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1996 Site Environmental Report Sandia National Laboratories Albuquerque, New Mexico

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Prepared by
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SITE ENVIRONMENTAL REPORT
SANDIA NATIONAL LABORATORIES
ALBUQUERQUE, NEW MEXICO

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ABSTRACT

Sandia National Laboratories/New Mexico (SNL/NM) is operated in support of the U.S. Department of Energy (DOE) mission to provide weapon component technology and hardware for national security needs, and to conduct fundamental research and development (R&D) to advance technology in energy research, computer science, waste management, electronics, materials science, and transportation safety for hazardous and nuclear components. In support of this mission, the Environmental Safety and Health (ES&H) Center at SNL/NM conducts extensive environmental monitoring, surveillance, and compliance activities to assist SNL's line organizations in meeting all applicable environmental requirements. This annual report (calendar year 1996) summarizes the compliance status of environmental regulations applicable to the site including those regulating radiological and nonradiological effluents and emissions. Also herein are included, the status of environmental programs that direct and manage activities such as terrestrial surveillance; ambient air and meteorological monitoring; hazardous, radioactive, and solid waste management; pollution prevention and waste minimization; environmental restoration (ER); oil and chemical spill prevention; and National Environmental Policy Act (NEPA) documentation. This report has been prepared in compliance with DOE Order 5400.1, *General Environmental Protection*.

PREFACE

This report presents summary information on the compliance status and monitoring results for Sandia National Laboratories, New Mexico (SNL/NM). The reader may also refer to the Ancillary Information at the end of the report for useful definitions and a listing of acronyms, units, and other abbreviations. A brief overview of the SNL/NM site and map location is also available on the INTERNET at: **http://www.sandia.gov/visit.htm**

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EXECUTIVE SUMMARY

As required by U.S. Department of Energy (DOE) Order 5400.1, this Annual Site Environmental Report (ASER) has been prepared for Sandia National Laboratories/New Mexico (SNL/NM) to characterize current environmental conditions in the vicinity of SNL/NM property and to summarize the compliance status with Federal, State, and local requirements and permits. This report represents a key component of the DOE's effort to keep the public informed about environmental conditions throughout the DOE complex. For this 1996 calendar year (CY1996) report, significant environmental program achievements are highlighted, as well as noting any areas of non-compliance, corrective actions, or other areas of ongoing improvements. Audit results from all external appraisals conducted in 1996 are briefly described.

SNL/NM is managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation. The site is located on the 80-square-mile Kirtland Air Force Base (KAFB) Military Complex, which includes 20,486 acres withdrawn from the U.S. Forest Service for various remote testing activities conducted by DOE, SNL, and the U.S. Air Force (USAF). The Complex is situated adjacent to and southeast of Albuquerque, New Mexico.

The primary mission of SNL/NM is to conduct research and development (R&D) for nuclear weapon system components and to ensure the integrity and reliability of the nation's defense systems. This mission has greatly expanded in recent years to focus on the development of non-weapon-specific technology such as microelectronics, computer technology, waste disposal technologies, accelerator and pulsed power energy research, robotics, and biomedical engineering.

The Environmental Safety and Health (ES&H) Center within SNL/NM supports SNL's mission by assisting R&D organization activities in meeting compliance with all applicable regulations.

The following paragraphs present the major activities, accomplishments, and results of various environmental programs conducted at SNL/NM during 1996. These major environmental program areas include:

- Waste Management and Waste Minimization
- Environmental Restoration (ER)
- Terrestrial Surveillance
- Wastewater and Storm Water Discharges
- Groundwater Protection
- Air Quality Compliance and Monitoring
- National Environmental Policy Act (NEPA) Activities
- Occurrence Reporting

WASTE MANAGEMENT AND WASTE MINIMIZATION

Waste management at SNL/NM is conducted at three primary waste handling areas: the Hazardous Waste Management Facility (HWMF), the Radioactive and Mixed Waste Management Facility (RMWMF), and the Solid Waste Transfer Facility (SWTF). In addition, representatives from SNL/NM's Waste Minimization and Pollution Prevention Programs confer with SNL/NM's line organizations to implement waste saving technologies and recycling wherever feasible.

- The **HWMF** operates under a Resource Conservation and Recovery Act (RCRA) Part B Permit. All nonradioactive, nonexplosive, hazardous chemical waste including RCRA waste, asbestos, polychlorinated biphenyls (PCBs), and medical waste is handled at this facility. Recycling is also carried out for various material categories that include oil, specific metals, vehicle batteries, and PCBs. The HWMF is responsible for verifying, labeling, packaging, storing, and shipping

waste to permitted facilities for disposal. In 1996, the HWMF handled the following:

HWMF
⇒ 51,549 kg hazardous waste (RCRA)
⇒ 52,019 kg of PCBs
⇒ 77,321 kg asbestos
⇒ 28,400 kg used oil (recycled)
⇒ 99,838 kg chemical waste
⇒ 5,517 kg ER waste

A total of 336,137 kg of waste was handled by the HWMF in 1996. The New Mexico Environment Department (NMED) conducted an audit of the facility's operations and waste generator sites in April 1996; no findings were reported.

- The **RMWMF** primarily handles only low level waste (LLW) and mixed waste (MW). In 1996, SNL/NM generated:

RMWMF	
⇒ 461,713	kg of LLW
⇒ 58,610	kg of MW

No radioactive waste was received from offsite in 1996. Larger quantities of LLW were shipped in 1996 (604,676 kg) due to the accumulation of past waste. MW continues to be a compliance issue due to the lack of approved MW treatment technologies that will allow the waste to meet RCRA's Land Disposal Restrictions (LDRs). Regulations require hazardous waste to be treated and disposed within one year of generation. Due to the lack of approved MW treatment technologies, SNL/NM stores MW beyond the one year time limit. SNL/NM is actively pursuing treatment methods and storage consolidation to comply with the regulations. In accordance with the Federal Facilities Compliance Act (FFCAct), SNL/NM has developed a Site Treatment Plan for MW. Commercial alternatives for MW treatment are being evaluated and are expected to be used.

- The **SWTF** opened in May 1996 to screen, bale, and store solid waste. The SWTF accepts nonhazardous waste such as office and laboratory trash, and recyclable paper and cardboard. Plans to expand the recycling effort are under review. Waste quantities produced in 1996 were estimated by doubling the total waste received at the facility during its six months of operation as follows:

SWTF
⇒ 1,083,422 kg solid waste (annual)
⇒ 423,719 kg of recycled waste (annual)

- The **Pollution Prevention Program** implemented 10 Return on Investment (ROI) Projects, which are granted based on the ability of the project to return the initial pollution prevention cost within two years of implementation. These projects will save thousands of dollars in reduced waste handling costs alone.

ENVIRONMENTAL RESTORATION (ER) ACTIVITIES

The assessment and remediation of potential release sites identified by the ER Project at SNL/NM are being regulated by the New Mexico Environment Department (NMED) as provided for by the Hazardous and Solid Waste Amendments of 1984 (HSWA) Module IV of the RCRA Part B Operating Permit, as delegated by EPA in January 1996. All remedial action is scheduled to be completed by the year 2001. During FY1996, 29 corrective actions were completed leaving 153 ER sites on the permit at the close of FY1996. A total of 100 of these sites have already been proposed to DOE, EPA, and NMED for No Further Action (NFA) either because contamination is insignificant (or not present), or remedial action has already been accomplished.

To facilitate the storage and treatment of ER waste, a Temporary Unit (TU) and Corrective Action Management Unit (CAMU) are expected to be operational in 1998. The TU/CAMU facility will allow for the treatment and storage of chemically-contaminated soils. The CAMU is designed to remove volatile organic chemicals, and remove or stabilize metals. Treated soil that meets regulatory standards will be disposed of onsite at the CAMU.

TERRESTRIAL SURVEILLANCE

SNL/NM conducts terrestrial surveillance as required by DOE Order 5400.1. Soil, sediment, vegetation, and surface water samples are collected from onsite, perimeter, and offsite locations. Sample locations are in areas of known contamination or in areas where contamination, if present, would be expected to accumulate. The surveillance sampling objectives are to detect any potential releases and/or migration of contaminated material to offsite locations as well as to determine if pollutants are migrating from offsite to onsite. Results have been categorized into four groups by the Prioritization Statistical Analysis Methodology. This method compares onsite values with offsite and perimeter values and determines if there are any trends. There were no Category 1 locations at any location (values higher than offsite with an increasing trend). Several Category 2 locations (higher than offsite but without an increasing trend) with respect to radiological parameters were observed, similar to previous years sampling results. Tritium contamination is present in TA-II and near the Mixed Waste Landfill (MWL) in TA-III. Cesium-137 has been found higher than offsite in three areas near the land withdrawal on the east side of KAFB. Category 2 locations with respect to nonradiological parameters indicated higher than offsite levels for cadmium and lead south of TA-IV; zinc, cobalt, and manganese at perimeter locations on the north side of KAFB; and manganese, barium, and zinc at Coyote Springs within the land withdrawal. The results from Coyote Springs are based on comparisons with river and creek water (from offsite) and therefore, do not make a true comparison of surface water sample types. It is suspected that Coyote Springs is naturally high in some of the elements mentioned above.

The Terrestrial Surveillance Program has initiated surveys of wildlife populations and natural vegetation for site baseline studies.

WASTEWATER DISCHARGES

Wastewater, in general, falls into three categories at SNL/NM: (1) sewer system discharges, (2) storm water runoff, and (3) surface discharges. SNL/NM discharges only nonradiological constituents that meet State standards. Radiological screening occurs in TA-V at the Liquid Effluent Control System (LECS). However, no radiological effluents have ever been detected in the system since operation of this equipment began in 1994.

- **Sewer System Discharges** – Wastewater from SNL/NM is discharged through four general outfall stations. Additionally, there are two pretreatment stations upstream of the general outfalls for the Advanced Manufacturing Process Laboratory (AMPL) and the Microelectronics Development Laboratory (MDL). Monitoring is conducted to ensure that wastewater discharges meet the standards for the Albuquerque Sewer Treatment Plant. Once water has been treated, it is discharged to the Rio Grande. There were no permit violations in the first three quarters of 1996 (FY1996). The City of Albuquerque awarded SNL/NM six Gold Pretreatment Awards for excellence in compliance during this time. However, in the last quarter of 1996 there were two minor pH violations from one general outfall and the AMPL station. No fines were incurred.

- **Surface Discharges** – All water to be discharged to the ground surface, either directly or to lined containments, must meet State surface discharge standards. There were 33 requests made for individual discharges to the ground surface. Five were

not approved and sent to the sanitary sewer authority for disposal. Additionally, routine surface discharges are made to the evaporation lagoons servicing the Pulsed Power Facility under an existing discharge permit. All permit requirements were met in 1996.

- **Storm Water Runoff** – SNL/NM reapplied for a storm water permit in 1996 using a "Multi-sector General Permit" application. The original "Individual Permit" application also remains pending. The "General Permit" is intended to accelerate the permitting process since the "Individual Permit," first applied for in 1992, has yet to be granted due to a backlog at the EPA in issuing these types of permits. The new permit is expected to be approved in 1997 and will require less storm water monitoring stations and a streamlined list of sampling parameters. Currently, storm water sampling is conducted at three stations; sampling is conducted in accordance with future permit specifications.

GROUNDWATER PROTECTION

Groundwater monitoring activities reported are those associated with SNL/NM's ER Project and the Groundwater Protection Program. In 1996, the Groundwater Surveillance Task of the Groundwater Protection Program performed base-wide water level measurements in 30 wells. Groundwater quality samples were taken from 16 wells and three springs. Water levels are measured monthly to infer groundwater flow patterns in the region and to define long-term groundwater quantity at KAFB. Water levels are continuing to drop at a rate of 1 to 3 ft per year in wells west of the Tijeras Fault Complex. These wells are screened within the upper units of the Santa Fe Group, which is the host formation for the major regional aquifer. Water level declines are the result of pumping from City of Albuquerque and KAFB water supply wells. Water quality data from the Groundwater Protection Program showed no parameters exceeding the Maximum Contaminant Limits (MCLs) except in several areas where natural conditions cause high results. This is the case for radium in the EOD Well and fluoride in the SFR-3P Well. Uranium-234, associated with granitic rocks, is also found above standards in several wells.

In 1996, water quality samples taken at ER sites, as required by the RCRA permit, showed elevated levels of known contaminants similar to past years. This includes trichloroethylene (TCE) at the CWL, TA-V, and areas in the vicinity of TA-I and TA-II. The concentrations of TCE are at low levels not exceeding 27 µg/L, as compared to the drinking water MCL of 5 µg/L. Elevated levels of nitrates are also present at TA-II, the Burn Site, and TA-V. There is no indication that contaminants are migrating from any ER sites.

AIR QUALITY COMPLIANCE AND MONITORING

- **Ambient Air Monitoring** – SNL/NM measures ambient air quality at six stations throughout the site to meet the requirements of the National Ambient Air Quality Standards (NAAQS) and local ambient air standards implemented by New Mexico regulations. The network includes one Criteria Pollutant Monitoring Station (CPMS)—which measures sulfur dioxide (SO_2), nitrous oxides (NO_x), particulate matter (PM), ozone (O_3), and carbon monoxide (CO)—and air monitoring equipment for volatile organic compounds (VOCs) and particulate matter (PM) located at the other stations. There were no exceedences in ambient air quality at any of SNL/NM's six stations.

- **Title V Requirements** – In accordance with the new requirements of the Clean Air Act Amendments (CAAA), SNL/NM has applied for a Title V Operating Permit. SNL/NM has been determined to be a major source (>100 tons per year) for nitrous oxides (NO_x). The permit will include many of the

current individually permitted sources under a site-wide comprehensive permit. The Title V permit application was submitted on March 1, 1996 and is expected to be granted by March 13, 1998.

- **Meteorological monitoring** – SNL/NM maintains a network of eight meteorological towers primarily to support dose assessment calculations performed to meet National Emission Standards for Hazardous Air Pollutant (NESHAP) requirements. The data also serves to provide current meteorological data for emergency response information in the event of a spill or other hazardous release. The towers are instrumented at various levels to record wind speed and direction, standard deviation of horizontal wind speed (sigma theta), temperature, relative humidity, precipitation, and barometric pressure.

- **NESHAP Compliance** – In 1996, there were 16 facilities reporting NESHAP-regulated emissions. Primary radionuclides released included tritium, Nitrogen-13, Oxygen-15, and Argon-41. The NESHAP calculated Effective Dose Equivalent (EDE) to the Maximally Exposed Individual (MEI) was determined to be again located at the USAF Kirtland Underground Munitions Storage Complex (KUMSC) facility. The EDE calculated for this location was 0.007 millirem per year (mrem/year). The offsite MEI receptor was 0.0014 mrem/year. Results are significantly less than the EPA's dose limit of 10-mrem/year. The total population dose for the 80-kilometer radius surrounding SNL/NM was calculated to be 0.14 person-rem. By comparison, the population received more than 57,000 person-rem from natural background radiation. SNL/NM was in full compliance with NESHAP regulations in 1996.

NEPA ACTIVITIES

NEPA activities in 1996 included the completion of three Environmental Assessments (EAs), each of which was issued a Finding of No Significant Impact (FONSI): (1) *Environmental Assessment of the ER Project*, (2) *SNL/NM Offsite Transportation of Low Level Waste*, and (3) *EA for Operations, Upgrades, and Modifications in SNL TA-IV*. Other NEPA activities included input to two Environmental Impact Statements (EISs): (1) *Final Programmatic EIS for Stockpile Stewardship*, and (2) *Medical Production Isotopes Project Molybdenum-99 and Related Isotopes Environmental Impact*.

OCCURRENCE REPORTING

There were four environmental occurrences in 1996 as follows:

- On August 16, a radioactive hot particle was discovered on the floor of the Radioactive and Mixed Waste Management Facility (RMWMF). The particle had fallen out of a waste bag during sorting. A minor dose was incurred by three workers during the period from August 2 to August 16. Plans have been revised to ensure a similar incident does not reoccur.

- On November 15, there was a violation of City Wastewater Discharge Permit #2069H3. The resultant pH excursion causing the violation was later found to be due to buildup of common cleaning supplies in a floor drain.

- On December 28, there was a pH excursion from a general outfall station (WW006) that was later traced to an overflow of the sodium hydroxide tank located at the Steam Plant. The root cause will be reported in 1997 after all reports have been completed.

- On December 30, approximately 10 to 25 gal. of sewage was inadvertently pumped from a sump area and released to a parking lot where it flowed into a storm drain. The release was not retrievable. The area was disinfected and no significant damage was incurred from this incident.

1.0 INTRODUCTION

This Annual Site Environmental Report (ASER) has been compiled to characterize the state of the environment in and around the Sandia National Laboratories/New Mexico (SNL/NM) site operational area for the calendar year 1996 (CY1996). The ASER summarizes all environmental program activities, encapsulates compliance status with respect to applicable Federal, State, and local laws, and refers readers to more comprehensive documents where available.

This report represents a collective effort by many SNL organizations who are responsible for the various components of SNL/NM's total site environmental management performance. Within each program area, significant efforts and successes are highlighted, as well as indicated areas where improvement or corrective actions are ongoing.

SNL/NM's Mission

SNL/NM is operated by the Sandia Corporation, a wholly-owned subsidiary of the Lockheed Martin Corporation. Sandia Laboratories has two main facilities: the primary lab in New Mexico and the California lab with facilities in Livermore and San Jose. Additionally, SNL operates two test areas; the Kauai Test Facility (KTF) located on the U.S. Navy's Pacific Missile Range Facility (PMRF), and a portion of the Tonopah Test Range (TTR) in Nevada.

As one of the national defense laboratories within the U.S. Department of Energy (DOE) complex, SNL/NM has been historically responsible for the research and development (R&D) of energy sources and weapons (both nuclear and non-nuclear). The primary mission has been to ensure the integrity and reliability of our nation's defense systems. Although the nuclear danger is greatly reduced in the wake of the Cold War, the United States still continues to rely on nuclear weapons as a vital military deterrent. Current work in this area includes the weaponization of nuclear explosives, (including the design of arming, fusing, and firing systems); safe transport and storage of radioactive materials; pulsed power and accelerator research; waste disposal technologies; and arms control and non-proliferation. Safely managing nuclear weapons and ensuring the reliability of weapon systems receives primary emphasis at SNL/NM.

SNL/NM has also been expanding its mission to develop new technologies in non-military areas. R&D areas at SNL/NM cover a broad spectrum of activities dealing with new emerging technologies in areas such as microelectronics and electronic products, computer systems, materials studies, robotics, biomedical engineering, and solar, wind, and fusion energy research.

SNL/NM performs its environmental management responsibilities in accordance with DOE orders and goals. Major DOE environmental safeguard requirements applicable in this report are embodied in the following orders and guidelines:

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

This report represents a key component of the DOE's effort to keep the public informed about environmental conditions at DOE sites.

SNL/NM's Environmental Safety and Health (ES&H) Structure

SNL/NM manages and conducts its operations in an environmentally sound manner to ensure as low as reasonably achievable (ALARA) risk levels to workers, the environment, and the public. With this philosophy, SNL has developed a corporate-wide culture that emphasizes environmental safety and responsibility, a policy that is evident

at all levels of operations—from line management to individual employees. SNL/NM strives to meet 100 percent regulatory compliance standards—both in letter and spirit—with all applicable environmental laws, and internal ES&H requirements. Environmental programs are primarily conducted under the ES&H 7500 Center; five separate departments within the 6600 Center conduct Environmental Restoration (ER) activities. Programs within these Centers, discussed in this report, include all environmental monitoring and surveillance activities, pollution prevention, waste management, National Environmental Policy Act (NEPA) activities, environmental audit information, environmental occurrences, and the overall quality assurance (QA) maintained for environmental program conduct.

1.1 SNL/NM OPERATIONAL AREAS

SNL/NM operations are conducted within the bounds of the 80-sqare-mile Kirtland Air Force Base (KAFB) military reservation, which includes the additional 20,486 acres within the Cibola National Forest that has been withdrawn by the United States Air Force (USAF) and/or the DOE, through an agreement with the Forest Service (Figure 1-1). SNL/NM shares this land withdrawal with KAFB and the DOE. Operations at SNL/NM are conducted on SNL/NM property within technical areas and on co-use land within KAFB. The following sections summarize activities conducted in each of SNL/NM's operational areas.

Technical Area I (TA-I) is the focus of SNL/NM's operations housing the main administrative center and a close grouping of various labs and offices. Although, the majority of TA-I is located within the fenced area, several facilities and buildings are located just beyond the main compound. Activities performed in TA-I are mostly dedicated to the design, research, and development of weapons systems; limited production of weapon system components; and energy research programs. TA-I facilities include the main technical library, several assembly/manufacturing areas, the steam plant, the Advanced Manufacturing Process Laboratory (AMPL), the Microelectronics Development Laboratory (MDL), the TANDEM accelerator, and the Neutron Generator Manufacturing Facility (NGMF).

Technical Area II (TA-II) includes the diamond-shaped compound south of TA-I and several facilities south of Hardin Road.. TA-II is primarily used to test explosive components. Research includes studies to develop techniques for measuring fractures in geologic strata. TA-II facilities within the main fenced area include the Explosive Components Facility (ECF), the recently remediated Radiological Waste Landfill (RWL), the Radioactive Materials Storage Yard (RMSY), and the Classified Waste Landfill. Other TA-II facilities include the Facilities Command Center, the Solid Waste Transfer Center, and the Hazardous Waste Management Facility (HWMF).

Technical Area III (TA-III) is the largest, most remote, and furthest south of all the technical areas. It contains facilities mostly separated by large undeveloped areas. TA-III is used to accommodate large-scale engineering test activities, which require large area buffers for safety and/or security, such as sled tracks used for collision testing, centrifuges, and a radiant heat facility. Facilities include the Radioactive and Mixed Waste Management Facility (RMWMF), the Hammermill (a paper pulverizer used to destroy classified documents); the Mixed Waste and Chemical Waste Landfills (MWL and CWL—both closed); the Large-Scale Melt Facility (LMF); and the Melting and Solidification Laboratory (MSL). The Solar Tower Facility is located in a remote area south of TA-III.

Technical Area IV (TA-IV) is a compound located just south of TA-I and TA-II. This area is used to conduct R&D in inertial-confinement fusion, pulsed-power, and nuclear particle acceleration. The two primary facilities are the Particle Beam Fusion Accelerator (PBFA) and the High Energy Radiation Megavolt Electron Source-III (HERMES-III). Several small or non-active

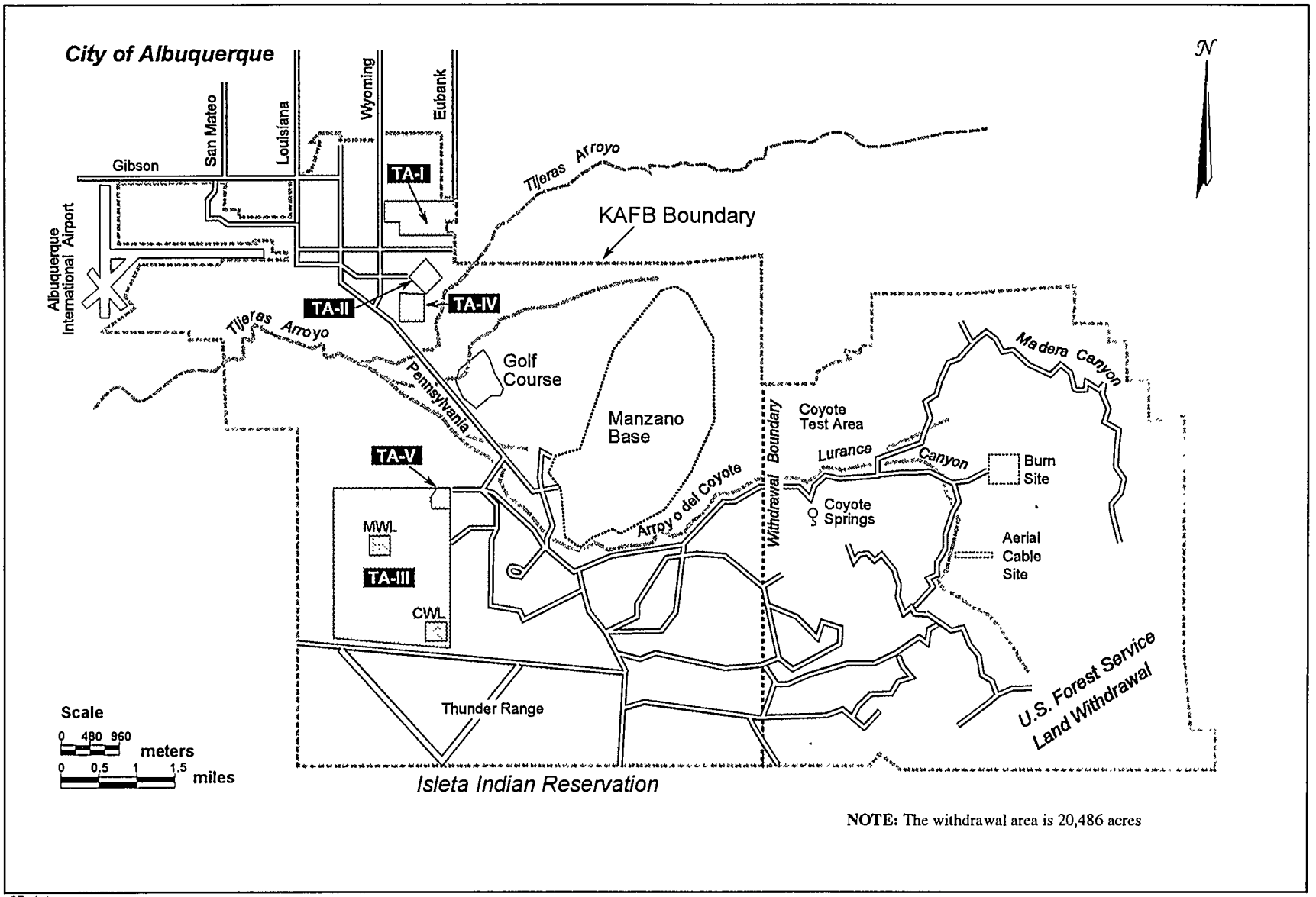

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Figure 1-1. SNL/NM and the KAFB site showing Technical Areas I through V, the U.S. Forest Service land withdrawal, and other remote test areas used by SNL/NM.

accelerators including the SATURN accelerator, the Sandia Accelerator Beam Research Experiment (SABRE), the Repetitive High Energy Pulsed Power (RHEPP-I and RHEPP II) accelerators, the High Power Microwave Lab, TROLL, ALIAS, PROTO-II, and SPHINX. Inactive pulsed-power facilities include the IMATRON (an x-ray device used in land mine detection research), the Subsystem Test Facility (STF), and the Exploding Metal Film Anode Plasma Source (EMFAPS).

Technical Area V (TA-V) is located adjacent to and northeast of TA-III. This high security facility routinely handles radioactive materials used in experimental research or nuclear fuel. TA-V houses the Sandia Pulsed Reactor (SPR) an intense gamma irradiation facility; the Annular Core Research Reactor (ACRR), and the Hot Cell Facility (HCF)—used to dismantle or handle highly radioactive materials.

Remote Test Areas are located south of TA-III and within the canyons and foothills of the land withdrawal (e.g., Lurance and Coyote Canyons). These areas are used for explosive ordnance testing, rocket firing experiments, and open-burn thermal tests. Permanent facilities in these remote areas include sled tracks, aerial cables, the Small WInd SHielded (SWISH) facility, the SMoke Emission Reduction Facility (SMERF) and the Open Pool Burn Site Facility (OPOL). No radioactive releases are currently produced at any of the remote test areas; however, depleted uranium (DU) has been spread over limited areas during past experimental activities. Environmental monitoring is performed at regular intervals to monitor if any contaminants are migrating from these sites.

1.2 SITE SETTING and DEMOGRAPHICS

SNL/NM is located in Bernalillo County adjacent to the City of Albuquerque with TA-I facilities the closest point to the city. TA-I is approximately 2.5 miles (4 km) south of Interstate 40 and approximately 6.5 miles (10.5 km) east of the downtown area (Figure 1-2).

The KAFB military reservation topography west of the withdrawal boundary is generally flat to gently rolling, being situated on broad alluvial mesas. The exception is Manzano Base which encompasses a group of hills surrounded by relatively flat terrain. The second major topographic feature on the base is the Tijeras Arroyo, which is up to 1300 m wide and 33 m deep. This drainage channel is dry except during storm water events. However, because it connects to a large potential watershed—including Tijeras Canyon where it originates, storm water runoff from the base, and adjoining arroyos connecting to the land withdrawal area—its water-carrying capacity is significant. The Tijeras Arroyo trends southwest across SNL/KAFB property and empties to the Rio Grande.

The land withdrawal on the east side of KAFB is intersected by the Manzanita Mountains. This area is topographically characterized by gently eroded mountains (compared to the Sandias) with a maximum elevation of 7,988 ft. Elevations in the Albuquerque regional area range from 4,900 ft at the Rio Grande near the intersection of I-40 and I-25 to 10,678 ft at Sandia Crest—the highest point in the regional area. The KAFB military reservation (excluding the withdrawal) has a mean elevation of 5,384 ft.

The population in the Albuquerque, and the surrounding area within a 50-mile radius of SNL/NM, is contained in all or part of nine counties (Table 1-1). A recent estimate for the population within the City of Albuquerque is 411,994 (DOC 1996). The Isleta Indian Reservation, which borders KAFB on the south, is the next nearest population center (2,953 in the 1990 census).

1.3 GEOLOGY and HYDROLOGY

SNL/NM and KAFB are located along the eastern margin of an enormous sediment-filled basin called the Albuquerque Basin. This major

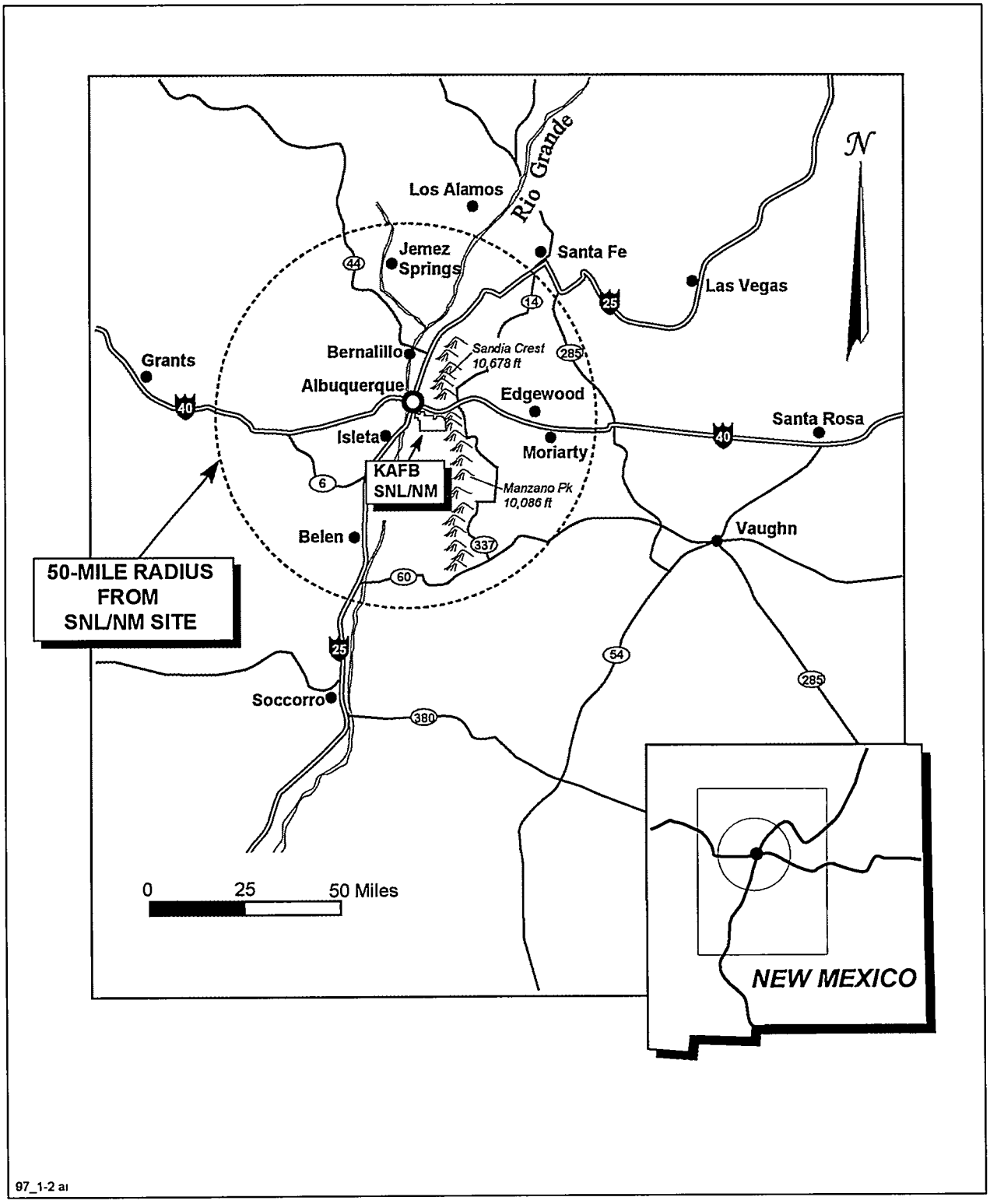

Figure 1-2. Albuquerque site regional setting in the vicinity of SNL/NM.

Table 1-1. Counties within a 50-mile radius of SNL/NM.

County	Primary Population Centers
Bernalillo	Albuquerque, KAFB, and East Mountain residents
Sandoval	Corrales, Rio Rancho, Bernalillo, and several Indian Pueblos
Valencia	Bosque Farms, Los Lunas, and Belen
Santa Fe	Edgewood and suburbs of Santa Fe
Torrance	Moriarty and small villages east of the Manzano Mountains
McKinley	Sparsely populated northwest edge of county
San Miguel	Sparsely populated southwest edge of county
Cibola	Laguna Pueblo
Socorro	Several small villages on the north edge of county

structural feature of the central Rio Grande Rift is approximately 30 miles (48 km) wide and 100 miles (161 km) long (Grant 1982) (Figure 1-3). This basin, also called the Rio Grande Trough, is one of the greatest troughs on earth.

The region is dominated by the north-south trending Sandia and Manzano Mountains forming the southern extension of the Rocky Mountains. The Sandia Mountains form an impressive 13-mile long steep west-face escarpment. The Manzanos, though large and rugged, are not characterized by this same cliff forming topography. These two ranges are divided by the east-west trending Tijeras Canyon. A smaller group of mountains, arising between the Sandias and the Manzanos—the Manzanita Mountains—back the KAFB land withdrawal and form the canyons in which SNL/NM's various test areas are located.

Regional Geologic History

The precambrian granite, gneiss, schist, quartzite, and greenstone exposed in the Sandia Mountains today represent the mountain roots of an ancient system formed 1.5 billion years ago (Kelly 1977). Over the eons this ancestral Sandia Range was eroded to a broad level peneplain forming the Great Unconformity that marks the stratigraphic bottom of all sedimentary rocks in the region.

Beginning about 500 million years ago and continuing through the Cretaceous, the entire regional area (most of New Mexico and west Texas) was inundated by episodic shallow seas, which laid down great thicknesses of marine limestone, sandstone, and shale (the Pennsylvanian Madera Limestone is what can be seen horizontally capping the Sandia Crest today). Significant terrestrial deposits are represented between marine inundations. By mid-Jurassic time (170 million years ago), the seas retreated and the area was covered by eolian sands (Entrada Sandstone); by late-Jurassic time the climate became wetter and vast lakes and floodplains covered the area creating the Morrison Formation; dinosaurs flourished during this period as indicated by numerous fossils excavated from this formation. During the Cretaceous, the seas returned and regional subsidence accelerated resulting in huge thicknesses of sandstone and shale forming a deposit nearly as great as the combined thicknesses of all the sedimentary rocks below it. At the close of Mesozic era (65 million years ago) the seas retreated for the last time.

By mid-Tertiary time (25 to 40 million years ago), the Albuquerque regional area became tectonically active. Volcanoes formed, such as Mt. Taylor near Grants seen on Albuquerque's western skyline, and Valle Grande, the huge caldera located near Los Alamos to the northwest. The tectonic activity was followed by tremendous faulting and uplift, and marked the beginning of the mountain building era that formed the current Sandia and Manzano Mountains. These mountain ranges are the result of an east-tilted fault block with the west face uplifted along a steep normal fault. The majority of the uplift occurred during the last 5 to 10 million years. Uplift continues today.

The Albuquerque Basin represents an enormous offset in vertical displacement. The equivalent stratigraphic sequence that is exposed

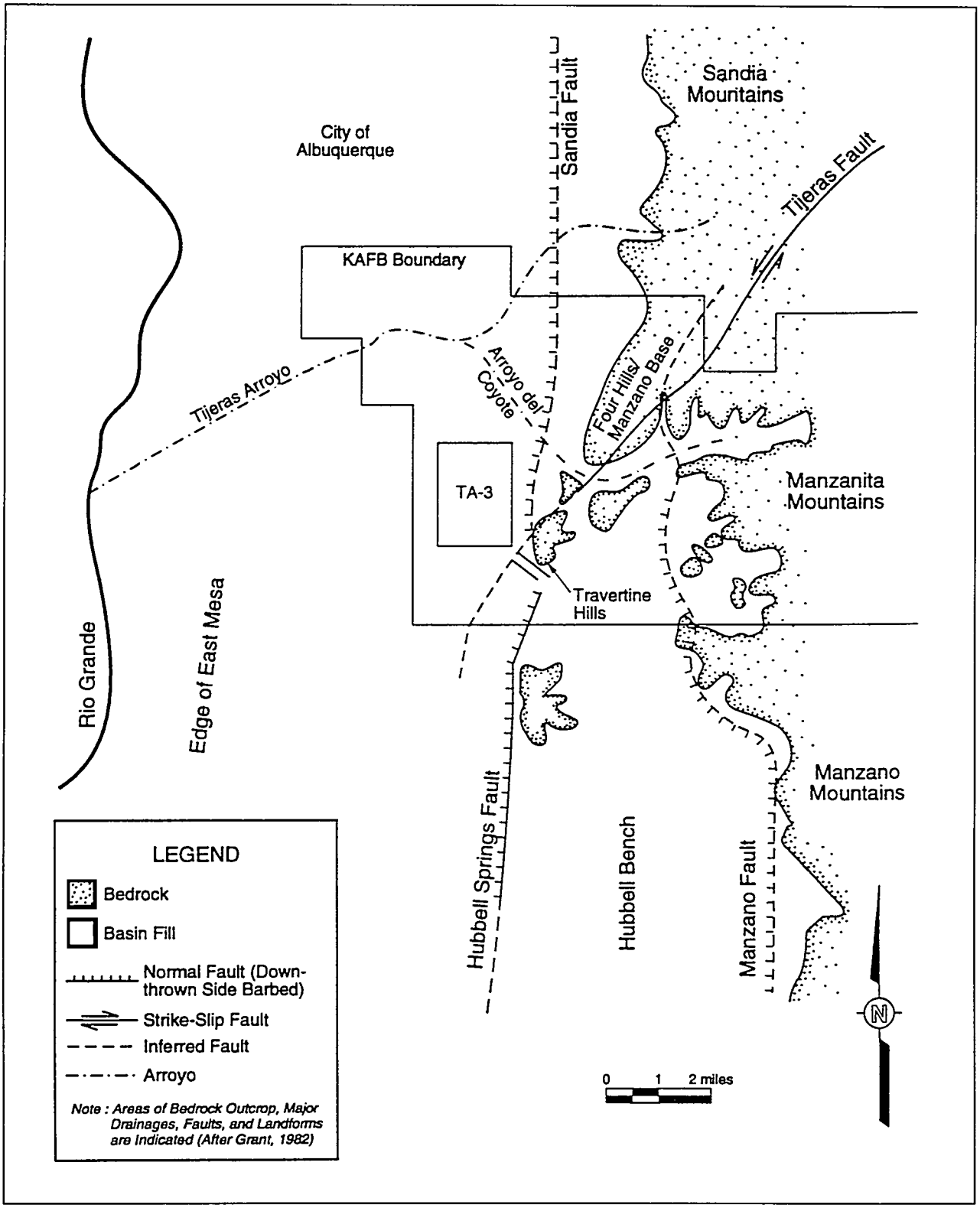

Figure 1-3. Generalized geology in the vicinity of SNL/NM and KAFB. Areas of bedrock outcrop, major drainages, faults, and landforms are indicated (Grant 1982).

on the crest of the mountains today (limestone cap) is located about 5 miles down at the bottom of the basin. The deposits that filled this basin are derived from the erosion of nearby highlands and the sediment carried and deposited by the ancestral Rio Grande (primarily the Galisteo Formation overlain by the Santa Fe Group). In recent geologic time (less than one million years ago) a small string of 18 volcanoes formed along the western fissure of the Rio Grande Trough (Albuquerque Volcanoes). Basaltic lava, extruded from deep within the earth's crust, spread in large sheets over the western Rio Grande Valley. The uneroded remains of this volcanic field are exposed in the low profile cliffs along the west mesa and comprise the rocks of the Petroglyph National Park.

The Rio Grande

The Rio Grande originates in the Rocky Mountains of southern Colorado and flows approximately 1800 miles to the Gulf of Mexico. This great river has been responsible for much of the landscape created in the region. It supports a narrow but dense swath of Bosque (forrested area) along its banks and has left a legacy of past flooding. Flood control has since been managed by the construction of the Cochiti Dam and an extensive system of flood control ditches built by the Corps of Engineers. Today, water from the Rio Grande is primarily used for agricultural irrigation. However, plans are being developed to use treated river water to supplement Albuquerque's drinking water supply, which currently is derived solely from deep groundwater wells.

Local Hydrogeologic Setting

The SNL/NM site is located in a structurally complex terrain with a number of major regional faults intersecting the area. The Sandia Fault is most likely the primary frontal fault that forms the eastern border of the Albuquerque Basin at the base of the Sandia-Manzano Ranges. The Tijeras Fault trends northeast-southwest through the mountains (Tijeras Canyon), across KAFB along the east side of the Four Hills/Manzano Base area, forming a distinct structural division. To the east of this fault zone complex, the rocks are characterized by fractured and faulted bedrock with a thin alluvium cover and shallow groundwater (50–100 ft below the surface). On the west side of the fault complex—where most SNL/NM facilities are located—the groundwater ranges from 300–500 ft below the surface. The vadose (or unsaturated zone) in the KAFB area represents an important feature of the hydrologic system. As in most semi-arid climates the thickness of this zone is quite large resulting in a significant distance that any surface contaminants must travel before reaching the groundwater system.

The primary water-yielding zones are within the upper unit, and to a lesser degree the middle unit, of the Santa Fe Group. Most of the City of Albuquerque's water supply wells are located on the east side of the Rio Grande and west of the eastern extent of the ancestral river channel deposits. The highest yield wells are screened in the sediments associated with the ancestral river channel.

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

Two perennial springs, Coyote Springs and Sol se Mete Spring, are present on KAFB. Hubbell Spring, also perennial, is located immediately south of the KAFB boundary on the Isleta Indian Reservation.

1.4 ECOLOGICAL SETTING

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

influences from each of these provinces, with the Great Basin influence generally dominating.

The semi-desert southwest climate produces low surface water availability, resulting in many species of drought-resistant flora such as cacti, yucca, grama grasses, and various desert shrubs. The photo in Figure 1-4 illustrates a typical collection of mesa vegetation found on the open spaces of KAFB. Russian thistle (tumbleweed)—a non-native plant—proliferates in mechanically disturbed areas. Figure 1-5, taken in the foothills of the Manzanita Mountains, illustrates typical vegetation growing in the canyon and foothills areas. Plants such as junipers (cedars), pinion, live oak, yucca, cholla, grama grass, ring muhly, galleta, and prickly pear cactus predominate. Ponderosa pines mark the transition zone at approximately 6500 ft (1981 m) and are present on the land withdrawal area in mountainous terrain.

Several miles to the west, along the Bosque area of the Rio Grande, cottonwoods, saltbrush, and salt cedar are common plant species.

Mammals, Reptiles, Fish, Amphibians, and Birds

Wildlife predominant on most areas of KAFB is typical of species found in grassy woodlands throughout central New Mexico. Typical wildlife includes rabbits, small rodents, skunks, deer, coyotes, snakes, lizards, and various amphibian species. The wooded mountain areas also support rarely-seen black bears, bobcats, and foxes.

Wild animals habitating near the Rio Grande areas include beavers, muskrats, small rodents, coyotes, skunks, rabbits, and various reptile and amphibian species. The river itself supports stocked trout and the endangered silver minnow.

Migratory birds are abundant and diverse in the KAFB area, as both the Sandia-Manzano Mountains and the Rio Grande represent major flyways. The mountain flyways host migratory birds such as hawks, falcons, eagles, and owls. Other common birds to this area include doves, blue jays, stellar jays, towhees, woodpeckers, chickadees, and hummingbirds. Along the river flyway, migratory birds consist mostly of cranes, geese, and ducks. Other birds common in the lower elevations include sparrows, hummingbirds, cow birds, red-winged black birds, pigeons, and ravens.

The most sensitive habitat on KAFB are the — very minor in extent—wetlands in the vicinity of springs. These areas provide a habitat mircocosm and often the only source of water for wildlife for miles around.

1.5 REGIONAL CLIMATE

The climate of the Albuquerque Basin is characterized by wide diurnal temperature extremes, seasonal brief heavy rain showers, and frequent drying winds. Air temperatures are characteristic of high-altitude, dry continental climates. Winter daytime high temperatures average 9.6 degrees Celsius (°C), while the lows average -4.6 °C. Summer daytime temperatures average 32.7 °C, while daily lows average 16.6 °C (NOAA, 1994). The monthly average relative humidity varies from a low of 30 percent in early summer to 56 percent in early winter. Annual precipitation, most of which occurs between July and October, averages approximately 21 cm. The winter season is typically dry with less than 4.0 cm of precipitation recorded. The strongest winds occur in the spring when monthly wind speed averages reach 4.6 meters a second (m/s).

While the regional climate is described by the atmospheric state variables of temperature, relative humidity, and annual rainfall, site specific meteorology at SNL/NM is influenced by the proximity to topographic features. Topographic features, such as mountains, canyons and arroyos, influence local wind patterns across the laboratories. Canyons and arroyos tend to channel or funnel wind, whereas mountains create upslope-downslope diurnal wind flows. These topographically induced wind flows can be enhanced or negated by synoptic weather systems that move across the southwest part of the United States. In addition to the different wind patterns found across SNL/NM, annual precipitation is generally greater than the climatological average in the far eastern part of the labs located in the foothills. Section 5.1 contains a description of SNL/NM's meteorological monitoring program and annual monitoring results.

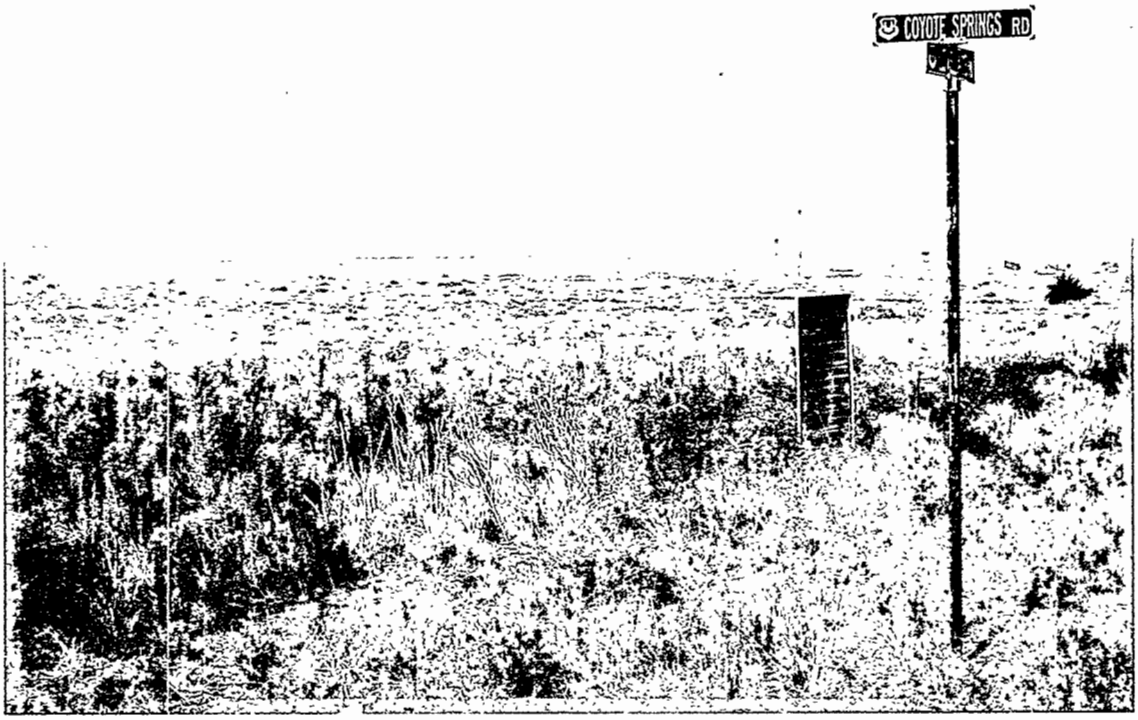

Figure 1-4. Typical vegetation found in the open areas of KAFB west of the land withdrawal boundary.

Figure 1-5. Typical vegetation found in the higher elevations and foothill areas of KAFB east of the land withdrawal boundary.

2 COMPLIANCE SUMMARY

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

2.1 COMPLIANCE STATUS

The following subsections briefly summarize SNL/NM's compliance status with major environmental laws, statutes, and EOs. A more thorough description of some of these major statutes are described in the Glossary. Summaries of the individual environmental programs responsible for supporting compliance activities are discussed more fully in the remaining chapters. Applicable environmental permits that were in effect during 1996 are listed in Table 2-6 at the end of the chapter.

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

The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), commonly known as "Superfund," provides cleanup funds and/or assessment requirements for inactive waste sites at all Federal facilities. CERCLA requirements are implemented under 40 CFR 302.

A Preliminary Assessment/Site Inspection (PA/SI), as required by the Superfund Amendments & Reauthorization Act (SARA) Section 120(c), was performed in 1988. This inspection confirmed that SNL/NM does not own any sites that would qualify for listing on the National Priorities List (NPL). Therefore, with respect to inactive waste sites, SNL/NM has no CERCLA reporting requirements. Other CERCLA reporting requirements defined under SARA are discussed in the following section.

SNL/NM was in full compliance with CERCLA and SARA in 1996; no reportable quantity (RQ) releases occurred as defined by either statute.

2.1.2 Superfund Amendments and Reauthorization Act (SARA) Title III

The relevant requirements to SNL/NM under SARA, is SARA Title III, also known as the "Emergency Planning and Community Right-to-Know Act of 1986" (EPCRA). EPCRA applies to all facilities in which there is present a threshold quantity of extremely hazardous substances (EHS) equal to or greater than the threshold planning quantities, or in specifically designated amounts as determined by the local community. Additionally, EO 12856, *Federal Compliance with Right-to-Know Laws and Pollution Prevention*, signed by President Clinton on August 3, 1993, directed all Federal agencies to comply with EPCRA.

RQs are defined as the amount of any extremely hazardous chemical listed in CERCLA or in EPCRA's list of EHSs, in quantities greater than or equal to the stated reportable quantities. There were no reportable releases under EPCRA in 1996; SNL was in full compliance with SARA Title III.

Table 2-1. SNL/NM reporting activities in 1996 with respect to SARA Title III compliance.

		SNL Reporting			
SARA, Title III (EPCRA)	**Regulation Section Description**	**Yes**	**No**	**Not Required**	**Explanation**
302 - 303	Planning Notification	✓			This report was submitted to notify State and local emergency response authorities and to carry out other facility notification responsibilities necessary for the development and implementation of State and local emergency response plans.
304	Emergency Release Notification			✓	No RQ releases of an EHS, or as defined under CERCLA, occurred in 1996.
311-312	MSDS/Chemical Inventory	✓			Submitted Tier 1 and 2 reports in March 1997. There are two reporting requirements: (1) an inventory report listing all hazardous chemicals on site above threshold levels must be submitted annually to State and local emergency response groups and fire departments; (2) all MSDS information must be made available to local emergency organizations.
313	Toxic Release Inventory (TRI) Reporting			✓	SNL was below the reporting threshold in 1996 and therefore did not submit a TRI report.

NOTE: MSDS = Material Data Safety Sheet. This lists all relevant chemical information on each chemical used onsite.

Table 2-1 lists the specific sections under EPCRA that require reporting. SARA Reporting requirements under Section 313 requires a Toxic Release Inventory (TRI) report to be submitted annually to the EPA if chemicals used onsite are above the reporting threshold. In 1996, a TRI report was not required because SNL/NM's chemical use did not exceed the reporting threshold. This was due in part to a change in the requirements that affected two types of acid use—sulfuric acid (H_2SO_4) and hydrochloric acid (HCl). The definition was changed for these acids by delisting non-aerosol H_2SO_4 and HCl. Reporting of these chemicals in future reports will only be required if they are in gaseous (aerosol) form. Other changes effecting the threshold limit in 1996 was a change in fuel use which reduced the quantities of toluene and xylene used. SNL/NM published a report detailing its 1996 chemical inventory use and calculations for determining acid aerosols dispersed (SNL 1997a).

2.1.3 Resource Conservation and Recovery Act (RCRA)

The Resource Conservation and Recovery Act (RCRA) regulates the generation, treatment, storage, and disposal of hazardous chemical waste, non-hazardous solid waste, and hazardous or petroleum products stored in underground storage tanks (USTs).

The Hazardous Waste Program at SNL/NM is under the authority of the New Mexico Environment Department (NMED), which regulates both hazardous waste and the hazardous component in radioactive mixed waste (MW).

The following bullets describe the status of SNL/NM's compliance with applicable RCRA requirements.

- **Hazardous Waste** - Hazardous waste is regulated under RCRA "Subtitle C," implemented by 40 CFR 260–268, 270–272, and 279. Hazardous waste is handled by the Hazardous Waste Management Facility (HWMF) in TA-II. This facility is included on the RCRA Part B Operating Permit as shown in Table 2-6. There were no releases, occurrences, or fines associated with the HWMF facility in 1996. The HWMF shipped a total of 51,549 kg of RCRA-hazardous waste in 1996.

- **Environmental Restoration (ER) Sites** - At present (end of CY1996), there are 153 ER sites listed at SNL/NM; all are regulated under the RCRA Part B Operating Permit. ER sites are being assessed and remediated as required by the Hazardous and Solid Waste Amendments (HSWA) module to RCRA, Section 3004(u) "Continuing Releases at Permitted Facilities." Corrective Actions (CAs) for continuing releases from Solid Waste Management Units (SWMUs)—whether active or inactive—are stipulated in the requirements for the RCRA Part B Permit, issued by NMED on August 26, 1993. The ER project generated 5,517 kg of RCRA-hazardous ER waste and approximately 483,740 kg of LLW in 1996. SNL/NM met all RCRA permit conditions for ER sites in 1996.

- **Solid Waste** - Non-hazardous solid waste generated at SNL/NM is regulated under RCRA "Subtitle D." The Solid Waste Transfer Facility (SWTF) in TA-II was opened in May of 1996 to handle most non-hazardous solid waste generated at SNL/NM and to serve as the centralized recycling center for paper and cardboard. The SWTF does not accept construction debris, liquids, or hazardous-characteristic waste. In 1996, the facility handled 541,711 kg (1,191,765 lb) of solid waste and recycled 211,859 kg (466,090 lb) of paper and cardboard. This included 52,462 kg (115,416 lb) of recyclables from DOE and Los Alamos National Laboratories (LANL). These figures represent six months of collection since the facility opened mid-year. Table 3-6 shows annual approximates based on these figures. The facility was in full compliance with all RCRA regulations in 1996.

- **Underground Storage Tanks (USTs)** - USTs are regulated under RCRA "Subtitle I," codified as 40 CFR 280—Underground Storage Tanks, and 40 CFR 281—Approval of State UST Programs. SNL/NM also must meet State of New Mexico regulations, which adopted the Federal UST standards in July of 1990. During 1996, SNL/NM removed two USTs from the motor pool leaving only three remaining active tanks in its ownership. SNL/NM was in compliance with all UST regulations in 1996.

- **Mixed Waste (MW)** - MW is dually regulated under RCRA and the Atomic Energy Act (AEA) of 1954. In 1996, SNL/NM generated 58,610 kg of MW; no MW was received from the SNL/CA site in Livermore. One offsite MW shipment (57 kg) occurred in 1996.

  Compliance status for MW continues to be an issue. Due to the lack of treatment capacity for MW, SNL/NM cannot meet the RCRA requirements, which stipulate a maximum of one year onsite storage before waste must be treated for disposal (RCRA 3004[j]). SNL/NM is, however, in compliance with the Federal Facility Compliance Act (FFCAct), which acknowledges this lack of capacity, and is working to develop treatability studies to facilitate MW disposal.

  SNL/NM is attempting to meet compliance through several strategies that had earlier included the development of mixed waste mobile treatment units (MTUs). However, the MTUs have been placed on hold due to funding constraints and SNL/NM

is currently pursuing commercial treatment facilities. A small quantity of MW was shipped to a commercial treatment facility in 1996 for treatment and disposal.

- **Thermal Treatment Facility (TTF)** - The TTF is used to treat explosive waste. It is an active component of the original complex—the Light Initiated High Explosives Facility (LIHE)—which was taken out of service in 1992. In 1996, two burns occurred totaling 1.9 kg (4.1 lb) of explosive-contaminated waste debris (such as gloves and wipes).

- **Temporary Unit (TU) and Corrective Action Management Unit (CAMU)** - Proposed treatment of ER-contaminated soils is scheduled to begin by fiscal year (FY) 1998. The TU is located north of the Radioactive and Mixed Waste Management Facility (RMWMF) in TA-III and consists of two temporary buildings and an administration trailer. The TU will store ER soils for up to one year, extending the normal 90 day allowance at a generator onsite facility. This extension was requested since it would be impractical to store the large volumes of ER waste at the HWMF. Although functionally ready at this time, the TU site will not be put into service until FY1998.

  The Corrective Action Management Unit (CAMU), scheduled to begin construction in FY 1998, will consist of several mobile treatment units designed specifically to treat ER waste stored at the TU. Treatment will be by one or more of the following methods:

  - Soil washing to remove RCRA metals
  - Thermal desorption volatile organic compounds (VOCs), such as burning off solvents
  - Stabilization to bind RCRA metals

  If, after processing, the waste meets RCRA 6A guidelines, it will be placed in a landfill disposal cell within the CAMU boundary. All remaining waste that does not meet requirements will be shipped offsite for disposal. The project is expected to complete all ER waste treatment within four years (2001).

2.1.4 Federal Facility Compliance Act (FFCAct)

On October 6, 1992, the Federal Facility Compliance Act (FFCAct) was passed into law, amending RCRA and addressing DOE's noncompliance with the Land Disposal Restrictions (LDRs), which require the treatment of hazardous waste to reduce the toxicity, volume, and likelihood of migration. The Act requires DOE to develop MW treatment technologies so that its MW will meet LDR and be disposable at permitted offsite facilities.

Mixed Waste Treatment Plan

On December 30, 1992, a Notification of Noncompliance (NON) was issued by the EPA to SNL/NM and the DOE for storage of RCRA-regulated waste over the one year time limit. This NON began the process toward full compliance with the LDRs at SNL/NM through a Federal Facility Compliance Agreement. As required by the FFCAct, SNL/NM submitted its MW inventory for the preliminary report and updated the inventory in November 1993, published in the *Final Mixed Waste Inventory Report* (DOE 1993a). At this time, SNL/NM also began developing a plan for MW treatment. The final *Site Treatment Plan for Mixed Waste* (SNL 1995a) developed by SNL/NM is now enforceable under the Compliance Order that was issued on October 6, 1995 by NMED. In 1996, all milestones were met with regard to the FFCAct Order.

2.1.5 National Environmental Policy Act (NEPA)

SNL/NM's National Environmental Policy Act (NEPA) Program, under the direction of

DOE/Kirtland Area Office (DOE/KAO), provides technical guidance for comprehensive compliance with NEPA and associated acts including the Cultural Resources Act, the Endangered Species Act (ESA), and other related resource protection laws. General program activities in 1996 included developing courses for the ongoing NEPA training program, development of baseline reports, and completion and follow-up of various NEPA documents.

1996 NEPA Documentation

NEPA compliance activities during 1996 included the completion of three Environmental Assessments (EAs) that each resulted in a Finding of No Significant Impact (FONSI), and input to two Environmental Impact Statements (EISs). Additionally, 10 EAs were in preparation or remained pending in 1996. The completed NEPA documents (EAs and EISs) are as follows:

- **EA 1140 SNA EA93-01** *Environmental Assessment of the ER Project at SNL/NM.* (FONSI issued March 25, 1996) (DOE 1996d).

- **EA 1153 SNA EA96-01** *Environmental Assessment for Operations, Upgrades, and Modifications in SNL Technical Area IV* (FONSI issued April 4, 1996) (SNL 1996b).

- **EA 1180** *SNL/NM Offsite Transportation of Low Level Radioactive Waste.* (FONSI issued November 20, 1996) (SNL 1996c).

- **DOE/EIS-0249F** - Input into EIS completed by DOE/AL: *Medical Production Isotopes Project: Molydenum-99 and Related Isotopes Environmental Impact, April 1996* (DOE 1996b).

- **DOE/EIS 0236F** - Extensive baseline information provided for EIS completed by DOE/HQ: *Final Programmatic Environmental Impact Statement for Stockp : Stewardship and Management, September 1996* (DOE 1996c).

During 1996, SNL/NM, submitted about 130 NEPA environmental checklists to the DOE for determination on proposed projects or actions. DOE decides if the proposed actions fall under a Categorical Exclusion, are already part of an existing EA or EIS, or require further NEPA documentation.

2.1.6 Clean Air Act (CAA) and CAA Amendments (CAAA) of 1990

The objectives of the Clean Air Act (CAA) and the Clean Air Act Amendments of 1990 (CAAA) are to protect and enhance the quality of the nation's air and thereby protect public health and the environment. The EPA is responsible for describing and regulating air pollutants from stationary and mobile sources, as well as setting ambient air quality standards.

Air Quality Compliance Status

There were no exceedences in ambient air quality standards at any of SNL/NM's six ambient air monitoring stations in 1996. SNL/NM was in full compliance with National Emission Standards for Hazardous Air Pollutants (NESHAP) and all other applicable air quality requirements in 1996.

Local Air Quality Alerts

The City of Albuquerque (COA) posts air quality alerts along major thoroughfares requesting voluntary or mandatory compliance. Yellow alerts request voluntary compliance to limit driving and burning. Red alerts are mandatory "No-Burn Periods," and request limited driving. SNL/NM honors these alerts by not performing any open burns during yellow or red alerts. The COA had a 100 percent compliance year, noting no exceedences in the ambient air quality standards.

National Emission Standards for Hazardous Air Pollutants (NESHAP), Subpart H Dose Assessment

The EPA designates radionuclides as a hazardous air pollutant (HAP). In 1996, SNL

had 16 facilities that produced air emissions subject to NESHAP regulations. As required by 40 CFR 61, Subpart H, a dose assessment was performed to evaluate radioactive air emissions with respect to exposed members of the public. The Maximally Exposed Individual (MEI) for 1996 was again located at the Kirtland Underground Munitions Storage Complex (KUMSC). The dose received at this location was 0.007 mrem/yr. This is approximately 10,000 times less than the maximum allowable dose. The population dose to all members of the public within a 50-mile radius was 0.14 person-rem. All NESHAP facilities were in full compliance with radionuclide air emission requirements.

Hazardous Chemical Inventory

As required by Title III under the CAA, (implemented by 40 CFR 70-71 and 20 NMAC 11.42) and SARA Title III's Toxic Release Inventory (TRI) reporting requirements (Section 313), a hazardous chemical inventory is conducted annually to determine hazardous chemical use onsite. Reports are created from Material Safety Data Sheets (MSDSs), which are made available for all chemicals used onsite, and from an inventory of purchased material. SNL Line organizations are polled to verify these computer-generated reports.

Table 2-2 presents the results of the 1996 hazardous chemical inventory. The inventoried chemicals include those from the SARA Toxic Chemical List.

Table 2-2. 1996 summary of SNL/NM's chemical purchases in quantities greater than 1,000 lb.

Chemical	Chemical Abstract System (CAS) Number	Usage (lb/year)
Methanol	67561	1,661
Isopropyl alcohol	67630	3,225
Acetone	67641	3,471
Benzene	71432	1,344
Chorodifluoromethane (HCFC 22)	75465	1,087
Trichlorofluoromethane (CFC 11)	75694	2,002
Trichloroethane	79016	1,805
Naphthalene	91203	1,335
1,2,4-trimethylbenzene	95636	1,669
Ethylbenzene	100414	1,084
Styrene	100425	1,335
Ethylene glycol	107211	5,787
Toluene	108883	8,946
n-Hexane	110543	1,062
Xylene	1330207	8,994
Methyl t-butyl ether	1634044	5,007
Nitric acid	7697372	5,468
TOTAL		**55,282**

NOTE: This list is a subpart of the Toxic Release Inventory (TRI) reporting.

2.1.7 Clean Water Act (CWA)

The Clean Water Act (CWA) sets forth goals to protect U.S. waters by controlling discharged pollutants. As it pertains to SNL/NM, the CWA applies to sanitary and septic system wastewater effluents, storm water runoff, and surface water discharges. The CWA is implemented through Federal, State and local water quality standards. The City of Albuquerque (COA) administers sanitary sewer discharges based on Federal pretreatment standards; the New Mexico Environment Department (NMED) administers regulations concerning surface discharges; the EPA retains oversight over storm water discharges and provides requirements for the *Oil Spill Prevention Control and Countermeasures (SPCC) Plan* (CDM 1995).

COA Sewer Discharge Regulations

There are six wastewater monitoring stations at SNL/NM. Four of these discharge directly to the publicly-owned sewer subject to the City's "Sewer Use and Wastewater Control Ordinance." There were two instances of high pH excursions above the maximum allowable permit standard late in 1996. These occurrences are discussed in Section 2.6. However for FY1996, ending on September 30, SNL/NM had 100 percent compliance and received six Gold Pretreatment Awards from the COA for this period.

National Pollutant Discharge Elimination System (NPDES)

There is currently no NPDES storm water permit in place at SNL/NM. The initial permit application was submitted to the EPA in 1992. A second permit application was resubmitted in 1996 for a "Multi-sector General Permit," which SNL/NM believes will accelerate the permit application process. During the time the permits are pending, storm water monitoring is carried out in accordance with anticipated future permit specifications. In 1996, there were no storm water analysis results reported over NPDES limits.

Surface Water Discharge

Surface discharges are evaluated for compliance with regulations implemented through the New Mexico Water Quality Control Commission (NMWQCC). Two surface discharge lagoons require permitting at SNL/NM; all permit conditions for these lagoons were met during the year. In 1996, there was one instance of noncompliance with surface discharge regulations; an excursion of approximately 10 to 25 gal. of sewage was inadvertently released to the ground during the pumping of a sump area. This occurrence is discussed in Section 2.6.

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

2.1.8 Safe Drinking Water Act (SDWA)

The Safe Drinking Water Act (SDWA), which has set National Primary Drinking Water Standards, is designed to protect human health by regulating the discharge of nontoxic and toxic pollutants into both groundwater and surface water sources from residential, municipal, and industrial discharges.

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

There are several remote water delivery systems at SNL/NM used to supply water to the test areas in Coyote Canyon and the 6000 Igloo Complex. This system has been classified as a Non-Transient, Non-Community (NTNC) water system. The NMED has approved the SNL/NM sampling plan for this NTNC system. SNL/NM samples for coliform, lead, and copper determinations.

Water quality samples collected under the Groundwater Protection Program are compared to drinking water standards, although none of the wells sampled are used for potable water and,

therefore, are not subject to the SDWA. In 1996, levels that were reported slightly above drinking water standards were determined to be due to naturally-occurring conditions.

2.1.9 Toxic Substances Control Act (TSCA)

At SNL/NM, compliance with the Toxic Substance Control Act (TSCA) primarily involves regulation of polychlorinated biphenyls (PCBs) and asbestos, as well as the import and export of specifically listed chemicals. There were no instances of non-compliance with TSCA regulations in 1996.

The PCB Program

A total of 52,019 kg of PCB waste was removed from service and shipped offsite for disposal and recycling in 1996. PCB waste and recylcables are handled and shipped by the Hazardous Waste Management Facility (HWMF). At the start of CY1996, 45 PCB-containing items remained in service; five more were identified during the course of the year. At the end of CY1996, only 13 items remained in service, resulting in a 74 percent reduction in PCB-contaminated equipment. Four of the remaining items are transformers; the rest are capacitors and other miscellaneous equipment.

The Asbestos Program

A total of 77,321 kg of asbestos waste was removed from facilities (e.g., structure abatement) and non-facilities (e.g., laboratory equipment) sources. Asbestos waste and recylcables are handled and shipped by the HWMF.

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

Compliance to the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) is overseen by SNL/NM's Pest Control Activity. Most FIFRA-regulated chemicals used at SNL/NM are for weed control. To a lesser extent, there is a need to control rodents and insects in food service areas. Annual pesticide use is reported to the KAFB Civil Engineering Department. All chemicals used are EPA-approved and applied with EPA-approved applicators. There were no instances of noncompliance with FIFRA in 1996.

2.1.11 Endangered Species Act (ESA)

The Endangered Species Act (ESA) applies to both private individuals and government agencies. Section 9 of the Act makes it illegal for any person to "take" any endangered species of fish or wildlife. "Take" means to harass, harm, pursue, shoot, hurt, kill, capture, or collect—and includes interfering with habitat. Section 7 applies only to Federal agencies, which must ensure that any action authorized, funded, or carried out by them will not jeopardize the continued existence of a threatened or endangered (T/E) species, or result in adverse modifications of its habitat.

The term "sensitive species" has a much broader connotation for NEPA compliance purposes than "threatened or endangered." It includes Federally-listed and State-listed T/E species, candidate species for listing, species listed by other Federal agencies, and species perceived by the public as "sensitive."

Prior to beginning any construction, ground-disturbing, and/or other proposed action—potentially affecting sensitive areas that may be present at the project location—SNL/NM representatives (through DOE) must confer with the following state agencies: (1) the U.S. Fish and Wildlife Service, (2) the New Mexico Game and Fish Department, and/or (3) the New Mexico

Energy, Minerals and Natural Resources Department. For proposed projects located on U.S. Forest Service withdrawal lands, SNL/NM, through DOE, confers with the U.S. Forest Service before commencing any activities. If DOE or SNL/NM determines that a potential presence of a listed or proposed species, or habitat, exists within the project area, a biological assessment will be prepared. Correspondence with the appropriate agencies and mitigation measures, when appropriate, are included in Environmental Assessments (EAs) or Environmental Impact Statements (EISs) in accordance with NEPA compliance. In some cases, mitigation action plans are required.

Of the Federally-listed threatened, endangered and sensitive species that are known to occur on KAFB (including withdrawn portions), only the peregrine falcon (*Falco periginus*)—also a state-listed Endangered Group 1 species—has been observed on KAFB. However, no nesting activity of this species has been observed and only marginal habitat exists for nesting.

No plant species that are currently listed as endangered by the New Mexico Forestry and Resource Conservation Division are known to occur on KAFB and only one sensitive (List 2) plant species, the Santa Fe milkvetch (*Astragalus feensis*) has been recorded.

The 1996 *Environmental Baseline Update* (SNL 1996d) includes a section on biological resources.

2.1.12 Cultural Resources Acts

Cultural resources management at SNL/NM is required under acts such as the:

- National Historic Preservation Act (NHPA)
- Archaeological Resources Protection Act (ARPA)
- American Indian Religious Freedom Act (AIRFA)

SNL/NM integrates cultural resources management into the NEPA program. *The Environmental Baseline Update* (SNL 1996d) provided information on the affected environment that must be addressed in the NEPA process. It is DOE policy that NEPA review must be performed for all DOE actions potentially affecting the environment; thus, even actions that are classified as Categorical Exclusions are reviewed for impacts on cultural resources.

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

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

The survey and records review resulted in the documentation of 31 new sites, 39 previously recorded sites, 128 IOs, and one potential historic district (located in TA-II). Of these sites, 29 of the prehistoric sites, 15 of the historic sites, 13 of the historic/prehistoric sites, and one site of unknown temporal affiliation are thought to be eligible, or potentially eligible, for nomination to the National Register of Historic Properties (NRHP). Only one site within TA-II, which is potentially eligible for nomination to the NRHP as a historic district, has been recorded on DOE-owned lands. All other cultural resources sites have been located on leased or withdrawn lands.

2.1.13 Executive Orders (EOs)

SNL/NM complies with Executive Orders 11988, *Floodplain Management* and 11990, *Protection of Wetlands*. These orders apply to NEPA-related activities and require evaluation of the potential effects of SNL/NM actions taken in floodplains and wetlands. There are very limited areas on KAFB in the vicinity of springs that can be considered wetlands. The SNL/NM boundary of the 100-year flood plain occurs along the arroyos (SNL 1996d). All active SNL/NM facilities are located outside the 500-year floodplain as described by the U.S. Army Corps of Engineers for both arroyos (U.S. ACE 1979).

2.2 SUMMARY OF ENVIRONMENTAL PERMITS

SNL/NM holds—or has submitted application for—all applicable environmental permits. Table 2-6 lists all environmental permits and registrations that were in effect in CY1996 including permits that are pending and under review by various agencies.

2.3 CURRENT COMPLIANCE ISSUES AND ACTIONS

This section highlights environmental issues and actions of concern or interest to SNL/NM for 1996.

The following bullets list air quality issues or regulations that were undergoing specific actions in CY1996.

- **20 NMAC 11.05, "Visible Air Contaminants"**—The SMoke Emission Reduction Facility (SMERF) and the Small WInd SHielded Facility (SWISH) were built for the purpose of limiting soot and visible emissions for small open burn tests conducted at the Burn Site. Emissions are reduced as compared to the same fuel burned in the open pool fire tests. However, because the SMERF and the SWISH are equipped with a stack, local regulations concerning visible air contaminants become effective (20 percent opacity standard). In accordance with 20 NMAC 11.05, Albuquerque Environmental Health Department (AEHD) granted an exemption from the opacity requirements for R&D fire test facilities in their letter dated January 17, 1996.

- **20 NMAC 11.23, "Stratospheric Ozone Protection"**—During 1996, SNL drafted and finalized an Ozone Depleting Substances (ODS) Management Plan (SNL 1997b). The document was signed on January 9, 1997, although implementation commenced in 1996. This plan describes SNL's strategy to recover and recycle ODSs and provides guidance for the development of individual procedures related to ODS-containing equipment. The document resolves the finding from the 1995 DOE EH-24 audit that found that a corporate-wide ODS plan was not in place.

- **20 NMAC 11.42 "Operating Permits"**—is the implementation of the CAAA, Title V State Operating Permit Program in Albuquerque/Bernalillo County. The program was approved by the EPA on March 13, 1995, requiring all existing major sources to apply for an operating permit by March 13, 1996. A major source is defined as a facility that emits, or has the potential to emit, at least 100 tons per year (tpy) of any criteria pollutant, 10 tpy of any single Hazardous Air Pollutant (HAP), or 25 tpy of any combination of HAPs. Based on the actual emissions from the steam plant in Bldg. 605 and the inventory of all boilers, heaters, and standby generators, SNL/NM is a major source for nitrous oxides (NO_x) and has the potential to emit more than 100 tpy of carbon monoxide (CO). SNL/NM submitted its permit application on March 1, 1996; the application was deemed complete

on May 1, 1996. The operating permit must be issued by the City on or before March 13, 1998.

- **20 NMAC 11.02, "Permit Fees"**—Since 1994, when Title V became effective, SNL/NM has been paying a $20.89 per ton emission fee based on its annual maximum potential to emit (a much higher estimate than actual operating conditions). With the proposed Title V permit application (#515) still under review, SNL/NM was hoping to realize a substantial savings by implementing a self-imposed fuel-use cap that would be based on a realistic estimate of actual fuel used, and thereby paying fees calculated on a lower volume of fuel throughput. However, in 1997 the COA raised the fee to $31.00 per ton. This action served to partially negate the potential cost savings since SNL/NM will be paying more per ton on less emissions.

- **EPA's Proposal to Change Standards for Particulate Matter (PM) and Ozone (O_3)**—On November 27, 1996, the EPA came out with a new proposed standard on particulate matter (PM) monitoring and ground level ozone (O_3). The proposed standards would regulate PM to 2.5 microns and O_3 to 0.08 ppm measured over 8 hours. The new requirements could impact SNL/NM by changing the attainment status for Bernalillo County and thus changes to future operations.

The following two bullets describe RCRA-related compliance actions in 1996:

- In 1996, DOE and SNL/NM proposed to NMED a facility-wide RCRA operating permit, which would include the operating condition requirements for all RCRA facilities.

- The FFCAct amendments to RCRA specifically address the Land Disposal Restrictions (LDR) treatment of MW as discussed in Section 2.1.4. As a result of the FFCAct, the DOE submitted plans to the NMED for treatment of SNL/NM's MW. A brief chronological summary of the permit process relevant to MW between SNL/NM and the regulator (NMED) is as follows:

  ⇒ **August 1990** – submitted RCRA Part A Permit application for MW storage to NMED.
  ⇒ **October 1992** – a permitting strategy in the form of a Letter Agreement was sent to NMED for submitting a RCRA Part B Permit for MW.
  ⇒ **November 8, 1992** – Part B Permit application submitted to NMED.
  ⇒ **August 1993** – amended Part A Permit application to include limited treatment of MW.
  ⇒ **August 26, 1993** – submitted the first amendment to the Part B Permit application to NMED.
  ⇒ **January 1995** – a second amendment to the Part B Permit application was sent to NMED.
  ⇒ **December 1996** – a third amendment was submitted to include the initial treatments needed to implement the final *Site Treatment Plan* (SNL 1995a) as are required by the FFCAct Compliance Order.

The management of MW continued to be an issue in 1997. MW issues will not likely be completely resolved for several years to come. In the future, other amendments are expected to include proposed treatment technologies identified in the *Site Treatment Plan*, but as of yet, are not well enough developed for adequate detail to be provided in a permit application.

2.4 TIGER TEAM SUMMARY OF ONGOING ACTIONS

In 1991, the Tiger Team audit identified 371 findings concerning issues such as waste management and characterization, radioactive

and MW storage, groundwater monitoring, sampling, well/borehole closure, UST management, and ER activities. Other deficiencies noted were in air quality monitoring, surface water protection, waste minimization programs, records management, radiological release control, and NEPA activities.

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

Status of findings

In 1995, DOE delegated authority to SNL to close the remaining Tiger Team findings. Since that time, SNL closed out all remaining findings with the exception of three that are still under review pending a "Certificate of Completion" signed by DOE or their delegate. Table 2-3 shows the progress made in addressing the findings since the 1991 Tiger Team Audit.

2.5 1996 AUDITS and APPRAISALS

SNL/NM operations are routinely subjected to audits by external regulatory agencies as well as internal self assessments and DOE inspections. Table 2-4 lists the external appraisals of various SNL/NM environmental programs that occurred in 1996.

The Appraisal Management Department assists SNL/NM organizations in tracking corrective actions incurred from various program audits. However, resolving audit findings is the responsibility of each program area. Monthly reports on corrective action status are submitted to DOE.

Audit results are reported as either "findings," "observations," or "noteworthy practices." Findings require corrective actions; observations are made as suggestions for improvements; and noteworthy practices identify positive commendations.

A new direction in audit activity at SNL/NM is the development of the ES&H Self Assessment Program. This initiative, started in 1996 and approved by DOE, allows SNL/NM to rely less on DOE for appraisal activities.

Table 2-3. Status of Corrective Actions resulting from the 1991 Tiger Team Audit.

YEAR	Completed	Closed	Open
1991	0	0	371
1992	50	3	321
1993	46	29	275
1994	42	62	233
1995	124	143	109
1996	109	132	0
TOTAL	371	369	0

NOTE: This table has been revised and corrected from last year's ASER. The remainder of all Tiger Team Findings were resolved in 1996.

Table 2-4. Audits and appraisals conducted by external agencies in 1996.

Appraising Agency	Title	1996 Audit Period	Summary
• NMED	RCRA Compliance Audit at the HWMF and the RMWMF	April 1	No findings.
• NMED and the COA	Sanitary Sewer Inspection	September 15	No findings.
• DOE/NV	Audit to Assess Readiness of Submission of LLW to NTS	April 8-12	No findings and seven observations noted.
• DOE/NV	Follow-up Surveillance to April Audit on LLW to NTS	July 8-10	All observations from April audit were satisfied.
• DOE	ER Program Baseline Review	November 4-8	No findings but minor baseline structure issues and some small errors noted. Errors corrected and suggested improvements were made where appropriate.
• Corps of Engineers	Documentation and Baseline Evaluation of ER Project	November 18-26	No findings.

NOTE: HWMF = Hazardous Waste Management Facility
RMWMF = Radioactive and Mixed Waste Management Facility
NTS = Nevada Test Site

2.6 1996 RELEASES and ENVIRONMENTAL OCCURRENCES

In CY1996, there were four environmental occurrences that because of their volume and/or ingredients were reported to DOE and the State of New Mexico. DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information* (DOE 1996a) establishes a DOE system for identification, categorization, notification, analysis, reporting, follow-up, and close-out of occurrences. DOE notifies appropriate agencies based on the nature of each occurrence.

SNL/NM trains ES&H staff and managers in the occurrence management process to quickly act in the case of an event. Corrective Actions (CAs) are tracked by the Compliance and Metrics Department. In 1996, this Department received an award for excellence in providing superior customer service support.

Environmental occurrences are categorized based on the degree of severity of an event from an emergency level occurrence—of which SNL has never had one—to off-normal events, which may involve the unplanned or abnormal release of CERCLA reportable quantities (40 CFR 302 and 40 CFR 355) or other regulated pollutants. An occurrence can also be incurred as the result of an audit finding or other break in permit compliance and/or official agreement. Table 2-5 list the various categories into which occurrences may be designated. The following bullets summarize the occurrences in 1996:

- On August 16, 1996, a radioactive hot particle was discovered on the floor at the Radioactive Mixed Waste Management Facility (RMWMF) in a non-contained area during the sorting and characterization of waste for the Historical Disposal Request Validation (HDRV) Project. The particle was assumed to have been present since August 2 when it dropped from a waste bag resulting in exposure to three workers between August 2 and August 16. The root

Table 2-5. Summary of environmental occurrence categories over the past five years. Each occurrence may fall into one or more categories.

Year	Number of Releases of Hazardous Substances or Regulated Pollutants	Number of Radionuclide Releases	Number of Ecological Resources	Discovery of Contamination due to DOE Operations	Audit Results and/or Agreement Compliance Activities	Number of Total Occurrences in FY
1996	0	0	0	0	1	1
1995	2	0	0	0	4	5
1994	5	0	0	0	13	16
1993	2	0	0	0	11	13
1992	5	0	0	2	4	11

NOTE: This table only shows reporting for the Fiscal Year which ends September 30. In late 1996, 3 additional incidences occurred, which will be officially reported in 1997 after a full investigation and root cause analysis is performed.

cause was determined to be a work organization/planning deficiency. Plans have revised to ensure a similar situation does not reoccur.

- On November 15, 1996, there was a violation of City Wastewater Discharge Permit #2069H-3 as a result of effluent from the Advanced Manufacturing Process Laboratory (AMPL) at Station WW009. A pH excursion lasting 1.5 hours at a pH range of 11.2 to 11.8 exceeded the standard (maximum of one hour for a pH between 5 and 11). The root cause of this occurrence was found to be residue buildup of common floor cleaning supplies (cleaners and strippers), which were disposed of in a drain as "mop" water. Since the drain was not used regularly, the liquid formed a residue gel that also accumulated in the pH probe meter. When normal pH effluent was drained through the system, the residue (pH 12) gave the appearance of a continuous pH excursion for over one hour. The drain was sealed off and re-piping of this area is under review.

- On December 30, 1996, approximately 10 to 25 gal. of sewage was released to a parking lot and ultimately flowed to a storm drain system washing out into an arroyo. The incident occurred when electricians, replacing a motor in Bldg. 869 (TA-I), placed a portable pump into what was believed to be a sump pump area in the basement. After pumping, for a few moments they realized that they had actually been pumping from a sewage ejector system, which had been turned off over the holidays. Operations were halted, the area was mopped up and all equipment was disinfected with a chlorine solution. The release was not retrievable and percolated into the ground. Root cause analysis and official reporting will be completed in the FY1997 report.

- On December 28, 1996, there was a pH excursion measured at the WW006 Manhole with pH levels above 11 for 3 hours. This outfall station serves most of TA-I and some non-SNL facilities. After several months, the source was tracked to the Steam Plant in TA-I. The root cause was the overflow of a sodium hydroxide (NaOH) holding tank. (NaOH is used to regenerate water systems.) Root cause analysis and official reporting will be completed in the FY1997 report.

Table 2-6. Summary of environmental permits and registrations in effect during 1996.

Permit Type and/or Facility Name	Location/Building	Permit Number	Issue Date	Expiration Date	Regulatory Agency
Sewer					
• General	WW001 station manhole, south of TA-IV at Tijeras Arroyo	2069 A-3		2/1/97	COA
• General	WW006 station manhole, at Pennsylvania Ave.	2069 F-3		2/1/97	COA
• Microelectronics Development Laboratory (MDL)	WW007 station manhole, Bldg. 858 in TA-I	2069 G-3		6/30/98	COA
• Advanced Manufacturing Process Laboratory (AMPL)	WW009 station manhole, Bldg. 878 in TA-I	2069 H-3		2/1/97	COA
• General	WW008 station manhole, south of TA-II at Tijeras Arroyo	2069 I-2		2/1/97	COA
• General	WW011 station manhole, north of TA-III (includes TA-III, TA-V, and Coyote Test Area sewer lines)	2069 K-2		5/31/98	COA
Surface Discharge					
• Pulsed Power Development Facilities (Discharge Plan) (first issue -1988)	TA-IV, Lagoons I and II	DP-530	2/24/1995	2/24/2000	NMED
Storm Water					
• NPDES "Individual" Permit	Storm water discharges	Pending Submitted on 10/1/92			EPA
• NPDES "Multi-sector General" Permit	Storm water discharges	Pending Submitted on 9/26/96 -- Resubmitted 5/97			EPA
RCRA Hazardous Waste					
• Hazardous Waste Management Facility (HWMF) Module I, II, III	TA-II, Bldgs. 958 and 959	NM5890110518-1	8/6/92	08/06/2002	NMED
• Thermal Treatment Facility (TTF)	TA-III, Bldg. 6715	NM5890110518-2	12/4/94	12/4/2004	NMED
• RCRA - HWSA- Module IV	ER sites	NM5890110518-1	8/26/93	9/20/2002	NMED/EPA
• RCRA - TU (permit/modification to HWSA module)	TA-III		Approved in 1996 but not yet operational	Expires 1 year after operations begin	
• RCRA - CAMU - proposed modification	TA-III	NM5890110518	**Submitted in 1996	Expires 5 years after operations begin	
• TEVES	CWL, TA-III	NM5890110518-3	5/26/94	12/20/95	NMED

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

Table 2-6. Summary of environmental permits and registrations in effect during 1996 (Concluded).

Permit Type and/or Facility Name	Location/Building	Permit Number	Issue Date	Expiration Date	Regulatory Agency
• RCRA Part A and B Permit Applications Hazardous Waste Management Units	- RMWMF, Bldg. 6920 - 7 Manzano Bunkers - ISS, TA-III, Bldg. 6921 - High Bay TA-V, Bldg. 6596	NM5890110518	Interim status first submitted 8/90; Rev. 3, 11/96	Nov 1997	NMED/EPA
• Electrokenetic (RD&D)	TA-III NMED	NM5890110518-RDD3	5/26/94	05/26/96	NMED
Open Burn Permits					
• Aerial Cable	Aerial Cable	76-OB-3-1996	11/15/96	06/30/97	COA
• Burn Site	Burn Site	76-OB-5-1995	8/10/95	6/30/96	COA
• Thermal Treatment Facility (TTF)	Bldg. 6715	76-OB-7-1995	1/10/96	12/30/96	COA
• Burn Site	Burn Site	76-OB-8-1995	1/10/96	12/31/96	COA
• Fire Extinguisher Training Site	Off 9th Street	76-OB-1-1996	5/1/96	12/31/96	COA
• Burn Site	Burn Site	76-OB-2-1996	5/1/96	12/31/96	COA
• 10,000 ft Sled Track	TA-III	76-OB-3-1995	6/6/95	5/1/96	COA
• Burn Site	Burn Site	76-OB-4-1995	6/8/95	5/1/96	COA
Air Permits & Registrations					
• Hammermill	TA-III, Bldg. 6583	#144	08/28/85	Biennial update	COA
• SMERF	Burn Site	#196	5/19/88	Registration†	COA
• Neutron Generator Manufacturing Facility (NGMF)	TA-I, Bldg. 870	#374	09/23/94	Registration†	COA
• Standby Diesel Generators	TA-I, Bldg. 862	#402 (#150 old)	05/07/96	Biennial update	COA
• Radioactive & Mixed Waste Mgt. Facility (RMWMF)	TA-III, Bldg. 6920	#415	05/07/96	Registration†	COA
• Isotope Production Facility	TA-V, Bldg. 6580	#428	07/08/96	Biennial update	COA
• Radiological Waste Landfill (RWL)	TA-II, RWL	#480	05/16/96	Biennial update	COA
• Title V Operating Permit	Site-wide	#515	Submitted** 3/1/96	Pending (5 year renewal)	COA
• Classified Waste Landfill	TA-II, Landfill	#560	12/17/96		COA
• Emergency Generator, Bldg. 878	TA-I, Bldg. 878	#646	1/23/97	Biennial update	COA
• Portable Burn Pools	Burn Site	#647	Submitted** 12/11/96	Biennial update	COA
• Radiological Waste Landfill (RWL)	TA-II, RWL	NESHAP	12/15/95	Approval††	EPA, Region VI
• NG Recertification Project, Phase II	TA-I, Bldg. 842/90	Pending	Submitted**	Registration†	City of Albuquerque
• CWL-VCM	TA-III, CWL				

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

2.7 SUMMARY OF REPORTING REQUIREMENTS

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

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

- **Reportable Quantity (RQ) Accidental Release Reporting:** RQ release reporting is required by CERCLA and SARA Title III. CERCLA requires that any release to the environment, in any 24-hour period of any pollutant or hazardous substance in a quantity greater than or equal to the RQ, must be reported immediately to the National Response Center (NRC) at telephone number (800) 424-8802. However, if the release is "Federally permitted" under CERCLA Section 101(10)H, it is exempted from CERCLA reporting. This reporting exemption also applies to any "Federally permitted" release under SARA Title III. In 1996, no release exceeding the RQ was reported at SNL/NM.

- **Radioactive Effluent Information System/Onsite Discharge Information System (EIS/ODIS) Annual Report:** DOE Order 5400.1 requires that data about radioactive effluent and onsite discharges from the previous year for all planned and unplanned releases must be reported to the Waste Information System Branch of Edgerton, Germeshausen, and Grier Corporation (EG&G), Idaho, Inc., by April 1 each year (DOE 1988a). The EIS/ODIS report for 1996, submitted in 1997, covered all routine and non-routine releases from SNL/NM operations. Unplanned releases of radioactive materials or effluents (such as spills and leaks) whether onsite or offsite, shall also be reported to EGG. This is in addition to meeting the reporting requirements of DOE Order 232.1 (DOE 1996a). Releases that are of no environmental concern, including those that are subsequently cleaned up, need not be reported.

- **National Emission Standards for Hazardous Air Pollutants (NESHAP) for Radionuclides Other than Radon from Department of Energy Facilities (Subpart H) Annual Report:** The NESHAP standards of 40 CFR 61, Subpart H, require that an annual report from each DOE site be submitted to the EPA by June 30 each year. The report includes the calculated Effective Dose Equivalent (EDE) in millirem per year for the Maximally Exposed Individual (MEI) and the person-rem dose to the local population. Section 5.4 presents results of the dose assessment for the public from SNL/NM operations in 1996 (SNL 1997c).

- **Emergency Planning and Community Right-to-Know Act (EPCRA), Section 313, Toxic Release Inventory (TRI):** The TRI Report is required by 40 CFR 372, EPCRA, for facilities that have a Standard Industrial Classification (SIC) code from 20 through 39 and that use listed toxic chemicals in quantities greater than 10,000 lb/yr for any of the listed chemicals. EO 12856 *Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements*, requires Federal facilities meeting reporting thresholds to submit TRI reports under EPCRA. SNL/NM has been filing TRI reports with DOE and the EPA since 1991. However, due to a recent change in the regulations, SNL/NM was under the reporting threshold limit in 1996 and, therefore, did not file a TRI report for 1996.

3 ENVIRONMENTAL PROGRAMS INFORMATION

SNL/NM has designed, established and implemented environmental management programs to meet or exceed the requirements of Federal, State, and local environmental regulations, Executive Orders (EOs) and DOE Orders. Additionally, environmental activities are conducted to identify potential concerns so that mitigation efforts may be carried out long before a compliance issue arises. SNL/NM's policy is to minimize risks to as low as reasonably achievable (ALARA). DOE Order 5400.1, *General Environmental Protection*, and/or DOE Order 5400.5, *Radiation Protection of the Public and the Environment* drive all environmental programs including those that are not externally required (DOE 1988a, DOE 1990a).

This chapter describes the environmental program activities conducted at SNL/NM in 1996. While all programs areas are discussed briefly here, the Terrestrial Surveillance Program, Air Quality Programs, Wastewater Monitoring Programs, and the Groundwater Protection Program are covered in more detail in subsequent chapters of this report (Chapter 4, 5, 6, and 7, respectively). Program areas covered fully in this chapter include the Environmental Restoration (ER) Program, Waste Management Programs, the Pollution Prevention Program, Oil Storage and Spill Containments Programs, and the National Environmental Policy Act (NEPA) Program.

Environmental progress at SNL/NM is tracked through performance measures and indicators including annual summaries such as this report. Trends in compliance status and/or other significant program results over the past five years are given where appropriate. Awards and commendations are highlighted where available.

3.1 ENVIRONMENTAL RESTORATION (ER) PROJECT

The ER Project is a phased DOE project to identify, assess, and remediate contaminated DOE facilities from past spill, release, and disposal activities. The DOE Kirtland Area Office (DOE/KAO) has oversight over SNL/NM's ER sites.

The ER project at SNL/NM was initiated in 1990 to implement assessment and remediation for ER sites at SNL/NM, SNL/CA, the Kauai Test Facility (KTF), and other locations under DOE/KAO jurisdiction. ER remediation at SNL/NM is projected to be completed by the year 2001—ahead of most other installments in the DOE complex.

Regulatory Authority

ER sites are regulated under RCRA as applied to SNL/NM under the Hazardous and Solid Waste Amendments Act of 1984 (HSWA), as specified in Module IV of the RCRA Part B operating permit. In 1996, corrective action authority was transferred from the Environmental Protection Agency (EPA) to the New Mexico Environment Department (NMED). SNL/NM remains in compliance with all RCRA permit conditions and is currently ahead of schedule for assessment and cleanup activities.

SNL ER Site Historical Status

The initial identification of ER sites at SNL/NM was completed in 1987; 117 sites were identified in the initial *Comprehensive Environmental Assessment and Response Program (CEARP) Assessment Report* (DOE 1987). A new document published in 1996—the *Management Action Process (MAP)* (SNL 1996e)—presents a comprehensive overview of SNL/NM's ER project describing its current status and future plans. Additionally, DOE's

Office of Environmental Management (DOE/EM) developed a complex-wide ER plan titled *Accelerating Cleanup: Focus on 2006 – Discussion Draft* (DOE 1997). This summary-level plan, with associated cost and schedule information, describes how the SNL/NM ER Project will be completed.

ER sites at SNL reached a maximum of 219 during 1993 and 1994. Many of these sites have been proposed for no further action (NFA) based on insignificant contamination present or after remediation had been accomplished. From 1993 to 1995, 109 sites were investigated and proposed for NFA after being assessed and/or remediated. The sites requiring a minor level of cleanup were accelerated under the Voluntary Corrective Measure (VCM) process; SNL/NM has expedited assessments of more than 60 VCMs since 1994. At the close of 1995, 64 of the 109 proposed sites had been approved for NFA.

1996 Activities and Future Plans

During 1996, 35 sites were proposed for NFA; of these, two were approved. At the end of 1996, 100 NFA proposals were pending regulatory review, although, it is estimated that fewer than 30 sites remain that will require some level of cleanup. By the close of FY1996, a total of 153 ER sites officially remained on the permit. The *ER Site Atlas* (SNL 1996g) lists SNL/NM's current ER sites. Table 3-1 shows the progress and status of the ER Project over the last five years. Table 3-2 lists important ER documents relative to the project.

During FY1997, SNL/NM will actively pursue the closure of remaining proposed NFA sites by working with the NMED to provide adequate and/or further verification, as necessary, for a successful determination. Based on current budget projections, the SNL/NM ER Project will maintain a high level of cleanup activity through FY1999, after which only one large-scale clean up effort will remain to be completed by the end of FY2001—the Chemical Waste Landfill (CWL).

Chemical Waste Landfill (CWL)

The CWL was used for chemical disposal from 1962 to 1985 and was permanently closed in 1988. Trichloroethylene (TCE), a volatile organic compound (VOC) at concentrations slightly above the EPA's drinking water standard, was discovered in the groundwater 500 ft beneath the site. This site is currently under RCRA interim status issued by the NMED in 1985. The site is managed in accordance with the *CWL Closure Plan* (SNL 1992c), which incorporates remedial corrective actions with respect to the TCE contamination. Monitoring of the site will continue after final remediation is completed by 2001.

Temporary Unit/Corrective Action Management Unit (TU/CAMU)

SNL/NM has designed the TU/CAMU to facilitate the handling of large volumes of contaminated soils generated by ER activities—most of which will come from the cleanup of the CWL. This will alleviate the load handling of ER waste at the Hazardous Waste Management Facility (HWMF) through which most hazardous (nonradionuclide) ER waste is currently handled. Start up at both facilities is anticipated by 1998. The TU/CAMU will be critical to the completion of SNL/NM's ER Project by the year 2001.

The TU will stage and store ER waste for up to one year before it is processed at the CAMU where soils will be treated to reduce contamination to trace levels, where possible. Treatment will include the thermal dissipation of volatiles for solvent-contaminated soils, and soil washing and/or stabilization for metal-contaminated soils. Disposal options for CAMU-treated soils will be based on Superfund 6A guidelines (EPA 1990). Soils meeting the required standard will be placed in a disposal cell at the CAMU. ER waste that does not meet the RCRA standards will be packaged and shipped offsite to other permitted disposal facilities.

Table 3-1. Five year summary of ER Program status.

Year	Total ER Sites at Start of FY*	ER Sites Proposed for NFA in FY*	Sites Approved for NFA in FY*	Corrective Actions Completed by End of FY*	New ER Sites Identified During FY*	Total ER Sites at End of FY*
1996	155	35	2	29	0	153
1995	191	61	36	34	0	155
1994	219	48	28	3	0	191
1993	219	0	0	0	0	219
1992	172	0	0	0	47	219

NOTE: FY = October 1 to Sept 30.

Table 3-2. Important program documents for the ER Project.

Program Document	Reference
Program Implementation Plan for Albuquerque Potential Release Sites	SNL 1995b
Revised Action Plan, Finish in the Year 2000	SNL 1995s
ER Site Atlas	SNL 1996g
Management Action Process (MAP) - ER project description and overview of status and future plans	SNL 1996e
The Chemical Waste Landfill Final Closure Plan and Postclosure Permit Application	SNL 1992c
Comprehensive Environmental Assessment and Response Program (CEARP) Assessment Report	SNL 1987
Accelerating Cleanup: Focus on 2006 – Discussion Draft	DOE 1997
Environmental Assessment of the ER Project at SNL/NM	DOE 1996d
SNL/NM ER Project 1993-1996. RCRA Facility Investigation Work Plans	DOE 1993b
Handbook: Baseline for Future Use Options	Keystone 1995
Workbook: Future Use Management Area 1	DOE 1995a
Workbook: Future Use Management Area 2	DOE 1995b
Workbook: Future Use Management Area 3, 4, 5, and 6	DOE 1996e
Workbook: Future Use Management Area 7	DOE 1996f

1996 Air Sampling Results From the Radiological Waste Landfill (RWL)

The RWL underwent remediation during the summer of 1996. Tritium bubblers and PM_{10} monitors (measuring particulate matter with a diameter less than 10 microns) were set up before and during remediation to monitor potential changes in the ambient air. Americium and plutonium were detected during a 24-hour period when items contaminated with these isotopes were being excavated and containerized.

3.2 WASTE MANAGEMENT PROGRAMS

Waste management at SNL/NM includes the safe handling, packaging, storing, treatment, and shipment of waste generated onsite and/or accepted from other DOE sources. Waste handled at SNL/NM falls into four primary categories:

- non-hazardous solid waste,
- hazardous waste,
- radioactive waste, and
- mixed waste.

The Waste Management Department is responsible for all waste handling facilities at SNL/NM. Waste is handled for packaging and shipment at three facilities onsite:

- **The Solid Waste Transfer Facility (SWTF)**, located in TA-II, handles most non-hazardous solid waste generated at SNL/NM. Non-hazardous waste primarily consist of laboratory and office trash, and recyclable cardboard and paper. Construction debris, liquids, pressurized cans, and light bulbs are some of the materials not accepted at the SWTF.

- **The Hazardous Waste Management Facility (HWMF)**, located in TA-II, handles all RCRA hazardous chemical waste, Toxic Substances Control Act (TSCA)-regulated polychlorinated biphenyl (PCB) and asbestos waste, medical waste, and any waste with hazardous characteristics that does not otherwise meet the waste acceptance criteria (WAC) at the SWTF. Recycling is carried out in all categories as applicable. The HWMF does not accept radioactive, mixed, or explosive wastes.

- **The Radioactive and Mixed Waste Management Facility (RMWMF)**, located in TA-III, handles radioactive and mixed waste (MW). In 1996, only low level waste (LLW) and MW were accepted at this facility. Additionally, a small quantity of transuranic (TRU) waste being stored at the Manzano Bunkers was temporarily brought to the RMWMF for shipping preparation. TRU waste will be stored until it can be shipped to the Waste Isolation Pilot Plant (WIPP) when it opens.

SNL/NM's individual Waste Management Programs are described in the following subsections. Documents relevant to these programs are compiled in Table 3-9.

3.2.1 Hazardous Waste Management

SNL/NM is classified as a large-quantity generator with respect to RCRA–hazardous waste. The HWMF is responsible for the safe handling, packaging, storing, and shipment of all RCRA-regulated and other hazardous and toxic waste categories.

The HWMF operates under SNL/NM's RCRA Part B Operating Permit and accepts RCRA waste types as stated in the permit. This facility also complies to the provisions of TSCA for asbestos waste handling (40 CFR 763) and PCB management (40 CFR 761). The HWMF manages used oil in accordance with 40 CFR 279 and biomedical waste in accordance with State of New Mexico requirements (20 NMAC 9.1).

"Cradle to Grave"

Hazardous waste is tracked from the point of generation to final disposal through meticulous documentation at each waste-handling step. The generator at SNL/NM initiates the "cradle to grave" tracking process by filling out a Disposal Request Form describing the quantity and type of waste requested for pickup. Generators characterize their own waste by either process knowledge or, if necessary, sampling and analysis. The form is sent to the HWMF for evaluation where it is assigned a U.S. Department of Transportation (DOT) hazard class and RCRA code, if applicable. Each individual waste item—which may be a bottle, plastic bag, or pressurized container—is labeled with a bar code for tracking at the generator site before pickup. Once the waste is received at the HWMF it is unpacked for verification. Items are placed in containment bays by DOT hazard class to ensure segregation of incompatible waste types. All bays are equipped with secondary chemical spill containments and earthquake-safe shelving. Waste items are eventually consolidated into 5 to 55 gal. transportation containers, which are also bar coded, and moved to an adjoining storage building to await shipment to an offsite disposal facility.

Table 3-3 presents a five year summary of waste handling activities at the HWMF. Table 3-4 details the waste categories received at the HWMF in 1996.

Hazardous Waste Documentation

SNL/NM shipments of hazardous wastes or pretreatment wastes are documented in the *Biennial Hazardous Waste Disposal Report,* which is submitted to the NMED. The Waste Management Department also prepares weekly, monthly, and annual inventory reports. Hazardous waste transporters, disposal facilities, and recycling facilities are documented in the *Hazardous Waste Management Facility (HWMF) Annual Report* and the *Biennial Hazardous Waste Disposal Report.*

Thermal Treatment Facility (TTF)

The TTF is used to thermally treat residual explosive waste generated during Research and Development (R&D) experimental operations. In 1996, 1.9 kg (4.1 lb) of residual explosive wastes were treated at the TTF. This represents only a small fraction of the explosive waste generated. The remainder was shipped for permitted treatment to an out-of-state facility or manifested to the KAFB Explosive Ordnance Disposal (EOD) Facility. In 1996, a total of 219.1 kg (482.1 lb) of explosive waste was shipped for treatment. Additionally, there was 2,340 kg (5,148 lb) of rocket motors manifested to the EOD for treatment.

Table 3-3. Five year summary of waste handling at the HWMF.

Year	Number of Individual Waste Items (ea)	Number of DOT Containers Shipped (ea)	Recyclable Oil (kg)	RCRA-regulated Waste (kg)	Other Hazardous Waste Categories and Recycled Materials Handled by HWMF (kg)	Soils and Other ER Wastes (kg)	Total Waste Handled (RCRA + Other hazardous) (kg)
1996	18,888	2,396	28,400	51,549	250,667	5,517	336,137
1995	33,273	4,188	31,166	91,876	371,613	303,966	798,621
1994	29,780	3,899	46,310	102,545	137,113	541,090	827,058
1993	25,263	6,022	38,781	140,613	304,368	144	483,606
1992	26,806	5,422	13,650	147,392	330,752	1,746	493,540

Table 3-4. Breakdown of hazardous waste handled by the HWMF in 1996.

Hazardous Waste Type	Waste Shipped (kg)
ER WASTE	
- ER Chemical Waste	3,164
- ER RCRA Waste	2,353
Total Hazardous ER Waste	**5,517**
RECYCLED WASTE	
- lead acid batteries - fluorescent lights - nickel cad batteries - gold solutions etc.	60,876
- PCBs	18,807
- used oil	28,400
Total Recycled	**108,083**
HAZARDOUS/TOXIC WASTE	
RCRA Waste	51,549
PCBs (TSCA)	52,019
Asbestos (TSCA)	77,321
Medical Waste	1,394
Chemical Waste	**99,838**
Total waste handled by HWMF	336,137

3.2.2 Radioactive Waste Management

In 1996, SNL/NM generated, processed and shipped offsite for disposal only LLW and MW. HLW is not currently generated onsite. (Spent fuel is not considered waste and is sent offsite for reprocessing). A small quantity of transuranic (TRU) waste is generated at SNL/NM and there is approximately 221 ft^3 being stored onsite.

The Radioactive Waste Program operates in compliance with environmental regulations and requirements given in:

- RCRA 40 CFR 260-299 (mixed waste)
- DOT 49 CFR 100-199
- DOE Order 5820.2a *Radioactive Waste Management* (DOE 1988b)
- DOE Order 5400.5 *Radiation Protection of the Public and the Environment*

LLW and MW are handled by the RMWMF, which opened on schedule in January 1996. The facility serves to assists radioactive waste generators in waste characterization and collection, as needed. Once received at the RMWMF, waste is verified, packaged, and stored until shipment. Presently, all newly generated radioactive waste is temporarily stored at three onsite locations: the RMWMF, the Manzano Bunkers, and the High Bay Waste Storage Facility, Bldg. 6596, in TA-V. (The Interim Storage Site [ISS] in TA-III is also allowed to store waste, but is not being used at this time.) LLW is shipped for permanent disposal to a facility in Utah or to the Nevada Test Site (NTS).

The bulk of the radioactive waste handled at the RMWMF in 1996 consisted of contaminated soils excavated from ER sites. The primary contaminants were isotopes of uranium and thorium. MW also increased significantly from both ER and Demolition and Decontamination (D&D) activities. The remainder of the waste handled by the RMWMF included contaminated personal protective equipment (PPE), lab debris, and various accelerator-activated materials. Table 3-5 lists the quantities of radioactive waste generated by SNL/NM over the last five years.

3.2.3 Mixed Waste (MW) Management

The majority of MW consist of sludges from septic tank system close-outs that had very low radioactive levels, organic debris (PPE, paper, and plastic), and inorganic debris (metallic objects). The radioactive contaminant component results primarily from Cesium-137 (Cs-137), Cobalt-160 (Co-160), tritium, and isotopes of uranium. Most of SNL/NM's MW

Table 3-5. Summary of radioactive waste generated at SNL/NM (or received from offsite) since 1992. Both the weight and volume are given where available.

Year	LLW Generated (kg) and (ft^3)	LLW Shipped Offsite (kg) and (ft^3)	MW Generated (kg) and (ft^3)	MW Shipped Offsite (kg) and (drum)	TRU Waste Generated or Received from offsite
1996	461,713 kg (17,908 ft^3)	604,676 kg[§] (15,368 ft^3)	58,610 kg (3,536 ft^3)	57 kg (1 drum)	0*
1995	13,160 kg (1839 ft^3)	3,327 kg (688 ft^3)	12,212 kg (506 ft^3)	0	216 ft^3**
1994	(1886 ft^3)	0	(59 ft^3)	1,888 kg (560 ft^3)	0
1993	(1533 ft^3)	0	(128 ft^3)	0	5
1992	(1086 ft^3)	0	NA	0	5

NOTE: NA = not available.

[§] Approximately 80 percent of this quantity was from ER-contaminated soils (483,740 kg).

*TRU waste generated from remediation of the Radiological Waste Landfill (RWL) was not received at the RMWMF in 1996.

** 26 drums were received from the Inhalation Toxicology Research Institute (ITRI).

inventory is stored at Bldg. 6596 in TA-V. Recently generated MW is also stored at the RMWMF.

Currently, MW generators are required to complete a request form describing the proposed waste characteristics before generating MW. This practice ensures that waste can be properly characterized and sorted into treatability groups. Process knowledge and direct sampling, as needed, is used to characterize the waste.

MW - Part A Permit Status

In August 1990, SNL/NM submitted a RCRA Part A interim status permit application for MW storage proposing nine MW storage units and eight treatment processes. The permit application, last revised in November 1996 (Amendment 3), currently proposes 14 treatment processes and 10 storage locations. New treatments listed include thermal desorption, amalgamation, deactivation, evaporative oxidation, and stabilization/solidification.

MW - Federal Facility Compliance Act (FFCAct) Requirements

The FFCAct requires the DOE to submit a Site Treatment Plan for developing MW treatment capacities and technologies to treat MW pursuant to RCRA requirements (Section M). The final Site Treatment Plan (SNL 1995a) is now enforceable by NMED and is intended to fulfill the requirements of the FFCAct.

MW - Treatability Studies

Two treatability studies continued into1996: a Vapor Extraction Pilot Test at the CWL and a study for stabilization and neutralization of acids in MW liquids. Also, a treatment study for radioactive cyanide was undertaken at Los Alamos National Laboratories (LANL).

The mobile treatments units previously planned for DOE/Albuquerque Operations Office (DOE/AL) and discussed in last year's ASER, are now on indefinite hold; future directions will likely seek commercial treatment as an alternative.

MW - Historical Disposal Requests Validation (HDRV) Project

In June of 1995, a comprehensive characterization process was started as a means of updating historical disposal requests for LLW and MW. This was necessary since, historically, MW was not sorted into treatability groups as is now required. Packages and drums of MW were opened and inspected to characterize the contents and separate the waste into treatability groups. All MW generated through September 30, 1995 was sorted; however, there is waste that has been generated since that date, which will also require sorting. The HDRV Project has been used to validate wastes identified in the *Site Treatment Plan for Mixed Waste* (SNL 1995f) to ensure the implementation of adequate treatment technologies.

3.2.4 Solid Waste Management

SNL/NM's solid waste is regulated under RCRA Subtitle D, EO 12780, *Federal Agency Recycling*, and New Mexico's Solid Waste Management Regulations.

The Solid Waste Transfer Facility (SWTF) in TA-II began operations in May 1996. The facility is designed to screen, bale, and store solid waste. This facility accepts non-hazardous solid waste such as that generated from offices and laboratories at SNL/NM.

All solid waste that does not meet the facility's waste acceptance criteria (WAC), such as liquids and pressurized cans, is manifested to the HWMF. Some sanitary solid waste at SNL/NM is still collected and transported directly to landfills without special handling, as is the case for construction debris.

The transfer station also serves as a recycling center for paper and cardboard generated from SNL/NM. White office paper and mixed paper is also received from LANL and other DOE facilities and for recycling. The SWTF works closely with the Pollution Prevention and Waste Minimization Program staff to implement recycling activities.

Table 3-6 presents a summary of solid waste management in 1996. Because the facility was only in operation for half of 1996, actual waste handling figures have been doubled to estimate the waste generated by SNL/NM for the entire year.

3.2.5 The Asbestos Program

Asbestos is regulated under the Toxic Substances Control Act (TSCA) and implemented by 40 CFR 763. Asbestos is also a hazardous air pollutant as defined and regulated under NESHAP 40 CFR 61, Subpart M.

At SNL/NM, the abatement of asbestos-containing equipment and building materials is ongoing; asbestos is managed in place and will remain in place unless it is found to be hazardous or is removed during building renovation. Asbestos-contaminated facility waste may consist of floor and ceiling tiles, various insulations, and other fire retardant building materials. Similarly, in instances where equipment has asbestos-containing material in a non-friable form and there is no risk of particle inhalation, the item will remain in service or will be redistributed through the property reapplication program. The typical asbestos waste generated from equipment abatement consists of gloves, fume hoods, cable insulations, and ovens.

The Facilities Department is responsible for removing asbestos building material. All other asbestos handling is managed under the Waste Management Program as described in the Asbestos Waste Operations Management Program Document (SNL 1995q). Asbestos waste is stored by the HWMF in trailers located within an adjoining compound where TSCA-regulated, biomedical, and other miscellaneous waste items are temporarily stored. Larger asbestos-contaminated items may be stored at the maintenance yard located across from the HWMF. Asbestos waste is generally shipped

Table 3-6. SWTF activity summary for 1996.

Category	Weight (actuals received in 6 months) (lb)	Bales (actual baled in 6 months)	Total estimate for the year [1] (lb)	Total estimate for the year [1] (kg)
Solid Waste	1,191,765 lb	685	2,383,530 lb	1,083,422 kg
Office Paper (recycled) [2]				
- SNL	172,666 lb	122	345,334 lb	156,970 kg
- LANL	106,798 lb	75	213,596 lb	97,089 kg
- DOE	8,618 lb	6	17,236 lb	7,834 kg
Mixed Paper (recycled) [2]	13,272 lb	--	26,544 lb	12,065 kg
Cardboard (recycled) [2]	164,736 lb	124	329,472 lb	149,760 kg

NOTE: [1] These figures have been estimated by doubling the actual waste handled during the SWTF's 6 months of operation in 1996.
[2]The actual handled total of recycled material is 466,090 lb (211,859 kg) for 6 months activity. The total yearly estimate for recycled material is 932,182 lb (423,719 kg).

offsite within a few days or weeks of being received and is disposed of at a New Mexico landfill permitted to accept friable asbestos waste. In 1996, 77,321 kg of asbestos waste was shipped for disposal. (This was 31,189 kg less than shipped in 1995).

3.2.6 The Polychlorinated biphenals (PCB) Program

PCBs are regulated under TSCA (implemented by 40 CFR 761). Materials having a PCB concentration equal to or greater than 500 ppm are defined as PCBs; materials with a PCB concentration greater than or equal to 50 ppm but less than 500 ppm are defined as PCB-contaminated. Non-PCBs, as defined by the EPA, are materials with less than 50 ppm of PCBs.

SNL/NM's PCB Program has been working to reduce the level of PCB and PCB-contaminated equipment to the greatest extent possible. Items affected by the program are primarily transformers, capacitors, switches, and fluorescent light ballasts (largest PCB waste source). Other substances that may be PCB-contaminated include dielectric fluids, contaminated solvents, hydraulic oils, waste oils, heat transfer liquids, lubricants, paints, and casting wax. The complete removal and disposal of this equipment is estimated to take one to three years. However, items that are suspected to contain PCBs but remain sealed (and would have to be otherwise destructively tested) may remain in service.

Like other TSCA waste, PCB waste is handled by the HWMF and stored within an adjoining fenced compound. In 1996, 52,019 kg of PCB waste was shipped offsite—including 18,807 kg of recyclable PCBs. (This was 39,619 kg more than shipped in 1995.) As of the end of 1996, 12,459 kg of PCB remained in storage.

The SNL/NM PCB Program produces an annual report by July 1st of the following reporting year detailing its activities as required by TSCA. Program information is described in the PCB Program document (SNL 1995t).

3.3 WASTE MINIMIZATION AND POLLUTION PREVENTION PROGRAMS

Pollution Prevention (P2) Program Scope

The P2 Program has been developed to infuse pollution prevention practices into SNL/NM's corporate culture by encouraging and enabling practices that reduce or eliminate waste sources, improve process efficiency, facilitate reapplication of potential waste items, and procure products with recycled content, wherever feasible. The P2 Program is concerned with all waste streams. Program drivers are listed in Table 3-7.

The P2 Program works in concert with waste generator liaisons, ES&H coordinators, and a team of P2 line representatives. The P2 Program supports SNL/NM's line organizations by providing background research on waste reduction technologies and products, performing cost-benefit analyses, and helping to locate and obtain P2 funding. The P2 Program has recently developed a Home Page on SNL/NM's internal web, which provides program information and extensive links to other pollution prevention/recycling sites on the world-wide web.

Generator Set-Aside Fee (GSAF) Program

The GSAF Program is part of a DOE pilot program to set aside funds for pollution prevention activities by collecting a small fee from waste generators. The GSAF Program was created to provide a direct incentive for waste generating organizations to minimize their waste. The fees collected are used to fund P2 activities at SNL/NM; in 1996, $45,000 in GSAF funds were used for implementation of P2 projects.

3.3.1 Pollution Prevention Opportunity Assessments (PPOAs)

PPOAs are based on discovering new ways to reduce waste through: (1) improving process efficiency, (2) substituting less toxic materials, (3) controlling chemical inventory, (4) improving preventive maintenance, and (5) cutting back on overall energy use. Two formal PPOAs were conducted at two SNL organizations in 1996:

- PPOA at Fleet Services - The P2 Team identified eight potential P2 opportunities of which four were implemented. These included installing a parts power washer, implementing a closed-loop oil recycling contract, eliminating the use of aerosol cans, and substituting a less hazardous brake cleaner.

- PPOA at the Machine Shop - The P2 Team identified four potential P2 opportunities. Recommendations included segregating skimmer oil, substituting clay absorbent with reusable microbial-cleaned towels, improving solvent use efficiency using EPA 2000 solvent, and implementing an automatic chemical ordering system.

Table 3-7. Drivers for P2 and Waste Minimization Programs.

Regulation	Title or Description	Regulator/ Agency
RCRA Section 6002	Federal Procurement	EPA
EO 12856	*Federal Agency Compliance with Right-to-Know Laws and Pollution Prevention Requirements*	Executive Office
EO 12902	*Energy Efficiency and Water Conservation at Federal Facilities*	Executive Office
EO 12873	*Federal Acquisition, Recycling, and Waste Prevention*	Executive Office
42 USC 13102	Pollution Prevention Act of 1990	EPA
DOE 5400.1	*General Environmental Protection Program*	DOE

3.3.2 Return on Investment (ROI) Funding

The P2 Program has received Return on Investment (ROI) funding from DOE for proposed projects that will return the initial investment cost within two years of implementation through various cost-saving mechanisms. The P2 Program proposed 10 ROI projects in 1996 that were approved by DOE. These are described below:

- *Closed Loop Oil Recycling* - Installed a tank system for used oil at Fleet Services and set up a closed-loop contract to recycle and reuse oil. This will eliminate approximately 5,675 kg/year of oil waste. This project was identified under a formal PPOA.

- *Power Washer* - Purchased and installed a high temperature and high pressure power parts washer at Fleet Services to clean and degrease parts. The washer is equipped with a recycling unit, which will eliminate 200 kg/year of hazardous waste. This project was identified during a formal PPOA.

- *Digital Camera* - Purchased a digital camera for the print shop. This replaced the photolithographic process and will eliminate 2,245 kg/year of hazardous photochemical waste.

- *Color duplicating Machine* - Purchased a color duplicating machine for the print shop to replace the photolithographic processing. This will eliminate approximately 750 kg/year of hazardous photochemical waste. The new process also improves the technical capability and worker conditions.

- *Personal Protective Equipment (PPE) for Radiation Protection* - Purchased washable PPE for TA-V operations. This will eliminate approximately 2,300 kg/year of radioactive waste.

- *Reactor Fuel Repackaging* - Shipped surplus uranium that will be used for fuel in commercial reactors. This will eliminate approximately 2,190 kg of radioactive waste.

- *Mini Reactor* - Purchased a high temperature 300-mL mini-reactor to synthesize reactants. This will eliminate approximately 9 kg of hazardous waste per year.

- *Depleted Uranium* - Fabricated transportation casks from depleted uranium (DU). The casks will be used to move irradiated enriched uranium targets for the Medical Isotope Production Project (MIPP). This project will eliminate 5,000 kg of radioactive waste.

- *Wastewater Recycler* - Purchased a total organic carbon (TOC) destroyer for the Microelectronics Development Laboratory (MDL). The new equipment will treat wastewater produced from a chemical mechanical polishing process, thus allowing reuse onsite. This will eliminate 10 million gallons of wastewater per year.

- *New Recycle Containers* - Purchased two recycling containers on wheels that will be used for storage and transport of paper and cardboard. These containers will be used by both SNL/NM and LANL in their joint recycling effort.

3.3.3 Recycling and Waste Minimization

SNL/NM is working toward continued improvement of its recycling program. Current materials recycled include paper, solvents, oil, metals, PCBs, tires, construction materials, office products, and various other categories. Implementation of recycling programs is through the waste management groups. Table 3-8 lists the categories and amounts of waste recycled by SNL/NM in 1996.

Other recycling and waste minimization efforts conducted in 1996 or underway at SNL/NM include the following:

- Chemical Exchange Program - In 1996, 227 kg of unused, unexpired chemicals were collected and redistributed.

- Lead Bank - Lead shielding and other lead material is collected for reapplication to avoid unnecessary waste disposal and repurchasing of new lead materials.

- Radioactive Source Bank - Radioactive source materials will be collected for reuse. The source bank will be fully implemented by September 1997.

- "Green" Landscaping Practices - SNL/NM reduces water, pesticide, and herbicide use though extensive desert-suitable landscape planning. Chemical use is reduced by choosing xeriscaping; water is conserved by selecting drought-tolerant plants for most landscapes; and landscape waste is recycled through mulching and composting, where feasible.

- Affirmative Procurement - Affirmative procurement is the purchase of products that contain recycled materials. SNL/NM's Affirmative Procurement Team, initiated in 1996, is made up of representatives from Purchasing, the P2 Program, Facilities, Secretarial, and Communications. The Team is responsible for encouraging purchases of recycled-content products. In 1996, SNL/NM's recycled purchases included construction materials, re-refined lubricating oils and coolants, landscape products, paper products, and non-paper office products.

Table 3-8. Categories of waste recycled at SNL/NM in 1996.

Recycled Categories	Weight (kg)
Scrap Metals (total)	487,760
. *steel*	10,180
. *copper*	43,140
. *iron*	307,730
. *aluminum*	49,800
. *lead*	35,400
. *zinc*	0
. *other metals*	41,510
Precious Metals	40
Toner cartridges	7,250
Batteries	19,790
Tires	13,610
Food Waste	1,180
Concrete	1,180
Wood (chips, compost)	2,940
Mercury Items	49.1
PCB (ballasts & transformers)	18,807
Safety Kleen Solvent	500
Chemical Exchange	227
Florescent light bulbs	8,780
Non-PCB ballasts	2,578
Paper	156,970
Cardboard	149,760
Phone books	11,810
Used oil	28,400
Aluminum cans	29,140

- Solid Waste Characterization - In 1996, an initiative to characterize SNL/NM's sanitary solid waste was undertaken to determine the percentage of recyclable content. A total of 3,024 kg (6,652 lb) of solid waste was sorted representing one half day of total solid sanitary waste generated by SNL/NM operations. It was determined that 55 percent of the waste could be recycled if cost effective recycling markets were found. For example, newsprint, shredded paper, glossy paper, books, and catalogs made up 15

Table 3-9. Important program documents for the Waste Management Program.

Waste Management Program Documents	**Reference**
Waste Management Program Document	SNL 1996a
Programmatic Waste Acceptance Criteria	SNL 1996v
Hazardous Waste	
Hazardous Waste Management Facility Annual Reports	(no reference)
Hazardous Waste Management Facility Monthly Reports	(no reference)
Biennial Hazardous Waste Disposal Report	(no reference)
Chemical Waste Management Program Document	SNL 1996w
Medical Waste Program Document	SNL 1996x
"Chemical Waste Management," *ES&H Manual*	SNL 1995h
Radioactive Waste	
Site Treatment Plan for Mixed Waste	SNL 1995f
"Radioactive Waste Management," *ES&H Manual*	SNL 1995i
"Mixed Waste Generator Planning," *ES&H Manual*	SNL 1995j
"Radioactive Materials Management Areas," *ES&H Manual*	SNL 1995k
TSCA Waste	
PCB Inventory and Waste Disposal Program	SNL 1995t
PCB Annual Report	(no reference)
PCB Annual Document Log	(no reference)
Asbestos Waste Management Program Document	SNL 1995q
Solid Waste	
Annual Solid Waste Reports	(no reference)
Waste Minimization and Pollution Prevention	
Pollution Prevention Plan	SNL 19___
Annual Report on Waste Generation and Waste Minimization Progress	(no reference)

NOTE: Operating procedures specific to waste programs are not listed.

percent of the waste. This category of paper, however, does not currently have well established markets for recycling. The remainder of recyclable material consisted of recyclable plastic (4 percent), reusable office supplies (3 percent), and beverage containers (1 percent).

- Trip Reduction Program - To reduce air emissions, SNL/NM participates in the City of Albuquerque's programs for ride sharing, busing, or non-automotive commuting. Currently, about one in six Sandians take part in ride sharing or other alternatives to single occupant vehicles including an estimated 900 employees using van or car

pools and 200 regular bicycle commuters. All trip reduction activities at SNL/NM are voluntary.

3.4 SPILL PREVENTION PLANS FOR OIL AND CHEMICAL STORAGE AND USE

SNL/NM has developed plans to prevent the release of oil, toxic, and hazardous materials from any potential container leak or unplanned release from all laboratory processes utilizing hazardous and/or toxic materials. Chemicals stored or used onsite and requiring special spill containment procedures include acids, bases, solvents, water-based chemicals, and oil. These plans address prevention, control, reporting, and cleanup procedures.

Oil Spill Containment

SNL has developed an *Oil Spill Prevention Control and Countermeasures Plan (SPCC)* (CDM 1995) in accordance with 40 CFR 112—Oil Pollution Prevention, to prevent the discharge of oil to "Waters of the U.S. or tributaries thereof." The plan specifically identifies oil storage requirements and secondary containments around transformer pads, oil tanks, and other oil containment equipment. As of January 1997, there were over 900 locations storing oil with a total capacity (excluding USTs) of 5,502,114 gal. Most applicable sites are provided with spill containment measures, some of which include concrete lined ditches, retaining walls, containment reservoirs, earthen berms, sloped pads, and trenches.

The annual SPCC Oil Storage Facilities inspection reports for SNL/NM's oil storage locations are on file in the Environmental Operations Record Center (EORC).

Chemical Spill Containment

Spill containments must also be provided in areas where toxic and hazardous materials are stored or routinely used. The basis for the requirements are contained in 40 CFR 302, 40 CFR 355, 40 CFR 370, and 40 CFR 372, as well as DOE Order 232.1 (DOE 1996a).

Chapter 10 of the ES&H Manual Section E, "Chemical Spill Prevention, Response and Reporting," documents general safety procedures for areas where chemicals are used or stored, including proper containments (SNL 1995c). These containments must be capable of holding the contents volume of the largest single container—or 10 percent of the total combined container volume, whichever is larger. In addition to proper containments, spill prevention protocols are summarized below:

- Floor drains are sealed in areas where chemicals are used or stored.
- A spill response plan is available in each work area.
- Proper cleanup materials are present and suitable for the chemicals on-hand (e.g., absorbent socks and clay).
- In the event of a spill, all cleanup materials are to be disposed of as hazardous waste.
- Signs are posted at sinks, drains, and in other areas of potential inadvertent releases stating that it is a violation to dispose of chemicals or radioactive materials to the sanitary sewer system.

3.5 UNDERGROUND STORAGE TANK (UST) MANAGEMENT

USTs at SNL/NM are regulated by NMED under "UST Regulations of 1989." In 1990, the State adopted Federal standards contained in RCRA Subpart I, and implemented under 40 CFR 280—Underground Storage Tanks. The EPA transferred authority to the State in accordance with 40 CFR 281—Approval of State UST Programs. Future UST regulations that will become effective in 1998

will require higher standards for tank components, including more rigorous spill, overfill, and corrosion standards. One tank currently in SNL/NM ownership meets these stricter requirements.

UST Status

SNL/NM's UST Program has been actively decreasing over the last 10 years. Since 1988, 53 tanks have been removed from the ground or closed in place (two tanks) using State approved methods.

In 1996, the last two USTs used for gasoline storage were removed from the motor pool. SNL/NM now buys all gasoline through KAFB sources. Soil sampling conducted at the excavation confirmed that no product leakage had occurred. At the close of 1996, three active USTs remained with a combined volume of 49,730 gal:

- 2 USTs used for oil storage (Bldg. 888)
- 1 UST used for emergency generator fuel (Bldg. 862)

The two oil storage tanks at Bldg. 888 will need to be removed or upgraded before the new regulations take effect.

There are no inactive USTs that remain to be addressed by the UST Management Program, although past UST sites are being investigated under the ER Program. UST Program Management is described under the ES&H Manual, Chapter 10, Section K, "Underground Storage Tanks" (SNL 1995d).

3.6 NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) COMPLIANCE ACTIVITIES

The National Environmental Policy Act (NEPA) requires that Federal agencies prepare Environmental Impact Statements (EISs) on proposals for "major Federal action significantly affecting the quality of the human environment." The most common type of NEPA compliance documentation prepared by Federal agencies or their contractors is the Environmental Assessment (EA) and, when applicable, the finding of no significant impact (FONSI). Many agencies prepare NEPA compliance checklists, internal memoranda, and other types of internal documents.

Although each Federal agency has its own NEPA procedures, implementing the Act's requirements is the primary responsibility of the President's Council on Environmental Quality (CEQ). The DOE's extensively revised NEPA implementing procedures were published in final form on April 24, 1992 (57 FR 15122). The regulations rewrote the old 10 CFR 1021 and adopted the CEQ regulations. The DOE amended these regulations on July 9, 1996 (61 FR 36222). The 1996 amendments incorporate changes that improve DOE's efficiency in implementing NEPA requirements by reducing costs and preparation time while maintaining quality consistent with the DOE Secretarial Policy Statement on NEPA issued in June 1994. In accordance with the CEQ NEPA regulations, 40 CFR 1507.3, DOE consulted with the CEQ regarding these final amendments to the DOE NEPA rule. CEQ found that the amendments conform with NEPA and the CEQ regulations and did not object to their promulgation.

Consistent with DOE guidance and rules, NEPA Document Managers are directed to take appropriate action to encourage and facilitate public participation throughout the NEPA process. Additionally, DOE Order 451.1 (DOE 1995e), issued on September 11, 1995, establishes responsibilities and procedures to implement NEPA in conformance with the new DOE NEPA regulations. Other drivers for the program are contained within the DOE Secretary's NEPA Notice of February 5, 1990 (DOE 1990b) and the Secretary's Policy Statement on NEPA made in June 1994 (DOE 1994a).

SNL/NM NEPA Program

SNL/NM's Integrated Risk Management Department implements the NEPA Program under the direction of DOE/KAO. Although only DOE has authority to decide the appropriate level of NEPA documentation required, SNL/NM assists DOE by drafting proposed documentation for DOE approval. Environmental Assessments (EAs) and FONSIs completed by SNL/NM in 1996 are listed in Chapter 2. Baseline characterization of the existing environment on lands used by SNL/NM also continued in 1996 with the publication of the SNL/NM *Environmental Baseline Update* in July 1996 (SNL 1996d).

The environmental baseline report was first published by SNL/NM in 1993 and updated in 1996. It provides a "building block" with which succinct and more readable NEPA documents can be prepared. This tool is discussed in a paper published in June 1996 (Wolff and Hansen 1996.)

Key Interfaces

The NEPA Compliance Team interfaces with many organizations within SNL. Key interfaces are the Environmental Regulatory Assessment Department; the Environmental Monitoring and Reporting Department; the Compliance and Metrics Department; and the Records and Information Services Department. The Team also maintains a key interface with the Sites Planning Department regarding Air Force Use Permits. Additionally, strong liaisons are maintained with the Environmental Restoration (ER) Department.

SNL/NM desires to maintain and promote a high level of NEPA awareness among its project managers and personnel through training and availability of resources. The NEPA Compliance Team offers guidance through direct consultation and through specially developed NEPA guides that serve as a roadmap through the complex levels of NEPA regulation (SNL 1995e). The Team has also developed a number of NEPA courses for SNL personnel that can be accessed online through SNL/NM's internal web or presented in a classroom setting. Other new online resources include the NEPA Home Page and electronic checklists complete with extensive online help menus. In addition to these specific published and electronic guides, NEPA orientation information is given in Chapter 10, Sections I, R, and S in the ES&H Manual (SNL 1995f, SNL 1995g, and SNL 1996h).

3.7 ENVIRONMENTAL MONITORING PROGRAMS

Environmental monitoring at SNL/NM began in 1959 at which time its principal objective was to monitor radioactive effluent and any associated environmental impacts. Since then, environmental monitoring, along with other ES&H activities, has greatly expanded at SNL/NM. Monitoring now includes measurements of both radioactive and nonradioactive constituents present within effluents and emissions in the ambient environment. Monitoring of the ambient environment is performed at routine intervals to establish the baseline presence and/or migration of contaminants in the environment—including air, soil, vegetation, surface water, and groundwater monitoring. These specific pollutant monitoring and environmental surveillance activities are covered in the remaining chapters of this report.

4 TERRESTRIAL SURVEILLANCE

The two major activities comprising environmental monitoring are environmental surveillance and effluent monitoring. The purpose of environmental surveillance is to measure ambient levels of pollutants in the environment and assess changes over time as compared to baseline or "natural" conditions. This chapter discusses that part of environmental surveillance that concerns terrestrial surface media. Other environmental surveillance programs have been developed for ambient air and groundwater (discussed in Chapters 5 and 7).

4.1 PROGRAM BACKGROUND

Terrestrial surveillance is performed by SNL/NM's Environmental Monitoring and Reporting Department Staff on an annual cycle. Program objectives are based on the requirements of DOE Orders 5400.1 and 5400.5 (DOE 1988a, and DOE 1990a). Though the performance of this activity is not externally regulated, pollutant levels are compared to standards where they exist (such as proposed RCRA action levels for soils and 40 CFR 143.3–Secondary Maximum Contaminant Levels). Soils and sediments are also compared to U.S. Surface Soil (CRC 1992) averages and local background levels. There are no set regulatory standards for radiological contaminants in soil.

Terrestrial surveillance activities include the collection of environmental samples and the examination of raw data and statistical analyses to determine impacts, if any, to the environment. The Terrestrial Surveillance staff currently collects environmental samples from surface water, soil, sediment, and vegetation. The measurement of ambient levels of gamma radiation (from both man-made and natural sources) are also performed quarterly. Terrestrial samples are collected from within all SNL/NM operational areas and at offsite locations up to a 25-mile radius of Sandia's facilities.

Sample analysis includes radiological and nonradiological parameters, providing a broad base of analytes to characterize environmental conditions. The data derived from these environmental measurements are used to identify contaminants, if present; establish the magnitude and location of contaminants; and ascertain if trends are present at a site—indicating either decreasing or increasing levels. The analysis performed on samples includes measuring annual sample parameter values as well as statistically analyzing current and past year's results to compare and determine if statistically significant differences exist. Most importantly, statistical analysis is used to determine if elevated levels are caused by SNL operations and, if so, to recommend or initiate further investigation and mitigation measures.

Program Objectives

Terrestrial Surveillance Program objectives are summarized in the following excerpts based on requirements given in DOE Order 5400.1:

- Collect and analyze samples so as to characterize environmental conditions and define increasing or decreasing trends;
- Establish background levels of pollutants to define baseline conditions;
- Provide a continuing assessment of pollution abatement programs;
- Identify and quantify new or existing environmental quality problems and their potential impacts, if any;

- Verify compliance with applicable environmental laws and regulations and commitments made in NEPA or other official documents.

4.2 SAMPLING LOCATIONS

Terrestrial sampling in 1996 was performed from late July to early August at 72 fixed locations. Fixed locations remain relatively constant from year to year to provide a basis for statistical comparisons. New locations, however, are added as necessary to reflect ongoing activities such as new facility start-ups, environmental remediation activities, and new sites of contaminant discovery. Conversely, some locations may be removed from the survey in conformance with current program objectives or to allow resources for new locations to be established in areas that are potentially more relevant. Other considerations that support the determination of an optimum sampling site include topography, wind direction, and the proximity to existing sampling sites (so as to reduce redundant data). No new sites were added in 1996, although one site was removed (65 – Sandia Research Park).

Sampling locations are located in three distinct areas:

- **Onsite** locations are sited within areas of past or present SNL/NM operations. Sampling areas are located either in areas of known or potential contamination (for example, near ER sites, reactor facilities, and landfills) or in areas where samples would likely provide a representative profile of the general pollutant accumulation from Sandia facilities as a whole. There are currently 39 onsite locations.

- **Perimeter** locations are sited within close proximity of SNL/NM operational areas on and off of KAFB. Perimeter locations are used to establish if contaminants are migrating to or from SNL/NM site operational areas. There are currently 17 perimeter locations.

- **Offsite** locations are chosen in areas where little, if any, contamination from any source is expected, and far enough away from SNL/NM operations that any contamination present cannot be SNL-derived. This provides a "clean environment" baseline from which SNL staff can statistically compare onsite and perimeter data. Offsite data is collected from 16 locations within a 25-mile radius of SNL/NM facilities. Nine of these locations are strictly thermoluminescent dosimeter (TLD) monitoring locations.

Figure 4-1 illustrates onsite and perimeter sampling locations. Tables 4-1 and 4-2 list onsite and perimeter locations and the media that was collected from each site in 1996. Similarly, Figure 4-2 shows offsite locations; Table 4-3 lists the corresponding location information.

4.3 MEDIA COLLECTED

Table 4-4 shows the type of analysis conducted on each media type collected. The sample size, collecting method, and sampling criteria for each environmental media sampled are described below.

Soil samples were gathered from 49 locations using a small trowel to scoop not more than a few inches from the ground surface. Samples are desiccated before analysis. Soil samples are used to ascertain the presence of air deposited contaminants.

Sediment samples were collected from 10 locations. A small trowel is also used for collecting sediments. Samples were collected from two dry arroyos onsite and near the waters edge at the Rio Grande, an offsite creek, and Coyote Springs. Desiccated samples are used to characterize water-transported or water-deposited contaminants.

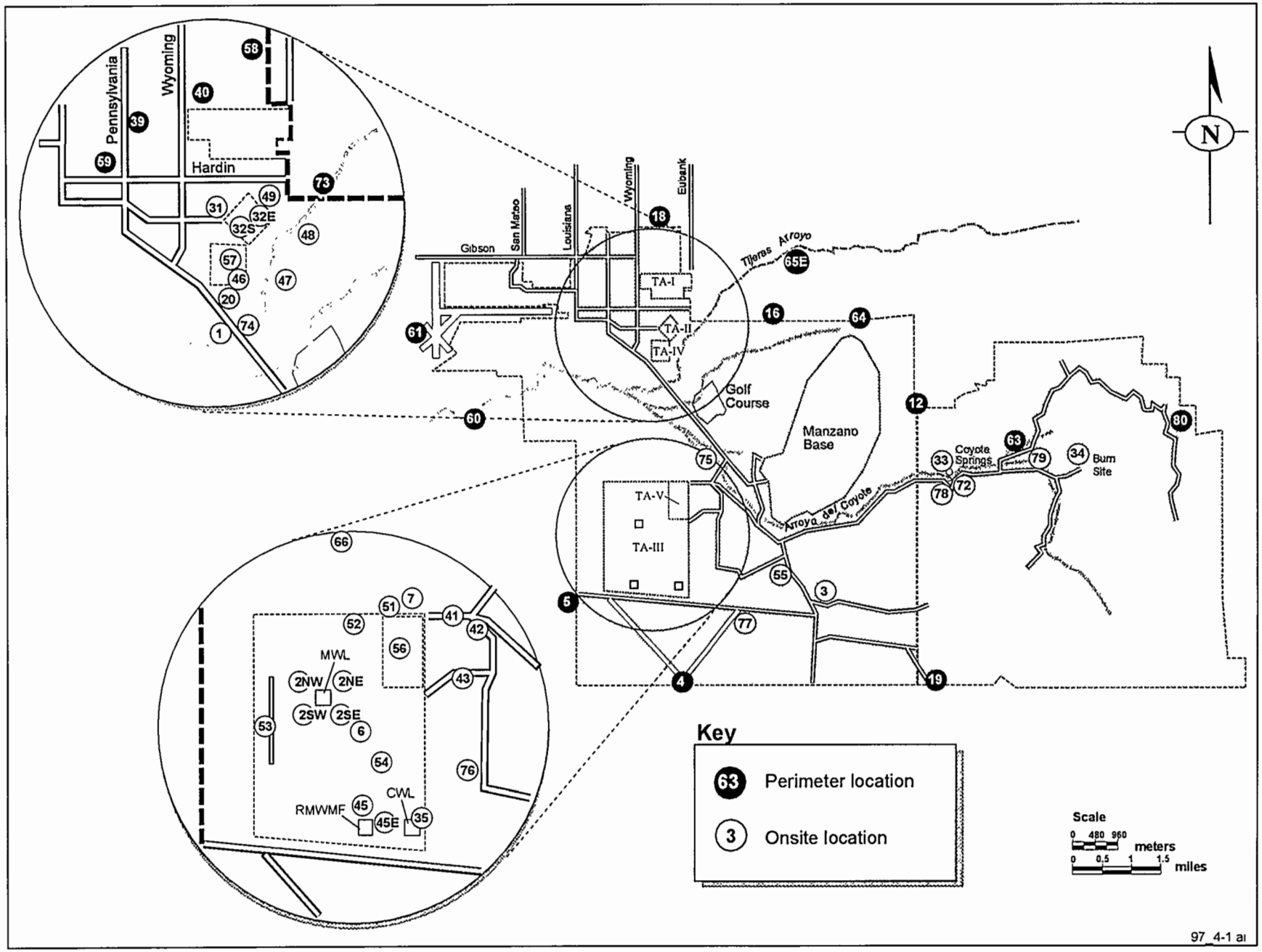

Figure 4-1. Onsite and perimeter sampling locations. Onsite locations are within areas of SNL operations. Perimeter locations are located both on and off KAFB property.

Table 4-1. Onsite terrestrial surveillance locations and sample types. There are 39 onsite sampling locations.

Location Number	Sampling Location	Vegetation	Soil	Surface water	Sediments	TLD
Onsite Locations						
1	Pennsylvania Ave.		⌖			⌸
2NW	Mixed Waste Landfill (northwest)	❖	⌖			⌸
2NE *	Mixed Waste Landfill (northeast)	❖	⌖			
2SE	Mixed Waste Landfill (southeast)		⌖			
2SW	Mixed Waste Landfill (southwest)		⌖			
3	Coyote Canyon Control		⌖			⌸
6	TA-III (east of water tower)	❖	⌖			⌸
7 *	Unnamed Arroyo, north of TA-V		⌖			⌸
20 *	TA-IV, (southwest)	❖	⌖			⌸
31	TA-II Guard Gate					⌸
32S	TA-II, Bldg. 935 (south bay door)		⌖			
32E	TA-II, Bldg. 935 (east personnel door)		⌖			
33	Coyote Springs	❖	⌖	💧		
34	Lurance Canyon Burn Site	❖	⌖			
35	Chemical Waste Disposal Site	❖	⌖			
41	TA-V (northeast fence)		⌖			⌸
42	TA-V (east fence)	❖	⌖			⌸
43	TA-V (southeast fence)	❖	⌖			⌸
45	RMWMF, TA-III (northwest corner)	❖	⌖			⌸
45E	RMWMF, TA-III (east fence)					⌸
46	TA-II (south corner)	❖	⌖			⌸
47	Tijeras Arroyo (east of TA-IV)					⌸
48	Tijeras Arroyo (east of TA-II)					⌸
49	Near the ECF site	❖	⌖			
51	TA-V (north of culvert)	❖	⌖			
52	TA-III, northeast of Bldg. 6716 & 6717	❖	⌖			
53 *	TA-III south of long sled track		⌖			
54	TA-III, Bldg. 6630		⌖			
55	LMF, Bldg. 9939	❖	⌖			
56	TA-V, Bldg. 6588 (west corner)		⌖			
57	TA-IV, Bldg. 970 (northeast corner)		⌖			
66	KAFB Facility	❖	⌖			
72	Arroyo del Coyote (midstream)				⊗	
74	TA-IV, Tijeras Arroyo (midstream)				⊗	
75	Arroyo del Coyote (downgradient)				⊗	
76	Thunder Range (north)		⌖			
77	Thunder Range (south)		⌖			
78	South House Mesa		⌖			
79	Arroyo del Coyote (upgradient)				⊗	

NOTE: * Replicate sampling locations: In addition to single samples taken for each media, two replicated samples are collected for internal checks on consistency of laboratory results.

Table 4-2. Perimeter terrestrial surveillance locations and sample types. There are 17 perimeter sampling locations.

Location Number	Sampling Location	Vegetation	Soil	Surface water	Sediments	TLD
Perimeter Locations						
4	Isleta Reservation Gate	❖	⌖			⊡
5	McCormick Gate	❖	⌖			⊡
12	Northeast Perimeter	❖	⌖			
16	Four Hills		⌖			⊡
18	North Perimeter Road					⊡
19	USGS Seismic Center Gate		⌖			⊡
39	Northwest DOE Complex					⊡
40	TA-I, northeast (by Bldg. 852)					⊡
58	North Base Housing	❖	⌖			
59	Zia Park (southeast)		⌖			
60	Tijeras Arroyo (downgradient)	❖	⌖		⊗	
61	Albuquerque International Sunport (west)		⌖			
63	No Sweat Boulevard		⌖			
64 *	North Manzano	❖	⌖			
65E	Tijeras Arroyo, east (upgradient)		⌖		⊗	
73 *	Tijeras Arroyo (upgradient)				⊗	
80	Madera Canyon		⌖			

NOTE: * Replicate sampling locations: In addition to single samples taken for each media, two replicated samples are collected for internal checks on consistency of laboratory results.

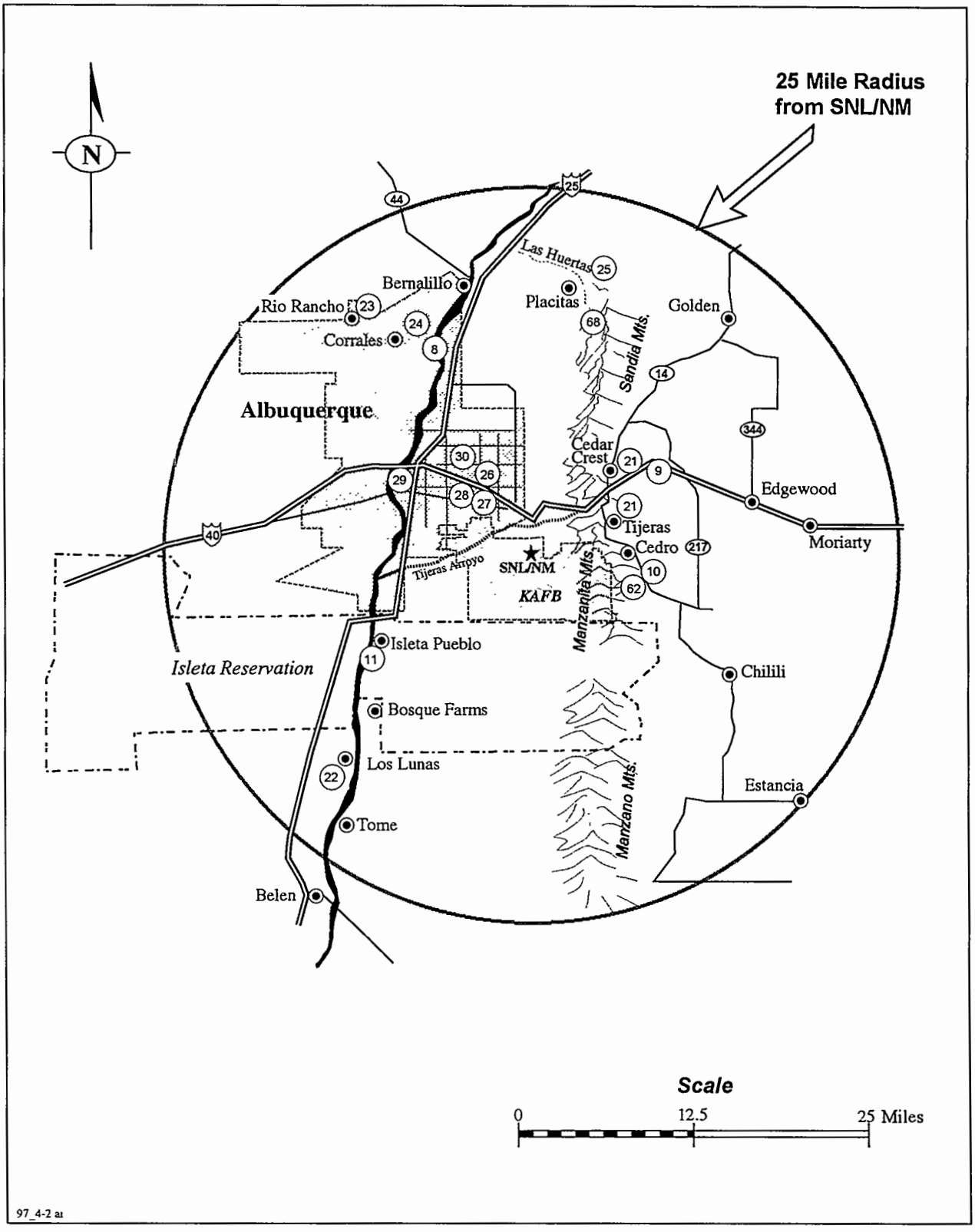

Figure 4-2. Offsite sampling locations.

Table 4-3. Offsite terrestrial surveillance locations and sample types. There are 16 offsite sampling locations within a 25-mile radius of SNL/NM operations.

Location Number	Sampling Location	Vegetation	Soil	Surface water	Sediments	TLD
Offsite (Community) Locations						
8	Rio Grande, Corrales Bridge (upgradient)	❖	⌖	♦	⊗	
9	Sedillo Hill, I-40 (east of Albuquerque)	❖	⌖			
10	Oak Flats	❖	⌖			⊡
11 *	Rio Grande, Isleta Pueblo (downgradient)	❖	⌖	♦	⊗	⊡
21	Bernalillo Fire Station 10, Tijeras					⊡
22	Los Lunas Fire Station					⊡
23	Rio Rancho Fire Station, 19th Ave.					⊡
24	Corrales Fire Station					⊡
25	Placitas Fire Station	❖	⌖			⊡
26	Albuquerque Fire Station 9, Menaul NE					⊡
27	Albuquerque Fire Station 11, Southern SE					⊡
28	Albuquerque Fire Station 2, High SE					⊡
29	Albuquerque Fire Station 7, 47th NW					⊡
30	Albuquerque Fire Station 6, Griegos NW					⊡
62	East resident	❖	⌖			
68	Las Huertas Creek			♦	⊗	

NOTE: *Replicate sampling locations: In addition to single samples taken for each media, two replicated samples are collected for internal checks on consistency of laboratory results.

Table 4-4. Analysis performed on environmental media sample types.

Media	Radiological Analysis					Nonradiological Analysis	
	Gross Alpha	Gross Beta	Gamma Spec	Tritium	U_{tot}	ICP-20 Metals	Percent H20
Soil			✓	✓	✓	✓	✓
Sediment			✓	✓	✓	✓	✓
Vegetation			✓	✓	✓ (new)	✓	✓
Surface Water							
- Filtered	✓	✓	✓	✓	✓	✓	
- Unfiltered	✓	✓	✓	✓	✓	✓	
- Filters (Suspended Solids)	✓	✓	✓	✓	✓	✓	

NOTE: ICP = inductively coupled plasma.

Vegetation samples were collected from 29 locations and primarily consisted of grasses. Grass is preferred due to its abundance and ubiquitous presence, though other vegetation is used if grasses are not available in the area. Samples are taken from the tops of the plant only. Also, a small leafy green foodstuff experimental garden was grown in TA-III during 1996: the sample results obtained from the garden were compared to vegetative results from the other locations sampled within TA-III. Study results are discussed in Section 4.7.

Surface water grab samples were collected from four locations including Las Huertas Creek, Coyote Springs, and two from the Rio Grande. Because there is a lack of standing perennial surface water on KAFB (only 2 springs), Coyote Springs is the only location sampled onsite. (It should be noted that comparing spring water to river water is not an ideal comparison). Rio Grande samples were taken at upgradient and downgradient locations relative to SNL/NM facilities. Water samples are separated into three divisions: unfiltered water (total water), filtered water, and suspended solids collected off filters (suspended solids > 0.45 micron [um]).

Thermoluminescent dosimeters (TLDs) are used to measure levels of gamma radiation in the ambient environment. Measurements are taken quarterly (TLDs are exchanged in Jan., Apr., Jul., and Oct.) at 33 stations. Gamma radiation is emitted by various naturally occurring radionuclides, potentially contaminated areas, cosmic rays, and some test facilities at SNL/NM.

TLDs are placed within film canisters and are located in open areas on aluminum poles at a height of 1–1.5 m.

4.4 PRIORITIZATION ANALYSIS METHODOLOGY

A new method developed in 1995 and published in 1997, referred to as Prioritization Statistical Analysis Methodology, was used to report 1995 and 1996 data (Shyr, Herrera, and Haaker 1997). This method is based on categorizing sampling locations into four groups to simplify—and bring clarity to—the presentation of results.

Data from onsite and perimeter locations over the last six years (August 1991 to August 1996) were compared to data from offsite locations gathered during the same time period. This set of data provides a record from which to perform a trend analysis. Onsite and perimeter data were also compared to detection limits, U.S. Surface Soil averages (CRC 1992), proposed RCRA (Subpart S) action levels (where available), and Secondary Maximum Contaminant Levels for drinking water.

The prioritization method is based on two questions:

(1) Are the results higher than offsite (baseline) measurements?

(2) Is there an increasing trend over the last six years?

Table 4-5 lists the four priority level categories and specifies the actions that will be taken for each location depending on the designated category. Because Category 4 locations are of no concern, only Category 1, 2, and 3 locations will be discussed. However, since the inception of the method, no Category 1 locations (worst case) have been identified.

4.5 TERRESTRIAL SURVEILLANCE RADIOLOGICAL RESULTS

4.5.1 Radiological Parameters

The following sections present summary radiological data from soil, sediment, vegetation, and surface water samples. A full report detailing terrestrial surveillance data results can be found in the *1996 Environmental Surveillance Data Analysis Report* (SNL 1997d).

Table 4-5. Decision matrix for determining priority action levels based on categories assigned at each sampling location.

Are contaminant measurements higher than offsite?	Is there an increasing trend over the last 6 years?	Category	Priority for further investigation
Yes	Yes	1	1st Priority - Immediate attention needed. Specific investigation planned and/or notifications made to responsible parties.
Yes	No	2	2nd Priority - Some concern. Investigation planned and/or notifications made to responsible parties.
No	Yes	3	3rd Priority - Only a minor concern since contaminants present are not higher than offsite values. An investigation may or may not be needed.
No	No	4	4th Priority - No concern. No further investigation required.

NOTE: Based on *Prioritization Statistical Analysis Methodology* (Shyr, Herrera, and Haaker 1997).

Radiological analyses include the following analytical procedures performed on all sample media except where noted:

- **Gross alpha:** detects the presence of alpha-emitting isotopes. A high result may trigger an isotopic analysis. Currently, this test is only run on water samples.
- **Gross beta:** detects the presence of beta-emitting isotopes. Again, a high result may trigger an isotopic analysis. Currently, this test is only run on water samples.
- **Gamma spectroscopy:** identifies and quantifies the presence of gamma-emitting isotopes (such as Cesium-137, a ubiquitous element present in the environment from nuclear atmospheric testing).
- **Tritium:** is a common DOE-related contaminant that is also naturally occurring in the environment.
- **Uranium, total (U_{tot}):** is a general trend indicator for detecting all isotopes of uranium. Elevated levels may trigger an isotope-specific analysis.

4.5.2 Onsite and Perimeter Radiological Results

The following paragraphs summarize the radiological results for onsite and perimeter locations with respect to each sample media and the radiological parameter tested. Significant locations that have been designated as Category 2 or 3 are also summarized in the shaded boxes. These results are presented graphically in Figure 4-3. Environmental sampling by Terrestrial Surveillance staff is shown in Figure 4-4.

Soil Results for Tritium

There were no changes from the 1995 status for Category 2 sites; locations **32E** and **32S** east of TA-11, and location **2NE** near the Mixed Waste Landfill (MWL), are areas of known tritium soil contamination. All three remained elevated but showed no increasing trend. The average result for 1996, combining these three sites, was 20.13 picocuries per milliliter (pCi/ml).

Changes were observed in Category 3 locations. Location **33**, which at first indicated

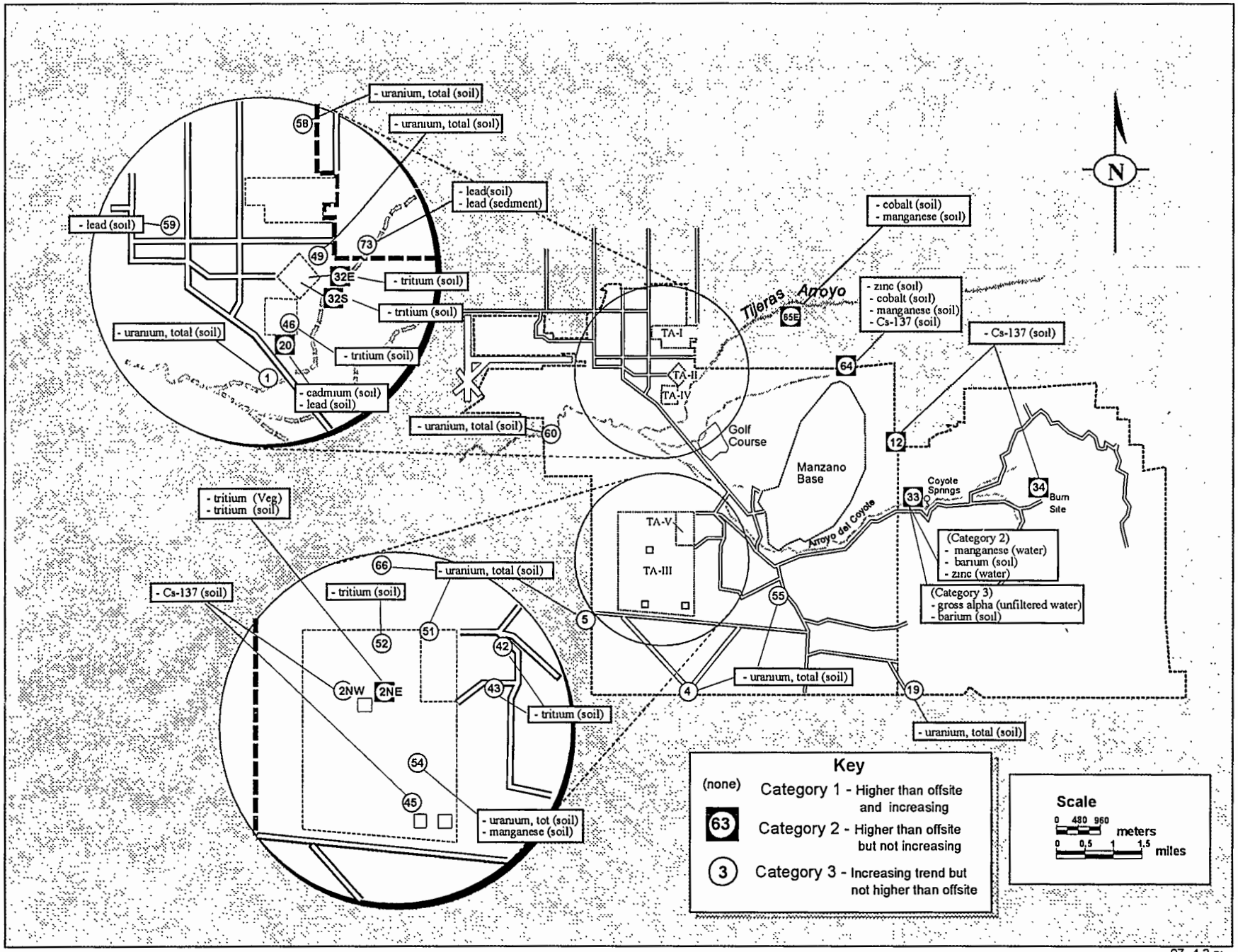

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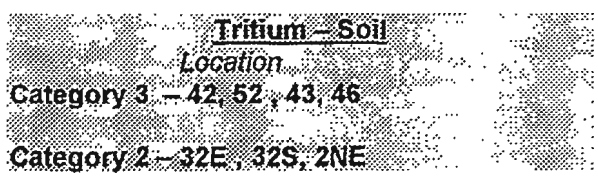
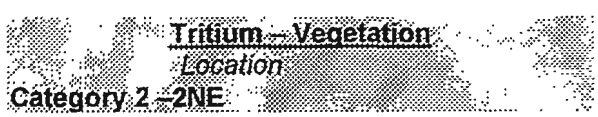
Figure 4-3. Onsite and perimeter sampling with Category 2 or Category 3 designations. Both radiological and nonradiologica parameters that show increasing or higher than offsite values are called out in the boxes at each location. (Category 4 sites are of no environmental concern and, therefore, are not discussed.)

an increasing trend for tritium in soil last year, no longer showed this trend; the high value recorded in May 1995 was negated by lower results from the second-period sampling in August 1995 and the August 1996 results. Other changes from last year were the addition of two Category 3 designated sites at location **42** and **52,** which showed increasing tritium where no measurable tritium had been detected before. Because these levels are only slightly elevated above the detection limit with results between 0.1 and 0.3 pCi/ml, it is not an operationally significant measurement. Results for Category 3 locations **43** and **46** remained similar to last year. Excluding the known contamination at sites **32E, 32S,** and **2NE,** onsite locations averaged 0.72 pCi/ml. Offsite averages were 0.03 pCi/ml.



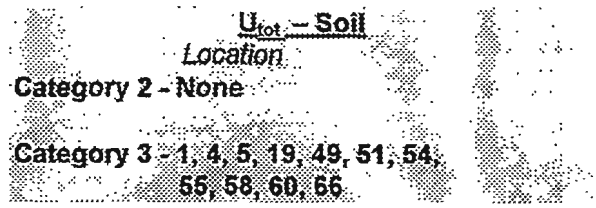
Vegetation Results for Tritium

Location **2NE** near the Mixed Waste Landfill (MWL) showed Category 2 results for tritium. This was the only site that showed elevated radiological results in vegetation.



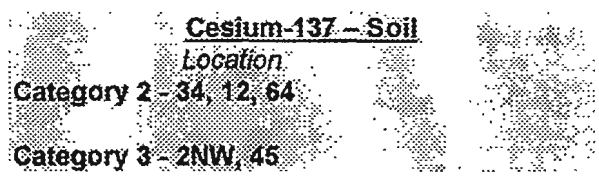
Soil Results for Uranium, total (U_{tot})

Similar to the 1995 analysis, there were no onsite values higher than offsite results. Category 3 locations changed with the removal of four previously designated locations from the list: **3, 32S, 42,** and **43.** The highest recorded value for these locations was during the 1994 sampling period; the value has since dropped thereby negating the increasing trend. Location **54** was new in 1996 showing values between 0.2 and 2.1 micrograms per gram (ug/g) for soil with a mean result of 0.89 ug/g. Offsite soil values were higher, averaging 1.93 ug/g.



Soil Results for Cs-137

There were no changes in Categories 2 and 3 designations from the 1995 analysis. Elevated results with no increasing trend (Category 2) were noted at locations **34, 12,** and **64;** all were on or near the withdrawal area in the northeast section of KAFB. Category 3 sites were noted at locations **2NW** and **45** both within TA-III, at the MWL and near the Radioactive and Mixed Waste Management Facility (RMWMF), respectively. Results from onsite sampling ranged from 0.09 pCi/g to 0.66 pCi/g. These values are within the range of background Cs-137 concentrations from soils in the Albuquerque vicinity (Hostak 1995). Offsite results ranged from 0.13 to 0.58 pCi/g.



Radiological Results for Surface Water

Coyote Springs, location **33,** is the only surface water sampling area onsite. This location was classified as Category 2 for several analytes—in error—during 1995; U_{tot} was reported as elevated in total water, filtered water, and suspended solids; gross alpha was reported as elevated in suspended solids. However, after corrections, the statistical differences showed that results were actually less than offsite values. Gross Alpha this year, however, does show an increasing trend (Category 3) in unfiltered water samples though readings remain lower than offsite values.

Radiological - Surface Water
Location
Category 2 - none
Category 3 - 33 (gross alpha)

Figure 4-4. Environmental monitoring staff collecting samples.

Thermoluminescent Dosimeter (TLD) Results

During 1996, the RMWMF went into operation. As a result of the handling of low level radioactive waste (LLW) at this facility, locations 45 and 45E are no longer considered representative of ambient levels of gamma radiation onsite at SNL/NM. Locations 45 and 45E are now classified as operational, and these results will be reported to RMWMF facility personnel. Table 4-6 shows 1996 TLD results for comparison purposes. The entire sampling period for 1996 was 370 days (Jan 3, 1996 - Jan 7, 1997).

In order to retain consistency with other terrestrial surveillance activities at SNL/NM, TLD results from 1991 through 1996 were compared for statistical analysis purposes, although, TLD results from 1983 through 1996 are on file and readily accessible.

Only onsite, perimeter, and community TLD results will be compared. (Locations 45 and 45E are excluded from the statistical analysis for reasons mentioned above.) There is no statistical difference between onsite, perimeter, or community TLD results. Figure 4-5 shows TLD results from 1991 through 1996 by location class.

4.6 TERRESTRIAL SURVEILLANCE NONRADIOLOGICAL RESULTS

4.6.1 Nonradiological Parameters

Beginning in 1993, the scope of the Terrestrial Surveillance Program was broadened to include sample analysis of certain metals that are key indicators of contaminants in soil. The list of 21 metals has been modified over time to best represent a broad range of toxic pollutant indicators that are based on RCRA and CERCLA target list metals. The list has also been modified over time by removing some metals, which naturally occur in local soils and present no significant health risks. For example, silicon, calcium, strontium, and titanium were removed from the analyte list in 1996 and replaced by thallium, selenium, arsenic, and antimony. Metals (with the exception of mercury) are analyzed by EPA's Inductively Coupled Plasma-Atomic Emission Spectrum (ICP-AES) method. The 21 nonradiological parameters are as follows:

Aluminum (Al)	Arsenic (As)
Antimony (Sb)	Chromium (Cr)
Cadmium (Cd)	Cobalt (Co)
Copper (Cu)	Barium (Ba)
Beryllium (Be)	Iron (Fe)
Lead (Pb)	Mercury (Hg)
Manganese (Mn)	Magnesium (Mg)
Nickle (Ni)	Potassium (K)
Silver (Ag)	Selenium (Se)
Thallium (Tl)	Vanadium (V)
Zinc (Zn)	

As was done for radiological results, locations were categorized from 1 to 4 based on the contamination present and the results from

the trend analysis. There were no sites designated as Category 1; Category 4 locations are of no environmental concern and are not discussed. Figure 4-3 shows locations where nonradionuclide contaminants have been assigned a Category 2 or Category 3. A full report detailing terrestrial surveillance data results can be found in the *1996 Environmental Surveillance Data Analysis Report* (SNL 1997d).

4.6.2 Onsite and Perimeter Nonradiological Results

Soil Results for all Metal Parameters

Category 2 sites included location **20** (near the skeet range) for cadmium and lead, **65E** and **64** for cobalt and manganese, and **64** for zinc. Category 3 sites included location **33** for barium, **59** for lead, and **54** for manganese. These sites are discussed individually below.

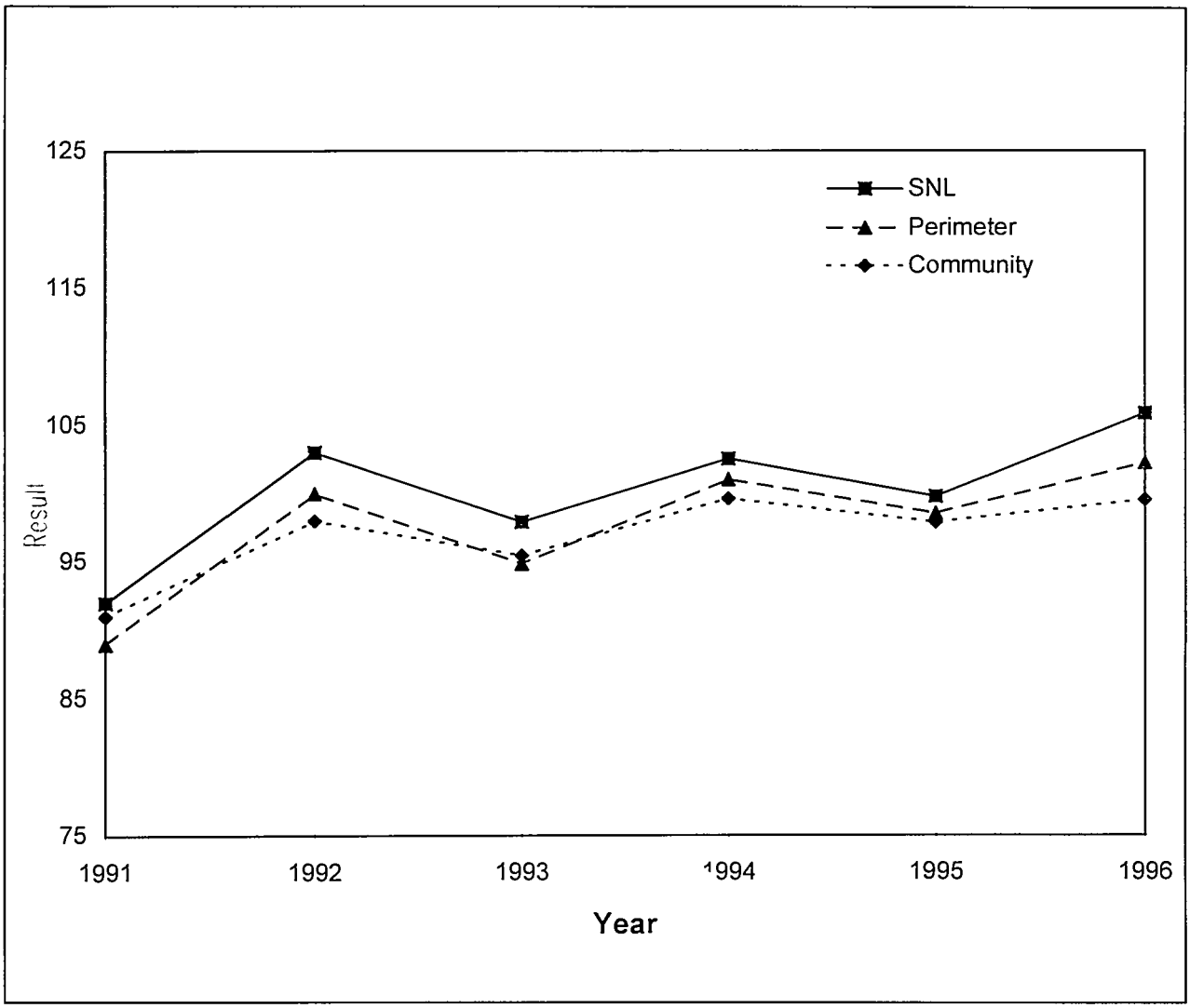


Figure 4-5. TLD results summarized over the past six years.

Table 4-6. Thermoluminescent dosimeter results for 1996.

Location Class	Sample Size	Mean	Std Dev	Minimum	Maximum
SNL/NM (Operational)	2	157.85	52.26	120.9	194.8
SNL/NM (Onsite)	13	105.81	6.15	95.5	115.6
Perimeter	7	102.19	12.63	89.0	126.8
Community	12	99.50	9.28	84.6	117.8

Positive indications are that 27 of the 56 total onsite and perimeter sampling locations were designated as Category 4 (no concern). Many of these sites showed values significantly below community levels and/or demonstrated decreasing trends. Several locations were taken off the Category 2 or 3 designation list from 1995 and are now also of no environmental concern. For example, location **16**, reported to have had elevated concentrations of zinc in 1995, was changed to a Category 4 in 1996. Locations **35, 2SE**, and **55**, classified as Category 3 for cobalt, copper, and lead in 1995, were also downgraded to Category 4.

- Location 20 - is at the KAFB skeet range. Samples are elevated for lead in the soil with an average of 7,750 ppm. A Toxicity Characteristic Leaching Procedure (TCLP) for lead was performed on soil samples to determine if lead shot from the skeet range was leaching into the soil (results indicate that it is not). The test results were forwarded to the Air Force and the Environmental Restoration (ER) Program to determine if further action is needed for this location. Average offsite lead values in soils were 18.67 ppm.

- Location 64 - is located on the KAFB perimeter north of Manzano base and is elevated for cobalt, manganese, and zinc. Previous sample analyses have also shown elevated levels for these three elements. Maximum cobalt concentration was recorded at 14 ppm as measured over the last six years. This is well below the proposed RCRA action level (4800 ppm) and also within the range of U.S. Surface Soil background cobalt concentrations (3 - 50 ppm) (CRC 1992). Maximum concentrations for manganese were reported at 760 ppm in August 1993. Although high, and above the proposed RCRA action level of 400 ppm, this was still within the average U.S. Surface Soil background levels of 20 - 3000 ppm. All other manganese results for 19 locations were between 490 and 590 ppm. Monitoring will continue at this site. If increasing levels continue to be noted, further analysis of this site will be initiated. The maximum value for zinc was reported in August 1993 at 110 ppm at a perimeter location (significantly below the proposed RCRA action level of 23,000 ppm). Since then, values have ranged between 64 and 78 ppm. In 1996, the average perimeter and offsite values (43.67 ppm and 41.17 ppm, respectively) were both higher than the average onsite value (33.84 ppm). The highest reported value is still within the range of average U.S. Surface Soil concentrations of 13 - 300 ppm (CRC 1992).

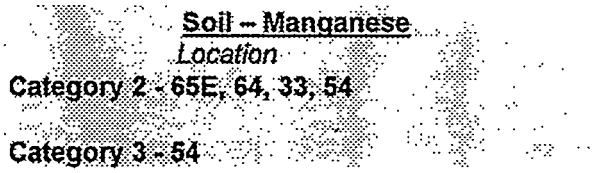
- Location 65E - is a new perimeter location that was added in 1995. It is located near the Tijeras Arroyo just upgradient of the point where the arroyo crosses over onto KAFB property. The location is designated as Category 2 with elevated manganese and cobalt concentrations. The maximum cobalt concentration in 1996 reported at 12 ppm is, however, significantly below the proposed RCRA action limit of 4800 ppm, and well within the average U.S. Surface Soil background levels of 3–50 ppm (CRC 1992). Manganese concentrations ranging from 460 to 750, however, are above the proposed

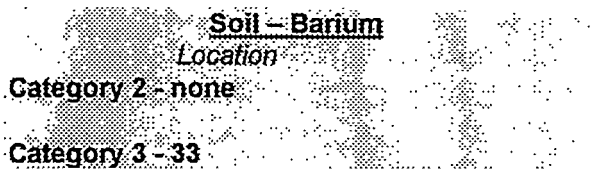
RCRA action limit of 400 ppm. Due to the limited sample size (three since 1995) monitoring will continue and any developing trends noted.

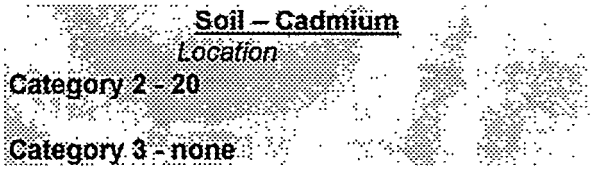
- Location 33 - is within the withdrawal area at Coyote Springs and is controlled for access. The site has also been posted, "Not a Source for Drinking Water," although it is still made available for local wildlife. For the first time, it was noted that barium in the soil shows an increasing trend (Category 3), with values ranging from 86 to 150 ppm. These concentrations are well within the range of soil concentrations reported for SNL soil concentrations (IT 1996). The range for U.S. Surface Soils is 20–1500 ppm (CRC 1992). The proposed RCRA Subpart S residential action limit for barium is 5600 ppm. No action is planned at this time because of the small values; however, monitoring will continue.

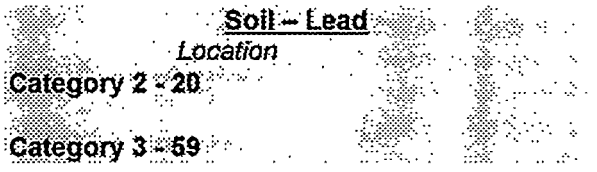
- Location 59 - is located at the corner of Hardin Road and Pennsylvania Boulevard near the on-base Zia Park Housing area. This year (1996) marks the first time that an increasing trend for lead was noted at this location. In the past six years, lead concentrations have been in the range of 8–19 ppm at this location. The concentrations are within the range of U.S. Soil Surface concentrations of 10–70 ppm (CRC 1992); there is no proposed RCRA Subpart S action level for lead. As this is the first year an increasing trend has been noted, no action is planned at this time and monitoring will continue.

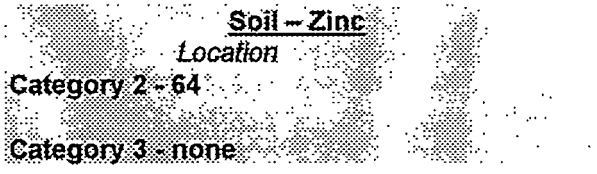
- Location 54 - is located within TA-III, near Bldg. 6630. For the first time, this location showed an increasing trend for manganese. Manganese concentrations are in the range of 140–170 ppm and are within the range of U.S. Surface Soil background levels of 20–3000 ppm, (CRC 1992) falling below the proposed RCRA action level of 400 ppm. The location will continue to be monitored closely to determine if manganese concentrations continue on an increasing trend.

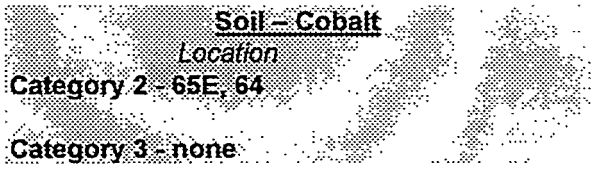












Sediment Results for All Metal Parameters

Sediments are collected from seven onsite and perimeter sampling locations at several points along two arroyos: Tijeras Arroyo and Arroyo del Coyote. There were no Category 2 designations and only one location classified as a Category 3: location **73** on the perimeter showed increasing lead values, as it did in 1995. The concentrations are low (5–7 ppm) and are below the U.S. Surface Soil backgrounds of proposed RCRA Subpart S action level, for lead (<10-70 ppm) (CRC 1992).

As a point of interest, for the remaining six sediment sampling areas, barium concentrations were statistically below concentrations reported for community levels. The other remaining metal analytes showed no statistical difference from offsite values.

Surface Water Results for all Metal Parameters

Surface water samples are collected at one onsite and three community locations. As mentioned above, Coyote Springs, location **33**, is posted as "Not a Source of Drinking Water." The location is designated as Category 2 with respect to manganese and zinc.

Manganese levels at Coyote Springs were recorded at 1.2–1.3 ppm in Total Water, and 1.2 –1.4 ppm in Filtered Water. (In 1995, manganese samples were also reported as elevated in the suspended solids samples, but did not show above community values in 1996.) Manganese is in the range of 24 to 30 times the level given in 40 CFR 143.3, Secondary Maximum Contaminant Levels (0.05 ppm). Secondary Maximum Contaminant Levels are goals related to the aesthetic quality of drinking water. The State may apply higher or lower levels as long as public health and welfare are not adversely effected. Manganese concentrations will continue to be monitored closely at this location.

Zinc was recorded at 0.038–0.056 ppm for Total Water, and 0.047–0.056 ppm for Filtered Water. Zinc was noted during the 1995 analysis, but concentrations are well below its established Secondary Maximum Contaminant Levels of 5 ppm. Zinc concentrations will continue to be monitored at this location.

4.7 ECOLOGICAL STUDIES

A biota monitoring pilot project began in 1995 as an additional element to SNL/NM's Terrestrial Surveillance Program. Biota data is not currently required by DOE Order 5400.1, although it is listed as an optional environmental sampling parameter. The following sections describe special ecological studies conducted in 1996.

4.7.1 TA-III Leafy Vegetable Garden

A one-time experimental leafy vegetable garden was grown in 1996 to obtain baseline results on foodstuff monitoring and as a screening tool by which to compare vegetation results obtained from other areas in TA-III. The garden, which contained three varieties of leafy vegetables, was planted near the Radioactive and Mixed Waste Management Facility (RMWMF). Results showed that eight analytes were observed at higher levels in the leafy vegetable garden than in the native vegetation. However, none of the stable element concentrations found in higher levels are considered toxic. Furthermore, the statistical difference in concentrations was not significant enough to require a repeat experiment in 1997. Foodstuff monitoring is not required by any authorities at this time; in accordance with DOE 5400.1, foodstuff monitoring is only required for facilities which report a radiological dose to the Maximally Exposed Individual (MEI) of at or greater than 0.1 mrem/year. The radioactive doses to the MEI resulting from SNL/NM activities is several magnitudes of order below this value—the MEI in 1995 was reported at 8.5×10^{-4} mrem/year (previous to planting in 1996).

4.7.2 TA-II Monitoring Study

Between May and June 1996, and during September, a special study was conducted to compare biota populations inhabiting the area around the Classified Waste Landfill in TA-II with control site populations located in the Manzanita Mountain area on the KAFB withdrawal. Various data sets were compiled including visual population counts, catch-and-release trapping, and wildlife specimen collection for tissue analysis. Populations

studied included small mammals, reptiles, amphibians, birds, and various plant species. None of the species collected were on State or Federally listed threatened or endangered (T/E) species lists.

The two basic components to the study were baseline monitoring and contamination monitoring. Baseline monitoring was performed to record basic environmental conditions at both the control site and the landfill area such as population density estimates, and plant/animal species identification. The catch-and-release portion of the study recorded individual data on each captured animal including species, sex, various body dimensions, and number of recaptures. The contaminant monitoring portion of the study required seven samples to be collected for whole-body analysis to determine what internal contaminant loads were present. Tissue samples were analyzed for radiological parameters—tritium, Strontium-90, U_{tot}, and by gamma spectroscopy. Nonradiological parameters included all metals as listed in Section 4.6.1. Results were compared to determine statistical differences between species located in the vicinity of the known contaminated area with species from the uncontaminated control site.

Baseline Monitoring Results

The following information summarizes the baseline results from TA-II study. All results are given in the ecological monitoring report (SNL 1997e).

- **Small mammals** trapped and released in the TA-II landfill area and control area consisted of four species: the deer mouse (*Peromyscus maniculatus*), the silky pocket mouse (*Perognathus flavus*), the wood rat (*Neotoma spp.*), and the spotted ground squirrel (*Spermophilus spilosoma*). During the summer (May/June), 38 animals were captured, of which eight were recaptures within the same trapping period. In general, population estimates from 1995 were at least two to three times higher in both areas than that recorded in 1996. The decrease in population was possibly related to the severe drought conditions in 1996.

- **Bird** species present in the area were identified by both visual and acoustical methods. In 1995, 14 species were recorded; in 1996, the count dropped to eight species (one of which was not previously identified in 1995). Bird species identification and estimated populations are described in the ecological monitoring report (SNL 1997e).

- **Reptile and Amphibian** populations and species determination were counted from both in-field visual identification and identification of trapped individuals. The sample size, however, was disappointingly small with only one amphibian, a Western spadefoot toad (*Scaphiopus hammondi*), and four snakes: Western diamond back rattlesnake (*Crotalus atrox*), prairie rattlesnake (*Crotalus viridis viridis*), New Mexico whiptail (*Snemidophoroous neomexicanus*), little striped whiptail (*Cnemidophorus inornatus*), and a desert grassland whiptail (*Cnemidophorus uniparens*). Density estimates could not be determined due to the small sample size.

- **Vegetation** representative of the TA-II was determined by recording plants present on predetermined points along several linear transects. Species identification and relative abundance was very similar to 1995 results.

Contamination Monitoring Results

During the May trapping session, seven rodent samples were collected for tissue analysis from the TA-II and control sites. The seven individuals included four species: the silky pocket mouse, the brush mouse (*Peromyscus boylii*), the pinion mouse (*Peromyscus trueii),* and the deer mouse. The two sample t-test was used in the analysis of analytes exceeding the Minimum Detectable Levels (MDLs) (Herrera 1996). Analytes included Al, Cu, Fe, Mg, Mn, K, Si, Sr, Zn, and K-40. Higher results were observed at

the TA-II site for three analytes—Al, Sr, and Fe. Ecological monitoring will continue in 1997.

4.8 TERRESTRIAL SURVEILLANCE DOCUMENT SUMMARY

All important program documents related to activities conducted by the Terrestrial Surveillance Program, as part of the Environmental Monitoring and Reporting Department, are listed in Table 4-7.

Table 4-7. Important documents for the Terrestrial Surveillance Program.

Program Document	Reference
1996 Annual Summary Pamphlet - SNL/NM	Pope, 1997
1996 Annual Site Environmental Report - SNL/NM	(this report)
Environmental Monitoring Plan - (SNL & KTF-Hawaii)	SNL 1996i
Environmental Protection Implementation Plan 95 (EPIP)	SNL 1995l
Quality Assurance Project Plan (QAPjP) - ESF	SNL 1996j
Preliminary Hazard Assessment - Environmental Surveillance	SNL 1994a
Environmental ALARA	SNL 1996k
A Prioritization & Analysis Strategy for Environmental Surveillance Results	Shyr, Herrera, and Haaker 1997
Ecological Monitoring for '96: Small Mammals, Reptiles, Amphibians, Birds, and Vegetation	SNL 1997e

5 AIR QUALITY COMPLIANCE and METEOROLOGICAL MONITORING

SNL/NM produces both radiological and nonradiological air pollutants from facility operations that include R&D activities, environmental remediation, waste handling, steam-generated heating, paint and machine shop production, emergency generator use, and vehicle emissions. Air quality compliance is met by compliance to specific permit conditions, ambient air monitoring surveillance, and periodic direct emission sampling, as required. Currently, there are only five radionuclide-producing facilities that require periodic sampling. SNL/NM complies with local, State, and Federal regulations in accordance with the objectives of the Clean Air Act (CAA) and the Clean Air Act Amendments (CAAA) of 1990.

5.1 METEOROLOGICAL MONITORING PROGRAM

The Meteorological Monitoring Program at SNL/NM commenced operations in January 1994 with the initiation of the Clean Air Network (CAN) Program. This program, a part of the Environmental Monitoring and Reporting Department, conducts both meteorological and ambient air monitoring activities (Section 5.2). Applicable program documents for the Meteorological and Ambient Air Monitoring Programs are listed at the end of the chapter in Table 5-13.

The Meteorological Program is integral to compliance with 40 CFR 61—National Emission Standards for Hazardous Air Pollutants (NESHAP), proposed 10 CFR 834—Radiation Protection of the Public and the Environment, and DOE Orders—specifically, 5400.1 (DOE 1988a), 5400.5 (DOE 1990a), and 5500.3 (DOE 1991a). Meteorological data generated is consistent with program guidelines required for regulatory modeling applications.

Tower Instrumentation

The meteorological monitoring network consist of eight fully instrumented meteorological towers: six 10-meter towers, one 50-meter tower, and one 60-meter tower. Tower locations are illustrated in Figure 5-1. All meteorological towers are instrumented to measure temperature, wind velocity, and the standard deviation of horizontal wind speed (sigma theta) at 3- and 10-meter levels—and at the top of the two taller towers. (The exception is tower A15, which has no 3-meter level instrumentation.) Additionally, relative humidity is measured at all 3-meter instrumented levels. Both rainfall and barometric pressure are measured at the 1-meter level at towers A36 and A21; tower SC1 measures rainfall only at the 1-meter level. All instrumentation is checked weekly and calibrated routinely.

Uses for Meteorological Data

The primary objective of the Meteorological Program is to provide representative local meteorological data for atmospheric dispersion and transport calculations used in NESHAP dose assessment. Other uses include providing meteorological information to emergency response personnel in the event of a hazardous or other unplanned releases contributing to the regulatory permitting process and decision making; determining optimum air monitoring station locations—based on wind speed and directions; and providing meteorological data to SNL/NM's R&D projects.

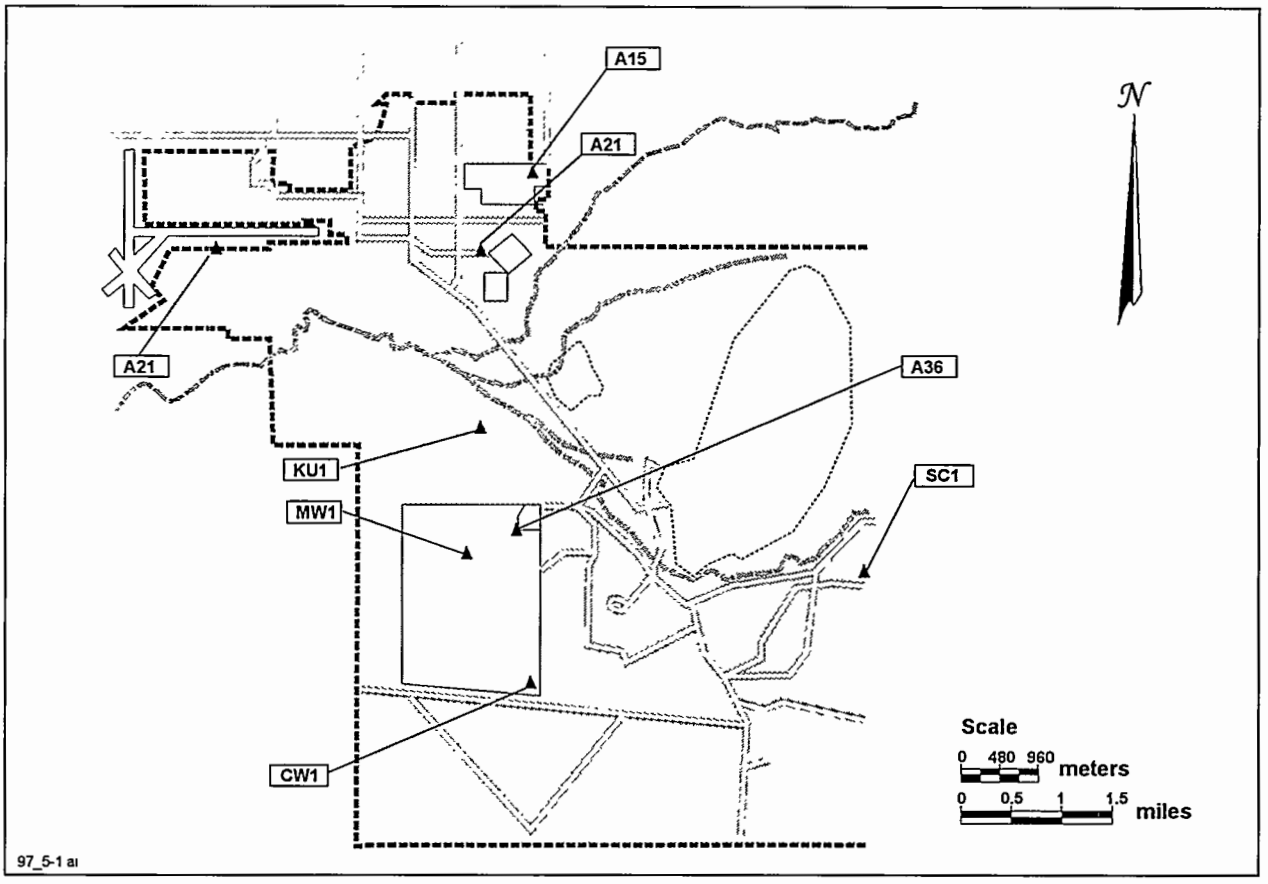


Figure 5-1. The meteorological tower newtwork at the SNL/NM site.

5.1.1 Meteorological Monitoring Results

The A36 60-meter meteorological tower is used to describe general meteorology at SNL/NM because of its central geographic position and availability of data at all instrument levels. The A15 50-meter tower, while closer to the most populous part of SNL/NM in TA-I, shows micro-scale urbanization effects not seen within the rest of the network. An annual climatic summary developed with information from the A36 tower is shown in Table 5-1.

In general, the annual statistics for each of the towers are similar. However, daily meteorology at each site varies considerably across the network. This has implications on transport and dispersion of pollutants, which is particularly important in atmospheric emergency scenarios and dispersion modeling. Table 5-2 lists some of the extremes and variations found in meteorological measurements across SNL/NM.

5.1.2 Wind Analysis

Figure 5-2 portrays annual wind roses for three locations across SNL/NM. A wind rose is a graphical presentation of a wind speed and direction frequency distribution. Wind direction is the true bearing when facing the wind (the direction from which the wind is blowing). As can been seen from the figures, wind directions and speeds can vary significantly across SNL/NM. While not shown, the annual wind frequency distribution for TA-I shows a different pattern with the greatest direction frequency from the east and east-northeast, as winds

1996	% Data Recovery *	Temperature (°C) Average	Temperature (°C) Maximum	Temperature (°C) Minimum	Wind (m/sec) Average	Wind (m/sec) Maximum	Rain (cm) Average	Rain (cm) Maximum in 24 hr	Pressure (mb) Average Pressure	Relative Humidity (%) Average RH
Jan	4.3	16.8	-10.1	3.5	25.3	0.86	0.51	836	42.0	
Feb	7.9	20.8	-8.6	4.0	21.3	0.53	0.43	836	42.7	
Mar	8.7	21.4	-6.1	4.2	23.7	0.05	0.05	834	30.8	
Apr	14.2	20.8	-1.1	4.9	23.7	0.00	0.00	833	21.7	
May	22.9	34.4	3.1	4.3	21.3	0.00	0.00	829	13.6	
Jun	24.5	37.2	12.3	4.2	23.7	3.66	1.60	832	33.6	
Jul (92.7)	25.3	36.9	15.4	3.7	20.5	1.52	0.66	833	46.8	
Aug (90.0)	23.7	35.4	14.8	3.8	23.7	7.19	1.75	835	47.8	
Sep (96.4)	18.5	31.2	-3.3	3.3	18.9	2.01	1.37	833	50.7	
Oct	13.7	28.3	-4.5	4.0	25.3	7.62	2.81	834	52.5	
Nov	7.9	21.8	-6.2	3.1	19.7	1.67	.94	835	52.6	
Dec (98.5)	4.4	16.9	-13.6	3.2	24.5	0.00	0.00	835	45.2	
Annual Average	14.7			3.8		25.12		834	40.0	
Annual Extreme		37.2	-13.6		25.3		2.81			

NOTE: * Data recovery is 100% unless noted otherwise in parentheses.
RH= relative humidity.
°C = Celcius degrees, mb = millibars, m/sec = meters/second.

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Table 5-1. The 1996 annual climatic summary from tower A36.

blow from Tijeras Canyon. A comparison of the A15 tower wind speed data with the rest of the network reveals building effects (urbanization) on wind speed; the large percentage of calms and very low wind speeds produces the slowest average annual wind speed as shown in Table 5-2. The annual predominant direction (from Figure 5-2) at most towers is produced by the topographic influence that also enhances nocturnal drainage flows.

Completely lost in the annual frequency distribution is the diurnal pattern of wind flow common through many areas of SNL/NM. Figure 5-3 shows the day and night wind frequency distributions respectively for tower A36. In general, the closer to the mountains or canyons the greater the frequency of winds coming from the easterly directions at night. Daytime wind patterns are not quite as pronounced but generally flow toward the mountains or channel into the canyons.

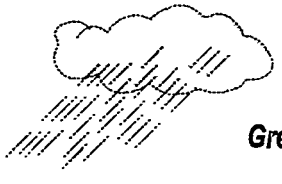
Extremes and Variations Across the CAN Network

	Windspeed (m/sec)		(m/sec)
Greatest variation in:	minimum	maximum	spread
Average annual wind speed	2.92 *(A15)*	4.13 *(CW1)*	1.21
Average daily wind difference	5.91 *(A15)*	9.68 *(KU1)*	3.77
Daily maximum wind speed difference	19.7 *(A15)*	32.5 *(CL1)*	12.8
Greatest extreme in:			
Average daily wind speed	1.47 *(all towers)*		

Temperature

	Temperature (° C)		(° C)
Greatest variation in:	minimum	maximum	spread
Annual temperatures (extremes)	-14.5 *(CW1)*	37.2 *(A36)*	51.7
Average annual temperature	13.9 *(SC1)*	14.7 *(A36)*	0.8
Average daily temperatrue difference	19.6 *(SC1)*	24.2 *(A36)*	4.6
Daily minimum temperatue difference	9.8 *(CW1)*	17.4 *(A15)*	7.6
Daily maximum temperatue difference	10.3 *(A15)*	14.8 *(CL1)*	4.5

Precipitation



	Precipitation (cm)		(cm)
Greatest variation in:	minimum	maximum	spread
Annual precipitation (extremes)	24.13 *(A21)*	27.83 *(SC1)*	3.70
Daily rainfall	0 *(A21 & SC1)*	2.81 *(A36)*	2.81
Monthly precipitation difference	4.09 *(SC1)*	7.62 *(A36)*	3.53
Greatest extreme in:			
Daily rainfall	2.81 *(A36)*		

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

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Table 5-2. Variations and extremes in meteorological measurements across the SNL/NM tower network. Tower locations are shown in parentheses.

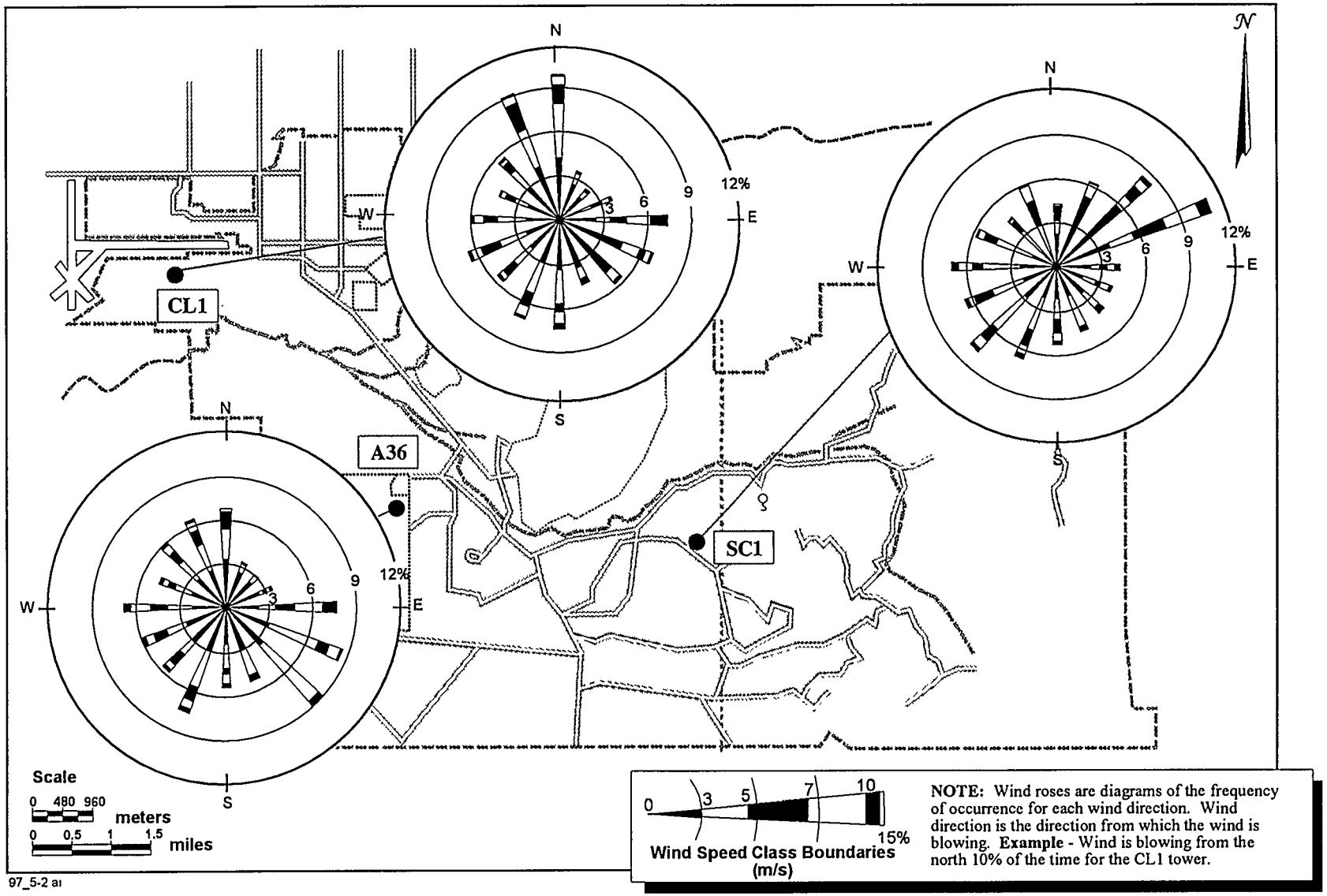

Figure 5-2. Annual wind roses for towers Cl1, A36, and SC1.

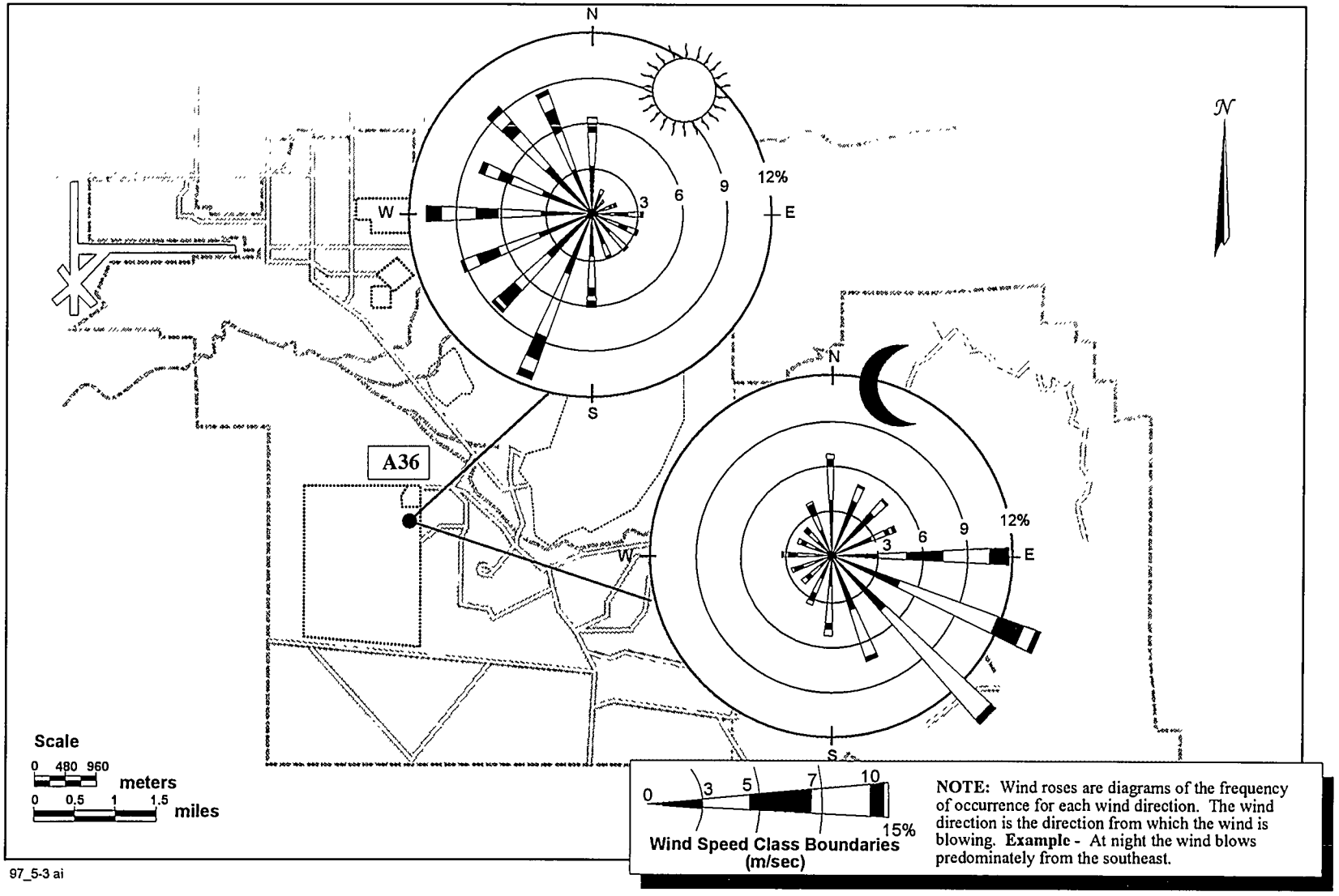

Figure 5-3. Annual wind roses for daytime and nighttime wind frequency at the A36 tower.

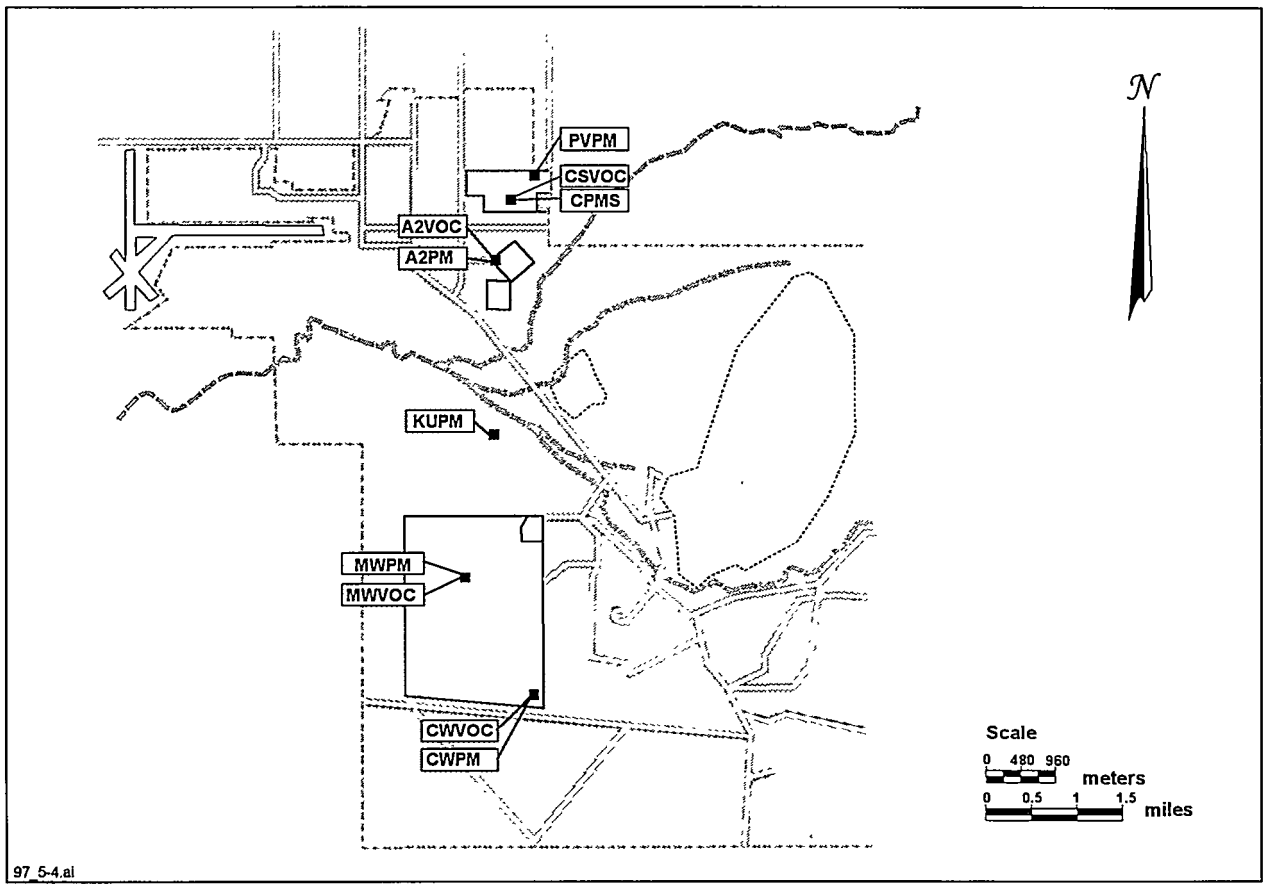

Figure 5-4. Ambient air monitoring equipment located at six stations throughout the SNL/NM site.

5.2 AMBIENT AIR SURVEILLANCE PROGRAM

Ambient air surveillance, conducted within the Clean Air Network (CAN) Program, is integral to compliance with 40 CFR 50—National Ambient Air Quality Standards (NAAQS), and 40 CFR 58—Ambient Air Quality Surveillance. Monitoring activities also follow DOE Orders 5400.1 and 5400.5. A complete list of applicable air quality regulations is given in Table 5-12 (Section 5.5).

The primary objective in gathering ambient air surveillance data is to establish background concentration levels for pollutants of concern, show compliance with the NAAQS and local ambient air quality standards, and evaluate effects, if any, from SNL/NM's operations on the public and the environment.

Ambient air monitoring is performed at six locations with 10 monitors described briefly below and illustrated in Figure 5-4.

- There is one criteria pollutant monitoring station (CPMS) in the network, located in the most populated area of SNL/NM. The CPMS performs continuous monitoring of sulfur dioxide (SO_2), carbon monoxide (CO), nitrous oxides (NO_x) and ozone (O_3). Data is then compiled into hourly averages. A particulate monitor is part of the CPMS and is used to collect data on lead (Pb) concentrations.

- There are six particulate matter (PM) monitoring stations distributed throughout the site. Particulate matter with a diameter equal to or less than 10 microns (PM_{10}) is a criteria pollutant because of its inhalable properties. PM_{10} samples are collected over a 24-hour period starting and ending at midnight, every sixth day. This schedule is consistent with the National Air Sampling Program.

- Volatile organic compound (VOC) monitoring takes place at four stations. VOCs comprise the organic vapors given off by such chemicals as petroleum products and solvents. VOC samples are collected once a month over a 24-hour period.

5.2.1 Ambient Air Monitoring Results

Criteria Pollutants

The automated data recovery for criteria pollutants in 1996 was 97.4 percent. Criteria pollutants, as defined by the EPA, are sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), PM_{10}, and lead (Pb). The CPMS station measures gaseous criteria pollutants and particulate lead. (The criteria pollutant, PM_{10}, is measured at PM stations). Table 5-3 lists the State and Federal ambient air quality standards for criteria pollutants and monitored results from the CPMS.

Table 5-3. 1996 criteria pollutant results as compared to regulatory standards.

Criteria Pollutant	Averaging Time	Unit	NMAQS† Standard	NAAQS‡ Standard	Yearly Summary of Measured Concentrations
Carbon Monoxide	1 hour	ppm	13.1	35	8.30
	8 hours	ppm	8.7	9	2.86
	Annual	ppm			0.78
Nitrogen Dioxide	24 hours	ppm	0.10		0.035
	Annual	ppm	0.05	0.053	0.012
Sulfur Dioxide§	3 hours	ppm		0.50	0.009
	24 hours	ppm	0.10	0.14	0.003
	Annual	ppm	0.02	0.03	0.0003
Ozone	1 hour	ppm	0.12	0.12	0.103
	Annual	ppm			0.033
PM_{10}	24 hours	$\mu g/m^3$	150	150	49*
	Annual	$\mu g/m^3$		50	14.76**
Total Suspended Particulates	7 days	$\mu g/m^3$	110		NA
	30 days	$\mu g/m^3$	90		NA
Lead	30 days	$\mu g/m^3$			.0021
	Any quarter	$\mu g/m^3$		1.5	.0010

NOTE: ppm = parts per million; $\mu g/m^3$ = micrograms per cubic meter

†NMAQS = New Mexico Air Quality Standards. ‡NAAQS = National Ambient Air Quality Standards.

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

* Highest 24-hour particulate loading measured at the KUPM site in August 1996.

** Highest annual particulate loading measured at the CPMS site

Table 5-4. Quarterly and annual averages of PM_{10} at SNL/NM for 1996.

STATION	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Annual
CPMS	16	16.21	16	10.85	14.76
PVPM	11.93	16.29	12	11	12.8
A2PM	10.4	15.07	11	10.357	11.7
KUPM	12.64	14.5	13	8.2857	12.11
CWPM	7.6	14.36	13	7.7857	10.69
MWPM	7.733	13.64	9.3	6.786	9.36

Table 5-5. PM_{10} sample analyses conducted at the five PM monitors and the CPMS site.

STATION	ICP Metals	Total Uranium	Gamma Spectroscopy	Gross Alpha	Gross Beta
PVPM	✓		✓	✓	✓
CWPM	✓		✓	✓	✓
A2PM	✓		✓	✓	✓
KUPM	✓	✓	✓	✓	✓
MWPM	✓	✓	✓	✓	✓
CPMS	(lead only)	--	--	--	--

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

The annual Federal standards cannot be violated, however, exceedences of the short-term standards are allowable once a year. State standards also allow short-term exceedences due to meteorological conditions such as in the case of an atmospheric inversion where air mixing may be extremely restricted. There were no short term exceedences in 1996. In comparing the annual averages of SNL/NM, there has, however, been a small but discernible decrease in criteria pollutant measurements over the last two years.

Particulate Matter - PM_{10}

Data recovery for PM_{10} was 97 percent complete based on the every-sixth-day sampling schedule. In general, 24-hour (daily) PM_{10} concentrations were quite low except for several days during the spring when gusty winds resuspended dust particles. The highest daily particulate loading occurred at the KUPM site in August (Table 5-3). Table 5-4 lists the quarterly PM_{10} averages and the annual average at each location. The CPMS station has the highest average annual loading due to the anthropogenic contribution of PM_{10} from combustion of fossil fuels. In general, sites furthest away from populated areas of SNL/NM show the lowest annual PM_{10} concentrations. There were no exceedences of Federal or State standards for PM_{10} during 1996.

Table 5-5 shows the types of radiological and nonradiological analyses conducted on samples collected at each PM_{10} station. PM samples are analyzed for 20 metals and four radiological determinations. Filters are consolidated into monthly composites for the analyses. Monthly composites varied from four

to six filters per month throughout 1996 depending on the sampling schedule and some missed samples (for example, monthly composites for two months contained four instead of five filters due to missed samples). Analysis is conducted by an EPA-approved offsite laboratory. The laboratory results for the samples are subtracted from the monthly blank (unused filter) analysis. The final analytical results are averaged over the year (Table 5-6) and compared to Threshold Limit Values as a reference using Time Weighted Averages (TWAs).

The PM_{10} analytical results are generally consistent with metals found in local soil analyses at SNL/NM. As can be seen from Table 5-6, beryllium as a total metal was not found above the detection limit—but it was found in the gamma analysis. All radiochemistry data is used in the averaging routine for reporting, regardless of the detection limit for that specific sample. This generally produces more conservative (higher total) concentrations.

Due to the low averages, a relatively small variation between the sites may be mis-interpreted as a significant difference. An analysis of variance was performed to determine if concentrations of any analyte were statistically and significantly different at any site. Results of this variance test showed that copper in the soil is statistically less at the MWPM and CWPM compared to the rest of the network. These results are generally consistent with the 1995 results depicting slightly higher copper concentrations in monitors near the Tijeras Arroyo area soils group.

Volatile Organic Compounds (VOCs)

Data recovery for all VOC monitoring was 92 percent (11 months). This incomplete recovery resulted when all March samples were invalidated due to freon contamination that produced laboratory instrument saturation at the time of analysis. Monthly VOC samples were analyzed for 25 VOC species and total non-methane hydrocarbons (TNMHC). Monthly results for compounds detected are reported as averaged concentrations shown in Table 5-7. These averages are not annual averages due to the method of including the sample only if the compound is detected. This type of averaging is done to prevent diluting the reported average.

The VOCs generally observed at SNL are products or by-products of fossil fuels or found in solvents. VOC data generally exhibits the similar pattern of distribution as does the particulate matter; higher concentrations are generally found closer to the population areas of SNL/NM. Exceptions are two compounds found at the landfills. Looking at the average concentrations, it is difficult to identify if there are actual differences between the sites except for 1,1,1-Trichloroethane (1,1,1-TCA) and TNMHC. An analysis of variance was performed on the monthly results to determine if VOC concentrations of any analyte were statistically and significantly different compared to other sites.

Landfills – A statistically significant site for 1,1,1-TCA is the Mixed Waste Landfill (MWL). Elevated concentrations have been noted seasonally since May 1995. After several exploratory wells were drilled around the MWL during ER characterization studies. Since that time, concentrations of 1,1,1-TCA have increased in the summer and decreased in the winter. The winter levels are still higher than the maximum concentrations at other locations. A maximum concentration of 174 parts per billion by volume (ppbv) was recorded in August, and a minimum concentration of 4.04 ppbv was recorded in November. The May through August average was 111.68 ppbv. As can be seen from Table 5-7, the time weighted average (TWA) for 1,1,1-TCA is three orders of magnitude higher than the maximum concentration found at that location. The TNMHC, which represents all carbon in a sample, is also higher at the MWL due to this organic presence.

Statistically significant results are also present at the Chemical Waste Landfill (CWL) for Trichloroethene. It is not unexpected to have small quantities of this chemical at the CWL.

CPMS Site – Excluding the large concentration of 1,1,1-TCA and TNMHC at the

Table 5-6. PM_{10} average annual metals concentration by station location.

Analyte	Units	A2PM	CWPM	KUPM	MWPM	PVPM	CPMS*	TLV[1]
Aluminum	µg/m3	0.0831	0.0900	0.0606	0.0779	0.0747	–	2,000
Arsenic	µg/m3	0.0000	0.0000	0.0000	0.0000	0.0000	–	10
Barium	µg/m3	0.0048	0.0039	0.0041	0.0041	0.0076	–	50
Beryllium	µg/m3	0.0000	0.0000	0.0000	0.0000	0.0000	–	2
Cadmium	µg/m3	0.0000	0.0000	0.0000	0.0000	0.0000	–	10
Calcium	µg/m3	0.2851	0.1661	0.1162	0.1115	0.2859	–	1
Chromium	µg/m3	0.0002	0.0002	0.0002	0.0001	0.0002	–	10
Cobalt	µg/m3	0.0000	0.0000	0.0000	0.0000	0.0002	–	20
Copper	µg/m3	0.0155	0.0099	0.0145	0.0086	0.0136	–	1,000
Iron	µg/m3	0.0902	0.0889	0.0734	0.0716	0.0919	–	5,000
Lead	µg/m3	0.0004	0.0001	0.0000	0.0000	0.0000	0.0000	150
Magnesium	µg/m3	0.0372	0.0329	0.0275	0.0346	0.0325	–	10,000
Manganese	µg/m3	0.0027	0.0026	0.0022	0.0021	0.0026	–	200
Molybdenum	µg/m3	0.0000	0.0000	0.0000	0.0000	0.0001	–	10,000
Nickel	µg/m3	0.0000	0.0001	0.0000	0.0001	0.0000	–	50
Potassium	µg/m3	0.0416	0.0541	0.0378	0.0448	0.0489	–	NA
Selenium	µg/m3	0.0000	0.0000	0.0000	0.0000	0.0000	–	2,000
Silicon	µg/m3	0.0334	0.0436	0.0233	0.0474	0.0695	–	10,000
Silver	µg/m3	0.0000	0.0000	0.0000	0.0000	0.0000	–	10
Sodium	µg/m3	0.8033	0.8503	0.5303	0.7133	1.0320	–	5,000
Thallium	µg/m3	0.0002	0.0004	0.0004	0.0002	0.0002	–	100
Vanadium	µg/m3	0.0002	0.0001	0.0001	0.0001	0.0001	–	50
Zinc	µg/m3	0.0049	0.0043	0.0055	0.0037	0.0098	–	10
Gross Beta	pCi/m3	0.0210	0.0162	0.0227	0.0145	0.0208	–	NA
Gross Alpha	pCi/m3	0.0066	0.0050	0.0059	0.0064	0.0086	–	NA
Beryllium-7	pCi/m3	0.1798	0.1502	0.1572	0.1491	0.1659	–	NA
Potassium-40	pCi/m3	0.0127	0.0347	0.0273	0.0102	0.0202	–	200
Uranium	µg/m3			0.0001	0.0000			

NOTE: TLV= Threshold Limit Value. The TLV is a guideline to assist in the control of health hazards. TLVs are not legal standards.

NA = not available

*The PM monitor at the CPMS measures only particulate Pb concentrations.

[1]Values listed are Time-Weighted Averages (TWAs). TWA is the concentration for a normal 8-hour work day and 40-hour week, to which nearly all workers may be exposed without adverse effect.

Table 5-7. VOC average concentration by station location compiled from monthly results. These averages are not true annual averages.

Compound	CPMS (ppbv)	CWL (ppbv)	MWL (ppbv)	TA-II (ppbv)	TLV[1]
1,1,1-Trichloroethane	0.342	0.155	44.745	0.281	350,000
1,4-Dioxane+2,2,4-TMP	0.450	0.150	NA	NA	25,000
1-Butene	0.244	0.098	0.108	0.247	NA
2,2,4-Trimethylpentane	0.142	0.031	0.030	0.072	NA
3-Methylpentane	0.255	0.030	0.047	0.126	NA
Acetone	6.675	3.262	5.073	5.522	750,000
Benzene	0.558	0.098	0.118	0.283	300
Bromodichloromethane	0.032	NA	NA	NA	NA
Carbon Tetrachloride	0.103	0.092	0.119	0.100	NA
Chloromethane	0.457	0.418	0.419	0.456	5,000
Dichlorodifluoromethane	0.629	0.546	0.593	0.589	1,000,000
Ethylbenzene	0.137	0.032	0.025	0.051	100,000
Halocarbon 113	0.096	0.097	0.090	0.093	NA
Isobutene	0.183	0.216	0.184	0.187	NA
Isobutene + 1-Butene	0.400	NA	NA	NA	NA
Isohexane	0.475	0.086	0.113	0.322	NA
Isopentane	1.842	0.513	0.550	1.456	600,000
m/p-Xylene	0.299	0.036	0.041	0.110	NA
Methylene Chloride	0.064	0.036	0.047	0.086	50,000
n-Butane	1.822	0.417	0.632	1.082	800,000
n-Hexane	0.277	0.037	0.080	0.159	50,000
n-Pentane	0.832	0.220	0.284	0.464	600,000
n-Undecane	0.010	0.011	0.021	0.073	NA
o-Xylene	0.145	0.022	0.051	NA	100,000
Tetrachloroethene	0.042	0.007	0.029	NA	NA
Toluene	1.039	0.119	0.148	0.479	50,000
Trichloroethene	0.018	0.122	0.032	NA	NA
Trichloroethylene + BDCmethane	0.065	NA	NA	NA	NA
Trichlorofluoromethane	0.277	0.226	0.235	0.257	1,000,000[2]
TNMHC	39.725	11.538	86.397	14.039	NA

NOTE: The analytical laboratory refined the equipment used for analyses during the year, resulting in better speciation of compounds. For this reason compounds are included separately and in combination with another analyte in the table.

TNMHC = total non-methane hydrocarbons

TLV= Threshold Limit Value. The TLV is a guideline to assist in the control of health hazards. TLVs are not legal standards.

NA = not available

[1] Values listed are Time-Weighted Averages (TWAs) except where marked. TWA is the concentration for a normal 8-hour work day and 40-hour week, to which nearly all workers may be exposed without adverse effect.

[2] Short-Term Exposure Limit (STEL) is a 15-minute TWA not to be exceeded at anytime during the work day.

MWL, additional comparisons of VOC sampling sites revealed statistically higher concentrations for several compounds measured at the CPMS site. Pentanes, xylenes, toluene, and benzenes compound concentrations are significantly higher. These compounds are all associated with fossil fuels. The station is located at a busy intersection and is across the street from the motor pool where vehicle maintenance is performed. Given this location, CPMS VOC concentrations should be (and generally are) higher than the rest of the monitoring sites.

5.3 RADIOLOGICAL AIR EMISSIONS NESHAP COMPLIANCE

The NESHAP Program, a part of the Environmental Monitoring and Reporting Department, provides compliance support to SNL/NM source owners subject to radionuclide air emissions regulations. Radionuclide air emissions are regulated by the EPA in accordance with National Emission Standards for Hazardous Air Pollutants (NESHAP)—40 CFR 61, Subpart H.

The EPA has set a maximum individual public dose limit of 10 mrem/year resulting from the combined radiological emissions produced from any DOE facility—meaning that the Effective Dose Equivalent (EDE) is combined from all of SNL/NM's radionuclide-producing facilities. As a comparison, the average dose (nation-wide) a person receives from all radioactive sources—natural and manmade—is 360 mrem/year. The bulk of this dose comes from natural sources such as natural background radon (53%), radioactive elements within the body (11%), and cosmic radiation (8%).

The 1996 annual NESHAP *Compliance Summary Report* was submitted to the EPA, as required, by June 30, 1997 (SNL 1997c). The report contains listed radionuclide emissions from each of SNL/NM's 16 NESHAP facilities (Figure 5-5) and a summary of the dose assessment results (discussed in Section 5.4). The *Compliance Summary Report* is also submitted to the DOE. A more comprehensive supplemental document detailing facility emission factors, demographic data, and dose assessment calculations is available to the EPA and the DOE upon request (SNL 1997c). NESHAP Program documents are listed at the end of the chapter in Table 5-13.

Emissions are described as either point or diffuse sources. Point sources are produced from an exhaust stack or vent, while diffuse sources emanate from broad areas of contamination—such as radionuclide-contaminated soils present at an ER site. Of the 16 sources, all but the Radiological Waste Landfill (RWL) and the Mixed Waste Landfill (MWL) were point sources. Table 5-8 lists the radionuclide species and total curies released from each NESHAP source.

NESHAP sources are categorized based on the dose thresholds:

- Facilities with measurable releases that produce an EDE greater than 0.1 mrem/year to the Maximally Exposed Individual (MEI) require continuous monitoring. At present, there are no facilities at SNL/NM that require continuous monitoring.

- Facilities with measurable releases, that result in an EDE to the MEI of less than 0.1 mrem/year require periodic confirmatory measurements to verify facility emissions. There are currently five facilities at SNL/NM that require periodic confirmatory measurements.

- Facilities with emissions too small to measure, and which produce a dose less than 0.1 mrem/year, are determined by calculations based on process knowledge.

Changes in NESHAP sources from last year include one source removed and three sources added: (1) The RWL became a new diffuse source during remedial earth-moving activities conducted between May and August; (2) the

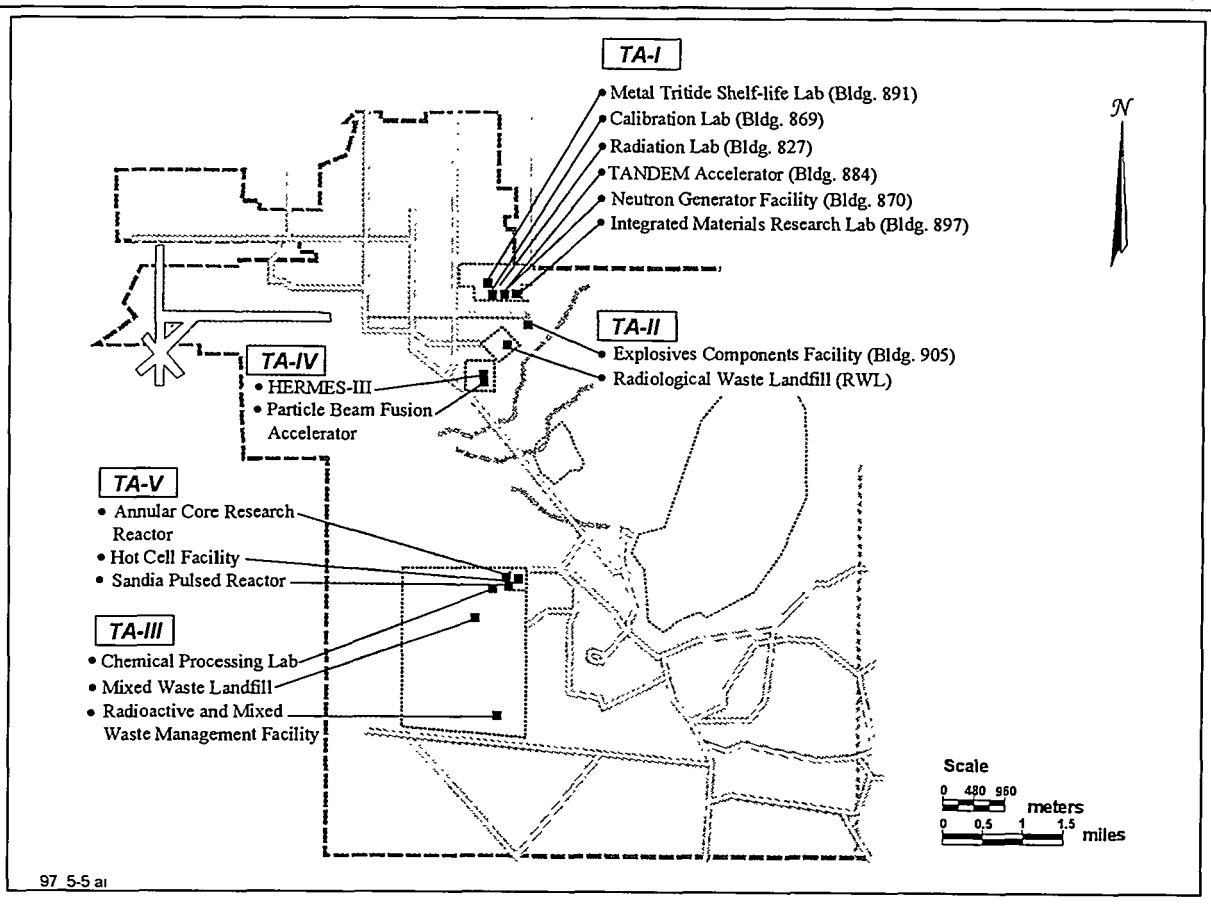

Figure 5-5. Locations of the 16 NESHAP facilities at SNL/NM that reported radionuclide releases in 1996.

newly completed Radioactive and Mixed Waste Management Facility (RMWMF) became a point source; and (3) the HCF produced limited emissions in 1996 in conjunction with small-scale-experiments being conducted in the Annular Core Research Reactor (ACRR). The Radiation Laboratory in Building 805 of TA-I was removed from the list. The highest activities found in atmospheric emissions during 1996 were primarily the result of Argon-41, tritium, and multiple isotopes of krypton, and xenon. Historically, these are the radionuclides that have generally been the most significant releases over the past 10 years. Figure 5-6 summarizes the annual release in curies from these species since 1987.

5.3.1 Technical Area I Sources

There were six sources in TA-I that reported radionuclide air emissions, all of which were too small to measure directly.

- The Metal Tritide Laboratory conducts R&D on tritium materials and reports releases of minute amounts of tritium.
- The Calibration Laboratory calibrates radiation detection equipment and reports minor releases of tritium.
- The Radiation Laboratory conducts small-scale experiments and releases primarily air-activation products.
- The TANDEM Laboratory is an accelerator facility used for ion solid interaction and defect physics experiments. Reported emissions

included air activation products, fluorine, and tritium.

- The Neutron Generator Facility is the principal production facility for neutron generators. This facility currently emits only tritium.

- The Integrated Materials Research Laboratory (IMRL) is used for R&D of new and superior materials for government and industrial uses. This facility emitted only Carbon-14.

5.3.2 Technical Area II Sources

There was two sources that produced emissions from TA-II in 1996:

- The Radiological Waste Landfill under went remediation from May 12, 1996 to August 23, 1996. During two days of this interval plutonium-contaminated soil was being moved, covered, and containerized. Continuous air monitors (tritium bubblers and PM_{10} monitors) were set up at the site, in three locations before and during remediation. Tritium bubbler results showed no elevated results at any time during the remediation process. However, PM_{10} results at one monitoring location did measure higher gross alpha over two sampling periods (48-hour composites) collected during the plutonium removal process. Subsequent analysis verified minor levels of plutonium and americium present.

- The Explosive Components Facility (ECF) also known as the Neutron Generator Test Facility (NGTF) conducts destructive testing on neutron generators. The ECF reports minor releases of tritium.

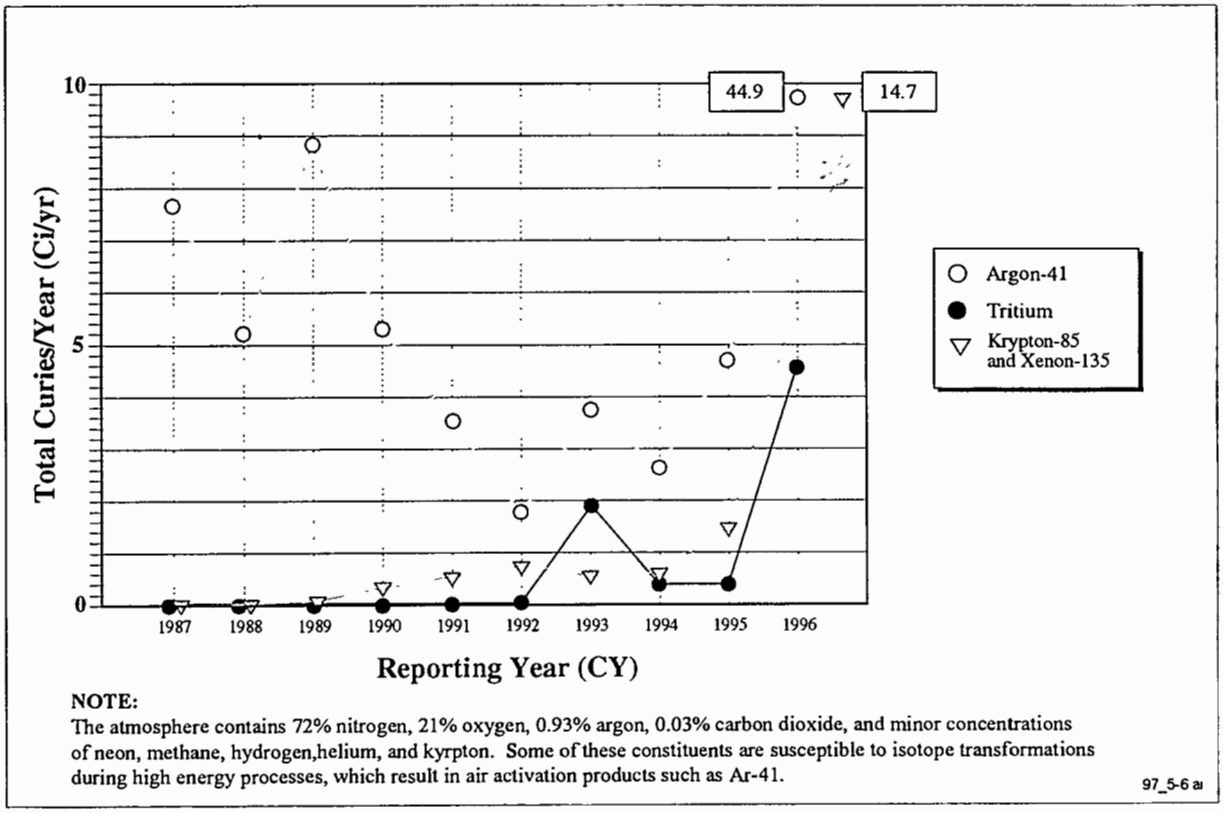

Figure 5-6. Summary of atmospheric releases of the most prevalent airborne radionuclides from SNL/NM facilities over the past 10 years.

Table 5-8. Summary of radionuclide releases from the 16 sources in 1996.

Facility Name	TA	Monitoring Type	Operations	Radionuclide	Release (Ci/yr)
• Annular Core Research Reactor (ACRR), Bldg. 6588	TA-V	Periodic	Reactor	Ar-41	3.54E+01
• Sandia Pulsed Reactor (SPR), Bldg. 6590	TA-V	Periodic	Reactor	Ar-41	9.51E+00
• Hot Cell Facility (HCF)	TA-V	Periodic	Radioactive material handling	I-131 I-132 I-133 I-135 Kr- 83m Kr-85 Kr-85m Kr-87 Kr-88 Xe-131m Xe-133 Xe-133m Xe-135 Xe-135m	1.96E-03 1.29E-04 9.51E-03 1.32E-03 9.57E-05 1.53E-03 5.87E-01 2.94E-02 5.27E-01 3.45E-04 1.75E+01 7.68E-01 1.47E+01 9.76E-01
• High-Energy Radioactive Megavolt Electron Source (HERMES III), Bldg. 970	TA-IV	Periodic	Accelerator	N-13 O-15	2.85E-04 2.85E-05
• Particle Beam Fusion Accelerator (PBFA), Bldg. 983	TA-IV	Calculation	Accelerator	O-15 N-13	4.20E-02 5.00E-03
• Mixed Waste Landfill (MWL)	TA-III	Periodic	ER site	Tritium	2.90E-01
• Chemical Processing Laboratory, Bldg. 6600	TA-III	Calculation	Laboratory	Na-22 Am-241 U-232 Pu-241	2.40E-12 1.00E-13 1.00E-13 1.00E-13
• Radioactive and Mixed Waste Management Facility (RMWMF), Bldg. 6920	TA-III	Periodic	Waste handling	Tritium	4.12E+00
• Radiological Waste Landfill (RWL)	TA-II	Calculation & short-term monitoring	ER site	Am-241 Pu-239/240 Pu-238	4.7E-13 3.9E-15 7.9E-15

NOTE: Ci/yr = curies/year
The "m" after isotopes indicates metastable.
E Notation denotes the exponent.

Table 5-8. Summary of radionuclide releases from the 16 sources in 1996 (Concluded).

Facility Name	TA	Monitoring Type	Operations	Radionuclide	Release (Ci/yr)
• Explosive Components Facility (ECF)*, Bldg. 905	TA-II	Calculation	Explosive testing	Tritium	7.00E-04
• Integrated Materials Research Laboratory (IMRL), Bldg. 897	TA-I	Calculation	Laboratory	C-14	2.2E-05
• Neutron Generator Facility, Bldg. 870	TA-I	Calculation	Accelerator	Tritium	1.1E-01
• TANDEM Accelerator, Bldg. 884	TA-I	Calculation	Accelerator	Tritium C-11 N-13 O-15 F-17 F-18	1.00E-06 5.30E-03 9.30E-08 2.10E-02 8.00E-04 4.40E-05
• Radiation Laboratory, Bldg. 827	TA-I	Calculation	Laboratory	Tritium N-16 N-13 Ar-41	1.00E-05 2.00E-07 1.00E-08 1.00E-09
• Metal Tritide Shelf-Life Laboratory, Bldg. 891	TA-I	Calculation	Laboratory	Tritium	5.00E-09
• Calibration Laboratory, Bldg. 869	TA-I	Calculation	Laboratory	Tritium	2.51E-04

NOTE: Ci/yr = curies/year
The "m" after isotopes indicates metastable.
E Notation denotes the exponent.
*Formerly known as the Neutron Generator Test Facility.

5.3.3 Technical Area III Sources

Three facilities in TA-III reported radioactive releases in 1996:

- The Radioactive and Mixed Waste Management Facility (RMWMF) was used primarily to handle large quantities of contaminated soils from ER projects. During 1996, the RMWMF reported tritium releases.

- The Chemical Processing Laboratory, west of TA-V, is used to perform small-scale experiments. The lab reported calculated emissions of Sodium-22, Plutonium-241, Americium-241, and Uranium-232.

- The Mixed Waste Landfill (MWL) is a source of diffuse tritium contamination. This site was closed as a landfill in 1988 and is scheduled to undergo remediation in the next five years. In 1992 and 1993, a special study was conducted to measure the tritium flux (Radian 1994). As conditions at this landfill have remained unchanged, the measured flux is assumed to remain fairly constant and is used to estimate the annual NESHAP emissions.

5.3.4 Technical Area IV Sources

Two accelerator facilities in TA-IV reported releases. Both facilities released Nitrogen-13 and

Oxygen-15 as a result of photo activation of the surrounding air.

- The High-Energy Radiation Megavolt Electron Source-III (HERMES-III) accelerator is used to test the effects of prompt radiation from a nuclear detonation on electronics and weapon components. This facility produces air activation products.

- The Particle Beam Fusion Accelerator (PBFA) accelerator conducts investigations on light ion inertial confinement fusion. The technology involves storing large amounts of electrical energy over a period of minutes and then releasing this energy to a target in an intense, concentrated burst. This facility also produces air activation products.

5.3.5 Technical Area V Sources

In 1996 three facilities reported measurable releases.

- The Annular Core Research Reactor (ACRR) is configured as a ring of 226 fuel elements in an open water tank (annular core) surrounding a central air-filled cavity where targets can be irradiated. The ACRR will support the Medical Isotope Production Project (MIPP) for the production of radiopharmacueticals. In anticipation of this upcoming project, the ACRR began performing small-scale experiments in 1996. The primary release was Argon-41, resulting from photo activation of air in its central cavity.

- The Hot Cell Facility (HCF) is used for remote handling of radioactive material such as irradiated targets. This facility will also be integral to supporting the MIPP. Releases vary depending on the material handled.

- The Sandia Pulsed Reactor (SPR) is an unreflected, unmoderated assembly of enriched uranium reactor used to produce intense neutron bursts for effects testing of materials and electronics. The SPR reported releases of Argon-41, an air activation product.

5.4 ASSESSMENT OF POTENTIAL DOSE TO THE PUBLIC

In general, the dose received by a person is dependent on the distance from the sources; various pathways in the environment (food chain, air, and water); radionuclide half lives and activities (total release); and meteorological conditions. Releases from SNL/NM have been, historically, several orders of magnitude below the EPA's maximum allowable standard of 10 mrem/year.

Dose Calculation

NESHAP—40 CFR 61, Subpart H specifically applies to the regulation of radionuclide emissions. To assess compliance, NESHAP facilities at SNL/NM must submit facility emission data to the NESHAP Program Administrator for input to dose assessment modeling. All dose calculation results presented in this section were obtained using the EPA Clean Air Act Assessment Package (CAP88-PC) computer code (EPA 1991).

The CAP88-PC code is a set of programs, databases, and associated utilities used to estimate dose and risk from radionuclide sources. The code uses a Gaussian Plume equation to determine horizontal and vertical air dispersion of radionuclides. The resulting dose calculation determines the Effective Dose Equivalent (EDE) to the Maximally Exposed Individual (MEI). The MEI is defined as a member of the public at any publicly-accessible location—such as a school, recreational area, place of business, or residence. All non-SNL workers[1], including KAFB personnel, are considered members of the public for the purpose of dose assessment. The

[1] Workers on SNL/NM property are not considered members of the public and are protected under other regulations.

dose calculation identifies the exact location where emissions from all facilities at SNL/NM contribute the highest EDE. CAP88-PC conservatively assumes that the MEI abides at the receptor location 24 hours a day to receive the maximum potential dose. Additionally, a dose to the collective population is calculated in units of person-rem. This translates to the average individual dose multiplied by the total population (number of people in the area within an 80-km radius). There is no standard given for a population dose, but the result allows for comparisons to be made from year to year. All model assumptions and input data used in the dose calculation are detailed in the NESHAP annual report (SNL 1997c).

5.4.1 NESHAP Dose Assessment Input

Emission Sources

As previously noted, Table 5-8 summarizes radionuclide species, and quantities of release from each of the 16 emission sources at SNL/NM in 1996. Many of the radionuclides released are of such short half-lives (for example, 10 minutes for Nitrogen-13 and 15 minutes for Rubidium-88) that radioactive decay during transport significantly reduces doses at most receptor locations considered.

Demographic Data

Data is gathered from over nine counties within the 80-km radius for parameters related to radionuclide dose pathways. This includes the total resident population, numbers of beef and dairy cattle, and the total area of food crops used for human consumption. In general, demographic data are available by county. The densities for population, cattle, and food crops were calculated as the quotient of the most recent county data and the county land area.

For the 1996 NESHAP calculations, data from the 1994-1995 census (DOC 1996) and 1992 agricultural statistics (DOC 1992) were used as follows:

12,611 dairy cattle
138,686 beef cattle
56.5 sq mi of food crops
732,823 resident population within 80 km

Public Receptors

The EDE measurement of interest for the purpose of compliance is the MEI in the vicinity of SNL/NM's emission sources. As a result, many different receptor locations have been evaluated as suspected locations of maximum exposure. The offsite and onsite receptors are listed in Tables 5-9 and 5-10, respectively. In addition to KAFB receptors, offsite receptor locations are located within the Isleta Indian Reservation, the Four Hills area north of the base, the East Mountains, and near the airport to the west of the base. There are a total of 29 receptor locations evaluated annually.

Meteorology

Data from four meteorological CAN towers in the proximity to NESHAP emission sources were used in 1996 (towers SW1, A36, A21, and MW1). Data from each tower consisted of approximately 35,000 meteorological observations of wind direction, wind speed, and stability class (inferred from wind and solar insulation data). The data is compiled into a normalized distribution from which all wind and stability class data are derived. The meteorological data is input to a database to create Stability Array (STAR) data files which are incorporated into the CAP88-PC computer code for the dose assessment.

5.4.2 Dose Assessment Results

Dose assessment results are summarized in Table 5-11 and discussed below.

MEI Dose

The dose contributions from each of the 16 radionuclide sources were combined to yield an

Table 5-9. Annual source-specific Effective Dose Equivalent (EDE) to offsite receptors.

Receptor	Source-Specific Effective Dose Equivalents (mrem/yr)								
	Radiation Lab (Bldg. 827)	Calibration Lab (Bldg. 869)	TANDEM (Bldg. 884)	Metal Tritide Lab (Bldg. 891)	ECF/NGTF (Bldg. 905)	Radiological Waste Landfill	Mixed Waste Landfill	Chemical Processing Lab (Bldg. 6600)	
Albuquerque City Offices	5.5E-10	1.2E-08	2.0E-08	1.5E-13	4.5E-08	1.1E-11	6.6E-06	3.4E-12	
East Resident	5.1E-10	1.1E-08	5.2E-10	1.3E-13	4.0E-08	1.2E-12	4.3E-06	4.1E-13	
Eubank Gate Area (Bldg. 8895)	9.8E-10	2.0E-08	2.4E-06	2.4E-13	6.6E-08	4.4E-11	4.9E-06	2.0E-12	
Four Hills	5.5E-10	1.2E-08	6.0E-08	1.5E-13	4.4E-08	1.0E-12	4.9E-06	2.0E-12	
Isleta Bingo	5.1E-10	1.1E-08	1.1E-09	1.4E-13	4.1E-08	2.1E-12	4.5E-06	6.5E-13	
Northeast Resident	5.1E-10	1.1E-08	5.6E-09	1.4E-13	4.1E-08	2.5E-12	4.6E-06	9.7E-13	
Seismic Center (USGS)	5.1E-10	1.1E-08	2.3E-09	1.3E-13	4.0E-08	1.5E-12	4.4E-06	7.5E-13	
Tijeras Arroyo (West)	5.5E-10	1.2E-08	2.4E-08	1.5E-13	4.3E-08	7.4E-12	7.7E-06	4.9E-12	

Receptor	Source-Specific Effective Dose Equivalents (mrem/yr)								
	NGF (Bldg. 870)	IMRL (Bldg. 987)	RMWMF (Bldg. 6920)	HERMES III Bldg. 970)	PBFA II (Bldg. 983)	Hot Cell Facility	ACRR (Bldg. 6588)	SPR (Bldg. 6590)	EDE (mrem/yr)
Albuquerque City Offices	7.0E-06	3.5E-08	4.1E-05	1.3E-09	4.2E-08	1.0E-04	6.9E-04	1.8E-04	1.0E-03
East Resident	6.6E-06	3.3E-08	3.1E-05	4.1E-12	5.7E-10	2.8E-05	4.8E-05	1.2E-05	1.3E-04
Eubank Gate Area (Bldg. 8895)	1.2E-05	3.7E-08	3.4E-05	6.1E-09	7.8E-07	6.8E-05	4.2E-04	1.0E-04	6.4E-04
Four Hills	7.1E-06	3.4E-08	3.4E-05	2.3E-09	2.9E-07	7.0E-05	4.3E-04	1.1E-04	6.6E-04
Isleta Bingo	6.6E-06	3.4E-08	3.7E-05	7.5E-12	1.1E-09	3.4E-05	9.0E-05	2.3E-05	2.0E-04
Northeast Resident	6.6E-06	3.4E-08	3.3E-05	2.5E-10	3.5E-08	4.5E-05	2.0E-04	5.0E-05	3.4E-04
Seismic Center (USGS)	6.6E-06	3.4E-08	3.3E-05	2.6E-11	3.7E-09	3.7E-05	1.3E-04	3.4E-05	2.5E-04
Tijeras Arroyo (West)	7.0E-06	3.4E-08	4.5E-05	1.8E-09	1.2E-07	1.3E-04	1.0E-03	2.6E-04	1.4E-03

NOTE: E notation denotes the exponent.

Table 5-10. Annual Effective Dose Equivalent to onsite receptors.

Receptor	Source-Specific Effective Dose Equivalents (mrem/yr)							
	Radiation Lab (Bldg. 827)	Calibration Lab (Bldg. 869)	TANDEM (Bldg. 884)	Metal Tritide Lab (Bldg. 891)	ECF (Bldg. 905)	Radiological Waste Landfill	Mixed Waste Landfill	Chemical Processing Lab (Bldg. 6600)
Airport (Bldg. 760)	2.1E-10	5.8E-09	2.8E-07	7.9E-14	7.8E-09	1.7E-11	1.0E-06	2.6E-12
Airport East (Bldg. 1064)	1.6E-10	4.2E-09	2.3E-07	5.9E-14	7.5E-09	1.3E-11	8.4E-07	2.1E-12
Bldg. 20706 (USAF)	2.0E-09	3.6E-08	4.8E-06	1.5E-13	3.4E-08	4.0E-11	7.9E-07	2.7E-12
Bldg. 24499 (USAF)	3.0E-10	6.2E-09	1.4E-06	9.0E-14	2.6E-08	2.7E-11	6.1E-07	1.7E-12
CERF (Bldg. 5701)	9.7E-12	2.4E-10	5.0E-09	4.2E-15	7.3E-10	1.9E-12	6.9E-07	1.5E-12
Coyote Canyon Control Center	1.0E-11	2.5E-10	5.4E-09	4.4E-15	7.7E-10	1.9E-12	5.6E-07	1.5E-12
Golf Course Clubhouse	4.2E-11	1.0E-09	5.7E-08	1.6E-14	3.7E-09	1.0E-11	2.0E-06	9.1E-12
Golf Course Maintenance Area	6.0E-11	1.5E-09	1.0E-07	2.1E-14	5.8E-09	1.7E-11	1.6E-06	5.7E-12
ITRI/Lovelace	8.3E-12	2.1E-10	3.6E-09	3.6E-15	6.1E-10	1.5E-12	5.6E-07	1.2E-12
KAFB Fire Station #4 (Bldg. 90002)	1.1E-11	2.8E-10	1.6E-09	4.9E-15	7.4E-10	1.6E-12	1.3E-06	1.9E-12
KAFB Landfill	1.4E-10	2.3E-09	4.4E-07	2.8E-14	2.0E-08	4.3E-11	1.0E-06	3.4E-12
KUMSC	4.6E-11	1.2E-09	4.5E-08	1.8E-14	3.1E-09	7.6E-12	4.0E-06	3.2E-11
Loop Housing	8.4E-10	2.1E-08	1.7E-06	2.2E-13	2.2E-08	2.8E-11	6.1E-07	1.7E-12
Manzano Offices (Fire Station)	1.4E-11	3.5E-10	2.0E-08	5.7E-15	1.8E-09	3.0E-12	1.3E-06	4.3E-12
Maxwell Housing	6.5E-11	1.7E-09	5.7E-08	2.7E-14	3.1E-09	6.7E-12	8.7E-07	2.3E-12
Pershing Park Housing	3.1E-10	7.9E-09	5.0E-07	1.1E-13	1.2E-08	1.9E-11	5.3E-07	1.4E-12
Riding Club	2.8E-11	7.0E-10	3.1E-08	1.1E-14	2.7E-08	6.4E-12	1.6E-06	6.9E-12
Sandia Federal Credit Union	1.8E-09	5.9E-08	5.2E-06	3.3E-13	3.0E-08	3.5E-11	7.0E-07	2.0E-12
TOSI	3.1E-10	9.2E-09	6.0E-07	8.0E-14	2.4E-09	8.4E-11	9.8E-07	3.0E-12
Zia Park Housing	3.6E-10	1.0E-08	7.2E-07	1.6E-13	1.4E-08	2.1E-11	9.1E-07	2.4E-12

NOTE: E Notation denotes the exponent.

Table 5-10. Annual Effective Dose Equivalent to onsite receptors (Concluded).

Receptor	Source-Specific Effective Dose Equivalents (mrem/yr)								
	NGF (Bldg. 970)	IMRL (Bldg. 897)	RMWMF (Bldg. 6920)	HERMES III (Bldg. 970)	PBFA II (Bldg. 983)	Hot Cell Facility	ACRR (Bldg. 6588)	SPR (Bldg. 6590)	Effective Dose Equivalent (mrem/yr)
Airport (Bldg. 760)	7.1E-07	2.3E-11	6.0E-06	3.4E-09	4.5E-07	1.0E-04	8.9E-04	1.4E-04	1.2E-03
Airport East (Bldg. 1064)	1.3E-06	1.5E-11	5.1E-06	2.3E-09	3.6E-07	5.1E-05	4.3E-04	1.1E-04	6.0E-04
Bldg. 20706	3.5E-06	6.5E-11	4.3E-06	1.8E-08	2.6E-06	6.6E-05	6.0E-04	1.5E-04	8.3E-04
Bldg. 24499	4.0E-06	2.9E-11	3.7E-06	4.5E-09	5.7E-07	4.3E-05	3.8E-04	9.4E-05	5.3E-04
CERF (Bldg. 5701)	1.1E-07	1.6E-12	8.4E-06	1.4E-10	2.0E-08	3.6E-05	3.7E-04	9.2E-05	5.1E-04
Coyote Canyon Control Center	1.1E-07	1.7E-12	7.6E-06	9.4E-11	2.2E-08	3.6E-05	3.7E-04	9.2E-05	5.1E-04
Golf Course Clubhouse	4.6E-07	6.6E-12	8.8E-06	5.0E-09	7.5E-07	1.9E-04	2.2E-03	4.8E-04	2.9E-03
Golf Course Maintenance Area	6.7E-07	9.4E-12	7.3E-06	8.3E-09	1.9E-06	1.2E-04	1.4E-03	3.3E-04	1.9E-03
ITRI/Lovelace	9.1E-08	1.4E-12	7.8E-06	8.5E-11	1.2E-08	3.2E-05	2.8E-04	7.2E-05	3.9E-04
KAFB Fire Station #4 (Bldg. 90002)	1.1E-07	1.5E-12	1.5E-05	2.9E-11	3.7E-09	4.5E-05	4.1E-04	1.0E-04	5.7E-04
KAFB Landfill	1.7E-06	2.2E-11	5.4E-06	4.1E-08	4.7E-06	7.6E-05	7.7E-04	1.9E-04	1.0E-03
KUMSC	4.7E-07	4.8E-12	1.4E-05	2.0E-09	3.3E-07	3.9E-04	5.4E-03	1.2E-03	7.0E-03
Loop Housing	5.2E-06	2.7E-11	3.6E-06	5.4E-09	7.4E-07	4.1E-05	3.6E-04	9.0E-05	5.0E-04
Manzano Offices (Fire Station)	2.4E-07	3.6E-12	8.7E-06	5.9E-10	8.4E-08	1.0E-04	1.1E-03	2.6E-04	1.5E-03
Maxwell Housing	6.2E-07	7.5E-12	4.2E-06	5.8E-10	8.6E-08	6.1E-05	4.7E-04	1.2E-04	6.6E-04
Pershing Park Housing	2.6E-06	1.8E-11	3.3E-06	2.7E-09	3.7E-07	4.5E-05	3.7E-04	7.5E-05	5.0E-04
Riding Club	3.1E-07	4.6E-12	1.0E-05	1.2E-09	2.8E-07	1.6E-04	2.0E-03	4.5E-04	2.6E-03
Sandia Federal Credit Union	7.7E-06	3.6E-11	4.0E-06	1.0E-08	1.5E-06	5.9E-05	5.2E-04	1.3E-04	7.3E-04
TOSI	2.4E-06	3.0E-11	5.1E-06	7.1E-08	2.2E-05	8.4E-05	8.0E-04	1.9E-04	1.1E-03
Zia Park Housing	2.6E-06	2.4E-11	5.5E-06	5.0E-09	7.9E-07	5.8E-05	5.0E-04	1.3E-04	7.0E-04

NOTE: E Notation denotes the exponent.

overall cumulative dose for the MEI. The EDE to the MEI was calculated to be 0.007 mrem/yr. The results located the MEI onsite at the Kirtland Underground Munitions Storage Complex (KUMSC), north of TA-V. This dose results primarily from exposure to Ar-41 released from the ACRR and the SPR. This dose is well below the standard of 10 mrem/year. Individual EDE doses to offsite and onsite SNL/NM receptors are presented in Tables 5-9 and 5-10, respectively. The offsite MEI was calculated to be 0.0014 mrem/year and was located approximately 1000 m due south from the point where the Tijeras Arroyo exits KAFB's western boundary.

Population Dose for KAFB

A population dose resulting from the exposure produced from all SNL/NM radiological emissions was calculated for KAFB residents based on four main housing areas. The maximum individual dose calculated for each of the housing areas was then multiplied by the number of persons living in that residential area. The total population dose for KAFB was obtained by summing the four areas assuming a total residential population of 6,477. This resulted in an estimated population dose of 0.004 person-rem. The dose results primarily from exposure to Argon-41.

Regional Population Dose

A population dose was calculated for the 80 km (50-mile) radius around SNL/NM using a single, common grid analysis for all SNL/NM sources. Because the analysis area is large, the relatively small distances between radionuclide sources have a minimal impact on the resulting population dose. The population dose was calculated to be 0.14 person-rem and resulted primarily from exposure to Argon-41.

5.5 AIR QUALITY REQUIREMENTS AND COMPLIANCE STRATEGIES

This section discusses all applicable air quality requirements as they apply to the SNL/NM site and include the requirements discussed under the Ambient Air Program (Section 5.2) and the NESHAP Program (Section 5.3).

Table 5-11. Calculated dose assessment results for onsite and offsite receptors and for collective populations.

Dose to Receptor	Location	1996 Calculated Dose	NESHAP Standard	Natural Background
Onsite Receptor EDE to the MEI	KUMSC	0.007 mrem/yr *(0.00007 msievert/yr)*	10 mrem/yr *(0.1 msievert/yr)*	95 mrem/yr[1]
Offsite Receptor EDE to the MEI	Tijeras Arroyo West of KAFB	0.0014 mrem/yr *(0.000014 msievert/yr)*	10 mrem/yr *(0.1 msievert/yr)*	95 mrem/yr[1]
Collective KAFB Population[3]	KAFB housing	0.004 person-rem/yr *(0.00004 person sievert/yr)*	(No standard available)	--
Collective Regional Population[2]	Residents within an 80-km radius	0.14 person-rem/yr *(0.0014 person sievert/yr)*	(No standard available)	--

NOTE: EDE = Effective Dose Equivalent
MEI = Maximally Exposed Individual
KUMSC = Kirtland Underground Munitions Storage Complex

[1] 95 mrem/yr is based on average local community values obtained from the thermoluminescent dosimeter (TLD) network maintained by SNL/NM. (The nationwide average is 360 mrem/yr.)

[2] Based on a population of 732,823 people estimated to be living within an 80-km radius.

[3] Based on a population of 6,477 people estimated to be living in permanent on-base housing.

Air quality for SNL/NM is governed by regulations promulgated by both the Albuquerque/Bernalillo County Air Quality Control Board (ABC/AQCB) and the Federal government. Radionuclide emissions are administered directly by the EPA under NESHAP–40 CFR 61, Subpart H. Drivers for air quality compliance also include DOE Order 5400.1 (Chapter IV, Part 5). A complete listing of air quality regulations applicable to SNL/NM is given in Table 5-12.

New Program Directions under CAAA Title V

Amendments to the Clean Air Act in 1990 (CAAA) contained provisions under Title V requiring all existing major air emission sources to obtain an operating permit. A major source is defined as the combined emissions from any facility with the potential to emit 100 tons per year (tpy) or greater of any criteria pollutant, 10 tpy of any hazardous air pollutant (HAP), or 25 tpy of any combination of HAPs. SNL/NM is considered a major source based on its potential to emit for NO_x and CO.

DOE submitted the CAAA Title V Operating Permit application on March 1, 1996, which included the steam plant (a major source in itself) and all other combined sources such as generators, and minor units. DOE's Title V permit application was deemed complete on May 1, 1996. The permit is expected to be approved by March 1998.

The proposed Title V operating permit will integrate all CAAA requirements into one site-wide permit which may be inclusive of several facilities in the general area including SNL/NM and DOE's facilities on KAFB. DOE will eventually submit just one report to the City of Albuquerque regarding its air quality compliance.

As discussed under Section 2.3, the Title V operating permit will change the current emission fee system. Currently, SNL/NM is assessed an annual per ton fee based on its maximum potential-to-emit of air pollutants; for example, the steam plant is assessed on the assumption that it will be operating at full capacity year-round. Under Title V, SNL/NM may be allowed to designate a self-imposed cap on fuel usage and thus project a more realistic estimate of the actual fuel used. The permit is also expected to limit the need to acquire individual source permits through preapproval.

5.5.1 New Air Compliance Activities in 1996

- **Removal of UST**
  To meet the stricter requirements for USTs, which will become effective in 1998, a 12,000-gal. gasoline tank was removed from the motor pool in TA-I in 1996. SNL will now obtain all gasoline through a contract with the KAFB motor pool. This tank had also previously been subject to 20 NMAC 11.65—Volatile Organic Compounds (VOCs) (USTs >3,000 gal.). With the removal of this tank, there are no other tanks that fall under 20 NMAC 11.65, however, this regulation may still be applicable for environmental remediation of any VOC-contaminated soils onsite.

- **New Air Permit for RWL Remediation**
  Remediation at the Radiological Waste Landfill (RWL) in TA-II began in the summer of 1996. SNL/NM applied for Authority-to-Construct Permit No. 480 for the remediation which has since been completed. Monitoring was reported initially on a weekly basis but, due to the very small emissions detected during the project, was later decreased.

5.5.2 Criteria Pollutants

The EPA must describe the characteristics and potential health effects of "criteria pollutants" known to be hazardous to human health (see Section 5.2.1). For these criteria pollutants, the EPA is empowered by the CAA to:

- Set ambient air quality standards including motor vehicle emissions.
- Require states to submit plans for protection and improvement of air quality.
- Institute a program to prevent the nation's air from deteriorating below standards.
- Establish a program for controlling hazardous air pollutants (HAPs).

Standards for criteria pollutants are implemented by 40 CFR 50 and 20 NMAC 11.01. Compliance is ensured through ambient monitoring conducted under the Ambient Air Monitoring Program (Section 5.2).

Criteria Pollutant Sources

The significant sources of criteria pollutants at SNL/NM are listed below. The steam plant is currently the only major source (>100 tpy).

- **Steam Plant** – The steam plant produces steam heat for buildings in TA-I and KAFB East. Because this is a "grandfathered" source, no permit was previously required, however, it is now required to obtain a Title V Operating Permit. During 1996, all five boilers at the plant were operated and consumed a total of 7.5 billion standard cubic feet of natural gas. These boilers can also be run on diesel oil; during 1996, they consumed 15,000 gal. of oil. SNL/NM is currently meeting Title V compliance by paying the maximum potential permit fee, but has started tracking fuel throughput in anticipation of meeting future Title V compliance with self-imposed fuel caps. Because fuel throughput will likely be used to estimate emissions, criteria pollutant calculations and stack sampling may not be used.
- **Emergency generator plant** – SNL/NM operates four standby generators, each with a 600-kilowatt (kW) capacity: these diesel-fired generators are located in TA-I and are currently permitted (No. 402). The generators are started up monthly for maintenance and testing. In anticipation of Title V fuel caps, SNL/NM has proposed a 500 hr/year generator usage which will include these and all other generators located onsite.
- **Vehicles** – SNL has a fleet of about 810 vehicles, which must meet local emissions testing. In addition, a program to introduce the use of alternatively fueled vehicles began in 1993. SNL/NM now has 33 Compressed Natural Gas (CNG) vehicles. CNG is the cleanest burning of alternative fuels; it is more economic, safer, and emits less carbon monoxide than gasoline. SNL/NM is making efforts to increase the use of CNG vehicles in its fleet.
- **Open Burns** – The open-burning regulation covers activities such as:
  - the disposal of explosives by burning to avoid the hazards of transport or handling;
  - above ground detonation of more than 20 lb of explosives;
  - single-event R&D activities of 2000 gal. or more of liquid fuel; and
  - ignition of rocket motors containing more than 4000 lb of fuel.

  In addition, the regulation differentiates the permit basis into two categories: multiple-event or single-event. The single-event permit was designed to regulate activities having significant impact. Open-burn permits were obtained from the City of Albuquerque for each scheduled regulated burn or test according to 20 NMAC 11.21.

Table 5-12. Applicable air regulations to SNL/NM. The relationship between State and Federal regulations and the underlying Clean Air Act Law is shown with specific relevant regulations discussed in the explanation.

CAA Title	Federal Regulation	Local Regulation	Subject	Applicable Activities and Facilities
Title I	40 CFR 93 B 40 CFR 51 W	20 NMAC 11.03 20 NMAC 11.04	Conformity (State and Federal Plans)	General
Title I	40 CFR 58 (Subpart C–Air Programs)		Ambient Air Quality Surveillance	Air Quality Surveillance Program - Standards for state and local air monitoring stations (SLAMS)
Title I	40 CFR 50	20 NMAC 11.01	National Primary and Secondary Ambient Air Quality Standards (NAAQS)	Establishes ambient air quality standards for criteria pollutants
Title I	40 CFR 52	20 NMAC 11.02	Permit Fees	Asbestos, inventories, permits, reviews
Title I	40 CFR 52	20 NMAC 11.05	Visible Air Contaminants	- SMERF *(exempt)* - SWISH *(exempt)*
Title I	40 CFR 52	20 NMAC 11.06	Emergency Action Plan	If formulated by AEHD
Title I	40 CFR 52	20 NMAC 11.07	Variance Procedure	If variance is sought
Title I	40 CFR 52	20 NMAC 11.20	Airborne Particulate Matter (PM)	Surface Disturbing over 3/4 acre (e.g., general construction or demolition)
Title I	40 CFR 52	20 NMAC 11.21	Open Burning	- Open burns conducted at the Burn sites and Cable Facility - Explosive detonations
Title I	40 CFR 51–52	20 NMAC 11.40	Source Registration	Facilities with emissions >1 tpy of HAP - SMERF - Neutron Generator Test Facility
Title I	40 CFR 51–52	20 NMAC 11.41	Authority-to-Construct	Stated operating conditions for facilities with emissions >25 tpy or 10 lb/hr or >5tpy of Pb or NESHAP-listed pollutant - Hammermill - 4 Stand-by generators
Title I	40 CFR 51.100	20 NMAC 11.43	Stack Height Requirements	Good engineering practice
Title I	40 CFR 51	20 NMAC 11.44	Emissions Trading	Applicable if credit taken
Title I	40 CFR 51–52	20 NMAC 11.60	Permitting in Nonattainment Areas	Applicable if > 100 tpy CO
Title I	40 CFR 52	20 NMAC 11.61	Prevention of Significant Deterioration	Applicable if > 250 tpy
Title I	40 CFR 60 40 CFR 63	20 NMAC 11.65	Volatile Organic Compounds	- Fuel use (N/A) - Remediation of solvent contaminated soil - Groundwater treatment
Title I	40 CFR 60	20 NMAC 11.66	Process Equipment	- Hammermill for PM
Title I	40 CFR 60	20 NMAC 11.22	Wood Burning	N/A

NOTE: N/A = not applicable

Table 5-12. Applicable air regulations to SNL/NM. The relationship between State and Federal regulations and the underlying Clean Air Act Law is shown with specific relevant regulations discussed in the explanation (Concluded).

CAA Title	Federal Regulation	Local Regulation	Subject	Applicable Activities and Facilities
Title I	40 CFR 60	20 NMAC 11.63	New Source Performance Standards	Prescribes operating conditions for new or modified facilities
Title I	40 CFR 60	20 NMAC 11.67	Equipment, Emissions and Limitations (regulates NO_2, PM, and SO_2 from gas-burning and oil-burning equipment)	N/A (the five natural gas-burning boilers at the steam plant produce less than the rated heat capacity threshold of 250 Mbtu/hr)
Title I	40 CFR 60	20 NMAC 11.68	Incinerators	N/A
Title I	40 CFR 60	20 NMAC 11.69	Pathological Waste Destructors	N/A
Title II	40 CFR 85–86	20 NMAC 11.100 20 NMAC 11.101 20 NMAC 11.103	Mobile Sources	SNL's fleet of over 800 vehicles, inspection and emissions testing
Title II	40 CFR 80	20 NMAC 11.02	Fuels and Fuel Additives	For motor vehicles
Title III	40 CFR 61 40 CFR 63	20 NMAC 11.64 *nonradionuclides*	NESHAP Subpart C – Beryllium (Be) Subpart H – Radionuclides other than Radon (EPA regulates directly) Subpart M – Asbestos	A hazardous chemical purchase inventory for CY 1996 was conducted
Title IV	40 CFR 72-78	20 NMAC 11.62	Acid Rain	N/A
Title V	40 CFR 70-71	20 NMAC 11.42	Operating Permit (Application under Review)	For existing major sources (>100 tpy): - Steam Plant - Generators
Title VI	40 CFR 82	20 NMAC 11.23	Ozone Protection	Limiting the use of Class I and Class II ODSs - Auto air conditioners - Refrigerators - Chillers
Title VII	40 CFR 64	20 NMAC 11.90	Administration, Enforcement, Inspection	Breakdown, abnormal operating condition or scheduled maintenance
		20 NMAC 11.100	Motor Vehicle Inspection – Decentralized	Emission testing

NOTE: N/A = not applicable

Pollution Prevention in Permitting Pilot (P4) Project

The City of Albuquerque nominated DOE to participate in the Pollution Prevention in Permitting Pilot (P4) Project. This is a new initiative started by the EPA to incorporate pollution prevention into its permitting activities. The primary goal of the P4 Project is to identify opportunities and barriers to using flexible regulatory and non-regulatory activities. DOE was nominated because the Albuquerque Environmental Health Department (AEHD) has expressed confidence in both the current working relationship with DOE, and DOE's technical capability for implementing a project of this importance. SNL/NM's role in the project will be the lead as the major source for NO_x and CO. The project will commence in January 1997 and conclude one year later.

5.5.3 Air Quality Compliance Documentation

Documents specific to the NESHAP Program, the Ambient Air Surveillance Program, the Meteorological Monitoring Program, and the Air Quality Compliance Program are shown in Table 5-13.

Table 5-13. Important documents for all Air Quality Programs at SNL/NM.

Program Document	Reference
NESHAP PROGRAM	
Annual NESHAP Report (EPA Summary)	(SNL 1997c)
Annual NESHAP Dose Assessment and Supplementation Report	(SNL 1997c)
NESHAP Quality Assurance Project Plan (QAPjP)	(SNL 1997j)
AQC PROGRAM	
Title V Permit Application (7-volume document)	no reference
ODS Management Plan	(SNL 1997b)
Air Quality Compliance Quality Assurance Project Plan	(SNL 1996l)
Supporting Documentation for the EPCRA Section 313 TRI Report (CY96)*	(SNL 1997a)
CAN PROGRAM	
PHA Air Quality Monitoring	(SNL 1996m)
PHA Meteorological Monitoring	(SNL 1996n)
Inspection Maintenance Plan for Guyed Structures (Met towers)	(SNL 1997f)
Quality Assurance Project Plan (CAN)	(SNL 19967g)

NOTE: * No TRI report was required for CY96. This report was published to document the calculations showing SNL/NM was under the threshold reporting values.

6 WASTEWATER MONITORING, SURFACE DISCHARGE, and STORM WATER RUNOFF

Effluent monitoring is the collection of samples or direct measurement taken from liquid or gaseous waste stream processes for the purpose of quantifying contaminants and determining regulatory compliance. Effluent monitoring in this chapter is confined to water monitoring activities that include sanitary and industrial sewer discharges, surface discharges, and storm water runoff.

6.1 SEWER WASTEWATER DISCHARGE PROGRAM

SNL produces both sanitary and industrial effluents, which are discharged to the City of Albuquerque's (COAs) sanitary sewer system. Sanitary effluents include wastewater from lavatories, cafeterias, and other domestic type activities. Industrial discharges originate from laboratory processes, general manufacturing, and various experimental activities. SNL/NM monitors its liquid effluent discharges and strives to minimize toxic pollutants through cognizant pollution prevention and waste minimization tactics. These prevention and conservation endeavors are implemented through good management and engineering practices, chemical substitution (where feasible), equipment modifications, reduction of hazardous material use at the source, and strict guidelines for what can and cannot be disposed of into the public sewer system. If pollutants above regulatory levels are detected in the waste stream, SNL/NM staff conducts an investigation to discover the source of the discharge and implements corrective actions, as needed.

As part of the wastewater management program, SNL/NM also maintains three active septic systems which are periodically pumped and discharged by certified pumping contractors. Contents are sampled prior to pumping to ensure the sewage meets all regulatory criteria.

Pollutants present in SNL/NM wastewaters include contaminants contained in rinse waters or process baths, which may include various toxic organics found in industrial cleaners, coatings, and solvents. Toxic organics and metals also arise as by-products from microelectronic manufacturing, metal finishing, electroplating and photographic processes. Other significant sources of pollutants come from cooling tower wastewaters (swamp coolers), which can be high in dissolved salts. SNL policy allows no direct disposal of toxic chemicals or radioactive materials into the sewer system.

6.1.1 Monitoring Stations and Sewer System

Currently, SNL/NM maintains six wastewater monitoring stations. Four of these stations measure general outfalls (industrial and sanitary effluents) and are the final discharge points into the Publicly Owned Treatment Works (POTW). Two stations are upstream of the general outfalls and are defined under categorical pretreatment operations. Station WW007 monitors only wastewater emanating from the acid waste neutralization system at the Microelectronics Development Laboratory (MDL); Station WW009 monitors only wastewater generated from the Advanced Manufacturing Process Laboratory (AMPL). Combined SNL/NM discharges are under one million gallons per day.

Discharges into the POTW are regulated by the COA Public Works Department, Liquid Waste Division, under the authority of the City's "Sewer Use and Wastewater Control Ordinance," Section 8-9-44.H. Discharges from SNL/NM flow to the COA Water Reclamation Plant located just north of the point where Tijeras Arroyo meets the Rio Grande. All wastewater is properly treated by the COA in accordance with their NPDES permit requirements before being discharged into the river. Table 6-1 lists the SNL/NM monitoring station characteristics. A map of the station locations and associated sewer lines are shown in Figure 6-1.

6.1.2 Permitting and Reporting

To comply with EPA regulations, the COA has implemented an industrial wastewater pretreatment program that specifies the required quality of discharges it will accept at the water reclamation plant and the required frequency of reporting. To meet these standards, SNL/NM requires all internal organizations producing continuous process discharges—other than normal sanitary effluent—to obtain prior approval from the Environmental Monitoring and Reporting Department. The Department is responsible for reviewing documentation describing the amount, frequency, location, composition, and process associated with the discharge and making a recommendation as to the acceptability of the discharge. Internal permits are reviewed annually, or whenever the wastewater processes change. One time releases are evaluated on a case-by-case basis. Semiannual reports were submitted as required by July 31, 1996 for the first reporting period (January to June) and by January 31, 1997 for the second reporting period (July to December).

In addition to the sampling performed by SNL/NM, the COA performs quarterly inspections and sampling. In March 1996, COA staff toured the facility to inspect for compliance with the discharge requirements. The New Mexico Environment Department (NMED) also took samples in June and September 1996. SNL/NM received six Gold Pretreatment Awards from the COA for its one hundred percent adherence to requirements in FY1996. (The two excursions that occurred late in the year were in FY1997).

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

Station Manhole	Waste Stream Process	Flume Size	Average Flow (gal./day)
WW001	General	3 inch Parshall	91,721
WW006	General	6 inch Parshall	385,747
WW007	MDL	45° v-notch Weir	144,722
WW009	AMPL	2 inch Parshall	2,082
WW008	General	6 inch Parshall	393,426
WW011	General	6 inch Parshall	54,798

NOTE: All discharges from the MDL and AMPL flow through a General Station before discharging to the POTW.

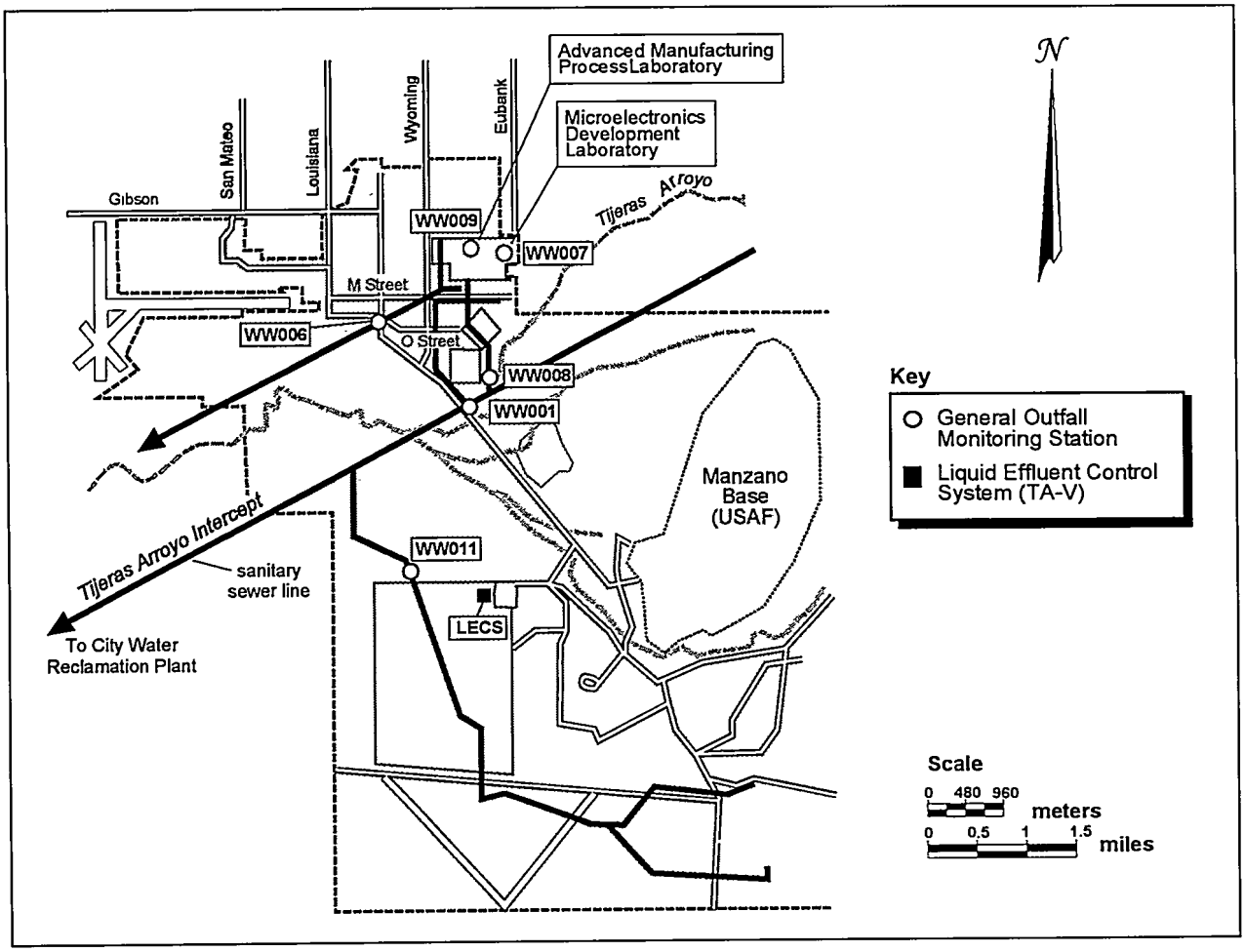

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Figure 6-1. SNL/NM's wastewater monitoring station locations.

The regulatory discharge limits, sampling procedures, sampling frequency, analytical methods, and quality control/quality assurance (QC/QA) criteria are documented in the *SNL/NM Wastewater Sampling and Analysis Plan* (SNL 1996p). Analytical results are also documented in *Wastewater Monitoring Program Monthly Reports* produced for internal records. Primary regulatory drivers for the Wastewater Program are listed in Table 6-2.

6.1.3 TA-V Radiological Screening

SNL/NM's policy prohibits the disposal of radiological material above regulatory levels into the sanitary sewer system. TA-V houses several research reactors, which have the potential to produce radiologically-contaminated process wastewater. To ensure that all wastewater from this facility meets regulatory standards, liquid effluent is separated into two streams; reactor and non-reactor wastewater. All non-reactor sanitary waste is discharged directly to the sanitary sewer. Reactor process wastewater, defined as effluent originating from any drain located in a building, which uses, processes, or stores radioactive material, is diverted to the Liquid Effluent Control System (LECS). The LECS consists of three 5,000-gal. tanks connected to an ion exchange and filter system. All wastewater is held for radiological screening before it is allowed to be discharged to the sanitary sewer. Alarms have been installed to alert personnel to the presence of radioactive materials or high water levels. Samples are

Table 6-2. Primary regulatory drivers for the Sewer Wastewater Discharge Program.

Regulation	Citation
Clean Water Act (CWA)	Title 33, U.S.C. 1251
COA Sewer Use and Wastewater Control Ordinance	Chapter XIII, Article IX Section 8-944.H (1990)
NMWQCC Regulations	20 NMAC 6.2*
USNRC regulations for radiological levels in wastewater	10 CFR 20
Radiation Protection of the Public and the Environment	DOE Order 5400.5

NOTE: *Implements the New Mexico Water Quality Act.

taken about once a month, depending on how much water is collected, and sent to an EPA-approved laboratory for analysis of gross alpha and gross beta activities, tritium, and gamma spectroscopy. Since this system began operating in 1994, no radioactive contaminants have been detected and the ion exchange system has not been needed. All discharges from TA-V flow through monitoring station WW011 (Permit 2069K).

6.1.4 Sewer Wastewater Sampling

Wastewater permits issued by the COA detail all of SNL/NM's potential pollutant sources and the raw materials used in its industrial processes. To determine compliance with discharge limits stated on each permit, SNL/NM collects monthly samples at each of the four general outfall monitoring stations and quarterly splits with the COA at selected stations. All samples are taken as 24-hour flow proportional composites. Additionally, continuous monitoring of pH and flow is conducted at stations. Samples are sent for analysis to EPA-approved laboratories using EPA-approved procedures.

In addition to sampling required by the State, SNL/NM also performs gross alpha, gross beta, tritium, and gamma spectroscopy on all wastewater samples to verify COA radioactive materials management requirements. Results of radiological sampling are contained in the *Wastewater Monitoring Program Monthly Reports.*

6.1.5 Summary of Monitoring Results

The 1996 wastewater results with respect to meeting permit requirements are documented in the *Wastewater Monitoring Program Semiannual Reports for 1996.*

A summary of compliance with each permit is as follows:

- **Permit 2069A-3.** (General Station WW001) No violations occurred.
- **Permit 2069F-3.** (General Station WW006) On December 28, 1996, a pH excursion above 11 occurred for 3 hours (maximum 12.7). Regulations state that pH cannot fall outside the range of 5–11 for over 1 hour. No associated fines were incurred.
- **Permit 2069G-3.** (MDL Station WW007) No violations occurred.
- **Permit 2069H-3.** (AMPL Station WW009) A minor violation occurred on November 8, 1996. A pH excursion lasting 1.5 hours exceeding a pH of 11 (maximum 11.8). No fines were imposed from the COA.

Table 6-3. Important Documents for the Sewer Wastewater Discharge Program

Program Document	Reference
Semiannual Reports (July 31, 1996 and January 31, 1997)	(no reference)
Wastewater Monitoring Program Monthly Report.	(no reference)
Handbook for Sampling and Sample Preservation of Water and Wastewater	EPA 1982
Solvent Management and Discharge Control Plan	SNL 1995p
Discharges to the Sanitary Sewer (ES&H Manual)	SNL 1995m
Septic System Monitoring Sampling and Analysis Plan	SNL 1995n
SNL/NM Wastewater Sampling and Analysis Plan	SNL 1996p
ES&H Program Document: Water Quality	SNL 1994b

- **Permit 2069I-2.** (General Station WW008) No violations occurred.

- **Permit 2069K-2.** (General Station WW011) No violations occurred.

6.2 SURFACE DISCHARGE PROGRAM

All discharges to the ground surface are evaluated for compliance with New Mexico Water Quality Control Commission (NMWQCC) regulations as implemented by the New Mexico Environment Department's (NMED's) Ground Water Bureau (Table 6-4). The Surface Discharge Program also follows the requirements of DOE Orders 5400.1 and 5400.5. During 1996, the Program was presented an award from the joint DOE and SNL Appraisal System for outstanding performance.

Surface discharges are made only after consultation and approval by Sandia's Environmental Monitoring and Reporting Department working under the requirements set forth by the State. All surface discharge requests must list source contaminants, if any, and must meet strict guidelines before water is released to roads, open areas, or impoundments. In 1996, 33 individual requests for discharges were made; five were rejected and sent to the sanitary sewer system authority for approval and disposal. All approved discharges to the ground surface were in full compliance with New Mexico Water Quality Standards.

Table 6-4. Primary regulatory drivers for the Surface Water Discharge Program.

Regulation	Citation
Clean Water Act (CWA)	Title 33, U.S.C. 1251 *(Environmental Monitoring & Reporting Requirements)*
NMWQCC Regulations	20 NMAC 6.2

Pulsed Power Evaporation Lagoons

A formal plan is in place for discharges made to the two large evaporation lagoons used by the Pulsed Power Development facilities in TA-IV. Due to the large volumes of water involved, and the ongoing nature of the discharges, these lagoons are permitted by the NMED. These lined lagoons are used to collect and evaporate large quantities of storm water pumped from containments around the facility's oil storage tanks. Additionally, water accumulates in several indoor floor containment trenches (e.g., from condensation and cleaning) and also must be pumped out. All visible oil is skimmed before discharge to the lagoons.

Lagoon I is a 137,500-gal. capacity rectangular pond, 50 by 70 ft in area and 11 ft deep. Lagoon II is a 127,000-gal. capacity trapezoidal shaped pond, approximately 40 by

Table 6-5. Important documents for the Surface Discharge Program

Program Document	Reference
Sampling and Analysis Plan for the Pulsed Power Development Facilities, Bldgs. 981/983 and 970, Lagoons I and II	SNL 1995o
Handbook for Sampling and Sample Preservation of Water and Wastewater	EPA 1982
DP-530 Semiannual Report	(no reference)
Surface and Storm Water Discharges, (ES&H Manual)	SNL 1996q

70 ft in area and 8 ft deep. NMED Discharge Plan DP-530 permits discharges to both Lagoon I and Lagoon II. The plan currently requires semiannual water quality analysis and water level measurements. Results are reported to the state six months after each sampling event.

Lagoon Sampling Results

Water level measurements and water quality samples were taken in June and December of 1996. Due to the limited surface area (less than 1000 sq ft) and depth, grab samples from the surface are considered representative for water quality analysis. Direct measures were also made of pH and specific conductance at the time of sampling. Parameters measured, as required by the permit, include total dissolved solids (TDS), chloride, sulfates, and various other major ions. Additionally, SNL/NM analyzes the water for calcium, sodium, magnesium, potassium, calcium carbonate, and VOCs. All permit requirements were met in 1996. Results are recorded in the *DP-530 Semiannual Report* (SNL 1996o).

1996 Surface Discharge Activities

A minor occurrence involving approximately 10 to 25 gal. of sewage inadvertently released to the surface is discussed in Section 2.6.

In 1996, DOE presented an award to SNL/NM for outstanding performance in surface discharge spill and prevention management.

6.3 STORM WATER MONITORING

Storm water that is not absorbed directly into the ground is transported as runoff from streets, parking lots, buildings, industrial areas, and other sites of potential contamination. Runoff is collected and channeled by the storm drain system or discharged directly off SNL/NM property.

The EPA regulates storm water as a "point source discharge" and defines the "point" as the location where any storm drain discharges waters directly into "waters of the United States." At SNL/NM, this point is defined as any runoff discharging to the Tijeras Arroyo from direct storm drain conduits, channels or surface flow that enters the arroyo from SNL/NM property. Tijeras Arroyo drains through SNL/NM before emptying into the Rio Grande about 14 km to the west. Based on the current facility configuration, only TA-I, TA-II, and TA-IV produce stormwater that discharges directly to Tijeras Arroyo. TA-III, TA-V, and test areas further south are more distant from Tijeras Arroyo and situated on sandy alluvium where runoff is absorbed into the ground before reaching Tijeras Arroyo. Several other small arroyos draining from the Manzanita Mountains, such as from Lurance and Coyote Canyon, do contribute runoff to the Tijeras Arroyo; however, this storm water does not originate from areas containing activities that require storm water monitoring.

Table 6-6. Primary regulatory drivers for the Storm Water Program.

Regulation	Citation
NPDES Regulations	40 CFR 122-125
Guidelines Establishing Test Procedures for the Analysis of Pollutants	40 CFR 136
NMWQCC Regulations	20 NMAC 6.2*

NOTE: *Implements the New Mexico Water Quality Act.

6.3.1 SNL/NM Storm Water Program

SNL/NM has implemented its Storm Water Program to meet the objectives and requirements of the National Pollutant Discharge Elimination System (NPDES) to prevent storm water pollution. Primary program drivers are listed in Table 6-6.

The storm drain system is inspected routinely for debris during dry weather (dry inspections) to detect any illicit discharges, and during storm events (wet inspections) to detect any unusual characteristics of the storm water discharge. Only storm water is allowed to be discharged to the storm water drainage system.

In 1996, storm water monitoring was conducted at three stations (Figure 6-2). Actual parameters measured were extensive and comparable to drinking water standards and included—but were not limited to—oil, cyanide, VOCs, coliform, total suspended solids (TSS), nitrates, pesticides, metals, explosives, gross alpha, and gross beta. The new storm water permit—expected to become effective in 1997—will require less extensive sampling. The set of analytes measured in 1996 were based on the storm water permit application submitted in 1992 that tailored sampling parameters based on the type of industrial processes upgradient of each storm water station. The complete list of 1996 sampling parameters and methods is documented in the *Storm Water and Non-storm Water Discharge Sampling and Analysis Project Plan* (SNL 1996r).

Several other environmental programs at SNL/NM work cooperatively to ensure storm water runoff meets or exceeds regulatory standards. These include the Pollution Prevention Program, the Surface Discharge Program, and program activities conducted under the *Oil Spill Prevention Control and Countermeasures Plan* (CDM 1995). Pollution prevention efforts include constructing equipment/material shelters, curbing, sloping pads, and spill/runoff containments to reduce the transport of potential pollutants from waste handling areas, oil storage facilities, and other chemical containment areas (SNL 1996u). Storm water runoff from construction sites exceeding 5 acres is permitted under the NPDES Construction Storm Water Permitting regulations. Effected construction projects have individual Storm Water Pollution Prevention Plans that impose requirements specific to each site. Storm water pollution mitigation activities include the use of silt fences and strict guidelines to prevent contamination from various construction materials and processes. Once the construction project is complete, open areas may be reseeded, xeriscaped, or asphalted to prevent the transport of residual pollutants.

6.3.2 NPDES Permit Application

The EPA requires an NPDES storm water permit for all industrial facilities that have processes defined in the Standard Industrial Classification (SIC) Codes listed in Appendix A of 40 CFR 122. SNL/NM has four "primary industrial" activities as defined in the regulation:

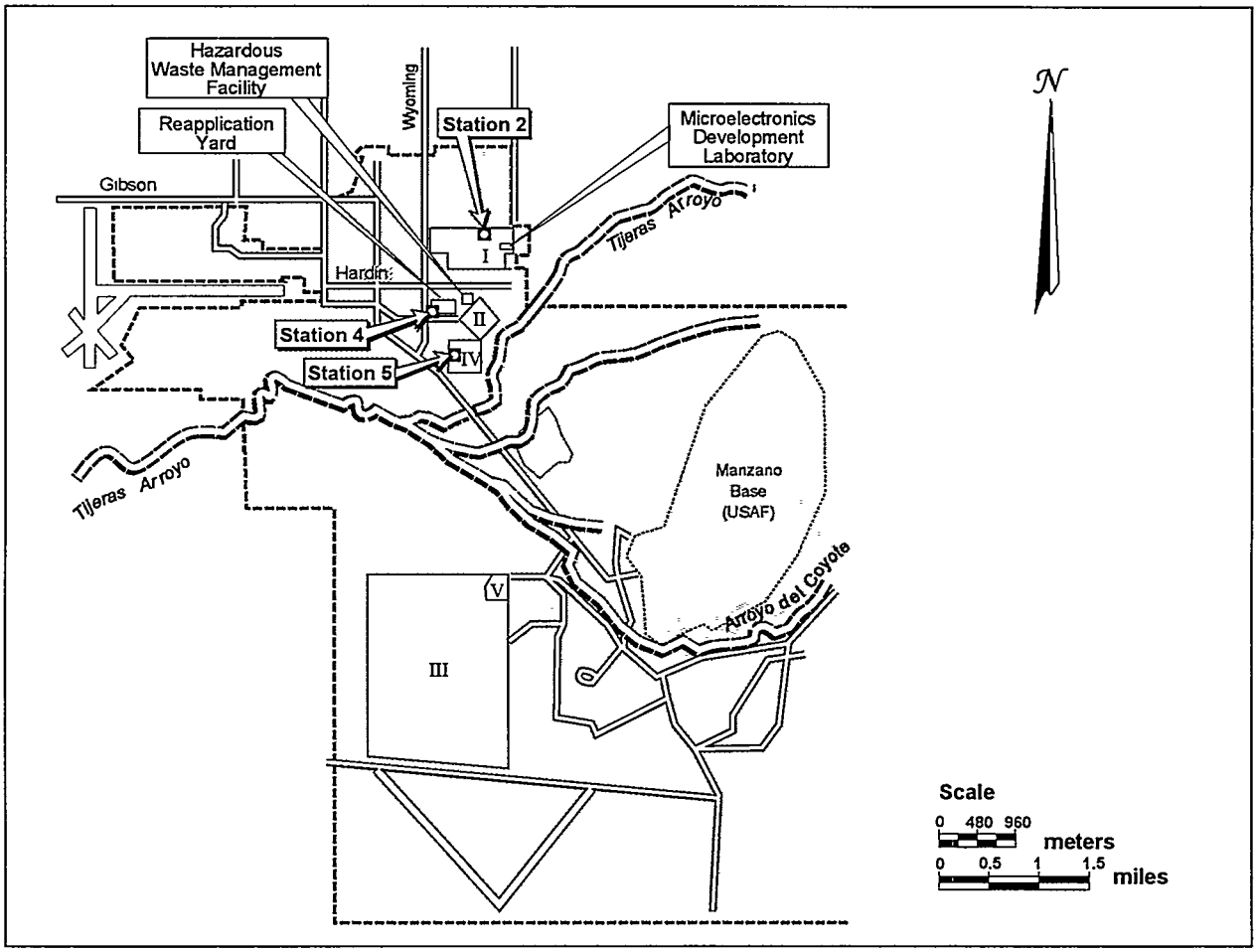

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Figure 6-2. Storm water monitoring station locations at SNL/NM.

(1) Any construction or disturbance of over five acres.

(2) Electronics manufacturing (applies to the Microelectronics Development Laboratory (MDL).

(3) Hazardous materials treatment, storage, or disposal (TSD) (applies to the HWMF).

(4) Scrap and waste recycling facilities (applies to the Reapplication Yard).

In 1996, activities conducted under the last three items required storm water monitoring. With respect to item 1, several facilities in 1996 required permitting, but did not require monitoring: the Explosive Components Facility (ECF), the Robotics Manufacturing Science and Engineering Laboratory (RMSEL), and the Technology Support Center (TSC). The ECF and RMSEL permits were terminated in 1996. The permit for the TSC will be terminated in 1997.

Historical Permit Status

SNL/NM first applied for an "Individual" storm water permit in 1992 that would be specifically tailored to all facilities at the site. This permit was still pending in 1996 due to the backlog at the EPA in processing these types of permits. After reassessing the activities presently conducted at SNL/NM, the decision was made to submit a new application under the "Multi-sector General Permit." The new type of permit sought is more specific in listing regulated pollutant levels in storm water and has limited the

constituent monitoring list to industry specific pollutants. In 1995, under the "Individual" permit, nine storm water monitoring stations were originally planned; the new permit will require only two. SNL/NM has left the original "Individual" permit pending while a determination is made by the EPA on the new "Multi-sector General" permit. Approval of the new permit is expected by the summer of 1997. NMED is now partially involved in oversight of NPDES regulations; it is likely that the EPA will delegate complete authority to the State by the year 2000.

EPA conducted a "spot check" of SNL/NM's Storm Water Program in 1996 and noted a satisfactory program.

6.3.3 Storm Water Monitoring Stations

In 1996, SNL/NM conducted storm water monitoring at three points, Stations 2, 4, and 5 (Figure 6-2). Station 2 monitors storm water runoff that enters SNL/NM property from a KAFB housing area, north of TA-I, to determine what, if any, pollutants are flowing onto SNL/NM property. Of particular interest is the pesticides and fertilizers that may be present from landscaped areas in the vicinity of KAFB housing. Station 4 monitors runoff from SNL/NM's Reapplication Yard. The Hazardous Waste Management Facility (HWMF) and the Microelectronics Development Laboratory (MDL) are monitored at Station 5. Station 5 is the furthest downgradient station and closest point to the Tijeras Arroyo intersect, and therefore, collects runoff from the majority of SNL/NM's industrial activities.

In general, most storm water sampling occurs during the rainy season from April through September. After a rainfall of sufficient intensity and duration (as defined in the regulation), storm water runoff flowing through each station is collected into composite and grab samples. Rainfall is also measured at each site; this data is shared with the National Weather Service.

The "Multi-Sector" Permit will require sampling four times per year every two years, weather permitting. Due to Albuquerque's semi-arid climate, precipitation rarely produces adequate runoff for monitoring in the months of October through March.

6.3.4 Storm Water Monitoring Results

In anticipation of the new NPDES storm water permit, the 1996 storm water sampling results are listed with respect to parameters that will be required once the permit is in place (Table 6-7). Due to miscommunication with the testing laboratory, the only sample taken at Station 5 was not tested for metals.

Complete sample analysis results of the 1996 Storm Water Program can be referenced in the *Results of 1996 Storm Water Sampling* (SNL 1997h). All other applicable program documents are listed in Table 6-8.

Table 6-7. Sampling results for storm water stations 2, 4, and 5.

Parameter	Station 2† (mg/L) 7/9/96	8/20/96	Station 4 (mg/L) 6/28/96	7/10/96	Station 5‡ 8/23/96	NPDES limit (mg/L)	State limit (mg/L)
Cyanide	--	*ND*	0.0091 j	*ND*	*ND*	0.0636	0.2
Arsenic	--	--	j	0.0028j	--	0.16854	0.01
Barium	--	--	0.14	0.15	--	1.0	1.0
Cadmium	--	--	0.0066	*ND*	--	0.05	0.01
Chemical Oxygen Demand	--	--	21.7	26.8	--	120	
Chromium	--	--	*ND*	0.0062 j	--	0.5	0.05
Copper	--	--	0.018 j	0.021	--	0.0636	
Lead	--	--	*ND*	*ND*	--	0.0816	0.05
Manganese	--	--	0.15	0.17	--		0.2
Mercury	--	--	*ND*	*ND*	--	0.0024	0.002
Nickel	--	--	*ND*	0.0099 j	--		0.2
Nitrate + Nitrite	--	--	1.2	1.8	--	0.68	0.68
Oil & Grease	1.1	1.4	0.60 j	1.1	0.44 j		
Selenium	--	--	*ND*	*ND*	--	0.2385	0.05
Silver	--	--	*ND*	*ND*	--	0.0318	0.05
Total Kjeldahl Nitrogen	--	--	1	1.5	--		
Total Suspended Solids	--	--	72.4	195	--	100	100
Zinc	--	--	0.11	0.084	--	0.065	10
Lead	--	--	*ND*	*ND*	--	0.0816	0.05
Gross Alpha	--	--	2.19	--	--	none	none
Gross Beta	--	--	5.74	--	--	none	none
Explosives (15 total)	--	--	*ND* **	*ND*	--		

NOTE: †Station 2 is being closed as a sampling station and will be used only to measure rainfall data.
‡Station 5 had insufficient sample recovery due to limited storm water runoff in 1996.
**One explosive parameter (1,3.5-trinitrobenzene) was detected at 0.11 mg/L and was below the limit
-- = Not tested
ND = Not detected
j = Detected below reporting limit or is estimated concentration

Table 6-8. Important program documents for the Storm Water Program.

Program Document	Reference
Storm Water Pollution Prevention Plan	SNL 1996u
Handbook for Sampling and Sample Preservation of Water and Wastewater	EPA 1982
Results of 1996 Storm Water Sampling Annual Report	SNL 1997h
Storm Water and Non-Storm Water Discharge Sampling and Analysis Project Plan for SNL/NM	SNL 1996r
Storm Water Management Program Plan	SNL 1996t
PHA- Storm Water Program	SNL 1996s
Surface and Storm Water Discharges (ES&H Manual)	SNL 1996q

7 GROUNDWATER MONITORING and PROTECTION PROGRAMS

This chapter describes the groundwater monitoring activities conducted at SNL/NM during 1996. Groundwater monitoring activities reported are those associated with two programs at SNL/NM: the Groundwater Protection Program and the Environmental Restoration (ER) Project. Regulations specific to the two task areas are shown in Table 7-1.

The Groundwater Surveillance Task is the groundwater monitoring function of the Groundwater Protection Program. This task performs site-wide water quality and water level measurements at SNL/NM to establish baseline information on the groundwater system in the vicinity of SNL/NM. SNL/NM conducts groundwater monitoring to determine the impact, if any, from its operations on the quality and quantity of groundwater, and to demonstrate compliance with all Federal, State, and local groundwater requirements. For the most part, wells are located on KAFB, although there are several wells and one spring located just west and south of the base boundary.

The ER Project is concerned with the determination of the nature and extent of groundwater contamination, if any, at specific sites at SNL/NM where past activities resulted in environmental contamination near the surface. In areas where contaminant migration has reached groundwater levels, the extent of the contaminant plume is being characterized through routine water level and water quality sampling.

The specific task areas performed for groundwater monitoring in 1996 are illustrated in Figure 7-1. All groundwater results determined by the Groundwater Surveillance Task and the ER Project Task are summarized in this chapter with respect to water level and water quality results. The first section of this chapter describes water level results and general groundwater trends. The second half of the chapter describes water quality results and describes contaminants found in concentrations over standards.

7.1 GROUNDWATER PROGRAM OVERVIEW

Groundwater Protection Program

The Groundwater Surveillance Task collects water quality samples and groundwater level measurements annually. Water quality data are used in baseline hydrogeochemical characterization and groundwater contamination detection monitoring. Water level data are collected monthly and quarterly and are used to infer the direction and rate of groundwater flow at KAFB. Wells in the Groundwater Protection Program network are selected to provide representative water samples for areas of SNL/NM based on historical water quality data. Figure 7-2 shows the network of wells used to monitor water quality and water levels. In 1996, 16 wells and three springs were sampled for water quality data. Water levels were measured in 30 wells. Some wells serve both functions.

ER Project

The ER Project collects groundwater level and water quality data at sites identified as having the potential for groundwater contamination associated with past hazardous waste disposal activities. These sites are managed in accordance with Resource Conservation and Recovery Act (RCRA) requirements detailed in Table 7-1.

ER site investigations are conducted as part of the site-specific activities under the Hazardous and Solid Waste Amendments (HSWA) permit

for SNL/NM. The HSWA requires that the RCRA process for investigating operating disposal facilities be applied to non-operating facilities. That is, investigations shall be carried out at the facilities using the RCRA facility investigation (RFI) process. RFI activities have been conducted in accordance with RFI work plans that are awaiting EPA approval. These preliminary activities have been designed to determine the amount and extent of any potential contamination in anticipation of formal RFI activities. Once the RFI process is complete, corrective measures can be initiated as needed.

Sites with the potential for groundwater contamination at SNL/NM are:

Chemical Waste Landfill (CWL)
Mixed Waste Landfill (MWL)
Technical Area-V (TA-V)
Canyons Test Area
Sandia North (includes TA-I and TA-II)

A brief description of the general contamination present at each area are as follows:

- **Chemical Waste Landfill** – Groundwater contamination at the CWL has been identified to include volatile organic compounds (VOCs), chromium, iron, and nickel. In 1996, samples were collected quarterly as required by the Closure Plan. Analytes and the frequency of sampling are specified in Appendix G of the Closure Plan (SNL 1992c and 1993a). The CWL is monitored by 14 wells located outside the CWL fenced perimeter.

- **Mixed Waste Landfill** – The MWL is primarily a tritium-contaminated site resulting from the past disposal of reactor coolant water. Currently, monitoring of the five wells located at this site is performed annually.

- **TA-V** – There are seven wells in the TA-V area including those which monitor the Liquid Waste Disposal System (LWDS) site. Samples are taken quarterly. Contaminants present include primarily VOCs such as trichloroethylene (TCE).

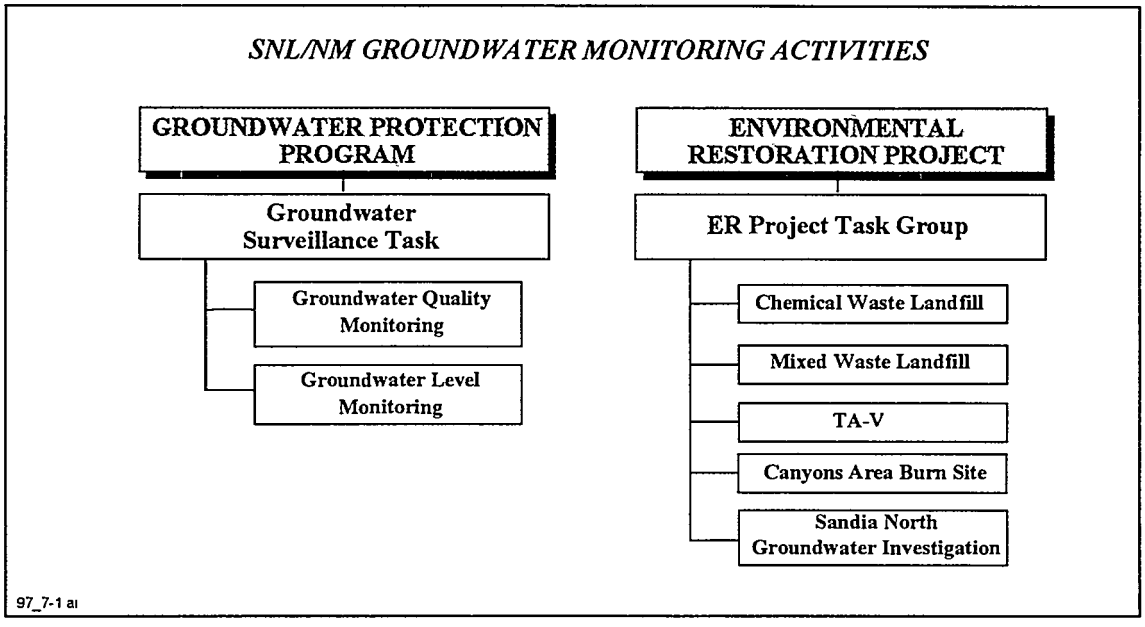

Figure 7-1. Organizational structure of groundwater monitoring activities in 1996.

- **Canyons Test Area** – Groundwater contamination with nitrates has been found at the Burn Site Well. At present, this is the only ER site in the Canyons where groundwater contamination is suspected. The ER project is currently working with the NMED to define additional groundwater investigation activities at the Burn Site. Water samples from the one production well were collected twice during 1996.

- **Sandia North** – This area includes ER sites in TA-I and TA-II. Sandia North is unique among ER sites in the existence of a perched or shallow water zone elevated above the regional groundwater system. Samples were collected in both the perched and regional wells in the Sandia North area. Groundwater contamination includes TCE, VOCs, and nitrates. Specific activities have been proposed in an investigation plan submitted to the NMED.

Table 7-1. Primary regulatory drivers for the Ground Water Protection Program and the ER Project.

Regulation	Citation	Note
Regulations specific to the GWPP		
Groundwater and Surface Water Protection	20 NMAC 6.2	New Mexico water quality standards.
Drinking Water	20 NMAC 7.1	New Mexico water quality standards.
National Primary Drinking Water Regulations	40 CFR 141	
Regulations specific to ER Sites		
RCRA Groundwater Monitoring Regulations (for interim status sites)	40 CFR 265, Subpart F	Applies to the CWL operating under the *CWL Closure Plan.*
Corrective Action for Solid Waste Management Units *	40 CFR 264, Subpart F, Section 264.101	All other ER Sites (excluding CWL), which are under RCRA's SWMU Corrective Action requirements.
General Environmental Protection Program	DOE Order 5400.1	--

NOTE: *As required by the HSWA Module to the RCRA Permit.
SWMU = Solid Waste Management Unit
HSWA = Hazardous and Solid Waste Amendments (to RCRA)

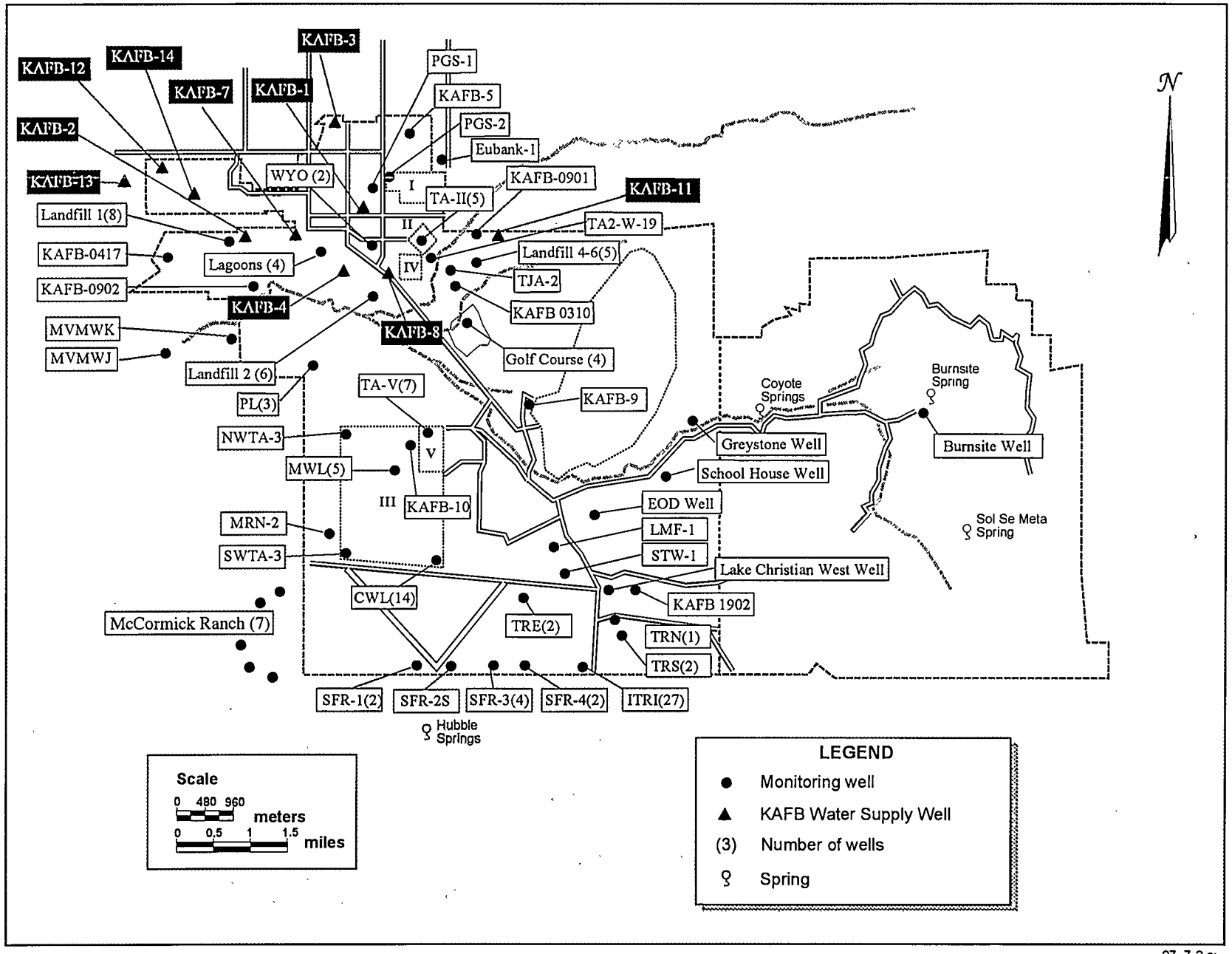

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Figure 7-2. Location of wells used for groundwater level and water quality monitoring in 1996.

7.2 WATER LEVEL TRENDS

Water level measurement activities were performed during 1996 by both the Groundwater Surveillance Task and the ER Project. The Groundwater Surveillance task and the ER Project Task measure water levels to establish groundwater gradients and infer the direction of groundwater flow. This information is vital to understanding the migration of contaminants in groundwater and their potential impacts. Water level information is also necessary to determine the future utility of existing monitor wells. Since well screens penetrate only a limited distance below the water table, the continuing decline of the water table will render some of these wells useless in the near future when the screens no longer intercept the water table.

The dynamics of water table fluctuations, as reflected by water levels in individual wells, are a balance of the water recharge to the groundwater system, the withdrawal from the system, and the properties of the aquifer materials. The quantity and location of local recharge to the aquifer on the east side of Tijeras Fault is currently not very well understood or documented. Recharge sources are from regional precipitation—the greatest amount of which occurs in the mountains on the eastern boundary of KAFB—and the Rio Grande several miles west of KAFB. Withdrawal of groundwater at KAFB has been reasonably well documented and is discussed in Section 7.3.4.

Water level trends

In general, the hydrographs constructed from water level information for wells throughout KAFB indicate water levels have been declining within the upper unit of the Santa Fe Group at rates of between 0.5 to over 3 ft per year. This decline is a result of water pumping from City of Albuquerque and KAFB water supply wells. Most of these water supply wells produce from coarser-grained layers of the upper and middle units of the Santa Fe Group. Water level information, with respect to the regional water table in the KAFB area, can be categorized into three general areas as shown in Figure 7-3.

Vicinity of TA-III

The "vicinity of TA-III" comprises the monitor wells within and around TA-III and TA-V. These wells are screened within the regional Santa Fe Group aquifer. In general, water levels do not show significant seasonal fluctuations but do show relatively steady declines that are consistent with basin-wide declines.

Sandia North Area

The "Sandia North Area" includes wells in the area or TA-I, TA-II, the Tijeras Arroyo and west of TA-II. This area includes the regional aquifer and a perched water zone near TA-I and TA-II. In this area, monitor wells, which are completed within the regional aquifer, demonstrate a seasonal fluctuation coincident with the water supply pumping at the active water supply wells, suggesting that these wells are within the radius of influence of the pumping wells. Wells in this area also show consistent, significant declines in water levels through the year as a result of basin-wide water level declines. The area in the vicinity of the golf course has elevated groundwater levels that may be connected to the perched zone observed to the north and west.

East of the Tijeras Fault Complex

"East of the Tijeras Fault Complex" includes wells along the southern boundary of KAFB, wells within Coyote and Lurance canyons, and the Lovelace Biomedical and Environmental Research Institute. Water levels in this area are not affected by the basin-wide water level declines within the Santa Fe Group

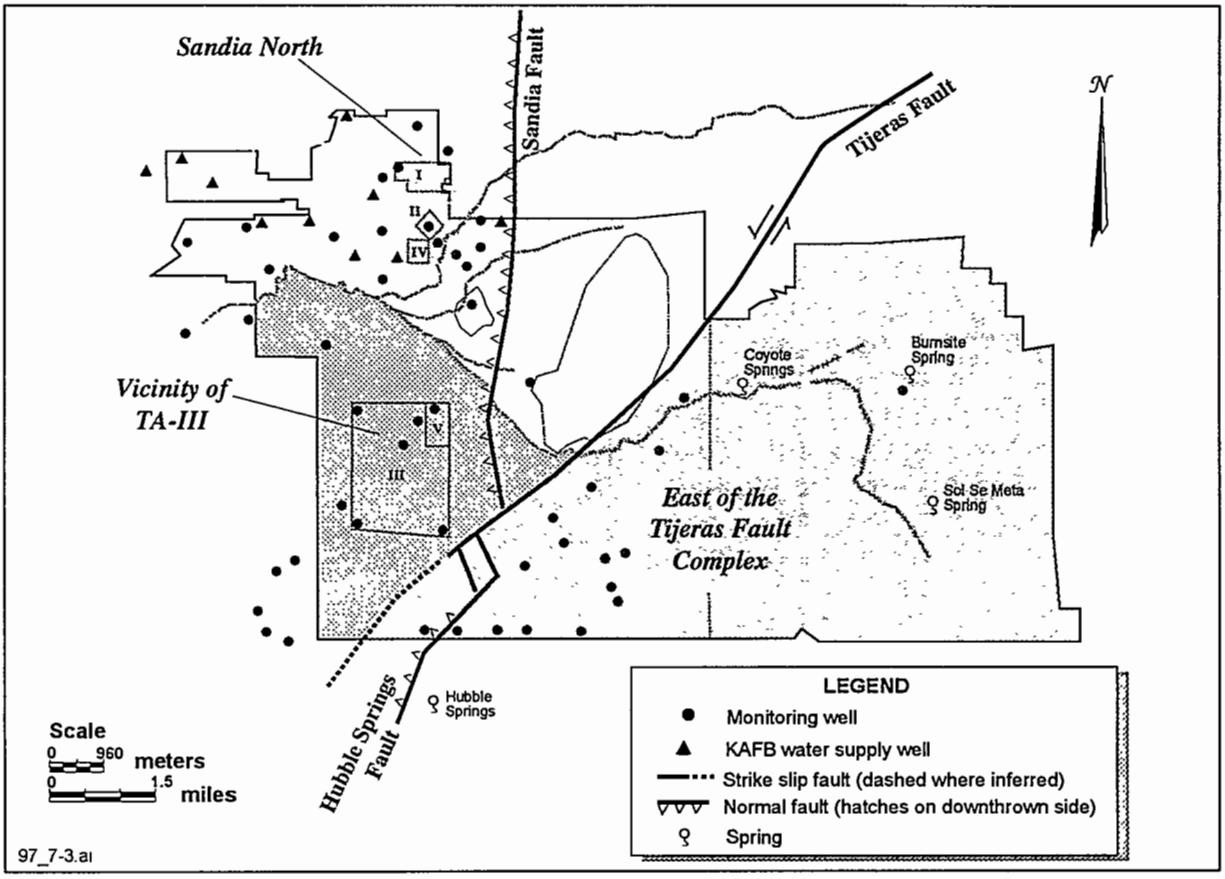

Figure 7-3. General areas (shaded) on KAFB in which wells are grouped for discussion based on the underlying geologic structure and regional aquifer systems.

aquifer system. Because of the proximity to recharge sources (mountain fronts) in the region east of the fault complex, water levels show seasonal fluctuations that probably reflect recharge from precipitation and runoff.

7.2.1 Water Level Trends in the Vicinity of TA-III

TA-III vicinity wells include CWL wells, MWL wells, the wells located along the western boundary of TA-III, and wells in and around TA-V.

CWL – The depth to water at the CWL ranges from 482 to 490 ft below ground level. Water levels in general are continuing to decline at approximately 0.9–1.0 ft/year. Slight increases in water levels occurred in most wells during March with relatively sharp declines during April and May. In July, water levels recovered slightly but thereafter decreased steadily. The drop during April and May is coincident with increased groundwater pumping from water supply wells at KAFB. Water levels in nested wells indicate a downward vertical gradient of approximately 0.07 ft/ft within the top 50 ft of saturation. This downward gradient may be a result of preferential flow through underlying coarser sediments. These coarser sediments drain more readily and consequently respond more rapidly to groundwater withdrawal at the production wells.

MWL – Water level trends at the MWL are generally similar to those measured at the CWL showing the same seasonal responses. The rate of decline during 1996 appears to be 0.44 ft/yr. The average historic rate is 0.8 ft/yr.

TA-V – Data collected from wells in TA-V indicated a general decline of 0.5–0.9 ft/yr. A vertical downward gradient of 0.02 ft/ft was calculated from data at two nearby wells.

West of TA-III – Wells west of TA-III indicate fairly similar water level responses. Water levels in these wells declined at rates between 1.3 ft/yr and 2.5 ft/yr with the highest level of decline from March through June. This is a significantly greater rate than that observed at the MWL and the CWL sites. These wells are screened within ancestral Rio Grande fluvial deposits in contrast to wells at the CWL and the MWL, which are screened in alluvial fan deposits. The fluvial material is significantly more permeable and responds more rapidly to groundwater withdrawal at the KAFB production wells. Vertical gradients appear to be insignificant at these locations.

7.2.2 Water Level Trends in the Vicinity of Sandia North

Wells in the Sandia North area include TA-I, TA-II, the Tijeras Arroyo Golf Course area, middle Tijeras Arroyo, and wells around the former KAFB sanitary waste lagoons. The regional aquifer under TA-I and TA-II is encountered approximately 540 ft below ground surface. This area also has a perched water bearing zone with water levels at 270 ft and 320 ft below the surface. Water levels in the regional aquifer show seasonal fluctuations imposed on the decreasing water level trend. Water levels decreased approximately 1.3 ft from May to November, probably reflecting the basin-wide declines in that area. The gradient of the regional flow is to the north-northwest.

Sandia North – During 1996, water levels decreased slightly in all wells screened within the perched water bearing zone; the average decrease in water levels was 0.66 ft. Based on water levels measured during the year, the general flow direction for the perched water bearing zone is south-southeast at a gradient of approximately 0.008 ft/ft.

Tijeras Arroyo Golf Course – Groundwater is first encountered beneath the Tijeras Arroyo Golf Course at approximately 130 ft above the projected regional groundwater surface at this location. Data show a continuing rise in water levels, as in previous years. The average rates of water level rises were between 1.5 and 2.7 ft/yr for the past six years. Currently, it is not known why water levels are increasing in the golf course wells and in nearby well KAFB-0310. One possible source is recharge from the irrigation of the golf course; however, recharge may also be occurring from potential sources to the northwest. The hydraulic connection between the anomalous high groundwater level at the golf course and the perched water-bearing zone to the northwest (Sandia North) is also currently unknown.

Tijeras Arroyo – The hydrographs for wells located near the Tijeras Arroyo generally show steady water level declines ranging from 3 ft/yr in the western portion of the Tijeras Arroyo to 1 ft/yr at KAFB-0901 (near where the arroyo crosses the western boundary of KAFB). All wells show minor fluctuations in their water levels that appear to be in response to pumping at nearby water supply wells KAFB-2 and KAFB-14.

KAFB Lagoon – Water levels were measured during 1996 at two monitor wells at the KAFB sewage lagoons. Two KAFB water supply wells are located near these wells but only KAFB-4 was used during 1996—and only in the months of February through May. The lagoon monitor wells showed fairly steep declines in water levels that corresponded to increased production pumping during these months. After pumping was discontinued, water levels continued to drop consistent with basin-wide water level declines. In previous years, levels declined during production pumping but recovered during periods of decreased pumping. In the area of the KAFB sewage lagoons, this decline appears to be approximately 2.5 ft/yr.

7.2.3 Water Level Trends East of the Tijeras Fault Complex

Wells located east of the Tijeras Fault Complex represent a variety of hydrogeologic conditions. The magnitude of water level changes over the period of one year is generally not more than 0.3 ft. Fluctuations of water levels are assumed to be in response to seasonal groundwater recharge at the mountain front.

School House Well – This well is believed to be completed within fractured bedrock of the Precambrian granite. In 1996, water levels in the School House Well increased in March and April, declined in May, then continued to increase until October. The total head change was about 0.2 ft for the year.

EOD Well – This well is believed to be completed within fractured bedrock of the Madera Limestone. This well showed slight increases in water levels, with the exception of a decline noted in May. The total change in water level head was approximately 0.1 ft.

Greystone Well – This well is screened within shallow alluvium. It shows a much more dynamic response to precipitation and has variations in water levels over the year of up to 1.5 ft. The Greystone Well showed steady water level increases from October 1995 through March 1996 of 1.4 ft. Water levels declined about 1.5 ft from March until October, with the exception of a small increase in September. Water levels began to rise after October. The hydrograph of the Greystone Well for the past seven years shows similarly high variability. In general, water levels within this well are highest during winter months and lowest during summer months.

The Lake Christian West Well and KAFB-1902 – These wells also showed increasing water levels until March, with subsequent declines through September and rising water levels through December. The total head change in 1996 was 0.5 ft in the Lake Christian West Well, and 0.3 ft in KAFB 1902.

The Target Road Wells – These wells are completed in the confined bedrock aquifer, as evidenced by the higher water level in TRS-1D as compared to TRS-1S. A thin alluvial aquifer overlies fractured bedrock at these locations. Water levels were fairly stable in both the bedrock and overlying alluvial aquifer. Similar to the Lake Christian West Well, water levels increased only slightly from April to June. The Lake Christian West Well is screened within shallow alluvium and shows a much more dynamic response to precipitation. Variations in water levels over the year of up to 1.5 ft.

KAFB South Fence Road (SFR) – Wells located along this area were installed by the Site-wide Hydrogeologic Characterization (SWHC) ER Project task group to assess the effects that the regional faults have on groundwater flow. Water levels were collected by the ER Project during 1996. All SFR wells are screened in the Santa Fe Group aquifer except for SFR-3T, SFR-4T, and SFR-4P, which are screened in bedrock. Water levels in the SFR wells screened within the Santa Fe Group aquifer were fairly stable with slight increases in water levels in March and April. The groundwater level in SFR-3T is about 80 ft higher than in the SFR-3 wells (within the Santa Fe Group). Water levels in SFR-3T increased less than 0.2 ft in 1996. SFR-4T and SFR-4P showed total increases through 1996 of approximately 6.5 ft. SFR-4T showed a decline of over 12 ft in April, followed by steep but steady water level increases.

Other monitor wells – Four wells were installed north of the south boundary to assess the fault zone (STW-1, TRE-1, TRE-2, and LMF-1). Water levels in the TRE wells were stable, showing only slight increases through the year of about 0.25 ft. Water levels continued to rise in LMF-1 for a total of 45 ft. Static water level has not been reached in this well since it was installed in 1995. This well probably has completion problems but is also screened within low permeability bedrock. The STW-1 well, located near the SNL/NM Solar Tower complex, showed a total water level decline of 1.45 ft in 1996.

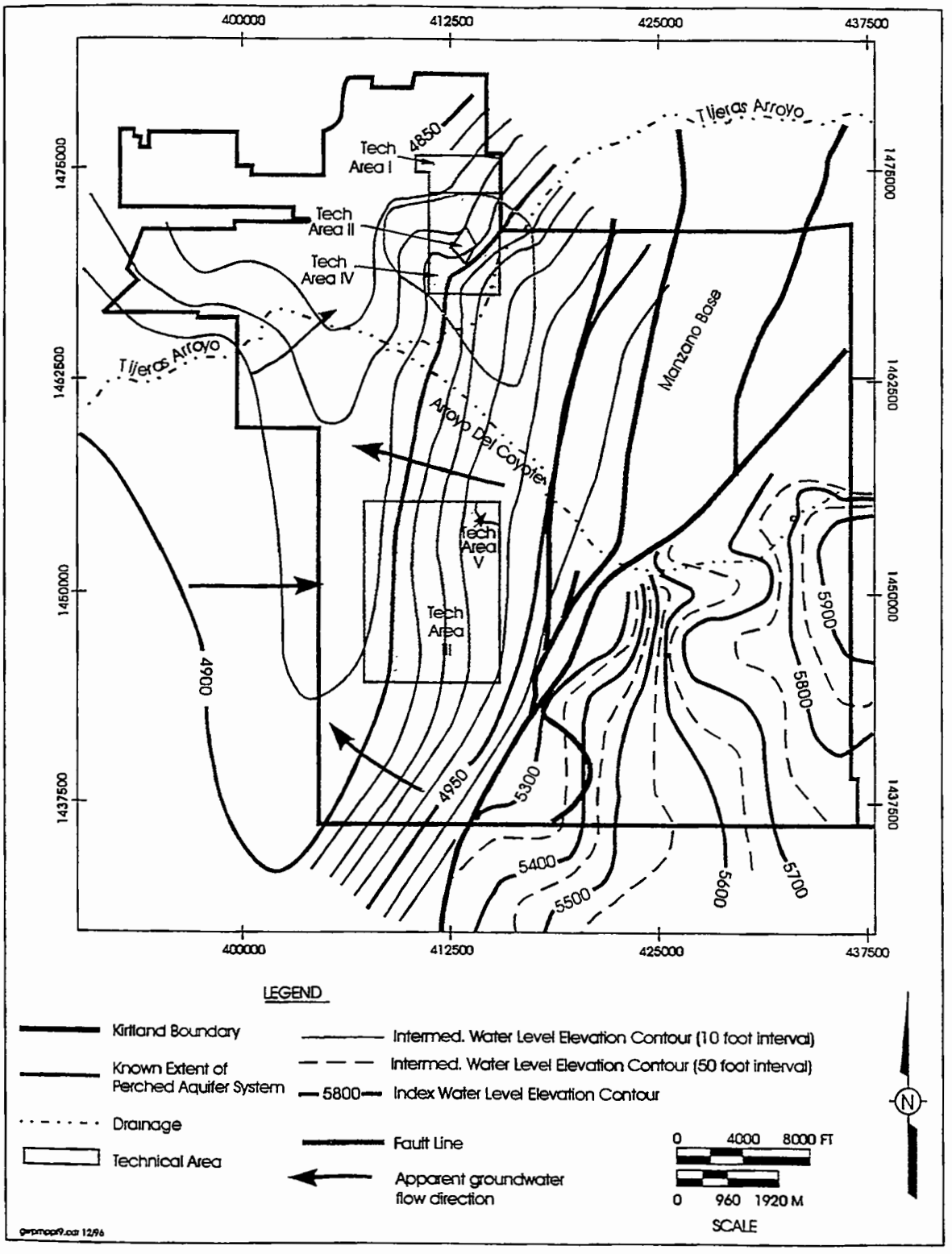

Figure 7-4. Potentiometric surface for the regional groundwater system at SNL/KAFB, June 1996.

7.3 POTENTIOMETRIC SURFACE

A potentiometric surface map (Figure 7-4) was constructed using June 1996 water level measurements taken at SNL/NM monitoring wells. Data was also contributed from water level measurements collected during quarterly water quality sampling under the KAFB Long Term Monitoring Program and the Lovelace Biomedical and Environmental Research Institute Environmental Program. The map represents the upper-most surface of the regional aquifer system showing the horizontal groundwater gradients. (Groundwater flow is perpendicular to potentiometric contours.) Static water levels were used to infer this potentiometric surface by interpolating between the wells. While many of the water levels represent an unconfined water table, the water levels measured in some of the wells indicate semiconfined or confined aquifers. Wells used to construct the 1996 potentiometric surface map are, for the most part, screened across the water table.

7.3.1 West of the Tijeras Fault Complex

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

7.3.2 East of the Tijeras Fault Complex

Groundwater is more than 400 ft higher east of the Tijeras Fault zone than in the basin. East of the fault complex, groundwater flow direction and hydraulic gradient are controlled by topography and aquifer lithology. The hydraulic gradients are higher within saturated fractured bedrock than in more conductive alluvial fan deposit aquifers. Groundwater in this area generally flows southwest through Lurance Canyon. The potentiometric contours then parallel the fault zone with the inferred flow to the west, perpendicular to the fault zone.

7.3.3 Perched Water Zones

Figure 7-5 shows the potentiometric surface map for the perched water-bearing zone within the Sandia North study area. The equipotential contours are drawn only for the known extent of this shallow groundwater table. The lateral extent of the shallow groundwater zone is currently under investigation. The horizontal direction of groundwater flow in this zone appears to be to the south-southeast. The hydraulic gradient appears to be about 0.008 ft/ft.

Figure 7-6 shows a map of the groundwater declines in feet per year for the KAFB area. In general, water levels are declining at 0.5–3.0 ft/year on KAFB. Water level declines within the fluvial ancestral Rio Grande deposits are much greater than the alluvial fan deposits.

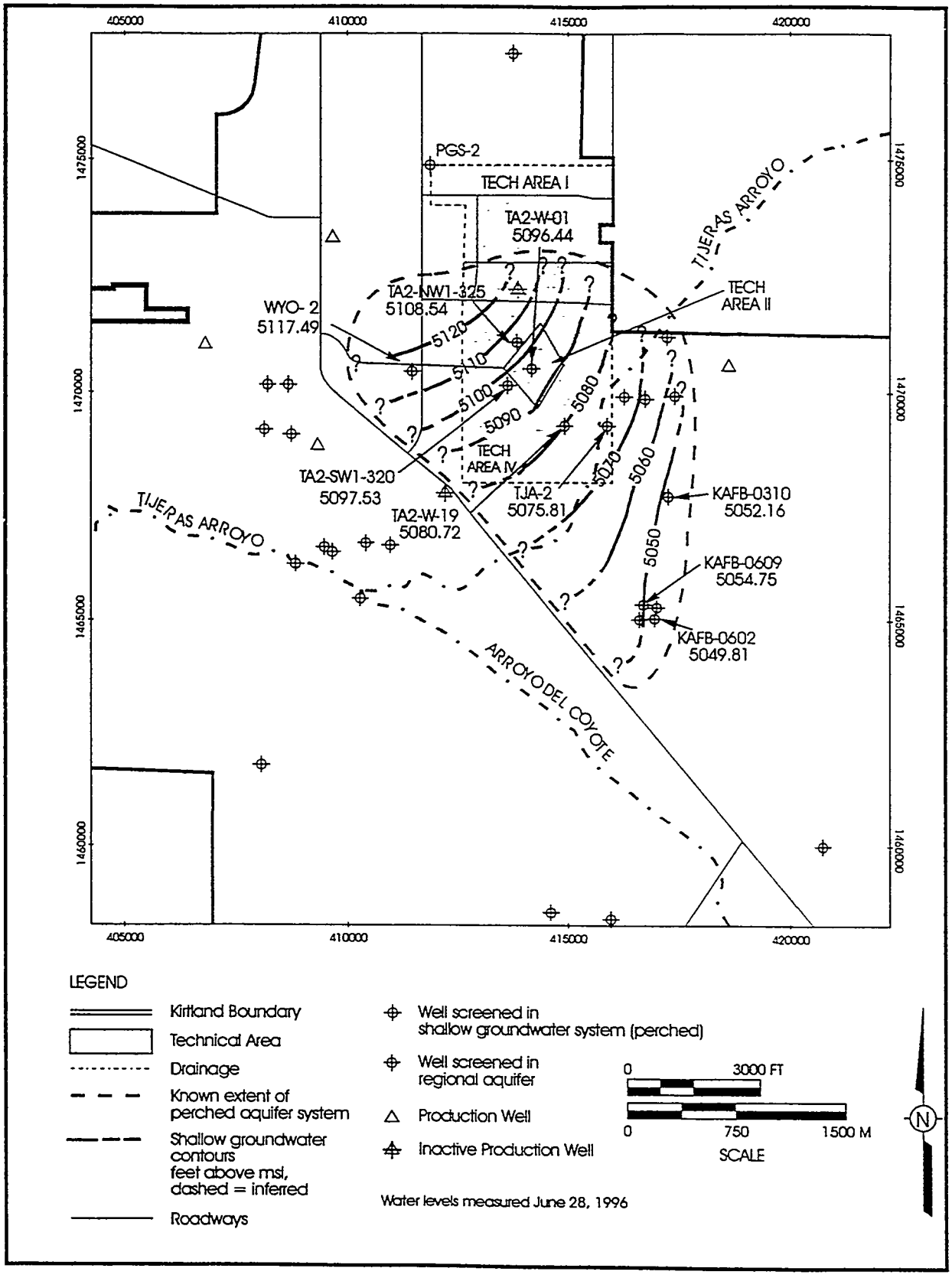

Figure 7-5. Potentiometric surface map for the perched aquifer system in the vicinity of Tijeras Arroyo, June 1996.

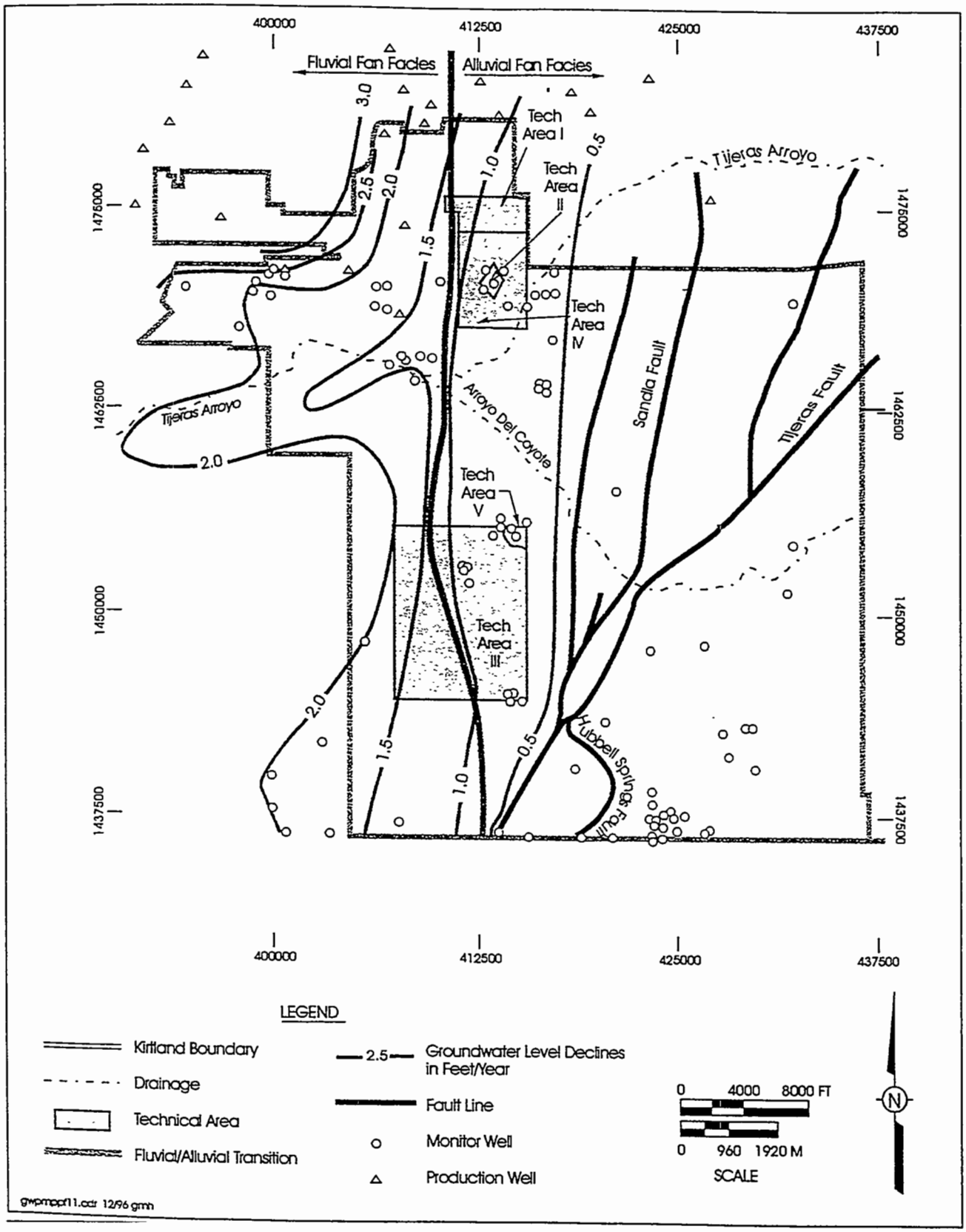

Figure 7-6. Average annual water level declines in the Santa Fe Group regional aquifer.

7.3.4 Groundwater Withdrawal

SNL/NM's impact on the quantity of water in the groundwater system can only be determined indirectly. Water used for SNL/NM operations is provided by wells owned and operated by KAFB. In addition, KAFB purchases some of its water from the City of Albuquerque. The distribution system on KAFB is interconnected and no provisions are made to meter SNL/NM water use. Currently, studies are underway to determine SNL/NM water use and to provide future metering capability.

During 1996, KAFB pumped approximately 1.15 billion gallons of groundwater from water supply wells located in the northern portion of KAFB. Both KAFB and City of Albuquerque wells are screened in the upper unit of the Santa Fe Group. KAFB wells are screened over a long interval (from about 500 to 1000 ft below the ground surface). The highest level of production from KAFB wells was in April (170 million gallons); the lowest was in December (43 million gallons). Historically, water use at KAFB has increased dramatically in April or May and then decreased again in September or October. Detailed information is available on the amount of groundwater pumped by the water supply wells at KAFB in the *Annual Groundwater Monitoring Report* (SNL 1997i).

The effects of pumping from a production well can often be observed by water level changes in one or more nearby monitoring wells. SNL/NM facilities that are within the radius of influence of production wells may observe significant changes in water levels in their monitor wells, in relation to the activity of the nearby water supply well(s).

Many of the City of Albuquerque water supply wells are located near the northern boundary of KAFB. Some of these well fields pump considerably more water than the KAFB wells. Their proportional contribution on fluctuations in groundwater levels at KAFB has not been evaluated.

7.4 GROUNDWATER QUALITY

This section summarizes the analytical results for groundwater water quality monitoring activities conducted by the Groundwater Surveillance Task Force and the ER Project. Due to the volume of data obtained from the analyses conducted at each of the locations, only results that exceeded one or more of the standards referenced in Table 7-2 are presented. The sampling frequency performed under each task during 1996 is listed in Table 7-3. All Groundwater results are detailed in the *Annual Groundwater Monitoring Report* (SNL 1997i).

Table 7-2. Guidelines used for groundwater quality sample comparisons.

Regulation/Requirements	Limits
National Primary Drinking Water Standards (this is a health standard) (40 CFR 141) (enforceable)	MCL
New Mexico Water Quality Control Commission Standards for Groundwater	MAC
DOE Drinking Water Guidelines for Radioisotopes (DOE 1990a)	DCG

NOTE: MCL = Maximum Contaminant Level
MAC= Maximum Allowable Concentrations
DCG = Derived Concentration Guides

7.4.1 Groundwater Surveillance Task Water Quality Results

Groundwater quality samples are collected on an annual schedule by the Groundwater Surveillance Task Group. The yearly sampling event occurred during March and April at 16 monitoring wells and three springs. Field personnel attempted, but were unable to collect samples from LMF-1 and STW-1.

The groundwater samples collected by the Surveillance Task were analyzed for the dissolved analyte fraction with the exception of analyses conducted for mercury, organic

Table 7-3. Sampling frequency for groundwater quality monitoring at SNL/NM during 1996.

Sampling Period	Groundwater Protection Program	ER Project Wells				
		CWL	MWL	TA-V	Sandia North	Burn Site
Dec 95				✓	✓	
Jan 96					✓	
Feb		✓				
Mar	✓			✓		
Apr			✓			✓
May		✓				
Jun				✓		
Jul						
Aug		✓			✓	
Sep				✓		
Oct						
Nov		✓*				✓*
Dec					✓*	

NOTE: Results from the November and December sampling were not available in time to be included in the Annual Groundwater Monitoring Report.

compounds and non-aqueous phase liquids. Groundwater quality results are compared with the State of New Mexico's Maximum Allowable Concentrations (MACs) for nonradioactive analytes. DOE's Derived Concentration Guides (DCGs) are used as a measure of comparison for radioisotopes. The samples were analyzed for major ions, phenolics, VOCs, trace metals, and radioisotopes.

VOCs

Groundwater samples were analyzed for VOCs using EPA's Method 8010 and 8020. Only one of the 16 wells and three springs sampled showed an elevated VOC result—a very low level for chloroform was measured at the Thunder Range East monitor well (TRE-1). All other groundwater samples showed no detectable VOCs above method quantitation limits of 0.001 to 0.002 mg/L.

Chloroform	*VOCs*	
Well	**Concentration**	**Period**
TRE-1	0.002 mg/L	Mar

Methylene chloride, a common laboratory contaminant, was detected in low concentrations consistent with inadvertent laboratory contamination in the equipment rinsate/decontamination solution composite sample and in four laboratory-prepared trip blank samples.

Major Ions, Phenolics, and Total Organic Carbon (TOC)

Non-metallic inorganic constituents analyzed in groundwater samples included:

Alkalinity
Bromide
Chloride
Total cyanide
Fluoride
Nitrate plus nitrite (as nitrogen)
Sulfate

The EPA MCL for fluoride was exceeded in one groundwater sample from SFR-4T.

Fluoride *Major Ions* MCL = 4 mg/L		
Well	**Concentration**	**Period**
SFR-4T	4.9 mg/L	Mar

Phenolics and TOC are organics. Phenolics were not detected in any groundwater samples. TOC was reported above the quantitation limit of 0.50 mg/L in groundwater samples from the Burn Site Well, Coyote Springs, EOD Well, Greystone Well, MVMWK, and Sol se Mete Spring. The greatest TOC concentration was reported at 2.4 mg/L in the sample from Sol se Mete Spring. In general, results of inorganic constituents, phenolics, and TOC analyses for 1996 groundwater surveillance samples are consistent with those obtained from previous sampling years.

Metals

Analyses were performed on all the samples for dissolved metals as follows:

Aluminum (Al)	Arsenic (As)
Antimony (Sb)	Chromium (Cr)
Cadmium (Cd)	Calcium (Ca)
Cobalt (Co)	Copper (Cu)
Barium (Ba)	Beryllium (Be)
Iron (Fe)	Lead (Pb)
Mercury (Hg)	Manganese (Mn)
Magnesium (Mg)	Nickle (Ni)
Potassium (K)	Silver (Ag)
Selenium (Se)	Sodium (Na)
Thallium (Tl)	Vanadium (V)
Zinc (Zn)	

The EPA MCL for specific metals was exceeded in groundwater samples from the SFR-3P well and Coyote Springs.

Metals Be = MCL is 0.004 mg/L Ni = MCL is 0.1 mg/L		
Well	**Concentration**	**Period**
Beryllium		
Coyote Springs	0.0051 mg/L	Mar
Nickel		
SFR-3P	0.36 mg/L,	Mar

In 1996, groundwater surveillance samples were analyzed on the dissolved fractions. Previous groundwater surveillance sampling rounds had metals analysis performed on unfiltered groundwater yielding total metals analysis results. The analysis results are generally comparable to or lower than concentrations reported for total metals analyses in prior years.

Gamma-emitting Radionuclides

Gamma spectroscopy was performed with a high-purity germanium gamma spectroscopy system on all samples. Six radionuclides were detected with activity concentrations greater than the associated minimum detectable activity (MDA) in 10 samples: eight groundwater samples; one equipment rinsate blank sample; and the equipment rinsate/decontamination composite waste sample.

Of the radionuclides detected by gamma spectroscopy, Radium-226 and Lead-214 are members of the naturally occurring uranium (4n+2) decay series, and Lead-212 is a member of the naturally occurring thorium (4n) decay series. Potassium-40 is a primordial radionuclide. Radium-226 was reported in samples from KAFB-0901, TRN-1, and TRE-1 at activity concentrations exceeding the MCLs and the DCGs. However, Radium-226 is primarily an alpha emitter that has a low gamma yield. Therefore, the gamma screen analysis is less accurate than the radioisotope analysis performed using alpha spectroscopy. Based on the results of the radioisotopic analysis, these Radium-226 activities do not exceed the MCLs or the DOE's DCGs. Therefore, the gamma spectroscopy results may be viewed as

false-positive values. Gamma spectroscopy results for Cesium-137 in samples from SFR-4T and Equipment Blank #2 (EQR031896) are also suspected false-positive results because the results are only slightly above the associated MDA, with measurement uncertainties extending below the MDA.

Radiochemistry

Radiochemical analyses were conducted on samples for gross alpha, gross beta, Radium-226, Radium-228, Technetium-99, tritium, and isotopic uranium. Technetium-99 was analyzed to provide baseline values for the Medical Isotope Production Project (MIPP). Results of these analyses are compared to the DCGs and the MCLs. The MCL and DCG are based on the gross alpha activity after subtracting uranium and radon activity. (Isotopic radon activity was not determined.)

Gross alpha and gross beta activities were detected at activities greater than the MDAs in all groundwater samples with the exceptions of those from SFR-3T and SFR-4T. Five samples exceeded the MCL gross alpha limit of 15 pCi/L; these were EOD Well, EOD Well duplicate, School House Well, SRF-3P, and TRE-1. However, after subtracting the uranium activities from the gross alpha values, none of the samples from the above locations exceeded the MCL or the DOE guideline for gross alpha activity.

Radium-226 was reported at activities slightly exceeding the MCL and DCG of 4 pCi/L in the sample and duplicate sample from the EOD Well. Most groundwater samples showed Radium-226 and Radium-228 activity concentrations fractionally greater than the MDA but significantly less than the MCL and the DOE guidelines. However, at the EOD Well, the sum of Radium-226 and Radium-228 exceeded the MCL of 5 pCi/L.

Radium-226 + Radium-228
MCL = 5 pCi/L (Total for both)

Well	Concentration	Period
EOD	6.99 ± 0.44 pCi/L	Mar

Technetium-99 was analyzed to obtain background measurements for the first time in March 1996. All sample analysis results showed Technetium-99 activities at less than detectable levels (below the MDA). The analytical laboratory reported the Technetium-99 measurements "as is" with low confidence because of nonconformance in calculating the scintillation quench curves.

Tritium was reported as 83.1 ± 49.3 pCi/L in the sample from Coyote Springs. This value is slightly greater than the MDA of 80.1 pCi/L and is not considered a strong positive result because of the relatively high measurement uncertainty. Tritium was not detected above the MDA in any other samples.

Uranium isotopes were reported with activities consistent with naturally occurring uranium isotopic ratios in all samples. Uranium isotope activity concentrations exceeding the DCGs were reported in three wells.

Uranium -234
DCG = 20 pCi/L

Well	Concentration	Period
EOD	114.7 ± 31.6 pCi/L	Mar
TRN-1	45.4 ±9.6 pCi/L	Mar
TRE-1	23.5 ± 7.9 pCi/L	Mar

The EOD Well data are consistent with past sampling and analysis results. The value for Uranium-234 obtained for the sample from TRE-1 is slightly above the DOE guideline. Since this was the first time TRE-1 was sampled, there are no historical data for comparison.

7.4.2 ER Project Water Quality Results

ER water quality sampling occurred at wells located at the Chemical Waste Landfill (CWL), Mixed Waste Landfill (MWL), TA-V, Sandia North, and the Canyons Test Area.

CHEMICAL WASTE LANDFILL

Groundwater sampling at the CWL was conducted four times during 1996—February, May, August, and November—although November results were not ready in time for inclusion into the annual report. Groundwater samples were collected from nine wells: two upgradient background wells (BW-3 and BW-4A) and seven downgradient monitoring wells (MW-1A, MW-2A, MW-2BL, MW-3A, MW-4, MW-5U, and MW-6U). The samples were analyzed for VOCs and RCRA metals, listed in Appendix IX of 40 CFR Part 264.

CWL - VOCs

All VOCs detected were at concentrations below the EPA's established MCL, where applicable, except for trichloroethene (TCE).

TCE was found in the Laboratory analysis of six CWL groundwater samples above the laboratory quantitation limits and in some instances above the MCL.

TCE MCL = 5 µg/L		
Well	**Concentration**	**Period**
CWL-MW2A	26 µg/L 10 µg/L 24 µg/L	Feb May Aug
CWL-MW2BU	4, 24 µg/L 4 µg/L	Feb Aug
CWL-MW3A	4 µg/L 2µg/L 2 µg/L	Feb May Aug
CWL-MW5L	2 µg/L 15 µg/L 5 µg/L	Feb May Aug
CWL-MW5U	2, 6 µg/L 5.8, 7 µg/L 2.5, 2 µg/L	Feb May Aug
CWL-MW6L	10 µg/L 9 µg/L 6 µg/L	Feb May Aug

Additional VOCs detected at or above laboratory quantitation limits include:

Acetone
1,1-dichloroethene
Methylene chloride
1,1,1-trichloroethane
Trichlorofluoromethane

Methylene chloride was also detected in associated trip blanks, equipment blanks, and/or laboratory method blanks. Their presence is considered to be a result of laboratory contamination and not an indication of groundwater contamination. All of these additional VOCs were present at concentrations below the established MCL, where applicable.

As concentrations of VOCs in the CWL monitoring wells have not varied significantly during the 1996 sampling year (four sampling periods), there is no indication that these constituents are migrating away from the site. This conclusion is supported by the conceptual model of limited contaminant transport developed for this site and discussed in the *CWL Closure Plan* (SNL 1992c) and the *CWL Ground Water Assessment Report* (SNL 1995r).

CWL - Metals

All groundwater samples collected from CWL monitoring wells during 1996 were analyzed for 40 CFR 264 Appendix IX metals. Chromium above the MCL was detected in two wells in August.

Chromium MCL = 0.1 mg/L		
Well	**Concentration**	**Period**
CWL-BW3	0.160 mg/L	Aug
CWL-MW2A.	0.110 mg/L (E)*	Aug

NOTE: * (E) indicates that the analyte was also detected in the equipment blank.

Total iron was analyzed during the February, May, August, and November sampling events. Iron was detected at concentrations at or above the Secondary Maximum Contaminant Level (SMCL) of 0.3 mg/L in groundwater samples collected from several wells. The SMCL value is established by the EPA for aesthetic reasons, not health consequences. The MAC for iron in groundwater for domestic water supply is 1.0 mg/L.

Iron
SMCL = 0.3 mg/L
MAC = 1.0 mg/L

Well	Concentration	Period
CWL-BW3	1.0, 1.1 1.0 (E) 2.2	Feb May Aug
CWL - BW4A	0.32	Feb
CWL - MW1a	0.66	Feb
CWL - MW2A	0.54 0.92 (E)	May Aug
CWL-MW2BL	0.45	Feb
CWL-MW3A	0.42	Feb
CWL-MW4	0.37	Feb

NOTE: SMCL = Secondary Maximum Contaminant Level

Nickel was detected at concentrations above the MCL of 0.1 mg/L in groundwater samples from four CWL monitor wells.

Nickel
MCL = 0.1 mg/L

Well	Concentration	Period
CWL-BW3	0.44 mg/L (E) 0.48 0.68 (E) 0.47	Feb Feb May Aug
CWL-MW2A	0.37 mg/L 0.43 (E)	May Aug
CWL-MW3A	0.12 mg/L	Feb
CWL-MW4	0.33 mg/L 0.23 mg/L 0.28 mg/L	Feb May Aug

CWL - Additional Analytes

Additional chemical parameters analyzed at the CWL included the following analytes:

Total alkalinity
Cations
Chloride
Total cyanide
Dioxins and furans
Fluoride
Herbicides
Chlorinated pesticides
Polychlorinated biphenyls (PCB)
Semivolatile organic compounds
Sulfate
Total sulfide
Total dissolved solids (TDS)

TDS was detected above the SMCL of 500 ppm for all wells analyzed at concentrations ranging from 20 - 200 ppm over the SMCL. The SMCL for TDS is an aesthetic standard and is therefore only a recommended limit.

TDS
SMCL = 500 ppm

Well	Concentration	Period
CWL-MW3A	520 ppm	Feb
CWL-MW2BL	700 ppm	Feb
CWL-MW5U	700 ppm	Feb

MIXED WASTE LANDFILL

Annual sample collection was conducted in April at the five MWL monitoring wells. Samples were analyzed for VOCs, 40 CFR 264 Appendix IX metals, and radionuclides. The radiochemical analyses included gross alpha, gross beta, tritium, and isotopes of uranium, thorium, plutonium, and Strontium-90.

MWL - VOCs

Methylene chloride was detected below the quantitation limit in four of the samples submitted. This compound was also found in the

method blank for these samples and is likely the result of laboratory contamination. Toluene and xylene (total) were detected below the quantitation limit in the sample submitted from MWL-MW2.

MWL - Metals

Nickel was detected at MWL-MW1 in concentrations slightly exceeding the MCL. No other metals exceeded established MCLs in all other groundwater samples.

Nickel MCL 0.1 mg/L		
Well	**Concentration**	**Period**
MWL-MW1	0.145 mg/L	Apr

Radionuclides

Naturally occurring isotopes of uranium were detected at activities slightly above their MDAs in all of the samples, but at activities within established SNL/NM site background ranges. Control charts for the indicator parameters tritium, gross alpha, and gross beta, were generated to identify potentially elevated activity values which indicate either contamination or laboratory error. None of the data for any of the parameters exceeded the 95 percent confidence value for any given monitoring well. Thus, there is no evidence of increasing activities of tritium, gross alpha, or gross beta in groundwater at the MWL over time.

TECHNICAL AREA V

Quarterly groundwater sampling was conducted at TA-V during December 1995, and March, June, and September 1996. Five wells (LWDS-1 & 2, TA5-MW1 & 2, and AVN-1) were sampled during each event. The Liquid Waste Disposal System (LWDS) has been adjoined to the TA-V investigational unit for operational purposes. All samples were analyzed for VOCs and nitrates. A full suite of analyses was performed in December 1995 including metals, radionuclides, VOCs, nitrates, and major ions.

TA-V - VOCs

Trichloroethene (TCE) was consistently detected in monitor well LWDS-MW1 above the MCL during all quarterly sampling events. No TCE was identified in any other TA-V monitor well and no other VOCs were detected above MCLs where established.

TCE MAC - 100 µg/L MCL - 5.0 µg/L		
Well	**Concentration**	**Period**
LWDS-MW1	14 µg/L 17 µg/L 18 µg/L 19 µg/L (duplicate)	Mar Jun Sep Sep

Nitrates were found to be present with the highest concentration of nitrate-plus-nitrite (NPN) detected in wells LWDS-MW1 and AVN-1. These concentrations slightly exceed the drinking water MCL of 10.0 mg/L.

Nitrate-plus-Nitrite MCL = 10.0 mg/L.		
Well	**Concentration**	**Period**
LWDS-MW1	12 mg/L 11 mg/L	Mar & Jun Sep
AVN-1	12 mg/L	Mar

TA-V - Metals

No 40 CFR 264 Appendix IX metals were detected in concentrations that exceeded primary drinking water MCLs in any TA-V monitor well.

TA-V - Radionuclides

No radionuclides were detected in concentrations that exceeded primary drinking water MCLs or drinking water DCGs.

SANDIA NORTH

The investigative unit identified as Sandia North is comprised of ER sites in both TA-I and TA-II. During the reporting period, groundwater samples were collected from Sandia North monitoring wells during December 1995, and in January, August and December 1996. Samples were collected from nine monitoring wells (TA2-W-01, W-19, SW1-320, NW1-325, & NW1-595, WYO-1 & 2, PGS-2, TJA-2). All samples were analyzed for VOCs and nitrates.

Sandia North - VOCs

TCE concentrations in groundwater samples collected in 1996 from well WYO-1 exceeded the MCL of 5 µg/L.

TCE MCL = 5 µg/L MAC = 100 mg/L		
Well	**Concentration**	**Period**
WYO-1	5.5 mg/L 5.6 mg/L	Jan Aug

Three perched water-bearing zone wells and one regional aquifer well also have consistently contained common TCE breakdown products: 1,1-dichloroethane (DCA) and cis-1,2-dichloroethene (DCE).

Sandia North - Nitrates

Sandia North monitor well, TA2-SW1-320 contained concentrations of nitrate above the MCL of 10 mg/L. The highest concentration of nitrate was detected in the August sampling. No other Sandia North monitor wells contained nitrate above the MCL level.

Nitrates MCL = 10 mg/L		
Well	**Concentration**	**Period**
TA2-SW1-320	25 mg/L 29 mg/L	Jan Aug

CANYONS TEST AREA

The water supply well at the Burn Site was sampled in August and November. The samples collected in August were analyzed for VOCs and nitrates. The November samples were analyzed for the isotopes of nitrogen and oxygen in an attempt to identify the source of nitrates. Although a full analysis for inorganic and organic analytes was conducted, of particular interest was the concentration of nitrates, which had been identified in prior years' analyses to be elevated above regulatory values. To help identify the source of the nitrates, isotopic nitrogen analyses were conducted in November.

Canyons Test - VOCs

No volatile organic constituents were detected.

Canyons Test - Nitrates

Nitrates ranged from 8 to 27 ppm and appeared to change dramatically as the well was pumped. These levels were close to or above the MCL. The purpose of the November analysis was to identify the source of nitrates by measuring the ratio of stable isotopes of nitrogen and oxygen in the well. (Sample results for November 1996 were not available for this report).

Nitrates MCL = 10 ppm		
Well	**Concentration**	**Period**
Burn Site Well	8–27 ppm	Aug

7.5 GROUNDWATER MONITORING SUMMARY

Groundwater Level Summary

The results for the SNL/NM groundwater level monitoring for 1996 indicated no major changes from prior years. Water level trends followed the same patterns observed for the past several years. Water levels in the eastern portion KAFB, east of the Tijeras Fault Complex, demonstrated very minor fluctuations with a rise and fall in a range from 0.3 to 1.5 ft/yr. These variations appear to be related to variable recharge resulting from seasonal precipitation.

Wells west of the fault complex demonstrate continued declines of the water table in the range from 1.0 to 3.0 ft/yr. Water levels in wells in the vicinity of water supply production wells very clearly manifest water level fluctuations in concert with the seasonal water demand.

Groundwater Quality Summary

Groundwater quality issues at SNL/NM focus on three principle areas of concern: (1) potential contamination from ongoing operations, (2) migration of contamination from known sources resulting from past activities, and (3) migration of contamination onto KAFB from offsite locations. Groundwater surveillance monitoring indicates no new sources from ongoing operations. Those groundwater analytes that exceed drinking water standards appear to be of natural origins as exemplified by fluoride in the SFR-3P well, radium in the EOD Well, and elevated values of Uranium-234 at the EOD, TRN, and TRE wells.

Groundwater monitoring at ER sites confirmed groundwater TCE contamination present at the CWL, TA-V, and Sandia North (TA-I and TA-II). The concentrations of TCE are at low levels, not exceeding 27 µg/L, and at some locations the concentrations are decreasing. For reference, the drinking water MCL for TCE is 5 µg/L and the MAC established by the New Mexico Water Quality Control Commission is 100 µg/L. Elevated values of nitrate above the drinking water MCL of 10 mg/L have been detected at TA-II, the Burn Site, and TA-V. Sources of the nitrates at TA-II and TA-V are associated with septic tanks and leachfields; the source of the nitrates at the Burn Site is currently undetermined. There is no evidence that contaminants present at any ER site are migrating from the source area.

Moderately elevated concentrations of chromium and nickel have been detected at several wells. Coincidentally, all the wells that routinely have detectable values of these two elements have stainless steel well screens. There is credible evidence to suggest that these concentrations are due to corrosion of the well screens rather than from a surface contamination source or natural sources. Currently, there is no evidence from surveillance monitoring of any contaminated groundwater migrating onto KAFB.

8 QUALITY ASSURANCE

SNL/NM is committed to providing quality work for sampling and analysis procedures to ensure the validity and accuracy of all monitoring data. Sample and data management quality assurance (QA) for environmental programs under the Environmental Safety and Health (ES&H) Center (7500) are handled by the Sample Management Office (SMO) Quality Assurance Program. The Environmental Restoration (ER) Project relies on SMO for samples sent to outside laboratories, although most ER sample analyses are conducted at their own laboratories. Nonradiological and radiological sampling is conducted under the following program areas:

- Groundwater
- Terrestrial Surveillance
- Wastewater
- Storm Water
- Surface Water
- Waste Management
- Demolition and Decontamination (D&D)
- Ambient Air
- NESHAP Air Emission Sources
- Oil Storage
- ER

8.1 CENTER LEVEL QA PLANS

Each environmental program area has developed individual QA plans and procedures. Additionally, the ES&H Center has developed the following two comprehensive plans that describe the connection between project and program initiation, execution, and assessment, and established SNL/NM practices:

- *7500 Quality Assurance Plan (QAP)* (SNL 1996y)
- *7500 Quality Assurance Management Plan (QAMP)* (SNL 1996z)

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

The 7500 QAMP is used when a higher QA standard is needed. This is a general plan designed to meet the requirements of rigorous standards, such as NQA-1, ISO 14000, and ANSI/ASQC E-4. The QAMP identifies basic elements consolidating comparable requirements contained in these other QA documents. The QAMP serves two basic purposes: (1) it allows the user to understand and evaluate what 7500 products and services are available; (2) it serves as a roadmap to direct users to other QA documents, regulatory requirements, and sections relevant to their work area or interest.

Both plans stress prevention of problems by ensuring the following criteria have been met before QA activities commence:

(1) The applicable requirements are defined in program documents (such as plans and procedures).

(2) Personnel understand the requirements through familiarization and training.

(3) Qualification of personnel has been verified through task leaders and/or management.

Each ES&H Center SNL/NM employee and contractor is responsible for ensuring that all environmentally related activities are performed according to applicable policies and practices set forth in the 7500 quality plans.

8.2 ENVIRONMENTAL SAMPLING and ANALYSIS

Environmental sampling is conducted in accordance with program-specific sampling and analysis plans (SAPs) or work plans, each of which contain the applicable QA elements. These program-specific documents are prepared and implemented in accordance with the *SMO Quality Assurance Plan* (SNL 1996z-1) and meet appropriate regulatory (e.g., EPA, State, and local) guidelines for conducting sampling and analysis activities.

Sample Management Office's (SMO) Role and Responsibility

SMO provides guidance and support for field activities conducted by SNL/NM organizations. The overall adherence and compliance of any sampling and analysis activity, however, is the responsibility of each particular project. Before field work commences, project leaders and SMO coordinators confer to ensure that the requirements of the sampling plan are established and communicated to the analysis laboratory. This step ensures that the Data Quality Objectives (DQOs) (e.g., minimum detection levels) stated in the plan will be achievable by the laboratory before the project begins. An analysis request form and a chain-of-custody form are filled out for each sample once the project begins. The SMO office assigns a unique control number with which the sample will be labeled and documented in the sample collection log. SMO is responsible for QA control at the point of sample relinquishment by the field team into the custody of SMO staff. Information about the quantities and types of samples processed through the SMO are available in the SMO Sample Tracking Analytical Results (STAR) database.

Project Specific Sample Analysis Plans (SAPs)

Each program involved in environmental monitoring and sampling has developed or follows a relevant SAP. The specific elements present in most plans include:

- Description of the sampling procedures (mechanics of the process) applicable to each activity, such as describing the handling of samples, their preservation, labeling, and event documentation.
- A listing of EPA-approved sample collection equipment, appropriate sample containers, and container decontamination procedures.
- The collection of quality control (QC) samples at defined frequencies to estimate sample representativeness and potential contamination acquired during the sampling and handling process.

Selection of a Contract Laboratory

All offsite contractor laboratories are selected based on an appraisal (pre-award audit) as described in the *SMO Quality Assurance Plan*. All previous and candidate laboratories must employ EPA test procedures wherever possible; otherwise, suitable and validated test procedures are to be used. Laboratory instruments must be calibrated in accordance with established procedures and the calibration verified before the instrument can be used in an analysis. Once a laboratory has passed the initial appraisal and awarded a contract, it is thereafter reappraised annually using SNL/NM inspections and audits.

Contractor laboratories operate under strict Quality Assurance/Quality Control (QA/QC) programs, which include regular participation in DOE's and the EPA's programs for blind-audit check sampling to monitor the overall precision and accuracy of analyses routinely performed on SNL/NM samples.

Quality Control (QC) Measures

Various field QC samples methods are used during the sample collection process to assess the quality of the data outcome. Errors that can be introduced into the sample process include possible sample contamination in the field or the lab, some of which are unavoidable.

Additionally, the variability present at each sample location can also affect outcomes.

QC samples are submitted to contractor laboratories in accordance with project-specific DQOs and SAPs. Depending on the type of investigation, one or more of the following QC sampling measures may be performed:

- Replicate samples – two environmental samples are collected from the same area and submitted to the laboratory to assess the overall variability of data associated with a particular sampling location.

- Split samples – a known homogeneous sample is divided and analyzed to compare precision of laboratory results.

- Field blank sampling – an unused (blank) sample is taken to measure conditions known to be present and associated with the field location—such as contributions which may be present from the ambient air during soil sampling or from the filter or collection vessel itself. Blank samples assess the quality and unavoidable contamination present in the sampling process.

- Equipment blank sampling – rinse water is collected off sampling equipment to determine what contaminants may be contributed from the field equipment itself.

- Trip blank sampling – a sample is prepared in the lab and carried through the entire sampling process (e.g., a deionized water sample) to identify baseline VOC contaminants that may be present from routine laboratory chemicals or other potential sources of contaminants.

- Double blind sampling – a sample with known concentrations of analytes is prepared and submitted to the laboratory to assess the precision and accuracy of the laboratory's stable chemistry analyses.

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

QC sample results were compared to statistically established control criteria. Analytical results—generated concurrent with QC sample results—that were within established control limits were considered acceptable. Analytical results that exceeded control limits were considered not acceptable and corrective action was initiated; reanalysis was performed for all samples in the analytical batch.

The QC process guarantees the quality of data generated by each analytical laboratory. QC sample data results are included in analytical reports prepared by subcontract laboratories for SNL/NM.

8.3 1996 QA ACTIVITIES

In 1996, SMO processed a total of 6,968 samples in support of SNL/NM projects which included environmental monitoring (air and water), waste characterization, D&D, and environmental restoration (ER). Of the total samples handled, 3,057 were for environmental monitoring and surveillance projects. A total of 1,172 QC samples were submitted to monitor overall contract laboratory performance in 1996; 440 of these QC samples were for environmental monitoring and surveillance projects.

SMO contract laboratories participate in inter-laboratory comparison programs of the EPA's Environmental Monitoring Systems Laboratory and the DOE Assessment Program. The SMO contract laboratories have a history of achieving a 90 percent or better success rate during these comparisons.

QC double blind check samples consisted of soils containing trace metals, cyanides, and a variety of organic compounds. Double blind check samples were submitted quarterly. All check samples were prepared in batch quantities

and subjected to round-robin analyses (multilaboratory analyses of selected analytes to determine a statistical result to verify analyte concentrations).

Results of each set of check sample analyses are documented in *Quarterly Performance Evaluation Reports* for each laboratory. Results include average percent recoveries for each suite of samples analyzed, the relative range of actual recoveries, and the relative percent differences for each analyte tested.

The resulting data were used to assess each contract laboratory's performance using relative percent difference and percent recovery for respective indicators of precision and accuracy. Review of laboratory performance data generated in 1996 indicated that the majority of analytes tested by the SNL/NM analytical laboratories are within EPA (or interlaboratory, round-robin) prescribed control limits. All reports, including laboratory results and audit corrective action responses are filed in the Environmental Operations Record Center (EORC).

QA Audits

DOE auditors from the Nevada Test Site (NTS) conducted an assessment of the sampling program for waste acceptance criteria that will be necessary at the NTS. No findings were identified with respect to SMO operations and commendations were noted for an excellent QA program. SMO also conducted audits of several of its contract laboratories. Using the centralized QA program criterias established by the Field Sample Management Program of DOE/AL, SMO identified numerous concerns, which have since been corrected or are near close out.

Data Validation and Records Management

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

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

2. By a knowledgeable member of the SNL/NM SMO staff who reviewed the analytical reports and corresponding sample collection and control documentation for completeness and laboratory contract compliance.

3. By the SNL/NM project leader responsible for program objectives and regulatory compliance and the project-specific data quality requirements.

QA Documents

Table 8-1 gives a list of QA documents specific to SMO as well as the general QA documents that guide all of SNL/NM's Environmental Programs.

Table 8-1. Important QA documents that guide SNL/NM's Environmental Programs.

QA Program Document	Reference
SNL Integrated Quality Plan	SNL 1996z-2
7500 QA Plan (QAP)	SNL 1996y
7500 QA Management Plan (QAMP)	SNL 1996z
SMO Quality Assurance Plan	SNL 1996z-1

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Cultural Resources Act

Emergency Planning and Community Right to Know Act (EPCRA) of 1986 (Enacted by Public Law 99-499, October 17, 1986; 42 U.S.C. 11001 et seq.)

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Federal Facility Compliance Act (FFCA) of 1992. Public Law 102-386

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as amended. Title 7 U.S.C. 136

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10 CFR 834	*Radiation Protection of the Public and the Environment,* draft.
10 CFR 1021	*National Environmental Policy Act Implementing Procedures for DOE.*
40 CFR 50	*National Primary and Secondary Ambient Air Quality Standards* (changed several times since 1971).
40 CFR 52	*Approval and Promulgation of Implementation Plans.*
40 CFR 58	*Ambient Air Quality Surveillance* (changed several times since 7/1/94).
40 CFR 60	*Standards of Performance for New Stationery Sources.*
40 CFR 61	*National Emission Standard for Hazardous Air Pollutants (NESHAP),* Subpart H. *National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities,* as amended. (changed many times since 1973 and 1985).
40 CFR 63	*National Emission Standard for Hazardous Air Pollutants for Source Categories,* 40 CFR 63, Subpart T, *National Emission Standard for Halogenated Solvent Cleaning.*
40 CFR 70	*State Operating Permit Programs* (changed since 1993).
40 CFR 80	*Regulation of Fuels and Fuel Additives.*
40 CFR 82	*Protection of Stratospheric Ozone.*
40 CFR 93	*Determining Conformity of Federal Actions to State or Federal Implementation Plans.*
40 CFR 112	*Oil Pollution Prevention* (changed several times since 1973).
40 CFR 122	*EPA Administered Permit Programs: The National Pollutant Discharge Elimination System (NPDES)* (changed several times since 1980).
40 CFR 123	*State Program Requirements, (NPDES)* (changed several times since 1980).
40 CFR 124	*Procedures for Decision Making, (NPDES)* (changed several times since 1980).
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40 CFR 141	*National Primary Drinking Water Regulations,* as amended. January 15, 1992, (changed many times since 1992).
40 CFR 143.3	Secondary Maximum Contaminant Levels.

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40 CFR 262	*Standards Applicable to Generators of Hazardous Waste.*
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40 CFR 264	*Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities*, including Subpart F, "Releases for Solid Waste Management Units," Section 264.101—"Corrective Action for Solid Waste Management Units," (changed since 1994).
40 CFR 265	*Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities*, (changed since 1991).
40 CFR 266	*Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities.*
40 CFR 268	*Land Disposal Restrictions*, (changed since 1991).
40 CFR 270	*EPA Administered Permit Programs: The Hazardous Waste Permit Program.*
40 CFR 271	*Requirements for Authorization of State Hazardous Waste Programs.*
40 CFR 272	*Approved State Hazardous Waste Management Programs.*
40 CFR 279	*Standards for the Management of Used Oil.*
40 CFR 280	*Technical Standards and Corrective Action Requirements for Owners and Operations of Underground Storage Tanks*, (changed many times since 1991).
40 CFR 281	*Approval of State Underground Storage Tank Programs.*
40 CFR 302	*Designation, Reportable Quantities, and Notification* (CERCLA Implementing).
40 CFR 355	*Emergency Planning and Notification* (EPCRA).
40 CFR 370	*Hazardous Chemical Reporting: Community Right-to-Know* (EPCRA).
40 CFR 372	*Toxic Chemical Release Reporting: Community Right-to-Know.*
40 CFR 761	*Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions.*
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40 CFR 1500 through 1508	Chapter V, *Council on Environmental Quality (NEPA Implementing Regulations)* (changed since 1978).
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DOE 1991a: U.S. Department of Energy, *Planning and Preparedness for Operational Emergencies*, DOE Order 5500.3A. DOE, Washington, DC (1991, change 1, February 27, 1992).

DOE 1991b: U.S. Department of Energy, *Quality Assurance*, DOE Order 5700.6C. DOE, Washington, DC (August 21, 1991).

DOE 1990a: U.S. Department of Energy, Chapter I, *General Radiological Protection of the Public and the Environment*; Chapter II, *Requirements for Radiation Protection of the Public and the Environment*; and Chapter III, *Derived Concentration Guides for Air and Water*, DOE Order 5400.5. DOE, Washington, DC (February 8, 1990, change 2, January 7, 1993).

DOE 1988a: U.S. Department of Energy, *General Environmental Protection Program*, DOE Order 5400.1. DOE, Washington, DC (1988, change 1, June 21, 1990).

DOE 1988b: U.S. Department of Energy, *Radioactive Waste Management*, DOE Order 5820.2A. DOE, Washington, DC (1988).

EXECUTIVE ORDERS

EO 11988: *Floodplain Management* (Signed May 24, 1977; 42 FR 26951, 3 CFR, 1977 Comp., p. 117; Amended by Executive Order 12148, July 20, 1979; 44 FR 43239, 3 CFR, 1979 Comp., p. 412).

EO 11990: *Protection of Wetlands* (Signed May 24, 1977; 42 FR 26961, 3 CFR, 1977 Comp., p. 121).

EO 12843: *Procurement Requirements and Policies for Federal Agencies for Ozone Depleting Substances.*

EO 12856: *Federal Agency Compliance With Right-to-Know Laws and Pollution Prevention Requirements* (Signed August 3, 1993; 58 FR 41981, August 6, 1993).

EO 12780: *Federal Agency Recycling and the Council on Federal Recycling and Procurement Policy.* (Signed October 31, 1991; 56 FR 56289, November 4, 1991).

EO 12873: *Federal Acquisition, Recycling and Waste Prevention.* (Signed October 20, 1993; 58 FR 54911, October 22, 1993; amended 6y EO 12995, March 25, 1996; 61 FR 13645, March 28, 1996).

EO 12902: *Energy Efficiency and Water Conservation at Federal Facilities.* (Signed March 8, 1994).

APPENDIX A

ENVIRONMENTAL REGULATIONS and STANDARDS

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CONTENTS

TABLES

A.1 INTRODUCTION

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

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

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

Table A-1. Derived Concentration Guides (DCGs) for selected radionuclides.*

	Drinking Water		Inhaled Air†	
Nuclide	DCG (µCi/L)	f_1 Value	DCG (µCi/m^3)	Solubility Class
Tritium (water)	2E+00	--	1E-01	--
Cesium-137	3E-03	1E+00	4E-04	D
Gross Alpha*	15E-06	--	--	--
Gross Beta	3E-05	--	--	--
Uranium§, total	6E-04	--	6E-6	--

NOTE: µCi/L = microcuries per liter; µCi/m^3 = microcuries per cubic meter.
*DOE Order 5400.5, Chapter III (DOE 1990).
†DCG for tritium in air (2×10^{-1}) is adjusted for skin absorption.
‡EPA-570/9-76-003 (EPA 1976).
§A conversion from picocuries per liter (pCi/L) to micrograms per liter (µg/L) may be made using 1.3×10^{-6} picocuries per microgram (pCi/ g) for uranium as it exists in drinking water (40 CFR 141).

Table A-2. Radiation standards for protection of the public in the vicinity of U.S. Department of Energy facilities.

General Dose Limits

All Pathways*

The Effective Dose Equivalent for any member of the public from all routine DOE operations (natural background and medical exposures excluded) shall not exceed the values given below:

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

Air Pathway**

	Effective Dose Equivalent	
	mrem/yr	(mSv/yr)
Maximum offsite residence	10	(0.10)

NOTE: *DOE Order 5400.5, Chapters I and II (DOE 1990).
†Routine DOE operations means normal planned activities, including remedial actions and naturally occurring radionuclides released by DOE processes and operations.
‡Effective Dose Equivalent (EDE) will be expressed in Roentgen Equivalent Man (rem) (or millirem) with the corresponding value in sievert (or millisievert) in parentheses.
**40 CFR 61, Subpart H for radionuclides, National Emission Standards for Hazardous Air Pollutants (NESHAP).

Table A-3. Groundwater monitoring parameters required by 40 CFR 265, Subpart F.*

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

NOTE: *Resource Conservation and Recovery Act (40 CFR 265).
†40 CFR 265, Appendix III.

Table A-4. U.S. Environmental Protection Agency Interim Primary Drinking-Water Supply parameters.

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

NOTE: mg/L = milligrams per liter; mL = milliliters; NTU = nephelometric turbidity unit; pCi/L = picocuries per liter; mR/yr = milliroentgens per year.
*40 CFR 265, Appendix III.
†Total metals (unfiltered sample).

REFERENCES

DOE 1988: U.S. Department of Energy, *General Environmental Protection Program*, DOE Order 5400.1. DOE, Washington, DC (1988; change 1, June 21, 1990).

DOE 1990: U.S. Department of Energy, Chapter I, *General Radiological Protection of the Public and the Environment*; Chapter II, *Requirements for Radiation Protection of the Public and the Environment*; and Chapter III, *Derived Concentration Guides for Air and Water*. DOE Order 5400.5. DOE, Washington, DC (February 8, 1990, change 2, January 7, 1993).

EPA 1976: U.S. Environmental Protection Agency, *U.S. EPA National Interim Primary Drinking Water Regulations*, EPA-570/9-76-003. EPA, Washington, DC (1976).

Resource Conservation and Recovery Act (RCRA) of 1976. Public Law 94-580, 1976, 90 Statute 2795.

57 FR 15122. National Environmental Policy Act Implementing Procedures, revises 10 CFR 1021.

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

40 CFR 141, 1975. *National Primary Drinking Water Regulations*, as amended January 15, 1992.

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

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APPENDIX B

SITE ENVIRONMENTAL REPORT
FOR THE
KAUAI TEST FACILITY (KTF)
OPERATED BY SANDIA NATIONAL LABORATORIES

ACKNOWLEDGEMENTS

The 1996 report for the Kauai Test Facility was compiled with contributions from Ted Wolff, Alonzo Lopez, Hans Odewage, Heidi Herrera, Adrian Jones and Dick Hay. Dianne Duncan and Rebecca Sanchez provided editing and word processing.

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ABBREVIATIONS

Acronyms

AIRF	American Indian Religious Freedoms Act
ARPA	Archeological Resources Protection Act
BMDO	Ballistic Missile Defense Organization
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CWA	Clean Water Act
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
EA	Environmental Assessment
EIS	Environmental Impact Statement
EORC	Environmental Operations Record Center
EMP	Environmental Monitoring Plan
EO	Executive Orders
EPA	U.S. Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
ER	Environmental Restoration
ES&H	Environment, Safety, and Health
ESA	Endangered Species Act
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FFCAct	Federal Facilities Compliance Act
FONSI	finding of no significant impact
FTU	Flight Test Unit
HCRR	Hawaiin Code of Rules and Regulations
ICP	inductively coupled plasma
IT	International Technology (Corp.)
KTF	Kauai Test Facility
MDT	Midcourse Demonstration Test
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NHPA	National Historic Preservation Act
NPDES	National Pollutant Discharge Elimination System
NRC	National Response Center
NSPS	New Source Performance Standards
PBV	Post Boost Vehicle
PCB	polychlorinated biphenyl
PMRF	Pacific Missile Range Facility
PSD	Prevention of Significant Deterioration
PTO	Permit-to-Operate
RCRA	Resource Conservation and Recovery Act
RIMPAC	Pacific Rim (Navy exercise)
RQ	Reportable Quantity
SARA	Superfund Amendments and Reauthorization Act
SDI	Strategic Defense Initiative
SDWA	Safe Drinking Water Act
SEA	site evaluation accomplished
SI	site inspection
SNL	Sandia National Laboratories
SNL/NM	Sandia National Laboratories/New Mexico
SPCC	Spill Prevention Control and Countermeasures (Plan)
STARS	Strategic Targeting System

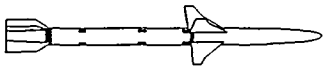
ABBREVIATIONS (Concluded)

TSCA	Toxic Substances Control Act
USASSDC	U.S. Army Space and Strategic Defense Command
UST	underground storage tank

Units

m	meter
ft	feet
in.	inch
mg	milligram
ppm	parts per million
lb	pounds
g	gram
µg	microgram
kg	kilogram

Sandia National Laboratories (SNL) operates the Kauai Test Facility (KTF) as a rocket preparation, launching, and tracking facility for the Department of Energy (DOE), as well as in support of other U.S. military agencies (DOE 1992). The site is located on the north end of the U.S. Navy's Pacific Missile Range Facility (PMRF), near Nohili Point on the island of Kauai, the northern-most and fourth largest of the Hawaiin Islands (Figure B-1). This Site Environmental Report for the KTF has been prepared according to the requirements of DOE Order 5400.1 (DOE 1988).



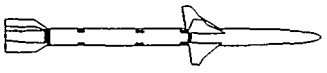
B.1 FACILITIES and OPERATIONS

KTF has been an active rocket-launching facility since 1962. The SNL's Range and Kauai Test Facility (KTF) and Range Interface Department manages and conducts the rocket-launching activities at KTF. The site is primarily used for testing rocket systems with scientific and technological payloads, advanced development of maneuvering reentry vehicles, scientific studies of atmospheric and exoatmospheric phenomena, and Strategic Defense Initiative (SDI) programs. Nuclear devices have never been launched from KTF nor have radiological materials been used at KTF.

The first facilities at KTF were constructed in the early 1960s to support the National Readiness Program. The most recent construction, completed in 1994, added four buildings to support DOE and SDI launches. From 1992 to 1996, 10 launches have occurred.

The KTF launcher field was originally designed to accommodate 40 launch pads, but only 15 were constructed. Of these, 11 have had their launchers removed. Beyond the implementation of portions of the original plan, two additional launch pads have been constructed: Pad 41 at Kokole Point, and Pad 42, the Strategic Targeting System (STARS) launch pad. The launcher field site has a number of permanent facilities used to support rocket operations and is configured to meet programmatic needs. In addition to rocket launch pad sites, KTF facilities include missle assembly areas, data acquisition and operations facilities, a maintenance shop, and a trailer compound for administration and technical support personnel. Other features at KTF include extensive radar tracking and world-wide radio communication access to Department of Defense (DoD) facilities.

The administrative area of KTF, known as the Main Compound, is located in a fenced area near the North Nohili access road from PMRF. Within the fenced compound, a number of trailers and vans are interconnected with a network of concrete docks and covered walkways. The majority of these temporary facilities are used during operational periods to support the field staff at KTF. During non-operational periods, general maintenance continues and dehumidifiers (to protect equipment) remain in operation. Additionally, there are a number of permanent buildings, most of which are in use year-round to support and maintain KTF facilities (Helgesen 1990).



B.2 1996 ROCKET LAUNCHES

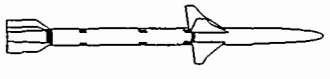
Four rocket launches from the KTF were executed in 1996: two Malamute rockets, one Black Brant rocket, and one STARS missle (the largest type of rocket launched from KTF). All launches were covered by the current KTF Environmental Assessment (EA) (DOE 1992). In addition, the STARS (M3) missle launch was covered by the specific STARS Environmental Impact Statement (EIS) (DoD 1992). A brief description of these launches is as follows:

- The two Malamute rockets were launched on January 31 and February 1. The Malamute rocket is a single stage solid propellent motor. The purpose of this mission was to provide a ballistic target for the Navy's Aegis ships in support of the Navy's development of their Theater Missile Defense

Program. Both rockets (targets) broke up shortly after burnout. The missiles were launched over the ocean area north of Kauai.

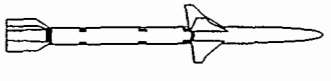
- The Black Brant missle was launched on June 13. This rocket is also a single stage solid propellent motor. The mission successfully provided a ballistic target for the Navy as part of their Pacific Rim (RIMPAC) exercises. The missile was launched over the ocean area north of Kauai.

- The STARS (M3) Midcourse Demonstration Test (MDT) was launched on August 31. This missile is similar in components to previous STARS missles. The system consists of three solid propellant stages and the liquid propellent Post Boost Vehicle (PBV). The mission successfully deployed 25 test objects, which were viewed by a space satellite and numerous ground-based and mobile sensors. These objects were successfully delivered on a ballistic trajectory from Hawaii to the broad ocean area near the Kwajalein Atoll. The information gathered will be applied to the develpment of a ballistic missile defense system. The mission was a success—all on-board systems functioned according to plan and all sensors aquired valid data.



B.3 DEMOGRAPHICS

The closest population center, Kekaha (population 3,300), is 8 miles from KTF. KTF employs 13 permanent onsite personnel; three are employed by SNL and the rest are SNL contractors. During operational periods, when rocket launches occur, an additional 50 to 130 persons from the U.S. mainland are employed at KTF (DOE 1992).



B.4 COMPLIANCE SUMMARY

The following list of statutes give a brief overview of compliance status at KTF in 1996. Nonapplicable laws and regulations are noted. Table B-1 lists the applicable permits in place at KTF.

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

The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), (also known as Superfund) addresses areas of past spills and releases. No compliance activities with regard to past environmental contamination were required in 1996.

🕮 Superfund Amendments and Reauthorization Act (SARA)

The Superfund Amendments and Reauthorization Act (SARA) Title III requires Reportable Quantity (RQ) information as directed by the Emergency Planning and Community Right-to-Know Act (EPCRA), Sections 311 and 312. All required information has been submitted to the State of Hawaii.

🕮 Resource Conservation and Recovery Act (RCRA)

In 1994, KTF reached "small quantity hazardous waste generator" status as defined by the Resource Conservation an Recovery Act (RCRA), and, therefore, obtained an Environmental Protection Agency (EPA) Identification Number. However, the volume of waste generated in 1996 qualified the KTF to maintain conditionally exempt small quantity generated status.

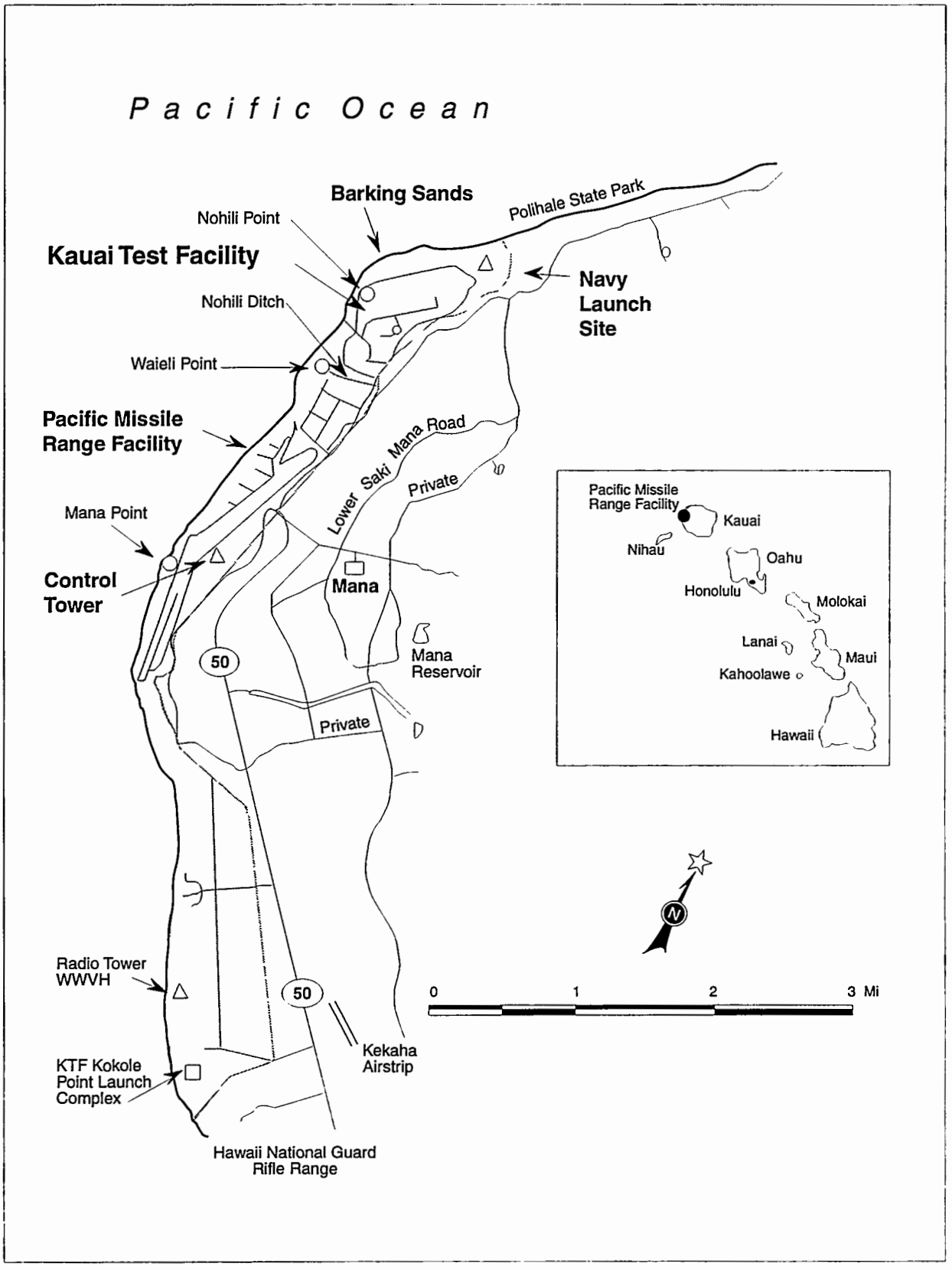


Figure B-1. Map of the Pacific Missile Range Facility (PMRF) and the adjacent area. The Kauai Test Facility (KTF) is to the north, near Nohili Point.

Federal Facilities Compliance Act (FFCAct)

The Federal Facilities Compliance Act (FFCAct) addresses the disposition of mixed waste (MW) at Federal facilities. No radioactive waste is presently generated or stored at KTF.

National Environmental Policy Act (NEPA)

The National Environmental Policy Act (NEPA) requires that all Federal facilities address environmental and cultural impacts in appropriate detailed documentation before initiating projects. Acts and DOE Orders directly related to NEPA compliance include the following:

- Endangered Species Act (ESA),
- Cultural Resources Act,
- National Historic Preservation Act (NHPA),
- Archeological Resources Protection Act (ARPA),
- American Indian Religious Freedoms Act (AIRF)
- Executive Orders for Protection of Wetlands (EO 11990), and Floodplain Management (EO 11988).

In accordance with NEPA, a comprehensive site-wide EA was completed for KTF in 1992 (DOE 1992). A finding of no significant impact (FONSI) was issued on July 17, 1992. This is the current document that covers rocket launching activities at the site. Additionally, a specific EIS for the STARS program is in place for rocket launching of this type (DoD 1992).

Clean Air Act (CAA) and Clean Air Act Amendments (CAAA) of 1990

Ambient air quality is regulated by Hawaiin Code of Rules and Regulations (HCRR), Title 11, Chapter 59 (11-59-4) under the jurisdiction of the Hawaii Department of Health, Air Pollution Control Department. Currently there are no facilities at KTF that require air permits or compliance with the New Source Performance Standards (NSPS), "Prevention of Significant Deterioration (PSD)," or 40 CFR 161, National Emission Standards for Hazardous Air Pollutants (NESHAP). Within PMRF no Federal air emission permits are held either by DOE for KTF, or by DoD for PMRF. However, the two electrical generators at KTF are permitted for operation by the State of Hawaii under "Permit-to-Operate" (PTO) (SNL 1996a).

According to EPA requirements, the Annual Emissions Report Form was submitted to the State of Hawaii on February 5, 1996. There were no air quality compliance issues in 1996.

Table B-1. Permits in place at KTF.

Type	Permit Number	Date Issued	Date Expired	Reg Agency
RCRA	HI0000363309	Sep. 23, 1994	N/A	EPA Region IX (and Hawaii Dept. of Health)
Diesel Generators (air emission)	PTO No. P-737-1591.	Oct. 25, 1993	Oct. 1, 1998*	State of Hawaii (SNL 1996a)

NOTE: PTO = Permit to Operate
* A change in State law after this permit was issued will likely require a new permit application at renewal time (as opposed to an extension).

Clean Waer Act (CWA)

The KTF facility currently has three septic tanks onsite, which do not require permits from the State of Hawaii. A National Pollutant Discharge Elimination System (NPDES) permit is not required due to the lack of significant stormwater runoff, or wastewater that discharges beyond the site boundary into waters of the U.S. There were no compliance issues with respect to any State or Federal water pollution regulations in 1996.

Safe Drinking Water Act (SDWA)

The Safe Drinking Water Act (SDWA) does not apply to SNL activities at KTF. All drinking water is obtained from PMRF facilities.

Toxic Substances Control Act (TSCA)

Under the Toxic Substances Control Act (TSCA), the oil contained in all electrical and/or mechanical equipment, and all hydraulic fluid-containing systems must be assumed to contain polychlorinated biphenyls (PCBs) unless sampling and analysis prove otherwise. The transformers on the KTF site have been tested and are free of PCBs.

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

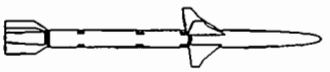
The Federal Incecticide, Fungicide, and Rodenticide Act (FIFRA) controls the distribution and application of pesiticides. Pesticide use at KTF follows all EPA requirements.

Audits

There were no environmental audits conducted at KTF in 1996.

Releases and Occurrences

There were no Reportable Quarterly (RQ) releases or other occurrences at KTF in 1996.



B.5 ENVIRONMENTAL PROGRAM ACTIVITIES

National Environmental Policy Act (NEPA) Program Activities

In completing the KTF EA, several environmental baseline surveys were conducted and are summarized briefly below:

- **Green Sea Turtle Survey Report** – This survey found at least 32 green sea turtles (*Chelonia mydas agassizi*) in five locations at KTF. The study concluded that constructing an additional launch pad and conducting further launches, similar to those conducted at KTF since 1962, most likely will not have any quantifiable negative effects on green sea turtles inhabiting waters near KTF (IT 1990a).

- **Botanical Survey Report** – This survey identified four major vegetation types at KTF and recommended that vehicles be kept off the beaches and dunes. The report recommended moving the entire *Ophioglossum concinnum* colony (a Category 1[a] proposed endangered fern) to a compatible area within PMRF because of the colony's proximity to a beach access road and its location in a frequently-mowed kiawe/koahaole vegetation zone (IT 1990b).

- **Ornithological and Mammal Survey Report** – This survey determined relative population densities of bird species and identified mammalian species at KTF (IT 1990c). Based on mitigations implemented and other

[a] Category 1 is a species for which biologic vulnerability exists to the point of support of proposal to list as endangered or threatened.

commitments made in the KTF EA, no adverse impacts are expected for birds or mammals as a result of KTF operations.

- **Soil Sampling Report** – Sampling was undertaken to delineate the extent and concentration of lead, aluminum, and beryllium in the soil at KTF and to determine whether the concentrations pose a risk to human health or the environment. The soil sampling results were used to estimate the potential for future soil contamination or human exposure from use of KTF as a launch facility (IT 1990d).

- **Archaeological Survey and Sampling** – No significant cultural resources were found on the surface at KTF, but subsurface testing within one area indicated a potential for subsurface cultural resource materials (Gonzalez and Berryman 1990).

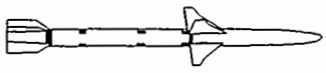
Spill Prevention Control and Countereasures Plan (SPCC)

SNL cooperates with the the PMRF *Spill Prevention Control and Countermeasures (SPCC) Plan* (U.S. Navy 1991), which provides support in the event of a diesel fuel spill from the 10,000-gallon above-ground fuel tank inside the Main Compound.

KTF has only one underground storage tank (UST) in its inventory (# 666C). This UST was placed in service in August 1991 and is registered with the State of Hawaii as a DOE-owned SNL UST system.

Environmental Restoration (ER) Project Activities

In regard to site remediation at KTF, no Environmental Restoration (ER) activities are planned. The Site Inspection (SI) report generated in 1994 and submitted to the EPA in May 1995, recommended that the EPA apply a "site evaluation accomplished" (SEA) designation to KTF. No additional assessment or sampling was done at the KTF site.



B.6 ENVIRONMENTAL SURVEILLANCE and MONITORING ACTIVITIES

This section summarizes various enviornmental programs and/or activities in place at KTF. Relevant environmental program documents are listed in Table B.2.

Environmental Surveillance

No terrestrial surveillance, which currently includes only soil samples or wastewater monitoring activities, were conducted in 1996. Currently, environmental sampling is conducted on a periodic and "as needed" basis due to the limited activities and past sampling results, which indicate that any contamination present is minimal and is not migrating. The last terrestrial sampling activity was conducted in 1994. Results and further analysis of the data were published in the *1995 Site Environmental Report* (SNL 1996b).

When sampling does occur, environmental monitoring and surveillance is conducted according to the KTF Environmental Monitoring Plan (SNL 1996c). Because of the high permeability of the dune sands on which KTF is sited, there is no terrestrial surface water or established drainages onsite; therefore, water and sediment samples are not collected. Routine groundwater sampling is also not performed because the water table consists of brackish non-potable water floating on seawater and is unacceptable for consumption or irrigation of any kind (DOE 1992). SNL ER Project personnel collected groundwater samples in 1994 from several temporary wells; no contamination was found. Future sampling will be dependent on resource availability and demonstrated need.

Summary of 1994 and 1995 Soil Sampling Results and Analysis

In July 1994, SNL Environmental Surveillance staff collected 32 soil samples—19 from onsite and perimeter locations, and 11 from offsite locations within a six-mile radius of the site. The specific objective of the 1994 sampling was to provide limited baseline data for the radiological and nonradiological (metal) concentrations of the soil in and around KTF.

Radiological results showed no statistical difference between onsite and offsite samples, supporting the historical process knowledge that no radioactive contaminants have been dispersed at the site.

Nonradiological results showed elevated concentrations of zinc, barium, lead, and strontium at locations around the Main Compound. Other onsite results showed elevated zinc, barium, chromium, cobalt, iron, magnesium, nickel, copper, silicon, and lead. Many of the elvated metals were only marginally above offsite locations. However, zinc and nickel showed significantly higher results as compared to offsite data. Original data results are published in the *1994 Site Environmental Report* (SNL 1995).

Further analysis of the nonradiological data was conducted in 1995 to provide a planning basis for future sampling activities (Shyr et al. 1996 and SNL 1996b). Of the metals reported as elevated, iron, magnesium, and silicon were removed from discussion because they occur in high concentrations in the soil naturally and have a low health impact. In the second analysis, zinc and lead showed statisically higher concentrations than offsite. The highest value for zinc (3100 ppm) was 10 percent of the proposed RCRA action level (23,000 ppm). Two locations had elevated lead concentrations, with one (110 ppm) above the RCRA toxcity level (100 ppm). Because lead is an expected pollutant generated during the launch of some rocket systems, lead contamination was addressed in the KTF EA. If KTF is decommissioned in the future, samples will be collected to determine if lead present in soils will require remediation (DOE 1992).

Wastewater Monitoring

KTF produces only sanitary sewage which is directed into five wastewater systems—three septic tanks and two french drains—in accordance with Hawaii Underground Injection Control regulations. The septic systems are periodically pumped by licenced State-certified contractors and inspected by State officials. The limited quantity of sewage released does not impact any protected waters and, as mentioned, there are no potable water wells in the area of KTF. Currently, septic tanks do not require permitting or sampling. Sampling is performed as a best-management practice on an "as needed" basis. The last sampling occurred in June 1993 (IT 1994).

Air Emission Monitoring

Based on effluent air monitoring results of the STARS Flight Test Unit 1 (FTU-1) in February 1993 (EPA 1993) and the CDX rocket launch in the summer of 1992 (SNL 1992b), it was determined that rocket launches at KTF were not a significant source of air pollutants—launches are infrequent and emissions recorded did not exceed Federal and State standards (DoD 1994). Because the STARS type rocket produces the greatest air emsissions and remained within acceptable limits, it can be assumed that future launches of this type will also be within acceptable limits. Therefore, no further air emission monitoring is planned at this time. If a new rocket is launched from KTF that differs in emission substance from the STARS rocket, or air emission requirements change, funding for future monitoring will be requested (SNL 1996c).

Meteorological Monitoring

Onsite meteorological instruments are used during test periods to characterize atmospheric transport, diffusion conditions, and stability classes. Due to the infrequency of launches, no formal meteorlogical monitoring plan is in place for KTF. Climatic information representative of KTF can be obtained from the PMRF.

Noise Monitoring

In accordance with the Quiet Communities Act (42 U.S.C. 4901 et seq.), noise monitoring was conducted in February 1993 during the STARS FTU-1 launch to confirm the determination made in the STARS EIS that noise produced from the largest launch would be below acceptable levels (SNL 1993). Data collected in the nearest town of Kekaha indicated that levels were no louder than noise generated from passing vehicles on a nearby highway. No further noise monitoring is planned at this time.

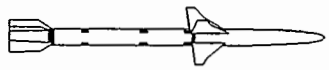


Table B-2. List of relevant environmental documents for the KTF site.

Title	Reference
KTF Environmental Assessment (EA)	DOE 1992
STARS Environmental Impact Statement (EIS)	DoD 1992
Septic System Monitoring Program Sampling and Analysis Plan	SNL 1992a
KTF Mitigation Action Plan	DOE 1992 (Appx D of the KTF EA)
KTF Environmental Monitoring Plan (EMP)	SNL 1996
See Chapter 4, Table 4-7 of the 1996 SNL/NM ASER for general documents related to the Terrestrial Sampling Program	(This document)

NOTE: All documents are on file at the Environmental Operations Record Center (EORC).

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DoD 1994: U.S. Department of Defense, *Ambient Air Quality Assessment No. 43-21-N3DD-94, Strategic Target System, Operational and Deployment Experiments Simulator Missile Launch, Pacific Missile Range Facility, Kauai Test Facility, Barking Sands, Kauai, Hawaii, 6-25 July 1994.* U.S. Army Environmental Hygiene Agency, Department of Defense (1994).

DoD 1992: *Final Environmental Impact Statement for the Strategic Target System,* Volumes I through III. U.S. Army Strategic Defense Command, Department of Defense (May 1992).

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DOE 1988: U.S. Department of Energy, *General Environmental Protection Program*, DOE Order 5400.1. DOE, Washington, DC (1988; change 1, June 21, 1990).

DOE 1992: U.S. Department of Energy Albuquerque Operations Office (DOE/AL), *Kauai Test Facility Environmental Assessment*, DOE/EA-0492. DOE/AL, Albuquerque, NM (1992).

EPA 1993: Environmental Protection Agency, "Memorandum, USAEHA, MCHB-ME-AQ: *Ambient Air Quality Assessment No. 43-21-N204-93, Strategic Target System Missile Launch, Pacific Missle Range Facility, Kauai Test Facility, Barking Sands, Kauai, Hawaii February 19-March 1, 1993.* U.S. Environmental Protection Agency, Washington, DC (June 9, 1993).

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Helgesen 1990: R. F. Helgesen, *Safety Assessment for the Kauai Test Facility at Barking Sands, Kauai*, SAND89-2548. Sandia National Laboratories, Albuquerque, NM (1990).

IT 1990a: IT Corporation, *A Survey of the Green Sea Turtle Population Fronting the Kauai Test Facility, Pacific Missile Range, Barking Sands, Kauai: An Analysis of Potential Impacts with Implementation of the Strategic Defense Initiative.* IT Corp., prepared for Sandia National Laboratories, Albuquerque, NM (1990).

IT 1990b: IT Corporation, *Botanical Survey of the Kauai Test Facility Site, Barking Sands, Kauai, Hawaii.* IT Corp., prepared for Sandia National Laboratories, Albuquerque, NM (1990).

IT 1990c: IT Corporation, *Ornithological Survey Report of the Kauai Test Facility Site, Barking Sands, Kauai, Hawaii.* IT Corp., prepared for Sandia National Laboratories, Albuquerque, NM (1990).

IT 1990d: IT Corporation, *Soil Sampling Program for Sandia National Laboratories, Kauai Test Facility, Kauai, Hawaii.* IT Corp., prepared for Sandia National Laboratories, Albuquerque, NM (1990).

IT 1994: IT Corporation, *Sandia National Laboratories/New Mexico Septic Tank Monitoring Report, Kauai Test Facility*. IT Corp., prepared for Sandia National Laboratories, Albuquerque, NM (June 1994).

SNL 1992a: Sandia National Laboratories, *Environmental Sampling Procedure,* SP471991. Sandia National Laboratories, Albuquerque, NM (November 19, 1992).

SNL 1992b: Sandia National Laboratories, "CDX Rocket Motor Effluent Monitoring," memo from W. E. Stocum (7712) to R. G. Hay (2723). Sandia National Laboratories, Albuquerque, NM (1992).

SNL 1993: Accoustic Monitoring Plan of the STARS Flight Test Unit 1." Memo to Linda Ninh from B. E. Swanson. Sandia National Laboratories, Albuquerque, NM (1993).

SNL 1995: *1994 SNL/NM Site Environmental Report,* SAND95-1953. Sandia National Laboratories, Albuquerque, NM (1995).

SNL 1996a: Sandia National Laboratories. "State of Hawaii Permit to Operate (PTO) No. P 738-1591," memo from Mike du Mond to Su Hwang, Sandia National Laboratories, Albuquerque, NM (February 1, 1996).

SNL 1996b: *1995 SNL/NM Site Environmental Report,* SAND96-2270. Sandia National Laboratories, Albuquerque, NM (September, 1996).

SNL 1996c: Sandia National Laboratories. *Environmental Monitoring Plan (EMP), Sandia National Laboratories, Kauai Test Facility*. Sandia National Laboratories, Albuquerque, NM (October 21, 1996).

Shyr et al. 1996: L. J. Shyr, R. Haaker, and H. Herrera, *1995 Terrestrial Surveillance Data Analysis Report for the SNL/NM and KTF Sites, SAND96___*, in preparation.
Sandia National Laboratories, Albuqueruqe, NM (1996).

U.S. Navy 1991: U.S. Navy, *Spill Prevention Control and Countermeasure Plan, Pacific Missile Range Facility.* Pacific Division, Naval Facilities Engineering Command, Pearl Harbor, HI (February 1991).

REGULATIONS and EXECUTIVE ORDERS

- Comprehensive Environmental Reponse, Compensation, and Liability Act (CERCLA) of 1980, as amended. Title 40 U.S.C. 9601.
- Superfund Amendments and Reauthorization Act (SARA) of 1986. Title III, Section 313, "Toxic Chemical Release Reporting."
- Clean Air Act (CAA) of 1955, as amended. Title 42 U.S.C. 7401.
- Clean Air Act Amendments (CAAA) of 1990.
- Clean Water Act (CWA) of 1948, (Federal Water Pollution Control Act), as amended. Title 33 U.S.C. 1251.
- Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as amended. Title 7 U.S.C. 136.
- National Environmental Policy Act (NEPA) of 1969, as amended. Title 42 U.S.C. 4321.
- Resource Conservation and Recovery Act (RCRA) of 1976. Public Law 94-580, 1976, 90 Statute 2795.
- Toxic Substances Control Act (TSCA) of 1976. U.S.C. §2601 et seq.
- "Quiet Communities Act of 1978," Public Law 95-609, 92 stat. 3079, 4901 et seq. November 9, 1978
- HCRR, Title II, Chapter 59, Hawaii Code of Rules and Regulations for Air Quality.
- Executive Order (EO) 11988, *Floodplain Management* (Signed May 24, 1977; 42 FR 26951, 3 CFR, 1977 Comp., p. 117; Amended by Executive Order 12148, July 20, 1979; 44 FR 43239, 3 CFR, 1979 Comp., p. 412).
- Executive Order (EO) 11990, *Protection of Wetlands* (Signed May 24, 1977; 42 FR 26961, 3 CFR, 1977 Comp., p. 121).

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Ancillary Information

GLOSSARY

Asbestos - is a fibrous mineral used in construction materials because of its fire-retardant and heat-resistant properties. Asbestos particles have the potential to pose significant health risks if inhaled. Asbestos materials are contained in insulation (e.g., above ceilings and around pipes and tanks), ovens, floor tiles, and various laboratory equipment. SNL/NM's policy on asbestos abatement is dependent on whether the asbestos material is uncontained and, therefore, inhalable. All uncontained friable asbestos in structures and equipment is removed for disposal. If the asbestos-contaminated portion cannot be practically disposed, it may be necessary for the entire piece of equipment or construction component to be removed for disposal.

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

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) - of 1980, as amended, defines certain assessment activities and reporting requirements for inactive waste sites for all Federal facilities.

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

Nonradioactive waste categories - are defined as:

- Chemical Waste - any chemical, certain metals, or chemical-contaminated items
- RCRA-Hazardous Waste - a chemical waste regulated under 40 CFR 261.3
- TSCA Waste - a substance contaminated with TSCA-regulated chemicals (e.g., PCBs and asbestos)
- Industrial Solid Waste - waste from manufacturing process that is not regulated under RCRA
- Municipal Waste - domestic/household trash
- Solid Waste - office related non-hazardous waste (as it applies to SNL/NM)

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

National Pollutant Discharge Elimination System (NPDES) - is contained in amendments to the Federal Clean Water Act of 1987 (40 CFR 122). Affected sites, as outlined in the amendment, must obtain an NPDES permit for storm water runoff to any municipal storm drain system and/or storm water discharge from industrial sites that enter significant bodies of water (e.g., lakes, rivers, and oceans). The criteria set by the EPA that mandate storm water runoff permitting includes all facilities that have been classified under a set of Standard Industrial Classification (SIC) codes for particular industrial activities (codes 20 through 39).

Operable Units (OUs) - are the potential Environmental Restoration (ER) release sites identified in the Installation Assessment report and subsequent evaluations that are grouped together within geographic and event-related boundaries for budget development and project tracking purposes. Section 3004(u) of the Resource Conservation and Recovery Act (RCRA), "Continuing Releases at Permitted Facilities," requires investigation of all past and present Solid Waste Management Units (SWMUs), which includes any facility that has collected, stored, processed, and/or disposed of refuse, sludge, garbage, or other discarded materials, and has a potential for release of hazardous waste or hazardous constituents.

Radioactive Waste - falls into four major categories:

- High-Level Waste (HLW) - typically contains highly radioactive short-lived fission products as well as other long-lived isotopes. Most DOE HLW comes from plutonium production activities.
- Transuranic (TRU) Waste - without regard for source or form, waste that is contaminated with alpha-emitting transuranium radionuclides with half-lives greater than 20 years and concentrations greater than 100 curies per gram (Ci/g) at the time of assay. In some cases, it may be determined that other alpha contaminated wastes, particular to a specific site, must be managed as transuranic waste.
- Mixed Waste (MW) - is waste that contains both RCRA-regulated hazardous constituents and radioactive materials.
- Low-Level Waste (LLW) - comprises most all other radioactive wastes that are not classified under the above three categories. Most LLW contains small amounts of radioactivity within a large volume of material.

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

Resource Conservation and Recovery Act (RCRA) - was signed into law on October 21, 1976, as amendments to the Solid Waste Disposal Act (SWDA) of 1965. Further amendments made to RCRA in 1984, entitled the Hazardous and Solid Waste Amendments (HSWA), provide a set of criteria for Land Disposal Restrictions (LDRs) of hazardous waste. These provisions were fully implemented on May 8, 1980, making it unlawful to dispose untreated waste to the ground (except in a case-by-case determination for a "No Migration Variance" made by the EPA). All hazardous waste must meet strict treatment standards to reduce the toxicity, volume, and/or likelihood of migration from a disposal site before it can be disposed of to land. The RCRA regulatory framework is a "cradle to grave" process which requires detailed reporting for all aspects of hazardous waste handling. Facilities that generate, treat, store, or dispose of hazardous waste must obtain a RCRA operating permit from the EPA or designated state authority. Hazardous waste generators who store waste onsite for more than 90 days must obtain a treatment, storage, and disposal facility (TSDF) RCRA Operating Permit. As part of the permit process, RCRA also requires owners to show a documented waste minimization program, which will reduce the volume and/or quantity and toxicity of their waste. Under the Part B Operating Permit at SNL/NM, RCRA regulated waste can be stored up to a maximum of one year before it must be shipped offsite to a permitted TSDF.

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

Superfund Amendments and Reauthorization Act (SARA) - of 1986 amended CERCLA, the Solid Waste Disposal Act (SWDA), and the Internal Revenue Code, as well as providing some free-standing provisions. Among the free standing provisions is SARA Title III, also known as the "Emergency Planning and Community Right-to-Know Act of 1986" (EPCRA). EPCRA applies to all facilities, in which there is present a threshold amount of extremely dangerous substances equal to or greater than the threshold planning quantity, or in specifically designated amounts as determined by the local community.

Tiger Teams - were created under an initiative by the Secretary of Energy in 1989 to conduct rigorous health and safety appraisals at DOE facilities. DOE established Tiger Teams of Environmental, Safety, and Health (ES&H) experts to inspect the various DOE owned and/or operated laboratories for compliance with Federal, State, and local environmental and safety regulations, permits, agreements, DOE Orders, best management practices, and internal facility requirements. A DOE Tiger Team conducted an assessment of the ES&H operations at SNL/NM from April 15 to May 24, 1991. Corrective actions (CAs) to address the Tiger Team findings were completed in 1996.

Toxic Substances Control Act (TSCA) - of 1976, as amended and administered by the EPA, specifies requirements for the manufacture, distribution, use, handling, and disposal of specific toxic chemicals and materials including polychlorinated biphenyls (PCBs) and asbestos. The main focus of this legislation, however, is on the production and manufacturing aspects of toxic chemicals before they become waste. It also requires testing and regulation of all new chemical substances, as well as regulation of some currently existing substances known or suspected to have harmful health and environmental effects. At SNL/NM, compliance with TSCA primarily involves regulation of PCBs and asbestos as well as the import and export of specifically listed chemicals. In the event of waste containing both a TSCA substance and a RCRA regulated hazardous substance, the stricter regulation will apply.

Underground Storage Tank (UST) - as defined by the New Mexico regulations, is any tank or combination of tanks and its associated piping that are used to contain regulated substances, and which has a tank/piping volume that is ten percent or more beneath the surface of the ground. The State regulations are based on both the age of the UST as well as the depth to groundwater.

ABBREVIATIONS

Acronyms

ABC/AQCB	Albuquerque-Bernalillo County/Air Quality Control Board
ACRR	Annular Core Research Reactor
AEA	Atomic Energy Act
AES	Atomic Emission Spectroscopy
AEHD	Albuquerque Environmental Health Department
AIRFA	American Indian Religious Freedom Act
ALARA	as low as reasonably achievable
ALIAS	(an accelerator facility)
AMPL	Advanced Manufacturing Process Laboratory
ANSI	American National Standards Institute
ARPA	Archaeological Resources Protection Act
ASER	Annual Site Environmental Report
CA	Corrective Action
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CAMU	Corrective Action Management Unit
CAN	Clean Air Network
CAP88-PC	Clean Air Act Assessment Package-1988
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFC	chlorofluorocarbon
CFR	Code of Federal Regulations
CNG	Compressed Natural Gas
COA	City of Albuquerque
CPMS	Criteria Pollutant Monitoring Station
CWA	Clean Water Act
CWL	Chemical Waste Landfill
CY	calendar year
D&D	Demolition and Decontamination
DCA	1,1-dichloroethane
DCE	cis 1,2-dichloroethene
DCG	Derived Concentration Guide
DOC	U.S. Department of Commerce
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOE/AL	U.S. Department of Energy/Albuquerque Operations Office
DOE/EH	U.S. Department of Energy/Environmental Health
DOE/EM	U.S. Department of Energy/Office of Environmental Management
DOE/EPD	U.S. Department of Energy/Environmental Protection Division
DOE/HQ	U.S. Department of Energy/Headquarters
DOE/KAO	U.S. Department of Energy/Kirtland Area Office
DOE/NV	U.S. Department of Energy/Nevada Operations Office
DOT	U.S. Department of Transportation
DP	Discharge Plan
DQO	Data Quality Objective
DU	depleted uranium

ABBREVIATIONS (Continued)

EA	Environmental Assessment
ECF	Explosives Components Facility
EDE	Effective Dose Equivalent
EG&G	Edgerton, Germeshausen & Grier Corporation
EHS	extremely hazardous substance
EIS	Environmental Impact Statement
EIS/ODIS	Effluent Information System/Onsite Discharge Information System
EMFAPS	Exploding Metal Film Anode Plasma Source
EO	Executive Order
EOC	Environmental Operations Center
EOD	Explosive Ordnance Disposal
EORC	Environmental Operations Records Center
EPA	U.S. Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
ER	Environmental Restoration
ESA	Endangered Species Act
ES&H	Environment, Safety, and Health
FFCAct	Federal Facility Compliance Act
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FONSI	Finding of No Significant Impact
FR	Federal Register
FY	fiscal year
GSAF	Generator Set-Aside Fee
HAP	hazardous air pollutant
HCF	Hot Cell Facility
HCFC	hydrochlorofluorocarbon
HDRV	Historical Disposal Requests Validation (Project)
HERMES-III	High-Energy Radiation Megavolt Electron Source-III
HLW	high level radioactive waste
HSWA	Hazardous and Solid Waste Amendments (RCRA)
HWMF	Hazardous Waste Management Facility
ICP	inductively coupled plasma (method)
IMATRON	(a land mine detector)
IMRL	Integrated Materials Research Laboratory
IO	Isolated Occurrence
ISS	Interim Storage Site
IT	International Technology Corporation
ITRI	Inhalation Toxicology Research Institute
KAFB	Kirtland Air Force Base
KTF	Kauai Test Facility
KUMSC	Kirtland Underground Munitions Storage Complex
LANL	Los Alamos National Laboratories
LDR	Land Disposal Restrictions
LECS	Liquid Effluent Control System

ABBREVIATIONS (Continued)

LIHE	Light Initiated High Explosive Facility
LLW	low-level radioactive waste
LMF	Large-Scale Melt Facility
LWDS	Liquid Waste Disposal System
MAC	Maximum Allowable Concentration
MAP	Mitigation Action Plan
MCL	Maximum Contaminant Level
MEI	Maximally Exposed Individual
MDA	Minimum Detectable Activity
MDL	Minimum Detection Level
MDL	Microelectronics Development Laboratory
MIPP	Medical Isotope Production Project
MOU	Memorandum of Understanding
MSDS	Material Safety Data Sheet
MSL	Melting and Solidification Laboratory
MTU	mobile treatment units
MW	mixed waste
MWL	Mixed Waste Landfill
NA	not available
NAEP	National Association of Environmental Professionals
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NFA	No Further Action
NG	Neutron Generator
NGTF	Neutron Generator Test Facility
NGMF	Neutron Generator Manufacturing Facility
NHPA	National Historic Preservation Act
NIOSH	National Institute for Occupational Safety and Health
NM	New Mexico
NMAC	New Mexico Administrative Code
NMAQS	New Mexico Air Quality Standards
NMED	New Mexico Environment Department
NMWQCC	New Mexico Water Quality Control Commission
NMWQR	New Mexico Water Quality Regulations
NOAA	National Oceanographic and Atmospheric Administration
NON	Notification of Noncompliance
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NPN	nitrate-plus-nitrite
NRC	National Response Center
NRHP	National Register of Historic Properties
NTNC	Non-Transient Non-Community
NTS	Nevada Test Site
ODS	ozone depleting substance
OEL	Occupational Exposure Limit
OPOL	Open Pool Burn Site Facility

ABBREVIATIONS (Continued)

OSHA	Occupational Safety and Health Administration
OSI	onsite investigation
P2	Pollution Prevention
P4	Pollution Prevention in Permitting Pilot (Project)
PA	Preliminary Assessment
PA/SI	Preliminary Assessment/Site Inspection
PBFA	Particle Beam Fusion Accelerator
PCB	polychlorinated biphenyl
PEIS	Programmatic Environmental Impact Statement
PM	particulate matter
PM_{10}	respirable particulate matter (diameter equal to or less than 10 microns)
PMRF	Pacific Missile Range Facility
POTW	publicly-owned treatment works
PPE	personal protective equipment
PPOA	Pollution Prevention Opportunity Assessment
PROTO-II	(an accelerator facility)
PSD	Prevention of Significant Deterioration
QA	quality assurance
QAMP	Quality Assurance Management Plan
QAP	Quality Assurance Program
QC	quality control
R&D	research and development
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RH	relative humidity
RHEPP	Repetitive High Energy Pulsed Power
RMSEL	Robotic Manufacturing Science and Engineering Laboratory
RMSY	Radioactive Materials Storage Yard
RMWMF	Radioactive and Mixed Waste Management Facility
ROD	Record of Decision
ROI	Return on Investment
RQ	reportable quantity
RSI	RCRA Site Investigation
RWL	Radiological Waste Landfill
SABRE	Sandia Accelerator Beam Research Experiment
SAP	Sampling Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SATURN	(an accelerator facility)
SDWA	Safe Drinking Water Act
SFR	South Fence Road
SHPO	State Historic Preservation Officer
SIC	Standard Industrial Classification
SIMS+	Sandia Issues Management System
SLAMS	State and local air monitoring stations
SMCL	Secondary Maximum Containment Level
SMERF	SMoke Emission Reduction Facility

ABBREVIATIONS (Continued)

SMO	Sample Management Office
SNL	Sandia National Laboratories
SNL/CA	Sandia National Laboratories/California
SNL/NM	Sandia National Laboratories/New Mexico
SPCC	Spill Prevention Control and Countermeasures (Plan)
SPDES	State Pollutant Discharge Elimination System
SPHINX	(an accelerator facility)
SPR	Sandia Pulsed Reactor
STAR	Stability Array (NESHAP data decks)
STAR	Sample Tracking Analytical Results (QA database)
STEL	Short-Term Exposure Limit
STF	Subsystem Test Facility
SWDA	Solid Waste Disposal Act
SWHC	Site-Wide Hydrogeologic Characterization
SWISH	Small WInd SHielded (facility)
SWMU	Solid Waste Management Unit
SWTF	Solid Waste Transfer Facility
TA	Technical Area
TANDEM	(an accelerator facility)
TCE	trichloroethylene or trichloroethene
TCLP	toxicity characteristic leaching procedure
TDS	total dissolved solids
T/E	threatened/endangered
TEVES	Thermal Enhanced (soil) Vapor Extraction System
TLD	thermoluminescent dosimeter
TNMHC	total non-methane hydrocarbon
TOC	total organic carbon
TRE	Thunder Range East
TRI	Toxic Release Inventory
TROLL	(an accelerator facility)
TRU	transuranic
TSC	Technology Support Center
TSCA	Toxic Substances Control Act
T/S/D	treatment, storage, and disposal (facility)
TSP	total suspended particulates
TSS	total suspended solids
TTF	Thermal Treatment Facility
TTR	Tonopah Test Range
TU	Temporary Unit
TWA	time weighted average
TYP	Ten Year Plan
USAF	United States Air Force
USGS	United States Geological Survey
USNRC	United States Nuclear Regulatory Commission
UST	underground storage tank
VCM	Voluntary Corrective Measure
VOC	volatile organic compound
WAC	waste acceptance criteria

ABBREVIATIONS (Continued)

Units of Measure

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

Radioactivity Measurements

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

ABBREVIATIONS (Continued)

Chemical Abbreviations

CFC	chlorofluorocarbon
CO	carbon monoxide
DCA	1,1-dichloroethane
DCE	cis-1,2-dichloroethene
NO_2	nitrogen dioxide
CO_2	carbon dioxide
NO_x	nitrogen oxides
O_3	ozone
pH	potential of hydrogen
SO_2	sulfur dioxide
HNO_3	nitric acid
H_2S	hydrogen sulfide
TCE	trichloroethylene or trichloroethene
TCA	trichloroethane
TTCE	tetrachloroethane
HF	hydrofluoric acid
H_2SO_4	sulfuric acid
HCl	hydrochloric acid
1,1,1,-TCA	1,1,1,-trichloroethane
TNMHC	total non-methane hydrocarbon

Elements and Isotopes

Ag	silver
Al	Aluminum
Am-241	Americium-241
Ar	Argon
Ar-41	Argon-41
As	arsenic
Ba	barium
Be	beryllium
C-11	Carbon-11
C-13	Carbon-13
C-14	Carbon-14
Ca	calcium
Cd	cadmium
Cs	cesium
Cs-137	Cesium-137
Cr	chromium
Co	cobalt
Co-60	Cobalt-60
Cu	copper
F-17	Flourine-17
F-18	Flourine-17
Fe	iron
Fe-55	Iron-55
Gd	gadolinium
Ge	germanium
H-3	tritium
Hg	mercury
HT	tritiated hydrogen
HTO	tritiated water vapor
I-129	Iodine-129
I-131	Iodine-131
I-132	Iodine-132
I-133	Iodine-133
I-135	Iodine-135
K	potassium
K-40	Potassium-40
Kr	krypton
Kr-83	Krypton-83
Kr-85	Krypton-85
Kr-87	Krypton-87
Kr-88	Krypton-88
Li	lithium
Mg	magnesium
Mn	manganese
Na	sodium
Na-16	Sodium-16
Na-22	Sodium-22
Ni	nickel
N-13	Nitrogen-13
N-15	Nitrogen-15
N-16	Nitrogen-16
O	oxygen
O-15	Oxygen-15
O-18	Oxygen-18
Pb	lead
Pb-212	Lead-212
Pu	plutonium
Pu-238	Plutonium-238
Pu-239	Plutonium-239
Pu-240	Plutonium-240
Pu-241	Plutonium-241
Po-210	Polonium-210
Ra-226	Radium-226
Ra-228	Radium-228
Rb-88	Rubidium-88
S	sulfur
Se	selenium
Sr-90	Strontium-90

ABBREVIATIONS (Concluded)

Th	thorium	Xe	xenon
U	uranium	Xe-131	Xenon-131
U_{tot}	total uranium	Xe-133	Xenon-133
U-232	Uranium-232	Xe-135	Xenon-135
U-238	Uranium-238	Zn	zinc
V	vanadium		

Approximate Conversion Factors For Selected Si (Metric) Units

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

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