ES&H Division
SLAC-R-963

Annual Site Environmental Report: 2010

September 2011

Prepared for the Department of Energy under contract number DE-AC02-76-SF00515

SLAC National Accelerator Laboratory, Stanford University, Stanford, CA 94309

NATIONAL ACCELERATOR LABORATORY

SLAC Site Office
SLAC National Accelerator Laboratory
2575 Sand Hill Road, MS-8A
Menlo Park, CA 94025

September 28, 2011

Subject: 2010 Annual Site Environmental Report (ASER) for the SLAC National Accelerator Laboratory

This report, prepared by the SLAC National Accelerator Laboratory (SLAC) for the U.S. Department of Energy (DOE), SLAC Site Office (SSO), provides a comprehensive summary of the environmental program activities at SLAC for calendar year 2010. Annual Site Environmental Reports (ASERs) are prepared for all DOE sites with significant environmental activities, and distributed to relevant external regulatory agencies and other interested organizations or individuals.

To the best of my knowledge, this report accurately summarizes the results of the 2010 environmental monitoring, compliance, and restoration programs at SLAC. This assurance can be made based on SSO and SLAC review of the ASER, and quality assurance protocols applied to monitoring and data analyses at SLAC.

Any questions or comments regarding this report may be directed to Dave Osugi of the SSO at (650) 926-3305, or by mail to the address above.

Sincerely,

Signature on File

Hanley Lee
Acting Site Manager
SLAC Site Office

Disclaimer

Publication Data

This document was designed and published by Environmental Safety & Health (ES&H) Division Publishing

Document Title: Annual Site Environmental Report: 2010

Original Publication Date: September 2011

Original Source: ES&H Division

Document Number: SLAC-R-963

Prepared for the United States Department of Energy under contract DE-AC02-76-SF00515

This report is available on line at http://www.slac.stanford.edu/pubs/slacreports/slac-r-963.html. Printed copies can be obtained by United States Department of Energy employees and contractors from the Office of Scientific and Technical Information, PO Box 62, Oak Ridge, TN 37831 and by the public from the National Technical Information Service, United States Department of Commerce, 5285 Port Royal Road, Springfield, VA 22161.

Comments on the report may be sent to

ES&H Publishing Coordinator
eshpubs@slac.stanford.edu
Mailstop 84
SLAC National Accelerator Laboratory
2575 Sand Hill Road
Menlo Park, CA 94025

Additional information about SLAC National Accelerator Laboratory is available at http://www.slac.stanford.edu/

Contents

Figures

Tables

Appendices

Preface

To satisfy the requirements of the United States Department of Energy Order 231.1, "*Environment, Safety and Health Reporting*", the Environment, Safety, and Health Division of the SLAC National Accelerator Laboratory prepares an annual report describing its environmental programs and activities.

This *Annual Site Environmental Report: 2010* summarizes the SLAC National Accelerator Laboratory compliance with standards and requirements, describes the management and monitoring systems in place, and highlights significant accomplishments for the year.

Organization

The report is published in a single volume, organized into the following chapters:

Chapter 1, "Site Overview", describes the environmental setting of the SLAC National Accelerator Laboratory and the activities conducted at the site

Chapter 2, "Environmental Compliance", gives an account of the regulatory framework and results concerning the site's environmental programs

Chapter 3, "Management Systems", outlines the organizational structure, methods, and responsibilities relevant to environmental programs

Chapters 4, 5, and 6, respectively "Environmental Non-radiological Programs", "Environmental Radiological Programs", and "Groundwater Protection and Environmental Restoration", give more detailed accounts of the programs and their results for the year

An executive summary provides an overview of the report.

Contributors

This report was prepared under the direction of Helen Nuckolls, ES&H Division, Environmental Protection Department.

Primary Coordinators and Authors

Micki De Camara (Chapter 3 and 4)

Ivy Chan, Olga Ligeti (Chapter 5)

Judy Fulton (Chapter 4)

Dwight Harbaugh (Chapter 6)

Darrin Gambelin (Chapter 4)

Mike Hug (Chapter 4)

Adam Ng (Chapter 6)

Dellilah Sabba (editor, executive summary, Chapters 1, 2, 3 and 6)

Kirk Stoddard (Chapter 4)

Additional Reviewers and/or Authors

Helen Nuckolls

Susan Witebsky

James Liu

Sayed Rokni

Brian Sherin

Jim Tarpinian

Editing and Publishing

ES&H Division Publishing edited and published this report; SLAC National Accelerator Laboratory Technical Publications provided electronic publishing and printing support.

Acronyms

^{3}H	tritium
AB	Assembly Bill
ASER	Annual Site Environmental Report
ASTs	aboveground storage tanks
BAAQMD	Bay Area Air Quality Management District
BaBar	SLAC B-Factory detector
BDE	beam dump east
BMP	best management practice
CalARP	California Accidental Release Prevention Program
CARB	California Air Resources Board
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
Ci	curie
CMS	chemical management system
COPC	chemicals of potential concern
CUPA	certified unified program agency
CWA	Clean Water Act
CY	calendar year
CX	categorical exclusion
DOE	United States Department of Energy
DPE	dual-phase extraction
DWS	drinking water standard
E85	blend of fuel where 85 percent is ethanol and 15 percent is gasoline
EA	environmental assessment
EBR	Environmental Baseline Report
EIS	environmental impact statement
EM	environmental management
EMP	environmental management program
EMS	environmental management system
EO	Executive Order

EP	Environmental Protection Department
EPCRA	Emergency Planning and Community-Right-to-Know Act
ERT	emergency response team
ES&H	environment, safety, and health
FHWSA	Former Hazardous Waste Storage Area
FMS	flow metering station
FSUST	Former Solvent Underground Storage Tank Area
FY	fiscal year
GDF	gasoline dispensing facility
GHG	greenhouse gas
gpd	gallons per day
HAPs	hazardous air pollutants
Haas	Haas *tcm*
HMBP	hazardous materials business plan
HMIS	Hazardous Materials Inventory Statement
ID/IQ	Indefinite Delivery/Indefinite Quantity
IDPE	interim dual-phase extraction
IR	interaction region
INL	Idaho National Laboratory
ISEMS	integrated safety and environmental management system
ISM	integrated safety management
ISO	International Organization for Standardization
JRBP	Jasper Ridge Biological Preserve
km	kilometer
L	liter
lbs	pounds
LEED	Leadership in Energy and Environmental Design
linac	linear accelerator
LCLS	Linac Coherent Light Source
LLRW	low-level radioactive waste
LRDP	long-range development plan
LSY	lower salvage yard
M&O	management and operating
MAPEP	mixed-analyte performance evaluation program

MEI	maximally exposed individual
MFPF	metal finishing pre-treatment facility
MGE	Main Gate East Channel
MPMWD	Menlo Park Municipal Water Department
MPR	monitoring plan report
mrem	millirem
mSv	milli-Sievert
NAE	North Adit East Channel
NEPA	National Environmental Policy Act
NESHAPs	National Emission Standards for Hazardous Air Pollutants
PAFD	Palo Alto Fire Department
PBR	permit by rule
PBVs	parameter benchmark values
PCB	polychlorinated biphenyl
PCGs	Preliminary Cleanup Goals
pCi/g)	picocuries per gram
pCi/L	picoCuries per liter
PEP	Positron-Electron Project
ppm	parts per million
PRGs	Preliminary Remediation Goals
PSA	Plating Shop Area
QA	quality assurance
QC	quality control
rad	unit used to quantify radiation exposure
RCRA	Resource Conservation and Recovery Act
RECs	Renewable Energy Certificates
RM	Requirements Management
RMP	risk management plan
RP	Radiation Protection Department
RWQCB	Regional Water Quality Control Board
SARA	Superfund Amendments and Reauthorization Act
SBSA	South Bayside System Authority
SLAC	SLAC National Accelerator Laboratory
SME	subject matter expert

SMOP	synthetic minor operating permit
SMP	self-monitoring program
SPCC	spill prevention, control, and countermeasures
SPEAR	Stanford Positron-Electron Asymmetric Ring
SSO	DOE SLAC Site Office
SSRL	Stanford Synchrotron Radiation Lightsource
STA	safety training assessment
SVOCs	semi-volatile organic compounds
SWMP	stormwater monitoring program
SWPPP	stormwater pollution prevention plan
SWRCB	State Water Resources Control Board
TCR	The Climate Registry
TDS	total dissolved solids
TL/CL	Test Lab and Central Lab Area
TPH	total petroleum hydrocarbons
TRI	toxic release inventory
TSCA	Toxic Substances Control Act
USEPA	United States Environmental Protection Agency
VOCs	volatile organic compounds
WBSD	West Bay Sanitary District
WM	Waste Management Group
WTS	waste tracking system
yr	year

Executive Summary

This report provides information about environmental programs during the calendar year of 2010 at the SLAC National Accelerator Laboratory (SLAC), Menlo Park, California. Activities that overlap the calendar year - i.e., stormwater monitoring covering the winter season of 2010/2011 (October 2010 through May 2011) are also included.

Production of an annual site environmental report (ASER) is a requirement established by the United States Department of Energy (DOE) for all management and operating (M&O) contractors throughout the DOE complex. SLAC is a federally-funded research and development center with Stanford University as the M&O contractor.

Under Executive Order (EO) 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*, EO 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*, and DOE Order 450.1A, *Environmental Protection Program*, SLAC effectively implements and integrates the key elements of an Environmental Management System (EMS) to achieve the site's integrated safety and environmental management system goals. For normal daily activities, SLAC managers and supervisors are responsible for ensuring that policies and procedures are understood and followed so that:

- Worker safety and health are protected
- The environment is protected
- Compliance is ensured

Throughout 2010, SLAC continued to improve its management systems. These systems provided a structured framework for SLAC to implement "greening of the government" initiatives such as EO 13423, EO 13514, and DOE Orders 450.1A and 430.2B. Overall, management systems at SLAC are effective, supporting compliance with all relevant statutory and regulatory requirements.

During 2010, there were no reportable releases to the environment from SLAC operations. In addition, many improvements in waste minimization, recycling, stormwater management, groundwater restoration, and SLAC's chemical management system (CMS) were continued.

The following are among SLAC's environmental accomplishments for 2010. To facilitate management and identification of future potential greenhouse gases (GHG) reduction opportunities, SLAC voluntarily completed GHG inventories for calendar year (CY) 2008 and CY 2009 and submitted the results to The Climate Registry. A Lead Management Plan was completed to reduce the potential of lead impacting the environment, and two large legacy tube-trailer modules, each containing 38 tubes of compressed ethane, were reused or recycled by an outside contractor, resulting in hazardous waste avoidance and cost savings of approximately $100,000 in transportation and disposal costs. SLAC continues to make progress on achieving the sustainability goals of EOs 13423 and 13514, which include, but are not limited to reductions in the use of water, energy, and fuel, building to green standards and reductions in GHG emissions. Phase I of the SLAC Advanced Metering project for electrical and natural gas systems was completed. Phase I included the design of the metering system and purchase of the enterprise software. The planning, design, and installation of an advanced water metering system for select buildings, landscape, and process systems were completed. In addition, the last major onsite chiller containing a Class I ozone-depleting substance was taken out of service, and SLAC continued to replace conventional vehicles with electric vehicles.

In 2010, there were no radiological impacts to the public or the environment from SLAC operations. The potential doses to the public were negligible and far below the regulatory and SLAC administrative limits. No radiological incidents occurred that increased radiation levels to the public or released radioactivity to the environment. In addition to managing its radioactive wastes safely and responsibly, SLAC worked to reduce the amount of waste generated. SLAC shipped 2,891 cubic feet of low-level radioactive waste, half of which was legacy waste, to appropriate treatment and disposal facilities for low-level radioactive waste. SLAC also continued its efforts to reduce the inventory of materials no longer needed for its mission by permanently removing 125 sealed radioactive sources from the inventory. Ninety-seven of the sealed sources were returned to the manufacturer, and 28 were sent to Energy Solutions for processing before being sent to the Nevada Test Site for burial. In addition, 87 concrete blocks which had been stored in an area known as the Bone Yard were surveyed for potential surface contamination and volumetric activation prior to off-site release. Based on the comprehensive measurements, all 87 blocks were qualified for release and were disposed of as ordinary materials at a landfill.

In 2010, the SLAC Environmental Restoration Program personnel continued work on site characterization and evaluation of remedial alternatives at four sites with volatile organic compounds in groundwater and several areas with polychlorinated biphenyls and low concentrations of lead in soil. SLAC is regulated under a site cleanup requirements order (board order) issued by the California Regional Water Quality Control Board (RWQCB), San Francisco Bay Region on October 19, 2009, for the investigation and remediation of impacted soil and groundwater at SLAC. Risk-based preliminary cleanup goals for impacted soil and groundwater have been established for SLAC, and the remedial efforts are being designed to meet these established goals. The board order also lists specific tasks and deadlines for completion of groundwater and soil characterization and other remediation activities. All deliverable submittals to the RWQCB in 2010 were completed and submitted on time.

1 Site Overview

This chapter describes the environmental setting of SLAC and the activities conducted at the site.

For an overview of site environmental planning, including descriptions of environmental resources, see the long-range development plan (LRDP) prepared in 2002 (revised June 2003).[1]

1.1 Introduction

SLAC is a national research laboratory operated by Stanford University under contract to the DOE. SLAC is located on the San Francisco Peninsula, about halfway between San Francisco and San Jose, California (see Figure 1-1). Current research and scientific user facilities are in the areas of photon science, particle physics, particle astrophysics, accelerator physics, and accelerator research and development. Six scientists have been awarded the Nobel Prize for work carried out at SLAC, and there are 10 members of its faculty in the National Academies.

The majority of SLAC funding comes from the DOE Office of Science, with smaller contributions from the National Aeronautics and Space Administration, National Institutes of Health, and other federal and non-federal sources. SLAC also receives funding from the DOE Office of Environmental Management (EM) for soil and groundwater investigation and remediation activities at the site, which are managed by SLAC for EM.

1.1.1 SLAC Mission

- Photon Science Discoveries
- To make discoveries in photon science at the frontiers of the ultrasmall and ultrafast in a wide spectrum of physical and life sciences

- Particle and Particle Astrophysics Discoveries
- To make discoveries in particle physics and particle astrophysics that redefine humanity's understanding of what the universe is made of and the forces that control it

- Operate Safely; Train the Best
- To operate a safe laboratory that employs and trains the best and brightest minds, helping to ensure the future economic strength and security of the nation

---

1 Stanford University Architect/Planning Office, *Stanford Linear Accelerator Center Long Range Development Plan* (December 2002, revised June 2003), http://www-group.slac.stanford.edu/bsd/SLAC_LRDP_final.pdf

1.1.2 Research Program

SLAC has three major research areas: photon science, particle physics, and accelerator science and technology. In the photon science program, SLAC develops and supports innovative research instrumentation for x-ray based studies of matter on length scales below the nanometer level and on time scales from milli- down to femto-seconds. Photon science research encompasses such diverse elements as magnetic materials science, molecular environmental science, and structural biology; it is a rapidly developing new field in ultrafast X-ray science.

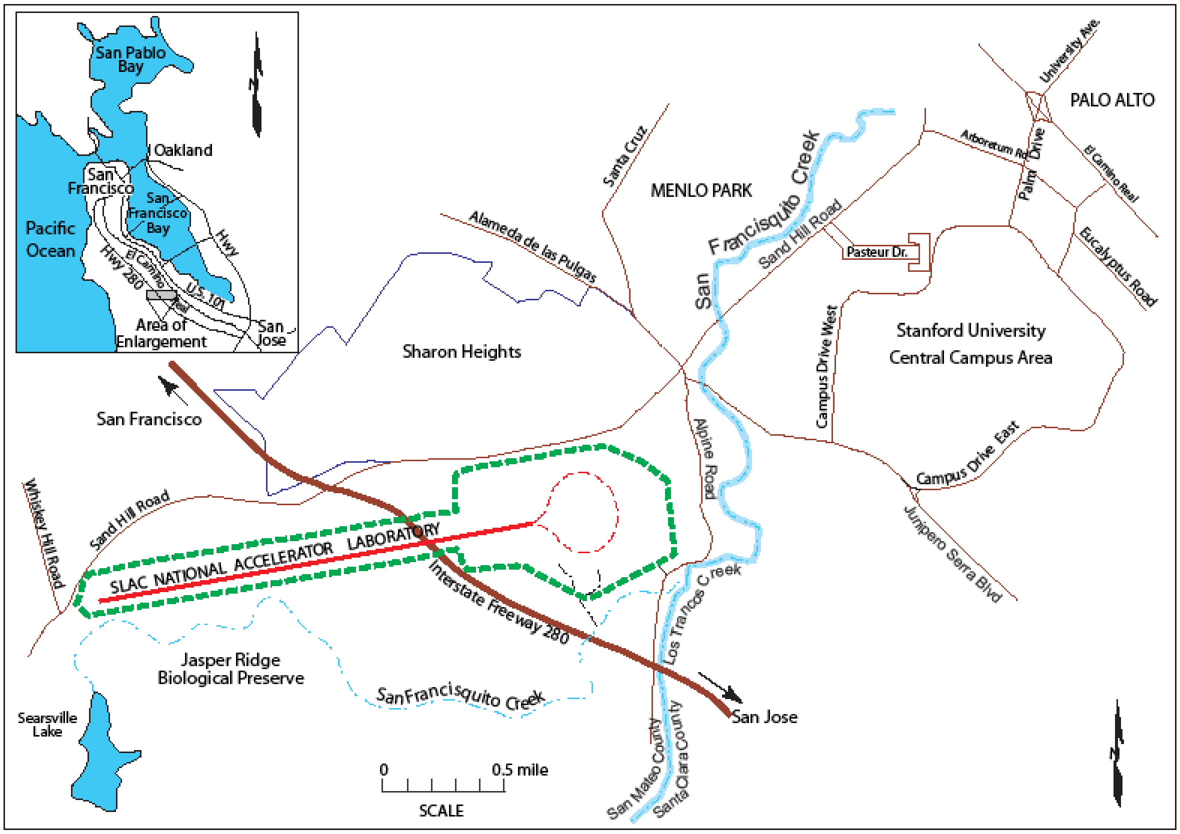

Figure 1-1 SLAC Site Location

The use of particle accelerators and observatories in space and on the ground helps us understand what our universe is made of at its most basic and fundamental level. The principal areas of particle physics studied at SLAC include the electron energy frontier using a linear collider, theoretical investigations of the quantum universe and, at the Kavli Institute for Particle Astrophysics and Cosmology, non-accelerator tests of the Standard Model through investigations of dark matter and dark energy.

In 2010, the Linac Coherent Light Source (LCLS) came online. The LCLS Directorate began experimental operations with the world's first hard X-ray free-electron laser and exceeded all expectations.

SLAC supports other world-class research in physics, as well. The two-mile linear accelerator (linac) at SLAC, constructed in the early 1960s, generates high-intensity beams of electrons and positrons up to 50 giga-electron volts. The linac is also used to inject electrons and positrons into colliding-beam storage rings for particle physics research. One of these, the Stanford Positron-Electron Asymmetric Ring (SPEAR), contains a separate, shorter linac and a booster ring for injecting accelerated beams of electrons. SPEAR is dedicated to synchrotron radiation research, and the synchrotron light it generates is used by the Stanford Synchrotron Radiation Lightsource (SSRL), a division of SLAC, to perform experiments. At SSRL, researchers work at the nanoscale, making discoveries in solid-state physics, material science, environmental science, structural biology, and chemistry. In the past, researchers at SSRL have: looked at remnants of soft tissues in hundred-million-year-old dinosaur fossils; mapped the distribution of elements in diseased brains: sought a deeper understanding of Alzheimer’s and Parkinson’s diseases; worked out the detailed structures of scores of proteins; and characterized the quantum electronic workings of new materials, leading the way toward the superconductors of the future.

1.2 Location

SLAC is located in a belt of low, rolling foothills between the alluvial plain bordering San Francisco Bay to the east and the Santa Cruz Mountains to the west. The site varies in elevation from 175 to 380 feet above sea level. The alluvial plain to the east lies less than 151 feet above sea level; the mountains to the west rise abruptly to over 2,000 feet.

The site occupies 426 acres of land owned by Stanford University. The property was originally leased by Stanford University in 1962 to the U.S. Atomic Energy Commission, the predecessor to the DOE, for purposes of research into the basic properties of matter. The DOE and Stanford University have signed a new lease which extends through 2043. The land is part of Stanford’s academic reserve, and is located west of the university and the city of Palo Alto in an unincorporated portion of San Mateo County.

The site lies between Sand Hill Road and Alpine Road, bisected by Highway 280, on an elongated parcel roughly 2.75 miles long, running in an east-west direction. The parcel widens to about 0.6 of a mile at the target (east) end to allow space for buildings and experimental facilities. The south side of much of the western end of the parcel is bordered by Stanford University’s Jasper Ridge Biological Preserve (JRBP), which includes part of the San Francisquito Creek riparian channel, the last channel of its kind between San Jose and San Francisco still in its natural state.

1.3 Geology

The SLAC site is underlain by sandstone, with some basalt at the far eastern end. In general, the bedrock on which the western half of the SLAC linac rests is the Whiskey Hill Formation (Eocene age), and the bedrock under the eastern half is the Ladera Sandstone (Miocene age). On top of this bedrock at various places along the accelerator alignment is the Santa Clara Formation (Pleistocene age), where alluvial deposits of sand and gravel are found. At the surface is a soil overburden of non-consolidated earth material ranging from 0.3 to 3 feet in depth. Figure 1-2 shows the general geographic and geologic setting of the area.

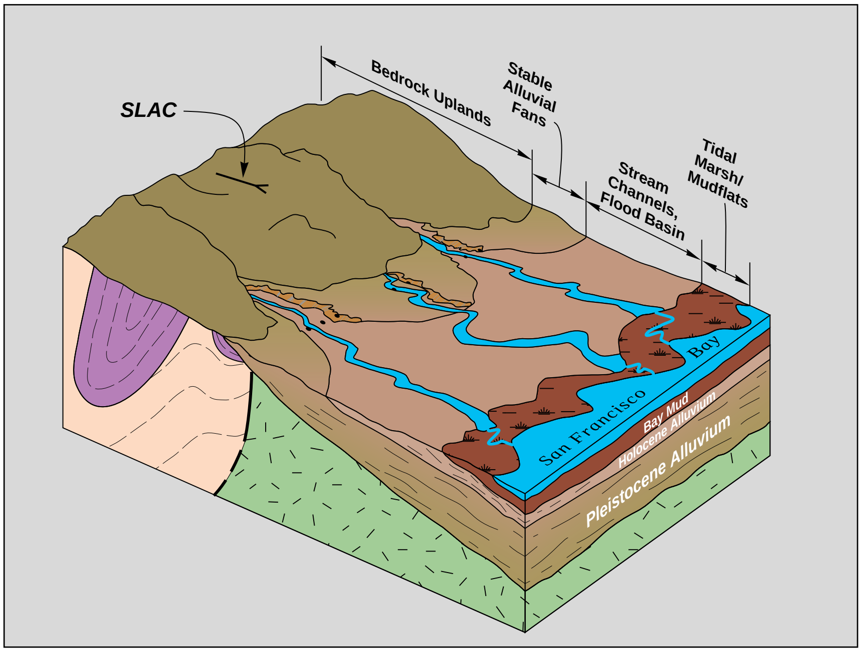

Figure 1-2 Site Area General Geographic and Geologic Setting

1.4 Climate

The climate in the SLAC area is Mediterranean. Winters are cool and moist, and summers are mostly warm and dry. Daily mean temperatures are seldom below 32 degrees Fahrenheit or above 86 degrees Fahrenheit. Rainfall averages about 22 inches per year. The distribution of precipitation is highly seasonal. About 75 percent of the precipitation, including most of the major storms, occurs during the four-month period from December through March. Most winter storm periods are from two days to a week in duration. The storm centers are usually characterized by relatively heavy rainfall and high winds.

1.5 Land Use

The SLAC site is located on an unincorporated portion of San Mateo County and is zoned in the San Mateo County General Plan as a *residential estate.* Approximately 34 percent of the property is developed with buildings and pavement, mostly in the core campus area.

Land use to the immediate west is commercial (office buildings and a hotel), and farther west is agricultural and the JRBP. Land use to the north is mostly commercial, residential, and recreational (a golf course), with a school and office buildings north of the central campus. Land use to the east is residential, recreational (another golf course), and educational (the Stanford campus). Land use to the south is agricultural (including a horse boarding and training facility), reserved open space, and residential.

1.6 Water Supply

Domestic water for SLAC is supplied by the Menlo Park Municipal Water Department (MPMWD). The source is the City of San Francisco-operated Hetch Hetchy aqueduct system, which is fed from reservoirs located in the Sierra Nevada. SLAC, the neighboring Sharon Heights development (to the north), and the Stanford Shopping Center all receive water service from an independent system (called *Zone 3*) within the MPMWD. This separate system taps the Hetch Hetchy aqueduct and pumps water up to a 268,391-cubic-feet reservoir north of Sand Hill Road, approximately 1.5 miles from central SLAC.

Drinking and process water are transported throughout the SLAC site by a distribution system protected by backflow prevention devices. Groundwater is not used onsite at SLAC; however, five offsite groundwater wells have been identified within a one-mile radius of SLAC, three of which are in use. The closest downgradient groundwater well is located approximately 500 feet south of SLAC along the stream margin of San Francisquito Creek. This well was formerly used for agricultural supply but is capped. Of four wells, one is capped, one is used for watering livestock, and the other two are used for residential drinking water. Use of water at SLAC is about equally divided between equipment cooling (such as the linac) and domestic uses (such as landscape irrigation and drinking water).

1.7 Demographics

SLAC's primary customers are the approximately 3,000 students, postdoctoral students, and scientists from around the world who make use of its accelerator-based instrumentation and techniques for their research each year. SLAC has an employee population of about 1,500, of which about 20 percent are PhD physicists. Approximately 60 percent staff members are professional, including physicists, engineers, programmers, and other scientific-related personnel. The balance of the staff comprises support personnel, including technicians, crafts personnel, laboratory assistants, and administrative assistants. In addition to the regular population, at any given time SLAC hosts between 900 and 1,000 visiting scientists.

The populated area around SLAC is a mix of offices, schools, single-family housing, apartments, condominiums, and Stanford University. SLAC is surrounded by five communities: the city of Menlo Park; the towns of Atherton, Portola Valley, and Woodside; and the unincorporated community of Stanford University, which is in Santa Clara County. Nearby unincorporated communities in San Mateo County include Ladera and two neighborhoods located in western Menlo Park. Within one mile of SLAC's perimeter are two public and two private schools with elementary and/or middle school students.

2 Environmental Compliance

2.1 Introduction

This chapter provides a summary of the regulatory framework within which the environmental programs of SLAC operate, and compliance with those regulations for 2010.

2.2 Regulatory Framework

The SLAC External Requirements Management Dataset cites the environmental protection and safety requirements and standards that are applicable to facilities and facility operations.[2]

2.3 Environmental Permits and Notifications

The permits held by SLAC in 2010 are shown in Table 2-1.

Table 2-1 General Permits Held by SLAC

Issuing Agency	Permit Type	Description	Number
Bay Area Air Quality Management District	Air quality	Synthetic Minor Operating Permit (SMOP), issued per Title V of the Clean Air Act	1
		Encompasses 35 permitted sources and 21 exempt sources of air emissions (after initial permitting, integrated into SMOP)	56
California Department of Toxic Substances Control	Hazardous waste treatment	Unit 1A – Building 025, permit by rule (PBR) for cyanide treatment tanks	1
		Unit 1B – Building 038, PBR for metal finishing pretreatment facility	1
		Unit 1C – Building 038, PBR for batch hazardous waste treatment tank	1
		Unit 2 – Building 038, PBR for sludge dryer	1
South Bayside System Authority and West Bay Sanitary District	Wastewater discharge	Mandatory Wastewater Discharge Permit	1
Regional Water Quality Control Board	Stormwater	Industrial activities stormwater general permit	1

2 SLAC National Accelerator Laboratory, External Requirements Database https://slacspace.slac.stanford.edu/sites/requirementsmanagement/database/

Issuing Agency	Permit Type	Description	Number
San Mateo County /CUPA	CUPA programs	Permit By Rule; Above Ground Tank/SPCC; HazMat Storage > 32000gal, 224000lb, 112000cf; HazWaste Generator 51-250 tons; CalARP	1
US Environmental Protection Agency	Hazardous waste	90-day hazardous waste generator	1

CUPA – certified unified program agency
SPCC - spill prevention control and countermeasures

2.4 Environmental Incidents

2.4.1 Non-radiological Incidents

SLAC was in compliance with all non-radiological requirements related to the environment throughout 2010. There were no reportable releases to the environment during 2010.

2.4.2 Radiological Incidents

In 2010, no radiological incidents occurred that increased radiation levels to the public or released radioactivity to the environment. As detailed in Chapter 5, "Environmental Radiological Program," SLAC was in compliance with all radiological requirements related to the environment and the public throughout 2010.

2.5 Assessments, Inspections, and Quality Assurance

The environmental programs at SLAC are subject to assessments, inspections, and quality assurance measures. Those conducted during 2010 are reported here.

2.5.1 Assessments

2.5.1.1 Internal

The DOE and SLAC National Environmental Policy Act (NEPA) programs were assessed to evaluate compliance during 2010. Although the NEPA program was found to be in compliance with the Federal and DOE regulations on the review of impacts of a project on the environment, two opportunities of improvement were identified: the update of the SLAC NEPA procedure and the expansion of the resources, reference documents, and contact information on the SLAC NEPA website to better assist project managers.

SLAC and the DOE Site Office performed a joint assessment of the Stormwater and Industrial Wastewater programs. The assessment noted that SLAC was in compliance with all stormwater and industrial wastewater permits and regulations. Interviews of SLAC personnel revealed that stormwater awareness was improved throughout the site. To further increase stormwater awareness, SLAC is developing an on-line version of the stormwater training course which all affected employees will complete every three years.

Most GHG emissions reporting protocols require independent verification of the data prior to submittal. Since 2007, SLAC has commissioned a third-party audit for its annual GHG emissions data submittal to The Climate Registry (TCR). Each audit evaluates SLAC operations in considerable detail and delves into staff training, equipment calibration and maintenance, alternate data sources, and documentation. As a result of these audits, SLAC has formalized various aspects of data management, improved its documentation procedures, and expanded data collection activities to facilitate comparison of aspects such as purchasing records versus actual usage data for a wider range of hazardous materials.

2.5.1.2. External

External assessments conducted by regulators occur periodically and include quarterly radiation monitoring of the SLAC perimeter by California Department of Health Services. However, results are not available to SLAC.

The San Mateo County certified unified program agency (CUPA) performed a hazardous waste inspection of SLAC between May 24 and 27, 2010. The inspector noted five violations including inaccessible emergency equipment, an incomplete hazardous waste label, open hazardous waste containers, and mismanaged universal waste. All violations were immediately corrected.

The CUPA provided positive comments regarding the performance of the SLAC Waste Management Group, including the clean and well organized hazardous waste yard and excellent recordkeeping. The CUPA also provided favorable comments on the Hazardous Materials Business Plan, Plating Shop operations, stormwater controls, and the spill prevention control and countermeasures (SPCC) plan.

2.5.2 Inspections

Periodic inspections of the environmental programs are performed at SLAC by environmental regulatory agencies. Table 2-2 lists the inspections conducted in 2010 by these agencies.

Table 2-2 Environmental Audits and Inspections

Regulatory Agency	Inspection Title	Date	Violations
South Bayside System Authority	Annual Compliance Inspection	May 20, 2010	0
San Mateo County CUPA	Annual Compliance Inspection	May 24-27, 2010	5

2.5.3 Quality Assurance

The SLAC site-wide quality assurance (QA) program is consistent with the requirements of the DOE Order 414.1C,[3] and includes documented roles, responsibilities, and authorities for implementing the 10 criteria from the DOE order.

The SLAC Office of Assurance is responsible for:

Auditing quality assurance for line work as well as Environment, Safety and Health (ES&H) programs

[3] United States Department of Energy, DOE Order 414.1C, “Quality Assurance”, http://www.directives.doe.gov/pdfs/doe/doetext/neword/414/o4141c.html

Maintaining the *SLAC Institutional Quality Assurance Program Plan*

Providing direction for implementation of the ten criteria from the DOE Order 414.1C

2.5.3.1 Environmental Non-radiological Program

The Environmental Restoration Program uses the *Quality Assurance Project Plan for the Environmental Restoration Program*[4] for soil and groundwater characterization and remediation activities. This document includes all components required of quality assurance project plans and is consistent with United States Environmental Protection Agency (USEPA), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, or Superfund), and DOE guidance documents. The components include defining required laboratory and field QA and quality control (QC) procedures and corrective actions, and data validation and reporting.

2.5.3.2 Environmental Radiological Program

Programmatic QA/QC is governed by the Radiological Environmental Protection program manual, and specific laboratory procedures and data validation and reporting are governed by the SLAC Radioanalysis Laboratory Quality Assurance manual. In addition, twice per year, SLAC participates in the Mixed Analyte Performance Evaluation Program (MAPEP) administered by the DOE Idaho National Laboratory (INL). Under this program, the INL provided the SLAC Radioanalysis Laboratory with samples that contained unknown gamma- and beta-emitting radionuclides. SLAC used these samples to test and improve its gamma counting and liquid scintillation counting capabilities. This ensures that the lab's counting system performs accurate measurements. The technical performances were acceptable.

[4] Stanford Linear Accelerator Center, Environment, Safety, and Health Division, Environmental Protection and Restoration Department, *Quality Assurance Project Plan for the Environmental Restoration Program* (SLAC-I-750-2A17M-003 R004, February 2008)

3 Management Systems

3.1 Introduction

This chapter provides an overview of the SLAC organizational structure, management approach, and EMS implementation used to protect the environment. The results for the various measures and reviews discussed below are contained in Chapter 2, "Environmental Compliance".

3.2 SLAC Organization

SLAC is organized into six directorates: Accelerator Directorate, Operations Directorate, Photon Science Directorate, Particle Physics and Astrophysics Directorate, Stanford Synchrotron Radiation Lightsource Directorate and Linac Coherent Light Source Directorate. Additionally, the SLAC Office of Assurance, which was renamed the Office of Planning and Assessment, was formed in 2006 in response to DOE Order 226.1A, *Implementation of Department of Energy Oversight Policy* . The purpose of SLAC's assurance program is to ensure that products and services meet or exceed customers' expectations. SLAC's customers include the DOE, the many users who participate in experiments at SLAC using the laboratory's unique experimental facilities, and the sponsors of work conducted under work-for-others program.

3.3 ES&H Division Organization

The ES&H Division consists of six departments (see below) and a Division Office. The Division Office is tasked with overall strategic planning and management and work planning and control. The shared goal is to ensure that SLAC operates in compliance with federal, state, and local laws and regulations, as well as DOE directives.

3.3.1 Environmental Protection Department

The Environmental Protection (EP) Department has two technical groups, and develops and manages requirements under the EMS. The EP Group develops and implements waste minimization and pollution prevention plans, and provides oversight of stormwater and industrial wastewater, air, toxic substances control, spill prevention and groundwater protection. The Environmental Restoration Group oversees work to restore soil and groundwater impacted with chemicals from historical operations. The EMS is the overarching system that SLAC uses for identifying and managing environmental aspects and is further described in Section 3.5.

3.3.2 Field Services Department

The Field Services Department consists of four technical groups. The Waste Management Group (WM Group) coordinates the management and off-site disposal of regulated and hazardous wastes, and develops and implements waste minimization and pollution prevention plans. The Industrial Hygiene Group assists with the management of SLAC's safety and health programs, and keeps SLAC healthy and safe by anticipation, recognition, evaluation, prevention, and control of environmental factors or stresses which may cause sickness or impaired health and well being. The Chemical Management Group is multifaceted and addresses chemical safety at every point in the chemical lifecycle from transportation, procurement, use, storage, inventory management, and implements the Toxic and Hazardous Material Reduction Plan. The Field Safety Group provides industrial and OSHA construction safety oversight to construction projects, operations and maintenance, as well as providing safety training classes to SLAC personnel.

3.3.3 Security and Emergency Management Department

The SLAC Security and Emergency Department consists of two groups: the Fire and Emergency Management group which include SLAC Emergency Response Team (ERT) and the Site Security Group. The Fire and Emergency Management Group is staffed by fire protection engineering professionals and is supported by personnel under contract from the Palo Alto Fire Department (PAFD). PAFD staffs Station 7 which is located on-site and provides emergency response services 24 hours-a-day, seven days-a-week basis. SLAC has a Security Manager, Emergency Coordinator and an emergency specialist. The SLAC Security group is staffed by contract security professionals and provides security services and emergency assistance 24 hours-a-day, seven days-a-week.

3.3.4 Radiation Protection Department

The Radiation Protection (RP) Department includes 5 technical groups and - a few programs such as Quality Assurance and Material Release. The Radiation Physics Group provides expertise in safety analysis and control (including shielding calculations and safety system design) for new or modified beamlines, experiments and facilities, and provides authorization and oversight for the safe operation of beam lines and experiments to protect the workers, the general public and the environment. The Field Operations Group oversees radiological monitoring, training, radiological control and work support. The Dosimetry and Radiological Environmental Protection Group provides dosimetry services (external, internal and area), assessment and/or monitoring of various types of environmental impact (described in more details in Section 5), operation of the Radioanalysis Laboratory, and operation of instrumentation program. The Radioactive Waste Management Group oversees radioactive waste management such as low level radioactive waste disposal, at SLAC (described in more details in Chapter 5). The Laser Safety Group is in charge of developing and implementing SLAC's Laser Safety Program-

3.3.5 Project Safety Department

The ES&H Project Safety Department consists of three groups. The Building Inspection Office provides Building Code oversight of construction projects during the plan review process, and during the construction phase. The Project Safety Support group consists of general construction safety oversight, subcontractor safety (occupational safety and health metrics) evaluation, project support (ES&H liaison) to PM's and scientists, and safety oversight of specific programs in areas such as oxygen deficiency hazards, and compressed gas systems. The Safety Officer group consists of the SLAC Fire Marshall and the Electrical Safety Officer.

3.3.6 Training and Information Management Department

The Training and Information Management Department assists with the implementation of SLAC's safety and health programs including ES&H training, ES&H publishing, and ES&H web and business applications.

3.4 Integrated Safety and Environmental Management System

SLAC ensures that the site is operated in a safe, environmentally responsible manner and complies with applicable laws, regulations, standards and other requirements through implementation of an Integrated Safety and Environmental Management System (ISEMS). The ISEMS is based on integrating the key elements of effective integrated safety and environmental management systems into the mission and everyday operations of the site.

3.4.1 Integrated Safety and Environmental Management System

The "plan, do, check, and improve" approach of ISEMS[5] has been formally adopted by SLAC, and is the foundation of the site's ISEMS[6] and the ES&H program. Work at SLAC follows the five core functions of Integrated Safety Management (ISM), which is consistent with the EMS process (policy, planning, implementation, checking and corrective action, and management review):

- Define the scope of work
- Analyze the hazards
- Develop and implement hazard controls
- Perform work within controls
- Provide feedback and continuous improvement

3.4.2 Requirements Management System

The laws and regulations that specify the ES&H and other external requirements of the Laboratory are cited in the centralized SLAC External Requirements dataset which is maintained by the SLAC Requirements Management (RM) team. Updates to the RM dataset occur when the DOE/Stanford University Contract for SLAC is modified affecting clauses or DOE Directives;, when Management System documentation (i.e. ES&H Manual) is revised;, and when other non-contractual external requirements (e.g. Industrial Standards) are identified based on subject matter expert (SME) input. In addition, RM vets the dataset content with respective SMEs at least annually to ensure that regulatory drivers are identified and incorporated.[7] In 2009, the Requirements Management System's External Requirements Database replaced what was formerly called the work smart standards.

3.4.3 Environmental Performance Measures

In addition to complying with external requirements, SLAC evaluates its activities against performance measures. Specific performance objectives, measures and targets are developed by DOE and SLAC, approved and formally incorporated into the M&O contract each fiscal year. DOE uses the contract performance measures and ongoing field observations of SLAC operations and construction activities to formally evaluate contractor performance in all areas, including ES&H.

In fiscal year (FY) 2010, SLAC established environmentally relevant performance goals to provide the following: a work environment that protects worker safety, health and the environment; efficient and effective implementation of ISEMS; and efficient and effective waste management, waste minimization, and pollution prevention.

SLAC received a grade of A- for its environmental performance, with the DOE noting among other things, SLAC received the DOE Bronze Award for the Federal Electronics Challenge, completed projects that resulted in tangible risk reduction such as the removal of hazardous materials that had been stored on site

[5] Stanford Linear Accelerator Center, Environment, Safety, and Health Division, "Integrated Safety and Environmental Management Systems", http://www-group.slac.stanford.edu/esh/general/isems/

[6] Stanford Linear Accelerator Center, Environment, Safety, and Health Division, *SLAC Integrated Safety and Environmental Management System Description* (SLAC-I-720-0A00B-001-R005), http://www-group.slac.stanford.edu/esh/general/isems/sms.pdf

[7] SLAC National Accelerator Laboratory, Requirements Management, https://slacspace.slac.stanford.edu/sites/ipm/requirementsmanagement/default.aspx

for many years, diverted over 60 percent of its sanitary waste destined to landfills and recycled over 90 percent of the construction and debris waste from a recently completed major construction project.

3.4.4 Training

To ensure every employee is both aware and capable of fulfilling his or her responsibilities, the ES&H Division operates an extensive program of classroom and computer-based training. For example, personnel who handle hazardous chemicals and waste are provided training in chemical and waste management, waste minimization, pollution prevention, stormwater protection, on-site transportation of hazardous chemicals and waste, and basic spill and emergency response. Details on the ES&H training program are available on line[8]. Workers are required to have all appropriate training related to environmental and safety prior to performing any work assigned to them. Training received by each worker is documented in his or her Safety Training Assessment (STA), which is reviewed and approved by their supervisor.

3.5 Environmental Management System

The EMS portion of the ISEMS is essentially a systematic approach for ensuring environmental improvement – a continual cycle of planning, implementing, reviewing and improving to ensure protection of the air, water, land, and other natural resources that may be potentially impacted by operational activities. SLAC's EMS program is described in detail in the *EMS Description*[9] document.

The Office of Management and Budget issues an annual Environmental Stewardship scorecard for the federal agencies and an EMS Report Card is one of four elements. SLAC achieved a score of "green" on its 2010 EMS Report Card, indicating that all elements of the EMS are in place and working. Despite a score of "green", SLAC strives to continually improve its EMS.

SLAC's EMS program is consistent with International Organization of Standardization (ISO) 14001:2004. It was first formally in place on December 21, 2005 following a DOE assessment of the site's EMS and issuance of a self-declaration letter of compliance with the requirements of DOE Order 450.1. In June of 2008, DOE Order 450.1 was replaced with DOE Order 450.1A[10] , to implement the requirements and sustainability goals listed in EO 13423 *Strengthening Federal Environmental, Energy, and Transportation Management*. SLAC's EMS was declared in compliance with DOE Order 450.1A on June 1, 2009 and will undergo a formal audit at least every 3 years to support re-declaration of compliance per DOE Order 450.1A.

Additional updates to the SLAC EMS will continue as a result of EO 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*[11], issued October 8, 2009. This EO builds on the sustainability requirements of EO 13423, with greater emphasis on the reduction of GHG emissions by federal agencies. It is expected that DOE Orders 450.1A and 430.2B will be replaced by a new DOE sustainability directive that incorporates the new requirements of EO 13514.

The annual review and ranking of environmental aspects and determination of significance was completed this year by SLAC's EMS Steering Committee, the Environmental Safety Committee (ESC), and 17 objectives and targets were established for 2010. For each objective and target, a work plan, termed an Environmental Management Program (EMP) was completed. Many of the EMPs developed for 2010 were

---

8 Stanford Linear Accelerator Center, Environment, Safety, and Health Division, "Training", http://www-group.slac.stanford.edu/esh/training/

9 SLAC National Accelerator Laboratory, "EMS Description", SLAC-750-0A03H-002 R2, January 2009

10 DOE Order 450.1A, http://www.directives.doe.gov/pdfs/doe/doetext/neword/450/o4501a.pdf

11 Executive Order 13514, http://edocket.access.gpo.gov/2009/pdf/E9-24518.pdf

developed to support progress toward achievement of the sustainability goals of EO 13423 and EO 13514. Objectives and targets were developed for the following environmental aspects in FY 2010:

- Air emission
- Chemical use, storage, and inventory
- Soil and groundwater contamination
- Surface and stormwater contamination
- Use, reuse, and recycling
- Conservation of resources
- Construction, renovation and demolition by-products

Several notable accomplishments for the 2010 EMPs include the following:

- To facilitate management and identification of future potential GHG reduction opportunities, SLAC voluntarily completed GHGs inventories for CY 2008 and CY 2009 and submitted the results to The Climate Registry. This registry is an international clearinghouse that since 2002 has allowed reporting facilities to establish a certified baseline for GHG emissions, against which all future reductions could be measured.
- To reduce GHG and particulate emissions from diesel engines, SLAC's diesel vehicles and equipment were evaluated to identify units that should be removed from service based on age, engine size or lack of use. As a result of the evaluation, nine units were removed from service, seven of which were at least 25 years old.
- A Lead Management Plan was completed to reduce the potential for lead impacts to the environment.
- Two large legacy tube trailer modules, each containing 38 tubes of compressed ethane, were reused or recycled by an outside contractor, resulting in hazardous waste avoidance and cost savings of approximately $100,000 in transportation and disposal costs.
- Phase I of the SLAC Advanced Metering project for electrical and natural gas systems was completed. Phase I included the design of the metering system and purchase of the enterprise software.
- The planning, design, and installation of an advanced water metering system for select buildings, landscape, and process systems were completed.
- The waste diversion rate from construction materials generated during the construction of a new office building, Building 901, achieved a waste diversion rate of 98 percent (563 tons of the 573 tons of non-hazardous waste was able to be recycled offsite).

Additionally, SLAC's progress on the sustainability goals of EO 13423 and EO 13514, including GHG, energy, water, fuel reduction, high performance sustainable building is provided in Section 4.7, *Sustainability*. SLAC's GHG inventory work is also discussed in Section 4.2.2.9.

4 Environmental Non-radiological Programs

4.1 Introduction

During the course of providing accelerators, detectors, instrumentation, and support for national and international research programs, SLAC manufactures and maintains one-of-a-kind research equipment, which requires the use and management of industrial chemicals, gases, and metals. In addition, SLAC has the potential to impact the environment due to storage and handling of chemicals and the large quantities of electricity and cooling water that are used in the operation of the accelerator. Finally, SLAC has environmental management issues relevant for any employer with more than 1,500 full-time staff, 3,000 scientific users per year, hundreds of buildings, and 426 acres of land adjacent to a biological preserve.

SLAC has focused considerable efforts to minimize potential environmental impacts. SLAC works to avoid generating waste and emissions. When unavoidable, SLAC attempts to minimize the amount it does produce and then carefully manages the impacts that may occur. Additionally, SLAC continually strives to increase its environmental performance.

Recent recognition of SLAC's environmental performance accomplishments is provided in Table 4-1.

Table 4-1 Recent Environmental Awards

Year	Organization	Award/Recognition Program	Description
2006	DOE	Pollution Prevention and Environmental Stewardship Accomplishment – Noteworthy Practice	Resource conservation achieved by building experimental facilities with reused materials
2006	DOE	Pollution Prevention and Environmental Stewardship Accomplishment – Best in Class	Instituted the Chemical Management Services which manages chemicals procurement and use
2008	USEPA	Federal Electronics Challenge – Bronze Award	Reducing the environmental impacts of electronics in the purchasing life-cycle phase
2009	USEPA	Federal Electronics Challenge – Bronze Award	Reducing the environmental impacts of electronics in the purchasing life-cycle phase

This chapter provides an overview of the non-radiological environmental programs SLAC implements to protect air and water quality, to manage hazardous materials in a safe and environmentally responsible manner, and to eliminate or minimize the generation of hazardous, non-hazardous, and solid waste. The chapter sections are organized by protection program and describe the regulatory framework, program status for 2010, and relevant performance trends. The environmental radiological program is discussed in Chapter 5, and programs covering the monitoring and remediation of groundwater, soil, and sediment are discussed in Chapter 6.

4.2 Air Quality Management Programs

SLAC operates various sources that emit air pollutants, including a plating shop, a paint shop, several machine shops, boilers, solvent degreasers, backup generators, and a vehicle fueling station. In addition, high-energy physics experiments have the potential to emit volatile organic compounds (VOCs), due to the composition of the gas atmospheres used in particle detectors. Finally, GHGs are used extensively in electrical substations and research equipment, and are being actively managed in response to the passage of

Assembly Bill (AB) 32, the California Global Warming Solutions Act. This section describes the regulatory framework to which SLAC is subject for the purpose of air quality protection, and presents the status of SLAC's air quality protection programs during 2010.

4.2.1 Regulatory Framework

In the San Francisco Bay Area, most federal and state air regulatory programs are implemented through the rules and regulations of the Bay Area Air Quality Management District (BAAQMD). Included in the BAAQMD roles and responsibilities is the implementation of Title V of the Clean Air Act. SLAC's Title V synthetic minor operating permit (SMOP) was issued by BAAQMD on July 26, 2002. The Title V SMOP stipulates limits on facility-wide emissions of VOCs, total hazardous air pollutants (HAPs), and individual HAPs, along with various other requirements. At the state level, the California Air Resources Board (CARB) is responsible for the implementation of AB32, and provides notices, workshops, training, lectures, and other means to disseminate information as it is developed, and solicits input.

Finally, SLAC is subject to the following two federal air quality programs, both of which are administered through the Air Division of USEPA Region 9:

National Emission Standards for Halogenated Solvent Cleaning, under Title 40, Code of Federal Regulations (CFR), Part 63.460

Protection of Stratospheric Ozone, under 40 CFR 82

4.2.2 Program Status

4.2.2.1 Annual Facility Enforcement Inspection

No annual inspection was performed by BAAQMD during 2010.

4.2.2.2 New Source Permits

One new emissions source was permitted in 2010. A 500-kilowatt backup generator was purchased and installed for the SLAC Computing Center. As a result, at the end of 2010, SLAC managed a total of 56 sources of air emissions, comprising 35 permitted sources and 21 exempt sources.

4.2.2.3 Annual Update for Permit-to-Operate and Annual Title V SMOP Emissions Report

SLAC submitted two primary annual deliverables to the BAAQMD. One was the annual information update requested by the BAAQMD for selected permitted sources, and covered CY 2009. This report was submitted on time in April 2010, and SLAC's permit-to-operate was renewed on June 27, 2010, effective through July 1, 2011.

The other BAAQMD deliverable was the Title V annual emissions report for all onsite sources for the SMOP and covered the period of July 1, 2009 through June 30, 2010. SLAC submitted the Title V annual emissions report on time in July 2010.

4.2.2.4 Annual Adhesives Usage Report

SLAC submitted its annual adhesives usage report to BAAQMD to satisfy Regulation 8-51-502.2c on time in April, 2010 (covering the 2009 reporting year).

4.2.2.5 Annual Air Toxics Report

SLAC submitted its annual air toxics report to BAAQMD in accordance with AB2588 on time in April 2010. This report was not required in 2009, but was reinstated as a reporting requirement in 2010.

4.2.2.6 Asbestos and Demolition Project Notification Program

For projects that involve the demolition of existing structures or the management of regulated asbestos-containing material, SLAC is required to provide advance notice to BAAQMD. During 2010, 26 construction projects were evaluated for the purpose of air quality protection. Based on the project scopes and the results of pre-work asbestos surveys, asbestos/demolition/renovation notifications were submitted to BAAQMD for four of these projects.

4.2.2.7 National Emission Standards for Hazardous Air Pollutants

SLAC operates four sources that are subject to 40 CFR 63, Subpart T, "National Emission Standards for Halogenated Solvent Cleaning", part of the National Emission Standards for Hazardous Air Pollutants (NESHAPs) regulations. The deliverables required by EPA are an annual performance report and two semi-annual exceedance reports. For CY 2009, the annual report is consolidated with the second semi-annual report, and was submitted on time in January 2010. The first semi-annual report for CY 2010 was submitted on time in July 2010. The four regulated units (solvent cleaners and degreasers) were operated in accordance with their NESHAPs emissions limits during the covered reporting periods, and no exceedances occurred.

4.2.2.8 Vehicle Fleet Management and Source Testing

SLAC operates, fuels, and maintains a diverse fleet of cars, trucks, and specialized pieces of heavy equipment to support its daily operations. Vehicles are provided by one of two federal agencies: the DOE or the United States General Services Administration. SLAC continues to replace and upgrade its service fleet as resources allow.

Despite its name, the onsite Gasoline Dispensing Facility (GDF) provides multiple fuels for SLAC vehicles, and fuel dispensing is tracked and reported annually to BAAQMD. The permit for this unit requires annual testing of the gasoline dispensing system to ensure proper functioning. A source test was performed on the GDF in September 2010 and all results were within regulatory limits.

To reduce the amount of petroleum-based fuel used at SLAC, in accordance with EO 13423 and EO 13514, in the summer of 2010 SLAC Fleet Services converted the GDF diesel pumping system to dispense an ethanol blend (E85). As such, diesel fuel is now pumped directly into portable trailer-mounted tanks. These tanks are then transported throughout the facility to refuel heavy equipment and stationary engines, such as emergency backup generators.

4.2.2.9 Greenhouse Gas Inventory and Baseline

SLAC compiled its first GHG inventory in 2004. Beginning with CY 2007 as its baseline year, SLAC has been reporting its GHG emissions voluntarily to TCR, an international entity. Between reporting CY 2007 and CY 2008, SLAC GHG emissions decreased more than 40 percent, largely due to the cessation of the SLAC B-Factory detector (BaBar) operations, which accounted for the majority of both the GHGs and electricity, used onsite. GHG emissions for 2009 were comparable to those for 2008, and were validated and reported to the TCR in 2010.

The DOE, in conformance with EO 13514 requirements, also began establishing an agency-wide GHG baseline of its Scope 1 and 2 emissions for FY 2008, using energy and fuel data collected in existing DOE reporting systems. Fugitive emissions data were calculated based on site chemical purchasing data. SLAC is striving to reduce its GHG emissions further in the coming years.

4.3 Industrial and Sanitary Wastewater Management Program

SLAC discharges industrial pollutants and sanitary sewage to the sewage collection system operated by the West Bay Sanitary District (WBSD). The sewage is then conveyed via the WBSD's collection system to the wastewater treatment plant operated by the South Bayside System Authority (SBSA). This section describes the regulatory framework under which SLAC operates for the purpose of water quality protection, and presents the status of SLAC's water quality protection programs in 2010.

4.3.1 Regulatory Framework

The Federal Water Pollution Control Act, also referred to as the Clean Water Act (CWA), was enacted in 1972 to halt the degradation of our nation's waters. The CWA established the National Pollutant Discharge Elimination System, which regulates discharges of wastewater from point sources such as a publicly owned treatment work and categorically regulated industrial facilities such as electroplating shops. In 1987, the CWA was amended to include non-point source discharges such as stormwater run-off from industrial, municipal, and construction activities. The CWA is the primary driver behind the SLAC water quality protection programs.

SLAC operates its industrial and sanitary wastewater programs under a mandatory wastewater discharge permit (WB 061216) which is negotiated jointly with the WBSD and SBSA. The permit, which covers the entire facility, was issued on December 16, 2006, and may be renewed annually until December 15, 2011. SLAC also has a contractual relationship with the WBSD, which specifies the total industrial and sanitary flow allowed to be discharged.

SLAC's industrial and sanitary monitoring locations are shown in Figure 4-1. SLAC's Sand Hill Road flow metering station (Sand Hill flow meter station [FMS]) is located immediately upstream of SLAC's sewer system connection to WBSD's Sand Hill Road trunk line, just to the north of the SLAC main gate.

SLAC also has four flow monitoring stations on the south side of the facility, which collectively monitor the flow SLAC discharges to the WBSD's Alpine Road trunk line. The four locations are the MSub, Alpine Gate, Former Hazardous Waste Storage Area (FHWSA) Treatment System and Interaction Region (IR) 8 (IR08), as shown on Figure 4-1.

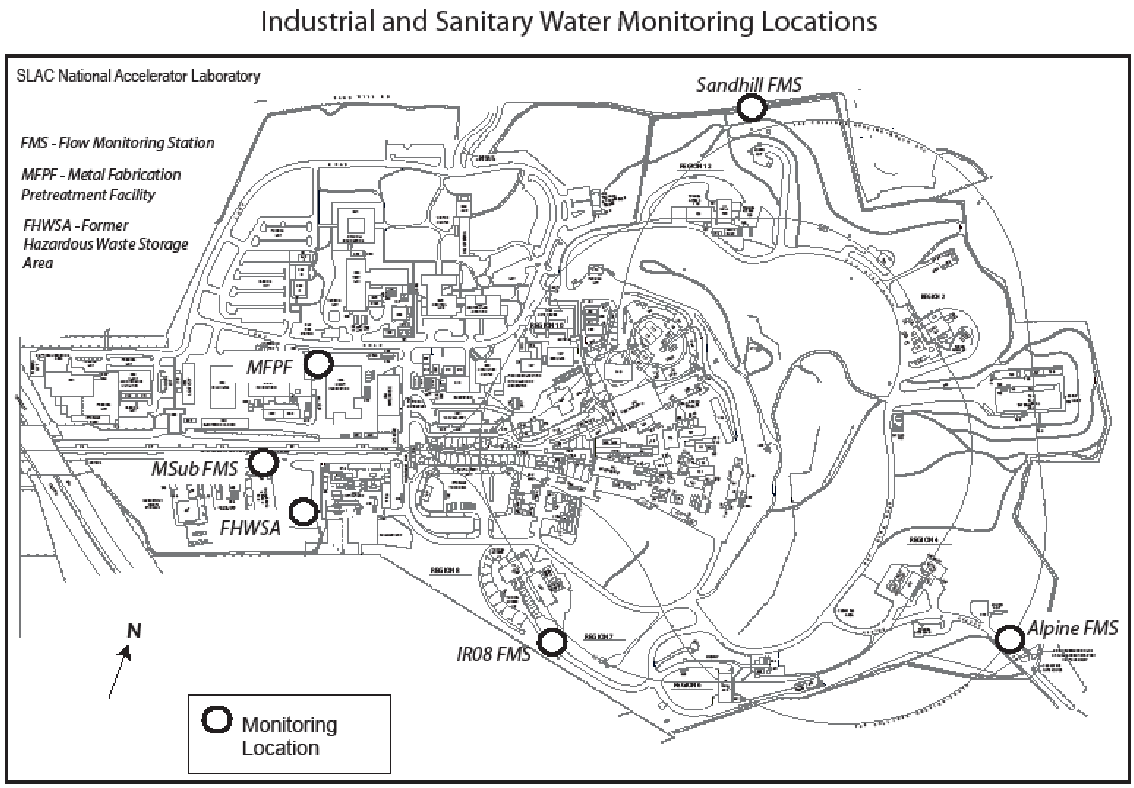

Figure 4-1 Industrial and Sanitary Wastewater Monitoring Locations

SLAC is required to submit a semi-annual self-monitoring report[12] which includes the results of its monitoring of the metal finishing pre-treatment facility (MFPF) and FHWSA Treatment System, certification of a solvent management plan for approximately 100 solvents selected by the SBSA, and reports for discharges of radioactivity in industrial wastewater (see Section 5.5.1).

4.3.2 Program Status

4.3.2.1 Annual Facility Enforcement Inspection

The SBSA conducted the annual facility enforcement inspection on May 20, 2010. No issues were noted.

4.3.2.2 Flow Monitoring Results

Total industrial and sanitary wastewater discharged to the WBSD's regional collection system was approximately 18.7 million gallons, which equates to an average of approximately 51,300 gallons per day (gpd). SLAC was within its discharge entitlement of approximately 23.6 million gallons, or 64,600 gpd.

---

[12] SLAC National Accelerator Laboratory, Environment, Safety, and Health Division, Environmental Protection Department, *Semiannual Self-Monitoring Report and SMP Certification Required Under Mandatory Wastewater Discharge Permit WB 061216* (July 30, 2010, submitted to Norman Domingo, Technical Services Supervisor, SBSA)

SLAC National Accelerator Laboratory, *Semiannual Self-Monitoring Report and SMP Certification Required Under Mandatory Wastewater Discharge Permit WB 061216* (January 30, 20011, submitted to Norman Domingo, Technical Services Supervisor, SBSA)

4.3.2.3 Water Quality Monitoring Results

SLAC collects water quality samples semi-annually from the MFPF and FHWSA monitoring locations. In addition, SBSA collects quarterly samples at the Sand Hill Road FMS and annually at the MFPF. Compliance with the water quality parameters contained in the permit is determined at the Sand Hill Road FMS and FHWSA by comparing the mass discharge limit with the average value of the samples taken over the previous 12 months. Results from the MFPF are compared to daily and monthly maximum concentrations. In 2010 SLAC was in compliance with all permitted discharge limits at all three monitoring locations.

4.3.2.4 Sanitary Sewer Overflow

SLAC filed a Notice of Intent with the State Water Resources Control Board (SWRCB) to comply with the terms of the Statewide General Waste Discharge Requirements for Sanitary Sewer Systems.[13] In August of 2010 the SLAC Sanitary Sewer Management Plan was completed and certified. The Plan includes descriptions of SLAC's sanitary sewer operations and maintenance activities, spill response, and reporting procedures.

SLAC registered with the SWRCB and the San Francisco Bay RWQCB sanitary sewer overflow reporting systems in October 2008. All spills from the sanitary sewer system are reported using the sanitary sewer overflow reporting systems. A Category 1 sanitary sewer overflow is any spill from the sanitary sewer which enters a storm drain channel, is not recovered from the storm drain system, or is greater than 1,000 gallons and must be reported within two hours. A Category 2 sanitary sewer overflow is any spill which is not Category 1 and is reported within 30 days after the end of the month in which it occurred. A no spill certification must be completed within 30 days of a month in which no spills occur. In 2010, SLAC reported one Category 2 spill.

In 2010, SLAC reported a single Category 2 sanitary sewer overflow. The volume of the overflow was approximately 5 gallons and did not enter a storm drain channel.

4.4 Surface Water Management Program

Stormwater flows from the 426-acre SLAC site through 25 drainage channels. In certain areas of the site, stormwater has the potential to come into contact with industrial activities or facilities. Such activities or facilities include metal working, outdoor storage, cooling towers, electrical equipment operation, and secondary containments. Many of the channels drain areas where the stormwater has little or no potential of exposure to industrial activities. SLAC has identified eight monitoring locations which are representative of stormwater discharges associated with industrial activities. These are listed below and shown in Figure 4-2.

- IR-8 Channel (IR-8) and IR-6 Channel (IR-6)
- North Adit East Channel (NAE)
- Main Gate East Channel (MGE)
- IR-2 North Channel (IR-2)
- Building 81 North Channel (B81)
- Buildings 15 and 18

[13] *Statewide General WDRs for Sanitary Sewer Systems*, WQO No. 2006-0003. *Available at* State Water Resources Control Board

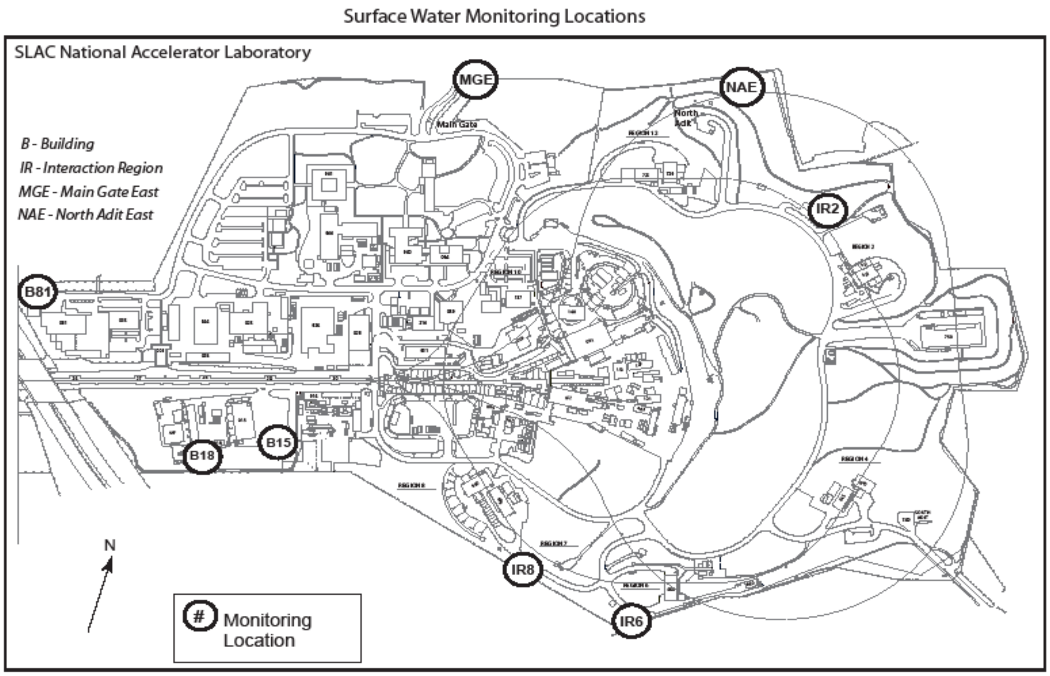

Figure 4-2 Surface Water Monitoring Locations

4.4.1 Regulatory Framework

Federal regulations allow authorized states to issue general permits to regulate industrial stormwater or non-point source discharges. California is an authorized state; and in 1991, the SWRCB adopted the industrial activities stormwater general permit, with the goal of reducing water pollution by regulating stormwater discharges associated with industrial activities. SLAC filed a notice of intent to comply with the general permit.

California's general permit was re-issued in 1997. SLAC adheres to the requirements of the general permit, through its development and implementation of a stormwater pollution prevention plan (SWPPP).[14] The SWPPP has two main components: a stormwater monitoring program (SWMP) and a best management practice (BMP) program.[15] The SWMP presents the rationale for sampling, lists the sampling locations, and specifies the analyses to be performed. The BMPs include a list of 17 generic and site-specific practices that serve to minimize the impact on stormwater from SLAC's industrial activities (see Section 4.4.2.2).

---

[14] Stanford Linear Accelerator Center, Environment, Safety, and Health Division, Environmental Protection and Restoration Department, *SLAC Stormwater Pollution Prevention Plan* (SLAC-I-750-0A16M-002)

[15] Stanford Linear Accelerator Center, Environment, Safety, and Health Division, Environmental Protection Department, "Stormwater", http://www-group.slac.stanford.edu/esh/groups/ep/water/stormwater/

4.4.2 Program Status

4.4.2.1 Water Quality Monitoring Results

SLAC's SWMP incorporates all general permit sampling and analysis requirements, such as frequency (samples collected from first storm of season and one additional storm), locations (samples collected from locations where stormwater comes into contact with industrial activities), analytes (SLAC analyzes for five metals and nine non-metal analytes), and sampling methodologies.

The general permit's definition of wet season runs from October 1 through May 31. This reflects SLAC's climatological conditions, as rain rarely falls during June through September. Since the general permit's definition of wet season spans two calendar years, the 2010 water quality monitoring results discussed below are for the 2010–2011 wet season (October 2010 through May 2011).

The general permit requires submission of an annual report on stormwater activities by July 1, following the May 31 close of the wet season.[16] SLAC met all sampling and analysis requirements in its SWMP and delivered its annual report, which included all water quality monitoring results, to the RWQCB.

Automated samplers are located at each of the stormwater monitoring sites. The samplers are triggered by rain gauges and level sensors. Samples are collected during the first storm event at each location and one other event during the rainy season. During the wet season of 2010-2011, 16 samples (two samples per location) were collected during four storm events.

The general permit requires analysis of stormwater samples for four parameters (pH, total suspended solids, specific conductance, and total organic carbon), and any other potential pollutants, identified by the facility, which may be present in the stormwater in significant quantities. During the wet season of 2010-2011, stormwater samples were analyzed for the four required parameters as well as seven additional parameters (Table 4-5). The additional parameters were selected after a review of SLAC's industrial activities and the results of previous sampling events.

SLAC reviews and compares the analytical results with previous sampling data, background levels and the SWRCB developed parameter benchmark levels (PBVs).[17] PBVs are not regulatory discharge limits, rather, they are meant to be used as guidance. The majority of the sample results from the wet season of 2010-2011 were below PBVs. At several of the discharge locations, specific conductance, aluminum, iron, zinc, copper, and total suspended solids were present at levels above PBVs. SLAC continues to investigate potential sources of these analytes to assist in the implementation of effective BMPs.

Table 4-2 Stormwater Parameters Analyzed

Metals	Non-Metals
Aluminum	Total Suspended Solids
Copper	Total Organic Carbon
Iron	pH
Lead	Specific Conductance
Zinc	Polychlorinated Biphenyls
	Radioactivity

[16] SLAC National Accelerator Laboratory, Environment, Safety, and Health Division, Environmental Protection Department, *2010–2011 Annual Stormwater Report* (30 June 2011), San Francisco Bay RWQCB)

[17] State of California, State Water Resources Control Board, *Sampling and Analysis Reduction Certification* (no date), http://www.swrcb.ca.gov/stormwtr/docs/smanlrdc.doc

4.4.2.2 Stormwater Management Improvements

BMPs are implemented at SLAC to reduce the potential for stormwater to come into contact with industrial activities. The BMPs are one component of an environmental management system that includes planning, implementing, checking, and improving performance.

BMP and surface water program-related initiatives during 2010 included the following:

- Increased preventive maintenance schedule for stormwater protection activities including annual site-wide street cleaning and catch basin cleanouts
- Increased storm drain channel maintenance conducted by the landscaping contractor
- The EP Department staff provided oversight of the SWPPP implementation at the DOE Indefinite Delivery /Indefinite Quantity (ID/IQ) contractor remediation sites
- The EP Department collected additional stormwater samples from selected locations across the facility to determine sources of stormwater constituents

4.5 Hazardous Materials Management

SLAC uses hazardous materials as part of its experimental programs including the manufacturing and maintenance of experimental devices; as well as in conventional facilities operations, maintenance and construction projects. Examples of hazardous materials managed at SLAC include the following:

- Cryogens
- Compressed gases
- Acids and bases
- Solvents
- Oils and Fuels, including Propane
- Adhesives
- Paints and epoxies
- Metals

Hazardous materials management spans numerous programs; but the purpose remains the same: to ensure the safe handling of hazardous materials in order to protect workers, the community, and the environment.

4.5.1 Regulatory Framework

The regulatory framework for hazardous materials regulations, especially in California, has historically been a complex and overlapping web of statutes and regulations. Some of the most important regulatory drivers at the federal level include Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA) also referred to as the Emergency Planning and Community Right-to-Know Act (EPCRA) which focuses on community safety, the Occupational Safety and Health Act (1970) addressing worker safety, the Hazardous Materials Transportation Act whose purpose is to ensure the safe transport of hazardous materials in commerce and the Toxic Substances Control Act (TSCA), the federal statute under which polychlorinated biphenyl (PCB) and asbestos are regulated.

Important drivers at the state level generally date back to the mid-1980s and include hazardous materials business plans (HMBP), the California Accidental Release Program (CalARP), the underground and aboveground storage tank programs, and pollution prevention and waste minimization programs.

In general, the local implementing agency for hazardous materials regulation in California is the California CUPA. The Environmental Health Division of the San Mateo County Health Services Agency is the CUPA responsible for overseeing hazardous materials and waste management at SLAC. A CUPA has broad enforcement responsibilities. Recently, the scope has expanded to include the SWPPP, the SPCC and Waste Tire Survey and Inspections in addition to the following six hazardous material subject areas:

- Hazardous Materials Business Plan/Emergency Response Plan
- Hazardous Waste/Tiered Permitting/Waste Minimization and Pollution Prevention
- Underground Storage Tanks
- Aboveground Storage Tanks (petroleum tanks only)
- California Accidental Release Program
- California Fire Code Hazardous Materials Management Plan (Section 2701.5.1 and 2701.5.2)

4.5.2 Program Status

Discussed in the following sections are the status of SLAC's 2010 programs related to hazardous materials life-cycle management, including its hazardous materials business plan, toxics release inventory (TRI), and CalARP programs. Also discussed are SLAC's above ground storage tanks program and its PCBs management program under TSCA.

4.5.2.1 Annual Facility Enforcement Inspections

The San Mateo County CUPA inspected SLAC May 24 through 27, 2010. There were no violations or findings in the Hazardous Materials program portion.

4.5.3 Hazardous Materials Business Plan Program

The EPCRA, passed in 1986 as Title III of the SARA, establishes requirements for emergency planning, notification, and reporting. In California, the requirements of SARA Title III are incorporated into the state's Hazardous Materials Release Response Plan and Inventory Law, more commonly referred to as the HMBP program.

For the 2010 reporting year, SLAC updated its HMBP and submitted it to the San Mateo County CUPA. The HMBP includes the Hazardous Materials Inventory Statement (HMIS). The inventory consists of all hazardous materials present at SLAC in amounts exceeding the state's aggregate threshold quantities (55 gallons for liquids, 500 pounds (lbs) for solids, and 200 cubic feet for compressed gases) on a building-by-building basis. It includes hazardous materials in storage as well as hazardous waste, oil-filled equipment, process and bulk tanks, and lead/acid batteries. A portion of the hazardous materials inventory is based on procurement data generated through the CMS. The hazardous waste inventory is based on the database maintained by the WM Group. Mixed waste and radioactive materials data are provided by the RP Department. Inventory of process and bulk tanks are part of the SLAC property and building databases. The CMS maps are used to indicate storage area locations. The plan also includes the SLAC *Consolidated Chemical Contingency Plan*.[18] This plan combines the emergency response requirements for the following programs:

- Hazardous Materials Business Plan
- Hazardous Waste Contingency Plan
- Spill Prevention Control & Countermeasure Plan
- Risk Management Plan

---

[18] SLAC National Accelerator Laboratory *Consolidated Chemical Contingency Plan* (SLAC-I-730-3A86H-008-R002)

4.5.4 Toxics Release Inventory Program

Under EO 13423, "Strengthening Federal Environmental, Energy, and Transportation Management", the DOE requires its facilities to comply with the Toxic Chemical Release Reporting and Community Right-to-Know requirements (40 CFR 312), more commonly referred to as the TRI program. SLAC annually provides the required information to the DOE, which reviews and sends the TRI information to the USEPA.

The TRI report is submitted to the USEPA in June each year and reports quantities from the previous calendar year. The report submitted in June 2010 covered CY 2009. Of the more than 400 listed TRI chemicals, only two, lead and copper, are used at SLAC in excess of their respective regulatory threshold criteria. As a result, SLAC prepared TRI forms for lead and copper and submitted them to the DOE SLAC Site Office (SSO) in June 2010. Of the metals removed offsite, roughly one fourth of the lead and three fourths of the copper were able to be recycled. TRI data are available to the public via the EPA website.

4.5.5 California Accidental Release Prevention Program

SLAC has only one regulated chemical in excess of the CalARP threshold: potassium cyanide, which is used only in the Plating Shop complex. Spent plating baths containing cyanide are stored temporarily at the Chemical Hazardous Waste Management Area pending transport for offsite disposal. As such, a Risk Management Plan (RMP) was prepared and submitted to the CUPA.

Because the worst-case scenario for a release of potassium cyanide does not generate offsite consequences, a more detailed process hazard assessment and an offsite consequence analysis were not required. The final Program 1 RMP for SLAC was submitted to the CUPA in 2006 and finalized in 2008 after a public comment period.

4.5.6 Aboveground Storage Tank Program

Aboveground Storage Tanks (ASTs) are regulated under the authority of the CWA and California's Aboveground Petroleum Storage Act. A listing of ASTs containing petroleum at SLAC during 2010 is presented in Table 4-6. All of the petroleum tanks at SLAC are constructed of steel. Each tank is either double-walled, or has a cinder-block or poured concrete containment basin surrounding the tank base.

An SPCC plan is required by 40 CFR 112 for all petroleum-containing ASTs greater than 660 gallons in size. The SLAC SPCC plan[19] was revised in 2008 to ensure it was in compliance with 40 CFR 112 Final Rule prior to its enactment.

SLAC did not have any underground storage tanks in operation during 2010.

Table 4-3 Aboveground Petroleum Tanks

Petroleum Product	Property Control Number	Location	Capacity (gallons)
Diesel	19683	B112 Master Substation	2,000
Gasoline/E85	21443	B035 Vehicle Refueling Station	1,500/500
*Vacuum Oil	19596	B020 North Damping Ring	500
Diesel	22658	B082 Fire Station	500

19 Stanford Linear Accelerator Center, Environment, Safety, and Health Division, Environmental Protection Department, *Spill Prevention, Control, and Countermeasures Plan* (SLAC-I-750-0A16M-001-R003), https://www-internal.slac.stanford.edu/esh/documents_internal/SPCC.pdf

Petroleum Product	Property Control Number	Location	Capacity (gallons)
Diesel	19781	B505A Generator Fueling	500
Diesel	21287	B007 MCC Generator Fueling	500
*Vacuum Oil	19595	B021 South Damping Ring	300
X-ray Oil	15192	B044 Klystron Test Lab	364/227/227
Compressor Oil	None	B127 Cryogenics	200
Compressor Oil	18562	B127 Cryogenics	200
Diesel	Non	B756 SLD Generator Fueling	500

* These tanks are used only for short-term storage

4.5.7 Toxic Substances Control Act Program

The objective of TSCA is to minimize the exposure of humans and the environment to chemicals introduced by the manufacturing, processing, and commercial distribution sectors. One portion of TSCA regulates equipment filled with oil or other dielectric fluids that contain PCBs.

TSCA regulations are administered by the USEPA. No USEPA inspections regarding TSCA were conducted at SLAC during 2010.

One oil-filled transformer at K10 was installed at SLAC during 2010, bringing the total number of oil-filled transformers at SLAC to 107. Transformers with PCB concentrations equal to or greater than 50 parts per million (ppm) but less than 500 ppm are defined by TSCA as PCB-contaminated transformers. Only ten of the oil-filled transformers are PCB-contaminated. SLAC has no PCB transformers (transformers with concentrations of PCB equal to or greater than 500 ppm). The total quantity of PCBs contained in the 107 transformers currently in service is estimated to be approximately 20 lbs.

4.5.8 Chemical Management System

SLAC has been purchasing chemicals solely through Haas *tcm* (Haas) since August 2005 under its CMS. Haas provides sourcing, purchasing, expediting, and vendor management support for all non-radioactive chemicals and gases used by SLAC.

The key objectives of the CMS program at SLAC are to:

- Reduce SLAC's chemical and gas cost through vendor leveraged buying power
- Reduce SLAC's risk and space requirements associated with storing, managing and handling chemicals
- Reduce time spent by SLAC researchers and other personnel on sourcing, ordering and tracking chemicals

By the end of calendar year 2010, the program has achieved the following:

- 3,919 active chemicals were in the catalogue.
- Approximately 49 items in vendor-owned inventory stocked for just-in-time delivery. This is a slight decrease from last year. Most chemicals are not used routinely and are ordered on request.
- There were 482 users of the CMS system.
- Purchase order cycle time continues to be less than half a business day on average

SLAC's CMS program continues to meet or exceed performance goals.

4.6 Waste Management and Minimization

During the course of its research operations, SLAC generates a variety of waste streams, including hazardous waste, and non-hazardous wastes, the latter including industrial waste, municipal solid waste, and scrap metal.

4.6.1 Hazardous Waste Management and Minimization

4.6.1.1 Regulatory Framework

SLAC is a 90-day hazardous waste generator. SLAC does not have a Resource Conservation and Recovery Act (RCRA) Part B permit that would allow it to treat hazardous waste, store it on site, and/or dispose of it on site (that is, a treatment, storage, and disposal facility permit) under the federal-level RCRA regulations. SLAC does have permits to treat a few RCRA-exempt and non-RCRA (that is, California-only) hazardous waste streams (see Section 4.6.1.2 regarding the state-level tiered permit program).

The USEPA has delegated authority to the state of California for implementing the federal RCRA program. In turn, the state has delegated its authority for certain aspects of hazardous waste program oversight to the local CUPA; the San Mateo County Health Services Agency, Environmental Health Division, serves as the CUPA with delegated authority to oversee SLAC's hazardous waste management.

4.6.1.2 Hazardous Waste Treatment: Tiered Permitting Program

The five tiers of California hazardous waste permits, presented in order of decreasing regulation, are the full permit, standard permit, *permit by rule*, *conditional authorization*, and *conditional exemption. S*LAC operates a total of four hazardous waste treatment units, all under permit by rule. These units are authorized to treat listed or characteristic hazardous wastes. The various units and tiered permit level are summarized in Table 4-4.

Table 4-4 Hazardous Waste Treatment Units Subject to Tiered Permitting

Tiered Permit Level	Unit Number	Location/Description
Permit by rule	Unit 1A	Cyanide Treatment Tanks
Permit by rule	Unit 1B	Metal Finishing Pre-treatment Facility
Permit by rule	Unit 1C	Batch Hazardous Waste Treatment Tank
Permit by rule	Unit 2	Metal Finishing Pre-treatment Facility – Sludge Dryer

4.6.1.3 Hazardous Waste Tracking

SLAC utilizes a self-developed, site-specific computerized hazardous waste tracking system (WTS). Hazardous waste containers are tracked from the time they are issued to the generator to eventual disposal off-site. The WTS includes fields that generate information for the biennial SARA Title III, TRI, and TSCA PCBs annual reports.

4.6.1.4 Hazardous Waste Minimization

SLAC's hazardous waste generation rates have been reduced through a combination of waste minimization and pollution prevention techniques, including the following:

- Reducing generation of excess chemicals through CMS
- Converting empty metal containers and drums to scrap metal

- Exchanging chemicals with other users
- Reclassifying waste streams to reduce hazardous waste volumes
- Reusing chemicals
- Returning unused material back to the vendor or manufacturer
- Sending electrical equipment off site for reuse by other organizations

SLAC continues to make progress in reducing hazardous waste generated from routine operations, as shown in Figure 4-3. Routine wastes are those wastes associated with SLAC's routine operations and maintenance processes. For 2010, SLAC reduced its hazardous waste from routine operations by 90 percent from the 1993 baseline of 147 tons. The increase in waste reduction from FY 2008 through FY 2010, compared to FY 2007, is due to accounting for wastes that were able to be recycled, such as waste oils. Measures will continue to be taken to further reduce hazardous waste by helping smaller generators increase their awareness of waste reduction opportunities, helping them select less hazardous chemicals, and helping them learn to develop for themselves more focused waste reduction measures for their work areas.

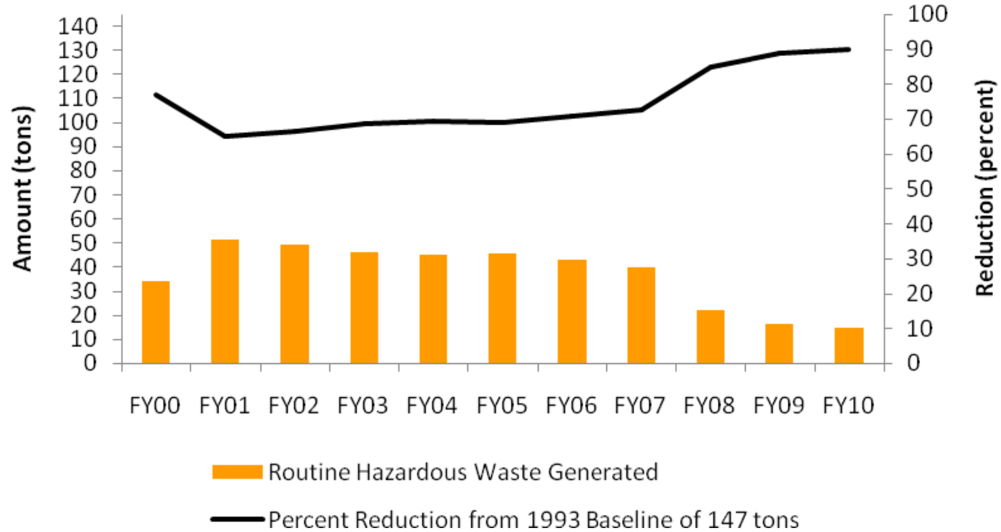

Figure 4-3 Routine Hazardous Waste Generation, 2000-2010

4.6.2 Non-Hazardous Waste Management and Minimization

Non-hazardous waste can be grouped into non-hazardous industrial waste and municipal solid waste.

4.6.2.1 Non-hazardous Industrial Waste Management

In addition to its hazardous waste management program, SLAC also operates various projects that involve disposal of non-hazardous waste classified as either non-hazardous industrial or regulated waste. SLAC's WM Group manages industrial waste resulting from SLAC's laboratory operations and remediation operations that, while not classified as hazardous, is not sufficiently "clean" to be disposed of in a municipal or sanitary solid waste landfill. Examples of industrial wastes include soils contaminated with low levels of petroleum hydrocarbons, PCBs or metals that are classified as non-hazardous but are not acceptable for disposal at municipal landfills. In California, industrial wastes are generally termed *Class 2* waste since they are specifically required to be disposed of at Class 2 landfills (these provide an intermediate level of protection to the environment between *Class 1*, hazardous waste landfills and *Class 3*, municipal solid waste landfills).

4.6.2.2 Municipal Solid Waste Management

SLAC's Facilities Department operates a municipal solid waste program that collects a variety of recyclable materials as well as regular dumpster refuse. SLAC's Property Control Department operates a salvage operation that sells metal and other industrial recyclables and equipment for their cash value.

The term *municipal solid waste* refers to the following waste streams generated at SLAC:

- Beverage containers (glass, aluminum, plastic)
- Paper (white paper, mixed paper)
- Cardboard
- Wood
- Scrap metal
- Garden/landscaping waste
- Construction debris (soil and miscellaneous non-hazardous construction and demolition debris)
- Universal (fluorescent light bulbs and mercury-containing equipment) and electronic wastes including cathode ray tubes
- Batteries (automotive and common [AA, AAA, C, D, nickel-cadmium, other] batteries)
- Salvage sales and transfers
- Office materials (toner and inkjet cartridges)
- Cafeteria wastes
- Tires
- Trash not otherwise sorted at the source and placed into dumpsters

A site-wide program that recycles mixed paper, beverage containers (glass, aluminum, and plastic), cardboard, and scrap wood has been fully operational for more than 15 years. Collection stations are strategically distributed around the site with each station incorporating anywhere from one to a dozen green containers. Dumpsters for cardboard collection are strategically placed around the site and a specific location is provided for waste wood and non-hazardous construction and demolition debris. Scrap metal and electronic waste is collected and construction materials from building demolition and rehabilitation projects are also recycled. For 2010, SLAC recycled 69 percent of its municipal solid waste. This is up from 63 percent from the previous fiscal year in large part due to a high quantity of construction materials recycled during construction of a new office building (i.e., Building 901). The contributions of the various waste streams being recycled are shown in Figure 4-4.

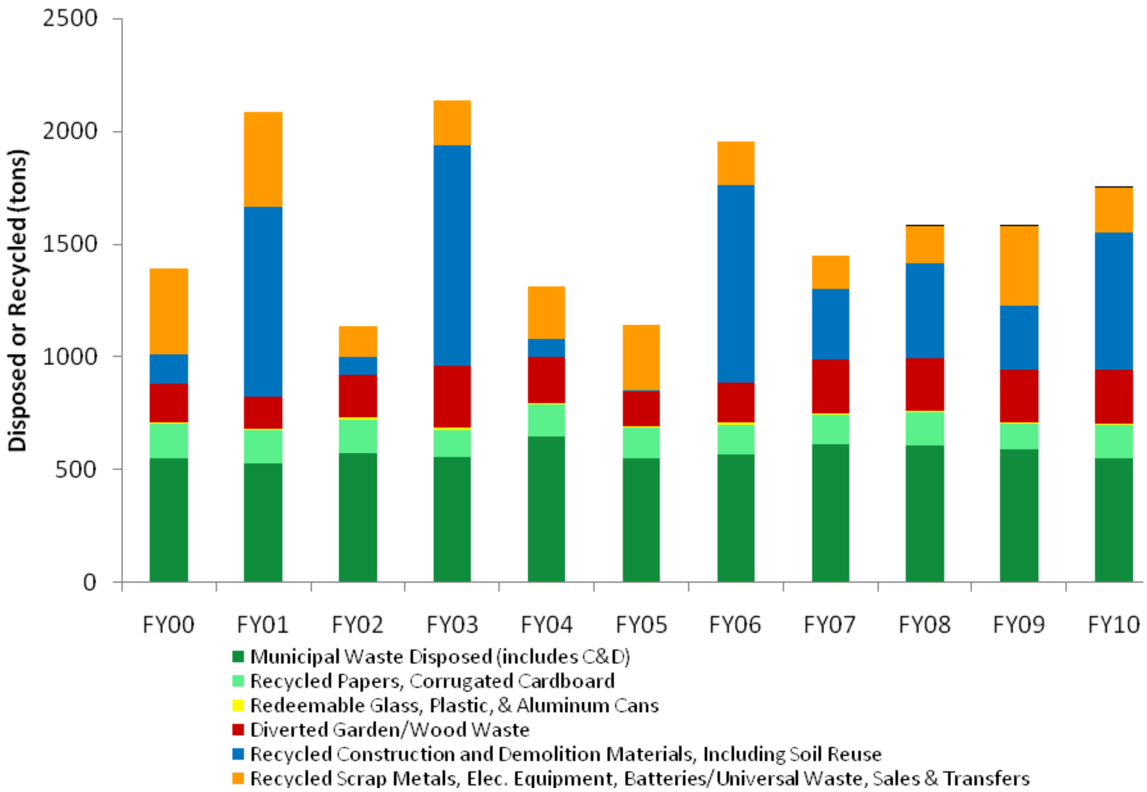

Figure 4-4 Municipal Solid Waste Recycling and Disposal, 2000–2010

4.6.3 Other Waste Management Activities

SLAC generates a small quantity of low-level radioactive waste every year; this waste stream is discussed in Chapter 5.

SLAC generates a small quantity of medical waste from the on-site Medical Department. In California, the state Medical Waste Management Act requires proper storage, treatment, and disposal of medical waste. The state program is administered by the California Department of Health Services.

4.7 Sustainability

SLAC's *Site Sustainability Plan*[20], formerly called the *Executable Plan*, summarizes SLAC's planned actions and performance status on the sustainability goals derived from EO 13423 and EO 13514, as adopted by DOE in their *Strategic Sustainability Performance Plan (SSPP)*[21].

A core part of SLAC's Environment, Safety and Health Policy is to "wisely use and conserve natural resources and conduct our activities in a sustainable manner. The EO and DOE SSPP goals and associated DOE Orders 430.2B and 450.1A complement SLAC's values on sustainability and provide quantifiable objectives and timeframes, consistent over the federal complex.

[20] SLAC National Accelerator Laboratory, "Site Sustainability Plan 2010", dated December 16, 2010.

[21] U.S. Department of Energy, "Strategic Sustainability Performance Plan", dated September 2010.

4.7.1 Progress on Sustainability Goals

Included below is a summary of progress on key sustainability goals, in the key areas of energy, GHG, water, sustainable building, fuel/fleet, and waste, as reported in SLAC's *Site Sustainability Plan*.

Table 4-5 Progress Against Select Sustainability Goals of EO 13423/13514 and the DOE SSPP through FY 2010

Category	EO 13423/13514 Goal	Progress
Energy Reduction	Reduce energy intensity 3 percent/year or 30 percent by FY 2015 relative to FY 2003 baseline.	SLAC has reduced its energy intensity by approximately 5 percent from a FY 2003 baseline through energy management of conventional systems. When savings from high energy mission specific facility (HEMSF) and conventional systems due to Positron Electron Project (PEP) II and BaBar shutdown are included, the reduction in energy intensity is 60 percent.
Renewable Energy	Implement at least one on-site renewable energy generating system by FY 2010.	Building 901, completed in FY 2010, was constructed with an 18.8 kilowatt roof-mounted photo-voltaic system.
	Procure 7.5 percent of the site's annual electricity consumption from renewable sources by FY 2010.	Renewable Energy Certificates (RECs) are being purchased equivalent to 7.5 percent of annual energy.
Greenhouse Gas Reduction	Reduce Scope 1 & 2 GHG 28 percent by FY 2020 from an FY 2008 baseline	SLAC has reduced Scope 1 & 2 GHG by 43 percent in FY2010 from an FY 2008 baseline. This was due in large part to reduced electrical demand as a result of the completion of the BaBar Experiment in FY 2008.

Category	EO 13423/13514 Goal	Progress
Water Reduction	Reduce potable water consumption intensity 2 percent per year through 2020 or 26 percent by 2020 relative to the FY 2007 baseline and reduce industrial, landscaping, and agricultural water consumption by 2 percent a year through FY 2020 or 20 percent by FY 2020 relative to the FY 2010 baseline	Leaking hot water, chilled water and landscaping water pipes have been repaired resulting in a significant reduction in water intensity. The total site water usage has decreased by over 40 percent from the FY 2007 baseline. Some of this was due to the BaBar experiment completion and associated reduction in makeup water for cooling towers. This reduction was difficult to quantify without sub meters in place. Sub meters were installed in FY 2010. New controllers have been installed on all landscaping circuits to enable further water consumption reduction efforts. Water meters have been installed on all landscaping circuits in order to establish a baseline and measure progress. All cooling tower make up circuits now have water meters installed.
Sustainable Building	All new construction and major renovation greater than $5 million to be Leadership in Energy and Environmental Design (LEED) Gold certified. Meet high performance and sustainable building (HPSB) guiding principles if less than or equal to $5 million.	Building 901, completed in FY 2010, received LEED Gold certification. Building 052 and Building 053 new construction, and Building 028 and Building 041 renovation are being designed to meet LEED Gold standards.
	15 percent of buildings larger than 5,000 gross square feet to be compliant with the five guiding principles of HPSB by FY 2015	In FY 2009, an assessment of 31 existing buildings was completed to identify candidates and needs for meeting the existing building goals. All new construction and renovations less than or equal to $5 million are reviewed by the SLAC Energy Manager for compliance with HPSB.
Petroleum Fuel Reduction	10 percent annual increase in fleet alternative fuel consumption by FY 2015 relative to a FY 2005 baseline.	The SLAC fuel station was converted to dispense E-85 Ethanol in July 2010. In FY 2010 SLAC dispensed 300 gallons (estimated) of E85, Ethanol alternative fuel.
	2 percent annual reduction in fleet petroleum consumption by FY2015 relative to a FY 2005 baseline.	SLAC has reduced fuel consumption by 9.3 percent for FY 2010 relative to a FY2005 baseline.

Category	EO 13423/13514 Goal	Progress
Waste Reduction	Divert at least 50 percent non-hazardous solid waste (excluding construction and demolition (C&D) debris). Divert 50 percent of C&D materials by FY 2015.	In FY 2010, SLAC diverted 53 percent of its non-hazardous solid waste (excluding C&D debris). In FY 2010, SLAC diverted 98 percent of the C&D debris generated from the Building 901 construction project.
Electronics Stewardship	Establish and implement policies to enable power management, duplex printing, and other environmentally preferable features; Implement best management practices for energy-efficient management of servers and Federal data centers	SLAC received a 2009 and 2010 bronze level award from the Federal Electronics Challenge for performance and accomplishments in FY 2008 and FY 2009 in the area of Acquisition & Procurement A new Data Center is being planned that will be a joint venture between SLAC and the University. This Data Center design will target a Power Usage Effectiveness (PUE) of 1.3.

4.8 Environmental Planning

SLAC's scientific and support facilities were constructed under a clearly conceived planning framework established in the site's original general development plan (1961) and master plan (1966). For over four decades, SLAC facilities expanded within this original framework, but over the years, many small support and storage buildings and more parking demands have crowded the core research areas and obscured the original circulation plan. To meet the challenges of constructing major new projects in this constricted and environmentally sensitive location, SLAC employs the NEPA analyses on a project-by-project basis.

4.8.1 SLAC Long Range Development Plan

In December 2002, SLAC published its LRDP, the result of both SLAC's LRDP Working Committee and the professional land use, environmental, and campus planners from the Stanford University Architect and Planning Office. The most recent revision of the LRDP was completed in 2010.

The LRDP encourages the gradual replacement of small, outdated structures with more efficient and well-planned development. The plan includes a series of diagrams that overlay planned structures and circulation systems with environmental constraints to intelligently guide the location of future projects. Environmental factors considered in developing the plan include the following:

- Geology and seismicity
- Topography
- Sedimentation and erosion potential
- Hazardous materials
- Considerations of site locations relative to sensitive receptors
- Flooding and wetlands

- Habitat and species protection
- Visual character of SLAC

4.8.2 National Environmental Policy Act

SLAC developed its NEPA program in 1992, and it is jointly administered by the DOE and the EP Department. Under this program, proposed projects and actions are reviewed to evaluate NEPA documentation requirements, as required. The EP Department works in conjunction with the DOE SSO and the NEPA Compliance Officer to determine which of the following three categories of NEPA documentation, presented in increasing order of complexity, is required:

- Categorical exclusion (CX)
- Environmental assessment (EA)
- Environmental impact statement (EIS)

Environmental aspects that must be considered when scoping and preparing NEPA documentation commonly include potential increases in air emissions or hazardous materials usage; waste generation; impacts on wetlands, sensitive species, and critical habitats; and increases in water consumption and wastewater discharge.

SLAC prepared and reviewed NEPA documentation for thirty three projects during 2010. The projects were relatively minor in scope and environmental impact. The projects were each assigned a CX reference number. Completed NEPA documents are forwarded to the DOE SSO and the NEPA Compliance Officer located at the Integrated Support Center, Oak Ridge Office, if necessary, for review and approval.

5 Environmental Radiological Program

5.1 Introduction

All members of the public receive radiation doses from natural background radiation and from an assortment of human activities. This chapter describes sources of radiation and radioactivity at SLAC and provides an overview of how SLAC's Radiological Environmental Protection Program assesses direct radiation and radioactivity in water, air, and soil for the purpose of determining the potential radiation dose to the public and impacts to the environment.

As in past years, the dose that members of the public receive due to SLAC operations is a small fraction of the dose received from natural background radiation in CY 2010. In addition, the potential radiation dose to the public and the radiation-related impacts to the environment from SLAC operations were significantly below all regulatory limits.

5.2 Sources of Radiation and Radioactivity

The 2-mile-long linac at SLAC is encased in a concrete tunnel 25 feet beneath the surface of the ground. Through this underground tunnel, beam particles are accelerated to nearly the speed of light.

Some beam particles strike accelerator components during the acceleration process. When that happens, the decelerating particles may emit secondary radiation in the form of high-energy photons and neutrons. This secondary radiation is present whenever beam particles are accelerated and lost, but that ceases as soon as power to the accelerator is terminated.

The secondary radiation may also make the substances they strike become radioactive. Table 5-1 lists the predominant radioactive elements produced in water or air and their half-lives.

Facilities at SLAC are designed to meet all applicable safety and environmental requirements. Nearly all direct radiation is stopped by the combined shielding on the accelerator structure and the ground or thick concrete walls that surround the accelerator tunnel. SLAC monitors the small fraction of photons and neutrons that pass through the accelerator components, through the surrounding earth or walls, to reach areas outside of the accelerator housing. This direct-radiation monitoring is described in Section 5.3.

SLAC also assesses, measures, and reports on radioactivity as required by its policies and by state or federal regulations. Sections 5.4 through 5.6 and 5.9 describe SLAC's programs to assess and control radioactivity that can be released into the environment. All known releases of radioactive materials are included in the tables in those sections.

Table 5-1 Activation Products in Water or Air

Radioactive Element	Half-life	Primarily Produced In
Oxygen (^{15}O)	123 seconds	Water or air
Nitrogen (^{13}N)	10.0 minutes	Air
Carbon (^{11}C)	20.3 minutes	Water or air
Argon (^{41}Ar)	1.8 hours	Air
Beryllium (^{7}Be)	53.6 days	Water
Hydrogen (^{3}H)	12.3 years	Water

^{3}H = tritium

5.3 Monitoring for Direct Radiation

DOE regulations (10 CFR 835) require SLAC to demonstrate that radiation and radioactivity from SLAC did not cause any member of the public to receive a radiation dose greater than 100 millirems (mrem, a unit used to quantify radiation dose to humans) during the year[22]. In CY 2010, the maximum dose that could have been received by a member of the public due to direct radiation from SLAC was less than 0.13 mrem (1.3×10^{-3} milli-Sievert (mSv)), which is the International System of units for dose equivalent). This is 0.13 percent of the 100 mrem regulatory limit. This Maximally Exposed Individual (MEI) is located near the buildings just north of SLAC's northern boundary, near Buildings 35 and 81 of SLAC.

During CY 2010, SLAC measured direct radiation at 43 locations around the SLAC site boundary to determine the potential radiation dose to a member of the public. Readings from these site-boundary dosimeters used to measure radiation were recorded each calendar quarter. The annual doses from these dosimeters were used to estimate the doses to the MEI based on continuous occupancy of 24 hours a day, 365 days per year. Landauer Incorporated, accredited by the DOE's Laboratory Accreditation Program and National Voluntary Laboratory Accreditation Program as a dosimeter supplier, provided and processed the dosimeters. Results from these dosimeters were also used to calculate the collective dose to the population (about 5 million) that lives within 80 kilometers (km) (50 miles) of SLAC, which was 0.012 person-rem for CY 2010.

Section 5.8 and Table 5-6 summarize annual doses to the MEI from both direct radiation (0.13 mrem) and airborne radioactivity (0.00086 mrem) and show how those doses compare with those from natural background radiation.

5.4 Assessment of Airborne Radioactivity

As required by 40 CFR 61 Subpart H, SLAC files an annual report to the EPA that describes the possible sources, types, and quantities of airborne radioactivity released into the atmosphere[23]. As detailed below, the resulting dose to the MEI of the off-site general public from CY 2010 releases of airborne radioactivity was 0.00086 mrem (8.6E-6 mSv) This is well below the regulatory limit which requires releases to be limited so that no member of the public receives a dose in excess of 10 mrem (0.1 mSv) in any one year[24]. In addition, there is no individual release point within SLAC facilities exceeding the 0.1 mrem/year (yr) (0.001 mSv) limit for the continuous monitoring requirement (the maximum value was 5.9E-4 mrem/yr

[22] United States Department of Energy, 10 CFR 835, "Occupational Radiation Protection," http://www.hss.energy.gov/healthsafety/wshp/radiation/rule.html

[23] SLAC National Accelerator Laboratory, Environment, Safety, and Health Division. Radiation Protection Department, *Radionuclide Air Emissions Annual Report – CY2010* (May 2011)

[24] United States Department of Energy, DOE Order 5400.5, "Radiation Protection of the Public and the Environment," http://www.directives.doe.gov/pdfs/doe/doetext/oldord/5400/o54005c2.html

from the LCLS Undulator release point). The collective effective dose equivalent to the population within 80 km of SLAC's site boundary (estimated 5 x 10^6 persons) due to releases of airborne radioactivity at SLAC in CY 2010 was calculated to be 0.0061 person-rem.

Based on these conservative estimates, the Effective Dose Equivalent (EDE) to the MEI of the off-site general public due to releases of airborne radioactivity at SLAC in CY 2010 was 0.00086 mrem (8.6E-6 mSv). This is well below the regulatory limit which requires releases to be limited so that no member of the public receives a dose in excess of 10 mrem in any year.

LCLS electron facilities contributed to about 98 percent of the total airborne radioactivity released to the atmosphere from SLAC operations. Approximately 5.7E-4 mrem (or 66 percent) of the 8.6E-4 mrem can be attributed to ^{13}N radioisotope. The MEI location that corresponds to the highest calculated EDE for releases in CY 2010 is at the east end of SLAC.

The maximum dose from a single release point is 5.9E-4 mrem/yr (from the LCLS Undulator release point), which is less than the 0.1 mrem/year limit for continuous monitoring requirement.

As detailed in the annual NESHAPs report, the released airborne radioactivity was calculated, based on conservative information about accelerator operations in CY 2010. Table 5-2 summarizes the released radioactivity, showing the quantities in curies (Ci). Potential doses to members of the public due to the released radioactivity were determined using USEPA software CAP88. In addition to providing information on maximum individual doses, SLAC also assessed and reported the collective dose to the population that lives within 80 km (50 miles) of SLAC, which was 0.0061 person-rem for CY 2010.

Table 5-2 and Table 5-6, as well as Section 5.8, provide a summary of the results and information on how the maximum possible doses compare with natural background radiation.

Table 5-2 Airborne Radioactivity Released in CY 2010

Category	Radioactive Element	Activity (Ci)
Tritium	Hydrogen (^{3}H)	n/a
Krypton-85	Krypton (^{85}Kr)	n/a
Noble gases ($T_{1/2}$ < 40 days)	Argon (^{41}Ar)	0.04
Short-lived activation products ($T_{1/2}$ < 3 hr)	Oxygen (^{15}O)	0.43
	Nitrogen (^{13}N)	0.80
	Carbon (^{11}C)	0.09
Other activation products ($T_{1/2}$ > 3 hr)	n/a	n/a
Total radioiodine	n/a	n/a
Total radiostrontium	n/a	n/a
Total uranium	n/a	n/a
Plutonium	n/a	n/a
Other actinides	n/a	n/a
Total		1.36

n/a – not applicable
$T_{1/2}$ – half life

5.5 Assessment of Radioactivity in Water

Three types of water are monitored for radioactivity at SLAC: industrial wastewater, stormwater, and groundwater. This section summarizes the CY 2010 monitoring and results for each water type.

5.5.1 Industrial Wastewater

Federal and state regulations (10 CFR 20.2003 and 17 CCR 30253) limit the radioactivity in industrial wastewater that SLAC releases to the sanitary sewer system. In CY 2010, SLAC releases 0.24 percent of the applicable limits (only $1.2x10^{-2}$ Ci for tritium).

Throughout the year, SLAC sampled and analyzed wastewater discharges. Total activity released during CY 2010 is summarized in Table 5-3.

As required by regulation, for each quarter of CY 2010, SLAC reported the results of wastewater monitoring and discharge to the SBSA at the end of each calendar quarter[25].

Table 5-3 Radioactivity in Wastewater Released into Sanitary Sewer in CY2010

Category	Radioactive Element	Activity (Ci)	Annual Release Limit (Ci)
Tritium	Hydrogen (^{3}H)	$1.2x10^{-2}$	5
Activation products ($T_{1/2}$ > 3 hr)	Sodium (^{22}Na)	0	1*
	Beryllium (^{7}Be)	0	
Total radioiodine	n/a	0	
Total radiostrontium	n/a	0	
Total uranium	n/a	0	
Plutonium	n/a	0	
Other actinides	n/a	0	

* Combined. Excluding ^{3}H (for which there is a 5 Ci annual limit), there is a 1 Ci limit for the combined activity of all radioactive elements released during the calendar year

n/a – not applicable

Table 5-4 summarizes the historical results of wastewater monitoring for calendar year 2000 through 2010. The final column of the table compares the radioactivity discharged by SLAC into the sanitary sewer with the annual limit for such discharges set by federal and state regulation. Each year, the quantities and types of radioactivity in wastewater discharged depend on past accelerator operations and on details of wastewater handling.

25 Stanford Linear Accelerator Center, Environment, Safety, and Health Division, Radiation Protection Department, *Radioactivity in Industrial Wastewater for the Period of 1 January 2010 to 31 March 2010, for the Period of 1 April 2010 to 30 June 2010, for the Period of 1 July 2010 to 30 September 2010, and for the Period of 1 October2010 to 31 December 2010*

Table 5-4 Summary of Radioactivity in SLAC Wastewater, CY 2000– 2010

Year	Radioactive Element	Activity (Ci)	Percentage of Annual Limit
2000	Hydrogen (^{3}H)	$2.4x10^{-3}$	0.05
2001	Hydrogen (^{3}H)	$2.1x10^{-3}$	0.04
2002	Hydrogen (^{3}H)	$2.4x10^{-2}$	0.5
	Sodium (^{22}Na)	$5.1x10^{-5}$	1.4*
	Beryllium (^{7}Be)	$1.4x10^{-2}$	
2003	Hydrogen (^{3}H)	$4.1x10^{-4}$	0.008
2004	Hydrogen (^{3}H)	$2.0x10^{-2}$	0.4
2005	Hydrogen (^{3}H)	$1.4x10^{-3}$	0.03
2006	Hydrogen (^{3}H)	$1.2x10^{-3}$	0.02
2007	Hydrogen (^{3}H)	2.3	46
2008	Hydrogen (^{3}H)	1.8	36
2009	Hydrogen (^{3}H)	$9.1x10^{-5}$	0.002
2010	Hydrogen (^{3}H)	$1.2x10^{-2}$	0.24

* ^{22}Na and ^{7}Be combined. Excluding ^{3}H (for which there is a 5 Ci annual limit), there is a 1 Ci limit for the combined activity of all radioactive elements released during the calendar year

5.5.2 Stormwater

The program for monitoring stormwater is described in Section 4.4 of this report. In CY 2010 (and in all previous years), no radioactivity above natural background was found in any stormwater or storm drain sediment samples.

SLAC reported the results of the CY 2010 stormwater monitoring (including checks for radioactivity) to the RWQCB[26].

5.5.3 Groundwater

Throughout CY 2010, SLAC performed in-house analysis of water samples from monitoring wells for the presence of radioactivity each time the wells were sampled under SLAC's groundwater Self-Monitoring Program (SMP) as described in Chapter 6 of this report. The SMP includes a Groundwater Sampling Plan which outlines the frequency of sampling the wells. Groundwater samples collected as part of the SMP are also sent to an external California-certified laboratory for independent tritium analysis. The results from the external laboratory are in general agreement with the in-house analysis.

With the exception of the four monitoring wells listed in Table 5-5, no radioactivity above natural background was detected in any of the groundwater samples.

The detected concentrations of tritium in the water samples summarized in Table 5-5 were below federal and state limits set for tritium in drinking water (drinking water standard is 20,000 picoCuries per liter (pCi/L) under 22 CCR 64443 and 40 CFR 141.66). In addition, groundwater is not used at SLAC for any

[26] SLAC National Accelerator Laboratory, Environment, Safety, and Health Division, Environmental Protection Department, *2010 -2011 Annual Report for Stormwater Discharges Associated with Industrial Activities* (June 30, 2011, to be submitted to Rico Duazo, San Francisco Bay RWQCB)

purposes because of its very low well yields. Even if there was an adequate supply of groundwater available at SLAC, it could not be used as drinking water due to the naturally high content of total dissolved solids (TDS).

Table 5-5 Summary of Tritium Concentrations Measured in Monitoring Wells in CY 2010

Period (Month)	Jan. to March	April to June	July to Sept.	Oct. to Dec.
EXW-4				
Avg ^3H (pCi/L)	2216	2212	2734	2944
percent of DWS[1]	11	11	14	15
No. of Samples	4	8	3	3
MW-30				
Avg ^3H (pCi/L)	< 500[2]	< 500[2]	671	963
percent of DWS[1]	n/a	n/a	3	5
No. of Samples	2	1	2	1
MW-81				
Avg ^3H (pCi/L)	824	1951	530	1113
percent of DWS[1]	4	10	3	6
No. of Samples	1	1	1	1
MW-94				
Avg ^3H (pCi/L)	1014	3831	1007	3310
percent of DWS[1]	5	19	5	17
No. of Samples	1	1	1	1

1 DWS – Drinking Water Standard: 20,000 pCi/L for tritium

2 500 pCi/L was the minimum tritium concentration that was detectable by SLAC in CY 2010

n/a – not available

5.6 Assessment of Radioactivity in Soil

Throughout CY 2010, SLAC sampled and analyzed soil for activities at a former storage area known as the Bone Yard, and Plating Shop Area.

For soil excavation at Bone Yard, soil samples were collected in the Bone Yard to verify the absence of radioactivity in excess of natural backgrounds. No tritium or gamma radioisotopes were found at levels above the detection limit for these samples collected at Bone Yard.

Shallow soil sampling was performed in the Plating Shop Area near groundwater monitoring well MW-81 in CY 2010. These samples were taken as a follow-up action to the previous soil samples in CY 2009 found to contain slightly positive tritium results that were taken in an area to be trenched. None of these CY 2010 samples was found to contain tritium greater than the SLAC detection limit for tritium in water (which is consistent with the EPA minimum detection limit requirement). All gamma spectroscopy results were also negative.

5.7 Release of Property Containing Residual Radioactive Material

All property, both real and personal, exposed to any process at SLAC that could cause it to have surface or volumetric contamination have to be measured using appropriate instruments which have increasing levels of sensitivity and verified to have no detectable radioactivity before it is permitted to be released from radiological controls. At SLAC, property that had any detectable radioactivity is identified as *radioactive*, and is either retained for appropriate reuse on site or is disposed of as radioactive waste. Only material which did not have detectable radioactivity can be released. Therefore, property releases at SLAC do not add to the potential public dose.

Following the above protocol, in CY 2010, 87 concrete blocks, which were measured using sensitive surface survey and laboratory sample analysis (with detection capability down to about 0.01 to 0.1 picoCuires per gram - pCi/g) and found without detectable radioactivity, were disposed at a landfill; however, metal materials that were subject to the DOE metals moratorium or suspension policies that have been in effect since CY 2000 continued to be stored on site..

There were additional controls on movement of property between locations on site, but these are not relevant to this report and are documented elsewhere.

5.8 Potential Dose to the Public

The maximum possible dose to members of the public due to SLAC operations are very small compared with doses from natural background radiation and are well below all regulatory limits.

Table 5-6 summarizes the dose results for the two modes that were the potential contributors to public radiation dose in CY 2010: direct radiation (0.13 mrem) and airborne radioactivity (0.00086 mrem). Releases of radioactivity in water and property were too small to result in a radiation dose to a member of the public under any credible scenario. Table 5-6 also compares the CY 2010 dose results with regulatory limits and natural background.

Table 5-6 Summary of Potential Annual Doses due to SLAC Operations in CY 2010

	Maximum Dose to General Public – Direct Radiation	Maximum Dose to General Public – Airborne Radioactivity	Maximum Dose to General Public – Airborne + Direct	Collective Dose to Population within 80 km of SLAC
Dose from SLAC	0.13 mrem	0.00086 mrem	0.13 mrem	0.012 (direct) + 0.006 (air) = 0.018 person-rem
DOE Radiation Protection Standard	100 mrem	10 mrem	100 mrem	n/a
SLAC Maximum Dose as Percentage of DOE Standard	0.13%	0.0086%	0.13%	n/a
Dose from Natural Background[27]	100 mrem	200 mrem	300 mrem	1,667,000 person-rem
SLAC Maximum Dose as Percentage of Natural Background	0.13%	0.00043%	0.04%	0.000001%

n/a – not applicable % - percent

The MEI due to direct radiation is near the business offices in the Addison Building Area. Like previous years' calculations, the CY 2010 calculation of the MEI dose does not include any dose reduction for hills that may lie between the locations of dose measurements and the MEI. However, since 2003, the effects of air attenuation for direct photon radiation calculations (a factor of 40) are taken into account.

Table 5-7 presents the maximum dose potentially received by a member of the public from both direct radiation and airborne radioactivity due to SLAC operations in CY 2000 through CY 2010 and compares it with the average dose due to natural background radiation and radioactivity.

[27] National Council on Radiation Protection and Measurement, NCRP Report No. 94, "Exposure of the Population in the United States and Canada from Natural Background Radiation," http://www.ncrponline.org/Publications/94press.html

Table 5-7 Potential Annual Dose (mrem/yr) to Maximally Exposed Individual, CY 2000–2010

Year	SLAC Direct and Airborne Radiation	Average, Total Natural Background Radiation	Percentage of SLAC Dose to Natural Background
2000	5.7	300	1.9%
2001	5.3	300	1.8%
2002	2.1	300	0.7%
2003*	0.2	300	0.07%
2004	0.2	300	0.07%
2005	0.3	300	0.1%
2006	0.5	300	0.2%
2007	0.1	300	0.03%
2008	0.05	300	0.02%
2009	0.06	300	0.02%
2010	0.13	300	0.04%

* Starting with the 2003 calculations, the effects of air attenuation were taken into account.

5.9 Biota Dose

The DOE technical standard, “A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota” (DOE-STD-1153-2002), suggests that DOE facilities protect plants and animals by assuring the following dose rates due to “exposure to radiation or radioactive material releases” into the applicable environment are not exceeded:

- Aquatic animals: should not exceed 1 rad/day Terrestrial plants: should not exceed 1 rad/day
- Terrestrial animals: should not exceed 0.1 rad/day
- Rad, instead of rem, is used here as rad is the unit to quantify radiation dose in a material (in this case animal and plants)

5.9.1 Dose to Biota from Direct Radiation

In CY 2010, SLAC monitored dose and dose rate at approximately 390 on-site locations (most outside shielding and some inside shielding) using passive radiation dosimeters posted for six month periods. For each period, the average dose rate among these 390 dosimeters was found to be less than 0.0002 rad/day[28] (dominated by those inside shielding), and the maximum dose rate was less than 0.009 rad/day (inside shielding). Based on the results of this monitoring program and the fact that we know animal populations could not have been present except in locations with the low dose rates outside shielding, doses to plant and animal populations at SLAC were well within the limits of the DOE standard throughout CY 2010.

5.9.2 Dose to Biota from Activation Products

In CY 2010, SLAC tested water and soil samples for the presence of radioactivity in excess of natural background, as described in sections 5.5 and 5.6. Tritium was occasionally found in industrial wastewater

[28] RP Note RP-10-12, “Monitoring Results for Integrated Area Dose around SLAC For Period from January 2010 through June 2010”; RP Note RP-11-02, “Monitoring Results for Integrated Area Dose around SLAC For Period from July 2010 through December 2010.”

in CY 2010, but plant and animal populations have no opportunity for access to industrial wastewater at SLAC. Since the radioactivity concentrations in these sampled media are much lower than from direct radiation, there is no possibility that plants or animals will receive dose rates that exceed the limits of the standard due to radioactive activation products at SLAC.

In CY 2010, no groundwater was found with tritium concentrations in excess of the human drinking water standard 20,000 pCi/L set by state and federal regulations. Section 5.5.3 summarizes the CY 2010 results of monitoring for radioactivity in groundwater. There is no potential that plants or animals will receive dose rates that exceed the limits of the standard due to radioactive activation products in groundwater at SLAC.

5.10 Low-level Radioactive Waste Management

SLAC generates low-level radioactive waste (LLRW) sporadically from routine operations, repairs, and special projects or experiments. Non-routine operations generate the bulk of LLRW at SLAC, amounting to 1130 cubic feet for CY 2010. Additionally, SLAC generated a total of 107 cubic feet of routine low level wastes, 101.6 cubic feet of LLRW and 5.4 cubic feet of mixed LLRW. LLRW minimization is accomplished through training of the waste generator, careful planning of work operations, thorough survey and characterization of materials, segregation, reuse, and volume reduction when applicable.

SLAC continues to manage its LLRW in compliance with all applicable laws and regulations. During CY 2010, SLAC shipped 2,891 cubic feet of LLRW (a total of 110 mCi and 53,868 kilograms) to appropriate treatment and disposal facilities for low-level radioactive waste. Legacy waste accounted for 50 percent of the volume shipped for disposal. An effort to reduce amount of materials no longer needed for SLAC mission continues. SLAC permanently removed 125 sealed sources from the inventory. Ninety seven of the sealed sources were returned to the manufacturer and 28 were sent to Energy Solutions for processing before being sent to Nevada Test Site for burial.

6 Groundwater Protection and Environmental Restoration

6.1 Introduction

This chapter describes the groundwater protection and environmental restoration programs at SLAC, including the regulatory framework, site cleanup objectives, an overview of potential chemical impacts, summary of most recent restoration activities, and SLAC's groundwater monitoring program.

6.2 Background Conditions

The document *Geologic Field Guidebook of SLAC* [29] provides a detailed description of the geology of SLAC. Based on many tests in exploratory borings and wells, the hydraulic conductivity of SLAC's bedrock is overall much less than the range of that generally accepted as representing natural aquifer material. The groundwater at SLAC is not used as a drinking water source because of low yield as well as naturally occurring high TDS content.

6.3 Areas with Potential Impact from Chemicals

A SLAC 1994 report entitled *Summary and Identification of Potentially Contaminated Sites*[30] provides a summary of areas that may have been impacted by chemicals of concern from past SLAC operations. Information for the report was collected from a variety of sources including incident reports, aerial photographs, operations records, reports on previous investigations, and interviews with personnel throughout the facility. Two additional environmental summary documents were completed in 2006. The *Environmental Baseline Report*[31] (EBR) provides an updated inventory of facilities and areas at SLAC that were considered to have the potential to have chemical impacts, and summarizes the results of the environmental investigations and remediation activities that have occurred to date. The EBR identifies chemicals of potential concern, defines Investigation Areas, and provides a decision process for determining which areas still require additional actions. The *Work Plan for the Remedial Investigation and Feasibility Study*[32] provides additional description and current status of investigation areas, defines Operable Units, and describes the framework for completing the environmental investigations and remedial actions at the facility.

---

[29] Stanford Linear Accelerator Center, *Geologic Field Guidebook of SLAC* (SLAC-I-750-2A32H-015, November 2006) http://www-group.slac.stanford.edu/esh/groups/ep/geology/geologicreport.pdf

[30] ESA Consultants, *Stanford Linear Accelerator Center, Summary and Identification of Potentially Contaminated Sites* (February 1994)

[31] Sapere Consulting, *Stanford Linear Accelerator Center Environmental Baseline Report* (February 2006)

[32] Stanford Linear Accelerator Center, *Work Plan for the Remedial Investigation and Feasibility Study* (SLAC-I-750-A17M-008, May 2006)

6.4 Strategies for Controlling Potential Sources of Chemicals

Strategies for chemical source control involve measures to control known soil or groundwater impacts as discussed in this chapter, and procedures and requirements to avoid practices that could adversely affect soil and groundwater as discussed in Chapter 4. These procedures include the site's SWPPP [33] which discusses BMPs for preventing adverse impacts from spills and operations at SLAC.

6.5 Restoration Activities

SLAC first began environmental investigation and restoration activities in the mid-1980s and by 1991 had developed a comprehensive environmental restoration program. Program activities range from discovery and characterization to remediation and long-term monitoring or maintenance where required.

The restoration approach at SLAC is to accomplish the following steps:

- Identify sites with actual or potential impacts (involving soil, groundwater, surface water, and/or air)
- Prioritize impacted sites based on site complexity, nature of chemical impact, associated risks, remaining data needs, and projected remedy
- Investigate sites and identify remedies that protect human health and the environment, beginning with the highest-priority sites
- Implement remedies and monitor for effectiveness

As of 2010, SLAC had generally reached the third and fourth steps. Restoration work conducted to date generally consists of two categories, soil excavation to remove localized areas of PCB or other chemically-impacted soils, and extraction and treatment of solvent-impacted soil vapor and groundwater. There are six areas with chemicals of potential concern (COPC) in groundwater. Each of these is described in Section 6.7, along with a description of sites where soil removal has recently been conducted.

6.6 Regulatory Framework

In October 2009, the RWQCB issued a new Board Order (No. R2-2009-0072) for SLAC for the investigation and remediation of impacted soil and groundwater resulting from historical spills and leaks that occurred during the course of operations at SLAC. The Board Order addresses release sites at SLAC and consolidates the investigation and cleanup activities at the facility. It also rescinds the Board Order issued in May 2005. In January 2006, the RWQCB was designated by the State of California as the Administering Agency (i.e., lead agency) for the environmental cleanup work at SLAC[34]. As the lead agency, the RWQCB has the responsibility to determine the adequacy and extent of cleanup, issue necessary authorizations and permits, and following the determination that an approved remedy has been accomplished, issues a certificate of closure. The RWQCB has specified site cleanup to residential

---

[33] Stanford Linear Accelerator Center, Environment, Safety, and Health Division, Environmental Protection and Restoration Department, *SLAC Stormwater Pollution Prevention Plan* (SLAC-I-750-0A16M-002)

[34] California Environmental Protection Agency, *Site Designation Committee Resolution No. 06-01* (January 2006)

standards for un-restricted land use[35], consistent with how the SLAC property is zoned. All deliverables required by the Water Board order have been met, and approvals for changes in the schedule for deliverables have been granted.

In addition, monthly meetings regarding site cleanup status continue to be regularly attended by the Core Team, a decision-making body consisting of representatives from the Water Board, DOE Office of Science, DOE Environmental Management, Stanford University, and SLAC. As needed, members of the technical team are present at these meetings. The monthly Core Team meetings are moderated by an outside facilitator.

SLAC follows as practicable the general CERCLA technical guidance in investigating and remediating soil and groundwater. SLAC was not listed in the National Priorities List as a Superfund site because USEPA determined that the conditions at the site did not warrant inclusion.

All sampling activities are performed according to the environmental restoration program's Quality Assurance Project Plan[36] and Standard Operating Procedures[37]. All samples are submitted to analytical laboratories certified by the California Department of Health Services. Analytical data generated by field activities are reviewed and validated for QA and QC purposes.

6.7 Groundwater Characterization Monitoring Network

As part of the Board Order, SLAC has a SMP that includes a Groundwater Sampling Plan with a schedule for collecting sediment samples from select catch basins and drainage channels, surface water samples, and groundwater samples from extraction and monitoring wells. The SMP Groundwater Sampling Plan outlines the frequency at which monitoring samples are to be collected and the chemicals to be analyzed for. Figures 6-1 through 6-3 show the network of wells used for monitoring.

SLAC has 173 wells across the site, 166 of which are used for groundwater monitoring and extraction. Figure 6-2 and Figure 6-3 identify the specific well locations. The groundwater monitoring wells are used to monitor general groundwater quality in the major areas of the facility that historically or currently store, handle, or use chemicals. Of the 166 wells, 89 wells are used to monitor COPC in six plumes and 64 wells are used as extraction wells for two of the six plumes. The other 13 groundwater monitoring wells are used for general site-wide surveillance.

The six locations where plume monitoring occurs include the following (Figures 2 and 3):

- Former Hazardous Waste Storage Area (FHWSA)
- Former Solvent Underground Storage Tank (FSUST) Area
- Test Lab and Central Lab Area (TL/CL)
- Plating Shop Area (PSA)
- Lower Salvage Yard (LSY)

---

[35] Regional Water Quality Control Board, *Approval of Stanford Linear Accelerator Center Long Range Redevelopment Plan* (November 18, 2005)

[36] Quality Assurance Project Plan for the Environmental Restoration Program, Revision 005, SLAC-I-750-2A17M-003 R005, SLAC, 2010

[37] Standard Operation Procedures Manual, Revision 004, SLAC-I-750-2A15D-001, R004, SLAC, 2008.

- Beam Dump East (BDE)

The COPC in groundwater at SLAC are primarily VOCs and to a lesser extent semi-volatile organic compounds (SVOCs). Two of the six plume sites, the FSUST and the FHWSA, have treatment systems that extract soil vapor and groundwater. Construction of treatment systems for two other sites, the PSA and TL/CL, was completed in late 2010 and are in operation. Operating data indicate that the treatment systems at the FSUST and FHWSA have helped to decrease concentrations of COPCs in groundwater since full-scale operation began in 2001 and 2006, respectively. A soil vapor extraction component was installed to the existing groundwater treatment system at the FSUST in 2007. Preliminary Cleanup Goals (PCGs) at SLAC have been established for groundwater and soil vapor. The systems at the FSUST and FHWSA, and the recently constructed systems at the PSA and TL/CL have been designed with the goal of achieving these PCGs.

Groundwater samples were collected at least once from 108 wells in 2010 and analyzed for a variety of constituents. The results of groundwater monitoring of wells were reported to the RWQCB in the semi-annual self-monitoring report for the winter of 2010[38] and the summer of 2010.[39] The groundwater analytical results were generally within each well's historical range of concentrations. Samples were analyzed for one or more of the following:

- Total petroleum hydrocarbons (TPH)
- Metals
- Polychlorinated biphenyls (PCBs)
- Tritium
- Volatile organic compounds (VOCs)
- Semi-volatile organic compounds (SVOCs)

---

[38] Stanford Linear Accelerator Center, *Semi-annual Self-Monitoring Report, Winter 2010* (SLAC-I-750-2A15H-033, June 2010)

[39] SLAC National Accelerator Laboratory, *Semi-annual Self-Monitoring Report, Summer 2010* (SLAC-I-750-2A15H-034, December 2010)

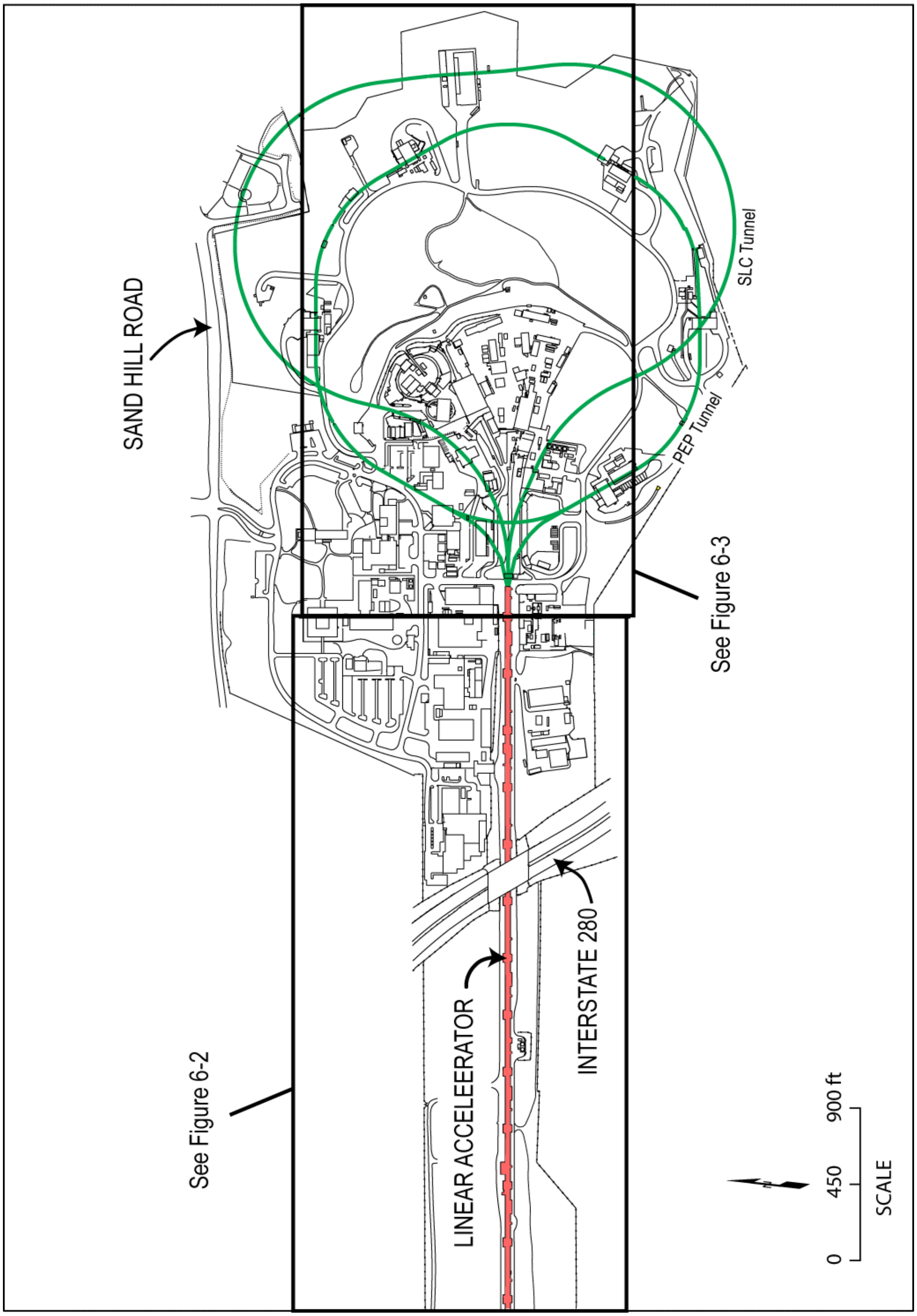

Figure 6-1 Groundwater Characterization Monitoring Network

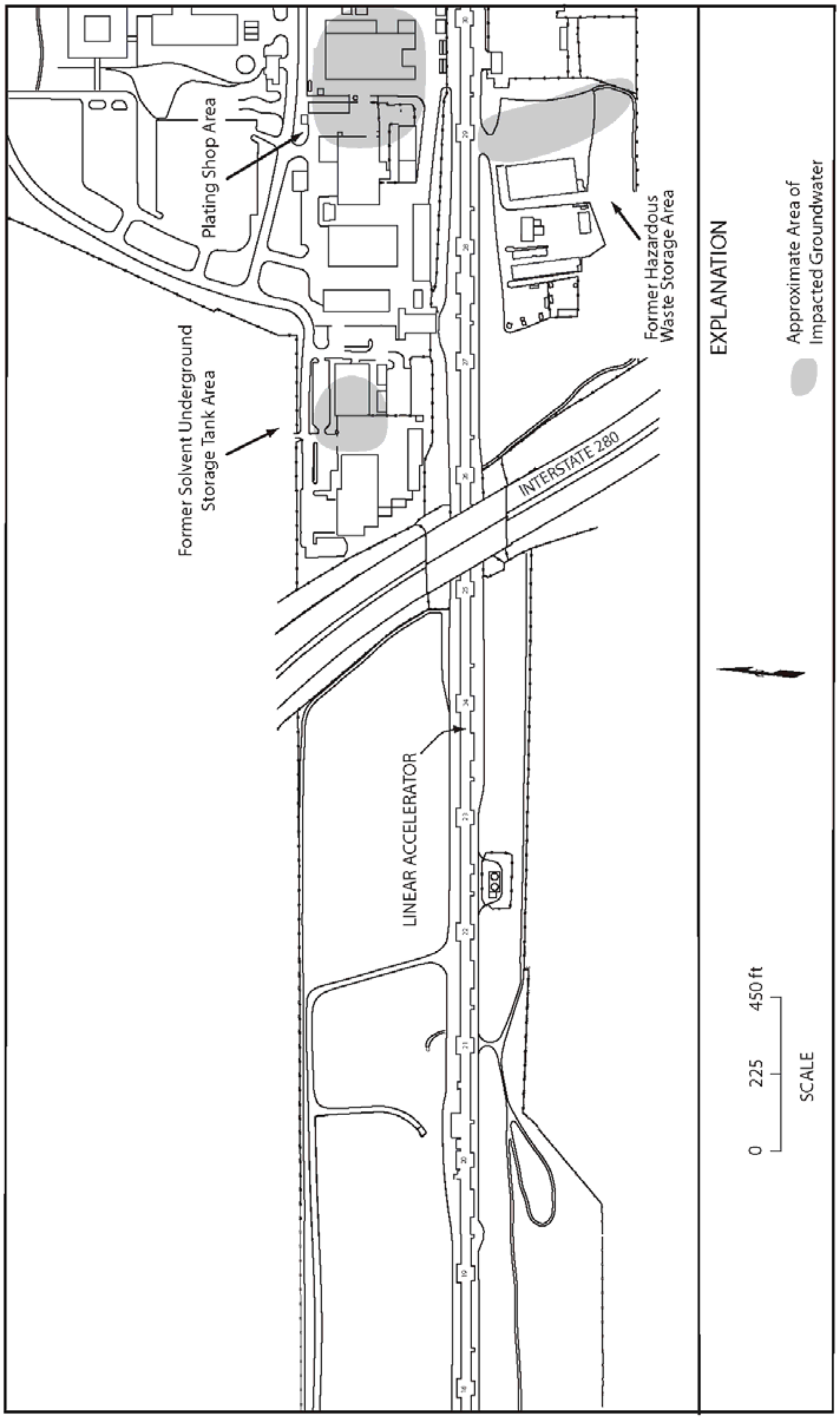

Figure 6-2 Westside Groundwater Network and Impacted Area

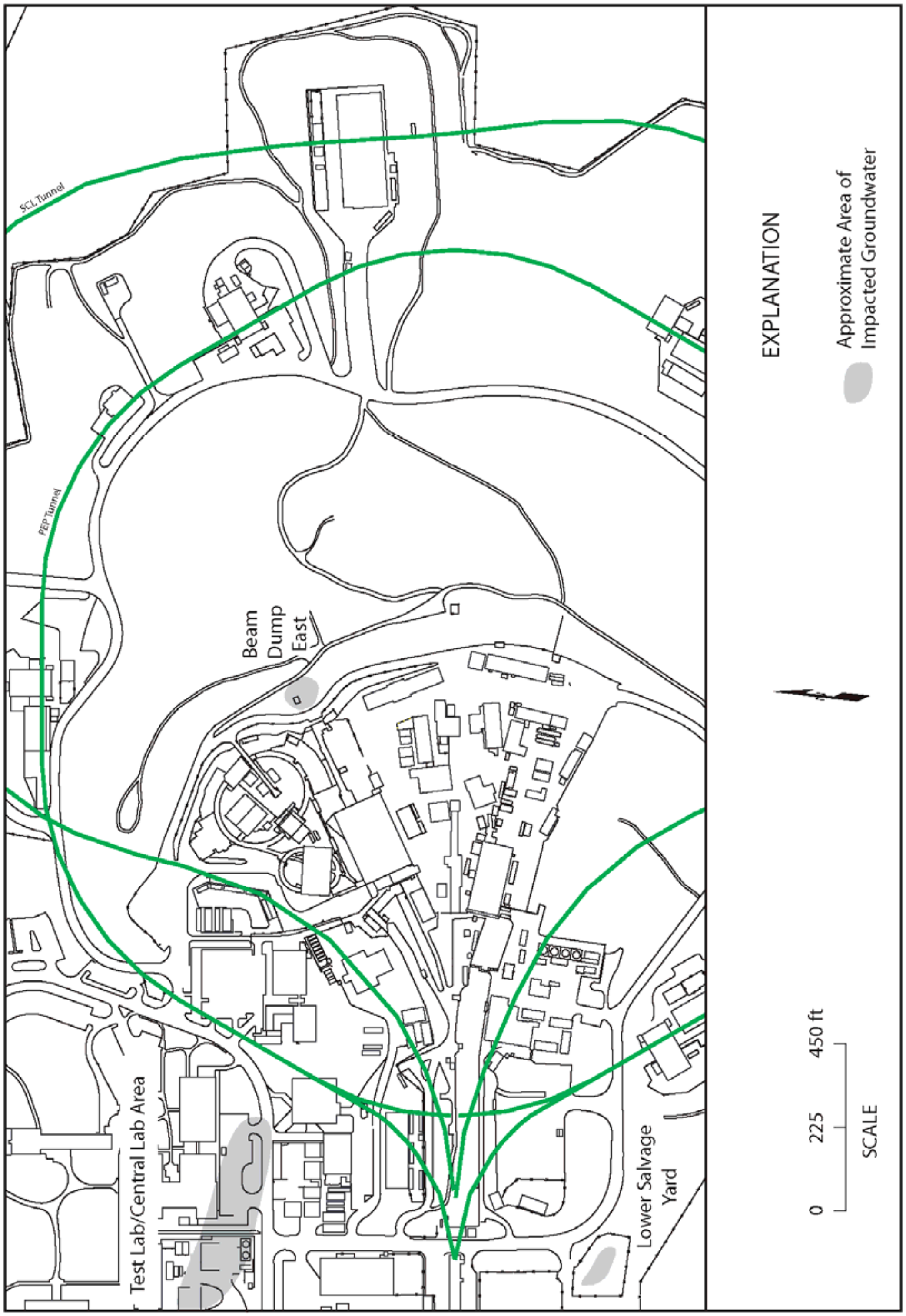

Figure 6-3 Eastside Groundwater Network and Impacted Areas

Table 6-1 summarizes the wells at SLAC by location, number of wells per location, and purpose of the wells.

Table 6-1 Monitoring Locations and Number of Wells

Location	Number of Wells
Plume Monitoring	
Beam Dump East	9
Former Hazardous Waste Storage Area	24
Former Solvent Underground Storage Tank	21
Lower Salvage Yard	2
Plating Shop	26
Test Lab and Central Lab	7
Subtotal	89
Extraction	
Former Solvent Underground Storage Tank	8
Former Hazardous Waste Storage Area	23
Plating Shop Area	26
Test Lab and Central Lab	7
Subtotal	64
Environmental Surveillance	
Centralized Waste Management Area	1
End Station B	1
Magnet Yard	2
Other (remote)	5
Research Yard	3
Vacuum Assembly	1
Subtotal	13
Total	166

6.8 Site Descriptions and Results

The six groundwater Investigation Areas are described below. The sites pose no current risk to human health or the environment. Through the work described below, remediation strategies that protect current and future potential uses of the property are being defined. Under the Board Order, the formal Feasibility Study Report and Remedial Action Plan for the four VOC-impacted groundwater Investigation Areas were prepared by SLAC and approved by the RWQCB in January 2010 and August 2010, respectively.

6.8.1 Former Solvent Underground Storage Tank Area

A chemical plume in groundwater associated with the FSUST is located in proximity to the SLAC Plant Maintenance building in the northwestern portion of the main SLAC campus (see Figure 6-2). The FSUST was used to store organic solvents from 1967 to 1978. A pressure test performed on the FSUST in 1983 indicated a leak. The FSUST and accessible chemically impacted soil were removed in December 1983. A network of 22 monitoring wells and eight extraction wells were subsequently installed, and groundwater has been monitored for VOCs and SVOCs.

A groundwater extraction and treatment system was installed in 2001 and upgraded in 2007 with a soil vapor extraction component. Dual Phase Extraction (DPE) operations, which started at the FSUST on October 18, 2007, increased the mass removal rate of VOCs and SVOCs from an average of 0.14 lbs per day to an average of 2.2 lbs per day for the remainder of 2007. In 2008 and 2009, the mass removal rates of VOCs and SVOCs were on average 0.57 and 0.47 lbs per day, respectively. In 2010, the average mass removal rate declined to 0.035 lbs per day, as anticipated as the more concentrated sources are removed in the soil vapor.

Since the start up of the remediation system at the FSUST in August 2001 and through December 2010, approximately 820,738 gallons of groundwater have been extracted and treated. Over 863 lbs of VOCs and SVOCs have been extracted from groundwater and soil vapor. Monitoring well data collected thus far indicate a capture zone encompassing the entire plume has been established and chemical data indicate that the plume appears to be continually shrinking in size.

The operating interim DPE system at the FSUST is similar to that recommended in the formal Feasibility Study and Remedial Action Plan, both documents approved by the Water Board in 2010.

6.8.2 Former Hazardous Waste Storage Area

The FHWSA was in use as a storage area from approximately 1973 to 1982. Following cessation of its use as a storage area, PCBs were found in shallow soils. As a result, several inches of topsoil were removed. A monitoring well was installed in this area in 1990, and VOCs were detected in the groundwater. Since then, two passive soil gas surveys have been performed; 22 monitoring wells, 23 soil vapor and groundwater extraction wells, 18 soil gas probes, and more than 50 soil borings have been installed at this site. Figure 6-2 shows the extent of VOCs in the groundwater.

In 2002, a DPE pilot test proved promising to treat impacted soil, and groundwater, and was recommended as a suitable remediation technology. Two DPE wells were installed at the FHWSA in 2003 as part of an interim dual-phase extraction (IDPE) system. The IDPE system was in operation from December 2003 to March 2006. The design of an interim full scale DPE system for the FHWSA was finalized in 2004[40] and the construction of the system was completed in March 2006 after six months of construction. The full scale system utilizes 19 groundwater/soil vapor extraction wells and four vacuum-enhanced groundwater extraction wells. Groundwater extraction and treatment began on March 6, 2006. Soil vapor extraction began on April 3, 2006.

At the end of December 2010, the IDPE and interim full scale DPE treatment systems at the FHWSA extracted a cumulative combined total of 1,347,230 gallons of groundwater and removed a cumulative combined total of 38.2 lbs of VOCs via groundwater and soil vapor extraction. The operating interim DPE

---

[41] Erler & Kalinowski, *Technical Specifications and Drawings for the Dual Phase Extraction and Treatment System at the Former Hazardous Waste Storage Area* (2004)

system at the FHWSA is similar to that recommended in the formal Feasibility Study and Remedial Action Plan approved by the Water Board.

6.8.3 Plating Shop Area

In 1990, three monitoring wells were installed down-gradient of the PSA. Chemicals of interest were detected in all three wells; and an investigation began and included installation of additional monitoring wells, a soil gas survey, and remediation beneath a steam cleaning pad. A total of 23 groundwater monitoring wells are currently located at the PSA (see Figure 6-2). Groundwater sampling results indicate that chemicals are present in groundwater within three co-mingled plumes.

Construction of a 26 DPE-well system with additional soil vapor probes and monitoring wells was completed in late 2010. The system is currently in operation and under evaluation.

6.8.4 Test Lab and Central Lab Area

Data from previous investigations, including a soil gas survey, soil borings and monitoring wells installed in the TL/CL have helped delineate the sources of groundwater and soil vapor impacts. Results of the investigation indicated three possible source areas for VOCs, including one adjacent to the TL, and two adjacent to the CL. The final remedial design specified two separate DPE systems at the TL/CL.

Construction of separate DPE-well systems at the TL and at the CL with additional soil vapor probes and monitoring wells was completed in late 2010. These systems are currently in operation and under evaluation.

6.8.5 Beam Dump East

BDE is used as a subsurface high-energy beam termination point for the End Station A beamline operations and is located in the hillside along the northeastern edge of the research yard. Groundwater is monitored in nine wells and sampled at least two times per year. Three of the nine wells were installed during 2007 to evaluate the groundwater for tritium. In 2010, as in previous years, the monitoring indicates that the tritium is localized to two wells in the area of the beam dump and present at levels far below the drinking water standards. The BDE is part of the Tritium Operable Unit, for which a formal Remedial Investigation Report has been prepared by SLAC under the Board Order and approved by the Water Board in June 2009. In addition, a Monitoring Plan Report (MPR) was prepared by SLAC under the Board Order and approved by the Water Board in December 2009. The MPR specifies continued groundwater monitoring at the BDE with contingent actions in the unlikely event that monitored tritium levels exceed any established threshold concentrations.

6.8.6 Lower Salvage Yard

There have been minor detections of TPH and VOCs in wells at the LSY. The two monitoring wells at the LSY were sampled in February and August 2010. Low levels of TPH continue to be reported in groundwater samples collected at the LSY.

6.8.7 Removal Actions

Soil removal actions were completed at five Group I Investigation Areas (Group I IAs) in 2008 to remove debris and soil impacted with PCBs, TPH, polycyclic aromatic hydrocarbons and/or metals at concentrations above Preliminary Remediation Goals (PRGs) or pre-established cleanup goals. Following the removal action work, the *Group 1 Removal Action Implementation Report* was prepared by SLAC and approved by the Water Board in April 2009. This report documents the excavation and removal of approximately 5,000 tons of chemically impacted soil and debris from the five areas at SLAC. The report includes a residual risk evaluation and forms the basis for proceeding to the closure process for these specific areas. In 2010, work continues on the preparation of closure summary information (Per the Water Board) for the Group 1 IAs where closure has been requested.

Removal action work at several additional Investigation Areas, collectively comprising the "Group 2 Investigation Areas", began in the summer of 2009 and continued throughout 2010. Soil removal actions performed during 2010 included work at the FHWSA Artificial Ridge, Buildings 24 and 34 Area, Sector 16 Soil Removal Area Drainage Channel Swale, Bone Yard Phase 1, Casting Pad/Building 18, Clean Landfill, and Lower Salvage Yard. Work in some of these IAs is expected to extend into 2011.

6.9 Excavation Clearance Program

During 2010, the excavation clearance program continued to support SLAC-wide projects to ensure proper disposal of excavated soil. An excavation permit form must be completed for activities that involve excavation or relocation of soil at SLAC. The permitting process is intended to identify potential hazards associated with excavation work at SLAC and ways to reduce worker exposure to these hazards. These hazards include underground utility lines, chemical contamination, and radiological hazards and ensure proper management and disposal of excavated materials. Ninety nine projects were supported by this program during 2010.

A Distribution List

Name	Title	Organization	E-mail
Thomas Traceski	Director	HS-22, Office of Environmental Policy and Assistance	
Andrew Wallo,	Deputy Director	HS-20, Office of Environmental Protection, Sustainability Support & Corporate Safety Analysis.	
Sat Goel	Office of Science	SC-31, Office of Safety, Security and Infrastructure	
Marc Jones	Office of Science, Associate Director	SC-31, Office of Safety, Security and Infrastructure	
David Page		Integrated Support Center, Oak Ridge Office	
David Allen		Integrated Support Center, Oak Ridge Office	
Rosario Natoli		HS-22, Office of Environmental Policy and Assistance	
Paul Golan	Site Manager	SLAC Site Office	
Hanley Lee	Deputy Site Manager	SLAC Site Office	Hanley.lee@sso.science.doe.gov
Tom Rizzi	EFO Team Lead	SLAC Site Office	Thomas.rizzi@sso.science.doe.gov
Dave Osugi	EFO	SLAC Site Office	David.osugi@sso.science.doe.gov
Annette Walton	Environmental Manager	Office of Stanford Real Estate	nettie@stanford.edu
Allan Chiu	Permit Engineer	Bay Area Air Quality Management District	achiu@baaqmd.gov
Gary Butner	Acting Director	California Department of Health Services, Radiologic Health Branch	gbutner@dhs.ca.gov
George Leyva		Regional Water Quality Control Board, San Francisco Bay Region	gleyva@waterboards.ca.gov
Dean Peterson		San Mateo County Department of Health Services, Office of Environmental Health	dpeterson@co.sanmateo.ca.us
Glen Rojas	City Manager	City of Menlo Park	grojas@menlopark.org
Magaly Bascones Dominguez		CERN. Library, Periodicals Unit	Magaly.bascones.dominguez @cern.ch