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Site Environmental Report for 2007
Sandia National Laboratories, California

B.L. Larsen

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Livermore, California 94550

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Site Environmental Report for 2007 Sandia National Laboratories, California

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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 National Nuclear Security Administration (NNSA). The NNSA Sandia Site Office oversees operations at the site, using Sandia Corporation as a management and operating contractor. This Site Environmental Report for 2007 was prepared in accordance with DOE Order 231.1A (DOE 2004a). The report provides a summary of environmental monitoring information and compliance activities that occurred at SNL/CA during calendar year 2007. General site and environmental program information is also included.

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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 2007 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 2007 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
CO	carbon monoxide
CRMP	Cultural Resource Management Plan
DOE	Department of Energy
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 Permit	State of California, NPDES General Permit for Storm Water Discharge Associated with Industrial Activities
ISO	International Standards Organization
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
MS4	California Small Municipal Separate Storm Sewer System
MSDS	material safety data sheet
mSv	milliSeivert
ND	non-detectable
NEPA	National Environmental Policy Act

NESHAPs	National Emission Standards for Hazardous Air Pollutants
NFPA	National Fire Protection Association
NNSA	National Nuclear Security Administration
NNSA/SSO	National Nuclear Security Administration, Sandia Site Office
NOx	nitrogen oxides
NPDES	national pollutant discharge elimination system
O&G	oil and grease
PCB	polychlorinated biphenyl
pCi/L	picocuries per liter
PM_{10}	respirable particulate matter
POTW	publicly owned treatment works
PP/WM	Pollution Prevention and Waste Minimization
QAPP	quality assurance program plan
RCRA	Resource Conservation and Recovery Act
ROG	reactive organic gases
RWQCB	Regional Water Quality Control Board (California)
SARA Title III	Superfund Amendments and Reauthorization Act of 1986, Title III
SHPO	State Historic Preservation Officer
SNL	Sandia National Laboratories
SNL/CA	Sandia National Laboratories, California
SNL/NM	Sandia National Laboratories, New Mexico
STA	Spare-the-Air
SWEA	Site-wide environmental assessment
TPHD	total petroleum hydrocarbons diesel
TSCA	Toxic Substances Control Act
TSS	total suspended solids
µg/L	micrograms per liter
µmhos/cm	micromhos per centimeter
U.S.	United States
USC	United States Code
USFWS	United States Fish and Wildlife Service
UST	underground storage tank

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 2007. 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 2007. 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 2007. 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 program uses the framework established by the international standard for EMS, ISO 14001 (ISO 2004). On September 25, 2006, SNL/CA obtained ISO 14001:2004 certification of its EMS. On February 7, 2008, SNL/CA also became a member of the National Environmental Performance Track Program established by the Environmental Protection Agency. Additional information on environmental management is presented in Chapter 4.

1.3 Performance Measures

SNL/CA measures environmental performance as progress towards achieving EMS objectives. During 2007, SNL/CA demonstrated improvement and progress towards achieving 14 of 22 EMS objectives. Measurement data for the remaining eight objectives

were not collected during 2007. SNL/CA received one notice of violation in 2007 for an exceedance of copper in the wastewater stream. Section 3.13 presents the details of this violation. Section 4.2 provides additional information about SNL/CA's environmental performance in 2007.

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. SNL/CA exceeded the wastewater discharge limit at the sewer outfall once during 2007 - for copper. SNL/CA continued to see carbon tetrachloride in groundwater at the Navy Landfill in 2007 with a concentration similar to that detected in past years. Wells at the Fuel Oil Spill site had insufficient water to sample during 2007; 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 58.6 mrem (0.59 mSv), which is within the dose range measured over the last fifteen 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 has provided distinguished service to the nation for over 50 years through engineering support and systems integration for nuclear weapons and related national security research and development efforts. Our programs support four key areas – the national nuclear deterrence policy and stockpile security, nonproliferation and materials control, energy and critical infrastructure, and emerging threats. SNL/CA is committed to collaborative research and development with industry and universities, resulting in new and enhanced technologies that have both commercial and national security benefits.

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 National Nuclear Security Administration (NNSA). The NNSA/Sandia Site Office (NNSA/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 by the remaining undeveloped SNL/CA land (276 acres) on the east, south, and west (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. A new residential development is located along the western boundary of the site.

Figure 2-1 Regional Location Map

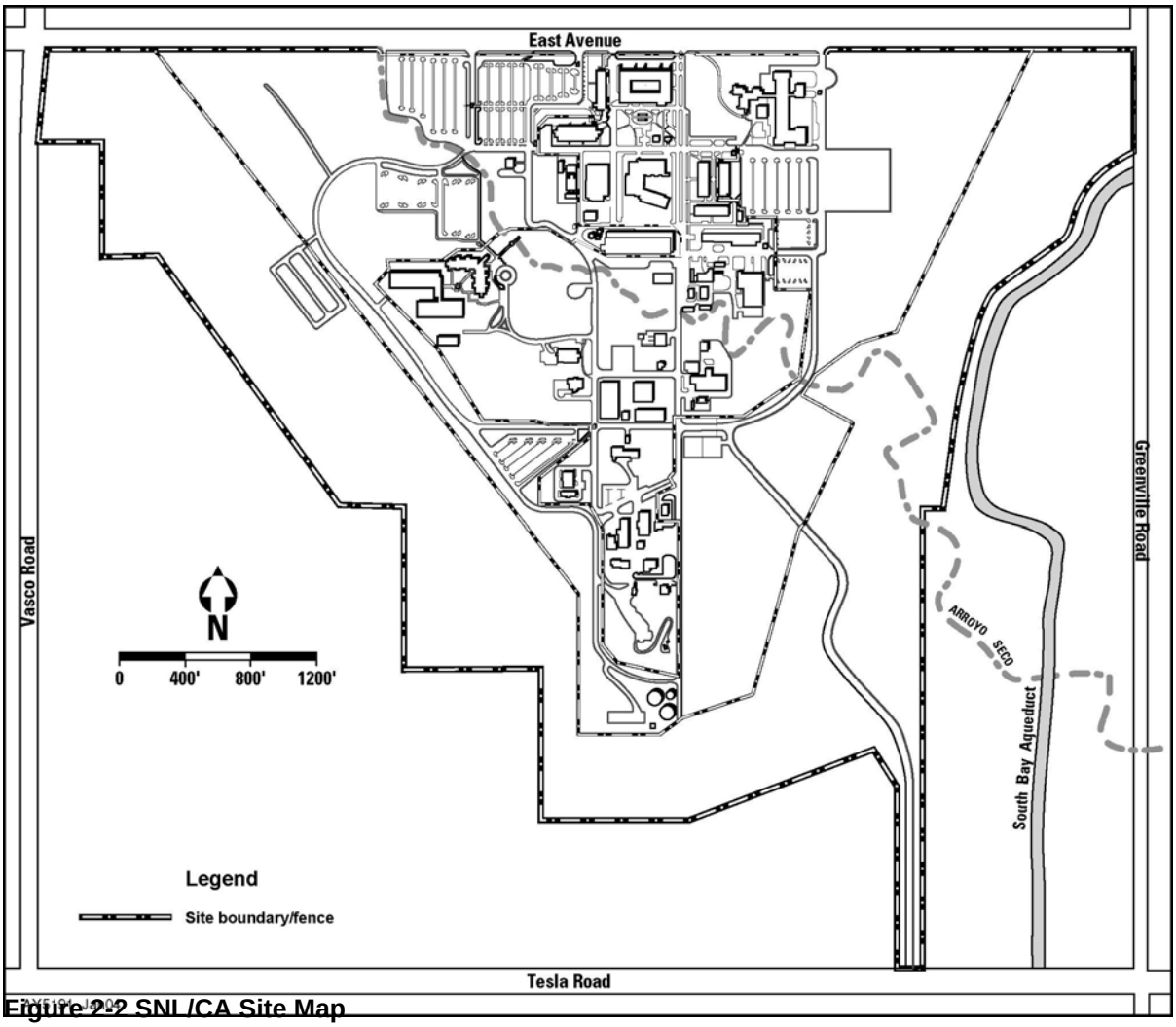

Figure 2-2 SNL/CA Site Map

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 contracted staff. In November 2007, there were 932 Sandia employees working at SNL/CA, a decrease of 108 from 2006. Eighty-eight percent of Sandia employees live in Alameda, Contra Costa, and San Joaquin counties. Thirty-seven percent live in Livermore. The contracted workforce fluctuates throughout the year depending on program staffing needs. An estimate of contracted 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.

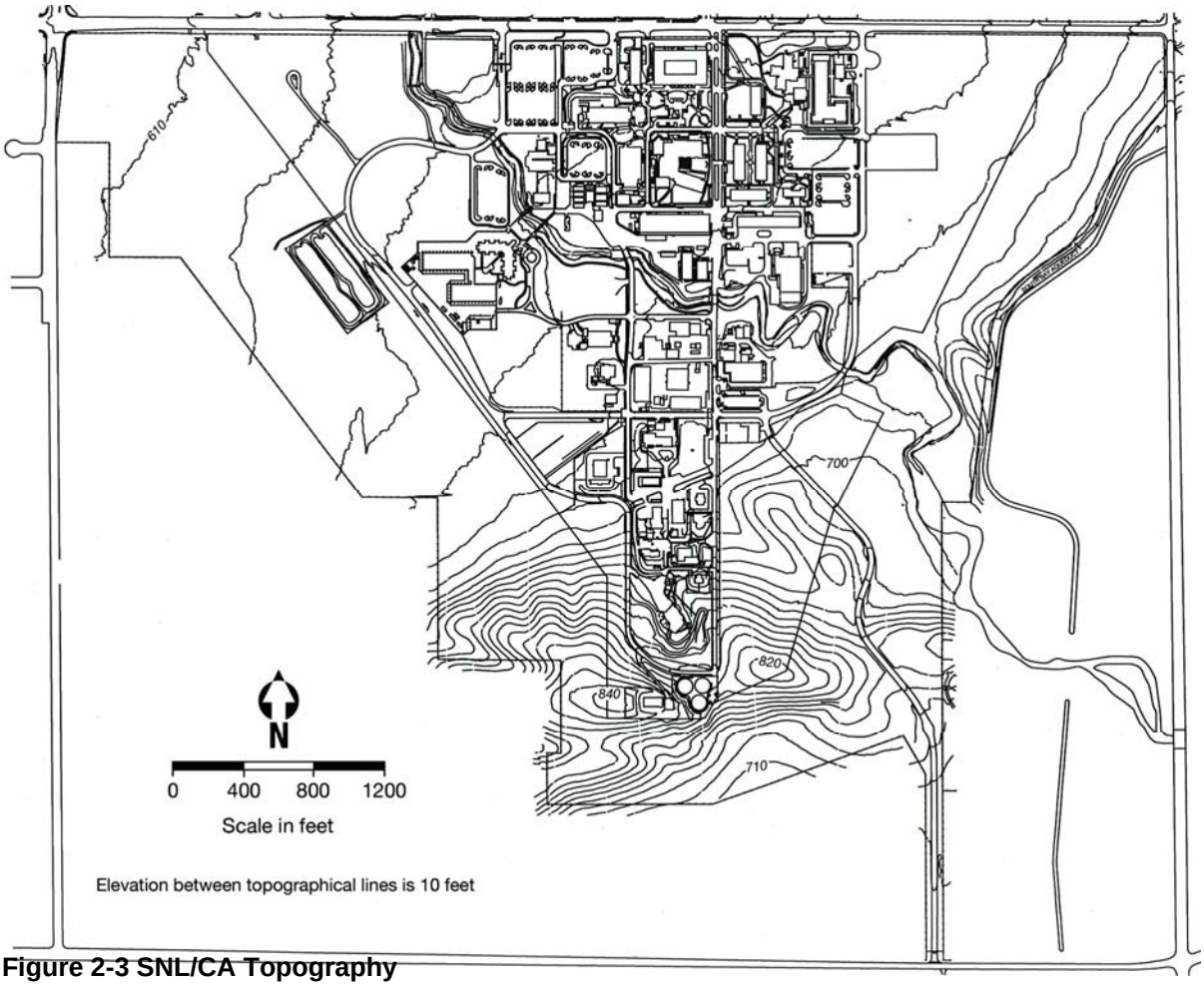

Figure 2-3 SNL/CA Topography

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.

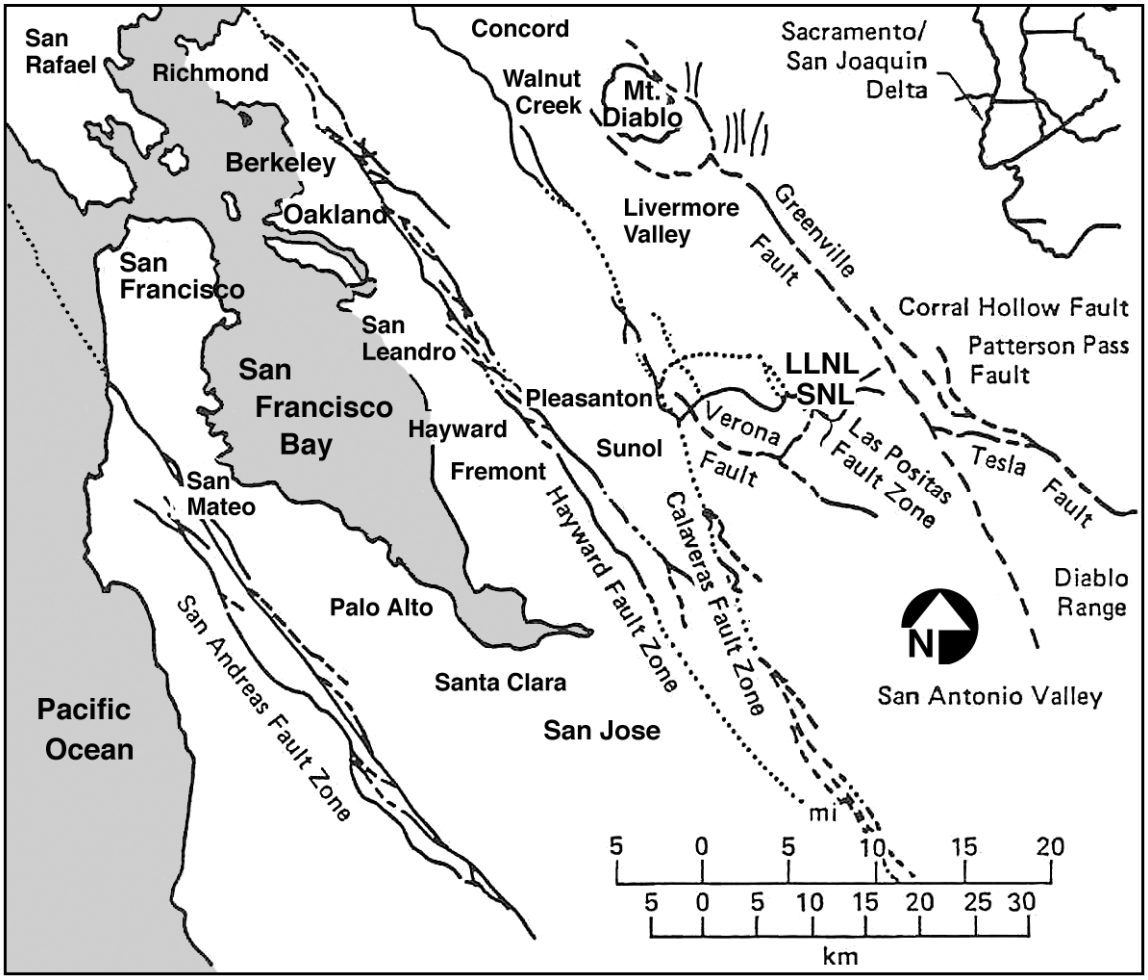

Figure 2-4 Regional Earthquake Faults

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. SNL/CA's water use is metered by LLNL as it enters the site. In calendar year 2007, SNL/CA used 71.78 million gallons of water, an increase of approximately 1.88 million gallons from water used in 2006. (See discussion in Section 4.2). The site discharged approximately 10.2 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, and fire system testing.

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.

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 2007 was obtained from the LLNL meteorological tower[1]. The annual rainfall for 2007 was 8.48 inches. Temperatures in 2007 ranged from 22° to 105° Fahrenheit. Average annual rainfall in the Livermore area over the last five years was 12.3 inches (LLNL 2008). 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

[1] The SNL/CA meterological tower was off-line for a portion of 2007 and unable to provide complete data for the year.

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 2007, SNL/CA identified 62 bird species, 2 amphibians, 5 reptiles, and 18 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 sightings of a mountain lion were reported at SNL/CA in 2007. 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 December 13, 2007, when an adult salamander was found within the developed area of the site. The first confirmed observation of California red-legged frogs at SNL/CA occurred in April 2004 when several individuals were found on the eastern portion of the site in shallow water contained within Arroyo Seco. California red-legged frogs were observed during 2005 and 2006, but not in 2007. Shallow pools of water typically observed in Arroyo Seco were dry by mid-May, likely resulting in the absence of red-legged frogs at SNL/CA for the year.

Numerous bird species nest or forage on site, most of which are protected under the Migratory Bird Treaty Act. Two species observed at SNL/CA in 2007, the Swainson's hawk *(Buteo swainsoni)* and Bank swallow (*Riparia riparia*) are also California state threatened species. Neither threatened species nested at SNL/CA. Several birds are also Federal and/or state special concern species or fully protected in California. These include the Black-chinned sparrow (*Spizella atrogularis)*, Cooper's hawk *(Accipiter cooperii)*, Peregrine falcon (*Falco peregrinus)*, Prairie falcon (*Falco mexicanus)*, Sharp-shinned hawk *(Accipiter striatus)*, Yellow warbler *(Dendroica petechia)*, White-tailed kite *(Elanus leucurus)*, Golden eagle *(Aquila chrysaetos)*, and Loggerhead shrike *(Lanius ludovicianus.* Of these special concern species, the Loggerhead shrike was the only one nesting at SNL/CA in 2007.

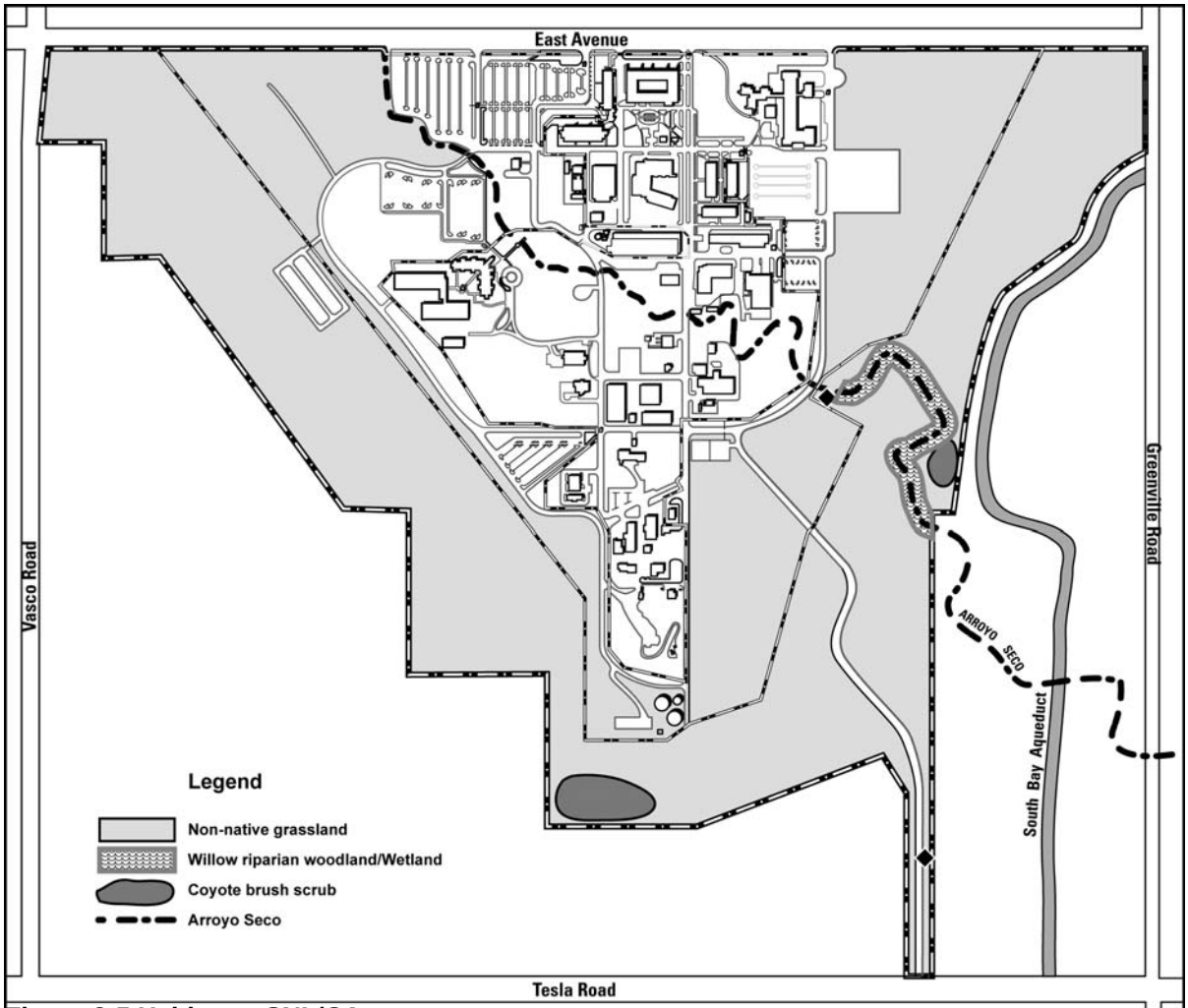

Figure 2-5 Habitat at SNL/CA

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 2007.

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 2007). 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 its EMS in December 2005, the DOE established deadline. In 2006, SNL/CA upgraded the EMS Program to conform to the international standard for EMS, ISO 14001:2004, and received third-party certification to the standard. In 2007, SNL/CA successfully completed two surveillance audits to retain ISO 14001 certification. Chapter 4 provides additional information on SNL/CA's EMS program.

3.2 Executive Order 13423

Issued in January 2007, *Executive Order 13423, Strengthening Federal Environmental, Energy, and Transportation Management (EO 13423)* sets goals in the areas of energy efficiency, acquisition, renewable energy, toxics reductions, recycling, sustainable buildings, electronics stewardship, fleets, and water conservation. EO 13423 also requires more widespread use of Environmental Management Systems as the framework in which to manage and continually improve these sustainable practices. EO 13423 incorporates the requirements of and cancels Executive Orders 13101, 13123, 13134, 13148, and 13149, which were implemented through DOE Order 450.1 in 2007. DOE is revising Order 450.1 to include the requirements of EO 13423 and expects to issue a revision early in 2008. Anticipating this change, SNL/CA established new EMS objectives and targets starting in fiscal year 2008 to support upcoming requirements.

3.3 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, DOE's National Nuclear Security Administration/Sandia Site Office (NNSA/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. During fiscal year 2007, 153 projects underwent NEPA review. None of these projects required preparation of an environmental assessment or environmental impact statement.

3.4 Air Quality

3.4.1 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 2006/2007 permit period[2], SNL/CA had 15 permitted emission sources. The number of permits remained at 15 for the 2007/2008 permit period. Table 3-5 (Section 3.14) provides a list of the permitted sources.

3.4.2 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*

[2] The BAAQMD permit period is July 1 through June 30 each year. Permit data is presented for the two periods applicable to 2007.

Energy Facilities (NESHAPs) (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 2007), 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 2007, SNL/CA evaluated two projects with the potential to produce radionuclides through nuclear fission in a non-sealed source. Conservative estimates based on the rate of fission indicated that the amount of radionuclides produced would be several orders of magnitude below the annual possession quantities in 40 CFR 61. No monitoring or reporting was required.

3.5 Natural and Cultural Resources

3.5.1 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, NNSA/SSO and SNL/CA initiated consultation with the U.S. Fish and Wildlife Service (USFWS) under Section 7 of the Endangered Species Act for maximum operations of the SNL/CA site. 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 (*Rana aurora draytonii*) and the California tiger salamander (*Ambystoma californiense*), the two threatened species present on site. The conference opinion concludes that site operations are not likely to destroy or adversely modify proposed critical habitat for the red-legged frog[3].

A man-made recharge basin consisting of two cells encompassing approximately 2.7 acres, is located in the west outer perimeter area at SNL/CA. Lawrence Livermore National Laboratories (LLNL) constructed the basin in 1989 to serve as a recharge basin for their groundwater treatment program. LLNL discontinued use of the basin in 2003 and terminated its agreement with SNL/CA for use of the area in June 2005. SNL/CA plans to return the area to pre-1989 condition by backfilling and reseeding with appropriate vegetation. SNL/CA and NNSA/SSO met with the USFWS in December 2006 to discuss the proposed action. Because California tiger salamanders were previously found in the area, the USFWS indicated that a mitigation offset would be required for the proposed construction zone.

[3] In 2002, when the consultation process began, the Sandia site was within designated critical habitat for the California red-legged frog. In November 2002, the designation was overturned (U.S. District Court 2002), and in April 2004, the USFWS re-issued proposed critical habitat that included the Sandia site (USFWS 2004). However, in November 2005, the USFWS issued a revised designation (USFWS 2005), and a final rule in April 2006 (USFWS 2006). Under the 2006 final designation, the Sandia site is not included in the critical habitat area.

SNL/CA and NNSA/SSO are preparing a mitigation proposal, and expect to submit a request for amendment of the biological opinion in 2008.

3.5.2 Interim Protections for California Red-legged Frogs

In October 2006, interim restrictions on pesticide use went into effect to protect the California red-legged frog. The restrictions are the result of a settlement agreement between the EPA and the Center for Biological Diversity that requires the EPA to consult with the USFWS under the Endangered Species Act on the impacts of 66 pesticide ingredients to the red-legged frog. The agreement, outlined in a Stipulated Injunction and Order (US District Court 2006), places restrictions on the use of these pesticides in red-legged frog aquatic and upland habitat until consultations are complete and biological opinions are issued by the USFWS. In response to these interim protections, SNL/CA has restricted the use of products containing the named pesticide ingredients in and along Arroyo Seco. In 2007, the EPA completed effects determinations for 20 of the 66 pesticide ingredients but no opinions have been issued.

3.5.3 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-eight of the 62 bird species observed at SNL/CA in 2007 are protected under this act. In 2007, 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 2007, four maintenance activities were delayed to protect nesting birds.

3.5.4 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, 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. As of December 2007, SNL/CA completed five improvement tasks. Continuation of the Arroyo Seco Improvement Program is pending Army Corp approval.

3.5.5 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 2007, SNL/CA did not conduct any activities in the wetland area, or affecting wetlands.

3.5.6 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 2007, there were no buried archaeological resources unearthed at SNL/CA.

In 2001, SNL/CA completed an historic building survey. None of the buildings onsite are 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 NNSA/SSO. In December 2004, NNSA transmitted the survey results to the California State Historic Preservation Officer (SHPO). In April 2005, NNSA/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.

3.6 Environmental Restoration

3.6.1 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 2006a). In 2007, there were no releases of hazardous substances that required notification under CERCLA.

3.6.2 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 (when there is sufficient water to collect a sample), and one at the Navy Landfill. Sampling results are presented in Chapter 5, Environmental Monitoring.

3.7 Hazardous Materials

3.7.1 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 Office of Emergency Services, Alameda County Department of Environmental Health, and the Alameda County Fire Department. EPCRA reporting requirements applicable to SNL/CA for 2007 are presented in Table 3-1.

Table 3-1 Status of EPCRA Reporting at SNL/CA, 2007

EPCRA Section	Description of Reporting	Required in 2007
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)

3.7.2 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.

3.7.3 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 3.7.2.

3.7.4 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 2006a). For SNL/CA operations, the only TSCA regulated chemicals imported or exported are for research and development purposes thus exempt from general reporting requirements. However, SNL/CA notifies EPA of exempt imports and exports when appropriate. In 2007, SNL/CA prepared one TSCA Notification of Export declaration for the chemical 2-ethoxyethanol. Shipment of the material did not require a TSCA license.

SNL/CA 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.

3.7.5 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 2004). Pesticide use at SNL/CA is overseen by a certified pesticide applicator.

3.8 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 19, 2007 (SNL/CA 2007c). Additionally, SNL/CA's Waste Minimization Certificate required by the Hazardous Waste Storage Facility Part B Permit was submitted to the California Department of Toxic Substances Control (DTSC) prior to the March deadline.

3.8.1 Pollution Prevention Requirements of DOE Order 450.1

DOE Order 450.1 establishes five performance-based pollution prevention and sustainable environmental stewardship goals. During 2007, SNL/CA continued implementation of site-specific activities to support these goals including:

- improvements to site outreach on Green Purchasing;
- obtaining regulatory approval for recycling of new waste stream resulting from destruction of hard drives;
- evaluation and recycling of electronic and other waste streams; and
- becoming a Federal Electronics Challenge partner.

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*

As required by Order 450.1, SNL/CA implements affirmative procurement programs that favor acquisition and use of environmentally preferable products and services[4]. 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 environmentally preferable purchasing requirements through presentations and training targeting individuals involved in purchasing products and services. Both groups

[4] Prior to DOE Order 450.1, these requirements were established in EO 13101, which was revoked in January 2007 by issuance of EO 13423.

work closely with suppliers to ensure that environmentally preferable products are available for purchase.

SNL/CA tracks improvements in environmentally preferable purchasing as part of the site environmental management system. In 2007, 92.8 percent of the products purchased by SNL/CA met EPA standards for justified and recycled content, compared to 86.7 percent in 2006. SNL/CA submitted the Annual Environmental Preferable Purchasing Report (SNL/CA 2007d) to DOE on December 19, 2007 for use in DOE's annual report.

Additional information about pollution prevention activities is provided in Chapter 4.

3.8.2 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 an agreement between DOE and DTSC, 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 submitted to DTSC on August 30, 2007 and provides information for 2003 through 2006. The plan also identifies waste reduction opportunities for any waste stream that is over 5 percent of a site's total routine regulated waste. The next plan, which will include information from calendar year 2010, will be prepared in 2011.

3.8.3 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 2007 (for lead only) will include source reduction and recycling information to meet this requirement. The report is due annually on July 1. See Section 3.7.1 for additional information on EPCRA reporting requirements.

3.9 Hazardous Waste

3.9.1 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 2007 was appropriately managed under the site's RCRA Hazardous Waste Facility Permit.

3.9.2 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 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 biennial report was submitted in February 2008 and provides information about the quantity of RCRA hazardous waste generated, stored, and shipped during the 2007 reporting period.

3.9.3 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) require 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. The EPA biennial report (see Section 3.9.2) satisfied this requirement for 2007.

3.9.4 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.

3.10 Radiation Protection

3.10.1 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).

3.10.2 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.

3.10.3 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 2007.

Table 3-2 Order 5400.5 Compliance Summary, 2007

Order 5400.5 Requirement	SNL/CA 2007 Summary
Maximum exposure to members of public = 100 mrem/yr	There were no radionuclide emissions in 2007. The average annual gamma radiation measurement at the site perimeter in 2007 was 58.6 mrem or 3 mrem more than distant locations, where the average annual dose was 55.6 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 the environment, safety, and health (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 2007.
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.
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 2007; therefore, there is no monitoring data available for dose evaluations.

3.11 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).

3.11.1 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. Permit exceedances that occurred in 2007 at the sanitary sewer outfall are presented in Table 3-3. See Section 3.13 for additional information regarding the March 15, 2007 copper exceedance.

Table 3-3 Wastewater Discharge Permit Exceedances at Sanitary Sewer Outfall, 2007

Parameter	No. of Samples Taken	No. of Compliant Samples	Percent Compliant	Date(s) of Exceedance	Description	Status / Resolution
Copper	52	51	98%	3/15/2007	Copper concentration was 1.3 mg/L. Discharge limit is 1.0 mg/L.	Probable source was entrainment of sediment from cooling tower basin. Centrifugal separator installed.

SNL/CA has three categorical processes that are subject to EPA's pretreatment standards: two metal finishing operations, and a semiconductor manufacturing operation. The two metal finishing operations are closed-loop processes and do not discharge any effluents. Wastewater generated from the semiconductor manufacturing process is sampled and monitored as part of the Environmental Monitoring Program. There were no exceedances of the discharge limits from this source during 2007.

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.

In 2007, SNL/CA visually monitored 21 storm water discharge locations and sampled nine locations. The result of monitoring and sampling activities conducted in 2007 did not identify any issues of concern. Section 5.1 presents a summary of 2007 results.

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 2007.

3.13 Environmental Occurrences

SNL/CA had two environmental occurrences in 2007. On March 15, 2007, the site discharge limit for copper in the sanitary sewer was exceeded (see Table 3-3). Wastewater samples collected at the sewer outfall on March 15 showed a copper concentration of 1.3 mg/L. The discharge limit for copper is 1.0 mg/L. The cause of the exceedance could not be determined. However, the most likely source is entrainment of sediment from the cooling tower basin at Building 943. In September 2007, SNL/CA installed a centrifugal separator at the cooling tower to remove sediment from cooling water before discharging to the sewer.

On November 16, 2007, approximately 1000 gallons of wastewater from the sanitary sewer outfall building overflowed to the surrounding area. The overflow occurred because of a pump failure caused by low voltage. SNL/CA restored pump service immediately. Monitoring equipment flooded by the overflow was repaired and put back into service within a week. Alarms at the pump station were connected to the Central Alarm Station for future notifications. A written report will be submitted to the California Water Resources Control Board once a waste discharge designation is received.

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 3-4 SNL/CA Audits, Assessments, and Inspections, 2007

Title	Area of Focus	Date Conducted	Results
Alameda County Inspection	Erosion at the Navy Landfill site	September 24, 2007	No violations
City of Livermore, Water Resources Division Inspections	Wastewater discharges and categorical process laboratories	October 22–23, 2007	No violations
California Department of Toxic Substances Control Inspection	Hazardous Waste Facility, RCRA permit compliance	May 31, 2007	No violations
Third Party Environmental Management System (EMS) Surveillance Audit (NSF-ISR)	Conformance with the ISO 14001:2004 EMS standard	April 10, 2007 and November 7-8, 2007	ISO certification retained
Pollution Prevention Program Review (NNSA/SSO and DOE Headquarters)	All components of the PP/WM Program	September 19, 2007	No concerns identified.
Alameda County Inspection	Underground Storage Tanks	March 12, 2007	No violations
Bay Area Air Quality Management District Inspection	Permitted air emission sources	January 31 – February 7, 2007	No violations
Alameda County Environmental Health Department Inspection	Tire Management Program	January 17, 2007 September 24, 2007	No violations
ES&H Audit (Lockheed Martin Corporation)	Procedures / controls associated with EMS components; hazardous waste management; spill prevention and control	November 12-19, 2007	One concern identified in hazardous material reporting

Table 3-5 SNL/CA Environmental Permits and Orders, 2007

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, 2007 - October 31, 2008	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

Type	Description	Effective Date	Statute / Regulation	Issuing Agency
Hazardous waste	Permit by Rule	November 1, 2007 - October 31, 2008	California Health and Safety Code	Alameda County Environmental Health Department
Hazardous waste	Conditionally Authorized Permit to Operate	November 1, 2007 - October 31, 2008	California Health and Safety Code	Alameda County Environmental Health Department
Medical waste	Small Quantity Generator with Onsite Treatment	August 9, 2007 - August 8, 2008	California Health and Safety Code	Alameda County Environmental Health Department
Medical waste	Small Quantity Generator without Onsite Treatment	April 11, 2007 - April 10, 2008	California Health and Safety Code	Alameda County Environmental Health Department
Wastewater	Wastewater Discharge Permit	August 4, 2007- August 3, 2008	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, 2007 - October 31, 2008	Resource Conservation and Recovery Act and California Health and Safety Code	Alameda County Environmental Health Department
Aboveground storage tanks	Storage statement	July 1, 2007 - June 30, 2008	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, 2007 - June 30, 2008	Clean Air Act	Bay Area Air Quality Management District
Universal waste	Generator statement	February 1, 2006	California Electronic Waste Recycling Act	California Department of Toxic Substances Control

[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 site's EMS program is dynamic, encompassing an annual cycle of planning, implementing, assessing, and improving operations in support of site-specific environmental goals.

SNL/CA's EMS program conforms to the international standard for environmental management systems, ISO 14001. On September 25, 2006 the site received ISO 14001:2004 certification. To ensure that the site maintains conformance with the standard, surveillance audits are conducted every six months by a third-party registrar. Recertification is required every three years. During 2007, SNL/CA completed two successful EMS surveillance audits to retain ISO certification.

In October 2007, SNL/CA submitted an application for membership in the National Environmental Performance Track Program. Performance Track members establish stretch goals that go beyond legal requirements and support environmental excellence. On February 7, 2008 SNL/CA received notice of acceptance into the Performance Track Program.

SNL/CA Environment, Safety, and Health (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 continual 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's EMS Program encompasses the seventeen elements of an effective EMS as identified in the ISO 14001 standard. 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. Table 4-1 identifies the EMS elements and summarizes the methods, tools, and programs implemented in support of each.

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 water discharges. SNL/CA evaluates site activities and operations annually to ensure environmental aspects are up-to-date and accurate. From this complete list (19 aspects), significant aspects are determined through a risk evaluation. For 2007, SNL/CA's significant environmental aspects are water discharges, air emissions, material procurement and use, land use, and general transportation.
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.

EMS Element	Implementation Summary
Objectives and targets	SNL/CA's EMS objectives support efforts to reduce potential environmental risk and enhance environmental stewardship. Broad objectives were established for all environmental aspects. The inclusion of objectives for all aspects is a best business practice that provides an expectation of overall environmental stewardship across the spectrum of activities conducted on site. SNL/CA evaluates and sets annual targets to support site objectives. At a minimum, targets are set for significant aspects and actions are identified to meet these targets. SNL/CA's objectives are to: ➢ Provide exceptional environmental management for the site. ➢ Minimize the volume and contamination of sewer water. ➢ Minimize the volume and pollution of storm water runoff. ➢ Minimize air emissions related to operations and transportation with particular emphasis on Spare-the-Air days. ➢ Procure and use environmentally friendly products and materials. ➢ Enhance the natural habitat. ➢ Design and manage all buildings and facilities using "green" principles. ➢ Minimize the use of vehicles by members of the workforce. ➢ Minimize the use of hazardous materials. ➢ Minimize the use of radiological materials. ➢ Minimize the generation of radioactive and mixed waste. ➢ Minimize the use of biological materials. ➢ Minimize the environmental impacts of site contaminated areas. ➢ Minimize the generation of hazardous waste. ➢ Reduce site legacy asbestos material. ➢ Minimize the quantity of landfill waste through reduced consumption and/or reuse/recycling. ➢ Minimize the potential environmental effects of hazardous material due to transportation. ➢ Minimize site natural gas consumption. ➢ Minimize site water consumption. ➢ Minimize site electrical consumption. ➢ Minimize the environmental effects of a site fire emergency. ➢ Minimize the environmental effects of a site seismic event.
Environmental programs	SNL/CA's EMS Program is supported by six functional environmental programs. ➢ Air Quality ➢ Environmental Monitoring ➢ Environmental Planning and Ecology ➢ Hazardous Materials Management ➢ Pollution Prevention and Waste Minimization ➢ Waste Management
Structure, responsibilities, and authorities	SNL/CA's EMS Program is implemented through existing site management and organizational structures. The site Vice President holds overall responsibility for success of the EMS Program. Director and senior management personnel ensure availability of resources. An environmental management representative and EMS core team are responsible for day-to-day management of the program. All members of the workforce hold responsibility and authority to implement EMS elements into their operations.
Competence, training, and awareness	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.

EMS Element	Implementation Summary
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	At SNL/CA, document control is accomplished with electronic documents that are available in online databases. If paper copies of technical work documents are maintained at the point of use, department managers ensure that a process is in place to keep them up to date. Permits and other regulatory documents of external origin are typically marked as valid for a specified period and controlled by limited distribution coordinated by environmental program leads.
Operational controls	Sandia employs an integrated system to address ES&H concerns associated with site operations. This integrated system provides the framework for planning work, evaluating hazards, identifying controls, conducting work, and improving work processes. Unique to SNL/CA, the ES&H, Facilities, and Security Interdisciplinary Team supports integrated safety and environmental management to ensure requirements and controls are identified during project planning. Typical operational controls used at SNL/CA include technical work documents, environmental permits and compliance documents, contract specifications, and a variety of engineered controls.
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 and measurement	Each of the six SNL/CA functional environmental programs monitors and measures the key characteristics of site operations that can affect the environment. Data collected supports compliance requirements as well as assessment of the site's overall progress in meeting EMS objectives. Monitoring data and metrics are available to the public in annual environmental reports.
Evaluating compliance	SNL/CA evaluates compliance with all environmental requirements through the Interdisciplinary Team process, self-assessments, and audits.
Nonconformity, corrective, and preventive action	SNL/CA documents, tracks, and verifies corrective and preventive actions with electronic assessment tracking and corrective action systems. The EMS Core Team also established a procedure for validating the effectiveness of select actions and to reduce the potential for recurrence of significant nonconformities.
Records	All information created by Sandia operations is managed as a record. ES&H information created at SNL/CA is managed by the site ES&H Records Center.
Management review	SNL/CA's top management team (VP and directors) review the EMS Program semi-annually. In 2007, management reviews resulted in three actions/recommendations related to planning for changes in regulatory requirements, feasibility of solar energy, and hazardous material controls.

4.2 Environmental Performance

SNL/CA measures the site's environmental performance by tracking progress towards achieving EMS objectives. Data is available to measure many EMS objectives, but not all. In 2007, the site measured performance towards achieving 14 of the 22 established objectives. The following diagrams and text summarize the site's progress and improvement in the last year. Table 4-1 provides the complete list of EMS objectives.

Program Management Objective: Provide exceptional environmental management for the site

SNL/CA tracks noncompliance with environmental requirements as a measure of our environmental management performance. Figure 4-1 shows the number of findings from third-party audits (includes DOE), notices of violation, and other environmental occurrences since 2000. The site goal is zero findings and zero violations. SNL/CA received one violation, but zero findings in 2007. Over the last two years, SNL/CA met the site goal of zero findings, but continued to receive minor violations. As a routine element of the EMS Program, Sandia identifies and implements corrective and preventive actions in an effort to improve environmental performance and reach the site goal of zero violations.

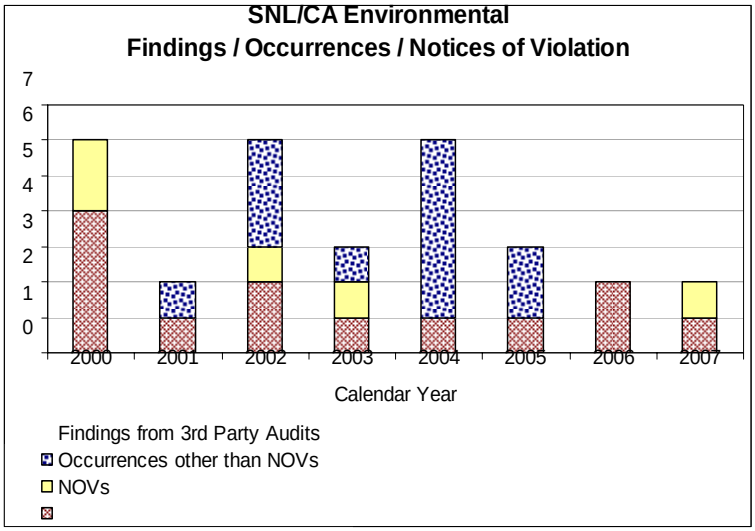

Figure 4-1 Measurement of Excellence in Environmental Management

Certification and recognition of SNL/CA's EMS program provide other indicators of excellence in environmental management. SNL/CA became the first Sandia division to obtain ISO 14001:2004 certification for its EMS. By conforming to the ISO standard, SNL/CA integrates sound environmental stewardship practices with regulatory compliance to reduce the site's environmental footprint. Also in 2007, SNL/CA received a DOE Star Award for the efficient process used to obtain ISO certification.

NSF International Strategic Registrations, Ltd.

A Subsidiary of NSF International
789 North Dixboro Road, Ann Arbor, Michigan 48105
(888) NSF-9000

Certificate of Registration

This certifies that the Environmental Management System of

Sandia National Laboratories, California

7011 East Avenue
Livermore, California, 94550 USA

has been assessed by NSF-ISR and found to be in conformance to the following standard(s):

ISO 14001:2004

Scope of Registration:

Operations, research and development programs, and facilities supporting national security, energy resources, environmental quality, and basic scientific research at Sandia National Laboratories, California in accordance with the site Environmental Management System.

Industrial Classification:

IAF: 35
SIC: 87
NACE: K 74

Certificate Number: 9Y221-E1
Certificate Issue Date: 10/12/2006
Company Initial Date: 09/25/2006
Registration Date: 09/25/2006
Expiration Date*: 09/24/2009

Christian B. Lupo, General Manager
NSF-ISR, Ltd.

Water Discharge Objective: Minimize the volume and contamination of sewer water

SNL/CA continuously monitors wastewater generated on site. Figures 4-2 and 4-3 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. Also reflected on the graphs are SNL/CA's goals of maintaining the level of copper and zinc below the regulatory trigger level (0.5 mg/L for copper and 1.5 mg/L for zinc).

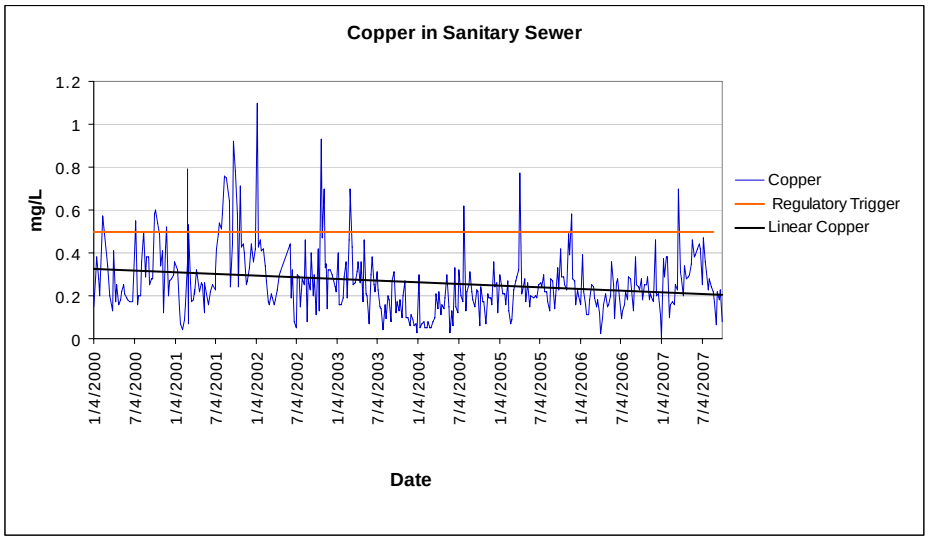

Figure 4-2 Weekly Composite Copper Concentrations in Wastewater

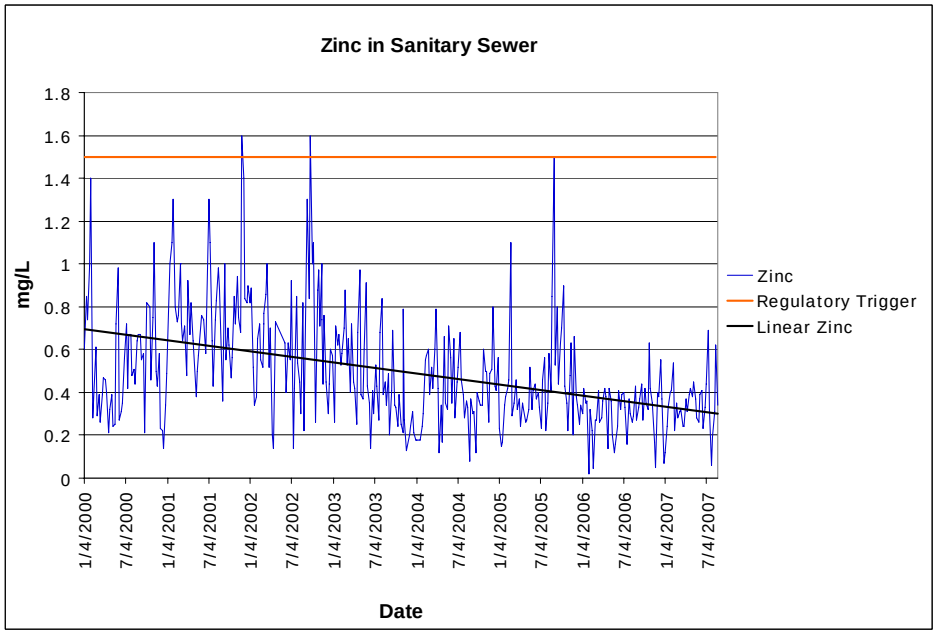

Figure 4-3 Weekly Composite Zinc Concentrations in Wastewater

Figure 4-4 shows volume of sewer effluent discharged by SNL/CA from 2000 through 2007.[5] Sewer discharge in 2007 was 10.2 million gallons, approximately one million gallons less than in 2006. SNL/CA has a stated goal of reducing the quantity of sewer effluent, although no numeric targets have been set.

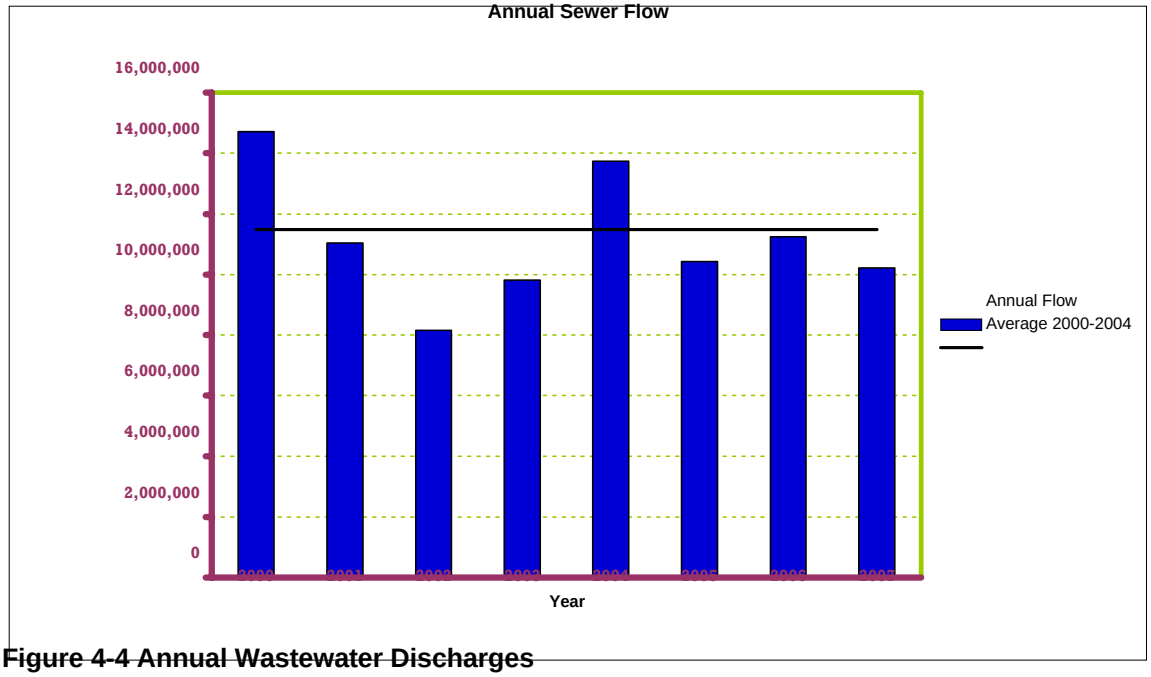

Figure 4-4 Annual Wastewater Discharges

Water Discharge Objective: Minimize the volume and pollution of storm water runoff

The State of California has not yet implemented numeric limits for pollutants in storm water. However, parameters such as total suspended solids (TSS) and oil and grease (O&G) are indicative of the quality of storm water runoff from SNL/CA parking lots and roads. Many factors can affect the quantities of TSS and O&G in the runoff, such as the length of dry weather before sample collection, volume of runoff during the storm, etc. Annually, SNL/CA clears debris from the storm water drainage system and sweeps streets to minimize pollutants in storm water runoff. In 2006 and 2007, Sandia collected approximately 176 cubic yards of debris during street cleaning efforts, thus removing potential storm water pollutants. Figure 4-5 shows the highest TSS and O&G concentrations obtained at SNL/CA storm water sampling locations during the 2006/2007 rainy season. The concentration of TSS in storm water improved during 2006/2007 as the highest concentration (25 mg/L) was less than obtained during the 2005/2006 rainy season (160 mg/L). The concentration of O&G in 2006/2007 was below the detection limit of 5 mg/L for all samples.

[5] The baseline measure displayed in Figure 4-4 is the average sewer flow from 2000 through 2004.

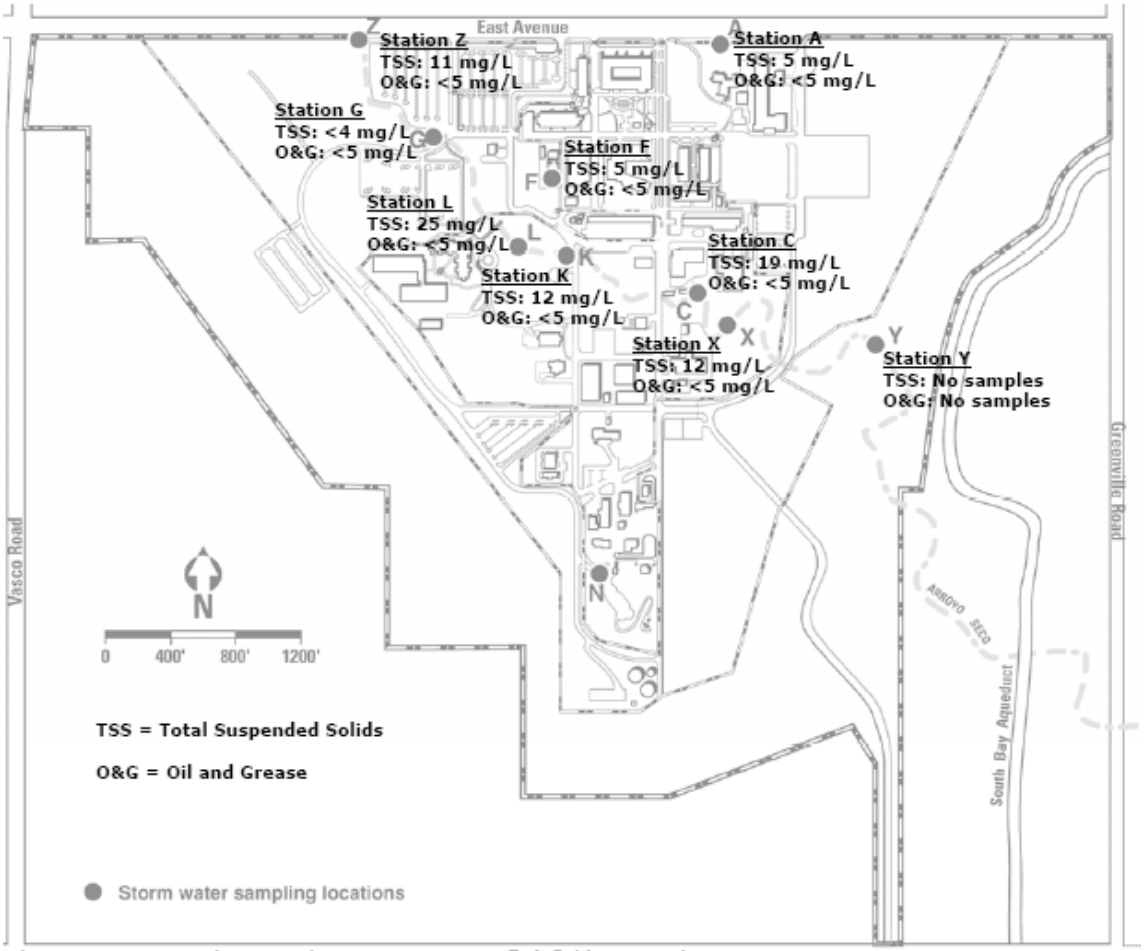

Figure 4-5 Constituents in Storm Water, 2006/2007 Rainy Season

Air Emissions Objective: Minimize air emissions related to operations and transportation with emphasis on Spare the Air (STA) days

During the summer of 2007, the Bay Area experienced several periods of unhealthy air quality, with the Bay Area Air Quality Management District (BAAQMD) issuing two weekday STA advisories, compared to the 2006 STA season when nine weekday advisories were issued. Advisories 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 2007, the Air Quality Program established an EMS target to maintain on-site fueling operations on STA days at an average of less than or equal to three fill-ups per STA day. A program was developed and implemented that encourages site personnel to plan their gasoline fueling activities for either before or after a STA day. The site's workforce appears to be committed to meeting this target, as there was only one fill-up during the two STA days in 2007. This averages to less than one fill-up per STA day, compared to an average of seven on a typical work-day. Figure 4-6 shows the number of fill-ups on STA days over the last five years.

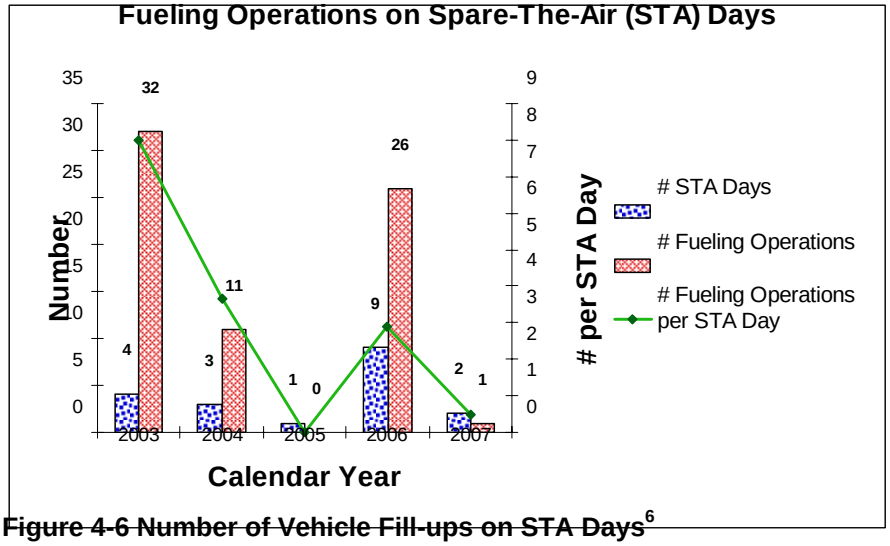

Figure 4-6 Number of Vehicle Fill-ups on STA Days[6]

SNL/CA has a second EMS target under the air emissions objective of reducing the site wide mobile source emissions by ten percent in fiscal year 2008. As a first step in meeting this target, the Air Quality Program established an emissions baseline for onsite mobile sources using 2004 data.[7] Onsite mobile sources include vehicles, carts, landscaping equipment, and construction and maintenance equipment that are not permanently attached to a stationary foundation.

In order to determine the progress in meeting this target, an annual follow-up analysis was completed using 2005 activity data (i.e., hours of operation or miles driven). The methodology, calculations, results and recommendations of this 2005 analysis are documented in the 2005 Emission Inventory of Mobile Sources Annual Progress Report (SNL/CA 2007a). The estimated emissions of reactive organic gases (ROG), carbon monoxide (CO), nitrogen oxides (NO_x), and respirable particulate matter (PM_{10}) and relative change between the 2004 baseline and 2005 are presented in Table 4-2.

SNL/CA's expectation was that very little would have changed between the baseline year (2004) and 2005 because implementation of plans to reduce site-wide mobile source emissions were just starting. In addition, the activity data for the baseline and the 2005 analysis are similar because the baseline incorporates some 2005 data (see footnote 7). The one significant change noted is the 18% reduction in total NO_x emissions, which is largely attributed to the replacement of the 1990 street sweeper with a 2005 model. Other reductions (PM_{10} by 3%) and increases (ROG by 3% and CO by 2%) are not, at this time, considered to be significant due to (1) the uncertainty and assumptions inherent in the emissions calculations and (2) the fact that the 2004 baseline included some 2005 data.

[6] In June 2006, the Bay Area experienced consecutive spare-the-air days, covering three consecutive workdays at SNL/CA. Site personnel deferred all fueling operations on the first two days, but were unable to sustain the delay on the third day, resulting in 17 fill-ups on June 26, 2006.
[7] The 2004 baseline emission report (SNL 2005) was completed in December 2005 and was in part based on 2005 data because complete 2004 data were not available.

Table 4-2 2005 Emission Inventory (tons/yr)

Source	ROG			CO			NO_x			PM_{10}		
	Baseline	2005	Change	Baseline	2005	Change	Baseline	2005	Change	Baseline	2005	Change
GSA	0.05	0.03	41%	0.71	0.46	34%	0.32	0.18	44%	0.01	0.01	26%
Carts	5.26	5.52	5%	64.0	65.8	3%	1.16	1.19	3%	0.10	0.11	6%
Landscaping	6.54	6.72	3%	15.65	16.0	2%	0.33	0.33	0%	0.257	0.264	3%
Construction	1.24	1.18	-4%	14.3	13.8	-3%	1.72	1.19	-31%	0.12	0.10	-19%
Total	13.09	13.45	3%	94.6	96.2	2%	3.53	2.90	-18%	0.49	0.48	-3%

ROG - reactive organic gases (similar to VOC - volatile organic compounds)
CO - carbon monoxide
NO_x - nitrogen oxides
PM_{10} - particulate matter with a diameter of <10 microns

Although the total percentage decreases or increases in ROG, CO and PM_{10} emissions may not be of significance, some observations and conclusions can be drawn from the relative numbers:

1. In order to significantly reduce ROG emissions, cart and landscaping usage (age of fleet, technology type, or hours used) must be affected.
2. Overall CO emissions can be most effectively reduced by influencing cart usage.
3. Overall PM_{10} emissions can be most effectively reduced by affecting landscaping equipment usage.

A mobile source emissions inventory for 2007 is currently in preparation and will be compared with the 2004 baseline. It is anticipated that a reduction in ROG and PM_{10} will be seen, due primarily to the replacement of old higher-polluting landscaping equipment. However, since the equipment was not replaced until September 2007, only a three-month emissions reduction will show in the data. Emissions for 2008 will benefit from a full year's use of the new lawnmowers and leaf blowers, and significant reductions in ROG and PM_{10} are anticipated.

Material Procurement and Use Objective: Procure and use environmentally friendly products and materials

SNL/CA's target for material procurement and use is to increase affirmative procurement in 2007 by ten percent over the fiscal year 2004/2005 average, from 81.5 to 89.6 percent of total available products procured. In 2007, Sandia achieved an increase of approximately seven percent in affirmative procurement from 2006 to exceed the ten percent target for 2007. The increase in fiscal year 2007 was due primarily to increases in recycled content paper, filing products, carpet, and furniture. During 2007, the Green Purchasing Team continued efforts to review a variety of office product categories for procurement improvements and added another office supply company that primarily offers products with recycled content. Additionally, SNL/CA began using bio-based products in 2007, which also contributed to achieving our ten percent target. In September 2007, SNL/CA established a new goal that by fiscal year 2010, purchases made by the Affirmative Procurement Program will equal or exceed 96 percent of available procurements. Progress towards meeting this new goal will be presented in future site environmental reports.

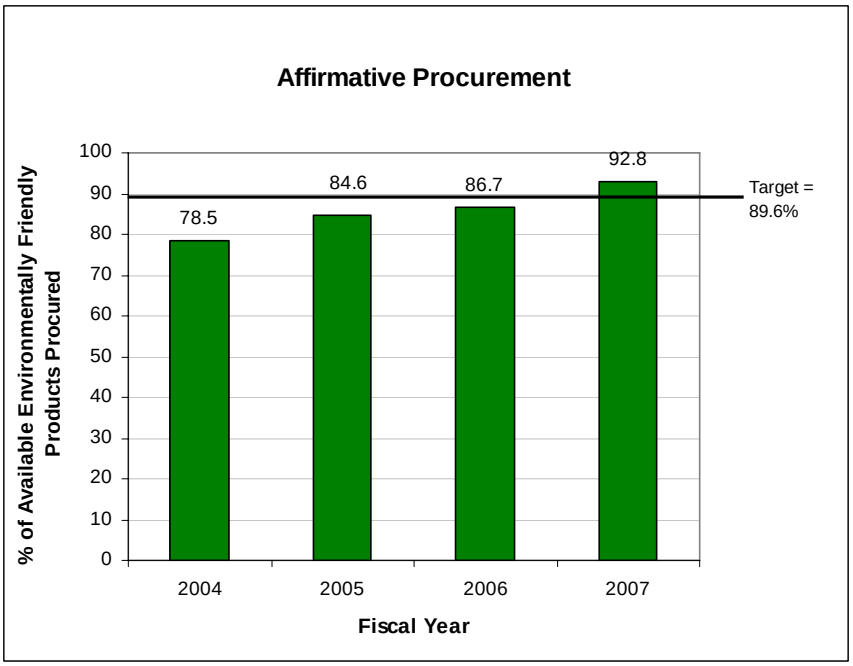

Figure 4-7 Procurement of Environmentally Friendly Products

Land Use Objective: Enhance the natural habitat

In June 2006, SNL/CA initiated an Arroyo Seco Improvement Program to address erosion and storm water control within the arroyo. The improvement program includes restoration of riparian habitat at select locations along the arroyo. SNL/CA restored approximately 0.05 acres of riparian habitat in 2006 by planting a variety of native trees and reseeding disturbed areas with native grasses. In 2007, plant survival and growth in restored areas was monitored for plant survival. Figure 4-8 shows tree survival for areas planted in 2006. As of August 2007, approximately 25 percent of total trees planted were still alive, well below the goal of 85 percent. Willow trees that did not survive will be replanted in spring 2008.

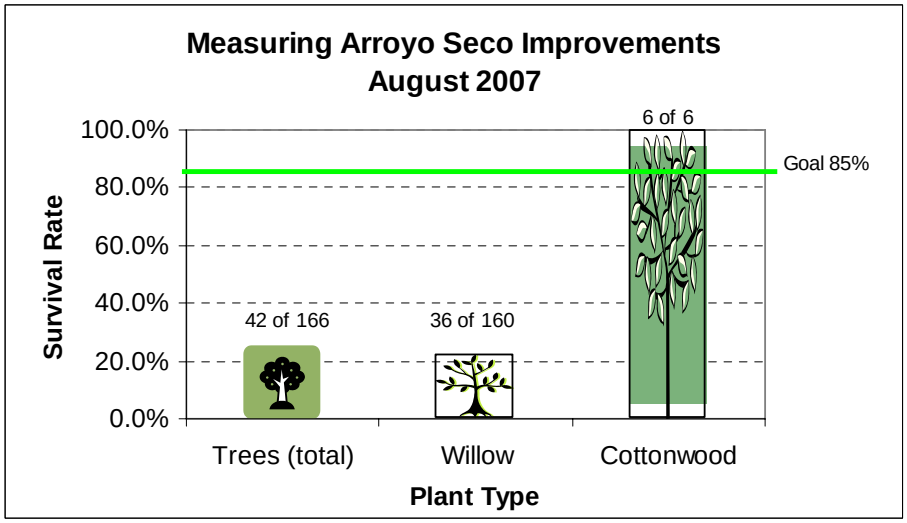

Figure 4-8 Plant Survival Rate for Arroyo Seco Improvements

Hazardous Materials Objective: Minimize the use 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 2007. SNL/CA has been using a barcoded container tracking system since 1993. Figure 4-9 suggests that amounts of hazardous materials, including the more toxic National Fire Protection Association (NFPA) 704 Health Hazard Rated 3 and 4 materials, increased through the 1990's and peaked in 2003. A successful EMS goal-driven campaign reduced the inventory of old (greater than10 years) NFPA 704 Health Hazard Rated 3 and 4 materials by 29 percent in 2007 surpassing the 20 percent reduction goal. While SNL/CA accomplished significant progress in 2007, there is potential for additional reduction in future years to attain an inventory sized appropriately for site operations.

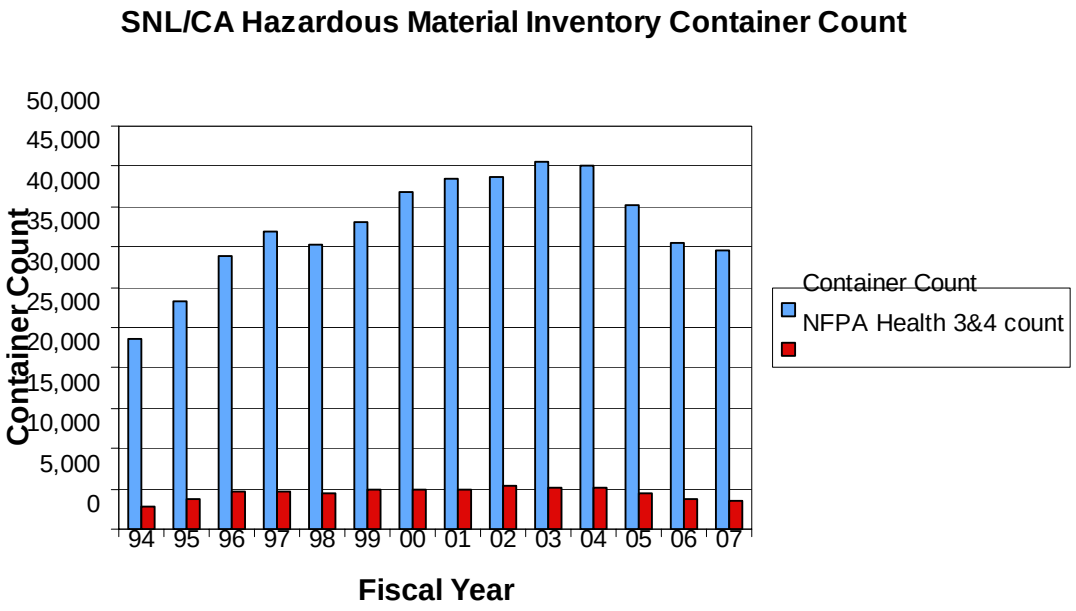

Figure 4-9 Quantity and Toxicity of Hazardous Materials at SNL/CA

Radioactive and Hazardous Waste Objectives: Minimize the generation of radioactive and hazardous waste

Although SNL/CA does not have a specific target for this objective, we strive to minimize generation of radioactive and hazardous waste through process controls, recycling, and reapplication of chemicals from one activity to another. Figures 4-10 and 4-11 show hazardous and radioactive waste generated since 2000, respectively. For both categories of waste, the trend shows a steady decline in quantities generated.

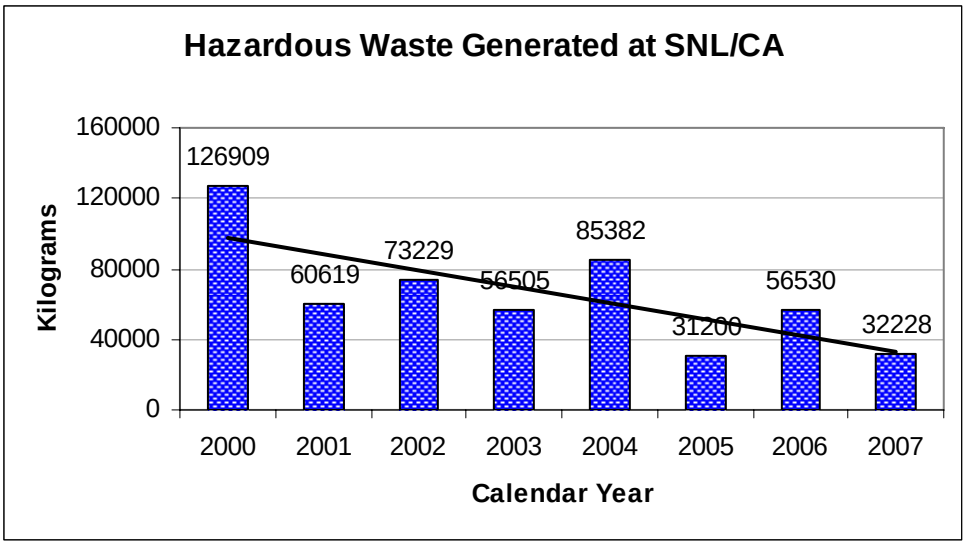

Figure 4-10 Hazardous Waste Generated at SNL/CA

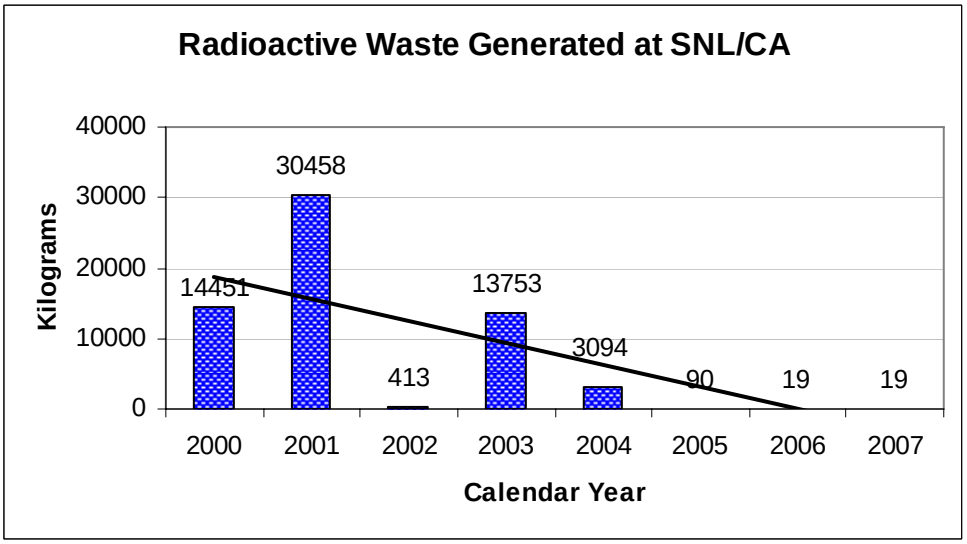

Figure 4-11 Radioactive Waste Generated at SNL/CA

Asbestos Objective: Reduce site legacy asbestos material

SNL/CA reduces site legacy asbestos material through routine abatement completed along with facility modification projects. In 2007, Sandia completed seven asbestos abatement activities generating 13,720 kilograms of asbestos waste. The majority of asbestos waste was generated from demolition of two small office buildings. Asbestos waste is a component of total hazardous waste presented in Figure 4-10.

Solid Waste Objective: Minimize the quantity of landfill waste through reduced consumption and/or reuse/recycling

SNL/CA transports non-hazardous solid waste (trash and construction debris) generated from site operations to local landfills for disposal. In fiscal year 2007, SNL/CA transported 131 metric tons of solid waste to landfills, a decrease of six metric tons from 2006. SNL/CA attributes the reduction in quantity of solid waste transported to landfills to increases in recycling. Figure 4-12 presents solid waste data for fiscal years 2003 to 2007.

Recycling data for most waste streams are presented in figures 4-13 through 4-15. As shown in figures 4-13 and 4-15, the quantity of scrap metal and light tubes recycled in 2007 increased significantly from 2006 (36% and 230%, respectively). This increase is attributed to recycling efforts implemented during deconstruction of two buildings that occurred in 2007.

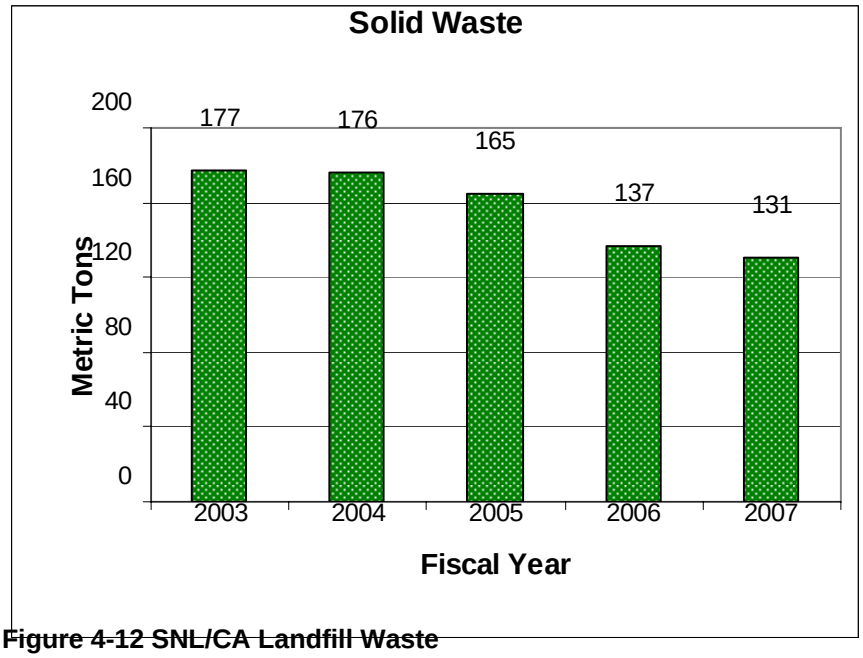

Figure 4-12 SNL/CA Landfill Waste

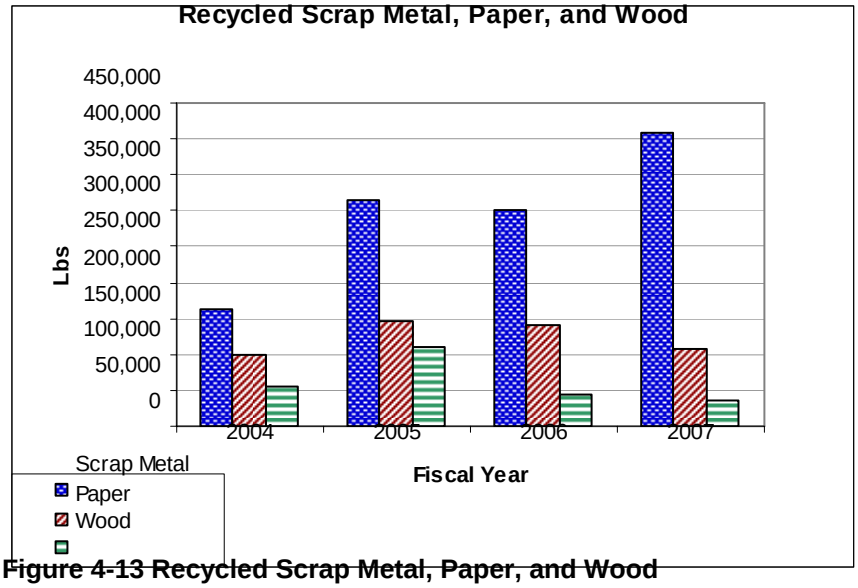

Figure 4-13 Recycled Scrap Metal, Paper, and Wood

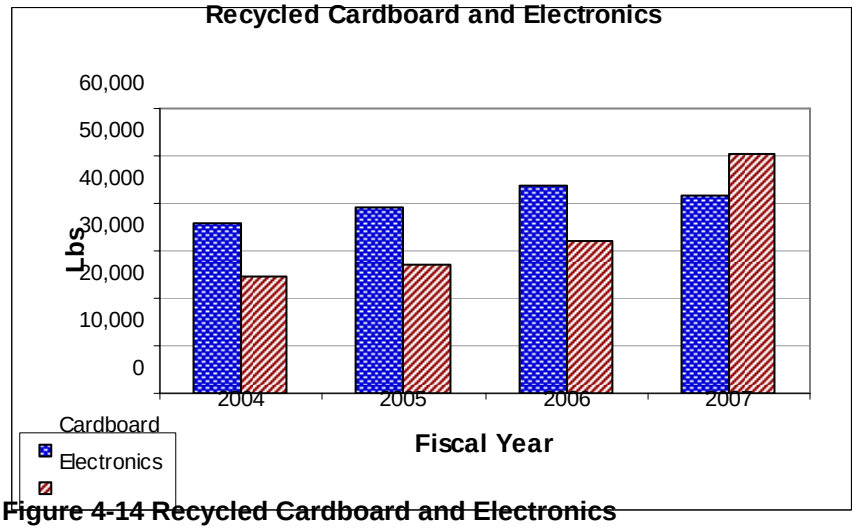

Figure 4-14 Recycled Cardboard and Electronics

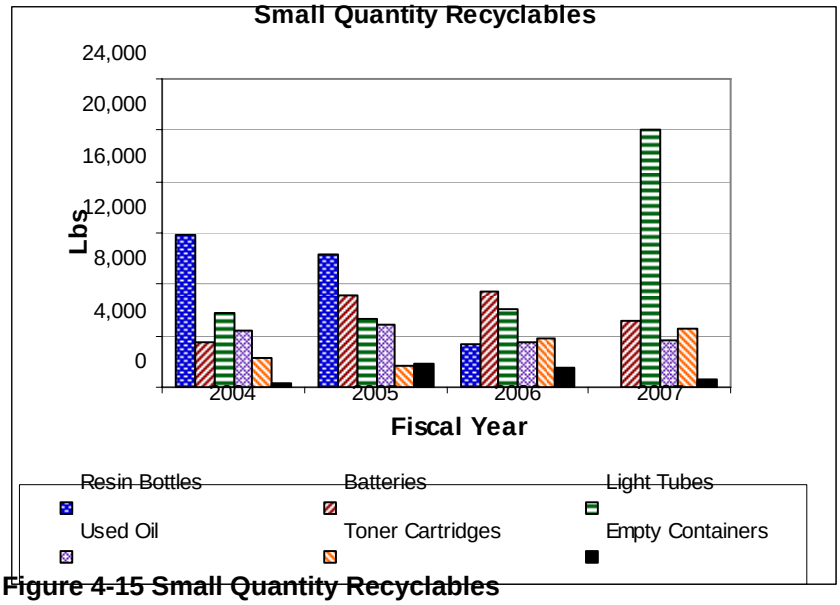

Figure 4-15 Small Quantity Recyclables

Energy Use Objectives: Minimize site consumption of natural gas and electricity

During 2007, SNL/CA's reduction target for energy use was two percent per year over a ten-year period starting in fiscal year 2006, using 2003 data as the baseline. This target was based on the goals established in the Energy Policy Act of 2005 (HR 2005). Figure 4-16 displays the Energy Policy Act energy reduction target for 2006 through 2015 and actual energy use data for the year. Data shows electricity and natural gas combined into British Thermal Units (BTUs). Between 2003 and 2007, SNL/CA reduced energy consumption by about 3.5 percent, which is less than the established target. The site experienced a one-year increase in energy use between 2006 and 2007 of approximately 4.8 percent, offsetting the reductions gained in 2006. SNL/CA attributes the increase in energy consumption during fiscal year 2007 to a colder than normal winter resulting in increased natural gas consumption.

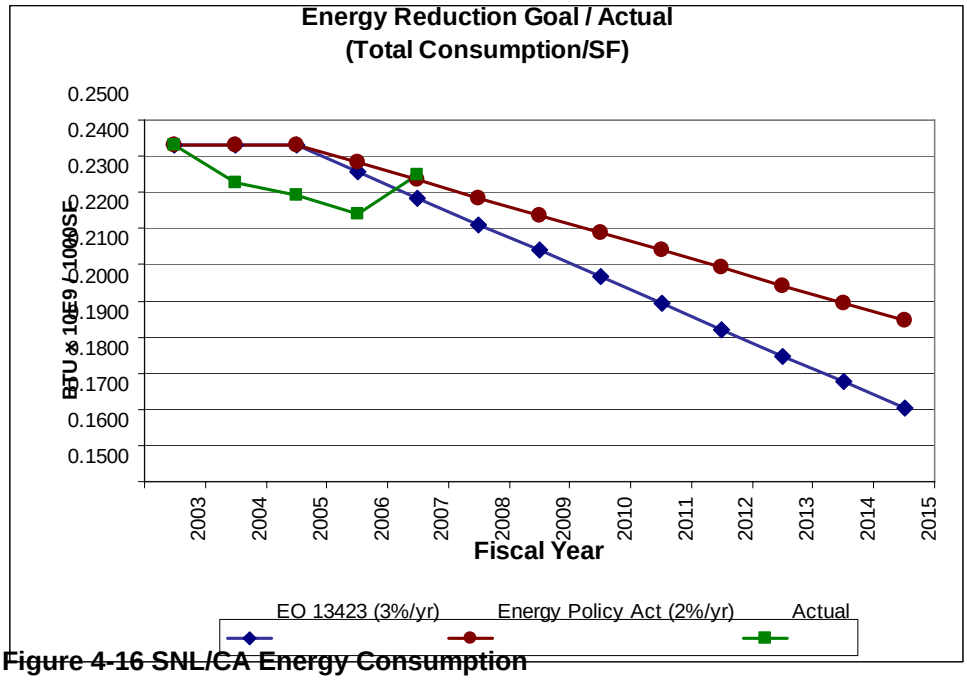

Figure 4-16 SNL/CA Energy Consumption

In January 2007 with the issuance of Executive Order (EO) 13423 (see Section 3.2), more aggressive energy reduction goals were established for all federal agencies. EO 13423 sets a goal of three percent per year starting in fiscal year 2006, using 2003 data as the baseline. This new target is also shown on Figure 4-15. DOE is modifying its environmental protection program order (Order 450.1) to incorporate the goals established in EO 13423. Sandia expects the revised DOE Order 450.1 to become effective for Sandia facilities in spring 2008.

Water Use Objective: Minimize site water consumption

Figure 4-17 presents water use data for SNL/CA since 2004. As shown, the site experienced a slight decrease in water consumption in fiscal year 2007.[8] In October 2007, SNL/CA established a target for reducing water consumption by 16 percent in fiscal year 2015, using fiscal year 2007 data as a baseline. To meet this target, SNL/CA is developing a plan to convert the site to water efficient landscaping and xeriscape. Landscape water accounts for approximately 30 percent of water used on site. Additionally, conservation efforts will continue through education and awareness of the site population, surveys for leaking fixtures, and modifications to and repair of fixtures.

[8] Water use data presented in Section 2.4.2 represents calendar year data and shows a 2.7 percent increase in water consumption in 2007.

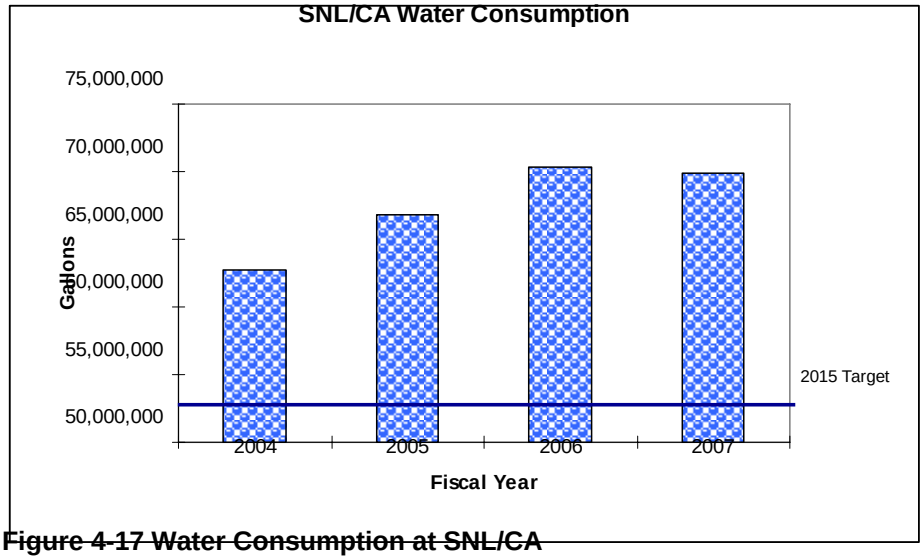

Figure 4-17 Water Consumption at SNL/CA

4.3 Functional Environmental Program Highlights

Six functional environmental programs support environmental management at SNL/CA, air quality, environmental monitoring, 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 2007.

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.

In 2007, Sandia replaced several higher-polluting pieces of landscaping equipment with new low-emissions, fuel-efficient machines. The Air Quality Program was instrumental in acquiring two new lawn mowers and two new leaf blowers for the Maintenance Department. Although relatively small in size, typically these two-stroke engines are deceptively high polluters.[9] With this new equipment, we anticipate a reduction in ROG, NO_x, and PM_{10} emissions. However, since the equipment was not acquired until late 2007, emissions calculations showing a full years' benefit of this new equipment will be provided in 2008.

[9] Using a commercial chain saw – powered by a two-stroke engine – for two hours produces the same amount of smog forming hydrocarbon emissions as driving ten 1995 cars about 250 miles each.

Early in 2007, an inspector with the Bay Area Air Quality Management District (BAAQMD) conducted a series of onsite inspections. The BAAQMD inspections are a rigorous and detailed review of permitted equipment and processes. The inspector examined 30 sources listed on our permit including the associated records and found no violations of District regulations or permit requirements.

4.3.2 Environmental Monitoring Program

The Environmental Monitoring 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 2007, the Environmental Monitoring Program conducted a water audit to identify areas for water use reduction. Through this audit, landscape watering was found to be the largest single water use on site, and an area where reductions could be implemented with minimal impact to site operations.

Also in 2007, SNL/CA switched contract analytical laboratories to a local laboratory to provide more efficient service for obtaining sample analyses. Prior to initiating the contract, Environmental Monitoring Program staff completed a facility inspection and review to ensure State of California certification and quality assurance protocols.

4.3.3 Environmental Planning and Ecology Program

The Environmental Planning and Ecology Program provides oversight for ecological resource management, National Environmental Policy Act (NEPA) reviews, 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 4-3 presents a summary of the comparison and an evaluation of the results.

Table 4-3 Comparison of 2007 Operations with SWEA Envelope

Activity / Unit	SWEA Envelope (maximum operations)	Calendar Year 2007	Site Operations Remain Within Impact Analysis
Proposed Action			
Site mission	Supports DOE, NNSA, DHS	No change	Yes
Arroyo Seco improvements	20 tasks	5 tasks completed	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	500 sf as of December 31, 2007 (badge office trailer)	Yes
Demolition	100,000 sf	26,136 sf as of December 31, 2007	Yes
Land Use			
Construction area	93 acres	8 acres as of December 31, 2007	Yes
Wildlife reserve	30 acres	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	450 cu yd	Yes
Backfill material brought onsite	6000 cu yd/yr	< 200 cu yd	Yes
Infrastructure			
Water use	91.8 million gal/yr	71.8 million gals	Yes
Sanitary sewer discharge	29.1 million gal/yr	10.2 million gals	Yes
Natural gas use	94 million cu ft/yr	75.2 million cu ft[e]	Yes
Electricity use	48,800 MW h/yr	35,412 MW hrs[e]	Yes
Biological and Ecological Resources			
Construct flood plains in Arroyo Seco	1800 linear feet	None	Yes
Create riparian habitat	0.2 acres	0.05 acres as of December 31. 2007	Yes
Ground disturbance in / along arroyo	10 acres	< 3 acres as of December 31, 2007	Yes
Cultural Resources	None known onsite	No change	Yes
Water Resources			
Impervious surface area	76.9 acres total	53.3 acres	Yes
Irrigation water use	17 million gal/yr	16.6 million gals	Yes
Waste Generation			
Radioactive waste	8,811 kg/yr	19 kg	Yes
Hazardous waste	133,820 kg/yr	32,228 kg	Yes
Construction debris (sub-set of solid waste)	200 tons/yr	802 metric tons – recycled 452 metric tons - waste	Although greater than projected in SWEA, landfill capacity in the region was not exceeded
Solid waste (non-hazardous, excludes construction debris)	378.7 metric tons/yr	111 metric tons	Yes

Activity / Unit	SWEA Envelope (maximum operations)	Calendar Year 2007	Site Operations Remain Within Impact Analysis
Proposed Action			
Transportation			
Hazardous / radioactive waste shipments	116 shipments/yr	9 shipments	Yes
Non-hazardous waste shipments (solid waste and construction debris)	80 shipments/yr	50 shipments	Yes
Air Emissions			
Total criteria pollutants	8,212 kg/yr	5.750 kg[a]	Yes
Total air toxics	2,880.16 kg/yr	1,900 kg[a]	Yes
Radioactive	0 emissions	0 emissions	Yes
Permits	57 permits annually	15 / 15 permits[b]	Yes
Human Health			
Recordable accidents / injuries	78 accidents / injuries annually	19 accident / injuries[e]	Yes
Lost work-day cases	19 days annually[c]	12 days[e]	Yes
Socioeconomics			
Employment	Up to 1931 persons annually	932 persons[d]	Yes
Operating budget	$262 million/yr	210.8 million[e]	Yes

[a] Annual emissions were calculated by multiplying the daily emissions reported in the BAAQMD Permit to Operate by 365. Emissions are based on 2006 data.
[b] Data provided for the 2006/2007 and 2007/2008 permit periods. See Section 3.4.1 for more information.
[c] Extrapolated from historical average.
[d] Sandia employees only. Does not include contract staff. Data from November 2007.
[e] Fiscal year data (October 1, 2006 – September 30, 2007).

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 an annual hazardous material inventory reconciliation. In 2007, the reconciliation team achieved a 93 percent “found rate” for the second consecutive year, representing the highest achieved rate since annual reconciliations began over ten years ago. This result surpasses by three percent the corporate performance target of 90 percent.

During 2007, a number of new features and reports were added to the CIS software as part of the continuous improvement process in the Hazardous Materials Management Program. Activities in the program in 2007 also included upgrades to improve accuracy of the data with a new incoming inventory verification process and a monthly emergency management highly hazardous validation process. These processes should also contribute to an increased “found rate” for 2008.

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 2007, SNL/CA implemented improvements to the management of several waste streams. SNL/CA improved the process for offsite recycling of used cathode ray tube (CRT) devices, used electronic devices, and used lamps. The Pollution Prevention Program prepared a solid waste management plan for use during decommissioning and demolition of two buildings. Pollution Prevention staff also obtained confirmation from the California Department of Toxic Substances Control that residual waste from the destruction of hard drives qualified for recycling as scrap metal, avoiding disposal as hazardous waste.

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 2007, Waste Management revised its Hazardous Waste Operation Plan (RCRA Part B Permit) to reflect current administrative conditions, to update processes, and to correct informational and typographical errors. SNL/CA also continued the process of transferring management of radioactive waste to SNL New Mexico, which is expected to be completed by spring 2008. Radioactive waste generated at SNL/CA is 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 routine hazardous waste generation at SNL/CA.

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. 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 2007 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 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

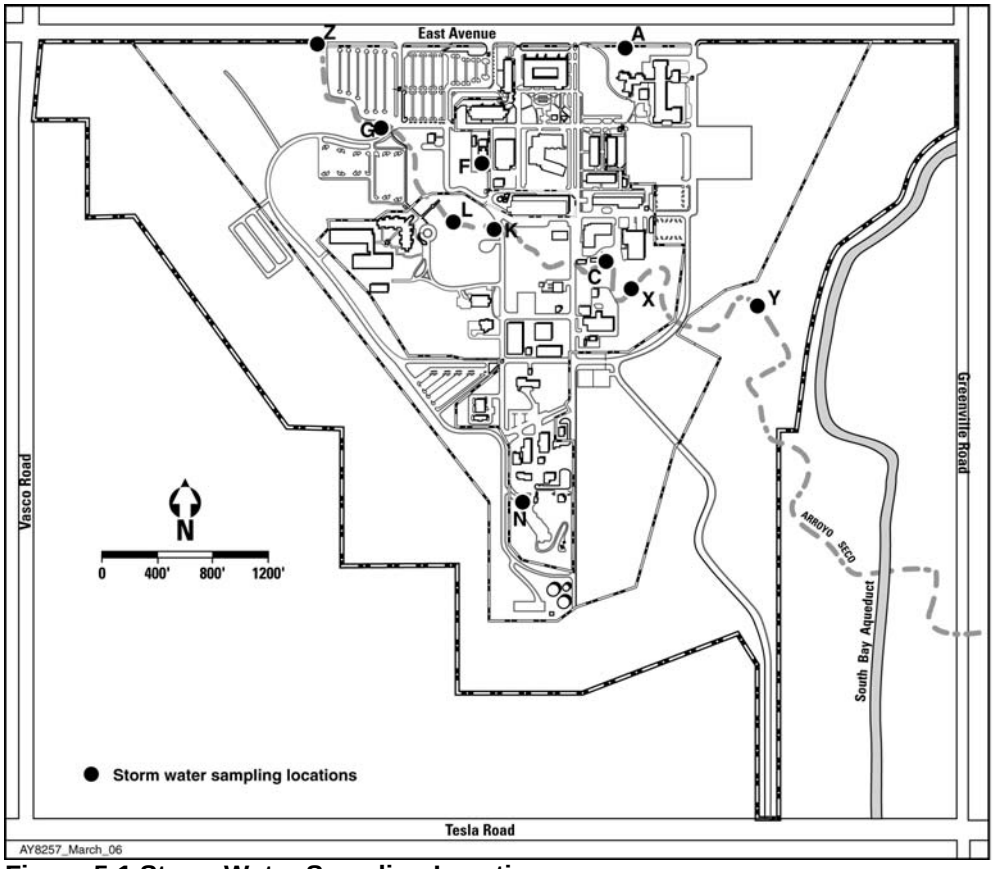

Figure 5-1 Storm Water Sampling Locations

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.

One additional sampling location, Station N, is used to monitor erosion from the Navy Landfill, but is not sampled for the storm water program. During the 2006/2007 rainy season, Station N was sampled once.

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 2006/2007 wet season 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, 2006/2007 Wet Season

Parameter	Number of Samples Analyzed	Number Found Below Detection Limit	Detection Limit[a]	Minimum Concentration	Maximum Concentration
Total suspended solids	15	4	3 mg/L	<3 mg/L	24.7 mg/L
Specific conductivity	15	0	1 µmho/cm	24.5 µmho/cm	49 µmho/cm
pH	15	0	None	6.55	7.2
Oil and grease	15	13	1 mg/L	<1.0 mg/L	1.1 mg/L
Chemical oxygen demand	15	1	10 mg/L	<10 mg/L	40 mg/L
Cyanide	15	15	0.002-0.01 mg/L	<0.002 mg/L	<0.01 mg/L
Tritium	15	15	208-799 pCi/L	<208 pCi/L	<799 pCi/L
Aluminum	15	0	0.05 mg/L	0.11 mg/L	1.3 mg/L
Arsenic	15	10	0.0005-0.005 mg/L	0.00063 mg/L	0.00097 mg/L
Cadmium	15	8	0.00025–0.002 mg/L	0.00038 mg/L	0.00057 mg/L
Iron	15	0	0.05 mg/L	0.16 mg/L	1.7 mg/L
Lead	15	6	0.0005-0.005 mg/L	0.0018 mg/L	0.0058 mg/L
Magnesium	15	0	0.10 mg/L	0.37 mg/L	1.3 mg/L
Mercury	15	13	0.000012-0.0002 mg/L	<0.000012 mg/L	0.000016 mg/L
Selenium	15	14	0.0005-0.002 mg/L	<0.0005 mg/L	0.0036 mg/L
Silver	15	15	0.00019-0.005 mg/L	<0.00019 mg/L	<0.005 mg/L
Zinc	15	0	0.02 mg/L	<0.047 mg/L	0.19 mg/L
Ammonia-N	15	15	0.2 – 0.5 mg/L	<0.2 mg/L	<0.5 mg/L
Nitrite + nitrate	15	8	0.1 / 0.1 mg/L	<0.1/<0.1 mg/L	2.4 mg/L

[a] Starting in 2007, new analytical methods with lower detection limits were used for sample analyses.

Annually, SNL/CA evaluates storm water pollution prevention practices at each drainage location as part of its monitoring activities. On May 15, 2007, Environmental Monitoring Program staff observed water in a storm drain channel. The source was determined to be discharge from annual potable water main testing. It did not appear that potable water reached Arroyo Seco. Best management practices were discussed with appropriate maintenance staff to ensure that the amount, if any, of potable water that may reach the arroyo is limited during future testing activities.

During years of sufficient runoff, SNL/CA compares the analytical results from storm water entering the site to storm water exiting the site. For the 2006/2007 storm season, there was insufficient runoff to collect a sample of storm water entering the site. Consequently, a comparison could not be made.

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, 2007

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 2007, all liquid effluent from the outfall complied with the site outfall discharge limits for regulated physical parameters and most metals. The site exceeded the discharge limit for copper one time in 2007. This exceedance is not reflected in Table 5-3 data because the table presents data for weekly composite samples. The copper exceedance was found in a daily sample collected on March 15, 2007. Additional information about the exceedance is presented in Section 3.11.

Table 5-3 Weekly Composite Sewer Outfall Monitoring Results – Physical Parameters and Metals, 2007

Parameter	Number of Samples Analyzed	Quantity Found Below Detection Limit	Detection Limit[a]	Sewer Discharge Limit	Minimum Concentration	Maximum Concentration
Total suspended solids	12	0	5 mg/L	None	108 mg/L	2100 mg/L
Total dissolved solids	12	0	5 mg/L	None	124 mg/L	484 mg/L
Biochemical oxygen demand	12	0	5 mg/L	None	74 mg/L	600 mg/L
Chemical oxygen demand[b]	12	0	5 mg/L	None	170 mg/L	1900 mg/L
Cyanide	12	1	0.002 - 0.2 mg/L	0.04 mg/L	0.0011 mg/L	0.022 mg/L
Arsenic	52	2	0.0005 - 0.005 mg/L	0.06 mg/L	0.00059 mg/L	0.0092 mg/L
Cadmium	52	5	0.00025 mg/L	0.14 mg/L	<0.00025 mg/L	0.011 mg/L
Chromium	52	3	0.0005 - 0.01 mg/L	0.62 mg/L	<0.0005 mg/L	0.015 mg/L
Copper	52	1	0.0005 - 0.005 mg/L	1 mg/L	<0.005 mg/L	0.70 mg/L
Lead	52	3	0.0005 - 0.05 mg/L	0.2 mg/L	0.00066 mg/L	0.015 mg/L
Mercury	52	2	0.000012 - 0.0005 mg/L	0.01 mg/L	0.000023 mg/L	0.0011 mg/L
Nickel	52	4	0.0005 - 0.02 mg/L	0.61 mg/L	<0.0005 mg/L	0.08 mg/L
Silver	52	7	0.00019 - 0.01 mg/L	0.2 mg/L	<0.00019 mg/L	0.0068 mg/L
Zinc	52	1	0.005 - 0.02 mg/L	3 mg/L	<0.05 mg/L	0.71 mg/L

[a] Starting in 2007, new analytical methods with lower detection limits were used for sample analyses.
[b] 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 2007, sewer outfall samples showed concentrations of acetone (<5 - 100 µg/L), chloroform (1.8 – 8.0 µg/L), bromoform (0.75 – 1.0 µg/L), phenol (110 µg/L), Dibromochloromethane (1.6 – 5.5 µg/L), Bromochloromethane (1.9 – 4.4 µg/L), and toluene (0.61 – 4.6 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 2007, 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 operated five LECS during 2007. Wastewater from LECS tanks is typically analyzed for metals. Analyses for other parameters associated with the process generating the wastewater may also be done. Four of the five LECS tanks are also continuously monitored for pH. One LECS tank is monitored every few years for tritium and uranium; however, in 2007, 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 2007, SNL/CA did not dispose of any tanks of wastewater through Sandia's Waste Management Program.

5.2.3 Categorical Processes

Three research operations at SNL/CA are defined as federal categorical processes subject to the EPA's pretreatment standards for point sources (40 CFR Part 403, 40 CFR Part 433). These categorical processes include two metal finishing operations and a semiconductor manufacturing operation.[10] Wastewater from the semiconductor manufacturing operation is sampled semiannually. The two metal finishing operations are closed-loop systems that do not discharge effluent to the sanitary sewer, and, therefore, wastewater monitoring is not required.

Samples collected from the semiconductor manufacturing operation are analyzed for pH, arsenic, and toxic organic pollutants. Table 5-4 presents a summary of semiannual monitoring results for the semiconductor manufacturing operation. In 2007, all wastewater from this operation met the pretreatment standards.

Table 5-4 Monitoring for Semiconductor Manufacturing Categorical Process, 2007

Parameter	Number of Samples Analyzed	Number Found Below Detection Limit	Detection Limit	Minimum Concentration	Maximum Concentration	Permit Limit [a]
pH	3	--	None	7.4	8.36	5-10
Arsenic	2	2	0.0005 mg/L	<0.0005 mg/L	<0.0005 mg/L	2.09 mg/L
Total toxic organics	3	--	Range[b]	All below detection limit	All below detection limit	1.37 mg/L[c]

[a] Permit limit for site outfall.
[b] Detection limits for the various organics included in this value range from 0.005 to 0.130 mg/L.
[c] The limit for total organics is a daily maximum concentration.

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

5.3 Groundwater

SNL/CA has seven groundwater monitoring wells. Sandia monitors groundwater at two former restoration areas and along Arroyo Seco. Three 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 at the Navy Landfill. 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. MW-406, an LLNL well, is also shown on Figure 5-2. SNL/CA discontinued monitoring at this location in 2005, but will continue to report the results of LLNL's monitoring efforts that occur every two years. Table 5-5 provides the sampling schedule for each SNL/CA well location.

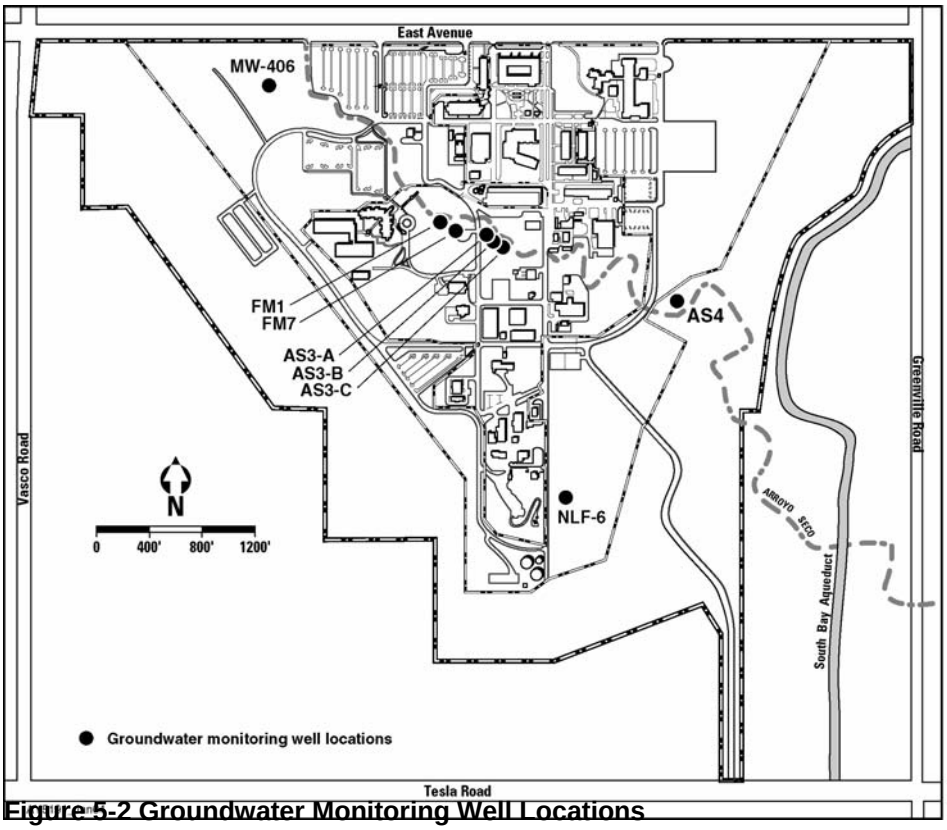

Figure 5-2 Groundwater Monitoring Well Locations

Table 5-5 Groundwater Sampling Schedule, 2007

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
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

Table 5-6 presents a summary of groundwater analytical results for the Navy Landfill. Groundwater analytical results for Arroyo Seco wells are summarized in Table 5-7. All wells at the Fuel Oil Spill had insufficient water for sampling during 2007; consequently, no samples were collected[11]. LLNL sampled MW-406 in October 2007. The results are presented in Table 5-6. 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.

As in past years, SNL/CA continued to detect carbon tetrachloride at the Navy Landfill well (NLF-6) in 2007. 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.

Table 5-6 Summary of Groundwater Analyses at Navy Landfill, 2007

	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	6/4/07	0.81	1.6	ND
Trudell Auto Repair Site				
MW-406	10/31/07	ND	ND	2.2

[a] All other EPA 601 parameters were non-detectable.
MCL – Maximum contaminant levels.

[11] The wells at the FOS have been dry four consecutive years.

Table 5-7 Summary of Groundwater Analyses at Arroyo Seco Wells, 2007

				CCR Metals[a]												
	Date	EPA 601	Diesel (8015) µg/L	Antimony mg/L	Arsenic mg/L	Barium mg/L	Chromium mg/L	Copper mgl/L	Lead mg/L	Mercury mg/L	Molybdenum mg/L	Nickel mg/L	Vanadium mg/L	Zinc mg/L	Tritium pCi/L
Detection limit			50		0.1	0.1	0.1	0.1	0.05	0.1	2	0.02	2	0.1	500
MCL - California						1	1		0.05						
MCL – Federal						2									
AS-3A	6/4/07	ND	ND	ND	0.00084	0.073	0.0008	0.0012	ND	0.000015	0.0014	0.0005	0.0022	ND	<170
AS-3B	6/5/07	ND	ND	0.00074	0.00084	0.13	0.0077	0.11	0.00051	0.000039	0.0037	0.00058	0.0022	0.0099	<210
AS-3C	6/5/07	ND	ND	0.0019	ND	0.16	0.0055	0.0035	ND	0.000078	0.0051	ND	0.00054	ND	<130
AS-4	6/4/07	ND	ND	0.00065	0.0019	0.14	0.017	0.008	0.008	0.00006	0.0035	0.0059	0.0068	0.097	<160

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

MCL – Maximum contaminant levels.

ND – 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 Radiation Doses to Aquatic and Terrestrial Biota* (DOE 2002). The technical standard includes models for calculating doses from radionuclide concentration data obtained from sediment and water analyses. In 2007, 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. Typically, SNL/CA uses tritium data from storm water sampling in the RAD-BCG Calculator. However, because tritium was not detected above analytical detection limits in storm water samples collected in 2007, the detection limit value was used. The sum of fractions from storm water data totaled 2.93×10^{-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 2007, the average annual perimeter dose was 58.6 mrem (0.59 mSv). The average annual dose measurement for distant locations was 55.6 mrem (0.56 mSv). The 2007 data for both perimeter and distant locations are within the range measured over the last fifteen 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 2007. SNL/CA does not appear to be a significant contributor to gamma radiation dose in the surrounding environment.

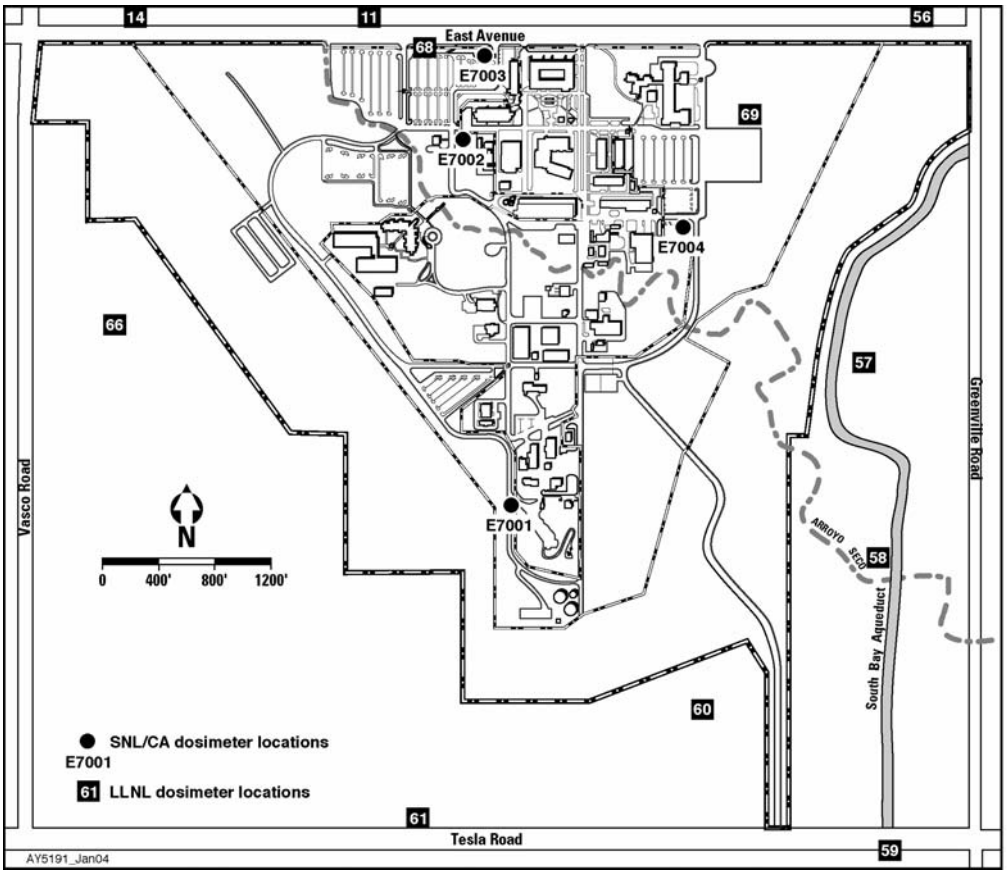

Figure 5-3 Dosimeter Locations at SNL/CA and Around Site Perimeter

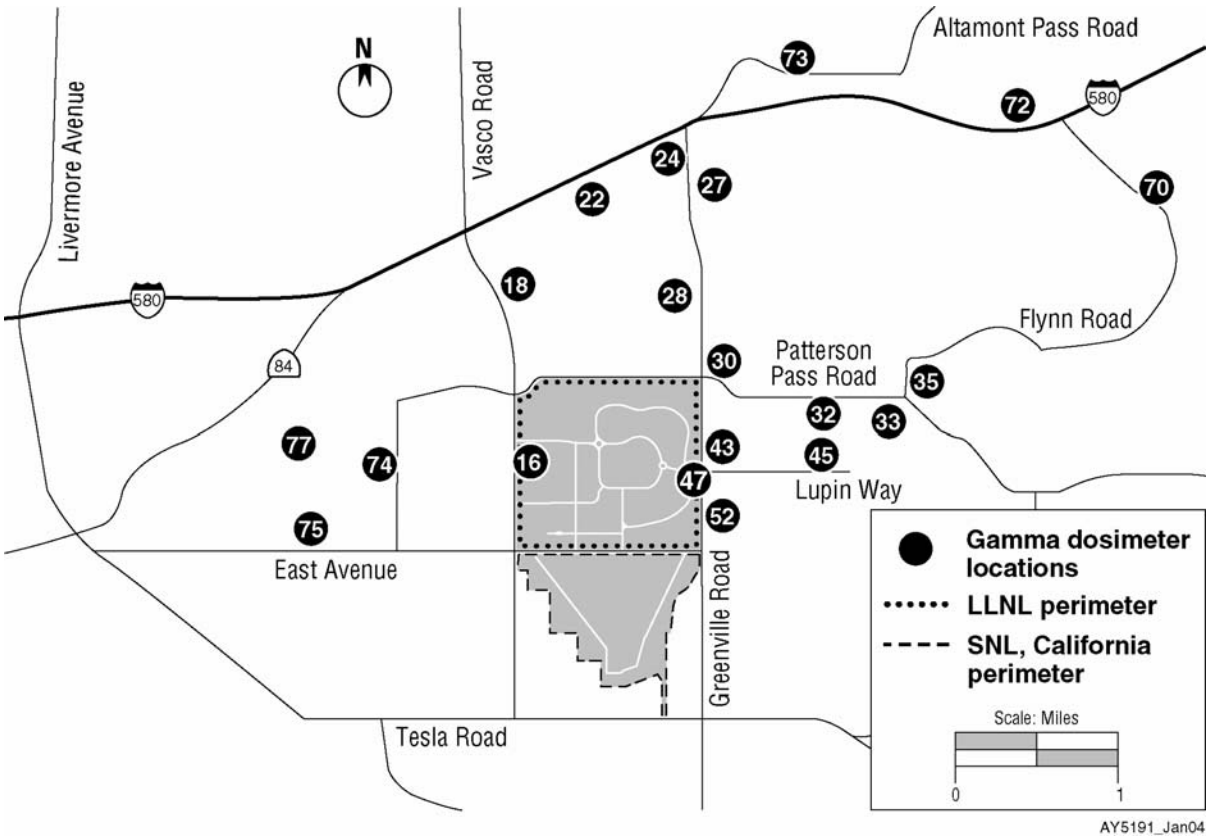

Figure 5-4 Dosimeter Locations in Livermore Valley

6 Quality Assurance

The Sandia Corporate Quality Assurance Program, defined in CPR001.3.2 (SNL 2007) is implemented at Sandia National Laboratories, California (SNL/CA) through the Sandia National Laboratories Division 8000, Quality Management Manual (SNL/CA 2006). 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 2005). The Environmental Management Department maintains a Quality Assurance Project Plan that describes the general quality requirements for SNL/CA environmental programs. Program-specific quality requirements are presented in annual program reports and implemented through operating procedures.

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 Environmental Monitoring Quality Assurance

The Environmental Monitoring 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 2005b). The SNL/CA Environmental Monitoring Annual Program Report provides a detailed description of the monitoring and surveillance activities conducted at SNL/CA (SNL/CA 2007b). 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 2006b), 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 Assurance Plan (SNL 2006b). 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 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 2007, SNL/CA collected twelve wastewater quality control samples representing 23 percent of the sample load. Four groundwater quality control samples were collected representing 44 percent of the sample load. Four storm water quality control samples were collected during the 2006/2007 wet season, representing 31 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 2007. The results show that all data quality objectives were met, with the exception of the number of groundwater and storm water samples the Environmental Monitoring Program was able to collect. The low number of samples collected was due to low groundwater levels, and lower than average rainfall respectively.

Table 6-1 Summary of Statistical Analyses, 2007

Sample Medium	Completeness Test	Precision Test		Accuracy Test	
	Results	# of Tests	Results	# of Tests	Results
Wastewater (sanitary sewer)	100%	6	All passed	18	17 passed
Storm water	65%[a]	11	All passed	--	--
Groundwater	56%[b]	1	All passed	--	--

[a]The low percentage of samples collected was due to an unusually dry year, not a failure of the sampling system. A nonconformance report was not required.
[b]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.

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

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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.

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

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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° to 61° 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, 2007

	Date	Dichlorodifluoromethane µg/L	Chloromethane µg/L	Vinyl Chloride µg/L	Bromomethane µg/L	Chloroethane µg/L	Trichlorofluoromethane µg/L	Methylene Chloride µg/L	Trans-1,2-Dichloroethene µg/L	1,1 Dichloroethane 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	2.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
MCL - California				0.5			150		10	5		200	0.5	0.5	5	5
MCL - Federal				2				5	100		100	200	5	5	5	5
Well ID																
NLF-6	6/4/07	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.81	ND	1.6	ND	ND	ND
	6/4/07[a]	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.77	ND	1.5	ND	ND	ND
AS-3A	6/4/07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-3A	6/4/07[b]	ND	ND	ND	ND	ND	ND	1.1	ND	ND	ND	ND	ND	ND	ND	ND
AS-3B	6/5/07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-3C	6/5/07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FM-1[c]		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
FM-7[c]		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AS-4	6/4/07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trip Blank	6/4/07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trip Blank	6/5/07	ND	ND	ND	ND	ND	ND	0.97	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 2007.

Table 9-1 Results of Groundwater Analyses at SNL/CA, 2007 (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	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	50
MCL - California			0.5		32	5		30		1		5		
MCL - Federal		100			5	5	100	100	100		600	75	600	
Well ID														
NLF-6	6/4/07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--
	6/4/07[a]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-3A	6/4/07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-3A	6/4/07[b]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-3B	6/5/07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-3C	6/5/07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FM-1[c]		--	--	--	--	--	--	--	--	--	--	--	--	--
FM-7[c]		--	--	--	--	--	--	--	--	--	--	--	--	--
AS-4	6/4/07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trip Blank	6/4/07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--
Trip Blank	6/5/07	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 2007.

Table 9-1 Results of Groundwater Analyses at SNL/CA, 2007 (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	0.0005	0.0005	0.005	0.0005	0.00025	0.0005	0.0005	0.0005	0.0005	0.000012	0.0005	0.0005	0.0005	0.00019	0.0005	0.0005
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	0.01	2	0.004	0.005	0.1		1 [d]		0.002		0.1	0.05	0.1 [d]	0.002	
Well ID																			
NLF-6	6/4/07	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6/4/07[a]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AS-3A	6/4/07	--	--	0.0006	0.0019	0.140	ND	ND	0.017	0.0014	0.008	0.008	0.00006	0.0035	0.0059	ND	ND	ND	0.0068
AS-3A	6/4/07[b]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AS-3B	6/5/07	--	--	0.00065	0.00084	0.13	ND	ND	0.0077	ND	0.011	0.00051	0.000039	0.0037	0.00058	ND	ND	ND	0.0022
AS-3C	6/5/07	--	--	0.0019	ND	0.16	ND	ND	0.0055	ND	0.0035	ND	0.000078	0.0051	ND	0.0012	ND	ND	0.00054
FM-1[c]		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
FM-7 [c]		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AS-4	6/4/07	--	--	ND	0.00084	0.073	BD	BD	0.0008	BD	0.0012	ND	0.000015	0.0014	0.0005	ND	ND	ND	0.0022

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 2007.
[d] Secondary drinking water standard.

Table 9-1 Results of Groundwater Analyses at SNL/CA, 2007 (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	Alkalinity as $CaCO_3$ 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		0.005	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	6/4/07	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6/4/07[a]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AS-3A	6/4/07	0.015	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AS-3A	6/4/07[b]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AS-3B	6/5/07	0.0099	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AS-3C	6/5/07	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
FM-1[c]		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
FM-7[c]		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AS-4	6/4/07	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 2007.
[d] Secondary drinking water standard.
[e] Result is less than the sample detection limit.

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.

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