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Site Environmental Report for 2017

Sandia National Laboratories, California

Pradnya A. Jadhav

Prepared by
Sandia National Laboratories
Livermore, California 94550

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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 2017 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 2017, 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, Sandia National Laboratories, California (SNL/CA) staff prepare a report to provide environmental information to the local community, under Department of Energy Order 231.1B, *Environment, Safety and Health Reporting*. The Site Environmental Report for 2017 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 2017 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 containment system
LLNL	Lawrence Livermore National Laboratory
MCLs	maximum contaminant levels
mg/L	milligrams per liter
mL	milliliter
M&O	Management and Operating Contract
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	Superfund Amendments and Reauthorization Act of 1986, Title III
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), National Nuclear Security Administration (NNSA) statutory responsibilities for nuclear weapons research and development. SNL is the most diverse of the three laboratories and includes other missions for 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 nanotechnologies, and basic science and engineering research.

This Site Environmental Report summarizes the environmental programs and compliance efforts at SNL/CA for calendar year 2017. It also discusses integration of environmental programs 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. The department has 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, SNL/CA's primary corporate management approach to achieving environmental improvement and minimizing impact, is also implemented through the site's environmental programs. The SNL/CA site is certified to the ISO 14001:2004 standard under the corporate multi-site certification established in May 2015.

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 2017, SNL/CA personnel measured performance in achieving four site EMS objectives, three corporate goals, and one performance objective established jointly between Sandia Corporation and the DOE NNSA, Sandia Field Office (SFO) from October 1, 2016 through April 30, 2017. Environmental performance from May 1, 2017 through September 30, 2017 will be included in the Fiscal Year (FY) 2017 – 2018 Performance Evaluation Report to be issued by NNSA/SFO for National Technology and Engineering Solutions of Sandia, LLC (NTESS) after the close of

FY 2018. SNL/CA did not receive any notices of violations (NOVs) in 2017. Chapter 4 presents additional information about SNL/CA's environmental performance.

1.4 Monitoring and Surveillance

Storm water, wastewater, groundwater, and direct (ambient) radiation are monitored at SNL/CA. The results of monitoring during the 2016/2017 wet season show that SNL/CA exceeded the Numeric Action Levels in storm water for iron and aluminum. During 2017, there was no permit exceedance of the wastewater discharge limit at the site sewer outfall. Monitoring results continued to show carbon tetrachloride in groundwater at the Navy Landfill in 2017 with a concentration similar to that detected in past years. Diesel was detected in groundwater from wells at the Fuel Oil Spill site in 2017. The average annual gamma radiation dose from all sources at the site perimeter in 2017 was 46 mrem (0.46 mSv), well below the allowable annual exposure dose to the public of 100 mrem established by DOE. Chapter 5 provides additional information about environmental monitoring at SNL/CA.

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, SNL/CA's role in supporting 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. 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 government owns the site, the buildings, and the equipment 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

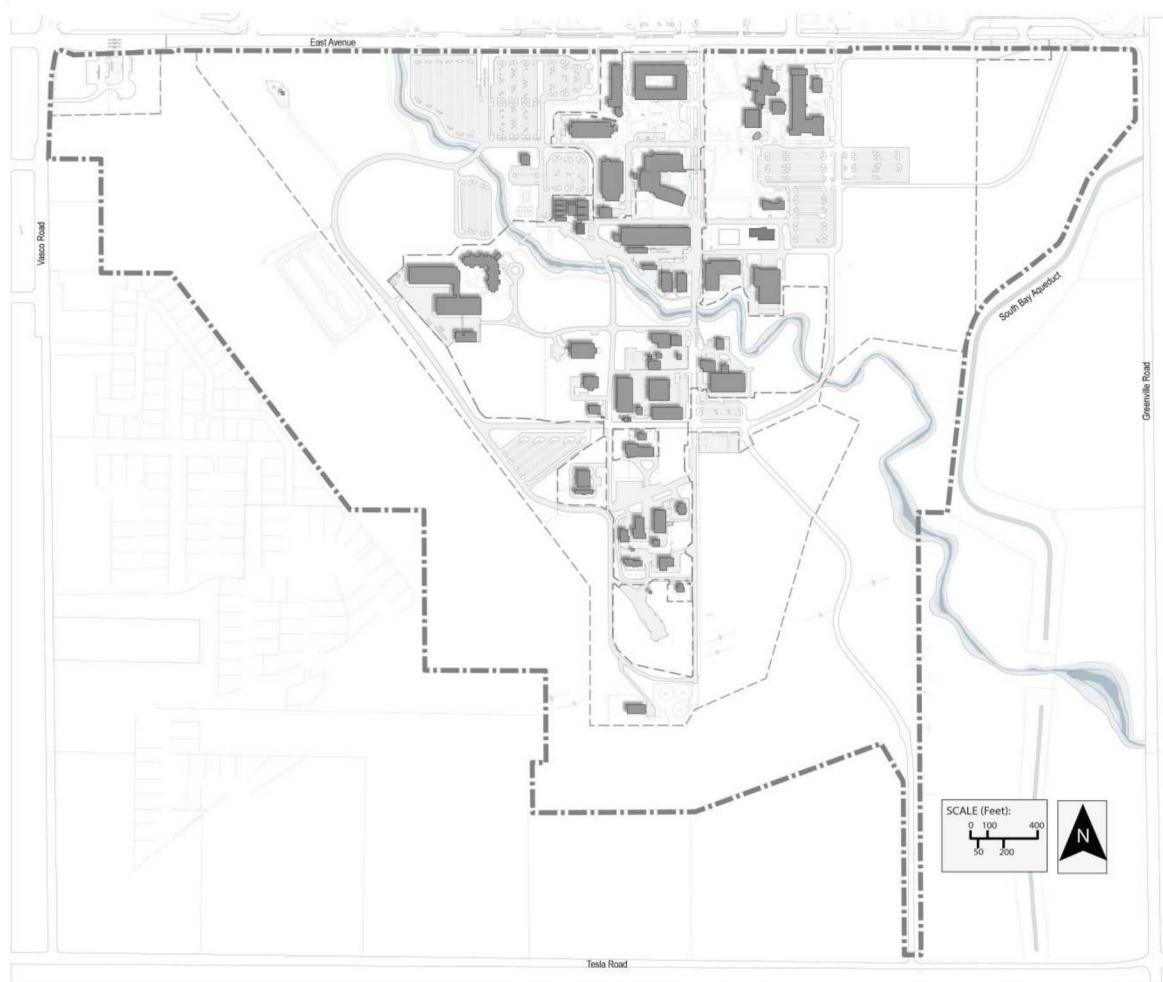


Figure 2-2 SNL/CA Site Map

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 2017, there were 1,396 personnel (employees and on-site contractors) working at SNL/CA, an increase of 130 from 2016.

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.

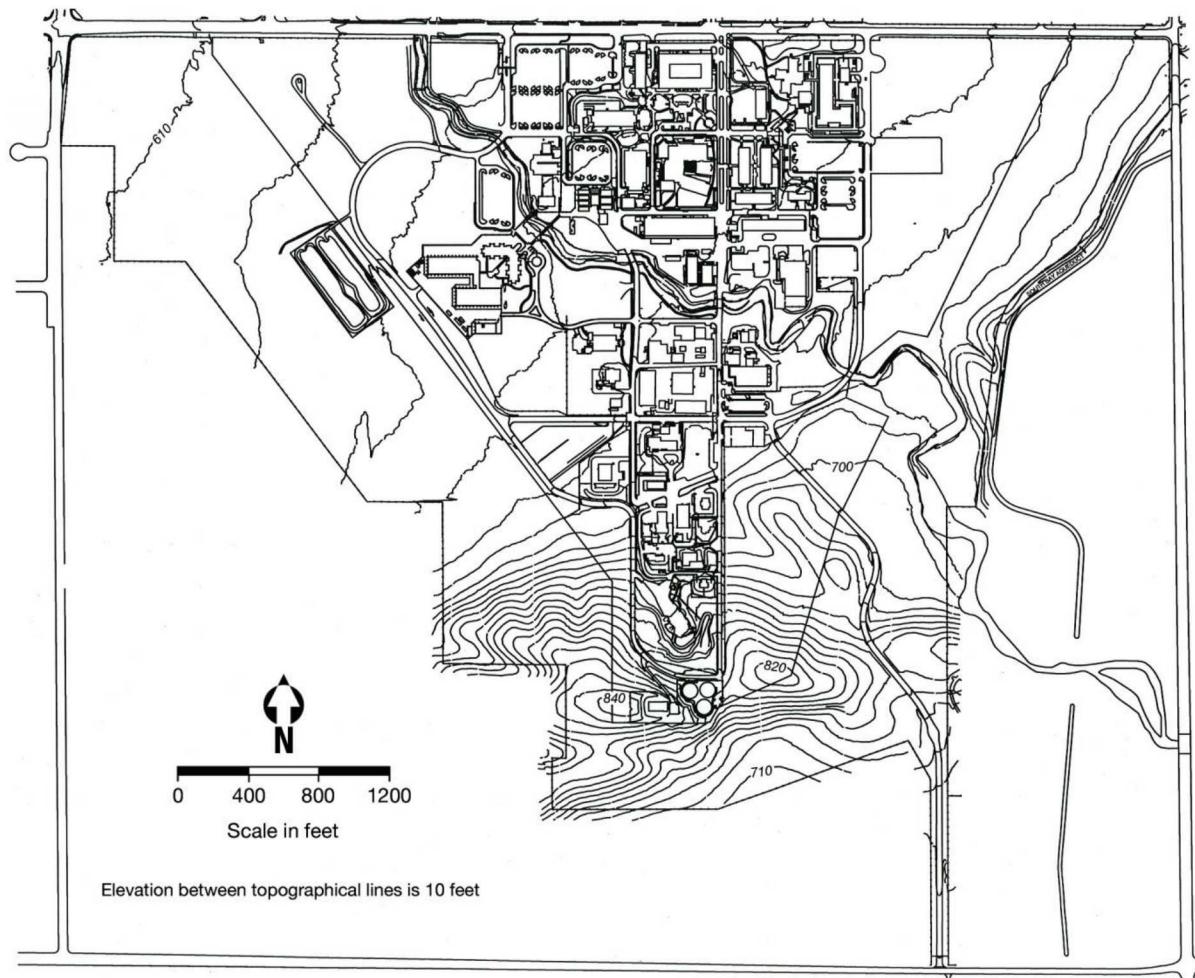


Figure 2-3 SNL/CA Topography

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. The last significant microseismicity in the vicinity was recorded on the Verona fault in 1980. These faults are shown on Figure 2-4.

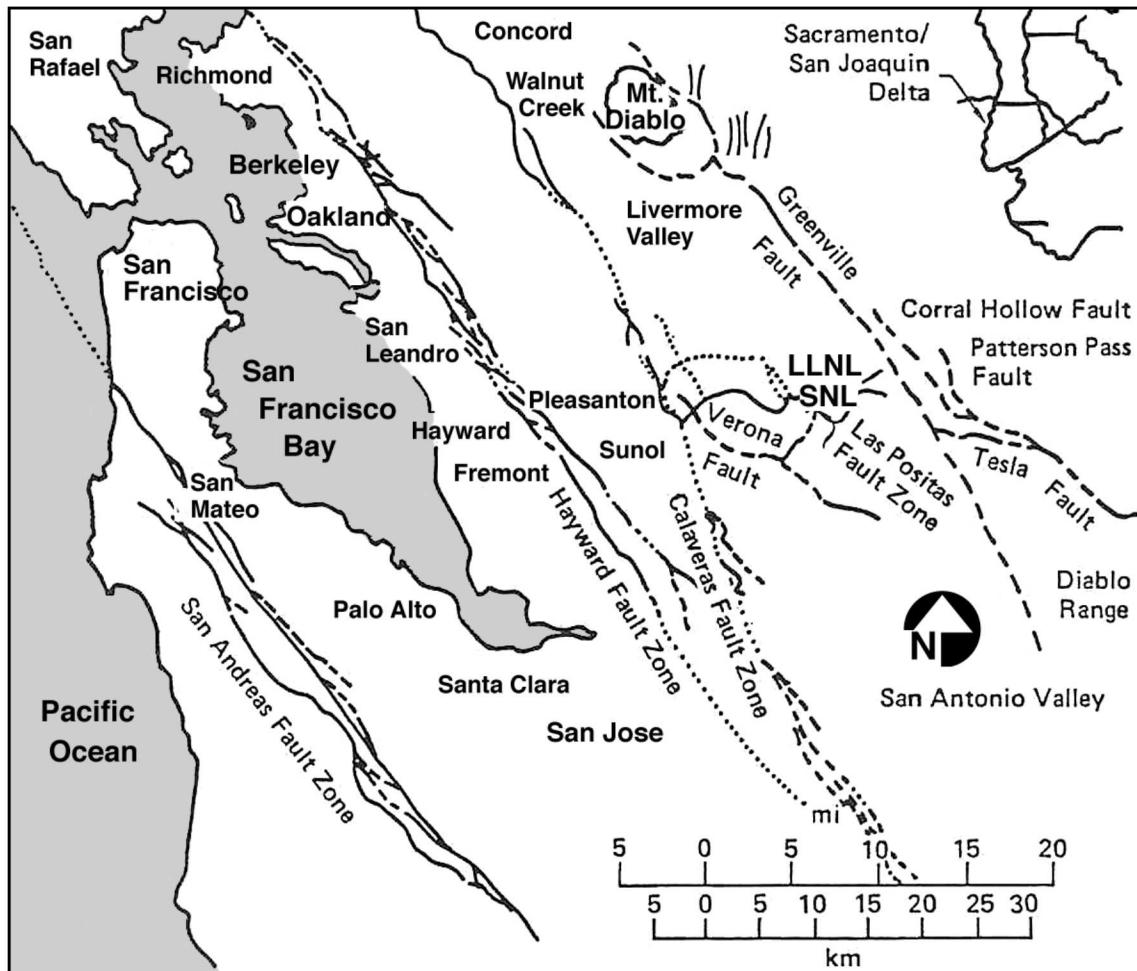


Figure 2-4 Regional Earthquake Faults

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. LLNL meters the water use at SNL/CA as the water enters the site. In fiscal year 2017, 37 million gallons of water were used at SNL/CA, a decrease of 9 percent (4.0 million gallons) from water used in fiscal year 2016. (See discussion in Section 4.2.2). The site discharged approximately 31 million gallons of wastewater during the fiscal year. Due to the failure of a wastewater flow monitor early in the year, the amount of wastewater discharges is not accurate. The meter was repaired in May 2017. 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. Arroyo Seco, an 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 2017 was obtained from a nearby meteorological tower located at LLNL (LLNL 2017). The annual rainfall for 2017 was 18.67 inches. Temperatures in 2017 ranged from 26.8 to 107.3° Fahrenheit. Average annual rainfall in the Livermore area over the last five years was 11.98 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. Figure 2-5 depicts the habitat types. No threatened, endangered, proposed, or candidate plant species are present on-site.

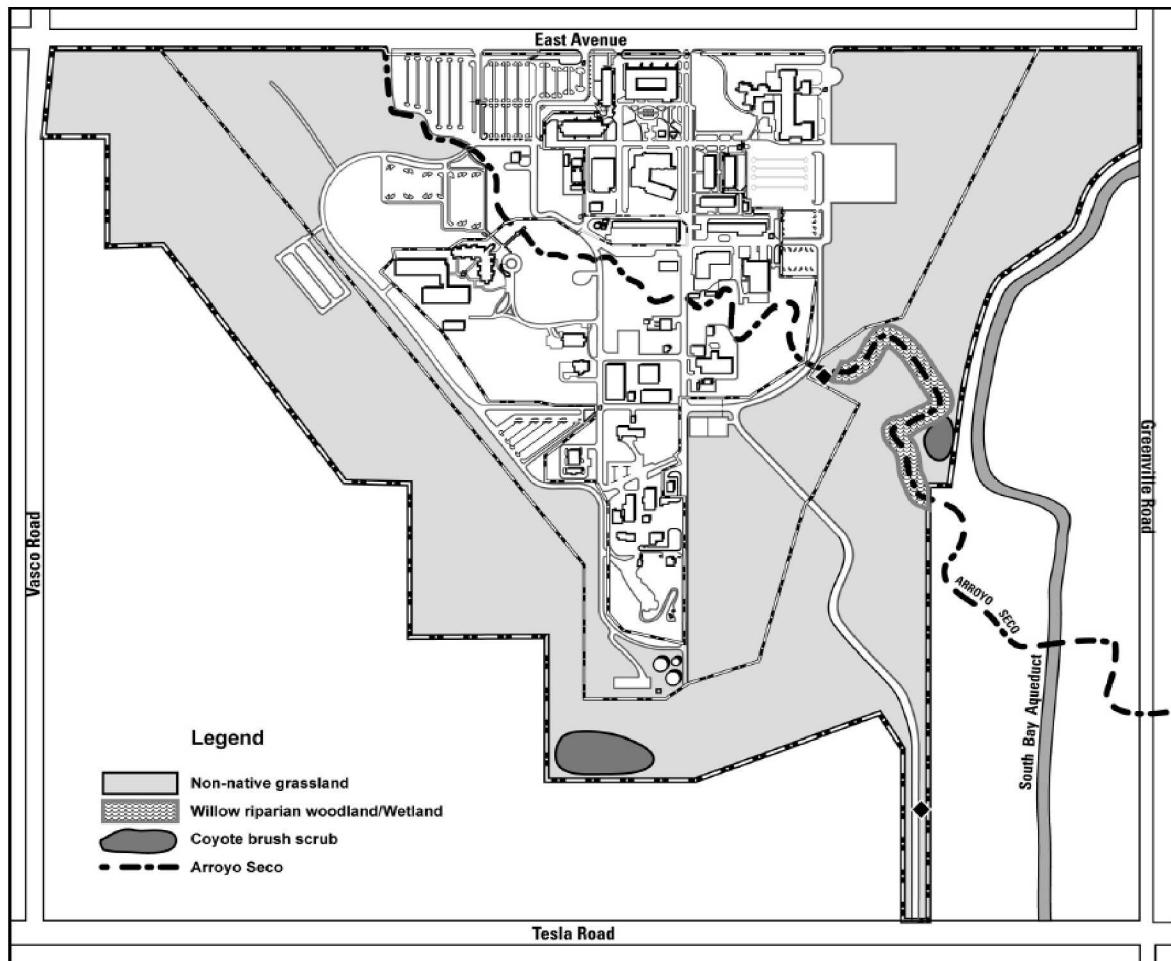


Figure 2-5 Habitat at SNL/CA

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 2017.

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. SNL/CA personnel monitor for California red-legged frogs on-site annually, and none were observed in 2017.

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>Psaltriparus 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 summarizes SNL/CA's compliance status with major environmental requirements for calendar year 2017, 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. DOE Order 436.1 is a requirement of the NTESS M&O Contract. It requires compliance with requirements of the Emergency Planning and Community Right-to-Know Act, establishment and implementation of a site sustainability plan (SSP), and an EMS that is certified to or conforms with the International Organization for Standardization (ISO) 14001.

A multi-site EMS certification to the ISO 14001 standard covers the primary locations of SNL/CA and SNL/NM with all remaining locations following the management approach, as verified by internal assessments conducted every three years. The SNL/CA site was transferred to the multi-site certification in May 2015. Results from a May 2017 surveillance audit at SNL/CA showed no non-conformances to the ISO standard at the 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 2017, site personnel provided input to the reports identified above and participated in development of the corporate SSP for fiscal year 2018.

Section 3.6.1 presents information on compliance with requirements of the Emergency Planning and Community Right-to-Know Act. 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 2017, 84 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 and nine registered sources (boilers) for the 2016/2017 and 2017/2018 permitting periods¹. Table 3-5 (Section 3.15) 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 2017, 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 2017.

² In 2002, when the consultation process began, the Sandia site was within designated critical habitat for the California red-legged frog. In November 2002, the designation was overturned (U.S. District Court 2002), and in April 2004, the USFWS re-issued proposed critical habitat that included the Sandia site (USFWS 2004). However, in November 2005, the USFWS issued a revised designation (USFWS 2005), and a final rule in April 2006 (USFWS 2006). The scientific integrity of the 2006 rule was questioned resulting in another revision to critical habitat. The USFWS issued a new designation in March 2010. The Sandia site is not included in the final determination of critical habitat for the California red-legged frog.

3.4.2 Interim Protections for California Red-legged Frogs

In October 2006, interim restrictions on pesticide use went into effect to protect the California red-legged frog. The restrictions are the result of a settlement agreement between the EPA and the Center for Biological Diversity outlined in a Stipulated Injunction and Order (US District Court 2006). The agreement 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, and it restricts 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 2017, 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 2017, 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 2017, 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 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 2017, approximately 100 trees were replanted at ASIP Area 17.



ASIP Area 17 Before Restoration



ASIP Area 17 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 2017, 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, clean-up, 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 2017, there were no releases of hazardous substances on-site 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 (RWQCB), San Francisco Bay Region. The RWQCB issues site clean-up orders under 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. Chapter 5, Environmental Monitoring presents sampling results.

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 EPCRA 302-303 and 311-312's federal, state, and local reporting requirements. To meet Section 313 of EPCRA, an annual report is submitted to EPA, and, if required a Section 304 report is also submitted. Table 3-1 presents applicable EPCRA reporting requirements for 2017.

Table 3-1 Status of EPCRA Reporting for SNL/CA, 2017

EPCRA Section	Description of Reporting	Required in 2017
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. The bill 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, §§ 2729-2732. In compliance with California requirements, a Hazardous Material Business Plan is submitted annually 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 has 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.

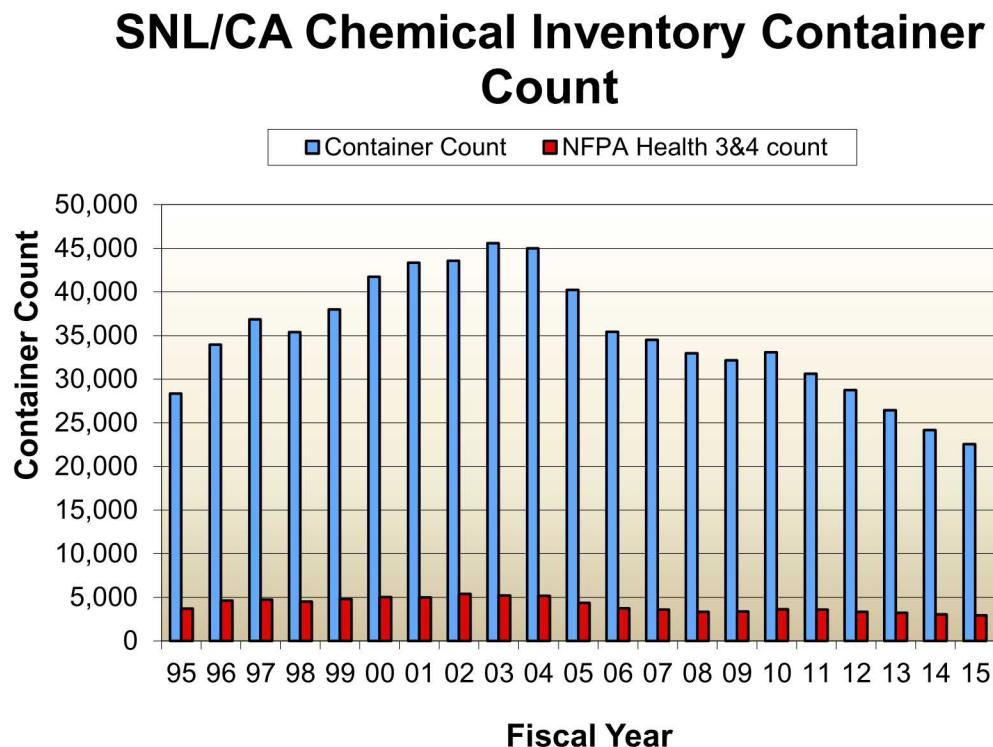


Figure 3-1 SNL/CA Hazardous Material Inventory

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. On September 21, 2017, SNL/CA removed the one UST on site in accordance with California requirements and replaced it with an aboveground storage tank (AST). The UST was removed from the Hazardous Material Business Plan described in section 3.6.2 and the permit to operate from the Livermore-Pleasanton Fire Department is closed.

Petroleum products stored in ASTs 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. Eighteen ASTs and one portable fuel tank are managed and operated at SNL/CA, ranging in size from 55 to 1000 gallons. SNL/CA personal also manage approximately twenty 55-gallon drums containing petroleum. Each year, the tanks and drums

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 2017c). At SNL/CA, the only TSCA-regulated chemicals imported to or exported from the site are for research and development purposes and 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 2017, 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 FIFRA is pesticide use. A licensed commercial pesticide applicator conducts this activity under a service contract. SNL/CA's contract requirements include a site-specific environmental specification. The service contractor manages all empty pesticide containers and removes them 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 hazardous waste reduction and elimination as national policy, and it 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 is submitted to the California Department of Toxic Substances Control (DTSC) by February 28 every year.

3.7.1 Pollution Prevention Goals of Site Sustainability Plan

The corporate SSP establishes a commitment to meet pollution prevention goals identified in DOE's Strategic Sustainability Performance Plan and Executive Order 13693. In 2017, Sandia Personnel continued to implement SNL/CA site-specific activities to support these goals through:

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

P2 Goals

- Divert 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 SSP team on November 15, 2017, for submittal to NNSA/SFO on December 12, 2017. Chapter 4 provides additional information about pollution prevention activities.

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: Lawrence Livermore National Laboratory (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 that 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 2017 (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 2017 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 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 first Notice of Deficiency (NOD) was issued by DTSC in June 2017. A NOD is essentially a request from DTSC for additional information. SNL/CA personnel submitted a formal response to the NOD in September 2017. The 2nd NOD was issued on January 22, 2018. SNL/CA personnel submitted a formal response to the 2nd NOD on March 23, 2018. SNL/CA expects DTSC to issue the new permit by June 2018. 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 that is 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.

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 Sandia National Laboratories, New Mexico (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. The increase in CY2017 shipment was a result of a combined shipment from CY2016 and CY2017. In addition, the wastewater from LECS was managed and shipped as a radioactive waste in CY2017. Figure 3.2 shows the quantity of total radioactive waste shipped from SNL/CA since 2008.

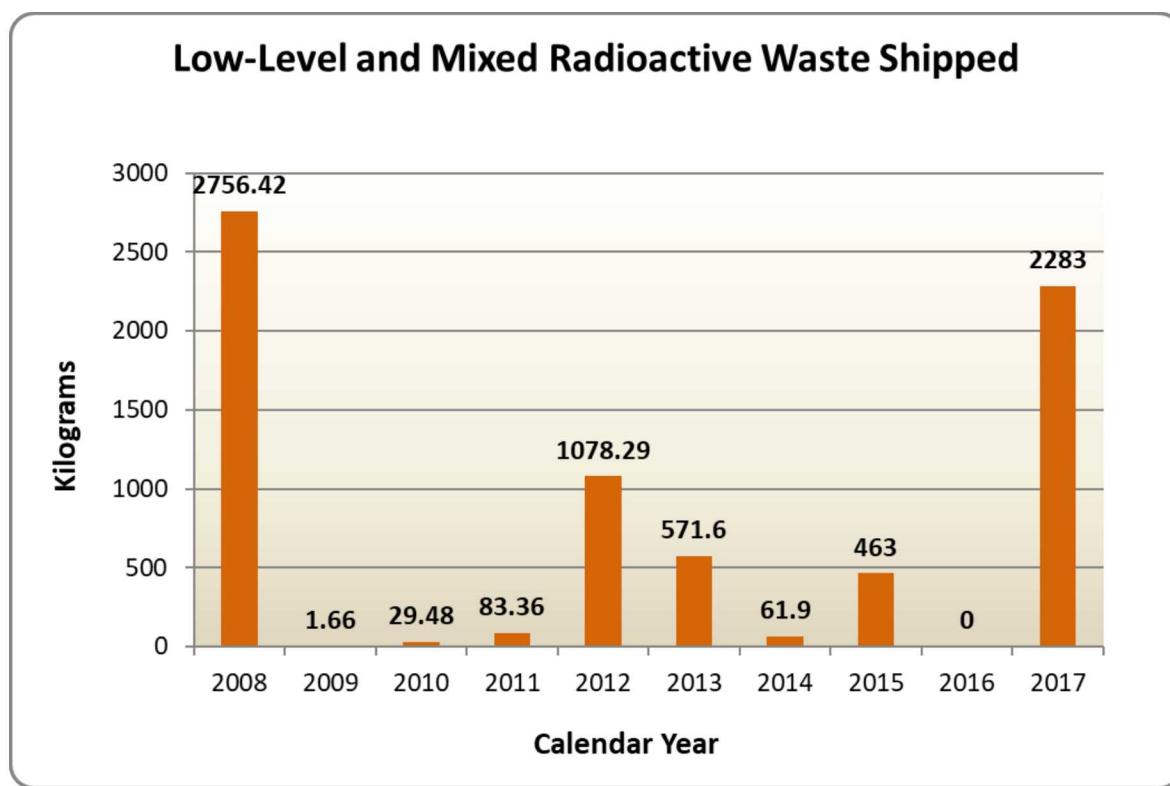


Figure 3-2 Radioactive Waste Shipped from SNL/CA

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 2017.

Table 3-2 Order 458.1 Compliance Summary, 2017

Order 458.1 Requirement	SNL/CA 2017 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. SNL/CA personnel completed an internal evaluation of the program in 2011 and 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 2017. The average annual gamma radiation measurement at the site perimeter in FY 2017 was 46 mrem and well below the total effective dose of 100 mrem.
Request authorization for temporary dose limits.	There were no special circumstances in 2017 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 2017; 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. 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 2017. Radioactive releases to the sanitary sewer above DOE Order 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.

Order 458.1 Requirement	SNL/CA 2017 Summary
Protect biota.	ES&H policy, processes, procedures, and management systems are incorporated into site operations to ensure proper handling and disposal of radioactive materials offsite at approved facilities. SNL/CA has no operations requiring biota monitoring.
Control the release of property with residual radioactivity.	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. Under 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 2017, 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. SNL/CA personnel complete process knowledge evaluations 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 2017.
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 2017 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 no permit exceedances in 2017 at the sanitary sewer outfall. For routine wastewater monitoring information, see Section 5.2.1.

There are three categorical processes at the SNL/CA site that are subject to EPA's pretreatment standards: one metal finishing operation, a robotic spray-paint booth, and a semiconductor manufacturing operation. The metal finishing operation is a closed-loop process and does 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 2017.

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 second year of monitoring under the new permit (2015-2016) showed exceedances of the Numeric Action Levels for iron and aluminum. SNL/CA has entered Level 2 status based on these levels. Section 5.1 presents the sampling results and compliance with the Industrial General Permit.

Under Section 438 of the Energy Independence and Security Act of 2007, federal agencies are required to reduce storm water runoff from development and redevelopment projects. In 2017, there were no projects undertaken that required action.

3.11 Emergent Contaminants

In 2003, the San Francisco Bay Regional Water Quality Control Board requested that SNL/CA personnel review the past and current use of certain chemicals of emerging regulatory concern. SNL/CA personnel were requested to undertake ground water sampling and analysis for these chemicals. The chemicals for which data was requested were Perchlorate, N-Nitrosodimethylamine (NDMA), 1,4-Dioxane, 1,2,3- Trichloropropane, hexavalent Chromium, and polybrominated diphenylether.

Investigation by SNL/CA personnel indicated that if these chemicals had been used at SNL/CA, they had been used in small quantities. Groundwater sampling and analyses were undertaken during 2004. The only chemical of concern detected was hexavalent chromium. The occurrence of naturally-occurring hexavalent chromium throughout the Livermore Valley has been well documented, and not deemed to have been caused by SNL/CA operations.

3.12 Adapting to Climate Change

In FY 2017, SNL personnel conducted a Vulnerability Assessment to assess the potential impact to SNL's current and planned facilities and mission within the context of a changing physical environment. Table 3-3 lists SNL/CA's climate stressors as identified in the assessment.

Currently, there are no formalized activities to specifically address climate impacts to the mission, operations, or people at SNL/CA.

Table 3-3 SNL/CA Climate Stressors

Area/Site/Program	Climate Stressors	Climate Stressor Likelihood	Impact on Mission Objective	Effect on Area/Site/Program
Main Campus	Extreme Heat (Electricity Usage)	Low	Medium	Programs may be affected if there are electricity shortages due to high heat.
Main Campus	Drought	Very High	Medium	If California experiences water shortages due to extended drought, SNL/CA's ability to perform programs or accept new programs may be affected.
Main Campus	Extreme Heat Wave	Very High	High	Extended high temperatures limit the amount of time Members of the Workforce can work outdoors, especially in personal protective equipment (PPE). Heat waves also stress the electric grid.
Outdoor Projects	Heat Waves	Very High	Very High	Any personnel working outdoors during extended heat waves, especially those in PPE, will have reduced productivity due to necessary health safety breaks.
Outdoor Projects	Wildfire	Medium	High	Wildfires would interrupt program operation and keep Members of the Workforce from job sites.

3.13 Audits, Assessments, and Inspections

Table 3-4 provides a list of environmental audits, assessments, and/or inspections conducted at SNL/CA during 2017.

Table 3-4 SNL/CA Audits, Assessments, and Inspections, 2017

Title	Area of Focus	Date Conducted	Results
Livermore-Pleasanton Fire Department	Underground Storage Tanks	March 16, 2017	No issues
Third Party EMS Surveillance Audit (NQA)	Conformance with the ISO 14001:2004 EMS standard	May 8–10, 2017	No issues
Livermore-Pleasanton Fire Department	Tiered permits, hazardous waste generator requirements, hazardous materials business plan, SB-14, SPCC compliance	May 16–18, 2017	No issues
Department of Toxic Substances Control (DTSC)	Hazardous Waste Facilities	May 22–23, 2017	No issues
Alameda County Office of Solid/Medical Waste Management	Medical Waste Management	August 22, 2017	No issues
City of Livermore, Water Resources Division Inspections	Wastewater discharges and categorical process laboratories	November 13–14, 2017	No issues
Alameda County Inspection	Erosion at the Navy Landfill site	December 20, 2017	No issues

3.14 Environmental Occurrences

An environmental occurrence is an event that meets the occurrence criteria established in DOE Order 232.2, Admin Change 1 (2014). In 2017, there were no environmental occurrences from SNL/CA operations.

3.15 Permits

Table 3-5 lists environmental permits and clean-up orders held for SNL/CA operations. Additional information is provided in previous sections under the related program or regulation.

Table 3-5 SNL/CA Environmental Permits and Orders, 2017

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 material	Controlled Substances Registration	March 3, 2017- February 28, 2018	Controlled Substances Act	US DOJ/Drug Enforcement Agency
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 10 – August 9, annually	California Health and Safety Code	Alameda County Dept. of Environmental Health
Medical waste	Small Quantity Generator without On-site Treatment	April 12 – April 11, 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
Aboveground storage tanks	Storage statement	January 1 – December 31 Required in CERS	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 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 2017. Emission sources for the 2017/2018 period include one non-retail gasoline dispensing facility, two miscellaneous sources (site-wide wipe-cleaning and adhesives source for maintenance activities), five emergency generators, and one spray paint booth used for research activities.

^c Registered sources include nine 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 presented in 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 are:

- Air Quality;
- Environmental Monitoring and Ecology;
- Environmental Planning;
- Pollution Prevention and Waste Minimization; and
- 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 help reduce the sites' environmental impacts and increase their 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 2017 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 representative.

4.1.1 SNL/CA EMS Objectives and Targets

In fiscal year 2017, four EMS objectives and four targets were established to support environmental improvement at SNL/CA. Site personnel met three of the four targets in 2017 and made progress on meeting the other. Table 4-1 summarizes EMS objectives, targets, and results for fiscal year 2017.

Table 4-1 SNL/CA EMS Objectives and Targets, FY 2017

Environmental Aspect	Objective	Target	FY 2017 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.	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 3 Target Not Met – Waste stream evaluations planned for FY 2017 were delayed. Completion is scheduled for the first quarter of FY18. Year 4 evaluations are on track for completion to achieve the target of 100% over a four-year period.
Water Discharges	Control sediment entering the storm drain system in order to return to Baseline Status	Implement storm water pollution controls as outlined in the Level 1 Exceedance Response Action Report	Target Met – Compost filter rolls were installed at two drainage areas and sediment inserts were installed in all appropriate catch basins during the first quarter of FY17.
Natural Resource Use	Establish long-term / sustainable water use in landscaped areas	Implement five landscape transition projects by 2020	Year 2 Target Met – Landscape designs have been completed for four locations and two areas have been converted to low-water use landscape. No additional projects were completed in FY17.

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 25 percent in goal-subject buildings by the end of FY 2025 from an FY 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. As shown, energy intensity decreased in 2017 compared to 2016. Personnel will continue to identify energy reduction opportunities at SNL/CA to support this target in future years.

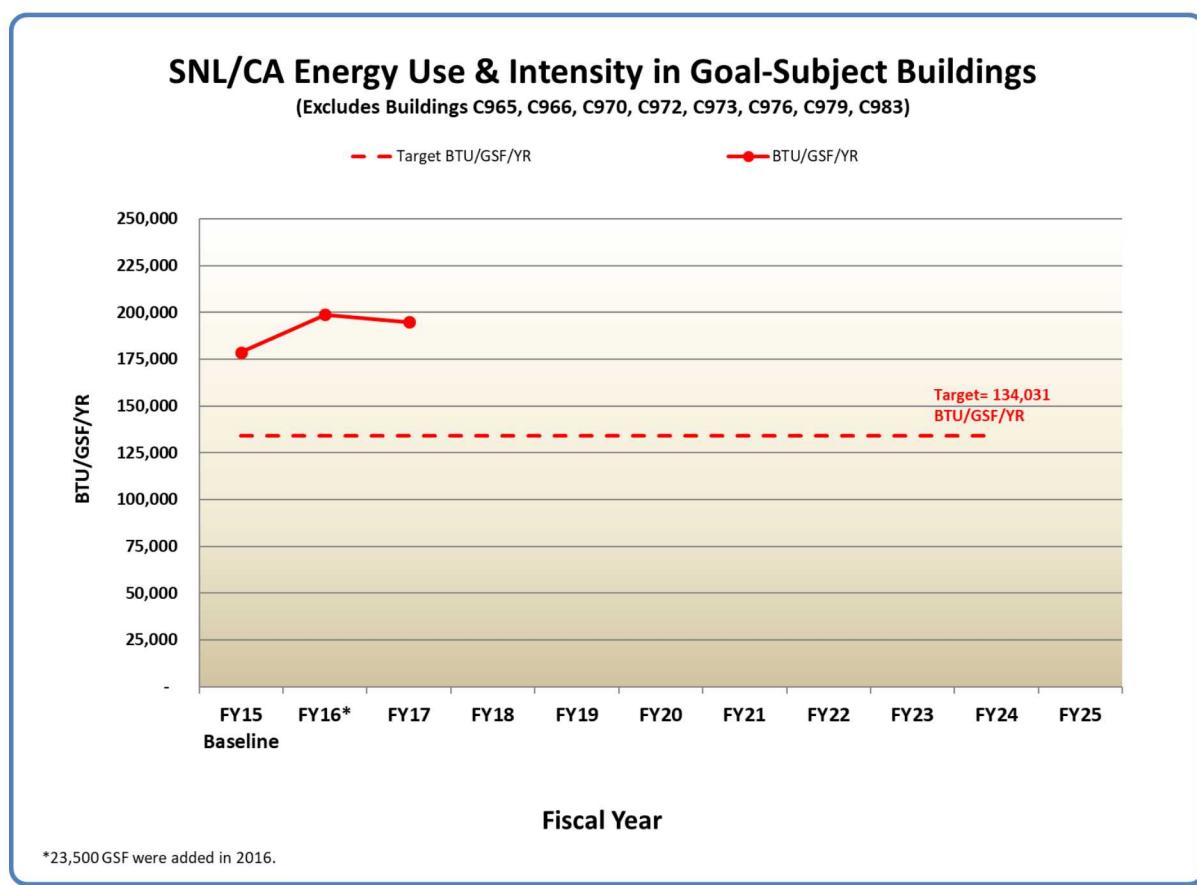


Figure 4-1 SNL/CA Energy Use Intensity

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 2017 was a 36 percent reduction by FY 2025, using FY 2007 data as a baseline. The 36 percent reduction goal was met in 2016 and maintained in 2017.

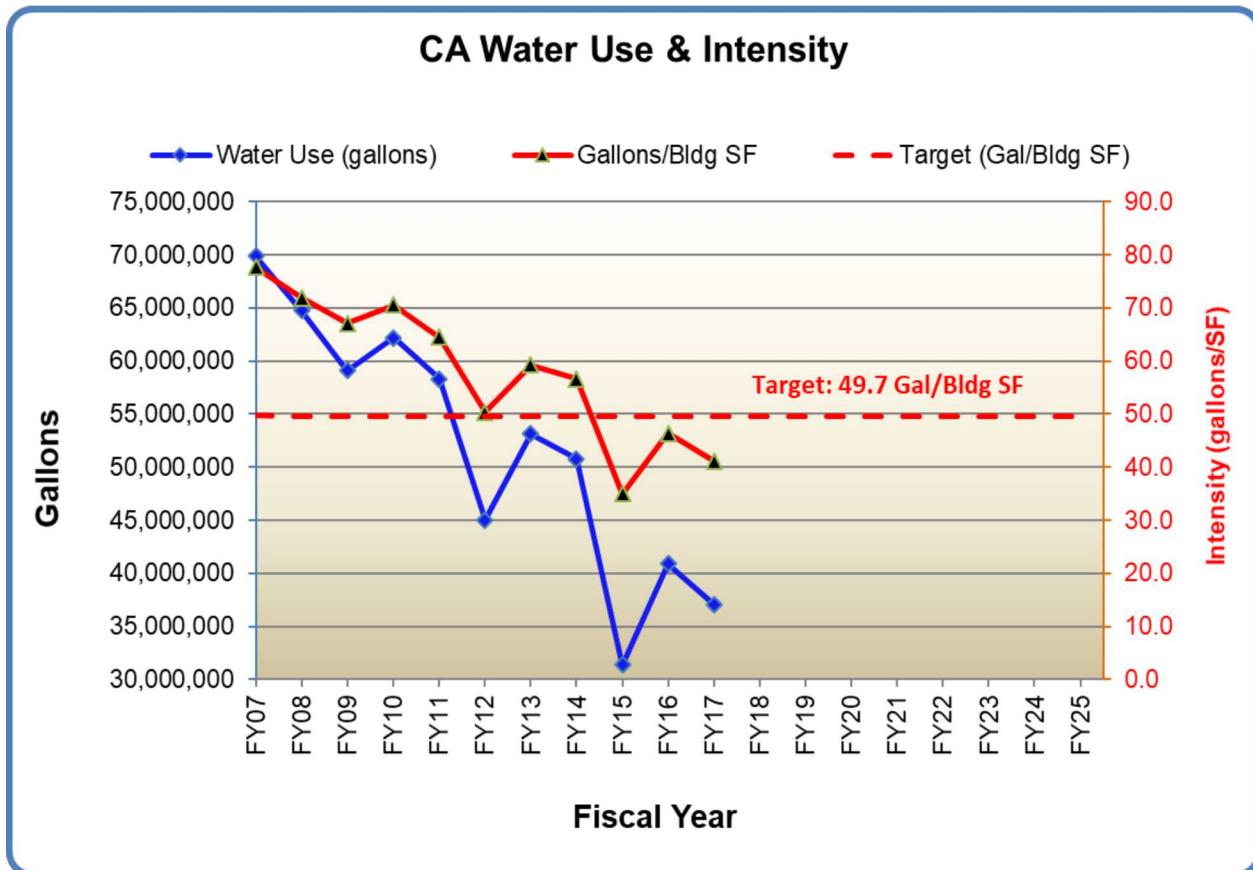


Figure 4-2 SNL/CA Water Use Intensity

4.2.3 Greenhouse Gas Reduction

Targets for air emissions in effect for 2017 include reducing scope 1 and 2 greenhouse gas (GHG) emissions by 50 percent and reducing scope 3 GHG emissions by 25 percent by FY 2025 from an FY 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) wastewater 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 52 percent. However, scope 3 GHG emissions increased by 23 percent relative to the 2008 baseline. This increase is likely a result of additional employee commuting and business travel.

In 2017, SNL/CA personnel completed the following activities to support the corporate targets:

- replaced five Sulfur Hexafluoride (SF6) gas insulated switchgear, bringing the total replaced to date to 16;
- 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 GHG usage and emissions, 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, 2017

Greenhouse Gas	Emissions
SF6 Emissions from Gas Insulated Switchgear	4.4 % leak rate (9.4 lbs of SF6)*
PFC for Semiconductor Operations	0 kg of SF6
SF6 for Research Operations	0 kg of SF6
Refrigerants	25 lbs of R-123

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

There is a margin of error in quantifying the amount of SF6 removed from 7 inactive switchgear (i.e., the Disbursements of SF6 factor).

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 (including those from DOE), notices of violation, and other environmental occurrences in the last ten years. The corporate goal is zero findings and zero violations. There were no findings, self-reported violations, or notices of violation from regulatory audits in 2017. 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 2017 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. Sandia Corporation was the management and operating (M&O) contractor during the reporting period from October 1, 2016, through April 30, 2017, and received a rating of very good for this performance objective. Reporting for remainder of FY 2017 will be incorporated into the NTESS FY 2017-2018 Performance Evaluation Report.

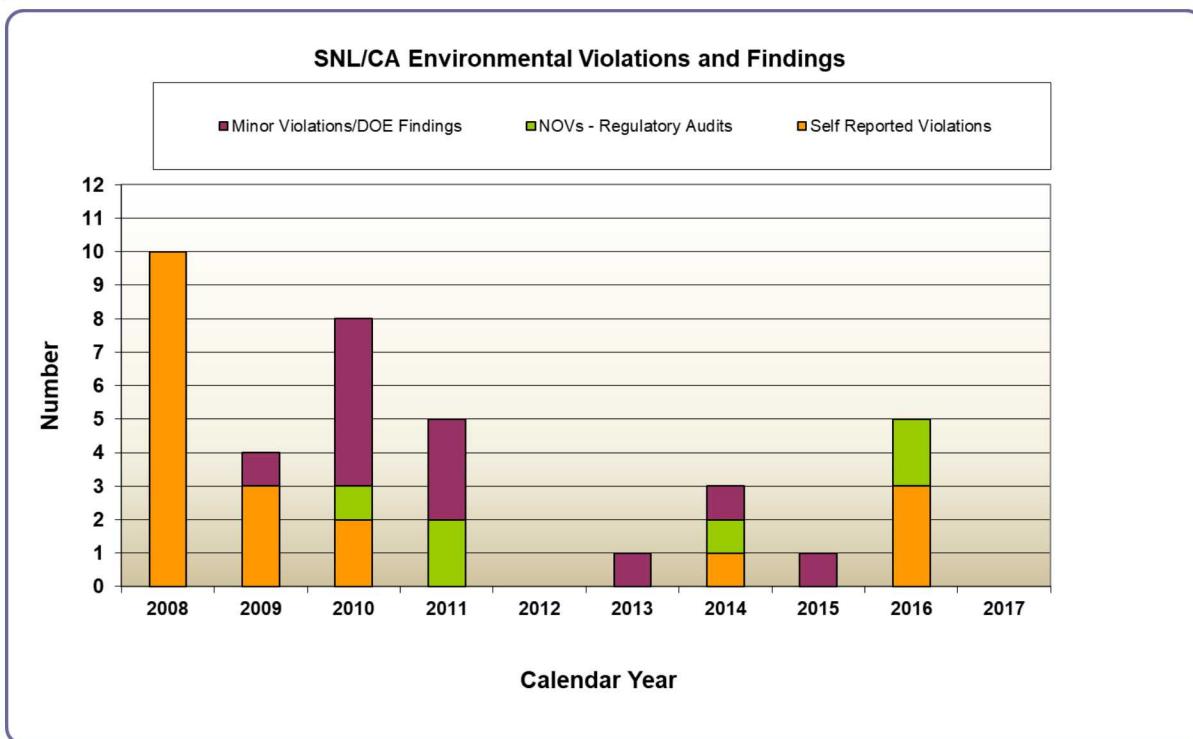


Figure 4-3 Measurement of Excellence in Environmental Management

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. Program staff manage the air permit process, from the initial steps of preparing permit applications through implementing 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 2017 support the state's endeavors through monitoring, compliance activities, and annual reporting. The Air Quality Program's additional highlights for 2017 are listed below.

- Completed and submitted the BAAQMD Annual Update Package (supporting documentation and data for renewal of BAAQMD Permit-To-Operate).
- Met all regulatory report deadlines in 2017, submitting eight reports on schedule.

4.5 Environmental Monitoring and Ecology Program

The Environmental Monitoring and Ecology staff routinely monitor 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. This section presents general monitoring data for the Environmental Monitoring and Ecology Program. Chapter 5 presents detailed monitoring activities and sample results.

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. The ten-year period ends in July 2018 but a request for an extension was submitted. 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. Under the ASIP, 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 2017 was approximately 31 million gallons, representing a 164% percent increase from 2016. Wastewater discharges typically fluctuate year-to-year in response to changes in site operations. In 2017, the failure in a wastewater flow monitor caused an inaccurate reading of the amount of sanitary sewer discharge. As a result, a noticeable increase in wastewater discharge was observed.

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 2007. 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 2017 included gasoline (1 liter), diesel (1 gallon) and six equipment leaks (approximately 5 gallons). None of the chemical spills shown in Figure 4-4 resulted in releases to groundwater or required environmental remediation.

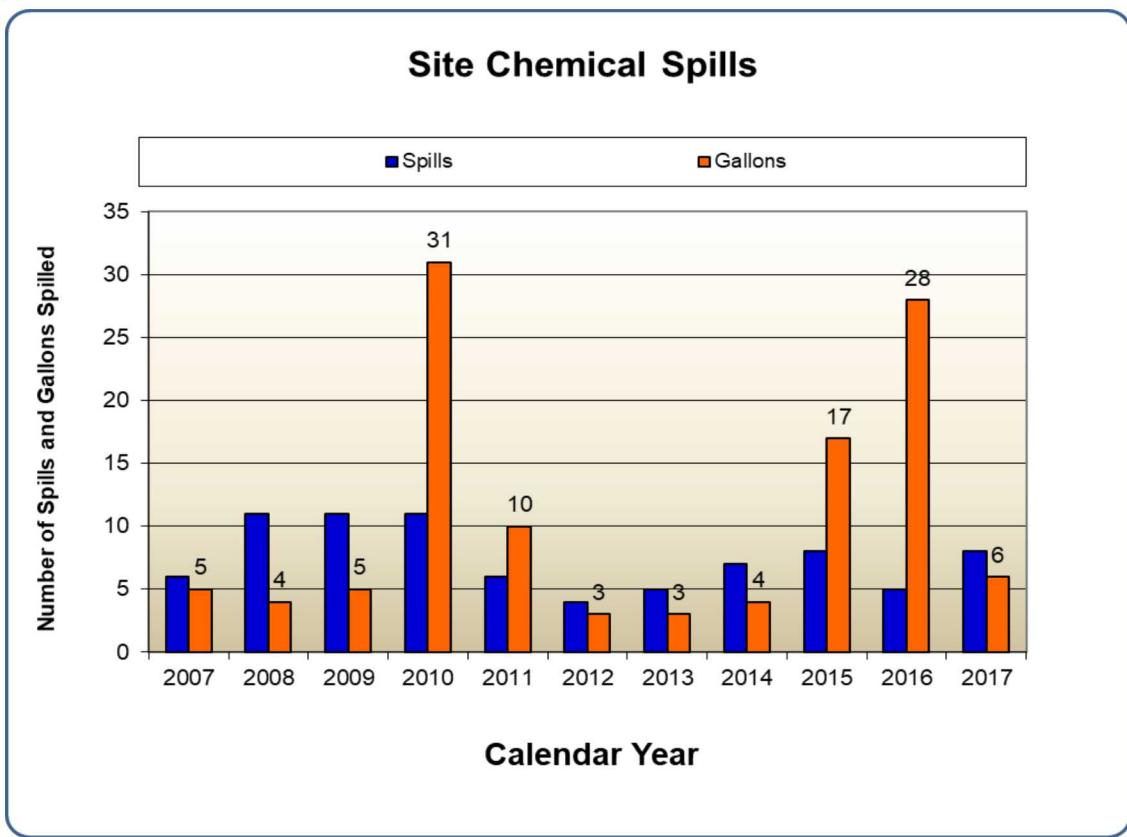


Figure 4-4 SNL/CA Chemical Spills

SNL/CA personnel are also required to report sanitary sewer overflows to the California State Water Resources Control Board. In 2017, there were no sanitary sewer overflows at SNL/CA.

4.6 Environmental Planning Program

The Environmental Planning Program focuses on integrating environmental considerations and initiatives into site planning and development. Program activities include site-wide environmental analyses and reporting and National Environmental Policy Act (NEPA) reviews. Each year, Environmental Planning staff compare 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 2017 comparison and an evaluation of results.

Table 4-4 Comparison of 2017 Operations with SWEA / SA Envelope

Activity / Unit	SWEA / SA Envelope (maximum operations)	Calendar Year 2017	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
	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, 2017 (C903 computational facility 8,364 sf; C926 office bldg. 19,247 sf)	No – a separate NEPA review was completed for C926 office building
New facilities		60,377 sf as of December 31, 2017	
Demolition	100,000 sf		Yes
Land Use			
		8 acres as of December 31, 2017	
Construction area	93 acres		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	80 cu yd	Yes
Soil managed on site	5000 cu yd/yr	<5000 cu yd	Yes
Backfill material brought on site	6000 cu yd/yr	<500 cu yd	Yes
Infrastructure			
Water use	91.8 million gal/yr	39.5 million gals	Yes
Sanitary sewer discharge	29.1 million gal/yr	28.6 million gals	Yes
Natural gas use	94 million cu ft/yr	40.6 million cu ft	Yes
Electricity use	48,800 MW hr/yr	33,974 MW hrs	Yes
Biological and Ecological Resources			
Construct flood plains in Arroyo Seco	1800 linear feet	612 linear feet as of December 31, 2017	Yes
Create riparian habitat	0.2 acres	5.64 acres as of December 31, 2017	No, Positive impact
Ground disturbance in / along arroyo	10 acres	< 6 acres as of December 31, 2017	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	14.2 million gals	Yes
Waste Generation			
Radioactive waste	8,811 kg/yr	34.01 kg	Yes
Hazardous waste	133,820 kg/yr	118,722 kg	Yes
Solid waste (non-hazardous, excludes construction debris)	378.7 metric tons/yr	100 metric tons ^{e,f}	Yes

Activity / Unit	SWEA / SA Envelope (maximum operations)	Calendar Year 2017	Site Operations Remain Within Impact Analysis of SWEA / SA
Proposed Action			
Transportation			
Hazardous / radioactive waste shipments	116 shipments/yr	60 shipments	Yes
Nonhazardous solid waste shipments to landfill	80 shipments/yr	1 equipment, 54 routine trash and 54 construction debris shipments	No
Air Emissions			
Total criteria pollutants	8,212 kg/yr	3517 kg ^a	Yes
Total air toxics	2,880.16 kg/yr	659 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	17 accident / injuries ^c	Yes
Lost work-day cases	19 cases annually ^c	5 cases ^c	Yes
Socioeconomics			
Employment	Up to 1931 persons annually	1396 persons ^d	Yes
Operating budget	\$316 million/yr	\$402 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. 2017 emissions are based on 2016 data.

^b Data provided for the 2016/2017 (9 permitted sources) and 2017/2018 (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 2017.

^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 FY 2015 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.

In 2017, Pollution Prevention staff conducted or supported the activities below.

- Continued working with corporate pollution prevention personnel to develop a zero waste plan for SNL/CA. In addition, program staff worked with a summer intern to prepare a white paper to recommend replacing paper towels with air handlers in high-traffic-use bathrooms.
- Hosted an Earth Day celebration that was attended by both Lawrence Livermore National Laboratory (LLNL) and SNL/CA staff. Attendees had an opportunity to recycle personal electronics, get information about recycling and composting.
- Met with the Bay Area DOE facilities LLNL, Lawrence Berkeley National Laboratory, and Stanford Linear Accelerator Center to discuss sustainability successes, challenges and opportunities to assist each other.
- Attended monthly meetings with LLNL staff to discuss opportunities to work together to combine resources to enhance Sustainability/Pollution Prevention Programs.
- Continued to work in unison with the Logistics organization to increase disposal at “waste-to-energy” facilities for products with no reuse or recycle options.

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 FY 2010. Solid waste diversion increased in 2017 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 2017. The quantity of non-hazardous solid waste sent to the landfill in 2017 decreased by 15 metric tons from 2016.

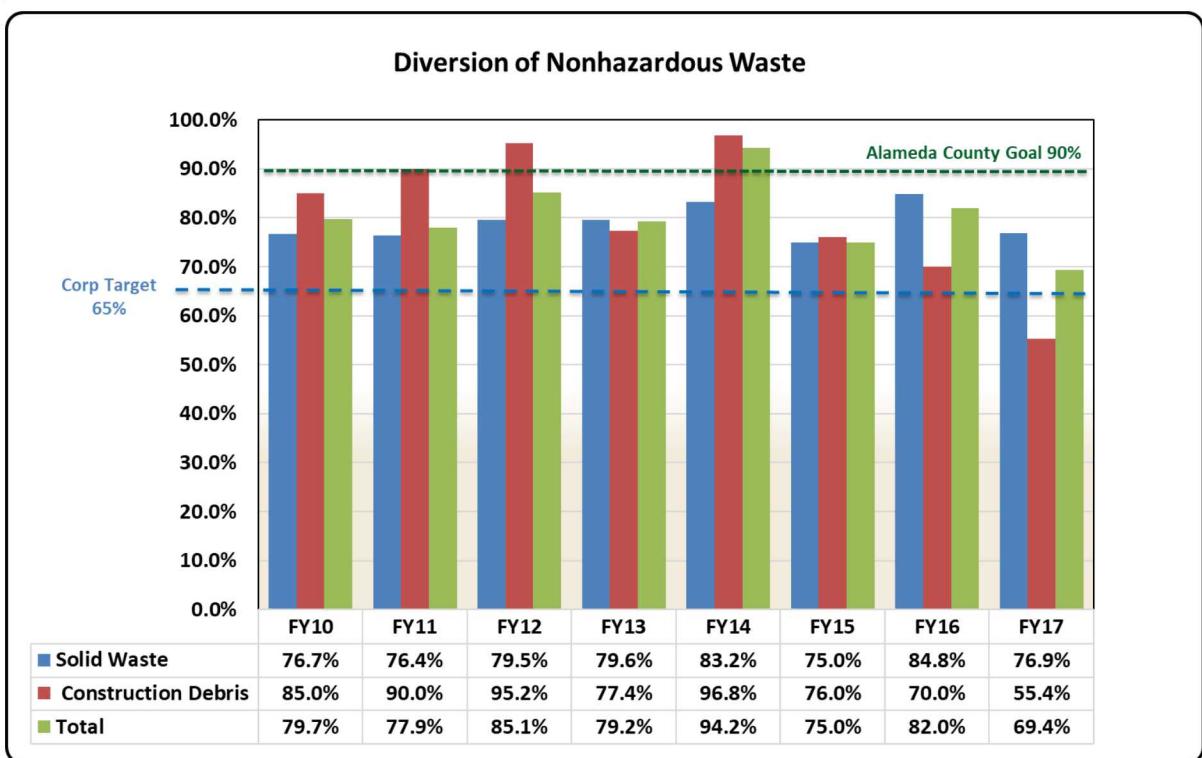


Figure 4-5 Solid Waste and Construction Debris Diverted From Landfill Disposal

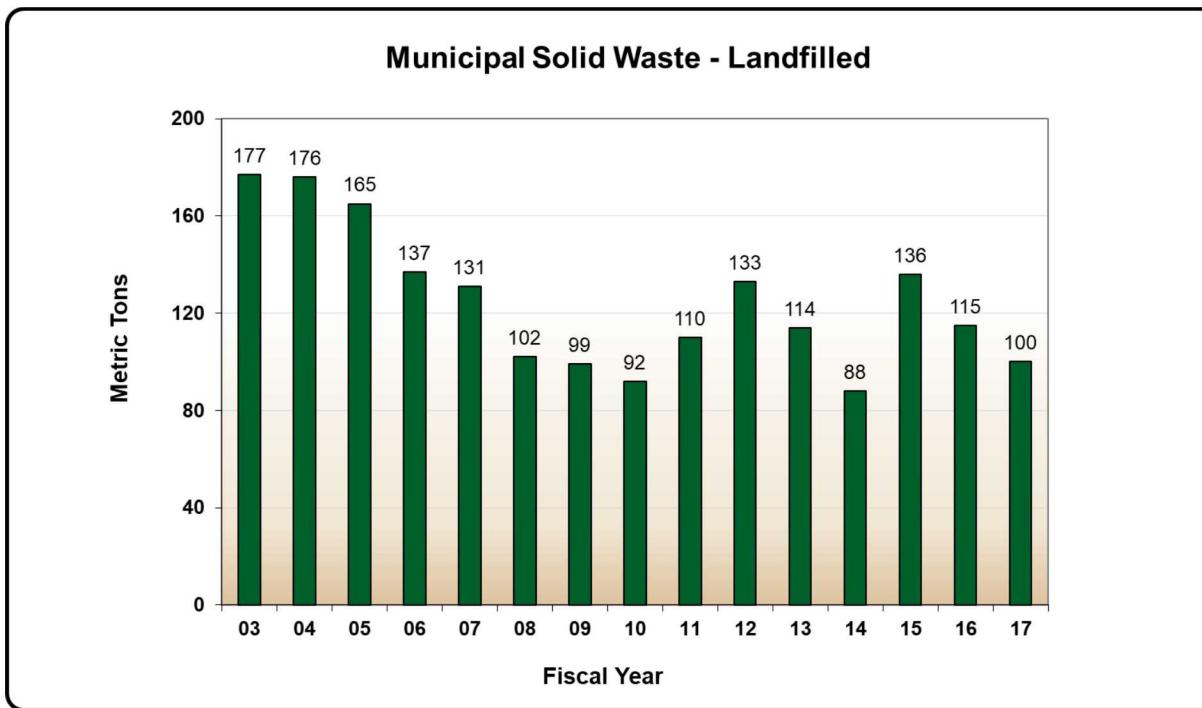


Figure 4-6 SNL/CA Landfill Waste

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 off-site 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 2017, 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 a 500-gallon diesel fuel concrete tank and soil from removal of an underground storage tank.
- Removal of outdated beryllium-contaminated equipment for disposal to a local facility.
- Continued work with SNL/NM personnel to roll out a new database for tracking the generation and management (cradle to grave) of hazardous waste.
- Coordinated disposition of multiple roll-off bins of asbestos/PCB contaminated metal from building retrofits.
- Coordinated removal of SF6 containing switchgear equipment.

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, respectively, over the last ten years. 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 2017 is attributed to construction and demolition activities and the removal of an underground storage tank and the contaminated fill. The radioactive waste generated in 2017 was from routine operations. Figure 3-2 depicts the radioactive waste shipped for the calendar year.

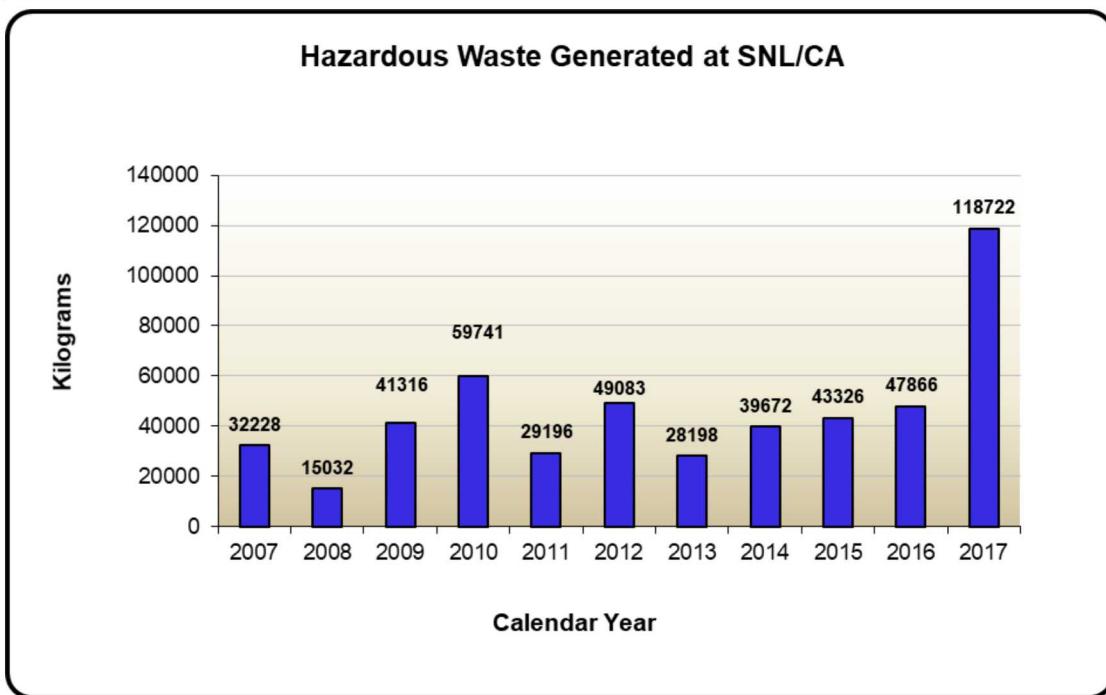


Figure 4-7 Hazardous Waste Generated at SNL/CA

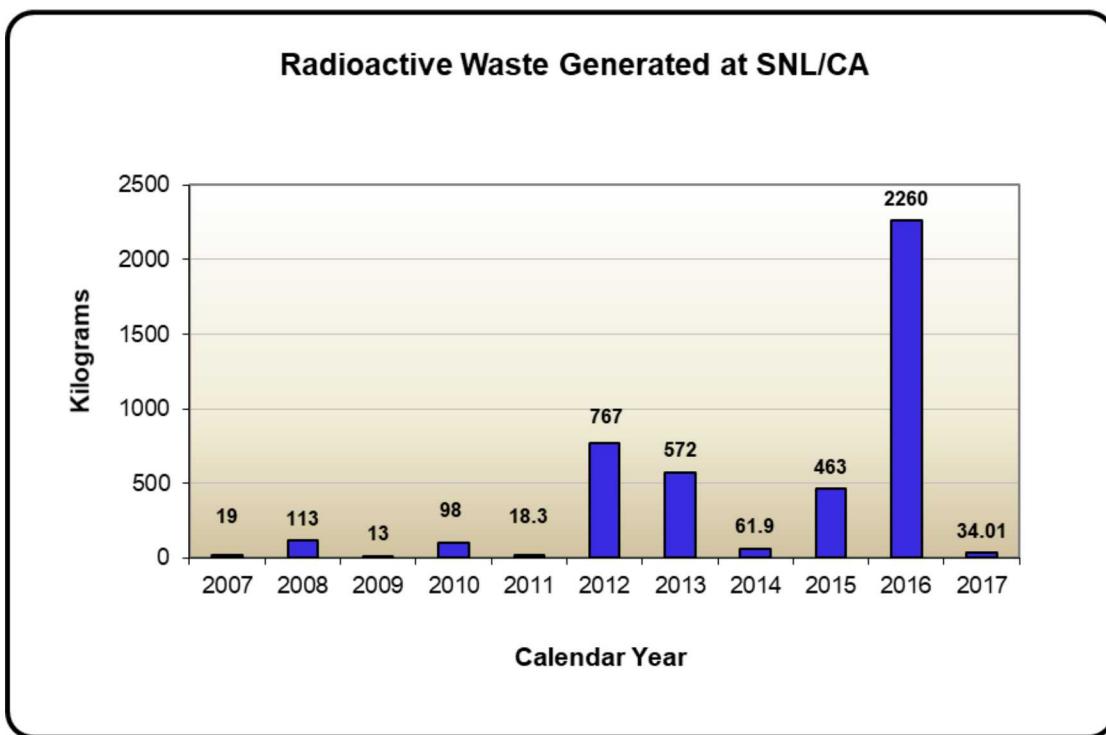


Figure 4-8 Radioactive Waste Generated at SNL/CA

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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 summarizes 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, SNL/CA personnel do maintain equipment and process usage records (e.g. hours of operation or quantity of solvents used) for emission. 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. SNL/CA personnel monitor ambient radiation. The results are presented in section 5.4.

In the past years, SNL/CA personnel conducted a biological dose assessment 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 biological dose assessment was discontinued in 2017 since SNL/CA has not had a routine source of tritium emissions since 1995.

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
- Phosphorus

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 2016/2017 reporting year (July 1 through June 30), SNL/CA personnel performed sampling at five locations and visual monitoring at 20 outfall locations. All the required samples were collected at each of the five locations during the year. Analytical results of storm water sampling for the 2016/2017 reporting year are presented in Table 5-1. These samples were collected under the provisions of the Industrial General Permit.

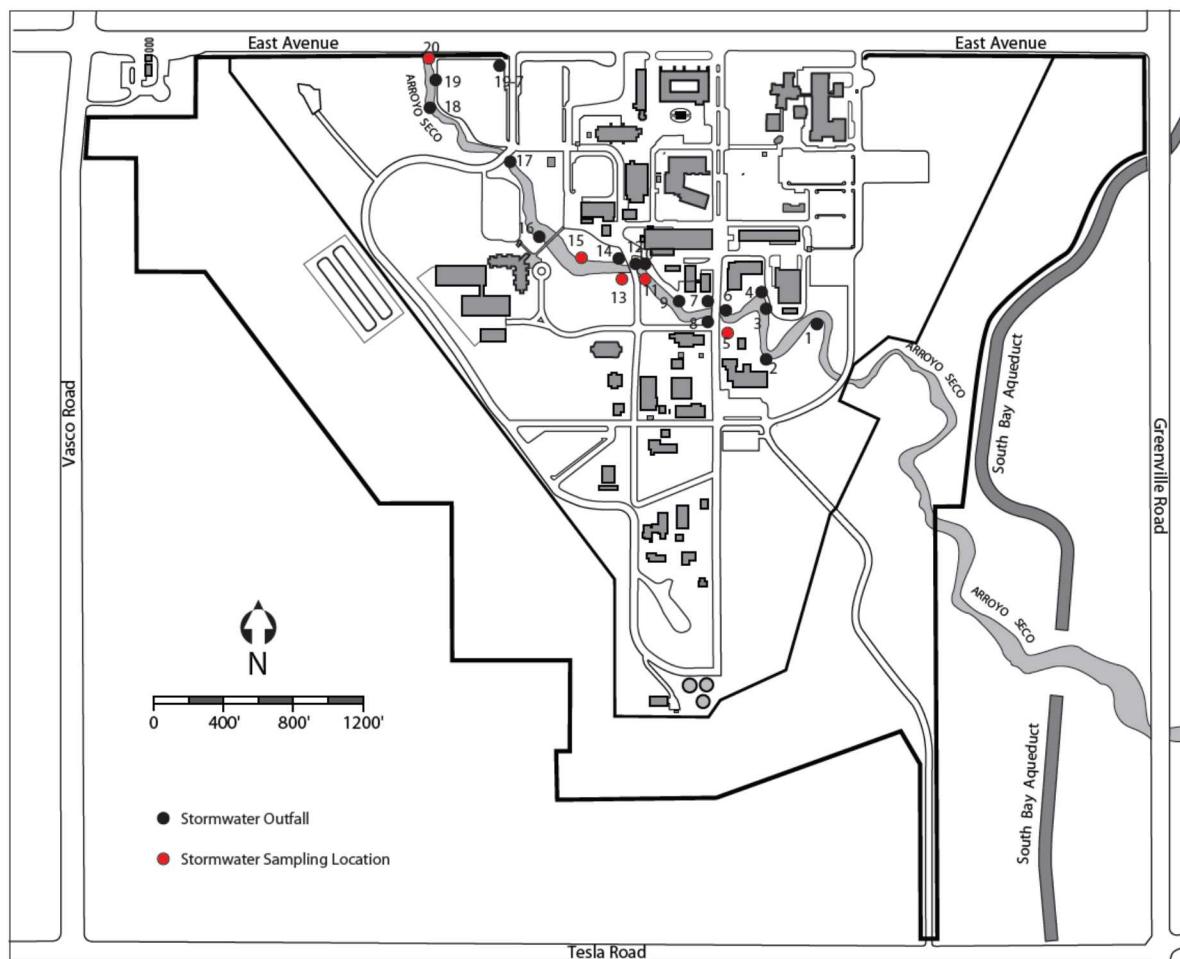


Figure 5-1 Storm Water Sampling Locations

Table 5-1 Summary of Analytical Results for Storm Water, 2016/2017 Reporting Year

Parameter	Number of Samples Analyzed	Number Found Below Detection Limit	Detection Limit	Numeric Action Level	Annual Average Concentration
Total suspended solids	21	0	1 mg/L	100 mg/L	23 mg/L
pH	21	NA	None	<6 or >9	7.0
Oil and grease	21	1	1.4 mg/L	15 mg/L	3.9 mg/L
Chemical oxygen demand	21	3	9 mg/L	120 mg/L	50 mg/L
Aluminum	21	0	0.008 mg/L	0.75 mg/L	0.95 mg/L
Iron	21	0	0.02 mg/L	1.0 mg/L	1.3 mg/L
Lead	21	0	0.00008 mg/L	0.26 mg/L	0.004 mg/L
Zinc	21	0	0.002 mg/L	0.26 mg/L	0.16 mg/L
Nitrite + nitrate	21	0	0.04 mg/L	0.68 mg/L	0.21 mg/L
Total Phosphorus	21	0	0.02 mg/L	2.0 mg/L	0.16 mg/L

Tritium analyses were discontinued in 2017 because SNL/CA has not had active tritium emissions since 1995.

To minimize 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 pollution. In 2017, maintenance personnel collected approximately 202 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 2016/2017 reporting year.

Under the 2014 Industrial General Permit (effective July 1, 2015), storm water samples collected by SNL/CA personnel for the 2016/2017 reporting year (July 1, 2016, through June 30, 2017) 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 and aluminum and thus has entered Level 2 status under the Industrial General Permit. SNL/CA personnel submitted a Level 2 Exceedance Response Action (ERA) Plan in December 2017 to address this status. The ERA report described actions taken or to be taken to address the iron and aluminum in storm water. Results will be presented in the 2018 Annual Site Environmental Report.

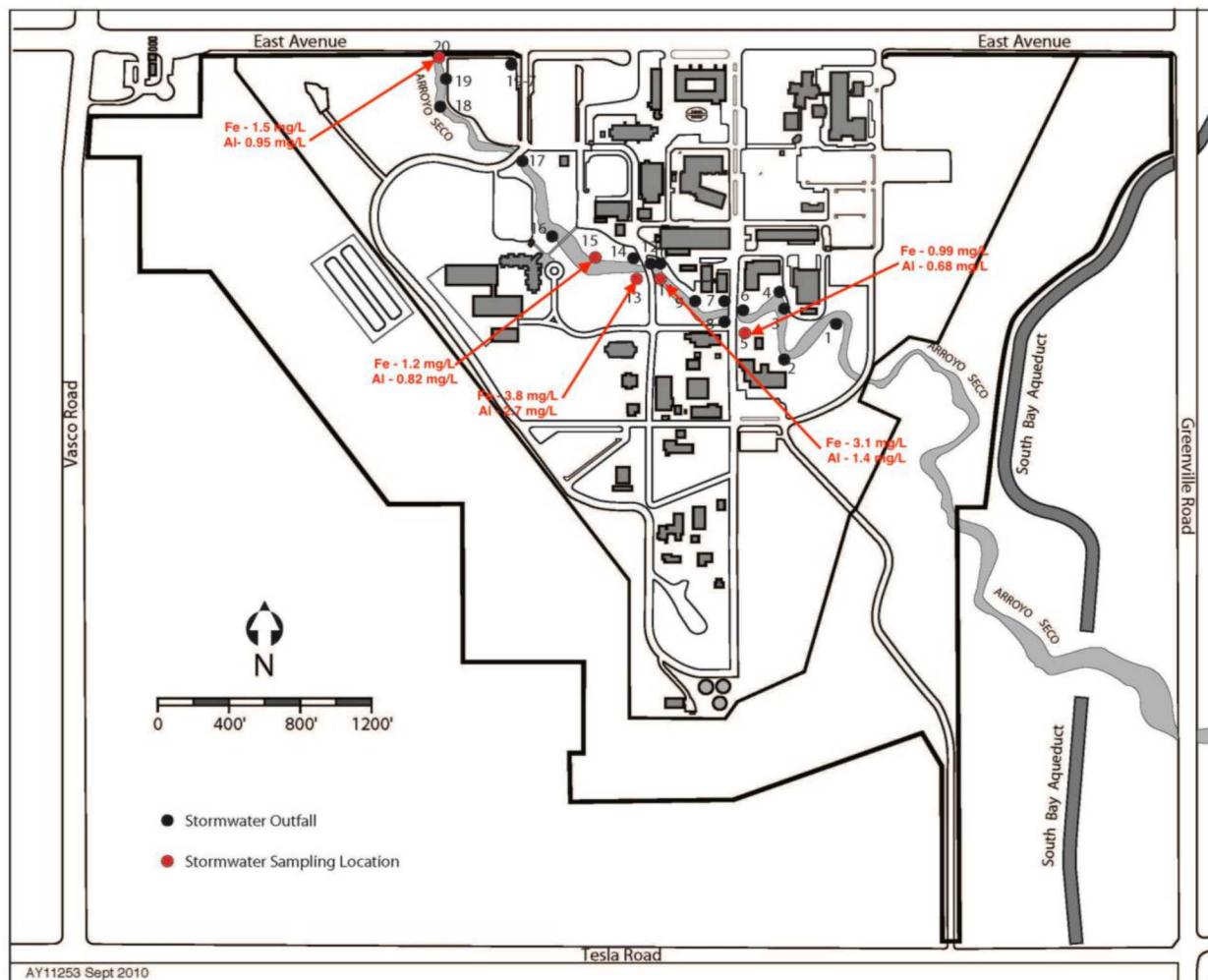


Figure 5-2 Constituents in Storm Water, 2016/2017 Reporting Year

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 containment 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. SNL/CA personnel also collect samples at the outfall to monitor compliance with wastewater discharge limits established in the *Wastewater Discharge Permit* for SNL/CA. Table 5-2 details the outfall sampling schedule and analytical parameters are presented. 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 Oil and grease
Monthly	Grab	Cyanide EPA priority organic pollutants

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

Table 5-3 provides a summary of analytical results for physical parameters and metals from the SNL/CA sanitary sewer outfall. In 2017, all liquid effluent from the outfall complied with the site outfall discharge limits for all parameters. Sewer outfall samples are also analyzed for priority pollutants that are listed by the U.S. Environmental Protection Agency (EPA) as toxic organics. Because the list is long, SNL/CA personnel report only positively identified organic constituents. In 2017, sewer outfall samples showed sporadic concentrations of Chloroform (up to 0.9 µg/L), Bromoform (up to 5 µg/L), Toluene (up to 1.6 µg/L), Dibromochloromethane (3.4 µg/L), Phenol (up to 150 µg/L), Bromodichloromethane (2.6 µg/L) and Benzoic acid (up to 690 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 1,000 µg/L. In 2017, SNL/CA operations did not exceed this discharge limit. Detailed sewer analysis results are provided in Section 9.

Table 5-3 Composite Sewer Outfall Monitoring Results – Physical Parameters and Metals, 2017

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	12	230
Total dissolved solids	12	0	5	None	330	600
Biochemical oxygen demand	12	1	2	None	<20	210
Chemical oxygen demand ^a	12	0	9	None	120	470
Oil & Grease – Mineral	12	5	1.4	100	<1.4	2.5
Oil & Grease – Animal / Veg.	12	1	1.4	100	<1.5	22
Cyanide	12	2	0.002	0.04	<0.002	0.006
Arsenic	52	10	0.0008	0.06	<0.0008	0.022
Cadmium	52	21	0.0002	0.14	<0.0002	0.00052
Chromium	52	6	0.00032	0.62	<0.00032	0.0046
Copper	52	0	0.0002	1	0.04	0.49
Lead	52	0	0.00008	0.2	0.0004	0.014
Mercury	52	42	0.00006	0.01	<0.00006	0.00039
Nickel	52	3	0.0012	0.61	<0.0012	0.0058
Silver	52	47	0.0002	0.2	<0.002	0.00043
Zinc	52	0	0.0002	3	0.06	0.21

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

5.2.2 Liquid Effluent Containment 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 2017. Wastewater from LECS tanks is typically analyzed for metals. Analyses for other parameters associated with the process that generates 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 2017, no tanks required offsite wastewater disposal.

5.2.3 Categorical Processes

Three research operations at SNL/CA are defined as federal categorical processes subject to the EPA's pretreatment standards for point sources (40 CFR Part 403, 40 CFR Part 433). These categorical processes include one metal finishing operation, a semiconductor manufacturing operation, and a spray paint booth. Wastewater from the semiconductor manufacturing operation is sampled semiannually. The 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 2017, all wastewater from this operation met the pretreatment standards.

Table 5-4 Monitoring for Semiconductor Manufacturing Categorical Process, 2017

Parameter	Number of Samples Analyzed	Number Found Below Detection Limit	Detection Limit	Minimum Concentration	Maximum Concentration	Permit Limit ^a
pH	2	--	None	7.55	8.23	5-10
Arsenic	2	2	0.0008 mg/L	<0.0008 mg/L	<0.0008 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 is 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. Figure 5-3 displays groundwater monitoring well locations. MW-406, an LLNL well, is also shown. SNL/CA personnel discontinued monitoring at MW-406 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.

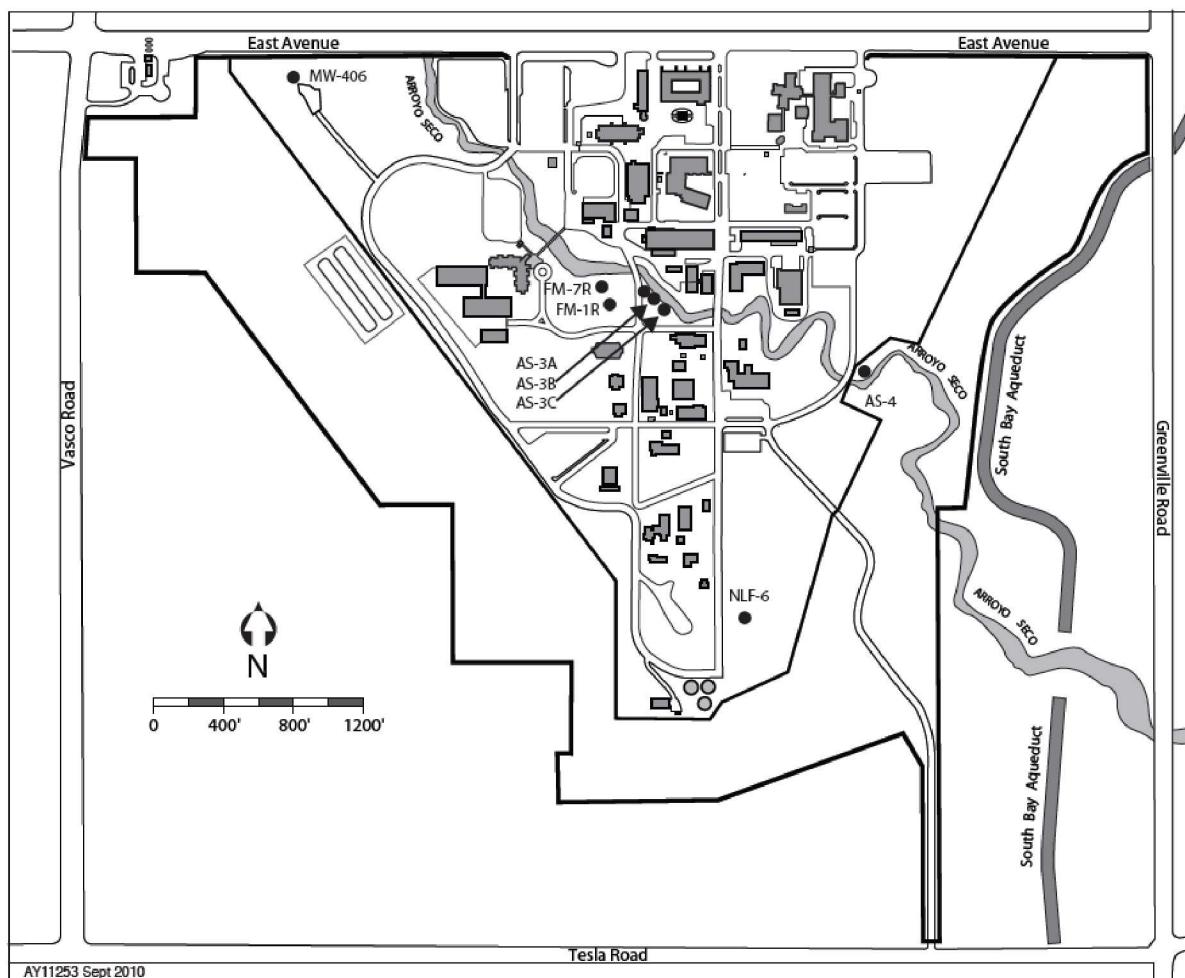


Figure 5-3 Groundwater Monitoring Well Locations

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. Tables 5-8 and 5-9 summarize groundwater analytical results for Arroyo Seco wells. Analyses for general minerals in Arroyo Seco samples are completed every two years. 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. Chapter 9 provides complete groundwater analytical results. As a point of reference, analytical results are compared to federal and state maximum contaminant levels (MCLs), which are applicable for drinking water sources. No wells at SNL/CA are 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 2017. The concentration was above the state MCL of 0.5 $\mu\text{g}/\text{L}$ but below the federal MCL of 5.0 $\mu\text{g}/\text{L}$. 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, 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 $\mu\text{g}/\text{L}$ for a 10-day exposure. A Mann-Kendall test for trend shows that the carbon tetrachloride shows an upward trend from 2005 to 2017, yet the level remains well below a level that would require action by SNL/CA personnel.

In 2017, diesel was detected at the Fuel Oil Spill site. The previous detection of diesel was during the development of well FM-1R in 2011. The diesel detections in 2017 are likely a result of heavy rains during winter 2016-2017 that caused water levels at the Fuel Oil Spill Site to rise by approximately 7 feet. This increase is believed to have brought the groundwater into contact with diesel remaining in the vadose zone. Table 5-7 summarizes groundwater analyses for the Fuel Oil Spill site. Future site environmental reports will include a trend graph for diesel at the Fuel Oil Spill site if it continues to be detected.

Table 5-6 Summary of Groundwater Analyses – Navy Landfill, 2017

Date	Trichloromethane ^a (chloroform) µg/L	Carbon Tetrachloride ^a µg/L	Tetrachloroethene ^a (PCE) µg/L
Detection limit	0.4	0.4	0.4
MCL – California		0.5	5
MCL – Federal	100	5	5
Navy Landfill			
NLF-6	6/21/17	0.78	1.8
			ND

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

Table 5-7 Summary of Groundwater Analyses – Fuel Oil Spill, 2017

Date	TPH-D µg/L	Benzene µg/L	Toluene µg/L	Ethylbenzene µg/L	Xylenes µg/L
Detection limit	50	0.3	0.3	0.4	0.5
MCL – California	-	1	150	300	1750
MCL – Federal	-	5	1000	700	10000
Fuel Oil Spill					
FM-1R	2/23/17	370	ND	ND	ND
FM-7R	2/23/17	ND	ND	ND	ND
FM-1R	8/23/17	1000	ND	ND	ND
FM-7R	8/23/17	ND	ND	ND	ND

MCL – Maximum contaminant levels.

Table 5-8 Summary of Groundwater Analyses at Arroyo Seco Wells - Metals, 2017

Date	EPA 624	Diesel (8015) µg/L	CCR Metals							
			Barium mg/L	Cadmium mg/L	Chromium mg/L	Copper mg/L	Molybdenum mg/L	Nickel mg/L	Selenium mg/L	
Detection limit		50	0.003	0.002	0.004	0.004	0.003	0.003	0.008	0.003
MCL - California			1	0.01	0.05	1			0.01	
MCL – Federal			2	0.005	0.1	1		0.1	0.05	0.002
AS-3A	6/21/17	-	0.11	ND	0.0044	0.0081	0.0060	ND	0.019	ND
AS-3B	6/21/17	ND	0.13	ND	0.015	0.017	0.0063	0.0039	0.019	0.0039
AS-3C	6/21/17	ND	0.37	ND	0.0079	0.0083	0.0065	ND	<0.0083	ND
AS-4	6/21/17	ND	0.22	ND	0.033	0.022	0.0044	0.033	<0.023	ND

Tritium was not analyzed in 2017 due to insufficient sample volume.

MCL – Maximum contaminant levels.

ND – Non-detectable.

Table 5-9 Summary of Groundwater Analyses at Arroyo Seco Wells – Minerals, 2017

General Minerals										
Date	Specific Conductance µmho/cm	Total Dissolved Solids mg/L	Bicarbonate Alkalinity as CaCO ₃ mg/L	Carbonate Alkalinity as CaCO ₃ mg/L	Hydroxide Alkalinity as CaCO ₃ mg/L	Total Alkalinity as CaCO ₃ mg/L	Hardness, Total mg/L	Nitrate as NO ₃ mg/L	Chloride mg/L	Sulfate as SO ₄ mg/L
Detection limit	-	50	0.1	0.1	0.1	0.1	0.1	0.05	0.1	2
AS-3A	6/21/17	1100	620	320	ND	ND	320	389	6.9	88
AS-3B	6/21/17	1200	730	280	ND	ND	280	427	9.4	120
AS-3C	6/21/17	660	400	15	20	ND	35	166	18	60
AS-4	6/21/17	1500	890	400	ND	ND	400	424	2.5	130
										230

5.4 Radiation Monitoring

SNL/CA personnel monitor gamma radiation to ensure that site operations are not significantly contributing 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. Twelve 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 2017, there were new dosimeters added at SNL/CA to provide more complete perimeter coverage and background locations. The dosimeters used for ambient radiation monitoring were changed so they are now being provided and read by an external service provider. SNL/CA personnel will no longer compare the TLDs to those used by LLNL. The annual average background dose in 2017 was 39 mrem (0.39 mSv). The average annual perimeter dose was 46 mrem (0.46 mSv), well below the allowable annual exposure dose to the public of 100 mrem established by DOE. Figure 5-4 shows the dosimeter locations at SNL/CA.

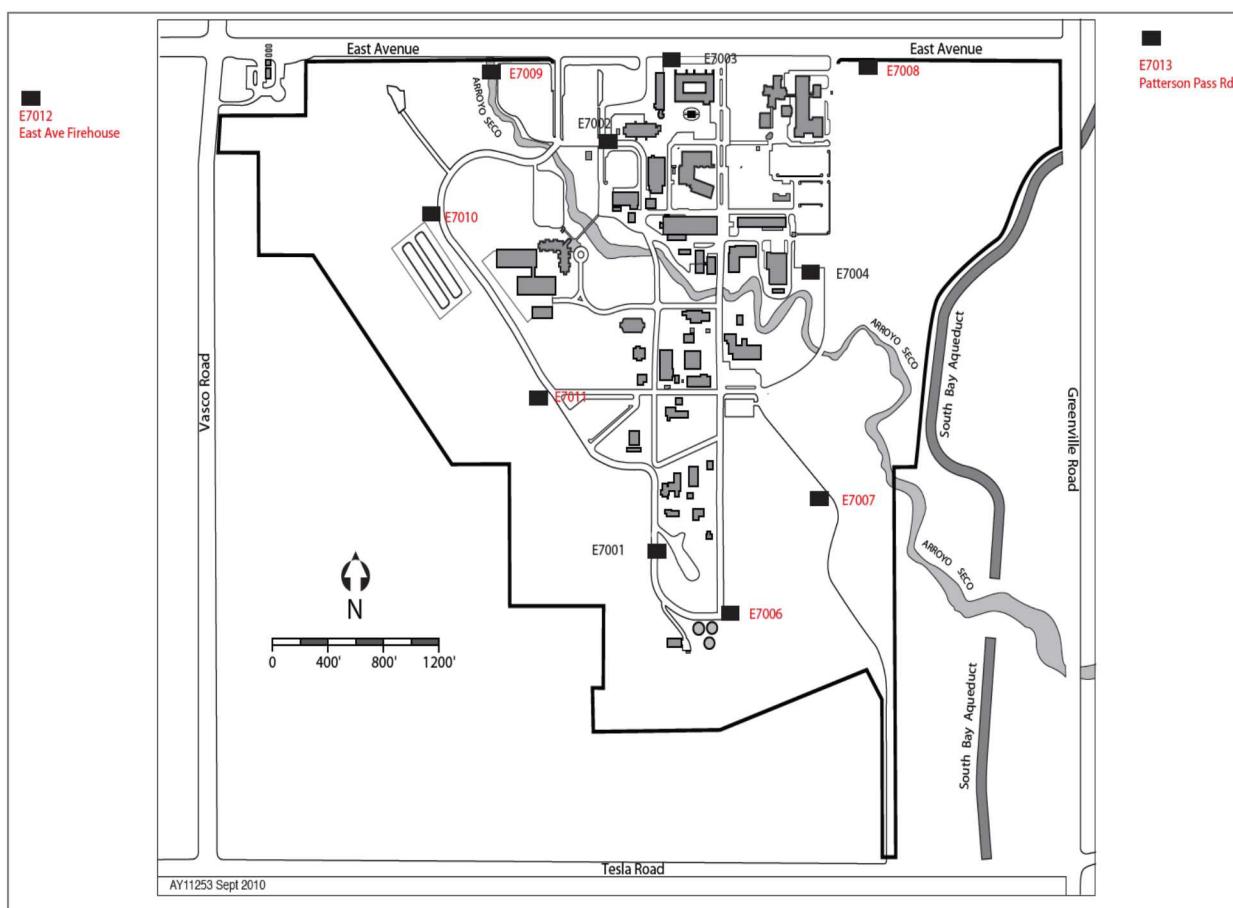


Figure 5-4 Dosimeter Locations at SNL/CA and Around Site Perimeter

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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 2017b).

Compliance with the corporate quality process satisfies the requirements established in the Department of Energy (DOE) regulation 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 10 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/NM Radiation Protection Dosimetry Program

The Radiation Protection Dosimetry Program (RPDP) at SNL/NM issues thermoluminescent dosimeters to measure gamma radiation. 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 2017, SNL/CA personnel collected 12 wastewater quality control samples and submitted one blind spike sample, representing 25 percent of the sample load. Three groundwater quality control samples were collected representing 33 percent of the sample load. Two storm water quality control samples were collected during the 2016/2017 wet season, representing 20 percent of the sample load.

6.4.2 Statistical Analyses

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

- Completeness is evaluated by determining the ratio between the number of samples collected and the number of samples scheduled for collection. The data quality objective for completeness is 85 percent.
- Precision is evaluated using three methods: determining the ratio between routine and duplicate samples, tests of significant difference, and calculating the 95 percent confidence interval. Data quality objectives vary for precision depending on the results of laboratory analyses.
- Accuracy is also evaluated using three methods: determining the ratio between sample results and known values of spiked samples, tests of significant difference, and calculating the 95 percent confidence interval. Data quality objectives vary for accuracy depending on the results of laboratory analyses.

Table 6.1 summarizes the results of statistical analyses conducted in 2017. As shown, some data quality objectives failed during the year. The 16 failed storm water precision tests were chemical oxygen demand (three samples), iron (two samples), lead, Nitrate + Nitrite (three samples), total suspended solids, oil and grease (four samples) and zinc (two samples). 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, 2017

Sample Medium	Completeness Test		Precision Test			Accuracy Test	
	Results	# of Tests	Results	# of Tests	Results		
Wastewater (sanitary sewer)	100%	6	6 passed	14	13 passed		
Storm water	100%	35	19 passed	-	-		
Groundwater	100%	1	1 passed	-	-		

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* as amended.

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.

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 2016, *2016 Strategic Sustainability Performance Plan*, September 2016.

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-bin/reports/simple_report.pl, January 4, 2018.

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*, RPD-00-01, Issue 9, May 9, 2016.

SNL 2017b, Corporate Process: CG100.6, *Ensure Quality Outcomes*, May 24, 2017.

SNL 2017c, Corporate Process: ESH100.2, *Analyze and Control Hazards*, November 20, 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, *Radiation Protection Dosimetry Program Quality Plan*, 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 Nastri, 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.
Criteria pollutants	The Clean Air Act requires EPA to set National Ambient Air Quality Standards for six common air pollutants, also known as Criteria Pollutants.
Dose	A term denoting the quantity of radiation energy absorbed.
Dosimeter	A portable detection device for measuring the total accumulated exposure to ionizing radiation.
Effluent	A liquid or gaseous waste discharged to the environment.
Emission	A gaseous or liquid stream containing one or more contaminants.
Environmental aspect	An organization's activities, products, or services that can interact with the environment.
Environmental impact	Any change to the environment, whether adverse or beneficial, wholly or partially, resulting from an organization's activities, products, or services.
Ephemeral stream	A stream that flows only for a short duration during and following rainfall.
External radiation	Radiation originating from a source outside the body.
Fluvial sediments	A sedimentary deposit consisting of material transported by, suspended in, or laid down by a river or stream.

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

9 Groundwater Analytical Results, Well Completion Data, and Sanitary Sewer Analytical Results

Table 9-1 Results of Groundwater Analyses at SNL/CA, 2017

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	6/21/17	ND	ND	ND	ND	ND	ND	0.78	ND	1.8	ND	ND	ND
Field Dup	6/21/17	ND	ND	ND	ND	ND	ND	0.59	ND	1.9	ND	ND	ND
Field Blank	6/21/17	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trip Blank	6/21/17	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-3A ¹	6/21/17	-	-	-	-	-	-	-	-	-	-	-	-
AS-3B	6/21/17	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-3C	6/21/17	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-4	6/21/17	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.

Table 9-1 Results of Groundwater Analyses at SNL/CA, 2017 (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	6/21/17	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Field dup	6/21/17	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Field blank	6/21/17	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trip Blank	6/21/17	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-3A ¹	6/21/17	-	-	-	-	-	-	-	-	-	-	-	-
AS-3B	6/21/17	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-3C	6/21/17	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-4	6/21/17	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FM-1R	2/23/17	-	-	-	-	-	-	-	-	-	-	-	370
FM-1R	8/23/17	-	-	-	-	-	-	-	-	-	-	-	1000
FM-7R	2/23/17	-	-	-	-	-	-	-	-	-	-	-	ND
FM-7R	8/23/17	-	-	-	-	-	-	-	-	-	-	-	ND

MCL – Maximum contaminant level.

ND – Non-detectable.

¹ Well was dry.

- Not required to analyze or sample not collected.

Table 9-1 Results of Groundwater Analyses at SNL/CA, 2017 (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
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
MCL - California	0.01	1		0.01	0.05			1	0.05	0.002			0.01	0.05			5
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	6/21/17	ND	ND	0.11	ND	ND	0.0044	ND	0.0081	ND	ND	0.0060	ND	0.019	ND	ND	ND
AS-3B	6/21/17	ND	ND	0.13	ND	ND	0.015	ND	0.017	ND	ND	0.0063	0.0039	ND	ND	0.0039	ND
AS-3C	6/21/17	ND	ND	0.37	ND	ND	0.0079	ND	0.0083	ND	ND	0.0065	ND	ND	ND	ND	0.015
AS-4	6/21/17	ND	ND	0.22	ND	ND	0.033	0.0067	0.022	ND	0.00030	0.0044	0.033	ND	ND	ND	0.036
FM-1R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FM-1R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FM-7R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FM-7R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

MCL – Maximum contaminant level.

ND – Non-detectable.

- Not required to analyze or sample not collected.

Table 9-1 Results of Groundwater Analyses at SNL/CA, 2017 (continued)

	Date	Specific Conductance µmhos/cm	Total Dissolved Solids Mg/L	Bicarbonate Alkalinity (CaCO ₃) mg/L	Carbonate Alkalinity (CaCO ₃) mg/L	Hydroxide Alkalinity (CaCO ₃) mg/L	Total Alkalinity (CaCO ₃) mg/L	Hardness, Total mg/L	Chloride mg/L	Nitrate (NO ₃) mg/L	Sulfate (SO ₄) mg/L
Detection limit		1.0	5.0	1.0	1.0	1.0	1.0	1	2.5	0.20	5.0
MCL - California	-	-	-	-	-	-	-	-	-	-	-
MCL - Federal	-	500	-	-	-	-	-	250	-	250	-
Well ID											
NLF-6	-	-	-	-	-	-	-	-	-	-	-
Field dup	-	-	-	-	-	-	-	-	-	-	-
Field blank	-	-	-	-	-	-	-	-	-	-	-
AS-3A	6/21/17	1100	620	320	ND	ND	320	389	88	6.9	110
AS-3B	6/21/17	1200	730	280	ND	ND	280	427	120	9.4	150
AS-3C	6/21/17	660	400	15	20	ND	35	166	60	18	11
AS-4	6/21/17	1500	890	400	ND	ND	400	424	130	2.5	230
FM-1R	-	-	-	-	-	-	-	-	-	-	-
FM-1R	-	-	-	-	-	-	-	-	-	-	-
FM-7 R	-	-	-	-	-	-	-	-	-	-	-
FM-7R	-	-	-	-	-	-	-	-	-	-	-

Table 9-1 Results of Groundwater Analyses at SNL/CA, 2017 (continued)

Date	Benzene µg/L	Toluene µg/L	Ethylbenzene µg/L	Xylenes (total) µg/L
Detection limit	0.3	0.3	0.4	0.5
MCL - California	1	150	300	1750
MCL - Federal	5	1000	700	10000
Well ID				
NLF-6	-	-	-	-
Field dup	-	-	-	-
Field blank	-	-	-	-
AS-3A	-	-	-	-
AS-3B	-	-	-	-
AS-3C	-	-	-	-
AS-4	-	-	-	-
FM-1R	2/23/2017	ND	ND	ND
FM-1R	8/23/2017	ND	ND	ND
FM-7R	2/23/2017	ND	ND	ND
FM-7R	8/23/2017	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, 2017

		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. 3	17A0150	<20	120	520	12	2.5	9.3	0.0034
February								
Feb. 7	17B0764	80	280	390	99	2.5	<1.5	0.0060
March								
Mar. 7	17C0672	150	390	400	160	1.8	21	0.0044
April								
Apr. 4	17D0270	140	470	420	160	<1.4	22	0.0048
May								
May 2	17E0252	130	400	600	140	2.2	20	0.0029
June								
Jun. 6	17F0548	45	180	330	73	<1.4	9.2	<0.0020
July								
Jul. 5	17G0251	170	390	380	140	<1.4	14	<0.0020
August								
Aug. 1	17H0161	51	210	370	52	<1.4	13	0.0053
September								
Sept. 5	17I0264	110	470	350	170	<1.4	9.6	0.0022
October								
Oct. 3	17J0302	88	250	360	84	1.7	2.8	0.0025
November								
Nov. 7	17K0669	210	450	400	230	1.8	6.0	0.0028
December*								
Dec. 5	17L0379	140	230	550	140	6.3	1.4	0.0024
Discharge Limit ^b		N/A ^e	N/A ^e	N/A ^e	N/A ^e	100		0.04

*Site shutdown from December 25, 2017, through January 1, 2018.

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

Table 9-4 Routine Monitoring Results for SNL/CA Sanitary Sewer Outfall, Method E200.8, 2017

		Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Silver	Zinc
Date ^a	Laboratory ID # ^b	All results reported in mg/L								
January										
January 3	17A0151	0.0022	<0.00020	<0.00032	0.10	0.00057	<0.000060	0.0016	<0.00020	0.08
January 10	17A0855	0.0029	<0.00020	0.0024	0.14	0.0014	<0.000060	0.0057	<0.00020	0.16
January 17	17A1521	0.012	<0.00020	0.0028	0.10	0.00091	<0.000060	0.0041	<0.00020	0.13
January 24	17A2245	0.0045	<0.00020	0.0027	0.06	0.00075	<0.000060	0.0051	<0.00020	0.10
January 31	17B0028	0.017	<0.00020	0.0020	0.26	0.00095	0.000080	0.0047	<0.00020	0.17
February										
February 7	17B0763	0.0088	<0.00020	0.0024	0.11	0.00088	<0.000060	0.0049	<0.00020	0.13
February 14	17B1416	0.0050	<0.00020	0.0017	0.10	0.00057	<0.000060	0.0055	<0.00020	0.15
February 21	17B1938	0.0018	<0.00020	0.0015	0.17	0.0013	<0.000060	0.0053	<0.00020	0.21
February 28	17C0028	0.0016	0.00021	0.0011	0.08	0.0012	<0.000060	0.0040	<0.00020	0.11
March										
March 7	17C0673	0.0014	<0.00020	0.0009	0.07	0.00057	<0.000060	0.0027	<0.00020	0.11
March 14	17C1368	0.0012	0.00007	0.0015	0.06	0.00078	<0.000060	0.0029	<0.00005	0.11
March 21	17C1941	0.0032	<0.00020	0.0029	0.13	0.0011	0.000060	0.0048	<0.00020	0.16
March 28	17C2561	0.019	0.00022	<0.00032	0.12	0.0012	0.000060	0.0058	<0.00020	0.13
April										
April 4	17D0268	0.0049	<0.00020	0.0009	0.05	0.00050	<0.000060	0.0021	<0.00020	0.06
April 11	17D1047	0.0075	<0.00020	0.0007	0.49	0.0012	<0.000060	0.0031	<0.00020	0.14
April 18	17D1642	0.0027	0.00032	0.0016	0.13	0.0011	0.000080	0.0032	<0.00020	0.13
April 25	17D2214	0.0048	<0.00020	0.0015	0.13	0.0014	0.000080	0.0048	0.00024	0.17
May										
May 2	17E0245	0.022	<0.00020	0.0019	0.16	0.0016	<0.000060	0.0025	<0.00020	0.10
May 9	17E0898	0.0053	0.00023	0.0018	0.12	0.0010	<0.000060	0.0029	0.0020	0.13
May 16	17E1559	<0.0008	<0.00020	0.0019	0.11	0.0014	<0.000060	0.0032	<0.00020	0.16
May 23	17E2135	0.0027	0.00026	0.0046	0.14	0.0014	<0.000060	0.0043	<0.00020	0.12
May 30	17E2606	0.0044	<0.00020	0.0008	0.13	0.0011	<0.000060	0.0021	<0.00020	0.09

Table 9-4 Routine Monitoring Results for SNL/CA Sanitary Sewer Outfall, Method E200.8, 2017 (continued)

Date ^a	Laboratory ID # ^b	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Silver	Zinc
All results reported in mg/L										
June										
June 6	17F0551	0.0012	<0.00020	0.0014	0.07	0.0005	<0.000060	0.0018	<0.00020	0.08
June 13	17F1276	0.0015	<0.00020	0.0017	0.08	0.0009	0.000070	0.0020	<0.00020	0.11
June 20	17F1889	0.0020	<0.00020	0.0025	0.07	0.0009	<0.000060	0.0027	<0.00020	0.11
June 27	17F2420	<0.0008	<0.00020	0.0006	0.04	0.0004	<0.000060	0.0027	<0.00020	0.06
July										
July 5	17G0247	0.0013	0.00031	0.0035	0.26	0.0037	0.00016	0.0050	0.00043	0.44
July 11	17G0938	0.0015	0.00052	0.0029	0.17	0.0026	<0.000060	0.0036	<0.00020	0.26
July 18	17G1603	<0.0008	<0.00020	<0.0003	0.05	0.0004	0.00014	0.0017	<0.00020	0.06
July 25	17G2314	0.0036	<0.00020	0.0023	0.07	0.014	0.00039	0.0028	0.00023	0.09
August										
August 1	17H0154	0.0024	<0.00020	0.0028	0.05	0.0006	<0.000060	0.0030	<0.00020	0.07
August 8	17H0890	0.0011	<0.00020	0.0014	0.06	0.0008	<0.000060	<0.0002	<0.00020	0.09
August 15	17H1561	0.0011	<0.00020	0.0014	0.06	0.0007	<0.000060	0.0033	0.00021	0.09
August 22	17H2114	0.0057	<0.00020	<0.0003	0.06	0.0012	<0.000060	0.0029	<0.00020	0.09
August 29	17H2728	<0.0008	<0.00020	0.0013	0.06	0.0007	<0.000060	0.0019	<0.00020	0.05
September										
September 5	17I0260	0.0013	0.00012	<0.0003	0.06	0.0010	0.00010	0.0025	<0.00020	0.10
September 12	17I1016	0.0015	0.00013	0.0016	0.07	0.0010	<0.000060	0.0050	<0.00020	0.10
September 19	17I1739	<0.0008	<0.00012	0.0033	0.05	0.0007	<0.000060	0.0014	<0.00020	0.08
September 26	17I2290	<0.0008	0.00019	0.0040	0.06	0.0008	<0.000060	0.0030	<0.00020	0.10

Table 9-4 Routine Monitoring Results for SNL/CA Sanitary Sewer Outfall, Method E200.8, 2017 (continued)

		Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Silver	Zinc
Date ^a	Laboratory ID # ^b	All results reported in mg/L								
October										
October 3	17J0300	<0.0008	0.00019	0.0011	0.07	0.0007	<0.000060	0.0020	<0.00020	0.11
October 10	17J1000	<0.0008	<0.00012	0.0018	0.05	0.0007	<0.000060	0.0018	<0.00020	0.08
October 17	17J1563	<0.0008	0.00016	0.0044	0.10	0.0014	<0.000060	0.0054	<0.00020	0.12
October 24	17J2200	0.0010	<0.00012	0.0014	0.05	0.0007	<0.000060	0.0026	<0.00020	0.09
October 31	17K0067	0.0030	0.00017	0.0010	0.06	0.0008	<0.000060	0.0030	<0.00020	0.08
November										
November 7	17K0672	0.0034	0.00017	0.0013	0.07	0.0009	<0.000060	<0.0012	<0.00020	0.09
November 14	17K1346	0.0056	0.00032	0.0011	0.11	0.0008	<0.000060	0.0033	<0.00020	0.10
November 21	17K2255	0.0140	0.00012	0.0014	0.08	0.0009	<0.000060	0.0034	<0.00020	0.09
November 28	17K2591	0.0017	0.00016	<0.00032	0.06	0.0004	<0.000060	0.0023	<0.00020	0.07
December*										
December 5	17L0380	0.0018	0.00020	0.0018	0.08	0.0006	<0.000060	0.0029	<0.00020	0.08
December 12	17L1069	<0.0008	0.00026	0.0018	0.08	0.0008	<0.000060	0.0028	<0.00020	0.10
December 19	17L1667	0.0016	0.0023	0.0018	0.07	0.0009	<0.000060	0.0033	<0.00020	0.10
December 26	18A0224	0.0013	<0.00012	0.0010	0.06	0.011	<0.000060	<0.0012	<0.00020	0.08
Discharge Limit ^c		0.06	0.14	0.62	1.0	0.20	0.01	0.61	0.20	3.0

* Site shutdown from December 25, 2017, through January 1, 2018.

^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.

Table 9-5 Routine Monitoring Results for SNL/CA Sanitary Sewer Outfall, 2017

Date	EPA Method 624 Purgeable Priority Pollutants ($\mu\text{g/L}$)	EPA Method 625 Extractable Priority Pollutants ($\mu\text{g/L}$)	EPA Method 608 Organochlorine Pesticides ($\mu\text{g/L}$)
January 3	None	None	None
February 7	None	None	None
March 7	Dibromochloromethane – 0.73 Chloroform – 0.90 Bromochloromethane – 1.0 Toluene – 0.33	None	None
April 4	Bromoform – 1.8	Phenol – 8.0	None
May 2	None	None	None
June 6	Toluene – 1.6	None	None
July 5	None	Phenol – 11	None
August 1	None	None	None
September 5	None	None	None
October 3	None	Bis(2-ethylhexyl) adipate 40	None
Phenol- 46			
November 7	Bromoform – 5.0 Dibromochloromethane – 3.4 Bromodichloromethane – 2.6	None	None
December 5	None	Benzoic Acid – 690 ^a	None
Phenol – 150			

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

This table reports all organic constituents positively identified by EPA Methods 624, 625, and 608. 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 1000 $\mu\text{g/L}$. The total toxic organic number is derived by summing up all organic constituents greater than 10 $\mu\text{g/L}$. Note that Trihalomethanes are reported in this table although they are a common constituent of chlorinated water.

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