

## SANDIA REPORT

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Sandia  
National  
Laboratories

# Site Environmental Report for 2019 Sandia National Laboratories, California

Christina Robinson

Prepared by  
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Livermore, California 94550

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## ABSTRACT

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# Site Environmental Report for 2019

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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 & Engineering Solutions of Sandia, LLC (NTESS). The DOE, NNSA, Sandia Field Office administers the contract and oversees contractor operations at the site.

DOE and its management and operating contractor for Sandia are committed to safeguarding environmental protection, compliance, and sustainability and to ensuring the validity and accuracy of the monitoring data presented in this Annual Site Environmental Report. This Site Environmental Report for 2019 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 2019, unless noted otherwise. General site and environmental program information is also included.

## **ACKNOWLEDGEMENTS**

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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 2019 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 2019 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.

## ACRONYMS AND DEFINITIONS

Abbreviation	Definition
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
BTU	British Thermal Unit
CCR	California Code of Regulations
CARB	California Air Resources Board
CEARP	Comprehensive Environmental Assessment and Response Program
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
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

Abbreviation	Definition
gal	gallon
GHG	greenhouse gas
GSF	Gross Square Feet
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 Contract	Management and Operating Contract
mrem	millirem
mSv	milliSievert
MW hr	Megawatt hour
NA	not applicable
NAL	Numeric Action Level
ND	non-detectable
NEPA	National Environmental Policy Act
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NFPA	National Fire Protection Association
NNSA	National Nuclear Security Administration
NNSA/SFO	National Nuclear Security Administration, Sandia Field Office
NOV	notice of violation

Abbreviation	Definition
NPDES	national pollutant discharge elimination system
NTESS	National Technology & Engineering Solutions of Sandia, LLC
oz	ounce
PCB	polychlorinated biphenyl
PCE	Tetrachloroethylene
pCi/L	picocuries per liter
POTW	publicly owned treatment works
QAPP	quality assurance program plan
RCRA	Resource Conservation and Recovery Act
RPDP	Radiation Protection Dosimetry Program
RWQCB	Regional Water Quality Control Board (California)
SA	supplement analysis
SARA Title III	Superfund Amendments and Reauthorization Act of 1986, Title III
sf	square feet
SF6	Sulfur Hexafluoride
SHPO	State Historic Preservation Officer
SNARL	Suggested No-Adverse Response Level
SNL	Sandia National Laboratories
SNL/CA	Sandia National Laboratories, California
SNL/NM	Sandia National Laboratories, New Mexico
SPCC	Spill Prevention Control and Countermeasure
SSP	Site Sustainability Plan
SWEA	site-wide environmental assessment
TDS	total dissolved solids
TLD	thermoluminescent dosimeter
TPHD	total petroleum hydrocarbons diesel

<b>Abbreviation</b>	<b>Definition</b>
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 2019. 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 requirements, including DOE directives in support of all site operations and activities.

The EMS, SNL's primary corporate management approach to achieving environmental improvement and minimizing impact, is also implemented through the SNL/CA site's environmental programs. The SNL/CA site is certified to the ISO 14001:2015 standard under the corporate multi-site certification.

### 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 2019, SNL/CA personnel measured performance in achieving three site EMS objectives and three corporate goals. SNL/CA received one notice of violation (NOV) in 2019. 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 2018/2019 wet season show that SNL/CA exceeded the Numeric Action Levels in storm water for iron and aluminum. During 2019, 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 2019 with a concentration similar to that detected in past years. Diesel was detected in groundwater from wells at the Fuel Oil Spill site in 2019. The average annual gamma radiation dose from all sources at the site perimeter in 2019 was 44 mrem (0.44 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.

The SNL/CA Facility is owned by the Department of Energy (DOE). 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 & Engineering Solutions of Sandia, LLC (NTESS). The NNSA/Sandia Field Office (NNSA/SFO) administers the contract and oversees the contractor 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

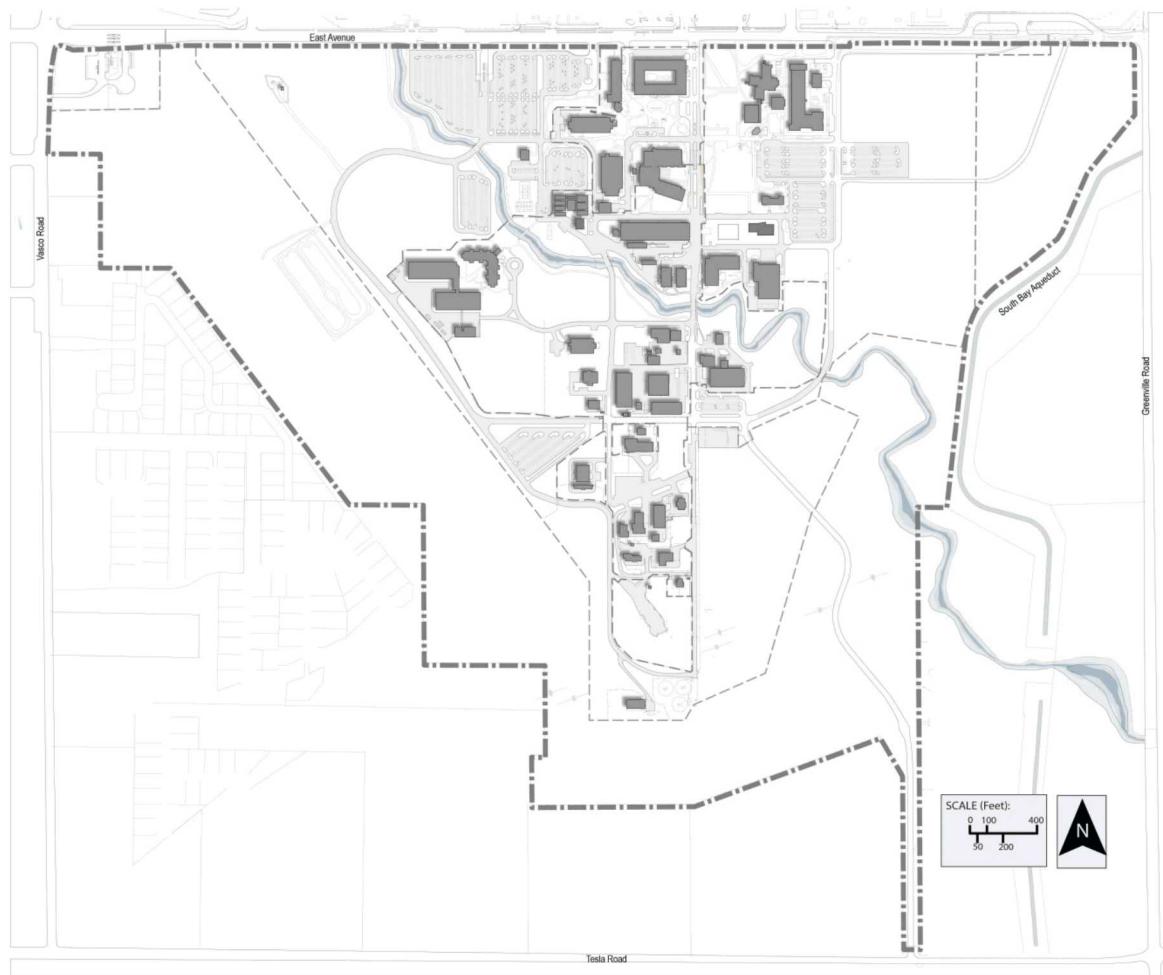
#### Research Activities at SNL/CA

- 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 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 2019, there were 1,583 personnel (employees and on-site contractors) working at SNL/CA, an increase of 97 from 2018.

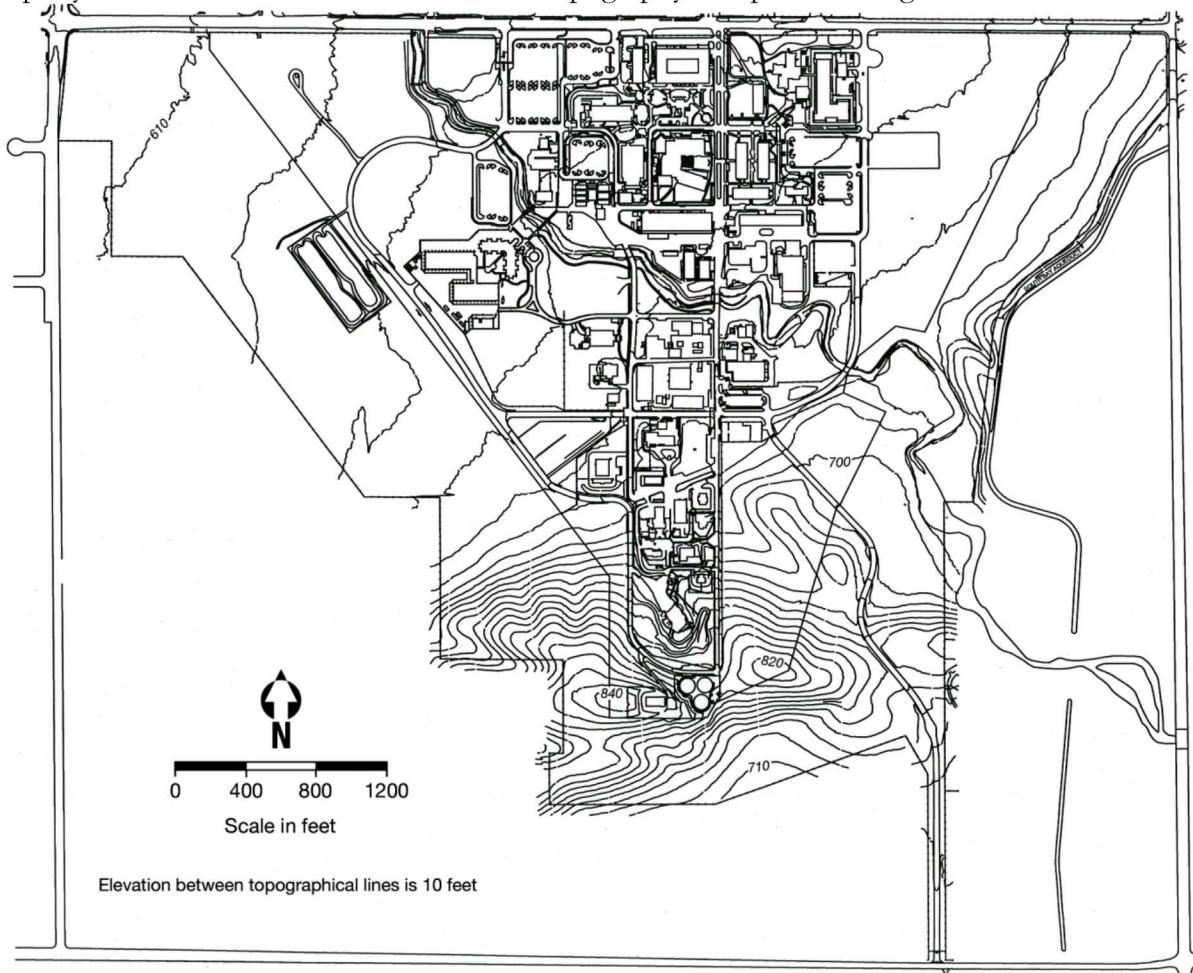
### 2.4. Environmental Setting

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

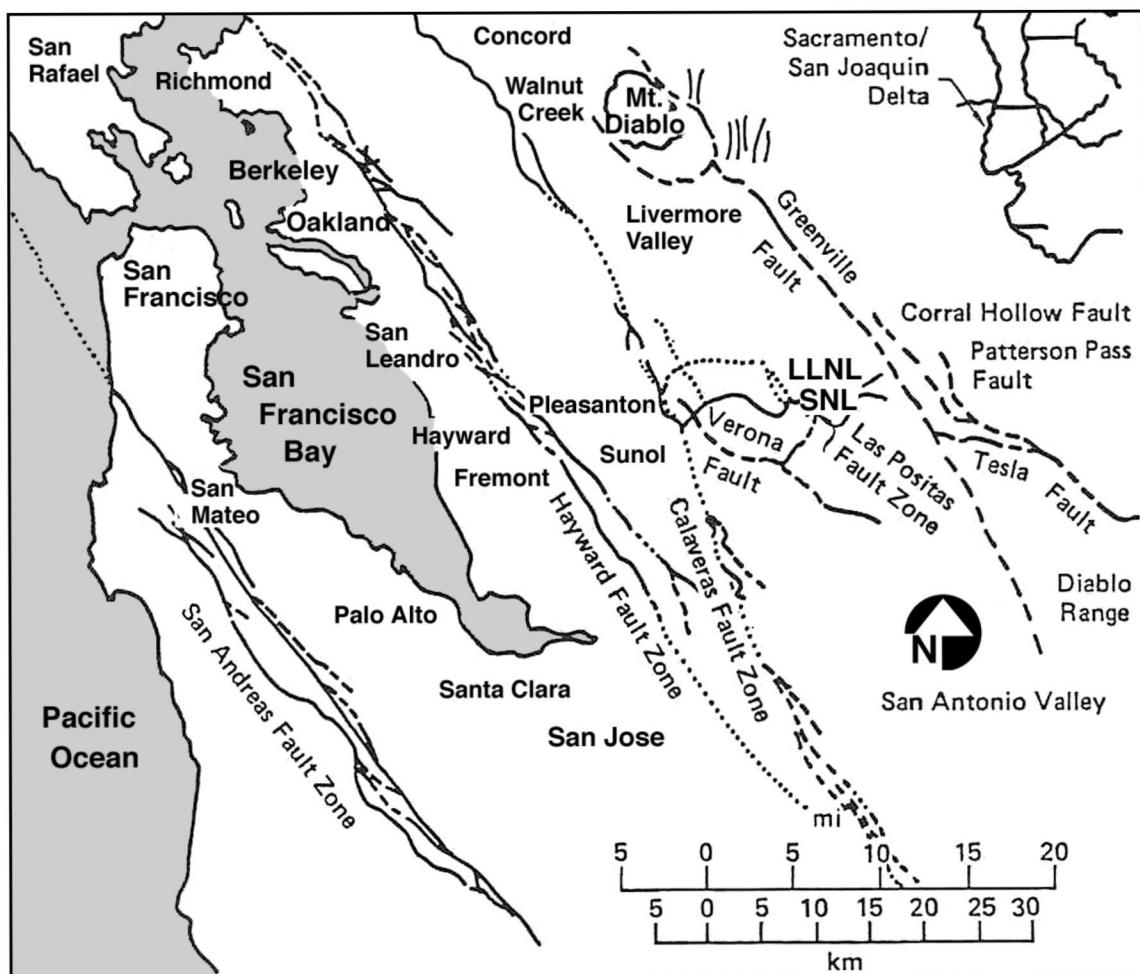
SNL/CA is located in the California Coast Ranges geologic province in the southeastern portion of the Livermore Valley. The valley forms an irregularly shaped lowland area about 16 miles long, east to west, and 7 to 10 miles wide, north to south. The land at SNL/CA slopes gently to the northwest and 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 2019, 38 million gallons of water were used at SNL/CA, a decrease of 11 percent (4.8 million gallons) from water used in fiscal year 2018. (See discussion in Section 4.2.2). The site discharged approximately 9 million gallons of wastewater during the fiscal year. Water loss, or the difference between water use and wastewater discharge, is attributed to irrigation, cooling towers, water tank releases, evaporative losses, eyewash and safety shower testing, and fire system testing.

There are no perennial streams or natural surface water bodies at SNL/CA. 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**

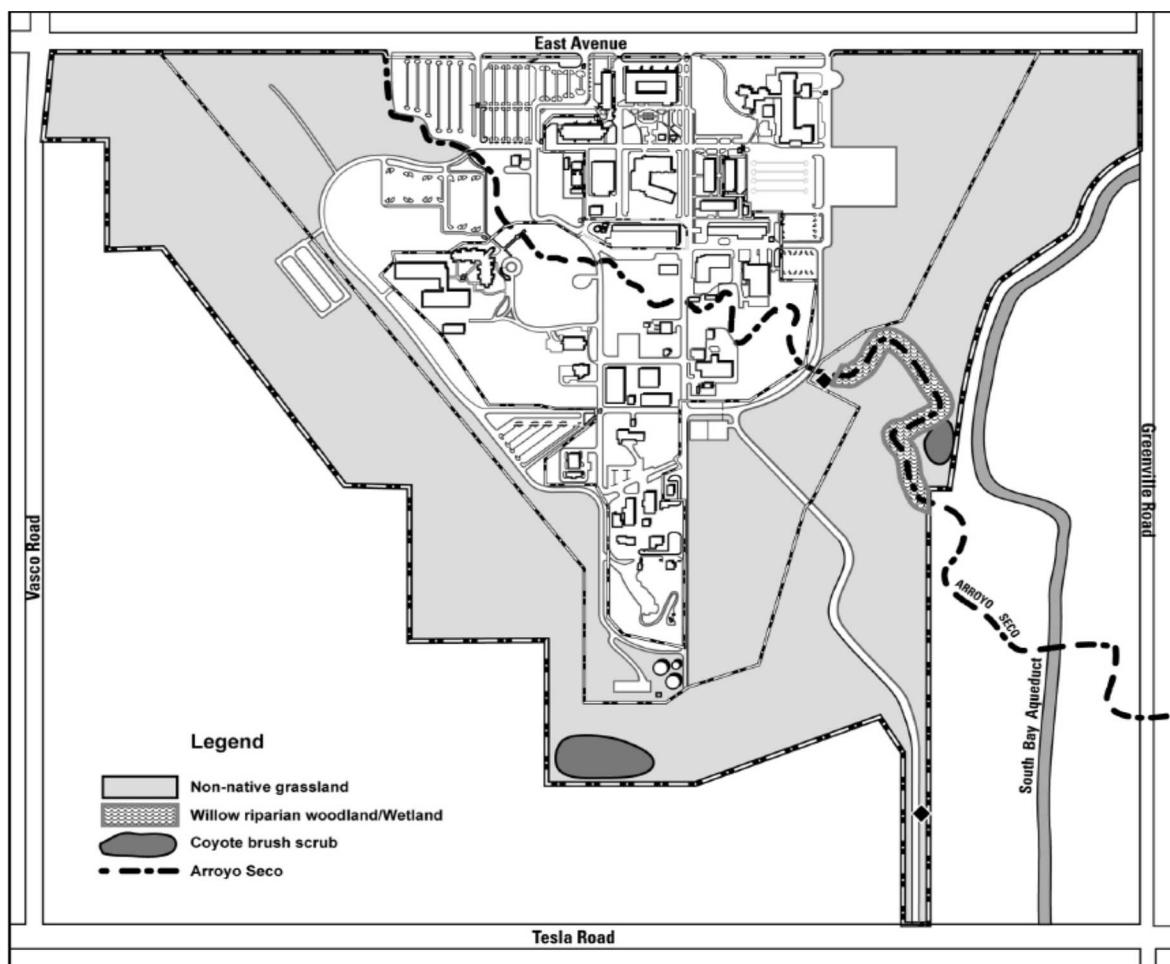
The climate at SNL/CA is typical of the Mediterranean conditions in the San Francisco Bay region where cool, wet winters and hot, dry summers are normal. In the summer, inland valleys, such as the Livermore Valley, generally experience more sunshine and higher temperatures than the coastal areas. In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

Annual meteorological data for 2019 was obtained from a nearby meteorological tower located at LLNL (LLNL 2020). The annual rainfall for 2019 was 15.61 inches. Temperatures in 2019 ranged from 26.3 to 103.8° Fahrenheit. Average annual rainfall in the Livermore area over the last five years was 14.29 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**

#### **2.4.4.1. 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**

#### 2.4.4.2. 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 2019.

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 a group of these frogs 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 2019.

**Table 2-1 Frequently Seen Animals at SNL/CA**

<b>BIRDS</b>			
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>
<b>MAMMALS</b>			
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>
<b>REPTILES AND AMPHIBIANS</b>			
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, and Notices) and implemented to meet or exceed goals and requirements delineated in applicable presidential executive orders. This chapter summarizes SNL/CA's compliance status with major environmental requirements for calendar year 2019, 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 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) 14001:2015.

A multi-site EMS certification to the ISO 14001:2015 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 recertified in May 2018. Results from the recertification 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 2019, site personnel provided input to the reports identified above and participated in development of the corporate SSP for fiscal year 2020.

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 (NSNSA/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, NSNSA/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 2019, 119 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 2018/2019 and 2019/2020 permitting periods<sup>1</sup>. Table 3-5 (Section 3.15) provides a list of the permitted and registered sources.

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<sup>1</sup> The BAAQMD permit period is July 1 through June 30 each year. Permit data is presented for the two periods applicable to 2018.

### **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 2019, 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 frog<sup>2</sup>.

### **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 2019, there were no new pesticides reviewed or approved for use at SNL/CA.

<sup>2</sup> 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.

### **3.4.3. 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 2019, there was no intentional take of migratory birds or disturbance to nests or eggs at the site. Five nesting bird surveys were conducted. One active nest was encountered and marked during 2019. The project was modified to avoid impacts to the nest.

### **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 2019, 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 issued by 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. Repair of the damage caused by the flooding during the winter of 2016-2017 was performed at ASIP Area 17 during 2018. 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, but did not survive due to inadequate irrigation. None were planted in 2019. A scour hole in the bed of the Arroyo Seco was repaired in 2019 in accordance with a permit issued by the U.S. Army Corp of Engineers.



**Figure 3-1 ASIP Area 8 Before Restoration**



**Figure 3-2 ASIP Area 8 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 2019, 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 2016c). In 2019, 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 2019.

**Table 3-1 Status of EPCRA Reporting for SNL/CA, 2019**

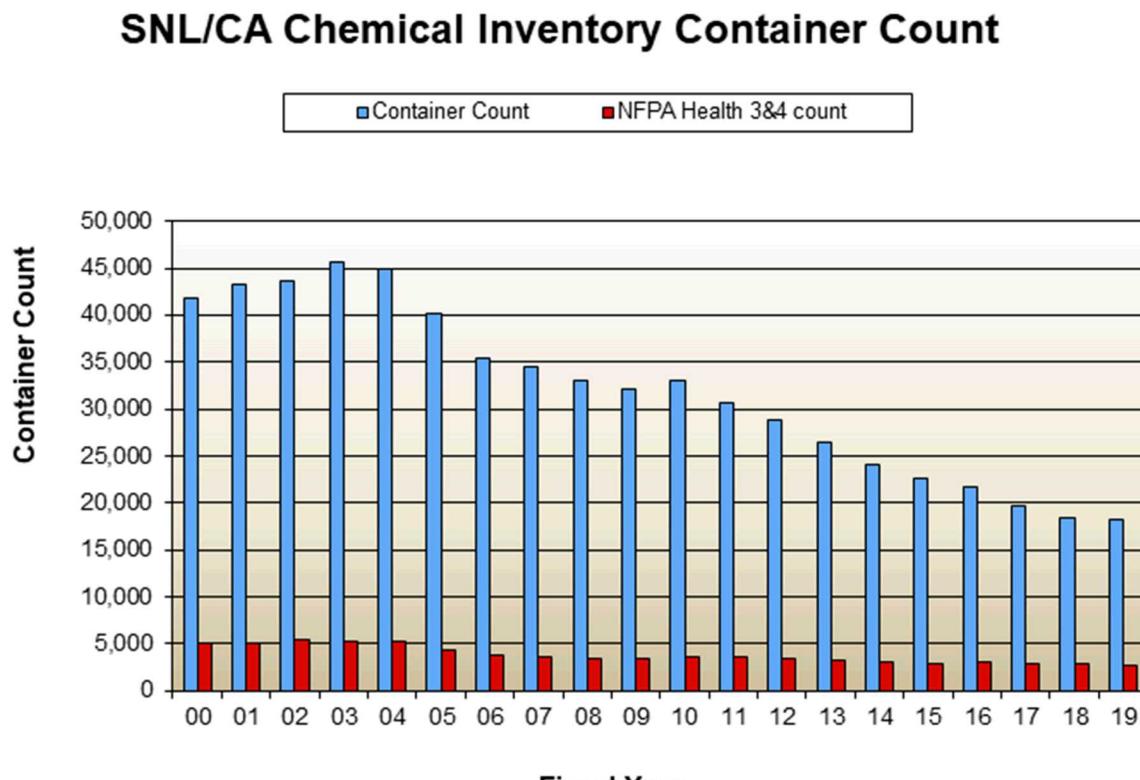
EPCRA Section	Description of Reporting	Required in 2019
Sec. 302-303*	Planning Notification	Yes (sulfuric acid only)
Sec. 304	Extremely Hazardous Substances Release Notification	No
Sec. 311-312*	Safety Data Sheet / Chemical Inventory	Yes
Sec. 313	Toxic Release Inventory Reporting	Yes (lead only)

\* Reporting accomplished through the annual Hazardous Materials Business Plan, a California Environmental Reporting System (CERS), 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 3-3, 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 3-3 SNL/CA Hazardous Material Inventory**

### 3.6.3. Oil Storage Program

Oil storage is regulated under Title 40 Code of Federal Regulations, Part 112 and the California Health and Safety Code Division 20, Chapter 6.67, § 25270-25270.13 and include containers with the capacity to store 55 gallons or more of oil. California code requires the owners/operators of an aggregate aboveground oil storage capacity greater than 1,320 gallons to prepare a Spill Prevention Control and Countermeasure (SPCC) Plan to define guidelines, practices, and procedures for storing and handling oil and ensure safe, efficient and timely response in the event of an oil spill or discharge and conduct periodic inspections. SNL/CA has an ongoing SPCC plan that is required to be reviewed every five years and must be updated when a change occurs in the oil storage inventory on-site. The Livermore-Pleasanton Fire Department is the regulating authority for aboveground storage tanks (ASTs) at SNL/CA. Approximately fifty-nine oil storage containers are managed and operated at SNL/CA, ranging in size from 55 to 1000 gallons. Each year, the containers 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 MN471022, *Environment, Safety, and Health Manual*. 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 2019, 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 13834. In 2019, 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 1, 2019, for submittal to NNSA/SFO on December 6, 2019. 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 1, 2019 and provided information for calendar year 2018. 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 2022, will be prepared in 2023.

### **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 CY2019 (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 2019 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 public meeting and hearing was held by DTSC on July 10, 2018, and a new ten-year permit was issued in September 2018 with an effective date of October 25, 2018.

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 medical waste facilities at SNL/CA. One is identified as small quantity generator (without onsite treatment), and the other is a large quantity generator (with on-site treatment). A small quantity generator is a facility that generated less than 200 pounds of medical waste monthly, whereas a large quantity generator is a facility that generated 200 pounds or more of medical waste monthly.

## **3.9. Radiation Protection**

### **3.9.1. Atomic Energy Act**

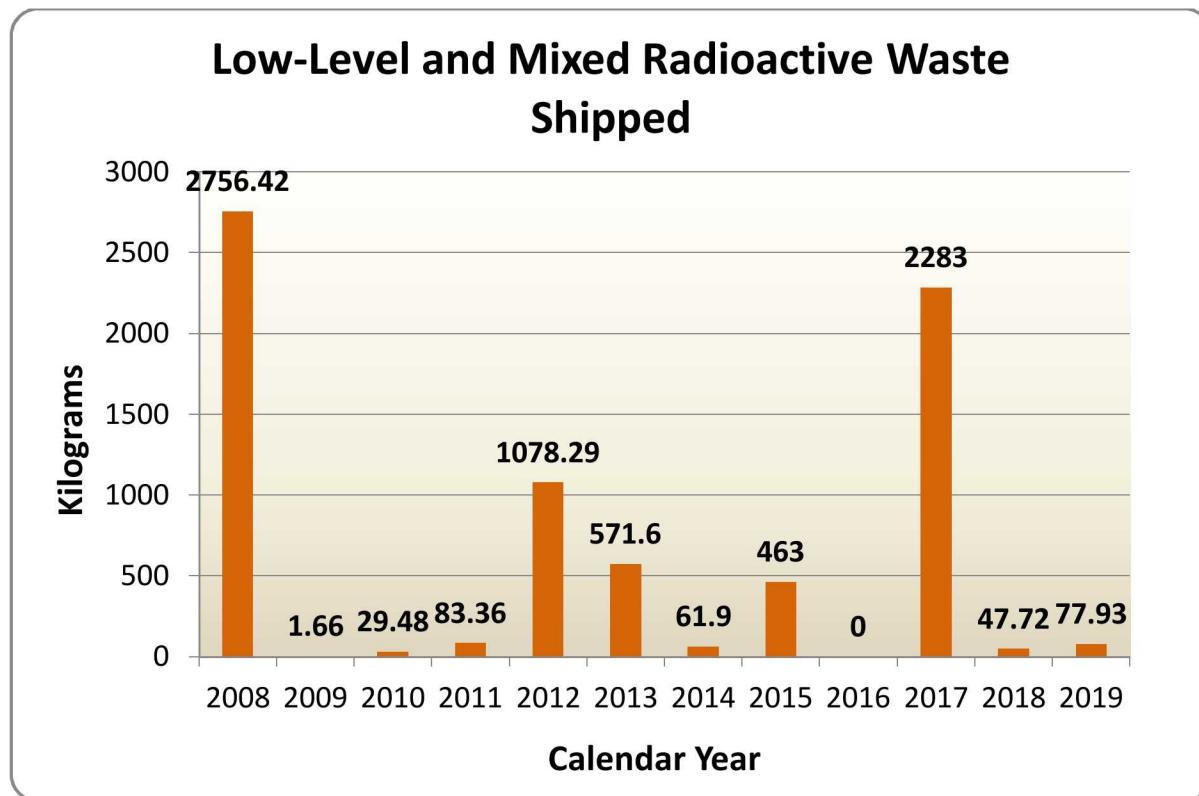
The purpose of the Atomic Energy Act (AEA) is to assure the proper management of source, special nuclear, and byproduct materials (42 USC § 2011 et. seq.). The DOE sets radiation protection standards and retains authority for radionuclides through department directives. Operations at SNL/CA are subject 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 typically generate low-level radioactive waste and low-level mixed waste. However, in 2018, two Americium-241 transuranic coin sources (1.577 uCi and 0.9856 uCi) were removed from “commercial off the shelf” smoke detectors and submitted for waste disposal. These sources were used to calibrate and test R&D radiation detectors at SNL/CA. No high-level radioactive waste is generated by SNL/CA operations. Radioactive and mixed wastes are stored prior to shipment in the Radioactive Waste Treatment and Storage Facility. 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. Figure 3-4 shows the quantity of total radioactive waste shipped from SNL/CA since 2008.



**Figure 3-4 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 2019.

**Table 3-2 Order 458.1 Compliance Summary, 2019**

Order 458.1 Requirement	SNL/CA 2019 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.

Order 458.1 Requirement	SNL/CA 2019 Summary
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 2018. The average annual gamma radiation measurement at the site perimeter in FY 2019 was 44 mrem and well below the total effective dose of 100 mrem.
Request authorization for temporary dose limits.	There were no special circumstances in 2019 requiring temporary dose limits.
Adopt ALARA exposures.	ALARA is incorporated into environment, safety, and health (ES&H) policy, processes, and operating 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 2018; therefore, there is no monitoring data available for dose evaluations.
Control airborne radioactive effluents.	ES&H policy, processes, operating 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 2019. Radioactive releases to the sanitary sewer above DOE Order 458.1 guidelines are not allowed at SNL/CA. ES&H policy, processes, operating procedures, and management systems are incorporated into site operations to ensure proper handling and disposal of radioactive materials.
Control radioactive waste.	SNL/CA typically generates low-level radioactive waste only. However, in 2018, two small americium-241 transuranic sources from commercial off-the-shelf smoke detectors were disposed through Radioactive Waste Management. 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, operating procedures, and management systems are incorporated into site operations to ensure proper handling and disposal of radioactive materials offsite at approved facilities. Routine analyses of groundwater and storm water samples include radioactive constituents.
Protect biota.	ES&H policy, processes, operating procedures, and management systems are incorporated into site operations to ensure proper handling and disposal of radioactive materials offsite at approved facilities. SNL/CA has no operations requiring biota monitoring.

Order 458.1 Requirement	SNL/CA 2019 Summary
Control the release of property with residual radioactivity.	There is no release of property to the public (e.g., vehicles, equipment, or other materials) with residual radioactivity above the limits specified in DOE Order 458.1. 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 2019, 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 2019.
	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 2019 with residual radioactivity above the limits in DOE Order 458.1.
Retain records.	ES&H policy, processes, and operating 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.

#### **3.10.1.1. 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<sup>3</sup> 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 2019 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 2019.

#### **3.10.1.2. Storm Water Discharge**

On July 1, 2015, a new industrial general permit<sup>3</sup> 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. 2018-2019 showed exceedances of the Numeric Action Levels for iron and aluminum. During 2018, SNL/CA installed storm water detention basins near the scrap yard as a Best Management Practice to address exceedances of the Numeric Action Levels. The basins were upgraded during 2019 to address continued exceedances. 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 2019, construction on a new parking lot on the east side of the site, and a replacement data center were initiated. Both of these projects include stormwater infiltration areas to meet the requirements.

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<sup>3</sup> Refer Table 3-5 SNL/CA Environmental Permits and Orders for permit/registration number.

### 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. The levels seen at SNL/CA were consistent with the levels found in the Livermore Valley, and thus are 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.

Area/Site/Program	Climate Stressors	Climate Stressor Likelihood	Impact on Mission Objective	Effect on Area/Site/Program
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 2019.

**Table 3-4 SNL/CA Audits, Assessments, and Inspections, 2019**

Title	Area of Focus	Date Conducted	Results
Livermore-Pleasanton Fire Department (CUPA)	Hazardous Waste Accumulation Area	November 5-7, 2019	One Minor Violation
Department of Toxic Substances Control (DTSC)	Hazardous Waste Facilities	January 16, 2019	No issues
Environmental Protection Agency (EPA)	Hazardous Waste Facilities and Accumulation Areas	June 26, 2018	No issues
Alameda County Office of Solid/Medical Waste Management	Medical Waste Management	December 3, 2019	No issues
City of Livermore, Water Resources Division Inspections	Wastewater discharges and categorical process laboratories	October 28-29, 2019	No issues
Alameda County Department of Environmental Health (ACDEH)	Inspection of Navy Landfill site	November 20, 2019	No issues
Orion Registrar, Inc.	Environmental Management System (EMS) ISO 14001 Surveillance Audit	March 11-12, 2019	1 Minor Nonconformance

### 3.14. Environmental Occurrences

An environmental occurrence is an event that meets the occurrence criteria established in DOE Order 232.2, Admin Change 1 (2017). In 2019, there was one environmental occurrence from SNL/CA operations as a result of a violation during an annual audit.

An annual Certified Unified Program Agency (CUPA) inspection was carried out from November 5<sup>th</sup> to the 7<sup>th</sup> by the Livermore-Pleasanton Fire Department. During the walk through performed on November 6<sup>th</sup>, the CUPA identified improper inspection process and documentation of tanks. Within 30 days, training was conducted for members of the work force with the different types of tanks. In addition, a pictorial guide for inspections was created and distributed to appropriate personnel.

### 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, 2019**

Type	Description	Permit/Registration Number	Effective Date	Statute / Regulation	Issuing Agency
Environmental restoration	Site Clean-up Order No. 89-184	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	CERS ID # 10135531	March 1– February 28, annually	California Health and Safety Code	Livermore-Pleasanton Fire Department
Hazardous material	Controlled Substances Registration	RM0154752	February 2, 2018– February 28, 2019	Controlled Substances Act	US DOJ/Drug Enforcement Agency
Hazardous waste	RCRA Hazardous Waste Facility Permit	EPA ID # CA2890012923	October 2018– October 2028 <sup>a</sup>	RCRA	California Department of Toxic Substances Control
Hazardous waste	Permit by Rule	943PBR1 943PBR2	January 1 – December 31, annually	California Health and Safety Code	Livermore-Pleasanton Fire Department
Hazardous waste	Conditionally Authorized Permit to Operate	NA	January 1 – December 31, annually	California Health and Safety Code	Livermore-Pleasanton Fire Department
Medical waste	Large Quantity Generator with On-site Treatment	PT0322429	July 10 – July 9, annually	California Health and Safety Code	Alameda County Dept. of Environmental Health
Medical waste	Small Quantity Generator without On-site Treatment	PT0304629	April 12 – April 11, annually	California Health and Safety Code	Alameda County Dept. of Environmental Health
Wastewater	Wastewater Discharge Permit	1251	August 4 – August 3, annually	Clean Water Act	City of Livermore Water Reclamation Plant
Storm water	State of California Industrial General Permit	2 011002598	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	ACOE:2006-400195S RWQCB Site No. 02-01-C0987	September 25, 2008 – December 31, 2020	Clean Water Act	Army Corp of Engineers
Aboveground storage tanks	Storage statement	1211-12142017	January 1 – December 31 Required in CERS	Aboveground Petroleum Storage Act	Livermore-Pleasanton Fire Department
Air	Permit to Operate- non-retail Gasoline Dispensing Facility	Plant 290 Source 32	July 1 – June 30, annually	Clean Air Act	Bay Area Air Quality Management District

Type	Description	Permit/Registration Number	Effective Date	Statute / Regulation	Issuing Agency
Air	Permit to Operate- Maintenance and Facilities Adhesive Usage	Plant 290 Source 93	July 1 – June 30, annually	Clean Air Act	Bay Area Air Quality Management District
Air	Permit to Operate- Site-wide wipe cleaning	Plant 290 Source 95	July 1 – June 30, annually	Clean Air Act	Bay Area Air Quality Management District
Air	Permit to Operate- Spray Paint Booth	Plant 290 Source 110	July 1 – June 30, annually	Clean Air Act	Bay Area Air Quality Management District
Air	Permit to Operate- Standby generator	Plant 290 Source 101	July 1 – June 30, annually	Clean Air Act	Bay Area Air Quality Management District
Air	Permit to Operate- Standby generator	Plant 290 Source 104	July 1 – June 30, annually	Clean Air Act	Bay Area Air Quality Management District
Air	Permit to Operate- Standby generator	Plant 290 Source 105	July 1 – June 30, annually	Clean Air Act	Bay Area Air Quality Management District
Air	Permit to Operate- Standby generator	Plant 290 Source 108	July 1 – June 30, annually	Clean Air Act	Bay Area Air Quality Management District
Air	Permit to Operate- Standby generator	Plant 290 Source 109	July 1 – June 30, annually	Clean Air Act	Bay Area Air Quality Management District
Air	Registered emission sources- boilers 9	Plant 290 Sources 81, 82, 121, 122, 123, 124, 125, 126, 127	July 1 – June 30, annually	Clean Air Act	Bay Area Air Quality Management District
Universal waste	Generator statement	Business ID # 516 Facility ID # 396	February 1, 2006	California Electronic Waste Recycling Act	California Department of Toxic Substances Control

<sup>a</sup> A permit renewal application for another ten-year period was submitted to DTSC on June 28, 2013. A public meeting and hearing was held by DTSC on July 10, 2018, and a new permit was issued in September 2018 with an effective date of October 25, 2018.

## 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

### 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, the fiscal year 2019 significant aspects were determined to be air emissions, hazardous waste, and water discharges. Objectives and targets were identified for the three aspects. SNL/CA personnel monitor objectives and targets quarterly and provide progress reports to site management and the corporate EMS program representative.

#### 4.1.1. SNL/CA EMS Objectives and Targets

In fiscal year 2019, three EMS objectives and corresponding targets were established to support environmental improvement at SNL/CA. Site personnel met all three of the targets in 2019. Table 4-1 summarizes EMS objectives, targets, and results for fiscal year 2019.

**Table 4-1 SNL/CA EMS Objectives and Targets, FY 2019**

Environmental Aspect	Objective	Target	FY 2019 Result
Solid Waste	Reduce Solid Waste	Place recycling/compost/solid waste bins so that they are reasonably	<b>Target Met</b> – Physical inspection of storage areas completed.

		available to all 8000 CA MOWs end of FY20.	
Air Emission Hazardous Materials Hazardous Waste Water Discharges	Minimize Regulatory Risk	By end of FY19, evaluate equipment related to environmental permit or regulatory compliance to ensure calibration is up to date and scheduled.	<b>Target Met-</b> Incorporated inspections and calibration schedules into management system.
Hazardous Waste Recycle Solid Waste Stormwater	Increase Awareness	Implement an awareness campaign for how to properly get rid of unwanted items at the CA site.	<b>Target Met</b> – Incorporated posts in California Daily Announcements to increase awareness to MOW.

## 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 British Thermal Unit/Gross Square Feet/Year (BTU/GSF/YR). The energy reduction target is 156,844 BTU/GSF/YR illustrated by the dashed red line in Figure 4-1. As shown, energy intensity increased in 2019 compared to 2018. This is likely due to an increase in personnel and associated electricity use. Personnel will continue to identify energy reduction opportunities at SNL/CA to support this target in future years.

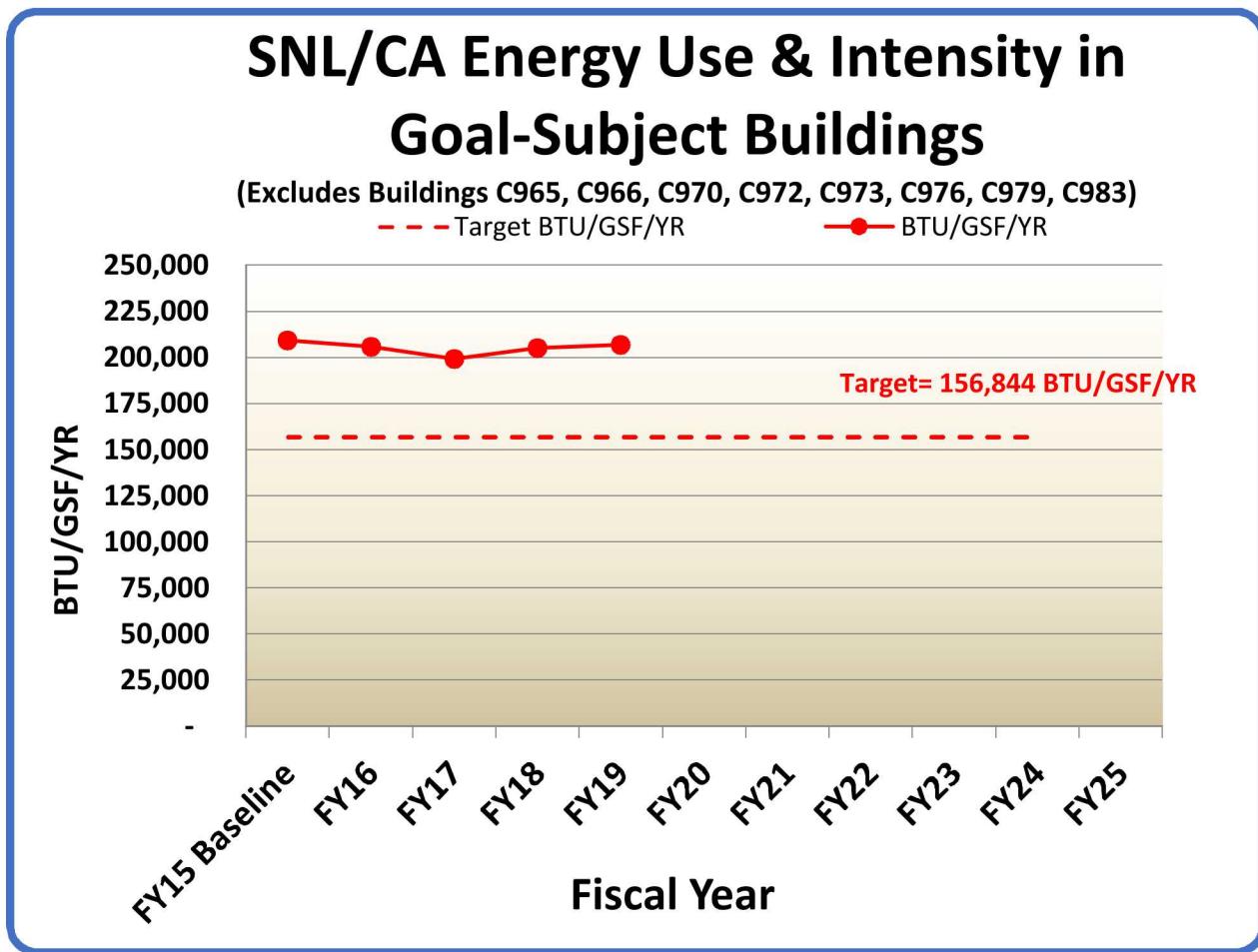
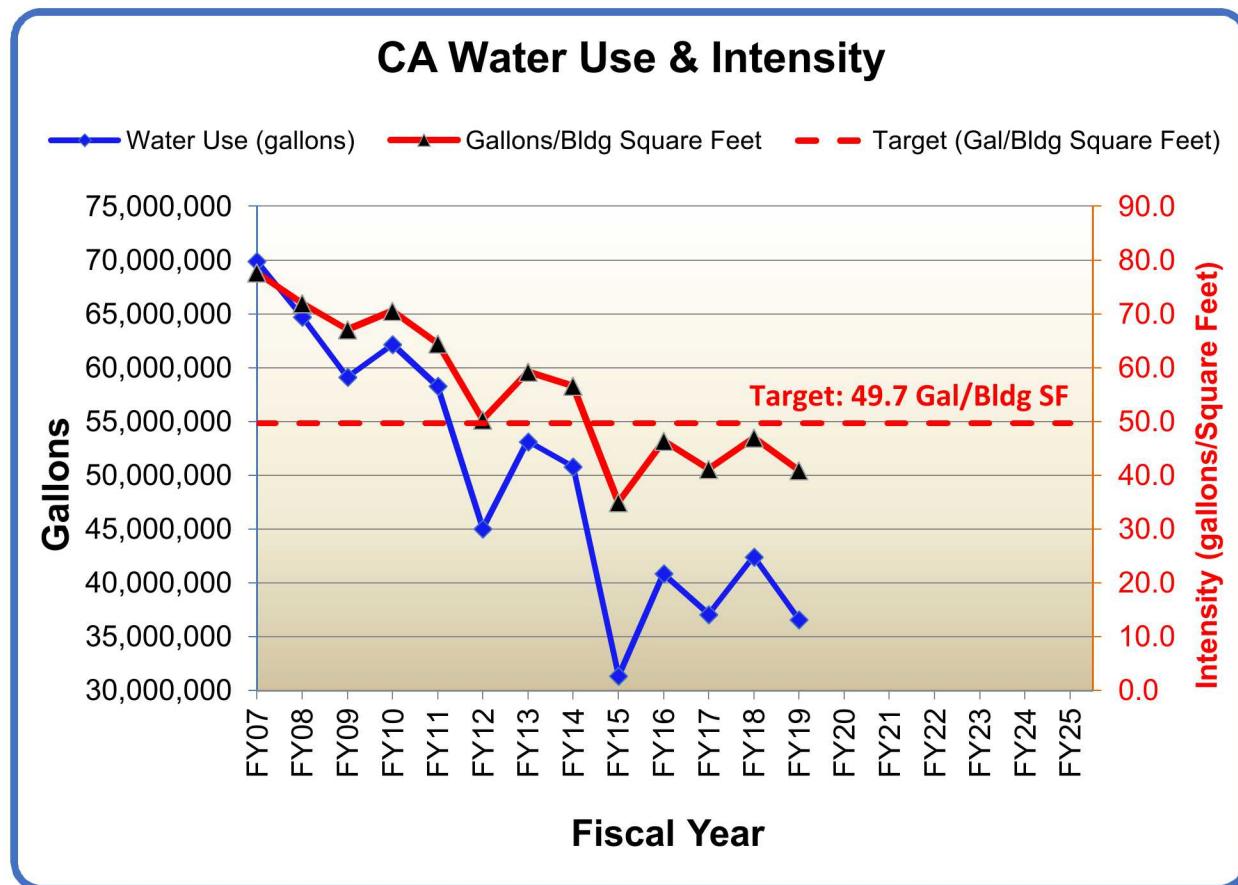


Figure 4-1 SNL/CA Energy Use Intensity

#### 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 2015 and has been maintained over the last four years.



**Figure 4-2 SNL/CA Water Use Intensity**

#### 4.2.3. Greenhouse Gas Reduction

Targets for air emissions in effect for 2019 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 46 percent relative to the 2008 baseline. Scope 3 GHG emissions have increased from the 2008 baseline since FY13. This increase is likely a result of additional employee commuting and business travel. However, there was a reduction of scope 3 GHG by 3.5 percent between FY18 and FY19.

In 2019, SNL/CA personnel completed the following activities to support the corporate targets:

- 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;
- encouraged participation of the Commuter Profile Survey;
- 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)
- 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.

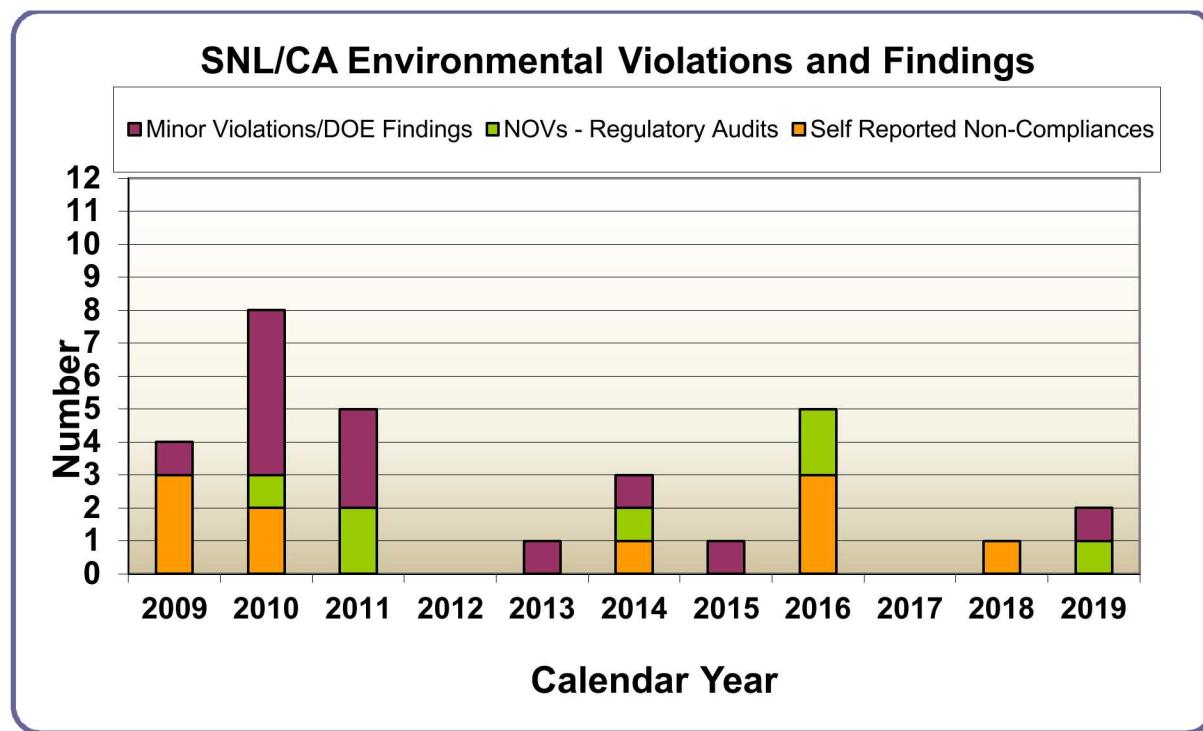
**Table 4-3 Summary of GHG Reporting, 2019**

Greenhouse Gas	Emissions
SF6 Emissions from Gas Insulated Switchgear	0 % leak rate (0 lbs of SF6)*
SF6 for Research Operations	0 kg of SF6
Refrigerants	256 lbs of R-123 35 lbs of R-22 0 lbs of R-410A 0 lbs of R-502 73 lbs of R-134a

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

### 4.3. General Environmental Compliance Metrics

SNL/CA personnel track noncompliance with environmental requirements as a measure of our environmental management performance at SNL/CA. Figure 4-3 shows the number of findings from third-party audits (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 was one minor nonconformance during an EMS ISO 14001:2015 surveillance audit performed on March 12, 2019. Two versions of an Oil Storage Facility Inspection Checklist were used in one storage location in 2018. In addition to the minor nonconformance, there was one Notice of Violation from regulatory agency audits in 2019. See Section 3.14 for additional information. SNL/CA had no self-reported non-compliances in 2019.



**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 2019 support the state's endeavors through monitoring, compliance activities, and annual reporting. The Air Quality Program's additional highlights for 2019 are listed below.

- Completed and submitted the BAAQMD Annual Update Package (supporting documentation and data for renewal of BAAQMD Permit-To-Operate).
- Provided regulatory oversight for SF6 emissions reduction effort from gas insulated switchgear. The SNL/CA leak rate for the year was 0%, meeting the required 2019 Air Resources Board Maximum Annual SF6 Emission Rate of two percent or less.
- Met all regulatory report deadlines in 2019, submitting seven 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.

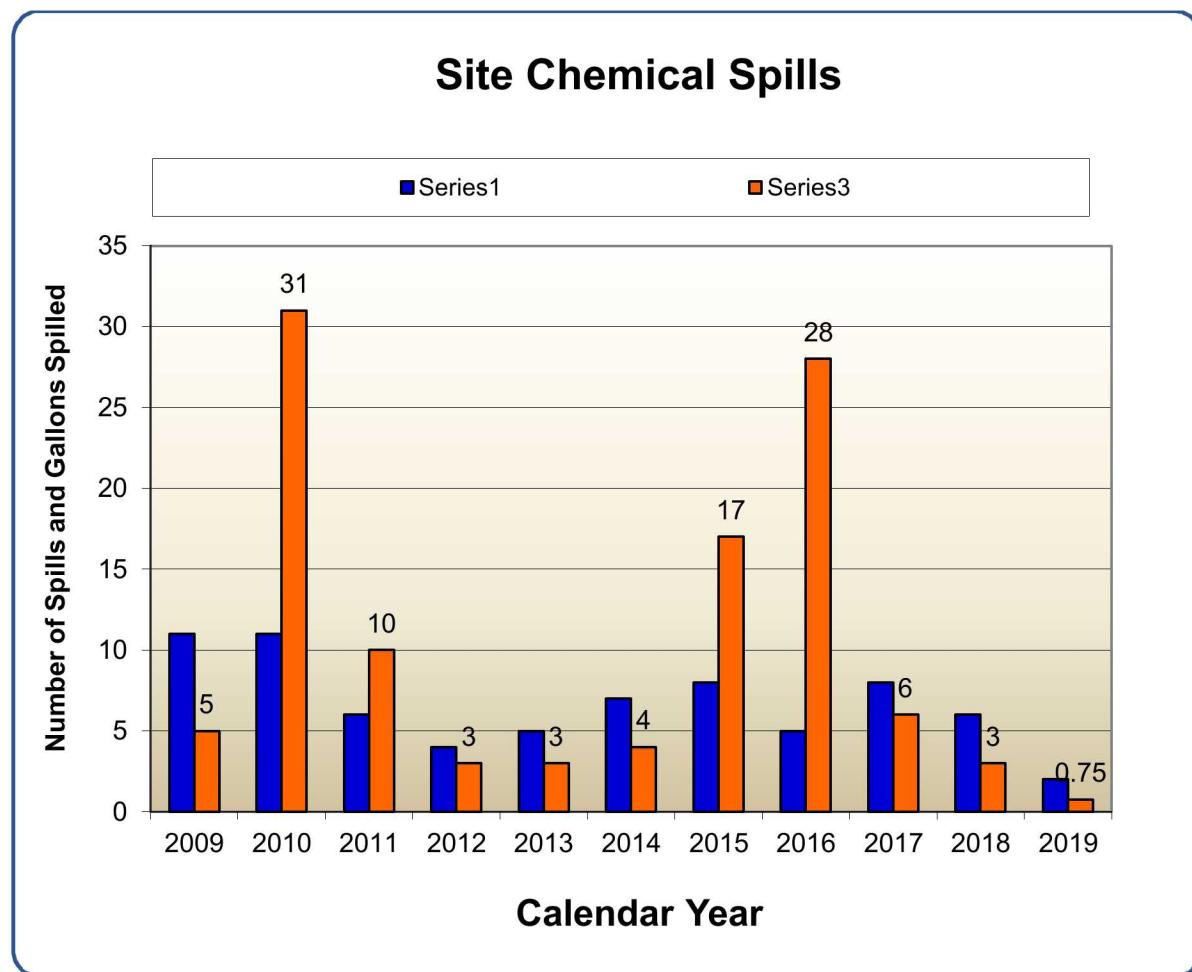
SNL/CA personnel will continue to monitor restored areas over a ten-year period to ensure restoration is successful and permit requirements for plant survival are met. The ten-year period ended in July 2018, but a permit extension was received in 2018 that is valid until December 2020. Repairs and replanting 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 2019 was approximately 9 million gallons, representing a 44% percent decrease from 2018. Wastewater discharges typically fluctuate year-to-year in response to changes in site operations. In 2019, the site's water source was primarily Hetch-Hetchy water. This cleaner source of water (as compared to Zone 7 water) causes less water to be used by the site's cooling towers, and consequently, less blow-down of wastewater from the cooling towers. In addition, late in 2019, the C807 cooling tower (the largest on-site) was replaced with an air-cooled unit. This will also decrease the amount of cooling tower blow-down received by the sanitary sewer.

### **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 2009. 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 2019 included battery sulfuric acid (less than a quart) and diesel exhaust fluid (0.5 gallon). None of the chemical spills shown in Figure 4-4 resulted in releases to groundwater or required environmental remediation.



\*Unqualified spill from equipment failure- see section 4.5.3.

**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. There was one sanitary sewer overflow at SNL/CA on June 26, 2019, totaling approximately 5 gallons.

#### 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 2019 comparison and an evaluation of results.

**Table 4-4 Comparison of 2019 Operations with SWEA / SA Envelope**

Activity / Unit	SWEA / SA Envelope (maximum operations)	Calendar Year 2019	Site Operations Remain Within Impact Analysis of SWEA / SA
<b>Action</b>			
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
		No new facilities were constructed in 2019. 27,611 sf as of	
	5,000 sf badge office; new 16,000 sf laboratory; 84,000 sf laboratory replacement for Building 916; 8,400 sf computational facility	December 31, 2018 (C903 computational facility 8364 sf, C929 office bldg. 19,247 sf. 60,377 sf as of	No- a separate NEPA review was completed for C929 office building.
New facilities			
Demolition	100,000 sf	December 31, 2019	Yes
<b>Land Use</b>			
		8 acres as of December 31, 2018	
Construction area	93 acres	31, 2018	Yes
Wildlife reserve	30 acres minimum	106 acres	Yes
<b>Geology / Soil</b>			
Solid waste management units	23 units total	22 units	Yes
Soil removed	5000 cu yd/yr	<500 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
<b>Infrastructure</b>			
Water use	91.8 million gal/yr	38 million gals	Yes
Sanitary sewer discharge	29.1 million gal/yr	8.8 million gals	Yes
Natural gas use	94 million cu ft/yr	42.1 million cu ft	Yes
Electricity use	48,800 MW hr/yr	36,852 MW hrs	Yes
<b>Biological and Ecological Resources</b>			
Construct flood plains in Arroyo Seco	1800 linear feet	612 linear feet as of December 31, 2018	Yes
Create riparian habitat	0.2 acres	5.64 acres as of December 31, 2018	No, Positive impact
Ground disturbance in / along arroyo	10 acres	< 6 acres as of December 31, 2018	Yes
<b>Cultural Resources</b>	None known on site	No change	Yes
<b>Water Resources</b>			
Impervious surface area	95.35 acres total	91 acres	Yes
Irrigation water use	17 million gal/yr	No data <sup>b</sup>	---
<b>Waste Generation</b>			
Radioactive waste	8,811 kg/yr	66.2 kg	Yes
Hazardous waste	133,820 kg/yr	97,450 kg	Yes
Solid waste (non-hazardous, excludes construction debris)	378.7 metric tons/yr	100 metric tons <sup>e,f</sup>	Yes

Activity / Unit	SWEA / SA Envelope (maximum operations)	Calendar Year 2019	Site Operations Remain Within Impact Analysis of SWEA / SA
<b>Action</b>			
<b>Transportation</b>			
Hazardous / radioactive waste shipments	116 shipments/yr	59 shipments	Yes
Nonhazardous solid waste shipments to landfill	80 shipments/yr	63 routine trash and 58 construction debris shipments; 121 total	No
<b>Air Emissions</b>			
Total criteria pollutants	8,212 kg/yr	4,474 kg <sup>a</sup>	Yes
Total air toxics	2,880.16 kg/yr	331 kg <sup>a</sup>	Yes
Radioactive	0 emissions	0 emissions	Yes
Permits	57 permits annually	9/9 permits <sup>b</sup>	Yes
<b>Human Health</b>			
Recordable accidents / injuries	78 accidents / injuries annually	13 accident / injuries <sup>c</sup>	Yes
Lost work-day cases	19 cases annually <sup>c</sup>	3 cases <sup>c</sup>	Yes
<b>Socioeconomics</b>			
Employment	Up to 1931 persons annually	1583 persons <sup>d</sup>	Yes

<sup>a</sup> Annual emissions were calculated by multiplying the daily emissions reported in the BAAQMD Permit to Operate by 365. 2019 emissions are based on 2018 data.

<sup>b</sup> Data provided for the 2018/2019 (9 permitted sources) and 2019/2020 (9 permitted sources) permit periods. See Section 3.3.1 for more information.

<sup>c</sup> Extrapolated from historical average.

<sup>d</sup> SNL/CA employees (U.S. citizens and foreign nationals) and on-site contractors. Data from October 2019.

<sup>e</sup> Fiscal year data (October 1 – September 30).

<sup>f</sup> Routine waste sent to the landfill.

<sup>g</sup> Fiscal year data represents Division 8000 managed budget. Increased from FY 2015 due to increase in weapons program funding.

<sup>h</sup> Water meters were not read in 2018, no data available for irrigation water use.

## 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 2019, Pollution Prevention staff conducted or supported the activities below.

- Hosted an Earth Day celebration that was attended by both Lawrence Livermore National Laboratory (LLNL) and SNL/CA staff. Attendees had an opportunity to go on a bird walk around the California site, recycle personal electronics, meet therapy dogs, and learn more about recycling and composting. Vendors were on hand showcasing equipment and processes for use by Sandians researching alternative energies, advanced materials, and the environmental or biological sciences.
- The SNL/CA Green Team continued work on sustainable acquisitions and waste reduction to meet Alameda County's waste management ordinance requiring 90% diversion of waste from landfill by 2020.

- Developed a standard process to collect and shred outdated bound books, with recycling of resultant shredded material. In 2019, more than 60 boxes of books were shredded and recycled.
- Attended monthly meetings with LLNL staff to discuss opportunities to work together to combine resources to enhance Sustainability/Pollution Prevention Programs.
- Awarded a Sandia Employee Recognition Award (ERA) in the category collaboration for Earth Day/ Scientist Fair 2019.

#### **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. During FY19, SNL/CA did not meet Alameda County's 90 percent diversion goal but increased total diverted waste from 71 percent in FY18 to 82 percent in FY19. Percent of construction debris diverted increased from 40 percent to 87 percent from FY18 to FY19 respectively. SNL/CA personnel will continue efforts to increase the diversion rate through recycling, composting, and reuse. The number of shipments of non-hazardous waste from the SNL/CA site was 121. This exceeded the maximum operation number of shipments identified in the SWEA of 80. The increase shipments was likely due to an increase in construction and site operations. However, the increase in shipments did not result in the need for additional capacity at the local landfill.

Figure 4-6 presents routine municipal solid waste sent to the landfill for fiscal years 2003 to 2019. The quantity of non-hazardous solid waste sent to the landfill in 2019 increased by 12 metric tons from 2018. The increase in waste at SNL/CA is most likely due to an increase in the work force onsite.

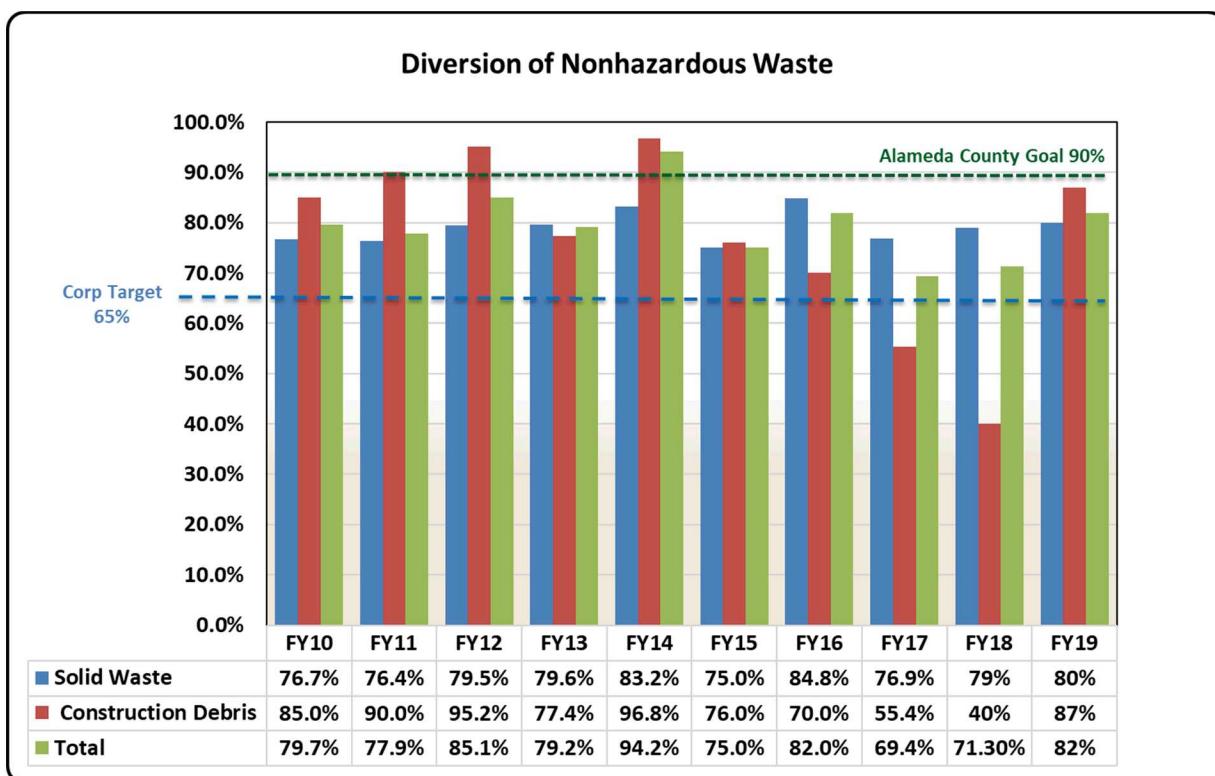


Figure 4-5 Solid Waste and Construction Debris Diverted from Landfill Disposal

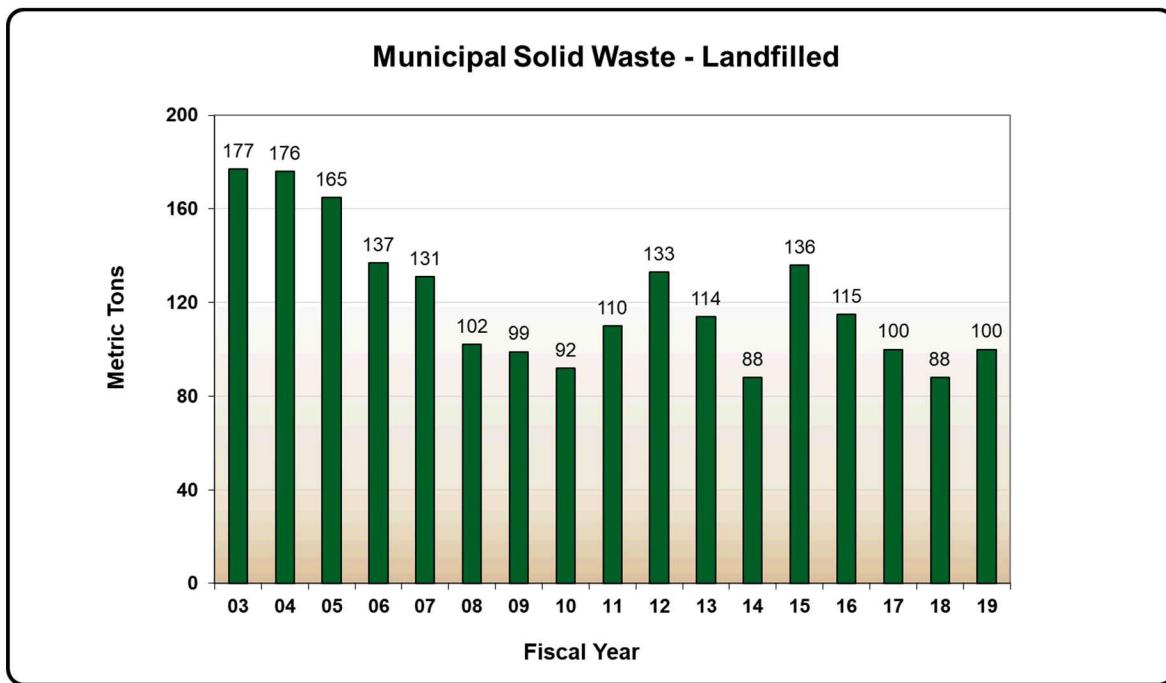


Figure 4-6 SNL/CA Landfill Waste

## **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 2019, 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.
- Continued ongoing 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 California Toxic/ asbestos/ PCB contaminated materials from building retrofits.
- Coordinated disposal of legacy export-controlled waste type material.
- Coordinated disposal of various energetic/ explosive materials

Assist with coordination of decontamination services to support onsite lab expansion and building retrofits.

### **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 radioactive waste generated in 2019 was from routine operations. Figure 3-2 depicts the radioactive waste shipped for the calendar year.

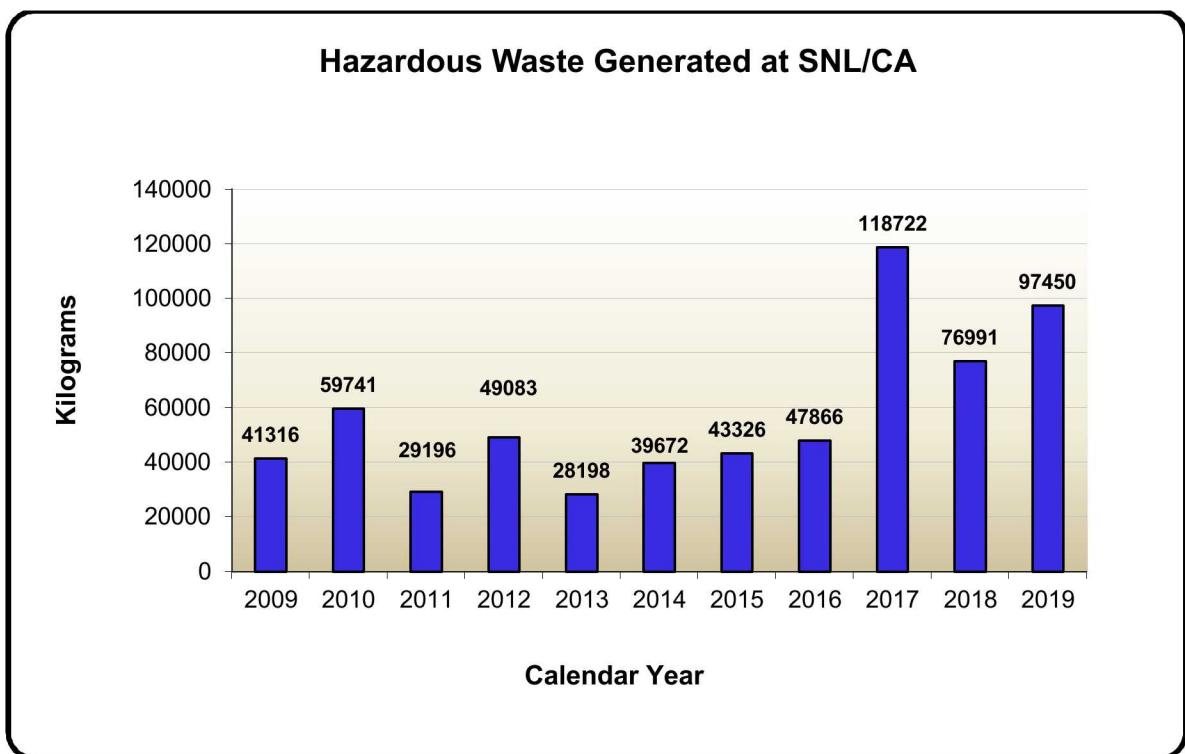


Figure 4-7 Hazardous Waste Generated at SNL/CA

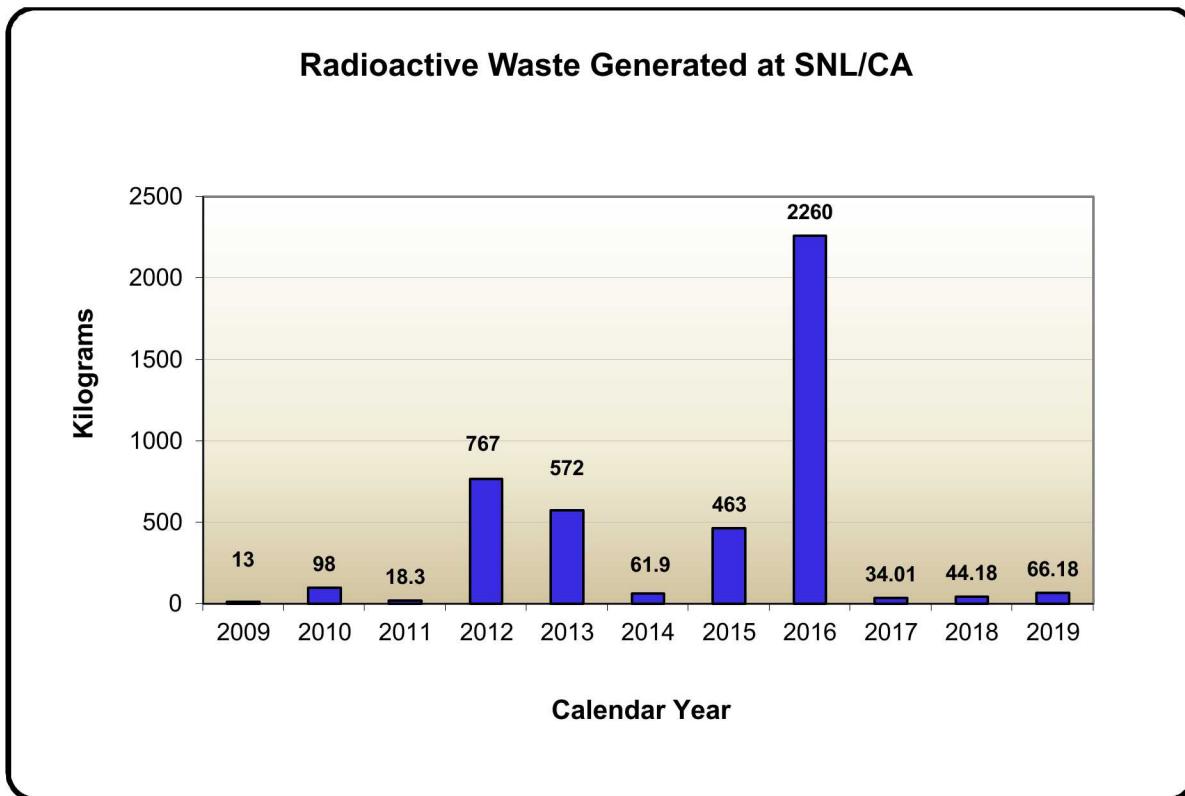


Figure 4-8 Radioactive Waste Generated at SNL/CA

## 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). 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

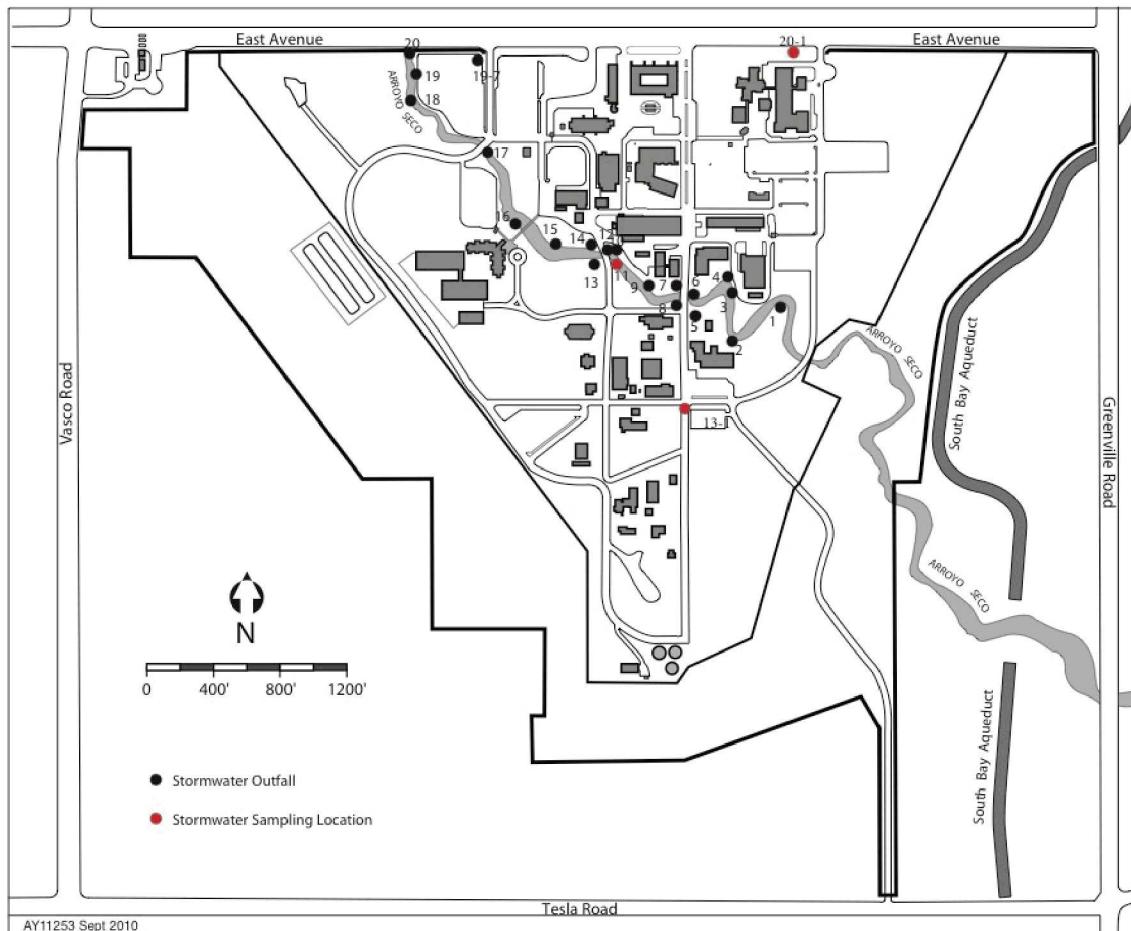
All storm water runoff from SNL/CA is conveyed to the Arroyo Seco that discharges into Alameda Creek and eventually to the San Francisco Bay. Storm water that flows off buildings, material-handling areas, parking lots, and other impervious surfaces, may pick up pollutants, such as oil and grease, soil, 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, three 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 three locations during the period or during any one storm.

During the 2018/2019 reporting year (July 1 through June 30), SNL/CA personnel performed sampling at two locations. Four samples were collected at Location 11 (the required number), and one sample was collected at Location 13. Location 13 is designed to contain flow up to the 95<sup>th</sup> percentile storm, so it is only sampled during heavy rain events. Analytical results of storm water sampling for the 2018/2019 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, 2018/2019 Reporting Year**

Parameter	Number of Samples Analyzed	Number Found Below Detection Limit	Detection Limit	Numeric Action Level	Annual Average Concentration
Total suspended solids	5	0	1 mg/L	100 mg/L	27 mg/L
pH	5	NA	None	<6 or >9	6.62
Oil and grease	5	5	1.4 mg/L	15 mg/L	<1.4 mg/L
Chemical oxygen demand	5	0	9 mg/L	120 mg/L	30 mg/L
Aluminum	5	0	0.008 mg/L	0.75 mg/L	1.23 mg/L
Iron	5	0	0.02 mg/L	1.0 mg/L	1.6 mg/L
Lead	5	4	0.0024 mg/L	0.26 mg/L	0.012 mg/L
Zinc	5	0	0.008 mg/L	0.26 mg/L	0.06 mg/L
Nitrite + nitrate	5	0	0.08 mg/L	0.68 mg/L	0.29 mg/L
Total Phosphorus	5	1	0.011 mg/L	2.0 mg/L	0.14 mg/L

Tritium analyses were discontinued 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.

Under the 2014 Industrial General Permit (effective July 1, 2015), storm water samples collected by SNL/CA personnel for the 2018/2019 reporting year (July 1, 2018, through June 30, 2019) at two 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. In 2018, SNL/CA personnel submitted a Level 2 ERA Technical Report, outlining the actions that were taken to address the exceedances. These actions included removing pollutant sources in some areas and installing detention basins near the scrap yard. Future data will show if the actions taken were effective in reducing the iron and aluminum concentrations.

## 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 <sup>a</sup> Oil and grease
Monthly	Grab	Cyanide EPA priority organic pollutants

<sup>a</sup>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 2019, 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. SNL/CA personnel report positively identified organic constituents. In 2019, sewer outfall samples showed sporadic concentrations of Chloroform (up to 4.4 µg/L), Bromoform (up to 32 µg/L), Toluene (up to 3.2 µg/L), Phenol (up to 21 µg/L), Gamma-BHC (at 0.017 µg/L), 4,4'-DDT (at 0.023 µg/L), Endosulfan sulfate (at 0.017 µg/L), and Endrin (at 0.019 µg/L). All other constituents on the EPA toxic organic list were below minimum detection limits. The toxic organic discharge limit for the site is 1,000 µg/L. In 2019, 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, 2019**

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	120	590
Total dissolved solids	12	0	5	None	400	760
Biochemical oxygen demand	12	0	2	None	120	410
Chemical oxygen demand <sup>a</sup>	12	0	9	None	140	920
Oil & Grease – Mineral	12	2	1.4	100	<1.4	30
Oil & Grease – Animal / Veg.	12	3	1.4	100	<1.4	50
Cyanide	12	7	0.002	0.04	<0.002	0.0075
Arsenic	52	44	0.0040	0.06	<0.0040	0.010
Cadmium	52	51	0.0010	0.14	<0.0010	0.0012
Chromium	52	52	0.0040	0.62	<0.0040	<0.0040
Copper	52	0	0.014	1	0.028	0.26
Lead	52	52	0.0070	0.2	<0.0070	<0.0070
Mercury	52	47	0.00006	0.01	<0.00006	0.00098
Nickel	52	8	0.0030	0.61	<0.0030	0.0087
Silver	52	52	0.0040	0.2	<0.0040	<0.0040
Zinc	52	0	0.0080	3	0.024	0.42

<sup>a</sup>Chemical 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 2019. 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 2019, no wastewater from the LECS tank was shipped off-site for 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 2019, all wastewater from this operation met the pretreatment standards.

**Table 5-4 Monitoring for Semiconductor Manufacturing Categorical Process, 2018**

Parameter	Number of Samples Analyzed	Number Found Below Detection Limit	Detection Limit	Minimum Concentration	Maximum Concentration	Permit Limit <sup>a</sup>
pH	2	--	None	8.0	8.0	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 <sup>b</sup>	All below detection limit	All below detection limit	1.37 mg/L <sup>c</sup>

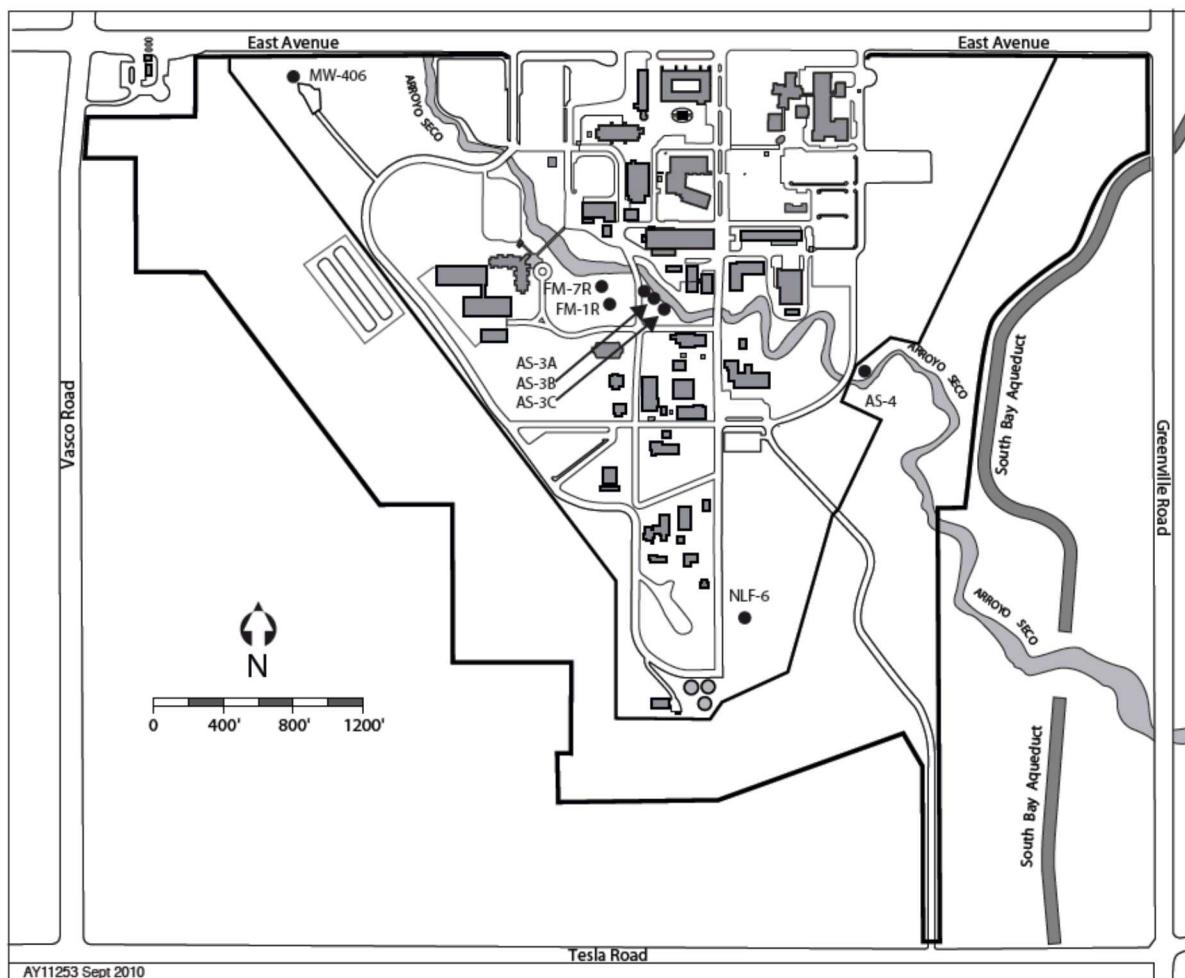
<sup>a</sup> Permit limit for site outfall.

<sup>b</sup> Detection limits for the various organics included in this value range from 0.005 to 0.130 mg/L.

<sup>c</sup> 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 5-2 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); Benzene, Ethylbenzene, Toluene, Xylenes (BTEX); Naphthalene; water elevation
Navy Landfill (Well NLF-6)	Annually	Volatile halogenated organics; water elevation
Arroyo Seco (Wells AS-3A, AS-3B, AS-3C, and AS-4)	Annually	Metals, volatile halogenated organics, total petroleum hydrocarbons-diesel, 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 summarize groundwater analytical results for Arroyo Seco wells. Analyses for general minerals in Arroyo Seco samples are completed every two years. General mineral analyses were required in 2019. LLNL personnel last sampled MW-406 during the second quarter of 2018. The only constituent of interest detected was tetrachloroethene at 0.88 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 2019. The concentration was above the state MCL of 0.5 µg/L, but below the federal MCL of 5.0 µg/L. The result is similar to that detected in past years. The presence of carbon tetrachloride in this well has been noted since well completion. The State Water Resources Control Board has required SNL/CA personnel to monitor this well for carbon tetrachloride, though the Navy Landfill is considered a closed site. It should be noted that well NLF-6 does not draw water from a drinking water or irrigation aquifer. The MCLs are shown for comparison only. A further comparison would be to EPA's Suggested No-Adverse Response Level (SNARL) — that of 200 µg/L for a 10-day exposure. A Mann-Kendall test for trend shows that the carbon tetrachloride shows an upward trend from 2005 to 2018, yet the level remains well below a level that would require action by SNL/CA personnel.

In 2019, diesel continued to be detected at the Fuel Oil Spill site. Diesel was not detected during the first quarter sampling but was detected during the third quart sampling. Table 5-7 summarizes ground water analyses for the Fuel Oil Spill site. Figure 5-3 shows the levels of diesel at Fuel Oil Spill site and the associated depth to ground water.

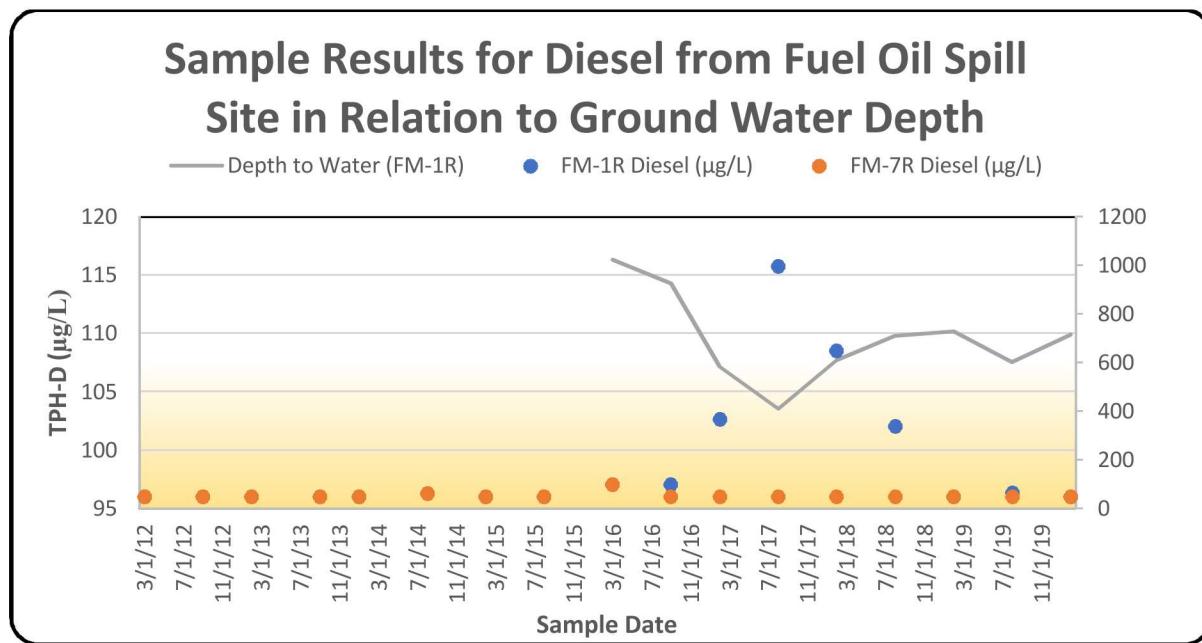


Figure 5-3 Sample Results for Diesel from Fuel Oil Spill Site in Relation to Ground Water Depth

**Table 5-6 Summary of Groundwater Analyses – Navy Landfill, 2019**

	Date	Trichloromethane <sup>a</sup> (chloroform) µg/L	Carbon Tetrachloride <sup>a</sup> µg/L	Tetrachloroethene <sup>a</sup> (PCE) µg/L
Detection limit	N/A	0.4	0.4	0.4
MCL – California	N/A		0.5	5
MCL – Federal	N/A	100	5	5
<b>Navy Landfill</b>				
NLF-6	5/22/19	ND	1.4	ND

<sup>a</sup>All other EPA 601 parameters were non-detectable.

MCL – Maximum contaminant levels.

N/A- Not Applicable

**Table 5-7 Summary of Groundwater Analyses – Fuel Oil Spill, 2019**

	Date	TPH-D µg/L	Benzene µg/L	Toluene µg/L	Ethylbenzene µg/L	Xylenes µg/L
Detection limit	N/A	50	0.3	0.3	0.4	0.5
MCL – California	N/A	-	1	150	300	1750
MCL – Federal	N/A	-	5	1000	700	10000
<b>Fuel Oil Spill</b>						
FM-1R	2/25/19	ND	ND	ND	ND	ND
FM-7R	2/25/19	ND	ND	ND	ND	ND
FM-1R	8/21/19	66	ND	ND	ND	ND
FM-7R	8/21/19	ND	ND	ND	ND	ND

MCL – Maximum contaminant levels.

N/A- Not Applicable

**Table 5-8 Summary of Groundwater Analyses at Arroyo Seco Wells - Metals, 2018**

Date	EPA 624	Diesel (8015) µg/L	Barium mg/L	CCR Metals						
				Cadmium mg/L	Chromium mg/L	Copper mg/L	Molybdenum mg/L	Nickel mg/L	Selenium mg/L	Thallium mg/L
Detection limit	N/A	50	0.003	0.001	0.004	0.014	0.003	0.003	0.008	0.003
MCL - California	N/A		1	0.01	0.05	1			0.01	
MCL - Federal	N/A		2	0.005	0.1	1		0.1	0.05	0.002
AS-3A	5/22/19	390 <sup>1</sup>	ND	0.11	ND	0.0056	ND	0.0077	ND	ND
AS-3B	5/22/19	ND	ND	0.13	ND	0.0054	ND	0.0074	ND	ND
AS-3C	5/22/19	ND	ND	0.13	ND	ND	ND	0.0099	ND	ND
AS-4	5/22/19	ND	ND	0.083	ND	0.0045	ND	0.0065	0.0056	ND

MCL – Maximum contaminant levels.

ND – Non-detectable.

N/A- Not Applicable

## 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.

The annual average background dose in 2019 was 35 mrem (0.35 mSv). The average annual perimeter dose was 44 mrem (0.44 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.

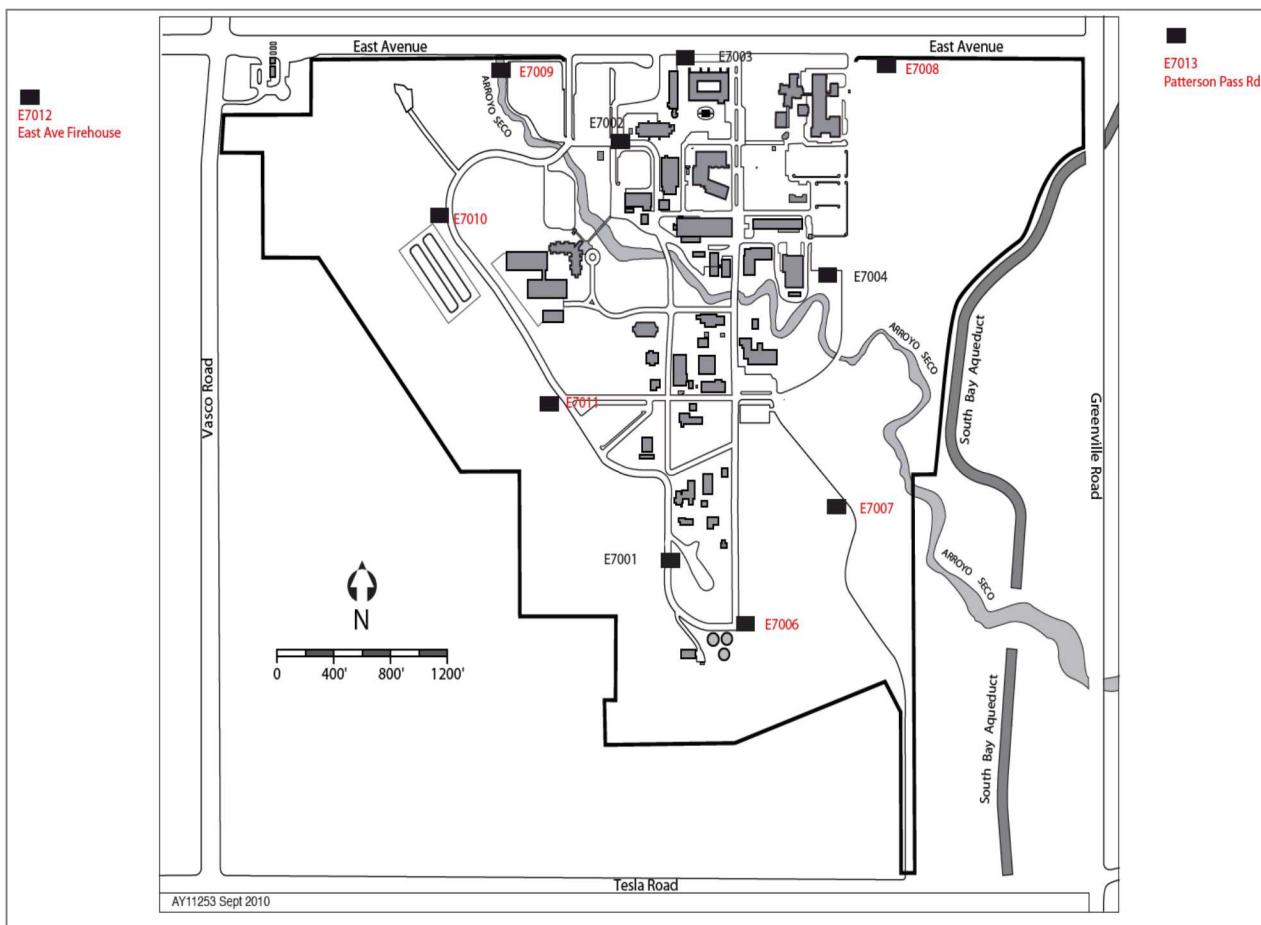


Figure 5-4 Dosimeter Locations at SNL/CA and Around Site Perimeter

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## 6. QUALITY ASSURANCE

Sandia National Laboratories, California (SNL/CA) personnel follow the Laboratory Policy for quality assurance, QA001, *Quality Assurance Policy* (SNL 2019).

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.

### 6.1. Environmental Monitoring Quality Assurance

**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

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 two avenues, depending on the sample medium or constituent analyzed. The two avenues are: a State accredited 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 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 and neutron radiation. The environmental dosimetry program utilizes dosimeters provided and read by Landauer Corporation. 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.

## **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 2019, 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. Four storm water quality control samples were collected during the 2018/2019 wet season, representing 60 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 2019. As shown, some data quality objectives failed during the year. The 2 failed storm water precision tests were Nitrate + Nitrite (one sample) and Total Suspended Solids (one sample). 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. The one failed wastewater accuracy test was addressed by the analytical laboratory. All other tests were within the acceptance criteria. One wastewater precision test failed (COD). The failure was likely due to heterogeneity in the sample. The test met 84% probability. No investigation was initiated.

**Table 6-1 Summary of Statistical Analyses, 2018**

Sample Medium	Completeness Test		Precision Test		Accuracy Test	
	Results	# of Tests	Results	# of Tests	Results	
Wastewater (sanitary sewer)	100%	6	5 passed	28	27 passed	
Storm water	100%	16	14 passed	-	-	
Groundwater	100%	1	1 passed	-	-	

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## 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*.

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

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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, 2019**

	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		0.3	0.4	0.4	0.4	0.5	0.4	0.3	0.4	0.4	0.4	0.4	0.4	0.4
MCL - California		0.5					10	5	200	0.5	0.5	5	5	
MCL - Federal		2				5	100		100	200	5	5	5	5
Well ID														
NLF-6	5/22/19	ND	ND	ND	ND	ND	ND	0.75	ND	1.4	ND	ND	ND	ND
Field Dup	5/22/19	ND	ND	ND	ND	ND	ND	0.75	ND	1.4	ND	ND	ND	ND
Field Blank	5/22/19	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trip Blank	5/22/19	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-3A <sup>1</sup>	5/22/19	-	-	-	-	-	-	-	-	-	-	-	-	-
AS-3B	5/22/19	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-3C	5/22/19	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-4	5/22/19	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FM-1R	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FM-1R	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FM-7R	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FM-7R	-	-	-	-	-	-	-	-	-	-	-	-	-	-

MCL – Maximum contaminant level.

<sup>1</sup> Well was dry.

ND – Non-detectable.

- Not required to analyze or sample not collected.

**Table 9-1 Results of Groundwater Analyses at SNL/CA, 2019 (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	0.1	0.4	50
MCL - California		0.5		32	5		30		1		5		
MCL - Federal	100			5	5	100	100	100		600	75	600	
Well ID													
NLF-6	5/22/19	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Field dup	5/22/19	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Field blank	5/22/19	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trip Blank	5/22/19	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-3A	5/22/19	-	-	-	-	-	-	-	-	-	-	-	-
AS-3B	5/22/19	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-3C	5/22/19	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-4	5/22/19	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FM-1R	2/25/19	-	-	-	-	-	-	-	-	-	-	-	650
FM-1R	8/21/19	-	-	-	-	-	-	-	-	-	-	-	340
FM-7 R	2/25/19	-	-	-	-	-	-	-	-	-	-	-	ND
FM-7R	8/21/19	-	-	-	-	-	-	-	-	-	-	-	ND

MCL – Maximum contaminant level.

† Well was dry.

ND – Non-detectable.

- Not required to analyze or sample not collected.

**Table 9-1 Results of Groundwater Analyses at SNL/CA, 2019 (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	0.0060	0.0040	0.0010	0.0002	0.0010	0.004	0.0020	0.014	0.007	0.00006	0.0030	0.0030	0.0080	0.0040	0.0030	0.0030	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	5/22/19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Field dup	5/22/19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Field blank	5/22/19																	
AS-3A	5/22/19	ND	0.0045	0.11	ND	ND	0.0056	ND	ND	ND	0.0077	ND	ND	ND	ND	ND	ND	
AS-3B	5/22/19	ND	ND	0.13	ND	ND	0.0054	ND	ND	ND	0.0074	ND	ND	ND	ND	ND	ND	
AS-3C	5/22/19	ND	0.0060	0.13	ND	ND	ND	ND	ND	ND	0.0099	ND	ND	ND	ND	0.0043	ND	
AS-4	5/22/19	ND	ND	0.083	ND	ND	0.045	ND	ND	ND	0.00017	0.0065	0.0056	ND	ND	ND	0.0068	ND
FM-1R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
FM-1R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
FM-7 R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
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, 2019 (continued)**

	Date	Specific Conductance µmhos/cm	Total Dissolved Solids mg/L	Bicarbonate Alkalinity (CaCO <sub>3</sub> ) mg/L	Carbonate Alkalinity (CaCO <sub>3</sub> ) mg/L	Hydroxide Alkalinity (CaCO <sub>3</sub> ) mg/L	Total Alkalinity (CaCO <sub>3</sub> ) mg/L	Hardness, Total mg/L	Chloride mg/L	Nitrate (NO <sub>3</sub> ) mg/L	Sulfate (SO <sub>4</sub> ) mg/L
Detection limit		1.0	10	1.0	1.0	1.0	1.0	1	2.0	0.20	4.0
MCL - California	-	-	-	-	-	-	-	-	-	-	-
MCL - Federal	-	500	-	-	-	-	-	250	-	250	-
Well ID											
NLF-6	-	-	-	-	-	-	-	-	-	-	-
Field dup	-	-	-	-	-	-	-	-	-	-	-
Field blank	-	-	-	-	-	-	-	-	-	-	-
AS-3A	5/22/19	1100	560	290	ND	ND	320	391	85	10	120
AS-3B	5/22/19	1200	800	290	ND	ND	290	442	130	12	160
AS-3C	5/22/19	910	550	200	ND	ND	200	275	74	16	130
AS-4	5/22/19	1700	1100	350	ND	ND	350	533	200	1.1	250
FM-1R	-	-	-	-	-	-	-	-	-	-	-
FM-1R	-	-	-	-	-	-	-	-	-	-	-
FM-7 R	-	-	-	-	-	-	-	-	-	-	-
FM-7R	-	-	-	-	-	-	-	-	-	-	-

**Table 9-1 Results of Groundwater Analyses at SNL/CA, 2019 (continued)**

<b>Date</b>		Benzene $\mu\text{g/L}$	Toluene $\mu\text{g/L}$	Ethylbenzene $\mu\text{g/L}$	Xylenes (total) $\mu\text{g/L}$
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	5/22/19	ND	ND	ND	ND
Field dup	5/22/19	ND	ND	ND	ND
Field blank	5/22/19	ND	ND	ND	ND
AS-3A	5/22/19	ND	ND	ND	ND
AS-3B	5/22/19	ND	ND	ND	ND
AS-3C	5/22/19	ND	ND	ND	ND
AS-4	5/22/19	ND	ND	ND	ND
FM-1R	2/25/19	ND	ND	ND	ND
FM-1R	8/21/2019	ND	ND	ND	ND
FM-7R	2/25/2019	ND	ND	ND	ND
FM-7R	8/21/2019	ND	ND	ND	ND

MCL – Maximum contaminant level.

ND – Non-detectable.

- Not required to analyze or sample not collected.

**Table 9-2 Well Depth and Screen Period Interval**

<b>Area</b>	<b>Well ID</b>	<b>Well Depth (ft)</b>	<b>Screen Period Interval (ft)</b>
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 <sup>a</sup>
Navy Landfill	NLF-6	110	87 – 102

<sup>a</sup> Start of screen interval. Length of screen interval is unknown.

**Table 9-3 Routine Monitoring Results for SNL/CA Sanitary Sewer Outfall, 2019**

		BOD <sup>c</sup> SM5210B	COD <sup>c</sup> E410.4	TDS <sup>c</sup> SM2540C	TSS <sup>c</sup> SM2540D	Oil & Grease – Mineral <sup>d</sup>	Oil & Grease – Animal / Veg <sup>d</sup>	Cyanide <sup>d</sup> Kelada-01
Date	Laboratory ID # <sup>a</sup>	All results reported in mg/L						
<b>January</b>								
Jan. 2	19A0191	300	140	590	240	13	1.5	0.003
<b>February</b>								
Feb. 5	19B0533	410	210	570	120	<1.4	11	<0.002
<b>March</b>								
Mar. 5	19C0527	410	190	560	260	12	<1.4	<0.002
<b>April</b>								
Apr. 2	19D0447	200	180	480	190	30	4.2	<0.002
<b>May</b>								
May 7	19E0869	310	710	760	590	8.1	1.8	0.0027
<b>June</b>								
Jun. 4	19F0394	130	430	480	130	22	2.2	<0.002
<b>July</b>								
Jul. 2	19G0436	370	410	440	160	8.3	<1.4	<0.002
<b>August</b>								
Aug. 6	19H0659	200	920	420	250	20	2.1	0.0075
<b>September</b>								
Sept. 3	19I0250	260	890	460	130	8.9	<1.4	<0.002
<b>October</b>								
Oct. 1	19J0255	140	280	470	150	9.4	5.9	0.0020
<b>November</b>								
Nov. 5	19K0653	120	310	400	140	2.3	50	<0.002
<b>December*</b>								
Dec. 3	19L0527	210	150	460	290	<1.4	28	0.0032
Discharge Limit <sup>b</sup>		N/A <sup>e</sup>	N/A <sup>e</sup>	N/A <sup>e</sup>	N/A <sup>e</sup>	100		0.04

\*Site shutdown from December 25, 2019, through January 1, 2020.

<sup>a</sup> Analyses performed by an offsite, state certified laboratory.

<sup>b</sup> Discharge concentration limits, City of Livermore Municipal Code 13.32.

<sup>c</sup> Weekly composite sample. The dates indicate the day the sample was collected. The sample represents a representative composite for the previous week.

<sup>d</sup> Grab sample.

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

Date <sup>a</sup>	Laboratory	As	Cd	Cr	Cu	Pb	Hg	Ni	Ag	Zn
	ID # <sup>b</sup>	All results reported in mg/L								
<b>January</b>										
01/02/19	19A0187	0.0013	<0.00024	<0.002	0.028	<0.00024	<0.00006	0.0025	<0.0002	0.024
01/08/19	19A0959	<0.0008	0.0012	<0.002	0.19	<0.00024	<0.00006	0.0087	<0.0002	0.14
01/15/19	19A1887	<0.0008	<0.00024	<0.002	0.10	<0.00024	<0.00006	0.0034	<0.0002	0.075
01/22/19	19A2750	<0.0008	<0.00024	<0.002	0.13	<0.00024	<0.00006	0.0038	<0.0002	0.07
01/29/19	19A3648	<0.0008	<0.00024	<0.002	0.12	<0.00024	<0.00006	0.0041	<0.0002	0.091
<b>February</b>										
02/05/19	19B0527	<0.0008	<0.00024	<0.002	0.11	<0.00024	0.000071	0.0059	<0.0002	0.094
02/12/19	19B1482	<0.0008	<0.00024	<0.002	0.092	<0.00024	<0.00006	0.0055	<0.0002	0.079
02/19/19	19B2247	<0.0008	<0.00024	<0.002	0.11	<0.00024	<0.00006	0.0048	<0.0002	0.11
02/26/19	19B3071	<0.0008	<0.00024	<0.002	0.11	<0.00024	<0.00006	0.0052	<0.0002	0.11
<b>March</b>										
03/05/19	19C0530	0.0077	<0.0010	<0.004	0.11	<0.007	0.00010	0.0045	<0.004	0.12
03/12/19	19C1415	0.0065	<0.0010	<0.004	0.16	<0.007	<0.00006	0.0051	<0.004	0.11
03/19/19	19C2269	<0.004	<0.0010	<0.004	0.15	<0.007	<0.00006	0.0040	<0.004	0.13
03/26/19	19C3043	<0.004	<0.0010	<0.004	0.10	<0.007	<0.00006	0.0030	<0.004	0.11
<b>April</b>										
04/02/19	19D0446	<0.0040	<0.0010	<0.0040	0.10	<0.0070	<0.000060	0.0033	<0.0040	0.11
04/09/19	19D1322	<0.0040	<0.0010	<0.0040	0.11	<0.0070	<0.000060	0.0043	<0.0040	0.15
04/16/19	19D2173	<0.0040	<0.0010	<0.0040	0.11	<0.0070	<0.000060	0.0053	<0.0040	0.16
04/23/19	19D2813	<0.0040	<0.0010	<0.0040	0.10	<0.0070	<0.000060	0.0052	<0.0040	0.16
04/30/19	19E0006	<0.0040	<0.0010	<0.0040	0.09	<0.0070	<0.000060	0.0038	<0.0040	0.11
<b>May</b>										
05/07/19	19E0870	<0.0040	<0.0010	<0.0040	0.08	<0.0070	<0.000060	0.0033	<0.0040	0.07
05/14/19	19E1753	<0.0040	<0.0010	<0.0040	0.13	<0.0070	<0.000060	0.0049	<0.0040	0.15
05/21/19	19E2481	<0.0040	<0.0010	<0.0040	0.26	<0.0070	<0.000060	0.0053	<0.0040	0.11
05/28/19	19E3099	<0.0040	<0.0010	<0.0040	0.17	<0.0070	0.00014	0.0052	<0.0040	0.13

**Table 9-4 Routine Monitoring Results for SNL/CA Sanitary Sewer Outfall, Method E200.8, 2019 (continued)**

Date <sup>a</sup>	Laboratory ID # <sup>b</sup>	As	Cd	Cr	Cu	Pb	Hg	Ni	Ag	Zn
All results reported in mg/L										
<b>June</b>										
06/04/19	19F0395	<0.0040	<0.0010	<0.0040	0.17	<0.0070	<0.000060	0.0049	<0.0040	0.16
06/11/19	19F1283	<0.0040	<0.0010	<0.0040	0.08	<0.0070	<0.000060	0.0074	<0.0040	0.17
06/18/19	19F2061	<0.0040	<0.0010	<0.0040	0.14	<0.0070	<0.000060	0.0037	<0.0040	0.13
06/25/19	19F2807	<0.0040	<0.0010	<0.0040	0.11	<0.0070	<0.000060	0.0037	<0.0040	0.12
<b>July</b>										
07/02/19	19G0433	<0.0040	<0.0010	<0.0040	0.05	<0.0070	<0.000060	<0.0030	<0.0040	0.07
07/09/19	19G1051	<0.0040	<0.0010	<0.0040	0.08	<0.0070	<0.000060	<0.0030	<0.0040	0.08
07/16/19	19G1938	<0.0040	<0.0010	<0.0040	0.16	<0.0070	<0.000060	0.0037	<0.0040	0.13
07/23/19	19G2714	<0.0040	<0.0010	<0.0040	0.13	<0.0070	<0.000060	0.0031	<0.0040	0.13
07/30/19	19G3404	<0.0040	<0.0010	<0.0040	0.09	<0.0070	0.00098	0.0035	<0.0040	0.12
<b>August</b>										
08/06/19	19H0657	<0.0040	<0.0010	<0.0040	0.22	<0.0070	<0.000060	0.0043	<0.0040	0.18
08/13/19	19H1611	<0.0040	<0.0010	<0.0040	0.18	<0.0070	<0.000060	0.0043	<0.0040	0.24
08/20/19	19H2416	<0.0040	<0.0010	<0.0040	0.10	<0.0070	<0.000060	0.0049	<0.0040	0.35
08/27/19	19H3157	<0.0040	<0.0010	<0.0040	0.13	<0.0070	<0.000060	0.0042	<0.0040	0.42
<b>September</b>										
09/03/19	19I0249	<0.0040	<0.0010	<0.0040	0.047	<0.0070	<0.000060	<0.0030	<0.0040	0.13
09/10/19	19I1234	<0.0040	<0.0010	<0.0040	0.067	<0.0070	<0.000060	0.0030	<0.0040	0.17
09/17/19	19I2118	<0.0040	<0.0010	<0.0040	0.067	<0.0070	<0.000060	0.0046	<0.0040	0.13
09/24/19	19I2903	<0.0040	<0.0010	<0.0040	0.075	<0.0070	<0.000060	<0.0030	<0.0040	0.12

**Table 9-4 Routine Monitoring Results for SNL/CA Sanitary Sewer Outfall, Method E200.8, 2019 (continued)**

Date <sup>a</sup>	Laboratory ID # <sup>b</sup>	As	Cd	Cr	Cu	Pb	Hg	Ni	Ag	Zn
All results reported in mg/L										
<b>October</b>										
10/1/19	19J0256	<0.0040	<0.0010	<0.0040	0.070	<0.0070	<0.000060	<0.0030	<0.0040	0.12
10/8/19	19J1153	<0.0040	<0.0010	<0.0040	0.078	<0.0070	<0.000060	0.0037	<0.0040	0.15
10/15/19	19J1957	<0.0040	<0.0010	<0.0040	0.085	<0.0070	<0.000060	0.0038	<0.0040	0.14
10/22/19	19J3211	0.0076	<0.0010	<0.0040	0.042	<0.010	<0.000060	<0.0030	<0.0040	0.15
10/29/19	19J3216	0.0070	<0.0010	<0.0040	0.024	<0.010	<0.000060	<0.0030	<0.0040	0.14
<b>November</b>										
11/5/19	19K0652	<0.0040	<0.0010	<0.0040	0.066	<0.0070	<0.000060	0.0043	<0.0040	0.17
11/12/19	19K1490	<0.0040	<0.0010	<0.0040	0.044	<0.0070	<0.000060	0.0030	<0.0040	0.12
11/19/19	19K2316	0.010	<0.0010	<0.0040	0.057	<0.0070	<0.000060	0.0050	<0.0040	0.17
11/26/19	19K3230	<0.0040	<0.0010	<0.0040	0.045	<0.0070	<0.000060	0.0033	<0.0040	0.17
<b>December*</b>										
December 3	19L0526	<0.0040	<0.0010	<0.0040	0.056	<0.0070	<0.000060	0.0034	<0.0040	0.17
December 10	19L1811	0.0040	<0.0010	<0.0040	0.055	<0.0070	0.000086	0.0060	<0.0040	0.19
December 17	19L2869	<0.0040	<0.0010	<0.0040	0.086	<0.0070	<0.000060	0.0060	<0.0040	0.17
December 24	20A0823	<0.0040	<0.0010	<0.0040	0.062	<0.0070	<0.000060	0.0043	<0.0040	0.19
December 31	20A0825	0.0048	<0.0010	<0.0040	0.034	<0.0070	<0.000060	<0.0030	<0.0040	0.14
Discharge Limit <sup>c</sup>		0.06	0.14	0.62	1.0	0.20	0.01	0.61	0.20	3.0

\* Site shutdown from December 25, 2019, through January 1, 2020.

<sup>a</sup> Samples are collected as a weekly composite.

<sup>b</sup> Analyses performed by an off-site, independent laboratory.

<sup>c</sup> Discharge concentration limits, City of Livermore Municipal Code 13.32.

**Table 9-4 Routine Monitoring Results for SNL/CA Sanitary Sewer Outfall, 2019**

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 2	Bromoform, 12 Chloroform, 4.9 Toluene, 4.0	Phenol, 120	None
February 5	Chloroform, 4.4 Toluene, 14	Phenol, 21	None
March 5	Chloroform, 4.2 Toluene, 3.2	Phenol, 33	None
April 2	Toluene, 2.0	Phenol, 4.4	None
May 7	Bromoform, 2.0 Chloroform, 13 Toluene, 2.5	None	None
June 4	Dibromochloromethane, 5.8 Chloroform, 3.6 Bromodichloromethane, 6.6	Benzoic Acid, 180 Phenol, 3.6	None
July 2	Dibromochloromethane, 3.8 Chloroform, 3.1 Bromodichloromethane, 3.6	None	None
August 6	Toluene, 1.8	None	None
September 3	None	Phenol, 5.5	None
October 1	Bromoform, 13	None	None
November 5	None	None	None
December 3	None	Benzoic Acid – 65 <sup>a</sup>	None

<sup>a</sup>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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