

***Annual Site Environmental Report***  
***Department of Energy***  
***Energy Technology Engineering Center***  
***– Area IV***  
***Santa Susana Field Laboratory***



***Prepared for:***  
**U.S. Department of Energy**



***Prepared by:***  
**North Wind, Inc.**  
**Santa Susana Field Laboratory**



**March 2018**



***Annual Site Environmental Report***

***Department of Energy Operations at the  
Energy Technology Engineering Center – Area IV  
Santa Susana Field Laboratory***

**March 2018**

**Contract No. DE-EM0000837-DT0007583**

**Prepared for:  
U.S. Department of Energy**

**Prepared by:  
North Wind, Inc.  
1425 Higham Street  
Idaho Falls, ID 83402**

This page intentionally left blank.

## **CERTIFICATE OF ACCURACY**

I certify that I have personally examined, and am familiar with, the information submitted herein and, based on inquiry of those individuals immediately responsible for preparing this report, believe that the submitted information is true, accurate, and complete.



Brad Frazee  
Program Manager  
North Wind, Inc.  
Santa Susana Field Laboratory

March 2018

This page intentionally left blank.

**DOE CERTIFICATION LETTER**

TBD

This page intentionally left blank.



## ACKNOWLEDGEMENTS

Preparation of this report has been a collaborative effort of members of DOE EMCBC, North Wind, Inc., and our subcontractors.

Principal technical contributors are:

- Radiological Topics: Brad Frazee (North Wind)  
Wade Miller (Cabrera)  
Scott Hay (Cabrera)
- Soil (Chemical): John Wondolleck (CDM)
- Groundwater (Chemical): T. Stewart Williford (North Wind)  
Brian Dow (North Wind)  
John Wondolleck (CDM)
- Surface Water (Chemical): John Wondolleck (CDM)
- Air (Chemical): Wade Miller (Cabrera)  
Scott Hay (Cabrera)
- ISMS: Micah Nielsen (North Wind)
- Training: Kathy Perez (North Wind)
- Public Outreach: Debbie Kramer (Trinity Engineering)
- Agency Inspection: T. Stewart Williford (North Wind)

Editing and review were performed by Brad Frazee, Brian Dow, Wade Miller, Scott Hay, and John Jones (DOE).

The staff of North Wind, Inc., CDM Federal Services (CDM), and the Department of Energy provided technical contributions to this report.

This page intentionally left blank.

## CONTENTS

1.	EXECUTIVE SUMMARY .....	1-1
2.	INTRODUCTION.....	2-1
2.1	Site Location and Setting .....	2-1
2.2	Operational History .....	2-4
2.3	Facility Descriptions .....	2-4
2.4	ASER Contents .....	2-7
3.	COMPLIANCE SUMMARY .....	3-1
3.1	Compliance Status.....	3-1
3.2	Current Issues and Actions.....	3-7
4.	ENVIRONMENTAL PROGRAM INFORMATION .....	4-1
4.1	Environmental Restoration.....	4-1
4.2	Environmental Monitoring Program .....	4-2
4.3	Integrated Safety Management System.....	4-4
4.4	Environmental Training .....	4-5
4.5	Waste Minimization and Pollution Prevention .....	4-5
4.6	Public Participation .....	4-6
5.	ENVIRONMENTAL RADIOLOGICAL MONITORING .....	5-1
5.1	Air Effluent Monitoring .....	5-1
5.2	Environmental Sampling.....	5-2
5.3	Estimation of Radiation Dose .....	5-8
5.4	Protection of Biota .....	5-9
6.	ENVIRONMENTAL NON-RADIOLOGICAL MONITORING .....	6-1
6.1	Surface Water Discharge.....	6-1

6.2	Air.....	6-3
6.3	Groundwater.....	6-3
6.4	Soil .....	6-11
7.	ENVIRONMENTAL MONITORING PROGRAM QUALITY CONTROL .....	7-1
7.1	Procedures .....	7-1
7.2	Records.....	7-1
8.	REFERENCES.....	8-1

## Tables

Table 3-1.	2017 Agency Inspections/Visits Related to DOE Operations .....	3-1
Table 3-2.	SSFL Permits.....	3-7
Table 5-1.	Sampling Location Description .....	5-4
Table 5-2.	Ambient Air Specific Isotopes – 2017 .....	5-5
Table 5-3.	Ambient Air Gross Alpha and Gross Beta – 2017 .....	5-5
Table 5-4.	2017 SSFL Ambient Radiation Dosimetry Data .....	5-8
Table 5-5.	Public Exposure to Radiation from DOE Operations at SSFL.....	5-9
Table 5-6.	Terrestrial Biota Radiation Exposure as a Fraction of Dose Limit .....	5-10
Table 6-1.	Groundwater Monitoring at Area IV in 2017.....	6-4
Table 6-2.	Ranges of Detected Non-Radiological Analytes in 2017 Groundwater Samples .....	6-4

## Figures

Figure 2-1.	Map Showing Location of SSFL.....	2-2
Figure 2-2.	Santa Susana Field Laboratory Site Arrangement .....	2-3
Figure 2-3.	Santa Susana Field Laboratory Site, Area IV (2017).....	2-5
Figure 2-4.	Map of Prior and Current Radiological Facilities in Area IV .....	2-6
Figure 3-1.	Conceptual Model of Potential Pathways .....	3-3
Figure 5-1.	Map of Santa Susana Field Laboratory Area IV Sampling Stations.....	5-3
Figure 6-1.	Locations of Surface Water Runoff Collectors .....	6-2
Figure 6-2.	Area IV Well and Piezometer Locations .....	6-8
Figure 6-3.	2017 TCE Occurrences in Groundwater at SSFL, Area IV .....	6-9
Figure 6-4.	2017 Tritium Occurrences in Groundwater at SSFL, Area IV .....	6-10

## Acronyms

AOC	Administrative Order on Consent
ASER	Annual Site Environmental Report
ASL	above sea level
BCG	biota concentration guide
CAA	Clean Air Act
CDM	Camp Dresser & McKee
CEDE	committed effective dose equivalent
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
D&D	decontamination and decommissioning
DCS	derived concentration standard
DPH	Department of Public Health
DPH/RHB	Department of Public Health/Radiologic Health Branch
DMR	discharge monitoring report
DOE	Department of Energy
DTSC	Department of Toxic Substances Control
EA	Environmental Assessment
EIS	Environmental Impact Statement
EMCBC	Environmental Management Consolidated Business Center
EPA	Environmental Protection Agency
ESH&Q	Environmental Safety Health and Quality
ETEC	Energy Technology Engineering Center
FESOP	Federally Enforceable State Operating Permit
FFCA	Federal Facilities Compliance Act
FONSI	Finding of No Significant Impact
FSDF	Former Sodium Disposal Facility
HMSA	Hazardous Material Storage Area
HWMF	Hazardous Waste Management Facility
IDW	investigation-derived waste
ISMS	Integrated Safety Management System

LARWQCB	Los Angeles Regional Water Quality Control Board
LUT	Look-up Table
MCL	maximum contaminant level
MEI	maximally exposed individual
MRL	method reporting limit
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NBZ	Northern Buffer Zone
ND	not detect
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NIST	National Institute of Standards and Technology
North Wind	North Wind, Inc.
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NSPS	New Source Performance Standards
ORISE	Oak Ridge Institute for Science and Education
OSLD	optical stimulated luminescence detector
PCE	tetrachloroethylene
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QC	Quality Control
R&D	research and development
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RMHF	Radioactive Materials Handling Facility
SIP	State Implementation Plan
SNAP	Systems for Nuclear Auxiliary Power
SPCC	Spill Prevention, Control and Countermeasure
SPTF/CHCF	Sodium Pump Test Facility / Component Handling & Cleaning Facility
SRE	Sodium Reactor Experiment
SSFL	Santa Susana Field Laboratory

STIG	Soil Treatability Investigation Group
STP	Site Treatment Plan
Tc-99	technetium-99
TCE	trichloroethylene
TCP	trichloropropane
TLD	thermoluminescent dosimeter
USEPA	U.S. Environmental Protection Agency
VCAPCD	Ventura County Air Pollution Control District
WQSAP	Water Quality Sampling and Analysis Plan

This page intentionally left blank.



## 1. EXECUTIVE SUMMARY

This Annual Site Environmental Report (ASER) for 2017 describes the environmental conditions related to work performed for the Department of Energy (DOE) at Area IV of the Santa Susana Field Laboratory (SSFL). The Energy Technology Engineering Center (ETEC), a government-owned, company-operated test facility, was located in Area IV. The operations in Area IV included development, fabrication, operation and disassembly of nuclear reactors, reactor fuel, and other radioactive materials. Other activities in the area involved the operation of large-scale liquid metal facilities that were used for testing non-nuclear liquid metal fast breeder reactor components. All nuclear work was terminated in 1988, and all subsequent radiological work has been directed toward environmental restoration and decontamination and decommissioning (D&D) of the former nuclear facilities and their associated sites. Liquid metal research and development (R&D) ended in 2002. Since May 2007, the D&D operations in Area IV have been suspended by the DOE, but the environmental monitoring and characterization programs have continued.

North Wind, Inc., (North Wind) officially assumed responsibilities for the ETEC Closure activities October 1, 2014, under contract DE-EM0000837. Boeing was previously responsible for the management of the site from 1996–2014.

Results of the radiological monitoring program continue to indicate that there are no significant releases of radioactive material from Area IV of SSFL. All potential exposure pathways are sampled and/or monitored, including air, soil, surface water, groundwater, direct radiation, transfer of property (land, structures, waste), and recycling.

No activities occurred in Area IV in 2017 that would have released effluents into the atmosphere. Therefore, the potential radiation dose to the general public through airborne release was zero. Similarly, the radiation dose to an off-site member of the public (maximally exposed individual) due to direct radiation from SSFL is indistinguishable from background.

No radioactive wastes were processed for disposal during 2017. No liquid radioactive wastes were released into the environment.

During 2017, five regulatory agency inspections and/or visits were conducted related to DOE operations in Area IV. These inspections and visits were carried out by the California Department of Public Health (DPH) and Ventura County Air Pollution Control District (VCAPCD). In addition, the Cal-EPA Department of Toxic Substances Control (DTSC) visited the site for meetings and to observe field activities.

In summary, this ASER provides information to show that there are no indications of any potential impact on public health and safety due to the DOE-sponsored operations conducted at Area IV of SSFL. The report summarizes the environmental and effluent monitoring results for the responsible regulatory oversight agencies.

This page intentionally left blank.

## 2. INTRODUCTION

This annual report describes the environmental monitoring programs related to the DOE activities at Area IV of the SSFL facility located in Ventura County, California, during 2017. Area IV was used for DOE activities since the 1950s. A broad range of energy-related R&D projects, including nuclear technology projects, were conducted at the site. All nuclear R&D operations in Area IV ceased in 1988 and efforts were directed toward environmental restoration and D&D. By 2007, D&D remained for two former nuclear facilities, two liquid metal facilities, and various support facilities. In May 2007, the D&D operations in Area IV were suspended until DOE completes the SSFL Area IV Environmental Impact Statement (EIS). The Draft EIS was released by DOE in January 2017 (DOE 2017). Environmental monitoring and characterization programs were continued throughout 2017.

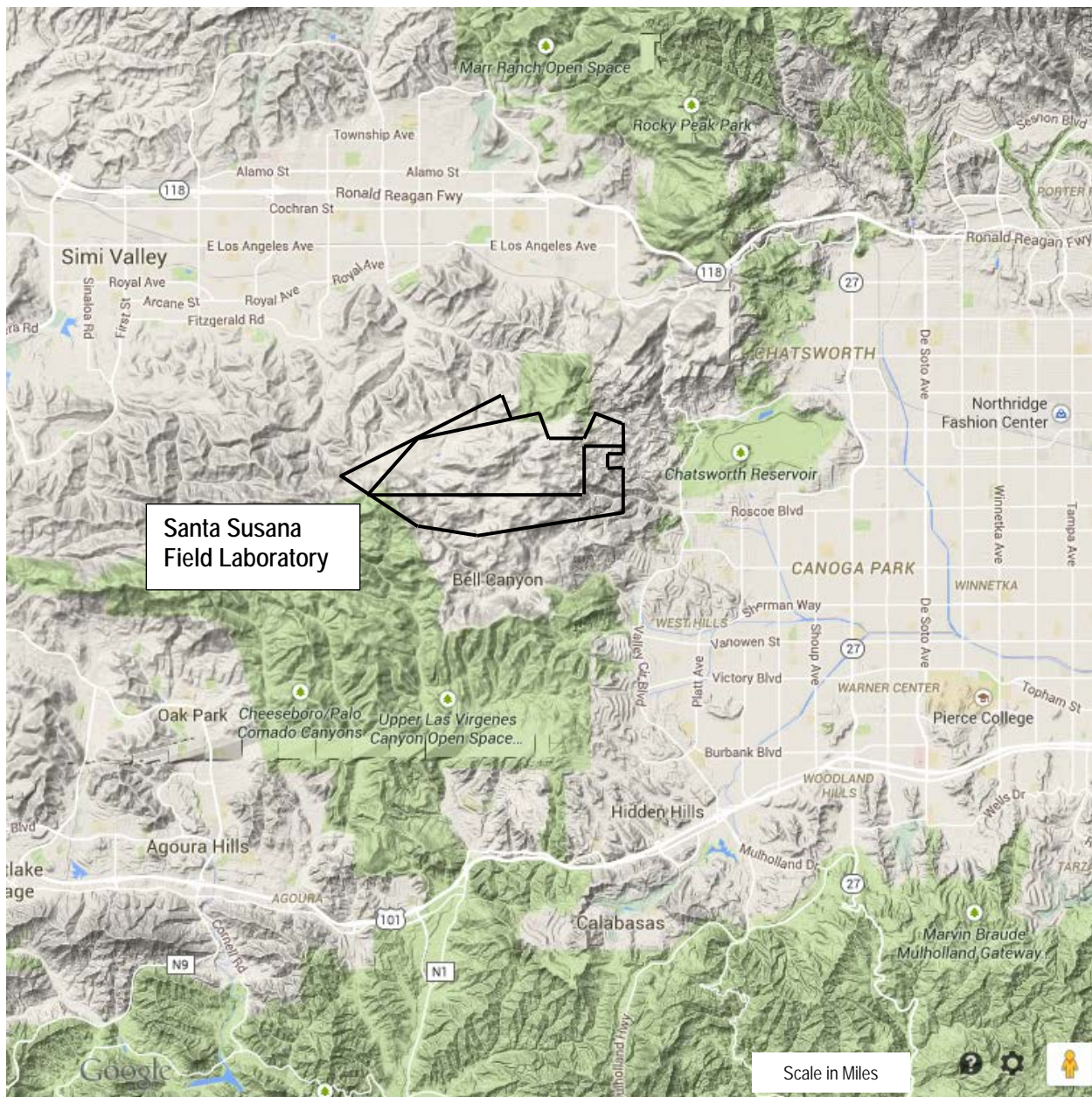
As required by DOE O 231.1B Admin Chg. 1, “Environment, Safety and Health Reporting,” this report is used to communicate internally to DOE, and externally to the public, the environmental monitoring results and the state of environmental conditions related to DOE activities at Area IV at SSFL. The report summarizes:

- Environmental management performance for DOE activities (e.g., environmental monitoring of effluents and estimated radiological doses to the public from releases of radioactive materials)
- Environmental occurrences and responses reported during the calendar year
- Compliance with environmental standards and requirements
- Significant programs and efforts related to environmental management.

### 2.1 Site Location and Setting

The SSFL site occupies 2,850 acres located in the Simi Hills of Ventura County, California, approximately 48 km (30 miles) northwest of downtown Los Angeles. The SSFL is situated on rugged terrain with elevations at the site varying from 500 to 700 m (1,640 to 2,250 ft) above sea level (ASL). The location of the SSFL site in relation to nearby communities is shown in Figure 2-1. No significant agricultural land use exists within 30 km (19 miles) of the SSFL site. Undeveloped land surrounds most of the SSFL site.

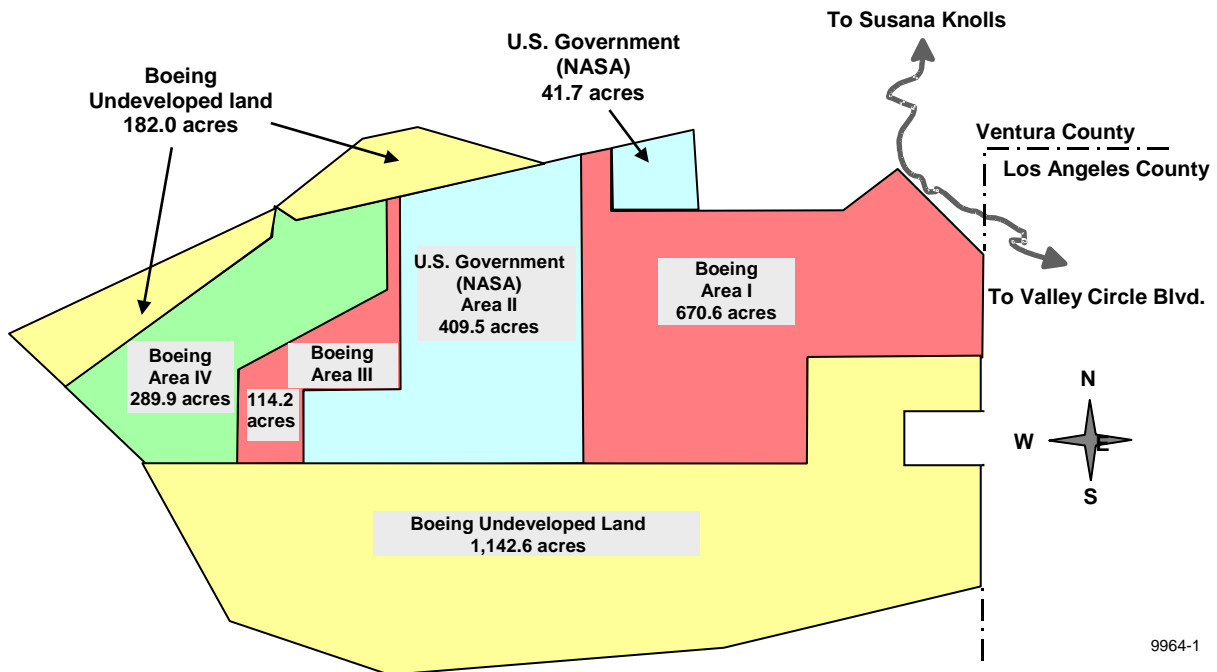
Boeing owns the majority of the site, which is divided into four administrative areas and undeveloped land. Figure 2-2 illustrates the arrangement of the site. Area IV consists of approximately 290 acres, of which DOE leases 90 acres. Boeing and DOE-operated facilities (Figures 2-3 and 2-4) share the Area IV portion of this site. While the land immediately surrounding Area IV is undeveloped, suburban residential areas are at greater distances. The community of Santa Susana Knolls lies 4.8 km (3.0 miles) to the northeast, the Bell Canyon area begins approximately 2.3 km (1.4 miles) to the southeast, and the American Jewish University is adjacent to the north. Except for the Pacific Ocean, which is approximately 20 km (12 miles) south, no recreational body of water of noteworthy size is located in the surrounding area. Four major reservoirs providing domestic water to the greater Los Angeles area are located within 50 km (30 miles) of SSFL; the closest to SSFL (Bard Reservoir, near the west end of Simi Valley), is more than 10 km (6 miles) from Area IV.



**Figure 2-1. Map Showing Location of SSFL**



Subdivisions			
Owner	Jurisdiction	Acres	Subtotals
Boeing	Boeing—Area IV	289.9	2,399.3
	Boeing—Areas I and III	784.8	
	Boeing (Undeveloped land)	1,324.6	
Government	NASA (former AFP 57)	409.5	451.2
	NASA (former AFP 64)	41.7	
<b>Total Acres</b>			2,850.5



**Figure 2-2. Santa Susana Field Laboratory Site Arrangement**

## 2.2 Operational History

The SSFL has been used for various research, development, and test projects funded by several U.S. government agencies, including DOE, Department of Defense, and National Aeronautics and Space Administration (NASA). Since 1956, various R&D projects had been conducted in Area IV, including small tests and demonstrations of reactors and critical assemblies, fabrication of reactor fuel elements, and disassembly and de-cladding of irradiated fuel elements. These projects were completed and terminated during the next 30 years. Details for projects can be found in the DOE website devoted to the ETEC closure: (<http://www.etec.energy.gov>).

All nuclear R&D operations in Area IV ceased in 1988. The only work related to the nuclear operations after 1988 has been the cleanup and decontamination of the remaining inactive radiological facilities and off-site disposal of radioactive waste. In 1998, DOE awarded Boeing a contract for the closure of all DOE facilities in Area IV. Environmental remediation and restoration activities at SSFL are conducted as directed by DOE. In May 2007, DOE suspended the D&D activities in Area IV, pending completion of an EIS. In October 2014 North Wind officially took over the responsibilities for the ETEC closure. DOE issued a draft EIS in January 2017 (DOE 2017).

## 2.3 Facility Descriptions

There were twenty-seven radiological facilities that operated in Area IV (See Figure 2-4). As of the end of 2014, twenty have been released for unrestricted use and four have been declared suitable for unrestricted release by DOE. Demolition is pending for two facilities: Building 4024 and the Radioactive Materials Handling Facility (RMHF). Six former radiological facilities in Area IV have been declared free of contamination: 4009 (Boeing), 4011 (Boeing), 4019 (DOE), 4029 (DOE), 4055 (Boeing), and 4100 (Boeing).

In addition to radiological facilities, two inactive sodium and related liquid metal test facilities remain in Area IV, as well as various support facilities. They are the Sodium Pump Test Facility/Component Handling & Cleaning Facility (SPTF/CHCF) and the Hazardous Waste Management Facility (HWMF). These were constructed at SSFL to support development testing of components for liquid metal electrical power production systems. The facilities will undergo closure and demolition pending completion of the EIS.

### 2.3.1 Radiological Facilities

#### Radioactive Materials Handling Facility (RMHF)

The RMHF complex consists of Buildings 4021, 4022, 4034, 4044, 4075, 4563, 4621, 4658, 4663, 4665, and 4688. Sump 4614 was a holdup pond located at the base of the drainage channel west of the RMHF complex. The use of the pond was discontinued, and the pond was excavated in 2006. The drainage channel and pond have been replaced with an above-ground storage tank that receives storm water runoff from the RMHF via a drainage pipe.

Operations at RMHF included processing, packaging, and temporary storage of radioactive waste materials for off-site disposal at DOE approved facilities. The radioactive waste included

uranium, plutonium, mixed fission products such as cesium-137 (Cs-137), strontium-90 (Sr-90), and activation products including cobalt-60 (Co-60), europium-152 (Eu-152), and tritium (H-3).

No effluents were released into the atmosphere through the stack at the RMHF and no radioactive liquid effluents were released from the facility. DOE has developed a draft closure plan for the RMHF, which is under review at the DTSC.



**Figure 2-3. Santa Susana Field Laboratory Site, Area IV (2017)**

### **Building 4024**

Building 4024, Systems for Nuclear Auxiliary Power (SNAP) Environmental Test Facility, housed four experimental reactor systems in the 1960s. Following termination of the experimental projects, all equipment and fuel were removed from the facility. The shielding concrete in the vaults has low-level activation products, including Co-60 and Eu-152. Building remediation began in 2004 and portions of the building used to support the office space and the mechanical ventilation systems were demolished.

The ventilation stack was removed and a geophysical study supporting final building demolition was completed. In 2007, final demolition of the building was put on hold by the DOE pending completion of the EIS.



**Figure 2-4. Map of Prior and Current Radiological Facilities in Area IV**

### **Building 4059**

Building 4059 is the former SNAP reactor ground test facility. Demolition of the building was completed in 2004, and radioactively contaminated building debris was shipped to the Nevada Test Site. In October 2004, Oak Ridge Institute for Science and Education (ORISE) conducted an independent verification survey and found that only H-3 and Ni-63 were present above background, with concentrations significantly below 2004 acceptable limits of 31,900 picocuries per gram (pCi/g) and 55,300 pCi/g, respectively. Two other verification surveys were completed; the first by the California Department of Health Services in October 2006, and the second by ORISE in February 2008. The ORISE survey encompassed the previous building footprint area and confirmed that 2008 release limits of 4.7 pCi/g for Cs-137 and 2.8 pCi/g for Eu-152 had been satisfied. As such, the site could be released for unrestricted use.



### **2.3.2 Former Sodium Facilities**

#### **Sodium Pump Test Facility / Component Handling & Cleaning Facility (SPTF/CHCF)**

All utility connections to the SPTF/CHCF buildings were severed in 2007. Demolition of Building 4461 was completed in early 2007. In May 2007, DOE halted demolition and the remaining buildings (4462 and 4463) were placed into a safe shutdown condition.

#### **Hazardous Waste Management Facility (HWMF)**

The HWMF, a DTSC Resource Conservation and Recovery Act (RCRA)-permitted facility consisting of buildings 4133 and 4029, was approved for closure and demolition by the DTSC in 2006. In May 2007, DOE halted plans for demolition pending completion of the EIS. This facility is maintained in a safe shutdown mode.

## **2.4 ASER Contents**

This ASER provides the following information related to ensuring protection of human health and the environment for DOE's operations at Area IV:

- Section 3, Compliance Summary, identifies and provides status of applicable permits and other regulatory requirements for DOE's closure mission.
- Section 4, Environmental Program Information, summarizes the programs in place to characterize, monitor, and respond to known or potential releases to the environment that may pose a threat to human health and the environment.
- Section 5, Environmental Radiological Monitoring, summarizes the data collection activities and associated results for radiological contaminants.
- Section 6, Environmental Non-Radiological Monitoring, summarizes the data collection activities and associated results for non-radiological contaminants.
- Section 7, Environmental Monitoring Program Quality Control, summarizes the Quality Assurance/Quality Control (QA/QC) elements incorporated into the data analysis program.

This page intentionally left blank.

### 3. COMPLIANCE SUMMARY

#### 3.1 Compliance Status

During 2017, five regulatory agency inspections, audits, and visits were conducted in Area IV. These inspections and visits were carried out by the California DPH and the DTSC RCRA Division. In addition, DTSC was frequently on-site for meetings and to observe field activities.

A list of inspections, audits, and site visits in 2017 by the various agencies overseeing the SSFL sites is given in Table 3-1.

**Table 3-1. 2017 Agency Inspections/Visits Related to DOE Operations**

Date	Agency	Subject Area	Results
January 12, 2017	State of CA, DPH	Quarterly Environmental TLD Exchange	Compliant
April 13, 2017	State of CA, DPH	Quarterly Environmental TLD Exchange	Compliant
June 27, 2017	State of CA, DPH	Quarterly Environmental TLD Exchange	Compliant
October 03, 2017	DTSC RCRA	Audit on the RCRA-permitted ETEC facilities (RMHF, Buildings 4133 and 4029)	Compliant
October 12, 2017	State of CA, DPH	Quarterly Environmental TLD Exchange	Compliant

##### 3.1.1 Radiological

The radiological monitoring programs at the SSFL comply with applicable federal, state, and local environmental regulations. The monitoring results indicate that the SSFL does not pose any significant radiological impact to the health and safety of the general public. All potential pathways, as illustrated in Figure 3-1, are monitored. These include air, soil, surface water, groundwater, direct radiation, transfer of property (land, structures, waste), and recycling.

##### 3.1.1.1 Airborne Activity

For potential airborne releases from the RMHF exhaust stack, the maximum radiation exposure dose to an off-site individual is limited to 10 mrem/yr or less, as specified in 40 Code of Federal Regulations (CFR) 61, the National Emission Standards for Hazardous Air Pollutants (NESHAP), Subpart H (DOE facilities). Due to the suspension of all DOE's D&D operations at SSFL, no effluents from the RMHF stack were released into the atmosphere in 2017. As a result, the potential radiation exposure dose from the airborne pathway was zero.

No soil excavation or building demolition with the potential to release airborne contaminants was conducted by DOE in Area IV in 2017. Annual NESHAP reports submitted by DOE to the U.S. Environmental Protection Agency (EPA) for 2017 and prior years are provided at:

[https://www.etec.energy.gov/Environmental\\_and\\_Health/NESHAPs.php](https://www.etec.energy.gov/Environmental_and_Health/NESHAPs.php).

### **3.1.1.2 Groundwater**

In accordance with the Water Quality Sampling and Analysis Plan (WQSAP; Haley and Aldrich 2010), which requires that annual groundwater sampling be performed, groundwater samples were collected from 66 monitoring wells and 9 seep wells located in Area IV during the first quarter sampling event during March and April 2017. Data review and validation were completed, and first quarter results were reported in the 2017 First Quarter Groundwater Sampling Report (North Wind 2017), the Technical Memorandum DOE Area IV Spring 2017 Seep Probe Sampling Results (CDM Smith 2018a), and the 2017 Report on Annual Groundwater Monitoring (North Wind 2018). Analyses were specific for each well based on contamination history and included a variety of chemical and radiological constituents. Groundwater reports are provided online under the RCRA Facility Investigation – Groundwater tab in the SSFL Document Library at the following link:

[https://www.dtsc.ca.gov/SiteCleanup/Santa\\_Susana\\_Field\\_Lab/ssfl\\_document\\_library.cfm](https://www.dtsc.ca.gov/SiteCleanup/Santa_Susana_Field_Lab/ssfl_document_library.cfm)

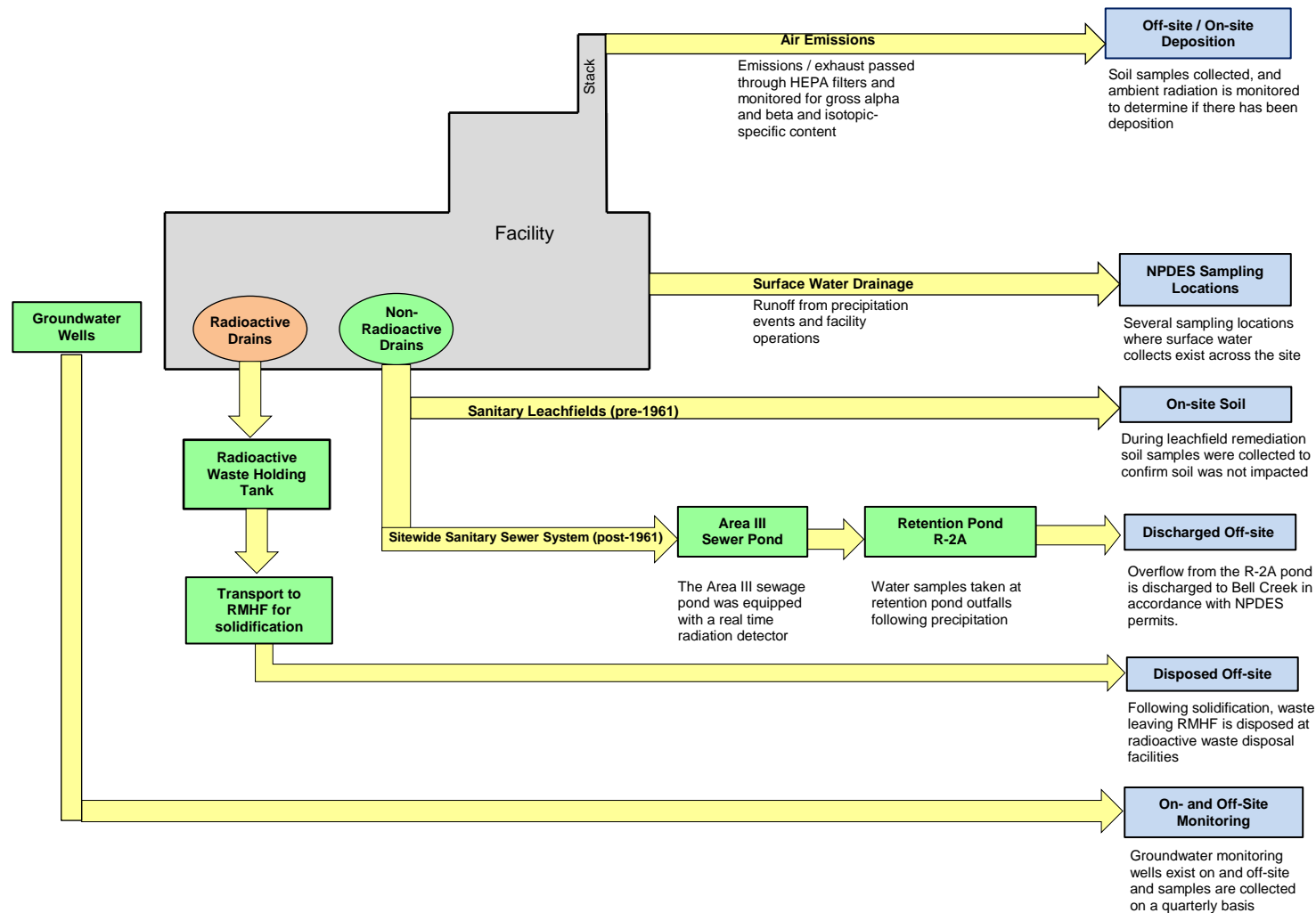
### **3.1.1.3 Surface Water**

Surface water is regulated under the Los Angeles Regional Water Quality Control Board (LARWQCB) National Pollutant Discharge Elimination System (NPDES). The existing NPDES Permit (CA0001309) for SSFL is held by Boeing and requires monitoring of storm water runoff, treated groundwater and fire suppression water into Bell Creek, a tributary to the Los Angeles River. The permit also regulates the discharge of storm water runoff from Area IV northwest slope locations into the Arroyo Simi, a tributary of Calleguas Creek. Storm water is collected at the five northwest outfalls (RMHF: Outfall 003; Sodium Reactor Experiment (SRE): Outfall 004; FSDF #1: Outfall 005; FSDF #2: Outfall 006; and Bldg 4100: Outfall 007), pumped to a centralized storage and treatment center at Silvernale Pond in Area III, and subsequently discharges into Bell Creek. The permit applies the numerical limits for radioactivity established for drinking water suppliers to these discharges. The permit requires radiological measurements of gross alpha, gross beta, tritium, strontium-90, total combined radium-226 and radium-228, potassium-40, cesium-137, and uranium isotopes. Detailed monitoring results are provided in the quarterly and annual NPDES discharge monitoring reports (DMR), which may be viewed under the California Regional Water Quality Control Board (RWQCB) tab in the SSFL Document library at the following link:

[https://www.dtsc.ca.gov/SiteCleanup/Santa\\_Susana\\_Field\\_Lab/ssfl\\_document\\_library.cfm](https://www.dtsc.ca.gov/SiteCleanup/Santa_Susana_Field_Lab/ssfl_document_library.cfm)

### **3.1.1.4 Direct Radiation**

The northern property boundary, the closest property boundary to the RMHF, is approximately 300 meters from the RMHF and separated by a sandstone ridge, effectively shielding the boundary from any direct radiation from the RMHF. Dosimeters placed on the RMHF side of this sandstone ridge, approximately 150 meters from the RMHF, read an average of 5 mrem/year above the SSFL ambient radiation level of 62 mrem/year. This is considerably below DOE's 100 mrem/year limit.



**Figure 3-1. Conceptual Model of Potential Pathways**

### **3.1.1.5 Protection of Biota**

There is no aquatic system in Area IV of SSFL. Storm water discharge from the site is monitored in accordance with the Boeing NPDES permit (see Section 3.1.1.3 above).

Terrestrial biota, i.e., vegetation and small wild animals, are abundant at SSFL. They are subject to potential exposure to the radioactivity in soil. Screening analysis indicates that the potential radiation exposure is less than the dose limit recommended by the DOE. Section 5.4 provides detailed information on biota protection.

### **3.1.2 Chemical**

#### **3.1.2.1 Resource Conservation and Recovery Act**

RCRA allows the EPA broad authority to regulate the handling, treatment, storage, and disposal of hazardous wastes. This authority has been delegated to the California EPA and DTSC. DOE owns and co-operated two RCRA-permitted treatment and storage facilities within ETEC: the RMHF and the HWMF. There are no active operations ongoing at either facility. Permit numbers are listed in Section 3.1.4.

**Radioactive Materials Handling Facility (RMHF)** - In 2017, the RMHF continued to be permitted as an Interim Status (Part A) facility. This facility was previously used primarily for the handling and packaging of low-level radioactive and mixed wastes. Interim status is required for the storage and treatment of the small quantities of mixed waste (waste containing both hazardous and radioactive constituents) resulting from D&D activities at ETEC. The final disposition of mixed waste is addressed under the DOE and DTSC approved Site Treatment Plan (STP), which is authorized by the Federal Facilities Compliance Act (FFCA). Currently there is no mixed waste at RMHF. The RMHF has been in a safe shutdown mode since May 2007 and is inactive, pending closure plan approval.

**Hazardous Waste Management Facility (HWMF)** - The HWMF includes an inactive storage facility (4029) and an inactive treatment facility (4133) that was utilized for reactive metal waste such as sodium. The HWMF is no longer in operation and is awaiting final closure.

**RCRA Facility Investigation (RFI)** - Under the Hazardous and Solid Waste Amendments of 1984, RCRA facilities can be brought into the corrective action process when an agency is considering any RCRA permit action for the facility. The SSFL was initially made subject to the corrective action process in 1989 by EPA, Region IX. The EPA has completed the Preliminary Assessment Report and the Visual Site Inspection portions of the RCRA Facility Assessment process. ETEC is now within the RCRA Facility Investigation (RFI) stage of the RCRA corrective action process under DTSC oversight for investigation of groundwater.

**Administrative Order on Consent (AOC)** - In December 2010, DOE and DTSC signed an Administrative Order on Consent (AOC), which outlines a specific soil investigation and remediation program for all of Area IV. Groundwater investigation and remediation is still being conducted under RCRA corrective action requirements specified in the 2007 Consent Order among DTSC, DOE, NASA, and Boeing. Samples collected and analyses performed to date at DOE locations are summarized in Section 6.

**Groundwater** - Characterization of the groundwater at the site continues (CDM Smith 2017). In the 2009 Draft Site-Wide Groundwater Remedial Investigation Report (MWH 2009), five distinct areas of trichloroethylene (TCE) impacted groundwater in Area IV were identified. From the groundwater samples collected in 2017, concentrations of TCE exceeding maximum contaminant level (MCLs) were present in all five areas. Detailed analytical results are discussed in Section 6.3.

### **3.1.2.2 Federal Facilities Compliance Act**

In 2017, there were no mixed wastes in the inventory; and as such, there were no additions or removals. Historically, any mixed wastes were managed in accordance with FFCA mandated STP, approved in October 1995. All mixed wastes that required extended on-site storage were managed within the framework of the STP. Characterization, treatment, and disposal plans for each of several different waste streams are defined in the STP with enforceable milestones. Previous management of the mixed waste has been in full compliance with the STP.

### **3.1.3 National Environmental Policy Act**

The National Environmental Policy Act (NEPA) establishes a national policy to ensure that consideration is given to environmental factors in federal planning and decision-making. For those projects or actions with a potential to affect human health or the environment, DOE requires that appropriate NEPA actions (e.g., Categorical Exclusion, Environmental Assessment [EA], Finding of No Significant Impact [FONSI], or Notice of Intent [NOI], draft EIS, final EIS, and/or Record of Decision), have been incorporated into project planning documents.

The DOE issued a FONSI and the final EA report on March 31, 2003. Subsequently, the Natural Resources Defense Council, City of Los Angeles, and the Committee to Bridge the Gap filed a lawsuit in federal court, claiming DOE had violated NEPA, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and the Endangered Species Act. Pursuant to a court order, the DOE released the *Draft EIS for Remediation of Area IV and the Northern Buffer Zone (NBZ) of the SSFL* on January 6, 2017:

<http://www.ssflareaiveis.com/>

### **3.1.3.1 Clean Air Act**

The 1970 Clean Air Act (CAA, amended 1977 and 1990) authorized the U.S. EPA to establish National Ambient Air Quality Standards (NAAQS) to limit the concentrations of pollutants in ambient (i.e., outdoor) air. The EPA has promulgated NAAQS for six “criteria” pollutants: ozone (O<sub>3</sub>), nitrogen dioxide (NO<sub>2</sub>), carbon monoxide (CO), sulfur dioxide (SO<sub>2</sub>), 10-micron and 2.5-micron particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>), and lead (Pb). All areas of the United States must maintain ambient levels of these pollutants below the ceilings established by the NAAQS; any area that does not meet the standards is considered a NAAQS “nonattainment” area. Under the CAA, states are required to develop State Implementation Plans (SIPs) that define how each state will carry out its responsibilities under the CAA, mainly through promulgation and enforcement of air pollution control rules and regulations. However, the EPA must approve each SIP, and it can enforce the CAA itself under a Federal Implementation Plan if it deems a state’s SIP unacceptable and the state or region is unwilling or unable to develop an acceptable SIP. Other requirements, including NESHAP, New Source Performance Standards (NSPS), and ambient air monitoring programs, were established to ensure that ambient air quality is acceptable for public health and environmental protection.

Area IV is regulated by the VCAPCD and must comply with all applicable rules, regulations, and permit conditions. DOE previously operated under Permit to Operate No. 00271. In 2008, this permit was consolidated with the existing Federally Enforceable State Operating Permit (FESOP) No. 00232 for SSFL, which presently covers Areas I, III, and IV. The NASA property – Area II and the former LOX Plant site located in Area I – was removed from the permit in January 2014.

### **3.1.3.2 Clean Water Act**

The Clean Water Act is the primary authority for water pollution control programs, including the NPDES permit program. The NPDES program regulates point source discharges of surface water and the discharge of storm water runoff associated with industrial activities.

Surface water discharges from SSFL are regulated under the California Water Code (Division 7) as administered by the LARWQCB. The existing Boeing NPDES Permit (CA0001309) for SSFL includes the requirements for a site-wide Storm Water Pollution Prevention Plan. The Storm Water Pollution Prevention Plan is revised as needed and includes by reference many existing pollution prevention plans, policies, and procedures implemented at the SSFL site.



The Spill Prevention, Control and Countermeasure (SPCC) plan serves to identify specific procedures for handling oil and hazardous substances to prevent uncontrolled discharge into or upon the navigable waters of the State of California or the United States. The U.S. EPA requires the preparation of an SPCC plan by those facilities that, because of their locations, could reasonably be expected to discharge oil in harmful quantities into or upon navigable waters. The SPCC plan was submitted by Boeing in January 2015 as a part of the 2014 Hazardous Materials Release Response Business Plan to the County of Ventura Environmental Health Division.

### 3.1.4 Permits and Licenses (Area IV)

Table 3-2 lists the permits applicable to activities in Area IV.

**Table 3-2. SSFL Permits**

Permit/License	Facility	Valid
<b>Air (VCAPCD)</b>		
Permit 00232	Combined permit renewed	Current
<b>Treatment Storage (EPA)</b>		
CAD000629972 (93-3-TS-002)	HWMF (Bldg. 4133 and Bldg. 4029)	Inactive. The closure plan was approved on 12/22/06, but demolition has been suspended by DOE pending completion of the EIS (Draft EIS was released by DOE in January 2017 [DOE 2017]). A permit Modification was approved by DTSC on January 22, 2015 to change the owner/operator from Boeing to DOE/North Wind, Inc.
CA3890090001	RMHF	Draft closure plan submitted in 2007. A permit Modification was approved by DTSC on January 22, 2015, to change the owner/operator from Boeing to DOE/North Wind, Inc.
<b>NPDES (LARWQCB)</b>		
CA0001309	SSFL	Current
<b>State of California</b>		
SWPPP 56C312650	Area IV	Current

## 3.2 Current Issues and Actions

### 3.2.1 Area IV Environmental Impact Statement

Pursuant to a federal court order issued in May 2007, the DOE submitted a Draft EIS for Area IV:

<http://www.ssflareaiveis.com/>

Activities conducted in support of this EIS are described below.

- DOE, in partnership with the state of California, completed the remaining "go-back" phase, including stepping down and any remaining data gap sampling as identified as Phase 3 in the 2010 AOC.
- DOE conducted extensive analysis of previous groundwater sampling conducted and developed groundwater sampling plans to complete groundwater characterization to understand the nature and extent of groundwater contamination.
- As both the groundwater and soil characterizations were nearing an end, DOE began to focus more completely on the EIS. In February 2014, DOE issued an Amended NOI to prepare the EIS.
- DOE conducted monthly community site visits and bi-monthly community meetings in conjunction with DTSC. The tours included inspection of ongoing field activities and areas of interest to stakeholders involved in the site investigation. Stakeholders also provided input to planning for co-located soil sampling described above.

### **3.2.2 Radiological D&D**

Since May 24, 2007, the D&D of the remaining DOE facilities in Area IV is on hold following the federal court order to conduct an EIS.

#### **3.2.2.1 Radioactive Materials Handling Facility**

During 2017, the RMHF remained in a safe shutdown mode with operations limited to routine inspections and surveys.

The status of the D&D at the RMHF may be found at:

[http://www.etec.energy.gov/Operations/Support\\_Ops/RMHF.php](http://www.etec.energy.gov/Operations/Support_Ops/RMHF.php)

<http://www.etec.energy.gov/Library/RMHFDocRecord.php>

#### **3.2.2.2 SNAP Environmental Test Facility**

During 2017, the SNAP Environmental Test Facility (Building 4024) remained in a safe shutdown mode with operations limited to routine inspections and surveys.

The status of the D&D of the Building 4024 may be found at:

[http://www.etec.energy.gov/Operations/Major\\_Operations/SNAP.php](http://www.etec.energy.gov/Operations/Major_Operations/SNAP.php)

<http://www.etec.energy.gov/Library/Building24DocRecord.php>

Groundwater that infiltrates into the cells and french drain of Building 4024 has historically been pumped into Baker tanks and sampled for radionuclides, and periodically for chemicals, prior to being shipped off-site as non-hazardous waste water. During 2017, approximately 72,000 gallons of water were pumped out of the Building 4024 sump into Baker tanks and shipped to the Cosby and Overton, Inc., waste water treatment facility in Long Beach, CA.

### **3.2.3 Disposal of Non-Radiological Waste and License-exempt Radioactive Material**

No non-radiological wastes were disposed of from the site in 2017.

### **3.2.4 Administrative Order of Consent**

In December 2010, the DTSC and DOE signed an AOC for Remedial Action that defines the process for characterization of the soil and the cleanup end-state for Area IV of the SSFL, including regional “background” for chemicals that currently have a background value, and method reporting limits (MRLs) for those chemicals that have no background value. Background values and MRLs have been incorporated into a Look-up Table (LUT), per the AOC, by DTSC. The LUT provides the cleanup standards, per the AOC for Area IV.

In November 2012, EPA made recommendations to DTSC regarding how the AOC LUT values for radionuclides should be calculated based on background soil data (EPA 2012). Subsequently, in January 2013, DTSC issued draft provisional LUTs for sixteen radionuclides (DTSC 2013a). In May 2013, the DTSC issued a “Chemical LUT Technical Memorandum” for more than 130 chemicals (DTSC 2013b).

### **3.2.5 DOE “CleanUpdate”**

DOE provides “CleanUpdate” newsletters to update stakeholders on its activities on the ETEC Closure Project. The newsletters may be found at:

[https://www.etec.energy.gov/Community\\_Involvement/Newsletters.php](https://www.etec.energy.gov/Community_Involvement/Newsletters.php)

This page intentionally left blank

## **4. ENVIRONMENTAL PROGRAM INFORMATION**

At SSFL, the ETEC Site Closure Program Office has programmatic responsibility for the former radiological facilities, former sodium test facilities, and related cleanup operations, including environmental restoration and waste management. Past environmental restoration activities have included D&D of radioactively contaminated facilities, building demolition, treatment of sodium, assessment and remediation of soil and groundwater, surveillance and maintenance of work areas, and environmental monitoring. Waste management activities include waste characterization and certification, storage, treatment, and off-site disposal. Waste management activities in the past were performed at the RMHF for radioactive and mixed waste. The HWMF was used to handle alkali metal waste, but it is now inactive and awaiting closure pending completion of the EIS.

### **4.1 Environmental Restoration**

Responsibility for implementing the Closure Program at ETEC falls under the DOE Environmental Management Consolidated Business Center (EMCBC). It includes the following responsibilities:

- Program management including performance, cost, and schedule
- Providing direction for waste management, environmental restoration including RCRA corrective action, and landlord activities
- Supporting DOE and its contractor(s) responsible for completing the EIS for Area IV
- Coordinating activities and interactions involving regulatory agencies and stakeholders
- Responding to DOE requests for special studies and information requests (technical and administrative services)
- Monitoring groundwater
- Management and shipment to DOE-approved disposal sites of radioactive waste generated during the D&D operations
- Operation of the RMHF as an interim status Part A permitted facility for the management of mixed waste
- Performance of the routine surveillance and maintenance activities for DOE-owned facilities to ensure that the buildings are properly maintained in a safe shutdown condition
- Ensuring compliance with applicable federal, state, and local rules and regulations; maintaining a working knowledge of applicable environmental laws; performing compliance audits; reviewing new and modified facility projects; coordinating solid and hazardous waste disposal; maintaining required records; preparing and submitting required regulatory reports; applying for and maintaining permits; assuring compliance with permit conditions; and performing sampling and analysis
- Responding to uncontrolled releases and reporting releases as required by law and contractual requirements

- Suspending operations determined to be in violation of environmental regulations
- Providing a program for motivating, informing, and training employees about their duties to comply with environmental regulations and protect the environment
- Recognizing and responding to the community's concerns regarding the environmental impact of operations, including escorting and cooperating with regulatory officials interested in environmental matters and responding to requests for information referred to communications
- Working with customers and suppliers to minimize the use of materials and processes that impact the environment while maintaining product quality and competitive pricing
- Making environmental concerns a priority (including energy and raw material conservation) when evaluating new and existing operations and products or when making decisions regarding land use, process changes, materials purchases, and business acquisitions
- Implementation of groundwater monitoring and treatment
- Implementation of RCRA soil sampling and cleanup activities
- Implementation of surface water management.

Health, Safety, & Radiation Services responsibilities include:

- Implementation of DOE's Integrated Safety Management System (ISMS)
- Review of health and safety plans and oversight of field operations associated with the DOE contract
- Compliance with all federal, state, and local regulations pertaining to occupational and environmental radiation protection, and occupational health and safety
- Provision of health physics oversight of D&D and radioactive waste management activities
- Performance of final surveys of D&D buildings and facilities to demonstrate acceptability for release for unrestricted use
- Review of soil sampling and groundwater monitoring data
- Response to employee and public concerns regarding radiological activities and the impact of these activities on the health and safety of the community.

## **4.2 Environmental Monitoring Program**

The purpose of the environmental monitoring program is to detect and measure the presence of hazardous and radioactive materials; maintain compliance with federal, state, and local laws and regulations; and identify other undesirable impacts on the environment. It includes remediation efforts to correct or improve contaminated conditions at the site and prevent off-site impact. For this purpose, the environment is sampled and monitored, and effluents are analyzed. A goal of this program is to demonstrate compliance with applicable regulations and protection of human

health and the environment. Environmental restoration activities at the SSFL include a thorough review of past programs and historical practices to identify, characterize, and correct all areas of potential concern. The key requirements governing the monitoring program are DOE Order 231.1B (DOE 2011a) and DOE Order 458.1 (DOE 2013). Additional guidance is drawn from California regulations and licenses, and appropriate standards.

The basic policy for control of radiological and chemical materials requires that adequate containment of such materials be provided through engineering controls, that facility effluent releases be controlled to federal and state standards, and that external radiation levels be reduced to as low as reasonably achievable through rigid operational controls. The environmental monitoring program provides a measure of the effectiveness of these operational procedures and of the engineering safeguards incorporated into facility designs.

#### **4.2.1 Historical Radiological Monitoring**

Monitoring the environment for potential impact from past nuclear operations has been a primary focus of DOE since the inception of operations in the mid-1950s.

In the mid-1950s, the Atomic Energy Commission, in concert with its contractor, Atomics International, then a Division of North American Aviation, began initial plans for nuclear research at its facilities in the west San Fernando Valley. In 1955, prior to initial operations, a comprehensive monitoring program was initiated to sample and monitor environmental levels of radioactivity in and around its facilities.

During the 60-year history of nuclear research and later environmental restoration, on-site and off-site environmental monitoring and media sampling has been extensive. In the early years, soil/vegetation sampling was conducted monthly. Sampling locations extended to the Moorpark freeway to the west, to the Ronald Reagan freeway to the north, to Reseda Avenue to the east, and to the Ventura freeway to the south. Samples were also taken around the Canoga and De Soto facilities as well as around the Chatsworth Reservoir. This extensive off-site sampling program was terminated in 1989 when all nuclear research and operations (except remediation) came to an end.

During the 1990s, extensive media sampling programs were conducted in the surrounding areas, including the Brandeis-Bardin Institute (now known as the American Jewish University) and the Santa Monica Mountains Conservancy to the north, Bell Canyon to the south, the Rocketdyne Recreation Center in West Hills to the east, and various private homes in Chatsworth and West Hills. Samples were also taken from such distant areas as Wildwood Park and Tapia Park. In addition, monitoring of off-site radiation, groundwater, and storm water runoff from the site were routinely performed during this time.

Ongoing radiological environmental sampling and monitoring ensures that DOE operations at the SSFL, including cleanup, do not adversely affect either on-site personnel or the surrounding community.

Additional details about on-site and off-site monitoring are available at:

[http://www.etec.energy.gov/Environmental\\_and\\_Health/Enviro\\_Monitoring.php](http://www.etec.energy.gov/Environmental_and_Health/Enviro_Monitoring.php)

From 2009 through 2012, EPA conducted extensive radiological sampling in off-site locations (Background Study) and on-site locations (Area IV Radiological Study). Results are available at:

[http://www.etec.energy.gov/Char\\_Cleanup/EPA\\_Soil\\_Char.php](http://www.etec.energy.gov/Char_Cleanup/EPA_Soil_Char.php)

#### **4.2.2 Non-radiological Monitoring**

Extensive monitoring programs for chemical contaminants in soils, surface water, and groundwater are in effect to assure that the existing environmental conditions and restoration activities do not pose a threat to human health or the environment. Extensive soil sampling has been performed under the RFI and other site-specific remedial programs.

Groundwater beneath Area IV is extensively monitored for chemical groundwater conditions. Groundwater sampling and analysis is conducted using a DTSC-approved sampling and analysis plan and EPA-approved analytical methods and laboratories.

Surface storm water is contained, treated, and monitored, in compliance with Boeing's NPDES permit, which was most recently revised in June 2010. All sources of air emissions were monitored as required by the VCAPCD.

### **4.3 Integrated Safety Management System**

The "ETEC Closure Contract, ISMS Description" details how the ISMS guiding principles and the core functions are met by utilizing North Wind guides and Santa Susana site procedures contained in ETEC Closure Program documents. General ISMS guidelines are tailored specifically for ETEC closure work. The tailored ISMS integrates safety, health, and environmental protection into management and work practices at all levels so that the ETEC Closure Contract work is accomplished while protecting the worker, the public, and the environment. The Annual ISMS Declaration reviews performance, accomplishments, and improvements to the site ISMS. The 2017 Annual ISMS Report was submitted in January 2018.

The site ISMS self-assessment plan incorporates quarterly program assessments, site audits, and the review and distribution of DOE Lessons Learned, Occurrence Reports, and Operating Experience Reports. All safety observations noted during quarterly program assessments during this term were addressed in a timely fashion.

To ensure that the ISMS continues to reflect current policies, procedures, processes, and business organization within the context of the ISMS principles, related program documents continue to be regularly reviewed and updated. No program updates were required during 2017 and no program changes to North Wind's approved ISMS are anticipated for 2018.



## **4.4 Environmental Training**

North Wind conducts training and development programs as an investment in human resources to meet both organizational and individual goals. These programs are designed to improve employee performance, ensure employee proficiency, prevent obsolescence in employee capability, and prepare employees for changing technology requirements and possible advancement.

The North Wind Environmental Safety, Health and Quality (ESH&Q) organization is responsible for the development and administration of formal training and development programs. The Program Manager is responsible for individual employee development through formal training, work assignments, coaching, counseling, and performance evaluation. Managers and employees are jointly responsible for defining and implementing individual training development goals and plans, including on-the-job training.

The ESH&Q organization currently maintains a list of 110 courses for North Wind Santa Susana personnel and contractors. Classes are available as both computer-based training and instructor-led training. Training is available through North Wind's ETEC Training Management website. Specialized training programs on new technological developments and changes in regulations are provided, as needed, to ensure effective environmental protection and worker health and safety. Additional off-site courses are also encouraged.

## **4.5 Waste Minimization and Pollution Prevention**

### **4.5.1 Program Planning and Development**

A Waste Minimization and Pollution Prevention Awareness Plan is in place and serves as a guidance document for all waste generators at ETEC. The plan emphasizes management's proactive policy of waste minimization and pollution prevention, and also outlines goals, processes, and waste minimization techniques to be considered for all waste streams generated at ETEC. The plan requires that waste minimization opportunities for all major restoration projects be identified and that all cost-effective waste reduction options be implemented.

The majority of wastes currently generated at ETEC result from environmental characterization. The typical wastes generated at ETEC during 2017 were:

- Investigation-derived waste (IDW)
- Groundwater and soil sampling disposable equipment, personal protective equipment, rinse water, and purge water
- Well purge water, including the purge water from wells containing low levels of tritium
- Basement water pumped to frac tanks.

#### **4.5.2 Waste Management and Pollution Prevention Activities**

The following are some routine activities related to waste minimization and pollution prevention:

- Hazardous waste containers in acceptable condition are reused to the maximum extent possible.
- Empty product drums are returned to the vendor for reuse when practical.

#### **4.5.3 Tracking and Reporting System**

Various categories of materials from procurement to waste disposal are tracked. Radioactive and mixed wastes are transferred to the RMHF, logged, characterized, and stored at the RMHF. Documents that accompany the wastes are verified for accuracy and completeness and filed at the RMHF. No radioactive wastes were generated during 2017.

#### **4.6 Public Participation**

Throughout 2017, DOE interacted with community members at DTSC Community Update meetings to inform them of plans and progress. Also in 2017, DOE continued its participation in bi-weekly meetings with NASA, Boeing, DTSC, and the LA RWQCB staff to coordinate public outreach efforts.

## 5. ENVIRONMENTAL RADIOLOGICAL MONITORING

The environmental radiological monitoring program at SSFL started before the first radiological facility was established in 1956. The program has continued with modifications to suit the changing operations. The selection of monitoring locations was based on several site-specific criteria such as topography, meteorology, hydrology, and the locations of the nuclear facilities. The prevailing wind direction for the SSFL site is generally from the northwest, with some seasonal diurnal shifting to the southeast quadrant.

Ambient air samples are measured for gross alpha and gross beta for screening purposes. These screening measurements can quickly identify an unusual release and provide long-term historical records of radioactivity in the environment. Air sampling at ETEC during 2017 was performed by North Wind. The individual air samples are screened for gross alpha and gross beta activity. Following screening, the air samples are stored until the end of the year, combined into composite samples, and analyzed for specific radionuclides.

Direct radiation is monitored by optically stimulated luminescent dosimeters (OSLDs). The OSLDs used to monitor direct radiation at ETEC were placed and analyzed by North Wind. These OSLDs are complemented by thermoluminescent dosimeters (TLDs) installed by the State of California DPH/RHB for independent surveillance.

Surface water samples collected by Boeing at ETEC are analyzed for radioactivity (as well as chemical constituents) and the results compared with NPDES limits intended to protect aquatic organisms.

Groundwater was sampled by North Wind in Q1 (February/March) of 2017 in accordance with the monitoring programs in place at the site. Samples were analyzed for chemical constituents, and some were also analyzed for radioactivity. The results are compared to the screening values as listed in the various groundwater reports. The analytical data suite used for laboratory analysis is updated annually after review of the previous year's data.

### 5.1 Air Effluent Monitoring

The only historical emission source from DOE facilities in Area IV is the exhaust stack at the RMHF. In May 2007, DOE suspended all D&D operations at SSFL. As a result, the entire facility was placed into a safe shutdown mode. No effluents were released to the atmosphere through the stack during 2017.

The EPA limit for emissions of radionuclides to ambient air from a DOE site was established to prevent an effective dose equivalent from exceeding 10 mrem/year, as specified in 40 CFR 61, Subpart H. The regulation also specifies that radiation exposure dose to the Maximally Exposed Individual (MEI) be calculated using the EPA's CAP88-PC computer model (EPA 2014). Since no effluents were released to the atmosphere from the DOE facility at SSFL, the potential airborne radiation exposure dose to the MEI was zero.

## 5.2 Environmental Sampling

### 5.2.1 Ambient Air

Due to the temporary suspension of D&D operations at SSFL, the number of environmental stations was reduced to two locations in 2009. The sampling locations are shown in Figure 5-1 and listed in Table 5-1.

During 2017, ambient air sampling was performed continuously at SSFL with air samplers operating on 7-day sampling cycles. Airborne particulate radioactivity was collected on glass fiber (Type A/E) filters that were changed weekly. The samples were counted for gross alpha and beta radiation following a minimum 120-hour decay period to allow the decay of short-lived radon and thoron daughters. The volume of a typical weekly ambient air sample was approximately 50.4 m<sup>3</sup>.

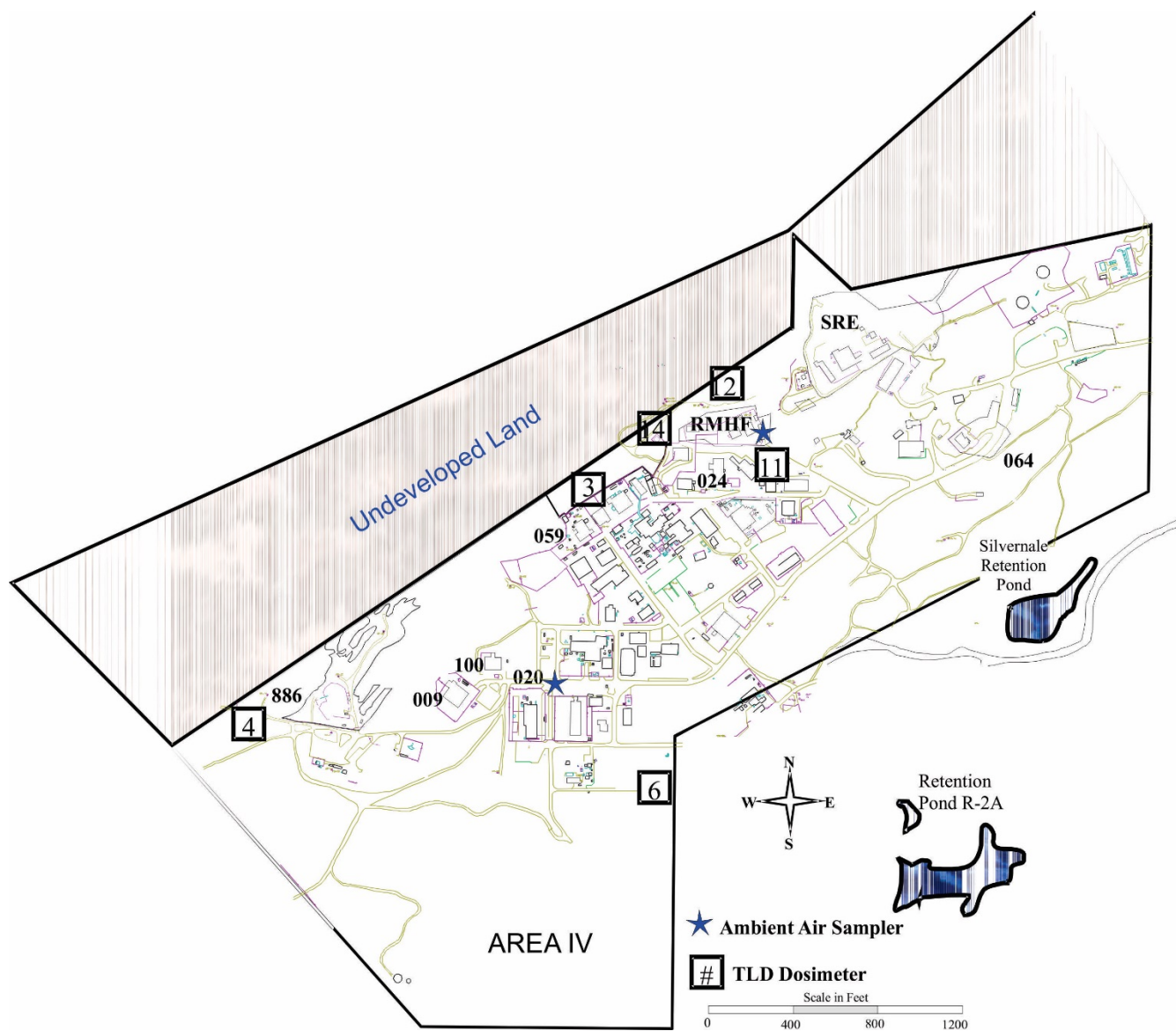
Weekly ambient air samples were counted using a dual-phosphor solid scintillation detector. The solid scintillation detector uses separate phosphors to detect high linear energy transfer (i.e., alpha) particles and low linear energy transfer (i.e., beta) particles. This detector is capable of simultaneously counting alpha and beta radiation. The sample-detector configuration provides nearly hemispherical (2 $\pi$ ) geometry. A preset time mode of operation is used for counting all samples.

Counting system efficiencies were determined routinely with technetium-99 (Tc-99) and thorium-230 (Th-230) standard sources. The activities of the standard sources are traceable to the National Institute of Standards and Technology (NIST).

Filter samples for each ambient air sampling location were combined for 2017 and analyzed for isotopic-specific activity. The weighted average ambient air sampling results for specific isotopes, as shown in Table 5-2, had radionuclide concentrations well below the DOE derived concentration standard (DCS) based on 100 mrem/year (DOE 2011b), and also well below the U.S. EPA NESHAP based on 10 mrem/year (EPA 2013). The variability in the measurements was primarily due to weather effects, as well as analytical and background variations. The results provided in Table 5-2 were not corrected for background air concentrations.

It should be noted that these measurements determine only the long-lived particulate radioactivity in the air and, therefore, do not show radon (Rn-222) and most of its progeny. Polonium-210 is a long-lived progeny and is detected by these analyses.

The gross radioactivity alpha and beta guidelines for SSFL site ambient air are based on the DCS specified in DOE-STD-1196-2011 (DOE 2011b). The conservative guideline for alpha activity is  $8.1 \times 10^{-14}$   $\mu\text{Ci/mL}$ , and the guideline for beta activity is  $1.0 \times 10^{-10}$   $\mu\text{Ci/mL}$ . These values are the DCSs for plutonium-239 and strontium-90 respectively. The results for the gross alpha and gross beta counts of the ambient air samples are given in Table 5-3. The results reported in Table 5-3 are corrected for instrument background but no corrections are made for background air concentrations.



**Figure 5-1. Map of Santa Susana Field Laboratory Area IV Sampling Stations**

**Table 5-1. Sampling Location Description**

Station	Location	Sampling Frequency
<b>Ambient Air Sampler Locations</b>		
A-2	SSFL Site, 4020, northeast of former 4020 site	(W)
A-3	SSFL Site, RMHF Facility, next to 4034	(W)
A-4	SSFL Site, 4886, FSDF	Discontinued
A-5	SSFL Site, RMHF Pond, north side	Discontinued
A-6	SSFL Site, 4100, east side	Discontinued
<b>On-site - SSFL - Ambient Radiation Dosimeter Locations</b>		
SS-3 (CA)	SSFL Site, Electric Substation 719 on boundary fence	(Q)
SS-4 (CA)	SSFL Site, west boundary on H Street	(Q)
SS-6 (CA)	SSFL Site, northeast corner of 4353	(Q)
SS-7 (CA)	SSFL Site, 4363, north side	Discontinued
SS-8 (CA)	SSFL Site, FSDF north boundary	Discontinued
SS-9 (CA)	SSFL Site, RMHF northeast boundary at 4133	Discontinued
SS-11 (CA)	SSFL Site, 4036, east side	(Q)
SS-12 (CA)	SSFL Site, RMHF northwest property line boundary	(Q)
SS-13 (CA)	SSFL Site, RMHF northwest property line boundary	Discontinued
SS-14 (CA)	SSFL Site, RMHF west of 4614	(Q)
SS-15 (CA)	SSFL Site, RMHF northwest property line boundary	Discontinued
EMB-1 (CA)	SSFL Site, SRE area north of 4003	Discontinued
EMB-2 (CA)	SSFL Site, south of Silvernale retention pond, off Test Area Road	Discontinued
<b>Off-site Ambient Radiation Dosimeter Locations</b>		
OS-1 (CA)	SSFL Front Gate	(Q)
BKG-11	Background Location, West Hills	Discontinued
BKG-12	Background Location, Somis	Discontinued
BKG-13	Background Location, Hollywood	Discontinued
BKG-15	Background Location, Calabasas	Discontinued
BKG-18	Background Location, Agoura	Discontinued
BKG-19	Background Location, Westlake Village	Discontinued
BKG-22	Background Location, Saugus	Discontinued
BKG-23	Background Location, Simi Valley	(Q)
<b>Codes</b>		<b>Locations</b>
A	Air Sampler Station	SS SSFL
W	Weekly Sample	OS Off-site
Q	Quarterly Sample	BKG Background
CA	State Confirmatory Location	EMB Environmental Management Branch



**Table 5-2. Ambient Air Specific Isotopes – 2017**

Radionuclide	Derived Concentration Standard <sup>1</sup> (DCS)	RMHF	4020	Average <sup>4</sup> (% of DCS)
	(μCi/mL)			
H-3	2.1E-07	NA <sup>2</sup>	NA	NA
Be-7 (natural)	9.3E-8	4.43E-14	4.31E-14	4.37E-14 (0.00005%)
K-40 (natural)	4.6E-11	ND <sup>3</sup>	ND	NA
Mn-54	1.1E-9	ND	ND	NA
Co-60	3.6E-10	ND	ND	NA
Sr-90	1.0E-10	ND	4.01E-16	4.01E-16 (0.0004%)
Cs-137	8.8E-10	ND	ND	NA
Po-210 (natural)	1.1E-12	6.30E-15	8.63E-15	7.46E-15 (0.68%)
Th-228	9.4E-14	3.89E-16	5.95E-16	4.92E-16 (0.52%)
Th-230	2.8E-13	5.46E-16	9.20E-16	7.33E-16 (0.26%)
Th-232	1.6E-13	4.27E-16	5.31E-16	4.79E-16 (0.30%)
U-234	1.1E-12	4.89E-16	7.29E-16	6.09E-16 (0.06%)
U-235	1.2E-12	ND	ND	NA
U-238	1.3E-12	7.02E-16	5.38E-16	6.20E-16 (0.05%)
Pu-238	8.8E-14	ND	ND	NA
Pu-239/240	8.1E-14	ND	ND	NA
Pu-241	4.6E-12	ND	ND	NA
Am-241	9.7E-14	ND	ND	NA

<sup>1</sup> DOE-STD-1196-2011, Derived Concentration Technical Standard, April 2011

<sup>2</sup> NA = Not applicable

<sup>3</sup> ND = Not detect

<sup>4</sup> As a conservative measure, ND reported results are excluded from average concentration calculations.

**Table 5-3. Ambient Air Gross Alpha and Gross Beta – 2017**

Area	Activity	Number of Weeks	Gross Radioactivity	
			Average Concentrations <sup>a</sup> (μCi/mL)	Average Percent of Standard <sup>b</sup>
SSFL Area IV 4020	Alpha	52	1.86E-15	2.30%
	Beta		8.07E-14	0.08%
SSFL Area IV RMHF	Alpha	52	9.32E-16	1.15%
	Beta		9.15E-14	0.09%

<sup>a</sup> Values include natural background. As a conservative measure, negative reported results are excluded from average concentration calculations.

<sup>b</sup> Based on the most restrictive derived concentration standard: 8.1E-14 μCi/mL alpha (Pu-239), 1.0E-10 μCi/mL beta (Sr-90), DOE-STD-1196-2011 (April 2011).

### **5.2.2 Groundwater**

Wells installed in both the Chatsworth Formation and the shallow subsurface are sampled annually to monitor groundwater conditions in Area IV, in accordance with the WQSAP (Haley and Aldrich 2010). Well locations are shown in Figure 6-2. The purpose of these wells is to monitor concentrations of chemicals and/or radioactivity released by historical DOE operations. Groundwater samples are analyzed for a suite of chemical constituents, while some are selected and analyzed for radioactivity, including gross alpha, gross beta, gamma-emitter radionuclides, Ra-226, Ra-228, Sr-90, H-3, and isotopic uranium. Complete sampling schedules and analytical results are presented in the First Quarter Groundwater Report as well as the Annual Groundwater Reports, which can be found under the RCRA Facility Investigation – Groundwater tab in the SSFL Document library located at the following link:

[https://www.dtsc.ca.gov/SiteCleanup/Santa\\_Susana\\_Field\\_Lab/ssfl\\_document\\_library.cfm](https://www.dtsc.ca.gov/SiteCleanup/Santa_Susana_Field_Lab/ssfl_document_library.cfm)

The 2017 Annual Groundwater Report was submitted in March 2018 (North Wind 2018).

### **5.2.3 Surface Water**

The most significant areas of Area IV (FSDF, RMHF, and SRE) drain to the north, while the remainder drains to the southeast. Runoff to the north is captured in five catch basins (two at the FSDF, one at Building 4100, one at the RMHF, and one at the SRE). Collected water from Area IV is pumped for treatment/filtration and sampling under the Boeing NPDES Permit. Precipitation in Area IV is collected by a series of drainage channels.

Boeing is the land owner as listed in its NPDES Permit No. CA0001309, which mandates the collection of surface water samples each year as well as the presentation of the information in DMRs for the SSFL published quarterly and annually. The DMR provides information and data, including summary tables of surface water sample analytical results, rainfall summaries, liquid waste shipment summaries, and analytical laboratory QA/QC procedures and certifications. Quarterly and Annual NPDES DMRs are found under the CA RWQCB tab in the SSFL Document library located at the following link:

[https://www.dtsc.ca.gov/SiteCleanup/Santa\\_Susana\\_Field\\_Lab/ssfl\\_document\\_library.cfm](https://www.dtsc.ca.gov/SiteCleanup/Santa_Susana_Field_Lab/ssfl_document_library.cfm)

### **5.2.4 Soil**

The last radiological soil sampling in Area IV was conducted by EPA in 2012. No radiological soil sampling was conducted in Area IV on behalf of DOE during 2017.

### **5.2.5 Vegetation**

No vegetation samples were collected or analyzed in 2017.

### **5.2.6 Wildlife**

No animal samples were collected or analyzed during 2017.



### 5.2.7 Ambient Radiation

As part of the ETEC Site Closure program during 2017, North Wind deployed OSLDs that use an aluminum oxide (“sapphire”) chip. These OSLDs are capable of measuring doses in increments of 1 mrem. During the first quarter of 2017, the control badge supplied with these dosimeters was used to eliminate all exposures not related to radiological activities at ETEC, not just transportation exposures. During the second, third, and fourth quarters of 2017, the control badge was stored in a lead container at ETEC so only transportation exposures were eliminated using the control badge results. To provide annual exposure data comparable to State Department of Public Health/Radiologic Health Branch (DPH/RHB) data, the minimum control badge reading from the second, third, and fourth quarters of 2017 reported with the North Wind dosimetry data was used to evaluate the first quarter North Wind dosimetry data. This usage provides a conservative estimate of external exposure comparable to the other data sets.

The State DPH/RHB deploys calcium sulfate ( $\text{CaSO}_4$ ) dosimeters for independent monitoring of radiation levels at SSFL and in the surrounding area. These dosimeters are placed at specific locations by DPH/RHB concurrent with placement of the Site OSLDs. The State dosimeters are collected by the Radiologic Health Branch for evaluation each quarter. Data obtained during 2017 from these Site and State TLDs are shown in Table 5-4. Potential differences between the Site and State results are due primarily to differences in dosimeter types.

The ambient radiation level as measured by the off-site TLDs ranges from 20 to 55 mrem/year. At SSFL, the ambient radiation level ranges from 52 to 71 mrem/year based on the data from dosimeters SS-3, -4, -6, and -11, as shown in Table 5-4. The variability observed in these values can be attributed to differences in elevation and geologic conditions at the various sites. The altitude range for the dosimeter locations is from approximately 260 m (850 ft) above sea level (ASL) at off-site location BKG-23 to a maximum of approximately 580 m (1,900 ft) ASL at SSFL. Many of the SSFL TLD locations are also affected by proximity to sandstone rock outcroppings, a condition that results in elevated exposure levels. Radiation doses measured at locations SS-12 and -14, north and west of the RMHF, are similar to those measured at other locations on-site.

The Area IV northern property boundary, the closest property boundary to the RMHF, is approximately 300 meters from the RMHF and separated by a sandstone ridge that effectively shields the boundary from direct radiation from the RMHF. Dosimeters placed on the RMHF side of this sandstone ridge (SS-12 and -14), approximately 150 m (490 ft) from the RMHF, read an average of 5 mrem/year above the SSFL ambient radiation level of 62 mrem/year. This amount is below the 100 mrem/year limit specified in DOE Order 458.1 (DOE 2013). These dosimeter results demonstrate that the potential external exposure at the site boundary is below the DOE’s dose limit.

**Table 5-4. 2017 SSFL Ambient Radiation Dosimetry Data**

Dosimeter-Locations		Annual External Dose (mrem/y)	Average External Dose Rate (µrem/h)	
			Site	State DPH
SSFL Ambient Radiation	SS-3	52	5.9	7.3
	SS-4	71	8.1	7.8
	SS-6	62	7.1	7.9
	SS-11	63	7.2	9.4
<b>Mean Values</b>		<b>62</b>	<b>7.1</b>	<b>8.1</b>
RMHF Boundary	SS-12	72	8.2	8.8
	SS-14	62	7.1	8.4
<b>Mean Values</b>		<b>67</b>	<b>7.6</b>	<b>8.6</b>
Off-site Ambient Radiation	OS-1	55	6.3	8.6
	BKG-23	20	2.3	-- <sup>1</sup>
<b>Mean Values</b>		<b>38</b>	<b>4.3</b>	<b>8.6</b>

<sup>1</sup> BKG dosimeters are located in staff members' yards and are not used by DPH/RHB.

The SSFL ambient radiation level, calculated as the average of all on-site dosimeters (excluding SS-12 and SS-14), is 62 mrem/year. This value is 24 mrem/year above the mean value of the off-site ambient radiation level, 38 mrem/year. This result can be attributed primarily to higher background radiation levels due to higher elevation and different geology. One off-site dosimeter is located at a staff member's residence (BKG-23 for a Cabrera employee). In contrast, SSFL lies atop the Chatsworth Formation. The Chatsworth Formation is composed of arkosic sandstone, rich in feldspar. Arkosic rocks are often high in naturally occurring radioactive material. As a result, the Chatsworth Formation rocks produce higher radiation exposure than the soil of the surrounding valleys.

## 5.3 Estimation of Radiation Dose

### 5.3.1 Individual Dose

In accordance with regulations, the total effective dose equivalent to any member of the public from all pathways (combining internal and external dose) shall not exceed 100 mrem/year (above background) for any DOE facility. Although the two TLD monitoring stations to the north and west of the RMHF, namely SS-12 and -14, recorded an external dose level of 5 mrem/year, above the SSFL ambient radiation level, the actual external dose at the property boundary is likely to be indistinguishable from the natural background. This is because the high rocky terrain between the actual property line and the dosimeter locations acts as an effective shield for external radiation. External exposure from radiation at the nearest residence is also expected to be indistinguishable from natural background because of additional shielding from the terrain and increased distance from the site.

Since no effluents were released to the atmosphere through the RMHF stack in 2017, the potential internal dose from airborne releases is zero mrem. For DOE operations, the air pathway standard is 10 mrem/year committed effective dose equivalent (CEDE), as established by EPA.

Public exposure to radiation and radioactivity is shown in Table 5-5. The table presents the estimated exposures in comparison to the regulatory standards. Dose values in the table represent both internal and external exposures.

### 5.3.2 Population Dose

Since no effluents were released to the atmosphere during 2017, the potential collective dose to the general population was zero person-rem.

**Table 5-5. Public Exposure to Radiation from DOE Operations at SSFL**

1. All pathways	
1. Maximum estimated external dose to an individual from direct radiation	0 mrem/yr
2. Maximum estimated internal dose to an individual	0 mrem/yr
Limit ("Radiation Protection of the Public and the Environment," DOE Order 458.1)	100 mrem/yr
2. Air pathway (reported in NESHAP report)	
Limit (40 CFR 61, Subpart H)	10 mrem/yr

## 5.4 Protection of Biota

DOE Order 458.1, "Radiation Protection of the Public and the Environment," requires that populations of aquatic organisms be protected using a dose limit of 1 rad/day. While there is no formal DOE dose limit for terrestrial biota, DOE strongly recommends that its site activities meet the internationally recommended dose limits for terrestrial biota, which are:

- The absorbed dose to aquatic animals will not exceed 1 rad/day (10 mGy/day) from exposure to radiation or radioactive material.
- The absorbed dose to terrestrial plants will not exceed 1 rad/day (10 mGy/day) from exposure to radiation or radioactive material.
- The absorbed dose to terrestrial animals will not exceed 0.1 rad/day (1 mGy/day) from exposure to radiation or radioactive material.

There is no aquatic system in the Area IV of SSFL. Therefore, the protection of aquatic organisms on-site is not an issue.

The terrestrial biota, i.e., vegetation and small wild animals, are abundant at SSFL. They are subject to potential exposure from radioactivity in the soil. The DOE Technical Standard, "A Graded Approach for Evaluating Doses to Aquatic and Terrestrial Biota" (DOE 2002), provides a methodology for demonstrating compliance with the requirement for protection of biota. RESRAD-BIOTA, a computer program developed by DOE, implements the graded approach for biota dose evaluation. There are three levels of dose evaluations in RESRAD-

BIOTA. The first level is a conservative screening tool for compliance demonstration. Once the screening test in Level 1 is met, no further evaluation is necessary.

In the Level 1 dose evaluation, measured radionuclide concentrations in environmental media are compared with the biota concentration guides (BCGs). Each radionuclide-specific BCG represents the limiting concentration in environmental media that would not cause the biota dose limits to be exceeded.

EPA soil concentrations in Area IV, taken in 2011 and 2012, are used for the Level 1 dose evaluation. Table 5-6 summarizes the comparison results. The total BCG fraction in Area IV, as shown in Table 5-6, is less than 1, indicating that the potential exposure is less than the dose limit recommended by the DOE.

**Table 5-6. Terrestrial Biota Radiation Exposure as a Fraction of Dose Limit**

Isotope	Soil			
	Draft LUT (pCi/g)	BCG Limit (pCi/g)	Avg. Soil Concentration above LUT (pCi/g)	Avg. Site Isotopic Partial Fraction
Am-241	3.86E-02	3.89E+03	1.50E-05	3.966E-09
Cm-243/244	3.96E-02	4.06E+03	9.00E-06	2.223E-09
Co-60	3.63E-02	6.92E+02	4.00E-06	6.080E-09
Cs-137	2.25E-01	2.08E+01	2.11E-01	1.012E-02
Eu-152	7.39E-02	1.52E+03	3.40E-05	2.252E-08
Pu-238	2.54E-02	5.27E+03	9.00E-06	1.624E-09
Pu-239/240	2.30E-02	6.11E+03	1.65E-04	2.705E-08
Sr-90	1.17E-01	2.25E+01	4.68E-02	2.082E-03
Th-230	2.38E+00	9.98E+03	9.85E-04	9.872E-08
Th-232	3.44E+00	1.51E+03	0.00E+00	0.00E+00
Th-234	3.54E+00	2.16E+03	1.30E-03	6.026E-07
U-233/234	2.18E+00	5.13E+03	2.56E-03	4.991E-07
U-235/236	1.52E-01	2.77E+03	1.47E-04	5.322E-08
U-238	1.96E+00	1.58E+03	1.49E-03	9.445E-07
<b>Sum of Partial Fraction</b>				<b>0.012</b>

## 6. ENVIRONMENTAL NON-RADIOLOGICAL MONITORING

SSFL maintains a comprehensive environmental program to ensure compliance with all applicable regulations, to prevent adverse environmental impact, and to restore the quality of the environment from past operations.

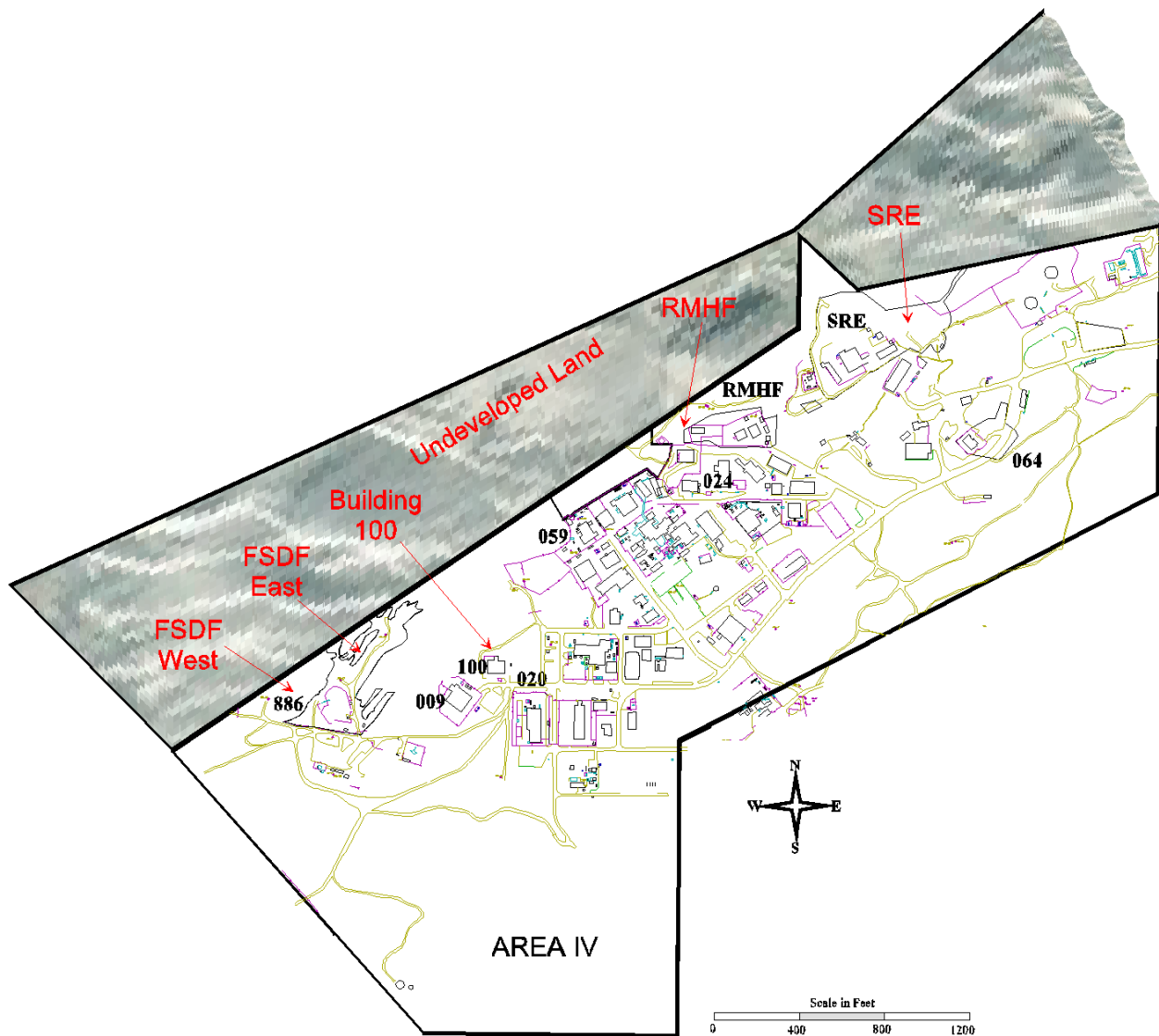
The LARWQCB regulates discharges through Boeing's NPDES permit. Surface water runoff is collected in the water reclamation/pond system, with discharges from this system being subject to effluent limitations and monitoring requirements as specified in Boeing's NPDES permit. The significant areas of Area IV discharge storm water runoff to five northern catchment basins (Figure 6-1), where water is contained and pumped to the central treatment system at Silvernale Pond in Area III.

The overall groundwater monitoring program at SSFL addresses collection and analysis of groundwater samples and measurement of the water levels. The locations of the wells and piezometers within and around DOE areas in Area IV are shown in Figure 6-2. Groundwater quality parameters and sampling frequency have been determined on the basis of historical water quality data, location of known or potential sources of groundwater contamination, operational requirements of groundwater extraction and treatment systems, and regulatory direction. Wells are gauged quarterly for groundwater levels and sampled annually. The specific analysis dictated for each well is modified annually by DOE and is determined by review of existing data and conditions. The groundwater monitoring program for Area IV includes the analysis of following parameters, which are analyzed using the appropriate EPA methods:

- Volatile organic compounds, including 1,4-dioxane
- Metals (including sodium)
- Fluoride
- Perchlorate
- Nitrate
- Petroleum hydrocarbons
- 1,2,3-Trichloropropane (TCP)
- Radionuclides (gross alpha, gross beta, tritium, strontium-90, total combined radium-226 and radium-228, potassium-40, cesium-137, and uranium isotopes).

### 6.1 Surface Water Discharge

The LARWQCB granted Boeing a discharge permit pursuant to the NPDES and Section 402 of the Federal Water Pollution Control Act. NPDES Permit No. CA0001309 initially became effective on September 27, 1976, was most recently renewed on June 16, 2010, and became effective on July 19, 2010.



**Figure 6-1. Locations of Surface Water Runoff Collectors**

The NPDES permit allows the discharge of storm water runoff from retention ponds into Bell Creek, a tributary of the Los Angeles River. Storm water from the southeastern portion of Area I is permitted to discharge to Dayton Creek and from the northeastern locations of Area II into the Arroyo Simi, a tributary of Calleguas Creek. The permit also allows for the discharge of stormwater runoff from the northwest slope (Area IV) locations into the Arroyo Simi. Since 2012, storm water from the northwest slope (RMHF: Outfall 003; SRE: Outfall 004; FSDF #1: Outfall 005; FSDF #2: Outfall 006; and T100: Outfall 007) is pumped to a retention pond in Area III (Silvernale Pond). Discharge from these outfalls occurs only if the pumps fail or the systems get overwhelmed by heavy rainfall.



Of the two retention ponds (R1 and Silvernale) at SSFL that have approved discharge points in the NPDES permit (i.e., Outfalls 011 and 018), only one, Silvernale Pond (Outfall 018), receives influent (storm water) from Area IV. When there is discharge from either the R-1 or Silvernale ponds, grab and composite samples are collected by Boeing and sent to a California State-certified testing laboratory for analysis. Analyses include chemical constituents such as heavy metals, volatile organics, base/neutral and acid extractables, general chemistry, E. coli and fecal coliform, and specified radionuclides. Toxicity testing is also conducted in the form of acute and chronic toxicity bioassays.

There is no sanitary sewer connection to a publicly owned treatment works from SSFL. Portable toilet facilities are currently in use in Area IV and have been for the prior four years.

Details on the NPDES discharge from the SSFL for the period of January 1, 2017, through December 31, 2017, are available in the 2017 quarterly DMR reports. These reports provide information and data, including summary tables of surface water sample analytical results, rainfall summaries, liquid waste shipment summaries, and analytical laboratory QA/QC procedures and certifications.

## **6.2 Air**

The SSFL is regulated by the VCAPCD and must comply with all permit conditions contained in FESOP No. 00232, which implement applicable VCAPCD rules and regulations. In 2008, the former Permit to Operate No. 00271 for DOE was consolidated into FESOP No. 00232. No substantive changes or modifications from the previous permit were made as a result of the permit consolidation (i.e., an Administrative Change). However, as permitted equipment is removed from the site, it is removed from the permit, along with any conditions applicable to the equipment. Per FESOP monitoring, recordkeeping, reporting requirements, calculated emissions of criteria air pollutants and precursors were under the mass limits defined in the permit conditions. As a present-day remediation site, the SSFL is not a major source of air pollutants under CAA Title V (i.e., Synthetic Minor source per FESOP conditions) and is not subject to 40 CFR 63 Subpart GG – National Emission Standards for Aerospace Manufacturing and Rework Facilities.

## **6.3 Groundwater**

A site-wide groundwater monitoring program has been in place at the SSFL site since 1984. Area IV contains 119 shallow and deep wells and 12 seep wells. Routine chemical and radiological monitoring of the wells and seep wells is conducted according to the monitoring plan submitted to DTSC for the Site-Wide Groundwater Monitoring Program and the RFI Program.

Groundwater reports are submitted to the regulatory agencies following each sampling event. Summaries of groundwater monitoring activities and sampling results for Area IV during 2017 are presented in Tables 6-1 and 6-2.



**Table 6-1. Groundwater Monitoring at Area IV in 2017**

	Remediation	Waste Management <sup>b</sup>	Environmental Surveillance	Other Drivers
Number of active wells monitored	1	NA	76	0
Number of samples taken	a	4	156	0
Number of method analyses performed	a	272	9209	0
% of analyses non-detect	a	74.3	74	NA

a – RS-54 extraction and sampling data provided in the Groundwater Interim Monitoring (GWIM) Technical Memorandum (CDM Smith 2018a) and discussed in the FSDf section below.

b – Water stored in Baker tank pumped from Building 4024 sump.

**Table 6-2. Ranges of Detected Non-Radiological Analytes in 2017 Groundwater Samples**

Analytes	Ranges of Results for Positive Detections
Fluoride (mg/L)	0.27 to 2.4
Metals (mg/L)	0.000033 to 290
Perchlorate (ug/L)	0.075J to 3.5
1,1-Dichloroethane (µg/L)	0.44J to 1,700
1,1-Dichloroethene (µg/L)	0.26 to 1,300
1,4-Dioxane (µg/L)	None detected
Acetone (µg/L)	2.7 to 19
cis-1,2-Dichloroethene (cis-1,2-DCE) (µg/L)	0.24J to 19
trans-1,2-Dichloroethene (µg/L)	0.16J to 12
Tetrachloroethene (PCE) (µg/L)	0.28J to 42
Toluene (µg/L)	0.32J to 1.3
1,1,1-Trichloroethane	11,000 (only one detection)
Trichloroethene (TCE) (µg/L)	0.43J to 1,200
Other Volatile Organic Compounds (µg/L)	0.19J to 16
Diesel Range Organics (µg/L)	120 to 890
Gasoline Range Organics (µg/L)	None detected

J = Estimated value. Analyte detected at a level less than the reporting limit and greater than or equal to the MDL.

Groundwater wells are screened in alluvium, weathered bedrock, and unweathered bedrock (Figure 6-2). For regulatory purposes, “near-surface groundwater” is defined to occur perched or vertically continuous with deeper groundwater within the site’s unconsolidated deposits (e.g., alluvium) and shallow weathered bedrock, whereas deep groundwater, referred to as “Chatsworth Formation groundwater,” occurs in unweathered bedrock. The alluvium is indicated to generally consist of unconsolidated sand, silt, and clay. Groundwater is ephemeral in some portions of the alluvium and upper weathered Chatsworth Formation. The principal water-bearing system at the Facility is the fractured Chatsworth Formation, predominantly composed of weak- to well-cemented sandstone with interbeds of siltstone and claystone. Several hydraulically significant features such as fault zones and shale beds are present at SSFL and may act as aquitards or otherwise influence the groundwater flow system.

Figures 6-3 and 6-4 present areas that have historically been impacted by trichloroethene (TCE) and tritium, respectively. There is one location between SNAP, DOE Landfill 2, and the RMHF that has been impacted by tritium. During 2017, tritium was above the MCL of 20,000 picocuries per liter (pCi/L) in well RD-90 at a concentration of 38,300 pCi/L and just below the MCL in well RD-95 at 19,600 pCi/L. These concentrations are similar to those detected during the previous round of tritium well sampling during 2016. All other wells sampled during 2017 for tritium had results that were nondetect or below the MCL.

The Draft Site-Wide Groundwater Remedial Investigation Report (MWH 2009) identified five distinct areas in Area IV roughly defined by monitoring well locations with historical TCE results equal to or above the MCL of 5 µg/L. These areas include the Former Sodium Disposal Facility/Empire State Atomic Development Authority (FSDF/ESADA), Building 4100/ Building 56 Landfill, DOE Leach Field 3 (DOE LF3), the Hazardous Materials Storage Area (HMSA), and the RMHF (Figure 6-3). The 2017 TCE results for these areas are discussed below.

#### FSDF / ESADA Area

TCE concentrations detected above the MCL of 5 µg/L for this area in 2017 include wells:

- RS-54 at 1,200 µg/L
- RD-21 at 27 µg/L
- RD-23 at 34 µg/L
- RD-64 at 25 µg/L
- RD-65 at 47 µg/L.

The detection at RS-54 is similar to previous detections during the most recent years in which the well contained water, including 2007, 2008, and 2013. The 2017 concentrations detected in wells RD-23, RD-64, and RD-65 increased compared to 2016 results of 19, 14, and 14 µg/L, respectively. The 2017 result at RD-21 decreased from 42 µg/L in 2016. TCE in RD-33A dropped below the MCL in 2017 from 7 µg/L detected during the first quarter 2016. New maximum detections of TCE were detected below the MCL in C-08 at 2.5 µg/L and in DS-46 at 1.1 µg/L. It is also the first time TCE has been detected at DS-46.

One of the regulatory requirements for DOE to complete in Area IV is conducting a GWIM at the Former Sodium Disposal Facility (FSDF). Shallow well RS-54 (installed to approximately 40 feet below ground surface) has exhibited 1,1,1-trichloroethane (1,1,1-TCA) concentrations exceeding 10,000 micrograms per liter (µg/L) and TCE concentrations exceeding 1,000 µg/L. RS-54 has been dry during recent years; however, water was observed in the well following higher than average rains during winter 2016/2017. Pumping of the well was initiated by CDM Smith on November 6, and it was determined that it could not sustain a pumping rate of 0.5 gallons per minute.

During each pumping event, the water column was lowered to the elevation of the pump intake, typically within a 20-minute period. The well was pumped by CDM Smith 13 times from November 6 to December 18. Approximately 193 gallons of water was removed. The average

concentration of 1,1,1-TCA observed was 7,100 µg/L and of TCE was 1,260 µg/L (CDM Smith 2018b).

#### Building 4100 / Building 56 Landfill Area

TCE concentrations detected above the MCL of 5 µg/L for this area in 2017 include well:

- RD-07 at 29 µg/L.

The 2017 TCE concentration at RD-07 decreased from the result detected in 2015 (50 µg/L). For reference, the TCE concentration detected in the adjacent Boeing well RD-91 was 200 µg/L in 2014.

#### DOE Leach Field 3 Area

TCE concentrations detected above the MCL of 5 µg/L for this area in 2017 include well:

- PZ-105 at 7.9 µg/L.

PZ-105 had insufficient water for sampling in 2016 and was nondetect for TCE in 2015; however, it is notable that the 2015 detection limit was above the MCL of 5 µg/L. The 2017 detection was similar in concentration to those detected in 2013 and 2014. The DOE Leach Field 3 area of impacted groundwater, assumed to originate at the Metals Clarifier, includes PZ-005, PZ-104, and PZ-105, and DD-145. This plume has been separated from the western wing of the Area III impacted groundwater.

#### Hazardous Materials Storage Area (HMSA) Area

TCE concentrations detected above the MCL of 5 µg/L for this area in 2017 include wells:

- DD-144 at 170 µg/L
- PZ-108 at 160 µg/L
- PZ-120 at 13 µg/L.

The concentration detected at DD-144 is similar to that detected during 2016. TCE increased in PZ-108 during 2017 from 75 µg/L in 2015. PZ-120 decreased during 2017 from 90 µg/L in 2014.

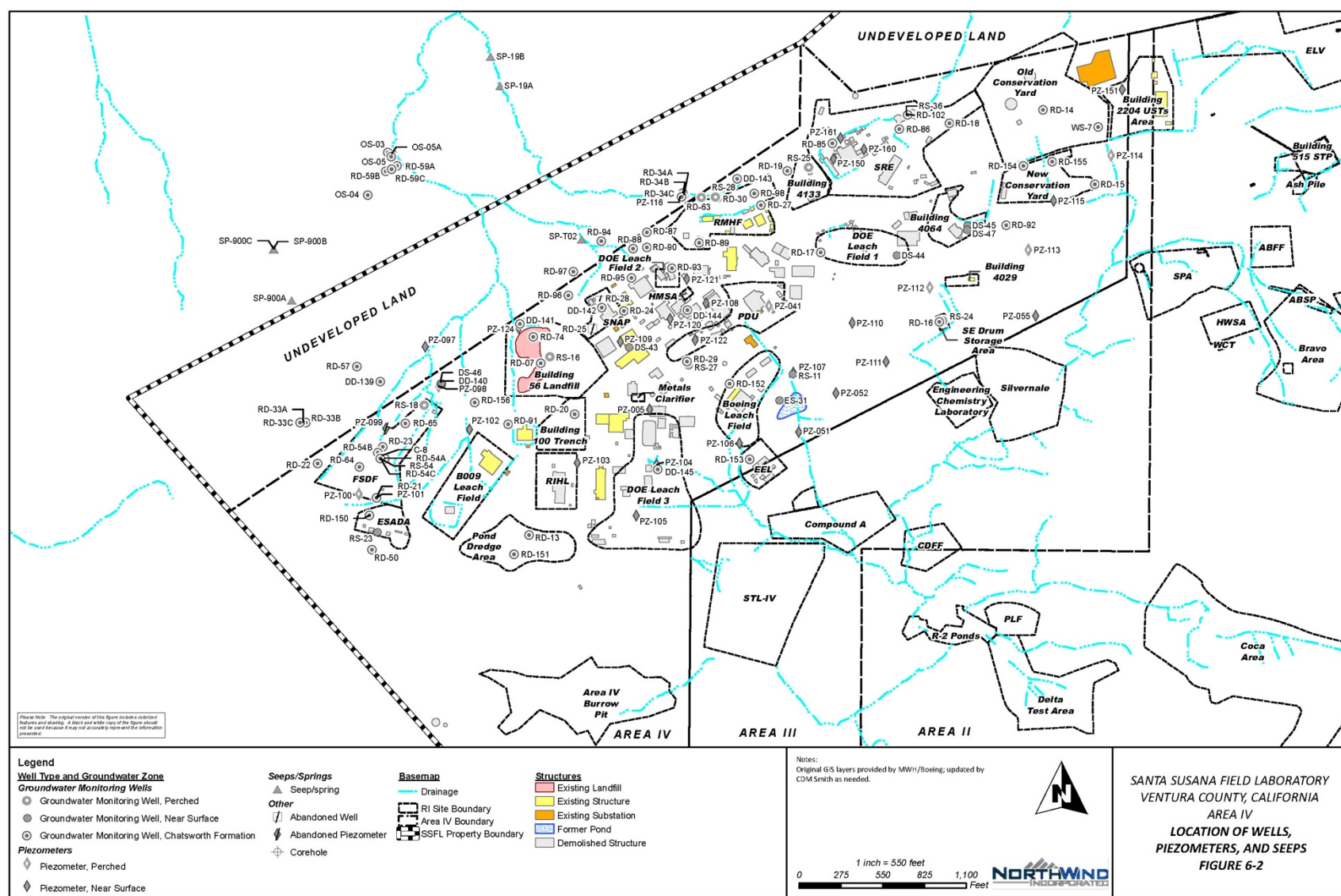
Other notable detections include TCE in PZ-109, which decreased from 8.9 µg/L during the first quarter 2016 to just below the MCL during 2017; TCE in RD-29 was just below the MCL; and TCE at PZ-122 is a new maximum (1.6 µg/L).

#### Radioactive Materials Handling Facility (RMHF) Area

TCE concentrations detected above the MCL of 5 µg/L for this area in 2017 include well:

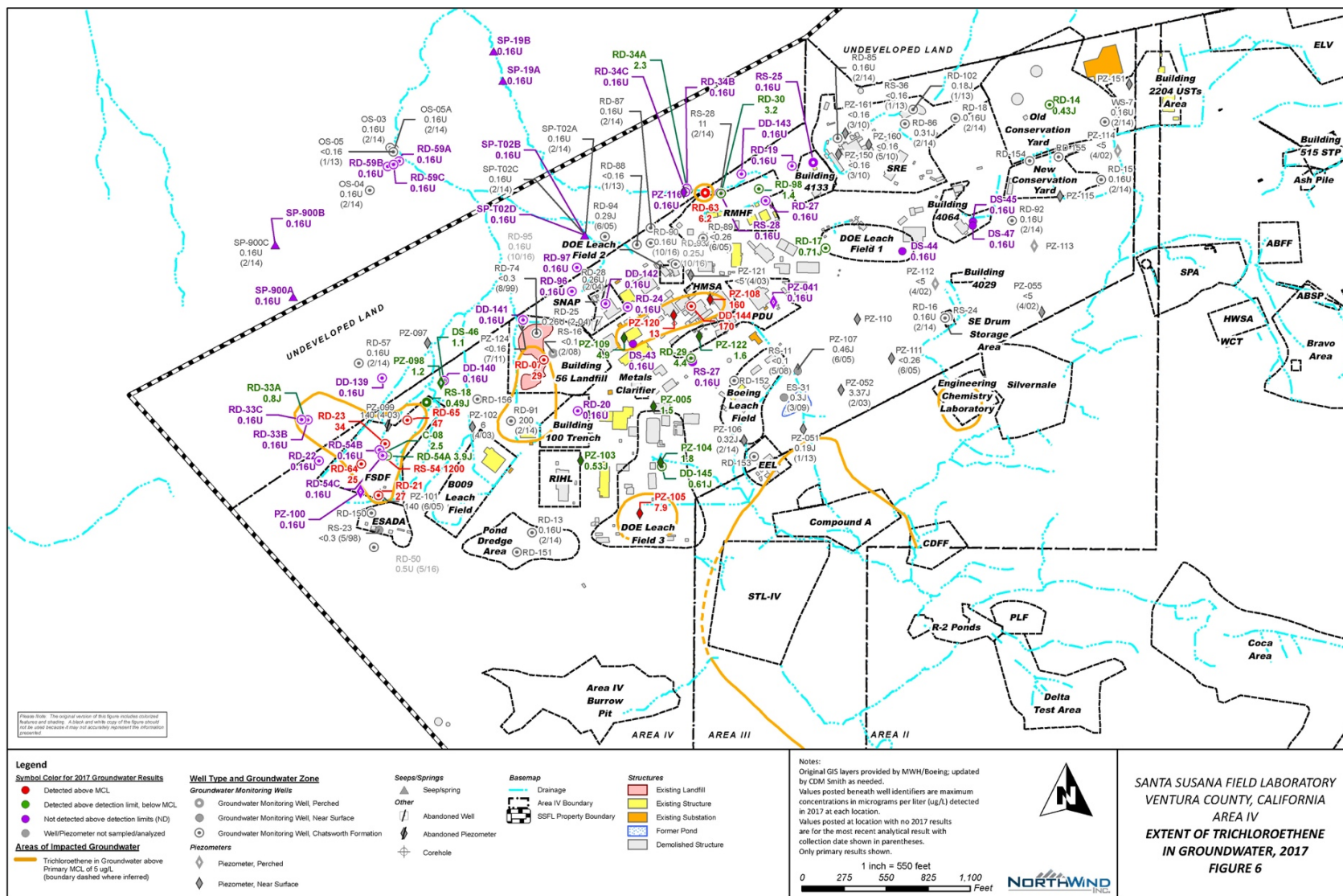
- RD-63 at 6.2 µg/L.

The TCE detection in RD-63 increased slightly from just below the MCL in 2016. TCE was detected at 11 µg/L during 2014 in well RS-28 (dry and not sampled during 2015 and 2016), but was nondetect in 2017.

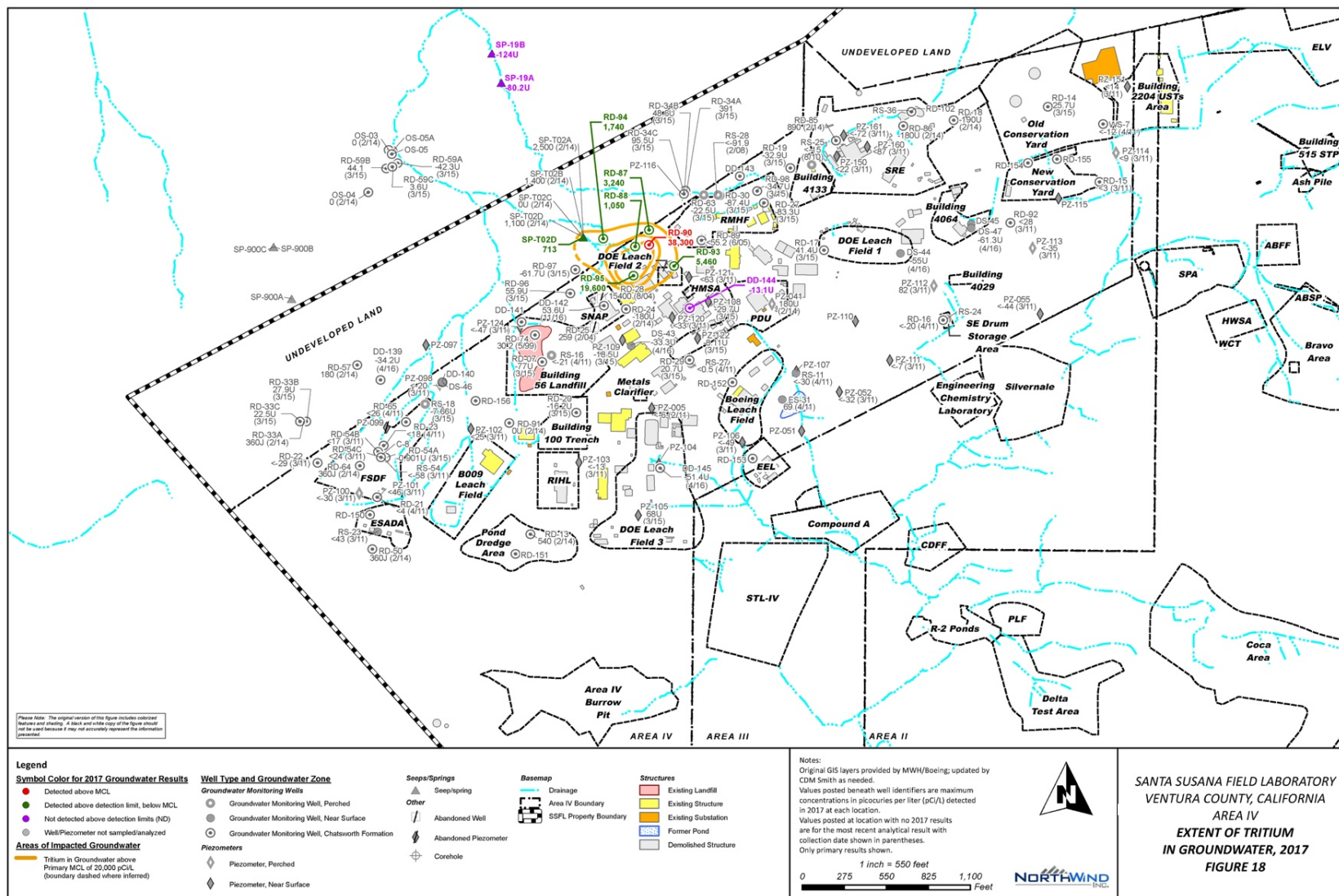


**Figure 6-2. Area IV Well and Piezometer Locations**





**Figure 6-3. 2017 TCE Occurrences in Groundwater at SSFL, Area IV**



**Figure 6-4. 2017 Tritium Occurrences in Groundwater at SSFL, Area IV**



## 6.4 Soil

The soils investigation program started at the SSFL site in 1996 and was completed in late 2014. Future remedial action is being planned for impacted soils at the site. From 2010 to 2014, potential chemically contaminated soils in Area IV were evaluated under the DTSC/DOE AOC sampling program. The agreement between the DOE and DTSC outlines an approach to investigate and clean up soil contamination in Area IV to specified cleanup levels (LUT) under DTSC oversight, with the objectives of determining the nature and extent of chemicals in soil and assessing the potential threat to groundwater quality in Area IV, the adjacent undeveloped land in the NBZ, and in contiguous areas where soil contamination has migrated. Prior to the signing of the AOC on December 6, 2010, investigation of chemical contamination in soil was performed as part of the RFI program under DTSC oversight. Per the AOC and as described above, investigation and cleanup of groundwater is continuing under the RCRA corrective action program under DTSC oversight.

The Phase 3 Chemical Data Gap Sampling Investigation was completed in 2015; however, a VOC source investigation was conducted at the FSDF to locate the VOC source to groundwater observed in well RS-54. Twenty passive soil gas samplers were installed by CDM Smith via direct-push rig in temporary vapor wells at the alluvial soil / bedrock interface in the FSDF area to locate the VOC source of impacted groundwater observed in well RS-54. The samplers were left in place for 48 hours, retrieved, and shipped to the analytical laboratory. The results indicated that the primary bedrock VOC source is in the vicinity of well RS-54 (CDM Smith 2018c). Recent information regarding the Phase 3 Chemical Data Sampling investigation may be found at:

[http://www.etec.energy.gov/char\\_cleanup/Phase3.php](http://www.etec.energy.gov/char_cleanup/Phase3.php)

The Draft Chemical Data Summary Report, which summarizes the data from all soil samples collected to date, was prepared in 2016 and released by DOE in January 2017 for DTSC review and approval. The Draft Chemical Data Summary Report may be found at:

[http://www.etec.energy.gov/char\\_cleanup/Chemical\\_Data.php](http://www.etec.energy.gov/char_cleanup/Chemical_Data.php)

Additionally, DOE will continue evaluation of Area IV sampling data and results of the soils treatability studies for soil cleanup remedial alternatives. DOE will continue to support soil treatability studies by university researchers and conduct Soil Treatability Investigation Group public meetings. The Draft EIS was released by DOE on January 6, 2017, and is in the public comment phase. Recent information regarding the Draft EIS may be found at:

<http://www.ssflareaiveis.com>

Information regarding the 2010 AOC requirements and AOC soil sampling efforts may be found at:

[http://www.etec.energy.gov/char\\_cleanup/AOC.php](http://www.etec.energy.gov/char_cleanup/AOC.php)

[http://www.etec.energy.gov/char\\_cleanup/Co-located.php](http://www.etec.energy.gov/char_cleanup/Co-located.php)

## **7. ENVIRONMENTAL MONITORING PROGRAM QUALITY CONTROL**

This section describes the QA elements incorporated into the SSFL environmental monitoring program applicable to the former ETEC. The following elements of QC are used for the program:

- Reagent Quality – Certified grade counting gas is used.
- Laboratory Ventilation – Room air supply is controlled to minimize temperature variance.
- Laboratory Contamination Control – Periodic laboratory surveys for fixed and removable surface contamination are performed. Areas are cleaned routinely and decontaminated when necessary.
- Control Charts – Background and reference source control charts for counting equipment are maintained to evaluate stability and response characteristics.
- Calibration Standards – Counting standard radioactivity values are traceable to NIST primary standards.
- Co-location of DPH TLDs.

### **7.1 Procedures**

Procedures followed include those for selection, collection, packaging, shipping, and handling of samples for off-site analysis; sample preparation and analysis; the use of radioactive reference standards, calibration methods, and instrument QA; and data evaluation and reporting.

### **7.2 Records**

Records generally cover the following processes: field sample collection and laboratory identification coding; sample preparation method; radioactivity measurement (counting) of samples, instrument backgrounds, and analytical blanks; and data reduction and verification.

QC records for laboratory counting systems include the results of measurements of radioactive check sources, calibration sources, backgrounds, and blanks as well as a complete record of all maintenance and service.

This page intentionally left blank.

## 8. REFERENCES

- CDM Smith, 2017, *Draft RCRA Facility Groundwater Remedial Investigation Report Area IV, Ventura County, California*, June.
- CDM Smith, 2018a, *Technical Memorandum DOE Area IV Spring 2017 Seep Probe Sampling Results, Santa Susana Field Laboratory, Ventura County, California*, January.
- CDM Smith, 2018b, *Technical Memorandum CDM Smith Status Report on Former Sodium Disposal Facility Groundwater Interim Measure (FSDF GWIM), Area IV, Santa Susana Field Laboratory, Ventura County, California*, February.
- CDM Smith, 2018c, *Technical Memorandum – FSDF Source Investigation – Soil Gas Sampling Progress Report Area IV, Santa Susana Field Laboratory, Ventura County, California*, February.
- DOE, 2002, “A Graded Approach for Evaluating Doses to Aquatic and Terrestrial Biota,” DOE-STD-1153-2002, U.S. Department of Energy.
- DOE, 2011a, “Environment, Safety and Health Reporting,” DOE Order 231.1B, Change 1, U.S. Department of Energy, June 27, 2011.
- DOE, 2011b, “Derived Concentration Technical Standard,” DOE-STD-1196-2011, April 2011.
- DOE, 2013, “Radiation Protection of the Public and the Environment,” DOE O 458.1, Change 3, U.S. Department of Energy, Washington, D.C., January 15, 2013.
- DOE, 2017, *Draft Environmental Impact Statement for Remediation of Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory (Draft SSFL Area IV EIS)*, DOE/EIS 0402, U.S. Department of Energy, Washington, D.C., January 2017.
- DTSC, 2013a, *Development of the Draft Provisional Radiological Look-up Table*, Department of Toxic Substances Control, January 30, 2013.
- DTSC, 2013b, *Chemical Look-up Table Technical Memorandum*, Department of Toxic Substances Control, May 21, 2013.
- EPA, 2014, *User’s Guide for CAP88-PC*, Version 4, EPA/402-B-92-001, U.S. Environmental Protection Agency, Office of Radiation Programs, September.
- EPA, 2012, *Final Technical Memorandum, Look-up Table Recommendations, Santa Susana Field Laboratory, Area IV Radiological Study*, U.S. Environmental Protection Agency, November 27, 2012.
- EPA, 2013, 40 CFR 61 Subpart H, “National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities.”

MWH, 2009, *Draft Site-Wide Groundwater Remedial Investigation Report, Santa Susanna Field Laboratory, Ventura County, California*, December 2009.

North Wind, 2017, *Report on Quarterly Groundwater Monitoring, Area IV First Quarter 2017, Santa Susana Field Laboratory Ventura County, California*, July 2017.

North Wind, 2018, *Report on Annual Groundwater Monitoring, Area IV 2017, Santa Susana Field Laboratory Ventura County, California*, March 2018.