Environmental Monitoring Plan

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1.0
Summary

The Lawrence Berkeley National Laboratory (Berkeley Lab) environmental monitoring program described in this Environmental Monitoring Plan (EMP) is part of Berkeley Lab's effort to ensure that its activities are conducted in a manner that will protect and maintain environmental quality, making it an important element in Berkeley Lab's overall Environmental Management System Plan [1]. The monitoring program is an important element in demonstrating compliance with requirements imposed by federal, state, and local agencies; confirming adherence to Department of Energy (DOE) environmental protection policies; and supporting environmental management decisions.

Environmental monitoring consists of four major activities:

1. **Effluent Monitoring:** The collection and analysis of samples, or measurements of liquid and gaseous effluents, for the purpose of characterizing and quantifying contaminants; assessing radiation exposures of members of the public; providing a means to control effluents at or near the point of discharge; and demonstrating compliance with applicable standards and permit requirements.
2. **Environmental Surveillance:** The collection and analysis of samples, or direct measurements of air, water, soil, foodstuff, biota, and other media from the Berkeley Lab site and its environs, for the purpose of determining compliance with applicable standards and permit requirements; assessing radiation exposures of members of the public; and assessing the effects, if any, on the local environment.
3. **Meteorological Monitoring:** The collection of representative meteorological data (e.g., wind speed and direction, precipitation, temperature, humidity, and atmospheric pressure) to characterize atmospheric transport and diffusion conditions in the vicinity of the Berkeley Lab, and to represent conditions that are important to environmental surveillance activities, such as air quality monitoring.
4. **Pre-operational Monitoring:** An environmental study conducted prior to the startup of a new facility or process for the purpose of establishing a baseline for environmental conditions.

Each of these activities will be covered in separate chapters of this EMP.

1.1 Environmental Monitoring Program Oversight

LBNL's Environmental Services Group (ESG) prepares, implements, and maintains this Environmental Monitoring Plan. ESG is under Technical Program Management – one of several organizational groups within the Environment / Health / Safety / Security (EHSS) Division, as shown in Figure 1-1. A full EHSS organizational chart is on the EHSS home page at http://www.lbl.gov/ehs/.

Figure 1-1 Environmental Programs Carried Out by the EHSS Environmental Services Group

The ESG Group Leader is responsible for the EMP. The Group Leader is supported by a team of technical professionals who carry out specific environmental programs with the help of field technicians who conduct the sampling needed for each topic area. Laboratory analyses of these samples are performed by certified commercial vendors for both radiological and nonradiological parameters. Throughout this document, reference to a *certified analytical laboratory* indicates that it is certified under the California Department of Public Health's (DPH) Environmental Laboratory Accreditation Program (ELAP) [2].

Regulatory oversight is performed by the DOE, United States Environmental Protection Agency (EPA), State of California Department of Toxic Substances Control (DTSC), California Department of Public Health (DPH), Regional Water Quality Control Board (RWQCB), East Bay Municipal Utility District (EBMUD), Bay Area Air Quality Management District (BAAQMD), and City of Berkeley. The cities of Berkeley and Oakland have a Memorandum of Understanding that grants the City of Berkeley authority for regulatory oversight of environmental programs within the Oakland portion of the LBNL site.

Investigations of areas of potential environmental contamination, including soil, surface water, and groundwater, are conducted under the Environmental Restoration Program (ERP), which is a major program of the Environmental Services Group. These activities comply with the Resource Conservation and Recovery Act's (RCRA) Corrective Action Process, including the preparation of planning documents. ERP documents are available on the web at http://www.lbl.gov/ehs/erp.

In addition to periodic updates to this Environmental Monitoring Plan, ESG produces an annual Site Environmental Report (SER) [3] for the Laboratory. The annual report summarizes monitoring results and compliance status of all environmental programs and includes detailed background on the Laboratory and surrounding area, covering the following topics that are factors in defining ESG's environmental monitoring programs:

- Berkeley Lab history and mission
- Physical location, population, space distribution, water supply, and adjacent land use
- Environmental setting, including climate, vegetation, wildlife, geology, and hydrogeology, and seismology

The SER is available on the web at: http://www.lbl.gov/ehs/esg/Reports/tableforreports.shtml

2.0

Environmental Monitoring Regulatory Requirements

Numerous regulatory requirements dictate the scope of the Berkeley Lab environmental monitoring program. These requirements include policies issued by the DOE to govern operations at contractor sites such as Berkeley Lab, environmental regulations promulgated by federal agencies, State of California requirements, and the requirements of local and municipal authorities, as outlined in this section.

2.1 DOE Orders and Guidance

DOE Order 436.1 *Departmental Sustainability* [4] requires that Berkeley Lab develop and implement an environmental management system (EMS) that is certified to or conforms with the International Organization for Standardization's (ISO) 14001:2004, *Environmental Management Systems - Requirements with Guidance for Use*. One element of the ISO standard addresses environmental monitoring and measurement. It states that "the organization shall establish, implement and maintain a procedure(s) to monitor and measure, on a regular basis, the key characteristics of its operations that can have a significant environmental impact." Procedures shall include the documenting of information to monitor performance, applicable operational controls and conformity with the organization's environmental objectives and targets. The organization shall ensure that calibrated or verified monitoring and measurement equipment is used and maintained and shall retain associated records.

Environmental monitoring requirements for radiation are specified in DOE Order 458.1 *Radiation Protection of the Public and the Environment* [5]. The objectives of this order are as follows:

- Conduct radiological activities so that exposure to members of the public is maintained within the dose limits established in the order;
- Control the radiological clearance of DOE real and personal property;
- Ensure that potential radiation exposures to members of the public are as low as reasonably achievable (ALARA);
- Ensure that Berkeley Lab has the capabilities, consistent with the types of radiological activities conducted, to monitor routine and non-routine radiological releases and to assess the radiation dose to members of the public; and
- Provide protection of the environment from the effects of radiation and radioactive material.

Orders 436.1 and 458.1 are incorporated into the contract between the University of California and the Department of Energy [6].

DOE Order 231.1B, *Environment. Safety, and Health Reporting*, [7] requires Berkeley Lab to provide DOE with timely and accurate information about events that have affected or could adversely affect the health, safety, and security of the public or workers, the environment, the operation of LBNL facilities, or the credibility of the DOE. This information is provided through an annual SER that includes the following:

- Site environmental management performance,
- Environmental occurrences and responses,
- Environmental compliance,
- Significant programs and efforts, and
- Property clearance activities.

DOE/EH-0173T, *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance* [8], provides guidance on radiological effluent monitoring and environmental surveillance program elements that DOE considers acceptable to meet DOE orders. It also provides specific monitoring guidance at a level of detail that is lacking in the directives. This guidance document describes suggested nonmandatory approaches that should not be construed as requirements.

DOE-STD-1153-2002, *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota* [9], provides methods, models, and guidance for taking a graded approach to evaluating doses from ionizing radiation to aquatic animals and terrestrial plants and animals. The methods in this standard can be used to demonstrate compliance with the biota dose requirements of DOE Order 458.1.

2.2 Federal Regulations

Title 40 of the Code of Federal Regulations (40 CFR) [10] contains rules promulgated by the EPA implementing federal legislation such as the Clean Air Act, the Federal Water Pollution Control Act, and the Clean Water Act.

The *National Primary and Secondary Ambient Air Quality Standards*, codified in 40 CFR 50, are designed to protect public health with an adequate margin of safety, and to protect the public from adverse effects of certain air pollutants. These air pollutants include carbon monoxide, hydrogen sulfide, lead, nitrogen dioxide, ozone, particulate matter, sulfates, sulfur dioxide, and vinyl chloride. The ambient air standards associated with these pollutants apply to the region, rather than a single facility or any of its operations. The Bay Area Air Quality Management District (BAAQMD), as the local administering agency, has regulatory authority under 40 CFR 58 to require either emissions monitoring or ambient air quality surveillance to verify compliance with these federal standards, as well as any additional state or local standards.

40 CFR 60 prescribes the standards of performance for emission of air pollutants from new or modified stationary sources. The basic framework for each standard is a definition of scope, establishment of an emission standard for one or more pollutants, setting of monitoring and testing methods, and

identification of reporting requirements. BAAQMD has incorporated the federal new source performance standards into their regulations, which are taken into consideration during a permit application review.

40 CFR 61 places restrictions on substances identified as hazardous air pollutants. These emission restrictions cover such substances as asbestos, benzene, beryllium, mercury, vinyl chloride, arsenic, radionuclides, and radon. Together, these regulations are called the National Emission Standards for Hazardous Air Pollutants, or NESHAP.

At Berkeley Lab, radionuclides are the only NESHAP substances for which routine sampling is required. Regulations for these substances are detailed in 40 CFR 61, Subpart H, *National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities* [11]. EPA retains enforcement authority for this type of air emission at Berkeley Lab.

40 CFR 63 regulates numerous categories of air emission sources that emit one or more hazardous air pollutants not covered by 40 CFR 61. Many of these source categories target production rather than research facilities. Only a few source categories – such as cleaning activities using halogenated solvents – apply to operations at Berkeley Lab, although no environmental monitoring is required of Berkeley Lab under this regulation.

40 CFR 82 establishes regulations to protect the earth’s stratospheric ozone layer. Berkeley Lab has only small amounts of ozone-depleting substances contained in various types of equipment, including air conditioning, refrigeration, and fire suppressant systems. Berkeley Lab is not required to conduct environmental monitoring under this regulation, although it has installed monitoring and alarm systems in certain mechanical rooms to aid in detecting leaks in cooling systems that serve critical buildings.

40 CFR 122-125 implements the National Pollutant Discharge Elimination System (NPDES) under Sections 318, 402, and 405 of the Clean Water Act. EPA has delegated permitting authority for this program to various California state agencies. The regulations define permit program requirements and establish permit criteria and treatment standards that must be met by effluent dischargers. Permits are required for sanitary sewer discharges to publicly-owned treatment works (POTW) as well as for specific surface water discharges.

40 CFR Part 403 establishes responsibilities of government and industry to prevent the discharge of any waste that is incompatible with, or passes through, a POTW with the effect of reducing treatment efficiency or inhibiting the disposal, reuse, or recycling of treated wastewaters or sludges. In addition to general pretreatment requirements, categorical limitations are imposed on specific process discharges. 40 CFR Part 433 places restrictions on the discharge of toxic organics, certain metals, cyanide, and excessive pH from metal finishing processes, and establishes the need for an investigation of any exceedence above restricted levels. 10 CFR Part 20.2003 regulates the disposal of radioactive materials to the sanitary sewer. Activity limits for specific radionuclides are contained in Table 3 of 10 CFR Part 20.2003.

2.3 California and Local Regulations

The State of California administers environmental regulatory programs authorized by statute and agreements with the EPA and Nuclear Regulatory Commission. The programs impacted at Berkeley Lab by these authorizations and agreements are predominantly limited to air and water quality.

Many air quality oversight functions, with the exception of radiological emissions from federal facilities, are delegated by EPA to the California Air Resources Board (CARB), which in turn delegates many of these responsibilities to the BAAQMD. Included in the CARB delegation are additional California-specific requirements derived from the state's own Clean Air Act.

BAAQMD has enacted numerous regulations in many different categories (e.g., stationary internal combustion engines, surface coating) to enforce its regulatory responsibilities. The rules cover emissions of hazardous and nonhazardous air pollutants included in the National Primary and Secondary Ambient Air Quality Standards, nonradiological hazardous air pollutants included in NESHAP regulations, and air toxics.

Berkeley Lab has operating permits issued by the BAAQMD for certain operations and activities, such as fuel dispensing and diesel-fueled emergency generators. Many of Berkeley Lab's other air emissions sources are exempt from permitting requirements because their emissions remain below threshold quantities. BAAQMD seldom requires emissions monitoring for the type of activities conducted at the Berkeley Lab. Fuel dispensing operations require periodic testing, for which Berkeley Lab contracts with specialized firms. Soil vapor extraction systems require emissions sampling, performed by trained Environmental Restoration Program technicians. No other monitoring requirements are administered by ESG's air monitoring program.

EBMUD is authorized by the state and the RWQCB to implement and enforce state and federal regulations for sanitary sewer discharge monitoring. Through its wastewater discharge permitting process, EBMUD administers and enforces permit conditions and monitoring requirements for specific fixed treatment units (FTUs), groundwater treatment systems, and site-wide discharges based on RWQCB standards and local Wastewater Control Ordinance 311A.

10 CFR 20, Subpart K, Section 20.2003, as referenced in Title 17, Section 30253 of the California Code of Regulations (CCR) [12], is the radiation protection standard for radionuclides in sewer discharge, and contains maximum permissible annual discharge limits. DOE and EBMUD each require that Berkeley Lab monitor radionuclide discharges to the sewer to demonstrate compliance with these limits.

Berkeley Lab's stormwater discharges are governed by the California General Permit for Discharges of Stormwater Associated with Industrial Activities [13]. This permit requires biannual pollutant monitoring during stormwater runoff, observation of wet season discharges, dry season observation of non-stormwater discharges, creation and implementation of specific plans and documents, and annual reporting of results to the San Francisco Bay RWQCB.

Berkeley Lab applies for coverage under the California NPDES General Construction Stormwater Permit [14] when the construction activities footprint encompasses more than one acre in size. Depending on the risk level, this permit potentially requires monitoring during qualified rain events for turbidity and pH, observation of stormwater runoff discharges during business hours, quarterly observations of non-stormwater discharges, creation and implementation of specific plans and documents, and annual reporting of results to the SWRCB's Stormwater Multiple Applications and Report Tracking System (SMARTS) database.

The Berkeley Lab Underground Storage Tank (UST) program is managed in compliance with 40 CFR 280, California Health & Safety Code 25280-25299, and Title 23, Sections 2610-2729 of the California Code of Regulations [15]. Requirements include permits for UST removal and installation, monitoring plans, and potential unauthorized release reports. The City of Berkeley Toxics Management Division has been given authority to implement and enforce state rules and issue UST permits.

Title 23 of the CCR, Sections 2550 and 2610, defines additional standards for leak detection, unsaturated zone, and groundwater monitoring activities associated with waste management units and USTs. These regulations are intended to protect state waters from discharges of hazardous or toxic substances. The state board has delegated responsibility for enforcement of these regulations and the provisions of the Porter-Cologne Water Quality Control Act to the RWQCB.

Title 17 of the CCR, Section 30253 [12] also places limits on dose levels from external penetrating radiation sources in uncontrolled areas. These levels must be less than 2 mrem (0.02 mSv) in any one hour.

A summary of key environmental monitoring and surveillance regulatory requirements is presented in Table 2-1.

Table 2-1 Environmental Monitoring Regulations and Agency Oversight Responsibility Summary

Regulations, Requirements, Guidelines	Topic	Oversight Agency
10 CFR 20.2003	Disposal by Release to the Sanitary Sewerage	EPA
17 CCR 30253	Radiation protection standards of radionuclides in sewer discharge and water	EBMUD, DPH
22 CCR 64443	Domestic Water Quality Maximum Contaminant Level (MCL) for Radioactivity	RWQCB
23 CCR 2610-2727	USTs	City of Berkeley
40 CFR Part 122-125	National Pollutant Discharge Elimination System Regulations, including Stormwater Discharge (Clean Water Act)	SWRCB, RWQCB
40 CFR Part 136	Guidelines Establishing Test Procedures for the Analysis of Pollutants (under the Clean Water Act)	EPA
40 CFR Part 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities[1]	DTSC
40 CFR Part 280	Standards and corrective actions for owners and operators of USTs	City of Berkeley
40 CFR Part 403	Responsibilities of government and industry to prevent the discharge of harmful pollutants to POTWs	EBMUD
40 CFR Part 50	National Primary and Secondary Ambient Air Standards	EPA
40 CFR Part 58	Ambient Air Quality Surveillance	EPA
40 CFR Part 60	Standards of Performance for New and Modified Stationary Sources	BAAQMD
40 CFR Part 61	National Emission Standards for Hazardous Air Pollutants	EPA
40 CFR Subchapter N	Effluent Guidelines and Standards (Clean Water Act)	EBMUD
California Health and Safety Code 25280-25299	USTs	City of Berkeley
DOE Order 231.1B	Environment, Safety, and Health Reporting	DOE
DOE Order 436.1	Departmental Sustainability	DOE
DOE Order 458.1	Radiation Protection of the Public and the Environment	DOE
DOE/EH-0173T	Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance	DOE
DOE-STD-1153-2002	A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota	DOE
SW-846	Test Methods for Evaluating Solid Waste	EPA

[1]40 CFR Part 264 Section 3004(u) of RCRA as amended by the Hazardous and Solid Waste Amendments (HSW), 40 CFR 264101, and 25200.10 of the California Health and Safety Code (HSC), require that Hazardous Waste Facility permits issued after November 8, 1994 address corrective action of all releases of hazardous waste.

3.0

Effluent Monitoring

For the purposes of this report, effluent monitoring is the collection and analysis of samples or measurements of liquid and gaseous effluents in order to determine process-stream characteristics and quantify contaminants, assess any chemical or radiological exposures to members of the public, and demonstrate compliance with applicable standards.

Berkeley Lab's monitoring objectives for radiological and nonradiological effluents are to:

- Verify compliance with emission discharge and effluent control limits as stated in applicable federal, state and local effluent regulations and operating permits.
- Determine compliance with commitments made in environmental and other official documents.
- Evaluate the effectiveness of effluent treatment and control as well as efforts toward achieving levels of radioactivity which are as low as reasonably achievable.
- Identify potential environmental problems and evaluate the need for remedial actions or mitigation measures.
- Support permit applications and permit revision as projects are completed.
- Detect, characterize, and report unplanned releases.
- Collect data that document site environmental management performance to meet the requirements of DOE Order 231.1B [7].

To accomplish these objectives, the Berkeley Lab implements the following elements:

- Representatively measure quantities and concentrations of pollutants as required by statute, permit, and other written commitments in liquid discharges, airborne releases, solid wastes, and waste treatment and disposal system effluent and influent.
- Establish alarm and action levels when necessary for radiological and nonradiological monitoring systems.
- Collect and analyze samples in a manner and frequency sufficient to characterize the effluent streams from its facilities and activities, as required by statute, permit, other written commitments, and this EMP.
- Collect samples in accordance with standard operating procedures to ensure reliable results.
- Maintain auditable records.

At Berkeley Lab effluent monitoring includes: (1) continuous real-time monitoring, (2) continuous sampling with off-line analysis, (3) periodic sampling with off-line analysis, and (4) administrative controls.

Specific standards for sewer, stormwater, and airborne effluent monitoring are discussed in their respective subsections, which are organized to address the following topics for each effluent type:

- Monitoring rationale and design criteria
- Monitoring parameters
- Laboratory analysis procedures
- Quality assurance requirements
- Program implementation procedures
- Preparation and disposition of reports

3.1 Sewer Effluent

Sewer effluent monitoring assesses two types of Berkeley Lab sewer discharges for compliance with regulations and permits: (1) controlled sanitary sewer discharges monitored for specific pollutants at point-of-release, and (2) monitoring of strategic points in the sewer system to determine total site discharges of major pollutants of concern.

3.1.1 Monitoring Rationale and Design Criteria

Berkeley Lab monitors sewer effluent at the point-of-release at the Building 77 Fixed Treatment Unit and seven groundwater treatment discharges near Buildings 6, 7, and 46, the sites of former Buildings 25A, 51 (former Motor Generator Room and Fire Trail), and 51L, and it monitors the Strawberry and Hearst site outfalls to determine total site discharges. These locations, as well as specific parameters, are monitored to comply with release limits stated in the EBMUD wastewater discharge permits. Additionally, the Strawberry and Hearst site outfalls are monitored for state and federal radionuclide release limits in Title 17 CCR, Section 30253 [12] and in DOE Order 458.1 [5].

The hazardous materials in use at Berkeley Lab with the potential to enter the sanitary sewer through accidental discharge include the following, (but certain materials routinely enter the sanitary sewer after treatment or if they are below regulatory thresholds):

- Many laboratories use small quantities of acids and bases. Once they become waste, certain acids and bases are stored and disposed of as hazardous waste, and others are treated by neutralization in a Fixed Treatment Unit (FTU) before entering the sanitary sewer.
- Solutions of metals used in various processes, such as metal finishing operations.
- Chlorinated hydrocarbons and other volatile organic compounds (VOCs) are used in research and operational processes. Major uses include wipe cleaning, painting, and laboratory research, and the spent solvent VOCs are recycled or handled as hazardous waste. Another source of VOCs is contaminated groundwater, which is treated to remove VOC contamination prior to reinjection into the ground or discharge to the sanitary sewer under a specific EBMUD permit.
- Total toxic organics (TTO) refers to a specific list of organic compounds defined in 40 CFR 433.11, and modified by the EBMUD permit, for any given permit category. At Building 77, Berkeley Lab is not required to monitor for EBMUD-defined toxic organics (as required for their category), but instead

certifies to EBMUD biannually that an appropriate solvent management plan is in place and that there is no discharge of toxic organics to the sanitary sewer.

- With approval through the EHSS Radiological Work Authorization (RWA) program, small amounts of radioactive materials may be discharged to the sanitary sewer within the limits set in the EBMUD permit by reference to CCR Title 17, Section 30253 [12], which is in accordance with 10 CFR 20.2003.

DOE Order 458.1 also sets limits on the amount of radioactive liquids that may be discharged to the sanitary sewer. Such discharges are prohibited unless all of the following conditions are met:

- The radioactive material is readily soluble;
- Average monthly release concentrations are less than five times DOE-approved values, or if they are greater, best available technology must be applied to limit such releases, and the process of selecting the technology must be documented in accordance with the Order;
- Annual releases are less than 5 curies of tritium, 1 curie of carbon-14, or 1 curie of all other radionuclides combined (above background radiation levels).

In addition, DOE requires that Berkeley Lab meet all applicable state and local agencies' requirements for discharge of radioactive liquids to sanitary sewers [5].

Guidance for analytical and sampling methods as well as requirements are taken from: ASTM's *Standard Methods for Analysis of Water and Wastewater* [16]; 40 CFR 136 [17]; SW-846 [18]; and monitoring criteria specified in wastewater discharge permits. Both the Environmental Services Group and the Facilities Division oversee design and construction of Berkeley Lab's sewer monitoring systems.

3.1.2 Monitoring Parameters

Figure 3-1 illustrates Berkeley Lab's separate point-of-discharge monitoring locations and two site sewer outfall monitoring stations. Table 3-1 presents a summary of the sampling activities at each point.

Table 3-1 Sampling Methods for Nonradiological Permitted Discharge Monitoring

Sampling Location	Sampling Point	Sampling Frequency	Sampling Method*
Building 77 FTU	FTU effluent discharge pipe	One representative operating day during the month of September in the permit year	24-hour composite and grab sample obtained and preserved
Hearst Sewer Outfall	Vault at Hearst St. and Highland Place. (Side Sewer #1)	One representative operating day twice in the permit year; once in March and once in September	24-hour composite and grab sample obtained and preserved
Strawberry Sewer Outfall	Vault on Centennial Dr. near UC swimming pools (Side Sewer #2)	One representative operating day twice in the permit year; once in March and once in September	24-hour composite and grab sample obtained and preserved
Groundwater discharge points near Buildings 6, 7, and 46, and sites of former Buildings 25A, 51 (2 locations), and 51L	Carbon drum effluent	Two times per permit year	Grab sample obtained and preserved

* per 40 CFR 136 and SW-846

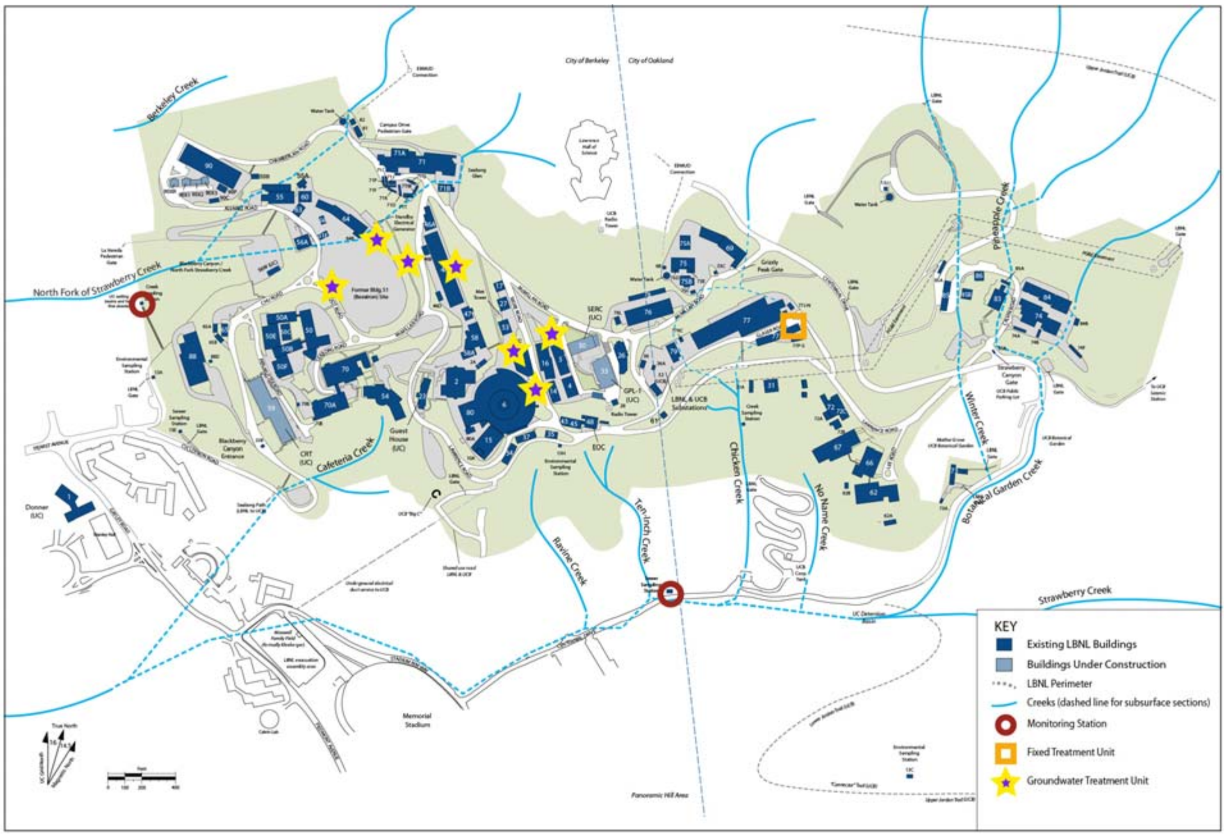

Figure 3-1 Berkeley Lab Sanitary Sewer System and Effluent Monitoring Locations

EBMUD mandates that Berkeley Lab perform self-monitoring for specific substances in its discharges at prescribed intervals. EBMUD also performs on-site monitoring to verify Berkeley Lab's self-monitoring methods and results.

3.1.2.1 Site Sewer Outfall Points

The monitoring locations for the site's sanitary sewer effluent are located at the site boundaries in vaults in the two separate drainage areas. The Hearst vault is located in Blackberry Canyon east of Hearst Avenue, and receives wastewater from the western portion of the site. It connects to the City of Berkeley sewer main at Hearst Avenue. The Strawberry Sewer, south of Berkeley Lab's border on Centennial Drive, receives discharges from the buildings on the eastern portion of the site and from some UC Berkeley locations. This outfall connects to University-owned piping at Centennial Drive and then to the City of Berkeley system on Rim Road.

Effluent from both of the sewers is directed to the EBMUD treatment plant, where it undergoes treatment prior to discharge into the San Francisco Bay. Effluent flows at both the Hearst and Strawberry monitoring stations are continuously recorded in order to calculate total discharge volumes. The flow meters are inspected weekly and calibrated quarterly.

Berkeley Lab's effluent – which includes both pretreated and untreated wastewaters – is sampled at the Hearst and Strawberry outfalls at the frequency prescribed in the EBMUD Wastewater Discharge Permit, and then analyzed according to the analytical parameters in the permit. Currently, the prescribed frequency is two sampling events per permit year at each sewer outfall monitoring point. Time composite samples are also automatically collected every month for laboratory radiochemistry analysis. These samples are analyzed for gross alpha and beta emitters, iodine-125, carbon-14, and tritium. For details of both radiological and nonradiological analyses, see Section 3.1.3, Laboratory Analysis Procedures.

3.1.2.2 Building 77

The Ultra High Vacuum Cleaning Facility in Building 77 cleans metal parts as needed to support Berkeley Lab activities. Coating activities added in 2005 include plating with electroless nickel, applying a chromate coating (Iridite 14-2) to aluminum parts, and anodizing aluminum parts, along with the capability to apply sealers and dyes. The facility includes an ultrasonic cleaner that uses aqueous detergents, cleaner tanks that use a caustic detergent, rinse tanks, and acid tanks. Spent solutions are drummed and shipped to an approved off-site hazardous waste disposal facility. The wastewaters from the primary rinse tanks and sumps are directed to the Fixed Treatment Unit. The secondary and tertiary rinse water is recycled through a de-ionizing filter system.

Wastewater pretreatments include neutralization, metals precipitation, flocculation, clarification, and filtration using a sand filter and a filter press. The dry filter cake is further dried in a drying oven and then disposed of as hazardous waste.

Effluent from the treatment process discharges to the sanitary sewer on a continuous basis during the unit's hours of operation. As specified by the EBMUD permit, wastewater samples are taken from the sampling port downstream of the treatment unit before this effluent combines with other wastewaters. The effluent is sampled by ESG personnel at the frequency stated in the permit. The samples are representative composites of a 24-hour average discharge and are analyzed for metals and pH. Berkeley Lab submits a Total Toxic Organics Compliance Report twice each year certifying that no toxic organics are being released to the sanitary sewer and that appropriate solvent management plans are in place.

EBMUD also periodically performs monitoring as specified in the permit to verify Berkeley Lab's self-monitoring results.

3.1.2.3 Groundwater Discharge Near Buildings 6, 7, and 46, and Former Buildings 25A, 51, and 51L

Under a separate permit, EBMUD allows Berkeley Lab to discharge groundwater to the sanitary sewer following treatment to remove VOC contamination. The treatment process consists of passing the contaminated groundwater through a dual-filtration carbon adsorption system. Samples are collected from each system's effluent to verify that permitted discharge levels are not exceeded. Presently, seven systems near Buildings 6, 7, and 46, as well as the sites of former Buildings 25A, 51 (former Motor Generator Room and Fire Trail), and 51L are permitted to discharge treated groundwater to the sanitary sewer. However, most of the treated water is injected into the subsurface as part of remediation to clean contaminated areas, so only a portion of the effluent from these systems is discharged to the sanitary sewer.

3.1.2.4 Direct Sources

Direct sources are regulated under conditional authorization permits from the City of Berkeley as follows:

1) Building 2 Acid Neutralization System,
2) Building 70A Acid Neutralization System.

The Fixed Treatment Unit at Building 77 discussed in Section 3.1.2.2 falls under the state's permit-by-rule tier for hazardous waste treatment and storage facilities. In December 2008 a Fixed Treatment Unit that neutralizes acids and or caustic wastes from the Nanofabrication Facility began operation at Building 67. This treatment unit is also permitted under the permit-by-rule tier.

Most other operations discharge directly to the sanitary sewer, combine with site sanitary sewer effluent, and are monitored at the site sewer outfall points, since EBMUD has determined that these discharge sources are not significant and do not merit individual permits.

Liquid wastes that are not individually permitted are characterized by the discharger to determine whether discharge to the sanitary sewer is appropriate. For radioactive sources, this characterization includes an RWA and working procedures that are subject to an internal ALARA review to account for direct sewer discharge of radionuclides under 17 CCR 30253 [12].

All onsite and offsite waste generators at Berkeley Lab are responsible for appropriate disposal practices to the sanitary sewer in their respective work areas. The RWA program requires waste generators to maintain disposal logs and report radionuclide discharges to the program. Of the offsite locations, only Building 1, which is located on the University of California-Berkeley campus, is subject to administrative controls, and no confirmatory sewer monitoring is required at any offsite location. Due to the small amount of waste generated, the discharger is only required to maintain disposal logs and analyze records. These are also reviewed periodically by ESG: the quarterly inventory report from the RWA program's database is reviewed to ensure that only authorized amounts of specified isotopes are released to the sanitary sewer. At other offsite buildings (i.e., 903, 937, 941, 943, 977 [Berkeley West Biocenter on Potter Street], the Joint Genome Institute in Walnut Creek, and the Joint BioEnergy Institute in Emeryville), no sewer discharge of radionuclides is currently authorized. Additionally, EBMUD has determined that no discharge permit is necessary at Building 977, and the permit from the Central Contra Costa Sanitary District for the Joint Genome Institute does not require effluent monitoring. Therefore, EHSS does not perform confirmatory sewer monitoring at these sites.

3.1.3 Laboratory Analysis Procedures

Laboratory analysis of samples is undertaken to satisfy the self-monitoring provisions of the EBMUD permit or, in the case of radionuclide effluent discharges, to meet the requirements of DOE orders. Table 3-2 presents the parameters analyzed and methods used.

Radiological procedures are based on DOE guidance and EPA methods. Analyses are performed at an offsite commercial laboratory. Gross alpha measurements by proportional counter are used as a screening mechanism. If the gross alpha measurement indicates alpha activity above the state Maximum Contaminant Level (MCL) for drinking water of 15 picocuries/Liter (pCi/L), then the analytical laboratory performs a gamma spectroscopy analysis to determine the specific radionuclides contributing to the alpha activity. Gross beta measurements by proportional counter are also used as a screening mechanism for beta emitters. If the gross beta measurement indicates beta activity above the state MCL for drinking water of 50 pCi/L, then the laboratory performs a gamma spectroscopy analysis to determine the specific radionuclides contributing to the beta activity.

Tritium samples are analyzed by a liquid scintillation counting technique. The collected water is distilled, mixed with a counting cocktail, and placed in a counter. As required in the contract Berkeley Lab has with any pre-qualified commercial radiological laboratories, the minimum detectable activity (MDA) for tritium is 7 Bequerel/L (Bq/L) (200 pCi/L).

In 2003 ESG reviewed the value of performing a periodic gamma spectroscopy analysis on sewer samples using data from the previous five years. It was determined that there is no need to perform routine gamma spectroscopy provided the overall values remain well within the range of the natural isotopic abundances identified by this technical assessment.

Water samples are prepared for gross alpha and beta analysis by acidification (HNO_3) and evaporation into 5-centimeter (2-inch) diameter stainless steel planchets. Organic residues not wet-washed by the nitric acid treatment are oxidized by flaming the planchets. The minimum detectable activity for gross alpha is 0.2 Bq/L (5 pCi/L), depending on the amount of dissolved solids in the sample. The MDA for gross beta is 0.15 Bq/L (4 pCi/L)

3.1.4 Quality Assurance Requirements

All wastewater samples are collected using containers, collection methods, and preservation techniques as specified in 40 CFR 136. Sampling methods include requirements for chain-of-custody, duplicate samples, field blanks, and sample tracking information for data management. Holding times and analytical methods are specified in the wastewater discharge permit. Instrumentation used to provide real-time or near real-time sewer monitoring information is also subject to Berkeley Lab quality assurance requirements. Specifically, each flow meter is calibrated at multiple flow levels to assure linearity.

Discharges of rainwater from secondary containment and any questionable liquid effluent are reviewed by Facilities Division staff to ensure environmental compliance and reduce the potential for an excursion or accidental increase in contaminants. In the case of rainwater, Facilities Division follows a procedure for aboveground storage tanks specifying that rainwater accumulated in aboveground storage tank secondary containment will not be directly discharged until appropriately evaluated.

Goals for the accuracy and precision of sewer monitoring data are established in ESG procedures. For additional details pertaining to quality assurance procedures, see Section 7, Quality Assurance and Data Review.

Table 3-2 Analytical Methods for Permitted Sewer Discharge Monitoring

Parameter	Sample Type	Method	Location
pH	Grab	SM 4500 H^+ B	77, Outfalls
Total Identifiable Chlorinated Hydrocarbons	Grab	EPA 624	Outfalls
Cadmium	Composite	EPA 200.7	77, Outfalls
Chromium	Composite	EPA 200.7	77, Outfalls
Copper	Composite	EPA 200.7	77, Outfalls
Lead	Composite	EPA 200.7	77, Outfalls
Nickel	Composite	EPA 200.7	77, Outfalls
Silver	Composite	EPA 200.7	77, Outfalls
Zinc	Composite	EPA 200.7	77, Outfalls
Chemical Oxygen Demand	Composite	EPA 410.4	Outfalls
Total Suspended Solids	Composite	SM 2540D	Outfalls
Gross Alpha Activity	Composite	EPA 900	Outfalls
Gross Beta Activity	Composite	EPA 900	Outfalls
Tritium	Composite	EPA 906	Outfalls
Iodine-125	Composite	Liquid Scintillation Counting	Outfalls
Carbon-14	Composite	Liquid Scintillation Counting	Outfalls
Volatile Organic Compounds	Grab	EPA 624 or EPA 8260	Treated Groundwater

3.1.5 Monitoring Operating Procedures

Sewer effluent monitoring program procedures are listed in Appendix C.

Operating procedures and operator training are provided by ESG personnel for permitted FTUs. Operating procedures may include the following, if appropriate for the unit:

- Instructions for calibrating monitoring instrumentation, determining of the accuracy of the pH meter, and other parameters.
- Guidance for inspecting equipment.
- Approved methods for equipment cleaning and maintenance.
- Approved methods for the generation and analysis of calibration/operation logs.

3.1.6 Reporting

Sewer effluent self-monitoring results are reported to EBMUD within the deadlines prescribed by the discharge permit, and within 24 hours of becoming aware of an exceedence of the permitted limit. Unusual discharges to sanitary sewer are also reported to the DOE Berkeley Site Office [5]. The reports to EBMUD include certifying signatures, analytical results, chain-of-custody forms, process description, field notes, and volumes discharged. Radiological results for wastewater form the basis for an annual certification to EBMUD that Berkeley Lab is operating within regulatory limits..

Monitoring results are also presented in the annual *Site Environmental Report* [3], which is distributed to many federal, state, and local regulatory agencies, made available to the public, and posted on the ESG web site at http://www.lbl.gov/ehs/esg.

3.2 Stormwater Effluent

Berkeley Lab monitors stormwater discharges as stated in its Alternative Stormwater Monitoring Plan (ASWMP) [19]. This plan is required by the NPDES General Permit for Stormwater Discharges Associated with Industrial Activities, administered by the Regional Water Quality Control Board [13]. Stormwater monitoring results are reported annually to the RWQCB. Additional information regarding stormwater effluent monitoring is found in the ASWMP, which is included in Appendix A of this Plan.

Under the California NPDES General Construction Stormwater Permit [14] stormwater discharges must be monitored when the risk level of a project is 2 or 3, as determined by specific regulatory criteria. In such cases, this permit requires that LBNL monitor during a qualified rain event (0.5 inch or greater) for turbidity and pH. LBNL’s stormwater monitoring results are reported annually to SWQCB via the SMARTS database.

3.3 Airborne Emissions

Berkeley Lab measures airborne radionuclides emitted from building exhaust systems through stacks or other vents to ensure compliance with the EPA's radionuclide NESHAP regulations in 40 CFR 61, Subpart H, *National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities* [11]. Measurements are made in one of two ways: sampling or monitoring. Sampling consists of extracting airborne radionuclides from the effluent stream using a filter collection device, while monitoring consists of taking continuous real-time measurements.

Berkeley Lab also measures nonradioactive airborne emissions, but this activity is limited to periodic testing for organic compounds at several BAAQMD-permitted soil vapor extraction projects operated by the Environmental Restoration Program. This testing is performed using direct-reading instrumentation such as hand-held photoionization detectors, and monitoring frequency and location is dictated by permit conditions. For details, see the current Environmental Restoration Program Semiannual Progress Report and Annual Summary [20].

3.3.1 Sampling/Monitoring Rationale and Design Criteria

The radionuclide NESHAP requirements stipulate that Berkeley Lab calculate the potential dose (from exposure over time to radionuclides) from each radionuclide emissions source. When determining this potential dose, ESG staff personnel consider the radionuclide quantities that are authorized for use in each laboratory, but do not consider emissions controls, such as filters. This approach is conservative, but it is consistent with regulatory requirements.

Based on the calculated potential dose, the radionuclide NESHAP regulation categorizes sources of radionuclide emissions as follows:

- Sources with a potential dose that could equal or exceed 1.0×10^{-3} mSv/yr (0.1 mrem/yr)
- Sources with a potential dose of less than 1.0×10^{-3} mSv/yr (0.1 mrem/yr)

None of Berkeley Lab's stacks fall into the category where the potential dose could reach 1.0×10^{-3} mSv/yr (0.1 mrem/yr) or more. For all sources, Berkeley Lab performs periodic confirmatory measurements. Since the NESHAP regulation does not provide details on such measurements, Berkeley Lab obtained DOE and EPA approval in 2005 to perform periodic confirmatory measurements using a graded approach, which is represented as minimum requirements in Table 3-3.

Berkeley Lab may, however, sample or monitor more frequently as warranted. For example, the potential dose from radionuclides released to the atmosphere from the Building 56 and Building 88 accelerators is very low, but considering that the expected emissions are short-lived (fluorine-18 from Building 56 has a 110-min half-life and carbon-11 from Building 88 has a 20-min half-life), the best way to measure these emissions is by real-time monitoring rather than by quarterly sampling.

Table 3-3 Radionuclide NESHAP Graded Measurement Approach

Category	Potential dose (mSv/yr)[a]	Requirements
1	$1.0 \times 10^{-1} > \text{dose} \geq 1.0 \times 10^{-2}$	Continuous sampling with weekly collection and analysis AND Real-time monitoring with alarming telemetry for short-lived ($t_{1/2}$ <100 h) radionuclides resulting in >10% of potential dose to the maximally exposed individual
2	$1.0 \times 10^{-2} > \text{dose} \geq 1.0 \times 10^{-3}$	Continuous sampling with monthly collection and analysis OR Real-time monitoring for short-lived ($t_{1/2}$ <100 h) radionuclides resulting in >10% of potential dose to the maximally exposed individual
3	$1.0 \times 10^{-3} > \text{dose} \geq 1.0 \times 10^{-4}$	Periodic sampling 25% of the year
4	$\text{Dose} \leq 1.0 \times 10^{-4}$	Potential dose evaluation before project starts and when annual radionuclide use limits are revised; no sampling or monitoring required

[a] 1 mSv/yr = 100 mrem/yr

All sampled stacks exhibit turbulent flow (Reynolds number >2100), so probe position and size are not critical. Nonetheless, for particulate sampling the location at each stack where particulate radioactive effluent is withdrawn is generally selected in accordance with the guidance of ANSI N13.1 [21] and the requirements of 40 CFR 60, Appendix A, Methods 1 and 1A. Probes are placed at positions of average flow in the effluent stream and the stream is drawn through the probes at isokinetic or subisokinetic flow rates so that large particles are accurately or over-represented in the sampling medium.

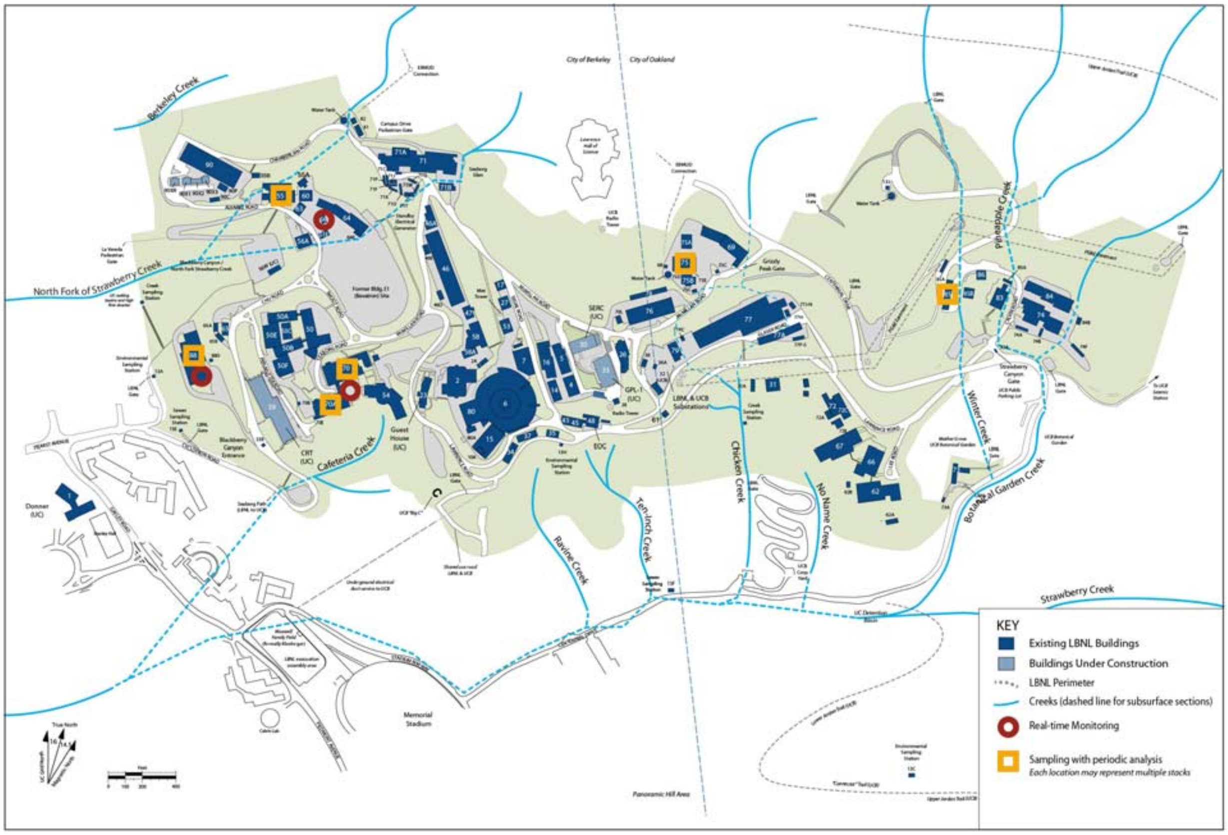

Figure 3-2 Stack Sampling and Monitoring Sites

For gases and vapors that are well-mixed, measurement design criteria can be less rigorous than for particulates [8]. Sampling probes that withdraw such radionuclides as gaseous species, air activation products from Berkeley Lab accelerators, or tritium are not selected in accordance with the ANSI N13.1 criteria, as these species are essentially uniformly distributed in an effluent stream and do not exhibit particulate behavior.

Sampled and monitored stack locations are shown in Figure 3-2 and discussed below.

- **Building 85 stacks:** Stacks from hoods and glove boxes in the Hazardous Waste Handling Facility (Building 85) are equipped with high-efficiency particulate air (HEPA) filters upstream of the sampling probes. Therefore, the average particle size collected by these systems is expected to be less than 0.3 µm in diameter. Any non-isokinetic flow variation has little effect on these small particles. Sampling of these stacks for particulate emissions is expected to be representative within the limits provided by adherence to the ANSI N13.1 standard [21]. These stacks are also sampled for gaseous iodine, gaseous carbon, and tritium vapor.
- **Buildings 70 and 70A stacks:** Stacks that exhaust the Building 70 Pit Room (a radionuclide storage facility) and Building 70A Heavy Elements Research Laboratory (HERL) fume hoods and glove boxes are continuously sampled for particulates with analytical laboratory alpha or beta analyses. Emissions from the HERL glove box stack are also measured for alpha emitters in real time using a continuous air monitoring system that sends data by telemetry to HERL and ESG staff. As at Building 85, HEPA

filters are upstream of the sampling probes on the Pit Room and HERL stacks and the small particles that pass through the filters are largely unaffected by any non-isokinetic flow variations. Other stacks on Building 70A are sampled quarterly and are discussed below under “Other stacks.”

- **Buildings 56 and 88 accelerator stacks:** Probes for sampling gaseous emissions passing through real-time monitors at Buildings 56 and 88 were designed to provide representative – but not isokinetic – samples.
- **Other stacks:** Sampling probes for the remainder of the sampled stacks were designed to provide isokinetic or subisokinetic sampling at a point of average flow across the stack cross-section and at the average flow rate expected from the stack. The effluent flow rate from certain stacks varies depending on how frequently the hood is used and how high the hood sash is opened. The probes were designed to sample at a fixed rate at the point of the average anticipated flow rate. Some stacks are equipped with HEPA filters upstream of the sampling site, which reduces the average size of particulate species these systems collect and minimizes the impact of any non-isokinetic flow variations.

For a summary of sampling and monitoring locations, see Table 3-4.

Table 3-4 Stack Sampling Parameters

<table>
<tr><th>Building Number</th><th>Radionuclides</th><th>Frequency</th></tr>
<tr><td>55</td><td>Alpha emitters, beta emitters, iodine-125</td><td>Continuous sampling with monthly analysis</td></tr>
<tr><td>56</td><td>Positron emitters</td><td>Real-time, continuous monitoring</td></tr>
<tr><td>70</td><td>Alpha emitters, beta emitters</td><td>Continuous sampling with monthly analysis</td></tr>
<tr><td rowspan="2">70A</td><td>Alpha emitters</td><td>Real-time, continuous monitoring</td></tr>
<tr><td>Alpha emitters, beta emitters</td><td>Continuous sampling with monthly analysis or continuous sampling for one month each quarter</td></tr>
<tr><td>75</td><td>Alpha emitters, beta emitters</td><td>Continuous sampling for one month each quarter</td></tr>
<tr><td>85</td><td>Alpha emitters, beta emitters, tritium, carbon-14, iodine-125</td><td>Continuous sampling for one month each quarter</td></tr>
<tr><td rowspan="2">88</td><td>Positron emitters</td><td>Real-time, continuous monitoring</td></tr>
<tr><td>Alpha emitters, beta emitters</td><td>Continuous sampling for one month each quarter</td></tr>
</table>

3.3.2 Sampling/Monitoring Parameters

Berkeley Lab uses a wide variety of radionuclides in its research programs, and they are described in detail in the Berkeley Lab’s annual *Radionuclide Air Emission Report* [23]. Emissions of radionuclides are accounted for annually by measuring stack emissions of alpha-emitting radionuclides, beta-emitting radionuclides, carbon-14, iodine-125, tritium, and positron-emitting radionuclides, and by maintaining an inventory of all radionuclides used or received for use throughout the year. At some sites samples are collected continuously and the filter paper is changed monthly, while at others samples are collected for one month once every quarter. Table 3-4 provides stack sampling parameters for all sampling locations.

Specific radionuclides are sampled or monitored as follows.

- **Alpha- and beta-emitting radionuclides:** Samplers collect particulates on 47-mm (2-in) diameter filter paper. The filter paper is sent to a certified analytical laboratory for analysis by gas proportional counting. For real-time monitoring of alpha-emitting radionuclides, the filter paper is in close contact with a passivated planar silicon detector. The detector records the alpha activity of the stack air in near real-time and sends the results to a database accessible through the Berkeley Lab web site.
- **Carbon-14:** Sampled stack air passes through a sodium hydroxide solution that is sent to a certified analytical laboratory for liquid scintillation analysis.
- **Iodine-125:** This radionuclide is collected by passing sampled stack air through a canister of charcoal that is sent to a certified analytical laboratory for analysis by gamma spectroscopy.
- **Tritium:** Sampled stack air passes through color-indicating silica gel that is sent to a certified analytical laboratory for tritium analysis by liquid scintillation.
- **Positron-emitting radionuclides:** Positron-emitting radionuclides are measured at accelerators when a continuous stream of stack air is passed into a gas proportional radiation detector. The detector records the activity of the air in near real-time, sending the results by telemetry to a database accessible through the Berkeley Lab web site. The telemetry system is described in Section 4.4, External Penetrating Radiation Measurements.

3.3.3 Laboratory Analysis Procedures

All sampled stack emissions are analyzed using procedures conforming to 40 CFR 61, Appendix B, Method 114 [11]. Procedures for each measured parameter are summarized below.

- **Alpha- and beta-emitting radionuclides:** Before air particulate filters are analyzed, they are set aside for five days to allow short-lived radon and thoron daughters, which are naturally occurring radionuclides, to decay. Filters are then analyzed by gas proportional counting for any significant radioactivity. Based on conservative, predetermined action levels, any significant radioactivity is further quantified and characterized by gamma spectroscopy in accordance with the approved EPA Method 114, Table 1 [11]. Action levels for alpha-emitting radionuclides are set at 0.0037 Bq/m^3 (0.1 pCi/m^3), while action levels for beta-emitting radionuclides are set at 0.0074 Bq/m^3 (0.2 pCi/m^3). By contract, the analytical laboratory must be able to detect 0.074 Bq (2 pCi) per sample or less of alpha-emitting radionuclides and 0.15 Bq (4 pCi) per sample or less of beta-emitting radionuclides.
- **Carbon-14:** Sodium hydroxide solution is analyzed for carbon-14 by mixing the solution with a counting cocktail and measuring the radioactivity by liquid scintillation counting. Action levels for carbon-14 are set at 11.1 Bq/m^3 (300 pCi/m^3). By contract, the analytical laboratory must be able to detect carbon-14 activity of 1.9 Bq (50 pCi) per sample or less.
- **Iodine-125:** Charcoal canisters are analyzed for iodine-125 by gamma spectroscopy. Action levels for iodine-125 are set at 0.0037 Bq/m^3 (0.1 pCi/m^3). By contract, the analytical laboratory must be able to detect iodine-125 activity of 0.15 Bq (4 pCi) per sample or less.

- **Tritium:** Silica gel is analyzed for tritium by distilling off the water, mixing the water with a counting cocktail, and measuring the radioactivity by liquid scintillation counting. Action levels for tritium are set at 11.1 Bq/m^3 (300 pCi/m^3). By contract, the analytical laboratory must be able to detect tritium activity of 0.37 Bq (10 pCi) per sample or less.

Laboratory analytical procedures are provided by offsite commercial laboratories. Sources for radioanalytical procedures include EPA methods, ASTM standard methods, the *EML (Environmental Monitoring Laboratory) Procedures Manual* [24], and the *Radiological and Environmental Sciences Laboratory Procedures Manual* [25].

3.3.4 Quality Assurance Requirements

The *Quality Assurance Program Plan for NESHAP Compliance* [25] describes the radioanalytical quality control (QC) program for airborne radionuclide emissions, as required by 40 CFR 61, Appendix B, Method 114, paragraph 4.5.

All stack sampling and monitoring activities that affect quality are documented and implemented by ESG procedures. Field and laboratory quality control samples are prepared and analyzed to monitor data quality. Quality control sample results are compared to preset limits to evaluate data acceptance. For additional details on quality assurance procedures, see Section 7, Quality Assurance and Data Review.

3.3.5 Sampling/Monitoring Procedures

The airborne radionuclide emissions program is implemented by established procedures listed in Appendix C. These procedures include requirements for stack sample collection, equipment calibration, effluent flow rate measurements, results reporting, and data quality.

All procedures are carried out by qualified personnel, including, as needed, subcontractors hired to perform system calibration, maintenance, or repair activities. In such instances, Berkeley Lab will assure that all subcontractor procedures and services conform to 40 CFR 61, Subpart H. The Radiation Protection Group calibrates and maintains stack real-time monitoring detector systems per their standard procedures.

3.3.6 Reporting

Two annual reports summarize the stack emission sampling and monitoring data for the calendar year:

- The *Radionuclide Air Emission Report* [23], which documents dose received by the public based on stack sampling and monitoring program data, is submitted to the EPA and DOE by June 30th of each year.
- The *Site Environmental Report* [3] summarizes laboratory environmental compliance issues and presents radiological and nonradiological environmental monitoring methods and results (including stack air emission data and dose assessments).

Both reports are posted on the Environmental Services Group website: http://www.lbl.gov/ehs/esg.

4.0

Environmental Surveillance

Environmental surveillance is conducted for the purpose of characterizing impacts of site activities on the onsite and offsite air, land, and water environs and natural resources. Surveillance is carried out by the sampling and analysis of environmental media, or by direct measurement of environmental conditions. Surveillance can be used to verify effluent measurements, dispersion modeling, and dose assessment results.

Through surveillance activities, the following objectives are achieved:

- Characterization of the environment, including definition of spatial and temporal trends in measured quantities.
- Establishment of baseline values for environmental quality indices so that long-term changes can be detected.
- Assessment of pollution protection programs by evaluation of environmental quality measurements.
- Identification of new or unmonitored effluents or emissions.
- Verification of compliance with applicable environmental laws and regulations.
- Verification of environmental commitments made in official documents.
- Collection of data that document site environmental management performance to meet the requirements of DOE Order 231.1B [7].

Each of the five surveillance sections (i.e., water, soil and sediment, vegetation and foodstuffs, external penetrating radiation measurements, and dose to animals and plants) is organized to address the following topics:

- Surveillance rationale and design criteria.
- Surveillance parameters.
- Laboratory analysis procedures.
- Quality assurance requirements.
- Program implementation procedures.
- Preparation and disposition of reports.

4.1 Water

4.1.1 Surveillance Rationale and Design Criteria

At Berkeley Lab, no intentional discharges other than stormwater and certain other minor discharges, which are listed in the *Stormwater Pollution Prevention Plan* [27], are made to the storm drain system. However, accidental releases, releases from onsite sewer and water line breaks, and releases from locations above the site may all enter the storm drain system. To assess these potential discharges, Berkeley Lab monitors both the storm drain and sanitary sewer systems (see sections 3.1 and 3.2). A stand-alone *Alternative Stormwater Monitoring Plan* was developed to satisfy state and local requirements and is included as Appendix A of this document.

Even though Berkeley Lab has no direct discharges to any freshwater bodies, other than surface water runoff to Strawberry Creek and its tributaries, nearby bodies of water such as lakes and reservoirs may receive trace amounts of pollutants through direct exchange, dry deposition, and rain out of contaminants released to the air. Potential human exposure pathways from these bodies of water include consumption of fish, consumption of foodstuff irrigated with the water, and external exposure and accidental ingestion from recreational activities.

The western portions of the Berkeley Lab site are drained by the North Fork of Strawberry Creek, while the eastern portions of the site are drained by Strawberry Creek. These perennial streams are fed by springs at their headwaters, and also receive stormwater runoff from the site through constructed storm sewers or through both ephemeral and perennial tributaries. Neither Strawberry Creek, nor any of its tributaries, is known to be used as a source of public drinking or irrigation water. The streams of the Strawberry Creek watershed converge at the west end of the UC Berkeley campus, where they are diverted underground, and eventually discharge into the San Francisco Bay.

San Francisco Bay lies 5 km west of the Berkeley Lab site. The bay is the ultimate receptor for all sub-surface and surface runoff discharges from Berkeley Lab, including discharges to the publically-owned treatment work facility. This is also the case for all surrounding San Francisco Bay Area communities and businesses.

Consistent with the operation of a research facility for more than 80 years, Berkeley Lab's activities have made use of many types of chemicals, and the lab has produced wastes. In earlier years, some of these chemicals were released to soil, groundwater, or both, but in the past several decades, the Lab has improved operation control systems and practices to prevent spills and releases. As a result of historical activities, groundwater in certain onsite areas is contaminated with volatile organic compounds (VOCs), fuel hydrocarbons, and tritium (see Figure 4-1). The groundwater at Berkeley Lab is not used for drinking, irrigation, or other domestic or industrial supply purposes

Under the oversight of DTSC, Berkeley Lab is cleaning up VOC-contaminated groundwater in certain onsite areas. The cleanup process consists of the extraction of contaminated groundwater and treatment with activated carbon as well as the concurrent reinjection of the treated water into the subsurface for *in situ* soil-flushing purposes. Excess water is released to the sanitary sewer under a wastewater discharge permit granted to Berkeley Lab by EBMUD (see Section 3.1.2.4).

Surveillance of groundwater is performed by periodically collecting samples from the majority of more than 200 onsite wells, and from hydraugers, which are horizontal wells that drain groundwater from slopes to help prevent landslides. Samples are analyzed for VOCs to monitor the effectiveness of the cleanup process, to document that areas of groundwater contamination are stable or decreasing, and to document that contaminants are not migrating offsite. Selected groundwater samples are also analyzed for metals, polychlorinated biphenyls, total petroleum hydrocarbons, and tritium to obtain additional information on groundwater quality. Samples from selected wells are also analyzed for hydrochemical parameters indicative of the potential for biodegradation; this type of analysis provides the necessary data to assess the potential effectiveness of monitored natural attenuation in achieving required groundwater cleanup levels. Groundwater sampling requirements are specified in the Groundwater Monitoring and Management Plan [22].

Groundwater from hydraugers and subsurface drain lines, and other groundwater that reaches the surface may flow into the storm sewer system. From the storm sewer, it enters surface waters of the Strawberry Creek watershed, and eventually, San Francisco Bay, as described earlier. In some areas of Berkeley Lab, groundwater that reaches the surface may flow directly into a creek. Where VOCs have been detected in hydrauger effluent, the effluent is treated by activated carbon and discharged to the sanitary sewer (under the same EBMUD wastewater discharge permit mentioned above).

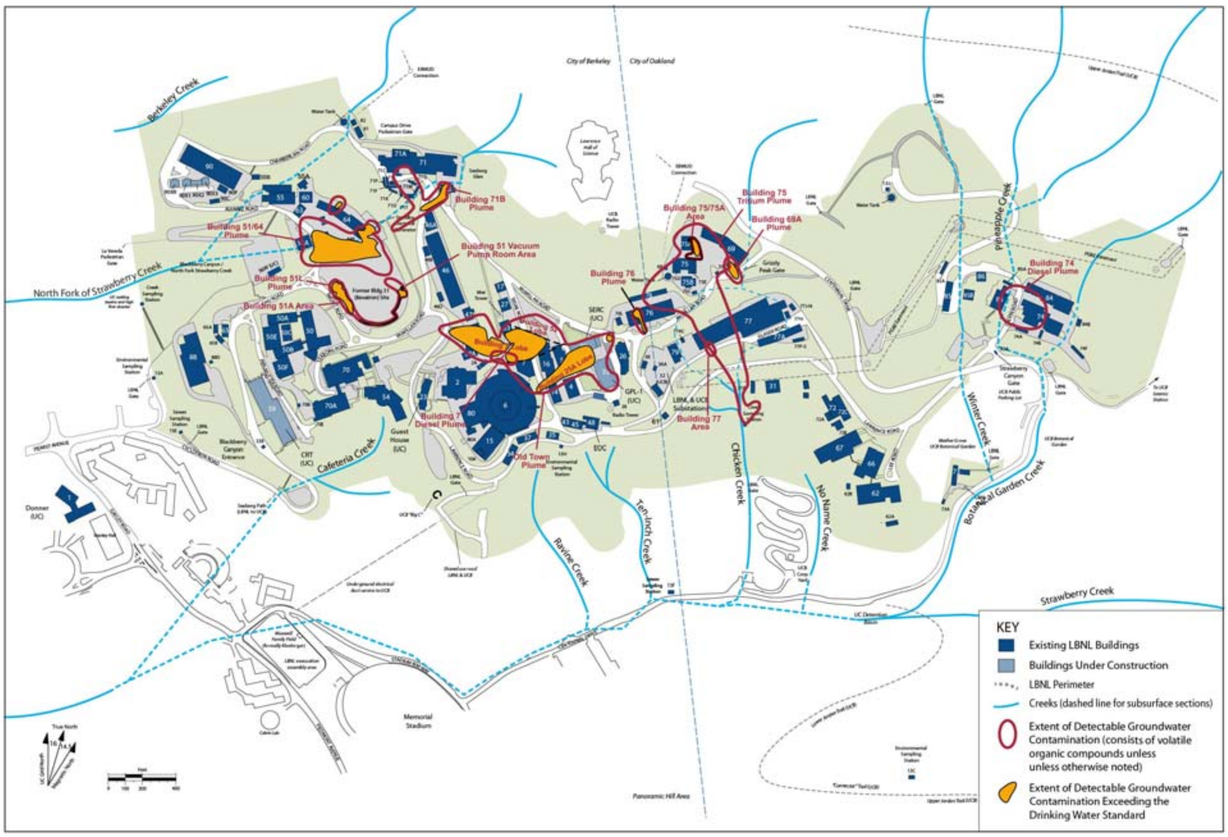

Figure 4-1 Groundwater Contamination Plumes

All groundwater monitoring (including groundwater wells, hydrauger discharges, and contamination studies) is integrated with other environmental monitoring activities. Radioactive materials discharged to the air have the potential for contributing contaminants to stormwater runoff and surface bodies of water through dry deposition during dry weather or washed out during a rain event. Berkeley Lab monitors the following radionuclides: gross alpha radiation, gross beta radiation, and tritium. Airborne emissions do not have the same deposition effect on effluent to the sanitary sewer system.

4.1.2 Water Surveillance Parameters

In 2009, creek monitoring locations were expanded to include Cafeteria Creek, Ravine Creek, Ten-Inch Creek, No Name Creek, and Botanical Garden Creek, in addition to North Fork of Strawberry Creek and Chicken Creek.

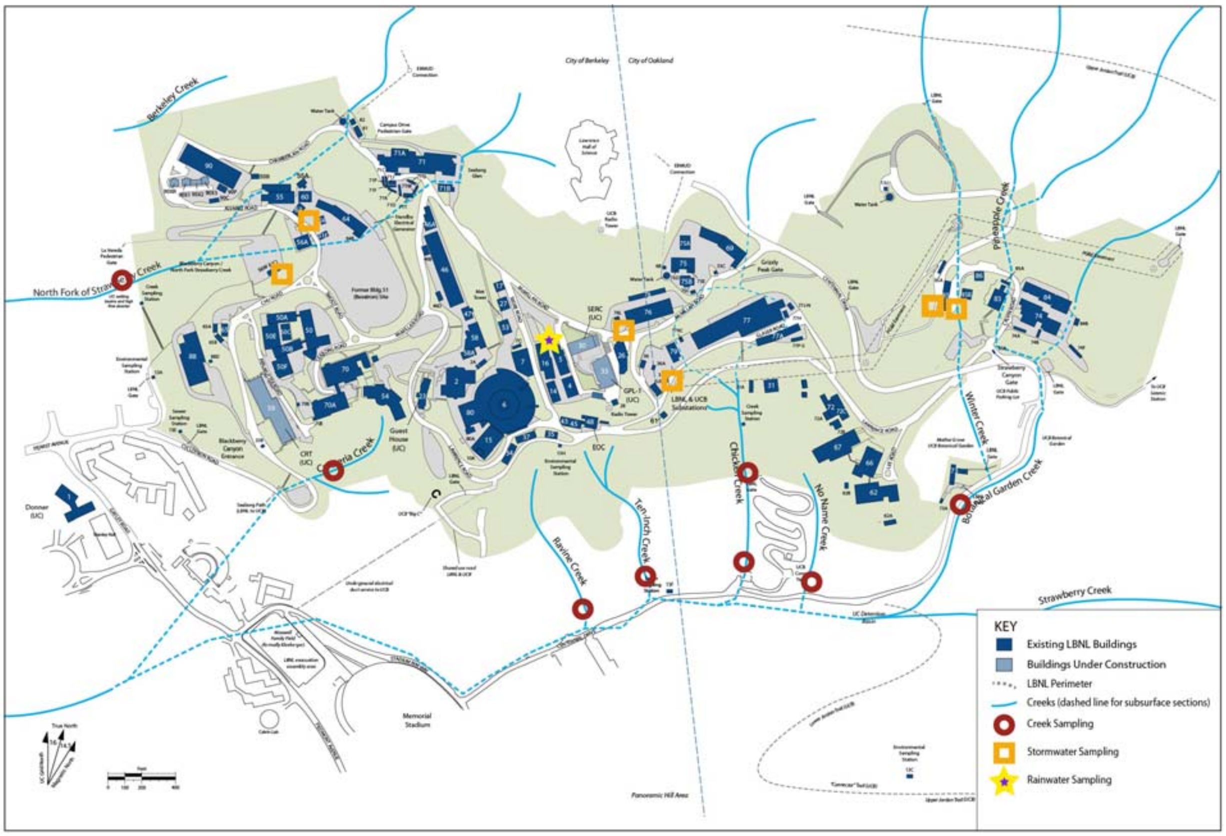

Figure 4-2 Creek and Rainwater Sampling Locations

Creek water samples are analyzed for radioactive components, including tritium, gross alpha and gross beta activity, and gamma-emitting isotopes. In addition, creek samples may also be analyzed for dissolved metals, total mercury, total aluminum, total iron, total magnesium, VOCs, pH, conductivity, total suspended solids, oil and grease, chemical oxygen demand, nitrate and nitrite and temperature. ESG Procedure 263, "Surface Water Sampling" contains specific sampling requirements.

4.1.3 Laboratory Analysis Procedures

Radiological procedures are based on DOE guidance and EPA methods. Gross alpha measurements by proportional counter are used as a screening mechanism. If the gross alpha measurement indicates alpha activity above the state MCL for drinking water of 15 pCi/L, then the analytical laboratory performs gamma spectroscopy to determine the specific radionuclides contributing to the alpha activity.

Gross beta measurements are used as a screening mechanism for beta emitters. If the gross beta measurement indicates beta activity above the state MCL for drinking water of 50 pCi/L, a gamma spectroscopy analysis is also performed to determine the specific radionuclides contributing to the beta activity.

Tritium analysis of water samples is accomplished by a liquid scintillation counting technique (EPA Method 906). The collected water is distilled, mixed with a counting cocktail, and placed in a counter. According to the analytical contract, the minimum detectable activity for tritium that the commercial radiological laboratory must achieve is 7 Bq/L (200 pCi/L).

Water samples are prepared for gross alpha and beta analysis by acidification (HNO_3) and evaporation into 5-centimeter (2-inch) diameter stainless steel planchets. Organic residues not wet-ashed by the nitric acid treatment are oxidized by flaming the planchets. The minimum detectable activity for gross alpha analysis is approximately 0.2 Bq/L (5 pCi/L), depending on the amount of dissolved solids in the sample. The MDA for gross beta analysis is approximately 0.13 Bq/L (3.5 pCi/L) for rainwater and 0.14 Bq/L (3.8 pCi/L) for creek water.

All the analyses described above are performed by a California state-certified commercial laboratory.

4.1.4 Quality Assurance Requirements

All water surveillance activities that affect quality are documented and implemented by ESG procedures listed in Appendix C. Field and laboratory quality control samples are prepared and analyzed in order to monitor data quality. Quality control sample results are compared to preset limits in order to perform data acceptance. For additional details pertaining to quality assurance procedures, see Section 7, Quality Assurance and Data Review.

4.1.5 Surveillance Procedures

The water surveillance program is conducted in accordance with the established ESG procedures listed in Appendix C. The procedures include sampling of storm and surface water, wastewater, and rainwater.

4.1.6 Reporting

Results from the water surveillance program are reported annually in the *Site Environmental Report* [3]. This report is available on the ESG web site (http://www.lbl.gov/ehs/esg) under the Publications link. Results of groundwater monitoring are reported in semiannual progress reports prepared under Berkeley Lab's RCRA Corrective Action Program. These reports are also available on the ESG website under the Environmental Restoration Program link. Stormwater results are also submitted to the RWQCB and City of Berkeley in an annual report, as mandated in the stormwater permit.

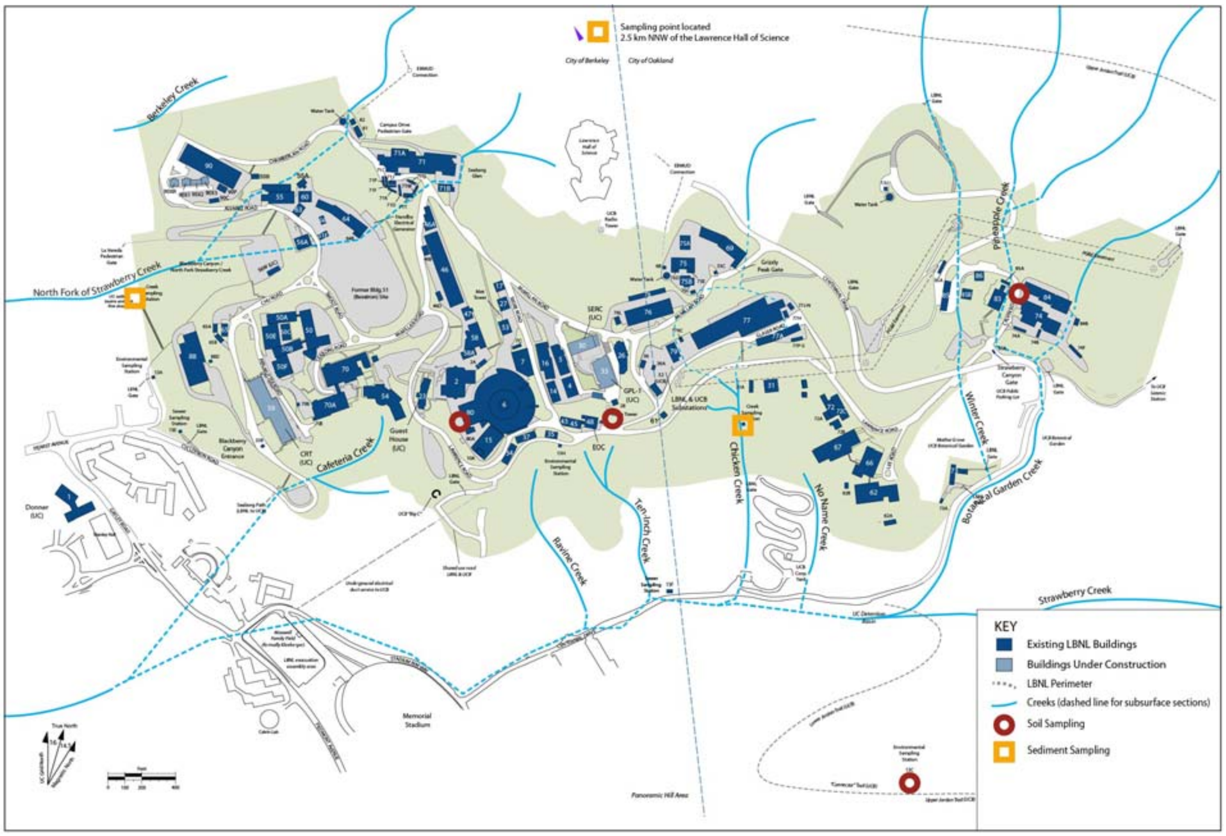

Figure 4-3 Soil and Sediment Sampling Sites

4.2 Soil and Sediment

4.2.1 Surveillance Rationale and Design Criteria

Soil provides an integrating medium that can account for contaminants released to the atmosphere or as liquid effluents. Note that the use of soil columns to dispose of radioactive liquids is prohibited at Berkeley Lab [5]. Soil sampling can be used to evaluate long-term accumulation trends and to estimate environmental radionuclide inventories. Sediment can provide an indication of the accumulation of contaminants in the aquatic environment. For contaminants, sediment sampling can be a more sensitive indicator than water sampling. Stormwater runoff through creeks and storm drains at and around the Lab ultimately discharges to San Francisco Bay. Accordingly, sediment is sampled from significant creeks at locations downstream from the Berkeley Lab.

4.2.2 Surveillance Parameters

Soil and sediment samples are collected and analyzed annually. The four locations for soil sampling are shown on Figure 4-3; three are onsite and one is off-site. Sediment sampling and analyses are selected to coincide with surface water sampling sites and analyses. The three sampling locations are shown on

Figure 4-3; one is at the north fork of Strawberry Creek, one at Chicken Creek, and one off-site location at Wildcat Creek in Tilden Regional Park in Berkeley.

4.2.3 Laboratory Analysis Procedures

Soil and sediment sample analyses procedures are summarized in Table 4-1. All analyses are performed at offsite certified commercial laboratories.

Table 4-1 Soil and Sediment Analysis Methods

Analysis	Soil Analysis Method	Sediment Analysis Method
Diesel	Not Performed	EPA 8015 modified
Gross Alpha and Gross Beta	Direct count with gas proportional detector	Direct count with gas proportional detector
Gamma Emitters	Direct count with high-resolution germanium detector	Direct count with high-resolution germanium detector
Metals	EPA 6010 EPA 7471	EPA 6010 EPA 7471
Oil and Grease	Not Done	EPA 1664
pH	EPA 9045	EPA 9045
Tritiated Water	Simple distillation/liquid scintillation counting	Simple distillation/liquid scintillation counting

4.2.4 Quality Assurance Requirements

All soil/sediment surveillance activities that affect quality are documented and implemented by ESG procedures listed in Appendix C. Field and laboratory quality control samples are prepared and analyzed in order to monitor data quality. Quality control sample results are compared to preset limits in order to perform data acceptance. For additional details pertaining to quality assurance procedures, see Section 7, Quality Assurance and Data Review.

4.2.5 Surveillance Procedures

The soil/sediment surveillance program is conducted in accordance with the established ESG procedures listed in Appendix C.

4.2.6 Reporting

Results from the soil and sediment surveillance program are reported annually in the *Site Environmental Report* [3].

4.3 Vegetation and Food Stuffs

There are no state or local regulations requiring the sampling of foodstuff or vegetation for pollutants. Berkeley Lab performs periodic sampling and analysis of indicator materials, such as vegetation, to determine if there is a long-term buildup of radionuclides in the terrestrial environment. This approach is consistent with DOE guidance [8].

4.3.1 Surveillance Rationale and Design Criteria

Historically, tritium accounted for most of Berkeley Lab's airborne radionuclide emissions. Tritium was released from Berkeley Lab primarily in the form of tritiated water vapor. As such it is susceptible to washout by rain or fog, and to vapor exchange with leaf surfaces and bodies of water. Tritiated water vapor behaves chemically and biologically in a manner very similar to normal water, and follows the same pathways in the food chain, becoming easily incorporated into plant and animal tissues.

In the vicinity of Berkeley Lab, there are no farms where vegetables or fruit are grown, and the nearest area where cattle are grazed is Wildcat Canyon Regional Park, 3.2 km (2 miles) northwest of Berkeley Lab's boundary. Vegetation in the area consists primarily of trees and grasses.

As part of an ongoing vegetation management program at Berkeley Lab, eucalyptus and pine trees are strategically removed to establish more native trees that produce healthier stands and reduce the fire danger.

4.3.2 Surveillance Parameters

Routine vegetation samples are collected and analyzed for tritium. Sampling locations are chosen to best represent air emissions from the former National Tritium Labeling Facility, which operated for nearly 30 years until its closure in 2002. Routine vegetation monitoring is conducted at least every five years.

Non-routine vegetation samples are collected in cooperation with the ongoing vegetation management program at Berkeley Lab. Before on-site trees near the former National Tritium Labeling Facility are removed from the Lab, the trees are sampled, analyzed for free-water and organically bound tritium, and determined to have tritium levels that are not distinguishable from regional background levels. The results of these analyses are used to better understand the distribution of tritium in vegetation at Berkeley Lab and to make decisions about the disposal of vegetation that may be affected by past activities.

4.3.3 Laboratory Analysis Procedures

Vegetation samples are typically analyzed for free-water and organically bound tritium only. These samples are shipped offsite to a certified commercial laboratory for analysis.

Free-water tritium is analyzed in vegetation samples by liquid scintillation counting. Water is extracted from samples using distillation, mixed with a counting cocktail, and measured with a liquid scintillation counter. By contract, the analytical laboratory must be able to detect free-water tritium concentrations of 0.0185 Bq/g (0.5 pCi/gram of plant material) or less.

Organically bound tritium in samples is analyzed by combustion followed by liquid scintillation counting. The vegetation samples are thoroughly mixed, dried, and combusted. The water from the oxidation process is collected, mixed with a counting cocktail, and measured with a liquid scintillation counter. By contract, the analytical laboratory must detect organically bound tritium concentrations of 0.185 Bq/g of plant material (5 pCi/g) or less.

4.3.4 Quality Assurance Requirements

All vegetation surveillance activities that affect quality are documented and implemented by ESG procedures listed in Appendix C. Field and laboratory quality control samples are prepared and analyzed in order to monitor data quality. Quality control results are compared to preset limits as part of data acceptance. For additional details pertaining to quality assurance procedures, see Section 7, Quality Assurance and Data Review.

4.3.5 Surveillance Procedures

The vegetation surveillance program is conducted in accordance with the established ESG procedures listed in Appendix C.

4.3.6 Reporting

Results from the vegetation surveillance program are reported annually in the *Site Environmental Report* [3].

4.4 External Penetrating Radiation Measurements

4.4.1 Surveillance Rationale and Design Criteria

DOE Order 458.1 requires that facilities perform environmental radiological monitoring to assess the potential radiation dose to members of the public that could result from site operations.

Exposures to members of the public from such routine DOE-related activities are limited to a total effective dose equivalent of 100 mrem (1 mSv) in a year [5]. The total effective dose equivalent is the sum of the effective dose equivalent from exposures to penetrating radiation sources external to the body plus the committed effective dose equivalent from radionuclides taken into the body during the year[1].

DOE requires that doses to members of the public in the vicinity of site activities be evaluated and documented to demonstrate compliance with dose limits and to assess exposures to the public from unplanned events. The order also requires that DOE facilities implement a program to maintain the maximum dose to members of the public and the collective dose to the population as far below the limits as reasonably achieveable, also referred to as ALARA. Thus, although the specific public dose equivalent limit of DOE 458.1 is 100 mrem (1 mSv), the ALARA concept requires that public exposures be maintained as far below the limit as practicable.

Berkeley Lab measures external penetrating radiation (neutron and gamma emissions) from its major accelerators and gamma emissions from small accelerators (Building 71) and stored radioactive materials. These measurements are taken with real-time neutron and gamma detectors, in conjunction with passive dosimeters that are used for gamma measurements only.

[1] Airborne radionuclide emissions, discussed in Section 4.3, are the only potential source of radionuclides that could be taken into the body. Berkeley is a developed urban area, where farming and livestock production are not practiced and private wells are not used for drinking water or crop irrigation. Thus the public is not exposed to groundwater, sewer releases, soil, or aquatic or terrestrial food products that could be affected by Berkeley Lab operations.

The potential sources of external exposure to members of the public by penetrating radiation from Berkeley Lab activities include the major accelerator facilities of the 88-Inch Cyclotron, the Advanced Light Source, and the Biomedical Isotope Facility; a small accelerator facility in Building 71; and facilities in which radioactive materials are stored in sufficient quantity and type to present a potential external exposure hazard.

4.4.2 External Penetrating Radiation Measurement Parameters

Berkeley Lab's environmental dosimetry program includes nine sites, shown on Figure 4-4; seven dosimeters are located near the site boundary, one is located near the Berkeley Lab Guest House, and one is located 1 km from the Lab boundary. Dosimeters measure only gamma radiation; they do not detect environmental levels of neutron radiation. Additionally, dosimeters measure background gamma radiation as well as gamma radiation from Lab operations. They provide time-averaged dose results that must be measured by an analytical laboratory rather than by real-time instrumentation.

The dosimetry network's objective is to confirm the exposures from external penetrating radiation to the public is below allowable regulatory limits.

Berkeley Lab's dosimeters use aluminum oxide with carbon (Al_2O_3:C) as the primary dosimeter material, which has a sensitivity as low as 0.1 mrem (0.001 mSv). After the dosimeter has been exposed to external penetrating radiation for a period of time, the radiation exposure is measured by optically stimulated luminescence. Other important considerations affecting the selection of dosimeters used in the Berkeley Lab environmental dosimetry program include:

- Type and energy of radiation to be measured.
- Expected environmental levels and corresponding background levels.
- Exposure period.

Dosimeters are placed at the monitoring locations for a period of three months, then removed and processed by a vendor to determine the integrated dose. Calibrations are also performed by the processing vendor. Four quarterly samples are collected from each station each year.

In addition to the dosimetry program, Berkeley Lab currently maintains three real-time gamma and neutron monitoring stations to assess external penetrating radiation levels and to support dosimeter measurements. In the past, Berkeley Lab maintained real-time gamma and neutron monitoring stations at various locations around the site. Many of those locations were discontinued, however, when monitoring results indicated that gamma and neutron levels were consistently measured at background levels only and there was no reason to expect elevated gamma or neutron radiation at those locations. Currently, the following real-time gamma and neutron monitoring stations are in operation:

- South of the Advanced Light Source housed in Building 6.
- Offsite on Panoramic Way approximately 1 kilometer south of Berkeley Lab, which is used as a background station.
- Near the site boundary, between Building 88 and the nearest residence.

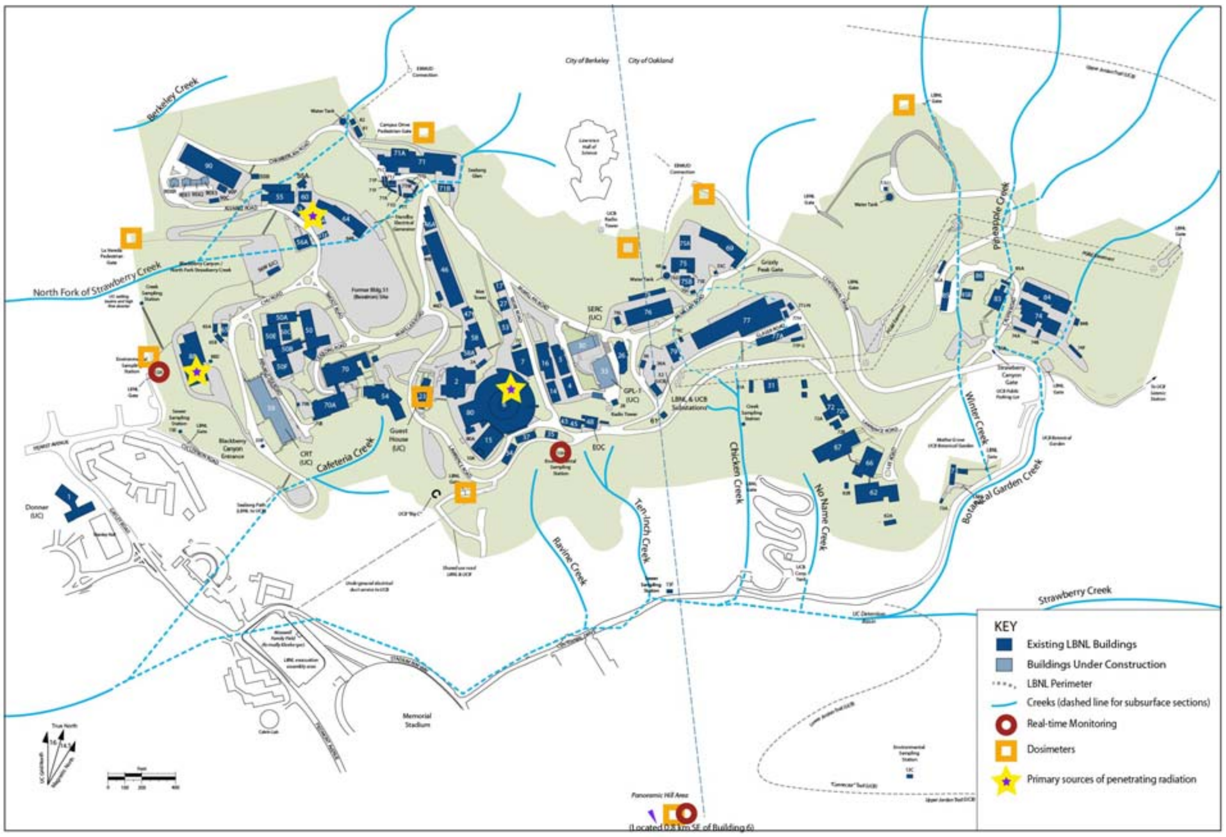

Figure 4-4 Environmental Penetrating Radiation Monitoring Locations

The real-time monitoring stations continuously detect and record gamma and neutron radiation. Each station contains sensitive pulse counters for each radiation type. The neutron detector is a modified Anderson Braun-type consisting of an LND model 252139 detector (helium-3) with dimensions of 2.5 cm by 8.8 cm and an effective volume of 24 cm^3. This gas-proportional counter is housed in a 20 cm by 25 cm thick polyethylene and boron plastic moderator. The neutron energy range is from 60 to 3,000 MeV (million electron volts). The gamma detector is an energy-compensated Geiger-Muller chamber (LND model 7807) with dimensions of 27.0 cm by 2.6 cm. Detector specifications are listed in Table 4-2.

Table 4-2 Real-Time Monitor Specifications

Detector Characteristic	Gamma	Neutron
Energy Response	80 - 1,600 keV	up to >100 MeV
Sensitivity (nominal counts/mrem)	650,000 counts/mrem	30,000 counts/mrem (insensitive to 500 rem/hr gamma)
Fill Gas	Neon & Halogen	Helium-3
Dose Range	0.001 - 100 mrem/hr	0.001 – 2000 mrem/hr

The calibrated output pulses from these detectors are transferred electronically via a link between the data source and a computer attached to the Berkeley Lab computer network. Data is transmitted over the network to a Unix server that hosts an Oracle database. There, the data are integrated and analyzed. This computer is dedicated to hosting multiple Berkeley Lab database applications and is maintained by the Berkeley Lab Information Systems and Services Department.

Calibrations of the detectors are performed annually using National Institute of Standards and Technology (NIST)-traceable standards. Each detector is given a unique calibration factor to convert its output from counts to millirem.

4.4.3 Laboratory Analysis Procedures

Exposed dosimeters are analyzed by the organization that supplied them. ESG analyzes dose data from the real-time monitoring systems.

4.4.4 Quality Assurance Requirements

All external penetrating radiation measurement activities that affect quality are documented and implemented by procedures maintained by the Radiation Protection Group and by ESG, as listed in Appendix C). For additional details pertaining to quality assurance procedures, see Section 7, Quality Assurance and Data Review.

4.4.5 Surveillance Procedures

The external penetrating radiation measurement program is conducted in accordance with established ESG procedures listed in Appendix C. Procedures for the Radiation Protection Group are listed on the Radiation Protection Group's website (http://ehswprod.lbl.gov/rpg/). The procedures include penetrating radiation monitoring, analysis, reporting, and data quality.

4.4.6 Reporting

Results from the external penetrating radiation measurement program are reported annually in the *Site Environmental Report* [3]. A link to this report is found at the ESG web site (http://www.lbl.gov/ehs/esg).

4.5 Dose to Animals and Plants

The DOE requires that aquatic animals, terrestrial plants, and terrestrial animals be protected from adverse effects of radiation and radioactive material released from Berkeley Lab operations [5]. Doses to aquatic animals are limited to 0.01 gray/day (1 rad/day). Doses to terrestrial animals should be limited to less than 0.001 gray/day (0.1 rad/day), and doses to terrestrial plants should not exceed 0.01 gray/day (1 rad/day).

To assist sites in demonstrating compliance with these limits, DOE approved a technical standard, *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota* [9] in July 2002. Berkeley Lab applies the standard to evaluate aquatic and terrestrial plants and animals across the main facility site.

As required by the DOE technical standard, Berkeley Lab summarizes the results of the biota dose assessment annually in its *Site Environmental Report* [3], which is distributed to all interested federal, state, and local regulatory agencies, as well as being available to the public. Berkeley Lab documents details of the assessment in an annual report retained on file.

5.0
Meteorological Monitoring

5.1 Surveillance Rationale and Design Criteria

Onsite meteorological data help assess the environmental impact of Berkeley Lab's airborne emissions for regulatory compliance requirements such as the radiological NESHAP regulations. Other applications for meteorological data include use in 1) human health risk assessment modeling, 2) obtaining environmental operating permits from regulatory agencies, 3) supporting regulatory reporting requirements such as the annual stormwater report, 4) responding to emergency situations such as spills, gas releases, or fires, and 5) supporting onsite researchers, who periodically request meteorological data to include in their research projects.

5.2 Meteorological Monitoring Parameters

Meteorological monitoring at Berkeley Lab consists of a single 26-meter tower located onsite west of Building 27 (see Figure 5-1). The tower serves as the source of representative onsite meteorological data because of its central location and relatively unobstructed surroundings. The tower is instrumented at the 26-meter level with horizontal wind speed and direction, vertical wind speed, and solar radiation sensors. Highly accurate temperature sensors are mounted at the 10-meter and 3-meter level to calculate delta-T, which is used to determine atmospheric stability. The 3-meter level is also instrumented with a temperature and relative humidity sensor. Precipitation and barometric pressure are measured near the 2-meter level.

5.3 Quality Assurance Requirements

Sensors are audited twice each year by a qualified external party. This frequency and the acceptance criteria for each sensor adhere to BAAQMD recommended guidance for air quality applications [28].

5.4 Surveillance Procedures

The meteorological monitoring program follows an established procedure largely based on BAAQMD guidance. The guidance addresses the major program topical areas, such as the parameters that should be collected for air quality applications, their collection interval (e.g., 15- or 60-minute data periods), as well as auditing and calibration criteria. ESG procedures are listed in Appendix C.

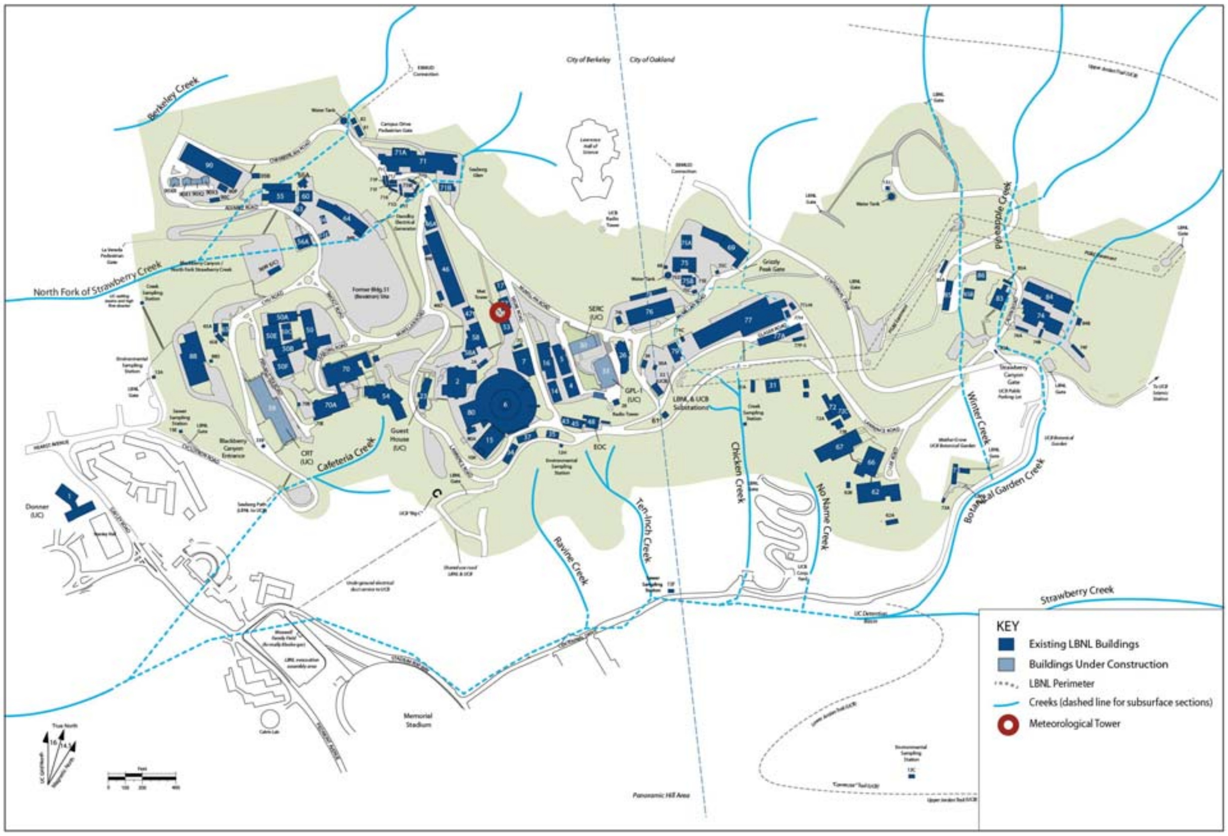

Figure 5-1 Meteorological Monitoring Tower

5.5 Reporting

Meteorological data from the sensors on the tower are collected continuously by a data logger at the base of the tower, which also processes the data into 15 minute and hourly average data sets. The data are retrieved and stored in redundant computer data acquisition systems. The data are available at the Environmental Services Group's web site (http://www.lbl.gov/ehs/esg) and through the EHSS Division's telemetry system, which presents the data in chart and table formats similar to that available on the ESG web site, and in an interactive graphical display for easy quality assurance review using a commercial program written with the Labview programming language. A summary of site meteorological conditions is also reported annually in the *Site Environmental Report* [3].

6.0
Pre-Operational Monitoring

6.1 Purpose

Pre-operational studies serve to characterize existing physical, chemical, and biological conditions, monitor background levels of radioactive materials and chemicals in the environment, characterize environmental parameters, and examine potential pathways for environmental contamination and public exposure prior to operation of a new Berkeley Lab facility that has the potential for significant environmental impact. An example of such a facility is the Berkeley Lab's Hazardous Waste Handling Facility.

The determination of significant adverse environmental impact and the need for a pre-operational study will be assessed prior to the start-up of new facilities or activities in coordination with National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA) compliance activities. The results of pre-operational studies are also used to ensure that radiation exposures to the public and the environment are kept as low as reasonably achievable.

For those facilities or activities with significant environmental impacts requiring an Environmental Impact Report or Environmental Impact Statement, pre-operational studies may be performed if projected facility operations will require a significant change in the environmental surveillance program. Information on the existing environment in the NEPA/CEQA evaluation may substitute for a pre-operational study if DOE 458.1 requirements are appropriately addressed, are otherwise not applicable (e.g., a nonradiological facility), or if facility operations would not require any change in the environmental surveillance program.

6.2 Scheduling

Wherever possible, the pre-operational study or NEPA/CEQA evaluation will be completed prior to start-up, assessing the existing environment, potential effects on the environment, and changes to the existing monitoring program to accommodate the new activity or facility. The study should begin at least one year prior to the anticipated date of operation in order to observe seasonal variation, and measurements should be timed to conclude at the beginning of operations.

Schedules and plans for pre-operational monitoring will be based on the potential effect on the environment, as defined in pre-operational NEPA/CEQA and safety analysis documentation.

6.3 Environmental and Ecological Parameters

The description of the existing environment will be limited to information that directly relates to the scope of the proposed action and that is necessary to assess or understand the impacts. Where appropriate, information may be incorporated by reference to more detailed descriptions of the affected environment.

Radiological and chemical components of interest are determined by characterizing the potential pollutant sources from new facilities and activities based on design plans, NEPA/CEQA reviews, and safety analyses. After determining significant radiological and chemical background components, the background levels are evaluated by studying current environmental monitoring program data, supplemented by a pre-operational sampling plan. Existing monitoring activities are coordinated with the supplemental pre-operational sampling activities.

The NEPA/CEQA evaluation will describe sensitive resources - such as threatened and endangered species and property of historic, archeological, or architectural significance - that may be affected by the new facility or activity. If such resources are present, the NEPA/CEQA compliance process shall satisfy requirements for pre-operational study.

6.4 Pathways for Human Exposure or Environmental Impact

The nature and extent of potential environmental impact or human exposure will be assessed by determining potential pathways for pollutants.

The pathway analysis will estimate source terms, concentrations in relevant pathway compartments, and effects of concentrations on the public and environment. Sampling strategies are developed for those critical pathways where environmental effects or public dose are most significant. Existing data from other environmental assessments and safety analysis reports may be cited to estimate source terms and effects.

6.5 Pre-Operational Monitoring Quality Assurance

All pre-operational monitoring activities that affect data quality are documented and implemented by ESG procedures (see Appendix C). Field and laboratory quality control samples are prepared and analyzed in order to monitor data quality. Quality control sample results are compared to preset limits in order to perform data acceptance. For additional details pertaining to quality assurance procedures, see Section 7, Quality Assurance and Data Review.

6.6 Implementation Procedures

Pre-operational monitoring is conducted in accordance with the established ESG procedures listed in Appendix C. The procedures include evaluating air emission sources, data quality, ambient air sampling, soil/sediment sampling, surface water sampling, and vegetation sampling.

6.7 Reporting

Results from any pre-operational monitoring studies are reported in the Berkeley Lab *Site Environmental Report* [3].

7.0

Quality Assurance and Data Review

7.1 Background

Quality assurance (QA) activities and processes ensure that environmental monitoring data meet user requirements. Quality control (QC) procedures verify that Berkeley Lab attains prescribed standards of performance for environmental monitoring. This chapter contains a summary discussion of QA and QC activities performed routinely within the environmental monitoring program.

Berkeley Lab's QA policy is documented in the *Operating and Quality Management Plan* [29]. This plan consists of a set of operating principles used to support internal organizations in achieving consistent, safe, and high-quality performance in their work activities. Its principles are applied to individual programs using a graded approach, with consideration given to factors such as the program's environmental, health, and safety consequences, its programmatic significance, and its mission.

When special quality assurance and quality control requirements are necessary for environmental monitoring, a Quality Assurance Project Plan is developed and implemented. The Berkeley Lab's NESHAP program has such a specific quality assurance plan. [26]

7.2 Sample Collection

Berkeley Lab's environmental monitoring program procedures for sample collection are in accordance with the specifications of the *Operating and Quality Management Plan*. The procedures prescribe sampling collection methods and related requirements for obtaining representative matrix samples. The following requirements are integrated into sample collection procedures:

- Appropriate methods developed by EPA or internally are used to obtain representative matrix samples.
- The environmental monitoring database generates chain-of-custody and field collection forms. Chain-of-custody sheet information are used to track sample status and disposition.
- Only qualified and experienced field staff collect samples using standard procedures and calibrated sampling instrumentation.
- Applicable field sampling information is documented on chain-of-custody forms and other field notes.
- Samples are packaged and shipped to an analytical laboratory using standard documented handling procedures and containers that preserve sample integrity.
- Field QC samples (i.e., duplicates, splits, blanks) are submitted to the analytical laboratory with each batch of samples, if practical and feasible.

7.3 Sample Analysis

The environmental monitoring program includes the use of both onsite laboratories and off site commercial laboratories to analyze samples. Both types of laboratories must meet demanding QA/QC specifications and certifications that were established to define, monitor, and document laboratory performance. The QA/QC data provided by these laboratories are incorporated into the data quality assessment processes.

The following summarizes the QA/QC requirements that analytical laboratories supporting the environmental monitoring program must meet:

- Have a written implemented QA/QC plan that meets Berkeley Lab requirements and specifications.
- Be certified by the California Department of Public Health's Environmental Laboratory Accreditation Program.
- Participate in interlaboratory QA programs such as the Environmental Monitoring Sampling Laboratory and the Department of Energy Environmental Measurement Laboratory. (Note: A DOE Consolidated Audit Program [DOECAP] team reviews results from these programs and initiates follow-up actions when data do not fall within satisfactory limits).
- Conform to the most recent statement of work for analytical services, which defines the analytical laboratory requirements needed by Berkeley Lab.
- May participate in annual audits and assessments conducted by DOECAP. (Berkeley Lab personnel participate on the DOECAP audit teams, which prepare a formal written report that summarizes findings and requirements for follow-up actions.).
- As applicable, have the following documented internal QC requirements:
    - Control limits
    - Method detection limit studies
    - Contract reporting limit
    - Matrix spikes, matrix spike duplicates, and laboratory control samples
    - Method blanks
    - Surrogates
    - Initial and ongoing calibration checks
    - Sample duplicates
    - Tracer yields

Deliverables from each analytical laboratory must include both hardcopy and electronic products. Hardcopy deliverables include case narratives, chain-of-custody documentation, and a summary of QC sample results. Electronic data deliverables include four specific types of files: sample, analysis, QA/QC, and a batch number reference.

7.4 Data Quality Assessment

Each set of data received from the analytical laboratory is systematically evaluated and compared to established data quality objectives categories that include accuracy, precision, representativeness, comparability, and completeness. When possible, quantitative criteria are used to define and assess data quality. Data quality is assessed for each analytical batch before the results can be authenticated and accepted into the environmental monitoring database.

To perform the large number of QC checks necessary to determine if data quality objectives have been met, the electronic data deliverables provided by the analytical laboratory are uploaded into the environmental monitoring database. This database performs computer-automated data quality checks on the laboratory data package. Data quality discrepancies are flagged, investigated, and resolved by Berkeley Lab staff. Following the automated data validation/verification checks and any necessary discrepancy resolution, program specialists perform final data authentication by reviewing the data and QC results before they are accepted.

7.5 Oversight of Environmental Monitoring Quality Assurance

To verify that environmental monitoring activities are adequate and effective, internal and external oversight is performed as required on specific environmental monitoring programs. Internal oversight activities consist of technical QA assessments performed by ESG and internal independent assessments conducted by the Berkeley Lab Office of Contract Assurance.

In addition to internal QA assessments, the ESG maintains a nonconformance and corrective action process documented in ESG Procedure 208. The purpose of this process is to improve the quality of ESG operations by identifying nonconformances and taking corrective action to prevent their recurrence. This process also seeks to improve the quality of work received from parties outside of ESG including LBNL and non-LBNL analytical laboratories, outside contractors, and vendors.

DOE’s oversight of Berkeley Lab programs is performed through the Operational Awareness Program, which includes participation of DOE staff in Berkeley Lab activities, such as field orientations, meetings, audits, workshops, document and information system reviews, and day-to-day communications. DOE criteria for performance evaluation include federal, state, and local regulations with general applicability to DOE facilities and applicable DOE requirements. DOE also provides external oversight through inspections performed by the Office of Environment, Safety and Health. In addition, EPA conducts external audits of the NESHAP monitoring program under 40 CFR 61, Subpart H.

7.6 Summary

Quality assurance for environmental monitoring at Berkeley Lab is a continuous and comprehensive process designed to ensure that monitoring results meet documented requirements. All results generated and reported by the environmental monitoring program undergo a stringent data quality assessment to verify that data quality objectives are met.

Throughout the QA process, data quality checks and communication links are in place to identify, document, and correct data quality discrepancies.

8.0 References

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[3] Lawrence Berkeley National Laboratory, "Site Environmental Report for 2011," Volume I, LBNL-27170E-2011, Environmental Services Group, September 2012.

[4] Department of Energy, "Departmental Sustainability," DOE Order 436.1, 2011.

[5] Department of Energy, "Radiation Protection of the Public and the Environment," DOE Order 458.1, 2011.

[6] Department of Energy, "UC-DOE Prime Contract for the Management and Operation of Lawrence Berkeley National Laboratory (No. DE-AC02-05CH11231)," Section J, Appendix I, DOE Directives/List B, 2012.

[7] Department of Energy, "Environment. Safety, and Health Reporting," DOE Order 231.1B.

[8] Department of Energy, "Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance," DOE/EH-0173T, 1991.

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[11] Environmental Protection Agency, "National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Faciliities," 40 CFR 61 Subpart H, 1989, as amended.

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APPENDIX A

Alternative Stormwater Monitoring Plan

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Alternative Stormwater Monitoring Plan

Prepared by:
Environment, Health and Safety Division
Environmental Services Group

September 2009

Revision 1

Ernest Orlando Lawrence Berkeley National Laboratory
Berkeley, CA 94720

This work was supported by the Director, Office of Science, U.S. Department of Energy under Contract Number DE- AC02-05CH11231

Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to ensure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine or imprisonment for knowing violations.

Certified By: Anita Aurah for J. Krupnick Date: October 1, 2010

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Record of Revisions

Revision Number	Description	Section(s)	Date of Revision
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Rev. 1	Update	All	9/30/09

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Acronyms

ACSCE	Annual Comprehensive Site Compliance Evaluation
ASTM	American Society for Testing and Materials
ASWMP	Alternative Stormwater Monitoring Plan
AST	Aboveground Storage Tank
BMP	Best Management Practice
COD	Chemical Oxygen Demand
DOE	Department of Energy
DSA	Drum Storage Area
EH&S	Environmental, Health and Safety
ESG	Environmental Services Group
LBNL	Lawrence Berkeley National Laboratory (also Berkeley Lab)
MSL	Mean Sea Level
NPDES	National Pollutant Discharge Elimination System
NSWD	Non-Stormwater Discharge
QA/QC	Quality Assurance and Quality Control
SC	Specific Conductance
SFRWQCB	San Francisco Bay Regional Water Quality Control Board
SIC	Standard Industrial Classification
SM	Standard Methods for the Examination of Water and Wastewater
SWRCB	California State Water Resources Control Board
SWPPP	Stormwater Pollution Prevention Plan
TOG	Total Oil and Grease
TSS	Total Suspended Solids
UC	University of California
USEPA	United States Environmental Protection Agency
WAA	Waste Accumulation Area
WDR	Waste Discharge Requirements

1.0
Introduction

This *Alternative Stormwater Monitoring Plan* ("ASWMP") has been prepared for the Lawrence Berkeley National Laboratory (LBNL) located at 1 Cyclotron Road in Berkeley and Oakland, Alameda County, California ("the Facility," Figure 1-1). The ASWMP fulfills the monitoring requirements and monitoring program objectives of the California State Water Resources Control Board (SWRCB) Order No. 97-03-DWQ *National Pollutant Discharge Elimination System (NPDES) General Permit No. CAS000001 (General Permit)*, *Waste Discharge Requirements* (WDRs) *for the Discharge of Storm Water Associated with Industrial Activities Excluding Construction Activities* ("General Permit"). This ASWMP has been prepared to provide a more industrial activity-specific indicator of pollutant contributions from regulated activities at LBNL and thus a more reliable basis for evaluating the performance and effectiveness of Best Management Practices (BMPs), as described in the *Stormwater Pollution Prevention Plan* for the Facility (SWPPP; ESG, 2009).

The monitoring program that has historically been implemented at LBNL has focused on larger drainage areas within the Facility, with the result that monitoring results have reflected the combined runoff from regulated and non-regulated areas. Approximately half of LBNL is undeveloped, native terrain, and runoff from these areas is not exposed to any industrial activity. Additionally, the developed areas of the Facility are largely dedicated to basic and applied scientific research (most of which is conducted indoors), with only incidental supporting industrial activity. The ASWMP is specifically designed to focus on the areas of industrial activity, which represent the only potential sources of pollutants that are specifically regulated under the General Permit.

1.1 Facility Description

1.1.1 Facility Location

The Facility occupies approximately 200 acres in Oakland and Berkeley, Alameda County, California (Figure 1-1).

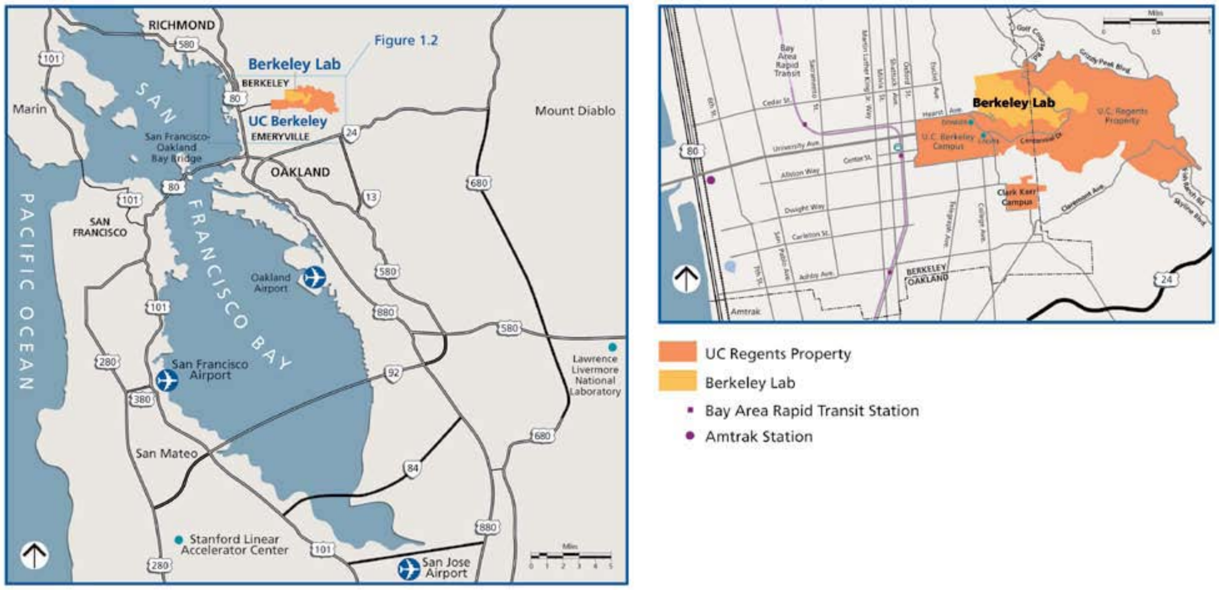

Figure 1-1. Vicinity Map

Eighty permanent buildings at the LBNL facility are used for administrative offices, research and development laboratories; site maintenance and operations activities; a cafeteria; a fire response station; construction trade shops (plumbing, electrical, and mechanical); hazardous waste storage; vehicle fueling and minor maintenance operations; site maintenance operations crew yard; and shipping and receiving, stores, and warehouse activities. Approximately 100 smaller buildings and trailers are used primarily as offices, but also house monitoring stations, emergency generators, and chemical and waste storage facilities. Figure 1-2 shows the overall layout of major buildings and structures at LBNL. Topography at the Facility slopes south to southwest. The ground surface elevations at the Facility range from approximately 500 feet above Mean Sea Level (MSL) to 1,000 feet above MSL.

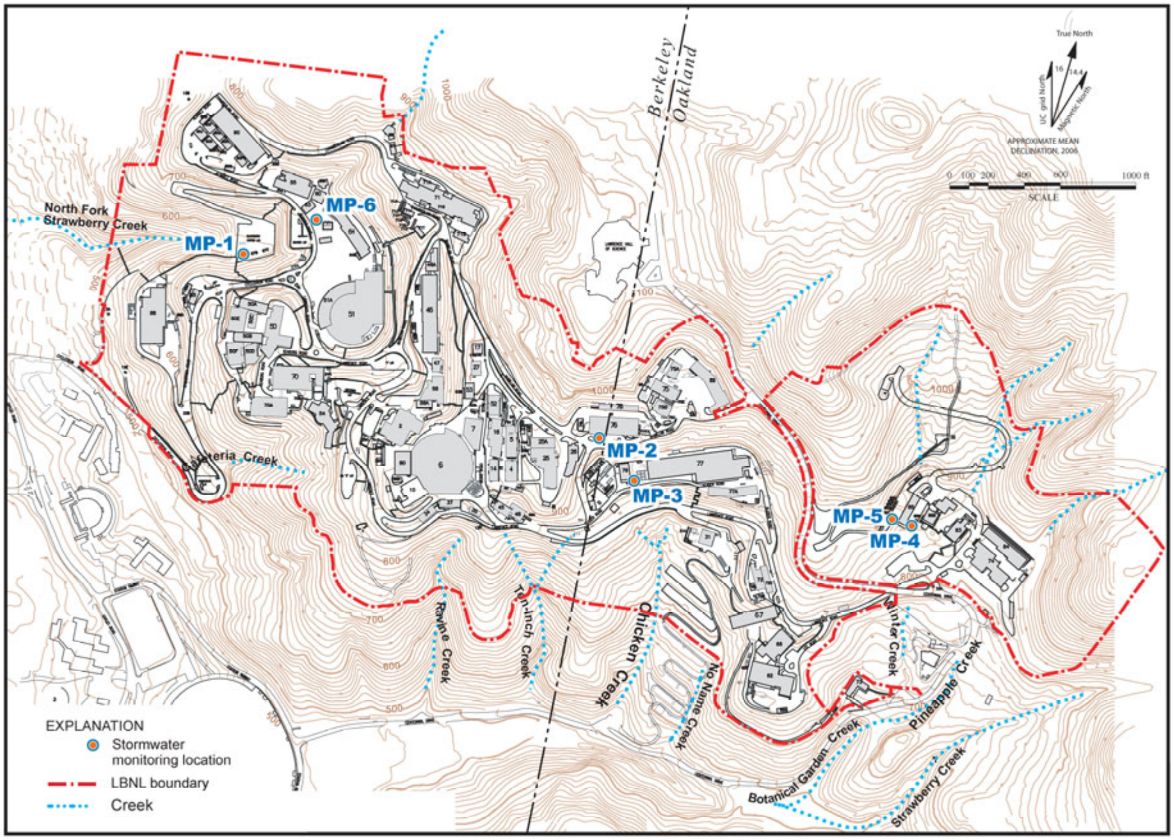

Figure 1-2. LBNL Facility Plan with Buildings, Topography, and Stormwater Monitoring Locations

1.1.2 Facility Operations

The Facility is managed by the University of California (UC) for the United States Department of Energy (DOE) and conducts basic and applied science research. Industrial operations conducted at LBNL to facilitate research include fabrication of metals, transportation services, fueling services, hazardous waste storage and handling, and scrap recycling. The Facility is regulated by the General Permit under Standard Industrial Classifications (SIC):

- 3499 – Fabricated Metal Products, Not Elsewhere Classified
- 4173 – Terminal and Service Facilities for Motor Vehicle Passenger Transportation
- 4953 – Hazardous Waste Treatment Storage or Disposal
- 5093 – Scrap Recycling Facility

A detailed description of the Facility, Facility activities, and stormwater management programs is presented in the SWPPP (ESG, 2009).

1.2 Report Organization

This ASWMP contains:

1) A rationale for the monitoring locations.
2) A description of planned monitoring activities, locations, and procedures.
3) A presentation of the record maintenance and reporting procedures to be followed.
4) Stormwater training requirements.
5) A presentation of the quality assurance and quality control procedures to be employed in obtaining complete and accurate data collection.

2.0 Planned Monitoring Activities

Monitoring of stormwater discharge and evaluation of the storm drainage system are required under the conditions of the General Permit. This ASWMP has been prepared to achieve the following objectives:

- Verify compliance with discharge prohibitions and limitations specified in the General Permit.
- Aid in evaluating the adequacy of the SWPPP.
- Aid in evaluating the effectiveness of BMPs in removing pollutants in stormwater discharge.
- Support future refinements to the ASWMP and SWPPP as needed to respond to observed conditions at the Facility.

2.1 Monitoring Location Rationale

The ASWMP identifies sample locations at or near pollutant sources where industrial activities regulated by the General Permit have the potential to be exposed to stormwater (Figure 1-2). The objective of the alternative monitoring is to provide equivalent or more accurate measurement of pollutants in stormwater associated with industrial activities, and to evaluate the effectiveness of BMPs in controlling discharges of pollutants in stormwater at these industrial areas. This alternative monitoring is presented in contrast to sampling an entire drainage area, where the stormwater discharge has commingled with stormwater from areas with little or no industrial activity.

Five areas with industrial activities regulated under the General Permit and with the potential for contributions to stormwater pollution were selected for monitoring:

1) Previous bus parking and storage at the Blackberry Canyon parking lot (Figure 2-1).
2) Fueling area at Building 76 (Figure 2-2).
3) Metal fabrication, storage, and scrap recycling at Building 77 and 79 (Figure 2-3).
4) Hazardous waste storage and handling at Building 85 (Figure 2-4).
5) Bus parking in front of Building 64 (Figure 2-5).

Stormwater monitoring data collected at these locations will be used to assess the effectiveness of the BMPs in controlling pollutants in stormwater from industrial activities across the Facility.

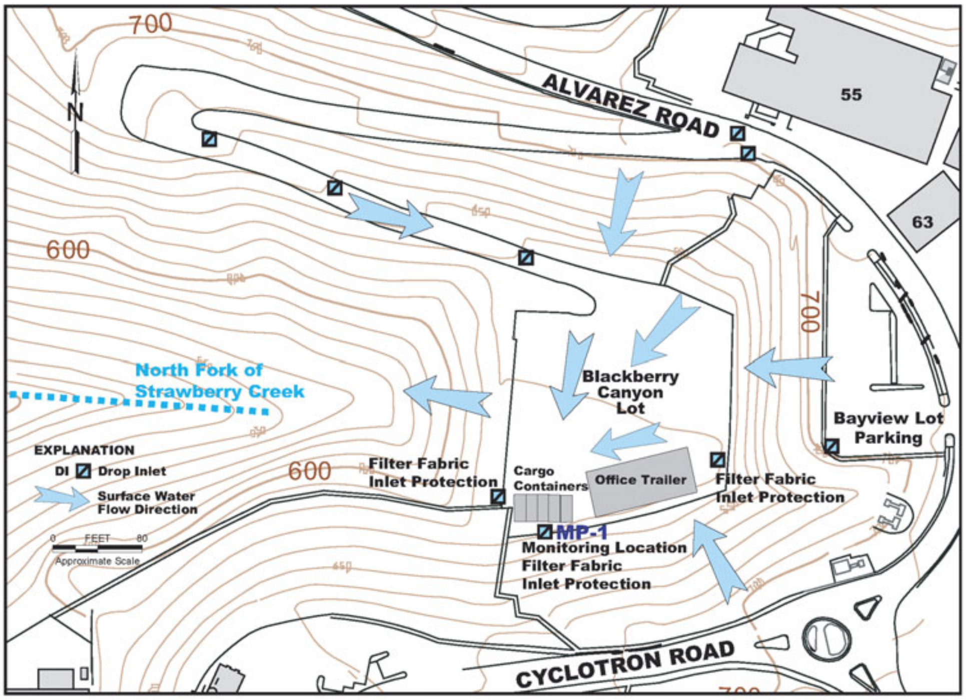

Figure 2-1. Monitoring Location and Surface Water Flow Direction of the Blackberry Parking Lot

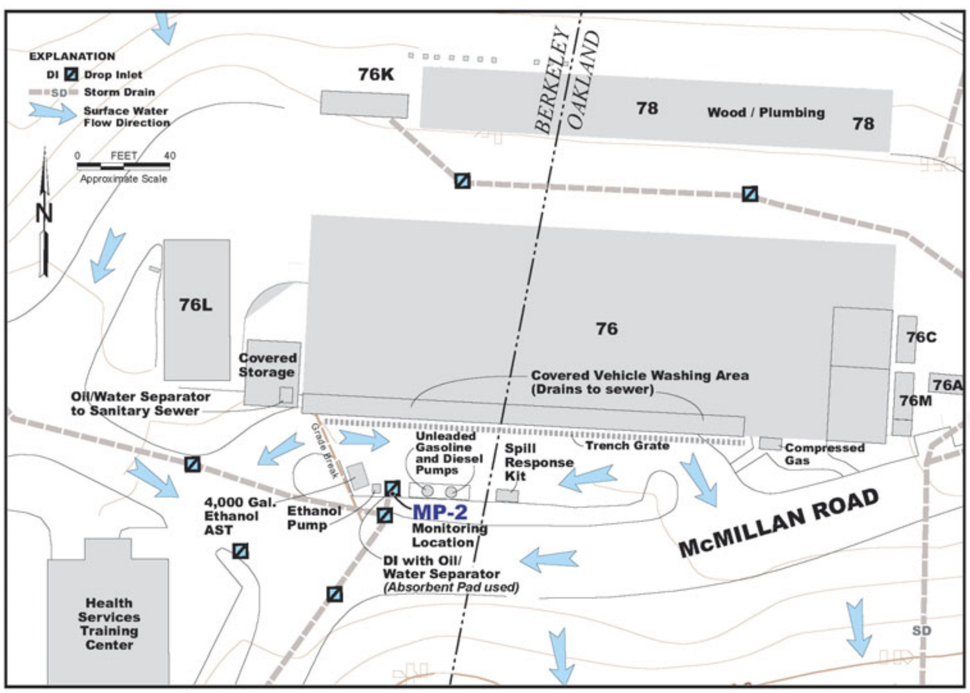

Figure 2-2. Monitoring Location and Surface Water Flow Direction in Vicinity of Fuel Dispensing Industrial Area

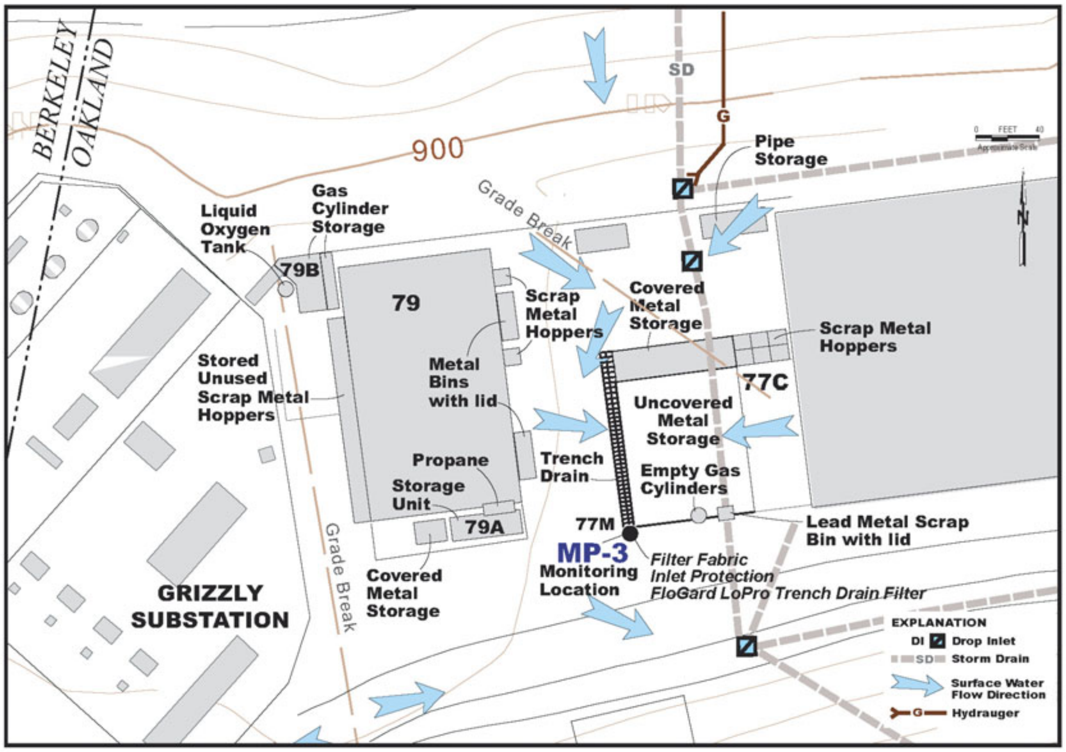

Figure 2-3. Monitoring Location and Surface Water Flow Direction in Vicinity of Metal Fabrication and Scrap Recycling Industrial Area

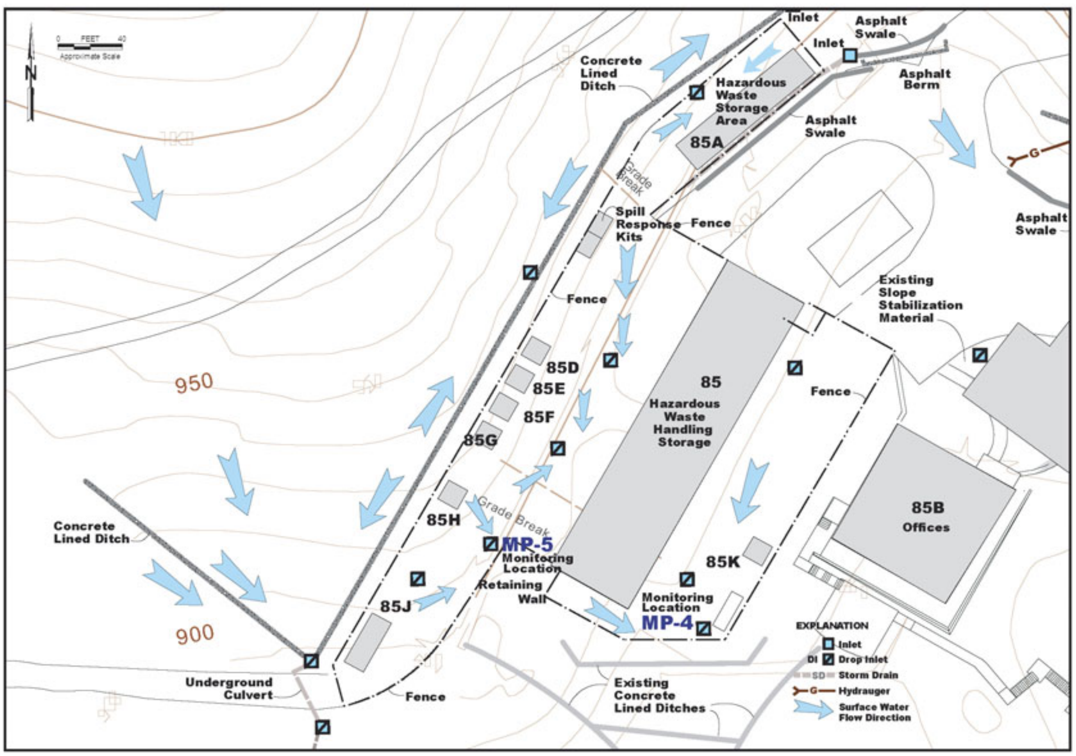

Figure 2-4. Monitoring Location and Surface Water Flow Direction in Vicinity of HWHF Industrial Area

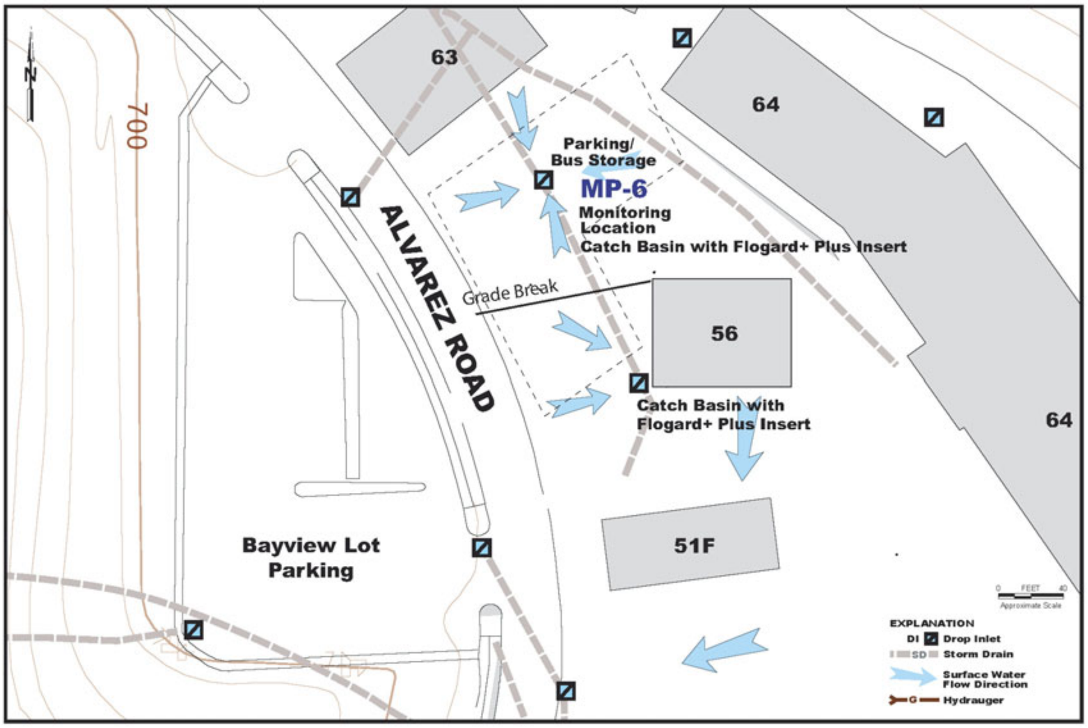

Figure 2-5. Monitoring Location and Surface Water Flow Direction in Vicinity of the Bus Parking Industrial Area

Waste Accumulation Areas (WAAs) and Drum Storage Areas (DSAs) were not selected as monitoring locations at the Facility as they should not be exposed to rainfall due to full or partial covering. Scrap metal hoppers were not selected as sampling locations as they are covered or stored under cover when not in use. Aboveground storage tank (AST) locations were not selected as monitoring locations as the ASTs are double-walled with leak detection and their contents should not be exposed to stormwater.

2.2 Quarterly Dry Weather Visual Observations of Authorized NSWDs

Visual observations will be conducted at each authorized non-stormwater discharge (NSWD) source, impacted drainage area, and discharge location on a quarterly basis. Authorized NSWD locations identified at the Facility include fire hydrant flushing, landscape watering, water line breaks, safety shower/eyewash testing and operation, air conditioning condensates, groundwater, and utility vault pump-outs, as described in detail in the Facility's SWPPP (ESG, 2009).

The observations will be conducted during daylight hours, dry weather, and scheduled Facility operating hours. The authorized NSWD inspections will consist of making visual observations of the NSWD points to verify adequate conveyance to storm drains, absence of soil erosion, and that NSWDs do not contact materials or equipment with the potential to contain significant quantities of pollutants. The visual observations will be recorded on the Quarterly Visual Observations of Authorized Non-Stormwater Discharges form provided in Appendix A (Form 2).

2.3 Quarterly Dry Weather Visual Observations of Unauthorized NSWDs

Visual observations to identify unauthorized NSWDs will be conducted quarterly during daylight hours, dry weather with no stormwater discharges, and scheduled Facility operating hours. The quarterly visual observations will be conducted during January to March, April to June, July to September, and October to December.

The unauthorized NSWD inspections will consist of making visual observations of the stormwater discharge points to verify the absence of flow in the system and to assess whether there are any visual indications of staining, sludges, odors, or other abnormal conditions. The visual observations will be recorded on the Quarterly Visual Observations of Unauthorized Non-Stormwater Discharges form provided in Appendix A (Form 3).

2.4 Monthly Visual Observations of Stormwater Discharges

Facility operators will visually observe stormwater discharge during one storm event per month during the wet-weather season (October 1 to May 30). Visual observations are only required of stormwater discharges that occur under the following conditions:

1) During daylight hours.
2) During scheduled Facility operating hours;.
3) Preceded by at least three working days without stormwater discharges.
4) The inspections will be conducted during the first hour of discharge at all discharge locations.

The inspections will include visual observations of stormwater runoff to evaluate the presence of floating or suspended materials, oil and grease, discoloration, turbidity, or other signs of pollutant impact to stormwater runoff. Records will be maintained of observation dates, locations observed, observations, and response taken, if needed, to reduce or prevent pollutants in stormwater discharges. Observations will also be made to assess the proper performance of stormwater collection and diversion structures, e.g., surface drains and concrete lined ditches. The visual observations will be recorded on the Monthly Visual Observations of Stormwater Discharges form provided in Appendix A (Form 4).

2.5 Annual Inspection

Annual inspections will be performed to evaluate compliance with the SWPPP and assess the effectiveness of stormwater management activities. The inspections will identify areas contributing to stormwater discharge associated with industrial activities. The inspections will consist of making visual observations of the storm drain systems, industrial activities, and location around the lower perimeter of the Facility where stormwater discharges into creeks to evaluate whether conditions related to stormwater runoff have changed since preparation of the SWPPP, and to assess compliance with the SWPPP and the General Permit.

The inspections will also allow evaluation of whether additional control measures are needed to reduce pollutants in stormwater discharge.

The BMPs will be inspected to verify that they are functioning and that there are no unauthorized non-stormwater discharges. Records of the inspections will be maintained on the Annual Site Stormwater Inspection Form (Appendix A – Form 5); the annual report includes a certification statement that the Facility complies with the General Permit. The General Manager or his designee will sign the certification.

3.0

Sampling and Analyses

Facility operators will collect stormwater samples from: (1) the first storm event of the wet-weather season starting October 1; and (2) at least one other storm event during the wet-weather season at the six sampling locations. If samples from the first storm event during the wet-weather season are not collected, the Facility operators are still required to collect samples from two other storm events during the wet-weather season. Stormwater samples are to be collected from sample locations as summarized on Figure 1-2 and shown in more detail on Figures 2-1 to 2-5. The samples are required to be collected during normal working hours (0800-1700). The samples are to be collected from storm events meeting the following criteria:

- The storm event is preceded by at least three working days of dry weather.
- The sample is collected during the first hour of runoff.
- The first hour of runoff occurs during normal working hours.

A Facility operator is not required to collect a sample or conduct visual observations under Section B.4 and Section B.5 of the General Permit if weather conditions pose safety risks, e.g., during a lightning storm.

3.1 Basic Analytical Parameters

The General Permit requires the analysis of at least four parameters for stormwater samples at each monitoring location. These parameters are pH, total suspended solids (TSS), specific conductance (SC), and total oil and grease (TOG). Therefore, the stormwater samples will be analyzed for the standard stormwater parameters as stipulated in the General Permit (5.c.i.):

- TSS by Standard Method (SM) 2540D
- pH by SM 4500 H+B
- SC by USEPA Method 120.1
- TOG by USEPA Method 1664 (HEM-SGT)

3.2 Sector-Required Analyses

Based on the SIC codes for specific industrial activities conducted at the Facility, the following sector-required analyses are specified in the General Permit monitoring program:

3499 – Fabricated Metal Products

- Nitrite and Nitrate as nitrogen by USEPA 300.0, 353.2 or SM 4500-NO_3
- Aluminum, Iron, and Zinc by USEPA 200.7/200.8

<u>4953 – Hazardous Waste Treatment Storage or Disposal</u>

- Ammonia by SM 4500 or USEPA 350.1
- Chemical oxygen demand (COD) by USEPA 410.4
- Magnesium by USEPA 200.7
- Arsenic, Cadmium, Lead, Selenium, and Silver by USEPA 200.7/200.8
- Mercury by USEPA 245.1 / 245.2
- Cyanide by USEPA 335.4 or SM 4500-CN-C, D, or E

<u>5093 – Scrap Recycling Facility</u>

- Chemical Oxygen Demand (COD) by USEPA 410.4
- Aluminum, Copper, Iron, Lead, and Zinc by USEPA 200.7/200.8

3.3 Other Suspected Chemicals

Other suspected chemicals in addition to those required under the General Permit have not been identified at the Facility.

3.4 Sampling Locations

Samples will be collected from the Facility at discharge locations where industrial activities have the potential to expose stormwater to pollutants (Figure 1-2). The sample locations have been selected to provide stormwater analytical data that is representative of the industrial activities conducted at the Facility. Stormwater samples will be collected from the monitoring points in accordance with the procedures outlined below.

3.5 Sampling Procedures

Stormwater samples will be collected directly into laboratory-supplied sample containers or collected using a plastic bailer, or dipper and transferred to the laboratory-supplied sample containers. EH&S Procedure 263, Surface Water Sampling Procedure, describes in detail the collection of stormwater samples. A few schematic diagrams of representative drop inlet details are depicted on Figure 3-1. Stormwater samples are collected by lifting the metal protective grate, without disturbing BMPs, if in place, and consequently collecting the stormwater sample.

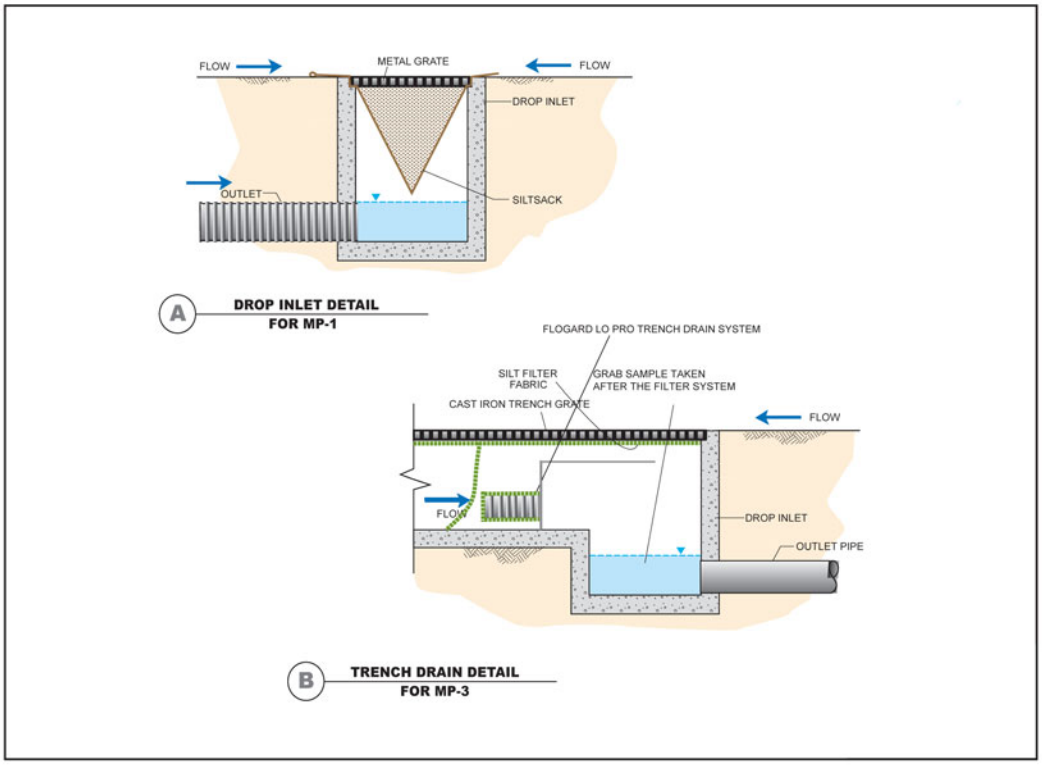

Figure 3-1. Schematic of Some Drop Inlet Details and Their Representative Filter Systems

After collection, the stormwater samples will then be labeled and stored in a chilled cooler until delivery to a California Department of Public Health, Environmental Laboratory Accreditation Program-certified analytical laboratory under the chain-of-custody procedures consistent with the requirements of ASTM D4840; except for the pH measurement which is carried out with field-monitoring equipment. Analytical methods to be employed are listed in Table 3-1. Sampling information and results will be recorded on Form 1 (Appendix A). An example of a chain-of-custody form is included in Appendix B.

PH is measured in the field using a temperature-corrected pH meter, in lieu of analytical laboratory analysis because of short holding times. The pH meter is calibrated and maintained in accordance with the manufacturer’s specifications. Calibrations, sample measurements and internal QAQC checks are documented on the appropriate form, in accordance with Facility procedures.

Table 3-1: Alternative Stormwater Monitoring Parameters

Location	Parameter	Method	Minimum Sample Container	Preservative	Hold Time
MP-1	pH	SM4500H+B	1L HDPE	None, cool, <6°C	24 hours
	Specific Conductance	USEPA 120.1			28 days
	Total Suspended Solids	SM 2540D			7 days
	Oil and Grease	USEPA 1664A-HEM	1L Amber Glass	HCl, cool , <6°C	28 days
MP-2	pH	SM4500H+B	1L HDPE	None, cool, <6°C	24 hours
	Specific Conductance	USEPA 120.1			28 days
	Total Suspended Solids	SM 2540D			7 days
	Oil and Grease	USEPA 1664A-HEM	1L Amber Glass	HCl, cool, <6°C	28 days
MP-3	pH	SM4500H+B	1L HDPE	None, cool, <6°C	24 hours
	Specific Conductance	USEPA 120.1			28 days
	Total Suspended Solids	SM 2540D			7 days
	Oil and Grease	USEPA 1664A-HEM	1L Amber Glass	HCl, cool, <6°C	28 days
	Al, Cu, Fe, Pb, Zn	USEPA 200.7/200.8	500 ml HDPE	HNO_3, cool, <6°C	6 months
	Nitrite plus Nitrate as Nitrogen	USEPA 300.0, 353.2 or SM 4500-NO_3	500 ml HDPE	Cool, <6°C; none for USEPA 300.0; H_2SO_4 to pH <2 for USEPA 353.3 or SM 4500-NO_3	48 hours/ 28 days
	COD	USEPA 410.4	500 ml HDPE	H_2SO_4, cool, <6°C	28 days
MP-4/ MP-5	pH	SM4500H+B	1L HDPE	None, cool, <6°C	24 hours
	Specific Conductance	USEPA 120.1			28 days
	Total Suspended Solids	SM 2540D			7 days
	Oil and Grease	USEPA 1664A-HEM	1L Amber Glass	HCl, cool, <6°C	28 days
	Ammonia (NH_3)	SM 4500 or USEPA 350.1	500 ml HDPE	H_2SO_4, cool, <6°C	28 days
	Cyanide (CN)	USEPA Method 335.4	500 ml HDPE	NaOH pH>12, <6°C	14 days
	Mg	USEPA 200.7	500 ml HDPE	HNO_3, cool, <6°C	6 months
	Ag, As, Cd, Pb, Se	USEPA 200.7/200.8			6 months
	Hg	USEPA 245.1 / 245.2			28 days
	COD	USEPA 410.4	500 ml HDPE	H_2SO_4, cool, <6°C	28 days
MP-6	pH	SM4500H+B	1L HDPE	None, cool, <6°C	24 hours
	Specific Conductance	USEPA 120.1			28 days
	Total Suspended Solids	SM 2540D			7 days
	Oil and Grease	USEPA 1664A-HEM	1L Amber Glass	HCl, cool , <6°C	28 days

Notes:

USEPA: United States Environmental Protection Agency
SM: Standard Method
ml: Milliliter
L: Liter
H2SO4: Sulfuric acid
HCl: Hydrochloric acid
HNO3: Nitric acid
NaOH: Sodium hydroxide
HDPE: High Density Polyethylene

Al: Aluminum
As: Arsenic
Cd: Cadmium
Cu: Copper
Fe: Iron
Hg: Mercury
Mg: Magnesium
Pb: Lead
Se: Selenium
Zn: Zinc

4.0
Record-Keeping and Reporting Procedures

Records and plans (including this ASWMP and all documents incorporated by reference) are maintained in accessible form by the Environmental, Health, and Safety Division's Environmental Services Group. These records of all inspections and sampling events will be retained in accordance with regulatory and DOE recordkeeping and archival requirements for a period of at least five years.

4.1 Annual Reporting

An Annual Comprehensive Site Compliance Evaluation (ACSCE) will be prepared for submittal to the California Regional Water Quality Control Board – San Francisco Bay Region (SFRWQCB) by July 1 of each year as required by the General Permit. The annual reports shall provide a summary of inspections, sampling events, and stormwater-related maintenance activities conducted during the year. An assessment of permit compliance and planned corrective actions will also be included. Results of chemical analyses and field measurements will be provided in tabular format. Copies of relevant field data forms, chain-of-custody (see Appendix B for example), and laboratory reports will be included in the ACSCE reports.

4.2 Supplemental Reporting

In the event that sampling results indicate a discharge that has caused or contributed to an exceedance of the General Permit requirements, a report will be submitted to the Regional Board within 60 days summarizing the BMPs currently being implemented and additional BMPs that will be implemented to address the exceedance. The report will also include an implementation schedule for the additional BMPs. Following approval of the report, the SWPPP shall be revised to incorporate the additional BMPs and any additional monitoring required within a timely manner, but in no case more than 90 days after the exceedance of the General Permit requirements was known.

5.0

Training

Training is performed as part of the quality control program for the stormwater pollution prevention program at the Facility. Training is required for facility personnel who are responsible for:

1) Implementing BMPs and other activities identified in the SWPPP such as bus drivers, construction managers, custodians, excess program laborers, grounds crew, laborers, plant maintenance technicians, plumbers, riggers, and truck drivers.
2) Conducting inspections, sampling, and visual observations.
3) Managing stormwater.

Training will address topics such as spill response, good housekeeping, material handling procedures, and actions necessary to implement all BMPs identified in the SWPPP. Training is conducted by the Stormwater Program Manager experienced in water quality monitoring and sampling, instrument maintenance and calibration, data management, and the regulatory framework.

The training schedule is identified in the SWPPP, but the Stormwater Management course is given on a monthly basis, and is a biennial requirement for all trained personnel. Training records are maintained by the Stormwater Program Manager and the EH&S training management system. As conditions or parameters change, or the scope of operations increases, additional training will be designed and implemented.

6.0

Quality Assurance/Quality Control and Program Evaluation

6.1 Purpose

This ASWMP has been developed in order to assist in implementing data collection activities and to generate thorough and accurate data. Where possible, this will be accomplished with data collection forms. The forms provide a "fill-in-the-blank" approach so that each item of interest can be addressed during the sampling events and inspections, and if not addressed, an appropriate explanation can be provided. In addition, all Facility inspectors and sampling personnel are trained in the proper sampling methods and documentation.

6.2 QA/QC Measures

This ASWMP is part of the overall environmental compliance program at the Facility. In keeping with the objectives of the ASWMP, the following quality assurance/quality control (QA/QC) measures have been adopted:

- All monitoring is conducted by trained personnel.
- Laboratory reporting limits should be below their respective data quality objectives for the chemicals analyzed.
- All personnel who will be conducting sampling are certified for completion of a training course in stormwater sampling, and the certification is included as part of the individual's training record.
- Records are maintained certifying that all field-monitoring instruments are calibrated and maintained in accordance with manufacturers' instructions and Facility procedures.
- Only state-certified laboratories with approved QA/QC programs for the analysis of samples are used, and such analysis is documented by chain-of-custody forms and laboratory reports (the pH measurement is carried out with field-monitoring equipment because of short holding times).
- Verification of data quality is carried out in accordance with USEPA Data Quality Objectives Guidelines.
- Procedures are initiated by which the Stormwater Program Manager will review activities and confirm that all elements of the ASWMP have been carried out.

The purpose of periodic evaluation is to monitor, in an ongoing and systematic fashion, the effectiveness of the ASWMP in meeting the objectives stated in the General Permit. The General Permit objectives include: (1) producing accurate, representative data on the amount of pollutants, if any, discharged by the Facility in its stormwater runoff; and (2) using the data to demonstrate a reduction in such pollutants due to measures and practices described in the SWPPP.

6.3 Procedures and Schedules

Upon receipt of the laboratory results, the Stormwater Program Manager or designee will review them for completeness and any reduction/increase in chemical concentrations. The Stormwater Program Manager will validate the results and address any unusual or unexpected results (See EH&S Procedure 268 for further detail). During the dry season, the stormwater monitoring activities are limited to the observation of non-stormwater discharge, if any. During the wet season, both the visual observation reporting forms and the results of any sampling analyses will be reviewed. The Stormwater Program Manager will also review the monitoring design to evaluate whether all activities that need to be conducted are in fact carried out.

Since rainfall and stormwater discharge may not occur during regular working hours, emphasis is placed upon collecting samples from at least two storm events per season, including the first storm event meeting permit conditions, if possible. During the dry season, activities will be reviewed once per month to confirm that observations are completed, since there will be no sampling results.

The Stormwater Program Manager shall periodically report the status of stormwater monitoring to the upper management. Any anomalies in monitoring results will be reported immediately. The Stormwater Program Manager will monitor the status of the program by reviewing the data at least once per month.

The records of observations and results of analyses will become part of the permanent record and provide the basis for the ACSCE, which is due to the SFRWQCB on July 1 each year (see EH&S procedure 200 for further details on reporting). The periodic program evaluation is the basis for the annual evaluation of the ASWMP also found in the ACSCE, and for any revisions or amendments to the ASWMP.

To be effective, the ASWMP must collect and present accurate, representative data that characterize the Facility’s stormwater runoff. The ultimate goal is to document the reduction in stormwater pollutants that industrial sources at the Facility may be contributing to runoff. If the levels of contaminants decrease or if levels are within acceptable benchmarks as listed in the Table 6-2, this will demonstrate that both the SWPPP and the ASWMP are fulfilling their respective functions; the former by achieving the reduction or elimination of stormwater pollutants through BMPs and the latter by documenting that achievement.

Table 6-1: Parameter Benchmark Values

Parameter	Method	Units	Acceptable Range
pH	SM4500H+B	pH Units	6.0-9.0
Specific Conductance	USEPA 120.1	µmhos/cm	NA
Total Suspended Solids	SM 2540D	mg/l	<100
Oil and Grease	USEPA 1664A-HEM	mg/l	<15
COD	USEPA 410.4	mg/l	<120
Nitrite plus Nitrate as Nitrogen	USEPA 300.0, 353.2 or SM 4500-NO_3	mg/l	<0.68
Ammonia (NH_3)	SM 4500 or USEPA 350.1	mg/l	<19
Cyanide (CN)	USEPA Method 335.4	mg/l	<0.0636
Aluminum (Al)	USEPA 200.7/200.8	mg/l	<0.75
Arsenic (As)	USEPA 200.7/200.8	mg/l	<0.17
Cadmium (Cd)	USEPA 200.7/200.8	mg/l	<0.0159
Copper (Cu)	USEPA 200.7/200.8	mg/l	<0.0636
Iron (Fe)	USEPA 200.7/200.8	mg/l	<1.0
Lead (Pb)	USEPA 200.7/200.8	mg/l	<0.0816
Magnesium (Mg)	USEPA 200.7	mg/l	<0.0636
Mercury (Hg)	USEPA 245.1 / 245.2	mg/l	<0.0024
Selenium (Se)	USEPA 200.7/200.8	mg/l	<0.2385
Zinc (zn)	USEPA 200.7/200.8	mg/l	<0.117

Notes:

USEPA: United States Environmental Protection Agency
SM: Standard Method
mg: milligram
µmhos: micromhos
l: liter
cm: centimeter

7.0 References

Environmental Services Group, Lawrence Berkeley National Laboratory, Berkeley, California, *Stormwater Pollution Prevention Plan, Revision 6*, June 2009 (ESG, 2009).

Environmental Services Group, Lawrence Berkeley National Laboratory, Berkeley, California, *Storm Water Discharges Associated with Industrial Activities*, 2008-2009 Annual Report, June 26, 2009 (ESG, 2009).

State Water Resources Control Board (State Water Board), *Water Quality Order No. 97-03-DWQ, National Pollutant Discharge Elimination System (NPDES) General Permit No. CAS000001 (General Permit), Waste Discharge Requirements (WDRs) For Discharges of Storm Water Associated with Industrial Activities Excluding Construction Activities*, Adopted 1997 (SWRCB, 1997).

United States Environmental Protection Agency (USEPA), *Final Modification of the National Pollutant Discharge Elimination Systems (NDPES) Storm Water Multi-Sector General Permit for Industrial Activities; Termination of the EPA NPDES Storm Water Baseline Industrial General Permit*, Washington D.C Federal Register, October 30, 2000 (USEPA, 2000).

APPENDIX A

Sampling and Inspection Data Forms

FORM 1-SAMPLING & ANALYSIS RESULTS
SECOND STORM EVENT

- If analytical results are less than the detection limit (or non detectable), show the value as less than the numerical value of the detection limit (example: <.05)
- If you did not analyze for a required parameter, do not report "0". Instead, leave the appropriate box blank
- When analysis is done using portable analysis (such as portable pH meters, SC meters, etc.), indicate "PA" in the appropriate test method used box.
- Make additional copies of this form as necessary.

NAME OF PERSON COLLECTING SAMPLE(S): **TITLE:** **SIGNATURE:**

DESCRIBE DISCHARGE LOCATION	DATE / TIME OF SAMPLE LOCATION	TIME DISCHARGE STARTED	BASIC PARAMETERS				Nitrate+ Nitrite (as N)	Al Fe Zn	Pb	Cu	As Cd Cn*	Mg Hg** Se Ag	NH_3 (as N)	COD
			pH	TSS	SC	O&G								
MP-1	☐ AM ☐ PM	☐ AM ☐ PM												
MP-2	☐ AM ☐ PM	☐ AM ☐ PM												
MP-3	☐ AM ☐ PM	☐ AM ☐ PM												
MP-4	☐ AM ☐ PM	☐ AM ☐ PM												
MP-5	☐ AM ☐ PM	☐ AM ☐ PM												
MP-6	☐ AM ☐ PM	☐ AM ☐ PM												
TEST REPORTING UNITS:			pH Units	mg/L	µmhos/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg O/L
TEST METHOD DETECTION LIMIT:			0.01	1.7-7.7	1.0	5.0	0.1	0.05	0.05	0.05	0.005-0.05	0.0002-0.1	0.20	25
TEST METHOD USED:			SM 4500 HB	SM 2540D	USEPA 120.1	USEPA 1664	USEPA 353.2	USEPA 200.7	USEPA 200.7	USEPA 200.7	USEPA 200.7 *335.4	USEPA 200.7 **245.1	USEPA 350.1	USEPA 410.4
ANALYZED BY (SELF/LAB):			SELF	LAB	LAB	LAB	LAB	LAB	LAB	LAB	LAB	LAB	LAB	LAB

Notes: TSS = Total Suspended Solids; SC = Specific Conductance; O&G = Oil & Grease; N = Nitrogen; Al = Aluminum; Fe = Iron; Zn = Zinc; As = Arsenic; Cd = Cadmium; Cn= Cyanide; Cu = Copper; Pb = Lead; Mg = Magnesium; Hg = Mercury; Se= Selenium; Ag = Silver; NH_3 = Ammonia; COD = Chemical Oxygen Demand.

FORM 1-SAMPLING & ANALYSIS RESULTS

SECOND STORM EVENT

If analytical results are less than the detection limit (or non detectable), show the value as less than the numerical value of the detection limit (example: <.05)

- If you did not analyze for a required parameter, do not report "0". Instead, leave the appropriate box blank
- When analysis is done using portable analysis (such as portable pH meters, SC meters, etc.), indicate "PA" in the appropriate test method used box.
- Make additional copies of this form as necessary.

NAME OF PERSON COLLECTING SAMPLE(S): **TITLE:** **SIGNATURE:**

DESCRIBE DISCHARGE LOCATION	DATE / TIME OF SAMPLE LOCATION	TIME DISCHARGE STARTED	BASIC PARAMETERS pH	TSS	SC	O&G	Nitrate+ Nitrite (as N)	Al Fe Zn	Pb	Cu	As Cd Cn*	Mg Hg** Se Ag	NH_3 (as N)	COD
MP-1	☐ AM ☐ PM	☐ AM ☐ PM												
MP-2	☐ AM ☐ PM	☐ AM ☐ PM												
MP-3	☐ AM ☐ PM	☐ AM ☐ PM												
MP-4	☐ AM ☐ PM	☐ AM ☐ PM												
MP-5	☐ AM ☐ PM	☐ AM ☐ PM												
MP-6	☐ AM ☐ PM	☐ AM ☐ PM												
TEST REPORTING UNITS:			pH Units	mg/L	µmhos/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg O/L
TEST METHOD DETECTION LIMIT:			0.01	1.7-7.7	1.0	5.0	0.1	0.05	0.05	0.05	0.005-0.05	0.0002-0.1	0.20	25
TEST METHOD USED:			SM 4500 HB	SM 2540D	USEPA 120.1	USEPA 1664	USEPA 353.2	USEPA 200.7	USEPA 200.7	USEPA 200.7	USEPA 200.7 *335.4	USEPA 200.7 **245.1	USEPA 350.1	USEPA 410.4
ANALYZED BY (SELF/LAB):			SELF	LAB	LAB	LAB	LAB	LAB	LAB	LAB	LAB	LAB	LAB	LAB

Notes: TSS = Total Suspended Solids; SC = Specific Conductance; O&G = Oil & Grease; N = Nitrogen; Al = Aluminum; Fe = Iron; Zn = Zinc; As = Arsenic; Cd = Cadmium; Cn= Cyanide; Cu = Copper; Pb = Lead; Mg = Magnesium; Hg = Mercury; Se= Selenium; Ag = Silver; NH_3 = Ammonia; COD = Chemical Oxygen Demand.

FORM 2-QUARTERLY VISUAL OBSERVATIONS OF AUTHORIZED NON-STORM WATER DISCHARGES (NSWDs)

* Quarterly dry weather visual observations are required of each authorized NSWD.
* Observe each authorized NSWD source, impacted drainage area, and discharge location.
* Authorized NSWDs must meet the conditions provided in Section D (pages 5-6), of the General Permit.
* Make additional copies of this form as necessary.

QUARTER: **JULY - SEPTEMBER** DATE:	Observers Name: ______ Title: ______ Signature: ______	**WERE ANY AUTHORIZED NSWD'S DISCHARGED DURING THIS QUARTER?**	☐ YES ☐ NO	If **YES**, Complete the reverse side of this form
QUARTER: **OCTOBER - DECEMBER** DATE:	Observers Name: ______ Title: ______ Signature: ______	**WERE ANY AUTHORIZED NSWD'S DISCHARGED DURING THIS QUARTER?**	☐ YES ☐ NO	If **YES**, Complete the reverse side of this form
QUARTER: **JANUARY - MARCH** DATE:	Observers Name: ______ Title: ______ Signature: ______	**WERE ANY AUTHORIZED NSWD'S DISCHARGED DURING THIS QUARTER?**	☐ YES ☐ NO	If **YES**, Complete the reverse side of this form
QUARTER: **APRIL - JUNE** DATE:	Observers Name: ______ Title: ______ Signature: ______	**WERE ANY AUTHORIZED NSWD'S DISCHARGED DURING THIS QUARTER?**	☐ YES ☐ NO	If **YES**, Complete the reverse side of this form

FORM 2-QUARTERLY VISUAL OBSERVATIONS OF AUTHORIZED NON-STORM WATER DISCHARGES (NSWDs)

DATE /TIME OF OBSERVATION	SOURCE AND LOCATION OF AUTHORIZED NSWD EXAMPLE: AC Condensate	NAME OF AUTHORIZED NSWD EXAMPLE: Groundwater	DESCRIBE AUTHORIZED NSWD CHARACTERISTICS Indicate whether unauthorized NSWD is clear, cloudy, discolored, causing stains; contains floating objects or an oil sheen, has odors, etc.		DESCRIBE ANY REVISED OR NEW BMPs AND PROVIDE THEIR IMPLEMENTATION DATE
			AT THE NSWD SOURCE	AT THE NSWD AREA & DISCHARGE LOCATION	
☐ AM ☐ PM					
☐ AM ☐ PM					
☐ AM ☐ PM					
☐ AM ☐ PM					

FORM 3-QUARTERLY VISUAL OBSERVATIONS OF UNAUTHORIZED NON-STORM WATER DISCHARGES (NSWDs)

- Unauthorized NSWDs are discharges (such as wash or rinse waters) that do not meet the conditions provided in Section D (pages 5-6) of the General Permit.
- Quarterly visual observations are required to observe current and detect prior unauthorized NSWDs.
- Quarterly visual observations are required during dry weather and at all facility drainage areas.
- Each unauthorized NSWD source, impacted drainage area, and discharge location must be identified and observed.
- Unauthorized NSWDs that can not be eliminated within 90 days of observation must be reported to the Regional Board in accordance with Section A.10.e of the General Permit.
- Make additional copies of this form as necessary.

QUARTER: **JULY - SEPTEMBER** Date/Time of Observations ☐ AM ☐ PM	Observers Name: ____ Title: ____ Signature: ____	**WERE UNAUTHORIZED NSWD'S OBSERVED?** WERE THERE INDICATIONS OF PRIOR UNAUTHORIZED NSWD'S?	☐ YES ☐ NO ☐ YES ☐ NO	If **YES** to either question, complete the reverse side of this form
QUARTER: **OCTOBER -DECEMBER** Date/Time of Observations ☐ AM ☐ PM	Observers Name: ____ Title: ____ Signature: ____	**WERE UNAUTHORIZED NSWD'S OBSERVED?** WERE THERE INDICATIONS OF PRIOR UNAUTHORIZED NSWD'S?	☐ YES ☐ NO ☐ YES ☐ NO	If **YES** to either question, complete the reverse side of this form
QUARTER: **JANUARY - MARCH** Date/Time of Observations ☐ AM ☐ PM	Observers Name: ____ Title: ____ Signature: ____	**WERE UNAUTHORIZED NSWD'S OBSERVED?** WERE THERE INDICATIONS OF PRIOR UNAUTHORIZED NSWD'S?	☐ YES ☐ NO ☐ YES ☐ NO	If **YES** to either question, complete the reverse side of this form
QUARTER: **APRIL - JUNE** Date/Time of Observations ☐ AM ☐ PM	Observers Name: ____ Title: ____ Signature: ____	**WERE UNAUTHORIZED NSWD'S OBSERVED?** WERE THERE INDICATIONS OF PRIOR UNAUTHORIZED NSWD'S?	☐ YES ☐ NO ☐ YES ☐ NO	If **YES** to either question, complete the reverse side of this form

FORM 3 QUARTERLY VISUAL OBSERVATIONS OF UNAUTHORIZED NON-STORM WATER DISCHARGES (NSWDs)

OBSERVATION DATE (FROM REVERSE SIDE)	SOURCE AND LOCATION OF UNAUTHORIZED NSWD EXAMPLE: Sewer discharge	NAME OF UNAUTHORIZED NSWD EXAMPLE: Sewer line Break	DESCRIBE UNAUTHORIZED NSWD CHARACTERISTICS Indicate whether unauthorized NSWD is clear, cloudy, discolored, causing stains; contains floating objects or an oil sheen, has odors, etc.		ACTIONS TO ELIMINATE UNAUTHORIZED NSWD AND TO CLEAN IMPACTED DRAINAGE AREAS. PROVIDE UNAUTHORIZED NSWD ELIMINATION DATE.
			AT THE UNAUTHORIZED NSED SOURCE	AT THE UNAUTHORIZED NSWD AREA & DISCHARGE LOCATION	
☐ AM ☐ PM					
☐ AM ☐ PM					
☐ AM ☐ PM					
☐ AM ☐ PM					

FORM 4-MONTHLY VISUAL OBSERVATIONS OF STORM WATER DISCHARGES (Continued)

SIDE A

- Storm water discharge visual observations are required for at least one storm event per month between October 1 and May 31.
- Visual observations must be conducted during the first hour of discharge at all discharge locations.
- Discharges of temporarily stored or contained storm water must be observed at the time of discharge.
- Indicate "None" in the first column of this form if you did not conduct a monthly visual observation.
- Make additional copies of this form as necessary.
- Until a monthly visual observation is made, record any eligible storm events that do not result in a storm water discharge and note the date, time, name, and title of who observed there was no storm water discharge.

OBSERVATION DATE:	Drainage Location Description	**North Fork Strawberry Creek Drainage Area**	**Chicken Creek Drainage Area**	**East Canyon Drainage Area**	**Storm Water Sampling Sites (MP1-MP6)**
Observer Name:	Observation Time	☐ AM ☐ PM	☐ AM ☐ PM	☐ AM ☐ PM	☐ AM ☐ PM
Title:	Time Storm Event and/or Discharge Began	☐ AM ☐ PM	☐ AM ☐ PM	☐ AM ☐ PM	☐ AM ☐ PM
Signature:	Were Pollutants observed (if YES, complete reverse side)	☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO
OBSERVATION DATE:	Drainage Location Description	**North Fork Strawberry Creek Drainage Area**	**Chicken Creek Drainage Area**	**East Canyon Drainage Area**	**Storm Water Sampling Sites (MP1-MP6)**
Observer Name:	Observation Time	☐ AM ☐ PM	☐ AM ☐ PM	☐ AM ☐ PM	☐ AM ☐ PM
Title:	Time Storm Event and/or Discharge Began	☐ AM ☐ PM	☐ AM ☐ PM	☐ AM ☐ PM	☐ AM ☐ PM
Signature:	Were Pollutants observed (if YES, complete reverse side)	☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO
OBSERVATION DATE:	Drainage Location Description	**North Fork Strawberry Creek Drainage Area**	**Chicken Creek Drainage Area**	**East Canyon Drainage Area**	**Storm Water Sampling Sites (MP1-MP6)**
Observer Name:	Observation Time	☐ AM ☐ PM	☐ AM ☐ PM	☐ AM ☐ PM	☐ AM ☐ PM
Title:	Time Storm Event and/or Discharge Began	☐ AM ☐ PM	☐ AM ☐ PM	☐ AM ☐ PM	☐ AM ☐ PM
Signature:	Were Pollutants observed (if YES, complete reverse side)	☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO
OBSERVATION DATE:	Drainage Location Description	**North Fork Strawberry Creek Drainage Area**	**Chicken Creek Drainage Area**	**East Canyon Drainage Area**	**Storm Water Sampling Sites (MP1-MP6)**
Observer Name:	Observation Time	☐ AM ☐ PM	☐ AM ☐ PM	☐ AM ☐ PM	☐ AM ☐ PM
Title:	Time Storm Event and/or Discharge Began	☐ AM ☐ PM	☐ AM ☐ PM	☐ AM ☐ PM	☐ AM ☐ PM
Signature:	Were Pollutants observed (if YES, complete reverse side)	☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO

ND = No significant storm events occurred **NR = Not Required as per SWRCP NPDES General Permit, Section B.4.b**

FORM 4-MONTHLY VISUAL OBSERVATIONS OF STORM WATER DISCHARGES

DATE/TIME OF OBSERVATION (From Reverse Side)	**DRAINAGE AREA DESCRIPTION** EXAMPLE: Discharge from material storage Area #2	**DESCRIBE STORM WATER DISCHARGE CHARACTERISTICS** Indicate whether storm water discharge is clear, cloudy, or discolored; causing staining; containing floating objects or an oil sheen, has odors, etc.	**IDENTIFY AND DESCRIBE SOURCE(S) OF POLLUTANTS** EXAMPLE: Oil sheen caused by oil dripped by trucks in vehicle maintenance area.	**DESCRIBE ANY REVISED OR NEW BMPs AND THEIR DATE OF IMPLEMENTATION**
☐ AM ☐ PM				
☐ AM ☐ PM				
☐ AM ☐ PM				
☐ AM ☐ PM				
☐ AM ☐ PM				

FORM 5-ANNUAL COMPREHENSIVE SITE COMPLIANCE EVALUATION
POTENTIAL POLLUTANT SOURCE/INDUSTRIAL ACTIVITY BMP STATUS

EVALUATION DATE: ____________ **INSPECTOR NAME:** ____________________ **TITLE:** ________________________ **SIGNATURE:** ______________________

EVALUATION DATE: ____________ **INSPECTOR NAME:** ____________________ **TITLE:** ________________________ **SIGNATURE:** ______________________

Potential Pollutant Source/Industrial Activity Area	**BMP Implementation** If YES to either question, complete the next two columns of this form.	**Describe deficiencies in BMPs or BMP implementation**	**Describe additional/revised BMPs or corrective actions and their date(s) of implementation**
Loading & Unloading Areas			
Industrial Activity Areas (B76, B77, B79, B85-HWHF)	Have Any BMPs not been Fully Implemented? ☐ Yes ☐ No Are Additional/revised BMPs Necessary? ☐ Yes ☐ No		
Non-Industrial Activity Areas (B69, Site-wide)	Have Any BMPs not been Fully Implemented? ☐ Yes ☐ No Are Additional/revised BMPs Necessary? ☐ Yes ☐ No		
Waste Accumulation Areas (Site-wide)	Have Any BMPs not been Fully Implemented? ☐ Yes ☐ No Are Additional/revised BMPs Necessary? ☐ Yes ☐ No		
Fixed Treatment Units (B25, B70A, B77)	Have Any BMPs not been Fully Implemented? ☐ Yes ☐ No Are Additional/revised BMPs Necessary? ☐ Yes ☐ No		
Material & Storage Use Areas			
Industrial Activity Areas (B76, B77, B79, B85-HWHF)	Have Any BMPs not been Fully Implemented? ☐ Yes ☐ No Are Additional/revised BMPs Necessary? ☐ Yes ☐ No		
Non-Industrial Activity Areas (B69, Site-wide)	Have Any BMPs not been Fully Implemented? ☐ Yes ☐ No Are Additional/revised BMPs Necessary? ☐ Yes ☐ No		
Waste Accumulation & Drum Storage Areas (Site-wide)	Have Any BMPs not been Fully Implemented? ☐ Yes ☐ No Are Additional/revised BMPs Necessary? ☐ Yes ☐ No		
Above Ground Storage Tanks (B25, B70A, B77)	Have Any BMPs not been Fully Implemented? ☐ Yes ☐ No Are Additional/revised BMPs Necessary? ☐ Yes ☐ No		
Metal & Trash Bins (Site-wide)	Have Any BMPs not been Fully Implemented? ☐ Yes ☐ No Are Additional/revised BMPs Necessary? ☐ Yes ☐ No		
Outdoor Equipment-GWTS, Generators, Cooling Towers, (Site-wide)	Have Any BMPs not been Fully Implemented? ☐ Yes ☐ No Are Additional/revised BMPs Necessary? ☐ Yes ☐ No		

FORM 5-ANNUAL COMPREHENSIVE SITE COMPLIANCE EVALUATION
POTENTIAL POLLUTANT SOURCE/INDUSTRIAL ACTIVITY BMP STATUS

EVALUATION DATE: ____________ **INSPECTOR NAME:** ____________________ **TITLE:** ________________________ **SIGNATURE:** ______________________

EVALUATION DATE: ____________ **INSPECTOR NAME:** ____________________ **TITLE:** ________________________ **SIGNATURE:** ______________________

Potential Pollutant Source/Industrial Activity Area	BMP Implementation If YES to either question, complete the next two columns of this form.					Describe deficiencies in BMPs or BMP implementation	Describe additional/revised BMPs or corrective actions and their date(s) of implementation
Vehicle Washing & Parking Areas							
Fueling Station/Motorpool (B76)	Have Any BMPs not been Fully Implemented?	☐	Yes	☐	No		
	Are Additional/revised BMPs Necessary?	☐	Yes	☐	No		
Fire Station (48)	Have Any BMPs not been Fully Implemented?	☐	Yes	☐	No		
	Are Additional/revised BMPs Necessary?	☐	Yes	☐	No		
Parking Areas (Site-wide)	Have Any BMPs not been Fully Implemented?	☐	Yes	☐	No		
	Are Additional/revised BMPs Necessary?	☐	Yes	☐	No		
Construction & Maintenance Areas							
B10 Site	Have Any BMPs not been Fully Implemented?	☐	Yes	☐	No		
	Are Additional/revised BMPs Necessary?	☐	Yes	☐	No		
B31 Area	Have Any BMPs not been Fully Implemented?	☐	Yes	☐	No		
	Are Additional/revised BMPs Necessary?	☐	Yes	☐	No		
B50 Site	Have Any BMPs not been Fully Implemented?	☐	Yes	☐	No		
	Are Additional/revised BMPs Necessary?	☐	Yes	☐	No		
B51 Site	Have Any BMPs not been Fully Implemented?	☐	Yes	☐	No		
	Are Additional/revised BMPs Necessary?	☐	Yes	☐	No		
Guest House	Have Any BMPs not been Fully Implemented?	☐	Yes	☐	No		
	Are Additional/revised BMPs Necessary?	☐	Yes	☐	No		
Erosion control Measures (Site Wide)	Have Any BMPs not been Fully Implemented?	☐	Yes	☐	No		
	Are Additional/revised BMPs Necessary?	☐	Yes	☐	No		

FORM 5-ANNUAL COMPREHENSIVE SITE COMPLIANCE EVALUATION
POTENTIAL POLLUTANT SOURCE/INDUSTRIAL ACTIVITY BMP STATUS

EVALUATION DATE: ____________ **INSPECTOR NAME:** ________________ **TITLE:** ____________________ **SIGNATURE:** __________________

EVALUATION DATE: ____________ **INSPECTOR NAME:** ________________ **TITLE:** ____________________ **SIGNATURE:** __________________

Potential Pollutant Source/Industrial Activity Area	**BMP Implementation** If YES to either question, complete the next two columns of this form.	**Describe deficiencies in BMPs or BMP implementation**	**Describe additional/revised BMPs or corrective actions and their date(s) of implementation**
Spills & Leaks			
	Have Any BMPs not been Fully Implemented? ☐ Yes ☐ No Are Additional/revised BMPs Necessary? ☐ Yes ☐ No		
	Have Any BMPs not been Fully Implemented? ☐ Yes ☐ No Are Additional/revised BMPs Necessary? ☐ Yes ☐ No		
	Have Any BMPs not been Fully Implemented? ☐ Yes ☐ No Are Additional/revised BMPs Necessary? ☐ Yes ☐ No		
	Have Any BMPs not been Fully Implemented? ☐ Yes ☐ No Are Additional/revised BMPs Necessary? ☐ Yes ☐ No Are Additional/revised BMPs Necessary? ☐ Yes ☐ No		

APPENDIX B

Example of Chain-of-Custody Form

U.C. Lawrence Berkeley National Laboratory
1 Cyclotron Road
Berkeley CA 94720

LBNL ENVIRONMENTAL SERVICES GROUP
Chain of Custody

Send Results to: Suying Xu, Mailstop 85B0198
For questions contact John Jelinski, e-mail: JAJelinski@lbl.gov
Phone: 510-486-7616 **Fax: 510-486-7034**

Purpose: Surface Water Monitoring Program-Semiannual Storm Water

COC No.: _______ **Page** ___ **of** ___

Release Number / DocumentControl No.: ______________

Collections: ____________________

Sample Location	Date & Time Sampled	Reference Date/time*	Collection Method	Sample Type	Container Volume & Code**	#	Preservative	Analysis Code	Field Sample ID***	Notes to Lab
all sites			composite	aqueous	1 liter PE	1	none	pH-aq:SM4500H+B		
"			composite	aqueous	same container		none	E120.1		
"			composite	aqueous	same container		none	TSS:SM2540D		
all sites			composite	aqueous	1 liter AG	1	HCl	E1664		
MP-3 only			composite	aqueous	500 ml PE	1	none	E200.7:AL, CU, FE, PB, ZN		
MP-3 only			composite	aqueous	250 ml PE	1	H_2SO_4	NO3+NO2(asN):MULT		for E300.0, no preservative
MP-4 & 5 only			composite	aqueous	1 liter PE	1	NaOH	E335.4		
"			composite	aqueous	500 ml PE	1	none	E200.7:Ag, As, Cd, Mg, Pb, Se		
"			composite	aqueous	same container		none	MET-aq:MULT-hg		
MP-4 & 5 only			composite	aqueous	250 ml PE	1	H_2SO_4	Ammonia(asN):MULT		
MP-3, 4 & 5 only			composite	aqueous	500 ml PE	1	none	E410.4		

Total No. of Containers:

Shipping Document ID:

Turnaround Time**:**

Lab Name:

Sampled By:

Special Instructions/Comments:

Relinquished By (Sampler)
Signature Time
Printed Name Date
Company

Received By
Signature Time
Printed Name Date
Company

Relinquished By
Signature Time
Printed Name Date
Company

Received By
Signature Time
Printed Name Date
Company

Relinquished By
Signature Time
Printed Name Date
Company

Received By
Signature Time
Printed Name Date
Company

*REFERENCE DATE/TIME: Use this value for decay calculations in radiological analyses when applicable **Container Codes: AG = amber glass CG = clear glass PE = polyethylene VV = VOA vi

*** Field Sample ID: If present, use this information as the sample identifier in hard-copy reports (please include Sample Location information in the notes). If blank, and in electronic deliverable files, use Sample Location as the identifier. ****Listed turnaround time is for reporting and is in work days, as defined in the Joint LBNL/LLNL Analytical Services blanket order.

APPENDIX B

Environmental Monitoring and Surveillance Summary Table

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Environmental Monitoring and Surveillance Summary

Sample Type	Collection Frequency	Collection Type	Radiological Analyses	Nonradiological Analyses
Ambient Air	Monthly	Continuous	Gross Alpha, Gross Beta	
Meteorology	15 min. and Hourly	Continuous		Wind Speed, Wind Direction, Standard Deviation of Wind Direction, Temperature, Dew Point, Relative Humidity, Barometric Pressure, Solar Radiation and Precipitation
External Penetrating Radiation	Quarterly	Continuous	Gamma	
External Penetrating Radiation	Direct Reading	Continuous	Gamma, Neutron	
Rainwater	Monthly, Wet Months	Continuous	Gross Alpha, Gross Beta, Tritium	
Sediment	Annually	Grab	Gross Alpha, Gross Beta, Tritium, Gamma Emitters	Metals, pH, Oil & Grease, Diesel Fuel
Soil	Annually	Grab	Gross Alpha, Gross Beta, Tritium, Gamma Emitters	Metals, pH
Stack Air Emissions	Direct Reading	Continuous	Gross Alpha, Positron	
Stack Air Emissions	Monthly/ Quarterly	Continuous	Gross Alpha, Gross Beta, Tritium, Carbon-14, Iodine-125	
Stormwater	2 Storm Events	Grab		pH, Total Suspended Solids, Specific Conductance, Oil & Grease (all monitoring points) Ammonia as Nitrogen, Nitrite & Nitrate as Nitrogen, Metals, Chemical Oxygen Demand (only at targeted locations)
Creeks	Semi-Annually	Grab	Gross Alpha, Gross Beta, Tritium, Gamma Emitters	Dissolved metals, VOCs, total mercury, conductivity, pH, and temperature.
Vegetation	Every 5 years	Grab	Tritium	
Wastewater-Nonradiological	2 Times/ Year	24-Hour Composite*		Metals, pH, Chemical Oxygen Demand, Filtered, Total Identifiable Chlorinated Hydrocarbons (624), Total Suspended Solids
Wastewater-Radiological	4 Weeks	Composite	Gross Alpha, Gross Beta, Tritium, Iodine-125, Carbon-14	

* The samples at Building 77 are only analyzed for metals.

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APPENDIX C

List of Environmental Monitoring Procedures

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ESG's Environmental Monitoring Procedure List

Procedure Title	Number
Environmental Reporting and Correspondence	200
Environmental Permitting	201
Dose Measurement and Calculations for Monitoring Environmental Penetrating Radiation	207
Nonconformance and Corrective Action Reporting	208
Calculating Dose from Radioactive Air Emissions for NESHAP Compliance	218
Categorizing Potential Sources of Radioactive Air Emissions	219
Stormwater Facilities Inspection	220
Data Quality Objectives and Assessment	252
Data Calculating and Reporting	253
Sample Processing, Packaging, and Transportation	254
Maintenance of ESG Sampling Databases	255
ESG Database Verification and Validation	256
Surface Water Sampling	263
Wastewater Sampling	265
Soil, Sediment and Vegetation Sampling	266
Environmental Sample Tracking and Data Management	268
Sitewide Air Sampling	280
Air Sampling Equipment Maintenance	286
Stack Air Flow Rate Measurement and Calibration	287
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