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Site Environmental Report for 2016 Sandia National Laboratories, California

Barbara L. Larsen

Prepared by
Sandia National Laboratories
Livermore, California 94550

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Environmental Management Department

Sandia National Laboratories, California

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Abstract

Sandia National Laboratories, California (SNL/CA) is a Department of Energy (DOE) facility. The management and operations of the facility are under a contract with the DOE's National Nuclear Security Administration (NNSA). On May 1, 2017, the name of the management and operating contractor changed from Sandia Corporation to National Technology and Engineering Solutions of Sandia, LLC (NTESS). The DOE, NNSA, Sandia Field Office administers the contract and oversees contractor operations at the site. This Site Environmental Report for 2016 was prepared in accordance with DOE Order 231.1B, *Environment, Safety and Health Reporting* (DOE 2012). The report provides a summary of environmental monitoring information and compliance activities that occurred at SNL/CA during calendar year 2016, unless noted otherwise. General site and environmental program information is also included.

Acknowledgements

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

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Preface

Each year, the preparation of a summary report for Sandia National Laboratories, California (SNL/CA) is completed 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 2016 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 2016 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
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
ES&H	environment, safety, and health
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FONSI	Finding of No Significant Impact
FY	fiscal year
gal	gallon
GHG	greenhouse gas
Industrial General Permit	State of California, NPDES General Permit for Storm Water Discharge Associated with Industrial Activities
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	milliSievert
MW hr	Megawatt hour
NA	not applicable
NAL	Numeric Action Level
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
NTESS	National Technology and Engineering Solutions of Sandia, LLC
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
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
SSP	Site Sustainability Plan
SWEA	site-wide environmental assessment
TDS	total dissolved solids
TLD	thermoluminescent dosimeter
TPHD	total petroleum hydrocarbons diesel
TSCA	Toxic Substances Control Act
TSS	total suspended solids
TTO	total toxic organics
µg/L	micrograms per liter
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 2016. It also discusses integration with the broader corporate 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.

The 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

SNL/CA 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 2016, SNL/CA personnel measured performance in achieving four site EMS objectives, three corporate goals, and one performance objective established jointly between SNL and the DOE National Nuclear Security Administration, Sandia Field Office (NNSA/SFO). Four notices of violation (NOV) were received in 2016 for SNL/CA operations resulting from two exceedances at the sewer outfall and two observations of improper labeling of hazardous waste containers. Section 3.12 presents the details of these NOVs. Additional information about SNL/CA's environmental performance in 2016 is presented in Chapter 4.

1.4 Monitoring and Surveillance

Storm water, wastewater, groundwater, and direct (ambient) radiation are monitored at SNL/CA. The results of monitoring during the 2015/2016 wet season show that SNL/CA exceeded the Numeric Action Levels in storm water for iron, aluminum, and zinc. During 2016, there were two 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 2016 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. The average annual gamma radiation dose from all sources at the site perimeter in 2016 was 46.3 mrem (0.463 mSv), well below the allowable annual exposure dose to the public of 100 mrem established by DOE. 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 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 to support stockpile stewardship ensuring nonproliferation and continued safety, security, and reliability, took on greater importance.

SNL/CA 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. SNL/CA 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 Department of Energy (DOE) facility. The site, the buildings, and the equipment are owned by the government, while management and operations are under a contract with the DOE's National Nuclear Security Administration (NNSA). On May 1, 2017, the name of the management and operating contractor changed from Sandia Corporation to National Technology and Engineering Solutions of Sandia, LLC (NTESS). The NNSA/Sandia Field Office (NNSA/SFO) oversees the operations at the site.

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

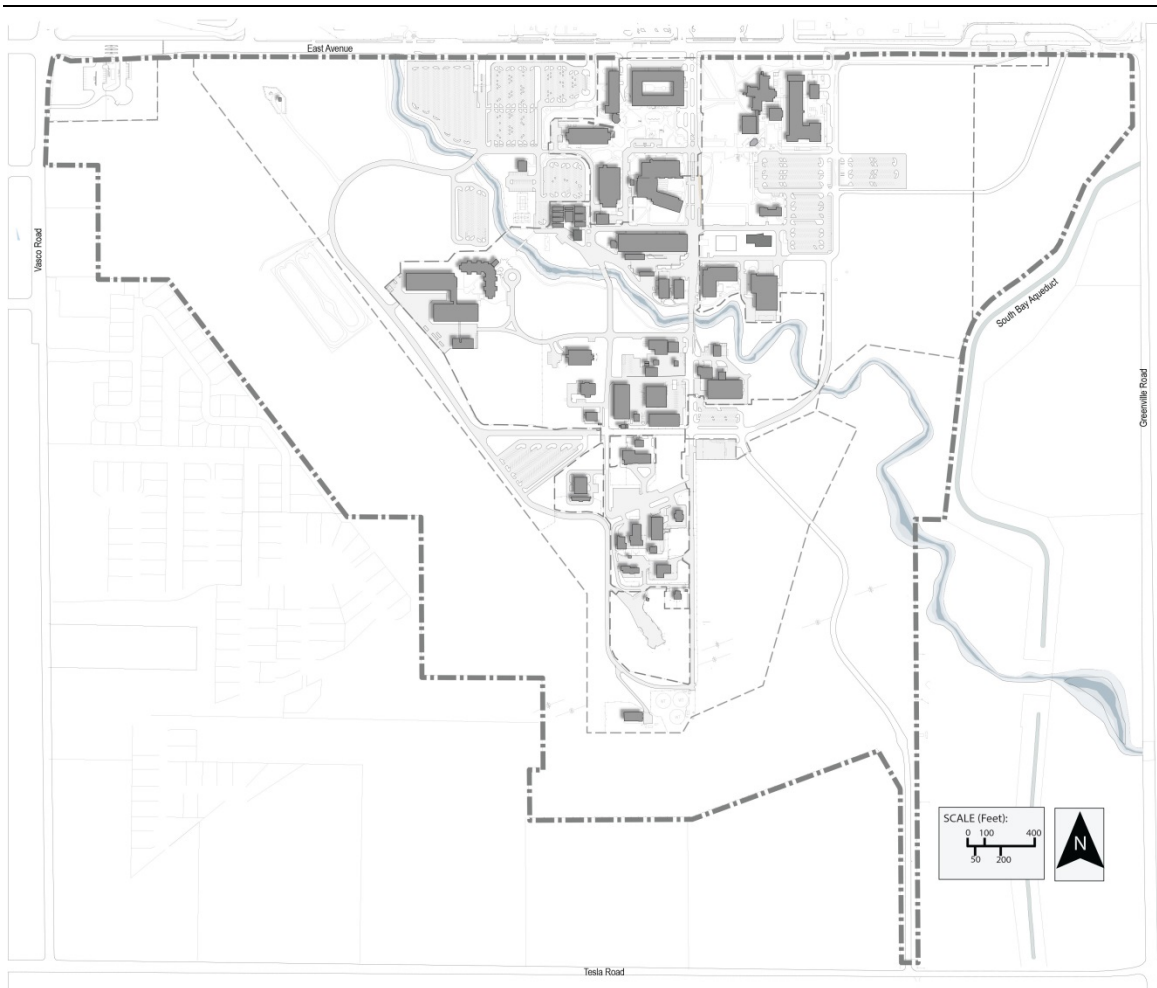


Figure 2-2 SNL/CA Site Map

2.3 Site Population

The SNL/CA workforce is comprised of employees (full and part-time staff, student interns, and post-doctoral appointees) and contracted staff. As of October 2016, there were 1,266 personnel (employees and on-site contractors) working at SNL/CA, an increase of 27 from 2015.

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.

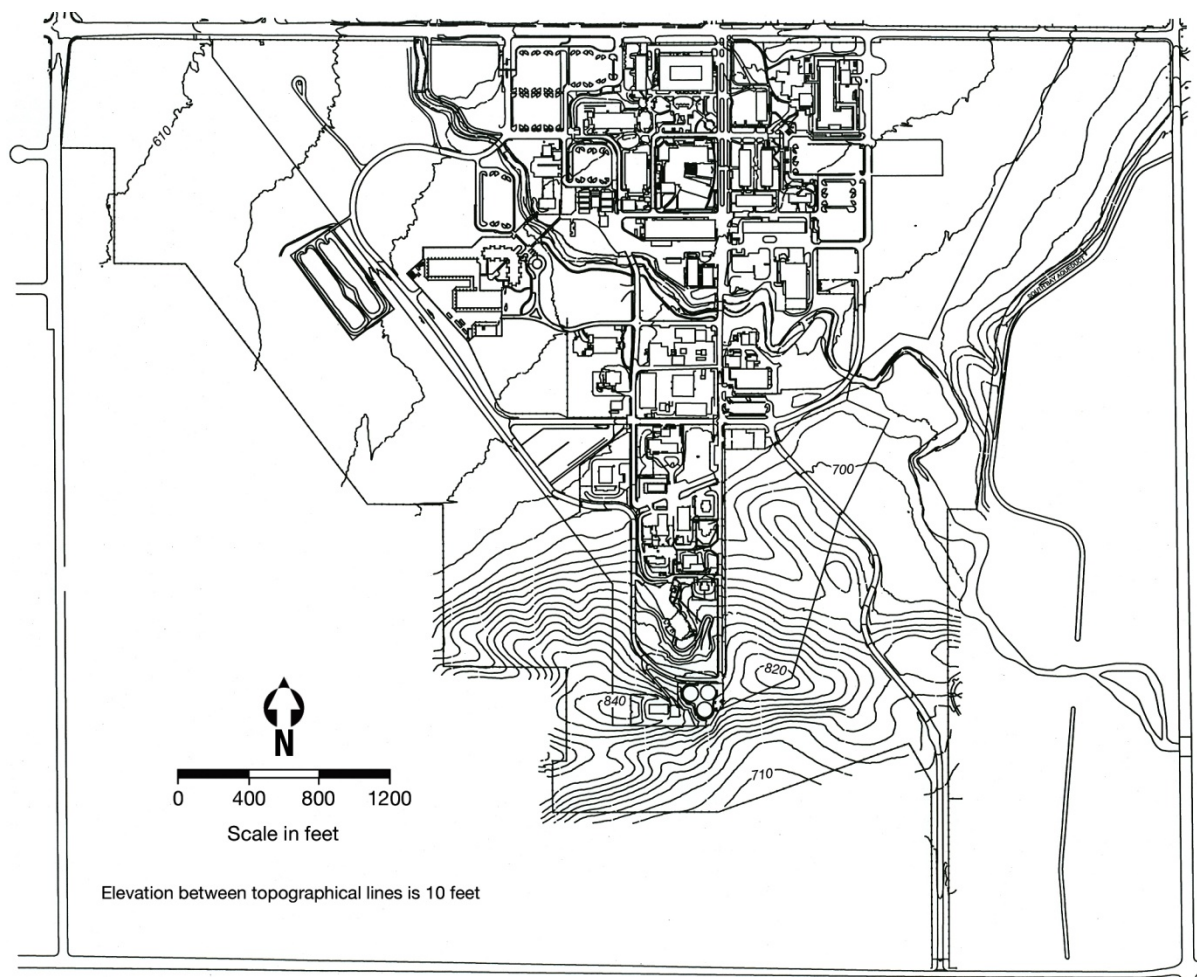


Figure 2-3 SNL/CA Topography

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.

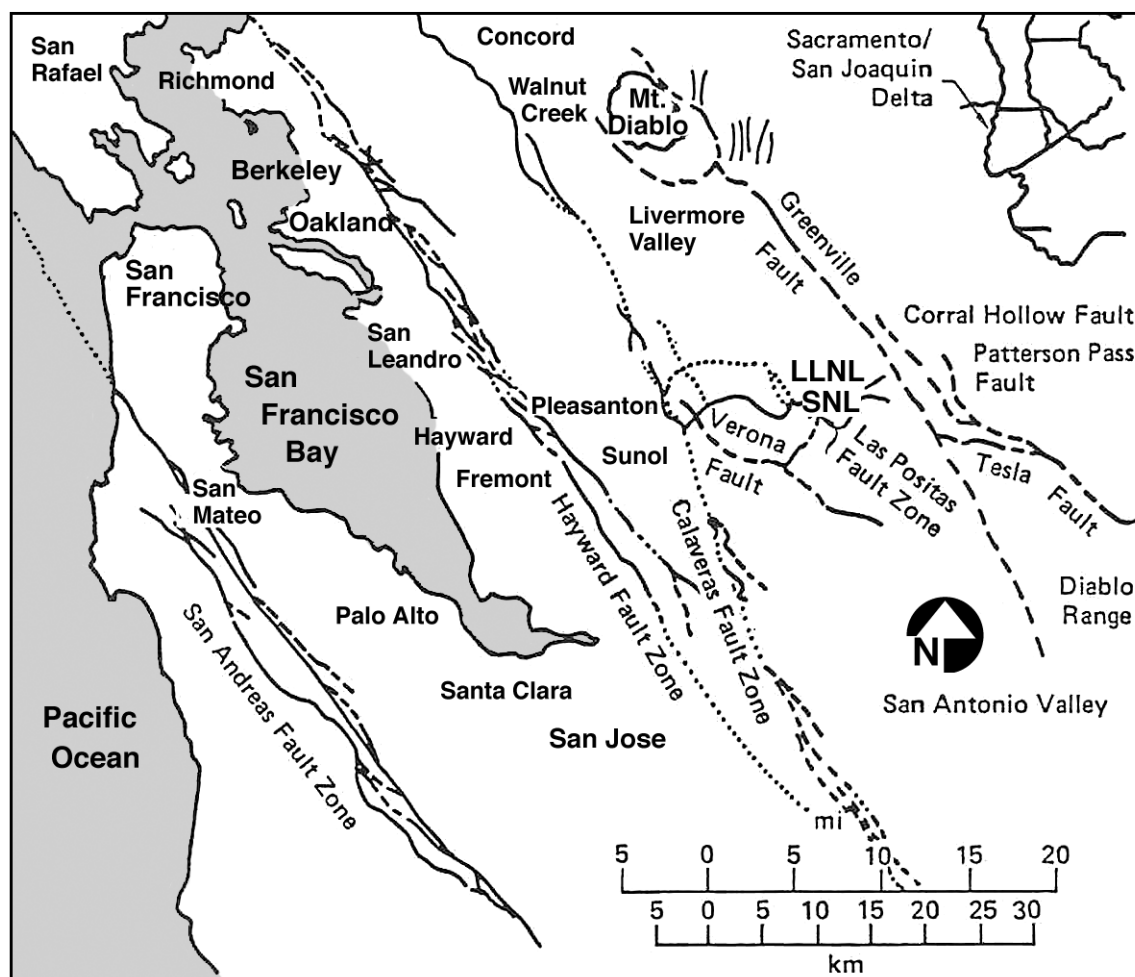


Figure 2-4 Regional Earthquake Faults

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. Water use at SNL/CA is metered by LLNL as it enters the site. In fiscal year 2016, 40.9 million gallons of water were used at SNL/CA, an increase of 28.2 percent (9.0 million gallons) from water used in fiscal year 2015. (See discussion in Section 4.2.2). The site discharged approximately 8.9 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 2016 was obtained from a nearby meteorological tower located at LLNL (LLNL 2017). The annual rainfall for 2016 was 17.17 inches. Temperatures in 2016 ranged from 25.6 to 102.8° Fahrenheit. Average annual rainfall in the Livermore area over the last five years was 10.67 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.

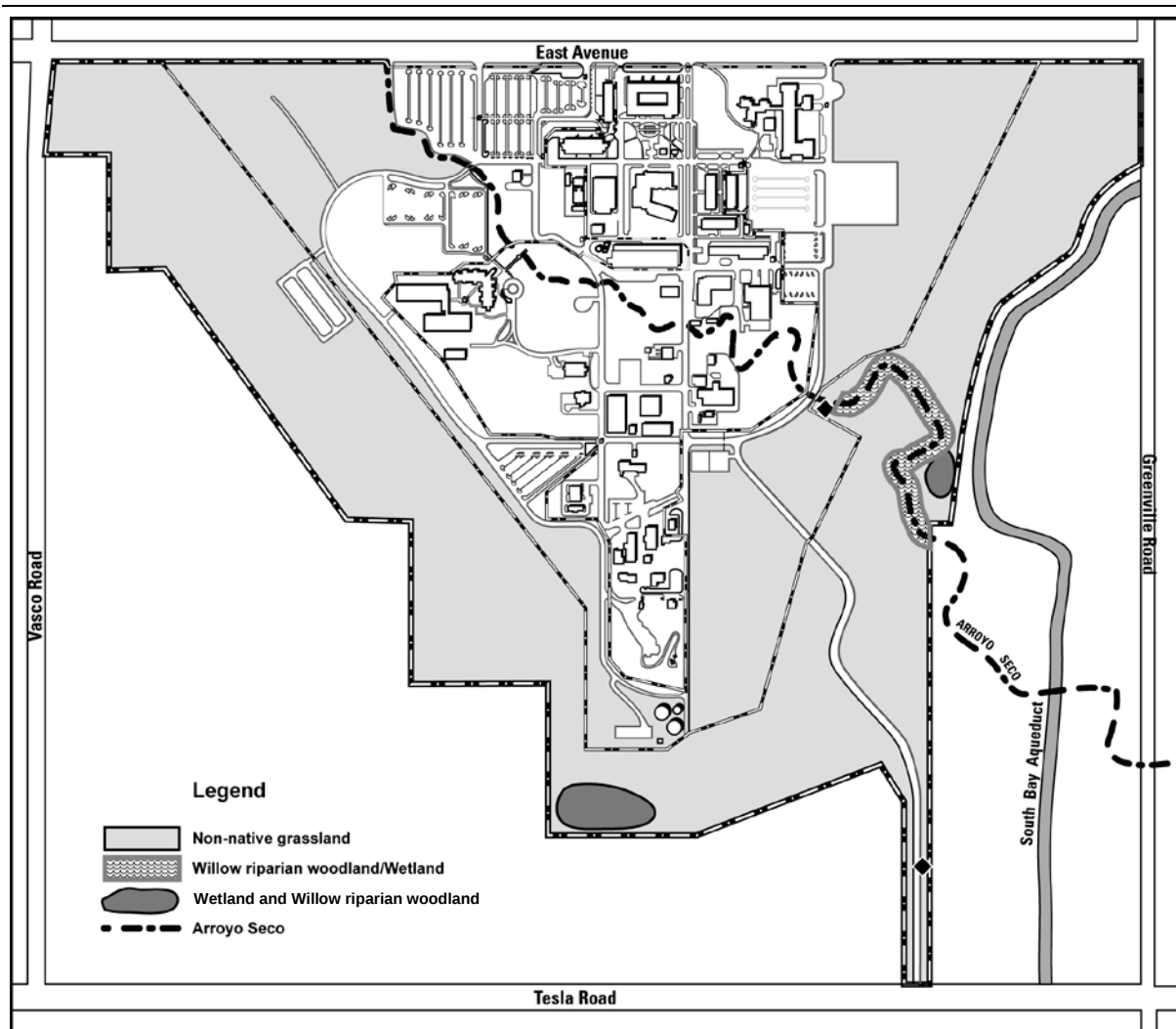


Figure 2-5 Habitat at SNL/CA

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 2016.

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 2016.

Table 2-1 Frequently Seen Animals at SNL/CA

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

3 Compliance Summary

Sandia National Laboratories, California (SNL/CA) is managed and operated 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 2016, 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. In 2016, the entire content of DOE Order 436.1 was not a requirement of the 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 was implemented in 2016 through a Special Contract Requirements clause in the M&O Contract that directed maintenance of 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 the multi-site certification received in May 2015. The first surveillance audit under the multi-site certification occurred in May 2016. The results of the audit showed no non-conformances to the ISO standard at the SNL/CA site.

The first corporate-wide SSP that addresses energy, water, fuels, and a variety of other environmental concerns for all SNL sites was developed in 2011. The corporate SSP is updated annually and 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 2016, site personnel provided input to the reports identified above and participated in development of the corporate SSP for fiscal year 2017.

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. SNL/CA 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 2016, 92 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.

There are no major sources of air pollutants (as defined in 40 CFR Part 70.2) present at SNL/CA. SNL/CA personnel work with the BAAQMD and CARB to permit or register all regulated emission sources. There were nine permitted sources for the 2015/2016 and 2016/2017 permitting periods¹. Starting with the 2016/2017 reporting year, registered sources are included on the BAAQMD permit. There were nine registered sources (boilers) at SNL/CA for this period. Table 3-4 (Section 3.13) provides a list of the permitted and registered 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).

There are no radionuclide emission sources at SNL/CA that are subject to the monitoring requirements of 40 CFR Part 61. To comply with national emission standards, individual projects with the potential to release radionuclide emissions are evaluated 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 2016, 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 SNL/CA 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 frog².

¹ The BAAQMD permit period is July 1 through June 30 each year. Permit data is presented for the two periods applicable to 2016.

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

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. In response to these interim protections, a review prior to use is conducted of all new pesticides to determine if they are suitable for use at SNL/CA. Any products containing the named pesticide ingredients are restricted from use in and along Arroyo Seco. In 2016, there were no new pesticides reviewed or approved for use at SNL/CA.

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 2016, 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. No active nests were found during these surveys; therefore, no project restrictions were needed.

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 2016, only wildlife and riparian monitoring 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

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.

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. Restored areas are also monitored to ensure channel improvements are functioning as intended and repaired. When needed, shrubs and trees are replanted or grasses reseeded and channel improvements are repaired. In 2016, willow stakes were replanted in several locations, but did not survive due to inadequate watering.



ASIP Area 15A Before Restoration



ASIP Area 15A 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 2016, there were no buried archaeological resources unearthed at SNL/CA.

In 2001, SNL/CA 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 establishes 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 analysis.

In addition to cleanup and emergency response requirements, CERCLA also establishes 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 spill control activities (SNL/CA 2016b). In 2016, 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, an annual report is submitted 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, an annual report is submitted to EPA, and, if required a Section 304 report is also submitted. Applicable EPCRA reporting requirements for 2016 are presented in Table 3-1.

Table 3-1 Status of EPCRA Reporting for SNL/CA, 2016

EPCRA Section	Description of Reporting	Required in 2016
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, a Hazardous Material Business Plan is annually submitted for SNL/CA to the Livermore-Pleasanton Fire Department via the CERS.

Annually, the number of hazardous materials containers in inventory are counted 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.

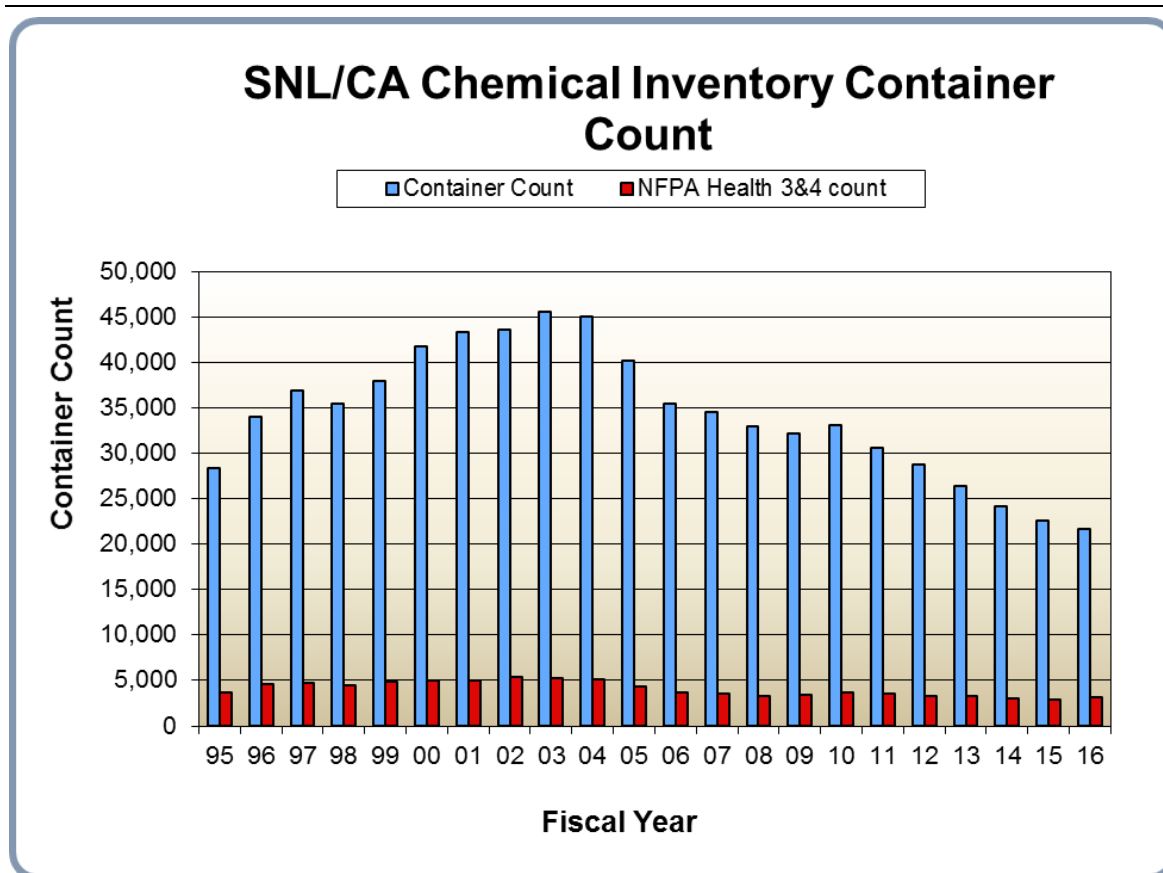


Figure 3-1 SNL/CA Hazardous Material Inventory

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. One UST is managed and operated in accordance with California requirements at SNL/CA. 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. Fifteen ASTs are managed and operated at SNL/CA, 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.

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 2016c). At SNL/CA, the only TSCA regulated chemicals imported or exported are for research and development purposes thus are exempt from general reporting requirements. However, SNL/CA personnel prepare a Notice of Export for Chemical Substances when a regulated chemical is exported out of the customs territory of the United States. In 2016, no TSCA Notice of Export forms were prepared for SNL/CA.

SNL/CA 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. SNL/CA personnel 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 corporate Site Sustainability Plan establishes a commitment to meet pollution prevention goals identified in DOE's Strategic Sustainability Performance Plan and Executive Order 13693. In 2016, implementation of SNL/CA site-specific activities to support these goals continued through:

- recycling of 27 solid waste streams;
- recycling of construction debris;
- chemical exchange;
- 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

Pollution prevention and waste minimization data for SNL/CA were reported to the corporate Site Sustainability Plan team on November 21, 2016 for submittal to NNSA/SFO on December 7, 2016. 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, SNL/CA 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 2016 (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, as no possession or storage of legacy mixed waste occurs at the SNL/CA site. All mixed waste generated at SNL/CA during 2016 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.

A Hazardous Waste Treatment and Storage Facility is managed and operated 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. A Determination of Administrative Completeness was received from DTSC on July 23, 2013. 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.

An annual facility report is submitted 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 disposal at the Nevada National 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.

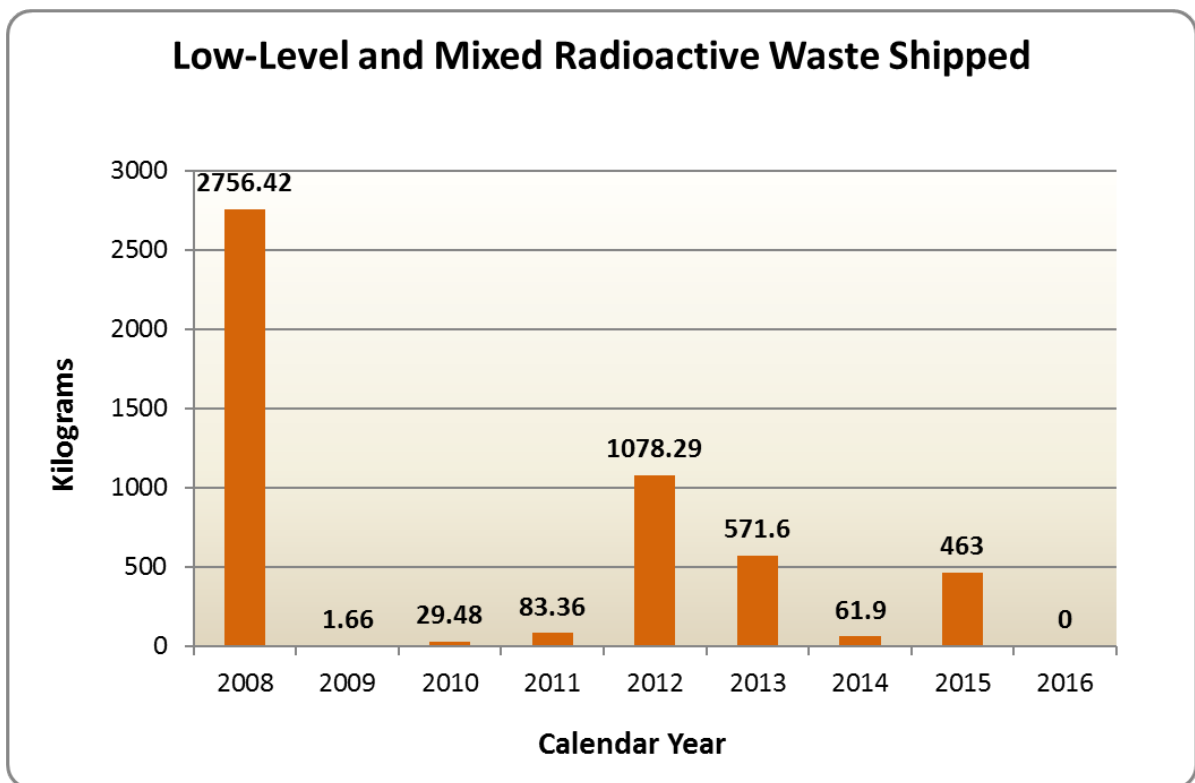


Figure 3-2 Radioactive Waste Shipped from SNL/CA

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 2016.

Table 3-2 Order 458.1 Compliance Summary, 2016

Order 458.1 Requirement	SNL/CA 2016 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 SNL/CA 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 2016. The average annual gamma radiation measurement at the site perimeter in FY 2016 was 46.3 mrem and well below the total effective dose of 100 mrem.
Request authorization for temporary dose limits.	There were no special circumstances in 2016 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 2016; 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 2016. 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.
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.

Order 458.1 Requirement	SNL/CA 2016 Summary
Control the release of property with residual radioactivity.	There is no release of 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 2016, 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 SNL/CA in 2016. 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 SNL/NM for offsite shipment and disposal to the Nevada National Security Site as radioactive waste. There were no releases of real property to the public in 2016 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. There is no public water system at the SNL/CA facility, and no 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. There is no requirement to treat or sample the drinking water at

SNL/CA. 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 two permit exceedances in 2016 at the sanitary sewer outfall, one exceeding daily arsenic limits and the second exceeding daily cyanide limits. See Section 3.12 for information about these exceedances. 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 2016.

Storm Water Discharge

On July 1, 2015, a new industrial general 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 Industrial General Permit) (California Water Resources Control Board 2014) contains Numeric Action Levels and a requirement to implement a Storm Water Pollution Prevention Plan. The first year of monitoring under the new permit (2015-2016) showed exceedances of the numeric action levels for iron, aluminum, zinc, and pH. SNL/CA has entered Level 1 status based on these levels. Results of sampling and compliance with the Industrial General 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 and continued into 2016.

Environmental Monitoring personnel worked with the building Architect/Engineer to ensure that this requirement was included in the design, and verified that controls were installed as designed.

3.11 Audits, Assessments, and Inspections

Table 3-3 provides a list of environmental audits, assessments, and/or inspections conducted at SNL/CA during 2016.

Table 3-3 SNL/CA Audits, Assessments, and Inspections, 2016

Title	Area of Focus	Date Conducted	Results
Livermore-Pleasanton Fire Department	Underground Storage Tanks	March 24, 2016	No issues
Third Party EMS Surveillance Audit (NQA)	Conformance with the ISO 14001:2004 EMS standard	May 16-17, 2016	No issues
Livermore-Pleasanton Fire Department	Tiered permits, hazardous waste generator requirements, hazardous materials business plan, SB-14, SPCC compliance	June 28-30, 2016	Two minor violations
City of Livermore, Water Resources Division Inspections	Wastewater discharges and categorical process laboratories	October 27-28, 2016	No issues
Alameda County Inspection	Erosion at the Navy Landfill site	November 15, 2016	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 2016, there were four environmental occurrences from SNL/CA operations – two for wastewater discharge exceedances, one for wastewater overflow, and one for hazardous waste labeling.

On January 12, 2016, the daily wastewater discharge permit limit for arsenic was exceeded with a concentration of 0.076 mg/L. The permit limit for arsenic is 0.06 mg/L. An evaluation of the exceedance found that the most likely cause was corrosion in old sewer pipelines.

On March 1, 2016, the daily wastewater discharge limit for cyanide was exceeded with a concentration of 0.12 mg/L. The permit limit for cyanide is 0.04 mg/L. The cyanide exceedance resulted from rinsing assay kits in Building 968 laboratory sinks. The practice was discontinued and assay kits are now collected for disposal as hazardous waste.

On April 20, 2016, approximately 100 gallons of wastewater from a restroom holding tank overflowed. A toilet in the restroom malfunctioned, causing water to fill the holding tank and overflow to the outside surrounding concrete pad. Water was shut-off and the restroom closed until the toilet was repaired. The overflow was contained locally and did not reach waterways or the storm drain system. As required, the overflow was reported to the California Water Resources Control Board as a sanitary sewer overflow.

During the annual Livermore-Pleasanton Fire Department inspection from June 28-30, 2016, two minor findings were received for improper labeling of hazardous waste accumulation containers. One finding was corrected during the inspection. The second finding required an update to computer generated labels and was corrected within 30 days.

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, 2016

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	RCRA	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 Industrial General 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	RCRA 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 9/9 emission sources ^b	July 1 - June 30, annually	Clean Air Act	Bay Area Air Quality Management District
Air	Registered emission sources 9 ^c	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 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 2016. Emission sources for the 2016/2017 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.

^c Registered sources include 9 boilers (4 MM BTU per hour).

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4 Environmental Programs Information

Sandia National Laboratories, California (SNL/CA) personnel take the responsibility of protecting the environment seriously, preventing pollution and conserving natural resources through adherence with the corporate Environment, Safety & Health (ES&H) policy. The environmental management system (EMS) is the primary management approach for addressing environmental aspects and impacts of operations and activities. Sustainability strategies and goals are within the annual Site Sustainability Plan (SSP). At 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:

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

ES&H Policy

It is the policy of Sandia National Laboratories to perform 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.*

4.1 SNL/CA EMS Implementation

The scope of the EMS encompasses all activities, products, and services at all of SNL'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 reduction of environmental impacts and increase operating efficiency through a continuing cycle of planning, implementing, evaluating, and improving processes.

The 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 SNL'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 SNL's activities, products, or services. Through the annual review process, fiscal year 2016 significant aspects were determined to be air emissions, hazardous waste, natural resource use, and water discharges. Objectives and targets were identified for each significant aspect to support environmental improvement. 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 2016, four EMS objectives and four targets were established to support environmental improvement at SNL/CA. Site personnel met one of the four targets in 2016 and made progress on meeting two others. One target was not met. Table 4-1 summarizes EMS objectives, targets, and results for fiscal year 2016.

Table 4-1 SNL/CA EMS Objectives and Targets, FY 2016

Environmental Aspect	Objective	Target	FY 2016 Result
Air Emissions	Minimize emissions related to fleet vehicle use	Replace gas-powered carts that are greater than 15 years old with new gas or electric carts.	Year 1 Target Met – Identified appropriate replacement carts that are compliant with California emissions standards. Worked with Corporate Fleet Services to obtain approval for both electric and gas model replacements. Established a process to review electric cart purchases in advance and identify charging infrastructure needs.
Hazardous Waste	Improve hazardous waste management practices	Waste stream evaluations at generator locations (25% / year over 4 year period)	Year 2 Target Not Met – Waste stream evaluations planned for FY 2016 were delayed due to staffing changes. These evaluations will be added to year 3 and 4 evaluations to achieve the target of 100% over a four-year period.
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
Natural Resource Use	Establish long-term / sustainable water use in landscaped areas	Implement five landscape transition projects by 2020	Year 1 Target Met – Landscape designs have been completed for four locations and two areas have been converted to low-water use landscape.

4.2 SSP Contributions

An annual SSP 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 the corporate SSP goals.

4.2.1 Energy Use

Figure 4-1 depicts the energy use intensity data for SNL/CA. Starting in 2016, the corporate target is to reduce energy intensity by twenty-five percent in goal-subject buildings by the end of fiscal year 2025 from a fiscal year 2015 baseline. Energy intensity is the amount of energy used per square foot of building space (presented as BTU/GSF/YR). The energy reduction target is 134,031 BTU/GSF/YR illustrated by the dashed red line in Figure 4-1. Fiscal year 2016 is the first reporting year for this energy reduction target. As shown, energy intensity in 2016 was higher than the target. Personnel will continue to identify energy reduction opportunities at SNL/CA to support this target in future years.

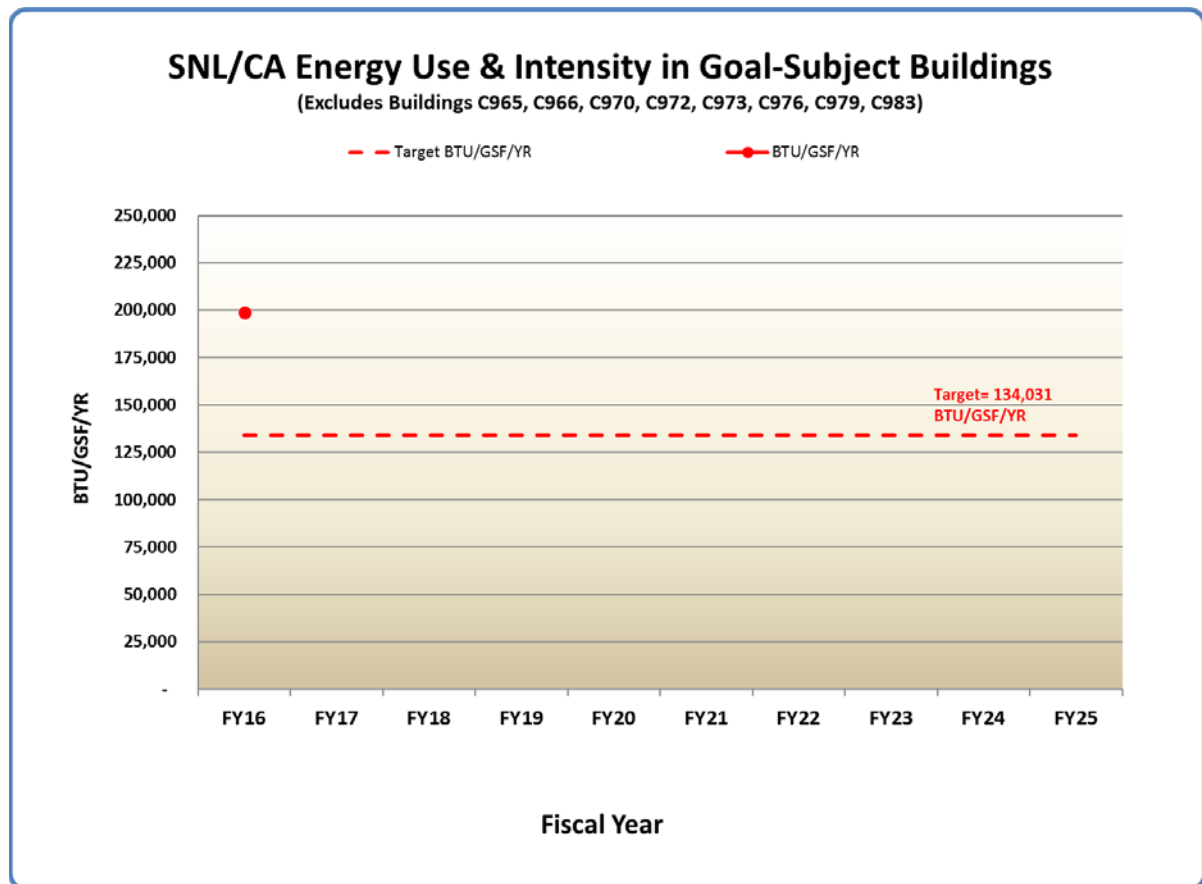


Figure 4-1 SNL/CA Energy Use Intensity

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 intensity in effect for 2016 was a 36 percent reduction by fiscal year 2025, using fiscal year 2007 data as a baseline. The 36 percent reduction goal in 2016 was met, although the site experienced an increase in water use when compared to 2015. The increase was primarily due to re-establishing irrigation in landscaped areas where irrigation was significantly reduced in response to California drought conditions.

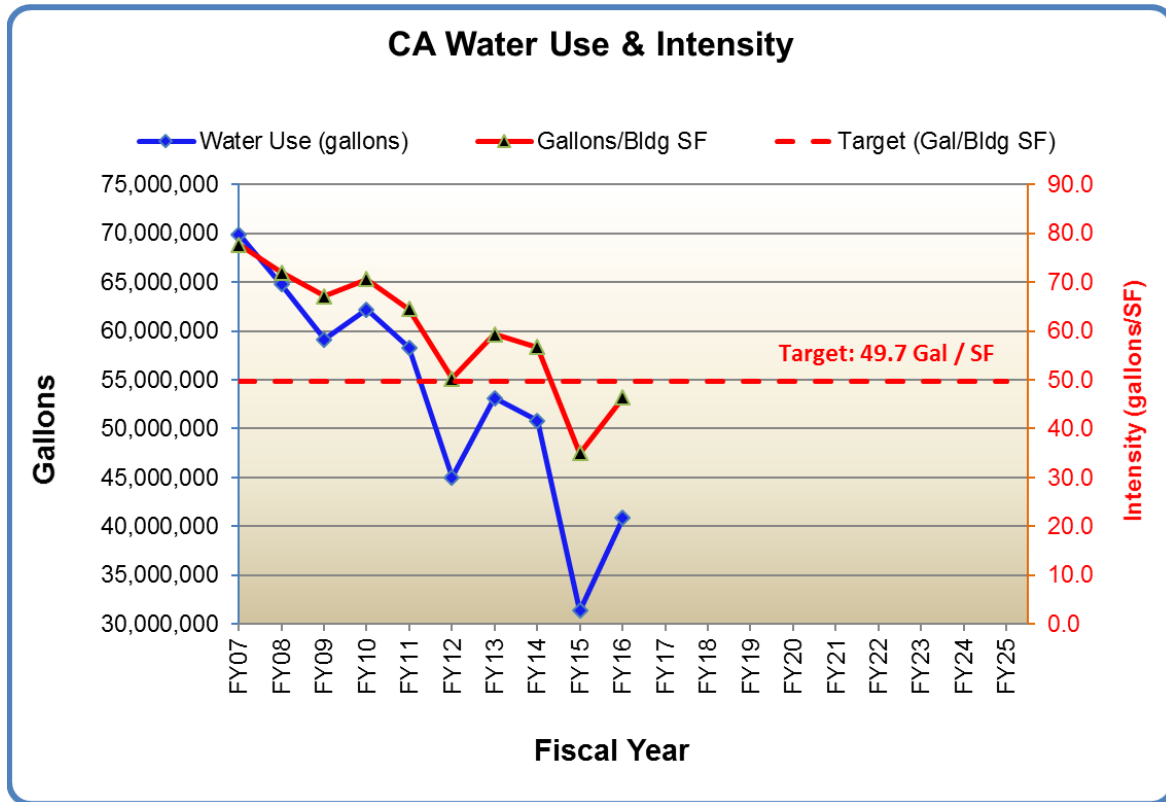


Figure 4-2 SNL/CA Water Use Intensity

4.2.3 Greenhouse Gas Reduction

Targets for air emissions in effect for 2016 include reducing scope 1 and 2 greenhouse gas (GHG) emissions by 50 percent and reducing scope 3 GHG emissions by 25 percent by fiscal year 2025 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

Reductions in GHG emissions are not measured separately at SNL/CA but site personnel provide input to corporate metrics. Overall, there has been a reduction of scope 1 and 2 GHG emissions by 53 percent. However, scope 3 GHG emissions increased by seventeen percent relative to the 2008 baseline. This increase is likely a result of additional employee commuting and business travel.

In 2016, SNL/CA personnel completed the following activities to support the corporate targets:

- replaced one Sulfur Hexafluoride (SF6) gas insulated switchgear, bringing the total replaced to date to eleven;
- purchased four new switchgear that are awaiting installation;
- 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
- continued a Workplace Charging Program that allows SNL/CA 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, 2016

Greenhouse Gas	Emissions
SF6 Emissions from Gas Insulated Switchgear	1.2 % leak rate (3 lbs of SF6)*
PFC for Semiconductor Operations	0.09 kg of SF6
SF6 for Research Operations	0 kg of SF6
Refrigerants	16.2 lbs of R-22

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

4.3 General Environmental Compliance Metrics

SNL/CA 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 corporate goal is zero findings and zero violations. There were three self-reported violations and two notices of violation from regulatory audits in 2016³. See Section 3.12 for additional information. As a routine element of EMS implementation, personnel identify and implement corrective and preventive actions in an effort to improve environmental performance and reach and maintain the goal of zero violations and zero findings.

This goal also supports a 2016 NNSA/SFO performance objective for operations and infrastructure. SNL/CA personnel contribute to meeting this objective by delivering efficient, effective, and responsive ES&H management and processes. While the M&O contractor during this reporting period, Sandia Corporation, received a rating of very good for this performance objective.

³ Self-reported violations include two sanitary sewer permit exceedances and one sewer overflow. The two regulatory audit notices of violation were for improper labeling of hazardous waste accumulation containers. All were documented as environmental occurrences and are summarized in Section 3.12.

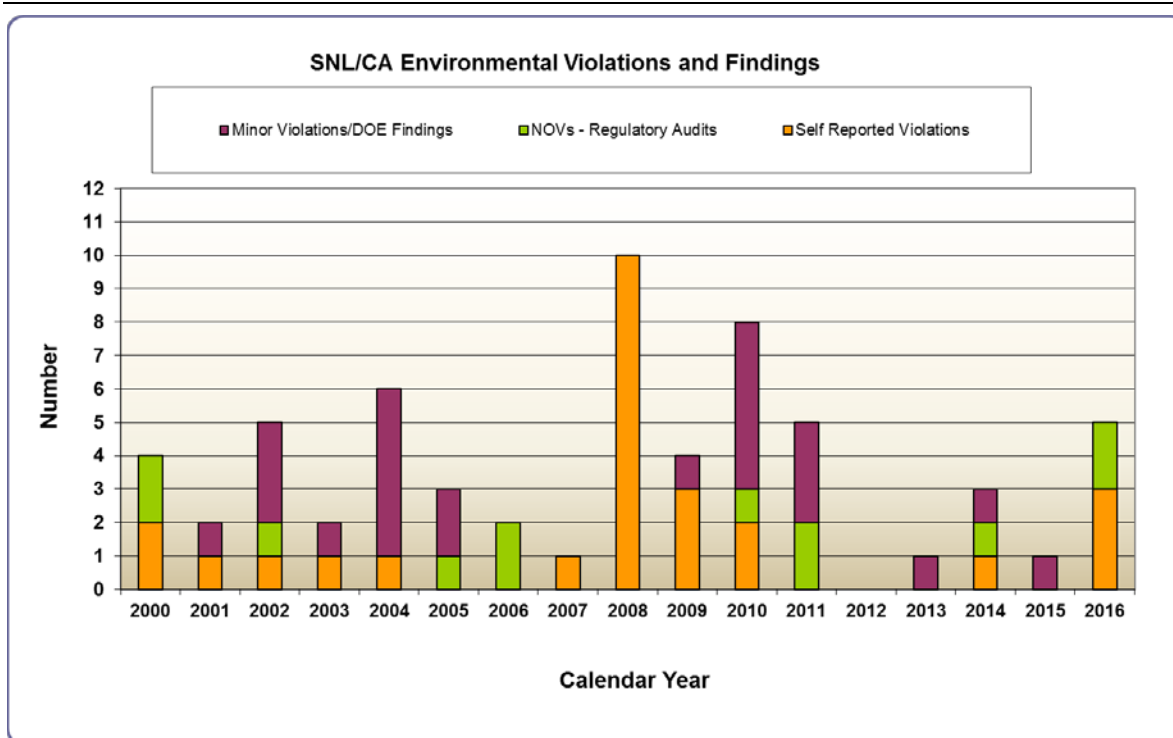


Figure 4-3 Measurement of Excellence in Environmental Management

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 2016 support these efforts through monitoring, compliance activities, and annual reporting. Additional highlights of the Air Quality Program for 2016 are listed below.

- Completed and submitted the BAAQMD Annual Update Package (supporting documentation and data for renewal of BAAQMD Permit-To-Operate).
- Provided regulatory oversight for SF₆ emissions reduction effort from gas insulated switchgear. The SNL/CA leak rate for the year was 1.2%, well ahead of the required 2016 Air Resources Board Maximum Annual SF₆ Emission Rate of five percent.
- Met all regulatory report deadlines in 2016 with submittal of 14 reports on schedule.

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. In 2015, SNL/CA personnel completed 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 included restoration of riparian habitat at select locations along the arroyo.

SNL/CA 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

The volume of sanitary sewer discharged in calendar year 2016 was approximately 11.7 million gallons, representing a 77 percent increase from 2015. Wastewater discharges typically fluctuate year-to-year in response to changes in site operations. In 2016, a noticeable increase in wastewater discharge was reported. From July through December 2016, the primary water source for SNL/CA was the Alameda County Water Conservation District, Zone 7. Zone 7 water is higher in total dissolved solids than water from the San Francisco Water District / Hetch Hetchy, resulting in increased cooling tower blowdown. During the last two months of the calendar year, SNL/CA personnel also recognized that the flow meter was not operating correctly resulting in inaccurate data reporting.

4.5.3 Pollutants Released to the Ground or Groundwater

SNL/CA personnel track chemical spills that occur throughout the year. Figure 4-4 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 SNL/CA spill response team. Spills in 2016 were from two leaking water treatment units (25 gallons), a coolant spill from equipment piping (2 gallons), dielectric oil from a failed transformer (6 ounces), and a 2-mercaptoethanol

laboratory spill (10 milliliters). None of the chemical spills shown in Figure 4-4 resulted in releases to groundwater or required environmental remediation.

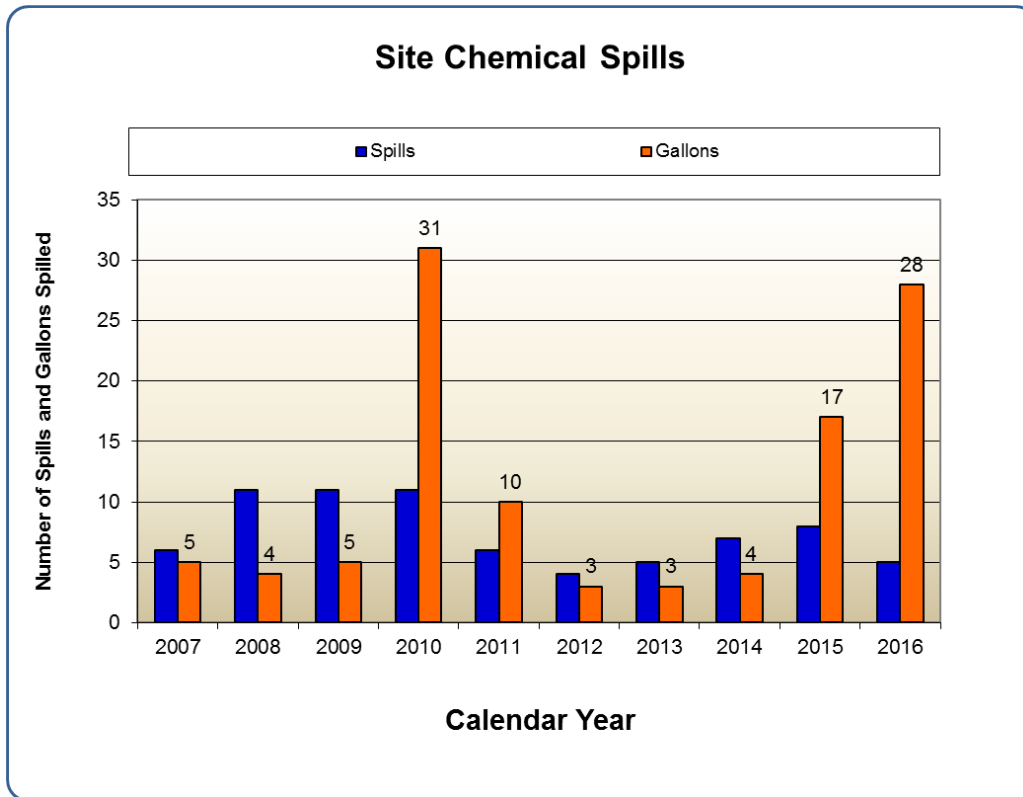


Figure 4-4 SNL/CA Chemical Spills

SNL/CA personnel are also required to report sanitary sewer overflows to the California State Water Resources Control Board. In 2016, there was one sanitary sewer overflow or approximately 100 gallons at SNL/CA. Information about the overflow is presented in Section 3.12.

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 2016 comparison and an evaluation of results.

Table 4-4 Comparison of 2016 Operations with SWEA / SA Envelope

Activity / Unit	SWEA / SA Envelope (maximum operations)	Calendar Year 2016	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 – improvements completed	Yes
Increase operations	Increase to 2 shifts	1 shift	Yes
New facilities	5,000 sf badge office; new 16,000 sf laboratory; 84,000 sf laboratory replacement for Building 916; 8,400 sf computational facility	27,611 sf as of December 31, 2016 (C903 computational facility 8,364 sf; C926 office bldg. 19,247 sf)	No – a separate NEPA review was completed for C926 office building
Demolition	100,000 sf	60,377 sf as of December 31, 2016	Yes
Land Use			
Construction area	93 acres	8 acres as of December 31, 2016	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	34.2 million gals	Yes
Sanitary sewer discharge	29.1 million gal/yr	11.7 million gals	Yes
Natural gas use	94 million cu ft/yr	45.3 million cu ft	Yes
Electricity use	48,800 MW hr/yr	35,932 MW hrs	Yes
Electricity use	48,800 MW hr/yr	35,932 MW hrs	Yes
Biological and Ecological Resources			
Construct flood plains in Arroyo Seco	1800 linear feet	612 linear feet as of December 31, 2016	Yes
Create riparian habitat	0.2 acres	5.64 acres as of December 31, 2016	No, Positive impact
Ground disturbance in / along arroyo	10 acres	< 6 acres as of December 31, 2016	Yes
Cultural Resources	None known on-site	No change	Yes
Water Resources			
Impervious surface area	95.35 acres total	91 acres	Yes
Irrigation water use	17 million gal/yr	3.8 million gals	Yes
Waste Generation			
Radioactive waste	8,811 kg/yr	2,260 kg	Yes
Hazardous waste	133,820 kg/yr	47,866 kg	Yes
Solid waste (non-hazardous, excludes construction debris)	378.7 metric tons/yr	115 metric tons ^{e,f}	Yes

Activity / Unit	SWEA / SA Envelope (maximum operations)	Calendar Year 2016	Site Operations Remain Within Impact Analysis of SWEA / SA
Proposed Action			
Transportation			
Hazardous / radioactive waste shipments	116 shipments/yr	62 shipments	Yes
Nonhazardous solid waste shipments to landfill	80 shipments/yr	54 routine trash and 49 construction debris shipments	No
Air Emissions			
Total criteria pollutants	8,212 kg/yr	2,262 kg ^a	Yes
Total air toxics	2,880.16 kg/yr	884 kg ^a	Yes
Radioactive	0 emissions	0 emissions	Yes
Permits	57 permits annually	9/9 permits ^b	Yes
Human Health			
Recordable accidents / injuries	78 accidents / injuries annually	12 accident / injuries ^e	Yes
Lost work-day cases	19 cases annually ^c	2 cases ^e	Yes
Socioeconomics			
Employment	Up to 1931 persons annually	1266 persons ^d	Yes
Operating budget	\$316 million/yr	\$440 million ^g	Yes (when base adjusted for inflation)

^a Annual emissions were calculated by multiplying the daily emissions reported in the BAAQMD Permit to Operate by 365. 2016 emissions are based on 2015 data.

^b Data provided for the 2015/2016 (9 permitted sources) and 2016/2017 (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 October 2016.

^e Fiscal year data (October 1 – September 30).

^f Routine waste sent to the landfill.

^g Fiscal year data represents Division 8000 managed budget. Increased from FY15 due to increase in weapons program funding.

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. Staff work closely with other SNL/CA organizations to establish routine and project-specific recycling programs. Pollution Prevention and Waste Minimization 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 2016 is provided below.

- Continued working with corporate pollution prevention personnel to develop a zero waste plan for SNL/CA.
- Worked closely with LLNL personnel to identify new opportunities for recycling.
- 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.
- Celebrated Earth Day by hosting a “personal” electronic waste recycling event for both LLNL and SNL/CA employees.

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 4-5 presents diversion results since fiscal year 2010. Diversion of solid waste increased in 2016 in both municipal solid waste (trash) and construction debris categories, but total non-hazardous solid waste diversion remains below the goal set by Alameda County. SNL/CA personnel will continue efforts to increase the diversion rate through recycling, composting, and reuse.

Figure 4-6 presents routine municipal solid waste sent to the landfill for fiscal years 2003 to 2016. The quantity of non-hazardous solid waste sent to the landfill in 2016 decreased by 21 metric tons from 2015.

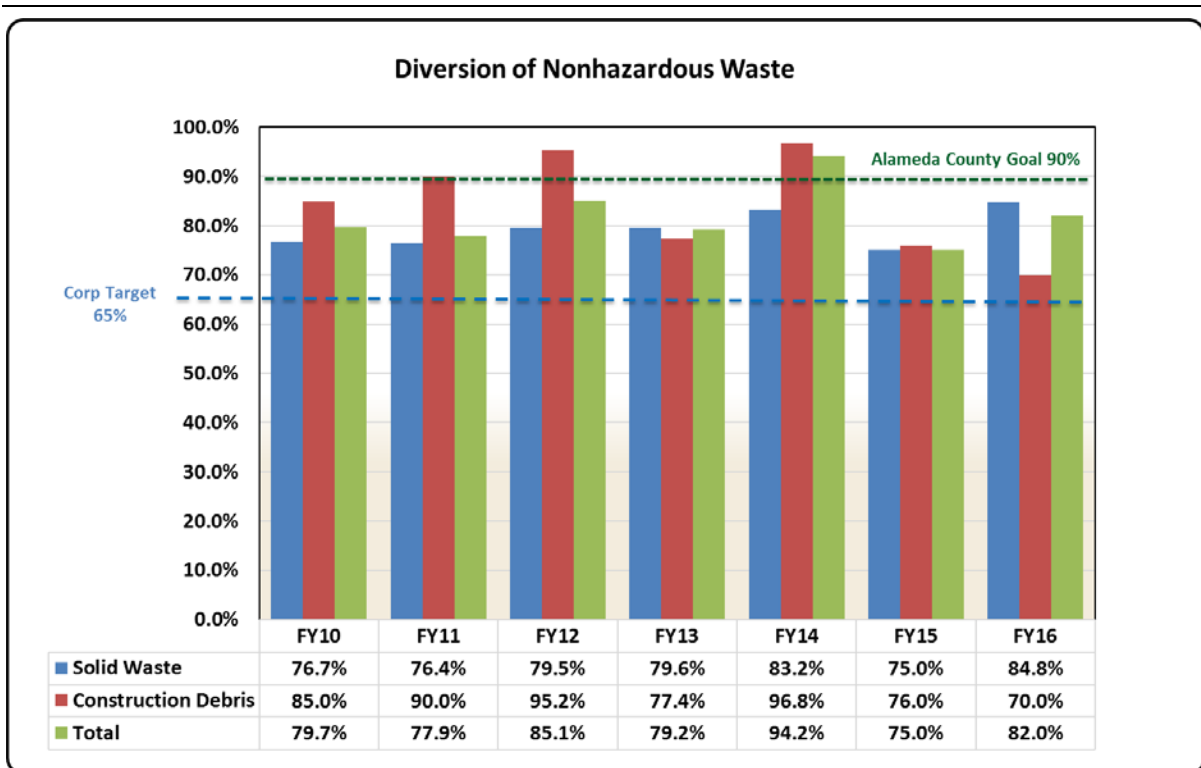


Figure 4-5 Solid Waste and Construction Debris Diverted From Landfill Disposal

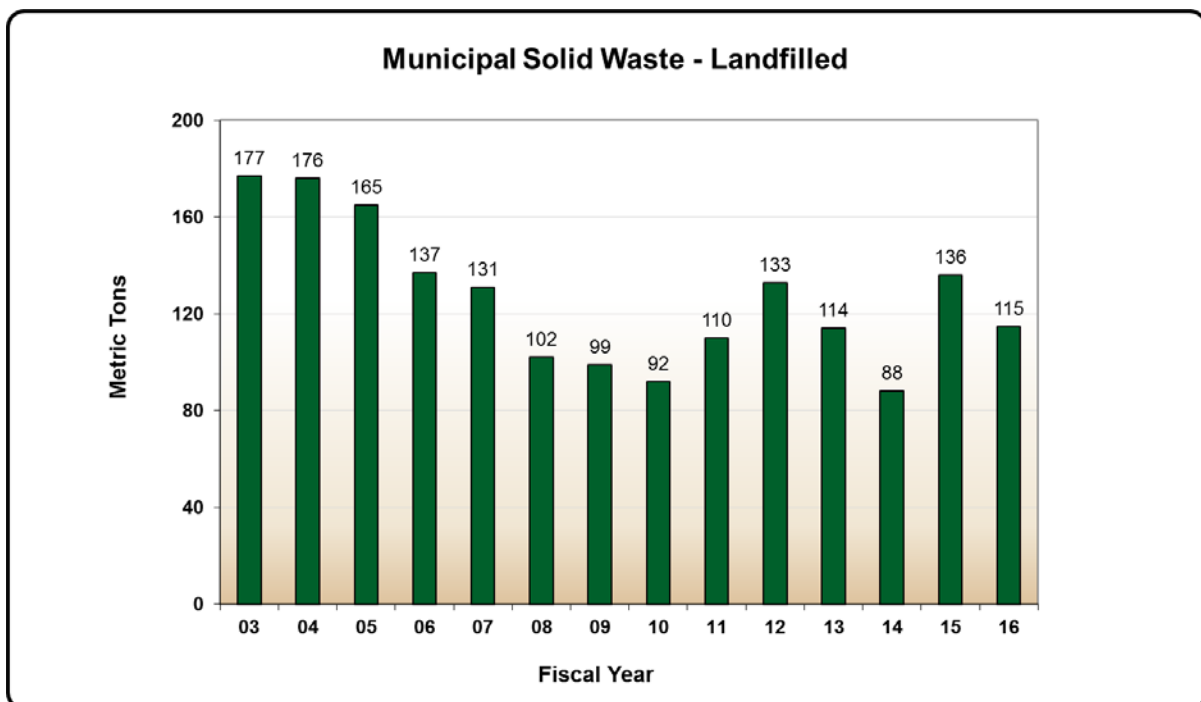


Figure 4-6 SNL/CA Landfill Waste

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 2016, Waste Management personnel conducted and/or supported the activities below.

- Coordinated with Environmental Management, Facilities, Occupational 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.
- Coordinated disposal of exhaust and fan systems used for plating shop operations resulting in removal of 80 cubic yards of contaminated ducting with trace acids and chromium.
- Removal of an outdated oil storage shed from an automotive maintenance area.
- Coordinated disposal of a 500-gallon portable diesel tank/trailer and residual product contained in the tank.
- Continued work with SNL/NM personnel to roll out a new database for tracking the generation and management (cradle to grave) of hazardous waste.
- Assisted with disposal of thermal batteries.

4.8.1 Hazardous and Radioactive Waste

SNL/CA personnel strive to minimize generation of hazardous and radioactive wastes through process controls, recycling, and reapplication of chemicals from one activity to another. Figures 4-7 and 4-8 show hazardous and radioactive waste generated over the last ten years, 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 2016 is attributed to construction and demolition activities, and disposal of equipment and hazardous materials no longer needed (see Section 4.8). The increase in radioactive waste generated in 2016 is due to pump-out of residual wastewater from a Liquid Effluent Control System tank located at the Radioactive Waste Management Facility.

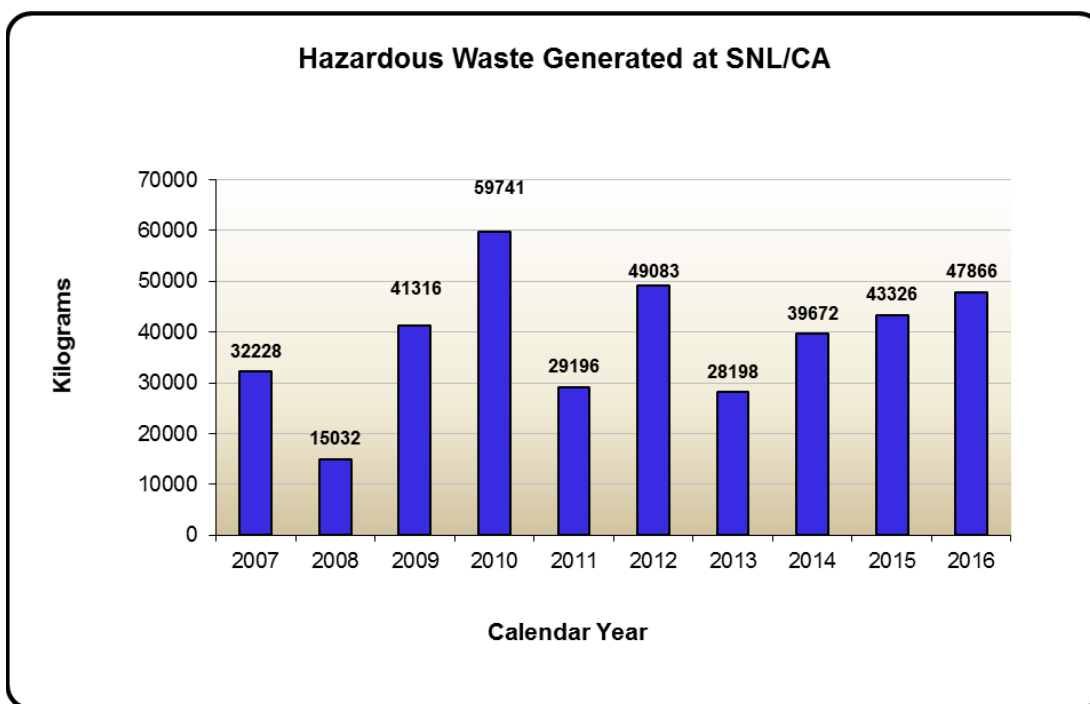


Figure 4-7 Hazardous Waste Generated at SNL/CA

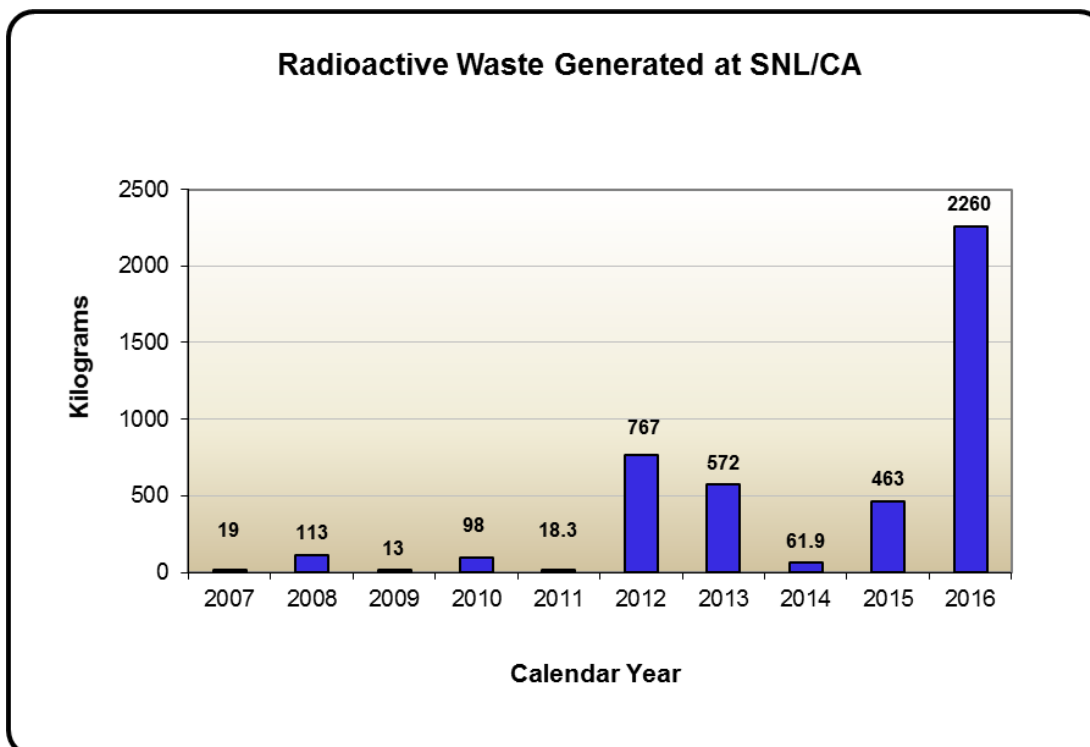


Figure 4-8 Radioactive Waste Generated at SNL/CA

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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.

SNL/CA 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. SNL/CA 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, SNL/CA 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 2016 are presented in Section 5.5.

5.1 Storm Water

All storm water runoff from SNL/CA is conveyed to the Arroyo Seco that 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.

Analytical Parameters – Storm Water

- ☐ pH
- ☐ Total suspended solids
- ☐ Oil and grease
- ☐ Metals – iron, lead, zinc, aluminum
- ☐ Chemical oxygen demand
- ☐ Nitrite + nitrate
- ☐ Tritium

To assess the impact of site operations to storm water discharges, five sampling locations and 20 outfall locations were identified 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 required to be sampled four times during the year, twice during each half of the year. However, storm events may not produce enough runoff to collect samples at all five locations during the period or during any one storm.

During the 2015/2016 reporting year (July 1 through June 30), sampling was performed at five locations and visual monitoring performed at 20 outfall locations. Two of the four required samples were collected at each of the five locations during the year. Analytical results of storm water sampling for the 2015/2016 reporting year are presented in Table 5-1. These samples were collected under the provisions of the General Industrial Permit.

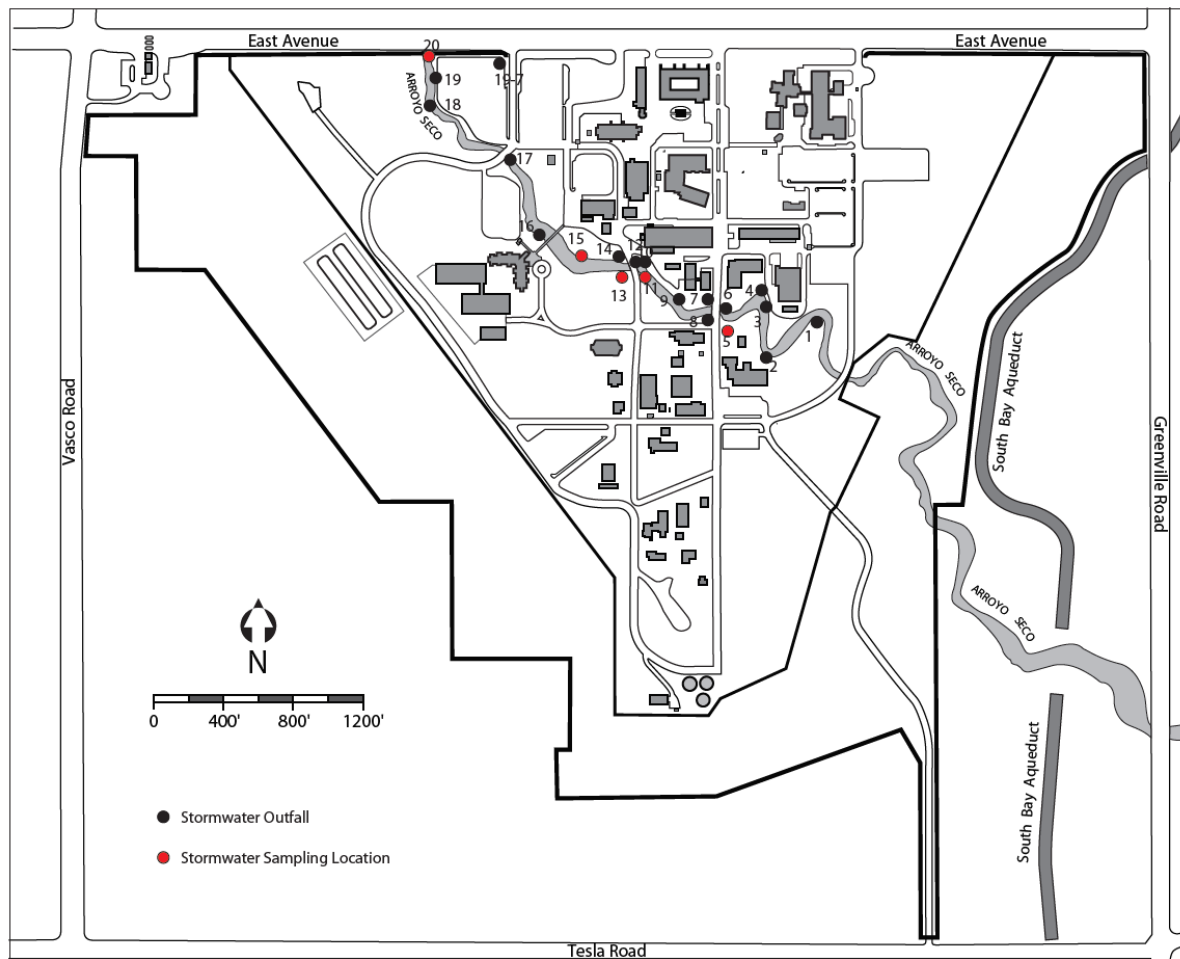


Figure 5-1 Storm Water Sampling Locations

Table 5-1 Summary of Analytical Results for Storm Water, 2015/2016 Reporting Year

Parameter	Number of Samples Analyzed	Number Found Below Detection Limit	Detection Limit	Numeric Action Level	Annual Average Concentration
Total suspended solids	10	0	1 mg/L	100 mg/L	67 mg/L
pH	10	NA	None	<6 or >9	6.3
Oil and grease	10	7	1.4 mg/L	15 mg/L	4.1 mg/L
Chemical oxygen demand	10	7	9 mg/L	120 mg/L	46 mg/L
Tritium	10	10	1250 pCi/L	<1250 pCi/L	<1250 pCi/L
			1130 pCi/L	<1130 pCi/L	<1130 pCi/L
Aluminum	10	0	0.008 mg/L	0.75 mg/L	1.9 mg/L
Iron	10	0	0.02 mg/L	1.0 mg/L	2.4 mg/L
Lead	10	1	0.00008 mg/L	0.26 mg/L	0.002 mg/L
Zinc	10	0	0.002 mg/L	0.26 mg/L	0.3 mg/L
Nitrite + nitrate	10	0	0.04 mg/L	0.68 mg/L	0.36 mg/L

To support minimizing pollution in the runoff, SNL/CA 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 2016, maintenance personnel collected approximately 208 cubic yards of debris during street cleaning efforts, thus removing potential storm water pollutants. Figure 5-2 shows the highest metals concentrations obtained at SNL/CA storm water sampling locations during the 2015/2016 reporting year.

Under the 2014 Industrial General Permit (effective on July 1, 2015), storm water samples collected by SNL/CA personnel for the 2015/2016 reporting year (July 1, 2015 through June 30, 2016) at five locations were averaged and compared to numeric action levels (NALs) to determine the site's compliance status. SNL/CA exceeded the NALs for iron, aluminum, and zinc, and thus has entered Level 1 status under the Industrial General Permit.

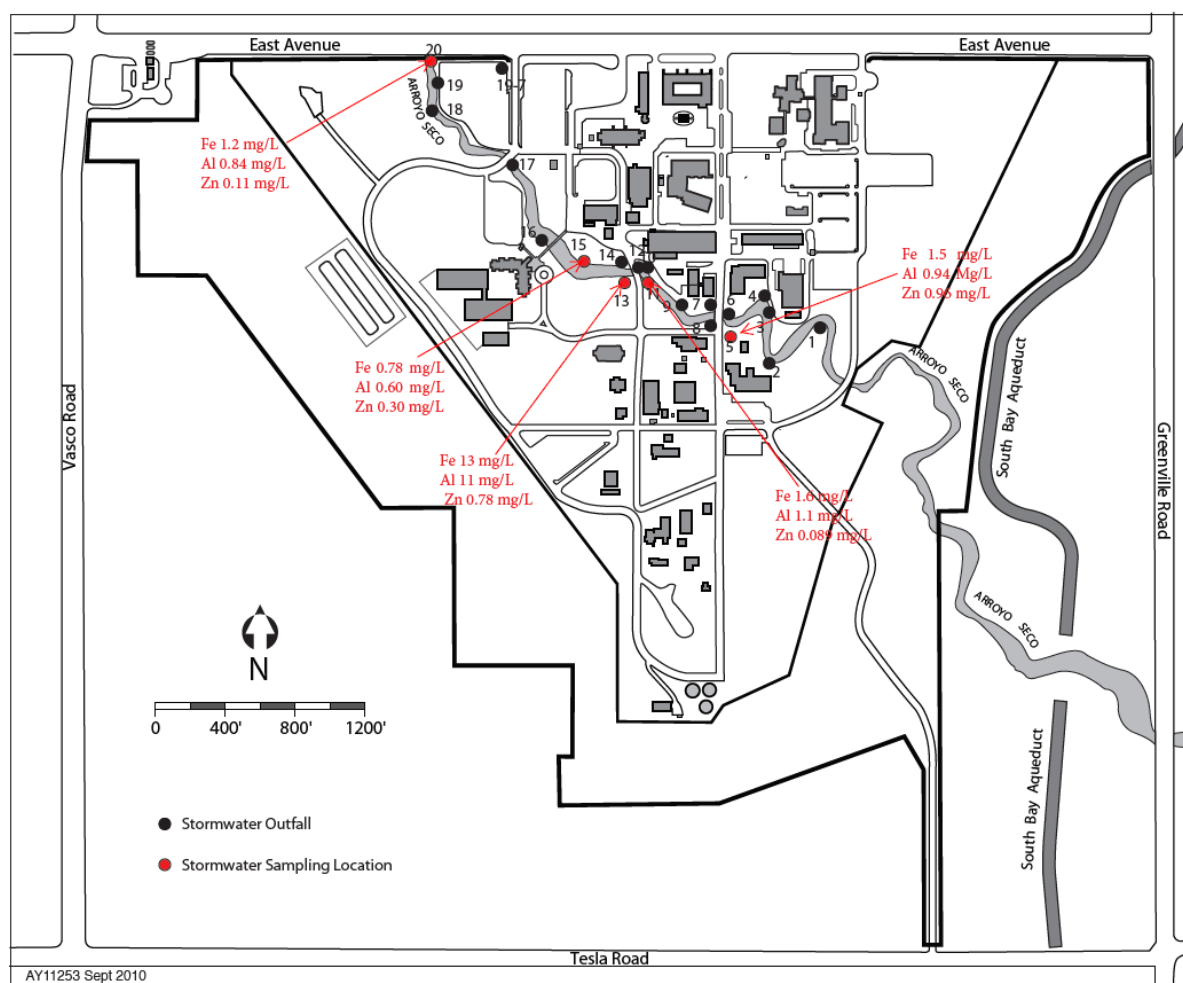


Figure 5-2 Constituents in Storm Water, 2015/2016 Reporting Year

5.2 Wastewater

Wastewater effluent generated at SNL/CA consists of sanitary and laboratory discharges. Sanitary effluent is discharged directly to the sewer system. Sewer discharges exit the site through a sewer outfall located at the northern boundary, and join with the Lawrence Livermore National Laboratory (LLNL) sewer system. Laboratory discharges are generated from general research activities, and from operations that qualify as categorical processes subject to Federal pretreatment standards. Laboratory effluent from most laboratory areas is diverted to liquid effluent control system (LECS) holding tanks prior to discharge to the sanitary sewer. SNL/CA 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 *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 2016, all liquid effluent from the outfall complied with the site outfall discharge limits for all parameters, with the exception of an exceedance of the limit for arsenic on January 12, 2016, and an exceedance of the limit for cyanide on March 1, 2016. Information about these exceedances is provided in Section 3.12.

Sewer outfall samples are also analyzed for priority pollutants that are listed by the U.S. Environmental Protection Agency (EPA) as toxic organics. Because the list is lengthy, SNL/CA personnel report only positively identified organic constituents. In 2016, sewer outfall samples showed sporadic concentrations of Chloroform (up to 4.8 µg/L), Bromoform (up to 12 µg/L), Toluene (up to 5 µg/L), Dibromochloromethane (3.4 µg/L), Phenol (up to 100 µg/L), Bromodichloromethane (2.6 µg/L), and Benzoic acid (up to 400 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 2016, 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, 2016

Parameter	Number of Samples Analyzed	Quantity Found Below Detection Limit	Detection Limit (mg/L)	Sewer Discharge Limit (mg/L)	Minimum Concentration (mg/L)	Maximum Concentration (mg/L)
Total suspended solids	12	0	1	None	64	560
Total dissolved solids	12	0	5	None	350	830
Biochemical oxygen demand	12	0	2	None	64	320
Chemical oxygen demand ^a	12	0	9	None	200	1500
Oil & Grease – Mineral ^b	5	1	1.4	100	<1.4	6.3
Oil & Grease – Animal / Veg. ^b	5	0	1.4	100	2.1	19
Cyanide	12	0	0.002	0.04	0.0022	0.12 ^c
Arsenic	52	3	0.0008	0.06	<0.0008	0.037 ^d
Cadmium	52	14	0.00008	0.14	<0.0002	0.00085
Chromium	52	2	0.00032	0.62	<0.00032	0.021
Copper	52	0	0.00016	1	0.04	0.35
Lead	52	0	0.00008	0.2	0.0003	0.02
Mercury	52	35	0.00006	0.01	<0.00006	0.0025
Nickel	52	1	0.00024	0.61	<0.00024	0.021
Silver	52	46	0.0002 0.00008	0.2	<0.0002	0.0019
Zinc	52	0	0.0002	3	0.04	1.1

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

^b Oil and grease analyses were reinstituted in August 2016.

^c A violation of the permit limit was found on March 1, 2016.

^d Weekly composite value. Daily samples analyzed. A daily violation of the permit limit was found on January 12, 2016.

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 tanks were operated at SNL/CA during 2016. 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 located at the Radioactive Waste Management Facility is used infrequently and monitored prior to discharge for tritium and uranium.

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 2016, wastewater from the LECS tank located at the Radioactive Waste Management Facility was transferred to drums and analyzed for radioactive constituents. Analytical results showed a low-level of tritium at approximately 1,250 pCi/L. Tritium is a DOE-added radioactive constituent; consequently, the wastewater was categorized as low-level radioactive waste. The radioactive contaminated wastewater is pending disposal at an approved off-site facility in accordance with all applicable requirements.

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 2016, all wastewater from this operation met the pretreatment standards.

Table 5-4 Monitoring for Semiconductor Manufacturing Categorical Process, 2016

Parameter	Number of Samples Analyzed	Number Found Below Detection Limit	Detection Limit	Minimum Concentration	Maximum Concentration	Permit Limit ^a
pH	2	--	None	7.38	7.6	5-10
Arsenic	2	1	0.0008 mg/L	0.00043 mg/L	0.0014 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. SNL/CA 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 5-3. MW-406, an LLNL well, is also shown on Figure 5-3. SNL/CA personnel discontinued monitoring at this location in 2005, but continue 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.

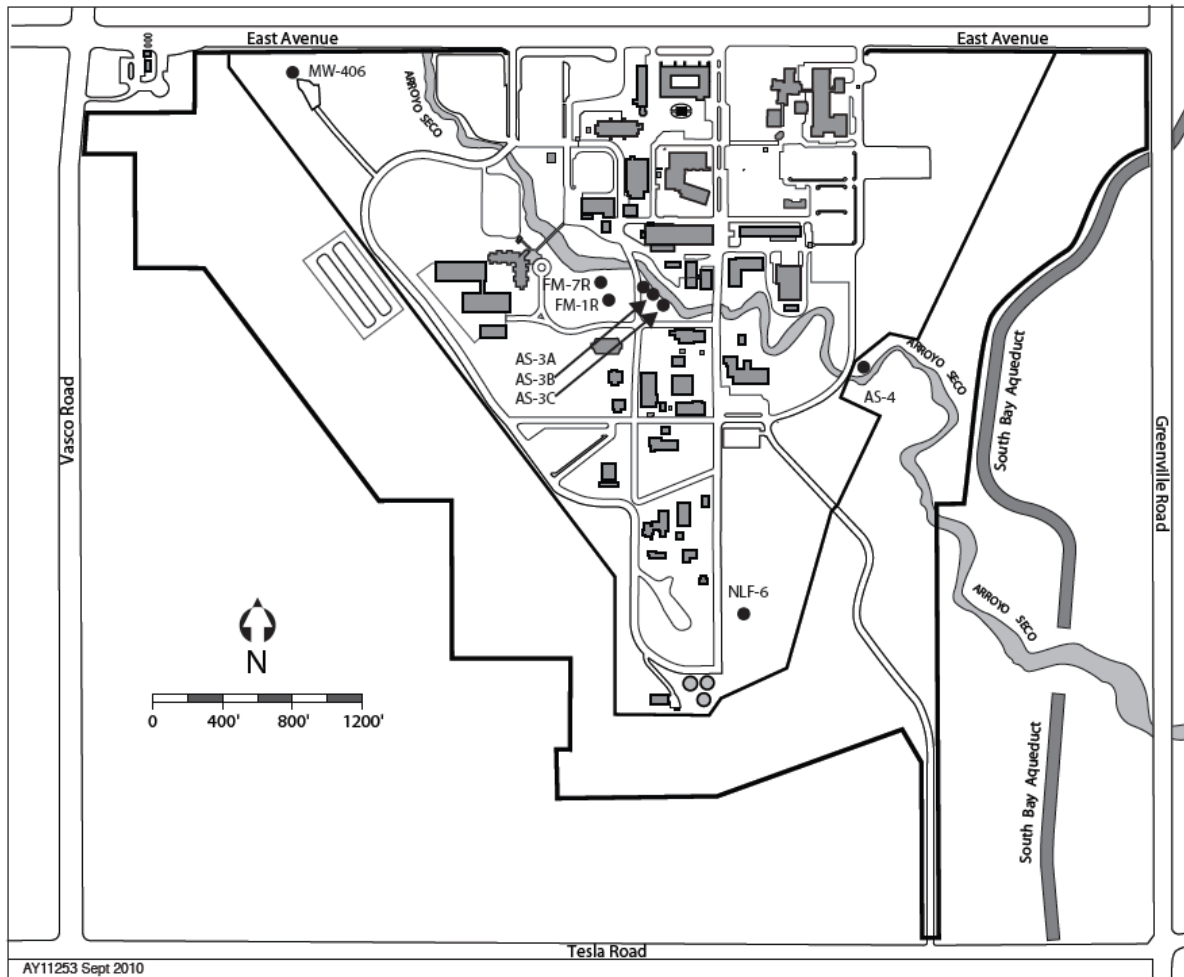


Figure 5-3 Groundwater Monitoring Well Locations

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); Naphthalene; 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 Table 5-8. Analyses for general minerals in Arroyo Seco samples are completed every two years. General mineral analyses were not required in 2016. LLNL personnel last sampled MW-406 during the first quarter of 2016. The only constituent of interest detected was tetrachloroethene at 0.93 mg/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 2016. 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 personnel 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 2016, yet the level remains well below a level that would require action by SNL/CA personnel.

Table 5-6 Summary of Groundwater Analyses – Navy Landfill, 2016

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 6/2/16	0.63	1.7	<0.4

^a All other EPA 601 parameters were non-detectable.

MCL – Maximum contaminant levels.

Table 5-7 Summary of Groundwater Analyses – Fuel Oil Spill, 2016

Date	TPH-D µg/L	Benzene µg/L	Toluene µg/L	Ethylbenzene µg/L	Xylenes µg/L
Detection limit	50/100	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 3/3/16	<100	<0.3	<0.3	<0.4	<0.5
FM-7R 3/3/16	<100	<0.3	<0.3	<0.3	<0.3
FM-1R 9/15/16	<50	<0.3	<0.3	<0.3	<0.5
FM-7R 9/15/16	<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, 2016

				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	6/2/16	5.4 ^b	220 ^c	0.14	0.00098	0.0056	0.041	0.013	0.0036	<0.008	0.0056	<378
AS-3C	6/2/16	ND	<50	0.18	<0.0003	0.0081	0.022	0.0084	0.0015	<0.008	0.0052	<384
AS-4	6/2/16	ND	<50	0.07	<0.0003	<0.004	0.021	0.0092	0.0023	<0.008	0.0066	<375

^a Well AS-3A was dry during 2016.

^b Acetone detected at 5.4 µg/L.

^c Detected, but not at a sufficient level to be quantified.

MCL – Maximum contaminant levels.

ND – Non-detectable.

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 2016, 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 2016. Therefore, the detection limit value (1410 pCi/L) was used in the RAD-BCG Calculator. The sum of fractions from storm water data totaled 5.33×10^{-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 (TLDs) are maintained at SNL/CA. Monitoring stations are shown on Figure 5-4. The dosimeters are collected and evaluated quarterly.

In 2016, the dosimeters used for ambient radiation monitoring were changed to now being provided and read by an external service provider. SNL/CA personnel will no longer compare the TLDs to those used by LLNL. SNL/CA plans to expand the TLD network in 2017 to provide more complete perimeter coverage, and background locations. The average annual perimeter dose in 2016 was 46.3 mrem (0.463 mSv), well below the allowable annual exposure dose to the public of 100 mrem established by DOE. Since previous years also included LLNL data, and the TLDs used were changed in 2016, no comparisons can be made to past years.

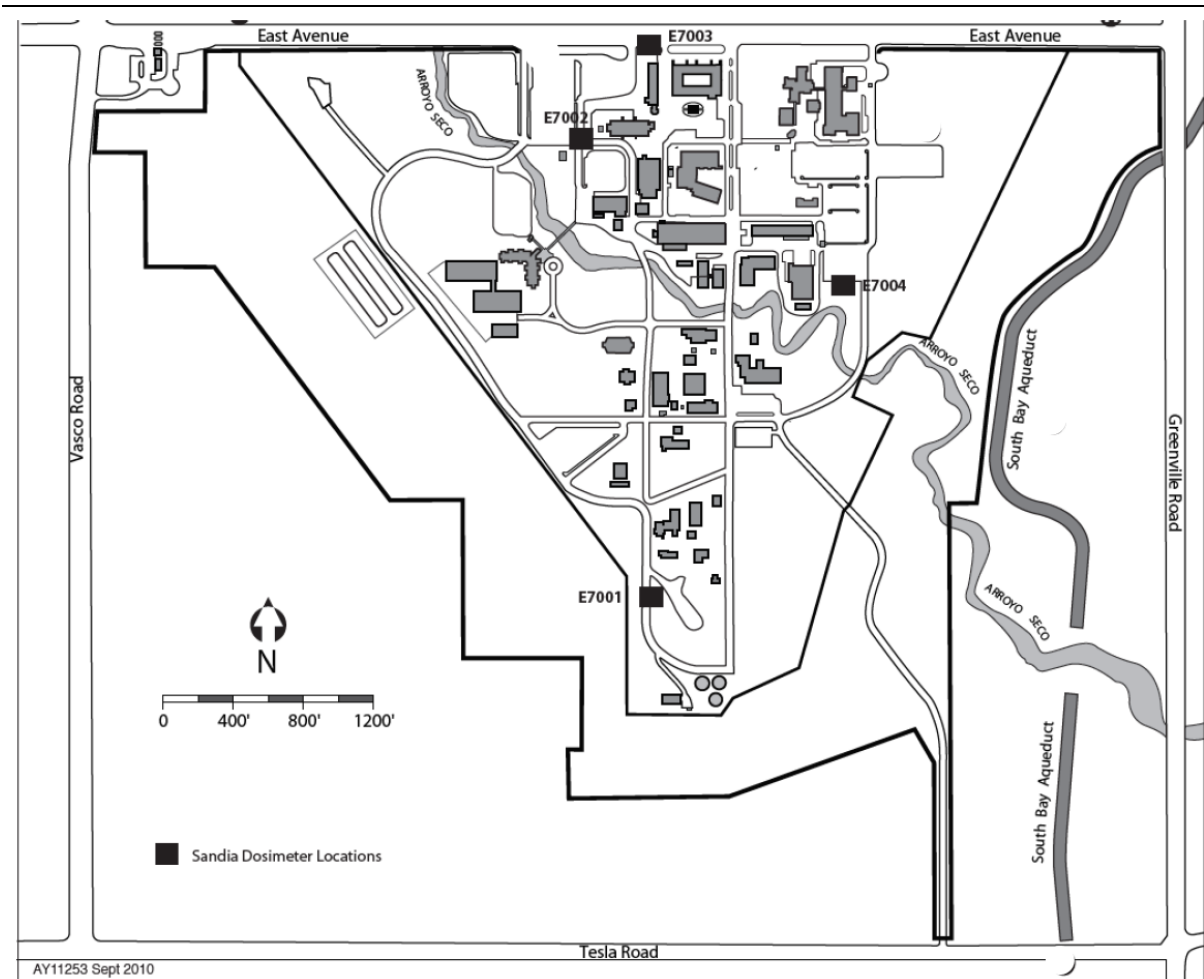


Figure 5-4 Dosimeter Locations at SNL/CA and Around Site Perimeter

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6 Quality Assurance

Sandia National Laboratories, California (SNL/CA) personnel follow the Corporate Process for quality assurance, CG100.6, *Ensure Quality Outcomes* (SNL 2016b).

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 414.1D 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 2016a). 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 Radiation Protection Laboratory; or the Sandia National Laboratories, New Mexico (SNL/NM) Radiation Protection Dosimetry Program.

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 Radiation Protection Laboratory

Tritium analyses of storm water are performed by the SNL/CA personnel in an on-site laboratory. These samples are analyzed by liquid scintillation counting, a standard technique for tritium analysis. The Radiation Protection Laboratory follows the guidance in the Sandia National Laboratories (SNL) Radiation Protection Sample Diagnostics Program Quality Assurance Plan (SNL 2017), and meets all corporate and DOE quality criteria.

6.3.3 SNL/NM Radiation Protection Dosimetry Program

Thermoluminescent dosimeters used to measure gamma radiation are issued 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 2016a). An external service provider performs the quarterly dosimeter processing.

6.4 Data Verification and Validation

SNL/CA 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.

The 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 2016, SNL/CA personnel collected 12 wastewater quality control samples and submitted two blind spike samples, representing 27 percent of the sample load. Two groundwater quality control samples were collected representing 22 percent of the sample load. Two storm water quality control samples were collected during the 2015/2016 wet season, representing 10 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 2016. As shown, some data quality objectives failed during the year. The seven failed storm water precision tests were chemical oxygen demand (two samples), iron, lead, Nitrate + Nitrite, total suspended solids, and zinc. All of these parameters are easily influenced by the heterogeneous nature of the storm water. An investigation was not initiated since the absolute differences were small.

As such, test results may not be indicative of a substantial problem in the storm water sampling.

Table 6-1 Summary of Statistical Analyses, 2016

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	50% ^a	14	7 passed	-	-
Groundwater	100%	1	1 passed	-	-

^a Storm water samples are required to be collected during normal business hours, and be preceded by two dry days. The timing of rain events did not allow for all samples to be collected. 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*.
- 42 USC §15801, *Energy Policy Act of 2005*.
- 42 USC §17001, *Energy Independence and Security Act of 2007*.
- Assembly Bill 2185, *California Hazardous Materials Release Response Plans and Inventory Law*, 1987.
- California Health and Safety Code, Division 20, Chapter 6.5, § 25100 et. seq., *Hazardous Waste Control Law*.
- California Health and Safety Code, Division 20, Chapter 6.67, §§ 25270-25270.13, *Aboveground Petroleum Storage Act*.
- California Health and Safety Code, Division 20, Chapter 6.7, §§ 25280-25299.8, *Underground Storage of Hazardous Substances*.
- California Health and Safety Code, Division 20, Chapter 6.95, § 25500, et. Seq., *Hazardous Materials Release Response Plans and Inventory*.
- California Health and Safety Code, Division 104, Part 14, §§ 117600-118360, *Medical Waste Management Act*.
- California Regional Water Quality Control Board, San Francisco Bay Region (California RWQCB) 1989, Order No. 89-184, *Revision of Site Cleanup Order, Sandia Corporation and U.S. Department of Energy, Livermore*, December 1989.
- California Water Resources Control Board 2014, State of California, *NPDES General Permit for Storm Water Discharge Associated with Industrial Activities*, Order 2014-0057-DWQ, April 1, 2014.

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- Department of Energy (DOE) 1986, *Comprehensive Environmental Assessment and Response Program, Phase I: Installation Assessment, Sandia National Laboratories, Livermore*, September, 1986.
- DOE 2001, DOE Order 435.1, change 1, *Radioactive Waste Management*, August 28, 2001.
- DOE 2002, DOE Standard 1153-2002, *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota*, July 2002.
- DOE 2003a, *Final Site-wide Environmental Assessment of the Sandia National Laboratories/California*, DOE/EA-1422, January 2003.
- DOE 2003b, *Site Wide Environmental Assessment for SNL/CA, Finding of No Significant Impact*, March 20, 2003.
- DOE 2011, DOE Order 436.1, *Departmental Sustainability*, May 2, 2011.
- DOE 2012, DOE Order 231.1B, Administrative Change 1, *Environment, Safety, and Health Reporting*, November 28, 2012.
- DOE 2013a, DOE Order 458.1, Administrative Change 3, *Radiation Protection of the Public and the Environment*, January 15, 2013.
- DOE 2013b, DOE Order 414.1D, Administrative Change 1, *Quality Assurance*, May 8, 2013.
- DOE 2014, DOE Order 232.2, Administrative Change 1, *Occurrence Reporting and Processing of Operations Information*, March 12, 2014.
- DOE 2015, *2015 Strategic Sustainability Performance Plan*, June 30, 2015.
- Executive Order (EO) 11988, *Floodplain Management*, Federal Register, Vol. 42, pp. 26951, May 25, 1977.
- EO 11990, *Protection of Wetlands*, Federal Register, Vol. 42, pp. 26961, May 25, 1977.
- International Organization for Standardization (ISO) 14001, *Environmental Management Systems – Requirements with guidance for use*, Second edition, November 15, 2004.
- Lawrence Livermore National Laboratory (LLNL) 1990, *CERCLA Remedial Investigation Report for Lawrence Livermore National Laboratory Livermore Site*, (Thorpe, R.K., W.F. Isherwood, M.D. Dresen, and C.P. Webster-Scholten).
- LLNL 2017, Simple Weather Report Tool, http://www-metdat.llnl.gov/cgi-pub/reports/simple_report.pl, January 3, 2017.
- Matthews, Graham & Associates (Matthews) 2002, *Management Plan for Arroyo Seco at Sandia National Labs, Livermore, CA*, April 2002.

Sandia National Laboratories (SNL) 1987, *Description and Procedures of the Environmental Radiation Dosimetry Program*, SAND87-1916, August 1987.

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

SNL 2016a, *Radiation Protection Dosimetry Program Quality Plan*, RPDP-00-01, Issue 9, May 9, 2016.

SNL 2016b, Corporate Process: CG100.6, *Ensure Quality Outcomes*, October 4, 2016.

SNL 2016c, Corporate Process: ESH100.2, *Analyze and Control Hazards*, November 10, 2016.

SNL 2017, Radiation Protection Sample Diagnostics Program Quality Assurance Plan, Issue 9, January 16, 2017.

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

SNL/CA 2016a, Administrative Procedure 800081, *Quality Assurance Project Plan*, May 13, 2016.

SNL/CA 2016b, Operating Procedure 471741, *Spill Prevention and Spill Control Activities*, Issue H, September 8, 2016.

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

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

US District Court, Northern District of California 2006, Case Number 02-1580-JSW (JL), Stipulated Injunction and Order, Center for Biological Diversity, Plaintiff, v. Stephen L. Johnson, Administrator, Environmental Protection Agency, and Wayne Natri, Region 9 Administrator, Environmental Protection Agency, Defendants, and Croplife America, American Forest & Paper Association, Western Plant Health Association, Oregonians for Food and Shelter, and Syngenta Crop Protection, Inc., Defendants-Intervenors, October 17, 2006.

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

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

USFWS 2006, *Final Rule, Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the California Red-Legged Frog, and Special Rule Exemption Associated with Final Listing for Existing Routine Ranching Activities*, Federal Register, April 13, 2006 (Volume 71, Number 71).

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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

Site Environmental Report for 2016

Table 9-1 Results of Groundwater Analyses at SNL/CA, 2016

	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	6/2/16	ND	ND	ND	ND	ND	ND	ND	0.63	ND	1.7	ND	ND	ND
Field Dup	6/2/16	ND	ND	ND	ND	ND	ND	ND	0.59	ND	1.7	ND	ND	ND
Field Blank	6/2/16	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trip Blank	6/2/16	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-3A ¹	6/2/16	-	-	-	-	-	-	-	-	-	-	-	-	-
AS-3B	6/2/16	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-3C	6/2/16	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-4	6/2/16	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
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.

Site Environmental Report for 2016

Table 9-1 Results of Groundwater Analyses at SNL/CA, 2016 (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	6/2/16	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Field dup	6/2/16	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Field blank	6/2/16	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trip Blank	6/2/16	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-3A ¹	6/2/16	-	-	-	-	-	-	-	-	-	-	-	-	-
AS-3B	6/2/16	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-3C	6/2/16	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-4	6/2/16	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FM-1R	3/3/16	-	-	-	-	-	-	-	-	-	-	-	-	ND
FM-1R	9/15/16	-	-	-	-	-	-	-	-	-	-	-	-	ND
FM-7R	3/3/16	-	-	-	-	-	-	-	-	-	-	-	-	ND
FM-7R	9/15/16	-	-	-	-	-	-	-	-	-	-	-	-	ND

MCL – Maximum contaminant level.

ND – Non-detectable.

¹ Well was dry.

- Not required to analyze or sample not collected.

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Table 9-1 Results of Groundwater Analyses at SNL/CA, 2016 (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	6/2/16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AS-3B	6/2/16	ND	ND	0.14	ND	0.0098	0.0056	ND	0.041	ND	ND	0.013	0.0036	ND	ND	0.0056	ND	0.025	<378
AS-3C	6/2/16	ND	ND	0.18	ND	ND	0.0081	ND	0.022	ND	ND	0.0084	0.0015	ND	ND	0.0052	ND	0.014	<384
AS-4	6/2/16	ND	ND	0.07	ND	ND	ND	ND	0.021	ND	ND	0.0092	0.0092	ND	0.00078	0.0066	ND	0.012	<375
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, 2016 (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	3/3/16	ND	ND	ND
FM-1R	9/15/16	ND	ND	ND
FM-7R	3/3/16	ND	ND	ND
FM-7R	9/15/16	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, 2016

		BOD ^c SM5210B	COD ^c E410.4	TDS ^c SM2540C	TSS ^c SM2540D	Oil & Grease – Mineral ^d	Oil & Grease – Animal / Veg ^d	Cyanide ^d Kelada-01
Date	Laboratory ID # ^a	All results reported in mg/L						
January								
Jan. 5	16A0342	120	460	440	180	<i>g</i>	<i>g</i>	0.0022
February								
Feb. 2	16B0282	310	1100	760	560	<i>g</i>	<i>g</i>	0.0022
March								
Mar. 1	16C0179	270	780	830	360	<i>g</i>	<i>g</i>	0.12 ^e
April								
Apr. 5	16D0365	310	1500	430	320	<i>g</i>	<i>g</i>	0.0052
May								
May 3	16E0280	240	690	350	290	<i>g</i>	<i>g</i>	0.0055
June								
Jun. 7	16F0733	320	670	350	190	<i>g</i>	<i>g</i>	0.0064
July								
Jul. 5	16G0293	250	1500	370	280	<i>g</i>	<i>g</i>	0.0061
August								
Aug. 2	16H0272	87	290	400	120	2.6	2.1	0.0036
September								
Sept. 6	16I0426	100	250	470	120	2.1	19	0.0045
October								
Oct. 4	16J0288	86	230	610	110	2.5	14	0.0042
November								
Nov. 1	16K0223	64	200	570	64	<1.4	15	0.0060
December*								
Dec. 6	16L0473	130	620	600	240	6.3	14	0.0040
Discharge Limit ^b		N/A ^f	N/A ^f	N/A ^f	N/A ^f	100	100	0.04

*Site shutdown from December 24, 2016 through January 2, 2017.

^a Analyses performed by an offsite, 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 Daily samples analyzed. A daily violation of the permit limit was found on March 1, 2016.

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

^g The monitoring requirement for oil and grease was suspended from January through August 2016 pending modification of the City of Livermore Municipal Code 13.32.

Table 9-4 Routine Monitoring Results for SNL/CA Sanitary Sewer Outfall, Method E200.8, 2016

Date ^a	Laboratory ID # ^b	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Silver	Zinc
All results reported in mg/L										
January										
January 5	16A0369	0.0068	0.00023	0.0014	0.34	0.0019	<0.000060	0.0030	<0.00020	1.1
January 12	16A1078	0.011	0.00021	0.0014	0.24	0.00079	0.000070	0.0029	<0.00020	0.17
January 19	16A1670	0.037 ^d	0.00043	0.0030	0.29	0.0018	0.000060	0.0051	<0.00020	0.37
January 26	16A2346	0.0032	0.00032	0.0021	0.24	0.0013	>0.000060	0.0040	<0.00020	0.19
February										
February 2	16B0269	<0.00080	0.00021	0.0024	0.26	0.0012	<0.000060	0.0050	<0.00020	0.24
February 9	16B0912	<0.00080	0.00020	0.0072	0.17	0.0014	<0.000060	0.0059	<0.00020	0.20
February 16	16B1446	<0.00080	<0.00008	0.0025	0.13	0.0011	<0.000060	0.0060	<0.00020	0.11
February 23	16B2002	0.0097	<0.00020	0.0042	0.12	0.00043	<0.000060	0.0019	<0.00050	0.17
March										
March 1	16C0176	0.0049	0.00034	0.0018	0.22	0.0024	<0.000060	0.0041	<0.00020	0.31
March 8	16C0901	0.00052	0.00028	<0.00032	0.15	0.0020	<0.000060	0.0048	<0.00020	0.34
March 15	16C1610	0.0029	0.00033	0.0029	0.14	0.0020	0.000070	0.0052	<0.00020	0.29
March 22	16C2236	0.0065	0.00017	0.0029	0.19	0.0028	<0.000060	0.0044	<0.00020	0.46
March 29	16C2788	0.0013	0.00027	0.0047	0.22	0.0019	<0.000060	0.0037	<0.00020	0.51
April										
April 5	16D0362	0.0038	0.00036	0.0072	0.25	0.0040	0.00015	0.0063	<0.00020	0.41
April 12	16D1094	0.0024	0.00030	0.0042	0.19	0.0026	0.000070	0.0049	<0.00020	0.31
April 19	16D1603	0.0037	0.00060	0.0033	0.18	0.0021	0.000070	0.0033	<0.00020	0.29
April 26	16D2215	0.0054	0.00033	0.0018	0.16	0.0020	<0.000060	0.0041	<0.00020	0.23
May										
May 3	16E0275-01	0.0049	0.00046	0.0025	0.21	0.0020	0.00018	0.0047	<0.00020	0.38
May 10	16E0952-01	0.0090	0.00028	0.0027	0.17	0.0019	<0.000060	0.0043	<0.00020	0.32
May 17	16E1557-01	0.0063	0.00038	0.0027	0.18	0.0030	0.00013	0.0052	<0.00020	0.29
May 24	16E2081-01	0.0051	0.00042	0.0042	0.21	0.0025	0.00021	0.0049	<0.00020	0.28
May 31	16F0042-01	0.0029	0.00035	0.00090	0.12	0.0015	<0.000060	0.0044	<0.00020	0.15

Table 9-4 Routine Monitoring Results for SNL/CA Sanitary Sewer Outfall, Method E200.8, 2016 (continued)

Date ^a	Laboratory ID # ^b	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Silver	Zinc
All results reported in mg/L										
June										
June 7	16F0731	0.0042	0.00034	0.0023	0.21	0.0028	<0.000060	0.0057	0.00031	0.24
June 14	16F1404	0.0065	0.00035	0.0030	0.35	0.0023	0.000060	0.0056	<0.00020	0.34
June 21	16F1945	0.0012	0.00083	0.0081	0.34	0.020	0.00014	0.021	0.0010	0.26
June 28	16F2478	0.0066	0.00068	0.0060	0.24	0.0031	0.00011	0.0057	<0.00020	0.31
July										
July 5	16G0291	0.010	0.00041	0.0018	0.26	0.0023	0.00010	0.0052	<0.00020	0.37
July 12	16G1063	0.0057	0.00085	0.0030	0.26	0.0055	0.00013	0.0059	0.00031	0.39
July 19	16G1683	0.0081	0.00047	0.021	0.33	0.014	0.0025	0.010	0.0019	0.43
July 26	16G2303	0.018	0.00033	0.0049	0.23	0.0017	<0.000060	0.0061	<0.00020	0.30
August										
August 2	16H0270	0.0026	0.00021	0.0020	0.11	0.0013	<0.000060	0.0035	<0.00020	0.14
August 9	16H0960	0.0027	0.00014	0.0018	0.11	0.0010	<0.000060	0.0033	<0.00020	0.16
August 16	16H1618	0.0035	0.00015	0.0018	0.14	0.0012	<0.000060	0.0030	<0.00020	0.17
August 23	16H2232	0.0011	0.00010	0.0018	0.11	0.0011	<0.000060	0.0025	<0.00020	0.12
September										
September 6	16I0384	0.0020	0.00026	0.0019	0.16	0.0016	<0.000060	0.0032	<0.00020	0.16
September 13	16I1207	0.0019	<0.00020	0.0020	0.16	0.0014	<0.000060	0.0035	<0.00020	0.17
September 20	16I1811	0.0034	<0.00020	0.0027	0.11	0.0009	<0.000060	0.0006	<0.00020	0.11
September 27	16I2357	0.0026	<0.00020	0.0009	0.05	0.0004	<0.000060	0.0003	<0.00020	0.04

Table 9-4 Routine Monitoring Results for SNL/CA Sanitary Sewer Outfall, Method E200.8, 2016 (continued)

Date ^a	Laboratory ID # ^b	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Silver	Zinc
All results reported in mg/L										
October										
October 4	16J0286	0.0023	<0.00020	0.0012	0.08	0.00067	<0.000060	0.0020	<0.00020	0.10
October 11	16J0983	0.0015	<0.00020	0.0006	0.09	0.00079	<0.000060	0.0031	<0.00020	0.13
October 18	16J1675	0.0041	0.00021	0.0026	0.12	0.0013	<0.000060	0.0032	<0.00020	0.20
October 25	16J2315	0.0076	0.00039	0.0037	0.14	0.0025	0.00018	0.0037	<0.00020	0.16
November										
November 1	16K0220	0.0011	<0.00020	0.0016	0.09	0.00086	<0.000060	<0.00024	<0.00020	0.08
November 8	16K0797	0.0008	<0.00020	0.0005	0.04	0.00030	<0.000060	0.0016	<0.00020	0.06
November 15	16K1486	0.0026	0.00051	<0.0003	0.07	0.0020	<0.000060	0.0032	<0.00050	0.14
November 22	16K2128	0.0022	<0.00020	0.0003	0.09	0.0019	<0.000060	0.0042	<0.00020	0.16
November 29	16K2489	0.0024	0.00044	0.0015	0.20	0.0016	<0.000060	0.0027	<0.00020	0.17
December*										
December 6	16L0481	0.0033	<0.00020	0.0005	0.14	0.0013	<0.000060	0.0035	<0.00020	0.14
December 13	16L1319	0.0029	<0.00020	0.0022	0.12	0.0013	0.000090	0.0052	0.00021	0.17
December 20	16L2173	0.0039	<0.00020	0.0013	0.12	0.0017	<0.000060	0.0011	0.00029	0.13
December 27	17A0149	0.0029	<0.00020	0.0022	0.19	0.0015	<0.000060	0.0059	<0.00020	0.16
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 24, 2016 through January 2, 2017.

^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. A daily violation of the permit limit was found on January 12, 2016.

Table 9-5 Routine Monitoring Results for SNL/CA Sanitary Sewer Outfall, 2016

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 5	Toluene - 1.7	None	None
February 2	Toluene – 5.0	None	None
March 1	Chloroform – 4.8	None	None
April 5	Chloroform – 4.3 Bromoform – 12	Benzoic Acid – 400 ^a Phenol - 25	None
May 3	Chloroform – 4.4 Toluene – 1.6	Phenol – 34	None
June 7	Chloroform – 3.9	Phenol – 70	None
July 5	Chloroform – 2.9 Toluene – 1.8	Phenol – 100	None
August 2	None	None	None
September 6	None	None	None
October 4	None	None	None
November 1	Bromoform – 5.0 Dibromochloromethane – 3.4 Bromodichloromethane – 2.6	None	None
December 6	None	Benzoic Acid – 320 ^a	None

^a Benzoic acid is not on the total toxic organics (TTO) list but is included here for completeness.

This table reports all positively identified organic constituents designated as 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. Note that Chloroform is reported in this table although it is a common constituent of chlorinated water.

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