# *Annual Site Environmental Report*

## *Department of Energy, Energy Technology Engineering Center - Area IV (FINAL)*

## *Santa Susana Field Laboratory*

***Prepared for:***
**US Department of Energy**

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

**May 2015**

# *Annual Site Environmental Report*

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

**May 2015**

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

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

**Prepared by:**
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# 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

May 2015

Energy Technology Engineering Center
4100 Guardian Street, Suite 160
Simi Valley, CA 93063

May 15, 2015

Subject: 2014 Site Environmental Report for the Energy Technology Engineering Center (ETEC)

Dear Sir or Madam:

North Wind Incorporated has prepared the subject report for the U.S. Department of Energy (DOE). It is a comprehensive summary of the Department's environmental protection activities at ETEC in Canoga Park, California for Calendar Year 2014. Site Environmental reports are prepared annually for all DOE sites with significant environmental activities and distributed to external regulatory agencies, interest organizations, and individuals.

To the best of my knowledge, this report accurately summarizes the results of the 2014 environmental monitoring and restoration program at ETEC for DOE. This statement is based on reviews conducted by DOE-ETEC staff, the staff of the Boeing Company, and the staff of North Wind Incorporated.

Questions may also be directed to me at (805) 416-0992.

Sincerely,

John B. Jones, PMP
Director of DOE/ETEC

cc: Ralph Holland, DOE EMCBC
Stephie Jennings, DOE ETEC
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**ACKNOWLEDGEMENTS**

Preparation of this report has been a collaborative effort of members of North Wind, Boeing Environment, Health and Safety Department, their contractors and DOE.

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The staff of Haley & Aldrich, Inc., MWH Global, Inc., and the Department of Energy provided technical contributions to this report.

The staff of North Wind, Inc., CDM, The Boeing Company, Haley & Aldrich, Inc., MWH Global, Inc., and the Department of Energy provided technical contributions to this report.

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# Acronyms

| | |
|---|---|
| ALARA | As Low As Reasonably Achievable |
| AOC | Administrative Order on Consent |
| ASER | Annual Site Environmental Report |
| ASL | Above Sea Level |
| BCG | Biota Concentration Guides |
| 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 |
| CWA | Clean Water Act |
| CX | Categorical Exclusion |
| 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 | Cal-EPA Department of Toxic Substances Control |
| EA | Environmental Assessment |
| EIS | Environmental Impact Statement |
| EPA | U.S. Environmental Protection Agency |
| ESA | Endangered Species Act |
| ESH&Q | Environmental Safety Health and Quality |
| ETEC | Energy Technology Engineering Center |
| FESOP | Federal Enforceable State Operation Permit |
| FFCAct | Federal Facilities Compliance Act |
| FIP | Field Implementation Plan |
| 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 |
| MARSSIM | Multi Agency Radiation Survey and Site Investigation Manual |
| MCL | Maximum Contaminant Level |
| MEI | Maximally Exposed Individual |
| MFSP | Master Field Sampling Plan |
| MRL | Method Reporting Limit |
| NAAQS | National Ambient Air Quality Standards |
| NASA | National Aeronautics and Space Administration |
| NBZ | Northern Buffer Zone |
| ND | Not Detected |
| NEPA | National Environmental Policy Act |
| NESHAPs | 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 |
| OSLDs | Optical Stimulated Luminescence Detector |
| PAH | Polyaromatic Hydrocarbons |
| PCBs | Polychlorinated Biphenyls |
| PCE | Tetrachloroethylene |
| QA | Quality Assurance |
| QA/QC | Quality Assurance/Quality Control |
| R&D | Research and Development |
| RCRA | Resource Conservation and Recovery Act |
| RFI | RCRA Facility Investigation |

| | |
|---|---|
| RMHF | Radioactive Materials Handling Facility |
| ROD | Record of Decision |
| RWQCB | Regional Water Quality Control Board |
| SIP | State Implementation Plans |
| 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 |
| STP | Sewage Treatment Plant or Site Treatment Plan |
| TCE | Trichloroethylene |
| TCP | Trichloropropane |
| TLD | Thermoluminescent Dosimeter |
| TPH | Total Petroleum Hydrocarbons |
| TSD | Treatment, Storage and Disposal |
| VCAPCD | Ventura County Air Pollution Control District |
| WQSAP | Water Quality Sampling and Analysis Plan |

# 1. EXECUTIVE SUMMARY

The Boeing Company has been conducting environmental monitoring for the Department of Energy (DOE) Energy Technology Engineering Center (ETEC) site since calendar year 1996. On September 30, 2014, the period of performance for Boeing's ETEC Closure contract DE-AC03-99SF21530, with the DOE was completed[1]. North Wind, Incorporated (North Wind) assumed responsibilities for the ETEC Closure activities under contract DE-EM0000837. Accordingly, this environmental report presents data collected by Boeing during January 1, 2014 - September 30, 2014 and data collected by North Wind during October 1, 2014 - December 31, 2014.

This Annual Site Environmental Report (ASER) for 2014 describes the environmental conditions related to work performed for the DOE at Area IV of the Santa Susana Field Laboratory (SSFL). The 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 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.

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 2014 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 offsite member of the public (maximally exposed individual) due to direct radiation from SSFL is indistinguishable from background.

All radioactive wastes are processed for disposal at DOE disposal sites and/or other licensed sites approved by DOE for radioactive waste disposal. No liquid radioactive wastes were released into the environment.

During 2014, six regulatory agency inspections, audits, and 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 the California Department of Toxic Substances Control (DTSC), and Ventura County Air Pollution Control District (VCAPCD). In addition, the DTSC was frequently onsite for meetings and to observe field activities.

[1] Boeing's commitments under the Energy Employees Occupational Illness Compensation Act under DE-AC03-99SF21530 will continue.

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.

# 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 2014. Area IV had been used for DOE's activities since the 1950s. A broad range of energy related research and development (R&D) projects, including nuclear technology projects, were conducted at the site. All the nuclear R&D operations in Area IV ceased in 1988, and the 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 supporting 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 environmental monitoring and characterization programs were continued throughout 2014.

As required by DOE Order 231.1B, "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 one to SSFL (Bard Reservoir, near the west end of Simi Valley) is more than 10 km (6 miles) from Area IV.

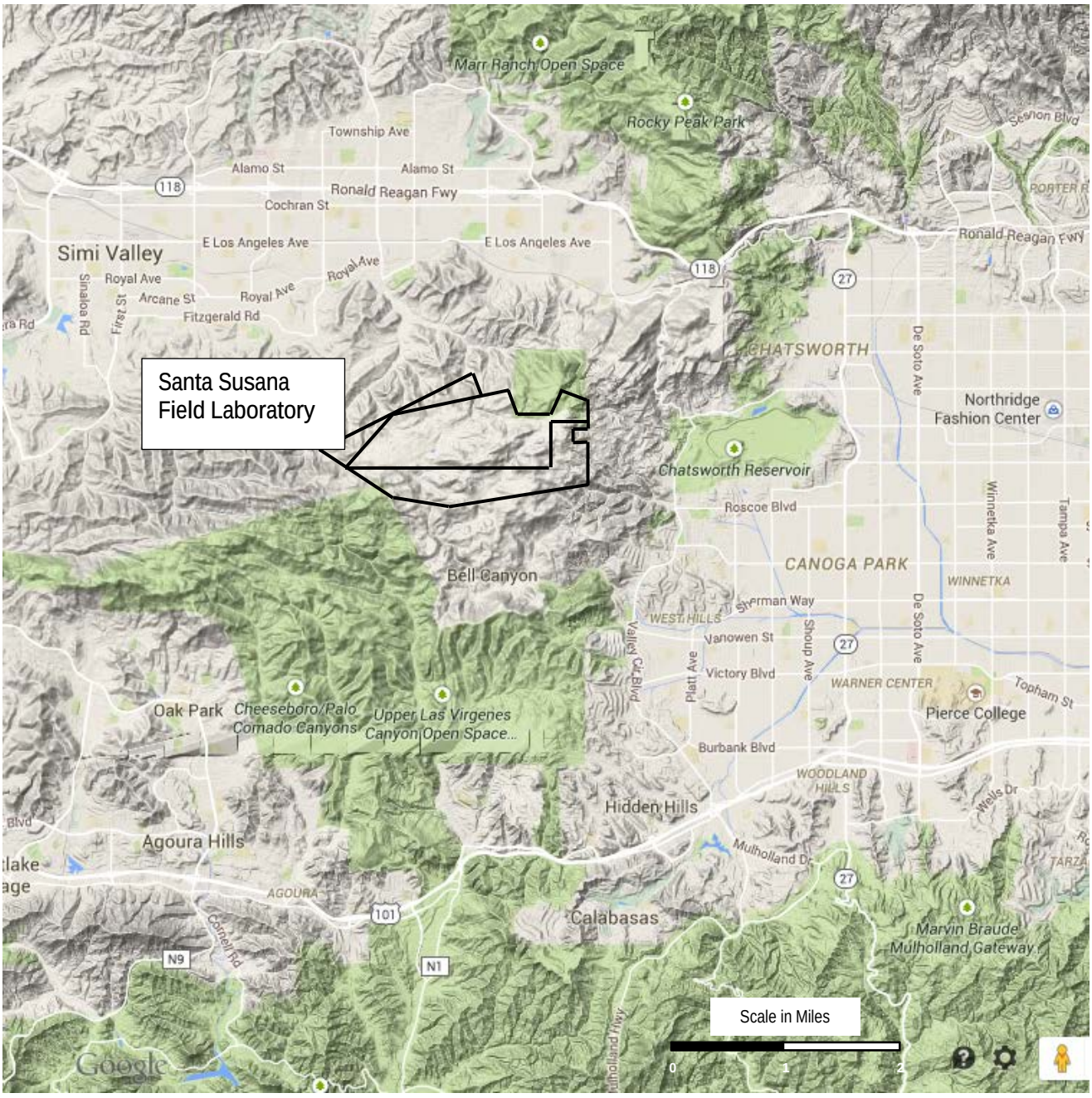


**Figure 2-1. Map showing location of SSFL**

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

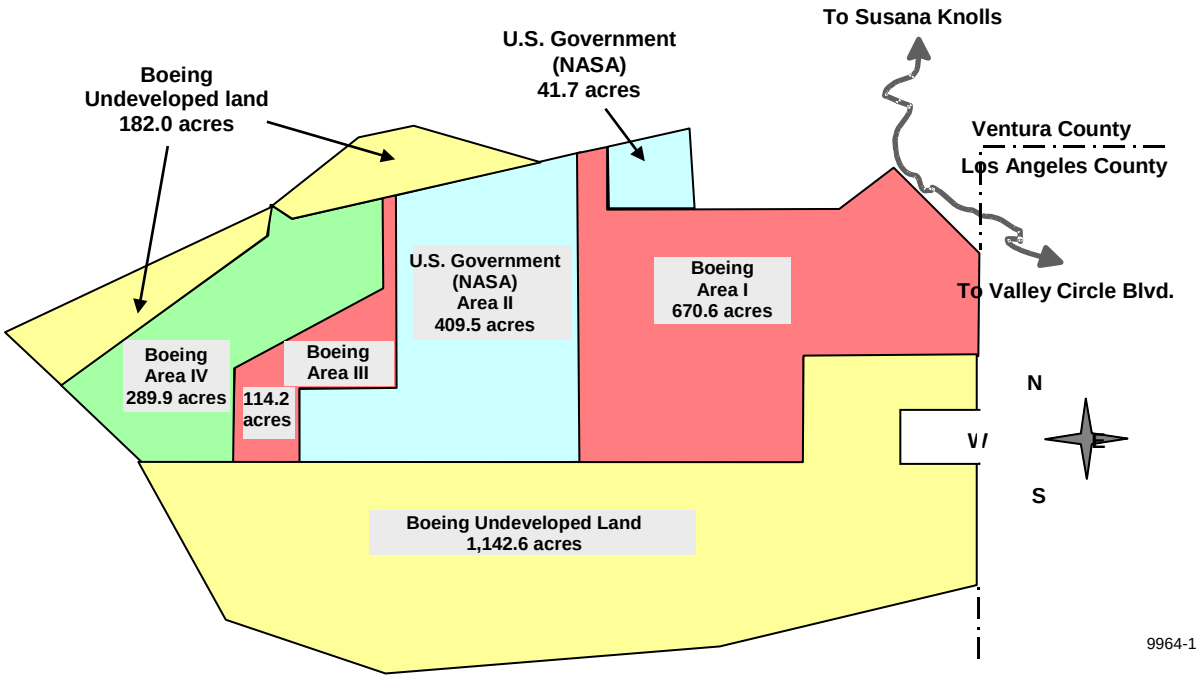


**Figure 2-1. Santa Susana Field Laboratory Site Arrangement**

## 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 in the course of 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 the 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, the D&D activities in Area IV were suspended by the DOE, pending completion of an EIS.

## 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 of them have been released for unrestricted use, 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 currently remaining former radiological facilities in Area IV have been declared free of contamination; they are 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 remain. 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 4668. 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, and the tank 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 offsite 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 such as 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 2-2. Santa Susana Field Laboratory Site, Area IV (2015)**

### Building 4024

Building 4024, the 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 levels of activation products including cobalt-60 and europium-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 2-3. Map of Prior and Current Radiological Facilities in Area IV**

## Building 4059

Building 4059 is the former SNAP reactor ground test facility. The demolition of the entire building was completed in 2004, and radioactively contaminated building debris was shipped to the Nevada Test Site. In October 2004, ORISE conducted an independent verification survey and found that other than naturally occurring radionuclides, only H-3 and Ni-63 were present at 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 (DHS) in October 2006, and the second in February 2008 by ORISE. 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 that are 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.

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# 3. COMPLIANCE SUMMARY

## 3.1 Compliance Status

During 2014, six regulatory agency inspections, audits, and visits were conducted in Area IV. These inspections and visits were carried out by the California DPH, the California (DTSC and VCAPCD). In addition, the DTSC was frequently onsite for meetings and to observe field activities.

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

**Table 3-1. 2014 Agency Inspections/Visits Related to DOE Operations**

| Date | Agency | Subject Area | Results |
|---|---|---|---|
| March 5, 2014 | Ventura County, VCAPCD | 2013 - 2014 Annual Inspection | Compliant |
| April 16, 2014 | State of CA, DPH | Quarterly Environmental TLD Exchange | Compliant |
| June 11, 2014 | State of CA, DTSC | Routine inspection of hazardous waste management | Compliant |
| June 27, 2014 | State of CA, DPH | Quarterly Environmental TLD Exchange | Compliant |
| Sept 29, 2014 | State of CA, DPH | Quarterly Environmental TLD Exchange | Compliant |
| Oct 22, 2014 | State of CA, DTSC | Routine inspection of hazardous waste management | 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 offsite 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 Pollutants (NESHAPs), 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 2014. 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 2014. Annual NESHAP reports submitted by DOE to the U.S. Environmental Protection Agency (EPA), for 2014 and prior years are provided at:

http://www.etec.energy.gov/Environmental_and_Health/NESHAPs.html.

#### *3.1.1.2 Groundwater*

In accordance with the Water Quality Sampling and Analysis Plan ([WQSAP] Haley and Aldrich, 2010) that requires annual groundwater sampling be performed, groundwater samples were collected from wells located in Area IV in February and March 2014. Nine near-surface groundwater and 44 Chatsworth Formation groundwater wells were sampled within or near Area IV. Data review and validation were completed and results were reported in the 2014 First Quarter Groundwater Sampling Report. Analyses were specific for each well based on contamination history, and included a variety of chemical- and radiological constituents. Groundwater reports are provided online at:

http://www.etec.energy.gov/Char_Cleanup/Groundwater.html

#### *3.1.1.3 Surface Water*

Surface water is regulated under the Los Angeles Regional Water Quality Control Board (LA RWQCB) National Pollutant Discharge Elimination System (NPDES). The existing NPDES Permit (CA0001309) for SSFL is held by Boeing and requires monitoring of stormwater runoff, treated groundwater and fire suppression water into Bell Creek, a tributary to the Los Angeles River. The permit also regulates the discharge of stormwater runoff from Area IV northwest slope locations into the Arroyo Simi, a tributary of Calleguas Creek. Stormwater is collected at the five northwest outfalls (RMHF: Outfall 003, Sodium Reactor Experiment (SRE): Outfall 004, Former Sodium Disposal Facility (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, potasium-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 at:

http://www.boeing.com/aboutus/environment/santa_susana/ents/monitoring_reports.html

#### *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 7 mrem/year above the SSFL ambient radiation level. This is considerably below DOE's 100 mrem/year limit.

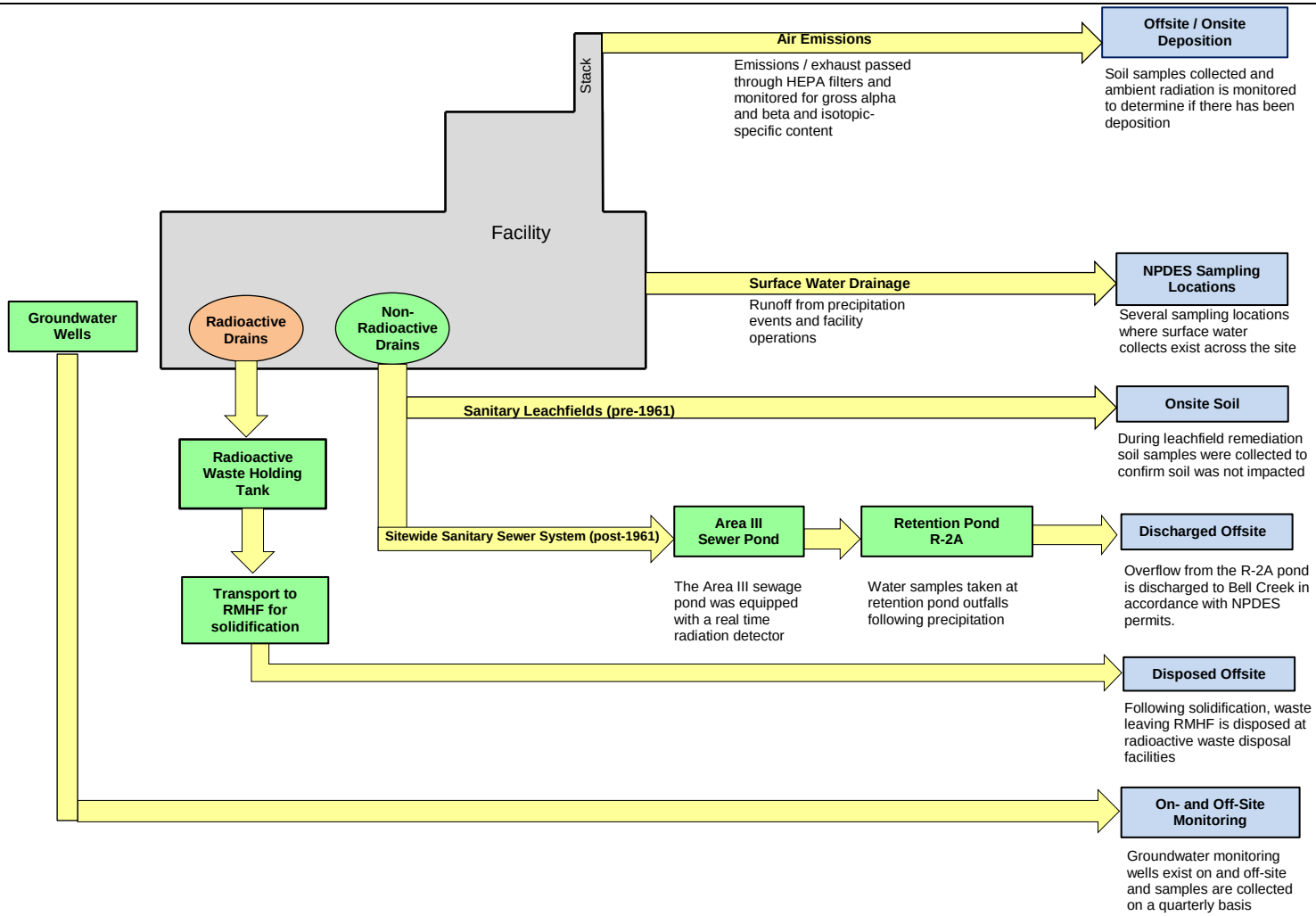


**Figure 3-1. Conceptual Model of Potential Pathways**

#### *3.1.1.5 Protection of Biota*

There is no aquatic system in Area IV of SSFL. Stormwater 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*

The 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 3.1.3.

**Radioactive Materials Handling Facility (RMHF) -** In 2014, 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 (FFCAct). 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 (Bldg 4029) and an inactive treatment facility (Bldg 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 between DTSC, DOE, NASA and Boeing.

In 2014, 374 soil matrix and 153 soil vapor samples were collected within Area IV and the Northern Buffer Zone (NBZ) as part of the Phase 3 data gap sampling program and soil treatability studies. Samples collected and analyses performed to date at DOE locations are summarized in Section 6 (Table 6-3). Review and validation of 2013 co-located sampling data collected at DOE sites within Area IV continued in 2014 with results published in Technical Memoranda. Data gap evaluations were also performed using Phase 3 sampling results to identify any final data needs to complete characterization of Area IV and the NBZ.

**Groundwater -** Characterization of the groundwater at the site continues. 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 2014, concentrations of TCE exceeding MCLs were present in four of the areas. Detailed analytical results are discussed in Section 6.3.

#### *3.1.2.2 Federal Facilities Compliance Act*

In 2014, 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 FFCAct-mandated Site Treatment Plan (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 wastes 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 [CX], Environmental Assessment [EA], Finding of No Significant Impact [FONSI], or Notice of Intent [NOI], draft EIS, final EIS, and/or Record of Decision [ROD]) have been incorporated into project planning documents.

The DOE issued a Finding of No Significant Impact 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, CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act) and the Endangered Species Act (ESA). Pursuant to a court order, an EIS is being prepared to comply with NEPA. The scheduled completion date for the EIS is currently December 2016.

#### *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 (O3), nitrogen dioxide (NO2), carbon monoxide (CO), sulfur dioxide (SO2), 10-micron and 2.5-

particulate matter (PM10 and PM2.5), 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 an 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 (FIP) if it deems a state's SIP unacceptable and the state or region is unwilling or unable to develop an acceptable SIP. Other requirements include NESHAPS, New Source Performance Standards (NSPS), and ambient air monitoring programs 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 – were removed from the permit in January 2014. On March 5, 2014 the VCAPCD performed its fiscal year (FY) 2013–2014 annual inspection of SSFL, including Area IV. No violations or compliance issues were identified and no citations were issued.

#### *3.1.3.2 Clean Water Act*

The Clean Water Act (CWA) 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 LA RWQCB. 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. Several key elements of the plan, including maps, are continually updated. 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 2014 SPCC plan was submitted by Boeing as a part of the 2014 Hazardous Materials Release Response Business Plan to the County of Ventura Environmental Health Division. The SPCC Plan is updated every two years, or sooner as needed. The next SPCC update is scheduled for 2016.

### 3.1.4 Permits and Licenses (Area IV)

Listed below are the permits applicable to activities in Area IV.

**Table 3-2. SSFL Permits**

| Permit/License | Facility | Valid |
|---|---|---|
| **Air (VCAPCD)** | | |
| Permit 00232 | Combined permit renewed | Current |
| **Treatment Storage (EPA)** | | |
| CAD000629972 (93-3-TS-002) | HWMF (Bldg/133 and Bldg/029) | Inactive. The closure plan was approved on 12/22/06, but demolition has been suspended by DOE pending completion of the ES. 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 |
| **NPDES (LARWQCB)** | | |
| CA0001309 | SSFL | Current |
| **State of California** | | |
| 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 is currently preparing an EIS for Area IV. Activities conducted in 2014 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:

  http://energy.gov/nepa/downloads/eis-0402-amended-notice-intent-prepare-environmental-impact-statement

- DOE conducted monthly community site visits and bi-monthly community meetings in conjunction with California 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 Decommissioning and Decontamination

Since May 24, 2007, the decommissioning and decontamination 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 Material Handling Facility*

During 2014, 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.html

http://www.etec.energy.gov/Library/RMHFDocRecord.html

#### *3.2.2.2 SNAP Environmental Test Facility*

During 2014, 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.html

http://www.etec.energy.gov/Library/Building24DocRecord.html

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. No nuclear by-product materials have been detected in this groundwater. Due to drought conditions in 2014, there was no infiltration of groundwater into Building 4024.

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

During 2014, miscellaneous groundwater well equipment, debris, purge water, soil sampling equipment, PPE and rinse water, which had been stored in storage tanks since 2007, was surveyed, released and safely dispositioned from the site.

Disposal of the groundwater well purge water with low levels of tritium were disposed of to the Clean Harbors' Aragonite facility in Utah. The State of Utah Radiation Control Division permits Aragonite to accept license-exempt radioactive material that meets the license-exempt concentrations of 10 CFR 30.70 Schedule A and the license-exempt quantities of 10 CFR 30.71 Schedule B.

During 2014, no metal from DOE radiological facilities was recycled.

### 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 (MRL) for those chemicals that have no background value. Background values and MRLs have been incorporated into a 'Look-up Table', per the AOC, by DTSC. The 'Look-up Table' provides the cleanup standards, per the AOC for Area IV.

In November 2012, EPA made recommendations to the DTSC how the AOC look-up table (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 Look-up Table Technical Memorandum" for over 130 chemicals (DTSC 2013b).

### 3.2.5 DOE "CleanUpdate"

DOE continued its periodic newsletters called "CleanUpdate" to provide stakeholders with an update on its activities on the ETEC Closure Project. In 2014, one CleanUpdate was published in June. These CleanUpdates may be found at:

http://www.etec.energy.gov/Community_Involvement/Newsletters.html

# 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

During 2014, the responsibility for implementing the ETEC Site Closure Program fell under two companies: The Boeing Company (January 1, 2014 through September 30, 2014) and North Wind, Inc. (October 1, 2014 through December 31, 2014). The responsibilities for the two companies are listed below.

The ETEC Site Closure Program Office responsibilities include:

- 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).
- Groundwater characterization and treatment.
- Management and shipment to DOE-approved disposal sites of radioactive waste generated during the D&D operations.
- Operation of the RMHF under an interim status Part A permitted facility for the management of mixed (radioactive and hazardous) wastes.
- 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.
- Support for successor contractor transition plan.

EO&C responsibilities include:

- Ensuring compliance with applicable federal, state, and local rules and regulations, including 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, including energy and raw material conservation, a priority 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 & 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 & 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 (ALARA) 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 of the surrounding community.

Additional details about onsite and offsite monitoring are available at:

http://www.etec.energy.gov/Environmental_and_Health/Enviro_Monitoring.html

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.html

http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/ViewByEPAID/CAN000908498

### 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 is being 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 Boeings' 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, Integrated Safety Management System 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 specific 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 the ETEC Closure Contract work is accomplished while protecting the worker, the public, and the environment. The ISMS Annual Report reviews performance, accomplishments and improvements to the site Integrated Safety Management System. The 2014 Annual ISMS Report is anticipated to be submitted March 31, 2015.

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. Boeing performed ISMS inspections during the first 3 quarters and North Wind covered the 4th quarter inspection for 2014. No program updates were required during 2014 and no program changes to North Wind's approved ISMS are anticipated for 2015.

## 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 North Wind ESH&Q organization currently maintains a list of 63 courses for North Wind Santa Susana personnel. Classes are available as both computer-based training and instructor-led training. Training is available to employees 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 outlines goals, processes, and waste minimization techniques to be considered for all waste streams generated at the former 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 waste currently generated at the former ETEC results from environmental characterization. The typical wastes generated at ETEC during 2014 were:

- Investigation Derived Waste (IDW)
- Groundwater and soil sampling disposable equipment, PPE, rinse water and purge water
- Infiltrated groundwater from Building 4024
- Well purge water containing low levels of tritium

### 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 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 2014. Hazardous waste tracking and verification (from generator to final off-site disposal) is conducted.

## 4.6 Public Participation

Throughout 2014, DOE interacted frequently with community members at public meetings and on tours to inform them of plans and progress, to involve them in ongoing planning, and to educate interested people about highly technical topics. DOE participated in or attended meetings of the SSFL Community Advisory Group, DOE/DTSC stakeholder meetings and DTSC Community Update meetings. Other activities in 2014 included:

- DOE participated in Boeing sponsored SSFL community bus tours over several Saturdays in 2014 for approximately 150 individuals.
- DOE continued its participation in bi-weekly meetings with NASA, Boeing, DTSC and the LA RWQCB staff to coordinate public outreach efforts.
- DOE issued email announcements including “DOE News form SSFL,” to inform stakeholders of key activities, meeting notifications, and final documents available on the ETEC website. One issue of the CleanUpdate Newsletter (June, 2014) was sent to DOE’s 600-plus electronic mailing list and also in hard copy via US Postal Service mail to an additional 4,300 interested parties.
- The Soil Treatability Investigation Group, which was established during Phase I of the Soil Treatability Study, will hold its final meeting in early 2015.

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# 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 any unusual release and provide long-term historical records of radioactivity in the environment. Air sampling for the first three quarters of 2014 (January through September) was performed by Boeing. Air sampling for the fourth quarter of 2014 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 thermoluminescent dosimeters (TLDs) and optically stimulated luminescent dosimeters (OSLDs). The TLDs for the first three quarters of 2014 were placed and analyzed by Boeing. The OSLDs for the fourth quarter were placed and analyzed by North Wind. These TLDs and OSLDs are complemented by TLDs installed by the State of California Department of Public Health Radiologic Health Branch (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 Boeing in Q1 (February/March) of 2014 by Boeing in accordance with the monitoring programs in place at the site. Samples are analyzed for chemical constituents, and some are also analyzed for radioactivity. The contaminant levels 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 years' 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, and no effluents were released to the atmosphere through the stack during 2014.

The EPA limit for emissions of radionuclides to ambient air from a DOE site is amounts of radionuclides that will result in an effective dose equivalent not exceeding 10 mrem/yr, 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 CAP88PC computer model (EPA 1992). Due to the fact that 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 2014, 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 $m^3$.

Weekly ambient air samples collected during the first three quarters of 2014 were counted for gross alpha and beta radiation with a low- background, thin-window, gas-flow proportional-counting system. The thin-window detector is continually purged with P-10 argon/methane counting gas. Weekly ambient air samples collected during the fourth quarter of 2014 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. Both systems are capable of simultaneously counting alpha and beta radiation. The sample-detector configuration for both systems 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 the first three quarters of 2014 and separately for the fourth quarter of 2014, 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 USDOE derived concentration standard (DCS) based on 100 mrem/y (DOE 2011b), and also well below the U.S. EPA National Emission Standards for Hazardous Air Pollutants based on 10 mrem/y (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 x10-14 µCi/mL, and the guideline for beta activity is 1.0 x 10-10 µCi/mL. These values are the DCSs for plutonium-239 and strontium-90 respectively. The results for the gross alpha

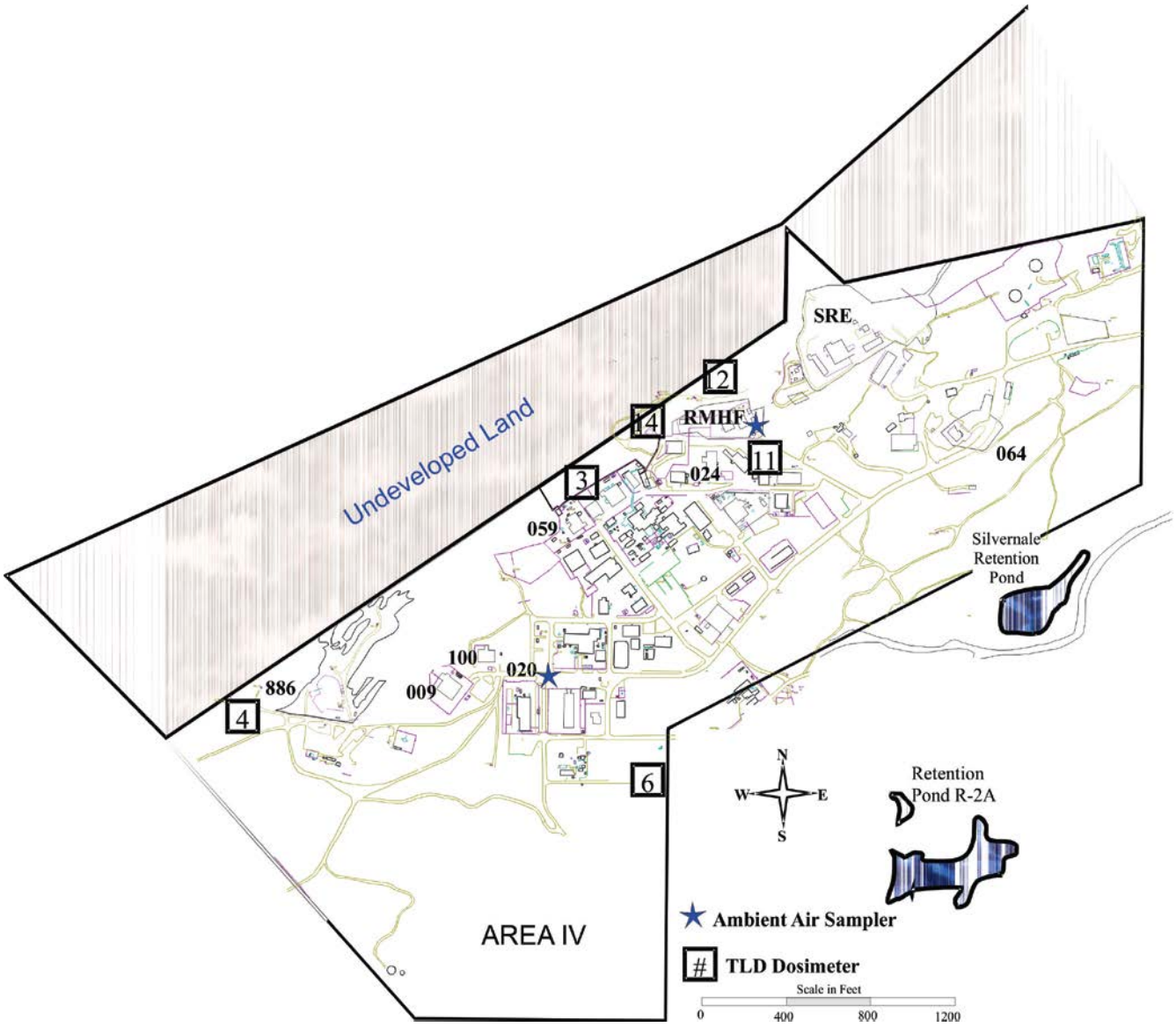


**Figure 5-1. Map of Santa Susana Field Laboratory Area IV Sampling Stations**

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.

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

| Station | Location | Sampling Frequency |
|---|---|---|
| **Ambient Air Sampler Locations** | | |
| 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, Former Sodium Disposal Facility | Discontinued |
| A-5 | SSFL Site, RMHF Pond, north side | Discontinued |
| A-6 | SSFL Site, 4100, east side | Discontinued |
| **On-site - SSFL - Ambient Radiation Dosimeter Locations** | | |
| 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, Former Sodium Disposal Facility 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 |
| **Off-site Ambient Radiation Dosimeter Locations** | | |
| OS-1 (CA) | SSFL Front Gate | (Q) |
| BKG-11 | Background Location, West Hills | (Q) |
| 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 |

| **Codes** | | **Locations** | |
|---|---|---|---|
| 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 – 2014

| Radionuclide | Derived Concentration Standard[1] (DCS) | RMHF | 4020 | Average[4] (% of DCS) |
|---|---|---|---|---|
| | (μCi/mL) | | | |
| H-3 | 2.1E-07 | NA[2] | NA | NA |
| Be-7 (natural) | 9.3E-8 | 2.94E-14 | 4.89E-15 | 1.71E-14 (0.000018%) |
| K-40 (natural) | 4.6E-11 | ND[3] | ND | NA |
| Mn-54 | 1.1E-9 | ND | ND | NA |
| Co-60 | 3.6E-10 | ND | ND | NA |
| Sr-90 | 1.0E-10 | 1.68E-14 | 6.33E-14 | 4.00E-14 (0.040%) |
| Cs-137 | 8.8E-10 | ND | ND | NA |
| Po-210 (natural) | 1.1E-12 | 9.68E-15 | 8.50E-15 | 9.09E-15 (0.83%) |
| Th-228 | 9.4E-14 | ND | ND | NA |
| Th-230 | 2.8E-13 | 4.93E-16 | 5.47E-16 | 5.20E-16 (0.19%) |
| Th-232 | 1.6E-13 | ND | ND | NA |
| U-234 | 1.1E-12 | 6.74E-16 | 4.98E-16 | 5.86E-16 (0.053%) |
| U-235 | 1.2E-12 | ND | ND | NA |
| U-238 | 1.3E-12 | 6.65E-16 | 5.28E-16 | 5.96E-16 (0.054%) |
| 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 |

[1] DOE-STD-1196-2011, Derived Concentration Technical Standard, April 2011
[2] NA = Not applicable
[3] ND = Not detected
[4] Averages do not include non-detects to avoid biasing low

## Table 5-3. Ambient Air Gross Alpha and Gross Beta - 2014

| Area | Activity | Number of Weeks | Gross Radioactivity | |
|---|---|---|---|---|
| | | | Average Concentrations[a] (□Ci/mL) | Average Percent of Standard[b] |
| SSFL Area IV 4020 | Alpha | 52 | 6.61E-15 | 8.16% |
| | Beta | | 4.72E-14 | 0.05% |
| SSFL Area IV RMHF | Alpha | 52 | 5.05E-15 | 6.24% |
| | Beta | | 5.20E-14 | 0.05% |

[a] Values include natural background.
[b] Based on the most restrictive derived concentration standard : 8.1E-14 [illegible] 1.0E-10 (Pu [illegible] □Ci/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, 3-H 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 at:

http://www.dtsc-ssfl.com/files/lib_rcra_groundwater/quarterly_an_gw_repo/annual/66328_2013_Annual_Report_GWM_Text,Tables,Figures.pdf

(At the time of submission of this report, the 2014 Annual Groundwater Report was not yet finalized or available for reference).

### 5.2.3 Surface Water

The most significant areas of Area IV (FSDF, RMHR and SRE) drain to the north, while the remainder drains to the southeast. Runoff to the north is captured in five catch basins (2 at the FSDF, 1 at building 4100, 1 at the RMHF and 1 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 their NPDES Permit No. CA0001309, which mandates the collection of surface water samples each year as well as the presentation 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 available at:

http://www.boeing.com/aboutus/environment/santa_susana/ents/monitoring_reports.html

### 5.2.4 Soil

The last radiological soil sampling in Area IV was conducted by USEPA in 2012. No radiological soil sampling was conducted in Area IV on behalf of DOE during 2014.

### 5.2.5 Vegetation

As part of on-going soil treatability studies, Cal Poly Technic State University (San Luis Obispo) conducted a phytoremediation study in 2014. Whole plant samples were collected for analyses, with roots separate from stems and leaves. Plant tissues were analyzed for metals, polychlorinated biphenyls (PCBs), petroleum aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPH), and dioxins. Plants were also grown in the university laboratory for uptake study.

### 5.2.6 Wildlife

No animal samples were collected or analyzed during 2014.

### 5.2.7 Ambient Radiation

As part of the ETEC Site Closure program during the first three quarters of 2014, Boeing deployed environmental TLDs that use an aluminum oxide ("sapphire") chip. These TLDs are capable of determining doses in increments of 0.1 mrem. Control badges supplied with these dosimeters allow elimination of the transportation exposure that occurs before and after the deployment of the environmental dosimeters to measure the ambient radiation. This usage permits accurate determination of the net exposure received while the environmental TLDs are in the field, exposed to the ambient radiation.

During the fourth quarter of 2014, North Wind deployed OSLDs that use an aluminum oxide ("sapphire") chip. These OSLDs are capable of determining doses in increments of 1 mrem. The control badge supplied with these dosimeters was used to eliminate all exposures not related to radiological activities at ETEC, not just transportation exposures. To provide exposure data comparable to Boeing and State DPH/RHB data, the minimum control badge reading from the first three quarters of 2014 reported with the Boeing data was used to evaluate the 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 (CaSO4) 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 TLDs. The State dosimeters are collected by the Radiologic Health Branch for evaluation each quarter. Data obtained during 2014 from these Sites and State TLDs, are shown in Table 5-4. Potential differences between the Site and State results are mainly due to the fact that different types of TLDs were used in the measurement.

The ambient radiation level as measured by the off-site TLDs ranges from 48 to 66 mrem/year. At SSFL, the ambient radiation level ranges from 70 to 75 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) ASL at two off-site locations ( BKG-11 and 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.

**Table 5-4. 2014 SSFL Ambient Radiation Dosimetry Data**

| TLD-Locations | Annual External Dose (mrem/y) | Average External Dose Rate (μrem/h) | |
|---|---|---|---|
| | | Site | State DPH |

| | | | | |
|---|---|---|---|---|
| SSFL Ambient Radiation | SS-3 | 70 | 7.9 | 6.6 |
| | SS-4 | 72 | 8.2 | 8.1 |
| | SS-6 | 75 | 8.6 | 7.9 |
| | SS-11 | 75 | 8.6 | 8.8 |
| **Mean Values** | | **73** | **8.3** | **7.9** |
| RMHF Boundary | SS-12 | 88 | 10.1 | 9.5 |
| | SS-14 | 72 | 8.2 | 8.3 |
| **Mean Values** | | **80** | **9.2** | **9.2** |
| Off-site Ambient Radiation | OS-1 | 66 | 7.5 | 6.8 |
| | BKG-11 | 62 | 7.0 | --[1] |
| | BKG-23 | 48 | 5.5 | --[1] |
| **Mean Values** | | **59** | **6.7** | **6.8** |

[1] BKG dosimeters are located in staff member's yards and are not used by DPH/RHB

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 meters from the RMHF, read an average of 7 mrem/year above the SSFL ambient radiation level. This amount is considerably below the 100 mrem/year limit specified in DOE Order 458.1 (DOE 2011b). The TLD results demonstrate that the potential external exposure at the site boundary is below the DOE's dose limit.

The SSFL ambient radiation level, calculated as the average of all onsite TLDs (excluding SS-12 and SS-14), is 73 mrem/year. This value is 14 mrem/year above the mean value of the off-site ambient radiation level, 59 mrem/year. This result can be attributed to the contribution of higher elevation and different geology. Off-site TLDs are located in SSFL staff members' backyards (BKG-11 for a Boeing employee, and BKG-23 for a North Wind employee), surrounded by natural soil. 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/yr (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 at 7 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 TLD monitoring stations 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.

Due to the fact that no effluents were released to the atmosphere through the RMHF stack in 2014, 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 tables represent both internal and external exposures.

### 5.3.2 Population Dose

Since no effluents were released to the atmosphere during 2014, 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 NESHAPs report)** | 0 mrem/yr |
| 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, and
- 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 |
| **Sum of Partial Fraction** | | | | **0.012** |

# 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 LA RWQCB 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.

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 listed below.

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

## 6.1 Surface Water Discharge

The LA RWQCB 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.

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 storm

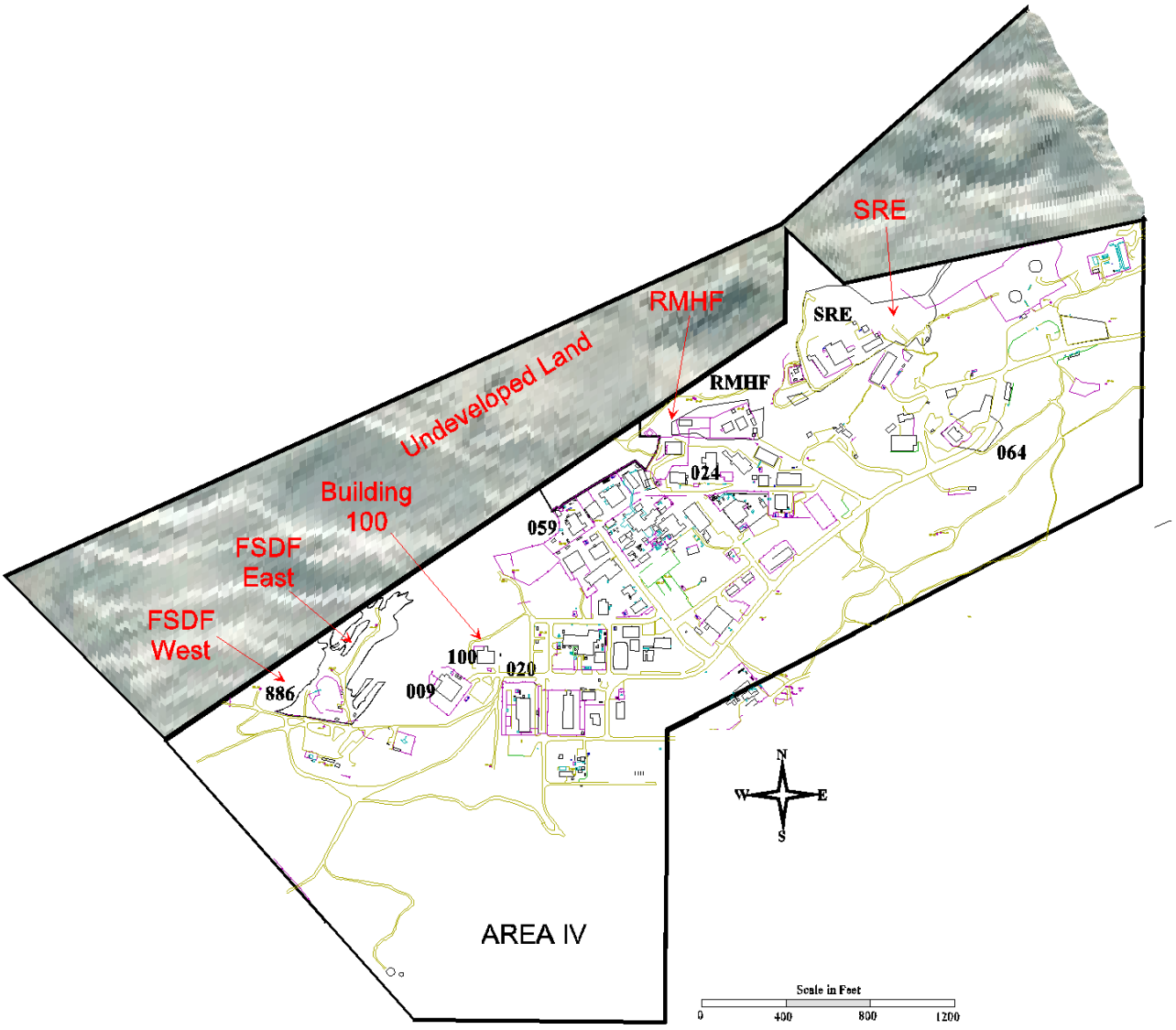


**Figure 6-1. Locations of Surface Water Runoff Collectors**

water runoff from the northwest slope (Area IV) locations into the Arroyo Simi, a tributary of Calleguas Creek. Since 2012, stormwater 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 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 (stormwater) 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. Boeing SSFL does not anticipate future use of any sewage treatment plant. Portable toilet facilities are currently in use in Area IV, and have been for the prior 2 years.

Details on the NPDES discharge from the SSFL for the period of January 1, 2014 through December 31, 2014 are available in the 2014 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. Reports may also be viewed at:

http://www.boeing.com/aboutus/environment/santa_susana/ents/monitoring_reports.html

## 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 PTO 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 taken off the permit, along with any conditions applicable to the equipment. Per FESOP monitoring, recordkeeping, and 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 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

Area IV contains 64 shallow and deep wells and 33 piezometers. The locations of the wells and piezometers are shown in Figure 6-2. Groundwater occurs at SSFL in the alluvium, weathered bedrock, and unweathered bedrock. First-encountered groundwater may be observed in any of these media under water table conditions. For regulatory purposes, “near-surface groundwater” is defined to occur within the site’s unconsolidated deposits (e.g., alluvium) and shallow weathered bedrock, where as deep groundwater, referred to as “Chatsworth Formation groundwater,” occurs in the unweathered bedrock. The near-surface groundwater may be perched or vertically continuous with deeper groundwater. The alluvium is indicated to generally consist of unconsolidated sand, silt, and clay. Some portions of the alluvium and upper weathered Chatsworth Formation are saturated only during and immediately following a wet season. The principal water bearing system at the Facility is the fractured Chatsworth Formation, predominantly composed of weak- to well- cemented sandstone with interbeds of

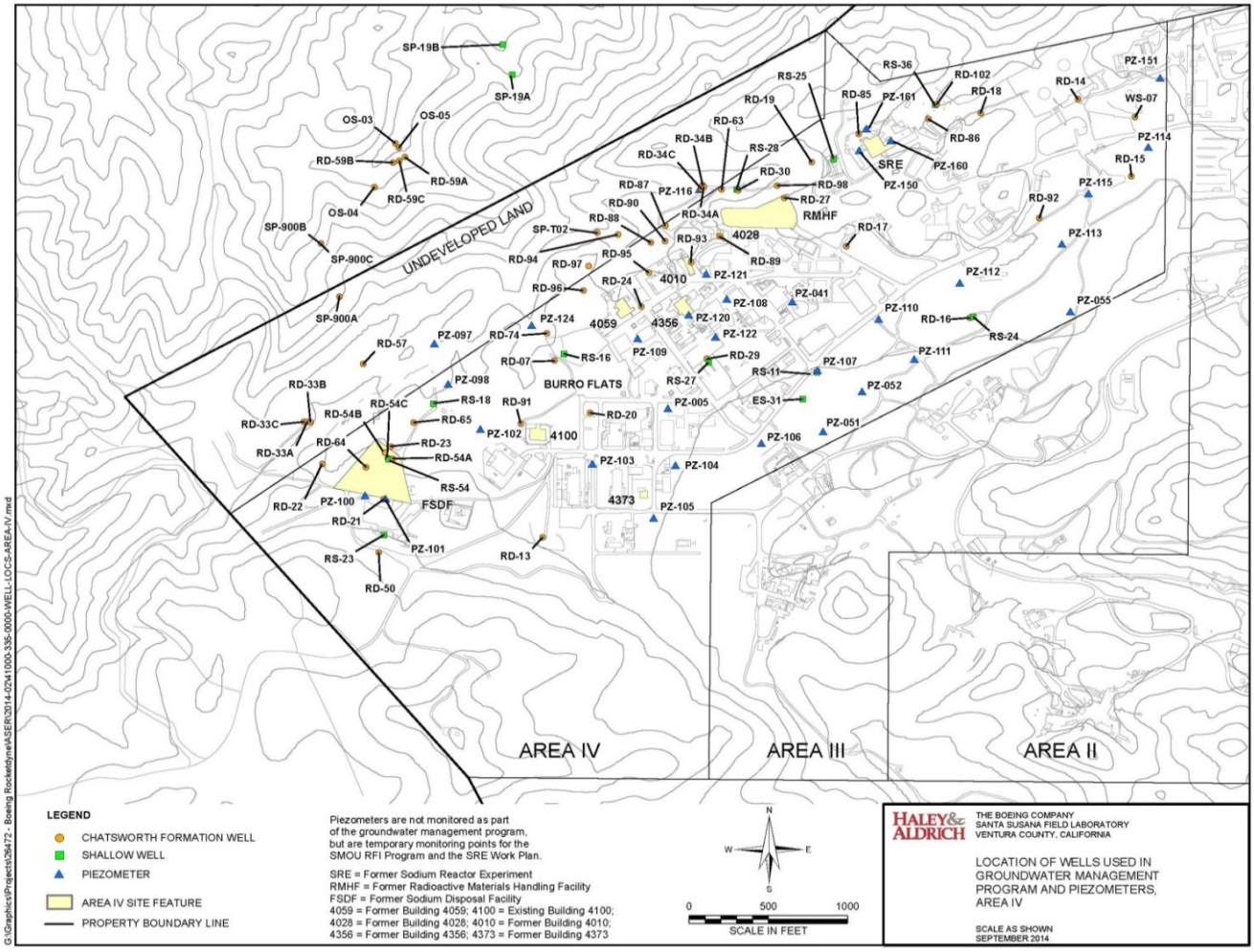


**Figure 6-2. Area IV Well and Piezometer Locations**

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.

The Draft Site-Wide Groundwater Remedial Investigation Report (MWH, 2009) identified five distinct areas of TCE-impacted groundwater in Area IV. These areas include the drainage below RMHF, the Hazardous Materials Storage Area (HMSA), the FSDF area, an area near former Building 4373, and in the northeastern corner of Area IV (this plume originates in Area II from NASA operations). These areas are roughly defined by the locations of monitor wells where results of laboratory analyses of water samples collected in 2014 or past years indicate concentrations of TCE equal to or above the maximum contaminant level (MCL) of 5 µg/L. Figure 6-3on the following page indicates the areas of TCE contamination in Area IV Groundwater. The following text provides a discussion of the current groundwater conditions that affect Area IV of the SSFL, including the TCE plumes, as well as a tritium- and PCE plume.

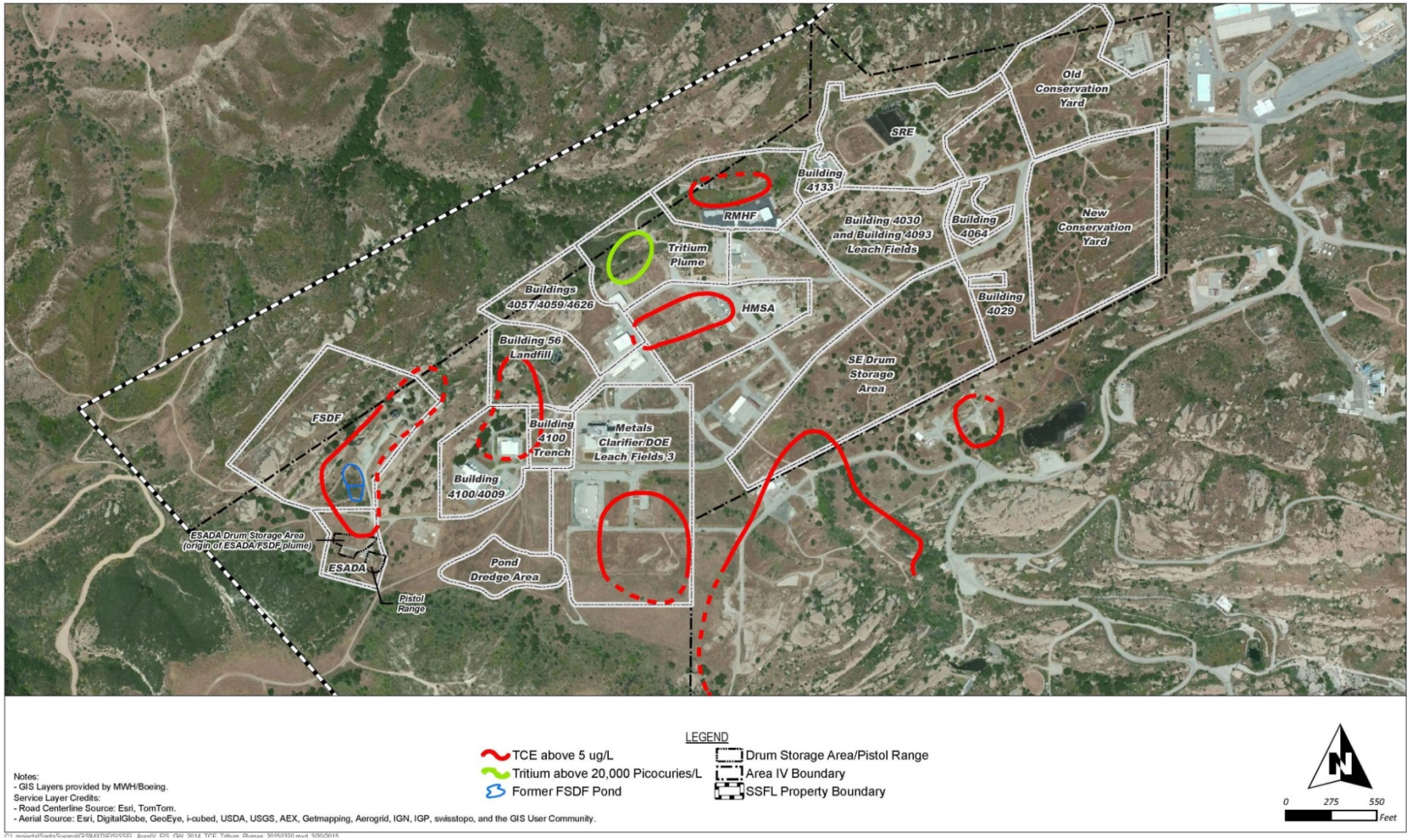


**Figure 6-3. 2014 TCE Occurrences in Groundwater at SSFL, Area IV**

HMSA TCE Plume - A relatively small area (2 to 3 acres) of TCE-contaminated groundwater has been identified in the perched water within the weathered bedrock in the HSMA. Groundwater quality in this area has historically been monitored through sampling of a series of 5 piezometers and one shallow well screened in the weathered bedrock, and three Chatsworth Formation bedrock monitoring wells.

Since monitoring of the HMSA began in 2001, TCE has been detected at concentrations greater than the MCL (5 µg/L) in the near-surface groundwater in piezometers PZ-108, PZ-120 and, in 2013, PZ-109. Concentrations of TCE below the MCL are detected in piezometers east, west, north and south of the HMSA TCE indicating that the extent of TCE contamination is fairly well defined in the near-surface groundwater of the HMSA**.** TCE has been detected at concentrations below the MCL in Chatsworth Formation monitoring wells RD-29 and RD-93 and has not been detected in RD-24. TCE concentrations in the piezometers has remained rather constant (75 µg/L) over the past five years indicating that the plume is not moving laterally or downward at its location.

Metals Clarifier/DOE Leach Fields 3 – TCE Plume - The Metals Clarifier/DOE Leach Field 3 groundwater investigation area is approximately 4 acres in the central part of Area IV. This area includes the location of the Building 4065 Metals Laboratory Clarifier and several former buildings that comprised the DOE Leach Fields 3 RFI Site where TCE may have been used and released to the environment. Groundwater is monitored by three piezometers located immediately downgradient of the Metals Clarifier (PZ-005) and the potential Leach Field source areas (PZ-104 and PZ-105) that monitor the Near-Surface Groundwater.

Former Sodium Disposal Facility - Building 4886 TCE Plume - At the FSDF, groundwater contamination is found in weathered bedrock and alluvium (during rainy periods) and in the bedrock aquifer. It appears that the majority of contamination remains in the upper bedrock due to the tightness of the bedrock below the FSDF. The TCE now found in the FSDF groundwater probably originated from discharge to the pounds or leakage to the ground from drums stored near the ponds. Through various removal actions, the original source of TCE to groundwater, contaminated soil and sediment at the Ponds, has been removed down to bedrock. As precipitation infiltrates downward, it can come in contact with existing contaminated near-surface groundwater and the contaminated weathered rock where TCE will diffuse from the rock matrix into the water.

In March 2013, DTSC approved a work plan for a Groundwater Interim Measure (GWIM) including groundwater pumping at the FSDF. The purpose of the GWIM is to collect data on aquifer properties, remove some contaminants mass, and possibly control plume migration for locations within SSFL that exceed 1,000 parts per billion (ppb) of TCE in groundwater. Within Area IV of SSFL, this definition applies to the FSDF. The scope of the GWIM for the FSDF is to pump groundwater from the near-surface groundwater and to treat the extracted groundwater locally to remove contaminants. Treated water would be released at the site in a manner to help flush contaminated soil towards the extraction well. Prior to aquifer pumping at the FSDF in 1997, the maximum TCE concentrations observed at the site was 4,100 µg/L. After pumping, the TCE concentrations decreased, with a maximum concentration of 1,600 µg/L reported in sample collected in 2013.

Radioactive Materials Handling Facility (RMHF) TCE Plume - Groundwater is monitored by one Near-surface groundwater and seven Chatsworth Formation monitoring wells near and potentially downgradient of the former RMHF leachfield. The source of the groundwater contamination is the RMHF leachfield located north of the RMHF described below. Other operations at the RMHF do not appear to have impacted groundwater below or adjacent to the facility. TCE was detected for samples collected during the 1990s and the location was subjected to prolonged groundwater pumping to remove TCE. The presence of Sr-90 in groundwater was found after well RD-98 was installed in 2008 at the western end of the former RMHF leachfield. When sampled first in 2008 and 2009, Sr-90 was below its MCL of 8 pCi/L. However, groundwater surface elevation levels were low at that time. Concentrations in RD-98 increase with increasing water levels. The highest concentration of Sr-90 in RD-98, reported by EPA in 2011, was 183 pCi/L also corresponding with the highest groundwater elevation level (Hydrogeologic, 2012). With the ongoing drought in southern California, the water table has been dropping along with Sr-90 concentrations. This indicates that remaining Sr-90 at the leachfield site is shallow and has not migrated deeply into the bedrock, but may remain for a significant period of time. Overall, Sr-90 contamination in the groundwater is projected to present limited risk beyond a local area near the RMHF former leachfield or for periods beyond several half-lives of Sr-90 (i.e., greater than about 100 years).

TCE concentrations in wells west of the RMHF ranged from 34 µg/L to 85 µg/L prior to 1994. At that time pumping of monitoring well RD-63 was initiated. Pumping continued periodically until 2005; in all, 3.9 million gallons were pumped from the well. TCE concentrations decreased significantly in the downgradient wells during and following RD-63 pumping.

Area IV Tritium plume – A plume of Tritium-contaminated groundwater is present over an approximately 4.4 acre area southwest of the RMHF, west of Building 4010 (SNAP 8ER), and east of former Building 4059. Tritium was first found in Area IV groundwater in 1989. Although the source of the Tritium plume has not been definitively determined, the Tritium was most likely produced as a by-product of neutron bombardment with concrete containment walls associated with the former Area IV reactors and then release into soil and bedrock by percolating groundwater. All reactor operations, and therefore Tritium production, had stopped by 1974.

Several monitoring wells have been sampled multiple times particularly 2004/2005, 2009/2010 by EPA, and recently in 2014, a span of nearly one Tritium half-life. Since there has been no Tritium production since 1974, the activity of remaining tritium is expected to decrease through radioactive decay. A comparison of the Tritium activity in wells that were sampled in 2004/2005 and 2014 indicates that the decrease in tritium activity is greater than predicted by radioactive decay alone, and is likely due to the diffusion of tritium from the fractures and into the rock matrix. In early 2014, tritium activities exceeded the MCL (20,000 pCi/L) at two wells RD-95 (28,000 pCi/L) and RD-90 (40,000 pCi/L). Based on radioactive decay rate alone, the tritium activities in these wells are predicted to be below the MCL in about 2026 and 2031, respectively. However the historical data from these wells indicates that tritium activities could be below the MCL much sooner possibly in 2015 and 2025, respectively.

Buildings 4057/4059/4626 PCE Plume - A plume of perchloroethylene (PCE)-contaminated groundwater is found in the vicinity of Building 4057 in Area IV, and former Buildings 4059 and

4626. The source of PCE that has been detected in the Near-surface and Chatsworth formation groundwater is likely from the contaminated soil near Building 4626 and, potentially, Building 4057.

## Summary of 2014 Analytical Results

Routine chemical and radiological monitoring of the Area IV groundwater wells and piezometers is conducted and reported annually according to the monitoring plan submitted to DTSC under the groundwater program. A summary of groundwater monitoring activities and sampling results for Area IV during 2014 are presented in Tables 6-1 and 6-2.

**Table 6-1. Groundwater Monitoring at Area IV in 2014**

| | Remediation | Waste Management | Environmental Surveillance | Other Drivers |
|---|---|---|---|---|
| Number of active wells | 0 | 0 | 55 | 0 |
| Number of samples taken | 0 | 0 | 71 | 0 |
| Number of analyses performed | 0 | 0 | 419 | 0 |
| % of analyses non-detect | NA | NA | 69 | NA |

**Table 6-2. Ranges of Detected Non-Radiological Analytes in 2014 Groundwater Samples**

| Analytes | Ranges of Results for Positive Detections |
|---|---|
| Fluoride (mg/L) | 0.32 J to 0.74 |
| Metals (mg/L) | 0.000053 J to 150 |
| Perchlorate (ug/L) | 0.18 J to 4.1 J |
| 1,1-Dichloroethane (µg/L) | 0.38 J to 2.9 |
| 1,1-Dichloroethene (µg/L) | 0.55 J to 15 |
| 1,4-Dioxane (µg/L) | 0.46 J to 1.8 J |
| Acetone (µg/L) | 2.1 J to 5.0 J |
| cis-1,2-Dichloroethene (cis-1,2-DCE) (µg/L) | 0.16 J to 120 |
| trans-1,2-Dichloroethene (µg/L) | 0.25 J to 81 J |
| Tetrachloroethene (PCE) (µg/L) | 0.47 J to 48 |
| Toluene (µg/L) | 0.25 J to 0.75 J |
| Trichloroethene (TCE) (µg/L) | 0.16 J to 200 J |
| Other Volatile Organic Compounds (µg/L) | 0.22 J to 14 J |
| Extractable Fuel Hydrocarbons (mg/L) | 0.17 J to 17 J |
| Gasoline Range Organics (µg/L) | 14 J to 86 J |

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

## 2014 TCE Summary:

RMHF - The TCE occurrence associated with the RMHF canyon (the northern occurrence) has historically been detected in shallow wells and Chatsworth Formation wells. TCE was detected above the MCL in the groundwater sample collected from shallow well RS-28 (11 µg/L) in 2014. TCE was detected below the MCL in the groundwater samples collected from Chatsworth Formation wells RD-17 (1.0 µg/L) and RD-34A (0.98 J µg/L) and above the TCE MCL of 5 µg/l

in the groundwater samples collected from Chatsworth Formation wells RD-63 (6.1 µg/L), RD-30 (8.4 µg/L), and RD-98 (5.6 µg/L) during 2014. Each of these concentrations was within or less than the historical maximum TCE concentration for its respective location. No TCE samples were collected from piezometers from this area in 2014.

HMSA - TCE was detected in groundwater collected from piezometer PZ-108 at a concentration of 79 µg/L and from PZ-120 at a concentration of 90 µg/L, above the MCL in the groundwater samples collected. Each of these concentrations were within the historical range of TCE concentrations for its respective locations.

FSDF - TCE was detected in groundwater collected from wells located near the FSDF area during 2014. TCE was detected below the MCL at Chatsworth Formation well RD-54A (2.3 µg/L). TCE was detected above the MCL at Chatsworth Formation wells RD-21 (140 µg/L), RD-23 (160 J µg/L), RD-64 (45 µg/L), and RD-65 (68 µg/L). Due to drought conditions in 2014, no shallow wells were dry and were not sampled. Each of the TCE concentrations was within the historical range of TCE concentrations for its respective locations.

Former Building 4373 Area - TCE was detected above the MCL in groundwater collected from piezometers located near the Former Building 4373 area during the year. TCE was detected at PZ-104 (3.4 µg/L) and PZ-105 (8.7 J µg/L). Each of the TCE concentrations were within the historical range of TCE concentrations for its respective locations.

Northeastern Corner of Area IV - No TCE samples were collected from this area in 2014. However, TCE was detected at 160 µg/L in Area III Well RD-60 which is located approximately 100 feet east of Area IV (within the NASA plume originating from Area II).

Other Areas - TCE was detected in groundwater at eight locations outside of the five concentrated areas of TCE-impacted groundwater: PZ-103, PZ-106, PZ-109, RD-07, RD-29, RD-86, RD-91, and RD-93. TCE was detected below the MCL in groundwater collected at piezometers PZ-103, PZ-106, and PZ-109 at concentrations of 2.2 µg/L, 0.32 J µg/L, and 2.8 µg/L, respectively. Piezometers PZ-103 and PZ-106 are located northwest and northeast, respectively, of former Building 4373. Piezometer PZ-109 is located southwest of the HMSA area. TCE was detected above the MCL in groundwater collected at Chatsworth Formation well RD-07 which is located west of former Building 4059. The RD-07 TCE result was an estimated 57 µg/L. TCE was detected above the MCL in groundwater collected at Chatsworth Formation well RD-91, which is located northwest of former Building 4100, at an estimated concentration of 200 µg/L. TCE was detected below the MCL in groundwater collected at Chatsworth Formation wells RD-29, RD-86, and RD-93, which are located south of HMSA, northeast of SRE, and east of former Building 4010, respectively. TCE concentrations in RD-29, RD-86, and RD-93 groundwater samples were 3.3 µg/L, an estimated 0.31 µg/L, and an estimated 0.16 µg/L. TCE concentrations at these eight locations were within historical concentration ranges.

Information associated with groundwater reporting and results may be found at:

http://www.dtsc-ssfl.com/files/lib_rcra_groundwater/quarterly_an_gw_repo/annual/66328_2013_Annual_Report_GWM_Text,Tables,Figures.pdf

## 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 (Look-up Table) 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.

During 2014, 374 soil matrix and 153 soil vapor samples were collected within Area IV and the NBZ as part of the Phase 3 data gap sampling program and soil treatability studies. Final data gap sampling plans were prepared and finalized after DTSC review, including the Phase 3 Master Field Sampling Plan (MFSP) Addendum 10 for Go-Back Sampling in Subareas 5B, 5C, and 3/6; the MFSP Addendum 11 for Go-Back Sampling in Subareas 5A, 5D, 8, and the NBZ; and, the MFSP Addendum 12 for Soil Vapor Implementation Plan for Area IV, including a Standard Operating Procedure (SOP) for Soil Vapor Sampling. Review and validation of 2013 co-located sampling data collected within Area IV continued in 2014, with results published in Technical Memoranda. Data gap evaluations were also performed using Phase 3 sampling results to identify any final data needs to complete characterization of Area IV and the NBZ. The Chemical Data Summary Report summarizing these findings will be prepared in 2015.

**Table 6-3. Surficial Media Sampling Summary - 2014**

| Date | Soil Matrix | | Soil Vapor | | Surface Water | |
|---|---|---|---|---|---|---|
| | Sample | Analyses | Sample | Analyses | Sample | Analyses |
| 1/1/14 to 12/31/14 | 374 | 374 | 153 | 153 | 0 | 0 |
| Total Through 2014 | 7,149 | 68,198 | 514* | 516* | 20 | 66 |

* The previously reported total of 470 soil vapor samples and analyses was in error; corrected total counts reported here for DOE locations.

Work and planning for DOE's EIS continued during 2014. In early February, DOE issued an Amended NOI for preparation of an Environmental Impact Statement for the proposed soils and groundwater cleanup action for Area IV and the NBZ, and conducted public scoping meetings on February 27 and March 1, 2014. Preparation of the Draft EIS is in progress, with an anticipated completion date of 2016. Work planned for 2015 includes continued preparation of the Chemical Data Summary Report for DTSC review and approval. 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 STIG public meetings. DOE plans to continue EIS alternative evaluations and issue the Draft EIS for public comment.

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

http://www.etec.energy.gov/char_cleanup/AOC.html

http://www.etec.energy.gov/char_cleanup/Co-located.html

Recent information regarding the ongoing Phase 3 Chemical Data Sampling investigation may be found at:

http://www.etec.energy.gov/char_cleanup/Phase3.html

The 2014 Annual Groundwater Monitoring Report can be found at:

66565_2014_Annual_Report_GWM_Text,Tables,Figures.pdf

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# 7. ENVIRONMENTAL MONITORING PROGRAM QUALITY CONTROL

This section describes the QA elements incorporated into the SSFL radiological monitoring program applicable to the former ETEC. The following elements of quality control 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 - 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 State 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.

Quality control 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.

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