SANDIA REPORT
SAND 2006-2453
Unclassified Unlimited Release
Printed June 2006

Site Environmental Report for 2005
Sandia National Laboratories, California

B.L. Larsen

Prepared by
Sandia National Laboratories
Livermore, California 94550

Sandia is a multiprogram laboratory operated by Sandia Corporation,
a Lockheed Martin Company, for the United States Department of Energy's
National Nuclear Security Administration under Contract DE-AC04-94AL85000.

Sandia National Laboratories

National Nuclear Security Administration

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

Available to DOE and DOE contractors from
U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831

Telephone: (865) 576-8401
Facsimile: (865) 576-5728
E-Mail: reports@adonis.osti.gov
Online ordering: http://www.doe.gov/bridge

Available to the public from
U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

Telephone: (800) 553-6847
Facsimile: (703) 605-6900
E-Mail: orders@ntis.fedworld.gov
Online order: http://www.ntis.gov/ordering.htm

SAND 2006-2453
Unclassified Unlimited Release
Printed June 2006

Site Environmental Report for 2005 Sandia National Laboratories, California

Barbara L. Larsen
Environmental Management Department
Sandia National Laboratories, California
7011 East Avenue
Livermore, CA 94550

ABSTRACT

Sandia National Laboratories, California (SNL/CA) is a government-owned/contractor-operated laboratory. Sandia Corporation, a Lockheed Martin Company, operates the laboratory for the Department of Energy's (DOE) National Nuclear Security Administration (NNSA). The DOE/NNSA Sandia Site Office (SSO) oversees operations at the site, using Sandia Corporation as a management and operating contractor. This Site Environmental Report for 2005 was prepared in accordance with DOE Order 231.1A. The report provides a summary of environmental monitoring information and compliance activities that occurred at SNL/CA during calendar year 2005. General site and environmental program information is also included.

Acknowledgements

This report was prepared by the Sandia National Laboratories, California Environmental Management Department, and reviewed and approved by the Department of Energy, National Nuclear Security Administration, Sandia Site Office. The author acknowledges the following key contributors to the content, review, and production of this report.

Karen Agogino
Ken Ball
Mark Brynildson
Laurie Farren
Leslee Gardizi
Janet Harris
Robert Holland
Jeff Irwin
Kristin Kerr
Sandy Leo
Maria Matos
Joanne Mount-Sartor
Gary Shamber

Additional information about this report can be obtained from:

Sandia National Laboratories, California
Public and Media Relations Office
P.O. Box 969
Livermore, CA 94551-0969
Attention: Mike Janes
Phone: (925) 294-2447
E-mail: mejanes@sandia.gov

Or

U.S. Department of Energy
National Nuclear Security Administration
Sandia Site Office
P.O. Box 5400
Albuquerque, NM 87185-5400
Attention: Karen Agogino
Phone: (505) 845-6100
E-mail: kagogino@doeal.gov

Contents

Tables

Figures

Preface

Each year, Sandia National Laboratories, California (SNL/CA) prepares a summary report to provide environmental information to the local community, pursuant to the requirements of Department of Energy Order 231.1A. The Site Environmental Report for 2005 summarizes SNL/CA's compliance with environmental requirements, presents the results of monitoring and surveillance activities, and provides an update of site environmental programs.

The Site Environmental Report for 2005 was prepared for ease in readability. Each chapter focuses on a specific topic or area. Reference to other sections and chapters is made throughout the report to avoid redundancy. Detailed data is provided only when necessary to improve the presentation of information and the quality of the document. Acronyms are defined within each chapter as well as listed at the beginning of the report. References are compiled into one list and presented at the end of the document.

Acronyms and Abbreviations

ALARA	as low as reasonably achievable
BAAQMD	Bay Area Air Quality Management District
BTU	British thermal unit
CCR	California Code of Regulations
CARB	California Air Resources Board
CEARP	Comprehensive Environmental Assessment and Response Program
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CRMP	Cultural Resource Management Plan
DOE	Department of Energy
DOE/SSO	Department of Energy, Sandia Site Office
DTSC	Department of Toxic Substances Control (California)
EMS	environmental management system
EO	executive order
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
ES&H	environment, safety, and health
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FONSI	Finding of No Significant Impact
General Construction Permit	State of California, NPDES General Permit to Discharge Storm Water Associated with Construction Activity
General Permit	State of California, NPDES General Permit for Storm Water Discharge Associated with Industrial Activities
ISMS	integrated safety management system
kg	kilogram
kg/yr	kilogram per year
LECS	liquid effluent control system
LLNL	Lawrence Livermore National Laboratory
MCLs	maximum contaminant levels
mg/L	milligrams per liter
mrem	millirem
mSv	milliSeivert
ND	non-detectable

NEPA	National Environmental Policy Act
ng/L	nanogram per liter
NNSA	National Nuclear Security Administration
NPDES	national pollutant discharge elimination system
ODS	ozone depleting substances
PCB	polychlorinated biphenyl
pCi/L	picocuries per liter
POTW	publicly owned treatment works
PP/WM	Pollution Prevention and Waste Minimization
QAPP	quality assurance program plan
RCRA	Resource Conservation and Recovery Act
RWQCB	Regional Water Quality Control Board (California)
SARA Title III	Superfund Amendments and Reauthorization Act of 1986, Title III
SNL	Sandia National Laboratories
SNL/CA	Sandia National Laboratories, California
SNL/NM	Sandia National Laboratories, New Mexico
SWEA	Site-wide Environmental Assessment
TPHD	total petroleum hydrocarbons diesel
TRI	toxic release inventory
TSCA	Toxic Substances Control Act
µg/L	micrograms per liter
U.S.	United States
USC	United States Code
USFWS	United States Fish and Wildlife Service
UST	underground storage tank
WRCC	Western Regional Climate Center

1 Executive Summary

1.1 Overview

Sandia National Laboratories is one of three national laboratories supporting the U.S. Department of Energy (DOE) statutory responsibilities for nuclear weapon research and design, development of energy technologies, and basic scientific research. Sandia has facilities in New Mexico, California, Nevada, and Hawaii. Sandia National Laboratories, California (SNL/CA) is a multi-program engineering and science laboratory supporting the nuclear weapons stockpile program, energy and environment research, homeland security, micro- and nano-technologies, and basic science and engineering research.

The Site Environmental Report provides a summary of environmental management performance and compliance efforts at SNL/CA for calendar year 2005. The document also satisfies the DOE requirement for preparation of an annual environmental report, one of the required reports listed in *DOE Order 231.1A, Environment, Safety, and Health Reporting* (DOE 2004a).

The Site Environmental Report is divided into ten chapters. Chapter 1, the Executive Summary, highlights compliance and monitoring results obtained in 2005. Chapter 2 provides a brief introduction to SNL/CA and the existing environment found on site. Chapter 3 summarizes SNL/CA's compliance activities with the major environmental requirements applicable to site operations. Chapter 4 presents information on environmental management, performance measures, and environmental programs. Chapter 5 presents the results of monitoring and surveillance activities in 2005. Chapter 6 discusses quality assurance. Chapters 7 through 9 provide supporting information for the report and Chapter 10 is the report distribution list.

1.2 Environmental Management

Sandia maintains a comprehensive environmental management system (EMS) that incorporates environmental stewardship, compliance, and a process of continual improvement. SNL/CA's EMS program tiers from the corporate program but is tailored to the environmental risks applicable to California operations. During 2005, the SNL/CA EMS team completed the framework for the site's EMS program, documented this framework in an EMS Program Manual, and initiated implementation of all EMS elements. On October 21, 2005, the site Vice President issued a written declaration that SNL/CA had met the corporate EMS milestones to implement an EMS program. Completion of this milestone supported a DOE requirement for Sandia as a whole to implement an EMS by December 31, 2005. The corporate EMS milestone was also achieved by the December deadline. Additional information on environmental management is presented in Chapter 4.

1.3 Performance Measures

In 2005, SNL/CA established fourteen broad environmental objectives under the site's EMS program. The SNL/CA EMS team established near-term targets for each objective and began collecting data to measure the site's performance under nine of the fourteen objectives. During 2005, SNL/CA demonstrated improvement and progress towards achieving eight EMS objectives. SNL/CA received one notice of violation related to a lag in certification for the designated underground storage tank operator. Section 4.2 provides additional information about SNL/CA's environmental performance in 2005.

1.4 Environmental Monitoring

SNL/CA monitors storm water, wastewater, groundwater, and direct (ambient) radiation. The results of monitoring show that no pollutants were detected in storm water runoff at levels that are a cause for concern, and that all wastewater generated by site operations complied with the site outfall discharge limits for regulated physical parameters and metals. SNL/CA continued to see carbon tetrachloride in groundwater at the Navy Landfill in 2005 with a concentration similar to that detected in past years. Wells at the Fuel Oil Spill site were dry during 2005; consequently, no samples were collected. Monitoring data indicate that SNL/CA is not contributing significantly to the external radiation dose in the area. The average annual external radiation dose at the site perimeter was 61.8 mrem (0.62 mSv), which is within the dose range measured over the last ten years. Additional information about environmental monitoring at SNL/CA is provided in Chapter 5.

2 Introduction

2.1 History and Mission

Sandia National Laboratories, California (SNL/CA) was established in 1956 by Sandia Corporation to provide a closer relationship with Lawrence Livermore National Laboratory (LLNL) and their nuclear weapons design work. The SNL/CA facility evolved into an engineering research and development laboratory by the early 1960s, and into a multi-program engineering and science laboratory during the 1970s. As international arms control efforts increased in the late 1970s and throughout the 1980s, the United States emphasized treaty monitoring, safety, security, and control of the national nuclear weapons stockpile. With the end of the Cold War in the late 1980s, the role of SNL/CA to support stockpile stewardship ensuring nonproliferation and continued safety, security, and reliability, took on greater importance.

Research Activities at SNL/CA

- Science-based performance and reliability testing and computer-based modeling of nuclear weapon components
- Development, design, and testing of nonnuclear components for nuclear weapon systems
- Development and testing of materials and diagnostic equipment in support of defense programs, homeland security, and basic science and engineering
- Energy and environmental research
- Research and development of microelectronics, microsystems, and nanotechonolgies

SNL/CA is a national laboratory dedicated to enabling global peace through unmatched contributions to our nation's security. Our core mission is exceptional stewardship of the nation's nuclear deterrent through valued solutions offered by our science based engineering approach. The mission and approach are expanded by broader roles in national security emphasizing defense and nonproliferation of weapons of mass destruction, energy and information surety, and unique contributions to our nation's conventional military capabilities.

SNL/CA is a government owned/contractor operated laboratory. The site, the buildings, and the equipment are owned by the government; while Sandia Corporation, a Lockheed Martin Company, operates the laboratory for the Department of Energy's (DOE) National Nuclear Security Administration. The DOE/Sandia Site Office (DOE/SSO) oversees the operations at the site, using Sandia Corporation as a management and operating contractor.

2.2 Location

SNL/CA is located approximately 40 miles east of San Francisco, near the City of Livermore in eastern Alameda County. The site lies at the western base of the Altamont Hills on relatively flat terrain with low relief sloping gently northwest and north. Figure 2-1 shows the regional location of the site.

SNL/CA occupies 410 acres. The main campus (134 acres) is surrounded on the east, south, and west by undeveloped land (Figure 2-2, Site Map). To the north of SNL/CA are East Avenue and LLNL. Land use to the east and south of the site is agricultural and low-density residential. To the west of SNL/CA, construction continues on a residential development that began in 2003.

Figure 2-1 Regional Location Map

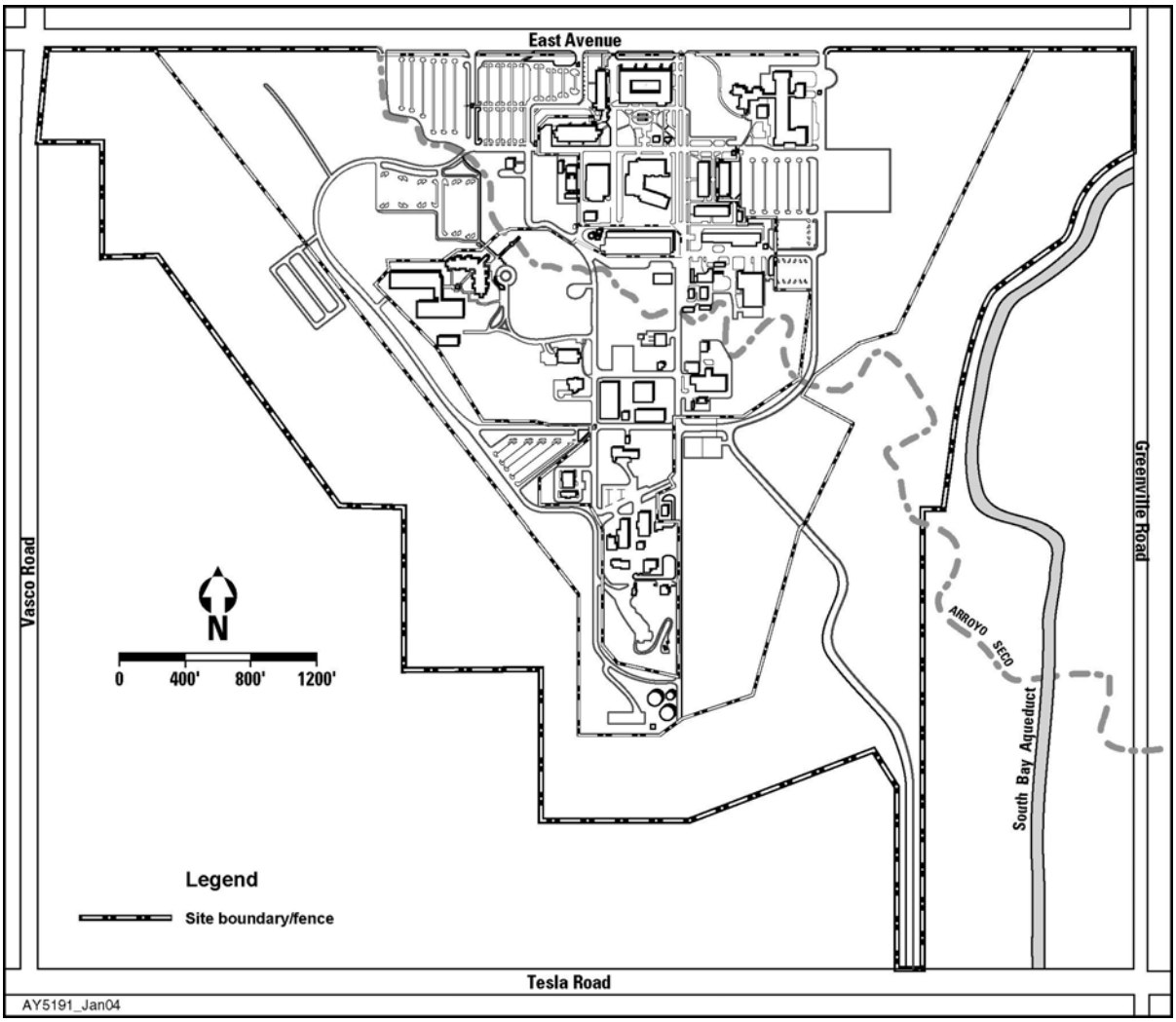

Figure 2-2 SNL/CA Site Map

2.3 Site Population

The SNL/CA workforce is comprised of Sandia employees (full and part-time staff, student interns, and post-doctoral appointees) and contractor staff. In September 2005, there were 1100 Sandia employees working at SNL/CA, an increase of six from 2004. Eighty-two percent of Sandia employees live in Alameda, Contra Costa, and San Joaquin counties. Thirty-five percent live in Livermore. The contractor workforce fluctuates throughout the year depending on program staffing needs. An estimate of contractor staff is not available.

2.4 Environmental Setting

The following summarizes the environmental setting at SNL/CA. Additional information can be found in the *Final Site-wide Environmental Assessment of the Sandia National Laboratories/California* (DOE 2003a).

2.4.1 Geology and Soils

SNL/CA is located in the California Coast Ranges geologic province in the southeastern portion of the Livermore Valley. The valley forms an irregularly shaped lowland area about 16 miles long, east to west, and 7 to 10 miles wide, north to south. The land at SNL/CA slopes gently to the northwest and north, with steep terrain in the southern portion of the site and along the banks of Arroyo Seco. The site ranges in elevation from 615 feet above mean sea level at the northwest corner of the property to 849 feet at the southern end. Site topography is depicted on Figure 2-3.

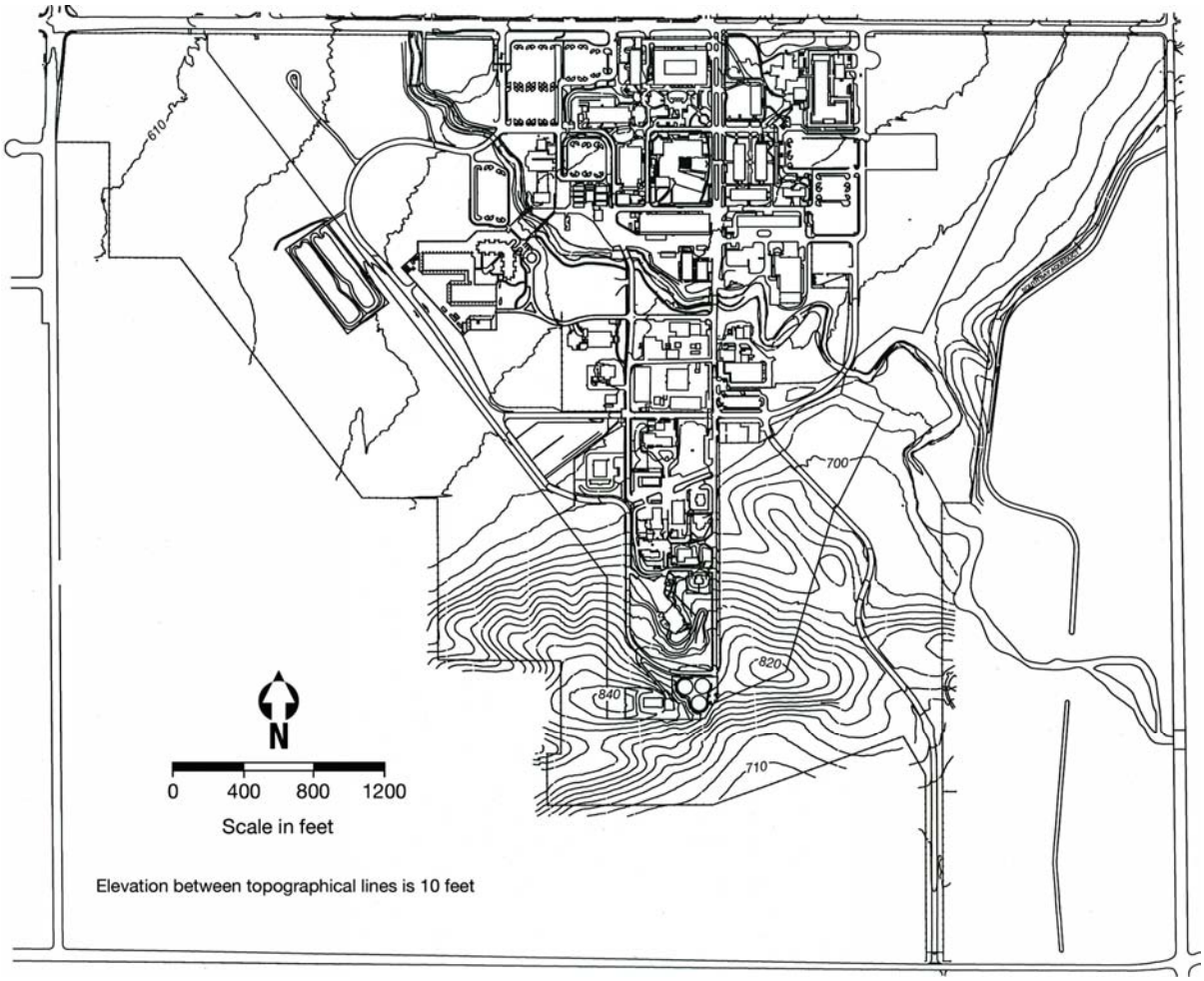

Figure 2-3 SNL/CA Topography

SNL/CA is located in a seismically active region. The major fault systems in the area are the San Andreas Fault system and the much older Coast Range thrust fault system. The upper plate of the Coast Range thrust formed the northwest trending Coast Range, including the Altamont Hills. Any seismic activity in the Livermore Valley would probably result from movement on the San Andreas Fault, a right-lateral strike-slip fault system trending northwest-southeast, extending from Point Arena to the Gulf of California. The regional faults closest to SNL/CA, the Hayward, Calaveras, Greenville, and Tesla faults follow this trend, and have been seismically active in the historic past. A magnitude 5.8 earthquake on

the Greenville fault in 1980 caused minor damage at SNL/CA and in the Livermore Valley. The Las Positas fault crossing SNL/CA is a transverse fault, at right angles to the Greenville fault, and was active during this earthquake. The Verona fault is a low angle thrust fault, dissimilar to the regional faulting, and probably not connecting with either the Calaveras or Las Positas faults. Only microseismicity was recorded on the Verona fault in 1980. These faults are shown on Figure 2-4.

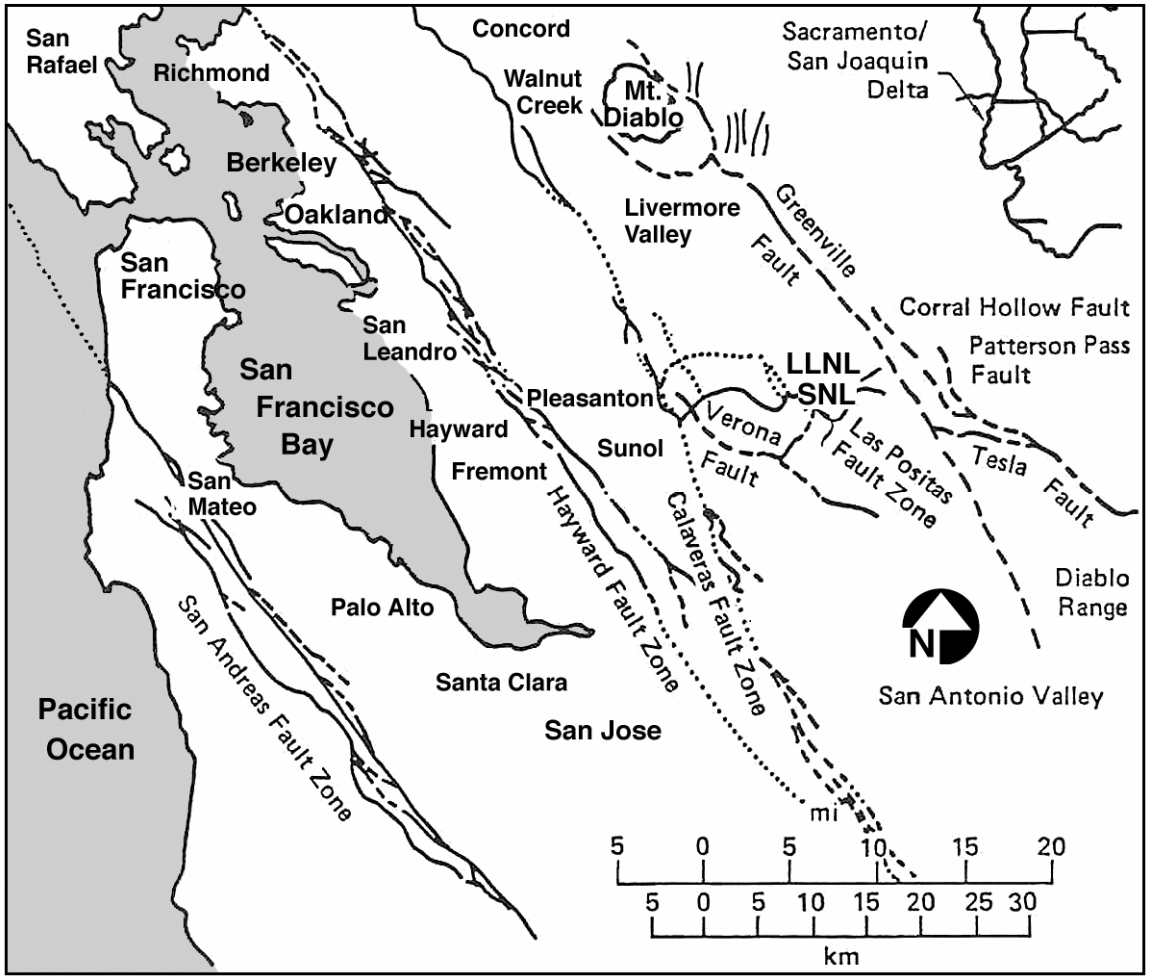

Figure 2-4 Regional Earthquake Faults

Surface soils and arroyo sediments cover the SNL/CA site. Underlying soils at the site are formed primarily upon sediments deposited by local streams. Three soils cover most of SNL/CA: Rincon clay loam, Positas gravelly loam, and Livermore gravelly loam. There are no known mineral resources or fossil occurrences at the site.

2.4.2 Hydrology and Water Resources

Groundwater in the SNL/CA area occurs within saturated unconsolidated geologic material. Depth to groundwater varies from less than 20 feet on the eastern portion of the site to 126 feet on the west side of the site. Water bearing-units beneath the site are composed of

shallow heterogeneous, unconsolidated alluvium and deep fluvial and lacustrine sediments. Groundwater near SNL/CA is generally suitable for use as domestic, municipal, agricultural, and industrial supply. However, some shallower groundwater may be of marginal quality and not suitable for industrial or agricultural purposes. Groundwater less than 300 feet deep is usually unsuitable for domestic use without treatment.

SNL/CA purchases potable water from LLNL, who is supplied by the San Francisco Water District through the Hetch Hetchy Aqueduct. Additionally, the Alameda County Flood Control and Water Conservation District, Zone 7, supplements this primary water source as needed. In the past, SNL/CA's water use was estimated at 20 percent of LLNL's water use. In 2005, LLNL provided actual water use data collected from an existing meter for the past five years (2001 through 2005). In 2005, SNL/CA used 54.6 million gallons of water, a decrease of approximately 11 million gallons from water used in 2004. This decrease is the result of a decrease in cooling water use and general water conservation awareness (See discussion in Section 4.2). The site discharged approximately 10.4 million gallons of wastewater during the year. Water loss, or the difference between water use and wastewater discharge, is attributed to irrigation, cooling towers, water tank releases, evaporative losses, eyewash and safety shower testing, fire system testing, and waste water from liquid effluent control system tanks that is trucked offsite for disposal.

There are no perennial streams or natural surface water bodies at SNL/CA. The Arroyo Seco, an ephemeral and intermittent stream, diagonally traverses the site from southeast to northwest. The arroyo typically flows only in very wet years, and for short periods of time during heavy storms. A seasonal wetland that is wet well into June, and sometimes July, is located in the streambed along the eastern part of the arroyo. Storm water runoff at SNL/CA is conveyed to Arroyo Seco through a system of storm drains and channels. The Arroyo Seco and seasonal wetland are shown on Figure 2-5.

A manmade recharge basin consisting of two cells encompassing approximately 2.7 acres, is located in the west outer perimeter area at SNL/CA. LLNL constructed the basin in 1989 to serve as a recharge basin for their groundwater treatment program. Between 1989 and 2003, treated water from the LLNL site was routinely discharged to the recharge basin cells. LLNL's groundwater restoration program has progressed to a point where recharge through the basin is no longer necessary or desirable. Consequently, in June 2005, LLNL terminated its agreement with SNL/CA for use of this area. SNL/CA plans to return the area to pre-1989 condition by backfilling and reseeding with appropriate vegetation.

2.4.3 Climate and Meteorology

The climate at SNL/CA is typical of the Mediterranean conditions in the San Francisco Bay region where cool, wet winters and hot, dry summers are normal. In the summer, inland valleys, such as the Livermore Valley, generally experience more sunshine and higher temperatures than the coastal areas. In the winter, temperatures in the valley are usually cooler than at the coast.

Annual meteorological data for SNL/CA was obtained from Sandia's meteorological tower located in the center of the site. The annual rainfall for 2005 was 16.31 inches. Temperatures

in 2005 ranged from 32^{o} to 101.7^{o} Fahrenheit. Average annual rainfall in the Livermore area over the last five years was 14.97 inches (WRCC 2006). The windiest months in the area occur in the spring and summer, and are dominated by westerly sea breezes. The winds during the fall and winter are typically lighter and more varied in direction.

2.4.4 Ecology

The plant community at SNL/CA is typical of the surrounding region, consisting primarily of grassland. Localized areas of coyote brush scrub, willow riparian woodland, and wetland habitat are also present. Areas developed and disturbed by Sandia operations constitute an additional habitat type, designated altered habitat. Habitat types are depicted on Figure 2-5. No threatened, endangered, proposed, or candidate plant species are present onsite.

A variety of wildlife species live and forage at SNL/CA. During 2005, SNL/CA identified 59 bird species, ten species of amphibians and reptiles, and fifteen mammal species on site. SNL/CA is located within the range of the mountain lion (*Puma concolor*), a "specially protected mammal" under California law. Several unconfirmed sightings of a mountain lion were reported at SNL/CA in 2005. Passive monitoring at the site for visiting mountain lions is ongoing.

SNL/CA provides habitat (or potential habitat) for two threatened wildlife species, the California red-legged frog *(Rana aurora draytonii)* and the California tiger salamander *(Ambystoma californiense)*. The most recent confirmed observation of a tiger salamander at SNL/CA was on January 6, 2003, when one salamander was found in a shallow depression filled with leaf litter. The first confirmed observation of California red-legged frogs at SNL/CA occurred in April 2004 when several individuals were seen on the eastern portion of the site in shallow water contained within Arroyo Seco. California red-legged frogs were also observed during 2005 in this location.


Cooper's Hawk

Most of the bird species found onsite are protected under the Migratory Bird Treaty Act. Several of these are also special concern species. The Cooper's hawk *(Accipiter cooperii)* is a California species of special concern. The white-tailed kite *(Elanus leucurus)* and the golden eagle *(Aquila chrysaetos)* are California fully protected species. The loggerhead shrike *(Lanius ludovicianus)* and tri-colored blackbird *(Agelaus tricolor)* are Federal birds of conservation concern and California species of special concern. The loggerhead shrike and tri-colored blackbird were the only special concern species observed nesting at SNL/CA in 2005. The others are believed to be foraging on site but not nesting.

SNL/CA maintains a wildlife website to provide information on the site's wildlife and ecology. The website was established in 2004 and includes information on site requirements, a photo gallery, summaries of survey activities, species information, and informational posters. The wildlife website is publicly available from the external Sandia California website at http://www.ca.sandia.gov/wildlife/.

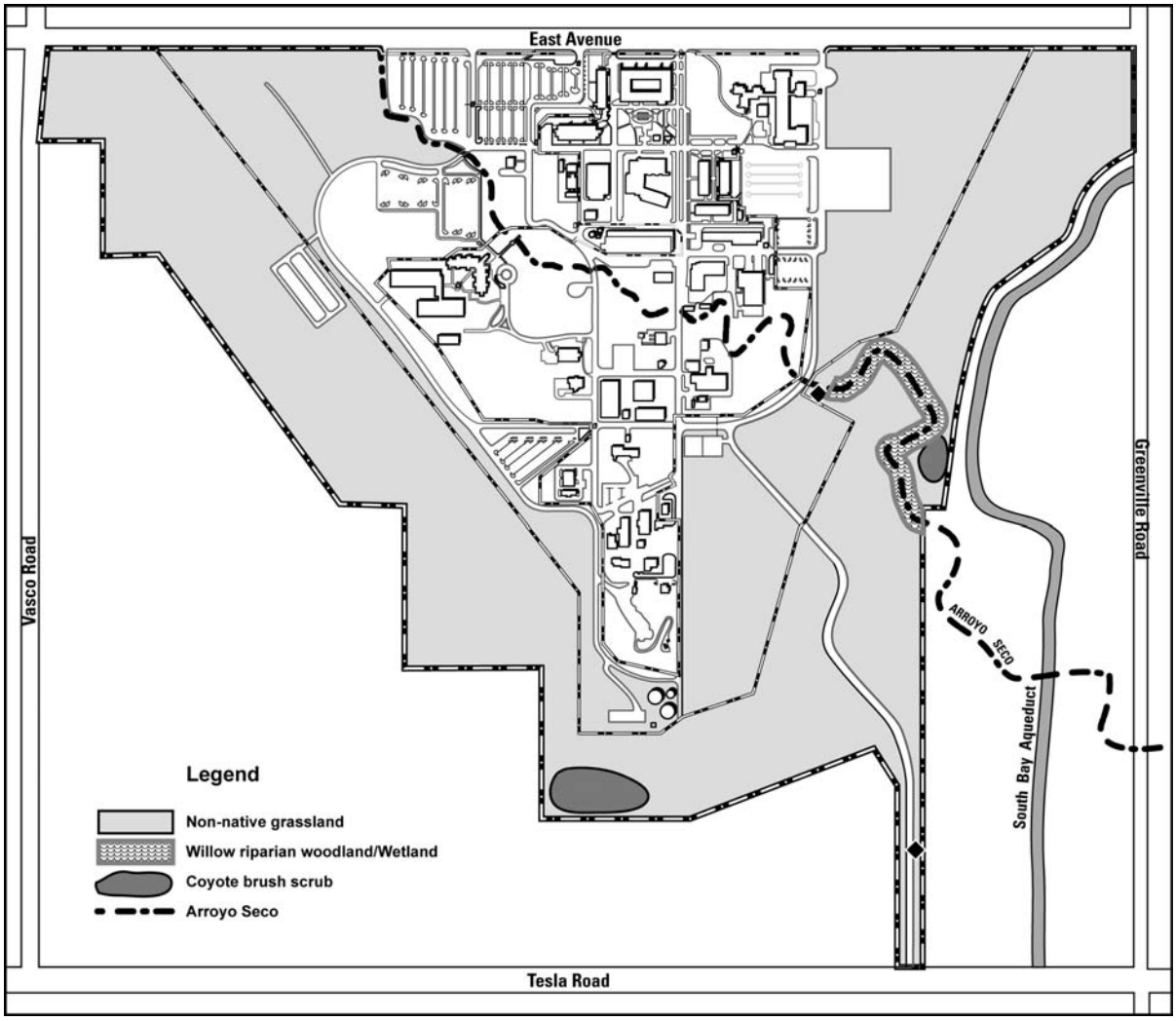

Figure 2-5 Habitat at SNL/CA

3 Compliance Summary

Sandia National Laboratories, California (SNL/CA) operates in compliance with the letter and spirit of applicable federal, state, and local environmental laws and regulations. Additionally, as a Department of Energy (DOE) facility, the site is subject to DOE directives (DOE orders), and to presidential executive orders. This chapter provides a summary of SNL/CA compliance with major environmental requirements for calendar year 2005.

3.1 DOE Order 450.1

DOE Order 450.1, Environmental Protection Program outlines the basic strategy for environmental compliance at DOE facilities, including SNL/CA. The objectives of Order 450.1 are to implement sound environmental stewardship practices, and to meet or exceed compliance with environmental, public health, and resource protection laws, regulations, and DOE requirements (DOE 2005a). The order requires DOE sites to meet these objectives through an environmental management system (EMS) that integrates environment, safety, and health into work planning and execution. Sandia implemented it's EMS in December 2005, the DOE established deadline. In 2005, the SNL/CA EMS team completed the framework for the site's EMS program, documented this framework in an EMS Program Manual, and initiated implementation of all EMS elements. SNL/CA (Division 8000) issued a written declaration to the corporate EMS Program Manager on October 21, 2005, stating that the division had fully implemented EMS and acknowledged meeting the requirements for EMS implementation as established in the corporate EMS Program Manual. Chapter 4 provides additional information on SNL/CA's EMS program.

3.2 National Environmental Policy Act

The National Environmental Policy Act (NEPA) is the basic national charter for protection of the environment. It requires all federal agencies to evaluate the affects of major federal actions on the human environment, including the physical, socioeconomic, and cultural environments. NEPA review of DOE actions is conducted in accordance with *DOE NEPA Implementing Procedures* (10 CFR 1021). Under these procedures, DOE may prepare a programmatic (including site-wide) document at any time to further the purposes of NEPA. In 2003, the DOE/Sandia Site Office (DOE/SSO) issued a site-wide environmental assessment (SWEA) for continued operations at SNL/CA (DOE 2003a) and a Finding of No Significant Impact (FONSI) on March 20, 2003 (DOE 2003b). The SWEA evaluates the impacts of site operations over the next ten years, and the FONSI concludes that continuation of site operations is not a major federal action significantly affecting the quality of the human environment.

SNL/CA supports compliance with NEPA and DOE's NEPA Implementing Procedures by reviewing all new projects and programs or changes to existing projects and programs to ensure that they fit within the bounds of existing NEPA documents and impact analyses for the site. The SNL/CA NEPA review process is documented in an administrative procedure

(SNL/CA 2005a) that is reviewed and updated every three years, or as needed. NEPA data for 2005 are provided in Section 4.3.3, Environmental Planning and Ecology Program.

3.3 Air Quality

3.3.1 Clean Air Act

The Clean Air Act (42 USC § 7401) is the federal statute that forms the basis for the national air pollution control effort. It authorizes the Environmental Protection Agency (EPA) to promulgate air quality regulations and establishes national ambient air quality standards for criteria pollutants. Authority to implement the requirements of the Clean Air Act is provided to each state that has an EPA approved State Implementation Plan. The State Implementation Plan for California describes how National Ambient Air Quality Standards will be obtained in each air district. Each district establishes and enforces air pollution regulations to attain and maintain state and federal ambient air quality standards. The Bay Area Air Quality Management District (BAAQMD) is the regulating authority for controlling air pollution from stationary sources at SNL/CA. The California Air Resources Board (CARB) is responsible for ensuring that federal and state standards are met for mobile and small "area" sources of air pollution.

SNL/CA does not have any major sources of air pollutants (as defined in 40 CFR Part 70.2) present on site. SNL/CA works with the BAAQMD and CARB to permit or register all regulated emission sources. For the 2004/ 2005 permit period[1], SNL/CA had 25 permitted emission sources. The number of permits decreased to 15 for the 2005/2006 permit period. Table 3-5 (Section 3.14) provides a list of the permitted sources.

3.3.2 Radionuclide Emissions

The *National Emissions Standards for Hazardous Air Pollutants, Subpart H – National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities* (40 CFR Part 61) establishes radiation protection standards, monitoring requirements, and annual reporting of radionuclide air emissions. Additional requirements pertaining to radionuclide emissions are contained in *DOE Order 450.1, Environmental Protection Program* (DOE 2005a), and *DOE Order 5400.5, Radiation Protection of the Public and the Environment* (DOE 1993).

SNL/CA does not currently have any radionuclide emission sources that are subject to the monitoring requirements of 40 CFR Part 61. To comply with national emission standards, SNL/CA evaluates individual projects with the potential to release radionuclide emissions to determine the worst-case dose to the public. Additionally, dose calculations are compared to the requirements to determine the need for annual monitoring. During 2005, there were no projects with the potential to release radionuclides to the atmosphere and thus no project evaluations were completed.

[1] The BAAQMD permit period is July 1 through June 30 each year. Permit data is presented for the two periods applicable to 2005.

3.4 Natural and Cultural Resources

3.4.1 Endangered Species Act

The Endangered Species Act (16 USC § 1531 et. seq.) provides for protection of plant and wildlife species in danger of becoming extinct. In 2002, SNL/CA and DOE/SSO prepared the *Biological Assessment for Continued Operation of Sandia National Laboratories, California* (DOE 2002). The biological assessment was submitted to the U.S. Fish and Wildlife Service (USFWS) on July 19, 2002. The document assesses possible effects that increased operations at the site would have on the threatened California red-legged frog (*Rana aurora draytonii*), proposed critical habitat for the red-legged frog[2], and the threatened California tiger salamander (*Ambystoma californiense*).[3] SNL/CA and DOE/SSO met with the USFWS on July 17, 2003 to discuss the biological assessment and future operations at the site. As a result of this meeting, an addendum to the biological assessment was prepared and submitted to the USFWS in December 2003.

On December 8, 2004, the USFWS issued a biological and conference opinion for continued operations at SNL/CA. The biological opinion concludes that proposed site operations are not likely to jeopardize the continued existence of the California red-legged frog and the California tiger salamander. The conference opinion concludes that site operations are not likely to destroy or adversely modify proposed critical habitat for the red-legged frog.

3.4.2 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (16 USC §703 et. seq.) provides for protection of migratory birds, their nests, and eggs. Fifty-three of the 59 bird species observed at SNL/CA in 2005 are protected under this act. In 2005, there was no intentional take of migratory birds or disturbance to nests or eggs at the site. Migratory birds often build nests within the developed campus in locations where they will be disturbed by maintenance activities. To avoid harming birds, nests, or eggs, SNL/CA delays activities until the young have fledged, or surveys determine that the nest is abandoned. In 2005, two maintenance activities were delayed to protect nesting birds.

3.4.3 Floodplain Management

Executive Order 11988, Floodplain Management (EO 11988), requires federal agencies to consider impacts associated with the occupancy and modification of floodplains, to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare,

[2] On November 6, 2002, the U.S. District Court issued a final ruling overturning the critical habitat designation for the California red-legged frog (U.S. District Court 2002). The ruling approves a settlement between the U.S. Fish and Wildlife Service and the Home Builders Association of Northern California that eliminates all but 200,000 acres of the original four million acres designated. A proposed designation for critical habitat was re-issued on April 13, 2004, and included the Sandia site (USFWS 2004a). On November 3, 2005, a revised proposed designation of critical habitat for the red-legged frog was issued. This latest proposal does not include the Sandia site (USFWS 2005).

[3] On August 4, 2004, the California tiger salamander was listed as threatened under the Endangered Species Act (USFWS 2004b).

and to restore and preserve the natural and beneficial values served by floodplains. In 2002, SNL/CA completed a management plan for the Arroyo Seco to identify channel improvements and stream zone management activities that will reduce flood and erosion risk and provide improved habitat for wildlife species that may use the arroyo (Matthews 2002). The plan identifies areas for constructing functional floodplains and for planting of native riparian vegetation. During 2005, the U.S. Army Corp of Engineers authorized five tasks identified in the Arroyo Seco management plan. This authorization is valid until March 18, 2007. In 2006, SNL/CA plans to submit design packages for the fifteen remaining arroyo improvements outlined in the management plan.

3.4.4 Protection of Wetlands

Executive Order 11990, Protection of Wetlands (EO 11990), requires federal agencies to minimize the destruction, loss, or degradation of wetlands and preserve and enhance the natural and beneficial values of wetlands. A small wetland area of 0.44 acres is present at SNL/CA. During 2005, SNL/CA did not conduct any activities in the wetland area, or affecting wetlands.

3.4.5 National Historic Preservation Act

The National Historic Preservation Act (16 USC § 470) requires federal agencies to identify, record, and protect cultural resources. In 1990, an assessment of cultural resources at the SNL/CA site was completed. Although no prehistoric resources, Native American resources, or historic archaeological sites were identified during this assessment, there is a possibility that buried resources could be present on site (DOE 2003a). SNL/CA includes provisions for cultural resources in all construction-related contracts where the potential for buried resources may be unearthed. In 2005, there were no buried archaeological resources unearthed at SNL/CA.

In 2001, SNL/CA completed an historic building survey. None of the buildings onsite were identified as historically significant or eligible for the National Register of Historic Places (SNL 2002). The results of the historic building survey were submitted to DOE/SSO. In December 2004, DOE transmitted the survey results to the California State Historic Preservation Officer (SHPO). In April 2005, DOE/SSO received concurrence from the California SHPO that none of the properties located at SNL/CA are eligible for inclusion in the National Register of Historic Places.

On September 22, 2004, DOE issued updated guidelines for developing cultural resource management plans (CRMP) for all DOE facilities (DOE 2004b). These guidelines are intended to assist each facility in meeting the statutory and regulatory requirements applicable to cultural resources. In 2005, SNL/CA prepared a site-specific CRMP following DOE guidance.

3.5 Environmental Restoration

3.5.1 Comprehensive Environmental Response, Compensation, and Liability Act

Between 1984 and 1986, DOE investigated the SNL/CA site under their Comprehensive Environmental Assessment and Response Program (CEARP) to identify and assess potential environmental problems (DOE 1986). The CEARP investigation evaluated compliance with major federal environmental laws, including the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 USC § 9601). CERCLA established liability compensation, cleanup, and emergency response for hazardous substances released to the environment. During the CEARP investigation, two potential CERCLA sites were identified at SNL/CA, the Fuel Oil Spill Site and the Navy Landfill. A Hazard Ranking System study was performed for each site to determine if either qualified for listing on the National Priorities List. Hazard Ranking System scores for both sites fell below 28.5, the qualifying score for listing. Since completion of the CEARP investigation, there have been no hazardous substance releases or contaminated sites found at SNL/CA that warranted CERCLA investigation or a Hazard Ranking System study.

In addition to cleanup and emergency response requirements, CERCLA also established a program to report spills of hazardous substances to the National Response Center. SNL/CA incorporates CERCLA reporting requirements into an operating procedure for spill prevention and control (SNL/CA 2004a). In 2005, there were no releases of hazardous substances that required notification under CERCLA.

3.5.2 Site Clean-up Orders

Since 1985, environmental restoration and monitoring activities at SNL/CA have been conducted in compliance with site clean-up orders issued by the California Regional Water Quality Control Board, San Francisco Bay Region under provisions established in the California Water Code (California RWQCB 1989). Although there are no active remediation sites at SNL/CA, groundwater monitoring is ongoing at two locations, the Fuel Oil Spill site and the Navy Landfill. SNL/CA currently samples three groundwater monitoring wells for residual contamination: two at the Fuel Oil Spill site; and one at the Navy Landfill. Sampling results are presented in Chapter 5, Environmental Monitoring.

3.6 Hazardous Materials

3.6.1 Emergency Planning and Community Right-to-Know Act

The Emergency Planning and Community Right-to-Know Act (EPCRA) — also known as the Superfund Amendments and Reauthorization Act of 1986, Title III (SARA Title III) (42 USC §11001, et. seq.) — requires reporting of toxic chemical usage and releases. To meet EPCRA requirements, SNL/CA submits annual reports to the EPA, the State of California, Alameda County Department of Environmental Health, and the LLNL Fire Department,

which serves as the local fire department. EPCRA reporting requirements applicable to SNL/CA for 2005 are presented in Table 3-1.

Table 3-1 Status of EPCRA Reporting at SNL/CA, 2005

EPCRA Section	Description of Reporting	Required in 2005
Sec. 302-303	Planning Notification	Yes (sulfuric acid only)
Sec. 304	Extremely Hazardous Substances Release Notification	No
Sec. 311-312	Material Safety Data Sheet/ Chemical Inventory	Yes
Sec. 313	Toxic Release Inventory Reporting	Yes (lead only)

3.6.2 California Hazardous Materials Release Response Plans and Inventory Law

The California Hazardous Materials Release Response Plans and Inventory Law (Assembly Bill 2185) addresses the management of hazardous and acutely hazardous materials in the state. Additional requirements pertaining to hazardous materials are codified in the California Health and Safety Code, Division 20, Chapter 6.95 §25500, et seq. In compliance with California requirements, SNL/CA annually submits a Hazardous Material Business Plan to the Alameda County Department of Environmental Health.

3.6.3 Underground Storage Tanks

Hazardous or petroleum products stored in underground storage tanks (UST) are regulated under California Health and Safety Code Division 20, Chapter 6.7, §§ 25280-25299.8. California code incorporates the UST provisions of the Resource Conservation and Recovery Act (RCRA) and establishes standards for construction, operation, maintenance, inspection, and testing of USTs. Alameda County Environmental Health Department is the regulating authority for USTs at SNL/CA. SNL/CA operates one UST in accordance with California requirements. Each year, SNL/CA declares and permits the tank with the Alameda County Office of Environmental Health. This declaration is part of the Hazardous Material Business Plan described in Section 3.6.2.

SNL/CA received a Notice of Violation from the Alameda County Office of Environmental Health on June 7, 2005. The violation concerned training of a designated operator for the time period of January to March 2005. Corrective actions were completed; no fines were assessed. Additional information is provided in Section 3.13.

3.6.4 Toxic Substances Control Act

The Toxic Substances Control Act (TSCA) is the primary Federal statute regulating the manufacture, use, distribution, disposal, import, or export of certain chemicals and substances (15 USC § 2601 et. seq.). TSCA requirements that are applicable to Sandia operations are incorporated into the Sandia ES&H Manual (SNL 1997). For SNL/CA operations, the only TSCA regulated chemicals imported or exported are for research and

development purposes thus exempt from reporting to EPA. In 2005, SNL/CA was not required to prepare any TSCA declarations to EPA.

SNL/CA also tracks disposal of TSCA materials that are not otherwise captured as RCRA or California toxic hazardous waste. These materials include asbestos and polychlorinated biphenyls (PCBs). The majority of TSCA waste generated onsite is asbestos from abatement activities. Only small quantities of PCB wastes are generated at SNL/CA, consisting of light ballasts that are not specifically marked as PCB-free.

3.6.5 Federal Insecticide, Fungicide, and Rodenticide Act

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) restricts the registration, sale, use, and disposal of pesticides (includes herbicides, insecticides, fungicides, and rodenticides) (7 USC § 136). Activities at SNL/CA that fall under the provisions of FIFRA include the storage and use of pesticides, and disposal of pesticide containers. Pesticide handling and storage follows a site-specific standard operating procedure that includes provisions for training, use of personal protective equipment, proper handling following manufacturers guidelines, secondary containment during storage, and disposal of product and containers (SNL/CA 2004b). Pesticide use at SNL/CA is overseen by a certified pesticide applicator.

3.7 Pollution Prevention and Waste Minimization

Pollution prevention concepts first appeared in RCRA. An expressed concern was to minimize the generation of hazardous waste through process substitution, materials recovery, recycling, reuse, and treatment. RCRA established the reduction or elimination of hazardous waste as national policy, and required that hazardous waste generators and RCRA permit holders have a program in place to minimize waste. SNL/CA is required to report waste generation and recycling information yearly to DOE. To meet this requirement, the Annual Waste Generation and Pollution Prevention Progress Report was submitted to DOE on December 15, 2005 (SNL/CA 2005e).

3.7.1 Pollution Prevention Requirements of DOE Order 450.1

On December 7, 2005, DOE issued changes to DOE Order 450.1 that establish five performance-based pollution prevention and sustainable environmental stewardship goals. These goals supersede the pollution prevention leadership goals that expired in 2005. During 2006, SNL/CA will identify and implement site-specific activities to support the new DOE goals.

DOE Order 450.1
Pollution Prevention and Sustainable Environmental Stewardship Goals

Protect the environment and enhance mission accomplishment through:

- *Waste prevention*
- *Reduction of environmental releases*
- *Environmentally preferable purchasing*
- *Incorporation of environmental stewardship in program planning and operational design*
- *Post-consumer material recycling*

3.7.2 Executive Order 13101

Executive Order 13101, Greening the Government Through Waste Prevention, Recycling, and Federal Acquisition (EO 13101) directs executive agencies to implement affirmative procurement programs that favor acquisition and use of recycled products and environmentally preferable products and services. EO 13101 also establishes an annual reporting requirement for federal agencies.

At SNL/CA, affirmative procurement is a coordinated effort between the Pollution Prevention and Waste Minimization (PP/WM) Program and the Procurement Department. The PP/WM staff communicates the requirements of EO 13101 through presentations and training targeting individuals involved in purchasing products and services. Both groups work closely with suppliers to ensure that environmentally preferable products are available for purchase.

DOE's goal, established in 1996, for purchases of EPA designated recycled products is 100 percent by 2005, except where products are not commercially available competitively at a reasonable price, or do not meet performance standards. In 2005, 84.6 percent of the products purchased by SNL/CA met EPA standards for justified and recycled content. SNL/CA electronically submitted this affirmative procurement information to DOE on December 22, 2005 for use in the annual DOE environmentally preferable products report.

Although SNL/CA has made considerable progress in the purchasing of recycled content products over the last four years (purchasing increased from 40% to 84% over this time), the site has not yet reached 100 percent. During 2005, the PP/WM Program completed a self-assessment of the affirmative procurement program. The results of the self-assessment indicate that additional education of the workforce and general awareness of affirmative procurement is needed to reach the goal. Communication efforts are underway to generate awareness of the program. Additionally, a green purchasing team was established in 2005 to assist the workforce in purchasing recycled-content alternatives.

3.7.3 Hazardous Waste Source Reduction and Management Review Act

The California Hazardous Waste Source Reduction and Management Review Act of 1989, (Senate Bill 14), requires hazardous waste generators to consider source reduction as the preferred method of managing hazardous waste. Under this act, facilities that generate more than 12,000 kilograms (kg) of hazardous waste or 12 kg of extremely hazardous waste annually are required to conduct source reduction planning.

Under this Act, all of DOE's California sites are considered one waste generator, rather than individual DOE facilities. Every four years, SNL/CA completes a Source Reduction and Evaluation Review and Plan in cooperation with the three other DOE sites in California: Lawrence Livermore National Laboratory (LLNL); Lawrence Berkeley National Laboratory; and Stanford Linear Accelerator Center. The most recent plan was completed in August 2003

and provides information for 1999 through 2002. The plan also identifies waste reduction opportunities for any waste stream that is over 5 percent of a site's total routine regulated waste.

3.7.4 Pollution Prevention Act

The Pollution Prevention Act of 1990 declares, as national policy, that pollution should be prevented or reduced at the source (42 USC § 13101 et. seq.). Facilities that meet the reporting requirements under EPCRA, Section 313 are also required to file a toxic chemical source reduction and recycling report. The Section 313 report for 2005 will include source reduction and recycling information to meet this requirement. See Section 3.6.1 for additional information on EPCRA reporting requirements.

3.8 Hazardous Waste

3.8.1 Federal Facility Compliance Act

The Federal Facility Compliance Act waives sovereign immunity with respect to RCRA for federal facilities (42 USC § 6961). The act gives EPA, and authorized states, authority to conduct annual inspections of federal facilities and establishes requirements for management of hazardous/mixed waste.

SNL/CA is not subject to a site-specific federal facility compliance agreement for mixed waste. The site does not possess or store any legacy mixed waste. All mixed waste generated at SNL/CA during 2005 was appropriately managed under the site's RCRA Hazardous Waste Facility Permit.

3.8.2 Resource Conservation and Recovery Act

RCRA regulates the generation, transportation, treatment, storage, and disposal of hazardous chemical waste, non-hazardous solid waste, and hazardous or petroleum products stored in USTs (42 USC §6901 et. seq.). The State of California has authority from the EPA to implement RCRA. The California Department of Toxic Substance Control (DTSC) administers most aspects of RCRA in the state, and is the regulating authority for hazardous waste operations at SNL/CA, including the hazardous component of radioactive mixed waste.

SNL/CA operates a Hazardous Waste Treatment and Storage Facility under a RCRA Hazardous Waste Facility Permit issued by DTSC on March 30, 2004. The permit is effective through March 2014 and allows for storage and treatment of hazardous waste.

By definition, SNL/CA is a large quantity generator of RCRA waste. As such, the site is required under RCRA standards and implementing regulations (40 CFR 262.41) to submit a biennial report to EPA. The next biennial report is due in March 2006 and will provide information about the quantity of RCRA hazardous waste generated, stored, and shipped during the 2005 reporting period.

3.8.3 California Hazardous Waste Control Law

The Hazardous Waste Control Law (California Health and Safety Code §25100 et. seq.) provides a separate regulatory framework for hazardous waste management in California. The state law incorporates all RCRA requirements and imposes additional requirements that are broader and more comprehensive than the federal system. Under the California law, additional waste materials (e.g., oils, metals, asbestos) or activities (e.g., treatment) are regulated as hazardous. State standards are incorporated into SNL/CA's Waste Management Program so that California regulated waste is managed as hazardous waste in compliance with state requirements.

The California Environmental Health Standards for Management of Hazardous Waste (22 CCR, Division 4.5) requires all permitted hazardous waste facilities to submit an annual facility report to DTSC. Annual facility reports provide information about the quantity of RCRA and California designated hazardous waste generated and stored at SNL/CA, and the quantity of waste shipped from the site. On March 1, 2005, the Annual Facility Report for the SNL/CA Hazardous Waste Treatment and Storage Facility was submitted to DTSC for the 2004 calendar year. An annual facility report was not prepared in 2005. DTSC accepted the biennial report submitted to EPA (see Section 3.8.2) as the 2005 annual report and did not request a separate report.

3.8.4 Medical Waste Management Act

The California Medical Waste Management Act (California Health and Safety Code, Division 104, Part 14, §§ 117600-118360) provides for regulation of medical waste generators, transporters, and treatment facilities. The Alameda County Department of Environmental Health is the regulating authority for medical waste generated at SNL/CA. SNL/CA has two facilities identified as small quantity generators of medical waste, one with limited onsite treatment and one without onsite treatment.

3.9 Radiation Protection

3.9.1 Atomic Energy Act

The purpose of the Atomic Energy Act is to assure the proper management of nuclear materials and radioactive waste (42 USC § 2011 et. seq.). The act allows DOE to set radiation protection standards to control exposure to the public and the environment that may result from operations at DOE facilities. DOE sets these standards through department directives or orders. Operations at SNL/CA are subject to the requirements established in *DOE Order 435.1, Radioactive Waste Management* (DOE 2001) and *DOE Order 5400.5, Radiation Protection of the Public and the Environment* (DOE 1993).

3.9.2 DOE Order 435.1, Radioactive Waste Management

DOE Order 435.1 establishes requirements to manage radioactive waste in a manner that protects the environment, and worker and public health and safety. Under this order, DOE

contractor operated facilities are required to plan, document, execute, and evaluate the management of radioactive waste. Requirements of Order 435.1 are incorporated into the SNL/CA radioactive waste management element of the Waste Management Program. The program includes certification and characterization of waste; provisions for inspections and audits; training requirements; and operating procedures for handling, storing, packaging, shipping, and offsite disposal of radioactive waste.

SNL/CA generates low-level radioactive waste and low-level mixed waste. No transuranic or high-level radioactive waste is generated by SNL/CA operations. Radioactive wastes are stored onsite in the Radioactive Waste Treatment and Storage Facility. Low-level waste is shipped offsite for land disposal at the Nevada Test Site. Low-level mixed waste is managed under RCRA and shipped offsite for disposal at commercial disposal sites in compliance with site-specific waste acceptance criteria.

3.9.3 DOE Order 5400.5, Radiation Protection of the Public and the Environment

DOE Order 5400.5 sets radiation protection standards for DOE operations so that radiation exposures to members of the public and the environment are as low as reasonably achievable (ALARA) and maintained within established limits of the order. Table 3-2 provides a summary of SNL/CA compliance with this order in 2005.

Table 3-2 Order 5400.5 Compliance Summary, 2005

Order 5400.5 Requirement	SNL/CA 2005 Summary
Maximum exposure to members of public = 100 mrem/yr	There were no radionuclide emissions in 2005. The average annual gamma radiation measurement at the site perimeter in 2005 was 61.8 mrem, or 5.5 mrem more than distant locations, where the average annual dose was 56.3 mrem. The difference between perimeter and distant locations is most likely the result of normal fluctuations and natural variations in ambient radiation.
Adopt ALARA exposures	ALARA is incorporated into ES&H policy, ES&H manual, and site operating procedures.
Control release of liquid radioactive wastes to the environment	No intentional discharges of liquid wastes to the environment occur onsite. No accidental releases of liquid radioactive waste occurred in 2005.
Control burial of low-level waste	Disposal of low-level waste does not occur onsite. ES&H procedures, manuals, and management systems are incorporated into site operations to ensure proper handling, and disposal of radioactive materials offsite at approved facilities.
Control radioactive releases to the sanitary sewer	Radioactive releases to the sanitary sewer above DOE 5400.5 guidelines are not allowed at SNL/CA. ES&H procedures, manuals, and management systems are incorporated into site operations to ensure proper handling and disposal of radioactive materials.

Order 5400.5 Requirement	SNL/CA 2005 Summary
Implement environmental monitoring and surveillance	An environmental monitoring and surveillance program has been in place at SNL/CA for more than 30 years.
Control the release of property with residual radioactivity	SNL/CA does not release any property to the public with residual radioactivity above authorized limits. Excess property of this type is either transferred to other DOE facilities for reuse or transferred to Waste Management for disposal.
NESHAPS Dose evaluations	There were no airborne radionuclide emission sources in 2005; therefore, there is no monitoring data available for dose evaluations.

3.10 Water Quality and Protection

SNL/CA is subject to the requirements of the Clean Water Act and equivalent California statutes. SNL/CA does not operate a public water system, and is not involved in any environmental restoration activities for which Safe Drinking Water Act standards are being applied.

Drinking water at SNL/CA is purchased through LLNL and obtained from the San Francisco Water District or the Alameda County Flood Control and Water Conservation District, Zone 7. The San Francisco Water District and Zone 7 are responsible for monitoring the quality of the incoming water. SNL/CA is not required to treat or sample the drinking water. LLNL maintains the drinking water distribution system for both sites and screens for water quality (SNL/CA 2002).

3.10.1 Clean Water Act

The Clean Water Act regulates all direct discharges into navigable waters of the United States (U.S.) (33 USC § 1251). Direct discharges to waters of the U.S. require permits issued under the National Pollutant Discharge Elimination System (NPDES). In California, the State Water Resources Control Board has authority from EPA to implement the Clean Water Act. Federal permitting requirements are included in Waste Discharge Requirements issued by Regional Water Quality Control Boards.

Wastewater Discharge

Wastewater generated at SNL/CA is discharged to the City of Livermore Water Reclamation Plant, a publicly owned treatment works (POTW). The Livermore POTW maintains an NPDES permit, and then regulates industry discharges into their sewer system. A Wastewater Discharge Permit issued by the Livermore POTW regulates SNL/CA's wastewater discharges. The permit is updated annually and includes discharge limits for the site sanitary sewer outfall and for processes subject to EPA pretreatment standards. During 2005, SNL/CA did not exceed established discharge limits at the sewer outfall.

SNL/CA has four categorical processes that are subject to EPA's pretreatment standards: three metal finishing operations, and a semiconductor manufacturing operation.[4] Two of the metal finishing operations are closed-loop processes and do not discharge any effluents. One of the closed-loop processes was added in 2005. Wastewater generated from the two processes that have effluents is sampled and monitored as part of the Environmental Monitoring and Restoration Program. No exceedances of the discharge limits from these sources occurred during 2005.

Storm Water Discharge

General storm water discharges at SNL/CA are covered under the *State of California NPDES General Permit for Storm Water Discharge Associated with Industrial Activities* (General Permit) (California Water Resources Control Board 1997). The General Permit requires SNL/CA to implement a storm water pollution prevention plan. The SNL/CA plan describes the rationale for monitoring discharge locations and identifies best management practices for reducing pollutant contact with storm water.

SNL/CA's storm water management program also incorporates the six minimum control measures required by the California Small Municipal Separate Storm Sewer System (MS4) General Permit. The MS4 General Permit was adopted in 2003 to meet EPA Phase II storm water regulations. Although the MS4 General Permit is not yet a regulatory requirement for SNL/CA, the site anticipates that it will be regulated as a non-traditional small MS4 when notification is provided by the regulating agency.

From 2002 through 2004, SNL/CA exceeded the five-acre threshold for construction activities, requiring the site to apply for coverage under the *State of California NPDES General Permit for Storm Water Discharges Associated with Construction Activity* (General Construction Permit) (California Water Resources Control Board 1999). By March 2005, SNL/CA completed the construction activities covered by this permit and filed a Notice of Termination with the state regulating authority.

In 2005, SNL/CA visually monitored twenty-two storm water discharge locations and sampled ten locations. The result of monitoring and sampling activities conducted in 2005 did not identify any issues of concern. Section 5.1 presents a summary of 2005 results.

3.11 Executive Order 13148

Executive Order 13148, Greening of the Government Through Leadership in Environmental Management (EO 13148), directs federal agencies to integrate environmental accountability into day-to-day decision making and long-term planning processes. Table 3-3 presents the activities conducted at SNL/CA in support of this executive order.

[4] The semiconductor manufacturing operation is a research and development activity exempt from local air pollution regulations.

Table 3-3 SNL/CA Activities in Support of Executive Order 13148

E.O. 13148 Goal	SNL/CA Activity
Develop and implement environmental management system (EMS)	EMS documented and implemented in 2005.
Establish and implement environmental compliance audit programs and policies that emphasize pollution prevention	SNL/CA's ES&H Interdisciplinary Team process ensures that each new and modified project is evaluated for pollution prevention and waste minimization opportunities. Additionally, SNL/CA maintains a PP/WM Program that periodically conducts pollution prevention opportunity assessments, and assists site customers in implementing new processes to reduce pollution and waste.
EPCRA Reporting	Conducted annually.
Reduce EPCRA 313 reported Toxic Release Inventory (TRI) releases and off-site transfers of toxic chemicals for treatment and disposal	SNL/CA meets the TRI reporting threshold for lead only. Lead releases are generated from activities at the firing range. To reduce TRI releases, a change in ammunition type would be required. Because DOE dictates the ammunition type used at SNL/CA, any changes would need to come from DOE.
Reduce use of toxic chemicals, hazardous substances, and pollutants, or generation of hazardous and radioactive waste types	SNL/CA maintains a PP/WM Program to identify waste minimization opportunities and to assist site customers in implementing new processes to reduce pollution and waste.
Reduce use of ozone-depleting substances (ODS)	SNL/CA complies with the regulations contained in 40 CFR 82 that are designed to end production of ODS, support recycling of ODS during servicing and disposal, and identify alternatives for ODS.
Promote sustainable management of federal lands through cost-effective, environmentally sound landscaping practices, and programs to reduce adverse impacts to the natural environment	Site landscaping practices follow the SNL/CA Visual Quality Guidelines and Landscape Master Plan that incorporates the use of drought tolerant and native plant species into landscape design.

3.12 Audits, Assessments, and Inspections

Table 3-4 provides a list of environmental program audits, assessments, and/or inspections conducted at SNL/CA during 2005.

3.13 Environmental Occurrences

SNL/CA had one environmental occurrence in 2005. On June 16, 2005, the Alameda County Department of Environmental Health issued a Notice of Violation to SNL/CA for noncompliance with a requirement for the site's Designated UST Operator to be certified as a California UST System Operator. Sandia's Designated UST Operator did not posses a valid certificate prior to the assignment. As a result, the monthly UST system inspections conducted by the Designated UST Operator in January and February 2005 were considered

invalid. The required certification was received on March 3, 2005. Alameda County verified and confirmed the certification on March 9, 2005.

Table 3-4 SNL/CA Audits, Assessments, and Inspections, 2005

Title	Area of Focus	Date Conducted	Results
Alameda County Inspection	Erosion at the Navy Landfill site	December 20, 2005	Inspection only, no issues
City of Livermore, Water Resources Division Inspections	Wastewater discharges and categorical process laboratories	September 26 and 27, 2005	No areas of non-compliance
Alameda County Department of Environmental Health	Underground storage tank	March 14, 2005 October 31, 2005	Notice of Violation
Independent Environmental Management System (EMS) Assessment (SNL corporate)	EMS implementation	July 2005	SNL/CA EMS one of four strengths identified; 2 program deficiencies noted and corrected
Packaging and Transportation Assessment (DOE/SSO)	Waste management packaging and transportation activities	August 2005	1 finding, 1 observation
Pollution Prevention Program Assessment (DOE/SSO)	Technical assistance and generator support, environmentally preferable purchasing, awareness and outreach, and metrics	July 18-21, 2005	No findings
Pollution Prevention Program Assessment (DOE/NNSA Service Center)	Technical assistance and generator support, environmentally preferable purchasing, awareness and outreach, and metrics	September 13, 2005	No findings

3.14 Permits

Environmental permits and clean-up orders held by SNL/CA are listed in Table 3-5. Additional information is provided in previous sections under the relative program or regulation.

Table 3-5 SNL/CA Environmental Permits and Orders, 2005

Type	Description	Effective Date	Statute / Regulation	Issuing Agency
Environmental restoration	Site Clean-up Order No. 89-184	December 1989 (no expiration date)	California Water Code	Regional Water Quality Control Board, San Francisco Bay
Hazardous materials	Business Plan Permit to Operate	November 1, 2005 - October 31, 2006	California Health and Safety Code	Alameda County Environmental Health Department
Hazardous waste	RCRA Hazardous Waste Facility Permit	March 2004 - March 2014	Resource Conservation and Recovery Act	California Department of Toxic Substances Control
Hazardous waste	Permit by Rule	November 1, 2005 - October 31, 2006	California Health and Safety Code	Alameda County Department of Environmental Health
Hazardous waste	Conditionally Authorized Permit to Operate	November 1, 2005 - October 31, 2006	California Health and Safety Code	Alameda County Department of Environmental Health
Medical waste	Small Quantity Generator with Onsite Treatment	August 9, 2005 - August 8, 2006	California Health and Safety Code	Alameda County Department of Environmental Health
Medical waste	Small Quantity Generator without Onsite Treatment	April 11, 2005 - April 10, 2006	California Health and Safety Code	Alameda County Department of Environmental Health
Wastewater	Wastewater Discharge Permit	August 4, 2005 - August 3, 2006	Clean Water Act	City of Livermore Water Reclamation Plant
Storm water	State of California General Industrial Permit	July 1997 - July 2002[a]	Clean Water Act	California Water Resources Control Board
Jurisdictional waters of the U.S.	Nationwide Permit Authorization	July 14, 2005 – March 18, 2007	Clean Water Act	Army Corp of Engineers
Underground storage tank	Permit to Operate	November 1, 2005 - October 31, 2006	Resource Conservation and Recovery Act and California Health and Safety Code	Alameda County Department of Environmental Health
Aboveground storage tanks	Storage statement	July 1, 2005 - June 30, 2006	Aboveground Petroleum Storage Act	California Water Resources Control Board
Air	Permit to Operate 15 emission sources: 1 Degreaser; 1 paint spray booth; 1 non-retail gasoline dispensing facility; 1 chromium electroplating operation; 5 miscellaneous (decontamination sink, waste compactor, drum crusher, two site wide sources for solvent emissions); 6 emergency generators	July 1, 2005 - June 30, 2006	Clean Air Act	Bay Area Air Quality Management District

[a] The current General Permit continues in effect until a new permit is issued by the State Water Resources Control Board (Permit Section C.18). When the renewal process is complete and a new General Permit issued by the State, SNL/CA will apply for coverage under the new permit.

4 Environmental Management

Sandia National Laboratories, California (SNL/CA) is firmly committed to sound environmental stewardship practices as well as compliance with environmental requirements. SNL/CA meets this commitment through an environmental management system (EMS) that integrates traditional environmental program elements with objectives for improving the environmental footprint of site operations. The SNL/CA EMS program is dynamic, encompassing an annual cycle of planning, implementing, assessing, and improving operations in support of site-specific environmental goals.

During 2005, SNL/CA completed the framework of the site's EMS program and initiated implementation of all program elements. Sandia conducted an internal, independent assessment of the EMS program in July to assess compliance with DOE requirements and site implementation status. SNL/CA received a positive assessment report noting that the site had *integrated EMS into planning tools and working documents to a level of excellence exceeding guidance provided by the corporate EMS team.* In December, the SNL/CA EMS Team received the prestigious gold Sandia President's Quality Award identifying and recognizing the team for performance excellence, process improvement, and commitment to quality concepts and principles.

SNL/CA ES&H Standard of Performance

SNL/CA is firmly committed to meeting all corporate and regulatory ES&H policies and requirements that apply to its operations. The application of compliant ES&H principles and practices is considered a fundamental element of everyone's work assignment.

In this regard, SNL/CA commits to:

- **Nurture a safety and health conscious work ethic and culture.** We will all assume responsibility for creating and maintaining a worksite, as well as performing our work, in a manner that respects and supports the safety and health of every individual. SNL/CA believes that all accidents are preventable. We will all strive to create a workplace that is free of accidents and injuries.
- **Be a responsible steward of the environmental resources in our care.** We will integrate environmental risk assessment, planning and impact mitigation into every aspect of our work. SNL/CA programs, operations, processes, and facilities will be planned and managed such that they support environmental objectives and targets to minimize the creation of waste, pollution, and adverse impact on the public and the environment. SNL/CA will remain committed to an efficient and effective Environmental Management System as part of the laboratory's Integrated Safety Management System.
- **Comply with all applicable laws, regulations and permits.** Compliance with the letter and the spirit of ES&H laws and regulations is viewed as the minimum acceptable standard. When necessary and appropriate we will go beyond legal mandates in order to implement more effective approaches and to nurture a positive and learning ES&H culture. SNL/CA is committed to continuous improvement in all aspects of our environment, safety, and health performance and commits to establish performance indicators to guide these efforts and measure our progress.

4.1 EMS Elements

SNL/CA modeled its EMS after the international standard for environmental management systems, ISO 14001. The ISO model identifies seventeen elements of an effective EMS Program. All seventeen elements are included in the SNL/CA EMS Program. The ISO elements overlap with those of Department of Energy (DOE) Order 450.1, thus SNL/CA's EMS Program also meets the DOE requirements. SNL/CA will seek registration to the ISO

14001 standard in 2006. Table 4-1 summarizes SNL/CA's EMS Program as it relates to the seventeen ISO 14001 elements.

Table 4-1 Elements of the SNL/CA EMS Program

EMS Element	Implementation Summary
Environmental policy	SNL/CA operates under a site-specific ES&H standard of performance that reinforces individual accountability, environmental stewardship, and compliance. SNL/CA stresses the need to move beyond compliance to nurturing of a positive ES&H culture at all levels of the workforce.
Environmental aspects	Environmental aspects are elements of operations and activities that can interact with the environment, such as waste generation and hazardous materials use. In 2005, the EMS Program focused primarily on decreasing the potential for environmental impact from the top five high-risk aspects – fire risk, hazardous materials, air emissions, hazardous waste, and wastewater discharges. As a secondary focus, the EMS Program includes five aspects that represent the highest areas of opportunity for environmental improvement – land use and habitat, electricity consumption, natural gas consumption, solid waste, and water consumption. Each year, the SNL/CA EMS team evaluates site operations, environmental aspects, and improvements achieved over the past year. Modifications to the EMS Program are implemented as appropriate.
Legal and other requirements	Sandia maintains a formal process for monitoring federal, state, and local government publications for regulatory changes and issues applicable to Sandia operations. SNL/CA augments this process by monitoring publications specific to functional environmental program areas and through interaction with regulating agencies. Environmental subject matter experts analyze all new requirements, and team with other site personnel to achieve compliance. New requirements and modifications to environmental programs are documented in annual program reports.
Objectives and targets	SNL/CA's EMS objectives support efforts to reduce potential environmental risk and enhance environmental stewardship. The objectives for 2005 are as follows: Compliance Objective 1. Meet or exceed all applicable environmental requirements. Risk aspect objectives 1. Minimize risk of fire. 2. Reduce quantities and toxicity of hazardous materials on site. 3. Reduce air emissions related to operations and transportation, with emphasis on Spare The Air days. 4. Reduce quantities of hazardous waste generated on site. 5. Reduce quantity of sewer water generated on site and improve quality. 6. Reduce volume and velocity of storm water runoff. 7. Minimize pollutants in storm water runoff. Opportunity aspect objectives 1. Enhance the natural habitat. 2. Use "green" design principles for design and construction of all buildings. 3. Decrease electrical consumption per building. 4. Decrease natural gas consumption per building. 5. Reduce quantity of solid waste transported to landfills through reduced consumption and/or recycling. 6. Decrease water consumption per building. SNL/CA's EMS Team establishes measurable targets to support each objective. Annually, the EMS Team identifies and completes a set of actions to ensure steady progress is made in obtaining site environmental targets and meeting site objectives.

EMS Element	Implementation Summary
Environmental programs	SNL/CA's EMS Program is supported by six functional environmental programs. ➢ Air Quality ➢ Environmental Monitoring and Restoration ➢ Environmental Planning and Ecology ➢ Hazardous Materials Management ➢ Pollution Prevention and Waste Minimization ➢ Waste Management
Structure and responsibilities	Sandia operates under strategic management units that support mission-related as well as facility-related programs. All strategic management units operate in accordance with a Corporate Business Rules System (CBR System) that defines Sandia's values, principles, and objectives. The CBR System is comprised of a hierarchy of requirements documents that establishes the boundaries within which Sandia conducts business, and for which all employees are held accountable. This hierarchy of documents addresses top-level contract requirements, corporate-wide requirements, as well as site-specific or local requirements, and encompasses all aspects of Sandia's operations including environment, safety, and health. Additionally, at SNL/CA key EMS personnel include the site Vice President, Director of Site Operations, ES&H Management, a designated management representative, and EMS functional program leads.
Training, awareness, and competence	SNL/CA employs a variety of mechanisms to ensure that the site workforce and visitors maintain the appropriate training and competence levels for their assignments, and to foster awareness. These mechanisms include corporate training programs, site-specific training programs, and activity-specific training programs. For contractor-directed activities that occur on site, SNL/CA issues standard specifications that identify training, credentials, and certifications required for each project.
Communication	SNL/CA communicates EMS information internally through project review teams, an EMS Advisory Team, publications, websites, briefings, assessments, and promotional information. Information is communicated externally through publications, websites, SNL/CA's Public and Media Relations Office, and regulatory-driven documents.
EMS Documentation	SNL/CA maintains an EMS Program Manual as the primary EMS document for the site. General corporate and site policies, document systems, and databases provide supporting documentation for the EMS Program.
Document control	For document control, SNL/CA follows established CBR System standards, requirements outlined in the corporate ES&H Manual, and ES&H quality assurance guidelines.
Operational controls	Operational controls at SNL/CA include administrative and engineered controls identified during facility and project review processes.
Emergency preparedness and response	An established Emergency Management Program that maintains responsibility for preparedness and response supports SNL/CA's EMS Program. Emergency Management conducts routine drills and communication tests, and annually conducts site-wide training exercises. Environmental representatives are active members of emergency response teams to ensure that potential environmental risks are managed and mitigated appropriately.
Monitoring, measurement, and maintenance	Each of the six SNL/CA functional environmental programs monitor site operations to assess overall progress in meeting site environmental objectives. The programs also complete annual self-assessments of program activities and site implementation of program requirements. Corrective actions are rolled into program activities for continual improvement. The overall site EMS Program is assessed and improved similarly.
Evaluating compliance	SNL/CA evaluates compliance with all environmental requirements through hazard screening and project review processes, self-assessments, and audits.
Nonconformity, corrective, and preventive action	SNL/CA identifies nonconformities through self-assessments and audits. Corporate and site requirements ensure that corrective actions are established for all deficiencies and tracked to completion. Nonconforming events are reported, tracked, and corrected through an occurrence management system that incorporates root cause analyses, corrective and preventive actions, and lessons learned.

EMS Element	Implementation Summary
Records	SNL/CA manages all information created by Sandia work in accordance with CBR System requirements. SNL/CA environmental records are managed and stored by a site-specific ES&H Records Center.
Management review	SNL/CA's Business Leadership Team and the Safety, Health & Environment Advisory Committee review the site's EMS performance annually. As part of these reviews, EMS objectives are re-affirmed, decision points are identified, and recommendations for improving the site's environmental performance are established.

4.2 Environmental Performance

SNL/CA measures environmental performance by tracking progress in achieving environmental targets and objectives. Baseline data is not yet available to measure all objectives established for the SNL/CA EMS Program. Actions are underway to establish these baselines and provide a complete measure of the site's environmental performance. In 2005, the site measured performance towards achieving nine of the fourteen established objectives. The following diagrams show our progress and improvement in the last year. The complete list of objectives is provided in Table 4-1.

Compliance Objective 1: Meet or exceed all applicable environmental requirements

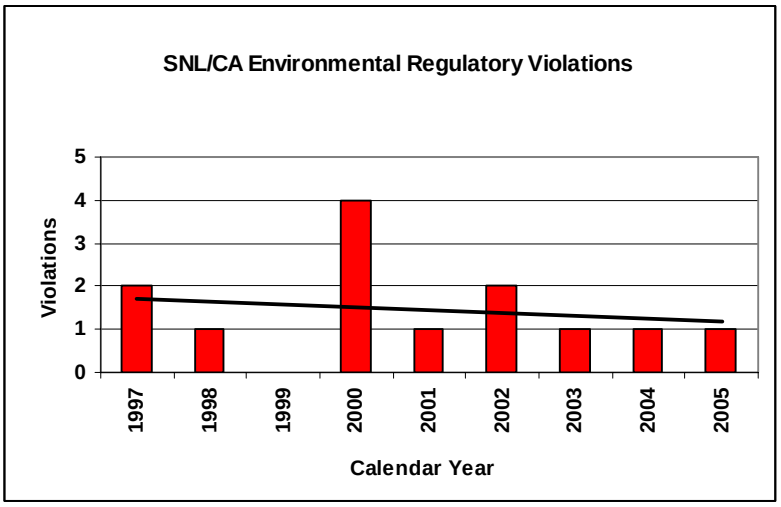

Figure 4-1 SNL/CA Compliance with Environmental Requirements

SNL/CA tracks regulatory violations as a measure of performance in complying with environmental requirements. Figure 4-1 shows the number of environmental violations received by SNL/CA since 1997. As shown, the site received one notice of violation in 2005. This violation related to a lag in certification for the SNL/CA-designated underground storage tank operator. Section 3.13 presents the details of this violation. In response to the violation, record-keeping responsibilities for the underground storage tank program were transferred to the Environmental Monitoring and Restoration Program. This transfer will ensure appropriate records management, and that certifications and training are obtained in a

timely manner. Since 1997, SNL/CA has shown steady improvement in the overall trend towards reducing the number of environmental regulatory violations to zero – a Sandia corporate goal.

SNL/CA maintains an active self-assessment process to identify environmental concerns throughout the site. Sandia uses self-assessments to communicate EMS objectives, foster environmental awareness, and correct issues that could lead to non-compliant practices or violations. Figure 4-2 shows the number of environmental concerns identified during self-assessments from 1998 through 2005. The results are not a direct measure of compliance, however, they indicate that SNL/CA continually strives to improve environmental management of site activities, which ultimately should lead to improved compliance.

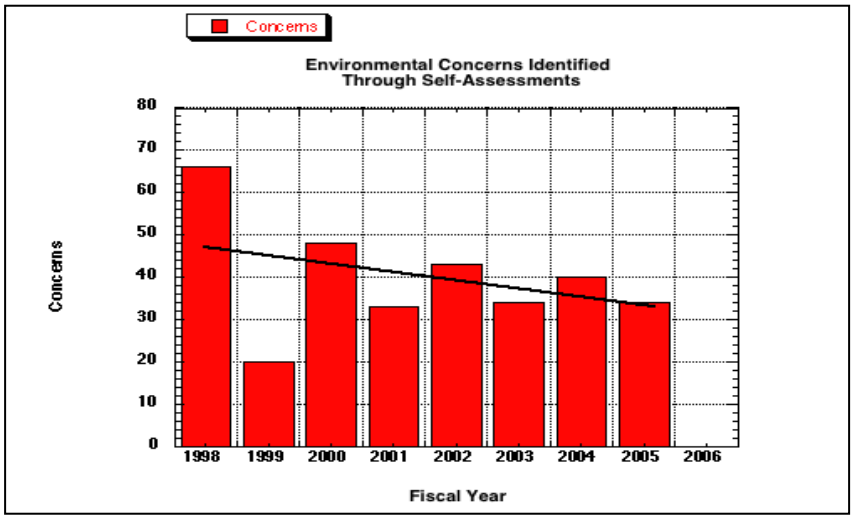

Figure 4-2 Self-assessment Environmental Concerns

Risk Objective 2: Reduce quantities and toxicity of hazardous materials

The overall goal of SNL/CA's EMS Program is protection of the environment from the negative effects of site activities including hazardous materials use. Central to this defense of the environment, is proper hazardous material inventory management. Right-sizing the inventory and minimizing toxicity is, therefore, key to environmentally friendly hazardous materials management, and was selected as an EMS target in 2005. SNL/CA has been using a barcoded container tracking system since 1993. Figure 4-3 suggests that amounts of hazardous materials, including the more toxic NFPA Health 3 and 4 rated materials, increased through the 1990's and peaked in 2002. A successful EMS goal-driven site wide campaign reduced the inventory by 15 percent in 2005 surpassing the 10 percent reduction goal. While SNL/CA accomplished significant progress in 2005, there is potential for additional reduction in future years to attain an inventory sized appropriately for site operations.

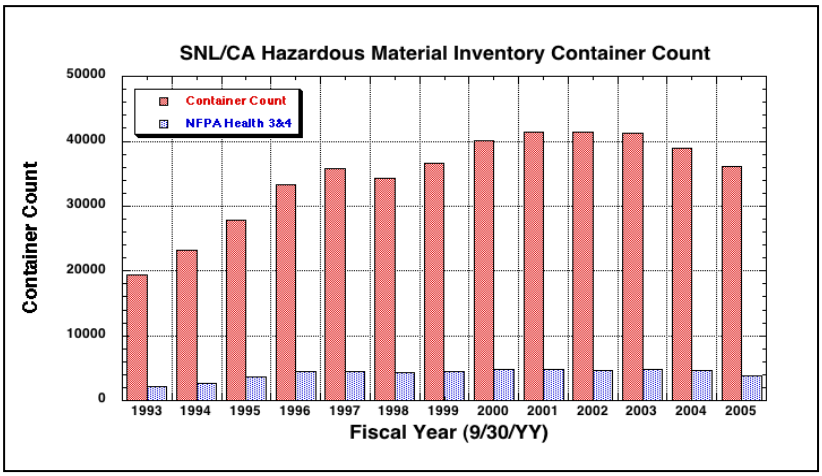

Figure 4-3 Quantity and Toxicity of Hazardous Materials at SNL/CA

Risk Objective 3: Reduce air emissions with emphasis on Spare The Air days

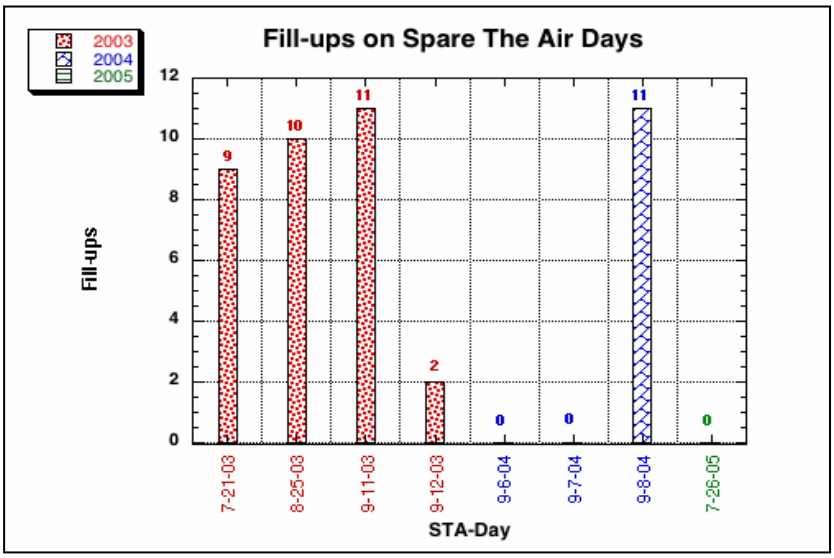

Figure 4-4 Number of Vehicle Fill-ups on Spare The Air Days

During the summer of 2005, the Bay Area experienced remarkably clean air. The Bay Area Air Quality Management District (BAAQMD) issued just one Spare the Air advisory on July 26, 2005. Advisories are used to notify the public when air pollution is expected to reach unhealthy concentrations and to encourage Bay Area residents to take individual action to reduce harmful pollutants. In 2005, the Air Quality Program established an EMS initiative to reduce the number of fill-ups from the on site gasoline tank on Spare the Air days. A program was developed and implemented that encouraged site personnel to plan their gasoline fueling activities for either before or after a Spare the Air day. Sandia's cart owners listened and planned well, as there were zero fill-ups from the on site tank on the July 26th Spare the Air day, down from an average of 7 on a typical work day. Figure 4-4 shows the number of fill-ups on Spare the Air days over the last three years.

Risk Objective 4: Reduce quantities of routine hazardous waste

Following DOE guidelines for waste reduction, SNL/CA sets annual goals for reducing the quantity of routine hazardous waste generated by site activities. Routine hazardous waste, as presented in Figure 4-5, includes waste regulated under the Resource Conservation and Recovery Act (RCRA), California toxic waste laws (non-RCRA), the Toxic Substances Control Act, and bio-hazardous waste regulations. As shown in Figure 4-5, SNL/CA improved its waste reduction efforts during fiscal year 2005 and reached the set goal for the fiscal year. A process change that redirects empty containers meeting specific requirements to recycling instead of disposal as hazardous waste, and implementation of waste reduction efforts identified through pollution prevention opportunity assessments contributed to successful waste reduction in 2005. DOE pollution prevention goals followed in fiscal year 2005 have expired. Modifications to 2006 and future goals are underway in response to new DOE guidance issued in December 2005.

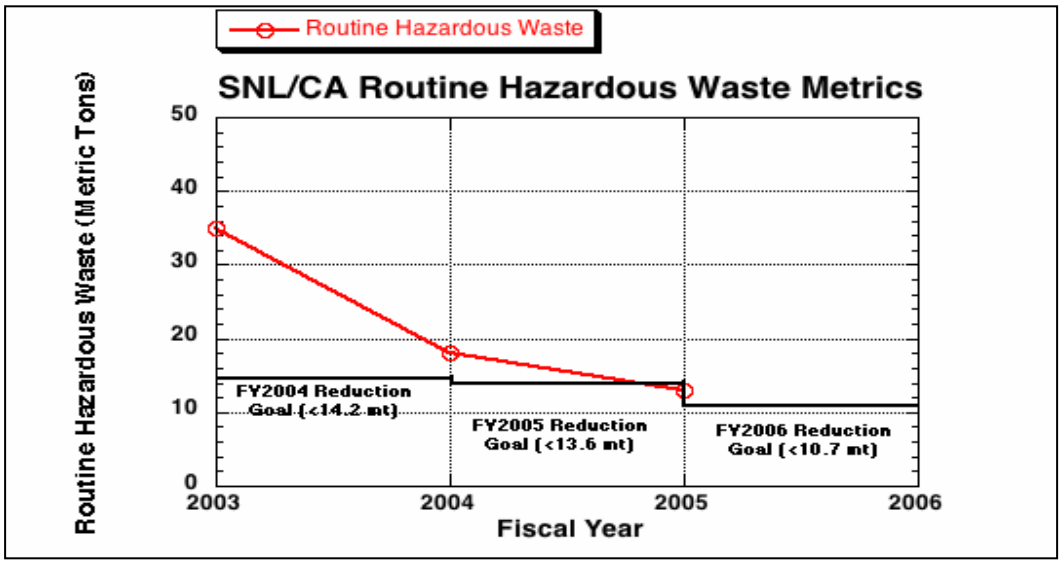

Figure 4-5 Routine Hazardous Waste Generated at SNL/CA

Risk Objective 6: Reduce sewer water quantity and improve quality

SNL/CA continuously monitors wastewater generated on site. Figures 4-6 and 4-7 show the trend in weekly monitoring results since 2000 for copper and zinc, respectively. As shown, the site has experienced a gradual downward trend in levels of both copper and zinc at the sewer outfall. This trend indicates a steady improvement in the quality of sewer water effluent generated at SNL/CA. Efforts that support improvement in sewer water quality are described in Chapter 5, Environmental Monitoring.

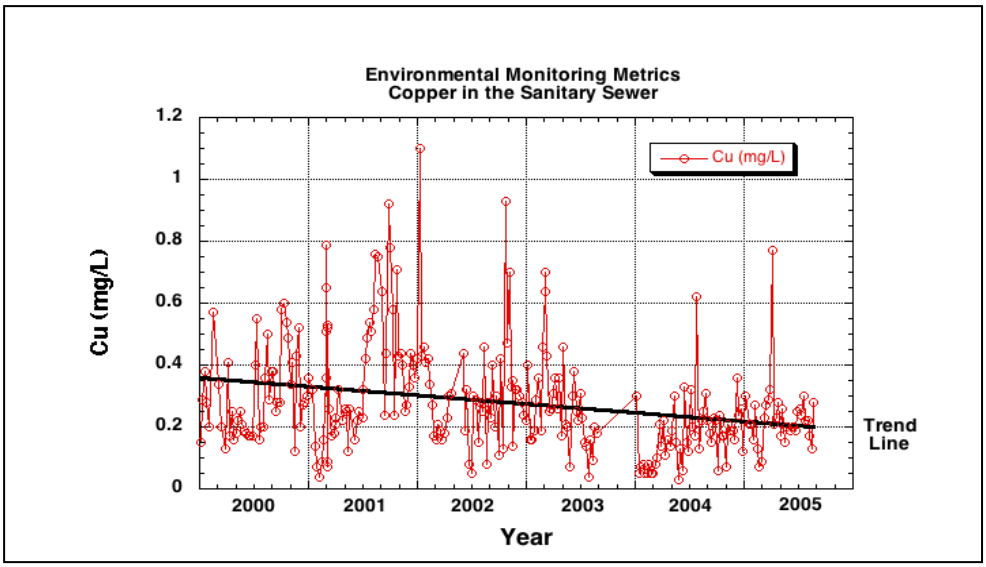

Figure 4-6 Weekly Composite Copper Concentrations in Wastewater

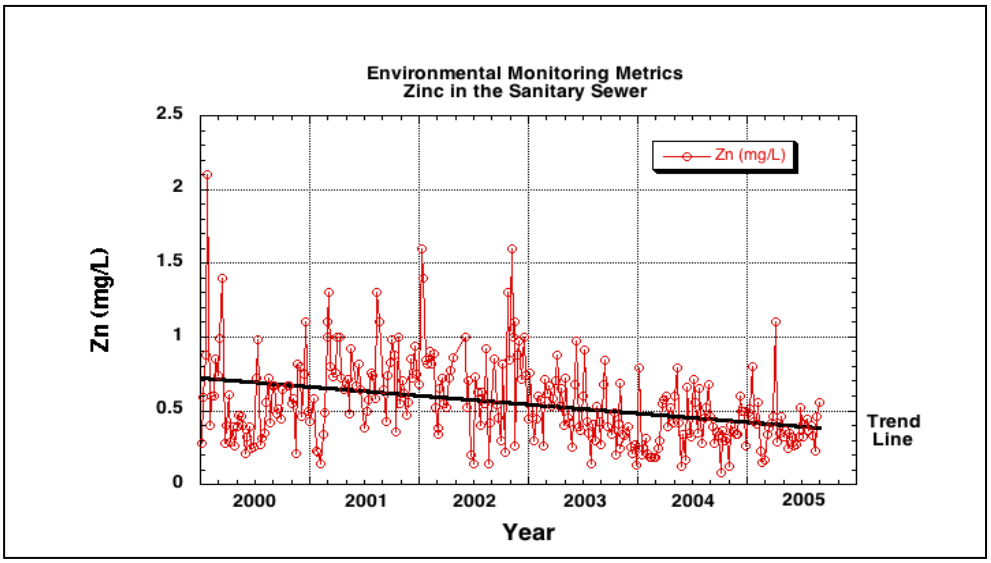

Figure 4-7 Weekly Composite Zinc Concentrations in Wastewater

Figure 4-8 shows volume of sewer effluent discharged by SNL/CA from 2000 through 2005. SNL/CA has a stated goal of reducing the quantity of sewer effluent. Efforts are underway to continue the downward trend indicated from 2004 to 2005.

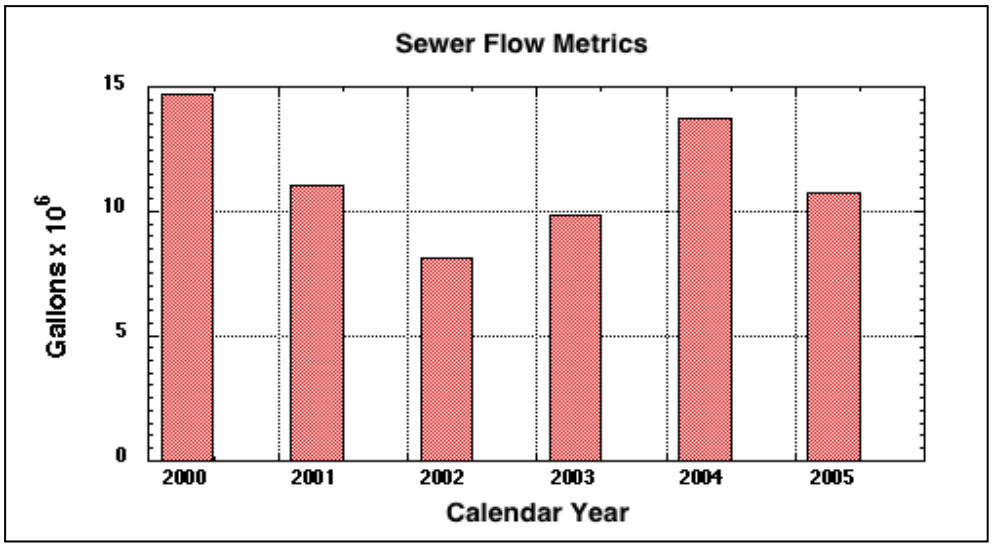

Figure 4-8 Annual Wastewater Discharges

Opportunity Objective 3: Decrease electricity consumption
Opportunity Objective 4: Decrease natural gas consumption

The Energy Policy Act of 2005 (HR 2005) establishes an energy reduction goal for federal agencies of two percent per year over a ten-year period starting in fiscal year 2006, using 2003 data as the baseline. Figure 4-9 displays SNL/CA's energy reduction target for 2006 through 2015. Data shows electricity and natural gas combined into British Thermal Units (BTUs). Between 2003 and 2005, SNL/CA reduced energy consumption by about nine percent, exceeding the established target for 2006 and beyond. SNL/CA attributes the reduction in energy consumption to two factors: 1) bringing two large facilities online that are energy efficient, and 2) milder weather conditions.

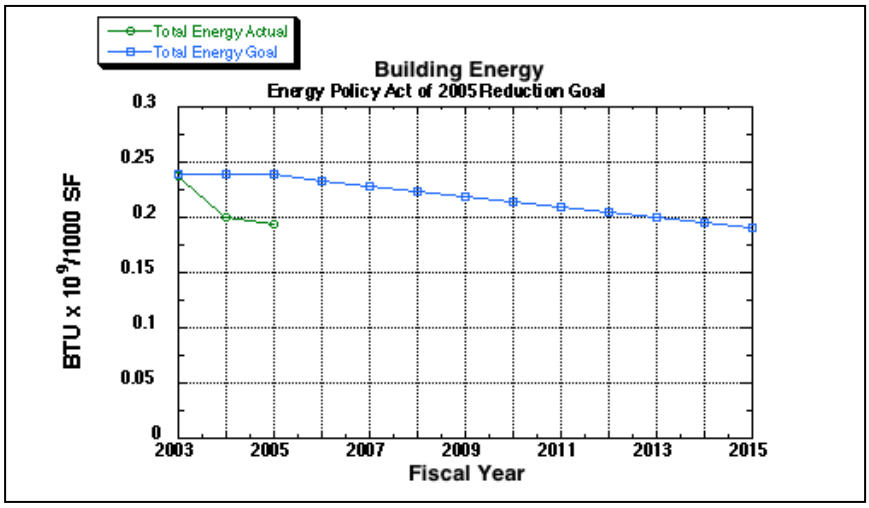

Figure 4-9 SNL/CA Energy Consumption

Opportunity Objective 5: Reduce quantity of solid waste transported to landfills through reduced consumption and/or recycling

SNL/CA transports solid waste (trash) generated from routine operations to local landfills for disposal. In fiscal year 2005, SNL/CA transported 181 metric tons of solid waste to landfills, representing a decrease from 2004 of 0.4 metric tons. SNL/CA attributes the reduction in quantity of solid waste transported to landfills to increases in recycling of wood, electronics, paper, metal materials, construction debris, and eighteen other waste streams. Figure 4-10 presents data on solid waste transported to landfills during the period from 2003 through 2005. Recycling data for this same period is shown in Figure 4-11.

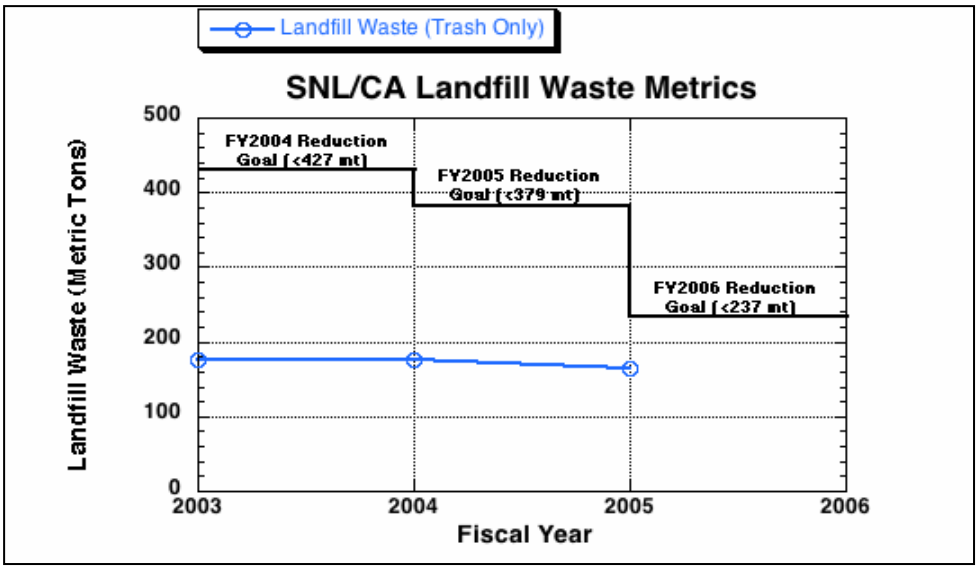

Figure 4-10 SNL/CA Solid Waste Transported to Landfills

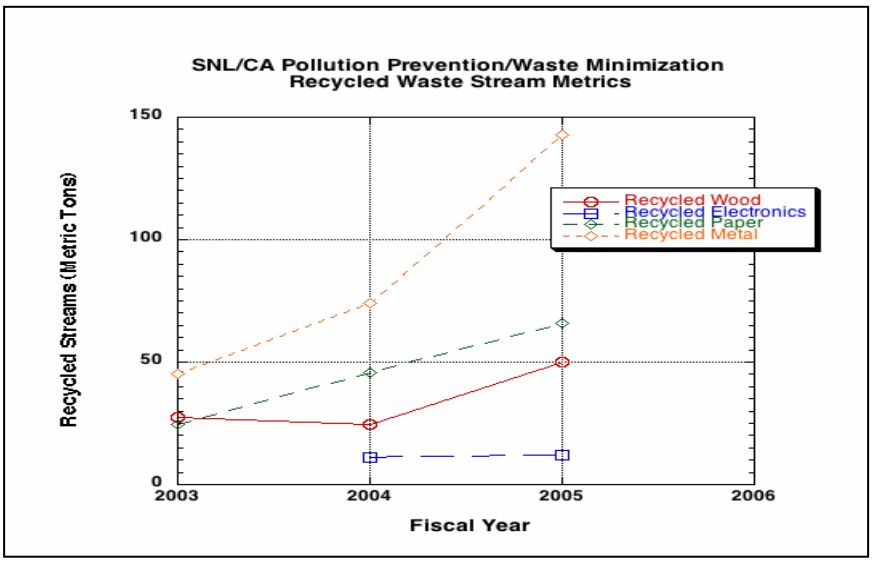

Figure 4-11 Materials Recycled at SNL/CA

Opportunity Objective 6: Decrease water consumption

Figure 4-12 presents water use data for SNL/CA over the last five years. As shown, the site has experienced an overall reduction in water use during this time-period. The decrease in 2005 is attributed to cooler than average temperatures during summer months resulting in a lower requirement for cooling water. SNL/CA's water conservation efforts will continue through education and awareness of the site population, surveys for and modifications to once-through cooling water systems, and repair of leaking fixtures.

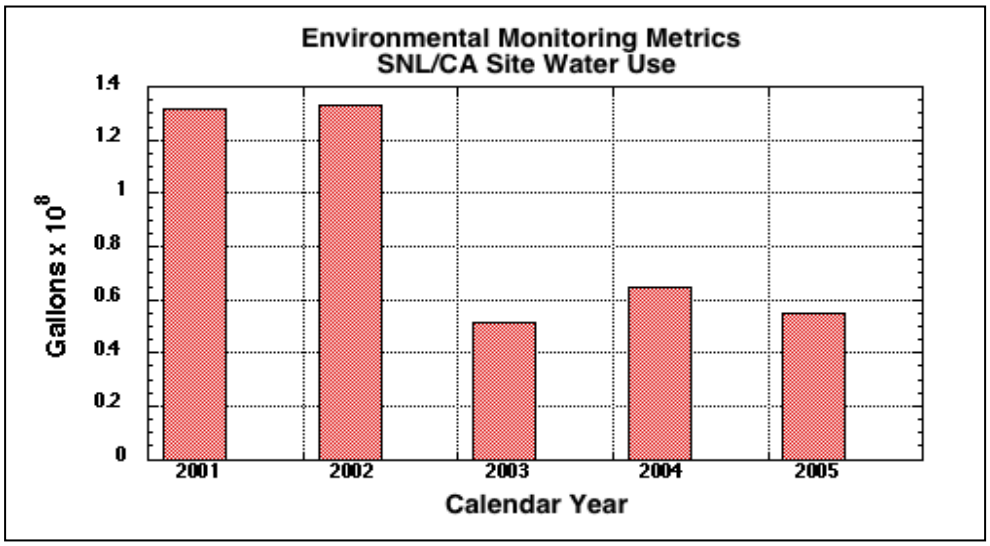

Figure 4-12 Water Consumption at SNL/CA

4.3 Functional Environmental Program Highlights

Six functional environmental programs support environmental management at SNL/CA, air quality, environmental monitoring and restoration, environmental planning and ecology, hazardous materials management, pollution prevention and waste minimization, and waste management. The following sections summarize the responsibilities of each program and identify the highlights that occurred during 2005.

4.3.1 Air Quality Program

The Air Quality Program provides compliance assistance for all nonradiological air emission sources at SNL/CA. Program staff review all directives, laws, and regulations relevant to air emissions for applicability to the site. This program manages the air permit process, from the initial steps of preparing permit applications through implementation of permit conditions and annual renewals. The Air Quality Program is responsible for evaluating proposed projects, assessing chemical use, and assessing emissions of all criteria pollutants and toxic air contaminants.

The Air Quality Program has an EMS target of reducing the site wide mobile source emissions by 10 percent by the end of 2008. As a first step in meeting this target, the Air Quality Program established an emissions baseline for onsite mobile sources. Onsite mobile

sources include vehicles, carts, landscaping equipment, and construction and maintenance equipment that are not permanently attached to a stationary foundation. One observation coming from an analysis of the baseline data is that the carts are the largest contributor to Sandia's mobile source emissions, with 45 percent of the reactive organic gases, 70 percent of the carbon monoxide, and 33 percent of the nitrogen oxide emissions. Emissions data from future years will be compared to the baseline to help track our progress in meeting the 10 percent reduction goal.

The Air Quality Program was instrumental in acquiring two new pieces of cleaning equipment for Sandia's painting operations, a paint gun washer and a parts wash rack. The paint gun washer provides a closed-loop cleaning process for the paint spray guns. Although this equipment still uses a solvent for cleaning, the closed-loop design greatly decreases the volatile organic compound (VOC) emissions compared to the hand cleaning process previously employed. The parts wash rack uses hot pressurized water to clean metal parts prior to painting. This piece of equipment replaces a hand cleaning method that used high VOC solvents. These new processes not only reduce the VOC emissions to the atmosphere, but also reduce the risk of violating the strict regulations governing the use of solvents.

4.3.2 Environmental Monitoring and Restoration Program

The Environmental Monitoring and Restoration Program routinely monitors wastewater, storm water, and groundwater systems at SNL/CA to assess the affect of site operations on the public and local environment. Monitoring of external radiation at the site perimeter is also conducted under this program. Routine monitoring activities and results are presented in Chapter 5.

During 2005, SNL/CA implemented changes to the cooling tower cleaning process to reduce copper and zinc levels in wastewater. Environmental Monitoring and Restoration Program staff identified this process as a major source of both metals in the site's effluent. In December, SNL/CA began operation of a water treatment unit to remove particulates from cooling water. The new process is a significant improvement over the previous process that involved capturing cooling water and allowing solids to settle out before discharge to the sanitary sewer. The new water treatment process also allows re-use of cooling water, supporting the site's water conservation goals.

In support of storm water pollution prevention efforts, SNL/CA purchased a vacuum-based storm drain cleaning machine. Newly developed site procedures require cleaning of storm drains before the beginning of the rain season. With the purchase of this new equipment, SNL/CA expects to fully implement the new site requirements for storm drain cleaning during 2006.

4.3.3 Environmental Planning and Ecology Program

The Environmental Planning and Ecology Program provides oversight for ecological resource management, site-wide National Environmental Policy Act (NEPA) review, and cultural and historic resource reviews. Each year, the Environmental Planning and Ecology Program compares actual site operations to the maximum operations scenario presented in a

site-wide environmental assessment (SWEA) to determine whether SNL/CA operations remain within the bounding impact analysis. Table 4-2 presents a summary of the comparison and an evaluation of the results.

In January 2005, SNL/CA began using an online system to complete NEPA reviews of new and modified actions. The online system streamlines the review process by guiding project representatives through a set of questions designed to prompt the user for all necessary information. The system is accessible by all members of the workforce, Sandia NEPA subject matter experts, and DOE/SSO staff. It supports document management and provides built-in reporting and tracking features. During fiscal year 2005, 158 actions underwent NEPA review. None of these actions required an environmental assessment or environmental impact statement.

Table 4-2 Comparison of 2005 Operations with SWEA Envelope

Activity / Unit	SWEA Envelope (maximum operations)	Calendar Year 2005	Site Operations Remain Within Impact Analysis
Proposed Action			
Site mission	Supports DOE, NNSA, DHS	No change	Yes
Arroyo Seco improvements	20 tasks over ten years	One task initiated as of December 31, 2005	Yes
Increase operations	Increase to 2 shifts	1 shift	Yes
New facilities	5,000 sf badge office; new 16,000 sf laboratory; 84,000 sf laboratory replacement for Building 916	None of the defined new facilities completed as of December 31, 2005	Yes
Demolition	100,000 sf over ten years	1,656 sf as of December 31, 2005	Yes
Land Use			
Construction area	93 acres over ten years	8 acres as of December 31, 2005	Yes
Wildlife reserve	30 acres over ten years	106 acres	Yes – results in a positive effect
Geology / Soil			
Solid waste management units	23 units total	22 units	Yes
Soil removed	5000 cu yd/yr	0 cu yd	Yes
Soil managed onsite	5000 cu yd/yr	< 1000 cu yd	Yes
Backfill material brought onsite	6000 cu yd/yr	< 1000 cu yd	Yes
Infrastructure			
Water use	91.8 million gal/yr	54.6 million gals	Yes
Sanitary sewer discharge	29.1 million gal/yr	10.4 million gals	Yes
Natural gas use	94 million cu ft/yr	38 million cu ft	Yes
Electricity use	48,800 MW h/yr	37,556 MW hrs	Yes
Biological and Ecological Resources			
Construct flood plains in Arroyo Seco	1800 linear feet over ten years	None	Yes
Create riparian habitat	0.2 acres over ten years	None	Yes
Ground disturbance in / along arroyo	10 acres over ten years	None	Yes
Cultural Resources	None known onsite	No change	Yes
Water Resources			
Impervious surface area	76.9 acres total	54.1 acres	Yes
Irrigation water use	17 million gal/yr	16.6 million gals	Yes

Activity / Unit	SWEA Envelope (maximum operations)	Calendar Year 2005	Site Operations Remain Within Impact Analysis
Proposed Action			
Waste Generation[d]			
Radioactive waste	8,811 kg/yr	90 kg	Yes
Hazardous waste	133,820 kg/yr	31,200 kg	Yes
Construction debris	200 tons/yr	126.6 metric tons	Yes
Solid waste (non-hazardous)	378.7 metric tons/yr	219.7 metric tons	Yes
Transportation			
Hazardous / radioactive waste shipments	116 shipments/yr	16 shipments	Yes
Solid waste shipments (non-hazardous)	80 shipments/yr	39 shipments	No
Air Emissions			
Total criteria pollutants	8,212 kg/yr	5,425 kg[a]	Yes
Total air toxics	2,880.16 kg/yr	1,250 kg[a]	Yes
Radioactive	0 emissions	0 emissions	Yes
Permits	57 permits annually	25 / 15 permits[b]	Yes
Human Health			
Recordable accidents / injuries	78 accidents / injuries annually	14 accident / injuries	Yes
Lost work-day cases	19 days annually[c]	0 days	Yes
Socioeconomics			
Employment	Up to 1931 persons annually	1100 persons	Yes
Operating budget	$262 million/yr	238.2 million	Yes

[a] Annual emissions were calculated by multiplying the daily emissions reported in the BAAQMD Permit to Operate by 365. Emissions are based on 2004 data.
[b] Data provided for the 2004/2005 and 2005/2006 permit periods. See Section 3.3.1 for more information.
[c] Extrapolated from historical average.
[d] Waste data represents calendar year data and may be different from that presented in Figure 4-5.

4.3.4 Hazardous Materials Management Program

The Hazardous Materials Management Program is responsible for tracking hazardous materials (chemical and biological), managing the Material Safety Data Sheet (MSDS) library, providing MSDS information to site personnel, and for regulatory compliance reporting required under various hazardous materials regulations.

Each year, the Hazardous Materials Management Program conducts annual hazardous material inventory reconciliation. In 2005, the reconciliation team achieved a 92 percent "found rate" equal to the highest achieved rate since annual reconciliations began over ten years ago. This result surpasses by two percent the corporate performance target of 90 percent.

A successful EMS goal driven site-wide campaign reduced the hazardous material inventory by 15 percent in 2005 surpassing the 10 percent reduction goal (see Section 4.1, Risk Objective 2). The redesigned Chemical Information System implemented in December 2004 aided this success greatly. New inventory management tools developed in the system were refined throughout 2005 providing information critical to the success of the inventory reduction campaign.

4.3.5 Pollution Prevention and Waste Minimization Program

The Pollution Prevention and Waste Minimization Program promotes the elimination or reduction of all waste types generated at SNL/CA. Program staff work closely with other SNL/CA organizations to establish routine and project-specific recycling programs. The program provides guidance for resource and energy conservation and assists in identifying recycled-content products for use throughout the site. See Section 4.1 for recycling and waste minimization data.

During 2005, SNL/CA implemented improvements to reduce waste generated from several site operations (see Figure 4-11). Sandia installed new equipment in a paint shop operation to minimize solvent use. Modifications to a plating line were also made to reduce the volume of RCRA waste generated from the operation. Both improvements were identified through routine pollution prevention opportunity assessments. Additionally, Sandia implemented a new contractor reporting mechanism to capture data on quantity of construction debris diverted from landfill disposal to recycling. This reporting mechanism supports awareness for building and demolition contractors to increase recycling and reuse.

4.3.6 Waste Management Program

The Waste Management Program manages hazardous, radioactive, and mixed wastes generated by SNL/CA operations. Program personnel collect waste from the point of generation and transfer waste to onsite waste storage facilities for storage, consolidation, commingling, and packaging. The Waste Management Program establishes and maintains several contracts for offsite reclamation, recycling, treatment, and disposal of wastes. Waste Management provides regulatory oversight in accordance with federal, state, and local regulations. The Program manages the Resource Conservation and Recovery Act (RCRA) and Tiered permit process, and implements RCRA and Tiered permit conditions. Program staff conduct process knowledge evaluations to characterize waste types generated from specific operations. The Waste Management Program also provides waste generator training to the Sandia workforce.

In 2005, Waste Management revised its Hazardous Waste Operation Plan to reflect current administrative conditions, to update processes, and to correct informational and typographical errors. SNL/CA also initiated the process of transferring management of radioactive waste to SNL New Mexico, which is expected to be completed by Spring 2006. Radioactive waste generated at SNL/CA will continue to be tracked locally and reported in the site annual reports. Waste Management supported the site-wide campaign for chemical inventory reduction and continued its efforts to minimize hazardous waste generation at SNL/CA.

Page Intentionally Left Blank

5 Environmental Monitoring

Sandia National Laboratories, California (SNL/CA) monitors storm water, wastewater, groundwater, and gamma radiation. This chapter provides a summary of monitoring activities and results for each of these media. Both radiological and non-radiological data are presented.

SNL/CA does not directly monitor airborne effluents. Non-radiological (chemical) emission sources do not require routine or continuous monitoring of ambient air quality concentrations. However, SNL/CA does maintain equipment and process usage records (e.g. hours of operation or quantity of solvents used) for emission sources. Similarly, there are no radionuclide emission sources that require routine monitoring. SNL/CA maintains an inventory of radioactive isotopes (small quantity sealed and unsealed sources), and operates several radiation generating devices. However, emission monitoring is not required for these materials and devices.

Typically, radiological emission data that would be obtained from radionuclide effluent monitoring is used to evaluate the potential effect that a particular site's operations may have on local populations and the environment. Because there are no radionuclide emission sources and no monitoring data for site operations, calculations for maximum individual dose or collective population dose are not possible. As an alternative to these calculations, SNL/CA compares gamma radiation data collected at the site perimeter to offsite data. Results of this comparison are presented in Section 5.4.

SNL/CA is not required to monitor biota or vegetation. The Department of Energy (DOE) RAD-BCG Calculator, a computer tool developed by DOE, is used each year to determine the need and level of monitoring required. The results from applying the tool in 2005 are presented in Section 5.4.

5.1 Storm Water

All storm water runoff from SNL/CA is conveyed to the Arroyo Seco, which discharges into Alameda Creek and eventually to the San Francisco Bay. Storm water that flows off buildings, material-handling areas, parking lots, and other impervious surfaces, may pick up pollutants, such as oil and grease, soil, litter, pesticides, and fertilizers. During heavy or continuing storms, runoff may transport pollutants to Arroyo Seco before the storm water has time to evaporate or infiltrate into the ground.

To assess the impact of site operations to storm water discharges, SNL/CA collects samples of surface runoff at nine[5] locations around the site. These locations, identified on Figure 5-1, were selected because they provide the best representation of drainage areas and activities onsite. Each of the nine locations is sampled twice each wet season, once each during two

[5] Nine of the ten sampling locations shown on Figure 5-1 are sampled for the storm water program. Station N is used to monitor erosion from the Navy Landfill.

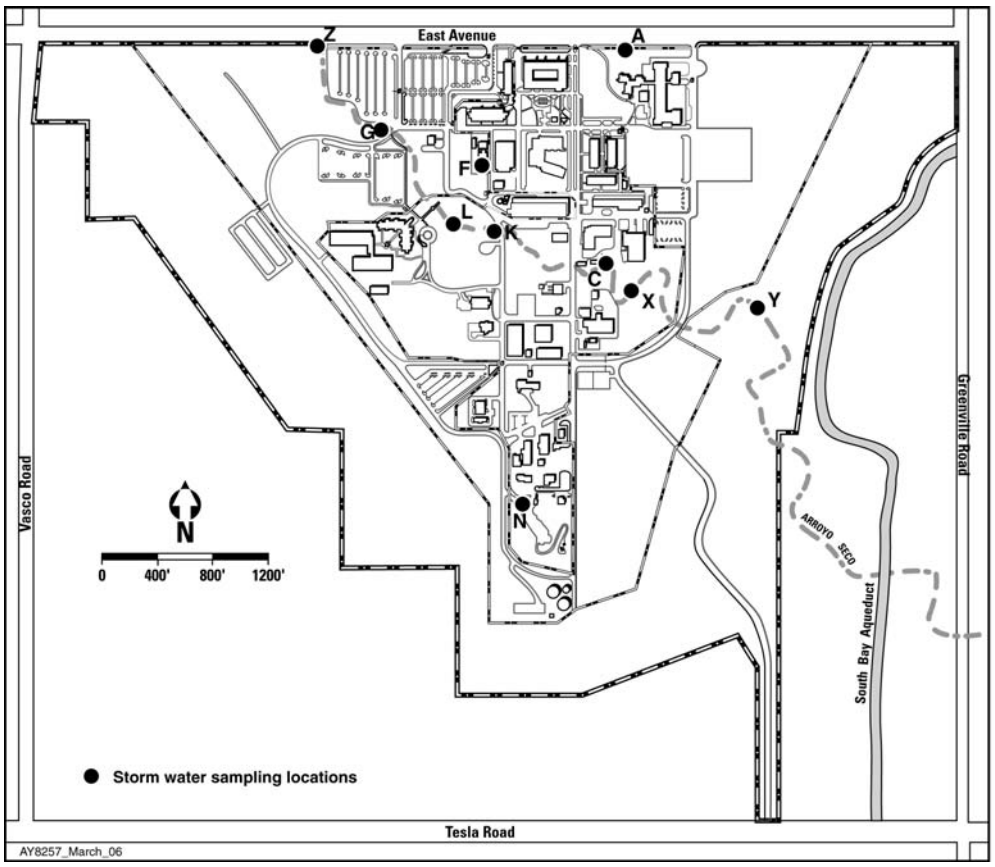

Figure 5-1 Storm Water Sampling Locations

separate storm events, provided there is sufficient runoff. The wet season is from October 1 through May 31. Because any one storm may not produce enough runoff to allow for sample collection at all nine locations, sampling during more than two storm events is generally required.

Storm water discharges at SNL/CA are covered under the State of California NPDES General Permit for Storm Water Discharge Associated with Industrial Activities (General Permit) (California Water Resources Control Board 1997). The General Permit does not establish water quality standards for storm water discharges. Consequently, a comparison of analytical results with regulatory standards cannot be made. Instead, the analytical data obtained from monitoring storm water discharge is used to optimize storm water pollution prevention activities at SNL/CA.

Analytical Parameters – Stormwater

- Specific conductivity
- pH
- Total suspended solids
- Oil and grease
- Cyanide
- Metals
- Chemical oxygen demand
- Nitrite + nitrate
- Ammonia
- Tritium

Analytical results of storm water sampling for the 2004/2005 wet season (October 2004 through May 2005) are presented in Table 5-1. No pollutants were detected in storm water

runoff at levels that are a cause for concern. The concentrations of constituents detected in storm water are similar to those detected historically.

Table 5-1 Summary of Analytical Results for Storm Water, 2004/2005 Wet Season

Parameter	Number of Samples Analyzed	Number Found Below Detection Limit	Detection Limit	Minimum Concentration	Maximum Concentration
Total suspended solids	22	0	3 mg/L	5 mg/L	520 mg/L
Specific conductivity	22	0	1 μmho/cm	9 μmho/cm	2000 μmho/cm
pH	22	0	None	6.8	8.1
Oil and grease	22	19	1 mg/L	<1.0 mg/L	2.0 mg/L
Chemical oxygen demand	22	3	5 mg/L	<5.0 mg/L	47 mg/L
Cyanide	22	22	0.01 mg/L	<0.01 mg/L	<0.01 mg/L
Tritium	22	22	1.45 – 1.53 pCi/L	<1.45 pCi/L	<1.53 pCi/L
Aluminum	22	1	0.05 mg/L	<0.05 mg/L	16 mg/L
Arsenic	22	21	0.005 mg/L	<0.005 mg/L	0.006 mg/L
Cadmium	22	22	0.002 mg/L	<0.002 mg/L	<0.002 mg/L
Iron	22	0	0.05 mg/L	0.08 mg/L	20 mg/L
Lead	22	15	0.005 mg/L	<0.005 mg/L	0.013 mg/L
Magnesium	22	0	0.10 mg/L	0.3 mg/L	76 mg/L
Mercury	22	19	0.0002 mg/L	<0.0002 mg/L	0.0003 mg/L
Selenium	22	21	0.002 mg/L	<0.002 mg/L	0.004 mg/L
Silver	22	22	0.005 - 0.01 mg/L	<0.005 mg/L	<0.01 mg/L
Zinc	22	1	0.02 mg/L	0.02 mg/L	0.24 mg/L
Ammonia-N	22	21	0.5 mg/L	<0.5 mg/L	6.0 mg/L
Nitrite + nitrate	22	20	1.0 + 0.05 mg/L	<1.0+<0.05 mg/L	4.0 mg/L

Annually, SNL/CA evaluates storm water pollution prevention practices at each drainage location as part of its monitoring activities. Environmental Monitoring staff located a chilled water overflow pipe outside a building that discharged to the ground. The pipe was rerouted to discharge to the sanitary sewer. In April 2005, staff also identified a discharge of non-contact closed loop cooling water to the storm drain. Inspection of the discharge found that the water was entering a covered storm drain that was incorrectly labeled as sanitary sewer. All outside drains in the area were tested to identify discharge location. All mislabeled, covered storm drains were relabeled with the stencil “No Dumping, Drains to Arroyo.”

During years of sufficient runoff, SNL/CA compares the analytical results from storm water entering the site to storm water exiting the site. In 2005, the total suspended solid concentration entering the site was uncharacteristically lower than the storm water exiting the site. Zinc, aluminum, and iron concentrations were all lower entering the site than exiting the site. Specific conductance and manganese concentrations were characteristically higher entering the site than leaving site. While some of the constituent concentrations were higher leaving the site than entering the site, these concentrations are not considered elevated.

5.2 Wastewater

Wastewater effluent generated at SNL/CA consists of sanitary and laboratory discharges. Sanitary effluent is discharged directly to the sewer system. Sewer discharges exit the site through a sewer outfall located at the northern boundary, and join with the Lawrence Livermore National Laboratory (LLNL) sewer system. Laboratory discharges are generated from general research activities, and from operations that qualify as categorical processes subject to Federal pretreatment standards. Laboratory effluent from most laboratory areas is diverted to liquid effluent control system (LECS) holding tanks prior to discharge to the sanitary sewer. SNL/CA monitors wastewater at the sewer outfall, LECS tanks, and at categorical process point sources.

5.2.1 Sewer Outfall

SNL/CA operates a sewer outfall and monitoring station at the northern site boundary to continuously monitor wastewater for flow and pH. Samples are also collected at the outfall to monitor compliance with wastewater discharge limits established in the site's *Wastewater Discharge Permit*. The outfall sampling schedule and analytical parameters are presented in Table 5-2. Consistent with permit requirements, SNL/CA does not analyze wastewater samples collected at the sewer outfall for radioactive constituents.

Table 5-2 Sewer Outfall Sampling Schedule, 2005

Frequency	Sample Type	Analytical Parameter
Daily	Composite	Archive sample; analyzed only when weekly composite sample shows concentration greater than or equal to 50% of discharge limit for metals.
Weekly	Composite	Metals
Monthly	Composite	Total dissolved solids
		Total suspended solids
		Biochemical oxygen demand
		Chemical oxygen demand[a]
Monthly	Grab	Cyanide
		EPA priority organic pollutants

[a] Chemical oxygen demand analyses are not required by the Wastewater Discharge Permit.

A summary of analytical results for physical parameters and metals from the SNL/CA sanitary sewer outfall is presented in Table 5-3. In 2005, all liquid effluent from the outfall complied with the site outfall discharge limits for regulated physical parameters and metals.

Table 5-3 Weekly Composite Sewer Outfall Monitoring Results – Physical Parameters and Metals, 2005

Parameter	Number of Samples Analyzed	Quantity Found Below Detection Limit	Detection Limit	Sewer Discharge Limit	Minimum Concentration	Maximum Concentration
Total suspended solids	12	0	5 mg/L	None	370 mg/L	2300 mg/L
Total dissolved solids	12	0	5 mg/L	None	170 mg/L	230 mg/L
Biochemical oxygen demand	12	0	5 mg/L	None	520 mg/L	1300 mg/L
Chemical oxygen demand[a]	12	0	5 mg/L	None	340 mg/L	2500 mg/L
Cyanide	12	12	0.01 mg/L	0.04 mg/L	<0.01 mg/L	<0.01 mg/L
Arsenic	52	47	0.005 mg/L	0.06 mg/L	<0.005 mg/L	0.007 mg/L
Cadmium	52	52	0.005 mg/L	0.14 mg/L	<0.005 mg/L	<0.005 mg/L
Chromium	52	43	0.01 mg/L	0.62 mg/L	<0.01 mg/L	0.03 mg/L
Copper	52	0	0.01 mg/L	1 mg/L	0.07 mg/L	0.77 mg/L
Lead	52	52	0.05 mg/L	0.2 mg/L	<0.05 mg/L	<0.05 mg/L
Mercury	52	43	0.0005 mg/L	0.01 mg/L	<0.0005 mg/L	0.0065 mg/L
Nickel	52	51	0.02 mg/L	0.61 mg/L	<0.02 mg/L	0.04 mg/L
Silver	52	40	0.01 mg/L	0.2 mg/L	<0.01 mg/L	0.03 mg/L
Zinc	52	0	0.02 mg/L	3 mg/L	0.15 mg/L	1.5 mg/L

[a] Chemical oxygen demand analyses are not required by the Wastewater Discharge Permit.

Sewer outfall samples are also analyzed for priority pollutants that are listed by the U.S. Environmental Protection Agency (EPA) as toxic organics. Because the list is lengthy, SNL/CA routinely reports only positively identified organic constituents. In 2005, sewer outfall samples showed concentrations of acetone (28 – 960 µg/L) and chloroform (6.5 – 12 µg/L). All other constituents on the EPA toxic organic list were below minimum detection limits. The toxic organic discharge limit for the site is 1000 µg/L. In 2005, SNL/CA did not exceed this discharge limit.

5.2.2 Liquid Effluent Control System

Effluent from major laboratory facilities is diverted to LECS holding tanks where wastewater can be sampled and analyzed prior to release to the sewer system. SNL/CA operates six LECS. Wastewater from LECS tanks is typically analyzed for metals. Analyses for other parameters associated with the process generating the wastewater may also be done. Five of the LECS tanks are also continuously monitored for pH. One LECS tank is monitored every few years for tritium and uranium; however, in 2005, analyses for radioactive constituents were not warranted.

Wastewater that does not meet the discharge limits at the sewer outfall is transferred to Waste Management for disposal. Depending on the constituents of the wastewater, it may be disposed as hazardous or non-hazardous waste. In 2005, SNL/CA disposed of one tank of

non-hazardous wastewater through Sandia's Waste Management Program due to elevated levels of zinc.

5.2.3 Categorical Processes

Four research operations at SNL/CA are defined as Federal categorical processes subject to the Environmental Protection Agency's pretreatment standards for point sources (40 CFR Part 403, 40 CFR Part 433). These categorical processes include three metal finishing operations and a semiconductor manufacturing operation.[6] Wastewater from two of these processes is sampled semiannually. Two of the metal finishing operations are closed-loop systems that do not discharge effluent to the sanitary sewer, and, therefore, wastewater monitoring is not required.

Table 5-4 Batch Discharges and Monitoring for Metal Finishing Categorical Process, 2005

Parameter	Number of Samples Analyzed	Number Found Below Detection Limit	Detection Limit	Minimum Concentration	Maximum Concentration	Permit Limit[a]
pH	16	--	None	6.5	7.3	5 – 10[b]
Arsenic[c]	16	12	0.005 mg/L	<0.005 mg/L	0.02 mg/L	None
Cadmium	16	16	0.005 mg/L	<0.005 mg/L	<0.005 mg/L	0.26 mg/L
Chromium	16	8	0.01 mg/L	<0.01 mg/L	0.38 mg/L	1.71 mg/L
Copper	16	0	0.01 mg/L	0.08 mg/L	0.49 mg/L	2.07 mg/L
Lead	16	5	0.05 mg/L	<0.05 mg/L	0.37 mg/L[d]	0.43 mg/L
Mercury[c]	16	16	0.0005 mg/L	<0.0005 mg/L	<0.0005 mg/L	None
Nickel	16	11	0.02 mg/L	<0.02 mg/L	0.21 mg/L	2.38 mg/L
Silver	16	15	0.01 mg/L	<0.01mg/L	<0.01 mg/L	0.24 mg/L
Zinc	16	12	0.02 mg/L	<0.02 mg/L	0.24 mg/L	1.48 mg/L
Cyanide	2	2	0.02 mg/L	<0.01 mg/L	<0.01 mg/L	0.65 mg/L
Total toxic organics	2	--	Range[e]	0.021mg/L	3.08 mg/L[f]	2.13 mg/L[g]

[a] Monthly average.
[b] Permit limit for site outfall.
[c] Analyses for arsenic and mercury are not required. Results are reported for informational purposes only.
[d] This wastewater batch was processed further to reduce metal concentrations to acceptable limits before discharge to the sanitary sewer. Result reflects maximum concentration before reprocessing.
[e] Detection limits for the various organics included in this value range from 0.005 to 0.130 mg/L.
[f] This value from SNL/CA's contract laboratory is based on nondetectable sample results at higher detection limits used in the summation. Calculating the TTO value from detectable samples only yields a result of 0.016 mg/L. A split sample, collected by the City of Livermore and analyzed at a separate contract laboratory yielded a TTO value of 0.21 mg/L. The TTO value calculated from SNL/CA's results that is greater than the permit limit should not be considered out of compliance because the City's split sample was below the limit, the higher TTO value can be attributed to higher detection limits of nondetectable samples and not higher TTO constituent concentrations, and the TTO concentration based on the 40 CFR 433.11(e) definition is below the permit limit.
[g] The limit for total toxic organics is a daily maximum concentration.

[6] The semiconductor manufacturing operation is a research and development activity exempt from local air pollution regulations.

Samples collected from the metal finishing operation are analyzed for pH, arsenic, metals, and toxic organic pollutants. Table 5-4 presents a summary of semiannual monitoring results for the metal finishing operation. In 2005, two samples contained concentrations of metals (lead) close to the permit limit. Wastewater batches from which these samples were collected were re-processed to reduce metal concentrations before discharge to the sanitary sewer. One sample was analyzed for total toxic organics (TTO) constituents. The TTO result was above the permit limit based on a summation of nondetectable sample results at higher detection limits than typically reported. However, calculating the TTO value from detectable samples yields a result of 0.016 mg/L, which is below the permit limit. A split sample, collected and analyzed by the City of Livermore yielded a TTO value of 0.21 mg/L, again below the permit limit. The initial TTO value calculated by SNL/CA is attributed to higher detection limits of nondetectable samples and not higher TTO constituent concentrations. The calculations from the City of Livermore analyses support this conclusion. Additionally, the TTO concentration based on the 40 CFR 433.11(e) definition (summation of detectable constituents only) is below the permit limit.

Samples collected from the semiconductor manufacturing operation are analyzed for pH, arsenic, and toxic organic pollutants. Table 5-5 presents a summary of semiannual monitoring results for the semiconductor manufacturing operation. In 2005, all wastewater from this operation met the pretreatment standards.

Table 5-5 Monitoring for Semiconductor Manufacturing Categorical Process, 2005

Parameter	Number of Samples Analyzed	Number Found Below Detection Limit	Detection Limit	Minimum Concentration	Maximum Concentration	Permit Limit (daily max)
pH	2	--	None	6.3	7.7	5-10
Arsenic	2	2	0.005 and 0.2 mg/L	<0.005 mg/L	<0.2 mg/L	2.09 mg/L
Total toxic organics	2	--	Range[a]	0.10 mg/L[b]	0.21 mg/L	1.37 mg/L

[a] Detection limits for the various organics included in this value range from 0.005 to 0.130 mg/L.
b A split sample collected by the City of Livermore and analyzed at a separate contract laboratory effectively yielded a TTO value of 0 mg/L because there were no detectable results and all nondetectable samples were below 20 ug/L.

5.3 Groundwater

SNL/CA has eight groundwater monitoring wells. Sandia monitors groundwater at three former restoration areas and along Arroyo Seco. Four groundwater monitoring wells are used to monitor residual contamination at former restoration areas under a 1989 site clean-up order issued by the Regional Water Quality Control Board, San Francisco Bay Region (RWQCB). Two of these wells are located at the Fuel Oil Spill site, and one each at the Trudell Auto Repair Shop site and the Navy Landfill. In 2005, the RWQCB allowed SNL/CA to discontinue monitoring the well at the Trudell Auto Repair Shop site. LLNL continues to monitor this groundwater well and at the RWQCB's request, SNL/CA will report these sample results in future reports. The RWQCB also, in 2005, allowed SNL/CA to decrease the sampling frequency of the Navy Landfill monitoring well from quarterly to

annually. Four monitoring wells are located along Arroyo Seco to monitor the effect of site operations on groundwater quality. Well AS-4 is located upgradient of the developed area of the site and provides background data about local groundwater quality. Groundwater monitoring well locations are shown on Figure 5-2. Table 5-6 provides the sampling schedule for each well location.

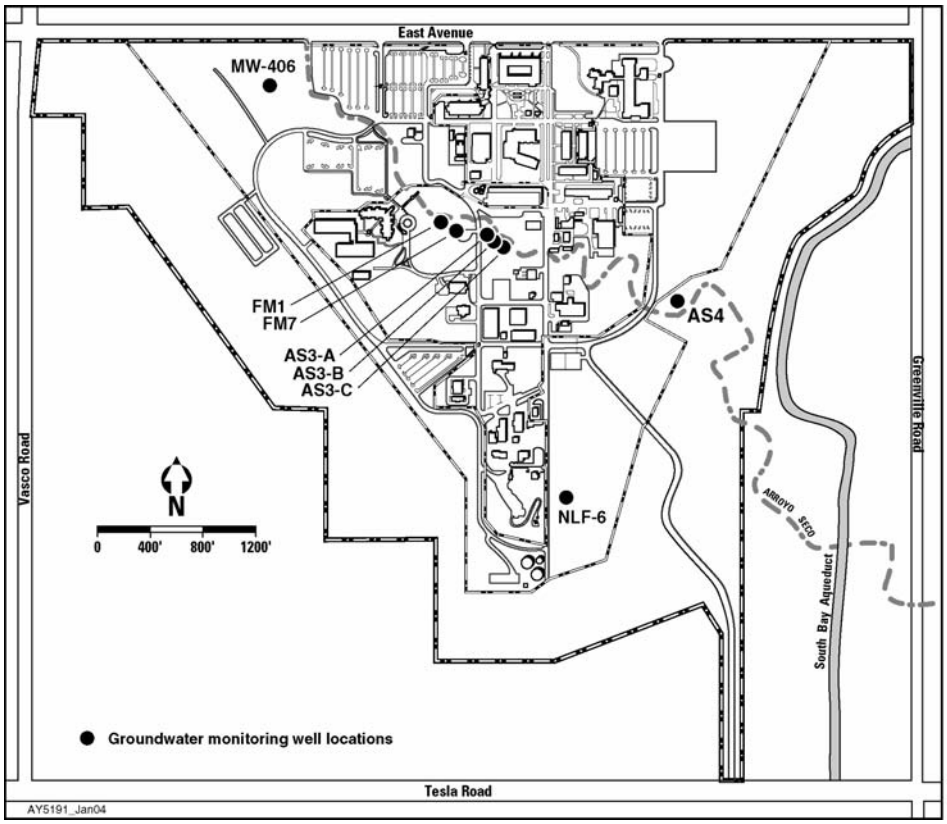

Figure 5-2 Groundwater Monitoring Well Locations

Table 5-6 Groundwater Sampling Schedule, 2005

Well location	Sampling frequency	Analytical parameter
Fuel Oil Spill site (Wells FM-1, FM-7)	Semi-annually	Total petroleum hydrocarbons diesel-methane (TPHD) (8015); water elevation
Trudell Auto Repair Shop site (Well MW-406)	Annually[a]	Volatile halogenated organics (EPA 601); water elevation
Navy Landfill (Well NLF-6)	Annually	Volatile halogenated organics (EPA 601); water elevation
Arroyo Seco (Wells AS-3A, AS-3B, AS-3C, and AS-4)	Annually	Metals, volatile halogenated organics (EPA 601), total petroleum hydrocarbons-diesel (8015), tritium, water elevation
Arroyo Seco (Wells AS-3A, AS-3B, AS-3C, and AS-4)	Every two years	General minerals

[a] SNL/CA will discontinue sampling at MW-406 in 2006. LLNL will continue sampling and the results will be reported in future reports.

Table 5-7 presents a summary of groundwater analytical results for the Navy Landfill and Trudell site. Groundwater analytical results for Arroyo Seco wells are summarized in Tables 5-8 and 5-9. All wells at the Fuel Oil Spill site were dry during 2005; consequently, no samples were collected. Complete groundwater analytical results are provided in Chapter 9. As a point of reference, analytical results are compared to federal and state maximum contaminant levels (MCLs), which are applicable for drinking water sources. There are no wells at SNL/CA used as a source for drinking water and MCLs are not standards applied to groundwater at the site.

Table 5-7 Summary of Groundwater Analyses at Navy Landfill and Trudell Wells, 2005

	Date	Trichloromethane[a] (chloroform) µg/L	Carbon Tetrachloride[a] µg/L	Tetrachloroethene[a] (PCE) µg/L
Detection limit		0.5	0.5	0.5
MCL – California			0.5	5
MCL – Federal		100	5	5
Navy Landfill				
NLF-6	3/14/05	<0.5	<0.5	<0.5
NLF-6	6/15/05[b]	<0.5	0.77	<0.5
NLF-6	12/13/05	<0.5	0.95	<0.5
Trudell				
MW-406	6/15/05	<0.5	<0.5	1.2

[a] All other EPA 601 parameters were non-detectable.
[b] The field duplicate sample also had a result of 0.77 ug/L carbon tetrachloride. The field blank associated with this sample had a chloroform result of 2.1 ug/L.
MCL – Maximum contaminant levels.

Table 5-8 2005 Summary of Groundwater Analyses at Arroyo Seco Wells, Metals

				CCR Metals[a]									
	Date	EPA 601	Diesel (8015) µg/L	Iron mg/L	Lead mg/L	Aluminum mg/L	Barium mg/L	Calcium mg/L	Potassium mg/L	Manganese mg/L	Zinc mg/L	Sodium mg/L	Copper mg/L
Detection limit			50	0.05	0.005	0.05	0.005	0.1	2	0.01	0.05	1	0.005
MCL - California					0.05	1	1						
MCL – Federal							2						
AS-3A	6/15/05	ND	<50	0.73	<0.005	0.53	0.11	77	3.0	0.02	<0.5	87	0.006
AS-3B	6/15/05	ND	<50	0.46	0.006	0.27	0.14	91	3.0	0.02	<0.05	94	0.009
AS-3C	6/15/05	ND	<50	0.07	0.005	<0.05	0.1	46	2.0	<0.01	<0.05	93	0.009
AS-4	6/15/05	ND	<50	0.58	<0.005	0.41	0.079	120	4.0	0.02	0.08	230	0.006

[a] All other California Code of Regulations (CCR) parameters were non-detectable.
MCL – Maximum contaminant levels.
ND – Non-detectable.

As in past years, SNL/CA continued to detect carbon tetrachloride at the Navy Landfill well (NLF-6) in 2005. Carbon tetrachloride was detected in two samples during 2005. The concentration was above the state MCL of 0.5 µg/L, but below the federal MCL of 5.0 µg/L. The result is similar to that detected in past years. The tetrachloroethene (PCE) contamination found at MW-406 is similar to that found in the past. This contamination is from prior operations at LLNL and part of an ongoing LLNL remediation program.

Table 5-9 2005 Summary of Groundwater Analyses at Arroyo Seco Wells, Minerals

		CCR General Minerals[a]											
	Date	Alkalinity mg/L	Carbonate mg/L	Bicarbonate mg/L	Chloride mg/L	Specific Conductivity mg/L	Fluoride mg/L	Hardness mg/L	Magnesium mg/L	Sulfate mg/L	Total Dissolved Solids mg/L	MBAS mg/L	Nitrate mg/L
Detection limit			1.0		3.0	1.0	0.3	1.0	0.1	6.0	5.0	0.05	2
AS-3A	6/15/05	230	<1.0	230	110	910	0.2	350	35	140	640	0.1	13
AS-3B	6/15/05	260	<1.0	260	140	1000	0.3	450	48	180	780	0.12	18
AS-3C	6/15/05	150	4.0	140	71	780	0.3	230	25	160	540	<0.05	26
AS-4	6/15/05	460	<1.0	460	250	1700	0.5	540	65	260	1200	0.18	<2.0

[a] All other California Code of Regulations (CCR) parameters were non-detectable.

5.4 Biological Dose Assessment

To meet the requirements of DOE Order 450.1 and 5400.5, SNL/CA conducts a biological dose assessment each year using the graded approach presented in *DOE Standard 1153-2002 A Graded Approach for Evaluating Doses to Aquatic and Terrestrial Biota.* The technical standard includes models for calculating doses from radionuclide concentration data obtained from sediment and water analyses. In 2005, the RAD-BCG Calculator, a computer tool

developed by DOE, was used to calculate doses and determine the need for and level of monitoring required.

The first step in the graded approach is a general screening that compares concentrations of radionuclides in environmental media with derived concentration guides. The ratios of the concentrations to the concentration guides are then summed. If the total equals or exceeds one, then additional analyses are required.

The radionuclides handled in greatest quantity at SNL/CA during past or present operations are tritium and depleted uranium. For 2005, tritium data in storm water runoff at SNL/CA was used in the RAD-BCG Calculator.[7] The sum of fractions from storm water data totaled 5.8×10^{-6}. This small fraction indicates that further analysis is not required and that SNL/CA is not required to monitor aquatic or terrestrial biota.

5.5 Radiation Monitoring

SNL/CA monitors gamma radiation to ensure that site operations are not contributing significantly to the ambient radiation dose in the surrounding environment. Onsite sources that could contribute to gamma radiation include small, unsealed radioactive isotopes, sealed sources, and several radiation generating devices. SNL/CA maintains four onsite monitoring stations equipped with thermoluminescent dosimeters. Monitoring stations are shown on Figure 5-3. The dosimeters are collected and evaluated quarterly. The data obtained from Sandia monitoring stations is combined with that from LLNL monitoring stations located around the perimeter of the Sandia site to determine the average annual gamma radiation dose at the site perimeter. The combined dose is then compared to the average annual gamma radiation dose at more distant locations in the Livermore Valley, shown on Figure 5-4. If site operations were contributing significantly to the gamma radiation dose, the dosimeters at the site perimeter would show a higher dose than those at more distant locations.

In 2005, the average annual perimeter dose was 61.8 mrem (0.62 mSv). The average annual dose measurement for distant locations was 56.3 mrem (0.56 mSv). The 2005 data for both perimeter and distant locations are within the range measured over the last fourteen years. Since 1992, the average annual dose at the SNL/CA perimeter ranged from 54.3 mrem to 68 mrem. Over this same period, the average annual dose measured at distant locations ranged from 53.4 mrem to 73 mrem.

Normal fluctuations and natural variations in ambient radiation are most likely the difference between the perimeter and distant location measurements for 2005. SNL/CA does not appear to be a significant contributor to gamma radiation dose in the surrounding environment.

[7] In 2002, the first time that the RAD-BCG Calculator was used, sediment data collected by LLNL within Arroyo Seco was also used to calculate doses and determine the need for monitoring. LLNL did not analyze sediments from Arroyo Seco in 2005. SNL/CA is also not required to analyze sediments for radionuclides.

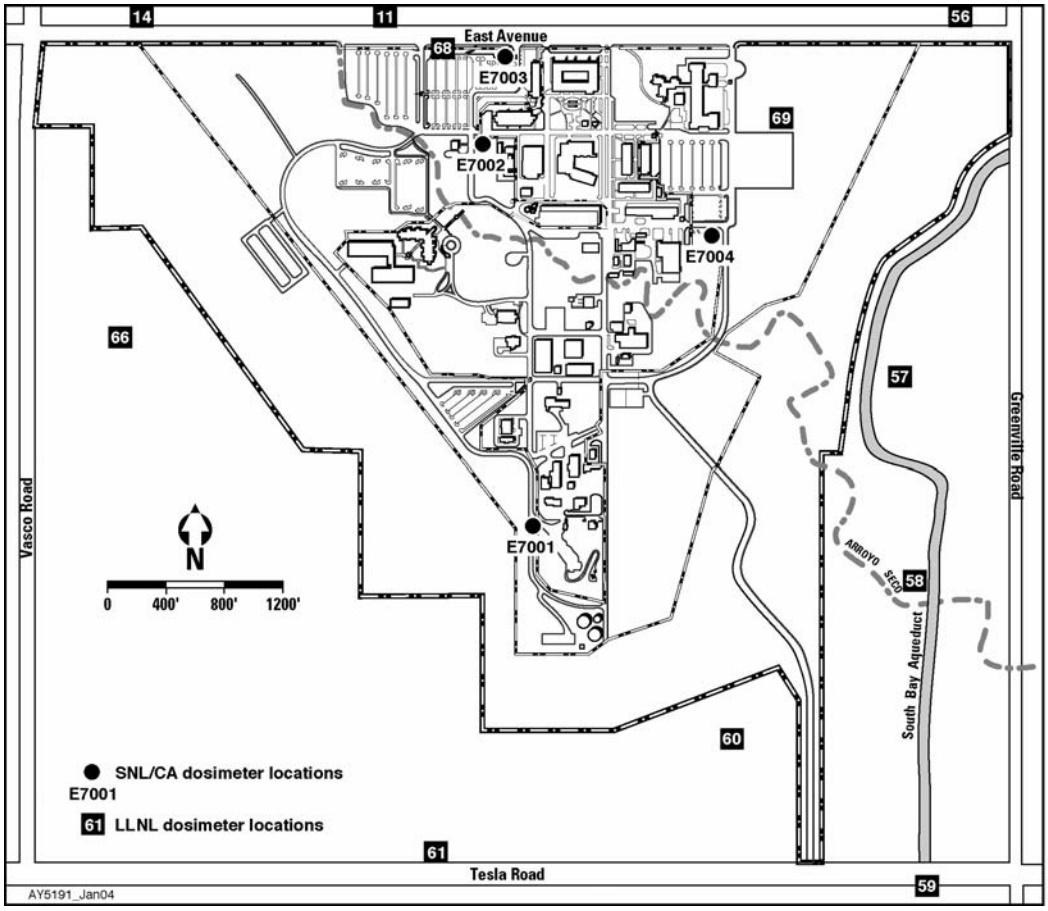

Figure 5-3 Dosimeter Locations at SNL/CA and Around Site Perimeter

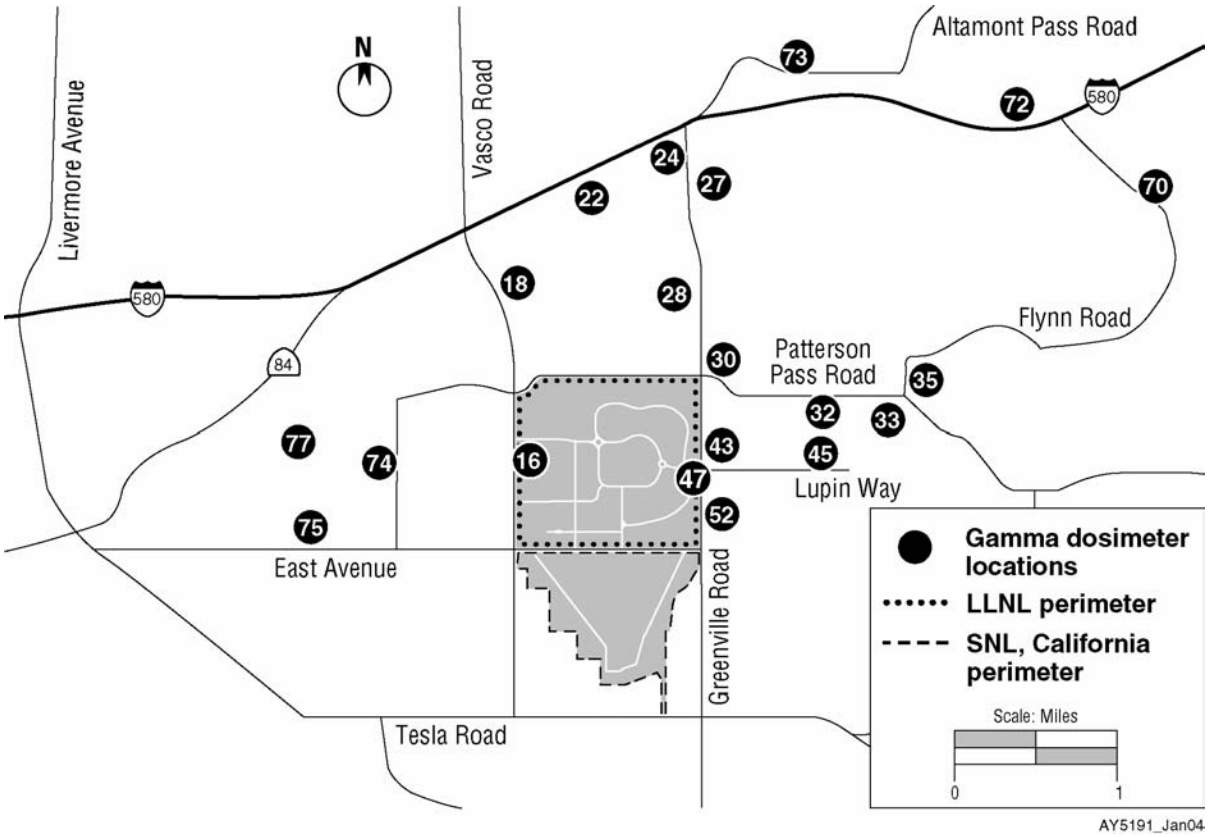

Figure 5-4 Dosimeter Locations in Livermore Valley

Page Intentionally Left Blank

6 Quality Assurance

The Sandia Corporate Quality Assurance Program, defined in CPR001.3.2 (SNL 2005a) is implemented at Sandia National Laboratories, California (SNL/CA) through the Sandia National Laboratories Division 8000, Quality Management Manual (SNL/CA 2005c). Compliance with the Quality Management Manual satisfies the requirements established in the Department of Energy (DOE) Nuclear Safety Management Regulations, Subpart A, Quality Assurance Requirements (10 CFR 830), and *DOE Order 414.1C, Quality Assurance* (DOE 2005b). Quality assurance requirements are incorporated into all site operations, including the Environmental Monitoring and Restoration Program.

DOE Order 414.1C identifies ten criteria that are integral to a quality program:

- Quality assurance program
- Personnel training and qualification
- Quality improvement process
- Documents and records
- Established work processes
- Established standards for design and verification
- Established procurement requirements
- Inspection and acceptance testing
- Management assessment
- Independent assessment

6.1 Program Quality Assurance

The Environmental Monitoring and Restoration Program ensures quality in its activities through implementation of quality assurance plans and procedures. A program-specific quality assurance project plan (QAPP) addresses each of the ten criteria listed above, and documents quality assurance activities performed for the program (SNL/CA 2005d). The SNL/CA Environmental Monitoring Annual Program Report provides a detailed description of the monitoring and surveillance activities conducted at SNL/CA (SNL/CA 2005b). Additional program operating procedures specify training requirements, establish work processes, define data verification and validation processes, and identify reporting and records management requirements. The operating procedures are reviewed by subject matter experts and approved by the Environmental Management Department Manager.

6.2 Environmental Sampling

Protocols for environmental sampling at SNL/CA are contained in activity specific operating procedures. Elements of these protocols include appropriate sampling methods and equipment; sampling frequency; sampling locations; and sample handling, storage, and packaging. Implementation of established protocols ensures that samples are representative of the environmental medium monitored and that monitoring requirements outlined in permits, DOE orders, and regulations are met. Chain-of-custody protocols are also used to ensure quality control through proper transfer of samples from the point of collection to the analytical laboratory.

6.3 Sample Analyses

Analyses of samples collected at SNL/CA are performed using one of three avenues, depending on the sample medium or constituent analyzed. The three avenues are: a State accredited laboratory; the SNL/CA Health Protection Laboratory; or the Sandia National Laboratories, New Mexico (SNL/NM) Health Instrumentation Laboratory.

6.3.1 Accredited Laboratory

A State of California accredited laboratory performs analyses of non-radiological samples collected at SNL/CA. To receive accreditation, a laboratory must implement a quality assurance plan. These laboratories are periodically inspected by the California Environmental Protection Agency to ensure that they are operating within regulatory and quality assurance requirements. Consistent with industry standards, non-radiological samples are processed according to Federal Environmental Protection Agency methods.

6.3.2 SNL/CA Health Physics Laboratory

Tritium analyses of storm water are performed by the SNL/CA Health Protection Department in an onsite laboratory. These samples are analyzed by liquid scintillation counting, a standard technique for tritium analysis. The Health Physics Laboratory follows the guidance in the Sandia National Laboratories (SNL) Radiation Protection Department Quality Assurance Plan (SNL 2005b), and meets the Sandia and DOE quality criteria.

6.3.3 SNL/NM Health Instrumentation Laboratory

Thermoluminescent dosimeters used to collect gamma radiation measurements are processed by the Health Instrumentation Department at SNL/NM following established protocols and quality assurance/quality control requirements under the SNL Radiation Protection Department Quality Plan (SNL 2005b). Automated equipment is used to process the samples and analyze the resulting data.

6.4 Data Verification and Validation

SNL/CA conducts data verification and validation to ensure that environmental data is precise, accurate, representative, comparable, and complete. Verification and validation are accomplished through analyses of quality control samples and by conducting statistical analyses.

6.4.1 Quality Control Samples

Types of quality control samples prepared for the Environmental Monitoring and Restoration Program include duplicate, spiked, and blank samples. A definition of each sample type follows.

- *Duplicate samples* are collected at the same time and location, and follow the same method, as a routine sample. These samples are used to assess the precision of sample collection and analytical processes.
- *Spiked samples* resemble a routine sample, but contain a known amount of one or more of the constituents of interest. These samples are obtained from an independent laboratory that certifies the concentration of the constituents.
- *Blank samples* resemble a routine sample matrix (e.g. deionized water is used for blank water samples), but lack the constituents of interest. These samples are used to assess background levels of constituents, and possible contamination of the samples in the laboratory or in the field.

SNL/CA's goal for number of quality control samples is 20 percent of the total sample load, where feasible. This includes quality control samples initiated at the laboratory. In 2005, SNL/CA collected twelve wastewater quality control samples representing 23 percent of the sample load. One groundwater quality control sample was collected representing fourteen percent of the sample load. Four storm water quality control samples were collected during the 2004/2005 wet season, representing 20 percent of the sample load.

6.4.2 Statistical Analyses

Statistical analyses are used to determine completeness, precision, and accuracy of monitoring and surveillance data. Prior to performing statistical analyses, the data is normalized to ensure that valid results are obtained. Descriptions of the statistical tests follow.

Completeness is evaluated by determining the ratio between the number of samples collected and the number of samples scheduled for collection. The data quality objective for completeness is 85 percent.

Precision is evaluated using three methods: determining the ratio between routine and duplicate samples; tests of significant difference; and calculating the 95 percent confidence interval. Data quality objectives vary for precision depending on the results of laboratory analyses.

Accuracy is also evaluated using three methods: determining the ratio between sample results and known values of spiked samples; tests of significant difference; and calculating the 95 percent confidence interval. Data quality objectives vary for accuracy depending on the results of laboratory analyses.

Table 6.1 summarizes the results of statistical analyses conducted in 2005. The results show that all precision tests passed. The accuracy tests that failed represent a failure of SNL/CA's contracted analytical laboratory to achieve accuracy goals for cadmium, chromium, and silver contained in a spiked sample. The contract laboratory was unable to identify a cause for the failure. Future samples showing detectable levels of metals will be re-analyzed to confirm the concentration. The failed completeness tests for groundwater were due to falling groundwater levels and not to a failure of the sampling program.

Table 6-1 Summary of Statistical Analyses, 2005

Sample Medium	Completeness Test	Precision Test		Accuracy Test	
	Results	# of Tests	Results	# of Tests	Results
Wastewater (sanitary sewer)	100%	6	All passed	9	67% passed
Storm water	100%	8	All passed	None	
Groundwater	80%[a]	1	All passed	None	

[a] The low percentage of samples collected was due to several wells being dry as a result of a drop in groundwater levels, not a failure of the sampling system. A nonconformance report was not required.

7 References

22 California Code of Regulations (CCR), Division 4.5, Environmental Health Standard for Management of Hazardous Waste.

10 Code of Federal Regulations (CFR) Part 830, Department of Energy, Nuclear Safety Management, Subpart A, Quality Assurance Requirements, Federal Register Vol. 66, Number 7, January 10, 2001.

10 CFR Part 1021, Department of Energy, National Environmental Policy Act Implementing Procedures, January 1997.

40 CFR Part 61, Environmental Protection Agency, National Emissions Standards for Hazardous Air Pollutants, Subpart H – National Emissions Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities, December 1989.

40 CFR Part 70, Environmental Protection Agency, State Operating Permit Programs, July 1, 2005.

40 CFR Part 82, Environmental Protection Agency, Protection of Stratospheric Ozone, July 1, 2004.

40 CFR Part 262.41, Environmental Protection Agency, Standards Applicable to Generators of Hazardous Waste, Subpart D, Record-keeping and Reporting, July 1, 2001.

40 CFR Part 403, Environmental Protection Agency, General Pretreatment Regulations for Existing and New Sources of Pollution.

40 CFR Part 433, Environmental Protection Agency, Metal Finishing Point Source Category.

7 United States Code (USC) §136, Federal Insecticide, Fungicide, and Rodenticide Act, 1972.

15 USC §2601 et. seq., Toxic Substances Control Act of 1976.

16 USC § 470, National Historic Preservation Act of 1966.

16 USC § 703 et. seq., Migratory Bird Treaty Act of 1918.

16 USC §1531 et. seq., Endangered Species Act of 1973.

33 USC §1251, Clean Water Act of 1977.

42 USC § 2011 et. seq., Atomic Energy Act of 1954.

42 USC § 6901 et. seq., Resource Conservation and Recovery Act of 1976.

42 USC § 6961, Federal Facility Compliance Act of 1992.

42 USC § 7401, Clean Air Act Amendments of 1990.

42 USC § 9601, Comprehensive Environmental Response, Compensation, and Liability Act of 1980.

42 USC §11001 et. seq., Superfund Amendments and Reauthorization Act of 1986, Emergency Planning and Community Right-to-Know Act.

42 USC §13101 et. seq., Pollution Prevention Act of 1990.

Assembly Bill 2185, California Hazardous Materials Release Response Plans and Inventory Law, 1987.

California Health and Safety Code, Division 20, Chapter 6.5, § 25100 et. seq., Hazardous Waste Control Law.

California Health and Safety Code, Division 20, Chapter 6.7, §§ 25280-25299.8, Underground Storage of Hazardous Substances.

California Health and Safety Code, Division 20, Chapter 6.95, § 25500, et. Seq., Hazardous Materials Release Response Plans and Inventory.

California Health and Safety Code, Division 104, Part 14, §§ 117600-118360, Medical Waste Management Act.

California Regional Water Quality Control Board, San Francisco Bay Region (California RWQCB) 1989, Order No. 89-184, Revision of Site Cleanup Order, Sandia Corporation and U.S. Department of Energy, Livermore, December 1989.

California Water Resources Control Board 1997, State of California, NPDES General Permit for Storm Water Discharge Associated with Industrial Activities, April 1997.

California Water Resources Control Board 1999, State of California, NPDES General Permit for Storm Water Discharge Associated with Construction Activity, August 1999.

Department of Energy (DOE) 1986, Comprehensive Environmental Assessment and Response Program, Phase I: Installation Assessment, Sandia National Laboratories, Livermore, September, 1986.

DOE 1993, DOE Order 5400.5, change 2, Radiation Protection of the Public and the Environment, January 7, 1993.

DOE 2001, DOE Order 435.1, change 1, Radioactive Waste Management, August 28, 2001.

DOE 2002, Biological Assessment for Continued Operation of Sandia National Laboratories, California, July 15, 2002.

DOE 2003a, Final Site-wide Environmental Assessment of the Sandia National Laboratories/California, DOE/EA-1422, January 2003.

DOE 2003b, Site Wide Environmental Assessment for SNL/CA, Finding of No Significant Impact, March 20, 2003.

DOE 2004a, DOE Order 231.1A, change 1, Environment, Safety, and Health Reporting, June 3, 2004.

DOE 2004b, DOE G 450.1-3, Environmental Guidelines for Development of Cultural Resource Management Plans – Update, September 22, 2004.

DOE 2005a, DOE order 450.1, change 1, Environmental Protection Program, January 24, 2005.

DOE 2005b, DOE Order 414.1C, Quality Assurance, June 17, 2005.

Executive Order (EO) 11988, Floodplain Management, Federal Register, Vol. 42, pp. 26951, May 25, 1977.

EO 11990, Protection of Wetlands, Federal Register, Vol. 42, pp. 26961, May 25, 1977.

EO 13101, Greening the Government Through Waste Prevention, Recycling, and Federal Acquisition, September 14, 1998.

EO 13148, Greening of the Government Through Leadership in Environmental Management, April 21, 2000.

House of Representatives H.R. 6 Conference Report 2005 (HR 2005), Energy Policy Act of 2005, August 8, 2005.

Matthews, Graham & Associates (Matthews) 2002, Management Plan for Arroyo Seco at Sandia National Labs, Livermore, CA, April 2002.

Sandia National Laboratories (SNL) 1997, Environment, Health, and Safety Manual (MN 471001), Section 6S – Toxic Substances Control Act (TSCA), December 3, 1997.

SNL 2002, Historic Building Survey, Sandia National Laboratories/California, October 30, 2002.

SNL 2005a, Corporate Quality Assurance Program, Corporate Process Requirements No. CPR001.3.2, **http://www-irn.sandia.gov/policy/leadership/quality.html**, June 17, 2005.

SNL 2005b, Radiation Protection Department Quality Assurance Plan, RPA-01-01, October 10, 2005.

SNL California (SNL/CA) 2002, Sandia National Laboratories, California Environmental Information Document, SAND 2002-8053, March 2002.

SNL/CA 2004a, Operating Procedure 471741, Storm Drain Spill Prevention and Control, Issue C, July 15, 2004.

SNL/CA 2004b, Standard Operating Procedure SP471911, Handling and Storage of Pesticides, May 10, 2004.

SNL/CA 2005a, Administrative Procedure for Conducting National Environmental Policy Act Reviews of Proposed Projects at Sandia National Laboratories, California, OP471343, Issue I, April 30, 2005.

SNL/CA 2005b, Sandia National Laboratories, California Environmental Monitoring Annual Program Report for 2005, SAND 2005-4232, June 1, 2005.

SNL/CA 2005c, Sandia National Laboratories Division 8000 Quality Management Manual, https://wfsprod01.sandia.gov/groups/srn-uscitizens/documents/document/wfs276273.pdf, July 12, 2005.

SNL/CA 2005d, Quality Assurance Project Plan for Environmental Monitoring Program, SAND 2005-6051, September 20, 2005.

SNL/CA 2005e, 2005 Annual Report on Waste Generation and Pollution Prevention Progress (as required by DOE Order 450.1, Section 5 a (2)(b), December 15, 2005.

Senate Bill 14, California Hazardous Waste Source Reduction and Management Review Act of 1989.

United States District Court for the District of Columbia (US District Court) 2002, Case Number 01-1291 (RJL), Home Builders Associations of Northern California, et al., Plaintiffs, and El Dorado County, California, Intervenor-Plaintiff, v. Gale A. Norton, Secretary of the Department of Interior, et. al., Defendants, and Jumping Frog Research Institute, et al., Intervenor-Defendants, November 6, 2002.

United States Fish and Wildlife Service (USFWS) 2004a, Proposed Rule, Endangered and Threatened Wildlife and Plants; Proposed Designation of Critical habitat for the California Red-legged Frog (*Rana aurora draytonii)*, Federal Register, April 13, 2004 (Volume 69, Number 71).

USFWS 2004b, Final Rule, Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the California Tiger Salamander, and Special Rule Exemption for Existing Routine Ranching Activities, Federal Register, August 4, 2004 (Volume 69, Number 149).

USFWS 2005, Proposed Rule, Endangered and Threatened Wildlife and Plants: Revised Proposed Designation of Critical Habitat for the California Red-Legged Frog (*Rana aurora draytonii*), Federal Register, November 3, 2005 (Volume 70, Number 212).

Western Regional Climate Center (WRCC) 2006, Livermore rainfall data, **www.wrcc.dri.edu/cgi-bin/cliGCStP.pl?calive**, March 14, 2006.

Page Intentionally Left Blank

8 Glossary

Ambient air	The surrounding atmosphere, usually the outside air, as it exists around people, plants, and structures. It does not include the air next to emission sources.
Biochemical oxygen demand	A measure of the amount of dissolved oxygen that microorganisms need to break down organic matter in water. Used as an indicator of water quality.
British thermal unit	BTU is the quantity of heat required to raise the temperature of one pound of water from 60^{o} to 61^{o} F at a constant pressure of one atmosphere.
Categorical process	An industrial process that discharges wastewater and is regulated under 40 CFR, Part 403.
Chemical oxygen demand	The amount of oxygen required to degrade the organic compounds of wastewater. Used to measure the overall level of organic contamination in wastewater.
Dose	A term denoting the quantity of radiation energy absorbed.
Dosimeter	A portable detection device for measuring the total accumulated exposure to ionizing radiation.
Effluent	A liquid or gaseous waste discharged to the environment.
Emission	A gaseous or liquid stream containing one or more contaminants.
Ephemeral stream	A stream that flows only for a short duration during and following rainfall.
External radiation	Radiation originating from a source outside the body.
Fluvial sediments	A sedimentary deposit consisting of material transported by, suspended in, or laid down by a river or stream.
Lacustrine sediments	Sediments formed in, or relating to, a lake.
Mixed waste	Waste that contains both radioactive and hazardous constituents.

pH	A measure of hydrogen ion concentration in an aqueous solution. Acidic solutions have a pH less than 7, basic solutions have a pH greater than 7, and neutral solutions have a pH of 7.
Riparian	Pertaining to, situated in, or adapted to living on the banks of rivers and streams.
Specific conductivity	Measure of the ability of a material to conduct electricity.
Strike-slip fault	A fault with horizontal movement along the break where slipping is parallel with the strike of the fault.
Thermoluminescent dosimeter	A type of dosimeter. After being exposed to radiation, the material in the dosimeter (lithium fluoride) luminesces upon being heated. The amount of light the material emits is proportional to the amount of radiation (dose) to which it was exposed.
Total dissolved solids	Solids in water that pass through a filter. A measure of the amount of material dissolved in water.
Total suspended solids	Solids in water that can be trapped in a filter. Solids can include silt, decaying plant and animal matter, industrial wastes, and sewage.
Transverse fault	A fault that strikes obliquely or perpendicular to the general structural trend of the region.

9 Groundwater Analytical Results and Well Completion Data

Table 9-1 Results of Quarterly Groundwater Analyses at SNL/CA, 2005

	Date	Dichlorodifluoromethane µg/L	Chloromethane µg/L	Vinyl Chloride µg/L	Bromomethane µg/L	Chloroethane µg/L	Trichlorofluoromethane µg/L	1,1-Dichloroethene µg/L	Methylene Chloride µg/L	Trans-1,2-Dichloroethene µg/L	1,1 Dichloroethane µg/L	Cis-1,2-Dichloroethene µg/L	Trichloromethane (chloroform) µg/L	1,1,1-Trichloroethane µg/L	Carbon Tetrachloride µg/L	1,2 Dichloroethane µg/L	Trichloroethene µg/L	1,2-Dichloropropane µg/L
Detection limit		2.0	0.5	1.0	1.0	0.5	0.5	0.5	2.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
MCL - California				0.5			150	6		10	5	6		200	0.5	0.5	5	5
MCL - Federal				2				7	5	100		70	100	200	5	5	5	5
Well ID																		
NLF-6	3/14/05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	6/15/05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.77	ND	ND	ND
	6/15/05(FD)[a]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.77	ND	ND	ND
	6/15/05(FB)[b]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.1	ND	ND	ND	ND	ND
	12/13/05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.95	ND	ND	ND
MW-406	6/15/05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-3A	6/15/05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-3B	6/15/05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-3C	6/15/05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FM-1[c]		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
FM-7[c]		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AS-4	6/15/05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trip Blank	3/14/05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trip Blank	6/1505	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trip Blank	12/13/05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

MCL – Maximum contaminant level.
ND – Non-detectable.
-- Not required to analyze or sample not collected.
[a] Field duplicate sample.
[b] Field blank sample.
[c] Well was dry during 2005.

Table 9-1 Results of Groundwater Analyses at SNL/CA, 2005 (continued)

Date	Bromodichloromethane µg/L	Cis-1,3-Dichloropropene µg/L	Trans-1,3-Dichloropropene µg/L	1,1,2-Trichloroethane µg/L	Tetrachloroethene µg/L	Dibromochloromethane µg/L	Chlorobenzene µg/L	Bromoform µg/L	1,1,2,2-Tetrachloroethane µg/L	1,3-Dichlorobenzene µg/L	1,4-Dichlorobenzene µg/L	1,2-Dichlorobenzene µg/L	Benzene µg/L	Toluene µg/L	Ethylbenzene µg/L	Xylenes µg/L	8015-Extractables µg/L	8015-Diesel (w/silica gel clean-up) µg/L
Detection limit	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	50	50
MCL - California		0.5		32	5		30		1		5		1			1750		
MCL - Federal	100			5	5	100	100	100		600	75	600	5	1000	700	10000		
Well ID																		
NLF-6	3/14/05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	--
	6/15/05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	--
	6/15/05(FD)[a]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	--
	6/15/05(FB)[b]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	--
	12/13/05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	--
MW-406	6/15/05	ND	ND	ND	ND	1.2	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	--
AS-3A	6/15/05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	ND
AS-3B	6/15/05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	ND
AS-3C	6/15/05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	ND
FM-1[c]		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
FM-7[c]		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AS-4	6/15/05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	ND
Trip Blank	3/14/05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	--
Trip Blank	6/15/05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	--
Trip Blank	12/13/05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	--

MCL – Maximum contaminant level.
ND – Non-detectable.
-- Not required to analyze or sample not collected.
[a] Field duplicate sample.
[b] Field blank sample.
[c] Well was dry during 2005.

Table 9-1 Results of Groundwater Analyses at SNL/CA, 2005 (continued)

	Date	pH (standard units)	Conductance umhos/cm	Antimony mg/L	Arsenic mg/L	Barium mg/L	Beryllium mg/L	Cadmium mg/L	Chromium mg/L	Cobalt mg/L	Copper mg/L	Lead mg/L	Mercury mg/L	Molybdenum mg/L	Nickel mg/L	Selenium mg/L	Silver mg/L	Thallium mg/L	Vanadium mg/L
Detection limit		None	1	0.006	0.002	0.005	0.004	0.005	0.05	0.05	0.005	0.005	0.002	0.01	0.01	0.05	0.01	0.002	0.01
MCL - California					0.05	1		0.01	0.05		1 [d]	0.05	0.002			0.01	0.05		
MCL - Federal			900[d]	0.006		2	0.004	0.005	0.1		1 [d]		0.002		0.1	0.05	0.1 [d]	0.002	
Well ID																			
NLF-6	3/14/05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6/15/05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6/15/05(FD)[a]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6/15/05(FB)[b]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	12/13/05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-406	6/15/05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AS-3A	6/15/05	7.9	910	ND	ND	0.11	ND	ND	ND	ND	0.006	ND	ND	ND	ND	ND	ND	ND	ND
AS-3B	6/15/05	8.0	1000	ND	ND	0.14	ND	ND	ND	ND	0.009	0.006	ND	ND	ND	ND	ND	ND	ND
AS-3C	6/15/05	8.4	780	ND	ND	0.10	ND	ND	ND	ND	0.009	0.005	ND	ND	ND	ND	ND	ND	ND
FM-1[c]		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
FM-7[c]		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AS-4	6/15/05	7.8	1700	ND	ND	0.079	ND	ND	ND	ND	0.006	ND	ND	ND	ND	ND	ND	ND	ND
Trip Blank	3/14/05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trip Blank	6/15/05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trip Blank	12/13/05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

MCL – Maximum contaminant level.
ND – Non-detectable.
-- Not required to analyze or sample not collected.
[a] Field duplicate sample.
[b] Field blank sample.
[c] Well was dry during 2005.
[d] Secondary drinking water standard.

Table 9-1 Results of Groundwater Analyses at SNL/CA, 2005 (continued)

	Date	Zinc mg/L	Aluminum mg/L	Surfactants (MBAS) mg/L	Chloride mg/L	Nitrate (as Nitrogen) mg/L	Nitrate (as NO3) mg/L	Sulfate mg/L	Hydroxide Alkalinity mg/L	Carbonate mg/L	Bicarbonate mg/L	Iron mg/L	Total dissolved solids mg/L	Calcium mg/L	Potassium mg/L	Magnesium mg/L	Manganese mg/L	Sodium mg/L	Hardness mg/L	Tritium pCi/L
Detection limit		0.05	0.05	0.05	10	0.2	3	20	1	1	1	0.05	5	0.1	2	0.1	0.01	1	1	210
MCL - California		5[d]	1	0.5[d]	500[d]		45	500[d]				0.3[d]	1,000[d]			0.05[d]	0.05[d]			20000
MCL - Federal		5[d]	0.2[d]	0.5[d]	250[d]	10		250[d]				0.3[d]	500[d]			0.05[d]	0.05[d]			
Well ID																				
NLF-6	3/14/05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6/15/05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6/15/05(FD)[a]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6/15/05(FB)[b]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	12/13/05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-406	6/15/05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AS-3A	6/15/05	ND	0.53	0.10	110	2.9	13	140	ND	ND	230	0.73	640	82	3.0	35	0.02	87	350	240
AS-3B	6/15/05	ND	0.27	0.12	140	4.1	18	180	ND	ND	260	0.46	780	100	3.0	48	0.02	94	450	510
AS-3C	6/15/05	ND	ND	ND	71	5.9	26	160	ND	4.0	140	ND	540	50	2.0	25	ND	93	230	60[e]
FM-1[c]		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
FM-7[c]		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AS-4	6/15/05	0.08	0.41	0.18	250	ND	ND	260	ND	ND	460	0.58	1200	110	3.0	65	0.02	230	540	90[e] (-30[e, f])
Trip Blank	3/14/05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trip Blank	6/15/05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trip Blank	12/13/05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

MCL – Maximum contaminant level.
ND – Non-detectable.
-- Not required to analyze or sample not collected.
[a] Field duplicate sample.
[b] Field blank sample.
[c] Well was dry during 2005.
[d] Secondary drinking water standard.
[e] Result is less than the sample detection limit.
[f] Contract laboratory duplicate sample.

Table 9-2 Well Depth and Screen Period Interval

Area	Well ID	Well Depth (ft)	Screen Period Interval (ft)
Fuel Oil Spill Site	FM-1	106.1	90 – 105
	FM-7	108.56	96 – 106
Arroyo Seco	AS-3A	112.58	100 – 110
	AS-3B	124.97	118 – 123
	AS-3C	157	150 – 155
	AS-4	28.57	15 – 25
Trudell Auto Repair Shop	MW-406	94	87[a]
Navy Landfill	NLF-6	110	87 – 102

[a] Start of screen interval. Length of screen interval is unknown.

10 Distribution List

U.S. Department of Energy

Karen Agogino (14)
U.S. Department of Energy
Sandia Site Office
P.O. Box 5400, MS 0184
Albuquerque, NM 87185-5400

John Gould
U.S. Department of Energy
Sandia Site Office
P.O. Box 5400, MS 0184
Albuquerque, NM 87185-5400

Jeff Irwin (MS 9221)
U.S. Department of Energy
DOE Facility Representative
Sandia National Laboratories, California

Connie Soden (2)
U.S. Department of Energy
NNSA Service Center
Pennsylvania & H Street
Kirtland Air Force Base
Albuquerque, NM 87116

Michael Thompson
U.S. Department of Energy
NA-117/Germantown Bldg
1000 Independence Ave, S.W.
Washington, D.C. 20585-1290

Richard Thorpe
U.S. Department of Energy
NA-117/Germantown Bldg
1000 Independence Ave, S.W.
Washington, D.C. 20585-1290

Alice Williams
U.S. Department of Energy
NA-56, Director Office of Environmental
Projects and Operations
1000 Independence Ave, S.W.
Washington, D.C. 20585

Robert Goldsmith
U.S. Department of Energy
Director Office of Core Technical Group
EM-23/Cloverleaf Building
1000 Independence Ave., S.W.
Washington, D.C. 20585-2040

Ross Natoli (3)
U.S. Department of Energy
EH-412/Forrestal Bldg
1000 Independence Ave, S.W.
Washington, D.C. 20585-2040

Ray Hardwick
U.S. Department of Energy
EH-2/270 Corporate Square Building
1000 Independence Ave, S.W.
Washington, D.C. 20585-0270

Glenn Podonsky
U.S. Department of Energy
SP-1/Germantown Bldg
1000 Independence Ave, S.W.
Washington, D.C. 20585-1290

Walter Warnick
U.S. Department of Energy
SC-33, Director Office of Scientific
And Technical Information
19901 Germantown Road
Germantown, MD 20874

Patrice Bubar
U.S. Department of Energy
Deputy Assistant Secretary for Corporate
Performance Assessment
ES-3/270 Corporate Square Building
1000 Independence Ave., S.W.
Washington, D.C. 20585-0270

Norbert Golchert
Argonne National Laboratory
9700 S. Cass Avenue
Building 200, Room B-11
Argonne, IL 60439

Roger Dirkes
Battelle Pacific Northwest Laboratories
P.O. Box 999
Richland, WA 99352

Eva Hickey
Battelle Pacific Northwest Laboratories
P.O. Box 999, MS K-3-66
Richland, WA 99352

Michael Ruggieri
Lawrence Berkeley National Laboratory
One Cyclotron Road
Berkeley, CA 94720

Lars Soholt
Los Alamos National Laboratory
Environmental Surveillance Group
P.O. Box 1663, MS-K490
Los Alamos, NM 87545

Tom Buhl
Los Alamos National Laboratory
Environmental Surveillance Group
P.O. Box 1663, MS-K490
Los Alamos, NM 87545

John Murphy
Oak Ridge National Laboratory
P.O. Box 2008
MS-6198
Oak Ridge, TN 37831-6198

Jim Heffner
Savannah River Plant
Environmental Monitoring
Health Protection Department
Building 735A
Aiken, SC 29809

Don Cassairt
Fermilab
P.O. Box 500
Batavia, IL 60510

Arthur Biermann (L-629)
Lawrence Livermore National Laboratory
7000 East Avenue
Livermore, CA 94550

Ellen Raber (L-626)
Lawrence Livermore National Laboratory
7000 East Avenue
Livermore, CA 94550

Robert Bainer (L-544)
Lawrence Livermore National Laboratory
7000 East Avenue
Livermore, CA 94550

William Hoppes (L-627)
Lawrence Livermore National Laboratory
7000 East Avenue
Livermore, CA 94550

LLNL Public Information Office (L-790)
Lawrence Livermore National Laboratory
7000 East Avenue
Livermore, CA 94550

Other Federal Agencies

Richard Lessler
U.S. Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, CA 94105

Joy Haftel
Congressional Information Services
4520 East-West Highway
Suite 800
Bethesda, MD 20814

Paul Weiss
Congressional Information Services
4520 East-West Highway
Suite 800
Bethesda, MD 20814

The Honorable Ellen Tauscher
U.S. House of Representatives
California 10th District
1801 N. California, Suite 103
Walnut Creek, CA 94596

The Honorable Ellen Tauscher
U.S. House of Representatives
California 10th District
1239 Longworth House Building
Washington DC 20515

State and Local Agencies

Edgar D. Bailey
California Department of Health Services
Radiologic Health Branch
P.O. Box 997414, MS 7610
Sacramento, CA 95899-7414

Stephen Woods
California Department of Health Services
Radiologic Health Branch
P.O. Box 997414, MS 7610
Sacramento, CA 95899-7414

Stephen Hsu
California Department of Health Services
Radiologic Health Branch
P.O. Box 997414, MS 7610
Sacramento, CA 95899-7414

J. Wong
California Department of Health Services
Environmental Management Branch
2151 Berkeley Way, Room 133
Berkeley, CA 94704

Devender Narala
California Regional Water Quality Control Board
San Francisco Bay Region
1515 Clay Street
Oakland, CA 94612

S. Gittings
Livermore Water Reclamation Plant
101 West Jack London Boulevard
Livermore, CA 94550

D. Greenwood
Livermore Water Reclamation Plant
101 West Jack London Boulevard
Livermore, CA 94550

Kelly Wee
Director of Compliance and Enforcement
Bay Area Air Quality Management District
939 Ellis Street
San Francisco, CA 94109

Robert Weston
Alameda County
Health Care Services Agency
Department of Environmental Health Services
1131 Harbor Bay Parkway
Alameda, CA 94501

Daniel Murphy
California Environmental Protection Agency
Department of Toxic Substances Control
Region 2, Facility Permitting Branch
700 Heinz Avenue, Suite 200
Berkeley, CA 94710

Mike Miller
Public Services Director
City of Livermore
3500 Robertson Park Road
Livermore, CA 94550

Linda Barton
City Manager
City of Livermore
1052 S. Livermore Avenue
Livermore, CA 94550

The Honorable Guy Houston
California State Assembly
15th District
Capitol Building, Room 4208
Sacramento, CA 95814

The Honorable Guy Houston
California State Assembly
15th District
1365 Chestnut Street, Suite A
Livermore, CA 94550

Scott Haggerty
Supervisor District 1
Alameda County Board of Supervisors
1221 Oak Street, Suite 536
Oakland, CA 94612

The Honorable Marshall Kamena
Mayor of Livermore
1052 South Livermore Avenue
Livermore, CA 94550

The Honorable Tom Torlakson
California State Senate
7th District
State Capitol Building, Suite 5061
Sacramento, CA 95814

The Honorable Tom Torlakson
California State Senate
7th District
2801 Concord Blvd.
Concord, CA 94519

Individuals and Organizations

Mike and Ann Mueller
2693 South Vasco Road
Livermore, CA 94550

Marylia Kelley
Tri-Valley CAREs
2528 Old First Street
Livermore, CA 94550

Sandia National Laboratories

MS 0101	T.O. Hunter, 1
MS 9001	M.E. John, 8000
MS 9004	J. Hruby, 8100
MS 9007	D. Henson, 8200
MS 9054	T. Michalske, 8300
MS 9002	P.N. Smith, 8500
MS 9405	R. Carling, 8700
MS 9151	L. Napolitano, 8900
MS 9221	E. Cull, 8510
MS 9221	G. Shamber, 8516
MS 9221	B. Larsen, 8516 (30)
MS 9221	R. Holland, 8516
MS 9221	L. Gardizi, 8516
MS 9221	A. Leo, 8516
MS 9221	L. Farren, 8516
MS 9221	J. Harris, 8516
MS 9221	M.E. Brynildson, 8516
MS 9221	D.A. Wright, 8517
MS 9221	T.B. Garcia, 8517
MS 9159	D. Beyer, 8518
MS 9131	J. Manchester, 8528 (3)
MS 9111	M.E. Janes, 8528
MS 9031	K.C. Olsen, 11600
MS 0342	P. Newman, 10300
MS 1139	J. Moya, 10330
MS 0141	B. Krauss, 11000
MS 0141	A. Blumberg, 11100
MS 1042	C. Fink, 10331
MS 1042	S. Salinas, 10331
MS 1042	H.A. Hwang, 10331
MS 1151	J.J. Thompson, 10339
MS 1089	R.E. Fate, 6147
MS 1089	F.B. Nimick, 6140
MS 9018	Central Technical Files, 8945 (2)
MS 0899	Technical Library, 4536 (2)
MS 9021	Classification Office, 8511
MS 9021	Classification Office, 8511 for DOE/OSTI