CWA	Clean Water Act
CWL	Chemical Waste Landfill
DMR	Discharge Monitoring Report
DOE	Department of Energy
DOT	Department of Transportation
DRCF	Dose Rate Conversion Factor
EA	Environmental Assessment
EIA	Environmental Impact Assessment
EID	Environmental Improvement Division (State of New Mexico)
EPA	Environmental Protection Agency
ER	Environmental Restoration (Program)
HRS	Hazard Ranking System
HWMF	Hazardous Waste Management Facility
IEEE	Institute of Electrical and Electronic Engineers, Inc
IRP	Installation Restoration Program (KAFB)
KAFB	Kirtland Air Force Base
LiF	Lithium Fluoride
MDA	Minimum Detectable Activity
MDL	Minimum Detectable Level
NBS	National Bureau of Standards
NEPA	National Environmental Policy Act
NESHAPS	National Emission Standards for Hazardous Air Pollutants
NOAA	National Oceanic and Atmospheric Science Administration
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRC	National Response Center
PBFA	Particle Beam Fusion Accelerator
RMWF	Radioactive and Mixed Waste Facility
POTW	Publicly Owned Treatment Works
RCG	Radiation Concentration Guide
RCRA	Resource Conservation and Recovery Act
RQ	Reportable Quantity
SDF	Strategic Defense Facility
SNL	Sandia National Laboratories
SPCC	Spill Prevention Control and Countermeasure
SPR	Sandia Pulsed Reactor
STL	Simulation Technology Laboratory
TLD	Thermoluminescent Dosimeter

ABBREVIATIONS (Continued)

TRU	Transuranic
TSCA	Toxic Substances Control Act
US	United States
WIPP	Waste Isolation Pilot Plant

System International Prefixes

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

Units

g	gram	h	hour
ha	10,000 square meters	min	minutes
°C	degree Celsius	s	seconds
m	meter	cm	centimeter
% moisture	weight percent of water	yr	year
L	liter	gpm	gallons per min
ml	milliliter	lps	liters per second
		gpd	gallons per day

Symbols

σ	statistical variance	>	greater than
s	standard deviation	<	less than
$\overline{x}$	mean value	β^-	Beta particle
$s_{\overline{x}}$	standard error of the mean	α	Alpha particle
P	Statistic probability		

Nuclide Symbols for Frequently Referenced Nuclides and Components

H-3	Tritium	PCB	Polychlorinated Biphenyl
HTO	Tritiated Water Vapor	U	Uranium
Co	Cobalt	U-238	Principal Component of Depleted Uranium
Cs	Cesium	U_{tot}	Total Uranium
K	Potassium	U_{nat}	Natural Uranium
Ar	Argon		
S	Sulphur		

Radioactivity Measurements

mR	milliroentgen (unit of radiation exposure)
mrem	millirem (unit of radiation dose)
person-rem	Radiation dose to population
Ci	Curie (unit of radioactivity)

Water Quality Measurements and Abbreviations

CN	Cyanide
CN_T	Cyanide - total
$CN_{amenable}$	Cyanide amenable to chlorination
pH	Hydrogen ion concentration, a measure of acidity
Sp.Cond	Specific Conductivity (mhos/l)
SWL	Depth to water below measuring point
TCA	1,1,1-Trichloroethane
TCE	Trichlorethylene
TOC	Total Organic Carbon
TOX	Total Organic Halogen
TR	Trace
TTO	Total Toxic Organics
WLEL	Water level elevation above mean sea level

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SANDIA NATIONAL LABORATORIES ALBUQUERQUE, NEW MEXICO

INTRODUCTION

Sandia National Laboratories (SNL), Albuquerque is operated by Sandia Corporation, a prime contractor of the US Department of Energy (USDOE). The Corporation, which is a subsidiary of AT&T Technologies, Inc., provides service to the US Government on a non-profit, no-fee basis. The major responsibilities[1] are national security and energy projects. SNL, Albuquerque's mission includes the weaponization of nuclear explosives: designing the arming, fuzing, and firing systems used in nuclear bombs and warheads. Safety, reliability, and survivability of weapon systems receive primary emphasis.

The energy programs, an important componant of SNL, Albuquerque's mission, includes nuclear reactor safety studies for the US Nuclear Regulatory Commission; development of safe transport and storage systems for special nuclear materials including plutonium and uranium; radioactive waste disposal techniques and site studies; pulsed power research; thermonuclear fusion research; solar energy research; vertical axis wind turbine research; fossil fuel and geothermal energy research.

LOCATION OF SANDIA NATIONAL LABORATORIES, ALBUQUERQUE

SNL, Albuquerque is located south of Albuquerque, New Mexico, within the boundaries of Kirtland Air Force Base (KAFB), in Bernalillo County. It consists of five technical areas and remote test areas situated in the eastern half of the 190-km^2 KAFB military reservation. KAFB is located on two broad mesas that are bisected by Tijeras Arroyo, an east-west canyon. These mesas are bound by the Manzano Mountains (Cibola National Forest) to the east and the Rio Grande, a river, on the west. Elevations range from a low of 1,500 m at the Rio Grande to a high of 3,255 m at Sandia Crest, which is in the Sandia Mountains adjacent to Albuquerque. KAFB is at a mean elevation of 1,630 m.

The largest population center in Bernalillo County, and also the closest population center to KAFB, is Albuquerque, located just north of the base. The 1980 census figures[2] gives an Albuquerque population of 331,767. The Isleta Indian Pueblo, which borders KAFB on the south, is the next nearest population center with a 1980 census of 1,872. An estimated total population of 450,000 people live within an 80 km radius of KAFB.[2] This includes permanent residents of KAFB living in the KAFB housing areas.

*This report was prepared to fulfill the requirements of USDOE Order 5484.1 and is for calendar year 1988.

ALBUQUERQUE CLIMATE AND METEOROLOGY

Albuquerque temperatures[3] are characteristic of high altitude, dry, continental climates (Appendix A). Daily temperature ranges are wide (Table A.1), although temperature extremes such as -18°C and 38°C occur infrequently. Daytime temperatures during the winter average near 10°C. Summer daytime maximum temperatures average less than 32°C except in July when the maximum reaches 34°C. The average annual precipitation is 21 cm; half of this precipitation occurs from July through September in the form of brief thunder showers. Winter months are typically dry with less than 5 cm of precipitation normally recorded. The average annual relative humidity is about 43% (Table A-2), although the humidity drops to less than 20% in April, May and June. Strong winds[3,4] often accompanied by blowing dust occur mostly in late winter and early spring. The wind speed reaches 13.3 m/s for less than 48 days each year. Prevailing surface winds on KAFB are from the east (Figure 1).[5] Rapid night-time ground cooling produces strong temperature inversions as well as strong drainage winds down Tijeras Canyon.

Table A.3 summarizes meteorological data for 1988. The total annual precipitation of 33 cm for 1988 was 12 cm above the 30-yr average of 21 cm (Table A.1).

GEOLOGY

The Sandia facilities in Albuquerque are located within the Albuquerque Basin which is bounded by the Sandia, Manzanita, and Manzano mountains on the east and the Lucero and Jemez uplifts (or mesas) to the west.[33] The Albuquerque basin consists of up to 12,000 feet of Miocene-Pliocene-Santa Fe alluvial and colluvial sediments. The basin deposits were formed by a complex mixture of aeolian, channel, debris flow, levee and floodplain mechanisms.

The general stratigraphy of sediments consists primarily of deposits of sands and gravels interbedded with silt and clay rich zones.[47] The observation of fining upward sequences in the stratigraphy is important in that typically these deposits have lenticular shapes in cross section. The nature of the cross sections observed in drilling activities have confirmed the sedimentary deposits and the presence of silt and clay rich zones that are discontinuous across the site.

HYDROLOGY IN CENTRAL NEW MEXICO

The major hydrologic[6] surface feature in central New Mexico is the Rio Grande, which runs north-south through Albuquerque, and is approximately 8 km west of KAFB. Rio Grande water is primarily used for irrigation of agricultural crops. There are no continuously running streams on KAFB. Tijeras Arroyo has intermittent flow during heavy thundershowers.

The uppermost aquifer underlying the site is approximately 480 feet below the ground surface. No perched aquifers have been detected in the zone between the main aquifer and the ground surface. Although drilling has not been performed to the entire depth of the aquifer, it is possible that the entire 12,000 feet of the Santa Fe formation contains groundwater.

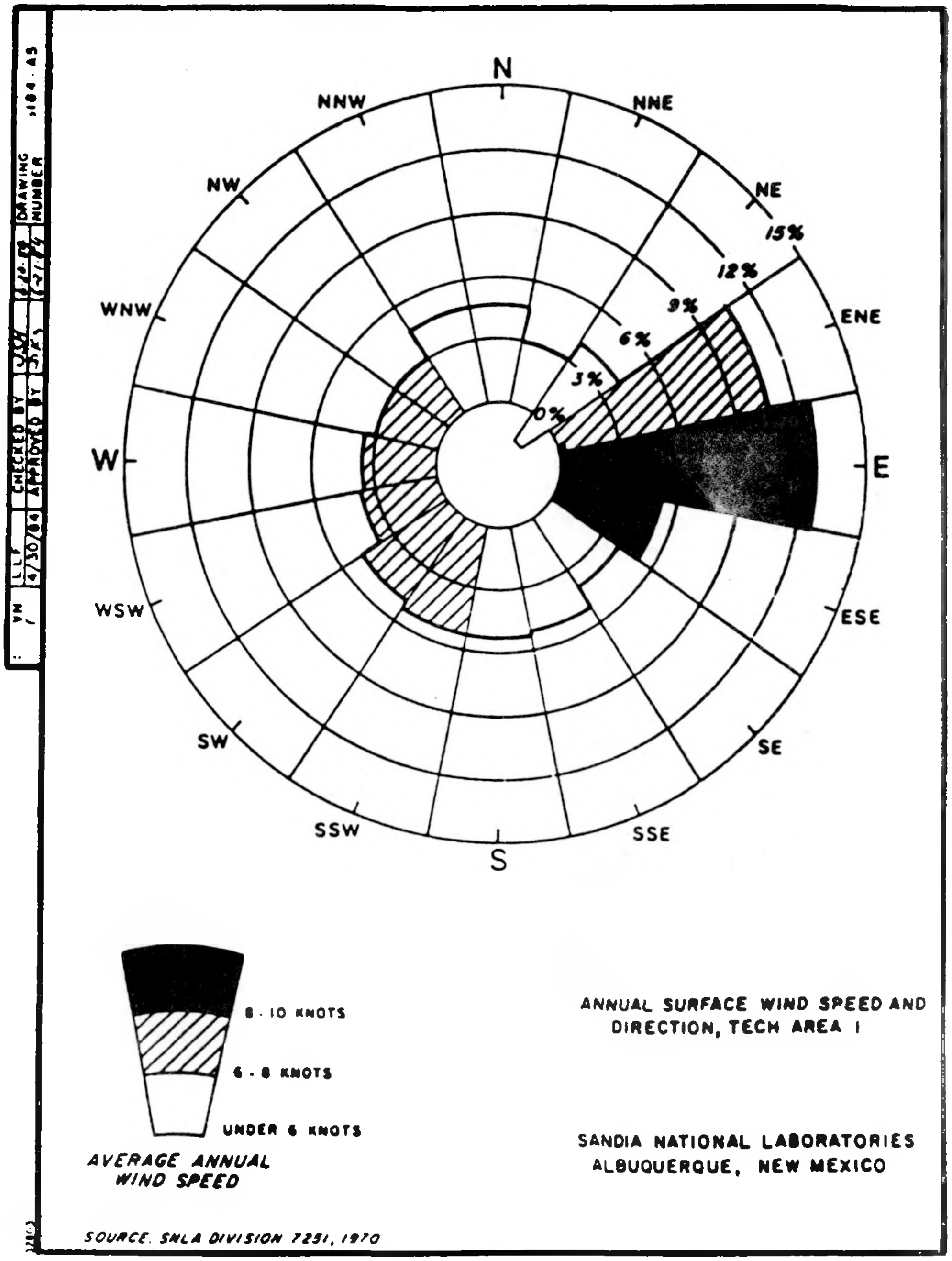

Figure 1. Annual Surface Wind Speed and Direction, Tech Area I

The groundwater underlying Sandia facilities is separated into two systems by major faulting. The Hubble Springs, Tijeras and Sandia faults separate the hydrogeology into a somewhat deep region west of the fault systems and a much shallower region on the east side. Many of the Sandia facilities are located west of the fault systems in the area of deeper groundwater.

West of the fault systems, the groundwater flows in a northwesterly direction. Prior to the growth of the City of Albuquerque the flow was reported to be more westerly. Albuquerque obtains all of its drinking water from the groundwater, and pumping from municipal supply wells has significantly altered the flow direction.

The municipal and domestic water needs of the Albuquerque vicinity are supplied by deep wells. These wells range from 148 to 365 m in depth, with an average depth of 305 m.

The hydrology east of the fault systems is poorly understood because there are a limited number of water supply wells, no monitoring wells and the geology between the fault systems and the mountains is very complex. The Sandia facilities located in this area are generally in the canyons of the Manzanita mountains. The groundwater flow would typically be out of the canyons and toward the fault systems.

BIOLOGY

New Mexico has low precipitation, wide temperature extremes, frequent drying winds, heavy showers with erosive effects, and erratic seasonal distribution of precipitation. This semidesert southwest climate combines with the low-water availability to produce many species[1] of drought-resistant flora such as cacti.

The mesa vegetation on KAFB, consisting of grasses and shrubs, is illustrated in Figure 2. Figure 3 shows juniper trees and cacti that are present at the higher elevations bordering the mountains east of KAFB. Russian thistle (tumbleweeds) proliferate in mechanically disturbed areas. The city of Albuquerque, adjacent to KAFB, has flora typically found in urban environments.

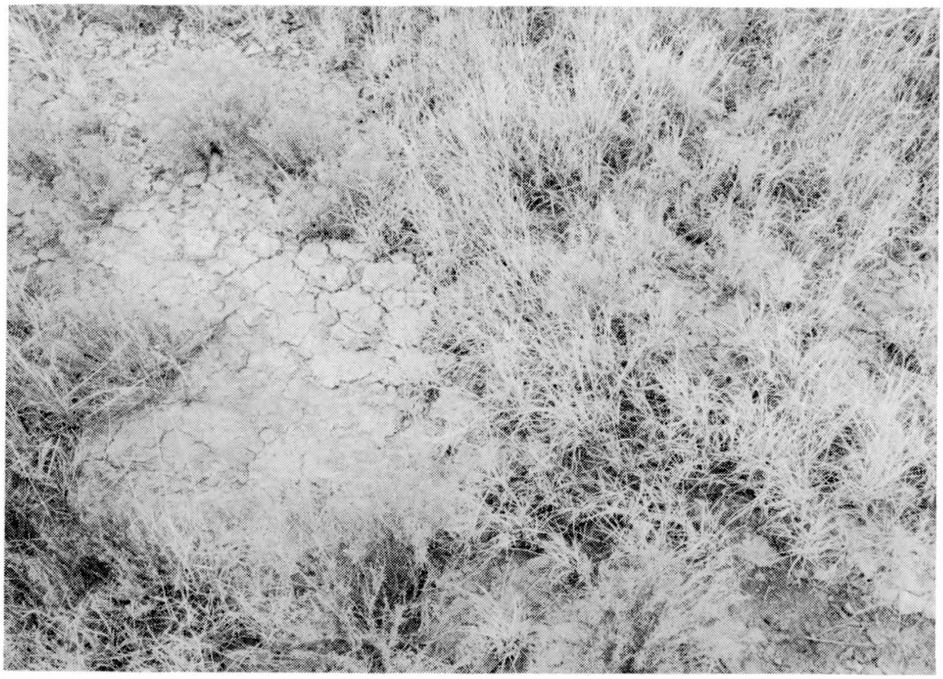

Figure 2. Mesa Vegetation

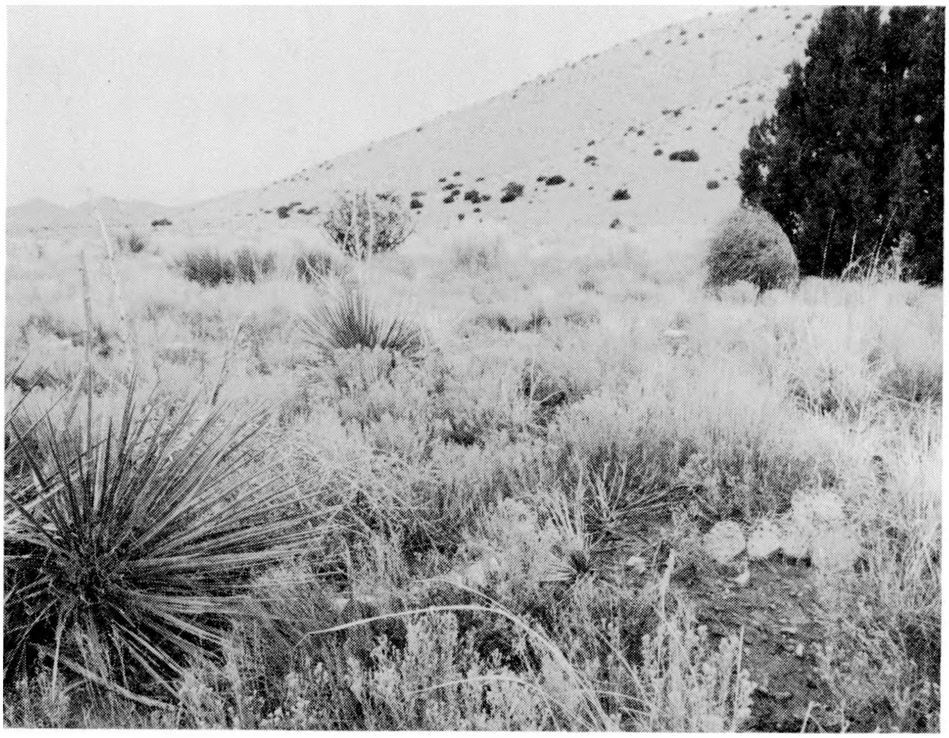

Figure 3. Manzano Foothills Vegetation

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ENVIRONMENTAL PROGRAM

ENVIRONMENTAL MONITORING AND COMPLIANCE PROGRAM AT SNL, ALBUQUERQUE

The Environmental Monitoring and Compliance Program at SNL, Albuquerque is administered by the Environmental Protection Division. The program is administered to ensure compliance with pertinent environmental regulations. The environmental monitoring program at snl, albuquerque was begun in 1959 with its principal objective to monitor radioactive effluents and associated environmental impacts resulting from snl, albuquerque operations. The program has expanded greatly to encompass nonradioactive effluents as well as hazardous and radioactive waste management and other environmental compliance activities. The growth of the program is in response to new environmental regulations as well as expanded snl, albuquerque research programs.

The current environmental monitoring and compliance activities at SNL, Albuquerque are described and documented in this report as required by DOE Order 5400.1, "General Environmental Protection Program." New programs which have been initiated within the last three years include a remedial action program, a groundwater monitoring program, a greatly expanded wastewater sampling program, an underground storage tank removal program and an improved spill prevention program.

SNL, Albuquerque Technical Areas

SNL, Albuquerque (Figure 4) consists of five technical areas and several additional test areas. Each area has its own distinctive operations. A brief description of the activities in each area and a summary of potential sources for radioactive and nonradioactive effluent releases follow.

Area-I (Figure 5) has the largest employee population (approximately 5,000). This area is dedicated primarily to the design, research, and development of weapon systems, limited production of weapon system components and energy program. It also includes laboratories and shops used by administrative and technical staff. Generally, the only potential radioactive release from Area-I is tritium (^3H) from two laboratory sources; however, no ^3H was released from these stacks in 1988. Potential sources for nonradioactive effluents include the paint shops, toxic machine shop, process development lab, emergency diesel generator plant, solvent spray booth, foundry and steam plant.

Area-II is a small facility used for explosive testing. Estimated millicurie amounts of tritium may be released each year from component testing. Techniques for measuring fractures in geologic strata are developed at this facility. A stabilized low-level radioactive waste disposal site, which has not been used for over 20 yrs, is located in Area-II. A small radioactive material decontamination and storage facility is sited in Area-II. A storage facility which is designed to temporarily hold PCB-contaminated material until they can be transported to an EPA-licensed disposal facility is also located in Area-II. A new facility, the explosive components facility (ECF) is planned for Area-II. This facility

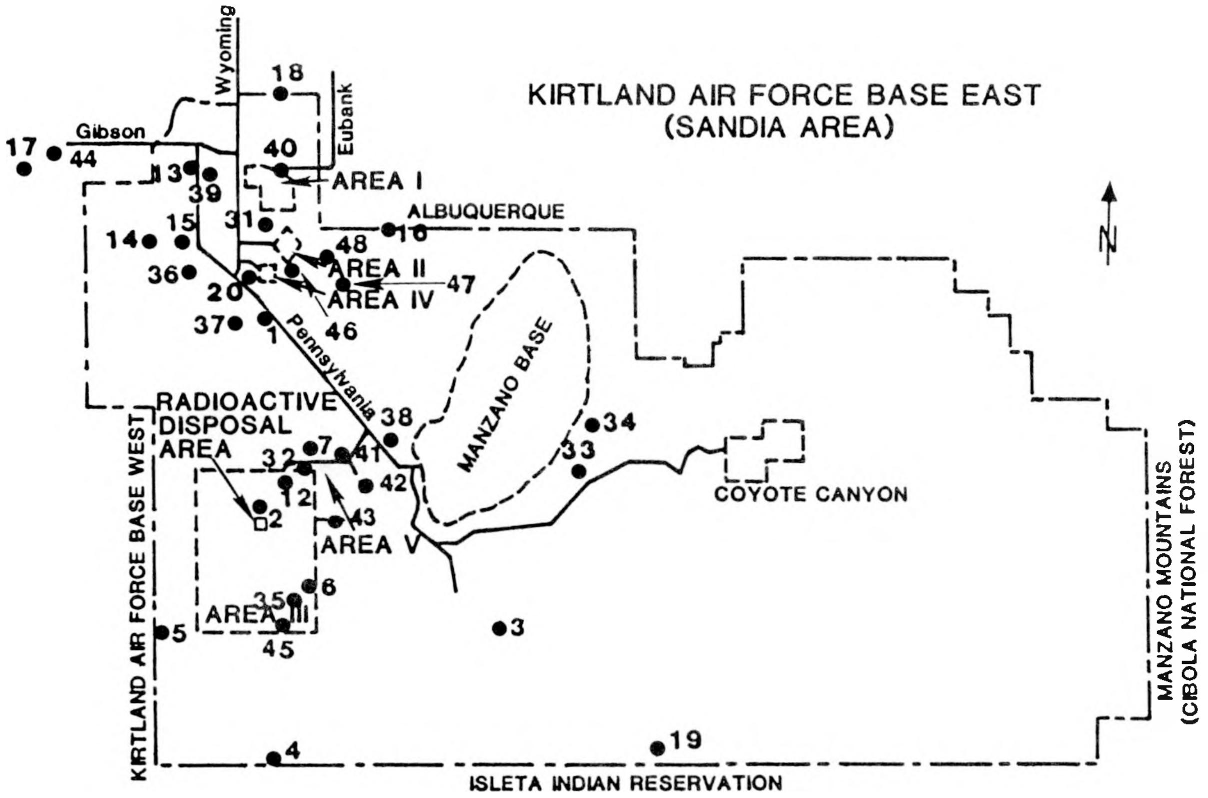

Figure 4. Environmental Monitoring Locations in Sandia Technical Areas I-V

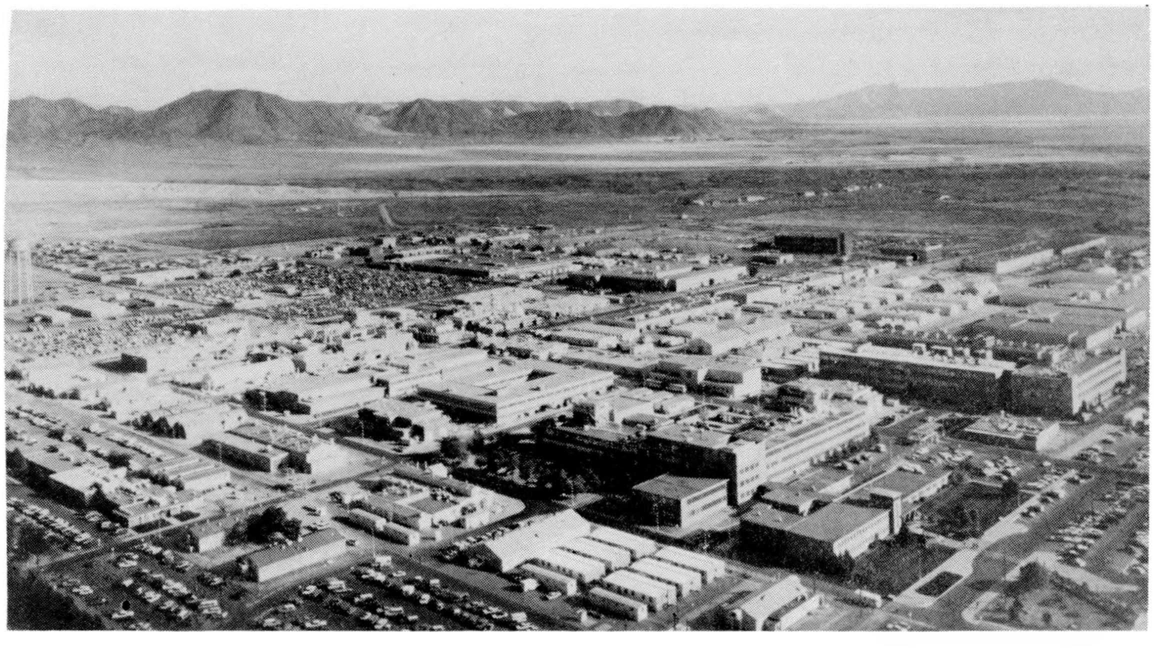

Figure 5. Sandia Techncial Area I

will integrate many of the existing Area-II activities as well as some remote testing activities currently done in other test areas.

Area-III is located 8 km south of Area-I. It is comprised of 20 test facilities which include extensive environmental test facilities (such as sled tracks, centrifuges, and a radiant heat facility). No radioactive effluents are released through normal operations in the area. Other facilities in Area-III include a paper incinerator, a low-level radioactive disposal site, and a hazardous waste storage facility.

The radioactive disposal site[7] in Area III consists of two adjoining fenced areas that occupy approximately 0.6 ha. One area has been used for low-level waste disposal in seven shallow trenches. Six of the trenches are no longer used and have been filled and covered with dirt. The second area has been used for disposal of classified low-level waste in 37 pits. Thirty-five of these pits have been filled and covered with a concrete cap. The low level radioactive waste consists primarily of tritium contaminated materials. Three additional pits located in the classified waste disposal area are used exclusively for natural and depleted uranium waste disposal. The site is scheduled for closure by 1991. Low-level radiation waste will be stored at a new radioactive and mixed waste storage facility which is scheduled for completion and use in FY90. This facility will be located in Area-III.

A hazardous waste disposal and storage site[7] is located near the southern boundary of Area-III. This facility has not been used for disposal of hazardous wastes since November 7, 1985. Hazardous wastes were stored at this facility from 1985 to 1988. A Closure plan and Post-Closure Permit Application was submitted to the State of New Mexico in May 1988 for the no-longer used hazardous waste disposal site. A new hazardous waste repackaging and storage building (located south of Area-I) was completed and in operation in 1988.

Area-IV consists of several inertial confinement fusion research and pulsed power research facilities. A large accelerator, the Particle Beam Fusion Accelerator-II (PBFA-II), was completed in 1985. Gaseous tritium effluents (primarily HT) will be released in the fusion research starting in 1991. A large accelerator facility (STL) was completed in 1986. It houses seven pulsed power accelerators - HERMES III, RLA, TROLL, STF, SPEED, HYDRAMITE, and in 1989, PROTO II. Several of these accelerators are being transferred from Area-V. HERMES III was operational in 1988. Another new accelerator facility, SATURN, was also completed in 1987. There were minimal radioactive releases from these facilities in 1988. A major new research facility (SDF) is under construction and will be operational by 1990. Predicted effluents from this facility will be short-lived radionuclides, primarily N-13 and O-15.

Area-V houses large electron beam accelerators, three research reactors in two reactor facilities, an intense gamma irradiation facility (using ^{60}Co and ^{137}Cs) and a hot cell facility. The largest accelerator is HERMES II. These facilities are being transferred to Area-IV except for HERMES II. No tritium was released in 1988 nor has been for several years due to the nature of current research efforts.

The two research reactor facilities in Area-V are quite dissimilar: the Sandia Pulsed Reactor (SPR) is an unreflected, unmoderated assembly of enriched uranium; the Annular Core Research Reactor (ACRR) is an annular core of 226 fuel elements in an open water tank. Both the SPR and ACRR air exhaust systems are equipped with particulate effluent samplers. The ACRR also has a continuous gaseous effluent monitor. The only airborne releases are air activation products from reactor operations primarily composed of ^{41}Ar. The reported amount of ^{41}Ar (which is released from both reactor areas) was computed from reactor operating parameters. The reported releases from both reactors for 1988 were very small (5.2 Ci) and were not significantly different from 1987 releases. Neither the ACRR nor SPR releases cooling water.

SNL, Albuquerque also has test areas outside of the five technical areas. These areas are located south of Area-III and in canyons on the west side of the Manzano Mountains. Coyote Canyon (Figure 4) is such an area. Depleted uranium is infrequently spread over limited areas during explosive testing in these remote test areas. The test areas are surveyed following each test and contaminated materials are collected and disposed of in accordance with USDOE requirements. Environmental monitoring is done as necessary. Operations in these areas are, in addition, administratively controlled to avoid uranium contamination in public areas beyond the confines of KAFB.

ENVIRONMENTAL MONITORING FOR RADIOACTIVE EFFLUENTS

SNL, Albuquerque has maintained an environmental monitoring program[8-24] since February 1959. The objectives of this surveillance program are to detect the release and/or migration of radioactive material from SNL, Albuquerque operations and to determine the resulting population exposures above normal background radiation levels. The monitoring program also provides a check on the effectiveness of reactor radiological safety systems which are in effect at Area-V. Radioactive effluent discharges to the environment are kept as low as reasonably achievable and in accordance with interim USDOE guidelines for environmental protection (Appendix G).[25] Soil, vegetation, water, and air are monitored for radionuclides, primarily ^{137}Cs and ^{3}H. Gross alpha (α) and gross beta (β^-) screening analysis are performed on water samples. Soil samples are analyzed for uranium to determine uranium concentrations resulting from explosive testing.

In addition to the other elements of the monitoring program, a program was begun in 1981 which uses integrating dosimeters (thermoluminescent dosimeters or TLDs) to measure ambient levels of external penetrating radiation around each major facility. Before a facility's contribution to a population dose can be calculated (in the event of an unplanned release), a good estimate of ambient background with its inherent variability must be available. Natural background radiation levels are affected by many environmental factors, including ground cover and seasonal variations in precipitation and temperature.

MONITORING LOCATIONS

The SNL, Albuquerque environmental monitoring locations (Figures 4 and 6) remain essentially the same from year to year. Monitoring locations are changed as necessary to accommodate facility changes or discontinuance of operations. Three new TLD locations were added in 1987. They were located at the north, east and south radiation control fence lines surrounding Area-V. Three additional TLD stations were placed in Area IV in 1988 to monitor radiation levels at new facilities. Groundwater samples for radiological analysis are collected from base wells in use at the time of sample collection and the sampled wells may differ from one year to the next.

Table B.1 (Appendix B) lists the SNL, Albuquerque environmental monitoring locations and specifies the type of sample collected (vegetation, water, soil) or presence of a TLD station for each location. Twenty locations are on-site at SNL, Albuquerque facilities; seven are on KAFB at the perimeter or boundary; 14 are community (or background) sites distributed around and in Albuquerque within an 80-km radius of SNL, Albuquerque. Water monitoring locations include ten KAFB wells and three surface water locations.

Location 8 is a surface water sampling location on the Rio Grande upstream of the SNL, Albuquerque facilities. It provides control data for comparison with Location 11, a downstream Rio Grande sampling location.

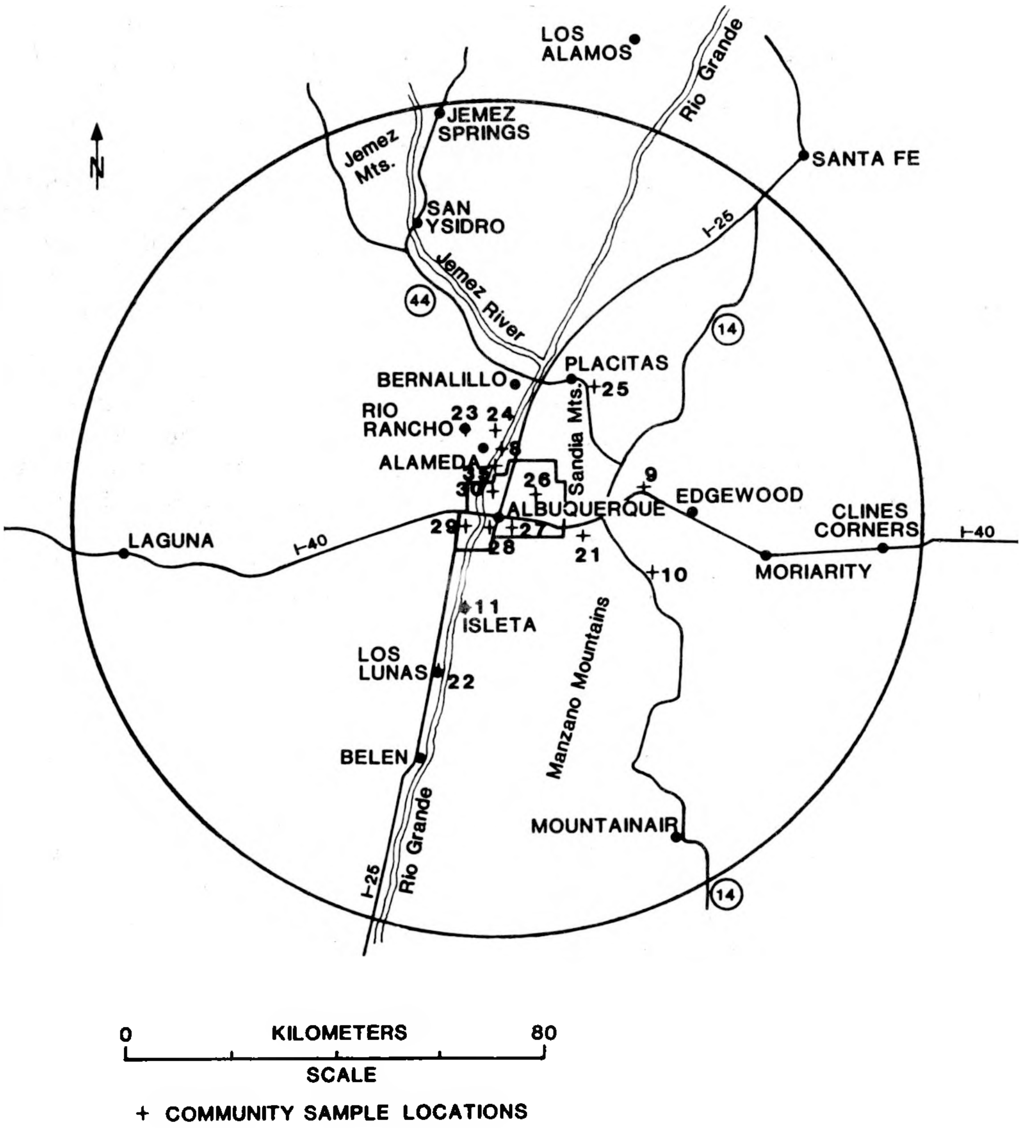

Figure 6. Environmental Monitoring Locations in the Albuquerque Area

SAMPLE COLLECTION AND ANALYSIS

Samples are gathered and stored in accordance with methods described in USDOE/EP-0023.[26] These procedures have been documented in an Environmental Monitoring Manual.[27] Native vegetation (grasses), soil, and water samples are collected annually at the end of the growing season. These procedures are described in Appendix C. Detection Limits for each type of radiochemical analysis are included in Appendix D.

A total of 78 samples were submitted for gamma spectrometry analysis in 1988. Fifty samples were analyzed for uranium. Seventy-eight samples were analyzed for tritium. Twenty-two water samples were screened for gross alpha and beta. Sampling frequencies are summarized in Table C.9.

LABORATORY QUALITY ASSURANCE

Laboratory quality assurance is achieved through successful participation in EPA (Environmental Monitoring Systems Laboratory) and USDOE (Environmental Measurements Laboratory) intercomparison programs. Table E.1 (Appendix E) provides results for 1988 gross alpha, gross beta, ^{137}Cs, ^{3}H, and uranium determinations in water, soil and vegetation. Ratios comparing SNL, Albuquerque values to reference values provided by USEPA and USDOE laboratories for quality assurance programs are included. Table E.2 lists the results of samples collected at the same location to determine sample variability. This is part of the routine sampling program.

MONITORING RESULTS

Appendix F lists the monitoring results for all sample locations. Calculated summary data tables are included and discussed in the following paragraphs. Less-than-Minimum Detectable Level (MDL) values were set equal to the MDL in the calculation of mean (x) values. Table F.1 gives concentrations of ^{3}H and ^{137}Cs in vegetation (primarily grass species) at thirteen SNL, Albuquerque, four perimeter, and five community locations. Table 1 compares the mean concentrations and respective standard deviations, as well as ranges, for ^{3}H and ^{137}Cs in vegetation for the three types of sampling locations. The ^{137}Cs concentrations ranged from <MDL values to 0.11 pCi/g. Only three locations had above MDL ^{137}Cs. The reported ^{137}Cs concentrations (Table 1) are consistent with fallout levels. Cs-137 concentrations at the three locations were not significantly different ($P<0.01$).

Tritium concentrations, reported as pCi per ml of extracted water, ranged from 0.2 to 18.6 pCi/ml. Most of the reported ^{3}H concentrations fall within the range of background ^{3}H levels for this area. Apparently elevated tritium concentrations are being investigated and appear to be a result of faulty detection equipment. An examination of the data in Table F.1 and Table E.2 for replicate samples shows a large variability for ^{3}H analysis at the same location. For example, at location 34, the data range from not detectable to 29 pCi/ml. Tritium analyses results therefore appear to be suspect for 1988.

Concentrations of uranium and ^{137}Cs and ^{3}H in soil samples are reported in Table F.2 for thirteen SNL, Albuquerque, four perimeter, and five community locations. Table 2 summarizes the mean concentrations, respective standard

Table 1. Mean Concentrations of ^{3}H and ^{137}Cs in Vegetation

Nuclide	Location	Sample Size	Concentration $\bar{x}$	s	Range
^{3}H (pCi/ml)	Sandia	13	6.2	5.4	0.2 to 18.6
	Perimeter	4	4.0	2.7	1.4 to 8.8
	Community	5	2.9	1.4	0.9 to 4.8
	Total	22	5.1	4.5	0.2 to 18.6
^{137}Cs (pCi/g)	Sandia	13	0.05	*	<0.05 to 0.06
	Perimeter	4	0.05	*	<0.05
	Community	5	0.06	0.03	≤0.05 to 0.11
	Total	22	0.05	0.01	<0.05 to 0.11

$\bar{x}$ = mean, s = standard deviation.
^{137}Cs <MDL (MDL = 0.03) values were used in calculations of $\bar{x}$.
*s not calculated since most values were <0.05.

Table 2. Mean Concentrations of Uranium, ^{137}Cs, and ^{3}H in Soil Samples

Nuclide	Location	Sample Size	Concentration $\bar{x}$	s	Range
Uranium (μg/g)	Sandia	13	2.5	0.3	2.0 to 2.9
	Perimeter	4	2.4	0.4	2.1 to 2.9
	Community	5	2.5	0.2	2.3 to 2.7
	Total	22	2.5	0.3	2.0 to 2.9
^{137}Cs (pCi/g)	Sandia	13	0.53	0.37	0.06 to 1.33
	Perimeter	4	0.42	0.23	0.15 to 0.68
	Community	5	0.28	0.25	0.06 to 0.66
	Total	22	0.45	0.33	0.06 to 1.33
^{3}H (pCi/ml)	Sandia	13	15.3	41.7	0.2 to 153.7
	Perimeter	4	2.8	3.4	<0.2 to 7.3
	Community	5	26.5	50.2	1.1 to 115.9
	Total	22	15.6	39.1	<0.2 to 153.7

$\bar{x}$ = Mean, s = Standard Deviation.

deviations, and range of values for radionuclides in each of the three types of sampling locations.

Uranium concentrations in soil ranged from 2.0 to 2.9 μg/g and are consistent with natural background levels. Differences between locations were not statistically significant ($P<0.01$). The ^{137}Cs concentrations ranged from 0.06 to 1.33 pCi/g and appear to reflect fallout levels of ^{137}Cs. Tritium concentrations were highly variable, ranging from 0.2 to 153.7 pCi/ml. These values appear to be suspect due to faulty instruments as discussed previously. Less-than-MDL values were set equal to the MDL in the calculation of $\bar{x}$ values. Concentration differences between locations were not statistically significant ($P<0.01$).

Replicate samples of soil and vegetation were collected in order to get an estimate of the variability associated with each location. Table E.2 lists $\bar{x}$ and standard error of the mean ($s_{\bar{x}}$) for the replicate samples. This estimate of variability includes both the sampling error and the analytical and counting errors. The ^{3}H data is extremely variable as reported above. The reported ^{137}Cs levels reflect background fallout concentrations. Potassium-40 (^{40}K) is a naturally occurring background radionuclide as are uranium and tritium.

Concentrations of gross alpha, gross beta, ^{137}Cs, ^{3}H, and uranium in water are reported for all sampled locations in Tables F.3 and F.4 for both total (unfiltered) water as well as filtered water and associated suspended solids. Table F.3 lists concentrations in surface waters while Table F.4 lists concentrations in groundwater. Tables 3 and 4 summarize the water sampling results for both well and surface water locations.

Table 3. Mean* Concentrations of Gross α, Gross β-, Uranium, ^{137}Cs and ^{3}H in Surface Water (streams)

Analysis (Units)	Total Water $\bar{x} \pm s$	Filtered Water $\bar{x} \pm s$	Suspended Solids $\bar{x} \pm s$
Gross α (10^{-9} μCi/ml)	7 ± 5	<MDL	<MDL
Gross β^- (10^{-9} μCi/ml)	6 ± 0.5	8 ± 1	1 ± 1
Uranium (10^{-3} μg/ml)	40 ± 57*	22 ± 25*	-
^{137}Cs (10^{-9} μCi/ml)	<MDL	<MDL	-
^{3}H (10^{-6} μCi/ml)	<MDL	<MDL	-

*Summary data for three surface water locations. Individual values are in Appendix Table F.3.

Table 4. Mean* Concentrations of Gross α, Gross β^-, Uranium, ^{137}Cs and ^{3}H in Groundwater (base wells).

Analysis (Units)	Total Water $\bar{x} \pm s$	Filtered Water $\bar{x} \pm s$	Suspended Solids $\bar{x} \pm s$
Gross α (10^{-9} μCi/ml)	3 ± 0.4	3 ± 0.7	<MDL
Gross β^- (10^{-9} μCi/ml)	3 ± 0.7	4 ± 1	<MDL
Uranium (10^{-3} μg/ml)	1 ± 0.4	1 ± 0.4	-
^{137}Cs (10^{-9} μCi/ml)	<MDL	<MDL	-
^{3}H (10^{-6} μCi/ml)	<MDL	<MDL	-

*Summary data for nine well water locations. Individual values are in Appendix Table F.4.

Tritium and ^{137}Cs concentrations in water were all at or near MDL. Uranium values averaged 1×10^{-3} μg/ml in groundwater and are consistent with background levels in water. Gross alpha and gross beta values were all at or near MDL values.

Table 5 gives the summary annual TLD dose estimates for SNL, Albuquerque, perimeter, and community locations noted in Table B.1. Data for individual locations are in Table F.5. These estimates include natural background plus facility contributions (if any). The mean annual doses for community and perimeter (Sandia boundary) locations were 99 mrem and 96 mrem, respectively. The mean annual dose at locations adjacent to on-site facilities was 117 mrem/yr. The mean annual external penetrating radiation dose for all location types was 104 mrem/yr.

Table 5. Thermoluminescent Dosimeter Dose Estimate Summary

Location	Sample Size	Mean Annual Dose (mrem) x	s_x	Range
Sandia	13	117	15	94 to 296
Perimeter	7	96	3	88 to 111
Community	12	99	3	87 to 112
Total	32	104	7	87 to 296

There was no statistically significant difference between the three location types in annual dose estimates. The on-site annual dose estimate is higher than perimeter and off-site areas primarily due to location 41. Location 41, on the radiation control fence northeast of Area V, was significantly higher than other Sandia locations. These higher values can be attributed to controlled operations at the HERMES-II accelerator in Area V. The mean annual dose from all other on-site locations averaged 97 mrem/yr.

Location 32 in Area V was significantly higher ($P<0.01$) than other locations with an estimated annual dose of 204 mrem. It is not included in the mean dose estimates since this particular location is inside a radiation controlled area near SPR in Area V. The applicable USDOE standard for a whole body exposure in a controlled area (occupational exposure) is 5 rem/yr effective dose equivalent (USDOE 5480.11).

Appendix G includes applicable radiation protection standards for uncontrolled areas.[24,25] The derived concentration guides in Table G.2 are based on the 100 millirem/yr effective dose equivalent standard proposed by USDOE (USDOE Memorandum from Robert J. Stern, dated February 28, 1986).

PUBLIC DOSE ASSESSMENT

Airborne concentrations of ^{41}Ar resulting from SNL, Albuquerque emissions are too low to be measured in public locations. These concentrations are therefore calculated by using Pasquill's atmospheric diffusion equations,[28] estimated activity released, and assumed meteorological conditions. Dose estimates are then made at site boundaries and for the Albuquerque area population as a whole.

The following is Pasquill's Gaussian diffusion equation for continuous releases:

$$\chi = \frac{fQ}{\pi \sigma_y \sigma_z u} \exp - \left[\frac{y^2}{2\sigma_y^2} + \frac{h^2}{2\sigma_z^2} \right] \quad (1)$$

where

Q = source strength in curies per second
u = mean wind speed in meters per second
y = receptor location in meters from the plume axis
h = source height in meters
σ_y, σ_z = diffusion coefficients in meters. These coefficients are a function of distance from the release point.
f = frequency the wind blows in a given direction
χ = concentration in curies per cubic meter

A neutral (Pasquill Type D) meteorological condition is assumed. A wind speed of 4 m/s is assumed (based on wind rose data), which is compatible with Type D conditions. A conservative simplifying assumption that y = 0 and h = 0 is also made. The maximum mean time the wind blows in a given direction is 11.4% (based on 10 yrs of data).[5] These parameters are used in Equation 1 to generate the effluent release data in Table F.6.

Dose rates for ^{41}Ar (Table 6) were then calculated by using dose rate conversion factors (DRCF).[29] Albuquerque area population doses were calculated with Equation 2. Approximately 450,000 people live within an 80-km radius of the Albuquerque area. Equation 2 uses a conservative assumption that this population is uniformly distributed within an inner 20-km radius.

Table 6. Site Boundary Dose Rates and Population Doses

Parameter	^{41}Ar	Natural** Background Radionuclides
Location	Site Boundary	Community
Dose Rate (mrem/yr)	0.00034	99
Albuquerque Area* Annual Population Dose (person-rem)	0.039***	44,500

*Albuquerque area population from 1980 census is 450,000 residents.
**Based on community TLD values (whole Body Dose from external penetrating radiation)
***Dose over 80-km radius Albuquerque Area

$$\text{Dose} = \frac{4.50 \times 10^5}{\pi (20\ \text{km})^2} \int_{0\text{km}}^{20\text{km}} \chi \cdot \text{DRCF} \cdot 2\pi r dr \qquad (2)$$

The integral in Equation 2 overestimates the ^{41}Ar dose, as it does not take into account the 1.83-h half-life decay of the radionuclide as it traverses the 20-km radius.

Site boundary dose rates have also been calculated using AIRDOS.EPA in compliance with 40 CFR 61 requirements. The 1988 releases were scaled using the 1987 AIRDOS.EPA calculations since input parameters have not changed and the activity released from the same sources reported in 1987 is about 30% less than in 1987. Doses were calculated at boundary locations and at nearby resident locations such as the KAFB housing areas (Appendix Table F.7). These values agree very well with the calculated values reported in Table 6. Two locations (adjacent to the KAFB housing areas) have TLD stations (Numbers 39 and 40). The annual radiation dose rate at both locations as measured by TLDs (Table F.5) was 89 mrem/yr for 1988. The annual radiation dose at these two locations resulting from Sandia facility air emissions averaged 0.00014 mrem/yr as calculated by AIRDOSE.EPA. This dose is negligible compared to natural background radiation and is well below the 25 mrem/yr air emission standard (Appendix Table G.1).

CONCLUSIONS

Background levels of ^{137}Cs from world-wide fallout were detected in vegetation. Values in vegetation ranged from less than MDL to 0.11 pCi/g. Soil concentrations for ^{137}Cs ranged from 0.06 to 1.33 pCi/g. Total uranium concentrations in soil ranged from 2.0 to 2.9 μg/g. These values are consistent with soil concentrations reported for soils in this area and reflect natural levels of uranium in regional soils.[30,31]

Concentrations of ^{3}H and ^{137}Cs in regional surface and well waters were less than MDL and are therefore well below the USDOE interim derived concentration guides (DCG). Gross alpha concentrations in well waters averaged 3 x 10^{-3} pCi/ml. Gross beta concentrations in well waters averaged 3 x 10^{-3} pCi/ml. Gross alpha concentrations in surface water averaged 7 x 10^{-3} pCi/ml. Gross beta concentrations in surface water averaged 6 x 10^{-3} pCi/ml. Gross alpha and beta concentrations are used for screening purposes only. No concentration guides are available. Reported values are low and required no investigative action. Uranium concentrations averaged 1.0 x 10^{-3} μg/ml in well water samples. Surface water uranium concentrations averaged 40 $\pm$ 57 mg/ml for the three locations sampled.

External penetrating radiation doses for the Albuquerque community area averaged 99 mrem/yr as measured by the SNL, Albuquerque TLD system. This is the natural background whole body dose rate for the region attributable to terrestrial and cosmic radiation excluding doses from naturally occurring, internally deposited nuclides and lung doses from radon and radon daughters.

The calculated site boundary concentrations for gaseous radionuclides are less than 0.001% of interim radiation protection guides. These concentrations cannot readily be measured. The estimated population dose due to the release of gaseous radionuclides from SNL, Albuquerque was 0.039 person-rem over the 80-km-radius Albuquerque area (Figure 5). The corresponding population dose due to natural background external penetrating radiation in the Albuquerque area (from the TLD measurements) is 44,500 person-rem based on the 1980 census population. The population dose attributable to SNL, Albuquerque operations is minimal in comparison.

Figure 7 graphically gives the nuclide release trends of gaseous radionuclide emissions from SNL, Albuquerque over the last 10 yrs; ^{85}Kr, ^{41}Ar and ^{3}H have been the major nuclides released from SNL, Albuquerque facilities. Ar-41 was the principal release in 1988. A small amount of ^{3}H was released from a new facility in 1988.

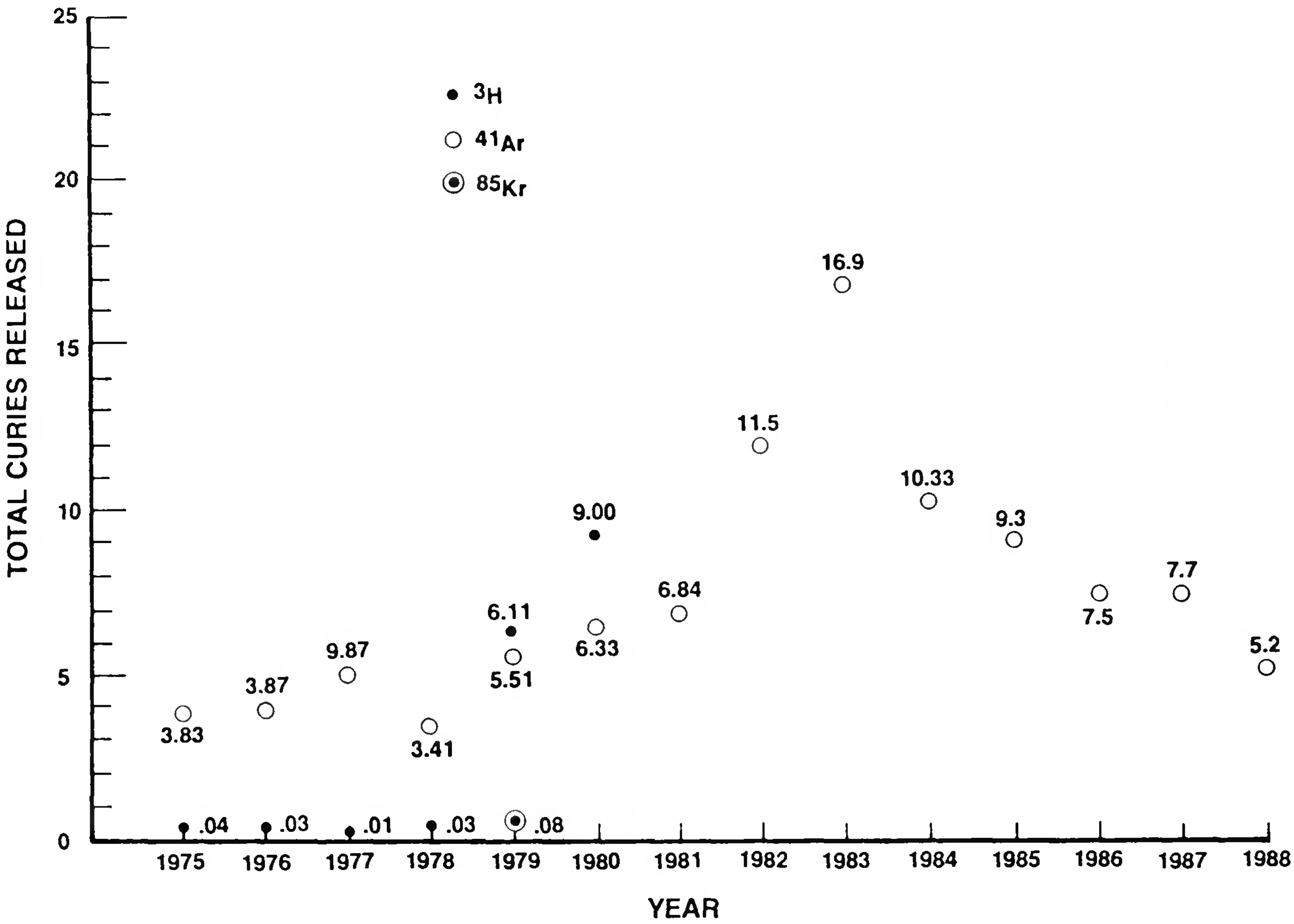

Figure 7. Summary of Atmospheric Release of ^{41}Ar, ^{3}H, and ^{85}Kr From Sandia-Albuquerque Facilities

ENVIRONMENTAL MONITORING FOR NONRADIOACTIVE EFFLUENTS

Sandia's nonradioactive effluent source terms consist of potential releases to the air, sanitary and storm sewers, and groundwater. While these source terms are small and the potentials for release are kept low by adherence to stringent administrative policies, a program to monitor these releases in compliance with environmental regulations was started in 1986. Preliminary results from this program were reported in the 1986 environmental monitoring report.[23] SNL, Albuquerque is expanding the monitoring program for nonradioactive effluents as needed and in compliance with changing regulations. A description of the current program to monitor nonradioactive effluents and environmental impacts follows.

GROUNDWATER MONITORING PROGRAM

The groundwater monitoring program at Sandia National Laboratories - Albuquerque consists of a groundwater pollutant detection monitoring system[33] at the Chemical Waste Landfill (CWL) located in Technical Area III. The system was initially installed in 1985 with five monitoring wells. In 1988, another four wells were installed to supplement the original system. This system is designed and operated to meet the groundwater monitoring requirements of the Resource Conservation and Recovery Act (RCRA) Part 265, Subpart F.

To date, the detection monitoring program has not detected a release from the CWL that has reached the groundwater beneath the site.

Groundwater Monitoring System

There are presently nine monitoring wells located at the chemical waste landfill. The wells are designated background well (BW) or monitoring well (MW). These nine wells are a composite of two groundwater monitoring systems installed during two separate time periods. The first was installed in 1985 and consists of BW1, BW2, MW1, MW2, and MW3 (Figure 8). The second set of wells was installed in 1988 to modify the original system. These wells include BW3, MW1A, MW2A, and MW3A (Figure 8).

All nine monitoring wells are not necessary nor appropriate for use as the RCRA, Part 265 Subpart F groundwater monitoring system. The following wells will be sampled for groundwater quality parameters and used to determine direction of groundwater flow as required by RCRA: BW3, MW1A, MW2A, MW3A. Additional investigations relative to aquifer characteristics will use MW2 and MW3, as necessary. Wells BW1 and BW2 await additional studies to determine if they will be included in the monitoring well system. Well MW1 was lost as a usable well in July 1988 when a bailer and bailer recovery equipment was left permanently lodged in the wellbore.

Groundwater Monitoring - 1988

During 1988, the 1985 wells were being used for detection monitoring as required by 40 CFR §265.92(d). This requires a semi-annual sampling and analysis of Contamination Indicator Parameters and annual sampling of

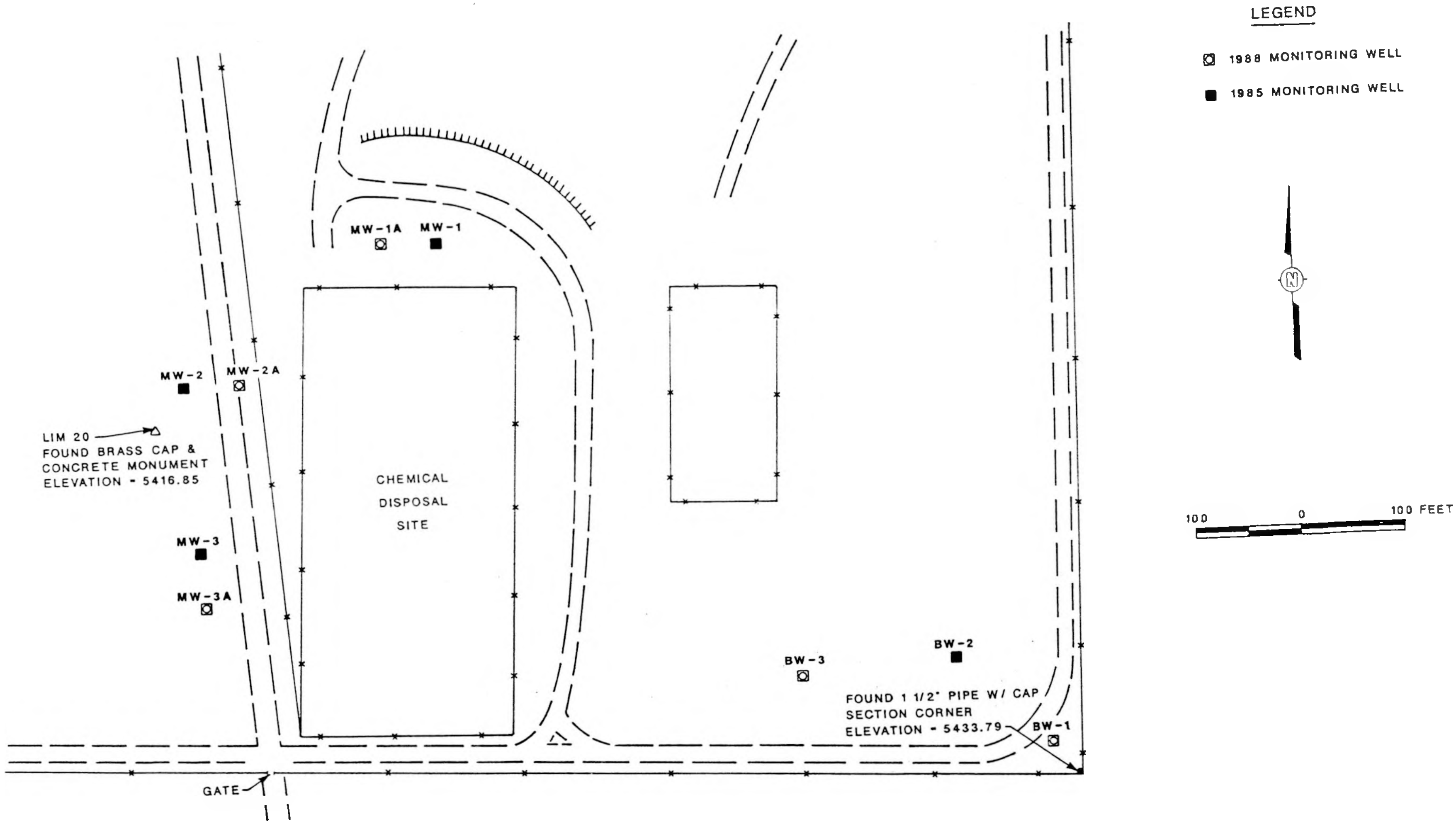

Figure 8. Location of Wells at the Chemical Waste Landfill

Groundwater Quality Parameters (Table G.3). The two sampling periods occurred in February and July, 1988.

To meet the requirements of a New Mexico Environmental Improvement Division (NMEID) Compliance Order, the 1988 wells are being used to re-establish the background water quality parameters required by 40 CFR 265.92(c). This requires four quarterly samples of Drinking Water Supply Parameters, Contamination Indicator Parameters and Groundwater Quality Parameters (Table G.3). The first quarterly background samples were obtained in December, 1988. After the background parameters have been re-established, the 1988 wells will be used for detection monitoring. Future use of the 1985 wells will be restricted to groundwater elevation measurements and the potential for aquifer characteristic testing and will no longer be used to monitor the quality of the groundwater.

The Chemical Waste Landfill is currently under the interim status regulations of RCRA (40 CFR Part 265). The regulations of 40 CFR 265 for interim status facilities requires the use of a Student's t-test for the determination of significant changes in the Contamination Indicator Parameters (§265.93(b)). This allows some latitude in the selection of a particular Student's t-test. However, the New Mexico Environmental Improvement Division (NMEID) has specified the use of the Cochrans Approximation to the Behrens-Fischer (CABF) Student's t-test,[32] and thus, that test was used for this report to determine if significant changes have occurred at the CWL. The CABF test originates in the regulations for permitted facilities in 40 CFR §264.97(h)(1)(i). Note that the requirements of §264.97(h)(1)(i) specifies a level of significance of 0.05, versus 0.01 for the interim status regulations. The NMEID has specified a significance level of 0.01 and was used in the calculation of the comparison statistic.

Evaluations for significant changes in the Contamination Indicator Parameters are made by comparing the semi-annual data to the pooled data from the four quarters of data collected during the background year for the upgradient well (BW2). Each downgradient well is compared to the upgradient, background year pooled data and similarly, the upgradient well is compared to its own background pooled data.

Additional samples from the downgradient wells must be taken, split into replicates and analyzed if results show a significant increase in Sp.Cond., TOX and TOC or increase/ decrease for pH. If the significant change has been confirmed, then the assessment monitoring program must be initiated. An outline of a groundwater quality assessment program is reported in the RCRA Groundwater Monitoring Plan, 1988.[33] Statistical changes in the upgradient well are just noted in the annual groundwater monitoring report with no confirmation samples required.

Each time a sample is taken from a groundwater monitoring well the elevation of the groundwater must be determined (§265.92(e)). In addition to this requirement, Sandia started monthly evaluations of groundwater elevations for each well in May, 1988. According to §265.93(f), each series of groundwater elevation measurements obtained pursuant to §265.92(e) must be evaluated to determine the direction of groundwater flow to assure that the groundwater monitoring system met the requirements of §265.91(a). The requirements of §265.91(a) state that the system must consist of at least one hydraulically upgradient well, representative of background groundwater quality in the uppermost aquifer, not affected by the facility, and three hydraulically downgradient monitoring wells, capable of immediately detecting statistically significant amounts of hazardous waste constituents that migrate from the CWL to the uppermost aquifer.

Groundwater Elevations

The wells installed in 1985 were installed in a hydrologically different zone in the aquifer than the 1988 wells. In general, the 1985 wells have longer screen lengths that extend deeper into the aquifer. The 1988 wells are limited to approximately fifteen feet of well screen that penetrates the piezometric surface. During the drilling of the 1988 wells it was apparent that a downward gradient exists in the aquifer beneath the site. The nested wells MW2 - MW2A and MW3 - MW3A show about a three foot difference in water levels with the deeper 1985 wells showing lower water levels.[33] It is important then to recognize that gradient and flow direction can only be determined from wells completed in similar water bearing zones.

The groundwater elevations were determined during both semi-annual detection monitoring events as required by §265.92(e). In addition, monthly groundwater elevations were determined starting in May, 1988. Table F.8 shows the groundwater elevations from the 1985 wells and the 1988 wells for all measurements obtained during calendar year 1988.

Direction of Groundwater Flow. As required by §265.94(a)(2)(iii), the groundwater surface elevations obtained during the sampling events were evaluated to determine if the facility continued to satisfy the requirements of §265.91(a). Careful selection of wells to be used for this evaluation was very important since the direction of groundwater flow, determined from a standard three-point solution, is very sensitive to small groundwater elevation changes for a piezometric surface that has a very small gradient.

Evaluation of the well completion diagrams and water level elevation histories for the upgradient well BW1 showed that this well should not be included in flow direction calculations. Well BW1 has shown erratic water level fluctuations over its history. When first installed the well did not produce sufficient water to be sampled. However, enough water was present in the well to measure the water level elevation. Water level elevations were not obtained for this well for the next 20 months. When obtained, the water level had risen about 16 feet. The water level was stable at that level for about 12 months when the water level abruptly dropped about 12 feet in one month. In addition, the water level elevation of BW1 was about 18 to 30 feet higher than well BW2 which is only 125 feet away from BW1. Because of this erratic history, well BW1 should not be used in flow direction calculations.

Well BW2 is completed similar to a water production well with approximately 500 feet of screen reaching a total depth of 980 feet (490 feet below the water table). Although not completed to this extreme depth, wells MW1 and MW3 were screened about 120 feet below the water table and MW2 was screened 170 feet below the water table. Compared to the 1988 wells, which were located about 50 feet from the 1985 wells for MW1, MW2, MW3, 125 feet for BW2, all show about a two (2) to three (3) foot lower water level elevation. Given the deeper well completion characteristics and consistent lower water level than its nested companion well, the wells BW2, MW1, MW2 and MW3 represent wells that should logically support meaningful flow direction calculations. Hence, the four combinations of these four wells to produce three-point flow direction calculations were determined. Table F.9 shows the bearing and gradient solutions to the groundwater flow calculations for the 1985 wells. Figure 9 shows the average groundwater flow direction bearing for the February and July, 1988 semi-annual detection monitoring displayed on a site map.

Since BW3, MW1A, MW2A and MW3A are all completed similarly, these wells can also support meaningful flow direction calculations. However, the combination MW1A - MW2A - MW3A does not provide reasonable three-point solutions because the wells form a very flat triangle with minimal differences in water level elevations. Thus, solutions are not presented for this combination. Table F.9 shows the groundwater bearing and gradient for the 1988 wells. Figure 10 shows the average bearing for the first quarterly background sampling of the 1988 wells.

The bearings calculated for both the February and July, 1988 semi-annual sampling events for the 1985 wells show that the downgradient wells MW1, MW2 and MW3 continued to be downgradient of the CWL and BW2 and BW1 continued to be upgradient. For the first quarterly background sampling of the 1988 wells the downgradient wells MW1A, MW2A and MW3A were downgradient and BW3 was upgradient. Thus, the groundwater monitoring system continued to satisfy the requirements of §265.91(a) specifying at least one upgradient well and three downgradient wells for both the 1985 wells and the 1988 wells during calendar year 1988.

Note that the groundwater flow gradients found beneath the site are extremely shallow. There is about a 2 to 4 feet of vertical rise for every 1000 feet in horizontal run. The consequences of this shallow gradient is that very small changes in water level elevations can have very profound changes in the direction of the groundwater flow direction. For the 1988 wells, the largest dimension in a three-point triangulation calculation is 600 feet (BW3 - MW2A); thus, for a gradient of 0.0030, the difference in water level elevations would be only 1.8 feet. Localized depressions or elevations of the water table on the order of one to several tenths of a foot (0.1 foot = 1.2 inches) will alter the flow direction by many degrees. The Albuquerque Basin Aquifer would not be expected to significantly alter flow direction in a short time period and the fluctuations in direction calculated from the wells of this system should not be indicative of the aquifer changing directions.

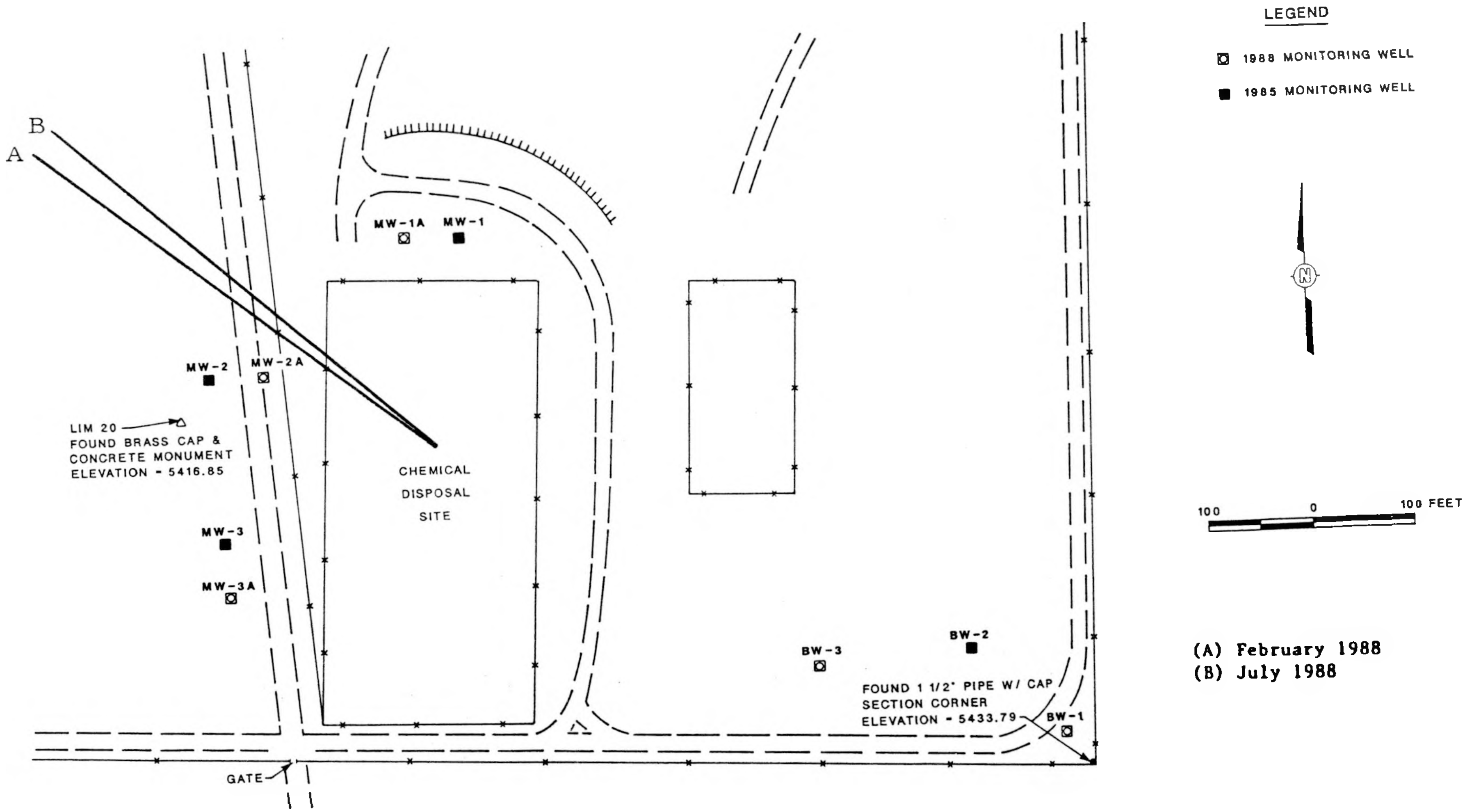

Figure 9. Groundwater Flow Directions from the 1988 Semi-Annual Sampling of the 1985 Wells

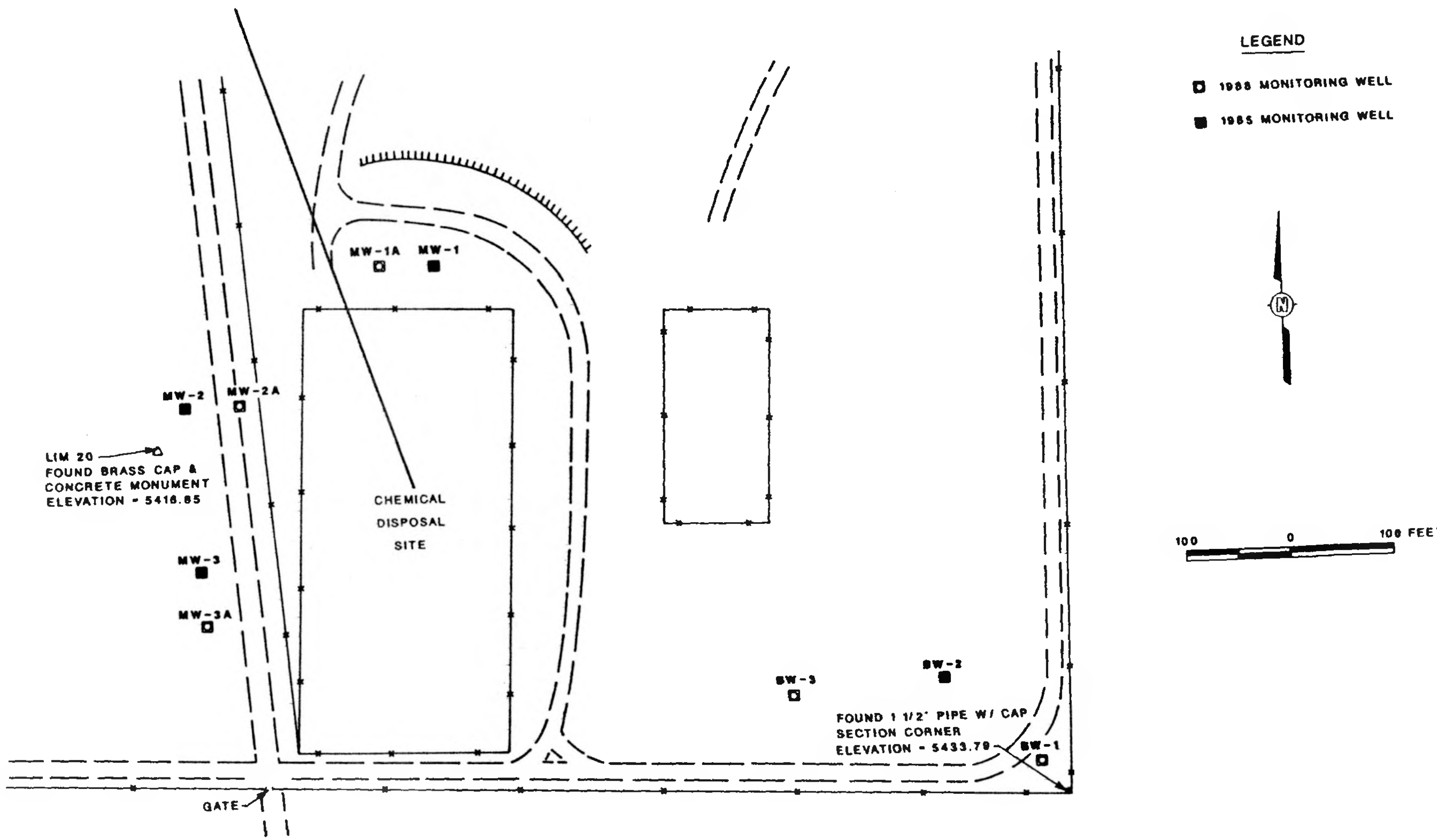

Figure 10. Groundwater Flow Directions from the First Quarter Background Sampling of the 1988 Wells

Water Quality Data Summary - 1985 Wells, Detection Monitoring

Contamination Indicator Parameters. Specific Conductivity and pH are obtained as field measurements during the purging of the wells. The wells are purged until at least three well bore volumes had been removed and the pH, Sp.Cond. and temperature had stabilized. Since four replicate measurements are needed, the last four readings of pH and Sp.Cond. are used as the required data.

Table F.10 presents the four quarters of background groundwater Contamination Indicator Parameters for the upgradient well BW2 with the values necessary for the statistical comparisons to downgradient detection monitoring data. Tables F.11 to F.15 show the calendar year 1988 detection monitoring data from BW1, BW2, MW1, MW2 and MW3, respectively, for the Contamination Indicator Parameters.

Groundwater Quality Parameters. Table F.10 also shows the four quarters of background Groundwater Quality Parameters. Tables F.11 to F.15 show the Groundwater Quality Parameters. After the background values were established, the Groundwater Quality Parameters were analyzed on the annual basis as required by §265.92(d) during the first year of detection monitoring; however, during the calendar year 1988 these parameters were analyzed twice (semi-annual).

Groundwater - Significant Changes From Background

On each Table noted above, the semi-annual statistical evaluations were performed to determine if there had been a significant increase in Sp.Cond., TOX and TOC and a significant pH increase or decrease at a 0.01 level of significance. Table 7 summarizes the statistical comparisons.

The statistical tests performed over the two semi-annual periods show eight statistically significant changes. Five can be explained as problems in analytical sensitivity (see TOX, below). However, one sampling period revealed a significant increase in pH in well MW1 during the February, 1988 semi-annual sampling. A careful review of the data and sampling methods reveals that significant measurement error in pH may have occurred during previous sampling periods. Appendix C.4 describes potential sources of error in the sampling and analytical methods used that may account for the apparent pH increase in MW1. These sources of error may be sufficient to question the reliability of the data to represent aquifer conditions and the meaning of the statistical tests.

Well BW1 had two significant increases in pH, one for each semi-annual sampling period. The same sources of error may be pertinent for this well as for MW1 since BW1 also required bailing for purging and sampling and the resultant elevated turbidity readings. In addition, the specific conductivity was much lower than all the other wells. Given the erratic changes in water level elevations and the higher pH/lower specific conductivity this well may be completed in a zone within the aquifer of a different geologic history. There is no known source of contaminants upgradient of BW1 that might be contributing to the water chemistry changes.

Table 7. Significant Changes in Contamination Indicator Parameters for Groundwater using the CABF Student's t-test

Well**	Date	pH	SC	TOX	TOC
MW1	2/88	yes #	no	yes *	no
	7/88	no	no	N/A	N/A
MW2	2/88	no	no	yes *	no
	7/88	no	no	no	no
MW3	2/88	no	no	yes *	no
	7/88	no	no	no	no
BW1	2/88	yes #	no	yes *	no
	7/88	yes #	no	no	no
BW2	2/88	no	no	yes *	no
	7/88	no	no	no	no

* These sampling periods experienced an increase in the detection limit from 50 μg/l to 80 μg/l. This is the source of the statistical increase.
**BW = Background well; MW = Monitoring well
\# Significant increase.
N/A - data not available to make comparison

TOX appeared to have a significant increase in all wells for the February 1988 sampling event. A closer inspection of the data revealed, however, that the reason for the significance is an increase in the laboratory detection limit from 50 to 80 μg/l and does not indicate a significant increase in TOX. This increase was due to a change in analytical laboratories.

No significant changes were identified for Sp.Cond. or TOC.

Due to the identified sources of error in pH measurement, it was determined that the significance attributed by the CABF statistical test was false. In addition, the requirements for the use of the CABF statistical test was not identified by the NMEID[32] until December 29, 1988 (1). After receipt of the analytical results from the February 1988 sampling event, a standard Student's t-test (independent samples of unequal sizes)[34] was performed and the increased pH value for MW1 was found not to be significant ($p>0.01$) (3). The allowance for any Student's t-test was allowed by §265.93(b) until the NMEID officially notified Sandia. Therefore, no confirmatory sampling and analysis was performed for MW1. The February and July, 1988 pH increases for BW1 were both significant ($p<0.01$), however, no confirmatory sampling is required for significant changes in upgradient wells.

Water Quality Data Summary - 1988 Wells, First Quarter, Background Monitoring

Contamination Indicator Parameters. The reporting of pH and Specific Conductivity measurements continued to utilize the field measurements obtained during the final stages of purging the wells. This practice will minimize some of the sources of error (Appendix C.4).

Table F.16a to F.19b presents the first quarter background monitoring data of the contamination indicator parameters for the 1988 wells. There were no major changes in the magnitude of parameters compared to the 1985 wells.

Groundwater Quality Parameters. Table F.16a to F.19b also contains the first quarter background monitoring data of the groundwater quality parameters. Again, there were no major changes in the magnitude of the parameters compared to the 1985 wells.

Drinking Water Supply Parameters. The data for the drinking water supply parameters are presented in Tables F.16b to F.19b for the first quarter background sampling event.

Parameters Exceeding Interim Primary Drinking Water Supply Maximum Contaminant Levels. As required by §265.94(a)(2)(i), for each monitoring well, each drinking water supply parameter that exceeds the maximum contaminant level of the Interim Primary Drinking Water Standards (Appendix G.4) must be separately identified. Table 8 identifies those parameters that exceed the Interim Primary drinking water standards.

Table 8. First Quarter, Background Year Parameters Exceeding the Interim Primary Drinking Water Standards for the 1988 Wells

Well	Parameter	Value	EPA Interim Primary Drinking Water Standard
BW3	Turbity	4.34 NTU	1 TU
	Gross Alpha	30 pCi/l	15 pCi/l
MW1A	Turbidity	2.4 NTU	1 TU
	Gross Alpha	26 pCi/l	15 pCi/l
MW2A	Chromium, total	0.060 mg/l	0.050 mg/l
	Turbidity	16.2 NTU	1 TU
	Gross Alpha	19 pCi/l	15 pCi/l
MW3A	Gross Alpha	23 pCi/l	15 pCi/l

Gross alpha concentrations exceeded the 15 pCi/l standard in all wells with a range of 19 to 30 pCi/l. These values are being investigated. Turbidity exceeded the 1 TU standard in three wells with values of 4.34, 2.40, and 16.2 NTU for BW3, MW1A, and MW2A, respectively. Total chromium (unfiltered) exceeded the 0.050 mg/l standard at 0.060 mg/l for MW2A; however, the dissolved chromium sample (filtered) showed non-detectable levels of chromium (<0.010 mg/l). This evidence and the turbidity value of 16.2 NTU for MW2A indicate that the source of the chromium is from the suspended filterable solids in the sample.

The chromium seems to be an artifact of the nature of unfiltered samples high in suspended solids that contain natural levels of chromium. A potential source for the high turbidity in MW2A may be from the repeated installation and removal of the pump due to repeated mechanical failures of the pump. As for the other two turbidity values that exceeded the standard, bottled water was tested and found to have a turbidity of 3 to 5 NTU.

AIR QUALITY PROGRAM

Air Quality Permits

Sandia is subject to air pollution regulation including demonstration of compliance with National Emission Standards for Hazardous Air Pollutants (NESHAPs). Air pollution regulations are administered at both the national and the city/county level.

For radionuclide emissions, a U.S. Environmental Protection Agency (EPA) permit is issued after compliance is demonstrated with the NESHAP for radionuclide emissions from DOE facilities. Except for radionuclide NESHAPs, all air pollution permits are issued after complying with the air quality control regulations for Albuquerque/ Bernalillo County.

For non-radionuclide emissions, compliance must be demonstrated with the emission standards for hazardous air pollutants of the Albuquerque/ Bernalillo County Air Quality Control Board. This Board imposes local requirements that are identical to federal NESHAPs. Thus, for non-radionuclide emissions, local government has assumed full authority from EPA for the administration and enforcement of the NESHAP program in Bernalillo County.

For sources that may emit radionuclides to air, Sandia must not:

- o start construction on new sources or
- o modify existing sources

without first obtaining separate EPA approval of each new stationary source or modification of any existing source.

Facilities in existence prior to February 6, 1985, such as the research reactors located in Area V, are not required to seek NESHAPs permits until they are modified. However, these facilities must still meet EPA emission standards and reporting requirements.

In 1988 NESHAPs applications were submitted to and approved by the EPA for two accelerators. One was for the Hermes-III accelerator, which has been in operation since February 1988. The second was for the PT2 accelerator, an emissions source associated with the DOE Strategic Defense Facility (SDF) Project, which is to be constructed in Area IV. EPA approved the new stationary source for radionuclides emission for Hermes-III as a modification of an existing facility (the entire SNL site) in a letter dated June 29, 1988. The NESHAPs application for the SDF was likewise approved on July 8, 1988. The projected doses to the nearest resident from the two accelerators are 3.69E-5 and 4.80E-4 mrem/yr respectively. These doses represent only a very small fraction of the EPA Air Emission Standard of 25 mrem/yr and are, in fact, miniscule.

In August, 1988 DOE/AL issued a MEMO TO FILE that concluded that a NESHAPs application for approval of the New Enclosed Burning Facility (Pool Fire) in Lurance Canyon is not necessary since it is not a new source or a modification under EPA regulations.

In September, 1988, DOE issued a second MEMO TO FILE stating that a NESHAPs permit application to EPA for the Fuel Ringed External Cavity (FREC II) Experiment was not necessary since the project is not a new source as it is within the design capacity of the Annular Core Research Reactor at Area-V.

Work commenced in late 1988 for preparation of a NESHAPs application for approval of the modification of the operating mode for the PBFA-II accelerator. The approval of modification of the operating mode is expected by April 1, 1989. The earliest allowed startup date will be May 11, 1989. The radionuclide NESHAP requirements are currently being reevaluated by EPA. This may provide future regulatory relief for Sandia Operations. A discussion is included in Appendix G.5.

Local air pollution permit activities included a Top Soil Disturbance Permit granted for the "O" Street Extension and "M" Street Parking Lot. Five Open Burning Permits were granted for shipping container tests. A permit application was submitted in February, 1988 for the Wind Shielded Fire Test Facility to be located at the Lurance Canyon Site. However, The City of Albuquerque determined that an air quality construction permit was not required to construct the proposed facility. Construction of emergency diesel generators was completed in 1988 and tests for CO, NO_x, SO_2, and visible emission were initiated on 3/9 and completed on 4/6 and 4/20/88 in compliance with permit conditions. A list of the air pollutions permits applied for in 1988 is provided in Table 9.

WASTEWATER, STORMWATER, AND SURFACE DISCHARGE PROGRAMS

Wastewater Programs

Discharges to Publicly Owned Treatment Works (POTW). SNL, Albuquerque has about 15 miles of sewer lines which are interconnected with those of Kirtland Air Force Base. On August 31, 1986, SNL, Albuquerque submitted a wastewater discharge permit application. SNL, Albuquerque was granted its

Table 9. 1988 SNL, Albuquerque Air Pollution Permitting Activities

Permit No. or Type	Date Permit Issued	Permit Description
Top Soil Disturbance	4/11/88	"O" Street Extension & "M" St Parking Lot
Open Burning Tests	5/12/88 (extended 7/18/88)	Trupact II Pool Fire
	9/6/89 (prepared 10/31/88)	Additional Trupact II Pool Fire
	8/18/88 (extended 12/1/88)	Monsanto/Mound Shipping Container
	10/23/88	Interim Transportation Overpack Container
	10/26/88 (extended 12/1/88)	GE Wood Crib Fire
NESHAPs (Accelerators)		
	6/29/88	Hermes-III
	7/8/88	PT-2 SDF accelerator

first wastewater discharge permits by the City of Albuquerque, Liquid Waste Division, on January 19, 1987. Because SNL, Albuquerque has several connections with the KAFB sewer system, in addition to several discharge points of its own, five permits were issued. The permits were subsequently amended on July 31, 1987. Figure 11 identifies the waste water discharge sampling locations. Wastewater programs at SNL, Albuquerque are divided into two major areas, each driven by different statutory and regulatory requirements. Discharges by SNL, Albuquerque to Publicly Owned Treatment Works (POTWs) fall under the statutory purview of the Clean Water Act (as amended). Regulation of SNL, Albuquerque discharges to POTWs has been delegated by the USEPA to the City of Albuquerque, Liquid Waste Division under the authority of the City of Albuquerque Sewer Use and Wastewater Control Ordinance.

In order for the City of Albuquerque to stay in compliance with EPA regulations that implement the Clean Water Act, the City has implemented a pretreatment program. This pretreatment program requires SNL, Albuquerque to obtain permits for discharges to the City of Albuquerque POTW. These permits Specify (1) the required quality of the discharges, (2) requirements for periodic monitoring of the discharges, and (3) frequency and method of reporting the results of the monitoring.

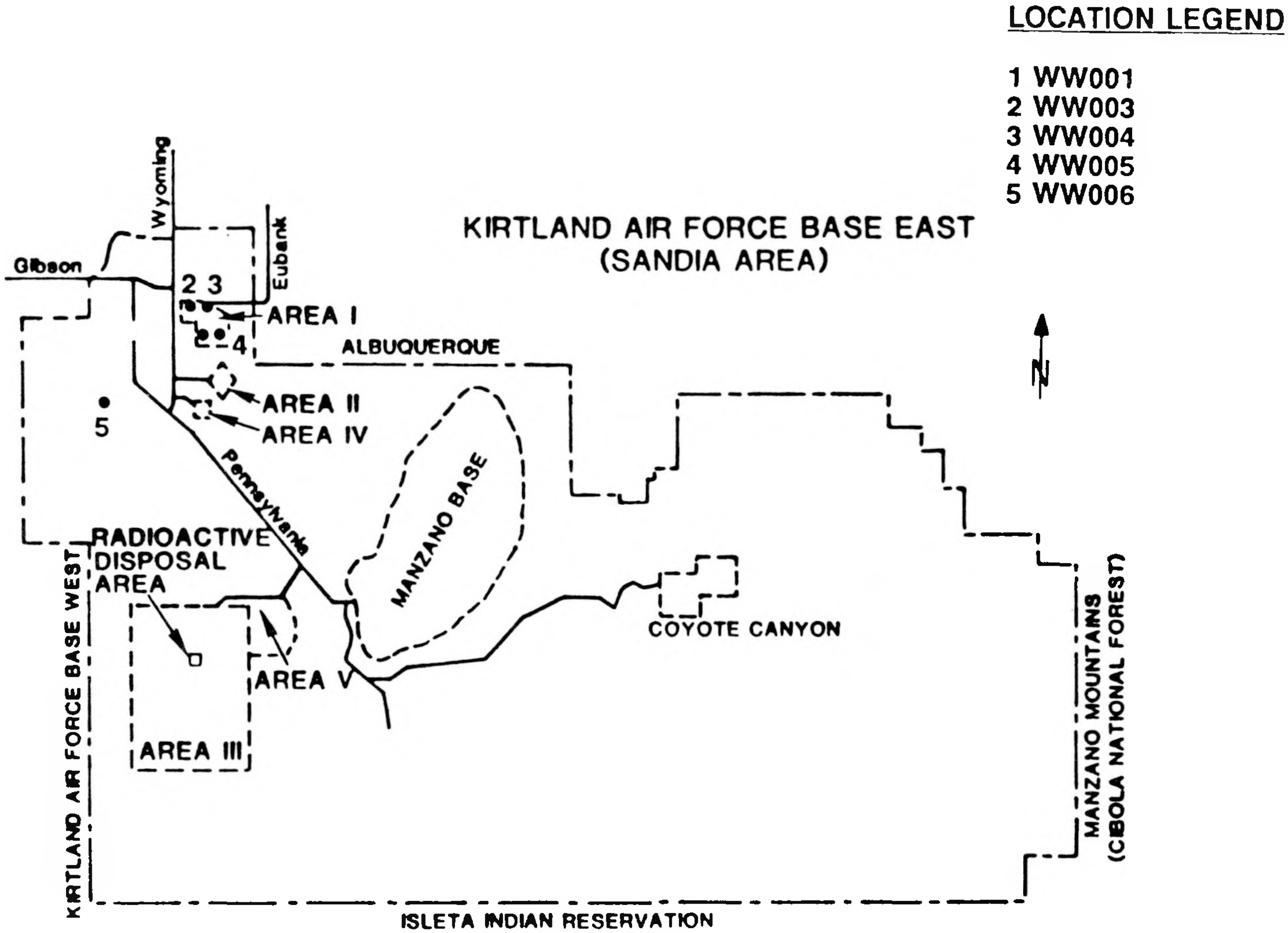

Figure 11. Wastewater Discharge Sampling Locations

During 1988, SNL, Albuquerque operated under five wastewater discharge permits issued by the City of Albuquerque, Liquid Waste Division. Three of the permits contained provisions for meeting categorical limits established by the U.S. Environmental Protection Agency (EPA). These wastewater discharge permits are identified in Table 10. The permits in Table 10 that have a 40 CFR designation in the "Issuing Agency" column contain EPA categorical discharge limitations.

Table 10. Wastewater Discharge Permits, Sandia National Laboratories, Albuquerque

Permit Number	Station Manhole	Wastestream Process	Issuing Agency	Permit Expiration
2069A	WW001	General	City of ABQ Ordinance	June 30, 1990
2069C-2	WW003	Electroplating/ printed circuit board	City of ABQ/ 40 CFR 413.84	June 30, 1990
2069D-2	WW004	Metal Finishing	City of ABQ/ 40 CFR 433.A15E	June 30, 1990
2069E	WW005	Electronics	City of ABQ/ 40 CFR Part 469.A	June 30, 1989
2069F	WW006	General	City of ABQ	June 30, 1990

Further details about the wastewater sampling program are found in Appendices B, D, E, and F. Appendix B.2 Table B.2 describes the sampling locations and brief characteristics of each; Appendix C.5 (Tables C.3 to C.8) describes sampling procedures and permit limits for individual sampling stations; Appendix D.2 provides analysis procedure numbers and detection limits for individual parameters; Appendix E briefly describes the wastewater sampling quality assurance program; and Appendix F Tables F.20 to F.27 provides the results of analyses on wastewater samples.

Discharge to POTWs: Compliance Summary. The discussion in this section addresses those instances in which the monitoring results reported in Appendix F were not in compliance with the permit limits described in Appendix C Tables C.3 to C.7.

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

During April, 1988 one pH measurement fell out of the pH 5.0-11.0 range allowed in the permit. No discharge-related explanation for the isolated pH of 2.2 could be found. It was the only pH excursion detected at sampling station WW001 during the calendar year.

Permit #2069C-2: Permit #2069C-2 is a permit that covers discharges from the categorically regulated printed circuit development activity in Building 841, SNL-Albuquerque Technical Area I. This permit is a renewal of Permit #2069C that expired in 1988.

The 24-hour composite sample collected from sampling station WW003 on April 18, 1988 showed a copper concentration of 42 mg/l, exceeding the one-day permit limit of 10.2 mg/l. This result also led to a four-day average concentration of 11 mg/l which exceeded the permit limit of 6 mg/l. Investigations by staff from Environmental Protection Division 3202 and management and staff from the cognizant SNL technical organization traced the permit violation to an operating procedure for replenishing the solutions in the copper plating baths. This procedure called for roughly one liter of concentrated plating solution to be removed from the tanks and replaced with fresh, concentrated plating solution. The plating solution removed from the tanks was discharged to the sanitary sewer, leading to the violation of permit limits for copper. The procedure was modified to provide for disposal of the removed plating solution by SNL's hazardous and chemical waste disposal program rather than discharge to the sanitary sewer. Training on the new procedure was provided to operating personnel. Plumbing changes were also made † provide for continuous, rather than batch discharge of plating rinse tanks. A Corrective Action Plan was submitted to the City of Albuquerque, Liquid Waste Division on December 9, 1988. The corrective actions proposed in the plan were approved by the City on December 15, 1988.

Permit #2069D-2: Permit #2069D-2 is a permit that covers discharges from the categorically regulated metal-plating research and development activity in Building 841, SNL-Albuquerque Technical Area I. This permit is a renewal of Permit #2069D that expired in 1988.

Copper

Sampling of wastewater from station WW004 by the City of Albuquerque on May 14 and 16, 1988 yielded copper concentrations of 11.8 mg/l and 17.9 mg/l respectively. These one-day concentrations exceeded the permit limit of 10.2 mg/l. SNL sampling at WW004 was within permit limits during the reporting period. Further, discussions with management and staff responsible for the operations that discharge to WW004 did not reveal any explanations for the excursions noted in the City sampling on May 14 and 16. Accordingly, the excursions were considered to by non-process-related failures of administrative controls. Administrative control procedures were reemphasized with responsible SNL management. The results of these evaluations and decisions were reported to the City of Albuquerque in the quarterly reports required by the permit.

pH

Starting in late spring, 1988 a series short duration, regular excursions from the allowable pH range of 5.0-11.0 were detected by the continuous pH monitoring equipment at station WW004. Typically, these excursions, with pH minima sometimes as low as 1.5, occurred Monday through Friday starting at about 8:00 a.m. with acidic spikes detected at roughly one-hour intervals until about 3:00 p.m. To determine whether the excursions were related to the regulated metal-plating activity, discharges from the plating rinse tanks were stopped for a one-day period. The regular pattern of pH excursions occurred even though discharges from the regulated activity were stopped. Non-regulated discharges from a paint shop, a cooling tower, and a film developing activity in buildings known or suspected to discharge to the same sanitary sewer line upstream of WW005, were evaluated and determined not to be the cause of the pH excursions. The source of these non-regulated process pH excursions was not determined by the end of the year. Investigations will continue; however, the excursions are not deemed to be of practical significance because the flow through station WW004 is low. The low pH excursions are not detected at station WW001 downstream of WW004. The status of these ongoing investigations is reported to the City of Albuquerque in the quarterly reports required by the permit.

Permit #2069E: Permit #2069E is a permit that covers the discharges from the categorically regulated semiconductor production activity conducted by Allied Signal Corporation, Albuquerque Microelectronics Operations (AMO) in Building 870, SNL-Albuquerque Technical Area I.

Fluoride

Analysis of samples collected from sampling manhole WW005 on March 2 and 4, 1988 showed fluoride concentrations of 47 mg/l and 50 mg/l respectively. These samples exceeded the permit one-day limit of 45 mg/l; these results also caused the 4-day average to exceed the permit limit of 30 mg/l. These limits are not categorical limits established by the EPA; rather, they are limits established by the City of Albuquerque under the authority of the Sewer Use and Wastewater Control Ordinance. Permit limits were also exceeded in samples from WW005 on April 6-7 with a fluoride concentration of 46 mg/l and on May 10-11 with a fluoride concentration of 60 mg/l.

Monthly sampling at station WW005 during June 1988, yielded fluoride concentrations of 68 mg/l on June 7-8, and 52 mg/l on June 9-10. These concentrations exceeded the permit one-day concentration limit of 45 mg/l. These results also led to a four-day average fluoride concentration of 35 mg/l which exceeded the permit limit of 30 mg/l.

Samples taken at station WW005 on July 26-27 showed a fluoride concentration of 56 mg/l, a concentration in excess of the 45 mg/l permit limit.

In August, the August 23-24 sample showed a fluoride concentration of 56 mg/l. Both this sample and the four-day average (34 mg/l) exceeded permit limits of 45 mg/l and 30 mg/l respectively.

As a result of the violations of the permit limits for fluoride discussed above, AMO conducted an extensive audit of plant operations. As a result of the audit, changes were made in the schedule for discharge of tanks containing hydrofluoric acid. This operational change successfully reduced the effluent fluoride concentration to less than permit limits during September through December, 1988.

As required by the permit, the City of Albuquerque was informed of the operational changes to reduce fluoride discharges.

pH

The pH of the effluent from station WW005 fell out of the pH 5.0-11.0 range allowed in the permit on numerous occasions from January through December, 1988. To correct these problems, changes are planned to the elementary neutralization unit (ENU) at AMO. These changes include:

1. The installation of a temporary chemical feed system that will allow better response to slug loads that enter the ENU.

2. Addition of two 2,000-gallon reactors to double the capacity to 4,000 gallons.

3. Addition of a redundant backup chemical feed control system.

4. A general upgrading of the control system.

5. Installation of a flow meter at the ENU discharge point.

The temporary chemical feed system is expected to be operational in January, 1989. The contract for installation of the long-term changes is expected to be awarded in February, 1989.

As required by the permit, the City of Albuquerque has been informed of these plans in quarterly reports.

Permit #2069F: Permit #2069F is a general permit that covers wastewater discharges from a portion of SNL-Albuquerque Technical Area I and some Kirtland Air Force Base Facilities.

The pH of the effluent from station WW006 fell out of the pH 5.0-11.0 range allowed in the permit on several occasions from July through November, 1988. In July and August, the excursions were attributed to the accumulation of debris on the pH probe. A shield was installed to prevent debris accumulation. Single, short duration pH excursions occurred in October and November. No source for these pH excursions was identified.

As discussed in Appendix C, annual sampling for all parameters is specified in SNL's wastewater discharge permits. Annual 24-hour composite sampling for all parameters specified in City permits was conducted during May, 1988. The results were all less than the concentration limits established by the permits. The results of the annual sampling analyses are contained in Table 11.

Table 11. Results of Annual Analyses SNL, Albuquerque Wastewater Sampling 24-Hour Wastewater Composite Samples Samples Collected May 17 and 18, 1988. All Results in mg/l Unless Otherwise Noted

Sampling Station	WW001	WW003	WW004	WW005	WW006
Parameter					
As	<0.01	<0.01	<0.01	<0.01	0.02
Ba	<0.2	<0.2	<0.2	<0.2	<0.2
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
$Cr_{(Total)}$	0.03	<0.01	<0.01	0.04	0.11
Cu	0.071	2.6	4.7	0.055	1.2
Hg	0.003	<0.0004	<0.0004	<0.0004	<0.0004
Mn	<0.015	<0.015	<0.015	0.015	0.019
Ni	<0.04	<0.04	<0.04	<0.04	<0.04
Pb	<0.05	<0.05	<0.05	<0.05	<0.05
Se	<0.005	<0.005	<0.005	<0.005	<0.005
Ag	<0.01	<0.01	<0.01	<0.01	0.10
Zn	<0.04	<0.02	<0.02	<0.02	0.11
Phenolic Compounds	<0.05	<0.05	<0.05	<0.05	<0.05
Oil & Grease	<5	<5	<5	<5	6.1
Fluoride	--	--	--	91	--
pH	7.5	7.1	7.1	7.3	7.2
Total Cyanide	<0.02	<0.02	<0.02	<0.02	0.03
Total Toxic Organics (TTO)	<0.02	<1.0	0.7	<0.005	<0.2
Total Metals (Cr+Cu+Ni+Zn)	<0.18	<2.67	<4.77	<0.16	<1.46

Discharges to Septic Tanks. In New Mexico these regulations are contained in Liquid Waste Disposal Regulations and New Mexico Water Quality Control Commission Regulations administered by the State of New Mexico Environmental Improvement Division.

SNL wastewater discharges to septic tanks are regulated by state agencies in New Mexico. In 1988, a survey was initiated to determine the regulatory requirements relating to septic tanks at SNL facilities. The results of this survey will be available in mid-1989 to guide appropriate SNL action with regulatory agencies.

Storm Water Programs

The discharge of storm water from SNL, Albuquerque facilities falls primarily under the statutory authority of the Clean Water Act (as amended) if the storm water is discharged to a surface receiving water designated as a water of the United States, such as Tijeras Arroyo which ultimately flows to the Rio Grande. For storm water, the provisions of this act are implemented by the EPA through the National Pollutant Discharge Elimination System (NPDES) described in 40 CFR 122. In New Mexico, NPDES permits are issued by the EPA with some review and concurrence responsibility assigned to the State of New Mexico. If storm water is discharged to a surface impoundment with no subsequent discharge to a receiving water, the discharges may fall under the permitting authority of state agencies concerned with groundwater protection.

During 1988 a survey was initiated to evaluate the regulatory status of storm water discharges from SNL, Albuquerque facilities. The results of this survey and evaluation should be available for program decision making during 1989.

In the Federal Register dated December 7, 1988, the EPA proposed changes to 40 CFR Parts 122, 123, 124, and 504. The proposed changes define NPDES permitting requirements for storm water discharges. The proposed regulations will be finalized sometime in 1990. Permits for storm water discharge from SNL, Albuquerque facilities may be required within one year after finalization of the proposed regulations.

Surface Discharge Programs

As discussed above, non-sanitary discharges to surface impoundments generally fall under the permitting authority of state agencies concerned with groundwater protection. If such discharges subsequently overflow to a receiving water designated as a water of the United States such as the Rio Grande or an arroyo that may flow to the Rio Grande, the NPDES permitting requirements of 40 CFR 122 will apply. In New Mexico, these NPDES permits are approved and issued by EPA.

Storm water discharge from oil-storage tank areas associated with SNL, Albuquerque's Pulsed Power Development Facilities in Technical Area IV is collected in two Lagoons. The discharge of water to these lagoons is regulated by the State of New Mexico, Environmental Protection Division, Groundwater Bureau under the authority of New Mexico Water Quality Control

Commission Regulations. A Discharge Plan (DP-530) was approved for these discharges in March, 1988. The approved Discharge Plan requires monthly measurement of water levels in each of the lagoons, and bi-monthly sampling and analysis for specified groundwater quality parameters (see Appendix C.6). Table G.5 describes the parameters and sample concentration limits specified in Discharge Plan DP-530. Reports containing the results of the monitoring are submitted quarterly to the State of New Mexico EID, Groundwater Bureau. During 1988, sampling was done in April, June, July, September, and November and water level was measured monthly from April through December.

Results of these analyses and measurements are shown in Appendix F, Tables 26 and 27. The results of the analyses of these samples were all less than the limits specified in Discharge Plan DP-530.

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OTHER ENVIRONMENTAL COMPLIANCE PROGRAMS

STATE AND USEPA ENVIRONMENTAL APPRAISALS

The Resource Conservation and Recovery Act requires state and federal environmental agencies to inspect federal facilities which generate and store hazardous waste. On July 17 and 18, 1988, the New Mexico EID and the Region VI EPA conducted a hazardous waste compliance inspection of Sandia National Laboratories, Albuquerque (SNL, Albuquerque).

A notice was issued on the following violations (which have since been corrected) of the New Mexico Hazardous Waste Act and the New Mexico Hazardous Waste Management Regulations (HWMR-5):

1. Two drums at the glass shop satellite accumulation area were not clearly marked as to contents.

2. There are no hazardous waste warning signs in Spanish at the chemical landfill.

3. The general facility Operating Plan does not include inspection schedules for the chemical landfill or the LIHET facility.

4. There are currently no inspections conducted at the chemical landfill.

5. An inspection log is currently not maintained at the chemical landfill.

NATIONAL ENVIRONMENTAL POLICY ACT COMPLIANCE

The National Environmental Policy Act requires preparation of environmental impact analyses for all federal actions that may adversely affect the environment. DOE Order 5440.1C and AL Order 5440.1B implement the NEPA requirements for DOE facilities under their jurisdiction.

An EIA for Sandia was prepared and released in 1977. Subsequently, Action Description Memorandums (ADMs), tiered to the EIA, are prepared for all major projects in accordance with the requirements of AL 5440.1B. Based on the ADM, the DOE will determine whether further NEPA documentation [an Environmental Assessment (EA) or Environmental Impact Statement (EIS)] is needed.

In March 1986, Sandia implemented procedures for preparation of ADMs as required by AL Order 5440.1B. The line organizations initiating proposed actions are responsible for preparing the ADMs, which are then reviewed by the Sandia Environment, Safety and Health Directorate.

Environmental Assessment

An Environmental Assessment (EA),[41] on the proposed Strategic Defenses Facility (SDF) at SNL, Albuquerque was published in July 1988 and distributed to the public for comment. The proposed SDF will enable SNL, Albuquerque to conduct experimental research leading toward future strategic defense systems. By memorandum of July 26, 1988, the Assistant Secretary for Environment, Safety and Health determined that the SDF EA satisfied the requirements of the National Environmental Policy Act (NEPA) and issued a Finding of No Significant Impact (FONSI).

Action Description Memoranda (ADMs)

Action Description Memoranda are used by DOE to determine the appropriate level of NEPA documentation for proposed actions.

The number of ADMs written in 1989 are expected to increase, since DOE now requires ADMs for General Plant Project (GPP) authorization requests. The 14 ADMs written in 1988 are listed in Appendix I.

ENVIRONMENTAL RESTORATION (ER) PROGRAM

The ER Program is a phased DOE program to identify, assess, and correct past spill, release or disposal sites at all DOE/AL facilities including Sandia National Laboratories, Albuquerque. The methodology parallels the EPA Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) program to identify, characterize, and cleanup release waste sites.

The identification of sites at the Albuquerque location was completed in 1987. The Installation Assessment report[39] identified 117 sites that will require further evaluation. Previously utilized properties located offsite were evaluated for environmental problems that would require action under the ER program. The Edgewood Test Site (ETS) is located 40 miles east of Albuquerque and was used from 1968 to 1979 as a ballistic test range for small mortars, electronic flyover operations and underground sonic locater tests. No sites were identified that required further evaluation under the ER program.[39] Other ER program activities are described in Appendix J.1.

The individual release sites identified in the Phase 1 installation assessment have been grouped together within geographic and event-related boundaries.[39] These groups of related release sites are called "tasks" for budget development and program tracking purposes. Table B.3 identifies the specific release sites that are assigned within an individual task. Figure 12 shows a map with the approximate locations of the groups of release sites assigned within each task.

The grouping of related potential release sites will allow the remedial investigation field work team to collect samples efficiently and cost-effectively. The geographically derived groups will also provide an opportunity to collect installation generic data on a regional basis during a single sampling campaign.

There is little information about source terms or migration of hazardous materials from release sites at SNL, Albuquerque. Thus, the methodology for prioritizing the tasks must be simplistic and not require detailed information.

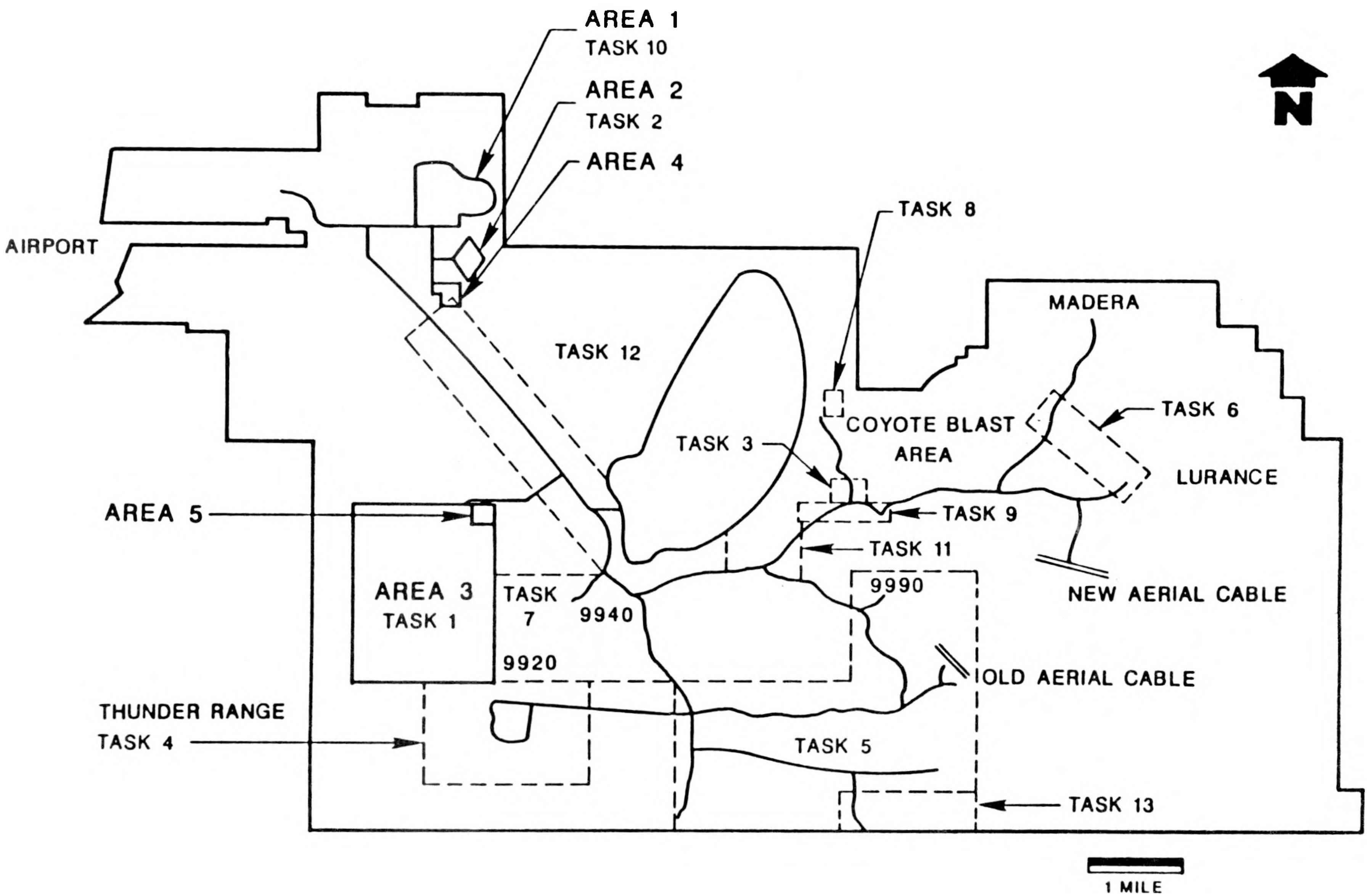

Figure 12. Task Map for Sandia National Laboratories, Albuquerque

The methodology selected to rank the tasks uses the available release site HRS scores developed in the installation assessment.[39] The HRS scores were developed using estimates for the rating factors on the characteristics of potential waste, conservative containment and migration pathway estimates, and reliable target/receptor information. Not all sites had sufficient information to score with the HRS. Thus, the tasks (groups of release sites) have been prioritized for remedial investigation/feasibility study work based on the magnitude of the HRS score that any one or more sites in the group may have.[40]

The tasks have been grouped according to priority. The high-priority tasks include release site HRS scores that are well above the HRS scores for potential release sites in the medium priority tasks. The low-priority tasks are composed of sites with insufficient information to rank with the HRS method. Table B.3 shows the results of the prioritization process, detailing the high-, medium-, and low-priority task groups and the HRS scores available for each potential release site.

NATIONAL RESPONSE CENTER REPORTING

As required by 40 CFR 302.6, Sandia is required to report certain releases of specific hazardous materials to the National Response Center (NRC). Each listed hazardous material has a threshold reportable quantity that must be exceeded to require this notification. The notification is required within 24 hours of the subject release.

During 1988 there were six releases of hazardous materials reportable to the National Response Center. All six releases were caused by the use of a NIKE rocket motor, which uses lead acetate as a component of the rocket propellant, in a sled track test. The threshold reportable quantity for lead is one (1) pound. The six releases were each of 3.73 pounds and were the result of tests conducted under the approval of an Action Description Memorandum (ADM) dated June 5, 1986. No corrective action can be taken to eliminate this type of release.

UNDERGROUND STORAGE TANKS (USTs) AND SPILL CONTROL

1988 was a year of increased activity for underground storage tanks (USTs). Final regulations for USTs containing petroleum or hazardous substances were published in the September 23, 1988 Federal Register to fulfill the requirements mandated by Section 9003 of RCRA. The effective date of the UST regulations (40 CFR Part 280-281) was December 22, 1988.

Efforts to develop an accurate inventory of tanks at SNL, Albuquerque resulted in a revised registration with the New Mexico Environmental Improvement Division (NMEID).

Table 12 summarizes the notifications to NMEID regarding USTS during 1988.

Twelve USTs were permanently closed by removal during 1988. Twelve tanks were closed and listed in Table H.1. Table H.2 lists the currently registered USTs.

Table 12. Notifications to NMEID Regarding USTs in 1988.

Month	NMEID Notifications - 1988
August 88	Revised the original 5-86 registration from 27 to 58 USTs. Paid 1988 fees.
October 88	Notification of removal of 5 USTs that were on the 5-86 registration and not on the 8-88 registration.
October 88	Notification of one UST to be removed.
November 88	Notification of three USTs to be removed.

Work was started in late 1988 on the development of a tank management plan.

An amendment was made on July 18, 1988 to the Spill Prevention Control and Countermeasures Plan (SPCC) in response to a finding in the Environmental Programs Appraisal Report. The SPCC Plan is required to be reviewed every three years and will be reviewed in 1989.

Work was started in late 1988 on a conceptual plan for waste minimization of waste oils and solvents.

WASTE MANAGEMENT PROGRAM

Hazardous and radioactive waste management programs at SNL, Albuquerque are administered by the SNL, Albuquerque Environmental Protection Division (3202) in compliance with pertinent EPA, DOT, and DOE regulations. A description of the program and detailed listing of waste generated is included in the annual Waste Management Site Plan[7] which is prepared each year for DOE in compliance with DOE Order 5820.2A.

<u>Hazardous Waste (RCRA)</u>. All RCRA wastes are transported off-site for disposal at EPA permitted facilities. The chemical waste landfill in Area III, used from 1962 through November 1985, is no longer used for disposal of hazardous materials. A closure plan for the facility was submitted to the State of New Mexico EID in May 1988. The Hazardous Waste Management Facility (HWMF) is in Bldgs 958 and 959, the construction of which was completed in January, 1988. The chemical wastes are transported to this facility for identification, analyses, bulking or segregation, packaging and storage. The packaged wastes are then transported to permitted commercial hazardous or industrial waste facilities for disposal. The commercial transporters and disposal facilities used in CY1988 are listed in Tables 13 and 14, respectively.

During CY1988, approximately 160,000 Kg of wastes (100,000 Kg of hazardous wastes and 60,000 Kg of non-hazardous industrial wastes) were generated at SNL, Albuquerque. The 100,000 waste packages ranged in size from a gram

Table 13. SNL, Albuquerque Hazardous Waste Transporters* Used in CY 1988

1. ENSCO, INC.
2. HAZMAT ENVIRONMENTAL GROUP INC
3. RINCHEM COMPANY, INC.
4. SAFETY-KLEEN CORP.
5. STAR MOTOR FREIGHT LINES, INC.
6. DELTA ENVIRONMENTAL

*Identification of these companies is not necessarily an endorsement of their services by SNL.

Table 14. SNL, Albuquerque Waste Disposal Facilities* Used in CY 1988

Disposal Facility	Treatment
1. BDT, INC.	- Hydrolysis of Reactive Metals
2. CHEMICAL WASTE MANAGEMENT, INC	- Encapsulation, Landfill
3. CONSERVATION SERVICES, INC.	- Non RCRA Waste Landfill
4. ENSCO, INC.	- Incineration
5. HYDROCARBON RECYCLERS, INC.	- Recycling
6. ROLLINS ENV SVCS, (TX) INC.	- Incineration
7. ROLLINS ENV SVCS, (LA) INC.	- Incineration
8. SAFETY-KLEEN CORP.	- Recycling
9. USPCI, GRASSY MT. UT	- Treatment, Encapsulation, Landfill

*Identification of these companies is not necessarily an endorsement of their services by SNL.

vial to a 55-gallon drum. Seventy-five percent of the wastes were lab-packed. Table 14 lists the disposal methods for the different types of wastes. Approximately 30% of the generated hazardous waste volume was recycled or reused.

Radioactive Waste. All low-level radioactive waste is currently disposed of at the Area III disposal facility. Approximately 183 cubic meters (40,758 kg) of low-level radioactive waste were disposed of in FY88. This waste consisted primarily of fission product and uranium contaminated waste (total of 25 curies). Any TRU waste generated at SNL, Albuquerque is packaged according to WIPP certification requirements and will ultimately be disposed of at WIPP. Wastes which are not TRU and do not meet the waste acceptance criteria for the Area III disposal facility will be transported and disposed of at a DOE authorized off-site disposal facility. A mixed waste packaging and storage facility is planned for future storage of mixed waste. The facility design was completed in 1988. Mixed waste will be transported to and disposed of at a EPA-approved facility when one becomes available.

Other Regulated Wastes. All Toxic Substances and Control Act (TSCA) regulated waste is transported and disposed of at an off-site EPA-permitted facility. A building in Area II is used for temporary storage of TSCA regulated waste, principally Polychlorinated Biphenyls (PCB), prior to off-site transport.

All waste oils at SNL, Albuquerque are sampled for PCB and other halogen content prior to disposal. Depending on the analyses, the oil can be recycled by a local firm, disposed as PCBs, or as hazardous waste by commercial EPA-permitted facilities. No PCB-contaminated items are disposed at salvage operations. All of the recycling and disposal facilities are inspected by SNL, Albuquerque for compliance with environmental regulations prior with the execution of any contractual agreements with the facilities.

The oils that are determined to be free of hazardous contaminants are picked up by a local oil recycler. The waste oils are dewatered, filtered and repackaged for resale. The oils that contain halogenated components, but no PCB's, are managed under the RCRA hazardous waste program. The remaining oils that are determined to contain PCBs are managed under the PCB waste management program. Waste PCB-containing oils and electrical equipment are stored in Building 920, which is a secured area located in Tech Area II. The storage facility conforms to 40 CFR 761 requirements for PCB storage as verified by an EPA inspection in March 1988. When sufficient PCB items are accumulated, a shipment to a commercial disposal facility is arranged. The PCB Standard Operating Procedure[42] was extensively revised in 1988 and will be issued in 1989.

A Toxic Substance Control Act (TSCA) PCB audit, conducted by EPA, took place on 5/18/88. No non-compliance items were reported to Sandia.

SNL, Albuquerque uses various types of oil-containing items within its facilities including transformers, generators, power supplies, and capacitors. In 1988 a Sandia-wide inventory of all oil-containing items was carried out to determine which items contained PCBs and to label items as to their PCB status. In this inventory, 10 areas and 605 buildings were surveyed. A following up survey is planned in 1989 to cover areas not surveyed in the 1988 survey and to ascertain current locations of PCB items still in use.

The 1987 survey covered the R&D oil containing items including non-utility transformers. Facilities Engineering inventories all utility transformers. The 1988 PCB survey involved locating and identifying oil-containing items, recording manufacturing data, collecting oil samples, compiling a computerized inventory, marking oil-containing items based on PCB content, and preparing a three volume report.[43]

A total of 431 oil samples were screened for PCB contamination in 1988 and 976 PCB-containing items (60,901 kg) were shipped to disposal facilities for chemical decomposition, thermal destruction or land filling as appropriate.

SNL, Albuquerque Facilities Engineering is retrofilling 21 electric utility transformers. The program involves replacing PCB oils with non-PCB oils and will be completed by October 1989. When completed the 21 PCB transformers will be classified as non-PCB and 6,631 gallons of PCB oils will have been removed. In addition to the retrofil program Facilities Engineering is replacing PCB utility transformers with non-PCB units. In 1988 40 PCB transformers containing a total of 2,404 gallons of PCB oils were replaced. As of December 7, 1988, 36 known PCB-filled transformers were located within SNL, Albuquerque. All PCB utility transformers are scheduled to be replaced by July of 1990.

MISCELLANEOUS ENVIRONMENTAL COMPLIANCE ACTIVITIES

Building 860 was surveyed for asbestos in 1989. The survey goal was to identify locations in the building where asbestos was used in construction. The information gathered was incorporated into a computer-base management system that is expected to provide the basis for any detailed surveys of this building that might be needed for future building renovation or modification. The methodology used in this survey may be useful in future asbestos surveys. Because the Building 860 survey was not an industrial hygiene survey, there was no health-related air monitoring for asbestos. Thus most sampling was by bulk methods. Air sampling was used only as an adjunct to bulk sampling methods in situations where bulk sampling was neither practical nor feasible. The survey report will be completed in 1989.

CONCLUSIONS

The program to monitor nonradioactive effluents has been further expanded at SNL, Albuquerque. This program now includes groundwater monitoring, wastewater monitoring, stormwater monitoring, and surface water monitoring.

In response to a NMEID Compliance Order, supplemental wells were installed at the Chemical Waste Landfill (CWL) as part of the Groundwater Monitoring Program. The existing wells installed in 1985 were alledged to be inappropriately contructed with excessive screen lengths penetrating an excessive length into the aquifer. The new wells will be sampled quarterly for one year to reestablish the background concentrations of Drinking Water Supply Parameters, Contamination Indicator Parameters and Groundwater Quality Parameters. Subsequent to the reestablishment of background water quality, these new wells will be used for semiannual detection monitoring. The original wells, which were utilized during 1987 and 1988, did not show any indication that contaminants from the CWL had impacted the quality of the groundwater beneath the site.

There were 19 violations of City of Albuquerque Wastewater Discharge Permits during CY1988. The section entitled "Discharges to POTWs: Compliance Summary," should be consulted for a discussion of these violations and associated corrective actions. There were no violations of the limits established by Surface Water Discharge Plan DP-530 during 1988.

Fourteen ADMs were written and reviewed to identify potential environmental impacts from new programs. In some cases no ADM was required and the proposed action was documented by a memo. One EA was prepared for a new facility at Area IV in 1988 and a Finding of No Significant Impact (FONSI) was issued by DOE headquarters in 1988.

The Environmental Restoration (ER) Program evaluated offsite properties for environmental problems that would require action under the ER Program. The Edgewood Test Site was found to have no ER problems that would require further action. The Salton Sea Test Base (see Appendix J-1) is currently under evaluation by the US Navy, and Sandia will support the US Navy with technical information and document review. The Kauai Test Facility (Appendix J.2) was found to have two sites that will require further action. The previously identified release sites located in Albuquerque were grouped into geographically and event-related tasks and prioritized for future evaluations.

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APPENDIX A

METEOROLOGY DATA

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Table A.1. Long-Term Historical Data (1951 to 1980) for the Albuquerque Area**

Month	Temperatures (°C) Daily Range Min	Max	Precipitation (cm) Water Equivalent	Wind Speed m/s	Wind Direction
JAN	-5.4	8.4	1.04	3.6	N
FEB	-3.4	11.6	1.02	4.0	N
MAR	-0.2	15.9	1.32	4.6	SE
APR	4.2	21.4	1.02	5.0	S
MAY	9.2	26.6	1.17	4.7	S
JUN	14.7	32.6	1.30	4.5	S
JUL	18.2	33.8	3.30	4.1	SE
AUG	17.1	31.9	3.84	3.7	SE
SEP	12.7	28.3	2.16	3.9	SE
OCT	6.2	22.1	2.18	3.7	SE
NOV	-0.7	14.0	0.97	3.5	N
DEC	-4.9	8.9	1.32	3.5	N

*The data were collected at the International Albuquerque Airport-Kirtland AFB, elevation 1.62 km. The original measurements have been converted to metric units.

**NOAA, Local Climatological Data, Annual Summary with Comparative Data, Albuquerque, New Mexico, 1983. Values are in parenthesis. Temperature and precipitation values are normals recorded for the 1951 to 1980 period. Wind direction is prevailing direction through 1963. Average wind speeds are reported.

Table A.2. Normals, Means, and Extremes, Albuquerque New Mexico for 1951 to 1980*.

NORMALS, MEANS, AND EXTREMES

ALBUQUERQUE, NEW MEXICO

LATITUDE: 35°03'N LONGITUDE: 106°37'W ELEVATION: FT. GRND 5311 BARO 05313 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	55.0	64.3	74.5	78.8	76.1	69.0	57.4	44.0	35.6	56.2
Extremes														
-Record Highest	46	69	75	85	89	98	105	105	101	100	91	77	72	105
-Year		1971	1972	1971	1965	1951	1980	1980	1979	1979	1979	1975	1958	JUN 1980
-Record Lowest	46	-17	-5	8	19	28	40	52	52	37	25	-7	3	-17
-Year		1971	1951	1948	1980	1975	1980	1985	1968	1971	1980	1976	1974	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	46	72	73	73	77	80	83	76	76	79	79	77	72	76
MEAN SKY COVER (tenths)														
Sunrise - Sunset	46	4.8	4.9	5.1	4.5	4.1	3.3	4.5	4.3	3.6	3.5	4.0	4.6	4.3
MEAN NUMBER OF DAYS:														
Sunrise to Sunset														
-Clear	46	12.9	11.3	11.2	12.8	14.7	17.9	12.0	13.8	16.8	17.5	15.1	13.9	170.0
-Partly Cloudy	46	7.8	7.8	10.0	9.4	10.2	8.6	14.3	12.4	7.7	7.6	7.7	7.5	111.2
-Cloudy	46	10.3	9.2	9.7	7.7	6.1	3.6	4.7	4.8	5.5	5.9	7.2	9.5	84.1
Precipitation														
.01 inches or more	46	3.9	4.0	4.5	3.3	4.3	3.7	8.8	9.3	5.7	4.8	3.3	4.0	59.8
Snow, Ice pellets														
1.0 inches or more	46	1.0	0.8	0.7	0.2	0.*	0.0	0.0	0.0	0.0	0.0	0.4	0.9	4.1
Thunderstorms	46	0.1	0.3	0.9	1.5	3.8	4.9	11.2	11.0	4.7	2.4	0.6	0.2	41.7
Heavy Fog Visibility 1/4 mile or less	46	1.2	1.0	0.6	0.2	0.*	0.*	0.1	0.*	0.1	0.3	0.6	1.4	5.6
Temperature °F														
-Maximum														
90° and above	25	0.0	0.0	0.0	0.0	2.6	17.4	24.0	16.9	4.3	0.2	0.0	0.0	65.3
32° and below	25	2.5	0.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.5	5.0
-Minimum														
32° and below	25	28.9	23.5	16.8	5.0	0.3	0.0	0.0	0.0	0.0	2.2	16.3	28.5	121.6
0° and below	25	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.6
AVG. STATION PRESS. (mb)	13	838.5	837.9	834.6	835.5	836.0	837.9	840.4	840.8	840.2	839.8	838.8	839.2	838.3
RELATIVE HUMIDITY (%)														
Hour 05	25	71	65	56	48	48	45	60	65	62	62	65	70	60
Hour 11 (Local Time)	25	51	44	34	26	25	23	34	39	40	38	42	50	37
Hour 17	25	41	32	25	18	18	17	27	30	31	30	36	43	29
Hour 23	25	62	52	44	35	34	32	47	52	52	50	55	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	46	1.32	1.42	2.18	1.97	3.07	1.71	3.33	3.30	1.99	3.08	1.45	1.85	3.33
-Year		1978	1948	1973	1942	1941	1967	1968	1967	1940	1972	1940	1959	JUL 1968
-Minimum Monthly	46	T	T	T	T	T	T	0.08	T	T	0.00	0.00	0.00	0.00
-Year		1970	1984	1966	1972	1945	1975	1980	1962	1957	1952	1949	1981	DEC 1981
-Maximum in 24 hrs	46	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	46	9.5	8.2	13.9	8.1	1.0				T	0.9	9.3	14.7	14.7
-Year		1973	1964	1973	1973	1979				1971	1979	1940	1959	DEC 1959
-Maximum in 24 hrs	46	5.1	4.2	10.7	6.6	1.0				T	0.9	5.5	14.2	14.2
-Year		1973	1946	1973	1973	1979				1971	1979	1946	1958	DEC 1958
WIND:														
Mean Speed (mph)	46	8.1	8.8	10.2	11.1	10.5	10.0	9.1	8.2	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 Mile														
-Direction (!!!)	44	E	NW	NW	S	W	SE	E	SE	SE	N	NW	SE	SE
-Speed (MPH)	44	61	68	80	72	72	82	68	61	62	66	57	90	90
-Year		1949	1944	1943	1946	1950	1946	1945	1951	1945	1959	1948	1943	DEC 1943
Peak Gust														
-Direction (!!!)	2	E	W	SW	SW	S	E	S	E	W	W	SW	E	SW
-Speed (mph)	2	41	63	58	64	54	48	58	47	61	51	52	46	64
-Date		1985	1984	1984	1984	1985	1985	1984	1984	1985	1984	1985	1984	APR 1984

*NOAA, Local Climatological Data, Annual Summary with Comparative Date, Albuquerque, New Mexico, 1985.

Table A.3. Summary Meteorological Data* for the Albuquerque Area in 1988**

Month	Temperatures (°C) Daily Range Min	Max	Precipitation (cm) Water Equivalent	Wind Speed m/s	Wind Direction
Jan	-5.0	0.8	0.38	3.8	N
Feb	-0.8	14.1	0.18	4.1	N
Mar	0.1	16.5	2.16	4.7	NW
Apr	5.0	20.7	3.61	4.3	SW
May	9.9	25.9	1.57	5.4	W
Jun	15.8	31.2	3.18	4.5	E
Jul	18.2	33.1	5.74	4.0	SE
Aug	17.6	30.1	8.36	3.4	SE
Sep	11.8	26.3	6.68	3.4	SE
Oct	8.1	24.2	0.81	3.2	E
Nov	-0.1	15.0	0.56	3.8	NW
Dec	-6.1	8.1	0.08	3.9	NE

*The data were collected at the International Albuquerque Airport-Kirtland AFB, elevation 1.62 km. The original measurements have been converted to metric units.

**NOAA, Local Climatological Data, Monthly Summaries, for January, 1988, through December 1988 - Wind direction is vector-averaged resultant values. Average wind speeds are reported.

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APPENDIX B

SANDIA ENVIRONMENTAL MONITORING LOCATIONS

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Table B.1. SNL, Albuquerque Environmental Monitoring Locations for Radioactive Effluents

Location Number	Location	Sample Description*	Type**
1	Pennsylvania Ave	S	V,S,T
2	Radioactive Waste Disposal Site NW	S	V,S,T
2 NE	Radioactive Waste Disposal Site NE	S	V,S
2 SE	Radioactive Waste Disposal Site SE	S	V,S
2 E	Radioactive Waste Disposal Site E	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	Area III, SE	S	V,S,T
7	Arroyo, N Area III	S	V,S,T
8	Corrales Bridge	C	V,S,W
9	Sedillo Hill, I-40 E of Albuquerque	C	V,S
10	Oak Flats	C	V,S,T
11	Isleta Pueblo, Rio Grande	C	V,S,T,W
12	Area III Well	S	W
13	Base Well 1	S	W
14	Base Well 2	S	W
15	Base Well 7	S	W
16	Four Hills	P	V,S,T
17	Base Well 14	S	W
18	North Perimeter Rd	P	T
19	Seismic Center Gate	P	V,S,T
20	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 Street	C	T
24	Corrales Fire Station	C	T
25	Placitas Fire Station	C	V,S,T
26	Alb. Fire Station 9, Menaul NE	C	T
27	Alb. Fire Station 11, Southern SE	C	T
28	Alb. Fire Station 2, High SE	C	T
29	Alb. Fire Station 7, 47th NW	C	T
30	Alb. Fire Station 6, Griegos NW	C	T
31	Area II Guard Gate	S	T
32	Area V, SW Corner***	S	T
33	Coyote Springs	S	V,S,W
34	Lurance Canyon	S	V,S
35	Chemical Waste Disposal Site	S	V,S
36	Base Well 4	S	W
37	Base Well 8	S	W
38	Base Well Lift Station to Manzano	S	W
39	NW DOE Complex	P	T
40	Area I NE by 852	P	T
41	Area V, NE fence	S	T
42	Area V, E fence	S	T
43	Area V, SE fence	S	T
44	Base Well 12	S	W
45	RMWF Site	S	V,S
46	AII south Corner	S	T
47	Tijeras Canyon East of AIV	S	T
48	Tijeras Canyon Northeast of AIV	S	T

*S = Sandia, P = Perimeter of Sandia, C = Community.
**V = Vegetation, S = Soil, W = Water, T = TLD (Thermoluminescent Dosimeters)
***Location 32 is inside controlled area and is not included in the environmental monitoring analysis.

Table B.2. SNL, Albuquerque Wastewater Sample Locations

Station Number	Location	Average* Flow (gpd)
WW001	South Area IV Tijeras Arroyo	326,000
WW003	Area I Bldg. 841 SW	15,000*
WW004	Area I Bldg. 841 SE	36,000
WW005	Area I Bldg. 870 SW	193,600
WW006	E. of KAFB Lagoons	788,000

* Approximate Average Flow Rate

Table B.3. Sandia National Laboratories, Albuquerque Environmental Restoration Program Sites

ER Program Task	ER Program Site No.	Site Name
I. HIGH PRIORITY TASKS		
AL-SA-RC-1 (RCRA Closures)	74.	Chemical Landfill
	76.	Radioactive Burial Site
AL-SA-1 (TA 3 and 5)	4.	Radioactive Surface Impoundment
	5.	Radioactive Seepage Basin
	18.	Storage and Salvage Yards
	26.	Burial Site (west fence of TA 3)
	31.	Elect. Transformer Oil Spill (Phase 5)
	34.	Centrifuge Oil Spill (Phase 5)
	35.	Vibration Facility Oil Spill (Phase 5)
	37.	PROTO Oil Spill
	51.	Bldg 6924 (pad, tank, pit)
	52.	Sandia Engineering Reactor
	78.	Gas Cylinder Disposal Pit
	83.	Sled Tracks
	100.	Bldg. 6620 HE Sump/Drain
	102.	Rad Disposal Site (E of TA 3)
	107.	Explosive Test Area (SE TA 3)
	111.	Bldg. 6715 Sump/Drains
AL-SA-19 (Septic Tanks)	48.	Bldg. 904
		Bldg. 906
		Bldg. 907
		Bldg. 6540/6542 Septic Tanks and Leach Field
		Bldg. 6630 Septic Tank and Leach Field
		Bldg. 9964 Septic Tank System
		Bldg. 9965 Septic Tank and Seepage Pit
		Bldg. 9967 Septic Tank and Seepage Pit
		Bldg. 9970 Septic Tank and Seepage Pit
		Bldg. 9972 Septic Tank and Leach Field
		Bldg. 9980 Septic Tank System
		Bldg. 9981/9982 Septic Tank and Leach Field
	49.	Bldg. 9820 Drains
	116.	Bldg. 9990 Septic Tank and Drain Field
	101.	Explosive Contaminated Sumps, Drains, and Drain Fields (Bldg. 9920)
		Bldg. 9925 Septic Tanks and Leach Field
		Bldg. 9927 Septic Tank and Seepage Pit

Table B.3. Sandia National Laboratories, Albuquerque Environmental Restoration Program Sites (Continued)

ER Program Task	ER Program Site No.	Site Name
		Bldg. 9930 Septic Tank and Seepage Pit
		Bldg. 9939/9939A Septic Tank and Seepage Pit
		Bldg. 9940 Septic Tank and Seepage Pit
		Bldg. 9950 Septic Tank and Leach Field
		Bldg. 9956 Septic Tank and Leach Field
		Bldg. 9960 Septic Tank and Seepage Pit
AL-SA-20 (Underground Storage Tanks)		Bldg. 6597 25,000 Gallon UST
AL-SA-2 (TA 2)	1.	Radioactive Burial Site
	2.	Classified Waste Disposal Trenches
	3.	Chemical Disposal Pit
	43.	Radioactive Storage Yard
	44.	Decontamination Site
	50.	Old Centrifuge Site
	113.	Area II Firing Sites
	114.	Explosives Burn Pit
II. MEDIUM PRIORITY TASKS		
AL-SA-3 (Coyote Cyn Blast Area)	8.	Open Dump
	58.	Coyote Canyon Blast Area
AL-SA-4 (Thunder Range)	6.	Gas Cylinder Disposal Pit
	17.	Scrap Yards/Open Dump
	54.	Pickax Site
	55.	Red Towers Site
	56.	Old Thunderwells
	79.	Gas Cylinder Disposal
	89.	Shock Tube Site
	90.	Beryllium Firing Site
	91.	Lead Firing Site
	110.	Thunder Range - Miscellaneous

Table B.3. Sandia National Laboratories, Albuquerque Environmental Restoration Program Sites (Continued)

ER Program Task	ER Program Site No.	Site Name
AL-SA-5 (Central Coyote Test Field)	11.	Radioactive/Explosive Burial Mounds
	19.	Scrap Yard (NW of old Aerial Cable)
	22.	Storage/Burn Area (W of DEER)
	57.	Workman Site (Phase 5)
	66.	Boxcar Site
	68.	Old Burn Site (Phase 5)
	70.	Explosive Test Pit (water towers)
	71.	Moonlight Shot Area
	87.	Bldg. 9990
	82.	Old Aerial Cable Site (scrap yard/dump/test area)
AL-SA-6 (Pendulum Area)	10.	Burial Mounds
	60.	Bunker Area
AL-SA-7 (Coyote Springs Area)	21.	Metal Scrap (Coyote Springs)
	27.	Bldg. 9820 - Animal Disposal Pit
	62.	Graystone Manor Site
	88.	Firing Site (SW of Coyote Springs)
III. LOW PRIORITY TASKS		
AL-SA-8 (SW Coyote Test Field)	14.	Burial Site (Bldg. 9920)
	38.	Oil Spill (Bldg. 9920)
	85.	Firing Site (Bldg. 9920)
	86.	Firing Site (Bldg. 9927)
	103.	Scrap Yard (Bldg. 9939)
	108.	Firing Site (Bldg. 9940)
	109.	Firing Site (Bldg. 9956)
	112.	Explosive Contaminated Sump (Bldg. 9956)
	115.	Firing Site (Bldg. 9930)
	117.	Trenches (Bldg. 9939)
AL-SA-9 (TA 1)	25.	Burial Site (S of TA 1)
	30.	PCB Spill (Reclamation Yard)
	32.	Steam Plant Oil Spill (Phase 5)
	33.	Motor Pool Oil Spill (Phase 5)
	41.	Bldg. 838 Mercury Spill
	96.	Storm Drain System

Table B.3. Sandia National Laboratories, Albuquerque Environmental Restoration Program Sites (Continued)

ER Program Task	ER Program Site No.	Site Name
AL-SA-10 (Lurance Canyon)	12.	Burial Site/Open Dump
	63.	Balloon Test Area
	65.	Lurance Canyon Explosive Test Site
	94.	Lurance Canyon Burn Site
	81.	New Aerial Cable Site (burial site/dump/test area)
	93.	Madera Canyon Rocket Launcher Pads Surface Impoundment
AL-SA-11 (Schoolhouse Mesa)	9.	Burial Site/Open Dump
	20.	Uranium Burn Site
	61.	Schoolhouse Mesa Test Site
AL-SA-12 (Tijeras Arroyo)	23.	Disposal Treches
	24.	Landfill/Open Dump
	45.	Liquid Discharge (behind TA 4)
	7.	Gas Cylinder Disposal (Arroyo del Coyote)
	16.	Open Dumps (Arroyo Del Coyote)
	40.	Oil Spill (6000 Igloo Area) (Phase 5)
	46.	Old Acid Waste Line Outfall
AL-SA-13 (South Coyote Test Field)	15.	Trash Pits (Frustration site)
	28.	Mine Shafts
	47.	Domed Bunker Outfall
	69.	Firing Pits (near USGS)

APPENDIX C

SAMPLE COLLECTION AND ANALYSIS

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C.1 SAMPLE COLLECTION FOR RADIOACTIVE EFFLUENTS

Samples are gathered and stored in accordance with methods described in DOE/EP-0023.[24] These procedures have been documented in the SNL, Albuquerque Environmental Monitoring Manual.[25] Native vegetation, soil, and water samples are collected annually at the end of the growing season. TLDs are exchanged quarterly (Table C.9).

Vegetation. Native vegetation samples are collected in late summer from a 9-m^2 area at each sample location. Since the native desert vegetation is sparse, a sample includes a mixture of species, with grass species predominating. Each sample weighs approximately half a kilogram and consists of stems and leaves representative of the species at each site. Consequently, radionuclide concentrations for vegetation include variability due to species uptake, retention, or deposition as well as location. Three samples are collected and composited at each location to ensure an adequate sample size for subsequent analysis. Replicate samples consisting solely of grasses were collected at each of three adjacent sample plots in order to estimate variability due to location. Each vegetation sample is cut and blended prior to radiochemical analysis for tritium and gamma spectrum analysis.

Water. Water samples are collected in acid-cleaned, plastic containers that have been rinsed in distilled water. Replicate samples of approximately 3.8 L of water are collected at each water sampling location. One sample is acidified immediately to 10% by volume with 2N HNO_3 and is used for total water radiochemical analysis.

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

Soil. Soil samples are randomly collected from the same 9-m^2 quadrat as the vegetation samples. Three 100-cm^2 samples of the top 5 cm of soil are collected and composited at each station. Each soil sample is dried, ball-milled, and sieved prior to a ^{137}Cs and uranium analysis. A separate aliquot is used for tritium analysis following EPA recommended procedures. Replicate (three) samples are collected at three or more locations to determine sample variability.

C.2 RADIOCHEMICAL ANALYSIS

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

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

Percent Moisture. Percent moisture for soil samples is determined in one of two ways. A moisture balance is used which provides a direct readout of percent moisture in 10 g of soil. An alternative method is to dry 10 g of soil at 110°C until a constant dry weight is reached. This weight is then used in calculating percent moisture.

Gamma Spectrum Analysis. Water, soil, and vegetation samples are analyzed according to American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE) Standard 680-1978 (Standard Techniques for Determination of Germanium Semiconductor Detector Gamma Ray Efficiency Using a Standard Marinelli Beaker Geometry). They are analyzed for gamma-emitting radionuclides by placing approximately 450 g of water, 862-g of soil, or 70 g of vegetation in 500-ml Marinelli beakers and counting for 1,000 min (100 min for soil) by using high-efficiency, high-resolution intrinsic Ge or Ge(Li) detectors and multi-channel analyzers. The vegetation samples are analyzed in a 250 ml geometry. The detectors are calibrated and checked routinely by using either a mixed radionuclide standard obtained from the National Bureau of Standards (NBS) or by using a standard for specific radionuclides traceable to NBS. The data are analyzed by computer software developed by Canberra Industries.

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

C.3 EXTERNAL PENETRATING RADIATION

TLDs are placed at 33 locations. The type of TLD phosphor used is LiF in chip form. All dosimeters are placed in open areas over soil substrates 1 m above ground level. A minimum of five TLDs are placed at each location in order to get an estimate of the variability in TLD response at that location. TLDs are exchanged on a quarterly basis. A dedicated set of environmental TLDs is maintained for this program.

All TLDs are annealed at 400°C for 1 h prior to field placement. Transit controls are used to document additional exposure received during transit from SNL, Albuquerque to field locations. The TLD readout equipment is calibrated by exposing TLDs to 0, 10, 20, 30, and 50 mR of ^{137}Cs midway through each quarterly field cycle. Ten TLDs are exposed at each level.

Procedures used in the SNL, Albuquerque environmental dosimetry program have been documented in the Dosimetry Procedures Manual.[36]

C.4 SAMPLE COLLECTION AND ANALYSIS FOR GROUNDWATER SAMPLES

Sampling protocol is as follows. Water level measurements are taken using a chalked tape. After four to 10 well volumes have been evacuated from each well, pumping is continued until pH, temperature and conductivity stabilize. The pH is considered stable when three consecutive measurements agree within 0.2 pH units. Temperature is considered stable when three consecutive measurements agree within 0.2°C. Conductivity is considered stable when two consecutive measurements agree within 10 micromhos. All groundwater samples are collected and preserved as described in Table C.1. Organic sample bottles are filled with a restricted water flow to minimize splashing which would volatilize low molecular weight compounds. Volatile aromatic organics are sampled by filling the bottle until a miniscus forms above the lip of the bottle to ensure no headspace. The concern is that the volatile materials will escape into the headspace and result in an erroneous reading. Because of the depth of the groundwater wells, dissolved carbon dioxide volatilizes when the samples are brought to the surface. The evolving carbon dioxide inevitably results in a headspace in the samples. This phenomena is documented in the field logs. EPA is reviewing the significance of headspace in samples containing organics.

For analysis, analytical methods described in USEPA (1982) and USEPA (1983) are used. If a method is not available in either of the above, an appropriate method from one of the standard references are used.

Inorganic analyses is performed primarily using Inductively Coupled Plasma Emission Spectrometry (ICP), Ion Chromatography and Graphite Furnace Atomic Absorption (GFAA). Organic analyses are performed primarily using Gas Chromatography and GC/MS.

SOURCES OF ERROR

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

pH

Since relatively small changes in parameter values may show a significant change, the data must reflect similar methods for collection and analysis, including calibration methods and corrections for changes in conditions affecting the measurement.

A review of the field data collection logs reveals that all pH measurements were made with a field pH instrument. Potential sources of error include temperature, gas exchange and suspension effects.

The meter was calibrated in the field using standard buffer solutions. A potential source of error for the pH measurements was thought to be in the calibration procedure if the buffer solutions were at a different temperature than the groundwater being measured. A review of the sensitivity of pH to temperature changes shows that the measurement is somewhat insensitive to temperature changes. Standard buffer solutions in the pH range near 7 will have a variation in pH of 0.02 to 0.03 units over a temperature range of 10 to 50°C. The field measurements of temperature of the solutions measured for pH ranged from 15 to 30°C.

Since it is not practical to make *in-situ* measurements of the groundwater pH, the sample must be brought to the surface. Two methods have been used to evacuate and sample the wells: pumping with a small diameter piston pump and bailing. The potential for having gas exchange occurring starts when the groundwater flows into the well bore and continues until the groundwater sample is measured at the surface. The use of the piston pump to purge and sample the well reduces the contact of the groundwater with the atmosphere. Generally, the water is pumped into a sample container and the pH is measured as soon as practical. Water collected by bailing in the well bore is generally surged and mixed with the atmosphere existing in the wellbore above the water. The water within the bailer is then removed and placed into a bucket. Both wells MW1 and BW1 are two inch wells that do not allow a pump to pass restricted zones within the casing. Thus, these two wells must be bailed for purging and sampling. The water in wells MW1 and BW1 was extremely turbid, therefore the suspension was allowed to settle for approximately 15 minutes prior to bailing. The loss or gain of certain volatile constituents that participate in controlling the solution pH, such as carbon dioxide and hydrogen sulfide, will alter the pH as a time dependent phenomenon. The absorption of CO_2 into the solution will generate carbonic acid, release hydrogen ions from carbonate-bicarbonate reactions, and an cause a decrease in the pH. The equilibrium pH due to the partial pressure of atmospheric CO_2 is about five.[35] Currently, the magnitude of this potential source of error for groundwater is not understood; however, a standard geochemistry textbook reveals a change of 1.5 pH units for a deaerated alkaline solution allowed to absorb atmospheric constituents.[35]

The effects of mineral suspensions on the results of a pH determination will also be an important source of error. Carbonate minerals such as calcite (limestone) and arragonite (caliche) will hydrolyze in solution releasing carbonate. The carbonate will remove hydrogen ions from the solution using the same carbonate-bicarbonate reaction noted above and act to increase the pH. The equilibrium pH due to calcite is about 9.5.[35]

The negative charges on the surfaces of clays will also be capable of removing hydrogen ions from solutions and increasing the pH. A small laboratory experiment was performed to determine the effect a clay found near the water table during the drilling of in well MW1A, just 50 feet to the west of MW1, on the pH of distilled water. The results showed that the addition of small amounts of the clay would linearly increase the pH from 7.2 to 8.9. Due to the large screen size and the necessity to bail MW1 for purging and sampling, well MW1 showed very high turbidity levels. During the February 1988 sampling event a measurement of the turbidity revealed a value of 8,400 NTU for MW1 and 3,100 for BW1.

Specific Conductivity

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

Statistical Assumptions

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

The CABF method was developed to analyze independent samples with unequal population variances. There has been much criticism of this method due to the inherently high false positive rate that the Environmental Protection Agency issued a final rule October 11, 1988 that amended the statistical tests required for groundwater monitoring.[36] The rule specifies five other tests, more appropriate to groundwater monitoring than the CABF method, for permitted facilities under Part 264. The EPA felt that most land disposal facilities would have permits by November 1988, and did not feel the need to modify the interim status regulations of Part 265.

Two sources have identified potential problems with using the CABF as a method to detect releases from a hazardous waste management unit. The Environmental Protection Agency (EPA) Technical Enforcement Guidance Document discusses t-tests available for facilities under interim status.[37] In that document, the authors detail an alternative t-test, the Averaged Replicate (AR) t-test, that is recommended as more appropriate than the CABF t-test for groundwater monitoring.

The October, 1988 Final Rule on statistical methods for groundwater monitoring[36] points out several reasons for rejecting the CABF method: (1) the replicate sampling method required by the regulations is not appropriate for the CABF method, (2) the CABF does not adequately consider the number of comparisons that must be made under the regulations, and (3) the CABF does not control for seasonal variations in parameter values. Concern arose regarding potential false positive errors and false negative errors exceeding reasonable rates for a regulated concern. As a result, four specific statistical tests, not including the CABF or the AR t-tests, and an option for the owner/operator to propose any other test were issued as a final rule on

October 11, 1988. Until Sandia certifies closure of the Chemical Waste Landfill and becomes a permitted facility requiring post-closure monitoring, the statistical tests must remain t-tests as specified in 40 CFR Part 265 for interim status facilities or by the NMEID.

C.5 SAMPLE COLLECTION AND ANALYSIS FOR WASTEWATER SAMPLING

The City of Albuquerque permits require that all parameters listed in Tables C.3 to C.7 be analyzed once each year. Stations WW001, WW004, WW005 and WW006 are monitored continuously for pH and flow. Station WW003 is monitored for pH in each of two grab samples taken during the four sampling days every month. Table C.8 describes the analytical methods used for each SNL permitted wastewater sampling station.

The sampling methods and procedures are detailed in the SNL, Albuquerque Wastewater Sampling Plan. Table C.2 summaries the SNL, Albuquerque wastewater sampling plan. Samples were collected at five locations (Table B.2). Methods used for sampling grab and composite samples are listed in Tables C.3 and C.4, respectively. Analytical methods and detection limits are listed in Table D.2 for each parameter. Monitoring requirements for each of the permitted stations may be separated into daily, monthly and yearly requirements. These requirements are summarized in Tables C.2 to C.7. Details about the parameters to be analyzed and the permit limits for each parameter are contained in Tables C.3 to C.7. Pollutants noted with an asterisk (*) on Tables C.3 to C.7 are analyzed in samples collected each month.

C.6 SAMPLE COLLECTION AND ANALYSIS FOR AREA IV LAGOONS

Approved Discharge Plan DP-530 requires monthly measurement of water level in each of the lagoons and bimonthly sampling for the water-quality parameters listed in Table G.5. The limits for these parameters are also shown in Table G.5.

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

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

Table C.1. Recommended Analytical Methods, Sample Containers, Preservation Techniques, and Holding Times for Groundwater

Parameter	Method No. SW-846[a]	Method Detection Limit	Container Type	Volume	Preservation[b]	Maximum Holding Time
Arsenic	7060	0.001 mg/l	P/G	500 ml	HNO_3 to pH <2	6 months
Barium	7080 6010	0.1 mg/l 0.002 mg/l	P/G	500 ml	HNO_3 to pH <2	6 months
Cadmium	7130 6010	0.005 mg/l 0.004 mg/l	P/G	500 ml	HNO_3 to pH <2	6 months
Total Chromium	7191 6010	0.001 mg/l 0.007 mg/l	P/G	500 ml	HNO_3 to pH <2	6 months
Iron	7380 6010	0.03 mg/l 0.007 mg/l	P/G	500 ml	HNO_3 to pH <2	6 months
Lead	7421	0.001 mg/l	P/G	500 ml	HNO_3 to pH <2	6 months
Manganese	7460 6010	0.01 mg/l 0.002 mg/l	P/G	500 ml	HNO_3 to pH <2	6 months
Mercury	7470	0.0002 mg/l	P/G	500 ml	HNO_3 to pH <2	6 months
Selenium	7740	0.002 mg/l	P/G	500 ml	HNO_3 to pH <2	6 months
Silver	7760 6010	0.01 mg/l 0.007 mg/l	P/G	500 ml	HNO_3 to pH <2	6 months
Sodium	7770 6010	0.002 mg/l 0.029 mg/l	P/G	500 ml	HNO_3 to pH <2	6 months
Gross Alpha	9310	3 pCi/l	P/G	1,000 ml	HNO_3 to pH <2	6 months

Table C.1. (Continued)

Parameter	Method No. SW-846[a]	Method Detection Limit	Container Type	Volume	Preservation[b]	Maximum Holding Time
Gross Beta	9310	4 pCi/l	P/G	1,000 ml	HNO_3 to pH <2	6 months
Total Radium	9315	3 pCi/l	P/G	1,000 ml	HNO_3 to pH <2	6 months
Endrin	8080	0.006 µg/l	AG, Teflon-lined cap	2x1,000 ml	Cool to 4°C, pH 5-9	7 days to extraction, 40 days after extraction
Lindane (gamma-BHC)	8080	0.004 µg/l	AG, Teflon-lined cap	2x1,000 ml	Cool to 4°C, pH 5-9	7 days to extraction, 40 days after extraction
Methoxychlor	8080	0.176 µg/l	AG, Teflon-lined cap	2x1,000 ml	Cool to 4°C, pH 5-9	7 days to extraction, 40 days after extraction
Toxaphene	8080	0.24 µg/l	AG, Teflon-lined cap	2x1,000 ml	Cool to 4°C, pH 5-9	7 days to extraction, 40 days after extraction
2,4-D	8150	1.2 µg/l	AG, Teflon-lined cap	2x1,000 ml	Cool to 4°C, pH 5-9	7 days to extraction, 40 days after extraction
2,4,5-TP Silvex	8150	0.17 µg/l	AG, Teflon-lined cap	1,000 ml	Cool to 4°C, pH 5-9	7 days to extraction, 40 days after extraction
Total Organic Carbon (TOC)	9060	1 mg/l	G, Teflon-lined cap	40 mlx4	Cool to 4°C, HCl or H_2SO_4 to pH <2	28 days
Total Organic Halogens (TOX)	9020	5 µg/l	AG, Teflon-lined septum	250 mlx4	Cool to 4°C, H_2SO_4 to pH <2	7 days
Phenols	9065	5 µg/l	G, Teflon-lined cap	1,000 mlx2	Cool to 4°C, H_2SO_4 to pH <2	28 days

Table C.1. (Continued)

Parameter	Method No. SW-846[a]	Method Detection Limit	Container Type	Volume	Preservation[b]	Maximum Holding Time
Chloride	9250/9251 EPA 300.0[c]	1 mg/l 0.015 mg/l	P/G	500 ml	None required, cool to 4°C	28 days
Fluoride	EPA 300.0[c] EPA 340.2[c]	0.005 mg/l 0.1 mg/l	P/G	500 ml	None required, cool to 4°C	28 days
Sulfate	9038 EPA 300.0[c]	1 mg/l 0.206 mg/l	P/G	500 ml	None required, cool to 4°C	28 days
pH	EPA 150-1[c]		P/G	500 ml	None required, cool to 4°C	Analyze immediately
Specific Conductance	EPA 120.1[c]		P/G	500 ml	None required, cool to 4°C	28 days
Turbidity	EPA 180.1[c]	<1 NTU	P/G	500 ml	Cool to 4°C	48 hours
Nitrate (as Nitrogen)	9200 EPA 300.0[c]	0.1 mg/l 0.013 mg/l	P/G	100 ml	Cool to 4°C	48 hours
Total Coliform Bacteria	9132	<1 colony/100 ml	P/G (sterilized)	250 ml	Cool to 4°C	6 hours

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

b Preservatives and holding times as specified in SW-846, Third Edition.

c EPA 1984, Methods for Chemical Analysis of Water and Wastewater, U.S. Environmental Protection Agency, EPA-600/4-84-017.

P - linear polyethylene

G - glass

AG - amber glass

HNO_3 - nitric acid

H_2SO_4 - sulfuric acid

HCL - Hazardous Substance List

NTU - nephlometer turbidity unit

Table C.2. Summary of Characteristics for SNL, Albuquerque Wastewater Sampling Stations

Station Number	Frequency	Flumes	Flow Meter and Sampling Equipment
WW001	4x/mo	3" Parshall	ISCO 2400 Flow Meter ISCO 2700 Sampling Leeds & Northrop pH Analyzer
WW003	4x/mo	none	ISCO 2700 Sampler
WW004	4x/mo	2" Parshall	ISCO 2400 Flow Meter ISCO 2700 Sampler Leeds & Northrop pH Analyzer
WW005	4x/mo	3" Parshall	ISCO 1870 Flow Meter ISCO 2700 Sampler Leeds & Northrop pH Analyzer
WW006	4x/mo	6" Parshall	ISCO 2400 Flow Meter ISCO 2700 Sampler Leeds & Northrop pH Analyzer

Table C.3. Pollutant Concentration Limits, Wastewater Discharge Permit 2069A, Sampling Station WW001

Pollutant	4-Day Average	1-Day Average	Grab Maximum
Phenols (ug/l)	1000	2000	4000
Silver (ug/l)	2000	3400	8000
Arsenic (ug/l)	500	800	2000
Barium (ug/l)	5000	7500	20000
Cadmium (ug/l)*	1000	1700	4000
Cyanide (mg/l)*	2	3.8	8
Chromium (ug/l)	5000	8800	20000
Copper (ug/l)*	6000	10200	24000
Mercury (ug/l)	20	40	100
Manganese (ug/l)	5000	7500	20000
Nickel (ug/l)	3000	4700	12000
Oil/Grease (mg/l)	50	75	150
Lead (ug/l)*	800	1200	3200
pH**			>5,<11
Selenium (ug/l)	500	800	2000
Temperature °F			<140
Total Metals (Cu, Cr)	1000	15400	40000
Total Toxic Org.	2100	3200	5000
Zinc (ug/l)*	7000	11300	28000

*Analyzed monthly
**Monitored continuously

Table C.4. Pollutant Concentration Limits, Wastewater Discharge Permit 2069C-2, Sampling Station WW003

Pollutant	4-Day Average	1-Day Average	Grab Maximum
Phenols (ug/l)	1000	2000	4000
Silver (ug/l)*	2000	3400	8000
Arsenic (ug/l)	500	800	2000
Barium (ug/l)	5000	7500	20000
Cadmium (ug/l)*	641.025	1098.9	4000
Cyanide (mg/l)*	641.025	1217.94	8000
Chromium (ug/l)*	5000	8800	20000
Copper (ug/l)*	5769.23	9615.38	24000
Mercury (ug/l)	20	40	100
Manganese (ug/l)	5000	7500	20000
Nickel (ug/l)*	2083.33	3285.25	12000
Oil/Grease (mg/l)	50	75	150
Lead (ug/l)*	732.6	1098.9	3200
pH**			>5,<11
Selenium (ug/l)	500	800	2000
Temperature °F			<140
Total Metals (Cu, Cr)*	1000	15400	40000
Total Toxic Org.	2100	1365.380	5000
Zinc (ug/l)*	4761.9	7692.3	28000

*Analyzed monthly
**Measured in two grab samples, four days each month

Table C.5. Pollutant Concentration Limits, Wastewater Discharge Permit 2069D-2, Sampling Station WW004

Pollutant	4-Day Average	1-Day Average	Grab Maximum
Phenols (ug/l)	1000	2000	4000
Silver (ug/l)*	436.3630	781.8180	8000
Arsenic (ug/l)	500	800	2000
Barium (ug/l)	5000	7500	20000
Cadmium (ug/l)*	371.428	985.714	4000
Cyanide (ug/l)*	650	860	
Chromium (ug/l)*	4275	6925	20000
Copper (ug/l)*	6000	10200	24000
Mercury (ug/l)	20	40	100
Manganese (ug/l)	5000	7500	20000
Nickel (ug/l)*	2975	4700	12000
Oil/Grease (mg/l)	50	75	150
Lead (ug/l)*	800	1200	3200
pH**			>5,<11
Selenium (ug/l)	500	800	2000
Temperature °F			<140
Total Metals (Cu, Cr)*	1000	15400	40000
Total Toxic Org.	2100	2130	5000
Zinc (ug/l)*	4228.57	7457.143	28000

*Analyzed monthly
**Monitored continuously

Table C.6. Pollutant Concentration Limits, Wastewater Discharge Permit 2069E, Sampling Station WW005

Pollutant	4-Day Average	1-Day Average	Grab Maximum
Phenols (ug/l)	1000	2000	4000
Silver (ug/l)	2000	3400	8000
Arsenic (ug/l)*	500	800	2000
Barium (ug/l)	5000	7500	20000
Cadmium (ug/l)*	1000	1700	4000
Cyanide (mg/l)	2	3.8	8
Chromium (ug/l)*	5000	8800	20000
Copper (ug/l)*	6000	10200	24000
Fluoride (mg/l)*	30	45	100
Mercury (ug/l)	20	40	100
Manganese (ug/l)	5000	7500	20000
Nickel (ug/l)*	3000	4700	12000
Oil/Grease (mg/l)	50	75	150
Lead (ug/l)*	800	1200	3200
pH**			>5,<11
Selenium (ug/l)	500	800	2000
Temperature °F			<140
Total Metals (Cu, Cr)*	1000	15400	40000
Total Toxic Org.	2100	11890	5000

*Analyzed monthly
**Monitored continuously

Table C.7. Pollutant Concentration Limits, Wastewater Discharge Permit 2069F, Sampling Station WW006

Pollutant	4-Day Average	1-Day Average	Grab Maximum
Phenols (ug/l)	1000	2000	4000
Silver (ug/l)	2000	3400	8000
Arsenic (ug/l)	500	800	2000
Barium (ug/l)	5000	7500	20000
Cadmium (ug/l)*	1000	1700	4000
Cyanide (mg/l)*	2	3.8	8
Chromium (ug/l)	5000	8800	20000
Copper (ug/l)*	6000	10200	24000
Mercury (ug/l)	20	40	100
Manganese (ug/l)	5000	7500	20000
Nickel (ug/l)	3000	4700	12000
Oil/Grease (mg/l)	50	75	150
Lead (ug/l)*	800	1200	3200
pH**			>5,<11
Selenium (ug/l)	500	800	2000
Temperature °F			<140
Total Metals (Cu, Cr)	10000	15400	40000
Total Toxic Org.	2100	3200	5000
Zinc (ug/l)*	7000	11300	28000

*Analyzed monthly
**Monitored continuously

Table C.8

SAMPLING AND ANALYTICAL METHODOLOGY
SANDIA NATIONAL LABORATORIES, ALBUQUERQUE
WASTEWATER MONITORING STATIONS

PARAMETER	WASTEWATER DISCHARGE PERMIT NO.	SAMPLING FREQUENCY	SAMPLE COLLECTION METHOD	EPA ANALYTICAL METHOD[a]	PRESERVATIVE	HOLDING TIME	CONTAINER TYPE
Arsenic	2069A	A	Flow-Composite[b]	206.3/200.7[c]	HNO_3 to pH<2	6 months	P,G
	2069C	A	Time-Composite[d]				
	2069D	A	Flow-Composite				
	2069E	M A	Flow-Composite				
	2069F	A	Flow-Composite				
Barium	2069A	A	Flow-Composite	208.1/200.7[c]	HNO_3 to pH<2	6 months	P,G
	2069C	A	Time-Composite				
	2069D	A	Flow-Composite				
	2069E	A	Flow-Composite				
	2069F	A	Flow-Composite				
Cadmium	2069A	M A	Flow-Composite	213.1/200.7[c]	HNO_3 to pH<2	6 months	P,G
	2069C	M A	Time-Composite				
	2069D	M A	Flow-Composite				
	2069E	M A	Flow-Composite				
	2069F	M A	Flow-Composite				
Chromium, total	2069A	A	Flow-Composite	218.1/200.7[c]	HNO_3 to pH<2	6 months	P,G
	2069C	M A	Time-Composite				
	2069D	M A	Flow-Composite				
	2069E	M A	Flow-Composite				
	2069F	A	Flow-Composite				
Copper	2069A	M A	Flow-Composite	220.1/200.7[c]	HNO_3 to pH<2	6 months	P,G
	2069C	M A	Time-Composite				
	2069D	M A	Flow-Composite				
	2069E	M A	Flow-Composite				
	2069F	M A	Flow-Composite				
Cyanide, total	2069A	M A	Flow-Composite	335.2/335.3[c]	Cool to 4 deg. C, NaOH to pH>12, 0.6g $C_6H_8O_6$/L	14 days	P,G
	2069C	M A	Time-Composite				
	2069D	M A	Flow-Composite				
	2069E	A	Flow-Composite				
	2069F	M A	Flow-Composite				

Table C.8

SAMPLING AND ANALYTICAL METHODOLOGY
SANDIA NATIONAL LABORATORIES, ALBUQUERQUE
WASTEWATER MONITORING STATIONS
(CONTINUED)

PARAMETER	WASTEWATER DISCHARGE PERMIT NO.	SAMPLE SAMPLING FREQUENCY	COLLECTION METHOD	EPA ANALYTICAL METHOD[a]	PRESERVATIVE	HOLDING TIME	CONTAINER TYPE
Fluoride	2069E	M A	Flow-Composite	340.2[c]	None required	28 days	G
Lead	2069A	M A	Flow-Composite	239.1/200.7[c]	HNO_3 to pH<2	6 months	P,G
	2069C	M A	Time-Composite				
	2069D	M A	Flow-Composite				
	2069E	M A	Flow-Composite				
	2069F	M A	Flow-Composite				
Manganese	2069A	A	Flow-Composite	243.1/200.7[c]	HNO_3 to pH<2	6 months	P,G
	2069C	A	Time-Composite				
	2069D	A	Flow-Composite				
	2069E	A	Flow-Composite				
	2069F	A	Flow-Composite				
Mercury	2069A	A	Flow-Composite	245.1[c]	HNO_3 to pH<2	28 days	P,G
	2069C	A	Time-Composite				
	2069D	A	Flow-Composite				
	2069E	A	Flow-Composite				
	2069F	A	Flow-Composite				
Nickel	2069A	A	Flow-Composite	249.1/200.7[c]	HNO_3 to pH<2	6 months	P,G
	2069C	M A	Time-Composite				
	2069D	M A	Flow-Composite				
	2069E	M A	Flow-Composite				
	2069F	A	Flow-Composite				
Oil and grease	2069A	A	Flow-Composite	413.1[c]	Cool to 4 deg. C, HCl to pH<2	28 days	P,G
	2069C	A	Time-Composite				
	2069D	A	Flow-Composite				
	2069E	A	Flow-Composite				
	2069F	A	Flow-Composite				

Table C.8

SAMPLING AND ANALYTICAL METHODOLOGY
SANDIA NATIONAL LABORATORIES, ALBUQUERQUE
WASTEWATER MONITORING STATIONS
(CONTINUED)

PARAMETER	WASTEWATER DISCHARGE PERMIT NO.	SAMPLING FREQUENCY	SAMPLE COLLECTION METHOD	EPA ANALYTICAL METHOD[a]	PRESERVATIVE	HOLDING TIME	CONTAINER TYPE
pH	2069A	C		150.1/150.2[c]	None required	analyze immediately	P,G
	2069C	(e)					
	2069D	C					
	2069E	C					
	2069F	C					
Phenolics	2069A	A	Flow-Composite	420.1/420.2[c]	Cool to 4 deg. C, H_2SO_4 to pH<2	28 days	P,G
	2069C	A	Time-Composite				
	2069D	A	Flow-Composite				
	2069E	A	Flow-Composite				
	2069F	A	Flow-Composite				
Selenium	2069A	A	Flow-Composite	270.3/200.7[c]	HNO_3 to pH<2	6 months	P,G
	2069C	A	Time-Composite				
	2069D	A	Flow-Composite				
	2069E	A	Flow-Composite				
	2069F	A	Flow-Composite				
Silver	2069A	A	Flow-Composite	272.1/200.7[c]	HNO_3 to pH<2	6 months	P,G
	2069C	M A	Time-Composite				
	2069D	M A	Flow-Composite				
	2069E	A	Flow-Composite				
	2069F	A	Flow-Composite				
Temperature	2069A	A	Grab	170.1[c]	None required	NA	P,G
	2069C	M A	Grab[e]				
	2069D	A	Grab				
	2069E	A	Grab				
	2069F	A	Grab				
Zinc	2069A	M A	Flow-Composite	289.1/200.7[c]	HNO_3 to pH<2	6 months	P,G
	2069C	M A	Time-Composite				
	2069D	M A	Flow-Composite				
	2069E	M A	Flow-Composite				
	2069F	M A	Flow-Composite				

Table C.8

SAMPLING AND ANALYTICAL METHODOLOGY
SANDIA NATIONAL LABORATORIES, ALBUQUERQUE
WASTEWATER MONITORING STATIONS
(CONTINUED)

PARAMETER	WASTEWATER DISCHARGE PERMIT NO.	SAMPLE SAMPLING FREQUENCY	COLLECTION METHOD	EPA ANALYTICAL METHOD[a]	PRESERVATIVE	HOLDING TIME	CONTAINER TYPE
TOTAL TOXIC ORGANICS:[g]							
Volatile compounds	2069A	A	Flow-Composite[h]	624[i]	Cool to 4 deg. C, 0.008% $Na_2S_2O_3$	14 days	AG, Teflon-faced silicone septa, no headspace
	2069C	A	Time-Composite[h]				
	2069D	A	Flow-Composite[h]				
	2069E	A	Flow-Composite[h]				
	2069F	A	Flow-Composite[h]				
BNA Extractable compounds	2069A	A	Flow-Composite	625[i]	Cool to 4 deg. C, 0.008% $Na_2S_2O_3$	7 days[j]	AG, Teflon-lined cap
	2069C	A	Time-Composite				
	2069D	A	Flow-Composite				
	2069E	A	Flow-Composite				
	2069F	A	Flow-composite				
Pesticides	2069A	A	Flow-Composite	608[i]	Cool to 4 deg. C, pH 5-9	7 days[j]	AG, teflon-lined cap
	2069C	A	Time-Composite				
	2069D	A	Flow-Composite				
	2069E	A	Flow-Composite				
	2069F	A	Flow-Composite				
Polychlorinated biphenyls	2069A	A	Flow-Composite	608[i]			AG, teflon-lined cap
	2069C	A	Time-Composite				
	2069D	A	Flow-Composite				
	2069E	A	Flow-Composite				
	2069F	A	Flow-Composite		Cool to 4 deg. C pH 5-9	7 days[j]	

Table C.8

SAMPLING AND ANALYTICAL METHODOLOGY
SANDIA NATIONAL LABORATORIES, ALBUQUERQUE
WASTEWATER MONITORING STATIONS
(CONTINUED)

NOTES

(a) Alternate EPA approved analytical methods are listed in 40 CFR Part 136.3, Table 1B.

(b) 24 Hour flow proportional composite sample collected with an ISCO 2700R sampler interfaced to an ISCO 2400 flow meter. Sample maintained near 4°C during sample collection. Specific sample collection techniques are identified in the draft SNLA Wastewater Sampling Plan (Oct. 1987).

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

(d) 24-hour time-weighted composite sample collected using an ISCO 2700 portable sampler. Sample collection container iced during sample collection.

(e) Two grab samples collected and measured for pH and temperature each day of monthly sample collection.

(f) Continuous monitoring with a Leeds and Northrup 200 series pH monitoring system.

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

(h) Volatile organic fraction collected each 12-hour interval during annual sample collection.

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

(j) Holding time is 40 days after extraction.

A - Annually
AG - Amber glass
C - Continuous monitoring
G - Glass
M - Monthly
NA - Not Applicable
P - Plastic, for metals polyethylene with polypropylene cap

Table C.9. Sampling Frequencies and Types of Analysis for Radioactive Effluent Monitoring Program

	Sample Media				
			Water		
Parameter	Vegetation	Soil	Total	Filtered*	TLDs
Number of Locations	22	22	11	11	33
Number of Samples	28	28	11	11	165
Sample Frequency	Annual	Annual	Annual	Annual	Quarterly
Analysis Performed					
Gross α			X	X**	
Gross β^-			X	X**	
U_{tot}		X	X	X	
Gamma Spec.	X	X	X	X	
Tritium	X	X	X	X	
Other (TLD)					X
Number of Analysis	84	84	55	77	165

*These water samples are filtered for analysis of suspended solids as well as water for selected analysis.

**Analysis performed on suspended solids in addition to water.

APPENDIX D

MINIMUM DETECTION LIMITS

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Table D.1. Radiochemical Analysis Minimum Detection Limits (MDL)

Analysis	Method	Sample Type	Sample Size	MDL Value	MDL Units	Count Time Minutes
^{3}H	Liquid Scintillation	Water	1 ml	0.45	pCi/ml	
U_{tot}	Flourescence	Water	1 ml	1.5×10^{-3}	μg/ml	
		Soil	1 g	1.2×10^{-2}	μg/ml	
Gross α	Gas Proportional	Water	100 ml	1.8×10^{-3}	pCi/ml	100
		Water	400 ml	4.4×10^{-3}		
Gross β	Gas Proportional	Water	100 ml	5.5×10^{-3}	pCi/ml	100
		Water	400 ml	1.4×10^{-3}		
^{137}Cs	Gamma Spectral* Analysis	Water	450 ml	5.0×10^{-3}	pCi/ml	1000
		*Vege.	70 g	5.0×10^{-2}	pCi/g	1000
		*Soil	450 ml	1.0×10^{-2}	pCi/g	100
^{40}K	Gamma Spectral* Analysis	Water	450 ml	1.0×10^{-1}	pCi/ml	1000
		*Vege.	70 g	9.0×10^{-1}	pCi/g	1000
		*Soil	450 ml	2.0×10^{-1}	pCi/g	100

*Soil and vegetation sample size is geometry volume. Sample mass varies from sample to sample. The Marinelli water standard is a 450 ml standard. The Marinelli soil standard is 783 g.

*Soil and water were analyzed using a PGT Intrinsic/Germanium Detector. Vegetation was analyzed using a Canterra Ge(Li) Detector.

Table D.2

ANALYTICAL METHODS, DETECTION LIMITS, AND QUALITY CONTROL ACCEPTANCE CRITERIA FOR ANALYSIS OF WASTEWATER SAMPLES

PARAMETER	EPA ANALYTICAL METHODS[a]	DETECTION LIMITS (μg/ℓ)	QUALITY CONTROL ACCEPTANCE CRITERIA		
			MATRIX SPIKE (% RECOVERY)	DUPLICATE SAMPLE (RPD)	CHECK SAMPLE (% RECOVERY)
Inorganics and Wet Chemistry:					
Arsenic	206.3/200.7	2/53	75-125%	±20 for values greater than 5 times the MDL; ± MDL for values less than 5 times the MDL[b]	80-120%
Barium	208.1/200.7	100/2	75-125%		80-120%
Cadmium	213.1/200.7	5/4	75-125%		80-120%
Chromium	218.1/200.7	50/17	75-125%		80-120%
Copper	220.1/200.7	20/6	75-125%		80-120%
Cyanide, Total	335.2/335.3	20	75-125%		80-120%
Fluoride	340.2	100	75-125%		80-120%
Lead	239.1/200.7	100/42	75-125%		80-120%
Manganese	243.1/200.7	10/2	75-125%		80-120%
Mercury, Total	245.1	0.2	75-125%		80-120%
Nickel	249.1/200.7	40/15	75-125%		80-120%
Oil and Grease	413.1	5000/200	75-125%	(c)	80-120%
Phenolics	420.1/420.2	5	75-125%		80-120%
Selenium	270.3/200.7	2/75	75-125%		80-120%
Silver	272.1/200.7	10/7	75-125%		80-120%
Zinc	289.1/200.7	5/2	75-125%		80-120%
Organics:					
Volatiles	624	(d)	(e)	(f)	(g)
Base Neutral and Acid extractables	625	(d)	(e)	(f)	(g)
Pesticides and PCBs	608	(d)	(e)	(f)	(g)

Notes:

(a)Alternate EPA approved analytical methods are listed in 40 CFR Part 136.3, Table 1B.

(b)If one result is above the 5 x MDL level and the other is below, use the ± MDL criteria.

(c)None specified. Precision of Oil and Grease analysis is highly dependent on field sampling methods.

(d)Detection limits are compound specific; see analytical method.

(e)Matrix Spike acceptance criteria limited to compounds identified in Contract Laboratory Program Protocol.

(f)Duplicate sample acceptance criteria compound dependent; see analytical method.

(g)Check sample acceptance criteria compound dependent; see analytical method.

RPD - Relative Percent Difference

MDL - Method Detection Limit

References:

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

EPA, 1987, Title 40, Code of Federal Regulations, Part 136, "Guidelines for Establishing Test Procedures for the Analysis of Pollutants."

EPA, October 1986, "Contract Laboratory Program, Statement of Work, Inorganic Analysis," SOW No. 786.

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APPENDIX E

QUALITY ASSURANCE

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E.1 ENVIRONMENTAL SAMPLE - QUALITY ASSURANCE

RADIOACTIVE ANALYSIS

The collection and analysis of environmental samples is done according to procedures described in the SNL, Albuquerque Environmental Monitoring Manual[25] and in accordance with methods described in DOE/EP-0023.[24]

Samples collected at each location are identified with a unique sample number which is assigned to a particular location and is entered into a sample log book at the time of collection. A sample description, date, location description and location number is also entered for each sample as well as the name of the collector. Samples are then transferred to the chemistry laboratory and an analytical request form is completed for each type of analysis requested. Sample numbers are listed on each form. The chemistry staff then assigns a chemical analysis log number to each sample. All analytical data is reported using the log numbers as a reference. These log numbers are later entered into the environmental monitoring data bases which list sample numbers, sample locations, analytical log numbers and associated data.

Samples are analyzed using standard procedures. Instruments are calibrated using approved methods and NBS standards. Lower limits of detection and analytical procedures are reviewed periodically to ensure samples are prepared and analyzed in accordance with current recommendations. Lower limits of detection listed in DOE/EP-0023 are used as a guide in sample analysis.

Laboratory quality assurance is verified through successful participation in intercomparison programs sponsored by EPA and DOE (Table E.1).

Multiple or replicate samples are collected at several locations to provide an estimate of the variability associated with each location (Table E.2). This would include sample collection and analytical variability as well as variability due to location. Samples with low activity (near MDL) typical of most environmental samples tend to have a large variability. Samples with high variability are investigated.

Sample analysis results are evaluated according to standard procedures. The data is reviewed and compared to previous years data. Unusual or unexpected results are further evaluated.

NONRADIOACTIVE ANALYSIS

During CY1988, SNL, Albuquerque generated 1457 non-radioactive environmental samples. Ninety percent of the samples were analyzed by commercial laboratories, while the balance was analyzed in-house by Div. 3211. Table E.3 lists the types, number of samples, and analyses requested. Table E.4 lists the commercial laboratories that analyzed samples for SNL, Albuquerque. In October 1988, SNL, Albuquerque entered into 4-year contracts with two commercial laboratories. The contracts stipulate that the labs implement and report QA with the analytical results. Concomitantly, SNL, Albuquerque began its own QA program where splits, blanks and check samples are submitted along with unknown samples. The QA data for wastewater, groundwater, and soils will be reported for CY1989.

E.2 GROUNDWATER SAMPLE - QUALITY ASSURANCE

Quality control includes the analytical laboratory's routine quality control procedure, which is audited by EPA through the CLP program. Also, blanks and replicate samples are submitted with all field samples. A field blank and transfer blank are submitted with each sample submitted for volatile organic analysis.

Sample labels are filled out and affixed to the sample containers before field sampling. Labeled and prepared containers for all sampling constituents are placed in a labeled box for each well. A Chain-of-Custody form accompanies all samples from the time they are collected until they are disposed of after analyses and reporting. A sample analysis request form accompanies all samples delivered to the lab. The field portion of the form is completed by the sample collector; the laboratory portion is completed by laboratory personnel.

Samples are normally shipped directly to the laboratory in an ice chest on the day of collection. If they cannot be delivered on the day of collection, they are stored in a sealed refrigerator in a locked building.

E.3 WASTEWATER SAMPLE - QUALITY ASSURANCE

A Wastewater Sampling Plan for SNL, Albuquerque has been completed. The Plan describes procedures, equipment maintenance, sample logs, sample frequencies, chain of custody, analytical methods, data storage and reporting, and the quality assurance program.

Contractor laboratory inspections are conducted before an analysis laboratory is selected. Trip blanks, check samples and replicates are submitted with the wastewater samples for analyses. Details and results of the SNL wastewater sample QA program will be reported in CY1989.

SURFACE-DISCHARGE LAGOON SAMPLE QUALITY ASSURANCE

Methods used to assure the quality of the data generated from this sampling and analysis program include trip blanks, method blanks and spiked surrogate recovery samples. Results of analyses associated with these quality assurance samples were within acceptable limits.

As discussed in Section E.1 SNL indicated an internal quality assurance program for environmental samples in late CY 1988. Details of this program and results of the analyses will be reported in CY 1989.

E.4 PCB QUALITY ASSURANCE

During the 1988 survey of in-use PCB inventory, approximately 154 field and 20 QA samples were submitted for analyses over a period of 6 months. Table E.5 lists the types and quantities of QA samples submitted. The results of the QA samples are listed in Tables E.6 and E.8.

Table E.6 indicates that the laboratories found negative PCBs in the blanks. Split field samples (C1 and C2) were submitted to test laboratory precision. As indicated in Table E.7, except for sample no. 50, the relative percent differences (RPD) were within 31%. It is postulated that the low concentration PCBs are more difficult to detect and quantify resulting in the 160% RPD for sample no. 50. Spiked samples at two different concentrations prepared by SNL, Albuquerque were also submitted to test for laboratory accuracy (Table E.8). One lab, A, was within 4% of the spiked value(s) in all three samples. Lab B was within 30% of the spiked value(s) in the three samples. These results suggest that Lab A may be superior in its PCB analytical accuracies.

E.5 ASBESTOS QUALITY ASSURANCE

During 1988, a pilot survey of asbestos in Bldg. 860 was conducted. The survey included 106 samples for asbestos determination. One sample was split into 6 samples (B3 through B8). One each sample was submitted to two laboratories (L1 and L2) on 9/23/88. Later, on 11/24/88, the laboratories each received two more of the split sample. Table E.9 lists the results of the analyses. The analyses results are qualitative and are determined by observation only. The results are provided as percent asbestos for two forms of asbestos (Chrysotile (C) and Anosite (A)).

As shown, each individual laboratory reported identical results for the three samples they received. However, the results between the two laboratories were slightly different. Evaluation related to this variation may include:

Natural Variability and Repeatability of Results - The results indicate that the natural variability of the samples was low because identical results were observed between the 9/23 and 11/24 samples. More precisely, the materials appear to be homogeneous within the immediate area of the samples. This is probably a correct conclusion because the isulator or manufacturer probably had a uniform process to produce each insulation type. The results, therefore, are repeatable if the laboratory method is repeatable.

Precision of the Laboratory Method - The results within each individual laboratory are very repeatable. That is, the intra-laboratory precision is very high. Because differences were observed between the two laboratories, the interlaboratory precision is not as high. No published precision and accuracy statements are available, however, the differences observed are within the average accuracy and precision of the method used.

Table E.1. 1988 Quality Assurance Results for Selected Radiochemical Analysis

Analysis	Units	Sample Type	Date	QA Program	Program Value	Sandia Value	Ratio**
Gross α	pCi/l	Water	09/23/88	EPA	8 ± 5	9 ± 1	1.13
		Water	05/20/88	EPA	11 ± 5	11 ± 1	1.00
		Water	01/22/88	EPA	4 ± 5	5.3 ± 0.6	1.33
Gross β^-	pCi/l	Water	09/23/88	EPA	10 ± 5	12.7 ± 0.6	1.27
		Water	05/20/88	EPA	11 ± 5	17 ± 1	1.55
		Water	01/22/88	EPA	8 ± 5	9.7 ± 0.6	1.21
^{3}H	pCi/l	Water	10/14/88	EPA	2316 ± 350	1903 ± 179	0.82
		Water	02/17/88	EPA	3327 ± 362	3491 ± 179	1.05
	pCi/ml	Water	03/01/88	DOE	20.7	19.2	0.93
^{137}Cs	pCi/l	Water	10/07/88	EPA	15 ± 5	16 ± 3	1.07
	pCi/l	Water	06/03/88	EPA	25 ± 5	27 ± 1	1.08
	pCi/l	Water	02/05/88	EPA	94 ± 5	99 ± 1	1.05
	pCi/ml	Water	03/01/88	DOE	1.84	1.82	0.99
	pCi/ml	Water	09/01/88	DOE	1.95	2.20	1.13
	pCi/g	Soil	03/01/88	DOE	0.40	0.49	1.23
	pCi/g	Soil	09/01/88	DOE	0.91	1.22	1.34
	pCi/g	Vegetation	03/01/88	DOE	4.62	6.09	1.32
	pCi/g	Vegetation	09/01/88	DOE	1.52	1.97	1.30
^{40}K	pCi/g	Soil	03/01/88	DOE	0.60	1.03	1.72
	pCi/g	Soil	09/01/88	DOE	7.48	1.07	0.14
	pCi/g	Vegetation	03/01/88	DOE	36.0	51.9	1.44
	pCi/g	Vegetation	09/01/88	DOE	10.0	12.6	1.20

$+1\sigma$ Counting Errors.
*EPA = Environmental Protection Agency Environmental Systems Laboratory Quality Assurance Intercomparison Study.
DOE = Department of Energy Environmental Measurements Laboratory Intercomparison Program.
**Ratio of Sandia to Program value.

Table E.2. Determination of Sample Variability in Replicate Samples for Selected Analysis in Vegetation and Soil

Sample Type	Location	U(ug/g) $\bar{x} \pm s\bar{x}$(%v)	^{137}Cs(pCi/g) $\bar{x} \pm s\bar{x}$(%v)	^{40}K (pCi/g) $\bar{x} \pm s\bar{x}$(%v)	^{3}H (pCi/g) $\bar{x} \pm s\bar{x}$(%v)
Vegetation	5	No analysis	0.05	8.36 ± 0.606(7)	3.70 ± 2.60(70)
	6	No analysis	0.053 ± 0.003(6)	5.86 ± 1.040(17)	3.00 ± 2.20(73)
	34	No analysis	0.051 ± 0.001(2)	6.60 ± 0.404(6)	12.7 ± 8.55(67)
Soil	5	2.36 ± 0.220(9)	0.520 ± 0.003(.5)	16.3 ± 0.144(.8)	3.13 ± 0.384(12)
	6	2.40 ± 0.250(10)	0.467 ± 0.040(9)	18.2 ± 0.086(.5)	3.93 ± 1.55(39)
	34	2.66 ± 0.066(2)	1.03 ± 0.196(19)	13 ± 1.04(8)	1.43 ± 0.694(48)

Table E.3. List of Non-Radioactive Environmental Samples Collected During CY1988

Type	No. of Samples	No. of Analyses
Groundwater	135	543
Wastewater	325	1812
Oils/PCBs	432	432
Hazardous Wastes	319	350
Asbestos	106	106
Other	140	220
Total	1457	3463

Table E.4. List of Laboratories* Used During CY1988

1. Analytical Technologies, Inc.
2. Assaigai Analytical Laboratories, Inc.
3. Encotec
4. Enseco-Rocky Mountain Analytical Labs
5. Hager Labs
6. IT Analytical Services
7. Sandia National Laboratories Div. 3211

*Identification of these companies is not necessarily an endorsement of their services by SNL.

Table E.5. PCB QA and Field Samples

Type	No. of Samples
Blanks	2
Replicates	12
Checks	6
Field	134
Total	154

Table E.6. Summary of Analytical Results for Submitted Blank Samples

Original Sample No.	Source	Lab	Concentrate (PPM)
92	N~30W Quaker State	A	ND
103	N~30W Quaker State	B	ND

ND indicates PCBs not detected at a detection limit of 1 ppm.

Table E.7. Summary of QA Results for Duplicate Field Samples*

Sample No.	Lab	C1 - 1st Concentrate (PPM)	C2 - 2nd Concentrate (PPM)	% RPD
50	B	1.1	9.8	160
51	B	4.3	3.9	9.8
57	B	56.0	41.0	30.9
27	A	ND	ND	0.0
70	A	ND	ND	0.0
74	A	ND	ND	0.0
120	B	144.0	163.0	12.4
123	A	ND	ND	0.0
125	B	33.3	26.0	23.7
127	A	8.7	8.2	5.9
128	B	27.0	25.0	7.7
133	A	0.56	ND	NC

*Samples were split into two containers (1st and 2nd concentrates) for analysis.
ND indicates not detected.
NC indicates value not calculated due to non-detectable levels measured.
RPD - Relative Percent Difference. Zero (0) value represents ideal precision.
RDD calculated as:

$$[|C_1 - C_2|][(C_1 + C_2)/2]^{-1}$$

Table E.8. Summary of Laboratory Analytical Results (L) for Spike Samples (S) Prepared by SNL, Albuquerque

Original Sample No.	Spike (S) Concentrate (PPM)	Lab	Lab (L) Concentrate (PPM)	% REC
76	13.3	A	12.9	97
77	13.3	A	12.7	96
78	473.1	A	490	104
79	473.1	B	410	87
80	13.3	B	9.5	71
81	473.1	B	330	70

$$\% \text{ REC} = \% \text{ recovery} = \frac{[L]}{[S]} \times 100\%$$

Table E.9. Percent Asbestos for Replicate Samples (B3 to B8) as Evaluated by Two Different Laboratories (L1 and L2).

Sample No.	Sampling Date	Laboratory	Percent Asbestos
B3	9/23/88	L1	5-15% C, 50-75% A
B5	11/24/88	L1	5-15% C, 50-75% A
B7	11/24/88	L1	5-15% C, 50-75% A
B4	9/23/88	L2	15-30% C, 30-50% A
B6	11/24/88	L2	15-30% C, 30-50% A
B8	11/24/88	L2	15-30% C, 30-50% A

C = Chrysotile asbestos.
A = Amosite asbestos.

APPENDIX F

ENVIRONMENTAL MONITORING DATA

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Table F.1. 1988 SNLA Vegetation Sample Analysis

Report No.	Loc. Type	H-3 pCi/mL	H-3 SDEV	% H^2O	C_s137 pCi/G	C^s137 SDEV	K-40 pCi/G	K-40 SDEV
1	S	6.90	0.60	29.10	<0.05		8.3100	0.6320
2 NE	S	9.60	0.60	41.20	<0.05		7.0800	0.5220
2 NW	S	10.70	0.60	39.90	<0.05		6.5900	0.4680
2 SE	S	18.60	0.80	28.70	<0.05		4.2200	0.6570
2 SW	S	8.40	0.60	46.90	<0.05		7.2500	0.5270
3	S	3.00	0.60	40.00	<0.05		6.4300	0.4630
4	P	1.4	0.60	50.80	<0.05		8.0000	0.5350
5 A	P	2.10	0.60	30.90	<0.05		9.2100	0.8520
5 B	P	<0.20		35.10	<0.05		8.6800	0.4670
5 C	P	8.80	0.60	27.10	<0.05		7.1800	0.4620
6 A	S	<0.20		28.00	<0.05		3.8200	0.5430
6 B	S	7.30	0.60	34.80	<0.05		6.6100	0.5000
6 C	S	1.50	0.60	40.40	0.0580	0.0150	7.1600	0.4620
7	S	3.20	0.60	33.80	<0.05		4.8500	0.513
8	C	2.60	0.60	35.00	<0.05		7.2600	0.4740
9	C	2.60	0.60	48.50	<0.05		9.9700	0.5550
10	C	0.90	0.60	58.00	0.1130	0.0230	11.9000	0.8560
11	C	3.40	0.60	44.10	<0.05		13.4000	0.6590
16	P	5.40	0.60	15.80	<0.05		5.8000	0.4340
19	P	7.10	0.60	38.50	<0.05		5.1000	0.4670
20	S	<0.20		40.50	<0.05		6.6900	0.4720
25	C	4.80	0.60	69.00	<0.05		21.3000	0.7640
33	S	8.80	0.60	51.10	<0.05		10.6000	0.6270
34 A	S	8.80	0.60	33.80	0.0540	0.0120	7.2200	0.5110
34 B	S	29.10	1.00	42.50	<0.05		6.6900	0.4790
34 C	S	<0.20	<0.20	42.00	<0.05		5.8700	0.4710
35	S	2.40	0.60	33.90	<0.05		5.1700	0.4720
45	S	<0.20		28.50	<0.05		6.4700	0.5170

Table F.2. 1988 Soil Sample Analysis

Report No.	Loc. Type	U-Tot ug/g	U-Tot SDEV	H-3 pCi/mL	H-3 SDEV	% H^2O	C_s-137 pCi/G	C_s-137 SDEV	K-40 pCi/G	K-40 SDEV
1	S	2.30	0.20	0.90	0.60	9.50	0.4240	0.0140	16.3000	0.3210
2 NE	S	2.20	0.20	1.90	0.60	7.20	0.1190	0.0100	16.6000	0.3280
2 NW	S	2.20	0.20	8.10	0.60	1.50	0.1760	0.0110	16.5000	0.3020
2 SE	S	2.60	0.20	6.60	0.60	7.90	0.1550	0.0090	16.5000	0.3210
2 SW	S	2.10	0.20	153.70	3.80	1.40	0.4430	0.0160	15.8000	0.2990
3	S	2.50	0.20	4.70	0.60	6.60	0.6640	0.0170	19.2000	0.3320
4	P	2.10	0.20	<0.20		14.00	0.6830	0.0190	18.8000	0.3660
5 A	P	2.10	0.20	3.30	0.60	0.93	0.5140	0.0150	16.6000	0.3010
5 B	P	2.80	0.20	2.40	0.60	0.61	0.5210	0.0170	16.4000	0.3120
5 C	P	2.20	0.20	3.70	0.60	0.67	0.5260	0.0150	16.1000	0.2990
6 A	S	2.90	0.20	6.90	0.60	11.00	0.5250	0.0180	18.1000	0.3490
6 B	S	2.20	0.20	1.70	0.60	11.90	0.387	0.014	18.2000	0.3450
6 C	S	2.10	0.20	3.20	0.60	10.70	0.4910	0.0160	18.4000	0.3520
7	S	2.90	0.20	2.60	0.60	10.80	0.4350	0.0140	18.0000	0.3310
8	C	2.50	0.20	1.10	0.60	1.60	0.0960	0.0080	18.6000	0.3430
9	C	2.30	0.20	115.90	3.20	7.70	0.6640	0.0240	16.2000	0.3860
10	C	2.70	0.20	10.90	0.60	4.40	0.4170	0.0140	14.1000	0.3010
11	C	2.40	0.20	1.10	0.60	0.55	0.0590	0.0080	17.3000	0.3130
16	P	2.90	0.20	7.30	0.60	0.83	0.1480	0.0100	26.5000	0.3680
19	P	2.60	0.20	<0.20		9.90	0.3310	0.0130	20.8000	0.3490
20	S	2.00	0.20	0.20	0.60	6.50	0.7800	0.0180	16.4000	0.3250
25	C	2.60	0.20	3.40	0.60	7.80	0.1760	0.0110	16.9000	0.3520
33	S	2.60	0.20	3.20	0.60	3.10	0.0590	0.0090	23.7000	0.3480
34 A	S	2.80	0.20	1.50	0.60	3.00	0.8430	0.0190	10.9000	0.2570
34 B	S	2.60	0.20	<0.20		3.70	1.4300	0.0260	13.5000	0.3240
34 C	S	2.60	0.20	2.60	0.60	3.00	0.8350	0.0200	14.4000	0.3090
35	S	2.70	0.20	5.30	0.60	9.90	0.9180	0.0210	19.9000	0.360
45	S	2.30	0.20	3.40	0.60	13.20	1.3300	0.0240	19.8000	0.3460

Table F.3. 1988 SNLA Water Sample Analysis - Surface Water

Sample Type	Gross Alpha x 10^{-3} pCi/ml	Gross Beta x 10^{-3} pCi/ml	U-Tot μg/ml	H-3 pCi/ml	C_s-137 x 10^{-3} pCi/ml
Number: 8					
F	<2.46	8.06 ± 1.45	0.0022 ± 0.0001	<0.20	<5.0
S	<0.48	1.36 ± 0.51			
T	11.62 ± 3.43	6.02 ± 1.38	<0.0010	<0.20	<5.0
Number: 11					
F	<2.46	6.66 ± 1.40	0.0130 ± 0.0001	<0.20	<5.0
S	<0.48	2.40 ± 0.55			
T	6.13 ± 2.87	6.29 ± 1.38	0.0130 ± 0.0001	<0.20	<5.0
Number: 33					
F	<2.46	8.85 ± 1.45	0.0500 ± 0.0001	<0.20	<5.0
S	<0.48	<0.48			
T	<2.46	6.99 ± 1.38	0.1060 ± 0.0001	<0.20	<5.0

Table F.4. 1988 SNLA Water Sample Analysis - Well Water

Sample Type	Gross Alpha x 10^{-3} pCi/ml	Gross Beta x 10^{-3} pCi/ml	U-Tot μg/ml	H-3 pCi/ml	C_s-137 x 10^{-3} pCi/ml
Number: 12					
F	4.47 ± 2.83	5.35 ± 1.32	<0.0010	<0.20	<5.0
S	<0.48	0.74 ± 0.48			
T	<2.46	3.16 ± 1.25	0.0022 ± 0.0001	<0.20	<5.0
Number: 13					
F	<2.46	4.48 ± 1.31	<0.0010	<0.20	<5.0
S	<0.48	<0.48			
T	3.47 ± 2.78	2.60 ± 1.23	<0.0010	<0.20	<5.0
Number: 14					
F	<2.46	2.10 ± 1.21	<0.0010	<0.20	<5.0
S	<0.48	<0.48			
T	<2.46	2.63 ± 1.24	<0.0010	<0.20	<5.0
Number: 15					
F	<2.46	3.14 ± 1.26	<0.0010	<0.20	<5.0
S	<0.48	<0.48			
T	<2.46	2.44 ± 1.23	<0.0010	<0.20	<5.0
Number: 36					
F	3.23 ± 2.73	4.24 ± 1.29	<0.0010	<0.20	<5.0
S	<0.48	<0.48			
T	<2.46	2.95 ± 1.24	<0.0010	<0.20	<5.0
Number: 37					
F	2.91 ± 2.68	4.74 ± 1.31	<0.0010	<0.20	<5.0
S	<0.48	<0.48			
T	<2.46	3.26 ± 1.25	<0.0010	<0.20	<5.0
Number: 38					
F	2.97 ± 2.68	2.80 ± 1.23	0.002200 ± 0.0001	<0.20	<5.0
S	<0.48	<0.48			
T	<2.46	4.43 ± 1.30	<0.0010	<0.20	<5.0
Number: 44					
F	<2.46	3.51 ± 1.27	<0.0010	<0.20	<5.0
S	<0.48	<0.48			
T	<2.46	3.78 ± 1.29	<0.0010	<0.20	<5.0

Table F.5. 1988 SNLA Thermoluminescent Dosimeter (TLD) Summary Radiation Exposure Data

Report No.	1st Field Days	Qtr. Exposure mR	2nd Field Days	Qtr. Exposure mR	3rd Field Days	Qtr. Exposure mR	4th Field Days	Qtr. Exposure mR	mR/365d
Location Type: C									
10	84	21.04	84	24.5	98	27.1	98	32.6	105.53
11	84	20.10	84	18.8	98	22.6	98	26.3	88.04
21	84	21.24	84	21.6	98	24.9	98	30.4	98.41
22	84	21.10	84	18.0	98	22.7	98	25.2	87.24
23	84	22.20	84	18.6	98	21.8	98	27.3	90.15
24	84	21.90	84	21.9	98	26.8	98	28.3	99.17
25	84	25.61	84	24.5	98	28.0	98	32.4	110.81
26	84	22.93	84	24.3	98	29.6	98	34.7	111.84
27	84	20.86	84	20.6	98	25.5	98	27.5	94.72
28	84	22.77	84	21.6	98	26.4	98	28.7	99.74
29	84	20.75	84	19.5	98	23.2	98	25.1	88.79
30	84	25.30	84	23.2	98	27.5	98	31.9	108.20
Location Type: P									
4	84	22.57	84	19.2	98	24.6	98	27.6	94.23
5	84	20.32	84	20.2	98	22.8	98	24.2	87.76
16	84	24.67	84	24.6	98	29.3	98	32.6	111.48
18	84	22.06	84	21.7	98	25.8	98	28.1	97.93
19	84	23.21	84	22.3	98	26.9	98	28.3	100.99
39	84	19.11	84	20.8	98	22.0	98	25.5	87.65
40	84	20.67	84	20.3	98	24.4	98	25.8	91.42
Location Type: S									
1	84	24.14	84	21.0	98	27.3	98	30.3	103.02
2	84	20.59	84	20.8	98	25.2	98	30.5	97.36
3	84	22.43	84	22.8	98	25.2	98	27.1	97.80
6	84	20.97	84	21.0	98	25.0	98	27.2	94.43
7	84	32.52	84	25.9	98	32.4	98	34.8	125.97
20	84	24.58	84	23.4	98	26.3	98	28.8	103.36
31	84	23.16	84	20.4	98	25.0	98	26.7	95.52
32	84	48.93	84	51.3	98	46.8	98	56.9	204.49
41	84	76.99	84	86.6	98	66.5	98	64.8	295.70
42	84	21.83	84	24.3	98	26.1	98	26.9	99.40
43	84	22.55	84	20.7	98	23.9	98	26.4	93.81
46			84	21.0	98	25.9	98	25.9	94.90
47			84	32.5	98	26.0	98	30.6	116.15
48			84	24.1	98	24.9	98	27.8	100.11

Table F.6. 1988 Calculated Effluent Release Data

Parameter	^{41}Ar
Release Point	Area V
χ/Q at 3 km*	3.06×10^{-13} s/ml
χ/Q at 80 km	2.27×10^{-16} s/ml
Activity Released	5.21 Ci
Released Rate (Q)	0.165 μCi/s
Boundary Concentration	5.02×10^{-14} μCi/ml
DCG for Average Population**	1.3×10^{-8} μCi/ml
Boundary Concentration/DCG	3.86×10^{-6}

*Release point to site boundary distance is 3 km.
**"Standards for Radiation Protection", DOE Order 5480.1.

Table F.7. Dose Calculations Based on AIRDOS.EPA for Sandia National Laboratories, Albuquerque

Location	Distance From A-V	Direction Degrees	Whole Body Dose* mrem/yr x 10^{-4}
1. NW Base Housing W. Penn. Ave. S. Gibson NW Site Boundary	5.8 km	337° NW	1.18
2. Four Hills By TLD Station NE Site Boundary	5.6 km	26° NE	0.64
3. N Base Housing N. of Gibson E. of Wyoming N Site Boundary	6.1 km	350° N	1.66
4. TLD Station NW DOE Complex NW Site Boundary	6.2 km	339° NW	1.05
5. "Mountain View" W. of KAFB Community	11.2 km	268° W	0.34
6. "Tijeras" E. of KAFB Community, near TLD (Intersection I-40/S-14)	16.0 km	54° NE	0.13
7. "Isleta Gate" S. Site Boundary By TLD Station	5.7 km	180° S	2.30

*The AIRDOS.EPA calculation was done in 1987 using site-specific meteorology STAR data for Albuquerque, New Mexico and results were ratioed for the 1988 report based on a 5.2 Ci release in 1988 compared to a 7.7 Ci release in 1987. All conditions, other than Ci release, were constant in the 1988 calculation compared to 1987.

Table F.8. Static Water Level Elevations for the Chemical Waste Landfill Around Water Monitoring Wells, Calendar Year 1988.

1985 Wells					
Date	BW1	BW2	MW1	MW2	MW3
2/02/88	4967.80	4939.75	4938.18	4937.74	4938.13
5/12/88	4967.70	4939.24	4937.57	4937.15	4937.43
6/07/88	4968.40	4939.44	4937.57	4937.27	4937.65
7/11/88	4969.38	4939.44	4937.61	4937.26	4937.63
8/22/88	4957.44	4939.47	#	4937.25	4937.65
9/08/88	4957.67	4938.87	#	4937.23	4937.63
10/10/88	4957.18	4938.60	#	4936.77	4936.90
11/28/88	*	*	#	*	*
12/12/88	4958.28	4939.52	#	4937.55	4938.00

1988 Wells				
Date	BW3	MW1A	MW2A	MW3A
10/10/88	4941.66	4939.13	4939.73	4939.93
11/28/88	4942.70	4941.44	4940.56	4940.80
12/12/88	4941.75	4940.02	4940.40	4940.80

* Water level measurements not obtained.
\# Well plugged. Not able to obtain measurements.

Table F.9. Groundwater Flow Directions Calculated from 1988 Static Water Level Elevations

		Semi-annual Sampling Event 1985 Wells	
		February 1988	July 1988
BW2 - MW1 - MW3	bearing	306	310
	gradient	0.0025	0.0029
BW2 - MW1 - MW2	bearing	294	306
	gradient	0.0027	0.0030
BW2 - MW2 - MW3	bearing	321	315
	gradient	0.0030	0.0031
MW1 - MW2 - MW3	bearing	306	310
	gradient	0.0038	0.0034
	Average	307	310
		0.0030	0.0031

		Background Monitoring Event 1988 Wells
		December 1988
BW3 - MW1A - MW3A	bearing	338
	gradient	0.0033
BW3 - MW1A - MW2A	bearing	353
	gradient	0.0037
BW3 - MW2A - MW3A	bearing	331
	gradient	0.0026
	Average	341
		0.0032

Table F.10

Background Concentrations
of
Groundwater Quality and Groundwater Contamination Indicator Parameters

Well BW2

Sample Date	pH (SU)	Sp.Cond. (umhos/cm)	TOX (ug/l)	TOC (mg/l)	Cl (mg/l)	Fe # (mg/l)	Mn # (mg/l)	Phenol (mg/l)	Na (mg/l)	SO4 (mg/l)
	Contamination Indicator Parameters				Groundwater Quality Parameters					
10/85	6.91	1083	25 *	1.0	120	0.040	0.030	0.001 *	79	86
10/85	6.90	1083	25 *	1.0						
10/85	6.90	1083	25 *	2.0						
10/85	6.88	1083	25 *	1.0						
1/86	6.74	1468	60	3.0	130	0.005 *	0.020	0.005	84	79
1/86	6.75	1581	25 *	2.0						
1/86	6.79	1548	50	3.0						
1/86			25 *	2.0						
4/86	6.02	1144	25 *	10.2	157	0.025 *	0.025 *	0.025 *	30	225
4/86	6.06	1196	25 *	9.2						
4/86	6.04	1220	25 *	6.1						
4/86	6.24	1220	60	9.4						
9/86	6.95	1069	5 *	18.9	160	0.700	0.030		90	80
9/86	6.98	1085	19	18.3						
9/86	7.00	1089	13	54.8						
9/86	7.00	1085	18	16.7						
mean	6.68	1202	28.13	9.91	142	0.192	0.026	0.010	71	118
variance	0.1429	32331.3	236.517	183.277	392.25	0.115	0.000	0.000	758	5146
n=	15	15	16	16						
Wb=	0.010	2155.42	14.78	11.45						
tb=	2.977	2.624	2.602	2.602						

dissolved metals (filtered sample)
* none detected. value is one-half the reported detection limit.

Blank parameters represent missing data values

Table F.11

Detection Monitoring Concentrations of Groundwater Quality and Groundwater Contamination Indicator Parameters

Well BW1

Sample Date	pH (SU)	Sp.Cond. (umhos/cm)	TOX (ug/l)	TOC (mg/l)	Cl (mg/l)	Fe # (mg/l)	Mn # (mg/l)	Phenol (mg/l)	Na (mg/l)	SO4 (mg/l)
	Contamination Indicator Parameters				Groundwater Quality Parameters					
Established Background Concentrations from BW2										
mean	6.68	1202	28.13	9.91						
variance	0.1429	32331.3	236.517	183.277						
n=	15	15	16	16						
Wb=	0.01	2155.42	14.78	11.45						
tb=	2.977	2.624	2.602	2.602						
2/88	7.55	853	40 *	2.0	150	380	4.3	0.0025 *	84	94
2/88	7.55	870	40 *	1.5						
2/88	7.44	891	40 *	0.5 *						
2/88	7.45	845	40 *	3.7						
mean	7.50	864	40	1.925						
variance	0.00369	408.14335	0.00000	1.7892						
Wm=	0.00092	102.03583	0.00000	0.4473						
tm=	7.8220	-7.1034	3.0875	-2.3150						
Comparison to BW2 Background Concentrations using CABF Student's t-test										
tc=	3.2190	2.7106	2.6020	2.6749						
signif	yes	no	yes	no						

\# total metals (unfiltered sample)

* none detected. value is one-half the reported detection limit.

Blank parameters represent missing data values

Table F.11 (cont'd)

Detection Monitoring Concentrations
of
Groundwater Quality and Groundwater Contamination Indicator Parameters

Well BW1

Sample Date	Contamination Indicator Parameters: pH (SU)	Sp.Cond. (umhos/cm)	TOX (ug/l)	TOC (mg/l)	Groundwater Quality Parameters: Cl (mg/l)	Fe # (mg/l)	Mn # (mg/l)	Phenol (mg/l)	Na (mg/l)	SO4 (mg/l)
Established Background Concentrations from BW2										
mean	6.68	1202	28.13	9.91						
variance	0.1429	32331.3	236.517	183.277						
n=	15	15	16	16						
Wb=	0.01	2155.42	14.78	11.45						
tb=	2.977	2.624	2.602	2.602						
7/88	7.25	972	25 *	3.0	120	240	6.7	0.003 *	79	98
7/88	7.29	968	70	2.0						
7/88	7.38	966	25 *	2.0						
7/88	7.36	968	25 *	2.0						
mean	7.32	968	36.25	2.25						
variance	0.0037	8.4080142	506.25	0.2500						
Wm=	0.0009	2.1020035	126.56	0.0625						
tm=	6.1254	-5.0308	0.6830	-2.2576						
Comparison to BW2 Background Concentrations using CABF Student's t-test										
tc=	3.2175	2.6259	4.3382	2.6125						
signif	yes	no	no	no						

total metals (unfiltered sample)

* none detected. value is one-half the reported detection limit.

Blank parameters represent missing data values

Table F.12

Detection Monitoring Concentrations of Groundwater Quality and Groundwater Contamination Indicator Parameters

Well BW2

Sample Date	pH (SU)	Sp.Cond. (umhos/cm)	TOX (ug/l)	TOC (mg/l)	Cl (mg/l)	Fe # (mg/l)	Mn # (mg/l)	Phenol (mg/l)	Na (mg/l)	SO4 (mg/l)
	Contamination Indicator Parameters				Groundwater Quality Parameters					
Established Background Concentrations from BW2										
mean	6.68	1202	28.13	9.91						
variance	0.1429	32331.3	236.52	183.28						
n=	15	15	16	16						
Wb=	0.01	2155.42	14.78	11.45						
tb=	2.977	2.624	2.602	2.602						
2/88	6.56	1270	40 *	9.0	150	0.05 *	0.005 *	0.0025 *	75	94
2/88	6.55	1253	40 *	12.0						
2/88	6.59	1217	40 *	12.0						
2/88	6.60	1226	40 *	9.0						
mean	6.58	1241.50	40.00	10.50						
variance	0.00057	595.00	0.00000	3.0000						
Wm=	0.00014	148.75	0.00000	0.7500						
tm=	-1.04	0.82	3.09	0.17						
Comparison to BW2 Background Concentrations using CABF Student's t-test										
tc=	3.02	2.75	2.60	2.72						
signif	no	no	yes	no						

total metals (unfiltered sample)

* none detected. value is one-half the reported detection limit.

Blank parameters represent missing data values

Table F.12 (cont'd)

Detection Monitoring Concentrations of Groundwater Quality and Groundwater Contamination Indicator Parameters

Well BW2

Sample Date	pH (SU)	Sp.Cond. (umhos/cm)	TOX (ug/l)	TOC (mg/l)	Cl (mg/l)	Fe # (mg/l)	Mn # (mg/l)	Phenol (mg/l)	Na (mg/l)	SO4 (mg/l)
	Contamination Indicator Parameters				Groundwater Quality Parameters					
Established Background Concentrations from BW2										
mean	6.68	1202	28.13	9.91						
variance	0.1429	32331.3	236.52	183.28						
n=	15	15	16	16						
Wb=	0.01	2155.42	14.78	11.45						
tb=	2.977	2.624	2.602	2.602						
7/88	6.44	1223	25 *	0.5 *	140	0.25	0.025 *	0.0025 *	88	69
7/88	6.43	1238	25 *	0.5 *						
7/88	6.75	1276	25 *	0.5 *						
7/88	6.63	1285	25 *	1.0						
mean	6.56	1255.50	25.00	0.63						
variance	0.0241	884.33	0.00000	0.0625						
Wm=	0.0060	221.08	0.00000	0.0156						
tm=	-0.93	1.10	-0.81	-2.74						
Comparison to BW2 Background Concentrations using CABF Student's t-test										
tc=	4.05	2.80	2.60	2.60						
signif	no	no	no	no						

total metals (unfiltered sample)
* none detected. value is one-half the reported detection limit.

Blank parameters represent missing data values

Table F.13

Detection Monitoring Concentrations of Groundwater Quality and Groundwater Contamination Indicator Parameters

Well MW1

Sample Date	pH (SU)	Sp.Cond. (umhos/cm)	TOX (ug/l)	TOC (mg/l)	Cl (mg/l)	Fe # (mg/l)	Mn # (mg/l)	Phenol (mg/l)	Na (mg/l)	SO4 (mg/l)
	Contamination Indicator Parameters				Groundwater Quality Parameters					
	Established Background Concentrations from BW2									
mean	6.68	1202	28.13	9.91						
variance	0.1429	32331.3	236.517	183.277						
n=	15	15	16	16						
Wb=	0.01	2155.42	14.78	11.45						
tb=	2.977	2.624	2.602	2.602						
2/88	7.18	1102	40 *	4.2	120	280	4.3	0.0025 *	68	68
2/88	7.17	1071	40 *	2.0 *						
2/88	7.18	1077	40 *	2.0 *						
2/88	7.25	1066	40 *	9.5						
mean	7.195	1079.0858	40	4.425						
variance	0.00136	256.30347	0	12.5225						
Wm=	0.00034	64.075867	0	3.13062						
tm=	5.0642	-2.6090	3.0875	-1.4364						
	Comparison to BW2 Background Concentrations using CABF Student's t-test									
tc=	3.072	2.679	2.602	3.297						
signif	yes	no	yes	no						

total metals (unfiltered sample)

* none detected. value is one-half the reported detection limit.

Blank parameters represent missing data values.

Table F.13 (cont'd)

Detection Monitoring Concentrations of Groundwater Quality and Groundwater Contamination Indicator Parameters

Well MW1

Sample Date	pH (SU)	Sp.Cond. (umhos/cm)	TOX (ug/l)	TOC (mg/l)	Cl (mg/l)	Fe # (mg/l)	Mn # (mg/l)	Phenol (mg/l)	Na (mg/l)	SO4 (mg/l)
	Contamination Indicator Parameters				Groundwater Quality Parameters					
	Established Background Concentrations from BW2									
mean	6.68	1202	28.13	9.91						
variance	0.1429	32331.3	236.517	183.277						
n=	15	15	16	16						
Wb=	0.01	2155.42	14.78	11.45						
tb=	2.977	2.624	2.602	2.602						
7/88	7.15	1198								
7/88	7.20									
7/88	7.00	1213								
7/88	6.92	1198								
mean	7.0675	1202.9523	ERR	ERR						
variance	0.01689	70.580788	ERR	ERR						
Wm=	0.00422	23.526929	ERR	ERR						
tm=	3.2492	0.0204	ERR	ERR						
	Comparison to BW2 Background Concentrations using CABF Student's t-test									
tc=	3.827	2.645	ERR	ERR						
signif	no	no	N/A	N/A						

Well plugged with sampling bailer; no samples available. pH and Sp.Cond. taken from purge water.

total metals (unfiltered sample)
* none detected. value is one-half the reported detection limit.

Blank parameters represent missing data values.

Table F.14

Detection Monitoring Concentrations of Groundwater Quality and Groundwater Contamination Indicator Parameters

Well MW2

Sample Date	Contamination Indicator Parameters				Groundwater Quality Parameters					
	pH (SU)	Sp.Cond. (umhos/cm)	TOX (ug/l)	TOC (mg/l)	Cl (mg/l)	Fe # (mg/l)	Mn # (mg/l)	Phenol (mg/l)	Na (mg/l)	SO4 (mg/l)
Established Background Concentrations from BW2										
mean	6.68	1202	28.13	9.91						
variance	0.1429	32331.3	236.517	183.277						
n=	15	15	16	16						
Wb=	0.01	2155.42	14.78	11.45						
tb=	2.977	2.624	2.602	2.602						
2/88	6.91	1132	40 *	4.8	140	0.05 *	0.005 *	0.0025 *	2.5 *	90
2/88	6.91	1134	40 *	2.7						
2/88	6.90	1134	40 *	6.4						
2/88	6.90	1132	40 *	2.1						
mean	6.905	1133.1008	40	4.0						
variance	0.00003	2.0045585	0.00	3.9						
Wm=	0.00000	0.5011396	0.00	0.975						
tm=	2.2491	-1.4839	3.0875	-1.6766						
Comparison to BW2 Background Concentrations using CABF Student's t-test										
tc=	2.979	2.624	2.602	2.754						
signif	no	no	yes	no						

total metals (unfiltered sample)

* none detected. value is one-half the reported detection limit.

Blank parameters represent missing data values

Table F.14 (cont'd)

Detection Monitoring Concentrations
of
Groundwater Quality and Groundwater Contamination Indicator Parameters

Well MW2

Sample Date	pH (SU)	Sp.Cond. (umhos/cm)	TOX (ug/l)	TOC (mg/l)	Cl (mg/l)	Fe # (mg/l)	Mn # (mg/l)	Phenol (mg/l)	Na (mg/l)	SO4 (mg/l)
	Contamination Indicator Parameters				Groundwater Quality Parameters					
	Established Background Concentrations from BW2									
mean	6.68	1202	28.13	9.91						
variance	0.1429	32331.3	236.517	183.277						
n=	15	15	16	16						
Wb=	0.01	2155.42	14.78	11.45						
tb=	2.977	2.624	2.602	2.602						
7/88	7.08	1271	25 *	0.5 *	120	0.41	0.025 *	0.0025 *	87	78
7/88	6.98	1266	25 *	0.5 *						
7/88	6.98	1268	25 *	0.5 *						
7/88	6.90	1260	90	0.5 *						
mean	6.985	1266.2951	41.25	0.5						
variance	0.00543	22.055833	1056.25	0.00						
Wm=	0.00135	5.5139583	264.062	0.00						
tm=	2.8618	1.3831	0.7857	-2.7809						
	Comparison to BW2 Background Concentrations using CABF Student's t-test									
tc=	3.320	2.629	4.438	2.602						
signif	no	no	no	no						

total metals (unfiltered sample)
* none detected. value is one-half the reported detection limit.

Blank parameters represent missing data values

Table F.15

Detection Monitoring Concentrations of Groundwater Quality and Groundwater Contamination Indicator Parameters

Well MW3

	Contamination Indicator Parameters				Groundwater Quality Parameters					
Sample Date	pH (SU)	Sp.Cond. (umhos/cm)	TOX (ug/l)	TOC (mg/l)	Cl (mg/l)	Fe # (mg/l)	Mn # (mg/l)	Phenol (mg/l)	Na (mg/l)	SO4 (mg/l)
	Established Background Concentrations from BW2									
mean	6.68	1202	28.13	9.91						
variance	0.1429	32331.3	236.517	183.277						
n=	15	15	16	16						
Wb=	0.01	2155.42	14.78	11.45						
tb=	2.977	2.624	2.602	2.602						
2/88	6.65	1125	40 *	11.0	140	0.24	0.005 *	0.0025 *	68	86
2/88	6.64	1125	40 *	8.3						
2/88	6.65	1125	40 *	7.4						
2/88	6.63	1122	40 *	5.4						
mean	6.6425	1124	40	8.025						
variance	0.00009	1.4524666	0.00	5.4025						
Wm=	0.00002	0.3631166	0.00	1.35062						
tm=	-0.3746	-1.6804	3.0875	-0.5269						
	Comparison to BW2 Background Concentrations using CABF Student's t-test									
tc=	2.984	2.624	2.602	2.807						
signif	no	no	yes	no						

total metals (unfiltered sample)
* none detected. value is one-half the reported detection limit.

Blank parameters represent missing data values

Table F.15 (cont'd)

Detection Monitoring Concentrations
of
Groundwater Quality and Groundwater Contamination Indicator Parameters

Well MW3

Sample Date	pH (SU)	Sp.Cond. (mhos/l)	TOX (ug/l)	TOC (mg/l)	Cl (mg/l)	Fe # (mg/l)	Mn # (mg/l)	Phenol (mg/l)	Na (mg/l)	SO4 (mg/l)
	Contamination Indicator Parameters				**Groundwater Quality Parameters**					
Established Background Concentrations from BW2										
mean	6.68	1202	28.13	9.91						
variance	0.1429	32331.3	236.517	183.277						
n=	15	15	16	16						
Wb=	0.01	2155.42	14.78	11.45						
tb=	2.977	2.624	2.602	2.602						
7/88	6.54	1223	25 *	0.5 *	120	0.31	0.025 *	0.0025 *	88	63
7/88	6.50	1234	120	0.5 *						
7/88	6.54	1234	70	0.5 *						
7/88	6.53	1234	80	0.5 *						
mean	6.5275	1231	73.75	0.5						
variance	0.00035	25.983074	1522.91	0						
Wm=	0.00008	6.4957686	380.729	0						
tm=	-1.5182	0.6240	2.2939	-2.7809						
Comparison to BW2 Background Concentrations using CABF Student's t-test										
tc=	3.002	2.630	4.469	2.602						
signif	no	no	no	no						

total metals (unfiltered sample)
* none detected. value is one-half the reported detection limit.

Blank parameters represent missing data values

Table F-16a

Background Concentrations
of
Groundwater Quality and Groundwater Contamination Indicator Parameters

Well BW3

Sample Date	Contamination Indicator Parameters				Groundwater Quality Parameters					
	pH (SU)	Sp.Cond. (umhos/cm)	TOX (ug/l)	TOC (mg/l)	Cl (mg/l)	Fe # (mg/l)	Mn # (mg/l)	Phenol (mg/l)	Na (mg/l)	SO4 (mg/l)
12/88	7.66	990	38	1.3	116	0.390	0.058	0.005 *	141	111
12/88	7.78	1110	21	1.2						
12/88	7.90	1100	24	1.2						
12/88		1100	36	1.4						

mean
variance
n=
Wb=
tb=

total metals (unfiltered sample)
* none detected. value is one-half the reported detection limit.

Blank parameters represent missing data values

Table F-16b

Background Concentrations
of
Drinking Water Supply Parameters

Well BW3

Parameter	units	Sample Dates 12/88	EPA Interim Primary Drinking Water Standards
As #	mg/l	<0.006	0.05
Ba #	mg/l	0.044	1.0
Cd #	mg/l	<0.005	0.01
Cr #	mg/l	0.03	0.05
Pb #	mg/l	<0.004	0.05
Hg #	mg/l	<0.0001	0.002
Se #	mg/l	0.006	0.01
Ag #	mg/l	<0.005	0.05
Fl	mg/l	1.8	1.4 - 2.4
NO3	mg/l	2.2	10
Total Coliform	col/100 ml	*	1/100 ml
Turbidity	NTU	4.34	1 TU
Ra 226	pCi/l	0.0	5 pCi/l
Ra 228	pCi/l	0.0	5 pCi/l
Gross Alpha	pCi/l	30.0	15 pCi/l
Gross Beta	pCi/l	8.4	4 mR/yr
Endrin	mg/l	<0.0001	0.0002
Lindane	mg/l	<0.0001	0.004
Methoxychlor	mg/l	<0.0005	0.1
Toxaphene	mg/l	<0.001	0.005
2,4-D	mg/l	<0.0002	0.1
2,4,5-TP	mg/l	<0.0001	0.01

* Too numerous to count non-coliform bacteria present, unable to determine presence of total coliform bacteria
# total metals (unfiltered sample)

Blank parameters represent missing data values

Table F-17a

Background Concentrations
of
Groundwater Quality and Groundwater Contamination Indicator Parameters

Well MW1A

	Contamination Indicator Parameters				Groundwater Quality Parameters					
Sample Date	pH (SU)	Sp.Cond. (umhos/cm)	TOX (ug/l)	TOC (mg/l)	Cl (mg/l)	Fe # (mg/l)	Mn # (mg/l)	Phenol (mg/l)	Na (mg/l)	SO4 (mg/l)
12/88	7.41	790	14	0.9	105	0.170	0.091	0.010	145	67
12/88	7.37	820	20	1.0						
12/88	7.36	810	26	1.0						
12/88	7.36	820	19	1.2						
mean										
variance										
n=										
Wb=										
tb=										

total metals (unfiltered sample)
* none detected. value is one-half the reported detection limit.

Blank parameters represent missing data values

Table F-17b

Background Concentrations of Drinking Water Supply Parameters

Well MW1A

Parameter	units	Sample Dates 12/88	EPA Interim Primary Drinking Water Standards
As #	mg/l	<0.02	0.05
Ba #	mg/l	0.15	1.0
Cd #	mg/l	<0.005	0.01
Cr #	mg/l	< 0.01	0.05
Pb #	mg/l	<0.002	0.05
Hg #	mg/l	<0.0001	0.002
Se #	mg/l	0.003	0.01
Ag #	mg/l	<0.005	0.05
Fl	mg/l	1.5	1.4 - 2.4
NO3	mg/l	0.9	10
Total Coliform	col/100 ml	<1	1/100 ml
Turbidity	NTU	2.40	1 TU
Ra 226	pCi/l	0.0	5 pCi/l
Ra 228	pCi/l	1.0	5 pCi/l
Gross Alpha	pCi/l	26.0	15 pCi/l
Gross Beta	pCi/l	7.7	4 mR/yr
Endrin	mg/l	<0.0001	0.0002
Lindane	mg/l	<0.0001	0.004
Methoxychlor	mg/l	<0.0005	0.1
Toxaphene	mg/l	<0.001	0.005
2,4-D	mg/l	<0.0002	0.1
2,4,5-TP	mg/l	<0.0001	0.01

total metals (unfiltered sample)

Blank parameters represent missing data values

Table F-18a

Background Concentrations
of
Groundwater Quality and Groundwater Contamination Indicator Parameters

Well MW2A

	Contamination Indicator Parameters				Groundwater Quality Parameters					
Sample Date	pH (SU)	Sp.Cond. (umhos/cm)	TOX (ug/l)	TOC (mg/l)	Cl (mg/l)	Fe # (mg/l)	Mn # (mg/l)	Phenol (mg/l)	Na (mg/l)	SO4 (mg/l)
12/88	7.29	950	106	0.2	99	0.960	0.066	0.005 *	78	65
12/88	7.49	970	103	0.2						
12/88	7.34	970	95	0.3						
12/88	7.56	980	110	0.4						
mean										
variance										
n=										
Wb=										
tb=										

total metals (unfiltered sample)
* none detected. value is one-half the reported detection limit.

Blank parameters represent missing data values

Table F-18b

Background Concentrations of Drinking Water Supply Parameters

Well MW2A

Parameter	units	Sample Dates 12/88	EPA Interim Primary Drinking Water Standards
As #	mg/l	<0.006	0.05
Ba #	mg/l	0.070	1.0
Cd #	mg/l	<0.005	0.01
Cr #	mg/l	0.06	0.05
Pb #	mg/l	<0.002	0.05
Hg #	mg/l	<0.0001	0.002
Se #	mg/l	<0.002	0.01
Ag #	mg/l	<0.005	0.05
Fl	mg/l	1.5	1.4 - 2.4
NO3	mg/l	1.0	10
Total Coliform	col/100 ml	*	1/100 ml
Turbidity	NTU	16.2	1 TU
Ra 226	pCi/l	0.0	5 pCi/l
Ra 228	pCi/l	0.2	5 pCi/l
Gross Alpha	pCi/l	19.0	15 pCi/l
Gross Beta	pCi/l	11.0	4 mR/yr
Endrin	mg/l	<0.0001	0.0002
Lindane	mg/l	<0.0001	0.004
Methoxychlor	mg/l	<0.0005	0.1
Toxaphene	mg/l	<0.001	0.005
2,4-D	mg/l	<0.0002	0.1
2,4,5-TP	mg/l	<0.0001	0.01

* Too numerous to count non-coliform bacteria present, unable to determine presence of total coliform bacteria

total metals (unfiltered sample)

Blank parameters represent missing data values

Table F-19a

Background Concentrations of Groundwater Quality and Groundwater Contamination Indicator Parameters

Well MW3A

Sample Date	Contamination Indicator Parameters: pH (SU)	Sp.Cond. (umhos/cm)	TOX (ug/l)	TOC (mg/l)	Groundwater Quality Parameters: Cl (mg/l)	Fe # (mg/l)	Mn # (mg/l)	Phenol (mg/l)	Na (mg/l)	SO4 (mg/l)
12/88	7.78	990	19	0.5	97	0.0025 *	0.022	0.005 *	101	68
12/88	7.80	990	32	0.6						
12/88	7.71	990	34	0.5						
12/88	7.71	920	32	0.6						

mean
variance
n=
Wb=
tb=

total metals (unfiltered sample)
* none detected. value is one-half the reported detection limit.

Blank parameters represent missing data values

Table F-19b

Background Concentrations of Drinking Water Supply Parameters

Well MW3A

Parameter	units	Sample Dates 12/88	EPA Interim Primary Drinking Water Standards
As #	mg/l	<0.06	0.05
Ba #	mg/l	0.049	1.0
Cd #	mg/l	<0.005	0.01
Cr #	mg/l	<0.01	0.05
Pb #	mg/l	<0.002	0.05
Hg #	mg/l	<0.0001	0.002
Se #	mg/l	<0.002	0.01
Ag #	mg/l	<0.005	0.05
Fl	mg/l	1.4	1.4 - 2.4
NO3	mg/l	1.1	10
Total Coliform	col/100 ml	<1	1/100 ml
Turbidity	NTU	0.51	1 TU
Ra 226	pCi/l	1.1	5 pCi/l
Ra 228	pCi/l	0.2	5 pCi/l
Gross Alpha	pCi/l	23.0	15 pCi/l
Gross Beta	pCi/l	5.5	4 mR/yr
Endrin	mg/l	<0.0001	0.0002
Lindane	mg/l	<0.0001	0.004
Methoxychlor	mg/l	<0.0005	0.1
Toxaphene	mg/l	<0.001	0.005
2,4-D	mg/l	<0.0002	0.1
2,4,5-TP	mg/l	<0.0001	0.01

total metals (unfiltered sample)

Blank parameters represent missing data values

Table F.20

RESULTS OF MONTHLY ANALYSES
SNLA WASTEWATER SAMPLING STATION WW001
PERMIT NO. 2069A, SAMPLE ID: 3069A-4
ALL RESULTS IN mg/l UNLESS OTHERWISE NOTED

JANUARY 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	01/04/88 8801040101 9-HOUR, AM	01/05/88 8801050101 9-HOUR, AM	01/06/88 8801060101 9-HOUR, AM	01/07/88 8801070101 9-HOUR, AM	FOUR-DAY AVERAGE
Parameter					
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
Cu	0.045	<0.02	<0.04	<0.04	<0.04
$CN_{(Total)}$	<0.02	<0.02	<0.02	<0.02	<0.02
Pb	<0.005	0.005	0.009	<0.005	<0.006
Zn	0.074	<0.05	<0.05	0.069	<0.06

FEBRUARY 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	02/01/88 8802010101 9-HOUR, AM	02/02/88 8802020101 9-HOUR, AM	02/03/88 8802030101 9-HOUR, AM	02/04/88 8802040101 9-HOUR, AM	FOUR-DAY AVERAGE
Parameter					
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
Cu	0.058	0.041	<0.025	0.046	<0.043
$CN_{(Total)}$	0.024	0.021	<0.02	<0.02	<0.02
Pb	<0.005	<0.005	0.005	<0.005	<0.005
Zn	0.062	0.062	0.041	0.065	0.058

MARCH 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	02/29/88 8802290101 9-HOUR, AM	03/01/88 8803010101 9-HOUR, AM	03/02/88 8803020101 9-HOUR, AM	03/03/88 8803030101 9-HOUR, AM	FOUR-DAY AVERAGE
Parameter					
Cu	0.032	<0.03	0.33	0.051	<0.11
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
$CN_{(Total)}$	<0.02	<0.02	<0.02	<0.02	<0.02
Pb	<0.2	<0.2	<0.2	<0.2	<0.2
Zn	0.049	0.12	0.043	0.034	0.06

Table F.20 (cont'd)

RESULTS OF MONTHLY ANALYSES
SNLA WASTEWATER SAMPLING STATION WW001
PERMIT NO. 2069A, SAMPLE ID: 3069A-4
ALL RESULTS IN mg/l UNLESS OTHERWISE NOTED

APRIL 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	04/04/88 8804040101 9-HOUR, AM	04/05/88 8804050101 9-HOUR, AM	04/06/88 8804060101 9-HOUR, AM	04/07/88 8804070101 9-HOUR, AM	FOUR-DAY AVERAGE
Parameter					
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
Cu	0.12	0.087	0.036	<0.025	<0.07
$CN_{(Total)}$	<0.02	<0.02	0.32	<0.02	<0.10
Pb	<0.005	<0.005	<0.005	<0.005	<0.005
Zn	0.07	0.07	0.04	0.10	0.07

MAY 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	05/06/88 8805060101 24-HOUR	05/09/88 8805090101 72-HOUR	05/10/88 8805100101 24-HOUR	05/11/88 8805110101 24-HOUR	FOUR-DAY AVERAGE
Parameter					
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
Cu	0.29	0.18	0.11	0.056	0.16
$CN_{(Total)}$	<0.02	<0.02	<0.02	0.06	<0.03
Pb	0.011	0.027	0.013	0.013	0.016
Zn	0.05	0.05	0.06	0.09	0.06

JUNE 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	06/06/88 8806060101 9-HOUR, AM	06/07/88 8806070101 9-HOUR, AM	06/08/88 8806080101 9-HOUR, AM	06/09/88 8806090101 9-HOUR, AM	FOUR-DAY AVERAGE
Parameter					
Cu	0.089	0.047	0.036	0.045	0.054
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
$CN_{(Total)}$	<0.02	<0.02	<0.02	0.025	<0.02
Pb	0.012	<0.005	<0.005	<0.005	<0.007
Zn	0.13	0.05	0.03	0.07	0.07

Table F.20 (cont'd)

RESULTS OF MONTHLY ANALYSES
SNLA WASTEWATER SAMPLING STATION WW001
PERMIT NO. 2069A, SAMPLE ID: 3069A-4
ALL RESULTS IN mg/l UNLESS OTHERWISE NOTED

JULY 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	07/11/88 8807110101 9-HOUR, AM	07/12/88 8807120101 9-HOUR, AM	07/13/88 8807130101 9-HOUR, AM	07/14/88 8807140101 9-HOUR, AM	FOUR-DAY AVERAGE
Parameter					
Cu	0.08	0.07	0.05	0.04	0.06
Cd	0.007	<0.005	0.006	0.007	<0.006
$CN_{(Total)}$	<0.02	<0.02	<0.02	0.2	<0.07
Pb	0.005	<0.005	<0.005	0.010	<0.006
Zn	0.13	0.09	0.06	0.22	0.13

AUGUST 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	08/08/88 8808080101 9-HOUR, AM	08/09/88 8808090101 9-HOUR, AM	08/10/88 8808100101 9-HOUR, AM	08/11/88 8808110101 9-HOUR, AM	FOUR-DAY AVERAGE
Parameter					
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
Cu	0.21	0.06	0.05	0.03	0.09
$CN_{(Total)}$	<0.02	<0.02	<0.02	<0.02	<0.02
Pb	<0.005	<0.005	<0.005	<0.005	<0.005
Zn	0.07	0.06	0.06	0.03	0.06

SEPTEMBER 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	09/13/88 8809130101 24-HOUR	09/14/88 8809140101 24-HOUR	09/15/88 8809160101 24-HOUR	09/16/88 8809160101 24-HOUR	FOUR-DAY AVERAGE
Parameter					
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
Cu	0.11	<0.03	<0.03	<0.03	<0.05
$CN_{(Total)}$	<0.02	<0.02	<0.02	<0.02	<0.02
Pb	<0.005	0.006	0.005	<0.005	<0.005
Zn	0.03	0.04	0.03	0.04	0.04

Table F.20 (cont'd)

RESULTS OF MONTHLY ANALYSES
SNLA WASTEWATER SAMPLING STATION WW001
PERMIT NO. 2069A, SAMPLE ID: 3069A-4
ALL RESULTS IN mg/l UNLESS OTHERWISE NOTED

OCTOBER 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	10/11/88 8810110101 24-HOUR	10/12/88 8810120101 24-HOUR	10/13/88 8810130101 24-HOUR	10/14/88 8810140101 24-HOUR	FOUR-DAY AVERAGE
Parameter					
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
Cu	0.03	<0.03	0.04	<0.03	<0.03
$CN_{(Total)}$	<0.02	<0.02	<0.02	<0.02	<0.02
Pb	<0.2	<0.2	<0.2	<0.2	<0.2
Zn	0.03	0.04	0.03	0.04	0.04

NOVEMBER 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	11/09/88 8811090101 24-HOUR COMPOSITE	11/10/88 8811100101 24-HOUR COMPOSITE	11/11/88 8811110101 24-HOUR COMPOSITE	11/12/88 8811120101	FOUR-DAY AVERAGE
Parameter					
Cd	<0.005	<0.005	<0.005	<.005	<0.005
Cu	0.05	0.04	0.02	<0.02	<0.03
$CN_{(Total)}$	0.037	0.105	<0.01	<0.01	<0.04
Pb	<0.02	<0.02	<0.02	<0.02	<0.02
Zn	0.22	0.02	0.18	<0.02	<0.11

DECEMBER 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	12/13/88 8812130101 24-HOUR	12/14/88 8812140101 24-HOUR	12/15/88 8812150101 24-HOUR	12/16/88 8812160101 24-HOUR	FOUR-DAY AVERAGE
Parameter					
Cd	<0.02	<0.02	<0.02	<0.02	<0.02
Cu	0.03	0.03	0.02	0.02	0.03
$CN_{(Total)}$	0.021	0.12	<0.01	0.03	<0.05
Pb	<0.02	<0.02	<0.02	<0.02	<0.02
Zn	0.27	0.31	0.35	0.25	0.30

Table F.21

RESULTS OF MONTHLY ANALYSES
SNLA WASTEWATER SAMPLING STATION WW003
PERMIT NO. 2069C, SAMPLE ID: 3069C-4
ALL RESULTS IN mg/l UNLESS OTHERWISE NOTED

JANUARY 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	01/18/88 8801180301 9-HOUR, AM	01/19/88 8801190301 9-HOUR, AM	01/20/88 8801200301 9-HOUR, AM	01/21/88 8801210301 9-HOUR, AM	FOUR-DAY AVERAGE
Parameter					
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
$Cr_{(Total)}$	<0.01	<0.01	<0.01	<0.01	<0.01
Cu	0.82	0.65	0.22	0.20	0.47
$CN_{(Total)}$	0.037	0.35	<0.02	<0.2	<0.2
Pb	0.011	0.009	0.007	0.006	0.008
Ni	<0.04	<0.04	<0.04	<0.04	<0.04
Ag	<0.01	<0.01	<0.01	<0.01	<0.01
Zn	0.07	0.10	0.3	<0.02	<0.1
Total Metals (Cr+Cu+Ni+Zn)	<0.94	<0.80	<0.6	<0.27	<0.7

FEBRUARY 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	02/22/88 8802220301 9-HOUR, AM	02/23/88 8802230301 9-HOUR, AM	02/24/88 8802240301 9-HOUR, AM	02/25/88 ---------- 9-HOUR, AM	THREE-DAY AVERAGE
Parameter					
Cd	<0.005	<0.005	<0.005		<0.005
$Cr_{(Total)}$	<0.01	<0.01	<0.01	---	<0.01
Cu	0.18	0.53	0.16	---	0.29
$CN_{(Total)}$	0.085	<0.02	0.022	---	<0.04
Pb	0.018	0.019	0.011	---	0.016
Ni	<0.04	<0.04	<0.04	---	<0.04
Ag	<0.01	<0.01	<0.01	---	<0.01
Zn	0.077	0.061	0.066	---	0.068
Total Metals (Cr+Cu+Ni+Zn)	<0.31	<0.64	<0.28	---	<0.41

Table F.21 (cont'd)

RESULTS OF MONTHLY ANALYSES
SNLA WASTEWATER SAMPLING STATION WW003
PERMIT NO. 2069C, SAMPLE ID: 3069C-4
ALL RESULTS IN mg/l UNLESS OTHERWISE NOTED

MARCH 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	03/14/88 9-HOUR, AM	03/15/88 8803150301 9-HOUR, AM	03/16/88 8803160301 9-HOUR, AM	03/17/88 8803170301 9-HOUR, AM	 THREE-DAY AVERAGE
Parameter					
Cd	- - -	<0.005	0.0064	<0.005	<0.005
$Cr_{(Total)}$	- - -	<0.01	<0.01	<0.01	<0.01
Cu	- - -	0.41	0.10	0.51	0.34
$CN_{(Total)}$	- - -	0.14	0.23	0.037	0.14
Pb	- - -	0.45	0.10	0.51	0.35
Ni	- - -	<0.04	<0.04	<0.04	<0.04
Ag	- - -	<0.01	<0.01	0.016	<0.01
Zn	- - -	0.21	0.055	0.078	0.11
Total Metals (Cr+Cu+Ni+Zn)	- - -	<0.67	<0.21	<0.64	<0.51

APRIL 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	04/18/88 8804180301 9-HOUR, AM	04/19/88 8804190301 9-HOUR, AM	04/20/88 8804200301 9-HOUR, AM	04/21/88 8804210301 9-HOUR, AM	 FOUR-DAY AVERAGE
Parameter					
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
$Cr_{(Total)}$	0.023	<0.01	0.016	0.017	<0.014
Cu	42	0.18	0.38	0.66	11
$CN_{(Total)}$	<0.02	<0.02	<0.17	0.11	<0.08
Pb	0.20	0.010	0.008	0.039	0.06
Ni	<0.04	<0.04	<0.04	<0.04	<0.04
Ag	<0.01	<0.01	<0.01	<0.01	<0.01
Zn	0.92	0.070	0.088	0.12	0.30
Total Metals (Cr+Cu+Ni+Zn)	<43.0	<0.30	<0.13	<0.21	<11.4

Table F.21 (cont'd)

RESULTS OF MONTHLY ANALYSES
SNLA WASTEWATER SAMPLING STATION WW003
PERMIT NO. 2069C, SAMPLE ID: 3069C-4
ALL RESULTS IN mg/l UNLESS OTHERWISE NOTED

MAY 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	05/06/88 8805060301 24-HOUR	05/09/88 8805090301 72-HOUR	05/10/88 8805100301 24-HOUR	05/11/88 8805110301 24-HOUR	FOUR-DAY AVERAGE
Parameter					
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
$Cr_{(Total)}$	0.03	0.01	<0.01	0.01	<0.02
Cu	0.53	0.28	0.27	0.14	0.31
$CN_{(Total)}$	<0.02	<0.02	<0.02	<0.02	<0.02
Pb	0.011	0.075	0.013	0.009	0.027
Ni	<0.04	<0.04	<0.04	<0.04	<0.04
Ag	<0.01	<0.01	<0.01	0.01	<0.01
Zn	0.05	0.06	0.06	0.09	0.07
Total Metals (Cr+Cu+Ni+Zn)	<0.65	<0.39	<0.38	<0.28	<0.43

JUNE 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	06/20/88 8806200301 9-HOUR, AM	06/21/88 8806210301 9-HOUR, AM	06/22/88 8806220301 9-HOUR, AM	06/23/88 8806230301 9-HOUR, AM	FOUR-DAY AVERAGE
Parameter					
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
$Cr_{(Total)}$	<0.01	<0.01	0.01	<0.01	<0.01
Cu	0.11	0.12	0.22	0.11	0.14
$CN_{(Total)}$	<0.02	<0.02	<0.02	<0.02	<0.02
Pb	0.014	<0.005	0.008	0.006	<0.008
Ni	<0.4	<0.04	<0.04	<0.04	<0.04
Ag	<0.01	<0.01	<0.01	<0.01	<0.01
Zn	0.07	0.07	0.08	0.06	0.07
Total Metals (Cr+Cu+Ni+Zn)	<0.59	<0.24	<0.35	<0.22	<0.35

Table F.21 (cont'd)

RESULTS OF MONTHLY ANALYSES
SNLA WASTEWATER SAMPLING STATION WW003
PERMIT NO. 2069C, SAMPLE ID: 3069C-4
ALL RESULTS IN mg/l UNLESS OTHERWISE NOTED

JULY 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	07/26/88 8807260301 9-HOUR, AM	07/27/88 8807270301 9-HOUR, AM	07/28/88 8807280301 9-HOUR, AM	07/29/88 8807290301 9-HOUR, AM	FOUR-DAY AVERAGE
Parameter					
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
$Cr_{(Total)}$	<0.01	<0.01	<0.01	<0.01	<0.01
Cu	0.19	0.22	0.20	0.17	0.20
$CN_{(Total)}$	<0.02	<0.02	<0.02	<0.02	<0.02
Pb	0.016	0.006	0.012	0.005	0.010
Ni	<0.04	<0.04	<0.04	<0.04	<0.04
Ag	<0.01	<0.01	<0.01	<0.01	<0.01
Zn	0.08	0.04	0.04	0.03	0.05
Total Metals (Cr+Cu+Ni+Zn)	<0.32	<0.31	<0.29	<0.25	<0.29

AUGUST 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	08/22/88 8808220301 9-HOUR, AM	08/23/88 8808230301 9-HOUR, AM	08/24/88 8808240301 9-HOUR, AM	08/25/88 8808250301 9-HOUR, AM	FOUR-DAY AVERAGE
Parameter					
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
$Cr_{(Total)}$	<0.01	<0.01	<0.01	<0.01	<0.01
Cu	0.46	2.3	1.3	2.3	1.6
$CN_{(Total)}$	1.5	<0.02	0.02	<0.02	<0.4
Pb	0.013	0.013	0.024	0.013	0.016
Ni	<0.04	<0.04	<0.04	<0.04	<0.04
Ag	<0.01	<0.01	<0.01	<0.01	<0.01
Zn	0.04	0.07	0.06	0.10	0.07
Total Metals (Cr+Cu+Ni+Zn)	<0.55	<2.4	<1.4	<2.5	<1.7

Table F.21 (cont'd)

RESULTS OF MONTHLY ANALYSES
SNLA WASTEWATER SAMPLING STATION WW003
PERMIT NO. 2069C, SAMPLE ID: 3069C-4
ALL RESULTS IN mg/l UNLESS OTHERWISE NOTED

SEPTEMBER 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	09/20/88 8809200301 24-HOUR	09/21/88 8809210301 24-HOUR	09/22/88 8809220301 24-HOUR	09/23/88 8809230301 24-HOUR	FOUR-DAY AVERAGE
Parameter					
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
$Cr_{(Total)}$	<0.01	<0.01	<0.01	<0.01	<0.01
Cu	0.25	0.26	0.15	0.23	0.22
$CN_{(Total)}$	<0.02	0.7	<0.02	<0.02	<0.19
Pb	0.012	0.090	0.030	0.014	0.037
Ni	<0.04	<0.04	<0.04	<0.04	<0.04
Ag	<0.01	<0.01	<0.01	<0.01	<0.01
Zn	0.18	0.13	0.13	0.14	0.15
Total Metals (Cr+Cu+Ni+Zn)	<0.48	<0.44	<0.33	<0.42	<0.42

OCTOBER 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	10/18/88 8810180302 24-HOUR	10/19/88 8810190301 24-HOUR	10/20/88 8810200301 24-HOUR	10/21/88 8810210301 24-HOUR	FOUR-DAY AVERAGE
Parameter					
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
$Cr_{(Total)}$	<0.01	<0.01	<0.01	<0.01	<0.01
Cu	0.18	<0.08	0.18	<0.22	<0.17
$CN_{(Total)}$	<0.02	0.1	0.04	<0.2	<0.01
Pb	0.21	0.008	0.014	0.065	0.074
Ni	<0.04	<0.04	<0.04	<0.04	<0.04
Ag	<0.01	<0.01	<0.01	<0.01	<0.01
Zn	0.04	0.02	0.05	0.25	0.09
Total Metals (Cr+Cu+Ni+Zn)	<0.27	<0.15	<0.28	<0.52	<0.31

Table F.21 (cont'd)

RESULTS OF MONTHLY ANALYSES
SNLA WASTEWATER SAMPLING STATION WW003
PERMIT NO. 2069C, SAMPLE ID: 3069C-4
ALL RESULTS IN mg/l

NOVEMBER 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	11/09/88 8811090301 24-HOUR COMPOSITE	11/10/88 8811100301 24-HOUR COMPOSITE	11/11/88 8811110301 24-HOUR COMPOSITE	11/12/88 8811120301 24-HOUR COMPOSITE	FOUR-DAY AVERAGE
Parameter					
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
$Cr_{(Total)}$	<0.02	<0.02	<0.02	<0.02	<0.02
Cu	0.33	0.38	0.53	0.25	0.37
$CN_{(Total)}$	0.012	<0.01	0.01	0.015	<0.01
Pb	<0.02	<0.02	<0.02	<0.02	<0.02
Ni	<0.04	<0.04	<0.04	<0.04	<0.04
Ag	0.04	<0.01	0.07	<0.01	<0.03
Zn	<0.02	0.22	0.27	<0.02	<0.13
Total Metals (Cr+Cu+Ni+Zn)	<0.41	<0.66	<0.86	<0.33	<0.56

DECEMBER 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	12/13/88 8812130301 24-HOUR	12/14/88 8812140301 24-HOUR	12/15/88 8812150301 24-HOUR	12/16/88 8812160301 24-HOUR	FOUR-DAY AVERAGE
Parameter					
Cd	<0.02	<0.02	<0.02	<0.02	<0.02
$Cr_{(Total)}$	<0.02	<0.02	<0.02	0.10	<0.04
Cu	0.13	0.55	0.19	0.19	0.27
$CN_{(Total)}$	0.066	0.017	0.010	<0.01	<0.03
Pb	<0.02	<0.02	<0.02	0.04	<0.03
Ni	<0.04	<0.04	<0.04	<0.04	<0.04
Ag	<0.01	<0.01	<0.01	<0.01	<0.01
Zn	0.34	0.26	0.24	0.41	0.31
Total Metals (Cr+Cu+Ni+Zn)	<0.53	<0.87	<0.49	<0.74	<0.66

Table F.22

RESULTS OF MONTHLY ANALYSES
SNLA WASTEWATER SAMPLING STATION WW004
PERMIT NO. 2069D, SAMPLE ID: 3069D-4
ALL RESULTS IN mg/l UNLESS OTHERWISE NOTED

JANUARY 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	01/18/88 8801180401 9-HOUR, AM	01/19/88 8801190401 9-HOUR, AM	01/20/88 8801200401 9-HOUR, AM	01/21/88 8801210401 9-HOUR, AM	FOUR-DAY AVERAGE
Parameter					
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
$Cr_{(Total)}$	0.038	<0.01	<0.025	<0.01	<0.02
Cu	<0.025	<0.025	<0.025	0.026	<0.025
$CN_{(Total)}$	<0.02	<0.02	0.21	<0.02	<0.07
Pb	0.007	<0.005	0.02	0.009	<0.01
Ni	0.065	<0.04	<0.04	<0.04	<0.05
Ag	<0.01	<0.01	<0.01	<0.01	<0.01
Zn	<0.02	<0.02	<0.02	<0.02	<0.02

FEBRUARY 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	02/22/88 8802220401 9-HOUR, AM	02/23/88 8802230401 9-HOUR, AM	02/24/88 8802240401 9-HOUR, AM	02/25/88 8802250401 9-HOUR, AM	FOUR-DAY AVERAGE
Parameter					
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
$Cr_{(Total)}$	<0.01	<0.01	0.013	<0.01	<0.01
Cu	0.051	0.043	0.04	<0.03	<0.04
$CN_{(Total)}$	<0.02	0.025	<0.02	<0.02	<0.02
Pb	0.008	0.008	0.008	<0.005	<0.007
Ni	<0.04	<0.04	0.092	<0.04	<0.05
Ag	<0.01	<0.01	<0.01	<0.01	<0.01
Zn	<0.02	<0.02	0.022	<0.02	<0.02

Table F.22 (cont'd)

RESULTS OF MONTHLY ANALYSES
SNLA WASTEWATER SAMPLING STATION WW004
PERMIT NO. 2069D, SAMPLE ID: 3069D-4
ALL RESULTS IN mg/l UNLESS OTHERWISE NOTED

MARCH 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	03/14/88 9-HOUR, AM	03/15/88 8803150401 9-HOUR, AM	03/16/88 8803160401 9-HOUR, AM	03/17/88 9-HOUR, AM	 TWO-DAY AVERAGE
Parameter					
Cd	- - -	<0.005	0.005	- - -	<0.005
$Cr_{(Total)}$	- - -	0.014	0.013	- - -	0.014
Cu	- - -	<0.025	0.035	- - -	<0.030
$CN_{(Total)}$	- - -	<0.02	<0.02	- - -	<0.02
Pb	- - -	0.011	<0.005	- - -	<0.008
Ni	- - -	<0.04	<0.04	- - -	<0.04
Ag	- - -	<0.01	<0.01	- - -	<0.01
Zn	- - -	0.037	0.029	- - -	0.033

APRIL 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	04/18/88 8804180401 9-HOUR, AM	04/19/88 8804190401 9-HOUR, AM	04/20/88 8804200401 9-HOUR, AM	04/21/88 8804210401 9-HOUR, AM	 FOUR-DAY AVERAGE
Parameter					
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
$Cr_{(Total)}$	<0.01	0.014	0.026	0.011	<0.02
Cu	0.039	0.037	0.048	0.17	0.07
$CN_{(Total)}$	<0.02	<0.02	0.024	<0.02	<0.02
Pb	0.015	0.007	0.005	0.006	0.008
Ni	0.046	<0.04	0.13	<0.04	<0.06
Ag	<0.01	<0.01	<0.01	<0.01	<0.01
Zn	0.021	0.044	0.037	0.034	0.035

Table F.22 (cont'd)

RESULTS OF MONTHLY ANALYSES
SNLA WASTEWATER SAMPLING STATION WW004
PERMIT NO. 2069D, SAMPLE ID: 3069D-4
ALL RESULTS IN mg/l UNLESS OTHERWISE NOTED

MAY 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	05/05/88 8805050401 24-HOUR	05/06/88 8805060401 24-HOUR	05/10/88 8805100401 24-HOUR	05/11/88 8805110401 24-HOUR	FOUR-DAY AVERAGE
Parameter					
Cd	0.01	<0.005	<0.005	<0.005	<0.006
$Cr_{(Total)}$	0.03	0.05	0.02	0.01	0.03
Cu	0.047	0.067	0.049	0.042	0.051
$CN_{(Total)}$	<0.02	<0.02	<0.02	<0.02	<0.02
Pb	0.009	0.007	0.009	0.010	0.009
Ni	<0.04	<0.04	<0.04	<0.04	<0.04
Ag	<0.01	<0.01	<0.01	<0.01	<0.01
Zn	0.03	0.04	0.02	<0.02	<0.03

JUNE 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	06/21/88 8806210401 24-HOUR	06/22/88 8806220401 24-HOUR	06/23/88 8806230401 24-HOUR	06/24/88 8806240401 24-HOUR	FOUR-DAY AVERAGE
Parameter					
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
$Cr_{(Total)}$	0.02	0.05	0.76	2.3	0.8
Cu	0.068	0.045	0.046	0.075	0.058
$CN_{(Total)}$	<0.02	<0.02	<0.02	<0.02	<0.02
Pb	<0.005	<0.005	<0.005	0.008	<0.006
Ni	0.17	<0.04	<0.04	<0.04	<0.07
Ag	<0.01	<0.01	<0.01	<0.01	<0.01
Zn	0.06	0.05	0.05	0.04	0.05

Table F.22 (cont'd)

RESULTS OF MONTHLY ANALYSES
SNLA WASTEWATER SAMPLING STATION WW004
PERMIT NO. 2069D, SAMPLE ID: 3069D-4
ALL RESULTS IN mg/l UNLESS OTHERWISE NOTED

JULY 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	07/26/88 8807260401 24-HOUR	07/27/88 8807270401 24-HOUR	07/28/88 8807280401 24-HOUR	07/29/88 8807290401 24-HOUR *	FOUR-DAY AVERAGE
Parameter					
Cd	0.014	<0.005	0.010	<0.005	<0.009
$Cr_{(Total)}$	0.07	0.02	0.07	0.03	0.05
Cu	0.03	<0.025	<0.025	0.03	<0.03
$CN_{(Total)}$	<0.02	<0.02	<0.02	<0.02	<0.02
Pb	0.013	0.005	0.011	0.009	0.010
Ni	<0.04	<0.04	<0.04	<0.04	<0.04
Ag	<0.01	<0.01	<0.01	<0.01	<0.01
Zn	0.16	0.02	0.10	0.03	0.08

AUGUST 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	08/23/88 8808230401 24-HOUR	08/24/88 8808240401 24-HOUR	08/25/88 8808250401 24-HOUR	08/26/88 8808260401 24-HOUR	FOUR-DAY AVERAGE
Parameter					
Cd	<0.005	0.01	<0.005	<0.005	<0.006
$Cr_{(Total)}$	<0.01	<0.01	0.03	0.06	<0.03
Cu	<0.03	<0.03	0.04	0.04	<0.04
$CN_{(Total)}$	<0.02	<0.02	<0.02	<0.02	<0.02
Pb	<0.005	<0.005	<0.005	<0.005	<0.005
Ni	<0.04	<0.04	<0.04	<0.04	<0.04
Ag	<0.01	<0.01	<0.01	<0.01	<0.01
Zn	<0.02	<0.02	<0.02	<0.02	<0.02

Table F.22 (cont'd)

RESULTS OF MONTHLY ANALYSES
SNLA WASTEWATER SAMPLING STATION WW004
PERMIT NO. 2069D, SAMPLE ID: 3069D-4
ALL RESULTS IN mg/l UNLESS OTHERWISE NOTED

SEPTEMBER 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	09/20/88 8809200401 24-HOUR	09/21/88 8809210401 24-HOUR	09/22/88 8809220401 24-HOUR	09/23/88 8809230401 24-HOUR	FOUR-DAY AVERAGE
Parameter					
Cd	<0.005	0.016	<0.005	<0.005	<0.008
$Cr_{(Total)}$	0.01	<0.01	0.01	<0.01	<0.01
Cu	<0.03	0.04	0.07	<0.03	<0.05
$CN_{(Total)}$	<0.02	<0.02	<0.02	<0.02	<0.02
Pb	0.005	0.014	0.007	0.012	0.010
Ni	<0.04	<0.04	<0.04	<0.04	<0.04
Ag	<0.01	<0.01	<0.01	<0.01	<0.01
Zn	0.09	0.09	0.10	0.07	0.09

OCTOBER 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	10/18/88 8810180401 24-HOUR	10/19/88 8810190401 24-HOUR	10/20/88 8810200401 24-HOUR	10/21/88 8810210401 24-HOUR	FOUR-DAY AVERAGE
Parameter					
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
$Cr_{(Total)}$	<0.01	<0.01	<0.01	<0.01	<0.01
Cu	0.34	<0.09	0.11	0.05	<0.15
$CN_{(Total)}$	0.03	<0.02	<0.02	0.03	<0.03
Pb	0.006	<0.005	<0.005	0.005	<0.005
Ni	<0.04	<0.04	<0.04	<0.04	<0.04
Ag	<0.01	<0.01	<0.01	<0.01	<0.01
Zn	<0.02	<0.02	<0.02	<0.02	<0.02

Table F.22 (cont'd)

RESULTS OF MONTHLY ANALYSES
SNLA WASTEWATER SAMPLING STATION WW004
PERMIT NO. 2069D, SAMPLE ID: 3069D-4
ALL RESULTS IN mg/l

NOVEMBER 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	11/09/88 8811090401 24-HOUR COMPOSITE	11/10/88 8811100401 24-HOUR COMPOSITE	11/11/88 8811110401 24-HOUR COMPOSITE	11/12/88 8811120401 24-HOUR COMPOSITE	FOUR-DAY AVERAGE
Parameter					
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
$Cr_{(Total)}$	<0.02	<0.02	0.03	0.02	<0.02
Cu	0.03	0.04	0.06	0.04	0.04
$CN_{(Total)}$	<0.01	<0.1	<0.01	<0.01	<0.01
Pb	<0.02	<0.02	<0.02	<0.02	<0.02
Ni	<0.04	<0.04	<0.04	<0.04	<0.04
Ag	<0.01	<0.01	<0.01	<0.01	<0.01
Zn	<0.02	<0.02	0.09	<0.02	<0.04

DECEMBER 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	12/13/88 8812130401 24-HOUR	12/14/88 8812140401 24-HOUR	12/15/88 8812150401 24-HOUR	12/16/88 24-HOUR	THREE-DAY AVERAGE
Parameter					
Cd	<0.02	<0.02	<0.02		<0.02
$Cr_{(Total)}$	0.02	<0.02	<0.02		<0.02
Cu	0.02	0.03	0.05		0.03
$CN_{(Total)}$	<0.01	0.02	<0.01		<0.01
Pb	0.33	<0.02	<0.02		<0.12
Ni	<0.04	<0.04	<0.04		<0.04
Ag	<0.01	<0.01	<0.01		<0.01
Zn	0.13	<0.02	0.22		<0.12

Table F.23

RESULTS OF MONTHLY ANALYSES
SNLA WASTEWATER SAMPLING STATION WW005
PERMIT NO. 2069E, SAMPLE ID: 3069E-4
ALL RESULTS IN mg/l UNLESS OTHERWISE NOTED

JANUARY 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	01/05/88 8801050501 24-HOUR	01/06/88 8801060501 24-HOUR	01/07/88 8801070501 24-HOUR	01/08/88 8801080501 24-HOUR	FOUR-DAY AVERAGE
Parameter					
As	<0.01	<0.01	<0.01	<0.01	<0.01
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
$Cr_{(Total)}$	<0.01	<0.01	0.01	0.013	<0.01
Cu	<0.02	<0.02	<0.02	<0.02	<0.02
F	6.4	68	13	57	36
Pb	<0.005	<0.005	<0.005	<0.005	<0.005
Ni	<0.04	<0.04	<0.04	<0.04	<0.04
Zn	<0.05	<0.05	<0.05	<0.05	<0.05
Total Metals (Cr+Cu+Ni+Zn)	<0.12	<0.12	<0.12	<0.12	<0.12

FEBRUARY 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	02/02/88 8802020501 24-HOUR	02/03/88 8802030501 24-HOUR	02/04/88 8802040501 24-HOUR	02/05/88 8802050501 24-HOUR	FOUR-DAY AVERAGE
Parameter					
As	<0.01	<0.01	<0.01	<0.01	<0.01
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
$Cr_{(Total)}$	<0.01	<0.01	<0.01	<0.01	<0.01
Cu	<0.025	<0.025	<0.025	<0.025	<0.025
F	5.7	38	15	55	28
Pb	0.007	<0.005	<0.005	<0.005	<0.006
Ni	<0.04	<0.04	<0.04	<0.04	<0.04
Zn	<0.02	<0.02	<0.02	0.02	<0.02
Total Metals (Cr+Cu+Ni+Zn)	<0.10	<0.10	<0.10	<0.10	<0.10

Table F.23 (cont'd)

RESULTS OF MONTHLY ANALYSES
SNLA WASTEWATER SAMPLING STATION WW005
PERMIT NO. 2069E, SAMPLE ID: 3069E-4
ALL RESULTS IN mg/l UNLESS OTHERWISE NOTED

MARCH 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	03/01/88 8803010501 24-HOUR	03/02/88 8803020501 24-HOUR	03/03/88 8803030501 24-HOUR	03/04/88 8803040501 24-HOUR	FOUR-DAY AVERAGE
Parameter					
As	<0.01	<0.01	<0.01	<0.01	<0.01
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
Cr$_{(Total)}$	<0.015	<0.015	<0.01	<0.01	<0.01
Cu	<0.03	<0.03	<0.03	<0.03	<0.03
F	21	47	6.6	50	31
Pb	<0.2	<0.2	<0.2	<0.2	<0.2
Ni	<0.04	<0.04	<0.04	<0.04	<0.04
Zn	<0.043	<0.02	<0.02	<0.02	<0.02
Total Metals (Cr+Cu+Ni+Zn)	<0.13	<0.11	<0.10	<0.10	<0.11

APRIL 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	04/05/88 8804050501 24-HOUR	04/06/88 8804060501 24-HOUR	04/07/88 8804070501 24-HOUR	04/08/88 8804080501 24-HOUR	FOUR-DAY AVERAGE
Parameter					
As	<0.01	<0.01	<0.01	<0.01	<0.01
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
Cr$_{(Total)}$	0.03	0.01	0.02	0.02	0.02
Cu	<0.025	<0.025	<0.025	<0.025	<0.025
F	4.5	29	46	27	27
Pb	<0.005	<0.005	<0.005	<0.005	<0.005
Ni	<0.04	<0.04	<0.04	<0.04	<0.04
Zn	0.02	<0.02	<0.02	0.03	<0.02
Total Metals (Cr+Cu+Ni+Zn)	<0.12	<0.10	<0.11	<0.12	<0.11

Table F.23 (cont'd)

RESULTS OF MONTHLY ANALYSES
SNLA WASTEWATER SAMPLING STATION WW005
PERMIT NO. 2069E, SAMPLE ID: 3069E-4
ALL RESULTS IN mg/l UNLESS OTHERWISE NOTED

MAY 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	05/06/88 8805060501 24-HOUR	05/09/88 8805090501 72-HOUR	05/10/88 8805100501 24-HOUR	05/11/88 8805110501 24-HOUR	FOUR-DAY AVERAGE
Parameter					
As	<0.01	<0.01	<0.01	<0.01	<0.01
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
$Cr_{(Total)}$	0.05	0.05	<0.01	0.06	<0.04
Cu	0.052	<0.025	0.026	<0.025	<0.032
F	26	15	13	60	29
Pb	<0.005	0.009	0.008	<0.005	<0.007
Ni	<0.04	<0.04	<0.04	<0.04	<0.04
Zn	0.02	0.02	0.03	<0.02	<0.02
Total Metals (Cr+Cu+Ni+Zn)	<0.16	<0.14	<0.11	<0.15	<0.14

JUNE 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	06/07/88 8806070501 24-HOUR	06/08/88 8806080501 24-HOUR	06/09/88 8806090501 24-HOUR	06/10/88 8806100501 24-HOUR	FOUR-DAY AVERAGE
Parameter					
As	<0.01	<0.01	<0.01	<0.01	<0.01
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
$Cr_{(Total)}$	0.03	0.04	0.02	0.04	0.03
Cu	<0.025	<0.025	<0.025	<0.025	<0.025
F	10	68	8.6	52	35
Pb	<0.005	<0.005	<0.005	<0.005	<0.005
Ni	<0.04	<0.04	<0.04	<0.04	<0.04
Zn	<0.02	<0.02	<0.02	<0.02	<0.02
Total Metals (Cr+Cu+Ni+Zn)	<0.11	<0.12	<0.10	<0.12	<0.11

Table F.23 (cont'd)

RESULTS OF MONTHLY ANALYSES
SNLA WASTEWATER SAMPLING STATION WW005
PERMIT NO. 2069E, SAMPLE ID: 3069E-4
ALL RESULTS IN mg/l UNLESS OTHERWISE NOTED

JULY 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	07/26/88 8807260501 24-HOUR	07/27/88 8807270501 24-HOUR	07/28/88 8807280501 24-HOUR	07/29/88 8807290501 24-HOUR	FOUR-DAY AVERAGE
Parameter					
As	<0.01	<0.01	<0.01	<0.01	<0.01
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
Cr(Total)	<0.01	<0.01	<0.01	0.02	<0.01
Cu	<0.025	0.03	<0.025	<0.025	<0.03
F	15	56	10	37	30
Pb	0.005	0.016	0.008	0.007	0.009
Ni	<0.04	<0.04	<0.04	<0.04	<0.04
Zn	<0.02	0.03	<0.02	<0.02	<0.02
Total Metals (Cr+Cu+Ni+Zn)	<0.10	<0.11	<0.10	<0.11	<0.10

AUGUST 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	08/23/88 8808230501 24-HOUR	08/24/88 8808240501 24-HOUR	08/25/88 8808250501 24-HOUR	08/26/88 8808260501 24-HOUR	FOUR-DAY AVERAGE
Parameter					
As	<0.01	<0.01	<0.01	<0.01	<0.01
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
Cr(Total)	<0.01	<0.01	0.04	0.05	<0.03
Cu	<0.03	<0.03	<0.03	<0.03	<0.03
F	22	58	16	40	34
Pb	<0.005	0.005	0.05	<0.005	<0.02
Ni	<0.04	<0.04	<0.04	<0.04	<0.04
Zn	<0.02	<0.02	<0.02	<0.02	<0.02
Total Metals (Cr+Cu+Ni+Zn)	<0.10	<0.10	<0.013	<0.14	<0.12

Table F.23 (cont'd)

RESULTS OF MONTHLY ANALYSES
SNLA WASTEWATER SAMPLING STATION WW005
PERMIT NO. 2069E, SAMPLE ID: 3069E-4
ALL RESULTS IN mg/l UNLESS OTHERWISE NOTED

SEPTEMBER 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	09/13/88 8809130501 24-HOUR	09/14/88 8809140501 24-HOUR	09/15/88 8809150501 24-HOUR	09/16/88 8809160501 24-HOUR	FOUR-DAY AVERAGE
Parameter					
As	<0.01	<0.01	<0.01	<0.01	<0.01
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
Cr(Total)	0.02	0.02	0.02	0.12	0.05
Cu	<0.03	<0.03	<0.03	<0.03	<0.03
Pb	<0.005	0.037	<0.005	<0.005	<0.013
Ni	<0.04	<0.04	<0.04	<0.04	<0.04
Zn	<0.02	0.05	0.03	0.02	<0.03
F	10	36	26	42	28.5

OCTOBER 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	10/11/88 8810110501 24-HOUR	10/12/88 8810120501 24-HOUR	10/13/88 8810130501 24-HOUR	10/14/88 8810140501 24-HOUR	FOUR-DAY AVERAGE
Parameter					
As	<0.01	<0.01	<0.01	<0.01	<0.01
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
Cr(Total)	0.02	0.02	0.01	0.02	0.02
Cu	<0.03	<0.03	<0.03	<0.03	<0.03
F	16	31	11	36	24
Pb	<0.2	<0.2	<0.2	<0.2	<0.2
Ni	<0.04	<0.04	<0.04	<0.04	<0.04
Zn	0.02	<0.02	<0.02	<0.02	<0.02
Total Metals (Cr+Cu+Ni+Zn)	<0.11	<0.11	<0.10	<0.11	<0.11

Table F.23 (cont'd)

RESULTS OF MONTHLY ANALYSES
SNLA WASTEWATER SAMPLING STATION WW005
PERMIT NO. 2069E, SAMPLE ID: 3069E-4
ALL RESULTS IN mg/l

NOVEMBER 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	11/09/88 8811090501 24-HOUR COMPOSITE	11/10/88 8811100501 24-HOUR COMPOSITE	11/11/88 8811110501	11/12/88 8811120301 24-HOUR COMPOSITE	FOUR-DAY AVERAGE
Parameter					
As	<0.002	<0.002	<0.002	<0.002	<0.002
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
$Cr_{(Total)}$	0.03	<0.02	<0.02	<0.02	<0.02
Cu	0.04	<0.02	0.02	<0.02	<0.03
F	25	6.1	20	15	16.5
Pb	<0.02	<0.02	<0.02	<0.02	<0.02
Ni	<0.04	<0.04	<0.04	<0.04	<0.04
Zn	<0.02	<0.02	<0.02	<0.02	<0.02
Total Metals (Cr+Cu+Ni+Zu)	<0.13	<0.10	<0.10	<0.10	<0.11

DECEMBER 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	12/06/88 8812060501 24-HOUR	12/07/88 8812070501 24-HOUR	12/08/88 8812080501 24-HOUR	12/09/88 8812090501 24-HOUR	FOUR-DAY AVERAGE
Parameter					
As	<0.002	<0.002	<0.002	<0.002	<0.002
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
$Cr_{(Total)}$	<0.03	0.16	<0.03	<0.03	<0.06
Cu	<0.02	<0.02	<0.02	<0.02	<0.02
F (Soluble)	3.6	21	39	13	19
Pb	<0.02	<0.02	<0.02	<0.02	<0.02
Ni	<0.04	<0.04	<0.04	<0.04	<0.04
Zn	<0.02	0.07	0.06	0.08	<0.06
Total Metals (Cr+Cu+Ni+Zn)	<0.11	<0.29	<0.15	<0.17	<0.18

Table F.24

RESULTS OF MONTHLY ANALYSES
SNLA WASTEWATER SAMPLING STATION WW006
PERMIT NO. 2069F, SAMPLE ID: 3069F-4
ALL RESULTS IN mg/l UNLESS OTHERWISE NOTED

JANUARY 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	01/11/88 8801110601 9-HOUR, AM	01/12/88 8801120601 9-HOUR, AM	01/13/88 8801130601 9-HOUR, AM	01/14/88 8801140601 9-HOUR, AM	FOUR-DAY AVERAGE
Parameter					
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
Cu	0.20	0.13	0.11	0.081	0.13
$CN_{(Total)}$	0.054	<0.02	<0.02	<0.02	<0.03
Pb	0.016	0.013	0.013	0.022	0.016
Zn	0.14	0.12	0.11	0.11	0.12

FEBRUARY 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	02/08/88 8802080601 9-HOUR, AM	02/09/88 8802090601 9-HOUR, AM	02/10/88 8802100601 9-HOUR, AM	02/11/88 8802110601 9-HOUR, AM	FOUR-DAY AVERAGE
Parameter					
Cd	0.90	<0.005	0.0065	<0.005	<0.23
Cu	0.093	0.15	0.12	0.16	0.13
$CN_{(Total)}$	<0.02	<0.02	<0.02	<0.02	<0.02
Pb	0.015	0.016	0.022	0.016	0.017
Zn	0.63	0.035	0.22	0.072	0.24

MARCH 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	03/07/88 8803070601 9-HOUR, AM	03/08/88 8803080601 9-HOUR, AM	03/09/88 9-HOUR, AM	03/10/88 8803100601 9-HOUR, AM	THREE-DAY AVERAGE
Parameter					
Cd	0.005	<0.005	- - -	<0.005	<0.005
Cu	0.095	0.33	- - -	0.17	0.20
$CN_{(Total)}$	<0.02	<0.02	- - -	<0.02	<0.02
Pb	0.028	0.028	- - -	0.010	0.022
Zn	0.20	0.13	- - -	0.064	0.13

Table F.24 (cont'd)

RESULTS OF MONTHLY ANALYSES
SNLA WASTEWATER SAMPLING STATION WW006
PERMIT NO. 2069F, SAMPLE ID: 3069F-4
ALL RESULTS IN mg/l UNLESS OTHERWISE NOTED

APRIL 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	04/04/88 8804040601 9-HOUR, AM	04/05/88 8804050601 9-HOUR, AM	04/06/88 8804060601 9-HOUR, AM	04/07/88 8804070601 9-HOUR, AM	FOUR-DAY AVERAGE
Parameter					
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
Cu	0.20	0.10	0.044	0.39	0.18
$CN_{(Total)}$	0.02	0.04	<0.02	<0.02	<0.02
Pb	0.025	0.022	0.010	0.020	0.019
Zn	0.14	0.22	0.069	0.23	0.16

MAY 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	05/06/88 8805060601 24-HOUR	05/09/88 8805090601 72-HOUR	05/10/88 8805100601 24-HOUR	05/11/88 8805110601 24-HOUR	FOUR-DAY AVERAGE
Parameter					
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
Cu	0.23	0.20	0.19	0.047	0.17
$CN_{(Total)}$	<0.02	<0.02	<0.02	<0.02	<0.02
Pb	0.013	0.046	0.017	0.009	0.021
Zn	0.14	0.16	0.10	0.05	0.11

JUNE 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	06/28/88 8806280601 9-HOUR, AM	06/29/88 8806290601 9-HOUR, AM	06/30/88 8806300601 9-HOUR, AM	07/01/88 8807010601 9-HOUR, AM	FOUR-DAY AVERAGE
Parameter					
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
Cu	0.08	0.06	0.08	0.06	0.07
$CN_{(Total)}$	0.04	0.06	0.08	0.20	0.10
Pb	0.011	0.007	0.21	0.006	0.06
Zn	0.10	0.05	0.08	0.12	0.09

Table F.24 (cont'd)

RESULTS OF MONTHLY ANALYSES
SNLA WASTEWATER SAMPLING STATION WW006
PERMIT NO. 2069F, SAMPLE ID: 3069F-4
ALL RESULTS IN mg/l UNLESS OTHERWISE NOTED

JULY 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	07/12/88 8807120601 24-HOUR	07/13/88 8807130601 24-HOUR	07/14/88 8807140601 24-HOUR	07/15/88 8807150601 24-HOUR	FOUR-DAY AVERAGE
Parameter					
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
Cu	0.26	0.10	0.06	0.22	0.16
$CN_{(Total)}$	0.02	<0.02	<0.02	0.03	<0.02
Pb	0.008	<0.005	<0.005	0.26	<0.07
Zn	0.10	0.16	0.09	0.09	0.11

AUGUST 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	08/09/88 8808090601 24-HOUR	08/10/88 8808100601 24-HOUR	08/11/88 8808110601 24-HOUR	08/12/88 8808120601 24-HOUR	FOUR-DAY AVERAGE
Parameter					
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
Cu	0.06	0.08	0.08	0.05	0.07
$CN_{(Total)}$	<0.02	<0.02	<0.02	<0.02	<0.02
Pb	<0.005	<0.005	<0.005	0.009	<0.006
Zn	0.07	0.04	0.06	0.07	0.06

SEPTEMBER 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	09/13/88 8809130601 24-HOUR	09/14/88 8809140601 24-HOUR	09/15/88 8809150601 24-HOUR	09/16/88 8809160601 24-HOUR	FOUR-DAY AVERAGE
Parameter					
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
Cu	0.14	0.09	0.17	0.14	0.14
$CN_{(Total)}$	<0.02	<0.02	<0.02	<0.02	<0.02
Pb	<0.005	0.006	<0.005	0.006	<0.006
Zn	0.10	0.06	0.06	0.06	0.07

Table F.24 (cont'd)

RESULTS OF MONTHLY ANALYSES
SNLA WASTEWATER SAMPLING STATION WW006
PERMIT NO. 2069F, SAMPLE ID: 3069F-4
ALL RESULTS IN mg/l UNLESS OTHERWISE NOTED

OCTOBER 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	10/11/88 8810110601 24-HOUR	10/12/88 8810120601 24-HOUR	10/13/88 8810130601 24-HOUR	10/14/88 8810140601 24-HOUR	FOUR-DAY AVERAGE
Parameter					
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
Cu	0.09	0.04	0.07	0.04	0.06
$CN_{(Total)}$	<0.02	<0.02	<0.02	<0.02	<0.02
Pb	<0.2	<0.2	<0.2	<0.2	<0.2
Zn	0.07	0.07	0.06	0.06	0.07

NOVEMBER 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	11/09/88 8811090601 24-HOUR COMPOSITE	11/10/88 8811100601 24-HOUR COMPOSITE	11/11/88 8811110601 24-HOUR COMPOSITE	11/12/88 8811120601	FOUR-DAY AVERAGE
Parameter					
Cd	<0.005	<0.005	<0.005	<0.005	<0.005
Cu	0.18	0.15	0.14	0.12	0.15
$CN_{(Total)}$	<0.01	<0.01	0.012	0.01	<0.01
Pb	<0.02	<0.02	<0.02	<0.02	<0.02
Zn	0.27	0.10	0.23	0.25	0.21

DECEMBER 1988

DATE COLLECTED SAMPLE NUMBER SAMPLE TYPE	12/06/88 24-HOUR	12/07/88 8812070601 24-HOUR	12/08/88 8812080601 24-HOUR	12/09/88 8812090601 24-HOUR	THREE-DAY AVERAGE
Parameter					
Cd		<0.005	<0.005	<0.005	<0.005
Cu		0.05	0.08	0.10	0.08
$CN_{(Total)}$		0.01	0.015	0.01	0.01
Pb		<0.02	<0.02	<0.02	<0.02
Zn		0.12	0.15	0.13	0.13

Table F.25

SUMMARY OF FIELD TEMPERATURE AND pH MEASUREMENTS OF GRAB SAMPLES DURING SAMPLE COLLECTION ACTIVITIES JANUARY 1988

SAMPLING STATION NO.	DATE	TIME SAMPLE COLLECTED	TEMPERATURE (°C)	pH
WW001	Jan 4	1015	19	8.15
	Jan 4	1650	20	7.32
	Jan 5	0930	18	7.33
	Jan 5	1607	16	7.33
	Jan 6	1135	16	7.69
	Jan 6	1625	18	7.32
	Jan 7	1158	18	7.68
	Jan 7	1603	19	7.58
WW003	Jan 18	0815	19	7.97
	Jan 18	1605	18	7.51
	Jan 19(1)	0830	19	7.54
	Jan 20	0845	18	7.41
	Jan 20	1608	19	7.36
	Jan 21	0830	16	7.28
	Jan 21	1610	18	8.70
WW004	Jan 18	0835	20	6.37
	Jan 18	1601	18	6.63
	Jan 19(1)	0847	21	7.25
	Jan 20	0901	19	7.10
	Jan 20	1615	18	7.69
	Jan 21	0845	18	7.19
	Jan 21	1610	18	7.59
WW005	Jan 4	1030	19	3.67
	Jan 4	1638	20	7.03
	Jan 5	1048	18	6.11
	Jan 5	1550	17	6.77
	Jan 6	1110	15	7.78
	Jan 6	1547	18	7.37
	Jan 7	1128	16	6.88
	Jan 7	1543	18	4.74
WW006	Jan 11	0928	19	7.57
	Jan 11	1620	19	7.88
	Jan 12	1010	18	7.90
	Jan 12	1640	20	8.03
	Jan 13	0925	20	8.13
	Jan 13	1615	20	7.92
	Jan 14	1058	21	7.67
	Jan 14	1613	19	8.00

(1) Unable to gain access to sampler. No pm grab sample collected for pH and temperature measurements.

Table F.25 (cont'd)

SUMMARY OF FIELD TEMPERATURE AND pH MEASUREMENTS OF GRAB SAMPLES DURING SAMPLE COLLECTION ACTIVITIES FEBRUARY 1988

SAMPLING STATION NO.	DATE	TIME SAMPLE COLLECTED	TEMPERATURE (°C)	pH
WW001	02/01/88	1200	20	8.10
	02/01/88	1615	19	8.17
	02/02/88	0825	17	8.35
	02/02/88	1623	18	8.02
	02/03/88	1235	20	8.02
	02/03/88	1604	18	7.73
	02/04/88	0915	16	8.16
	02/04/88	1601	18	6.96
WW003	02/22/88	0834	18	7.97
	(1)	---	---	---
	02/23/88	1305	20	8.14
	02/23/88	1625	21	7.53
	02/24/88	0830	18	7.84
	02/24/88	1605	24	7.90
	02/25/88	0828	19	7.57
	02/25/88	1615	20	7.26
WW004	02/22/88	0840	26	7.21
	(1)	---	---	---
	02/23/88	1325	21	7.23
	02/23/88	1605	23	7.15
	02/24/88	0841	19	7.21
	02/24/88	1614	24	7.63
	02/25/88	0835	21	7.15
	02/25/88	1625	22	7.38
WW005	02/01/88	1215	19	8.03
	02/01/88	1550	19	8.56
	02/02/88	1315	21	7.86
	02/02/88	1605	19	8.51
	02/03/88	1310	19	8.26
	02/03/88	1530	20	8.06
	02/04/88	1106	19	8.42
	02/04/88	1405	19	6.20
WW006	02/08/88	1215	21	8.61
	02/08/88	1615	21	7.63
	02/09/88	0850	21	7.60
	02/09/88	1620	22	7.76
	02/10/88	1038	19	7.91
	02/10/88	1625	19	7.99
	02/11/88	0955	18	7.69
	02/11/88	1622	18	7.97

(1) Unable to access station, no pm grab sample measurement for pH and temperature collected.

Table F.25 (cont'd)

SUMMARY OF FIELD TEMPERATURE AND pH MEASUREMENTS OF GRAB SAMPLES DURING SAMPLING ACTIVITIES MARCH 1988

SAMPLING STATION NO. (PERMIT NO.)	DATE	TIME SAMPLE COLLECTED	TEMPERATURE (°C)	pH
WW001 (2069A)	Feb. 29	1015	20	7.49
	Feb. 29	1610	21	7.45
	Mar. 1	0730	20	7.87
	Mar. 1	1610	21	7.41
	Mar. 2	0916	20	7.30
	Mar. 2	1605	21	7.83
	Mar. 3	1000	20	7.40
	Mar. 3	1605	20	9.61
WW003 (2069C)	Mar. 14	0903	18	7.16
	Mar. 14	1615	20	7.57
	Mar. 15	1040	23	7.70
	Mar. 15	1608	23	7.73
	Mar. 16	0750	18	7.36
	Mar. 16	1615	18	6.39
	Mar. 17	0750	16	7.89
	Mar. 17	1605	22	7.80
WW004 (2069D)	(1)	---	---	---
	(1)	---	---	---
	Mar. 15	1045	21	7.02
	Mar. 15	1614	21	7.82
	Mar. 16	0803	21	7.40
	Mar. 16	1605	20	7.59
	(1)	---	---	---
	(1)	---	---	---
WW005 (2069E)	Feb. 29	0955	21	6.82
	Feb. 29	1550	22	6.54
	Mar. 1	0810	22	8.03
	Mar. 1	1548	22	6.96
	Mar. 2	0850	20	7.37
	Mar. 2	1545	21	7.83
	Mar. 3	0945	19	8.05
	Mar. 3	1555	22	7.71
WW006 (2069F)	Mar. 7	0947	22	7.69
	Mar. 7	1614	20	7.93
	Mar. 8	1255	23	8.05
	Mar. 8	1605	22	8.39
	(1)	---	---	---
	(1)	---	---	---
	Mar. 10	0810	22	8.01
	Mar. 10	1610	23	7.59

(1) No sample collected, sampling and monitoring manhole construction in progress.

Table F.25 (cont'd)

SUMMARY OF FIELD TEMPERATURE AND pH MEASUREMENTS OF GRAB SAMPLES DURING SAMPLING ACTIVITIES APRIL 1988

SAMPLING STATION NO. (PERMIT NO.)	DATE	TIME SAMPLE COLLECTED	TEMPERATURE (°C)	pH
WW001 (2069A)	April 4	0850	20	7.59
	April 4	1620	22	7.84
	April 5	0959	21	7.17
	April 5	1618	25	2.24
	April 6	1042	21	6.90
	April 6	1621	24	7.01
	April 7	0740	20	6.79
	April 7	1630	25	7.86
WW003 (2069C)	April 18	0800	18	7.46
	April 18	1600	22	7.42
	April 19	0800	18	7.46
	April 19	1613	22	7.49
	April 20	0750	22	6.97
	April 20	1616	25	6.43
	April 21	0750	21	7.06
	Arpil 21	1620	24	5.74
WW004 (2069D)	April 18	0800	19	6.98
	April 18	1605	22	7.00
	April 19	0750	20	7.57
	April 19	1618	22	7.51
	April 20	0745	21	7.21
	April 20	1618	28	8.37
	April 21	0745	22	7.38
	April 21	1620	34	7.42
WW005 (2069E)	April 4	0915	20	6.59
	April 4	1610	23	8.13
	April 5	0925	16	2.09
	April 5	1605	27	8.05
	April 6	1026	23	7.66
	April 6	1601	26	7.32
	April 7	0745	20	7.56
	April 7	1306	23	7.70
WW006 (2069F)	April 11	0755	20	6.97
	April 11	1250	23	7.86
	April 12	1415	25	7.96
	April 12	1616	23	7.99
	April 13	1010	24	7.74
	April 13	1618	24	7.55
	April 14	0813	21	7.18
	April 14	1618	24	7.64

Table F.25 (cont'd)

SUMMARY OF FIELD TEMPERATURE AND pH MEASUREMENTS OF GRAB SAMPLES DURING SAMPLING ACTIVITIES MAY 1988

SAMPLING STATION NO. (PERMIT NO.)	DATE	TIME SAMPLE COLLECTED	TEMPERATURE (°C)	pH
WW001	May 9	1003	18	7.36
(2069A)	May 9	1544	25	7.25
	May 10	0845	21	7.27
	May 10	1552	26	7.28
	May 11	0818	20	7.54
	May 11	1700	25	7 (1)
	May 13	0908	24	7.43
WW003	May 9	1012	21	7.43
(2069C)	May 9	1430	27	7.24
	May 10	1013	24	7.47
	May 10	1522	26	7.46
	May 11	0750	21	7.33
	May 11	1730	23	7 (1)
	May 13	1015	25	7.77
WW004	May 9	0955	18	7.14
(2069D)	May 9	1440	24	6.87
	May 10	0905	26	7.00
	May 10	1508	34	7.49
	May 11	0733	23	7.03
	May 11	1745	23	7 (1)
	May 12	1005	24	7.33
WW005	May 9	0915	21	7.42
(2069E)	May 9	1526	26	8.35
	May 10	0850	22	7.02
	May 10	1530	27	5.42
	May 11	0830	21	7.02
	May 11	1230	27	6.50
	May 12	0950	23	7.32
WW006	May 9	1048	24	7.68
(2069F)	May 9	1550	28	8.01
	May 10	1010	25	7.48
	May 10	1544	27	7.29
	May 11	0811	23	7.40
	May 11	1645	27	7 (1)
	May 12	0908	24	7.40

(1) pH meter broken in field; pH taken with ColorpHast® pH indicating paper.

Table F.25 (cont'd)

SUMMARY OF FIELD TEMPERATURE AND pH MEASUREMENTS OF GRAB SAMPLES DURING SAMPLING ACTIVITIES JUNE 1988

SAMPLING STATION NO. (PERMIT NO.)	DATE	TIME SAMPLE COLLECTED	TEMPERATURE (°C)	pH
WW001	June 6	0840	22	7.96
(2069A)	June 6	1630	25	8.41
	June 7	0928	24	6.73
	June 7	1615	25	7.56
	June 8	0815	23	7.81
	June 8	1615	24	7.45
	June 9	0820	24	8.09
	June 9	1605	26	8.64
WW003	June 20	0845	26	7.38
(2069C)	June 20	(1)		
	June 21	0825	28	8.08
	June 21	1610	29	7.54
	June 22	0810	26	7.88
	June 22	(1)		
	June 23	0825	27	7.64
	June 23	1600	27	7.72
WW004 (2069D)	(2)			
WW005	June 6	1320	26	8.50
(2069E)	June 7	0958	26	5.38
	June 7	1330	25	9.61
	June 8	0832	25	7.63
	June 8	1210	25	8.90
	June 9	0900	25	9.02
	June 9	1210	27	8.49
	June 10	1340	26	7.51
WW006 (2069F)	(2)			

(1) Unable to gain access to sampler; no p.m. grab sample collected for pH measurement.

(2) Automatic pH monitoring device installed in monitoring station; no grab sample measurement required.

Table F.25 (cont'd)

SUMMARY OF DAILY MINIMUM AND MAXIMUM pH[1]
JUNE 1988

DATE	STATION WW004 MINIMUM pH	STATION WW004 MAXIMUM pH	STATION WW005 MINIMUM pH	STATION WW005 MAXIMUM pH	STATION WW006 MINIMUM pH	STATION WW006 MAXIMUM pH
June 20	6.5 (2)	10.5 (2)	3	(3) 12	(3) (4)	(4)
21	7.5	9.5	4.5 (3)	10.5 (3)	(4)	(4)
22	2 (5)	13.5	3.5	10	7	8
23	2 (5)	9	3	10.5	6	8
24	2 (5)	11.5 (5)	4.5	10	6	8
25	8	8	7.5	9	5.5	6
26	8	8	3 (5)	10	5 (6)	5.5(6)
27	6.5	10.5	3.5	(3) 12	(3) 5	8
28	7.5	9.5	2.5 (3)	10.5 (3)	5.5 (6)	8 (6)
29	2 (5)	13.5	3	9.5	6	8.5
30	2 (5)	9	4	11	5.5	8

(1) pH values listed to nearest 0.5 pH unit.
(2) Unable to access station to replace chart, pH data overlap on chart from June 20 to July 5, 1988. Minimum and maximum pH values listed indicate minimum and maximum pH values for that weekday during periods of data overlap (e.g., minimum and maximum pH measurements on Monday, June 20, correspond to values listed for Monday, June 27, 1988).
(3) pH data overlap on June 20 and 27 and June 21 and 28, 1988. Values listed correspond to minimum and maximum pH during days of overlapping data.
(4) No pH data available.
(5) Short duration pH fluctuation; may be due to instrument noise.
(6) Excessive material accumulation on pH electrode; inaccurate pH reading.

Table F.25 (cont'd)

SUMMARY OF FIELD TEMPERATURE AND pH MEASUREMENTS OF GRAB SAMPLES DURING SAMPLING ACTIVITIES JULY 1988

SAMPLING STATION NO. (PERMIT NO.)	DATE	TIME SAMPLE COLLECTED	TEMPERATURE (°C)	pH
WW001	July 11	0830	24	7.47
(2069A)	July 11	1615	28	7.90
	July 12	0900	26	7.73
	July 12	1645	27	7.82
	July 13	0830	26	7.95
	July 13	1605	28	7.80
	July 14	0830	26	8.31
	July 14	1630	28	8.24
WW003[1]	July 25	0945	26	7.82
(2069C)	July 26	0930	24	7.81
	July 27	0915	26	7.73
	July 28	0845	26	7.85
	July 29	1120	25	7.96
WW004 (2069D)	(2)			
WW005 (2069E)	(2)			
WW006 (2069F)	(2)			

(1) Unable to access station; no pm grab sample measurement for pH and temperature collected.

(2) Automatic pH monitoring device installed in monitoring station; no grab sample measurement required.

Table F.25 (cont'd)

SUMMARY OF DAILY MINIMUM AND MAXIMUM pH[1]
JULY 1988

DATE	STATION WW004 MINIMUM pH	STATION WW004 MAXIMUM pH	STATION WW005 MINIMUM pH	STATION WW005 MAXIMUM pH	STATION WW006 MINIMUM pH	STATION WW006 MAXIMUM pH
July 1	2 (2)	11.5 (2)	2	12.5	5	5.5
2	8	8	5.5	9	5.5	6
3	8	8	8	9	5	6.5
4	6.5	10.5	6.5	10.5	5.5	6.5
5	6.5	8	5.5	10	5	8
6	2	10	3	10	6	8
7	1.5	8.5	4	10	6	7
8	4	12	4	10	5	7
9	7.5	8.5	7.5	8	5	7
10	7	8.5	4	10	5	7
11	3	8.5	5	8.5	5	8
12	6.5	8	3 (3)	9 (3)	(4)	(4)
13	2	10	3.5 (3)	9 (3)	(4)	(4)
14	1.5	8.5	2.5 (5)	11	(4)	(4)
15	4	12	4.5	9.5	(4)	(4)
16	7.5	8.5	6	8.5	(4)	(4)
17	7	8.5	2.5	10	(4)	(4)
18	3	8.5	4	10	(4)	(4)
19	6.5	8	3 (3)	9 (3)	(4)	(4)
20	2	10	2.5 (3)	9 (3)	6	8
21	7	8.5	1.5 (5)	10	5.5 (7)	7.5 (7)
22	7	9	3.5 (5)	9.5	5 (7)	6 (7)
23	4	7.5	3 (5)	10	5 (7)	5 (7)
24	7	8.5	2.5 (5)	10	4.5 (7)	5 (7)
25	7	8	3 (6)	10 (5,6)	4.5 (7)	8.5 (7)
26	(4)	(4)	1.5	10 (5)	6	8.5
27	(4)	(4)	2	10.5 (5)	6	7.5
28	(4)	(4)	4	10.5 (5)	6	7.5
29	(4)	(4)	5.5	10.5 (5)	6	8
30	(4)	(4)	1.5 (5)	9.5	6	7.5
31	(4)	(4)	2	11	6	6

(1) pH values listed to nearest 0.5 pH unit.
(2) Unable to access station to replace chart, pH data overlap on chart from June 20 through July 5 and July 5 through July 20, 1988. Minimum and maximum pH values listed indicate minimum and maximum pH values for that weekday during that time period (e.g., minimum and maximum pH measurements on Tuesday, July 5, correspond to values listed for Tuesday, July 12, 1988).
(3) pH data overlap on July 12 and 13 and July 19 and 20. Values listed correspond to minimum and maximum pH during days of overlapping data.
(4) No pH data available.
(5) Short duration pH fluctuation; may be due to instrument noise.
(6) pH data overlap on chart from July 25 to August 8, 1988. Minimum and maximum pH values listed indicate minimum and maximum pH for weekdays that overlap (e.g., pH measurements on Monday, July 25, correspond to values listed for Monday, August 1, 1988).
(7) Excessive material accumulation on pH electrode; inaccurate pH reading.

Table F.25 (cont'd)

SUMMARY OF DAILY FLOW AND pH MEASUREMENTS
SNLA WASTEWATER SAMPLING STATION WW004
AUGUST 1988

DATE	DAILY FLOW (GALLONS)[1]	MINIMUM pH[2]	MAXIMUM pH[2]
August 1	(2)	(4)	(4)
2	(2)	(4)	(4)
3	(2)	(4)	(4)
4	(2)	(4)	(4)
5	(2)	(4)	(4)
6	(2)	(4)	(4)
7	(2)	(4)	(4)
8	(2)	7	8
9	(2)	7	9
10	(2)	6	11.5
11	(2)	5	9
12	(2)	7	9.5
13	(2)	7.5	8
14	(2)	7.5	8
15	(2)	7	8
16	(2)	7	9.5
17	(2)	6	11.5
18	(2)	5	8
19	(2)	7	9.5
20	(2)	7.5	8
21	(2)	7.5	8
22	(2)	7	9
23	(2)	6.5	8
24	(2)	2.2	8
25	(2)	6	8
26	(2)	2	9
27	(2)	7	8
28	(2)	7	8
29	(2)	7	8
30	(2)	7	8
31	(2)	1	8.5

(1) Total daily flow values taken from ISCO model 2310 strip chart record at 0200 hours each day.
(2) Flow monitoring equipment malfunction; no flow data available.
(3) pH values listed to nearest 0.5 pH unit.
(4) No pH data available.

Table F.25 (cont'd)

SUMMARY OF DAILY FLOW AND pH MEASUREMENTS
SNLA WASTEWATER SAMPLING STATION WW005
AUGUST 1988

DATE	DAILY FLOW (GALLONS)[1]	MINIMUM pH[2]	MAXIMUM pH[2]
August 1	800,500[3]	2 [4]	11.5[4]
2	181,440	1.5 [6]	10
3	134,720	3 [6]	10.5
4	(5)	2 [6]	10.5
5	(5)	2.5 [6]	10.5
6	(5)	2	9.5
7	(5)	2	11
8	(5)	2	11.5
9	159,250	3 [6]	11 [6]
10	171,350	2.5 [6]	10
11	177,780	4.5 [6]	11 [6]
12	183,690	2.5 [6]	9.5
13	165,580	8	9.5
14	170,790	8	10
15	186,540	(7)	(7)
16	198,390	(7)	(7)
17	169,430	(7)	(7)
18	120,050	(7)	(7)
19	127,560	(7)	(7)
20	134,680	(7)	(7)
21	136,810	(7)	(7)
22	162,510	(7)	(7)
23	182,380	5.5	11
24	190,610	3.5	10
25	194,050	3 [6]	10
26	195,470	5.5	10
27	172,100	3 [6]	10.5
28	161,350	8.5	11.5
29	201,850	3 [6]	11
30	217,140	3	10.5
31	207,030	2 [6]	10.5

Average Daily Flow: 172,102 gallons per day

(1)Total daily flow values taken from ISCO model 2310 strip chart record at 0200 hours each day.
(2)pH values listed to nearest 0.5 pH unit.
(3)Interruption in flow measurements at approximately 1600 hours 8/1/88. Suspect data. Daily flow rate for 8/1/88 not used in average daily flow rate calculation.
(4)pH data overlap on chart from July 25 to August 8, 1988 (e.g., minimum and maximum pH measurements on Monday, July 25, correspond to values listed for Monday, August 1, 1988).
(5)Power failure and/or equipment malfunction, no flow data available.
(6)Short duration pH fluctuation; may be due to instrument noise.
(7)Equipment malfunction; no pH data available.

Table F.25 (cont'd)

SUMMARY OF DAILY FLOW AND pH MEASUREMENTS
SNLA WASTEWATER SAMPLING STATION WW006
AUGUST 1988

DATE	DAILY FLOW (GALLONS)[1]	MINIMUM pH[2]		MAXIMUM pH[2]
August 1	906,460	5.5		7
2	867,290	6		7
3	877,090	5		7
4	(3)	5.5		7
5	(3)	5		7
6	(3)	5		7
7	(3)	5		6.5
8	(3)	5		8.5
9	939,170	6		7.5
10	922,800	5	(4)	6.5
11	915,420	5	(4)	5.5
12	881,300	4.5	(4)	4.5
13	753,280	4	(4)	5
14	739,210	4	(4)	5
15	962,250	4	(4)	8
16	954,080	5.5	(4)	6.5
17	932,460	5	(4)	7
18	(3)	5		5.5
19	818,570	4.5	(4)	5
20	638,370	4.5	(4)	5
21	789,060	4.5	(4)	5
22	894,460	4.5	(4)	8
23	871,380	5.5	(4)	7.5
24	840,930	5.5	(4)	6
25	848,170	5	(4)	5.5
26	822,030	4.5	(4)	4.5
27	630,750	4.5		4.5
28	(3)	4.5		4.5
29	818,490	4.4		8
30	(3)	7		8.5
31	(3)	6		8.5

Average Daily Flow: 846,501 gallons per day

(1) Total daily flow values taken from ISCO model 2310 strip chart record at 0200 hours each day.
(2) pH values listed to nearest 0.5 pH unit.
(3) Power failure and/or equipment malfunction, no flow data available.
(4) Material accumulation on pH electrode, invalid pH reading.

Table F.25 (cont'd)

SUMMARY OF FIELD TEMPERATURE AND pH MEASUREMENTS OF GRAB SAMPLES DURING SAMPLING ACTIVITIES
September 1988

SAMPLING STATION NO. (PERMIT NO.)	DATE	TIME SAMPLE COLLECTED	TEMPERATURE (°C)	pH
WW001 (2069A)	Sept. 12	0940	22	7.41
	Sept. 12	1615	25	7.31
	Sept. 13	0930	14	8.04
	Sept. 13	0930	21	7.32
	Sept. 14	0940	14	7.83
	Sept. 14	1000	21	7.98
	Sept. 14	1615	23	7.79
	Sept. 15	1020	20	7.80
WW003 (2069C)	Sept. 15	1020	23	6.57
	Sept. 15	1615	25	7.13
	Sept. 16	0915	11	7.73
	Sept. 19	1107	24.5	7.73
	Sept. 19	1540	25.5	7.36
	Sept. 20	1604	26	7.30
	Sept. 21	1130	9	7.58
	Sept. 21	1116	22	7.33
	Sept. 22	0830	9	7.36
	Sept. 22	0944	26	7.91
	Sept. 22	1342	26	7.62
	Sept. 23	0830	9	8.41
WW004 (2069D)	(1)			
WW005 (2069E)	(1)			
WW006 (2069F)	(1)			

(1) Automatic pH monitoring device installed in monitoring station, no grab sample measurement required.

Table F.25 (cont'd)

SUMMARY OF FIELD TEMPERATURE AND pH MEASUREMENTS OF GRAB SAMPLES DURING SAMPLING ACTIVITIES September 1988

SAMPLING STATION NO. (PERMIT NO.)	DATE	TIME SAMPLE COLLECTED	TEMPERATURE (°C)	pH
WW001 (2069A)	Sept. 12	0940	22	7.41
	Sept. 12	1615	25	7.31
	Sept. 13	0930	21	7.32
	(1)			
	Sept. 14	1000	21	7.98
	Sept. 14	1615	23	7.79
	Sept. 15	1020	23	6.57
	Sept. 15	1615	25	7.13
WW003 (2069C)	Sept. 19	1107	24.5	7.73
	Sept. 19	1540	25.5	7.36
	Sept. 20	1015	25	7.40
	Sept. 20	1604	26	7.30
	Sept. 21	1116	22	7.33
	(1)			
	Sept. 22	0944	26	7.91
	Sept. 22	1342	26	7.62
WW004 (2069D)	(2)			
WW005 (2069E)	(2)			
WW006 (2069F)	(2)			

(1) Unable to access samplers due to security or inclement weather.
(2) Automatic pH monitoring device installed in monitoring station, no grab sample measurement required.

Table F.25 (cont'd)

SUMMARY OF DAILY FLOW AND pH MEASUREMENTS
SNLA WASTEWATER SAMPLING STATION WW004
SEPTEMBER 1988

DATE	DAILY FLOW (GALLONS)[1]	MINIMUM pH[2]	MAXIMUM pH[2]
September 1	(3)	(4)	(4)
2	(3)	(4)	(4)
3	(3)	(4)	(4)
4	(3)	(4)	(4)
5	(3)	(4)	(4)
6	(3)	(4)	(4)
7	(3)	(4)	(4)
8	(3)	(4)	(4)
9	(3)	(4)	(4)
10	(3)	(4)	(4)
11	(3)	(4)	(4)
12	(3)	3	7.5
13	(3)	5	8.5
14	(3)	6	12
15	(3)	5	10
16	(3)	3.5	11
17	(3)	6	8.5
18	(3)	6.5	7.5
19	(3)	4.5	8.5
20	(3)	1.5	7.5
21	(3)	5	9.5
22	(3)	5.5	8
23	(3)	5	10.5
24	23,879	7	8
25	23,763	7	7.5
26	39,637	5	7.5
27	(3)	5.5	8
28	43,748	5	8
29	43,975	6	12
30	31,143	6	7.5

Average Daily Flow: 34,358 gallons per day.

(1) Total daily flow values taken from ISCO model 2310 strip chart record at 0100 hours each day except for September 28-30, where values are taken at 0200 hours.
(2) pH values listed to nearest 0.5 pH unit.
(3) Flow monitoring equipment malfunction; no flow data available.
(4) No pH data available.

Table F.25 (cont'd)

SUMMARY OF DAILY FLOW AND pH MEASUREMENTS
SNLA WASTEWATER SAMPLING STATION WW005
SEPTEMBER 1988

DATE	DAILY FLOW (GALLONS)[1]	MINIMUM pH[2]	MAXIMUM pH[2]
September 1	(3)	2	11.5
2	(3)	3.5	10
3	(3)	8	10
4	(3)	8	10
5	(3)	3	11
6	(3)	3	11.5
7	253,270	3	10.5
8	258,890	3	11
9	277,000	1.5	12
10	229,450	6	11
11	187,440	6	9
12	203,130	2	11
13	214,070	2.5	11
14	237,540	3.5	11.5
15	(3)	4	11
16	252,760	4	10.5
17	253,200	2.5	9.5
18	243,920	4.5	10
19	264,950	4	10
20	273,300	3	10.5
21	290,040	4.5	12
22	277,060	2	12
23	266,730	2	11.5
24	241,880	2	11.5
25	246,010	2.5	11
26	242,260	2.5	12
27	244,400	2	12
28	238,050	3	10.5
29	217,140	4	11.5
30	213,420	4.5	10

Average Daily Flow: 244,605 gallons per day

(1)Total daily flow values taken from ISCO model 2310 strip chart record at 0100 hours each day.
(2)pH values listed to nearest 0.5 pH unit.
(3)Power failure and/or equipment malfunction, no flow data available.

Table F.25 (cont'd)

SUMMARY OF DAILY FLOW AND pH MEASUREMENTS
SNLA WASTE WATER SAMPLING STATION WW006
SEPTEMBER 1988

DATE	DAILY FLOW (GALLONS)(1)	MINIMUM pH(2)	MAXIMUM pH(2)
September 1	837,980	(4)	(4)
2	742,670	(4)	(4)
3	650,920	(4)	(4)
4	645,870	(4)	(4)
5	660,660	(4)	(4)
6	(3)	7	8
7	(3)	7	8
8	(3)	7	9
9	(3)	7.5	8
10	(3)	7.5	9
11	(3)	7.5	9
12	(3)	7	9.5
13	877,660	7	8.5
14	766,490	7	8
15	761,910	7	8
16	744,620	7	7.5
17	682,700	7	7.5
18	634,870	7	8
19	744,440	(4)	(4)
20	789,380	(4)	(4)
21	856,160	(4)	(4)
22	812,910	(4)	(4)
23	768,900	(4)	(4)
24	630,080	7	8.5
25	637,460	(4)	(4)
26	834,560	(4)	(4)
27	828,380	(4)	(4)
28	815,400	(4)	(4)
29	813,640	(4)	(4)
30	740,020	(4)	(4)

Average Daily Flow: 751,204 gallons per day

(1) Total daily flow values taken from ISCO model 2310 strip chart record at 0200 hours each day data available.
(2) pH values listed at nearest 0.5 pH unit.
(3) Power failure and/or equipment malfunction, no flow data available.
(4) Power failure and/or equipment malfunction, no pH data available.

Table F.25 (cont'd)

SUMMARY OF FIELD TEMPERATURE AND pH MEASUREMENTS OF GRAB SAMPLES DURING SAMPLING ACTIVITIES OCTOBER 1988

SAMPLING STATION NO. (PERMIT NO.)	DATE	TIME SAMPLE COLLECTED	TEMPERATURE (°C)	pH
WW001	October 10	0920	20.5	7.49
(2069A)	October 10	1440	23	7.60
	October 11	0856	22	8.12
	October 11	1300	20	8.92
	October 12	0845	23	7.62
	October 12	1320	23	7.62
	October 13	0900	22	7.83
	October 13	1445	25	7.67
WW003	October 17	0900	26	6.63
(2069C)	October 17	1415	26	7.62
	October 18	0830	21	6.52
	October 18	1330	25	7.12
	October 19	0900	21	7.35
	October 19	1306	23	7.50
	October 20	0835	22	7.28
	October 20	1438	25	7.31
WW004 (2069D)	(1)			
WW005 (2069E)	(1)			
WW006 (2069F)	(1)			

(1) Automatic pH monitoring devise installed in monitoring station, no grab sample measurement for pH and temperature required.

Table F.25 (cont'd)

SUMMARY OF DAILY FLOW AND pH MEASUREMENTS
SNLA WASTEWATER SAMPLING STATION WW004
OCTOBER 1988

DATE	DAILY FLOW[1] (GALLONS)	MINIMUM pH[2]		MAXIMUM pH[2]	
October 1	25,417	7.5		8	
2	25,594	7.5		8	
3	39,069	5.5		8	
4	46,019	2		11.5	(3)
5	47,731	4.5		10.5	
6	49,269	1.5	(3)	7.5	
7	44,284	1	(3)	11.5	(3)
8	28,711	7.0		7.5	
9	28,127	7.0		7.5	
10	58,637	1		7.5	
11	66,183	2	(3)	8	
12	62,564	1	(3)	8	
13	65,074	5		8	
14	60,494	1	(3)	12.0	(3)
15	47,389	7.5		9	
16	47,484	7.5		9	
17	57,075	6		8.5	
18	62,687	6		9	
19	67,185	2	(3)	8.5	
20	66,140	3	(3)	8.5	
21	53,150	2	(3)	7.5	
22	38,897	7		8.5	
23	35,650	7.0		7.5	
24	45,688	5.5		7.5	
25	48,915	5		8.5	
26	52,789	6		12	(3)
27	52,748	2	(3)	7.5	
28	52,775	3	(3)	8.5	
29	(4)	7.5		7.5	
30	44,603	7.0		7.5	
31	67,817	5		7.5	

AVERAGE DAILY FLOW = 49,605 Gallons Per Day

(1) Total Daily Flow values taken from ISCO 2310 strip chart record at 0200 hours each day.
(2) pH values listed to nearest 0.5 pH unit.
(3) Short duration pH fluctuation.
(4) Power failure and/or equipment malfunction, no data available.

Table F.25 (cont'd)

SUMMARY OF DAILY FLOW AND pH MEASUREMENTS
SNLA WASTEWATER SAMPLING STATION WW005
OCTOBER 1988

DATE	DAILY FLOW[1] (GALLONS)	MINIMUM pH[2]	MAXIMUM pH[2]
October 1	193,420	6.5	9
2	182,430	5	11 (3)
3	188,600	4.5	11.5 (3)
4	189,260	3	10.5 (3)
5	205,210	4 (3)	10 (3)
6	215,350	5.5	11 (3)
7	215,550	4	10 (3)
8	194,980	7	9.0
9	199,710	8	9
10	246,130	4	9.5
11	268,870	1	11 (3)
12	249,020	3 (3)	10.5 (3)
13	228,400	4 (3)	10 (3)
14	227,800	6	10 (3)
15	214,500	6.5	8.5
16	210,740	3.5	11 (3)
17	233,410	3.5	11.5
18	223,580	2 (3)	11 (3)
19	253,540	1 (3)	10 (3)
20	232,240	1 (3)	10 (3)
21	227,500	2.5 (3)	10
22	201,790	6	10
23	200,090	4	11 (3)
24	216,360	1.5 (3)	9.5
25	229,150	2.5	10.5 (3)
26	232,850	3	11
27	220,310	1.5 (3)	11 (3)
28	226,390	1 (3)	10 (3)
29	205,300	3.5 (3)	10
30	202,920	7.0	10.5 (3)
31	178,610	3.5	10 (3)

AVERAGE DAILY FLOW: 216,581 Gallons Per Day

(1) Total Daily Flow values taken from ISCO 2310 strip chart record at 0100 hours each day.
(2) pH values listed to nearest 0.5 pH unit.
(3) Short duration pH fluctuation.

Table F.25 (cont'd)

SUMMARY OF DAILY FLOW AND pH MEASUREMENTS
SNLA WASTEWATER SAMPLING STATION WW006
OCTOBER 1988

DATE		DAILY FLOW (GALLONS)(1)	MINIMUM pH(2)	MAXIMUM pH(2)
February	1	626,480	(3)	(3)
	2	638,240	(3)	(3)
	3	720,060	(3)	(3)
	4	653,780	7.5	11
	5	663,750	7.0	9
	6	676,700	7	11
	7	645,420	6.5	8.5
	8	439,330	6.5	8
	9	440,320	6.5	7
	10	621,640	6.5	9
	11	637,840	4.5	11
	12	595,660	7	9
	13	656,920	6.5	8.0
	14	538,420	7	9
	15	(3)	7	8
	16	391,600	7	7.5
	17	570,400	6	8
	18	617,870	7	9
	19	646,610	6	8
	20	668,730	6	7.5
	21	569,080	6	8.0
	22	383,630	7	8.5
	23	383,500	7	8.5
	24	586,130	7	8.5
	25	591,000	7	8
	26	616,660	6.5	8.5
	27	616,250	6.5	8
	28	590,330	6.5	7.5
	29	422,250	6.5	8.5
	30	424,910	7	8.5
	31	(3)	7	8

AVERAGE DAILY FLOW RATE: 570,431 GALLONS PER DAY

(1) Total daily flow values taken from ISCO 2310 strip chart record at 0100 hours each day data available.
(2) pH values listed to nearest 0.5 pH unit.
(3) Power failure and/or equipment malfunction; no dta available.

Table F.25 (cont'd)

SUMMARY OF FIELD TEMPERATURE AND pH MEASUREMENTS OF GRAB SAMPLES DURING SAMPLING ACTIVITIES NOVEMBER 1988

SAMPLING STATION NO. (PERMIT NO.)	DATE	TIME SAMPLE COLLECTED	TEMPERATURE (°C)	pH
WW001 (2069A)	November 7	0935	23	7.38
	November 8	0900	23	7.21
	November 8	1415	23	7.15
	November 9	0800	19	7.36
	November 9	1415	21	7.49
	November 10	0800	21	7.61
	November 10	1350	24	7.71
	November 11	0800	19	7.91
	November 11	1400	21	7.62
WW003 (2069C)	November 7	0955	21	7.36
	November 8	0900	19.5	7.54
	November 8	1415	21	7.35
	November 9	0800	20	7.14
	November 9	1400	23	7.23
	November 10	0800	20	7.05
	November 10	1350	22	7.32
	November 11	0800	21	7.21
	November 11	1400	21	7.23
WW004 (2069D)	(1)			
WW005 (2069E)	(1)			
WW006 (2069F)	(1)			

(1) Automatic pH monitoring device installed in monitoring station, no grab sample measurement for pH and temperature required.

Table F.25 (cont'd)

SUMMARY OF DAILY FLOW AND pH MEASUREMENTS
SNLA WASTEWATER SAMPLING STATION WW004
NOVEMBER 1988

DATE		DAILY FLOW (GALLONS)[1]	MINIMUM pH[2]	MAXIMUM pH[2]
NOVEMBER	1	74,323	6	8.5
	2	75,499	6	8
	3	74,133	6	7.5
	4	64,302	1.5 (4)	12.5 (4)
	5	49,712	7.5	7.5
	6	49,458	7	7.5
	7	49,486	5 (4)	8
	8	36,412	4.5 (4)	8
	9	39,967	2.5 (4)	8
	10	35,629	6	8
	11	34,645	1.5 (4)	9
	12	22,911	7	8
	13	22,720	7	8
	14	35,744	6	8
	15	15,811	6	8.5
	16	23,483	4.5 (4)	8.5
	17	26,183	4 (4)	8.5
	18	23,250	3.5 (4)	9
	19	16,579	7	8
	20	16,975	7	8
	21	28,253	3 (4)	9 (4)
	22	25,904	3.5 (4)	11.5 (4)
	23	27,161	2 (4)	8
	24	15,283	7	7.5
	25	15,669	7	7.5
	26	15,519	7	7.5
	27	15,398	7	7.5
	28	28,361	3 (4)	7.5
	29	32,246	2.5 (4)	12 (4)
	30	(3)	3 (4)	7.5

AVERAGE DAILY FLOW RATE: 34,173 GALLONS PER DAY

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(1) Total daily flow values taken from ISCO 2310 strip chart record at 0100 hours each day.
(2) pH values listed to nearest 0.5 pH units.
(3) Flow monitoring equipment malfunction; no data available.
(4) Short duration pH fluctuation.

Table F.25 (cont'd)

SUMMARY OF DAILY FLOW AND pH MEASUREMENTS
SNLA WASTEWATER SAMPLING STATION WW005
NOVEMBER 1988

DATE	DAILY FLOW (GALLONS)(1)	MINIMUM pH(2)	MAXIMUM pH(2)
NOVEMBER 1	142,370	2.5(4)	11(4)
2	151,830	3(4)	11(4)
3	136,620	2	11(4)
4	129,890	2(4)	10.5(4)
5	125,880	5.5	8
6	121,010	7.5	11(4)
7	156,180	1(4)	10.5(4)
8	(3)	2.5(4)	10(4)
9	(3)	1(4)	10(4)
10	193,130	2(4)	10(4)
11	183,940	1(4)	11(4)
12	175,650	1.5(4)	10.5(4)
13	(3)	4	10.5
14	173,720	2.5(4)	11(4)
15	176,960	1(4)	10(4)
16	178,290	1(4)	11(4)
17	187,600	2(4)	11(4)
18	194,290	1(4)	10(4)
19	184,460	2(4)	11(4)
20	187,830	6	8
21	190,040	1(4)	10.5(4)
22	199,550	3	10(4)
23	189,890	2(4)	11(4)
24	155,320	8	9
25	152,380	8	9
26	150,140	8	9
27	171,500	7.5	8.5
28	170,460	3(4)	11(4)
29	177,640	2(4)	11(4)
30	182,760	2(4)	11.5(4)

AVERAGE DAILY FLOW RATE: 168,123 GALLONS PER DAY

(1) Total daily flow values taken from ISCO 2310 strip chart record at 0100 hours each day.
(2) pH values listed to nearest 0.5 pH units.
(3) Flow monitoring equipment malfunction; no data available.
(4) Short duration pH fluctuation.

Table F.25 (cont'd)

SUMMARY OF DAILY FLOW AND pH MEASUREMENTS
SNLA WASTEWATER SAMPLING STATION WW006
NOVEMBER 1988

DATE		DAILY FLOW (GALLONS)[1]	MINIMUM pH[2]	MAXIMUM pH[2]
NOVEMBER	1	(3)	7	8.5
	2	(3)	6.5	8
	3	(3)	6	7
	4	(3)	6	8
	5	405,050	6.5	7.5
	6	439,120	6.5	7.5
	7	622,990	6	9
	8	(3)	6.5	9
	9	(3)	6.5	8
	10	(3)	6	8
	11	(3)	6	8
	12	457,210	6	7.5
	13	502,290	6	8
	14	(3)	6	8.5
	15	(3)	7	8
	16	(3)	6.5	8
	17	(3)	6	7.5
	18	(3)	6	7.5
	19	(3)	6	8
	20	(3)	6	7.5
	21	(3)	7	9.5
	22	(3)	7.5	9.5
	23	(3)	7	8
	24	(3)	7	8
	25	(3)	7	8
	26	(3)	7	8
	27	(3)	7	8
	28	(3)	7	9
	29	(3)	7.5	9
	30	(3)	3	9

AVERAGE DAILY FLOW RATE: 485,332 GALLONS PER DAY

(1) Total daily flow values taken from ISCO 2310 strip chart record at 0100 hours each day.
(2) pH values listed to nearest 0.5 pH units.
(3) Flow monitoring equipment malfunction; no data available.

Table F.25 (cont'd)

SUMMARY OF FIELD TEMPERATURE AND pH MEASUREMENTS OF GRAB SAMPLES DURING SAMPLING ACTIVITIES DECEMBER 1988

SAMPLING STATION NO. (PERMIT NO.)	DATE	TIME SAMPLE COLLECTED	TEMPERATURE (°C)	pH
WW001	Dec. 12	1130	18	7.21
(2069A)	Dec. 12	1500	21	7.37
	Dec. 13	0915	20	7.35
	Dec. 13	1115	21	7.42
	Dec. 14	0915	20	7.17
	Dec. 14	1115	21	7.52
	Dec. 15	0900	20	7.49
	Dec. 15	1115	21	7.53
WW003	Dec. 12	1130	18	7.74
(2069C)	Dec. 12	1500	16	7.46
	Dec. 13	0915	14	7.69
	Dec. 13	1115	15	7.62
	Dec. 14	0915	18	7.74
	Dec. 14	1115	18	7.62
	Dec. 15	0900	14	7.45
	Dec. 15	1100	14	7.47
WW004 (2069D)	(1)			
WW005 (2069E)	(1)			
WW006 (2069F)	(1)			

(1) Automatic pH monitoring device installed in monitoring station; no grab sample measurement for pH and temperature required.

Table F.25 (cont'd)

SUMMARY OF DAILY FLOW AND pH MEASUREMENTS
SNLA WASTEWATER SAMPLING STATION WW001
DECEMBER 1988

DATE		DAILY FLOW (GALLONS)[1]	MINIMUM DAILY pH	MAXIMUM DAILY pH
DECEMBER	1	(3)	(4)	(4)
	2	(3)		
	3	(3)		
	4	(3)		
	5	(3)		
	6	(3)		
	7	(3)		
	8	(3)		
	9	(3)		
	10	(3)		
	11	281,540		
	12	371,135		
	13	376,005		
	14	375,174		
	15	354,642		
	16	353,789		
	17	352,929		
	18	169,564		
	19	517,863		
	20	405,117		
	21	433,758		
	22	(3)		
	23	318,880		
	24	126,472		
	25	130,017		
	26	(3)		
	27	(3)		
	28	(3)		
	29	(3)		
	30	(3)		
	31	(3)		

AVERAGE DAILY FLOW RATE: 326,206 GALLONS PER DAY

(1) Total daily flow values taken from ISCO 2310 strip chart record at 0100 hours each day data available. Flow is recorded in cubic feet on the strip chart; daily volume converted to gallons.
(2) Flow monitoring equipment malfunction; no data available.
(3) pH monitoring equipment malfunction; no data available.

Table F.25 (cont'd)

SUMMARY OF DAILY FLOW AND pH MEASUREMENTS
SNLA WASTEWATER SAMPLING STATION WW004
DECEMBER 1988

DATE		DAILY FLOW (GALLONS)[1]	MINIMUM DAILY pH[2]		MAXIMUM DAILY pH[2]	
DECEMBER	1	5,755	2.5	(4)	9	(4)
	2	33,487	2.5	(4)	10.5	(4)
	3	34,184	5.5	(4)	7.5	
	4	30,683	6		7.5	
	5	37,614	2.5		8	
	6	42,589	NDA		NDA	
	7	47,161	NDA		NDA	
	8	43,700	6		7.5	
	9	37,122	5.5		8.5	
	10	18,829	6.5		7.5	
	11	19,957	6.5		7.5	
	12	37,529	3.5	(4)	8.5	
	13	31,752	5.5		9	
	14	34,589	6		8	
	15	34,178	1.5	(4)	8.5	
	16	27,350	3	(4)	8	
	17	23,722	6		7.5	
	18	23,974	6		7.5	
	19	37,883	5	(4)	10.5	(4)
	20	37,030	4.5	(4)	12.5	(4)
	21	36,452	5		11	(4)
	22	37,092	1.5	(4)	8.5	
	23	16,355	2	(4)	8.5	
	24	420	7		8	
	25	543	7		8	
	26	352	7		8	
	27	834	7		8	
	28	1,916	7		8	
	29	1,557	7		8	
	30	(3)	7		8	
	31	(3)	7		8	

AVERAGE DAILY FLOW RATE: 25,342 GALLONS PER DAY

(1) Total daily flow values taken from ISCO 2310 strip chart record at 0100 hours each day data available.
(2) pH values listed to nearest 0.5 pH unit.
(3) Flow monitoring equipment malfunction; no data available.
(4) Short duration pH fluctuation.

Table F.25 (cont'd)

SUMMARY OF DAILY FLOW AND pH MEASUREMENTS
SNLA WASTEWATER SAMPLING STATION WW005
DECEMBER 1988

DATE		DAILY FLOW (GALLONS)(1)	MINIMUM DAILY pH(2)		MAXIMUM DAILY pH(2)	
DECEMBER	1	182,570	1.5	(3)	11.5	(3)
	2	169,710	3	(3)	10	(3)
	3	166,650	3	(3)	11	
	4	165,560	5.5		11	
	5	189,760	3		8	
	6	189,270	1.5		11	
	7	195,560	6		9.5	
	8	217,670	3		11	
	9	229,750	3		9	
	10	228,560	6.5		8	
	11	217,930	6.5		9	
	12	204,690	4	(3)	10.5	
	13	163,890	1		11	
	14	162,020	1		11	
	15	159,710	1	(3)	10	
	16	158,520	1.5	(3)	11	
	17	170,440	1		9.5	
	18	147,020	6		9.5	
	19	164,220	1.5	(3)	10	(3)
	20	172,080	2	(3)	10	(3)
	21	165,300	1.5		11	(3)
	22	164,860	1	(3)	11	
	23	165,480	1	(3)	12	
	24	99,570	7.5		8.5	
	25	100,820	7.5		8.5	
	26	129,340	7		9	
	27	144,430	7		8	
	28	162,220	7		8	
	29	111,700	7		8.5	
	30	81,970	7		8.5	
	31	88,390	7.5		9.5	

AVERAGE DAILY FLOW RATE: 163,731 GALLONS PER DAY

(1) Total daily flow values taken from ISCO 2310 strip chart record at 0100 hours each day data available.
(2) pH values listed to nearest 0.5 pH unit.
(3) Short duration pH fluctuation.

Table F.25 (cont'd)

SUMMARY OF DAILY FLOW AND pH MEASUREMENTS
SNLA WASTEWATER SAMPLING STATION WW006
DECEMBER 1988

DATE		DAILY FLOW (GALLONS)(1)	MINIMUM DAILY pH(2)		MAXIMUM DAILY pH(2)	
DECEMBER	1	(3)	7.5		9	(4)
	2	(3)	7		9	
	3	(3)	7.5		11.5	(4)
	4	(3)	7.5		9	
	5	(3)	7.5		8.5	
	6	(3)	7		9	
	7	(3)	6.5		8.5	
	8	(3)	6		7	
	9	(3)	6		7	
	10	(3)	6		7	
	11	(3)	6.5		8	
	12	(3)	6.5		8.5	
	13	(3)	7		9	
	14	1,456,020	7.5		8	
	15	1,502,440	7		8	
	16	1,479,570	6.5		7	
	17	1,262,620	6.5		7.5	
	18	1,282,200	6.5		8	
	19	1,489,950	7.5		8	
	20	1,396,700	7		9	
	21	1,451,880	7		8.5	
	22	1,311,840	7	(5)	8.5	(5)
	23	1,316,870	(5)		(5)	
	24	1,055,510	(5)		(5)	
	25	1,058,030	(5)		(5)	
	26	1,055,970	(5)		(5)	
	27	1,086,080	(5)		(5)	
	28	1,091,990	(5)		(5)	
	29	(3)	(5)		(5)	
	30	(3)	(6)		(6)	
	31	(3)	(6)		(6)	

AVERAGE DAILY FLOW RATE: 669,055 GALLONS PER DAY

(1) Total daily flow values taken from ISCO 2310 strip chart record at 0100 hours each day data available. Flow is recorded in gallons on the strip chart.
(2) pH values listed to nearest 0.5 pH unit.
(3) Flow monitoring equipment malfunction; no data available.
(4) Short duration pH fluctuation.
(5) pH monitoring equipment malfunction.
(6) Due to holiday season break, flow abnormally low, pH electrode not immersed in wastewater effluent. No pH data recorded January 1 or 2, 1989.

Table F.26. Results of Water-Level Measurements for Lagoons I and II in SNL-Albuquerque Technical Area IV 1988

	Lagoon I		Lagoon II	
Date	Water Level	% Full	Water Level	% Full
4/20/88	4 ft. 0 in.	36	4 ft. 0 in.	25
5/16/88	3 ft. 9 in.	33	4 ft. 6 in.	33
6/16/88	4 ft. 8 in.	41	4 ft. 0 in.	25
7/15/88	5 ft. 11 in.	55	4 ft. 4 in.	30
7/22/88	5 ft. 9 in.	54	4 ft. 0 in.	25
8/16/88	6 ft. 9 in.	64	4 ft. 6 in.	33
9/15/88	5 ft. 7 in.	52	4 ft. 0 in.	25
10/18/88	5 ft. 4 in.	49	3 ft. 4 in.	18
11/21/88	5 ft. 7 in.	52	1 ft. 0 in.	05
12/29/88	5 ft. 6 in.	51	0 ft. 0 in.	<5

Table F.27. Results of Surface Water Discharge Analyses for Lagoons I and II in SNL-Albuquerque Technical Area IV 1988.

	Parameter (mg/l)							
Date	TDS	Cl	SO4	Alk	Na	Ca	Mg	K
				Lagoon I				
4/88	1,100	500	88	230	236	77	19	9
6/88	466	140	31	100	87.3	40.2	88.8	5
7/88	340	120	15	95	68	33	5.9	<5
9/88	270	74	9.9	100	48	36	<5	5
11/88	360	110	18	110	84	40	6	10
				Lagoon II				
4/88	480	150	64	260	125	40	11	5
6/88	698	100	210	140	155	44.0	16.5	6
7/88	460	190	65	89	120	27	9.0	<5
9/88	260	49	3.4	110	46	31	7	<5
11/88	370	25	82	160	37	61	12	4.6

Note: No purgeable or extractable organics specified in DP-530 were detected in any samples during 1988.

APPENDIX G

ENVIRONMENTAL COMPLIANCE
REGULATIONS AND STANDARDS

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Table G.1. Radiation Standards* for Protection of the Public in the Vicinity of DOE Facilities

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/year	(mSv/year)
Occasional annual exposures	500	(5)
Prolonged period of exposure****	100	(1)

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

Air Pathway

	Dose Equivalent mrem/year	(mSv/year)
Whole body dose	25	(.25)
Any Organ	75	(.75)

*DOE interim standards, Memorandum, dtd August 5, 1985, DOE 5480.11 (Draft), November 1988.

**Routine DOE operations means normal planned operations and do not include actual or potential accidental or unplanned releases.

***Effective dose equivalent will be expressed in rem (or millirem) with the corresponding value in sievert (or millisievert) in paranthesis.

****For the purposes of these standards, a prolonged exposure will be one that lasts, or is predicted to last, longer than 5 years.

Table G.2. Derived Concentration Guides (DCG) For Selected Radionuclides*

Nuclide	Drinking Water		Inhaled Air****	
	DCG μCi/L	f, Value	DCG $\mu Ci/m^3$	Solubity Class
3H (Water)	2E+00	-	1E-01	-
137Cs	3E-03	1E+00	4E-04	D
Gross α**	15E-06	-	-	-
Gross β-**	3E-05	-	-	-
Unat***	6E-04	-	6E-6	-

*USDOE Memorandum from Robert J. Stern, dated February 28, 1986, DOE 5400.xx (Draft), March 1988.

**USEPA National Interim Primary Drinking Water Regulations (EPA-570/9-76-003).

***One Curie of natural uranium is equivalent to 3000 kg of natural uranium. A conversion from μg to μCi may be made by multiplying μg by 3.3 x 10-7.

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

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

Parameter*		
Contamination Indicator	Groundwater Quality	Appendix III Drinking Water Supply
pH	Chloride (Cl)	Arsenic
Specific Conductivity	Iron (Fe)	Barium
Total Organic Halogen (TOX)	Manganese (Mn)	Cadmium
Total Organic Carbon (TOC)	Phenol	Chromium
	Sodium (Na)	Fluoride
	Sulfate (SO_4)	Lead
		Mercury
		Nitrate (as N)
		Selenium
		Silver
		Endrin
		Lindane
		Toxaphene
		2,4-D
		2,4,5-TP
		Radium
		Gross Alpha
		Gross Beta
		Coliform Bacteria
		Turbidity

*RCRA 40 CFR 265

Table G.4. EPA Interim Primary Drinking Water Supply Paramters

Parameter	Standard**	Units
As*	0.05	mg/l
Ba*	1.0	mg/l
Cd*	0.01	mg/l
Cr*	0.05	mg/l
Pb*	0.05	mg/l
Hg*	0.002	mg/l
Se*	0.01	mg/l
Ag*	0.05	mg/l
Fl	1.4 - 2.4	mg/l
NO3	10	mg/l
Total coliform	1/100 ml	col/100 ml
Turbidity	1 TU	NTU
Ra 226	5 pCi/l	pCi/l
Ra 228	5 pCi/l	pCi/l
Gross Alpha	15 pCi/l	pCi/l
Gross Beta	4 mR/yr	pCi/l
Endrin	0.0002	mg/l
Lindane	0.004	mg/l
Methoxychlor	0.1	mg/l
Toxaphene	0.005	mg/l
2,4-D	0.1	mg/l
2,4,5-TP	0.01	mg/l

*total metals (unfiltered sample)
**40 CFR 265, Appendix III.

Table G.5. Sampling Parameters and Concentrations Limits Specified by Surface Water Discharge Plan DP-530

Parameter	Concentration Limit
Purgeable and Extractable Organics per NMWQCC regulations,	Sections 1-101
UU and 3-103.A Total Dissolved Solids	1000 mg/l
Chloride	250 mg/l
Sulfate	600 mg/l
Alkalinity	None specified
Sodium	None specified
Calcium	None specified
Magnesium	None specified
Potassium	None specified

G.6 NESHAP Proposed Changes to Radionuclide Air Emissions.

In response to a 1987 court decision, EPA is revisiting regulatory decisions (Re: FR 54, 9612 No. 43, Thursday, March 7, 1989) and issues to control the emissions of radionuclides from source categories that include DOE operations. EPA is under court order to take final action by August 31, 1989 on the rule proposed on March 7. This reexamination of the radionuclide NESHAP may provide some regulatory relief for Sandia operations that emit radionuclides.

In the proposed rule, EPA presents four alternative risk-based policy approaches (four options) that could be used in setting NESHAPs. The least restrictive level proposed is 10 mrem/y effective dose equivalent.[1] In the proposed rule EPA does not change the current definition of modification. No limit below regulatory concern is contained in the current or proposed rule: "A change that causes any increase in the rate of emissions is a modification, no matter how small that increase is." However EPA permit applications may be avoided in cases of small changes (see attachment).

Some provisions of the proposal as they effect DOE facilities are:

- EPA gets away from organ doses[2] and uses effective dose equivalent. This is an ICRP risk-weighted summation of organ dose equivalents. The dose to each organ is weighted according to the risk that the dose represents and the organ doses are then added together to obtain the effective dose equivalent. To keep the current limits on organ doses, EPA's new standard could be 10 mrem/y effective dose equivalent. However, more stringent alternative standards are also discussed in the proposed rule.

- AIRDOS-EPA remains EPA'S model of choice.

- EPA proposes a screening approach to decide if modification or new construction require regulatory approval. In other words, EPA proposes a threshold dose level below which no application to construct or modify would be required. This would eliminate the need for DOE to submit inconsequential activities for EPA approval. Under the proposed rules, DOE facilities use AIRDOS to determine the dose to the most exposed individual due to the modification or new construction. If the maximum individual doses added by the new construction or modification is less than 1% of the standard, then

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1. In final draft comments on the proposed NESHAP, DOE proposes a dose limit of 25 mrem/y effective dose equivalent.

2. The current NESHAP standard for DOE facilities limits emissions such that no individual receives a whole body dose of 25 mrem/y or receives a dose of 75 mrem/y to any organ.

the modification or new construction would not require prior EPA approval.[3] A 1% threshold based on DOE's proposed standard of 25 mrem/y effective dose equivalent would provide considerable relief to Sandia. Such a provision will save a minimum of four months in the approval process. This is true because at least one month is required to prepare an application, another month is required for Sandia DOE/AL application review, and an additional two months are allowed EPA by regulation to review the application. Even if EPA adopts a 10 mrem/y effective dose equivalent standard, we would not have to obtain prior EPA approval for modifications or new construction in cases where our AIRDOS calculations result in an estimated maximum individual dose of less than 0.01 mrem/y. Had such a rule been in effect last year, no prior EPA approval would have been required for the HERMES-III, the PT-II, or the PBFA-II accelerators to start up once the AIRDOS calculations were complete.

The final NESHAP's for radionuclides must be assessed before we know the extent of regulatory change.

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3. In final draft comments on the proposed NESHAP, DOE also recommends that EPA exclude from notification requirements under 40 CFR Part 61.09 sources exempted from the need to apply for approval to construct or modify.

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APPENDIX H

MISCELLANEOUS ENVIRONMENTAL COMPLIANCE ACTIVITIES: UNDERGROUND STORAGE TANKS

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Table H.1. SNL, Albuquerque Tanks Removed in 1988

Tank I.D.	Capacity	Contents	Year Installed
865-02	55 GAL	WASTE OIL	UNKNOWN
880-01	5000 GAL	DIESEL	UNKNOWN
6020-01	3000 GAL	FUEL OIL	UNKNOWN
6503-01	600 GAL	FUEL OIL	1977
6527-01	2360 GAL	FUEL OIL	UNKNOWN
6536-01	25000 GAL	FUEL OIL	1967
6540/1-01	500 GAL	FUEL OIL	UNKNOWN
6597-01	4000 GAL	FUEL OIL	1973
6620-01	600 GAL	FUEL OIL	1975
6650-01	1000 GAL	FUEL OIL	UNKNOWN
9925-03	5000 GAL	FUEL OIL	1969
9926-01	1000 GAL	FUEL OIL	1968
6581-01	500 GAL	FUEL OIL	1958
6587-02	10000 GAL	GASOLINE	1963
6587-03	6000 GAL	DIESEL	1963
6588-01	5000 GAL	FUEL OIL	1978
6595-01	34120 GAL	TRANSFORMER OIL	1968
6595-02	34120 GAL	TRANSFORMER OIL	1968
6595-03	34120 GAL	TRANSFORMER OIL	1968
6595-04	34120 GAL	TRANSFORMER OIL	1968
6595-05	34120 GAL	TRANSFORMER OIL	1968
6596-05	1000 GAL	FUEL OIL	1968
6597-02	25000 GAL	TRANSFORMER OIL	1978
6597-03	25000 GAL	TRANSFORMER OIL	1978
6597-04	25000 GAL	TRANSFORMER OIL	1978
6597-05	25000 GAL	TRANSFORMER OIL	1978
6597-06	25000 GAL	TRANSFORMER OIL	1978
6597-07	25000 GAL	TRANSFORMER OIL	1978
6597-08	25000 GAL	TRANSFORMER OIL	1978
6630-01	560 GAL	FUEL OIL	1966
6720/1-01	500 GAL	FUEL OIL	1959
9832-01	650 GAL	FUEL OIL	1976
9925-01	6000 GAL	GASOLINE	1978
9925-02	6000 GAL	DIESEL	1971
9970-01	500 GAL	FUEL OIL	1973
9980-01	6000 GAL	FUEL OIL	UNKNOWN

Table H.2. 1988 SNLA Tank Inventory Listing

Tank I.D.	Capacity	Contents	Year Installed
605-07	1000 GAL	FUEL OIL	1968
605-08	12000 GAL	FUEL OIL	1956
605-09	12000 GAL	FUEL OIL	1956
605-10	12000 GAL	FUEL OIL	1956
605-11	12000 GAL	FUEL OIL	1956
831-01	1000 GAL	EMERGENCY WASTE WATER	1968
840-01	500 GAL	COOLANT/WATER	1953
844-01	150 GAL	TRITIATED WATER	1968
862-01	9730 GAL	FUEL OIL FOR GENERATOR	1987
867-01	4000 GAL	NEUTRALIZATION TANK	1973
876-01	1000 GAL	WASTE OIL	1950
876-02	12000 GAL	GASOLINE	1985
876-03	12000 GAL	DIESEL	1986
888-01	550 GAL	WASTE OIL	1982
888-02	550 GAL	WASTE OIL	1982
888-03	20000 GAL	TRANSFORMER OIL	1982
888-04	20000 GAL	TRANSFORMER OIL	1982
888-05	20000 GAL	TRANSFORMER OIL	1982
888-06	20000 GAL	TRANSFORMER OIL	1982
901-01	120 GAL	GASOLINE	1951
910-01	120 GAL	GASOLINE	1951
911-01	120 GAL	GASOLINE	1951
912-01	120 GAL	GASOLINE	1951
970-01	1000 GAL	FUEL OIL	1987
970-03	1000 GAL	WASTE OIL	1987
983-08	60000 GAL	BROMINE WATER	1986
983-09	2000 GAL	WASTE OIL	1985
6018-01	500 GAL	DIESEL	UNKNOWN
6028-01	5000 GAL	GASOLINE	1987
6500-01	600 GAL	FUEL OIL	1978
6503-01	600 GAL	FUEL OIL	1977
6505-01	300 GAL	FUEL OIL	1956
6525-01	500 GAL	FUEL OIL	UNKNOWN
6536-01	25000 GAL	FUEL OIL	1967
6580-05	5000 GAL	FUEL OIL	1958

APPENDIX I

ACTION DESCRIPTION MEMORANDUMS

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Table I.1. Action Description Memorandums (ADMs) Written at SNLA During 1988

Action Description Memoranda	Date Written
New Fire Test Facility	1/88
TRUPACT II Pool Fire Test	2/88
Wood Crib Fire Tests of Component Shipping Containers for Monsanto/Mound	7/88
W33/M422 Stockpile Integrated Laboratory Test	6/88
Weapons Production Primary Standards Lab	4/88
The Integrated Materials Research Laboratory	7/88
HERMES-III	7/88
Interim Transportation Overpack Container (ITOC)	8/88
Wood Crib Fire Tests of Explosive Components for General Electric	10/88
Shipping and Receiving Facility	10/88
Additional TRUPACT-II Pool Fire Tests	10/88
Detonation Tests for Bldg. 9926	10/88
Closure of Chemical Waste Landfill	12/88
Weapons Training Center Classrooms	12/88

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APPENDIX J

ENVIRONMENTAL COMPLIANCE AT OTHER SNL FACILITIES

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J.1 SALTON SEA

The Salton Sea Test Base (SSTB) was utilized by Sandia National Laboratories from 1945 to 1962 as an instrumented ballistic test range for obtaining performance data on inert atomic weapon development prototypes. Prior to 1945 and after 1962 the SSTB was controlled by the U.S. Navy. As the present operator, the U.S. Navy has taken the lead in meeting the requirements of CERCLA/SARA Section 120(d) for environmental assessments. Sandia is supporting the U.S. Navy by providing information on the Sandia operations, reviewing and providing technical comment on documents developed by the U.S. Navy.

J.2 KAUAI

Introduction. The Department of Energy (DOE) operates a rocket preparation and launch facility called the Kauai Test Facility (KTF) at the Navy's Pacific Missile Range Facility - Barking Sands (PMRF), operating on a tenant basis via the Sandia National Laboratories. The KTF is used to launch rockets associated with Sandia's DOE mission as well as in support of other US Government projects.[46]

Site Description. Much of the following text is taken from a Preliminary Environmental Assessment[46] prepared in 1986 for Kauai.

The KTF and PMRF are located on the seaward margin of the broad Mana coastal plain of Kauai. The Mana coastal plain is composed of alluvium washed from uplands, calcareous and clayey lagoon deposits, and sand dunes and beach rock. The poorly consolidated deposits of the present plain were formed in a shallow lagoon behind an ancient beach ridge. The large wetland was largely filled in and planted with sugarcane by 1936, leaving only some small areas of wetland near Mana, about 10,000 ft from the KTF.

The KTF lies in the rain shadow of Mounts Kawaikini and Waialeale. The annual rainfall is about 20 inches per year. The greatest single day of rain on record for the area was 5.02 inches on February 1, 1975. 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. Rains simply sink into the sand and disappear.

The Mana Plain is composed of a wedge of terrestrial and marine sediments overlying a volcanic basement. The basement rock outcrops at the inland edge of the Plain, its steep slope a cliff formed during a former high-stand of the sea. The volcanic basement plunges below the Plain at a dip of about 5 degrees until at the coast it is about 400 feet deep.

The seaward edge of the Plain is covered by fossil sand dunes formed when the sea was lower than it is now. The PMRF is located almost entirely on these dunes, which now are no higher than 10 feet or so except just to the north of the KTF, where they are up to 100 feet high.

The three geological formations (bedrock, alluvium, and dunes) constitute hydraulically connected aquifers. The basement volcanics are highly permeable, containing brackish water floating on sea water. The overlying sediments act as a caprock because of their low permeability; they are saturated but are not exploitable as an aquifer because of their unfavorable hydraulic characteristics.

The dune sand aquifer, on which the PMRF lies, has a moderate hydraulic conductivity and a reasonable porosity. It consists of a lens of brackish groundwater floating on sea water, and is recharged by storm rainfall and by seepage from the underlying sediments. The only record of an attempt to exploit this groundwater is of a well drilled for the Navy in 1974 4-5 miles south of the KTF. It was dug to a total depth of 42 feet, encountering only fine sand and coral gravel. Tested at 300 gpm, it initially yielded water having 2800 mg/l chloride, which is too brackish for plants. This well is not used.[46]

The principal vegetation found on Kauai consists of two introduced shrub species: Kiawe - a mesquite and koa-haole - a wild tamarind. Portions of the island are covered with nearly impenetrable thickets of kiawe and koa-haole.[46] The land on which the present KTF facilities lie has been cleared from brush and has a thin cover of grasses and herbs.

The sandy soil appears barren and incapable of supporting agriculture unless improved by mixing with soil, fertilizing extensively, and irrigating it.

No mammals or signs of mammals were encountered during a 1986 field survey.[46] However, it is quite likely that there may be populations of mice and rats. The endangered Hawaiian Hoary Bat (Lasiurus cinereus semotus) may also be found, at least occasionally, as there are breeding populations elsewhere on Kauai.

Twenty-two (22) species of birds were found on the range, plus three more just outside the range.[46] There are also several species of waterfowl that may be present on the range during some portion of the year, even though they were not seen during the 1986 survey. These 25 include five species native to Hawaii.

The nearest off-base community is the village of Mana, estimated population 30, 10,000 feet to the south.

Environmental Restoration Program at Kauai

The Environmental Restoration Program performed a Preliminary Assessment (PA) of the Kauai Test Facility to identify sites where past spills or releases might have caused environmental degradation. Two sites were identified: Drum Rock Area and Photo Lab Discharges. Completed PA forms, Hazard Ranking System (HRS) packages, and a discussion of the environmental setting used for the HRS scoring were submitted April 25, 1988 to satisfy the requirements of Section 120(d) of SARA for two sites. Both sites scored 4.17 on the HRS.

Environmental Compliance Activities at Kauai

An Environmental Report was prepared for Kauai Test Facility in 1986. Additional ADMs have been prepared for specific tests. Table J.1 summarizes the 1988 ADMs.

Table J.1. Action Description Memorandums (ADMs) Written by SNL, Albuquerque for Kauai During 1988

Action Description Memoranda	Date Written
Thorny Merit Rocket Launch	5/88
NUBE Rocket Launch	8/88

In 1988 Sandia prepared a "Preliminary Environmental Assessment" for submission to the US Navy for Sandia's Kauai Test Facility (KTF) at the Navy's Pacific Missile Range Facility. This preliminary assessment was prepared to meet Navy NEPA requirements for Sandia's Thorny Merit experiment for the US DOE.

Sandia believes it will be more efficient to prepare an Environmental Assessment (EA) for the KTF that bounds the impacts from all activities at the facility. This will allow future ADM's to be simply written and tiered to the EA. DOE/AL concurred in the desirability of writing a KTF EA and the effort was initiated in November of 1988.

Once the Kauai EA is finalized, a draft FONSI, if appropriate, will be prepared for approval by DOE headquarters.

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