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Site Environmental Report for 2015 Sandia National Laboratories, California

Barbara L. Larsen

Prepared by
Sandia National Laboratories
Livermore, California 94550

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Abstract

Sandia National Laboratories, California (SNL/CA) is a government-owned/contractor-operated laboratory. Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, manages and operates the laboratory for the Department of Energy's National Nuclear Security Administration (NNSA). The NNSA Sandia Field Office administers the contract and oversees contractor operations at the site. This Site Environmental Report for 2015 was prepared in accordance with DOE Order 231.1B, *Environment, Safety and Health Reporting* (DOE 2012b). The report provides a summary of environmental monitoring information and compliance activities that occurred at SNL/CA during calendar year 2015, unless noted otherwise. General site and environmental program information is also included.

Acknowledgements

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Preface

Each year, Sandia Corporation (Sandia) prepares a summary report for Sandia National Laboratories, California (SNL/CA) to provide environmental information to the local community, pursuant to the requirements of Department of Energy Order 231.1B, *Environment, Safety and Health Reporting*. The Site Environmental Report for 2015 summarizes compliance with environmental requirements, presents the results of monitoring and surveillance activities, and provides an update of site environmental program activities for SNL/CA.

The Site Environmental Report for 2015 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 in Chapter 7.

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Acronyms and Abbreviations

AEA	Atomic Energy Act
ALARA	as low as reasonably achievable
ASIP	Arroyo Seco Improvement Program
AST	aboveground storage tank
BAAQMD	Bay Area Air Quality Management District
BOD	biochemical oxygen demand
BTEX	benzene, ethylbenzene, toluene, xylenes
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
CERS	California Environmental Reporting System
CFR	Code of Federal Regulations
COD	chemical oxygen demand
cu ft	cubic feet
cu yd	cubic yard
DHS	Department of Homeland Security
DOE	Department of Energy
DTSC	Department of Toxic Substances Control (California)
EISA	Energy Independence and Security Act
EMS	environmental management system
EO	executive order
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
EPEAT	Electronic Product Environmental Assessment Tool
ES&H	environment, safety, and health
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FONSI	Finding of No Significant Impact
FY	fiscal year
gal	gallon
General Industrial Permit	State of California, NPDES General Permit for Storm Water Discharge Associated with Industrial Activities
GHG	greenhouse gas

ISO	International Organization for Standardization
kg	kilogram
lb	pound
LECS	liquid effluent control system
LLNL	Lawrence Livermore National Laboratory
MCLs	maximum contaminant levels
mg/L	milligrams per liter
mL	milliliter
M&O Contract	Management and Operating Contract
mrem	millirem
mSv	milliSeivert
MW hr	Megawatt hour
NA	not applicable
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/SFO	National Nuclear Security Administration, Sandia Field Office
NOV	notice of violation
NPDES	national pollutant discharge elimination system
O&G	oil and grease
oz	ounce
PCB	polychlorinated biphenyl
PCE	Tetrachloroethylene
pCi/L	picocuries per liter
POTW	publicly owned treatment works
QAPP	quality assurance program plan
RCRA	Resource Conservation and Recovery Act
RPDP	Radiation Protection Dosimetry Program
RWQCB	Regional Water Quality Control Board (California)
SA	supplement analysis
Sandia	Sandia Corporation
SARA Title III	Superfund Amendments and Reauthorization Act of 1986, Title III
sf	square feet
SF6	Sulfur Hexafluoride

SHPO	State Historic Preservation Officer
SNARL	Suggested No-Adverse Response Level
SNL	Sandia National Laboratories
SNL/CA	Sandia National Laboratories, California
SNL/NM	Sandia National Laboratories, New Mexico
sf	square feet
SSP	Site Sustainability Plan
SWEA	site-wide environmental assessment
TDS	total dissolved solids
TPHD	total petroleum hydrocarbons diesel
TSCA	Toxic Substances Control Act
TSS	total suspended solids
TTO	total toxic organics
µg/L	micrograms per liter
µmho/cm	micromhos per centimeter
U.S.	United States
USC	United States Code
USFWS	United States Fish and Wildlife Service
UST	underground storage tank
yr	year

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1 Executive Summary

1.1 Overview

Sandia National Laboratories (SNL) is one of three national laboratories supporting the United States Department of Energy (DOE) statutory responsibilities for nuclear weapon research and design, development of energy technologies, and basic scientific research. SNL facilities are located 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.

This Site Environmental Report summarizes the environmental programs and compliance efforts at SNL/CA for calendar year 2015. It also discusses integration with the broader Sandia environmental management system (EMS) and site contributions to corporate sustainability goals.

1.2 Environmental Programs

At SNL/CA, environmental monitoring, surveillance, and compliance are supported by a site-specific Environmental Management Department, with five focused programs: Air Quality, Environmental Monitoring and Ecology, Environmental Planning, Pollution Prevention and Waste Minimization, and Waste Management. Environmental personnel apply their expertise with federal, state, and local environmental regulations, and DOE directives in support of all site operations and activities.

Sandia's EMS, the primary corporate management approach to achieving environmental improvement and minimizing impact, is also implemented through our site environmental programs. In May 2015, SNL/CA's site-specific ISO 14001:2004 certification, initially received in 2006, was transferred to a multi-site certification under the corporate EMS.

1.3 Environmental Performance

Sandia personnel measure environmental performance as progress towards achieving site environmental objectives, meeting or exceeding compliance, and contributing to corporate goals and contract performance objectives. During 2015, Sandia personnel measured performance in achieving six site EMS objectives, three corporate goals, and one performance objective established jointly between Sandia and the DOE National Nuclear Security Administration, Sandia Field Office (NNSA/SFO). Sandia received one notice of violation (NOV) in 2015 resulting from a violation of underground storage tank training regulations. Section 3.12 presents the details of the NOV. Additional information about SNL/CA's environmental performance in 2015 is presented in Chapter 4.

1.4 Monitoring and Surveillance

Sandia personnel monitor storm water, wastewater, groundwater, and direct (ambient) radiation at SNL/CA. The results of monitoring during the 2014/2015 wet season show that no pollutants were detected in storm water runoff at levels that are a cause for concern. During 2015, there were no exceedances of the wastewater discharge limit at the site sewer outfall. Monitoring results continued to show carbon tetrachloride in groundwater at the Navy Landfill in 2015 with a concentration similar to that detected in past years. No constituents of concern were found in groundwater from wells at the Fuel Oil Spill site or along Arroyo Seco. The average annual gamma radiation dose from all sources including background radiation at the site perimeter in fiscal year 2015 was 61.5 mrem (0.615 mSv), which is within the dose range measured over the last ten years. The measured background for this area is approximately 51.8 mrem (0.518 mSv). The difference between the two values is statistically significant. However, since both numbers are within the historical range, and there are no known sources of new or increased radiation exposure at SNL/CA, the difference is not considered to be indicative of increased radiation from Sandia operations. 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 (Sandia) 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 Sandia to support stockpile stewardship ensuring nonproliferation and continued safety, security, and reliability, took on greater importance.

Sandia personnel have provided distinguished service to the nation for over 60 years through engineering support and systems integration for nuclear weapons and related national security research and development efforts. At SNL/CA, 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. Sandia personnel are committed to collaborative research and development with industry and universities, resulting in new and enhanced technologies that have both commercial and national security benefits.

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 nanotechnologies

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

2.2 Location

SNL/CA is located approximately 40 miles east of San Francisco, within 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 is comprised of 410 acres. The main campus (134 acres) is surrounded by the remaining undeveloped 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 residential development is located along the western boundary of the site.

Figure 2-1 Regional Location Map

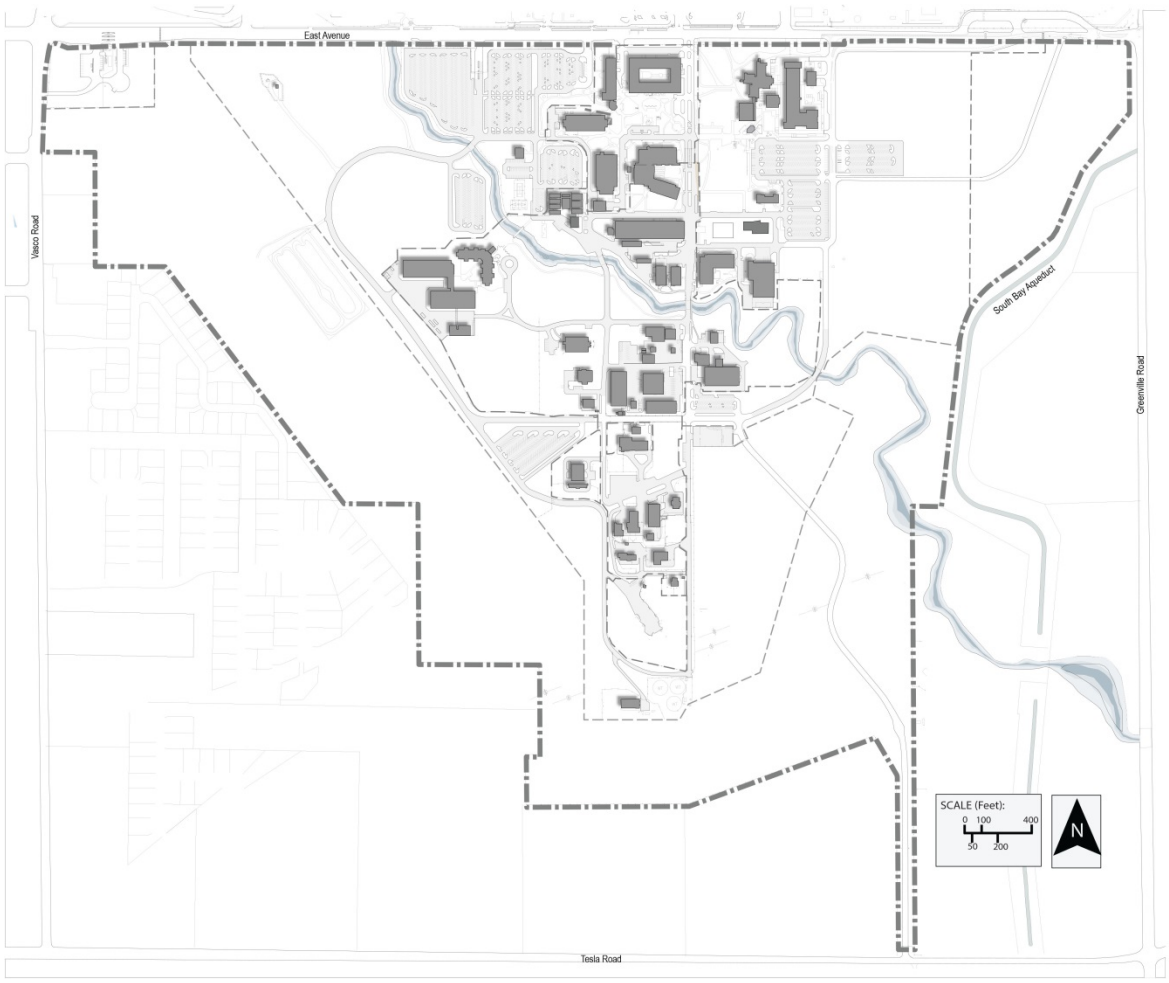

Figure 2-2 SNL/CA Site Map

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. As of January 2016, there were 1239 personnel (employees and on-site contractors) working at SNL/CA. Eighty-three percent of Sandia employees live in Alameda, Contra Costa, and San Joaquin counties. Thirty-three percent live in Livermore. Place of residence data is not available for on-site contractors.

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.

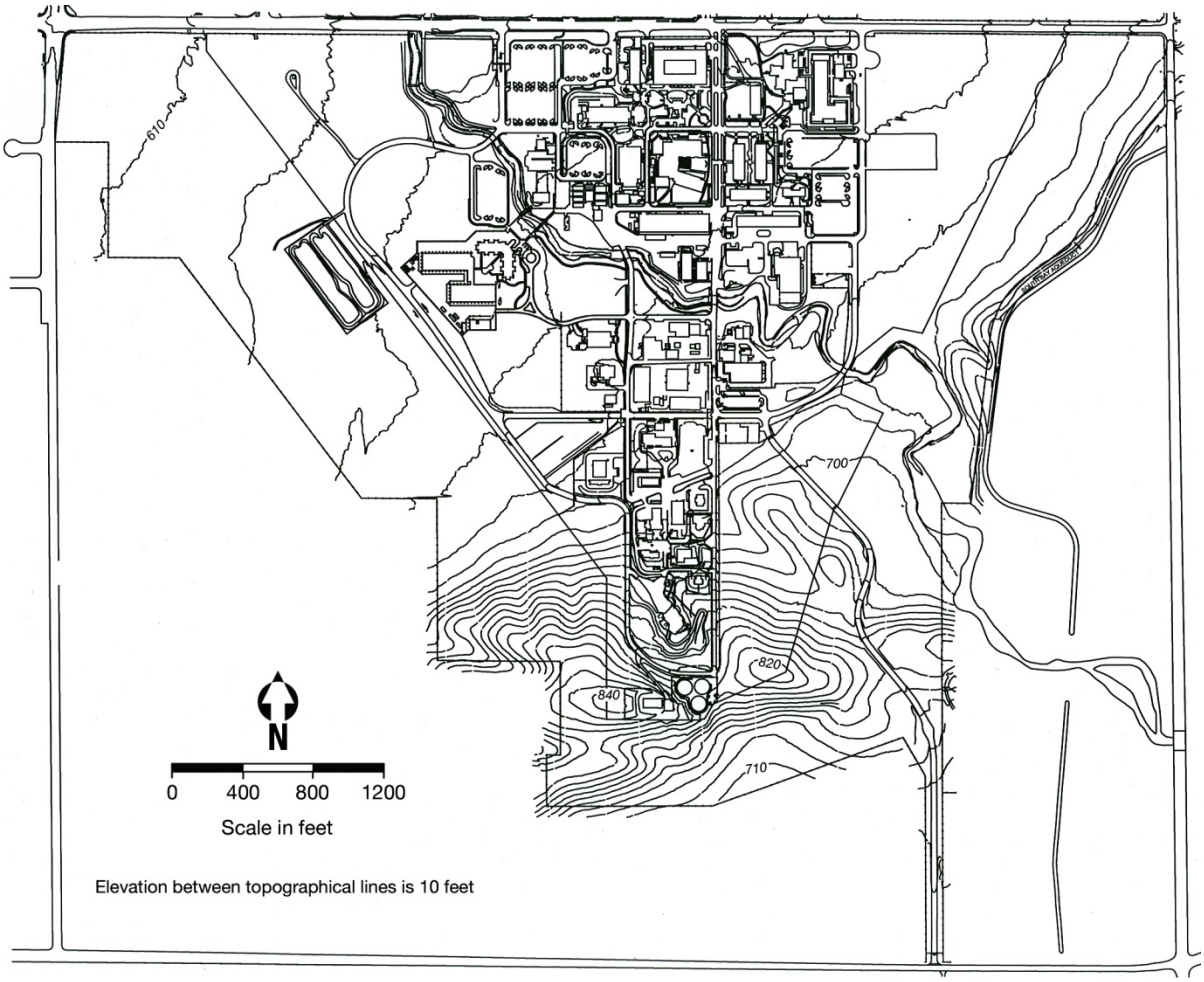

Figure 2-3 SNL/CA Topography

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.

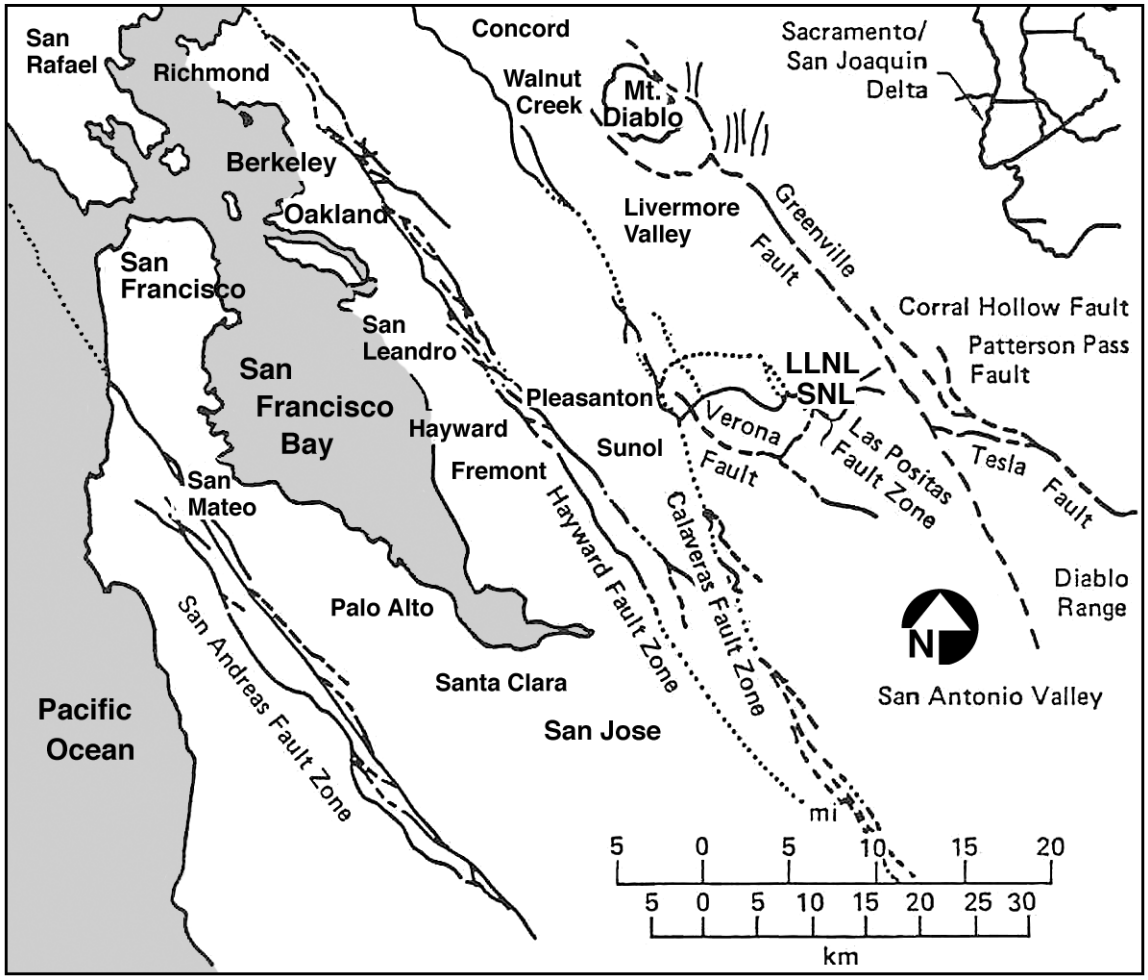

Figure 2-4 Regional Earthquake Faults

Surface soils and arroyo sediments cover the SNL/CA site. 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 (SNL/CA 2002). There are no known mineral resources or fossil occurrences at the site.

2.4.2 Hydrology and Water Resources

Groundwater at SNL/CA 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 (LLNL 1990).

Potable water used at SNL/CA is purchased from LLNL, which 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. Sandia's water use at SNL/CA is metered by LLNL as it enters the site. In fiscal year 2015, 31.4 million gallons of water were used at SNL/CA, a decrease of 38.2 percent (19.4 million gallons) from water used in fiscal year 2014. (See discussion in Section 4.2.2). The site discharged approximately 5.6 million gallons of wastewater during the fiscal 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 2015 was obtained from a nearby meteorological tower located at LLNL (LLNL 2016). The annual rainfall for 2015 was 8.05 inches. Temperatures in 2015 ranged from 27.8 to 102.6^{o} Fahrenheit. Average annual rainfall in the Livermore area over the last five years was 9.22 inches. 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

Plant Species

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 SNL operations constitute an

additional habitat type, designated altered habitat. Habitat types are depicted on Figure 2-5. No threatened, endangered, proposed, or candidate plant species are present on-site.

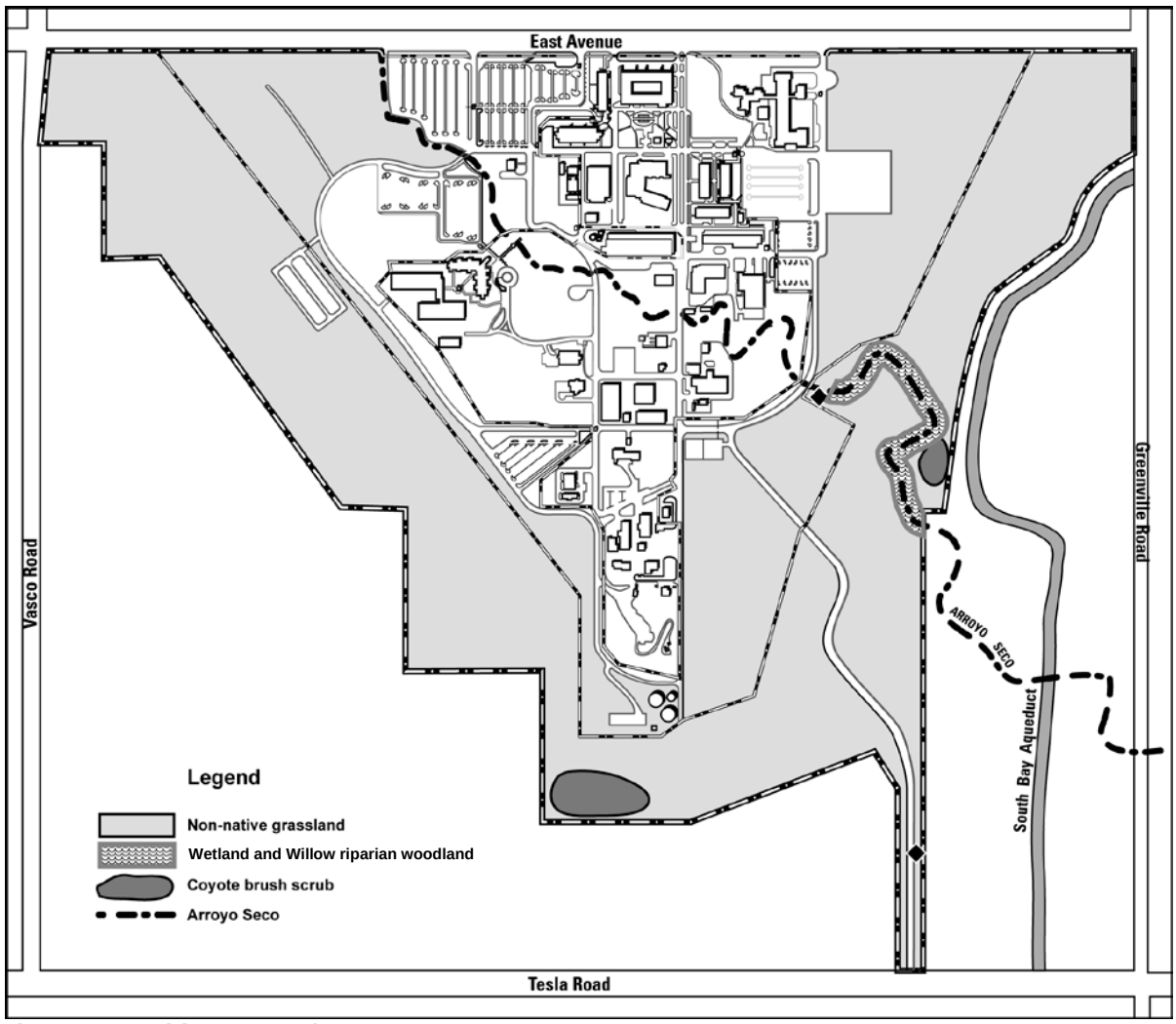

Figure 2-5 Habitat at SNL/CA

Wildlife Species

A variety of wildlife species live and forage at SNL/CA. Table 2-1 provides a list of animals frequently seen on site. State and Federally protected animals are not included in this list but discussed separately below.

SNL/CA is located within the range of the mountain lion (*Puma concolor*), a "specially protected mammal" under California law. There were no reports of a mountain lion at SNL/CA in 2015.

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. The most recent observation of red-legged frogs at SNL/CA was in 2010. Monitoring for California red-legged frogs is conducted annually, but none were observed in 2015.

Table 2-1 Frequently Seen Animals at SNL/CA

BIRDS			
American crow	*Corvus brachyrhynchos*	Northern mockingbird	*Mimus polyglottos*
American kestrel	*Falco sparverius*	Nuttall's woodpecker	*Picoides nuttallii*
American robin	*Turdus migratorius*	Red-tailed hawk	*Buteo jamaicensis*
Anna's hummingbird	*Calypte anna*	Turkey vulture	*Cathartes aura*
Barn owl	*Tyto alba*	Western kingbird	*Tyrannus verticalis*
Bushtit	*Psaltriparus minimus*	Western meadowlark	*Sturnella neglecta*
California towhee	*Pipilo crissalis*	Western scrub jay	*Aphelocoma californica*
Golden-crowned sparrow	*Zonotrichia atricapilla*	White-crowned sparrow	*Zonotrichia leucophrys*
Kildeer	*Charadrius vociferous*	White-tailed kite	*Elanus leucurus*
Northern flicker	*Colaptes auratus*	Yellow-rumped warbler	*Dendroica coronata*
MAMMALS			
Bobcat	*Lynx rufus*	Fox squirrel	*Sciurus niger*
California ground squirrel	*Spermophylus beecheyii*	Raccoon	*Procyon lotor*
Coyote	*Canis latrans*	Red fox	*Vulpes vulpes*
Desert cottontail	*Sylvilagus audubonii*	Striped skunk	*Mephitis mephitis*
REPTILES AND AMPHIBIANS			
Pacific chorus frog	*Pseudacris regilla*	Western fence lizard	*Sceloporus occidentalis*
Pacific gopher snake	*Pituophis catenifer catenifer*	Western toad	*Bufo boreas*

3 Compliance Summary

Sandia Corporation (Sandia) manages and operates the Sandia National Laboratories, California (SNL/CA) site 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, site activities are subject to DOE directives (i.e., Orders, Manuals, Policies, Notices, and Guides) and to presidential executive orders. This chapter provides a summary of compliance status with major environmental requirements for calendar year 2015, unless noted otherwise.

3.1 Environmental Management System and Sustainability

DOE Order 436.1, *Departmental Sustainability* was established in 2011 to ensure that an environmental management system (EMS) and site sustainability are at the forefront of environmental excellence at DOE facilities. The entire content of DOE Order 436.1 is not a requirement of the Sandia Management and Operating Contract (M&O Contract). Applicable sections of the order identify requirements for establishing and implementing a Site Sustainability Plan (SSP).

The EMS provision of DOE Order 436.1 is implemented through a Special Contract Requirements clause in the M&O Contract that directs Sandia to maintain an EMS that is registered to the International Organization for Standardization (ISO) 14001. In 2015, the site-specific ISO 14001:2004 certification of SNL/CA's EMS was recertified and transferred to a multi-site certification under the corporate EMS. This transfer streamlines processes and maximizes the efficient use of corporate resources. The recertification and transfer audit for the SNL/CA site occurred in April 2015 and Sandia received the multi-site certification in May 2015.

Sandia developed the first corporate-wide SSP that addresses energy, water, fuels, and a variety of other environmental concerns for all Sandia sites in 2011. The corporate SSP is updated annually. The Sandia SSP addresses the following DOE reporting requirements:

- DOE's Annual Energy Report, as required by the National Energy Conservation Policy Act, Energy Policy Act of 2005, and Energy Independence and Security Act (EISA) of 2007;
- Section 432 of EISA 2007, which requires reporting of energy and water conservation measures that are identified as a result of site audits; and
- Commitments in the DOE Strategic Sustainability Performance Plan.

In 2015, site personnel provided input to the reports identified above and participated in development of the Sandia SSP for fiscal year 2016.

Chapter 4 presents SNL/CA's environmental performance supporting site and corporate objectives and targets.

3.2 National Environmental Policy Act

The National Environmental Policy Act (NEPA) (42 USC § 4321) is the basic national charter for protection of the environment. It requires all federal agencies to evaluate the effects 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. DOE's National Nuclear Security Administration/ Sandia Field Office (NNSA/SFO) issued a site-wide environmental assessment (SWEA) for continued operations at SNL/CA (DOE 2003a) in 2003 and a Finding of No Significant Impact (FONSI) on March 20, 2003 (DOE 2003b). The SWEA provides an evaluation of the impacts of site operations, and the FONSI concludes that continuation of site operations is not a major federal action significantly affecting the quality of the human environment.

In 2012, NNSA/SFO completed a review of SNL/CA's SWEA through a supplement analysis. The results of the analysis found that continuing operations at SNL/CA do not constitute substantial changes to the SWEA, FONSI, or result in significant new circumstances or information relevant to environmental concerns. No further NEPA documentation is required as the SWEA and FONSI remain valid for site operations. Sandia personnel support 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. During fiscal year 2015, 136 SNL/CA projects underwent NEPA review. None of these projects required the preparation of an environmental assessment or an environmental impact statement.

3.3 Air Quality

3.3.1 Clean Air Act

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

SNL/CA does not have any major sources of air pollutants (as defined in 40 CFR Part 70.2) present on site. Sandia personnel work with the BAAQMD and CARB to permit or register all regulated emission sources. There were eleven permitted sources for the 2014/2015 permitting period and nine permitted sources for the 2015/2016 permitting period[1]. Table 3-4 (Section 3.13) provides a list of the permitted sources.

3.3.2 Radionuclide Emissions

The *National Emissions Standards for Hazardous Air Pollutants, Subpart H – National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities* (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 458.1 *Radiation Protection of the Public and the Environment* (DOE 2013a).

Sandia does not currently have any radionuclide emission sources at SNL/CA that are subject to the monitoring requirements of 40 CFR Part 61. To comply with national emission standards, Sandia personnel evaluate 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 2015, there were no projects using radionuclides above the Annual Possession Quantity; consequently, no NESHAPs evaluations were completed.

3.4 Natural and Cultural Resources

3.4.1 Endangered Species Act

The Endangered Species Act (16 USC § 1531 et. seq.) provides for protection of plant and wildlife species in danger of becoming extinct. In 2002, NNSA/SFO and Sandia personnel 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[2].

[1] The BAAQMD permit period is July 1 through June 30 each year. Permit data is presented for the two periods applicable to 2015.

[2] 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). The scientific integrity of the 2006 rule was questioned resulting in another revision to critical habitat. The USFWS issued a new designation in March 2010. The Sandia site is not included in the final determination of critical habitat for the California red-legged frog.

3.4.2 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, products containing the named pesticide ingredients are restricted from use in and along Arroyo Seco. By December 31, 2009, the EPA had completed effects determinations (or canceled the registration) for all 66 pesticide ingredients.

3.4.3 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (16 USC §703 et. seq.) provides for protection of migratory birds, their nests, and eggs. Most of the bird species observed at SNL/CA are protected under this act. 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 activities are delayed until the young have fledged, or surveys determine that the nest is abandoned. In 2015, there was no intentional take of migratory birds or disturbance to nests or eggs at the site. Surveys for nesting birds were completed for all projects that had the potential to disturb trees and shrubs. One active nest was encountered, marked, and avoided during project activities**.**

3.4.4 Protection of Wetlands

Executive Order 11990, Protection of Wetlands (EO 11990), requires federal agencies to minimize the destruction, loss, or degradation of wetlands and preserve and enhance the natural and beneficial values of wetlands. A small wetland area of 0.44 acres is present at SNL/CA. During 2015, Arroyo Seco Improvement Program activities were conducted in the wetland area in accordance with a permit issued by the U.S. Army Corp of Engineers (see Section 3.4.5).

3.4.5 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, a management plan for the Arroyo Seco was completed to identify channel improvements and stream zone management activities that will reduce flood and erosion risk and provide improved habitat for wildlife species that may use the arroyo (Matthews 2002). The plan identifies areas for constructing functional floodplains and for planting of native riparian vegetation. During 2006 and 2007, five improvement tasks were completed under a two-year

permit issued by the U.S. Army Corp of Engineers. A new permit request was submitted in 2006 for the remaining improvement actions. In September 2008, a new ten-year permit for SNL/CA was received from the U.S. Army Corp of Engineers to continue the Arroyo Seco Improvement Program (ASIP). In 2015, the last remaining improvement project was completed under the ten-year permit. Restored areas are monitored annually to determine progress in meeting survival and growth criteria established in the permit. When needed, shrubs and trees are replanted or grasses reseeded. In 2015, no replanting or reseeding was needed. Restored areas are also monitored to ensure channel improvements are functioning as intended and repaired when needed. In 2015, four previously restored areas were repaired.

ASIP Area 7 Before Restoration

ASIP Area 7 After Restoration

3.4.6 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). Provisions for cultural resources are included in all construction-related contracts where the potential for buried resources may be unearthed. In 2015, there were no buried archaeological resources unearthed at SNL/CA.

In 2001, Sandia personnel completed an historic building survey. None of the buildings on-site 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/SFO. In December 2004, NNSA transmitted the survey results to the California State Historic Preservation Officer (SHPO). In April 2005, NNSA/SFO 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.

3.5 Environmental Restoration

3.5.1 Comprehensive Environmental Response, Compensation, and Liability Act

Between 1984 and 1986, the 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. CERCLA reporting requirements are incorporated into an operating procedure for spill prevention and control (SNL/CA 2013). In 2015, there were no releases of hazardous substances that required notification under CERCLA.

3.5.2 Site Clean-up Orders

Since 1985, environmental restoration and monitoring activities at SNL/CA have been conducted in compliance with site clean-up orders issued by the California Regional Water Quality Control Board, San Francisco Bay Region under provisions established in the California Water Code (California RWQCB 1989). Although there are no active remediation sites at SNL/CA, groundwater monitoring is ongoing at two locations, the Fuel Oil Spill site and the Navy Landfill. SNL/CA personnel currently sample 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.

3.6 Chemical Management

3.6.1 Emergency Planning and Community Right-to-Know Act

The Emergency Planning and Community Right-to-Know Act (EPCRA) -- also known as the Superfund Amendments and Reauthorization Act of 1986, Title III (SARA Title III) (42 USC §11001, et. seq.) -- requires reporting of toxic chemical usage and releases. To meet EPCRA requirements applicable to SNL/CA operations, Sandia personnel submit an annual report to the Livermore-Pleasanton Fire Department online through the California Environmental Reporting System (CERS). The CERS submittal satisfies Federal, state, and local reporting requirements of EPCRA 302-303 and 311-312. To meet Section 313 of EPCRA, Sandia personnel annually submit a report to EPA, and if required a Section 304 report is also submitted. Applicable EPCRA reporting requirements for 2015 are presented in Table 3-1.

Table 3-1 Status of EPCRA Reporting for SNL/CA, 2015

EPCRA Section	Description of Reporting	Required in 2015
Sec. 302-303*	Planning Notification	Yes (sulfuric acid only)
Sec. 304	Extremely Hazardous Substances Release Notification	No
Sec. 311-312*	Safety Data Sheet / Chemical Inventory	Yes
Sec. 313	Toxic Release Inventory Reporting	Yes (lead only)

* Reporting accomplished through the annual Hazardous Materials Business Plan, a California requirement. See Section 3.6.2.

3.6.2 California Hazardous Materials Release Response Plans and Inventory

The California Hazardous Materials Release Response Plans and Inventory (Assembly Bill 2185) addresses the management of hazardous and acutely hazardous materials and is codified in the California Health and Safety Code, Division 20, Chapter 6.95 §25500, et seq. Specific requirements pertaining to hazardous materials are in Title 19, California Code of Regulations, Division 2, Chapter 4, sections 2729-2732. In compliance with California requirements, Sandia personnel annually submit a Hazardous Material Business Plan for SNL/CA to the Livermore-Pleasanton Fire Department via the CERS.

Annually, Sandia personnel count the number of hazardous materials containers in inventory at SNL/CA. The results of the inventory are used to encourage chemical owners to right-size inventories and minimize higher toxicity materials through chemical exchange or reduction. As shown in Figure 3-1, the number of hazardous materials containers peaked in 2003 and have been steadily declining since. Overall, the number of containers for higher toxicity materials (shown as NFPA Health 3&4) has also declined since 2003. These declines reduce the risk inherent to personnel and the environment from hazardous materials used and stored on site.

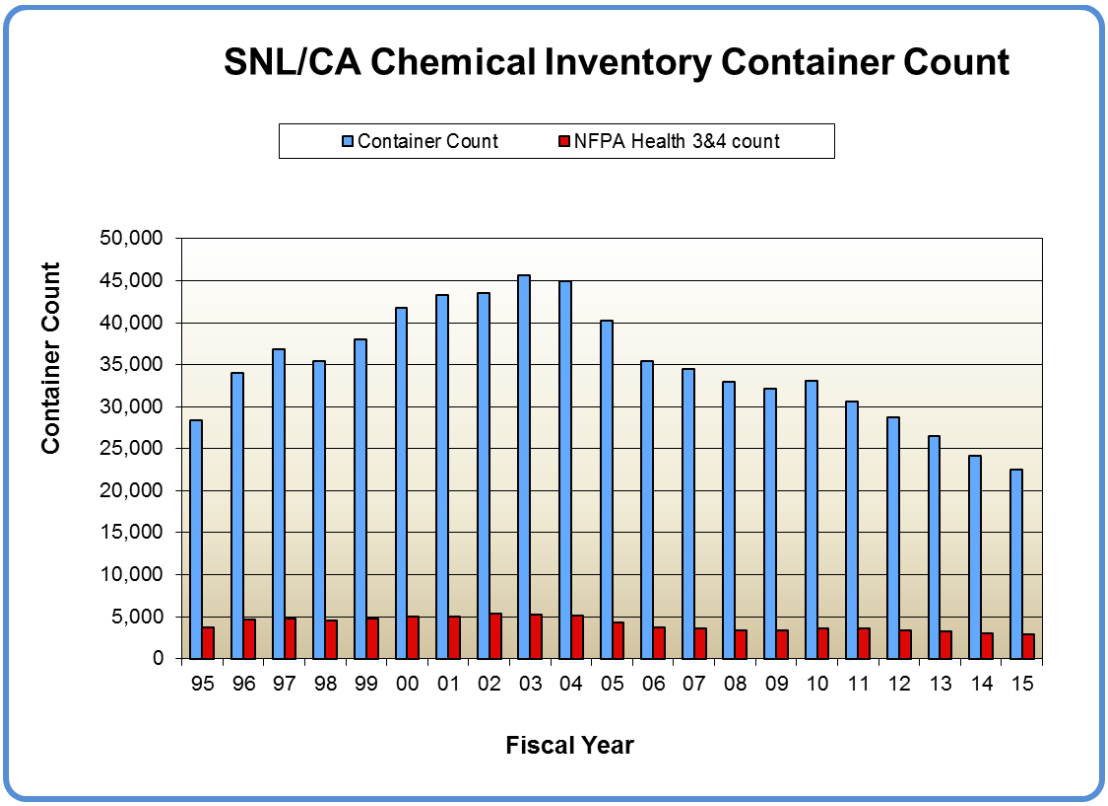

Figure 3-1 SNL/CA Hazardous Material Inventory

3.6.3 Underground and Aboveground 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. The Livermore-Pleasanton Fire Department is the regulating authority for USTs at SNL/CA. Sandia personnel operate one UST in accordance with California requirements. Each year, the UST is declared through the Hazardous Material Business Plan described in Section 3.6.2, and it receives a permit to operate from the Livermore-Pleasanton Fire Department.

Petroleum products stored in aboveground storage tanks (AST) are regulated under California Health and Safety Code Division 20, Chapter 6.67, §§ 25270-25270.13 and include tanks (containers) with the capacity to store 55 gallons or more of petroleum. California code requires AST owners/operators to prepare a spill prevention control and countermeasure plan and conduct periodic inspections. The Livermore-Pleasanton Fire Department is the regulating authority for ASTs at SNL/CA. Sandia personnel manage and/or operate 15 ASTs, ranging in size from 55 to 1000 gallons. Each year, the tanks are declared through the Hazardous Material Business Plan described in Section 3.6.2. One AST used as a gasoline dispensing facility is also permitted as an emission source by the BAAQMD.

In July 2015, Sandia closed and removed two ASTs under a permit issued by the Livermore-Pleasanton Fire Department. One tank had a capacity of 1,000 gallons and the second was a 2,000 gallon tank. Both tanks provided diesel as a back-up fuel source for dual-fuel boilers. However, the boilers operated solely on natural gas and the back-up diesel fuel was never used. The ASTs were taken out of service in 2005, the diesel removed, and the tanks maintained for future use. In 2014, Sandia determined that the tanks were no longer needed and, in 2015, initiated the closure and removal process.

3.6.4 Toxic Substances Control Act

The Toxic Substances Control Act (TSCA) is the primary Federal statute regulating the manufacture, use, distribution, disposal, import, or export of certain chemicals and substances (15 USC § 2601 et. seq.). TSCA requirements that are applicable to SNL operations are incorporated into Corporate Process ESH100.2, *Analyze and Control Hazards* (SNL 2014). For SNL/CA operations, the only TSCA regulated chemicals imported or exported are for research and development purposes thus are exempt from general reporting requirements. However, Sandia personnel notify EPA of exempt imports and exports when appropriate. In 2015, no TSCA Notification of Export or Import declarations were prepared.

Sandia personnel track disposal of TSCA materials generated from SNL/CA operations 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 on-site is asbestos from abatement activities. Only small quantities of PCB wastes are generated at SNL/CA, consisting of light ballasts that are not specifically marked as PCB-free.

3.6.5 Federal Insecticide, Fungicide, and Rodenticide Act

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) restricts the registration, sale, use, and disposal of pesticides (includes herbicides, insecticides, fungicides, and rodenticides) (7 USC § 136). The only activity conducted at SNL/CA that falls under the provisions of FIFRA is pesticide use. This activity is conducted by a licensed commercial pesticide applicator under a service contract. Contract requirements include a site-specific environmental specification. All empty pesticide containers are managed by the service contractor and removed from the site.

3.7 Pollution Prevention and Waste Minimization

Pollution prevention concepts first appeared in RCRA. An expressed concern was to minimize the generation of hazardous waste through process substitution, materials recovery, recycling, reuse, and treatment. RCRA established the reduction or elimination of hazardous waste as national policy, and required that hazardous waste generators and RCRA permit holders have a program in place to minimize waste. Sandia personnel are required to report waste generation and recycling information annually to DOE through the Site Sustainability Plan. 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.

3.7.1 Pollution Prevention Goals of Site Sustainability Plan

The Sandia Site Sustainability Plan establishes a commitment to meet pollution prevention goals identified in DOE's Strategic Sustainability Performance Plan and Executive Order 13693. In 2015, Sandia personnel continued to implement SNL/CA site-specific activities to support these goals through:

- recycling of 27 solid waste streams;
- recycling of construction debris;
- chemical exchange;
- awareness campaigns encouraging material sustainability and environmentally-preferred purchasing;
- chemical acquisition program that encourages purchasing only the quantity needed;
- management of batteries as universal waste; and
- reapplication of equipment and supplies.

P2 Goals

- ❒ Diversion of solid waste and demolition / construction debris from landfill disposal
- ❒ Strive for net zero waste from operations in existing facilities
- ❒ Promote sustainable acquisition
- ❒ Purchase EPEAT registered products
- ❒ Recycle and reuse, whenever feasible

Sandia personnel reported pollution prevention and waste minimization data for SNL/CA to the corporate Site Sustainability Plan team on November 16, 2015 for submittal to NNSA/SFO on December 2, 2015. Additional information about pollution prevention activities is provided in Chapter 4.

3.7.2 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 the DOE and DTSC, all of DOE's California sites are considered one waste generator, rather than individual DOE facilities. Every four years, Sandia personnel complete a Source Reduction and Evaluation Review and Plan in cooperation with the other three DOE sites in California: LLNL; Lawrence Berkeley National Laboratory; and Stanford Linear Accelerator Center. As of 2015, DTSC no longer requires the plan to be submitted; however, each site is to retain a copy on file which will be reviewed during routine annual audits.

The most recent plan was completed on September 30, 2015 and provided information for calendar year 2014. The plan also identifies waste reduction opportunities for any waste stream that is over five percent of a site's total routine regulated waste. The next plan, which will include information from calendar year 2018, will be prepared in 2019.

3.7.3 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 2015 (for lead only) will include source reduction and recycling information to meet this requirement. The report is due annually on July 1. See Section 3.6.1 for additional information on EPCRA reporting requirements.

3.8 Hazardous Waste

3.8.1 Federal Facility Compliance Act

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

Activities at SNL/CA are not subject to a site-specific federal facility compliance agreement for mixed waste. Sandia does not possess or store any legacy mixed waste at the SNL/CA site. All mixed waste generated at SNL/CA during 2015 was appropriately managed under the site's RCRA Hazardous Waste Facility Permit.

3.8.2 Resource Conservation and Recovery Act

RCRA regulates the generation, transportation, treatment, storage, and disposal of hazardous chemical waste, non-hazardous solid waste, and hazardous or petroleum products stored in USTs (42 USC §6901 et. seq.). The State of California has authority from the EPA to implement RCRA. The 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.

Sandia operates a Hazardous Waste Treatment and Storage Facility at SNL/CA under a RCRA Hazardous Waste Facility Permit issued by DTSC on March 30, 2004. The permit was effective through March 2014 and allowed for storage, consolidation, commingling, and packaging of hazardous waste. A permit renewal application for another ten-year period was submitted to DTSC on June 28, 2013. Sandia received notice from DTSC on July 23, 2013 granting a Determination of Administrative Completeness. The technical review of the permit renewal application is underway. The conditions of the expired permit will continue in force until DTSC issues a new permit.

By definition, the SNL/CA facility is a large quantity generator of RCRA waste. As such, site personnel are required under RCRA standards and implementing regulations (40 CFR 262.41) to submit a biennial report to EPA on even numbered years.

3.8.3 California Hazardous Waste Control Law

The Hazardous Waste Control Law (California Health and Safety Code, Division 20, Chapter 6.5, §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 the Waste Management Program at SNL/CA 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.

Sandia personnel submit an annual facility report to DTSC either in the form of the federal Biennial Report or the California Annual Facility Report, or both if requested by DTSC.

3.8.4 Medical Waste Management Act

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

3.9 Radiation Protection

3.9.1 Atomic Energy Act

The purpose of the Atomic Energy Act (AEA) is to assure the proper management of source, special nuclear, and byproduct materials (42 USC § 2011 et. seq.). The DOE sets radiation protection standards and retains authority for radionuclides through department directives. Operations at SNL/CA are subject to the requirements established in DOE Order 435.1, *Radioactive Waste Management* (DOE 2001) and DOE Order 458.1, *Radiation Protection of the Public and the Environment* (DOE 2013a).

3.9.2 DOE Order 435.1, Radioactive Waste Management

DOE Order 435.1 establishes requirements to manage radioactive waste in a manner that protects the environment, and worker and public health and safety. Under this order, DOE contractor operated facilities are required to plan, document, execute, and evaluate the management of radioactive waste. Requirements of Order 435.1 are incorporated into the radioactive waste management element of the SNL/CA site 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 off-site disposal of radioactive waste.

SNL/CA operations generate low-level radioactive waste and low-level mixed waste. No transuranic or high-level radioactive waste is generated by SNL/CA operations. Low-level radioactive and mixed wastes are stored prior to shipment in the Radioactive Waste Treatment and Storage Facility. Low-level radioactive waste is shipped off-site to SNL/NM with final land disposal at the Nevada Nuclear Security Site. Mixed waste is managed under federal RCRA and state waste regulations and shipped off-site for treatment and disposal via commercial disposal facilities. Figure 3.2 shows the quantity of total radioactive waste shipped from SNL/CA since 2008. The increase in radioactive waste in 2015 is attributed to a clean-out campaign targeting unwanted materials and equipment.

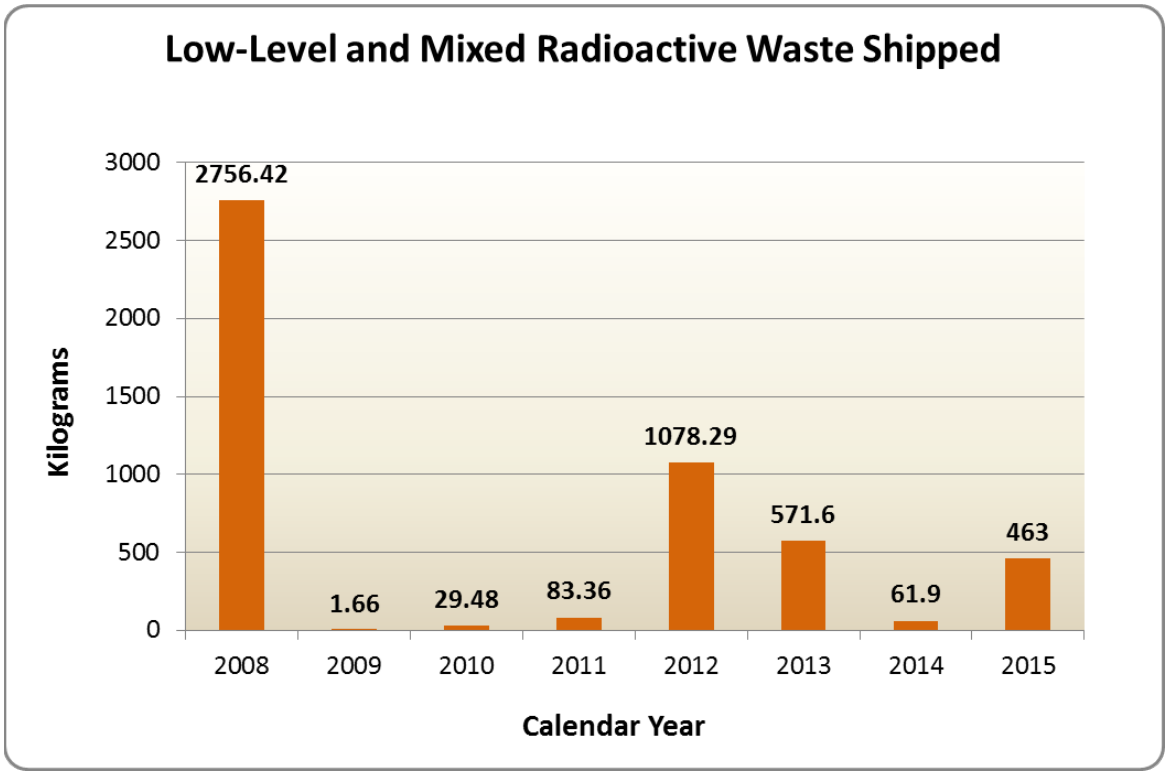

Figure 3-2 Radioactive Waste Shipped from SNL/CA

3.9.3 DOE Order 458.1, Radiation Protection of the Public and the Environment

DOE Order 458.1 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 related compliance activities conducted at SNL/CA in 2015.

Table 3-2 Order 458.1 Compliance Summary, 2015

Order 458.1 Requirement	SNL/CA 2015 Summary
Develop and implement an environmental radiological protection program	An environmental radiological protection program has been in place at SNL/CA for more than 30 years. An internal evaluation of the program was completed in 2011 by Sandia personnel and it was determined that the program meets the requirements of DOE Order 458.1.
Control exposure to the public such that annual exposure will not exceed a total effective dose of 100 mrem, an equivalent dose to the lens of the eye of 1500 mrem, or an equivalent dose to the skin or extremities of 5000 mrem.	There were no radionuclide emissions in FY 2015. The average annual gamma radiation measurement at the site perimeter in FY 2015 was 61.5 mrem or 9.7 mrem more than the local background dose of 51.8 mrem. The difference between the perimeter and distant locations is most likely the result of normal fluctuations and natural variations in ambient radiation.
Request authorization for temporary dose limits.	There were no special circumstances in 2015 requiring temporary dose limits.
Adopt ALARA exposures.	ALARA is incorporated into environment, safety, and health (ES&H) policy, processes, and procedures.
Demonstrate compliance with public dose limits from the air pathway.	NESHAPS dose calculations are completed as needed. There were no airborne radionuclide emission sources in 2015; therefore, there is no monitoring data available for dose evaluations.
Control airborne radioactive effluents.	ES&H policy, processes, procedures, and management systems are incorporated into site operations to ensure that projects are reviewed for potential airborne effluents and dose calculations are performed, as needed.
Control release of liquid radioactive discharges.	No intentional discharges of liquid radioactive wastes to the environment occur on-site. No accidental releases of liquid radioactive waste occurred in 2015. Radioactive releases to the sanitary sewer above DOE O 458.1 guidelines are not allowed at SNL/CA. ES&H policy, processes, procedures, and management systems are incorporated into site operations to ensure proper handling and disposal of radioactive materials.
Control radioactive waste.	SNL/CA generates only low-level radioactive waste. ES&H policy, processes, procedures, and management systems are incorporated into site operations to ensure proper handling and disposal of radioactive waste.

Order 458.1 Requirement	SNL/CA 2015 Summary
Protect drinking water and groundwater.	ES&H policy, processes, procedures, and management systems are incorporated into site operations to ensure proper handling, and disposal of radioactive materials offsite at approved facilities. Routine analyses of groundwater and storm water samples include radioactive constituents.
Protect biota.	ES&H policy, processes, procedures, and management systems are incorporated into site operations to ensure proper handling, and disposal of radioactive materials offsite at approved facilities. SNL/CA has no operations requiring biota monitoring.
Control the release of property with residual radioactivity.	Sandia does not release property to the public (e.g., vehicles, equipment, or other materials) with residual radioactivity above the limits specified in DOE Order 458.1. Pursuant to written procedures, items that are potentially contaminated or activated are either surveyed prior to the release to the public, or a process knowledge evaluation is conducted to verify that the material has not been exposed to radioactive material or to energy capable of inducing radioactivity in the material. In some cases, both a radiological survey and a process knowledge evaluation are performed. In 2015, no required equipment clearance surveys were processed by SNL/CA's Radiation Protection personnel. SNL/CA personnel track property with an acquisition cost greater than $10,000 and routinely release items without residual radioactivity to the public. Process knowledge evaluations are completed for all property items to verify that they had not been exposed to radioactive material or to energy capable of inducing radioactivity. DOE issued a moratorium in January 2000 prohibiting the release of volume-contaminated metals and subsequently suspended the release of metals for recycling purposes from DOE radiological areas in July 2000. No metals subject to the moratorium or suspension were released from Sandia in 2015. Excess property with residual radioactivity above the limits in DOE Order 458.1 is either transferred to other DOE facilities for reuse, or transferred to LLNL's Radioactive and Hazardous Waste Management for disposal as radioactive waste. There were no releases of real property to the public in 2015 with residual radioactivity above the limits in DOE Order 458.1.
Retain records.	ES&H policy, processes and procedures are in place to manage records.

3.10 Water Quality and Protection

SNL/CA operations are subject to the requirements of the Clean Water Act and equivalent California statutes. Sandia does not operate a public water system at the SNL/CA facility, 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. Sandia is not required to treat or sample the drinking water. LLNL maintains the primary drinking water distribution system that feeds to SNL/CA and screens for water quality (SNL/CA 2002).

3.10.1 Clean Water Act

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

Wastewater Discharge

Wastewater generated at SNL/CA is discharged to the City of Livermore Water Reclamation Plant, a publicly owned treatment works (POTW). The Livermore POTW maintains an NPDES permit, and then regulates industry discharges into their sewer system. A Wastewater Discharge Permit issued by the Livermore POTW regulates SNL/CA's wastewater discharges. The permit is updated annually and includes discharge limits for the site sanitary sewer outfall and for processes subject to EPA pretreatment standards. There were no permit exceedances in 2015 at the sanitary sewer outfall. For routine wastewater monitoring information, see Section 5.2.1.

There are four categorical processes at the SNL/CA site that are subject to EPA's pretreatment standards: two metal finishing operations, a robotic spray-paint booth, and a semiconductor manufacturing operation. The two metal finishing operations are closed-loop processes and do not discharge any effluents. The spray-paint booth is not connected to the sanitary sewer, and does not discharge 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 2015.

Storm Water Discharge

On July 1, 2015, a new general industrial permit for storm water discharges at SNL/CA became effective. The *State of California NPDES General Permit for Storm Water*

Discharge Associated with Industrial Activities (2014 General Industrial Permit) (California Water Resources Control Board 2014) contains Numeric Action Levels and a requirement to implement a Storm Water Pollution Prevention Plan. Implementation of the 2014 General Industrial Permit is underway. The first year of reporting under the new permit will be the 2015/2016 reporting year (July 1, 2015 through June 30, 2016). A summary of results for the first reporting year will be presented in the 2016 Site Environmental Report.

For the 2014/2015 reporting year, storm water discharges at SNL/CA were covered under the 1997 *State of California NPDES General Permit for Storm Water Discharge Associated with Industrial Activities* (1997 General Industrial Permit) (California Water Resources Control Board 1997). Results of sampling and compliance with the 1997 General Industrial Permit are presented in Section 5.1.

Under Section 438 of the Energy Independence and Security Act of 2007, federal agencies have requirements to reduce storm water runoff from development and redevelopment projects. In 2015, construction began on building C926. Environmental Monitoring personnel worked with the building Architect/Engineer to ensure that this requirement was included in the design.

3.11 Audits, Assessments, and Inspections

Table 3-3 provides a list of environmental audits, assessments, and/or inspections conducted at SNL/CA during 2015.

Table 3-3 SNL/CA Audits, Assessments, and Inspections, 2015

Title	Area of Focus	Date Conducted	Results
Bay Area Air Quality Management District	Permitted air sources	February 18, 2015	No issues
Livermore-Pleasanton Fire Department	Underground Storage Tanks	March 30, 2015	One minor violation - training
Third Party Environmental Management System (EMS) Surveillance Audit (NSF-ISR)	Conformance with the ISO 14001:2004 EMS standard	May 2015	No issues
Livermore-Pleasanton Fire Department	Tiered permits, hazardous waste training, hazardous materials business plan, above ground tank closure	July 14 – 16, 2015	No issues
City of Livermore, Water Resources Division Inspections	Wastewater discharges and categorical process laboratories	October 26 – 27, 2015	No issues
Alameda County Inspection	Erosion at the Navy Landfill site	December 2, 2015	No issues

3.12 Environmental Occurrences

An environmental occurrence is an event that meets the occurrence criteria established in DOE Order 232.2 (DOE 2014). In 2015, there was one environmental occurrence from SNL/CA operations. The occurrence was for a minor violation issued by the Livermore-Pleasanton Fire Department during the annual UST inspection conducted on March 30, 2015. The violation resulted from a lapse in training for UST monitoring personnel. Training was completed prior to the new date identified by the inspector and no fines or other enforcement actions occurred.

3.13 Permits

Environmental permits and clean-up orders held for SNL/CA operations are listed in Table 3-4. Additional information is provided in previous sections under the related program or regulation.

Table 3-4 SNL/CA Environmental Permits and Orders, 2015

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	January 1 – December 31, annually	California Health and Safety Code	Livermore-Pleasanton Fire Department
Hazardous waste	RCRA Hazardous Waste Facility Permit	March 2004 - March 2014[a]	Resource Conservation and Recovery Act	California Department of Toxic Substances Control
Hazardous waste	Permit by Rule	January 1 – December 31, annually	California Health and Safety Code	Livermore-Pleasanton Fire Department
Hazardous waste	Conditionally Authorized Permit to Operate	January 1 – December 31, annually	California Health and Safety Code	Livermore-Pleasanton Fire Department
Medical waste	Small Quantity Generator with On-site Treatment	August 9 - August 8, annually	California Health and Safety Code	Alameda County Dept. of Environmental Health
Medical waste	Small Quantity Generator without On-site Treatment	April 11 - April 10, annually	California Health and Safety Code	Alameda County Dept. of Environmental Health
Wastewater	Wastewater Discharge Permit	August 4 - August 3, annually	Clean Water Act	City of Livermore Water Reclamation Plant
Storm water	State of California General Industrial Permit	July 1, 2015	Clean Water Act	California Water Resources Control Board
Jurisdictional waters of the U.S.	Channel Improvements under the Arroyo Seco Improvement Program	September 25, 2008 – July 11, 2018	Clean Water Act	Army Corp of Engineers
Underground storage tank	Permit to Operate	January 1 – December 31, annually	Resource Conservation and Recovery Act and California Health and Safety Code	Livermore-Pleasanton Fire Department
Aboveground storage tanks	Storage statement	January 1 – December 31 annual declaration biannual permit	Aboveground Petroleum Storage Act	Livermore-Pleasanton Fire Department
Air	Permit to Operate 11/9 emission sources[b]	July 1 - June 30, annually	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] A permit renewal application for another ten-year period was submitted to DTSC on June 28, 2013.The conditions of the expired permit will continue in force until DTSC issues a new permit.

[b] The BAAQMD permit period is July 1 through June 30 each year. Permit data is presented for the two periods applicable to 2015. Emission sources for the 2015/2016 period include 1 non-retail gasoline dispensing facility, 2 miscellaneous sources (site-wide wipe-cleaning and adhesives source for maintenance activities), 5 emergency generators, and 1 spray paint booth used for research activities.

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4 Environmental Programs Information

Sandia Corporation (Sandia) takes the responsibility of protecting the environment seriously and requires employees, contractors, and visitors to prevent pollution and conserve natural resources by adhering to the corporate Environment, Safety & Health (ES&H) policy. Sandia's environmental management system (EMS) is the primary management approach for addressing environmental aspects and impacts of operations and activities. Sandia also defines sustainability strategies and goals in its annual Site Sustainability Plan (SSP). At Sandia National Laboratories, California (SNL/CA), the site's Environmental Management Organization supports both the corporate EMS and SSP goals. Additionally, SNL/CA management maintains five site-specific environmental programs to monitor environmental aspects of site operations and provide compliance assistance for all site activities. SNL/CA's environmental programs include:

Sandia's ES&H Policy

Sandia National Laboratories performs work in a safe and environmentally responsible manner by committing to:

- ❒ *Maintain a safe workplace, prevent incidents, and protect the public.*
- ❒ *Protect the environment, conserve resources, and prevent pollution.*
- ❒ *Maintain compliance with legal and other requirements.*
- ❒ *Strive for continual improvement.*

- Air Quality
- Environmental Monitoring and Ecology
- Environmental Planning
- Pollution Prevention and Waste Minimization
- Waste Management

4.1 SNL/CA EMS Implementation

The scope of the EMS encompasses all activities, products, and services at all of Sandia's locations that have the potential to interact with the environment. Specifically, the EMS is a set of interrelated elements used to establish policy, objectives, and targets that enable Sandia to reduce environmental impacts and increase operating efficiency through a continuing cycle of planning, implementing, evaluating, and improving processes.

Sandia's EMS includes an annual process to review and determine environmental aspects and impacts relevant to the corporation, management divisions, and locations. An *environmental aspect* is an element of Sandia's activities, products, or services that can interact with the environment. An *environmental impact* is any change to the environment, whether adverse or beneficial, wholly or partially, resulting from Sandia's activities, products, or services. Through the annual review process, SNL/CA determined that its fiscal year 2015 significant aspects were air emissions, hazardous materials, hazardous waste, and water discharges. Sandia personnel identified objectives and targets for each significant aspect to support environmental improvement. Objectives and targets for an additional aspect, natural resource use, was also included in 2015 to support general site efforts to reduce water and energy use.

SNL/CA personnel monitor objectives and targets quarterly and provide progress reports to site management and the corporate EMS Program representative.

4.1.1 SNL/CA EMS Objectives and Targets

In fiscal year 2015, six EMS objectives and nine targets were established to support environmental improvement at SNL/CA. Site personnel met five of the nine targets in 2015 and made progress on meeting two others. Two targets were not met. Table 4-1 summarizes EMS objectives, targets, and results for fiscal year 2015.

Table 4-1 SNL/CA EMS Objectives and Targets, FY 2015

Environmental Aspect	Objective	Target	FY 2015 Result
Air Emissions	Minimize emissions related to vehicle use (fleet and personal)	Identify additional fleet cart charging locations and cost to install	**Target Met -** Completed an evaluation of ten locations in February 2015, electrical charging outlets were installed at two locations, additional locations to be considered in future years and phased in as appropriate
		Establish Workplace Charging Program	**Target Met -** Pilot program implemented August 2015, five participants have joined workplace charging program, estimated emissions saved of 5.9 million grams CO_2 (Oct. – Dec. 2015)
Hazardous Materials	Minimize hazardous material inventory	Close / remove two diesel aboveground tanks	**Target Met -** Completed July 2015 and removed from inventory (see Section 3.6.3 for additional information)
		Chemical age profile: <15% for 10-15 years; <10% for >15 years; 0% for expired chemicals	**Target Not Met** - The chemical inventory age profile as of October 2015 was 18% for chemicals 10-15 years; 12% for chemicals more than 15 years old; and 1% for expired chemicals
		RFID pilot barcoding in chemical supply chain	**Target Met** - Corporate-level pilot conducted in spring 2015 resulting in process improvements, roll-out at SNL/CA expected in 2016
Hazardous Waste	Improve hazardous waste management practices	Waste stream evaluations at generator locations (25% /year over 4 year period)	**Year 1 Target Met** – Waste stream evaluations were completed at 25% of generator locations by September 2015, evaluations will continue in 2016
Water Discharges	Improve knowledge and control of wastewater discharges	Adopt / roll-out corporate permitting program at CA site	**Target Met** – The wastewater discharge permitting system was updated to include SNL/CA, roll-out was completed in December 2015

Environmental Aspect	Objective	Target	FY 2015 Result
Natural Resource Use	Reduce water consumption	Establish water reduction committee to support long-term water reduction efforts	**Target Met** – By spring 2015, a water reduction committee had been established, water reduction efforts resulted in decreased water use by 38% from FY2014 to FY2015, water reduction efforts will continue into 2016 to support mandatory reductions established by the State of California (see Section 4.2.2 for additional information)
	Reduce energy (electricity & natural gas) consumption	Complete an assessment of office and laboratory space and develop list of high energy use equipment and appliances by the end of FY 2016	**Target Not Met** - Target cancelled due to a shift in resources during the year, SNL/CA continues to contribute an SSP goal for reducing energy use (see Section 4.2.1 for information about the SSP goal)

4.2 SSP Contributions

Sandia prepares an annual SSP that articulates the corporation's performance status and planned actions for meeting DOE's Strategic Sustainability Performance Plan goals and broader sustainability program. SNL/CA contributes to many of Sandia's SSP goals.

4.2.1 Energy Use

SNL/CA personnel support the corporate target for energy reduction. The corporate target in effect for 2015 was to reduce energy intensity by thirty percent by the end of fiscal year 2015 from a fiscal year 2003 baseline. Figure 4-1 shows energy use and intensity at SNL/CA since 2003. Energy intensity is the amount of energy used per square foot of building space (presented as BTU/GSF/Yr). Since 2003, SNL/CA has reduced energy intensity by 11.81%. Decreased energy use in 2014 and 2015 is attributed to new control systems installed in several high-use buildings over the last few years and cool roof renovations.

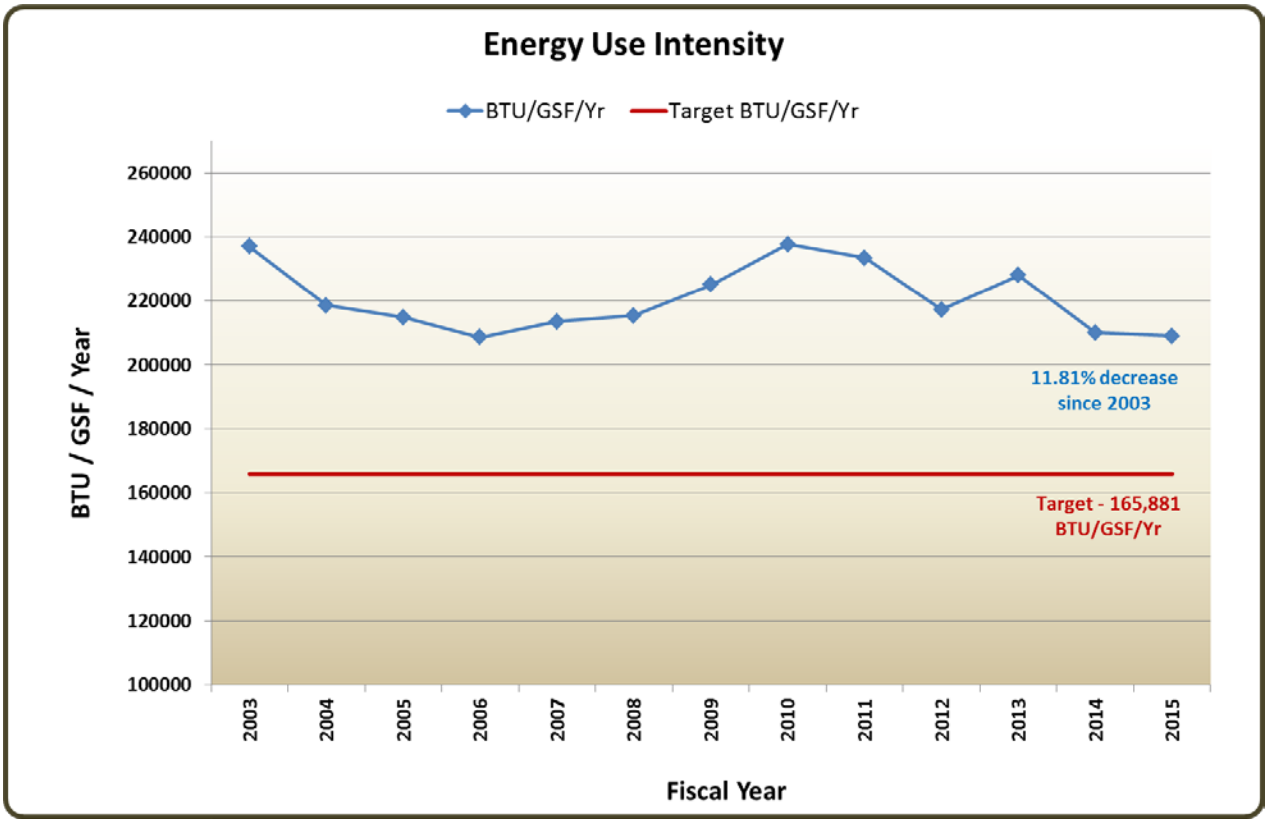

Figure 4-1 SNL/CA Energy Use Intensity

4.2.2 Water Use

Figure 4-2 presents fiscal year water use data for SNL/CA since 2007. The corporate target for water use in effect for 2015 was a 26 percent reduction by fiscal year 2020, using fiscal year 2007 data as a baseline. Overall, there has been a decrease in water use and intensity at SNL/CA since 2007. The site experienced a decrease in water use during 2015 when compared to previous years. This decrease is attributed to reduced irrigation in response to California drought conditions.

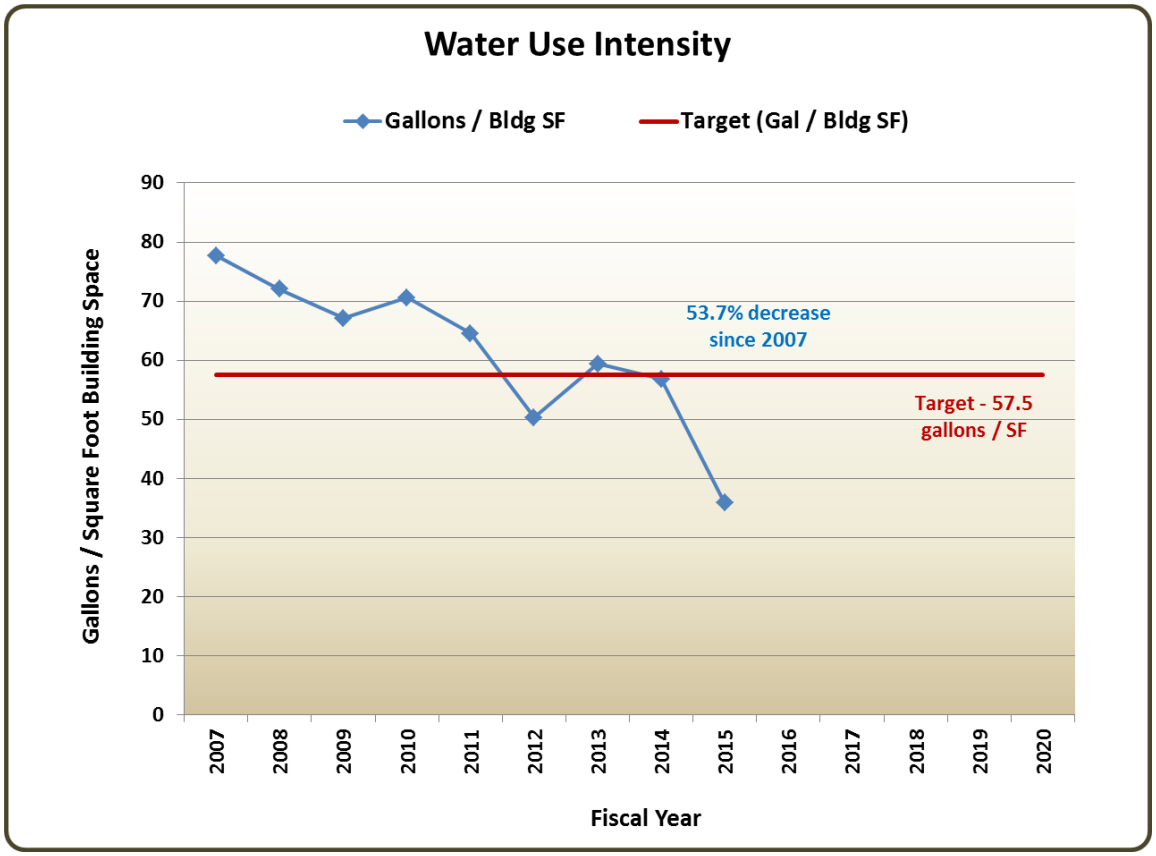

Figure 4-2 SNL/CA Water Use Intensity

4.2.3 Greenhouse Gas Reduction

Sandia's targets for air emissions in effect for 2015 include reducing scope 1 and 2 greenhouse gas (GHG) emissions by 28 percent and reducing scope 3 GHG emissions by 13 percent by fiscal year 2020 from a 2008 baseline. Table 4-2 identifies the components of each emissions category.

Table 4-2 Greenhouse Gas Emissions by Category

Scope 1	Scope 2	Scope 3
Natural gas consumption	Purchased electricity	Employee commuting
Stationary combustion		Business ground and air travel
Fleet fuel consumption		Transmission and distribution losses
Process gases and fugitive emissions		Contracted (off-site) waste water treatment
		Contracted (off-site) municipal waste disposal

Sandia does not measure reductions in GHG emissions separately at SNL/CA but site personnel provide input to Sandia's corporate metrics. Overall, Sandia has reduced scope 1 and 2 GHG emissions by 53 percent. However, scope 3 GHG emissions increased by nine percent relative to the 2008 baseline. This increase is likely a result of additional employee commuting and business travel.

In 2015, SNL/CA personnel completed the following activities to support the corporate targets:

- refurbished three Sulfur Hexafluoride (SF6) gas insulated switchgear, bringing the total to date to ten;
- removed three additional SF6 gas insulated switchgear that are awaiting shipment to the manufacturer for refurbishment;
- continued design and replacement of heating / air conditioning control systems in site buildings to allow for automatic shutdown and set-back during nonstandard work hours;
- continued implementation of automatic computer power management;
- continued to divert solid waste from landfill disposal; and
- implemented a Workplace Charging Program that allows Sandia personnel to utilize fleet vehicle charging stations for personal electric vehicles.

The State of California has many regulations addressing the reduction of GHG emissions. The regulations that are applicable to SNL/CA operations are:

- SF6 Emission Reductions from Gas Insulated Switchgear
- SF6 Reductions from Non-Electric and Non-Semiconductor Applications (e.g. research applications)
- Reduction of Emissions of Fluorinated Gases from Semi-Conductor Operations
- Refrigerant Management Program: Regulation for Non-Residential Refrigeration Systems

SNL/CA personnel track usage and emissions of GHGs, repair leaks and equipment, and report data to either the California Air Resources Board or the Bay Area Air Quality Management District (BAAQMD) as required by these regulations. Table 4-3 provides a summary of GHG reporting.

Table 4-3 Summary of GHG Reporting, 2015

Greenhouse Gas	Emissions
SF6 Emissions from Gas Insulated Switchgear	2.7 % leak rate (5.9 lbs of SF6)*
PFC for Semiconductor Operations	1.36 kg of SF6
SF6 for Research Operations	0 kg of SF6
Refrigerants	3 ozs of R-410A
	100 lbs of R-123
	56 lbs of R-122

*Leak rate and lbs of SF6 emitted are calculated per CCR Title 17 Article 4 Subarticle 3.1.

4.3 General Environmental Compliance Metrics

Sandia personnel track noncompliance with environmental requirements as a measure of our environmental management performance at SNL/CA. Figure 4-3 shows the number of findings from third-party audits (includes DOE), notices of violation, and other environmental occurrences since 2000. The Sandia goal is zero findings and zero violations. Sandia received one minor violation in 2015 for a lapse in training of underground storage tank monitoring personnel. See Section 3.12 for additional information. As a routine element of EMS implementation, Sandia personnel identify and implement corrective and preventive actions in an effort to improve environmental performance and reach and maintain the Sandia goal of zero violations and zero findings.

This goal also supports a 2015 NNSA/SFO performance objective for operations and infrastructure. Sandia contributed to meeting this objective by delivering efficient, effective, and responsive ES&H management, processes, and systems. Sandia received a rating of very good for this performance objective.

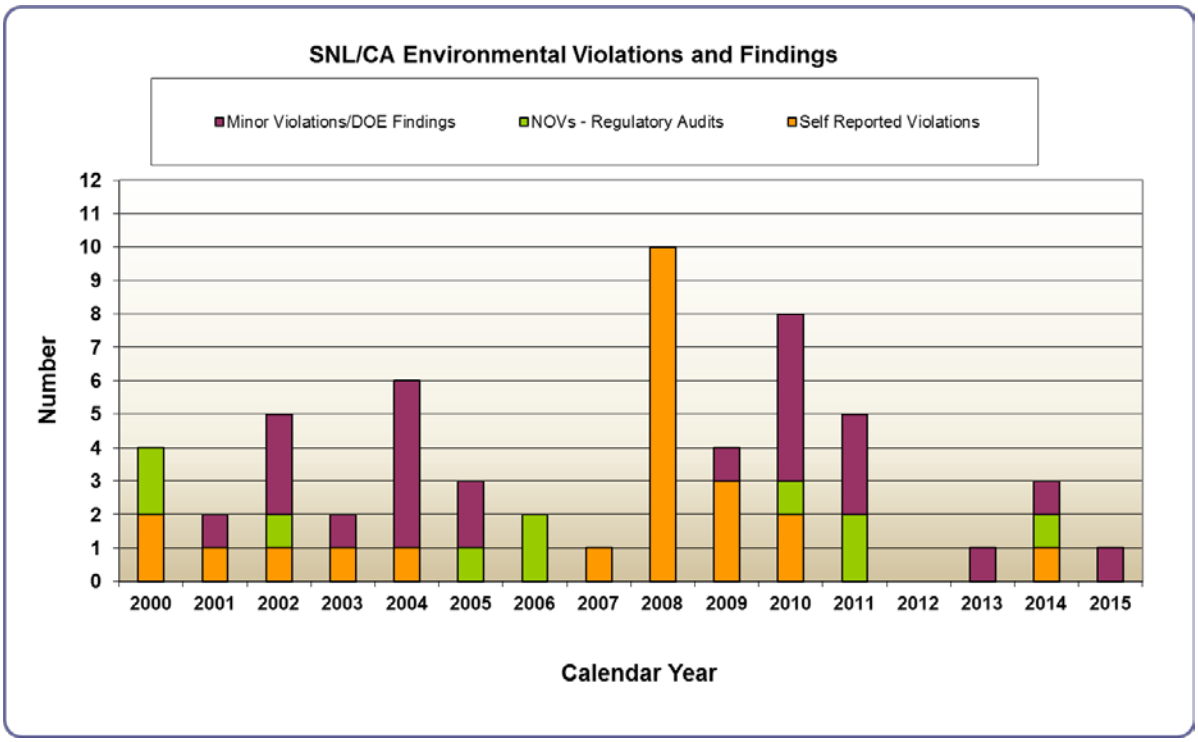

Figure 4-3 Measurement of Excellence in Environmental Management

4.4 Air Quality Program

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

Federal, state, and local agencies continue to develop measures to reduce exposure to toxic air contaminants and criteria pollutants. In addition, the State of California is well underway in implementing many new regulations aimed at reducing emissions from diesel engines and greenhouse gases, such as SF6 and other fluorinated gases. Many of the Air Quality Program efforts undertaken in 2015 support these efforts through monitoring, compliance activities, and annual reporting. Additional highlights of the Air Quality Program for 2015 are listed below.

- Completed and submitted the BAAQMD Annual Update Package (supporting documentation and data for renewal of BAAQMD Permit To Operate).
- Prepared notifications to the BAAQMD to discontinue two air permits, one for an emergency generator and the other for a low-use portable generator.
- Interfaced with the BAAQMD on permitting and environmental review requirements for a short-term, strategic partnership project executed at SNL/CA in 2015. The

environmental regulatory issues for the project were complex, requiring a series of discussions with BAAQMD personnel, the project team, and stakeholders.

4.5 Environmental Monitoring and Ecology Program

The Environmental Monitoring and Ecology staff routinely monitors wastewater, storm water, and groundwater systems at SNL/CA to assess the effect of site operations on the public and local environment. This program also monitors ecological resources and external radiation at the site perimeter. General monitoring data for the Environmental Monitoring and Ecology Program is presented here. Detailed monitoring activities and sample results are presented in Chapter 5.

4.5.1 Ecological Resources

In June 2006, an Arroyo Seco Improvement Program (ASIP) was initiated to address erosion and storm water control within the arroyo. Sandia is conducting Arroyo Seco improvements under a U.S. Army Corp of Engineers permit authorizing specific activities within a jurisdictional water of the United States. The improvement program includes restoration of riparian habitat at select locations along the arroyo.

In 2015, the last improvement activity under the ASIP permit was completed. Four areas previously restored were also repaired this year. Sandia personnel will continue to monitor restored areas over a ten-year period to ensure restoration is successful and permit requirements for plant survival are met. Repairs and replanting will be conducted, as needed. Approximately 5.64 acres of riparian habitat have been restored under the ASIP by planting a variety of native trees and reseeding disturbed areas with native grasses. The goal for tree survival at all areas is 85 percent. For grasses and shrubs, the goal is 75 percent cover.

4.5.2 Wastewater Discharges

Figure 4-4 shows volume of sewer effluent discharged by SNL/CA from 2000 through 2015. Sewer discharge in 2015 was approximately 6.6 million gallons representing a sixteen percent increase from 2014. Wastewater discharges typically fluctuate year-to-year in response to changes in site operations. A noticeable decrease in wastewater discharge was reported from 2010 to 2011. SNL/CA personnel installed a new flow meter in 2011 that provided more accurate discharge data. The decrease from 2010 to 2011 is most likely a result of better data and not a significant decrease in discharges.

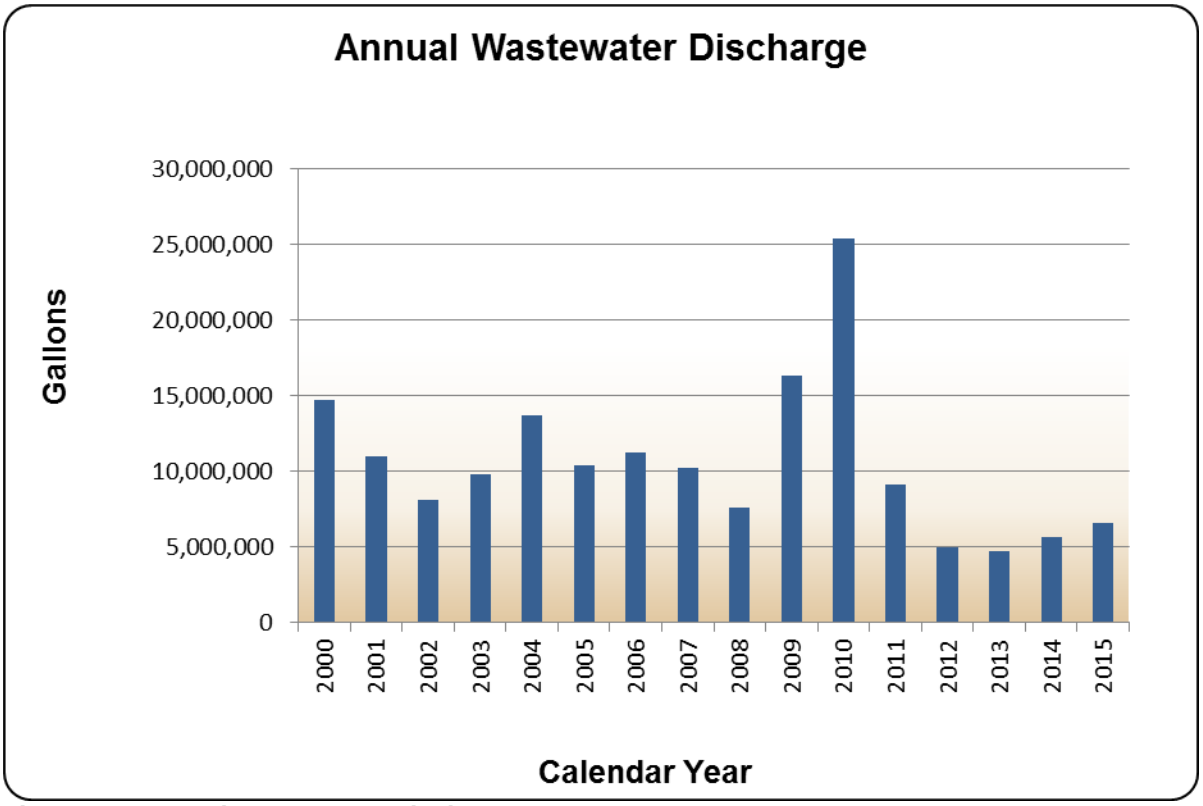

Figure 4-4 Annual Wastewater Discharges

4.5.3 Pollutants Released to the Ground or Groundwater

Sandia personnel track chemical spills that occur throughout the year. Figure 4-5 shows the number of spills and total gallons spilled each year since 2005. Typical materials spilled include motor oil, hydraulic oil, and coolants. Small releases to the ground surface are cleaned-up within a few hours by the Sandia spill response team. Spills in 2015 were from two leaking water treatment units (12 gallons) and six hydraulic oil spills from equipment piping (4 to 5 gallons). None of the chemical spills shown in Figure 4-5 resulted in releases to groundwater or required environmental remediation.

SNL/CA personnel are also required to report sanitary sewer overflows to the California State Water Resources Control Board. In 2015, there were no sanitary sewer overflows at SNL/CA.

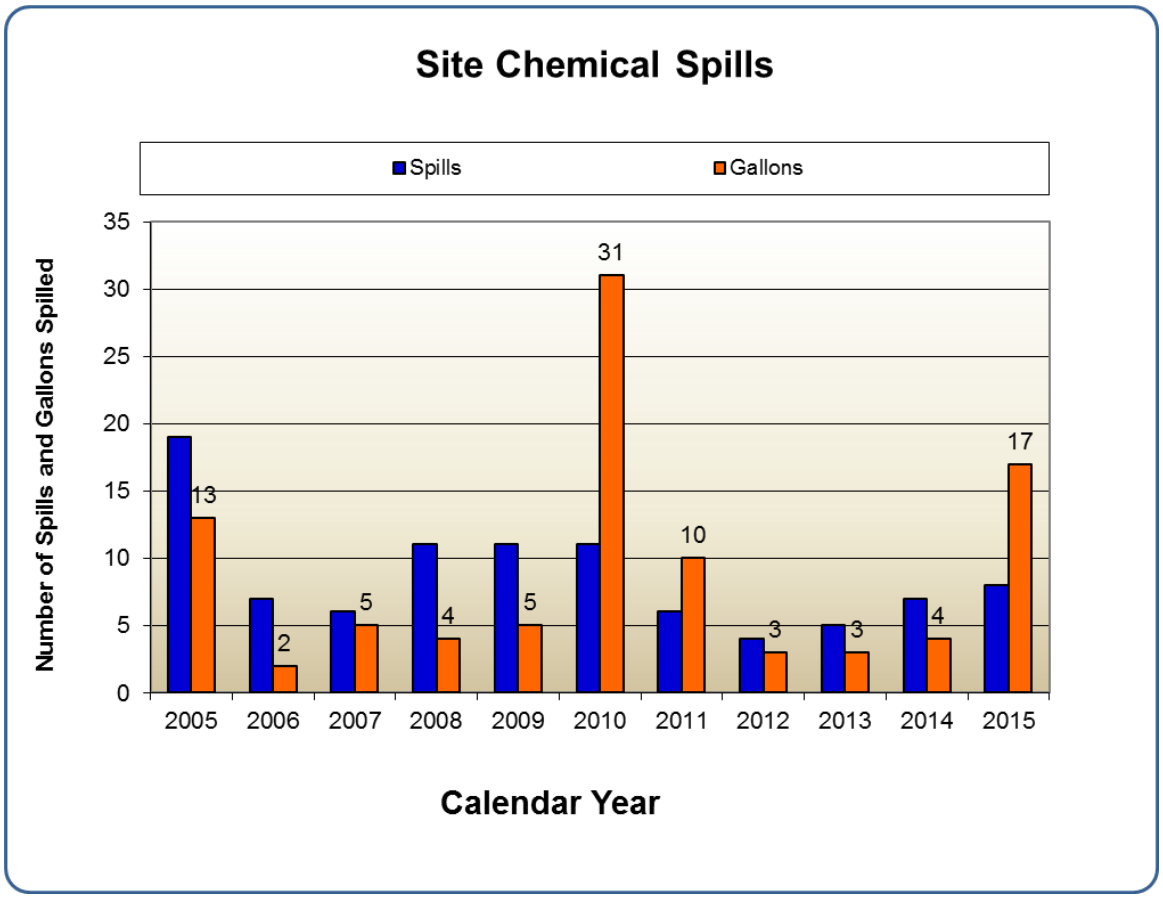

Figure 4-5 SNL/CA Chemical Spills

4.6 Environmental Planning Program

The Environmental Planning Program focuses on integration of environmental considerations and initiatives into site planning and development. Program activities include site-wide environmental analyses and reporting and National Environmental Policy Act reviews. Each year, Environmental Planning staff compares actual site operations to the maximum operations scenario presented in a site-wide environmental assessment (SWEA) and supplement analysis (SA) to determine whether SNL/CA operations remain within the bounding impact analysis. Table 4-4 presents a summary of the comparison and an evaluation of results.

Table 4-4 Comparison of 2015 Operations with SWEA / SA Envelope

Activity / Unit	SWEA / SA Envelope (maximum operations)	Calendar Year 2015	Site Operations Remain Within Impact Analysis of SWEA / SA
Proposed Action			
Site mission	Supports DOE, NNSA, DHS	No change	Yes
Arroyo Seco improvements	20 tasks	20 tasks completed as of December 31, 2015	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	9,000 sf as of December 31, 2013 (badge office trailer 500 sf, computational facility 8,500 sf)	Yes
Demolition	100,000 sf	60,377 sf as of December 31, 2015	Yes
Land Use			
Construction area	93 acres	8 acres as of December 31, 2014	Yes
Wildlife reserve	30 acres minimum	106 acres	Yes
Geology / Soil			
Solid waste management units	23 units total	22 units	Yes
Soil removed	5000 cu yd/yr	0 cu yd	Yes
Soil managed on-site	5000 cu yd/yr	<500 cu yd	Yes
Backfill material brought on-site	6000 cu yd/yr	0 cu yd	Yes
Infrastructure			
Water use	91.8 million gal/yr	36.8 million gals	Yes
Sanitary sewer discharge	29.1 million gal/yr	6.6 million gals	Yes
Natural gas use	94 million cu ft/yr	55.7 million cu ft[e]	Yes
Electricity use	48,800 MW hr/yr	36,320 MW hrs	Yes
Biological and Ecological Resources			
Construct flood plains in Arroyo Seco	1800 linear feet	612 linear feet as of December 31, 2015	Yes
Create riparian habitat	0.2 acres	5.64 acres as of December 31. 2015	No, Positive impact
Ground disturbance in / along arroyo	10 acres	< 6 acres as of December 31, 2015	Yes
Cultural Resources	None known on-site	No change	Yes

Activity / Unit	SWEA / SA Envelope (maximum operations)	Calendar Year 2015	Site Operations Remain Within Impact Analysis of SWEA / SA
Proposed Action			
Water Resources			
Impervious surface area	95.35 acres total	91 acres	Yes
Irrigation water use	17 million gal/yr	2.7 million gals	Yes
Waste Generation			
Radioactive waste	8,811 kg/yr	463 kg	Yes
Hazardous waste	133,820 kg/yr	43,326 kg	Yes
Solid waste (non-hazardous, excludes construction debris)	378.7 metric tons/yr	136 metric tons[e,f]	Yes
Transportation			
Hazardous / radioactive waste shipments	116 shipments/yr	43 shipments	Yes
Nonhazardous solid waste shipments to landfill	80 shipments/yr	40 routine trash and 4 construction debris shipments	Yes
Air Emissions			
Total criteria pollutants	8,212 kg/yr	2,540 kg[a]	Yes
Total air toxics	2,880.16 kg/yr	894 kg[a]	Yes
Radioactive	0 emissions	0 emissions	Yes
Permits	57 permits annually	11/9 permits[b]	Yes
Human Health			
Recordable accidents / injuries	78 accidents / injuries annually	11 accident / injuries[e]	Yes
Lost work-day cases	19 cases annually[c]	3 cases[e]	Yes
Socioeconomics			
Employment	Up to 1931 persons annually	1239 persons[d]	Yes
Operating budget	$316 million/yr	$323 million[e]	No

[a] Annual emissions were calculated by multiplying the daily emissions reported in the BAAQMD Permit to Operate by 365. 2015 emissions are based on 2014 data.
[b] Data provided for the 2014/2015 (11 permitted sources) and 2015/2016 (9 permitted sources) permit periods. See Section 3.3.1 for more information.
[c] Extrapolated from historical average.
[d] SNL/CA employees (U.S. citizens and foreign nationals) and on-site contractors. Data from January 2016.
[e] Fiscal year data (October 1 – September 30).
[f] Routine waste sent to the landfill.

4.7 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. Sandia staff work closely with other SNL/CA organizations to establish routine and project-specific recycling programs. Pollution Prevention staff provide guidance for resource and energy conservation and assist in identifying recycled-content products for use throughout the site.

A list of activities conducted or supported by Pollution Prevention staff in 2015 is provided below.

- Continued working with corporate pollution prevention personnel to develop a zero waste plan for SNL/CA.

- Worked with the Livermore Valley Transit Authority to improve bus service to the Livermore Valley Open Campus.
- Worked closely with LLNL personnel to identify new opportunities for recycling or reusing HDPE plastics, as both SNL/CA and LLNL lost the ability to utilize local plastics recyclers.
- Revised New Employee Orientation and Universal Waste training in response to customer feedback. Improvements focus on promoting material sustainability and proper management of universal waste.
- Established new universal waste accumulation areas for PC-boards and small electronics to ensure proper management and recycling.
- Continued to work in unison with the Logistics organization to increase disposal at "waste-to-energy" facilities for products with no other reuse or recycle options.
- Assisted Logistics organizations at SNL/CA and SNL/NM in developing and implementing a new Reapplication Request System that improves customer service and reduces excess equipment waste.
- Worked with Regulatory Compliance and Waste Management personnel to allow reuse of select 55 gallon oil drums as an alternative to disposal as hazardous waste.
- Worked with Waste Management and Logistics personnel to include power supplies in the electronic waste recycling stream.
- Worked with Health Physics personnel to establish a Tyvek accumulation area for recycling of Tyveks used for training.

4.7.1 Solid Waste

Consistent with an Alameda County ordinance, SNL/CA's goal for solid waste is to divert 90 percent of non-hazardous solid waste from landfill disposal by 2020. Figure 4-6 presents diversion results since fiscal year 2010. The solid waste diversion rate decreased in 2015 primarily resulting from inappropriate use of routine waste bins for construction debris by construction contractors. Construction contractors are now required to provide project-specific waste hoppers to collect debris, and to provide waste data to SNL/CA Environmental Management personnel on a timely basis. Additionally, SNL/CA personnel are evaluating and analyzing more waste items that are potentially non-hazardous to reduce the quantity of hazardous waste generated from site activities resulting in increased non-hazardous landfill disposal. For wastes that are determined to be non-hazardous through the evaluation and analysis process, SNL/CA personnel seek approval for disposal in an appropriate non-hazardous waste landfill. In past years, SNL/CA personnel did not routinely analyze potentially non-hazardous waste, and consequently more waste was shipped offsite for disposal as hazardous.

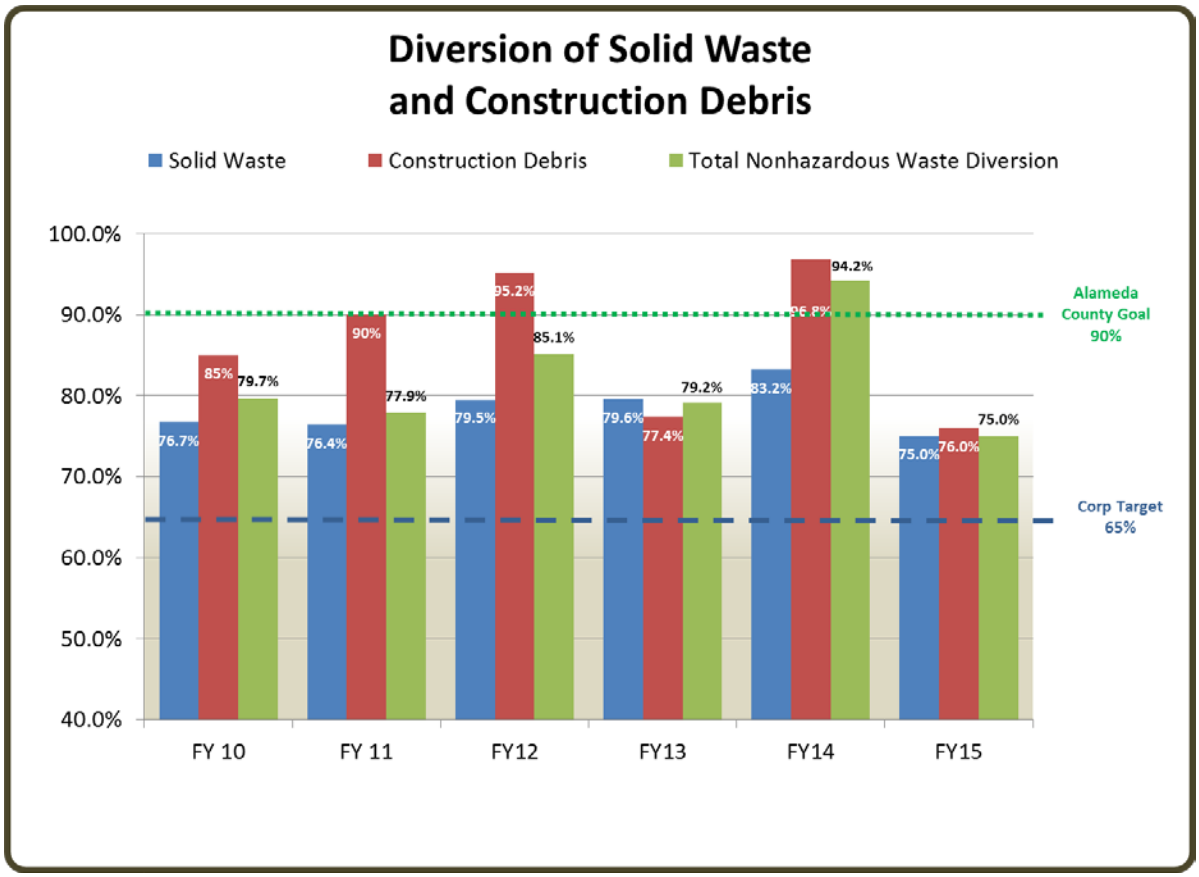

Figure 4-6 Solid Waste and Construction Debris Diverted From Landfill Disposal

Figure 4-7 presents routine landfill waste data for fiscal years 2003 to 2015. The quantity of non-hazardous solid waste sent to the landfill in 2015 increased by 48 metric tons from 2014.

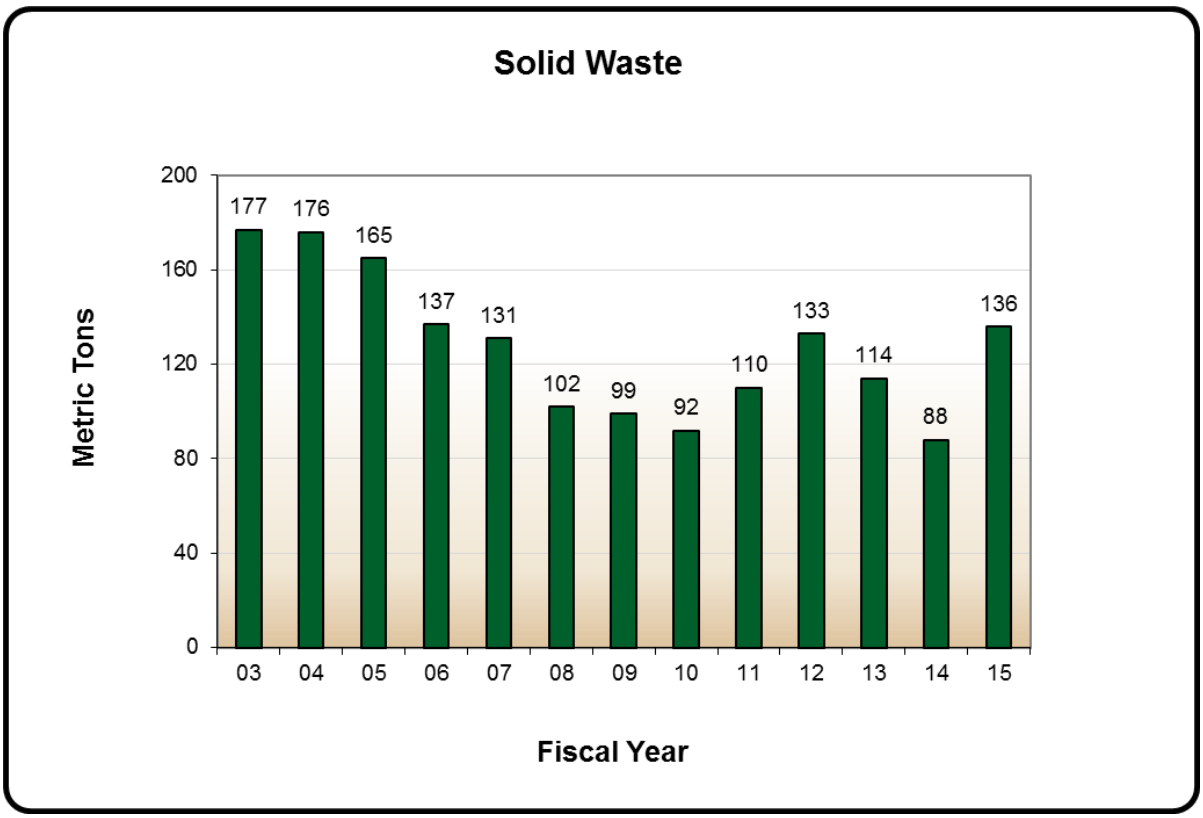

Figure 4-7 SNL/CA Landfill Waste

4.8 Waste Management

The Waste Management Program is responsible for managing hazardous, radioactive, and mixed wastes generated by SNL/CA operations. Waste Management personnel collect waste from the point of generation and transfer waste to on-site waste storage facilities for storage, consolidation, commingling, and packaging. Program personnel establish and maintain contracts for offsite recycling, treatment, and disposal of wastes. They provide regulatory oversight in accordance with federal, state, and local regulations, manage the Resource Conservation and Recovery Act (RCRA) and tiered permit process, and implement RCRA and Tiered permit conditions. Waste Management personnel conduct process knowledge evaluations to characterize waste types generated from specific operations and provide waste generator training to the workforce at SNL/CA.

In 2015, Waste Management personnel conducted and/or supported the following activities.

- Coordinated with Environmental Management, Facilities, Occupation Health and Safety and research personnel to dispose of equipment and hazardous materials no

longer needed for SNL/CA activities. All waste streams generated from this effort were processed and disposed as hazardous waste.
- Provided oversight and preparation for disposal of a large oven and auxiliary components previously used for weapons testing.
- Coordinated disposal of 750 gallons of heat transfer fluid previously used for a hydrogen storage project and approximately 500 gallons of rinseate generated from cleaning two aboveground diesel storage tanks that were closed and removed from the site. (See Section 3.6.3 for additional information about closure of the aboveground storage tanks.)
- Changed the hazardous waste shipment schedule to allow more frequent, but smaller, shipments. Hazardous waste shipments now occur every two months, resulting in more effective waste management.
- Worked with SNL/NM personnel to roll out a new database for tracking the generation and management (cradle to grave) of hazardous waste.
- Assisted Weapons Program personnel with disposal of approximately 1,530 kilograms of non-radioactive and non-hazardous metal and electrical components generated from a clean-out of legacy storage areas.

4.8.1 Hazardous and Radioactive Waste

Sandia personnel strive to minimize generation of hazardous and radioactive wastes through process controls, recycling, and reapplication of chemicals from one activity to another. Figures 4-8 and 4-9 show hazardous and radioactive waste generated since 2005, respectively. As shown, waste generation in both categories fluctuates from year to year depending on the nature and scope of projects conducted. The increase in hazardous waste in 2015 is attributed to construction and demolition activities, and disposal of equipment and hazardous materials no longer needed (see Section 4.8).

In 2015, Sandia continued to remove unwanted materials and equipment from the SNL/CA site. Some items that contained radioactive materials were dispositioned as low-level radioactive and/or mixed waste and transferred offsite to approved disposal facilities. The increase in radioactive waste in 2015 is attributed to this clean-out campaign.

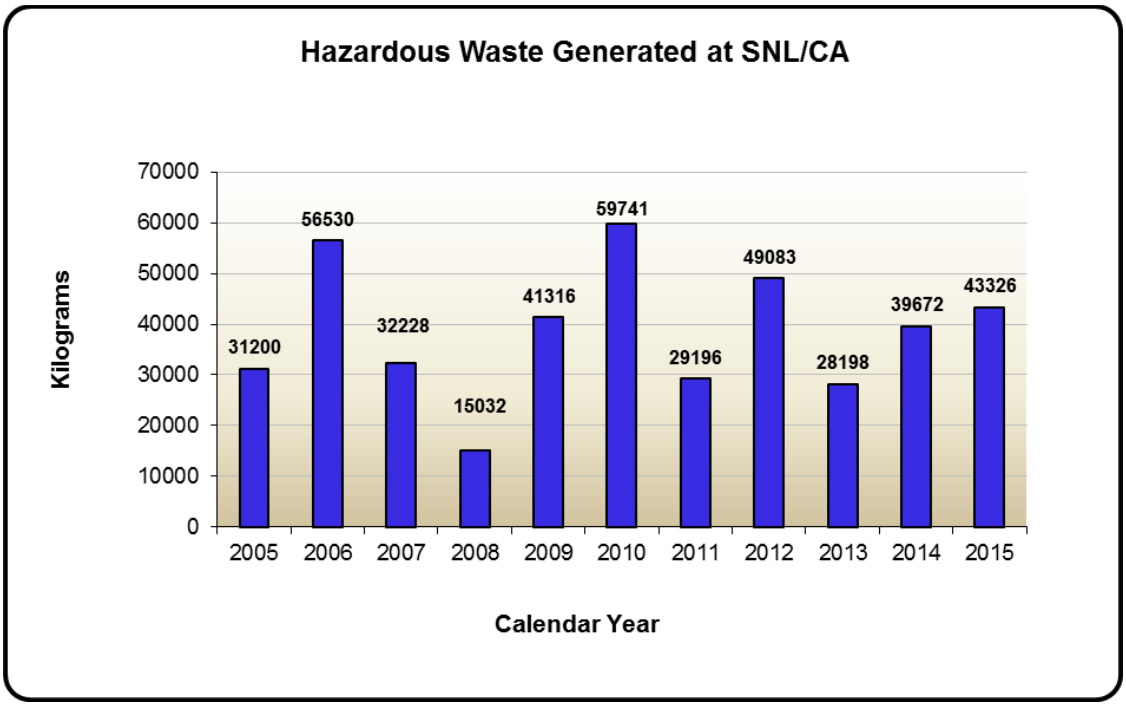

Figure 4-8 Hazardous Waste Generated at SNL/CA

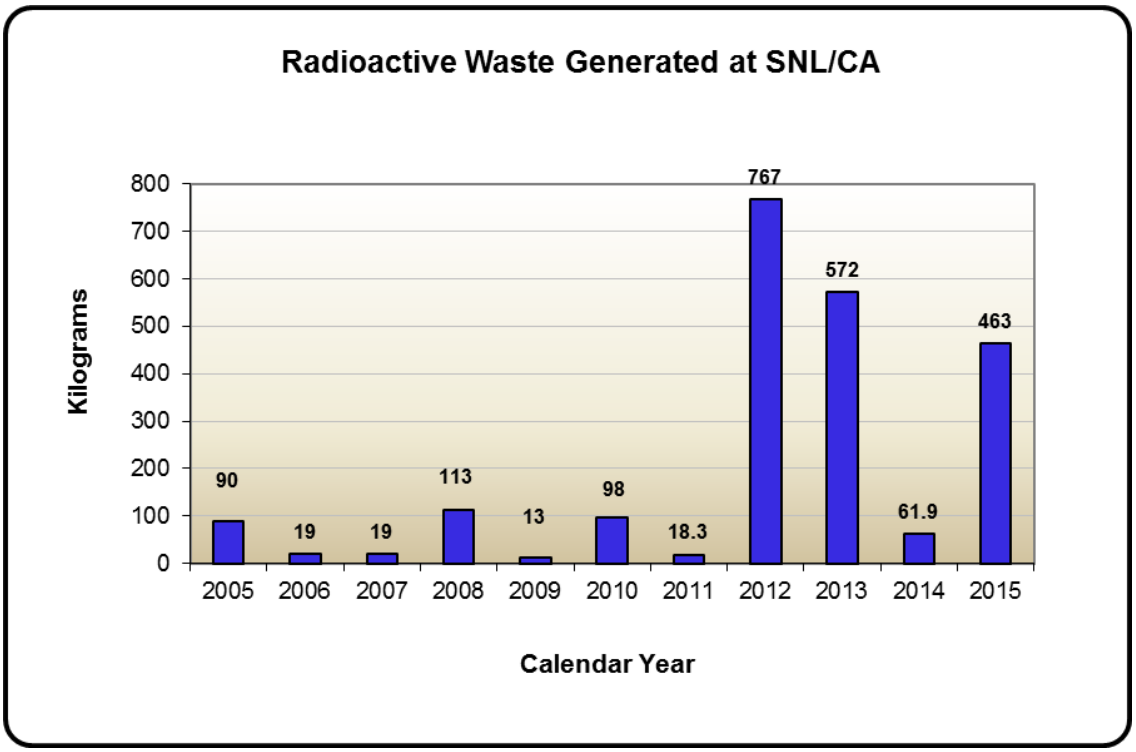

Figure 4-9 Radioactive Waste Generated at SNL/CA

5 Environmental Monitoring

Personnel at Sandia National Laboratories, California (SNL/CA) monitor 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.

Sandia personnel do not directly monitor airborne effluents. Non-radiological (chemical) emission sources do not require routine or continuous monitoring of ambient air quality concentrations. However, equipment and process usage records (e.g. hours of operation or quantity of solvents used) for emission sources are maintained. Similarly, there are no radionuclide emission sources that require routine monitoring. Sandia personnel maintain an inventory of radioactive isotopes (small quantity sealed and unsealed sources), and operate 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, Sandia personnel compare gamma radiation data collected at the site perimeter to offsite data. Results of this comparison are presented in Section 5.4.

Monitoring of biota or vegetation is not required for SNL/CA operations. The Department of Energy (DOE) RAD-BCG Calculator, a computer tool developed by the DOE, is used each year to determine the need and level of monitoring required. The results from applying the tool in 2015 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, Sandia personnel identified nine sampling locations and 22 outfall locations that provide the best representation of drainage areas and activities on site. Storm water sampling locations are shown on Figure 5-1. Representative locations are sampled twice during the rain year, once each during two

separate storm events. However, storm events may not produce enough runoff to collect samples at all nine locations during the rain year or during any one storm.

During the 2014/2015 reporting year (July 1 through June 30), Sandia personnel sampled eight of nine locations and visually monitored 22 outfall locations. Two samples were collected at each of the eight locations during the year. One location lacked sufficient runoff to sample. Analytical results of storm water sampling for the 2014/2015 rain year are presented in Table 5-1. No pollutants were detected in storm water runoff at a level to cause concern. These samples were collected under the provisions of the 1997 General Industrial Permit.

Analytical Parameters – Storm Water

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

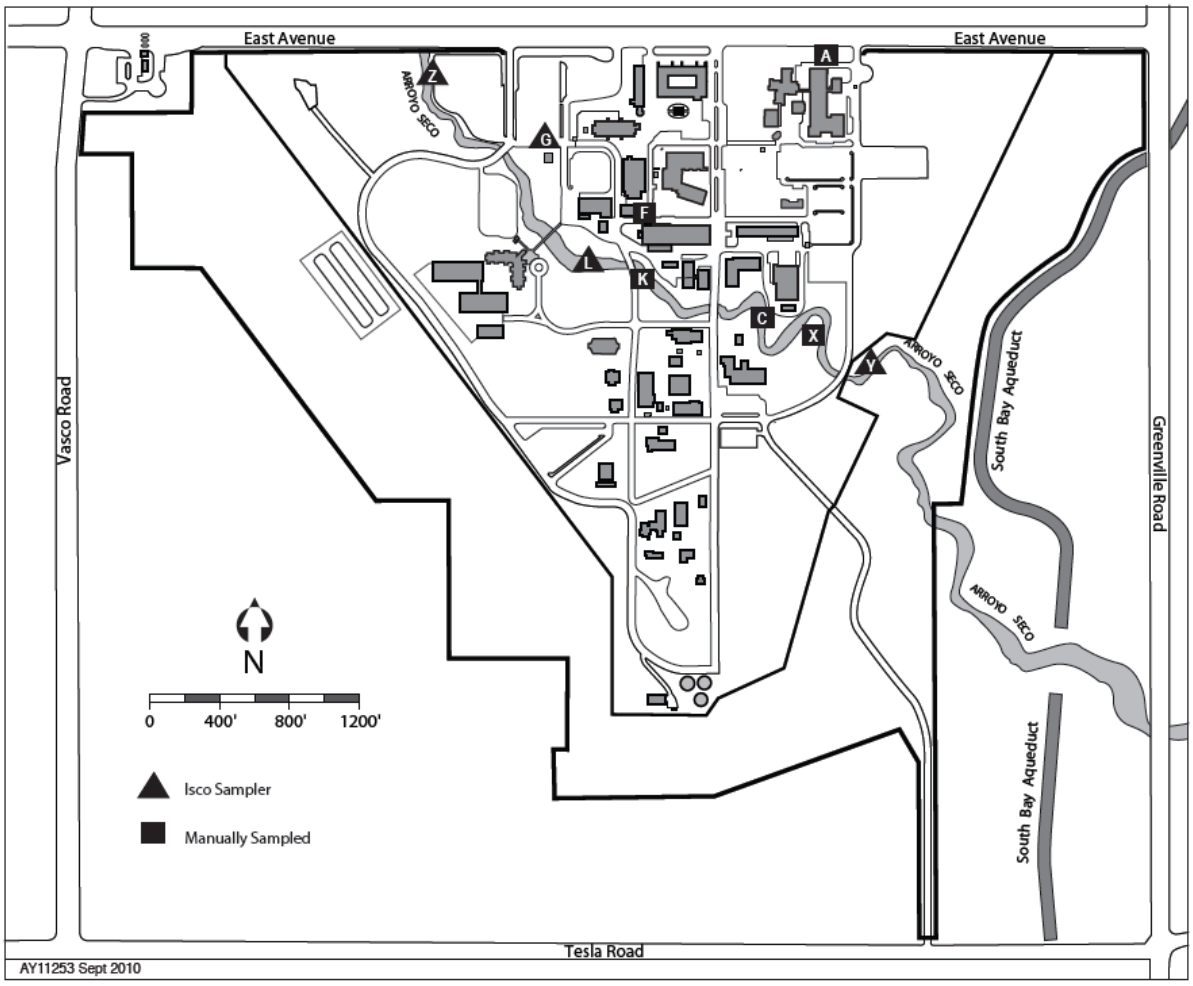

Figure 5-1 Storm Water Sampling Locations

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Table 5-1 Summary of Analytical Results for Storm Water, 2014/2015 Rain Year

Parameter	Number of Samples Analyzed	Number Found Below Detection Limit	Detection Limit	Minimum Concentration	Maximum Concentration
Total suspended solids	16	0	1 mg/L	2.2 mg/L	380 mg/L
Specific conductivity	16	0	1 µmho/cm	12 µmho/cm	50 µmho/cm
pH	16	NA	None	7.0	8.4
Oil and grease	16	3	1.4 mg/L	<1.4 mg/L	2.9 mg/L
Chemical oxygen demand	16	3	9 mg/L	<9 mg/L	150 mg/L
Cyanide	16	16	0.002 mg/L	<0.002 mg/L	<0.002 mg/L
Tritium	16	16	1250 pCi/L 1130 pCi/L	<1250 pCi/L <1130 pCi/L	<1250 pCi/L <1130 pCi/L
Aluminum	16	0	0.002 mg/L	0.098 mg/L	16 mg/L
Arsenic	16	7	0.0008 mg/L	<0.0008 mg/L	0.0018 mg/L
Cadmium	16	1	0.00002 mg/L	<0.00002 mg/L	0.00062 mg/L
Iron	16	0	0.02 mg/L	0.10 mg/L	19 mg/L
Lead	16	0	0.00002 mg/L	0.00034 mg/L	0.024 mg/L
Magnesium	16	0	0.008 mg/L	0.22 mg/L	5.3 mg/L
Mercury	16	16	0.00006 mg/L	<0.00006 mg/L	<0.00006 mg/L
Selenium	16	16	0.000080 mg/L 0.0002 mg/L	<0.000080 mg/L	0.0002 mg/L
Silver	16	16	0.00002 mg/L 0.000080 mg/L	<0.000020 mg/L <0.000080 mg/L	<0.000020 mg/L <0.000080 mg/L
Zinc	16	0	0.0005 mg/L	0.086 mg/L	0.85 mg/L
Ammonia as NH3	16	5	0.0002 mg/L	<0.0002 mg/L	1.5 mg/L
Nitrite + nitrate	16	0	0.02/ 0.2 mg/L	<0.02/0.78 mg/L	0.21/2.5 mg/L

During years of sufficient runoff, Sandia personnel compare the analytical results from storm water entering the site to storm water exiting the site. For the 2014/2015 rain year, a sample of storm water entering the site was not able to be collected due to insufficient runoff at sampling station Y (Figure 5-1).

Parameters such as total suspended solids (TSS) and oil and grease (O&G) are indicative of the quality of storm water runoff from parking lots and roads at SNL/CA. 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. To support minimizing pollution in the runoff, Sandia personnel inspect and clean debris from the storm water drainage system at least once per year, before rains begin. In addition, street sweeping is implemented as another best management practice to minimize storm water pollutants. In 2015, Sandia's maintenance personnel collected approximately 220 cubic yards of debris during street cleaning efforts, thus removing potential storm water pollutants. Figure 5-2 shows the highest TSS and O&G concentrations obtained at SNL/CA storm water sampling locations during the 2014/2015 rain year. The highest concentration of TSS in storm water during 2014/2015 (380mg/L – Station L) was higher than that obtained during the 2013/2014 rain year (130 mg/L – Station F), but within the range historically seen. The highest concentration of O&G observed in 2014/2015 (2.3 mg/L – Station L) was lower than the highest concentration observed in 2013/2014 (4.2 mg/L – Station K).

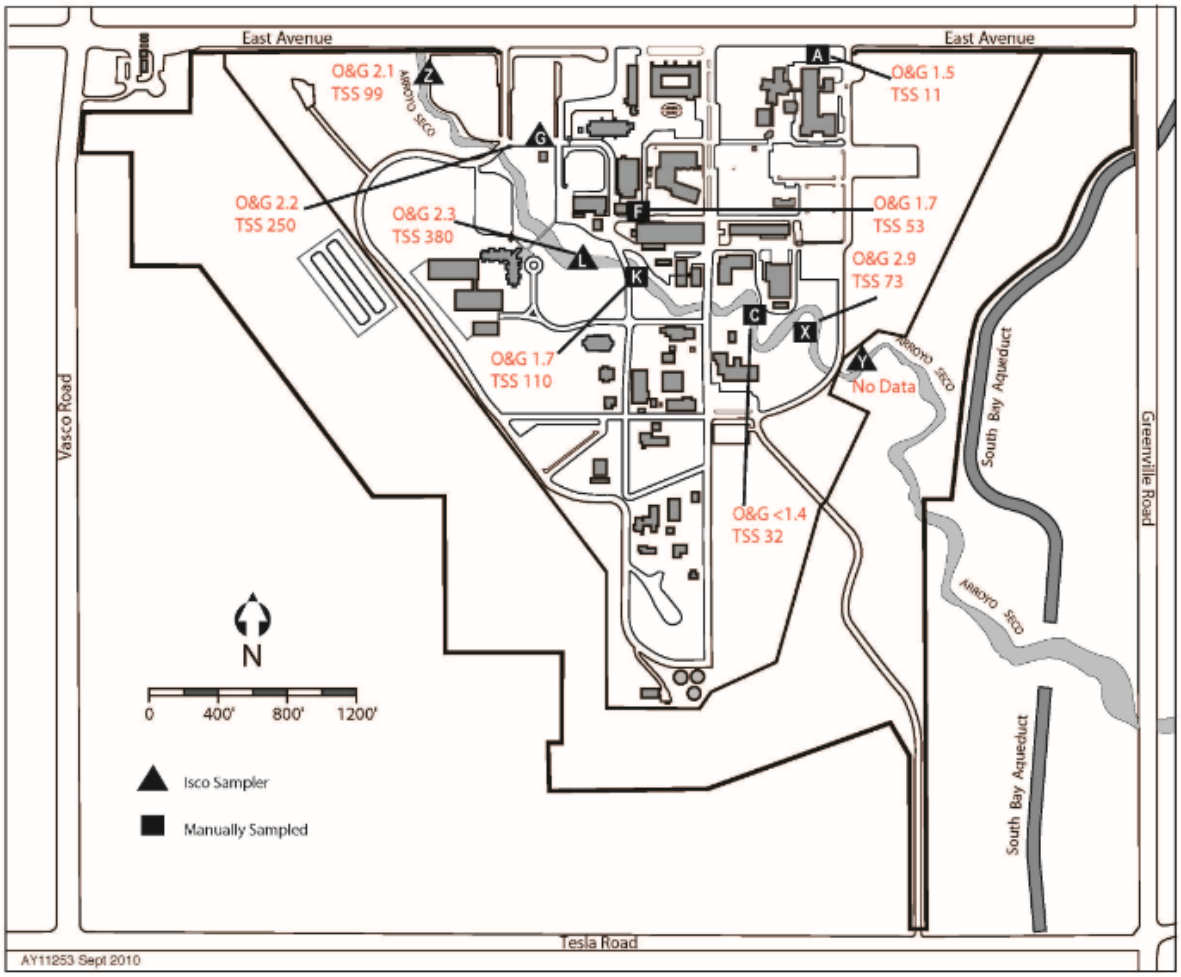

Figure 5-2 Constituents in Storm Water, 2014/2015 Rain Year

Under the 2014 General Industrial Permit (effective on July 1, 2015), storm water samples collected by SNL/CA for the 2015/2016 reporting year (July 1, 2015 through June 30, 2016) at five locations will be averaged and compared to Numeric Action Levels to determine the site's compliance status. Until such time, SNL/CA is considered to be in "baseline" status. Also in 2015, SNL/CA began visually observing storm water discharge at 20 outfall locations in accordance with the new Storm Water Pollution Prevention Plan. Results for the 2015/2016 reporting year will be presented in the 2016 Site Environmental Report.

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. Sandia personnel monitor wastewater at the sewer outfall, LECS tanks, and at categorical process point sources.

5.2.1 Sewer Outfall

A sewer outfall and monitoring station is operated at the northern SNL/CA 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 Sandia *Wastewater Discharge Permit* for SNL/CA. The outfall sampling schedule and analytical parameters are presented in Table 5-2. Consistent with permit requirements, wastewater samples collected at the sewer outfall are not monitored for radioactive constituents.

Table 5-2 Sewer Outfall Sampling Schedule

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 2015, all liquid effluent from the outfall complied with the site outfall discharge limits for all parameters.

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, Sandia personnel report only positively identified organic constituents. In 2015, sewer outfall samples showed sporadic concentrations of Chloroform (up to 4.3 µg/L), Bromoform (up to 22 µg/L), Toluene (up to 14 µg/L), Phenol (up to 160 µg/L), and Benzoic acid (up to 1200 µg/L, but not on the Priority Pollutants List). 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 2015, SNL/CA operations did not exceed this discharge limit. Detailed sewer analyses results are provided in Section 9.

Table 5-3 Composite Sewer Outfall Monitoring Results – Physical Parameters and Metals, 2015

Parameter	Number of Samples Analyzed	Quantity Found Below Detection Limit	Detection Limit	Sewer Discharge Limit	Minimum Concentration	Maximum Concentration
Total suspended solids	12	0	1 mg/L	None	110 mg/L	610 mg/L
Total dissolved solids	12	0	5 mg/L	None	160 mg/L	810 mg/L
Biochemical oxygen demand	12	0	2 mg/L	None	72 mg/L	350 mg/L
Chemical oxygen demand[a]	12	0	9 mg/L	None	280 mg/L	950 mg/L
Cyanide	12	1	0.002 mg/L	0.04 mg/L	<0.002 mg/L	0.0051 mg/L
Arsenic	52	3	0.00080 mg/L	0.06 mg/L	<0.00080 mg/L	0.020 mg/L
Cadmium	52	2	0.000080 mg/L	0.14 mg/L	<0.000080 mg/L	0.00075 mg/L
Chromium	52	0	0.00032mg/L	0.62 mg/L	0.00074 mg/L	0.0091 mg/L
Copper	52	0	0.00016 mg/L	1 mg/L	0.065 mg/L	0.53 mg/L
Lead	52	0	0.000080 mg/L	0.2 mg/L	0.00060mg/L	0.0076 mg/L
Mercury	52	14	0.000060 mg/L	0.01 mg/L	<0.000060 mg/L	0.002 mg/L
Nickel	52	1	0.00024 mg/L	0.61 mg/L	<0.00024 mg/L	0.0074 mg/L
Silver	52	26	0.0002 mg/L 0.000080 mg/L	0.2 mg/L	<0.000080 mg/L	0.0022 mg/L
Zinc	52	0	0.0002 mg/L	3 mg/L	0.090 mg/L	0.68 mg/L

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

Equipment in place at SNL/CA continuously monitors wastewater generated on-site. Figure 5-3 shows weekly monitoring results since 2008 for copper. Since the 2008 – 2009 period when the site experienced numerous exceedances, Sandia continues to maintain concentrations of copper in wastewater below the regulatory limit. Also reflected on the graph is Sandia's goal of maintaining the level of copper below the regulatory analysis trigger level (0.5 mg/L for copper).

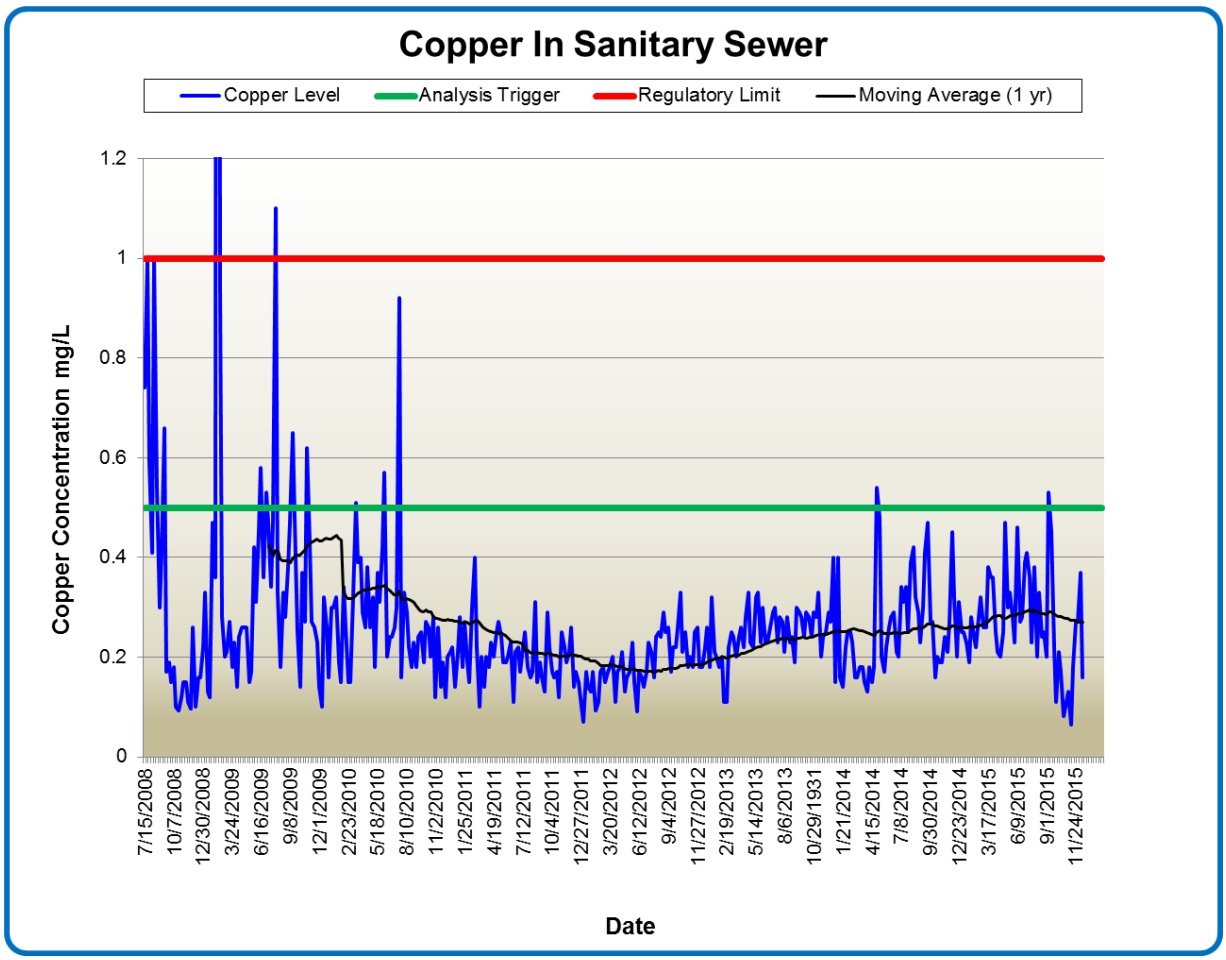

Figure 5-3 Weekly Composite Copper Concentrations in Wastewater

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. Five LECS were operated at SNL/CA during 2015. 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 that is used infrequently is monitored prior to discharge for tritium and uranium. The tank did not require discharge in 2015; consequently, analyses for radioactive constituents were not necessary.

Wastewater captured in LECS tanks that does not meet wastewater discharge permit limits at the sewer outfall is evaluated on a case-by-case basis to ensure appropriate disposal requirements are met. Depending on the constituents of the wastewater, it may be released to the sanitary sewer (the standard process), disposed off-site as non-hazardous waste, or disposed off-site as hazardous waste. In 2015, no tanks required offsite wastewater disposal.

5.2.3 Categorical Processes

Four 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, a semiconductor manufacturing operation, and a spray paint booth. Wastewater from the semiconductor manufacturing operation is sampled semiannually. The two metal finishing operations and the spray paint booth are closed-loop systems that do not discharge effluent to the sanitary sewer, and, therefore, wastewater monitoring is not required. There is an additional laboratory that may infrequently use metal cyanide complexes for electroplating, but this is done on a very small scale (less than 50 mL), and all liquid waste is handled as hazardous waste. There is no discharge from this process.

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 2015, all wastewater from this operation met the pretreatment standards.

Table 5-4 Monitoring for Semiconductor Manufacturing Categorical Process, 2015

Parameter	Number of Samples Analyzed	Number Found Below Detection Limit	Detection Limit	Minimum Concentration	Maximum Concentration	Permit Limit[a]
pH	2	--	None	7.88	8.34	5-10
Arsenic	2	1	0.00020 mg/L	0.00043 mg/L	0.00083 mg/L	2.09 mg/L
Total toxic organics	2	--	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.

5.3 Groundwater

There are seven groundwater monitoring wells at SNL/CA. Sandia personnel monitor 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 up gradient of the developed area of the site and provides background data about local groundwater quality. Groundwater monitoring well locations are shown on Figure 5-4. MW-406, an LLNL well, is also shown on Figure 5-4. Sandia discontinued monitoring at this location in 2005, but continues to report the results of LLNL's monitoring efforts that occur every two years. Table 5-5 provides the sampling schedule for each well location.

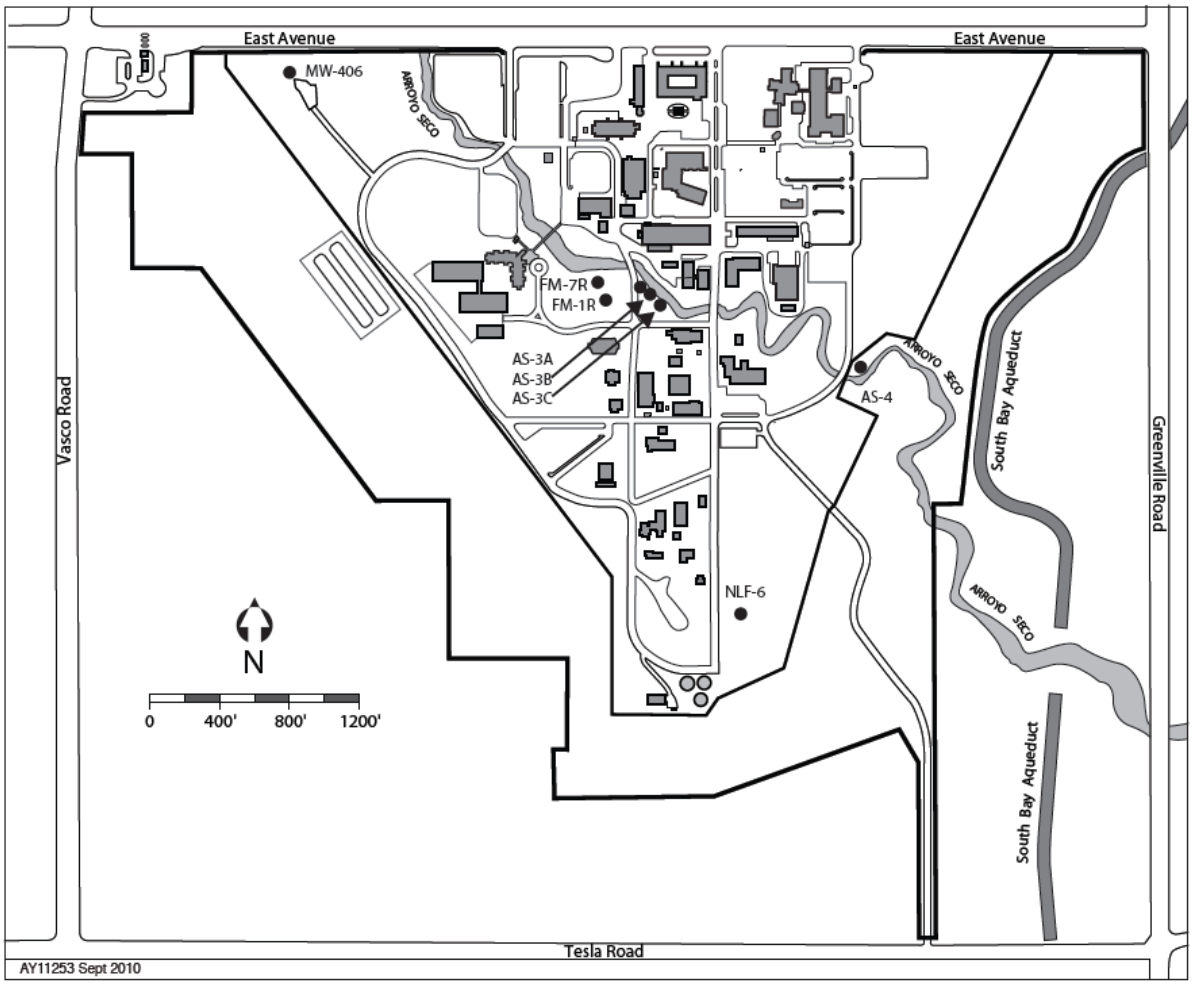

Figure 5-4 Groundwater Monitoring Well Locations

Table 5-5 Groundwater Sampling Schedule

Well location	Sampling frequency	Analytical parameter
Fuel Oil Spill site (Wells FM-1R, FM-7R)	Semi-annually	Total petroleum hydrocarbons diesel-methane (TPHD) (8015); Benzene, Ethylbenzene, Toluene, Xylenes (BTEX); Napthalene; water elevation
Navy Landfill (Well NLF-6)	Annually	Volatile halogenated organics (EPA 624); water elevation
Arroyo Seco (Wells AS-3A, AS-3B, AS-3C, and AS-4)	Annually	Metals, volatile halogenated organics (EPA 624), 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. Table 5-7 presents a summary of groundwater analytical results for the Fuel Oil Spill wells. Groundwater analytical results for Arroyo Seco wells are summarized in tables 5-8 and 5-9. LLNL personnel last sampled MW-406 in March 2014. The only constituent of interest detected was tetrachloroethene at 1.3 μg/L. 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, sample results continued to show carbon tetrachloride at the Navy Landfill well (NLF-6) in 2015. The concentration was above the state MCL of 0.5 μg/L, but below the federal MCL of 5.0 μg/L. The result is similar to that detected in past years. The presence of carbon tetrachloride in this well has been noted since well completion. The State Water Resources Control Board has required SNL/CA to monitor this well for carbon tetrachloride even though the Navy Landfill is considered a closed site. It should be noted that well NLF-6 is not completed in a drinking water or irrigation aquifer. The MCLs are shown for comparison only. A further comparison would be to EPA's Suggested No-Adverse Response Level (SNARL), that of 200 μg/L for a ten-day exposure. A Mann-Kendall test for trend shows that the carbon tetrachloride shows an upward trend from 2005 to 2015, yet the level remains well below a level that would require action by SNL/CA.

Table 5-6 Summary of Groundwater Analyses – Navy Landfill, 2015

	Date	Trichloromethane[a] (chloroform) μg/L	Carbon Tetrachloride[a] μg/L	Tetrachloroethene[a] (PCE) μg/L
Detection limit		0.4	0.4	0.3
MCL – California			0.5	5
MCL – Federal		100	5	5
Navy Landfill				
NLF-6	5/27/15	0.79	2.6	<0.3

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

Table 5-7 Summary of Groundwater Analyses – Fuel Oil Spill, 2015

	Date	TPH-D µg/L	Benzene µg/L	Toluene µg/L	Ethylbenzene µg/L	Xylenes µg/L
Detection limit		50	0.3	0.3	0.4	0.5
MCL – California		-	1	150	300	1750
MCL – Federal		-	5	1000	700	10000
Fuel Oil Spill						
FM-1R	2/19/15	<50	<0.3	<0.3	<0.4	<0.5
FM-7R	2/19/15	<50	<0.3	<0.3	<0.3	<0.3
FM-1R	8/26/15	<50	<0.3	<0.3	<0.3	<0.5
FM-7R	8/26/15	<50	<0.3	<0.3	<0.3	<0.5

MCL – Maximum contaminant levels.

Table 5-8 Summary of Groundwater Analyses at Arroyo Seco Wells - Metals, 2015

				CCR Metals								
	Date	EPA 624	Diesel (8015) µg/L	Barium mg/L	Cadmium mg/L	Chromium mg/L	Copper mg/L	Molybdenum mg/L	Nickel mg/L	Selenium mg/L	Thallium mg/L	Tritium pCi/L
Detection limit			50	0.003	0.0003	0.004	0.004	0.0005	0.0008	0.001	0.002	125
MCL - California				1	0.01	0.05	1			0.01		20000
MCL – Federal				2	0.005	0.1	1		0.1	0.05	0.002	
AS-3A	a	-	-	-	-	-	-	-	-	-	-	-
AS-3B	5/27/15	ND	b	0.12	<0.0003	0.015	0.004	0.0086	0.0015	<0.008	0.0073	<241
AS-3C	5/27/15	ND	<50	0.19	<0.0003	0.0086	<0.004	0.0085	0.0019	<0.008	<0.0030	-
AS-4	5/27/15	ND	<50	0.077	<0.0003	0.0056	<0.004	0.0064	0.0028	<0.008	0.0098	<237

[a] Well AS-3A was dry during 2015.
[b] Well AS-3B did not have sufficient water for all analyses to be completed.
MCL – Maximum contaminant levels.
ND – Non-detectable.

Table 5-9 Summary of Groundwater Analyses at Arroyo Seco Wells – Minerals, 2015

General Minerals

	Date	Specific Conductance µmho/cm	Total Dissolved Solids mg/L	Bicarbonate Alkalinity as CaCO3 mg/L	Carbonate Alkalinity as CaCO3 mg/L	Hydroxide Alkalinity as CaCO3 mg/L	Total Alkalinity as CaCO3 mg/L	Hardness, Total mg/L	Nitrate as NO3 mg/L	Chloride mg/L	Sulfate as SO4 mg/L
Detection limit		-	50	0.1	0.1	0.1	0.1	0.1	0.05	0.1	2
AS-3A	a	-	-	-	-	-	-	-	-	-	-
AS-3B	5/27/15	b	b	b	b	b	b	b	20	63	120
AS-3C	5/27/15	680	360	<1.0	16	27	43	130	11	110	150
AS-4	5/27/15	2000	1200	410	<1.0	<1.0	410	658	0.95	250	290

[a] Well AS-3A was dry during 2015.

[b] Well AS-3B did not have sufficient water for all analyses to be completed.

5.4 Biological Dose Assessment

SNL/CA personnel conduct 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 2015, the RAD-BCG Calculator, a computer tool developed by the 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. Tritium was not detected above analytical detection limits in any storm water samples collected in 2015. Therefore, the detection limit value (1250 pCi/L) was used in the RAD-BCG Calculator. The sum of fractions from storm water data totaled 4.72×10^{-6}. This small fraction indicates that further analysis is not required, nor is monitoring of aquatic or terrestrial biota.

5.5 Radiation Monitoring

SNL/CA personnel monitor gamma radiation to ensure that site operations are not contributing significantly to the ambient radiation dose in the surrounding environment. On-site sources that could contribute to gamma radiation include small, unsealed radioactive isotopes, sealed sources, and several radiation generating devices. Four monitoring stations equipped with thermoluminescent dosimeters are maintained at SNL/CA. 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 SNL/CA 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 fiscal year (FY) 2015, the average annual perimeter dose was 61.5 mrem (0.615 mSv). The average annual dose measurement for distant locations was 51.8 mrem (0.518 mSv). The FY 2015 data for both perimeter and distant locations are within the range measured over the last ten years. Over the last ten years, the annual dose at the SNL/CA perimeter ranged from a low of 58.6 mrem to a high of 66.1 mrem. The ten-year average annual dose at the SNL/CA perimeter is 61.3 mrem (0.613 mSv). Over this same period, the annual dose measured at distant locations ranged from a low of 51.8 mrem to a high of 55.8 mrem. The ten-year

average annual dose measured at distant locations is 54.6 mrem (0.546 mSv). The difference between the perimeter and distant location measurements for FY 2015 is statistically significant. However, since both numbers are within the historical range, and there are no known sources of new or increased radiation exposure at SNL/CA, the difference is not considered to be indicative of increased radiation from Sandia operations.

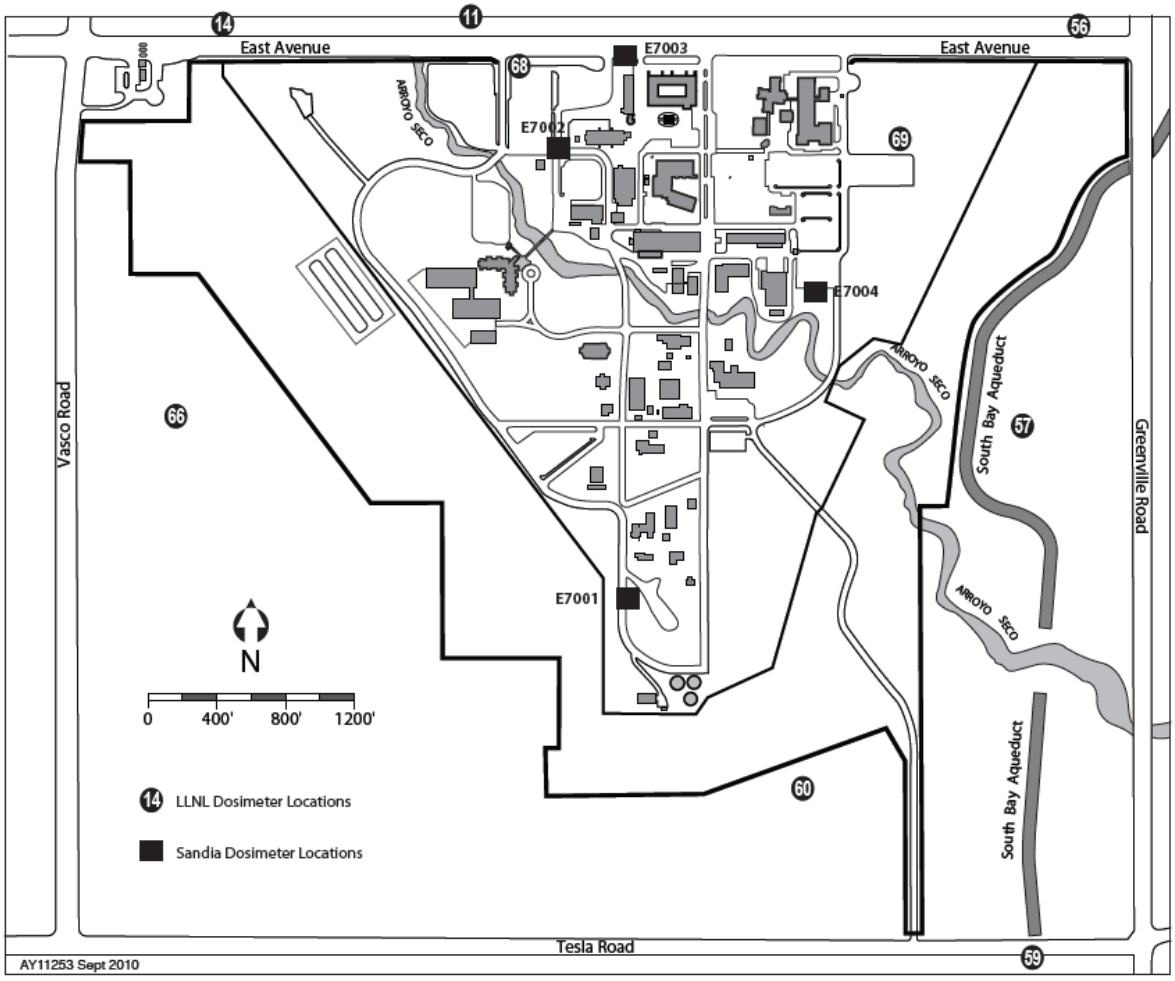

Figure 5-5 Dosimeter Locations at SNL/CA and Around Site Perimeter

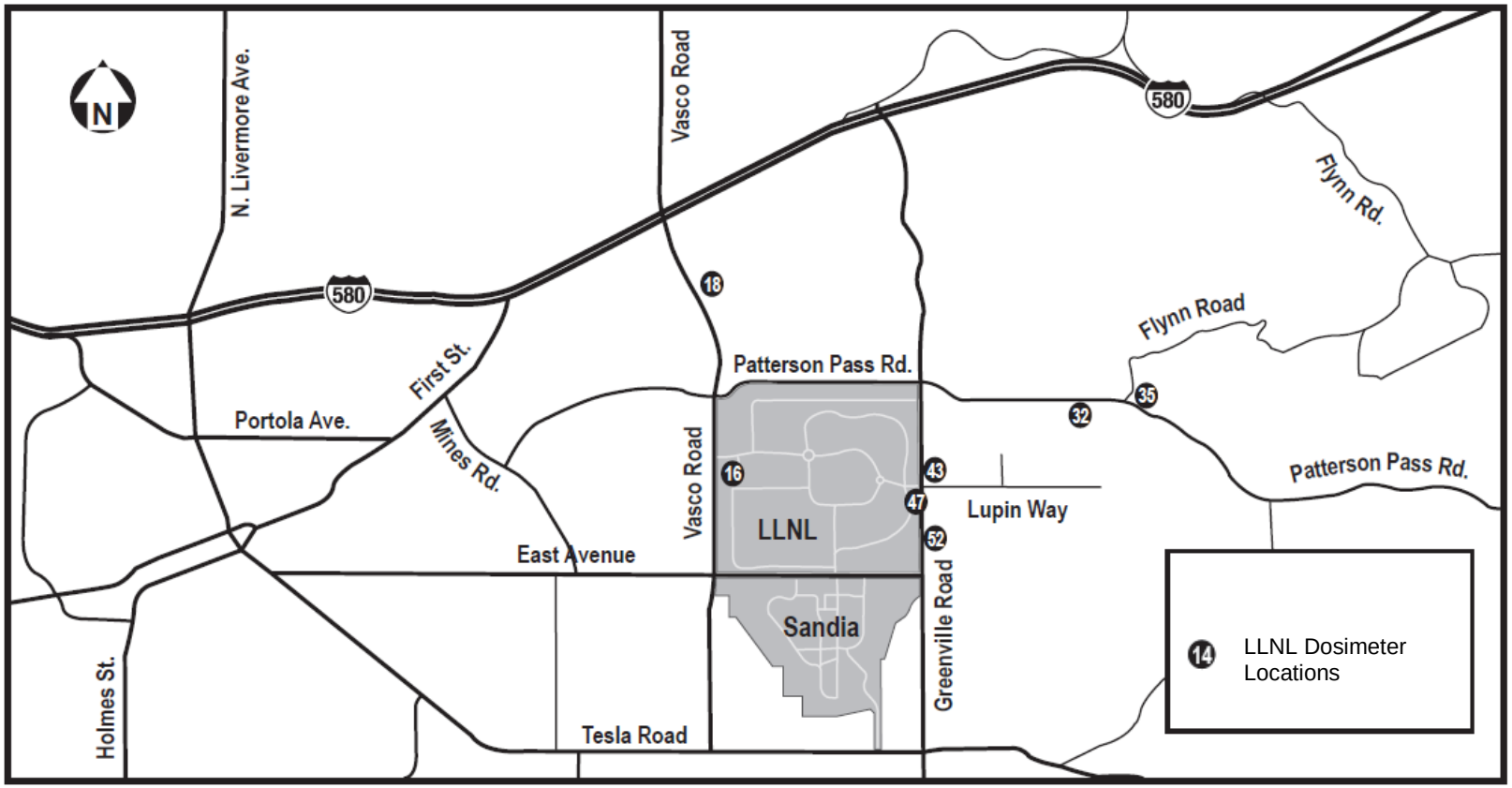

Figure 5-6 Dosimeter Locations in Livermore Valley

6 Quality Assurance

Sandia National Laboratories, California (SNL/CA) personnel follow the Sandia Corporate Process for quality assurance, CG100.5, *Ensure Quality* (SNL 2015b). Compliance with the corporate quality process satisfies the requirements established in the Department of Energy (DOE) regulation of 10 CFR 830, *Nuclear Safety Management*, Subpart A, *Quality Assurance Requirements*, and DOE Order 414.1D, *Quality Assurance* (DOE 2013b). The Environmental Management Department implements specific quality requirements through functional area operating procedures.

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

1) Quality assurance program
2) Personnel training and qualification
3) Quality improvement process
4) Documents and records
5) Established work processes
6) Established standards for design and verification
7) Established procurement requirements
8) Inspection and acceptance testing
9) Management assessment
10) Independent assessment

6.1 Environmental Monitoring Quality Assurance

The Environmental Monitoring and Ecology Program ensures quality in its activities through implementation of quality assurance plans and procedures. An Environmental Management Department-specific quality assurance project plan (QAPP) addresses each of the ten criteria listed above, and documents quality assurance activities performed for the function (SNL/CA 2015). Additional 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 Directives, 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 Sandia personnel in an on-site 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 2013), and meets the Sandia and DOE quality criteria.

6.3.3 SNL/NM Health Instrumentation Laboratory

Thermoluminescent dosimeters used to measure gamma radiation are owned, issued, and processed by the Radiation Protection Dosimetry Program (RPDP) at SNL/NM. The technical basis for the environmental dosimeter monitoring program is provided in *Description and Procedures of the Environmental Radiation Dosimetry Program* (SAND87-1916) (SNL 1987). Dosimeters are issued and processed quarterly following established protocols and quality assurance/quality control requirements specified in RPDP operating procedures and the RPDP Quality Plan (SNL 2015a). Automated dosimeter processing equipment are used to process environmental dosimeters. Data reduction and dose calculations are performed by the RPDP external dosimetry technical staff.

6.4 Data Verification and Validation

Sandia personnel conduct 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.

Sandia's goal for number of quality control samples at SNL/CA is 20 percent of the total sample load, where feasible. This includes quality control samples initiated at the laboratory. In 2015, Sandia personnel collected 12 wastewater quality control samples and submitted two blind spike samples, representing 27 percent of the sample load. Three groundwater quality control samples were collected representing 37 percent of the sample load. Two storm water quality control samples were collected during the 2014/2015 wet season, representing 11 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 2015. As shown, some data quality objectives failed during the year. The three failed storm water precision tests

were aluminum and total suspended solids (TSS, 2 samples). TSS and aluminum are parameters easily influenced by the heterogeneous nature of the storm water. An investigation was not initiated since the absolute differences were small, and the precision tests are based on only one storm water sample for the year. As such, test results may not be indicative of a substantial problem in the storm water sampling.

Table 6-1 Summary of Statistical Analyses, 2015

Sample Medium	Completeness Test	Precision Test		Accuracy Test	
	Results	# of Tests	Results	# of Tests	Results
Wastewater (sanitary sewer)	100%	6	6 passed	14	14 passed
Storm water	22%[a,b]	10	7 passed	-	-
Groundwater	100%	1	1 passed	-	-

[a] Storm water samples are required to be collected during normal business hours, and be preceded by three dry days. The timing of rain events did not allow for all samples to be collected.
[b] 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.

7 References

17 California Code of Regulations (CCR), Subchapter 10, Article 4, Subarticle 3.1, *Regulation for Reducing Sulfur Hexafluoride Emissions from Gas Insulating Switchgear*.

19 CCR, Division 2, Chapter 4, *Hazardous Material Release Reporting, Inventory, and Response Plans*.

22 CCR, Division 4.5, *Environmental Health Standard for Management of Hazardous Waste*.

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

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

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

40 CFR Part 70, Environmental Protection Agency, *State Operating Permit Programs*.

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

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

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

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

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

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

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

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

33 USC §1251, *Clean Water Act of 1977.*

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

42 USC § 4321 et. seq., *National Environmental Policy Act of 1970.*

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

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

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

42 USC § 8201 et, seq., *National Energy Conservation Policy Act.*

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

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

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

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42 USC §17001, *Energy Independence and Security Act of 2007.*

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

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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.
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.
Environmental aspect	An organization's activities, products, or services that can interact with the environment.
Environmental impact	Any change to the environment, whether adverse or beneficial, wholly or partially, resulting from an organization's activities, products, or services.
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, Well Completion Data, and Sanitary Sewer Analytical Results

Table 9-1 Results of Groundwater Analyses at SNL/CA, 2015

	Date	Chloromethane µg/L	Vinyl Chloride µg/L	Bromomethane µg/L	Chloroethane 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		0.4	0.4	0.2	0.4	0.5	0.3	0.5	0.4	0.4	0.4	0.4	0.4	0.4
MCL - California			0.5				10	5		200	0.5	0.5	5	5
MCL - Federal			2			5	100		100	200	5	5	5	5
Well ID														
NLF-6	5/27/15	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.6	ND	ND	ND
Field Dup	5/27/15	ND	ND	ND	ND	ND	ND	ND	0.79	ND	2.0	ND	ND	ND
Field Blank	5/27/15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trip Blank	5/27/15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-3A [1]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AS-3B	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AS-3C	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AS-4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FM-1R	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FM-1R	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FM-7R	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FM-7R	-	-	-	-	-	-	-	-	-	-	-	-	-	-

MCL – Maximum contaminant level.
ND – Non-detectable.
[1] Well was dry.
- Not required to analyze or sample not collected.

Table 9-1 Results of Groundwater Analyses at SNL/CA, 2015 (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		0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.4	0.3	0.4	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	5/27/15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Field dup	5/27/15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Field blank	5/27/15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trip Blank	5/27/15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-3A[1]	5/27/15	-	-	-	-	-	-	-	-	-	-	-	-	-
AS-3B	5/27/15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-3C	5/27/15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-4	5/27/15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FM-1R	2/19/15	-	-	-	-	-	-	-	-	-	-	-	-	ND
FM-1R	8/26/15	-	-	-	-	-	-	-	-	-	-	-	-	ND
FM-7 R	2/19/15	-	-	-	-	-	-	-	-	-	-	-	-	ND
FM-7R	8/26/15	-	-	-	-	-	-	-	-	-	-	-	-	ND

MCL – Maximum contaminant level.
ND – Non-detectable.
[1] Well was dry.
- Not required to analyze or sample not collected.

Table 9-1 Results of Groundwater Analyses at SNL/CA, 2015 (continued)

	Date	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	Zinc mg/L	Tritium pCi/L
Detection limit		0.0006	0.0040	0.003	0.0002	0.0003	0.004	0.0003	0.004	0.02	0.00006	0.0005	0.0008	0.008	0.0005	0.003	0.008	0.008	125
MCL - California			0.01	1		0.01	0.05		1	0.05	0.002			0.01	0.05			5	20000
MCL - Federal		0.006	0.01	2	0.004	0.005	0.1		1		0.002		0.1	0.05	0.1	0.002		5	
Well ID																			
NLF-6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Field dup	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Field blank	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AS-3A[1]	5/27/15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AS-3B	5/27/15	ND	ND	0.12	ND	ND	0.015	ND	0.004	ND	ND	0.0086	0.0015	ND	ND	0.0073	ND	ND	<241
AS-3C	5/27/15	ND	ND	0.19	ND	ND	0.0086	ND	ND	ND	ND	0.0085	0.0019	ND	ND	ND	ND	ND	-
AS-4	5/27/15	ND	ND	0.077	ND	ND	0.0056	ND	ND	ND	ND	0.0064	0.0028	ND	ND	0.0098	ND	ND	<237
FM-1R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FM-1R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FM-7 R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FM-7R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

MCL – Maximum contaminant level.
ND – Non-detectable.
[1] Well was dry.
- Not required to analyze or sample not collected.

Table 9-1 Results of Groundwater Analyses at SNL/CA, 2015 (continued)

	Date	Benzene µg/L	Toluene µg/L	Ethylbenzene µg/L	Xylenes (total) µg/L
Detection limit		0.3	0.3	0.4	0.5
MCL - California		1	150	300	1750
MCL - Federal		5	1000	700	10000
Well ID					
NLF-6	-	-	-	-	-
Field dup	-	-	-	-	-
Field blank	-	-	-	-	-
AS-3A	-	-	-	-	-
AS-3B	-	-	-	-	-
AS-3C	-	-	-	-	-
AS-4	-	-	-	-	-
FM-1R	2/19/15	ND	ND	ND	ND
FM-1R	8/26/15	ND	ND	ND	ND
FM-7R	2/19/15	ND	ND	ND	ND
FM-7R	8/26/15	ND	ND	ND	ND

MCL – Maximum contaminant level.
ND – Non-detectable.
- Not required to analyze or sample not collected.

Table 9-2 Well Depth and Screen Period Interval

Area	Well ID	Well Depth (ft)	Screen Period Interval (ft)
Fuel Oil Spill Site	FM-1R	129	99 – 129
	FM-7R	129	99 - 129
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.

Table 9-3 Routine Monitoring Results for SNL/CA Sanitary Sewer Outfall, 2015

Date	Laboratory ID #[a]	BOD[c] SM5210B	COD[c] (mg/L) E410.4	TDS[c] (mg/L) SM2540C	TSS[c] (mg/L) SM2540D	Oil & Grease (mg/L)[d]	Cyanide[d] (mg/L) Kelada-01
		All results reported in mg/L					
January							
January 6	15A0239	240	580	340	340	*f*	0.0044
February							
February 3	15B0227	220	720	810	320	*f*	0.0026
March							
March 3	15C0325	200	580	380	610	*f*	0.0039
April							
April 7	15D0791	310	850	370	510	*f*	0.0025
May							
May 5	15E0424	350	950	360	450	*f*	0.0051
June							
June 2	15F0361	280	910	430	540	*f*	0.0051
July							
July 7	15G0764	210	430	160	200	*f*	0.0031
August							
August 4	15H0325	300	670	270	440	*f*	0.0036
September							
September 1	15I0111	100	290	190	110	*f*	0.0037
October							
October 6	15J0623	160	950	310	260	*f*	<0.002
November							
November 3	15K0423	72	280	710	110	*f*	0.0029
December*							
December 1	15L0194	230	840	550	560	*f*	0.003
Discharge Limit[b]		N/A[e]	N/A[e]	N/A[e]	N/A[e]	100	0.04

* Site shutdown from December 25, 2015 through January 3, 2016.

[a] Analyses performed by an off-site, state certified laboratory.

[b] Discharge concentration limits, City of Livermore Municipal Code 13.32.

[c] Weekly composite sample. The dates indicate the day the sample was collected. The sample represents a representative composite for the previous week.

[d] Grab sample.

[e] N/A indicates not applicable; i.e., there is no specific discharge limit for this parameter.

[f] The monitoring requirement for oil and grease has been suspended until such time as the City of Livermore Municipal Code 13.32 can be modified to remove references regarding specific analytical methods effective May 3, 1999.

Table 9-4 Routine Monitoring Results for SNL/CA Sanitary Sewer Outfall, Method E200.8, 2015

Date[a]	Laboratory ID #[b]	As	Cd	Cr	Cu	Pb	Hg	Ni	Ag	Zn
		All results reported in mg/L								
January										
January 6	15A0246-01	0.0073	0.00019	0.0017	0.25	0.0021	<0.000060	0.0029	<0.000080	0.13
January 13	15A0750-01	0.012	0.00041	0.0017	0.23	0.0020	0.000080	0.0061	0.00038	0.16
January 20	15A1150-01	0.0049	0.00035	0.0015	0.19	0.0016	<0.000060	0.0062	0.00020	0.16
January 27	15A1562-01	0.0057	0.00048	0.0029	0.28	0.0024	<0.000060	0.0073	0.00047	0.30
February										
February 3	15B0216-01	0.011	0.00032	0.0013	0.24	0.0016	0.00010	0.0064	0.00050	0.14
February 10	15B0837-01	0.0032	0.00022	0.00074	0.22	0.0011	<0.000060	0.0045	0.00025	0.11
February 17	15B1311-01	0.0049	0.00033	0.0016	0.28	0.0031	<0.000060	0.0071	<0.000080	0.24
February 24	15B1718-01	0.0057	0.00044	0.0024	0.32	0.0035	<0.000060	0.0069	0.00036	0.27
March										
March 3	15C0322-01	0.013	0.00025	0.0026	0.26	0.0026	0.00024	0.0055	0.00031	0.21
March 10	15C1075-01	0.0040	0.00021	0.0027	0.26	0.0038	0.00012	0.0058	0.00021	0.22
March 17	15C1724-01	0.0057	0.00040	0.0026	0.38	0.0030	0.00012	0.0059	0.00019	0.20
March 24	15C2341-01	0.0034	0.00031	0.0014	0.36	0.0021	0.000090	0.0038	<0.000080	0.18
March 31	15D0011-01	0.013	0.00055	0.0015	0.36	0.0025	0.00025	0.0040	0.00019	0.25
April										
April 7	15D0786-01	0.0041	0.00032	0.0018	0.25	0.0028	0.000070	0.0051	0.00038	0.23
April 14	15D1569-01	0.0066	0.00025	0.0030	0.21	0.0057	0.00010	0.0051	<0.000080	0.19
April 21	15D2260-01	0.0039	0.00021	0.0025	0.20	0.0030	0.000060	0.0040	<0.000080	0.19
April 28	15D2891-01	0.0042	0.00041	0.0024	0.25	0.0025	0.00040	0.0045	0.0022	0.23
May										
May 5	15E0421-01	0.010	0.00049	0.0030	0.47	0.0028	<0.000060	0.0048	0.00038	0.19
May 12	15E1186-01	0.0058	0.00046	0.0014	0.30	0.0021	0.00011	0.0035	<0.000080	0.13
May 19	15E1865-01	0.0051	0.00041	0.0034	0.33	0.0042	0.000060	0.0058	<0.000080	0.22
May 26	15E2374-01	0.0082	0.00029	0.0039	0.28	0.0030	0.00011	0.0051	0.00045	0.17

Table 9-4 Routine Monitoring Results for SNL/CA Sanitary Sewer Outfall, Method E200.8, 2015 (continued)

Date[a]	Laboratory ID #[b]	As	Cd	Cr	Cu	Pb	Hg	Ni	Ag	Zn
		All results reported in mg/L								
June										
June 2	15F0357-01	0.0066	0.00075	0.0026	0.23	0.0028	0.000060	0.0035	<0.000080	0.15
June 9	15F1123-01	0.0085	0.00030	0.0026	0.46	0.0023	0.00013	0.0038	0.00028	0.19
June 16	15F1756-01	0.0063	0.00047	0.0064	0.27	0.0038	0.000070	0.0056	0.00032	0.30
June 23	15F2435-01	0.0060	0.00041	0.0054	0.28	0.0032	0.000080	0.0051	0.00018	0.22
June30	15G0054-01	0.010	0.0011	0.0076	0.39	0.0072	0.0015	0.0063	0.00032	0.27
July										
July 7	15G0767-01	0.013	0.00031	0.0054	0.41	0.0046	0.00068	0.0051	0.00014	0.20
July 14	15G1506-01	0.0072	0.00035	0.0091	0.36	0.0076	0.0010	0.0066	0.0012	0.30
July 21	15G2230-01	0.0074	0.00037	0.0049	0.23	0.0053	0.00064	0.0053	<0.000080	0.24
July 27	15G2798-01	0.0049	0.00036	0.0031	0.38	0.0039	0.00013	0.0058	0.00063	0.24
August										
August 4	15H0316-01	0.0025	0.00039	0.0035	0.20	0.0023	0.00075	0.0029	<0.000080	0.16
August 11	15H1096-01	0.0084	0.00035	0.0032	0.33	0.0029	0.00011	0.0037	0.00029	0.25
August 18	15H1744-01	0.0079	0.00059	0.0017	0.24	0.0046	0.00010	0.0015	<0.00040	0.27
August 25	15H2355-01	0.0012	0.00021	0.0033	0.25	0.0030	0.00010	0.0048	<0.00020	0.27
September										
September 1	15I0108-01	0.0012	0.00031	0.0026	0.20	0.0026	0.000080	0.0056	<0.00020	0.15
September 8	15I0739-01	0.017	0.00050	0.0035	0.53[d]	0.0046	0.00027	0.0074	0.00024	0.31
September 15	15I1403-01	0.013	0.00053	0.0038	0.45	0.0047	0.00036	0.0057	0.00050	0.26
September 22	15I2068-01	0.0037	0.00024	0.0029	0.22	0.0021	0.000060	0.0040	<0.00020	0.20
September 29	15I2653-01	0.0098	0.00033	0.0022	0.11	0.0017	0.000090	0.0027	<0.00020	0.10

Table 9-4 Routine Monitoring Results for SNL/CA Sanitary Sewer Outfall, Method E200.8, 2015 (continued)

Date[a]	Laboratory ID #[b]	As	Cd	Cr	Cu	Pb	Hg	Ni	Ag	Zn
		All results reported in mg/L								
October										
October 6	15J0620-01	0.020	0.00045	0.0033	0.21	0.0034	0.000060	0.0058	<0.00020	0.25
October 13	15J1308-01	0.0062	0.00023	0.0021	0.17	0.0026	<0.000060	0.0053	0.00043	0.21
October 20	15J1976-01	0.0014	<0.000080	0.0022	0.082	0.0013	<0.000060	0.0027	<0.00020	0.090
October 27	15J2589-01	0.0036	0.00011	0.0026	0.10	0.0011	<0.000060	0.0045	<0.00020	0.091
November										
November 3	15K0421-01	0.0028	0.000080	0.0017	0.13	0.0014	<0.000060	0.0033	<0.00020	0.13
November 10	15K1245-01	0.0013	<0.000080	0.0014	0.065	0.00060	0.000080	<0.00024	<0.00020	0.12
November 17	15K1792-01	0.0022	0.00047	0.0022	0.18	0.0029	<0.000060	0.0061	<0.00020	0.39
November 24	15K2503-01	0.011	0.00055	0.0045	0.27	0.0057	0.002	0.0067	<0.00020	0.47
December*										
December 1	15L0192-01	0.010	0.00039	0.0027	0.27	0.0034	0.00011	0.0060	<0.00020	0.68
December 8	15L0988-01	<0.00080	0.00051	0.0035	0.37	0.0033	0.000070	0.0054	<0.00020	0.60
December 15	15L1756-01	<0.00080	0.00039	0.0026	0.16	0.0021	<0.000060	0.0053	<0.00020	0.44
December 22		0.0077	0.00044	0.0038	0.31	0.0062	<0.000060	0.0061	0.00048	0.23
December 29		0.0055	0.00069	0.0029	0.25	0.0032	<0.000060	0.0033	<0.000080	0.19
Discharge Limit[c]		0.06	0.14	0.62	1.0	0.20	0.01	0.61	0.20	3.0

*Site shutdown from December 25, 2015 through January 3, 2016.

a Samples are collected as a weekly composite.

b Analyses performed by an off-site, independent laboratory.

c Discharge concentration limits, City of Livermore Municipal Code 13.32.

d Daily samples analyzed. No violations of the permit limit were found.

Table 9-5 Routine Monitoring Results for SNL/CA Sanitary Sewer Outfall, 2015

Date	EPA Method 624 Purgeable Priority Pollutants (µg/L)	EPA Method 625 Extractable Priority Pollutants (µg/L)	EPA Method 608 Organochlorine Pesticides (µg/L)
January 6	Chloroform – 3.9	None	None
February 3	None	None	None
March 3	Chloroform – 3.4	Benzoic Acid – 340 Phenol – 34	None
April 7	Chloroform – 26	Phenol – 160	None
May 5	Chloroform – 2.4 Bromoform – 2.1	Benzoic Acid – 1200 (J)	None
June 2	Chloroform – 3.0	Phenol – 91	None
July 7	Chloroform – 3.5	Phenol – 16	None
August 4	None	Phenol – 43	None
September 1	Chloroform – 2.6	None	None
October 6	Chloroform – 3.3 Bromoform – 22	None	None
November 3	Bromoform – 7.4 Toluene – 14	None	None
December 1	Chloroform – 4.3 Toluene – 2.0	Phenol – 62	None

This table reports all positively identified organic constituents designated as total toxic organics (TTO) by the United States Environmental Protection Agency. All other compounds comprising the EPA toxic organic list were below minimum detection limits, and therefore were not listed. The toxic organic discharge limit for SNL/CA is 1000µg/L. The total toxic organic number is derived by summing up all organic constituents greater than 10 µg/L. Also, note that Chloroform is reported in this table although it is a common constituent of chlorinated water.

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