CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION

TENTATIVE ORDER

UPDATED SITE CLEANUP REQUIREMENTS AND RESCISSION OF ORDER NO. R2-2005-0022 for:

STANFORD UNIVERSITY
UNITED STATES DEPARTMENT OF ENERGY

for the:

STANFORD LINEAR ACCELERATOR CENTER – NATIONAL ACCELERATOR LABORATORY
2575 SAND HILL ROAD
MENLO PARK, SAN MATEO COUNTY

The California Regional Water Quality Control Board, San Francisco Bay Region (hereinafter Regional Water Board), finds that:

1. **Purpose of Order**: The purpose of this Order is to revise the deadlines of the existing site cleanup requirements contained in Regional Water Board Order No. R2-2005-0022 for the Stanford Linear Accelerator Center - National Accelerator Laboratory (SLAC) due to the Stanford University's and the United States Department of Energy's (collectively, the "Discharger") non-compliance with the existing cleanup order. In conjunction with this Order, the Regional Water Board is adopting a time schedule order prescribing the liabilities that will be due in the event of future non-compliance with this Order due to the Discharger's history of non-compliance and threatened future non-compliance. This Order does not contain any new requirements beyond what is required in the existing cleanup order. This Order also rescinds Regional Water Board Order No. R2-2005-0022.

2. **Site Location**: SLAC (the site) is a 426-acre, high-energy particle physics and particle astrophysics, synchrotron radiation and photon science research facility. It is located approximately two miles west of the main Stanford University campus adjacent to Menlo Park in an unincorporated portion of San Mateo County, California (Figure 1). It is located within an area consisting of properties that are residentially zoned by the County of San Mateo. Its unusually shaped property boundary is due to the two-mile long, narrow linear accelerator (LINAC), which runs east-west under Highway 280, and the larger rectangular target/research area at the eastern end of the LINAC.

3. **Site Ownership and History**: SLAC is a federally-funded national research laboratory constructed in 1963 and continuously managed and operated by Stanford University under a contract with the United States Department of Energy (DOE). It is located on land owned by Stanford University and leased to DOE. The original lease agreement was signed in 1962 between the Atomic Energy Commission (DOE's predecessor) and Stanford University for a period of 50 years, expiring in 2012. The SLAC land is part of the original land grant that established Stanford University; the land cannot be sold and must be held in perpetuity by Stanford University's trustees to support its

educational mission. Land use at the facility is a combination of industrial, educational, and short-term residential.

4. **Adjacent Land Use**: As shown in Figure 1, SLAC is bordered to the north by Sand Hill Road, with the commercial and residential development of Sharon Heights across the road. SLAC is also bordered by residential development (Stanford Hills) and agricultural/equestrian facilities (Harry Cohn Ranch) to the east, agricultural (Webb Ranch, Harry Cohn Ranch) and equestrian facilities (Portola Valley Training Center) to the south, and by undeveloped areas to the west, including the Jasper Ridge Biological Preserve, which is owned, monitored and protected by Stanford University.

5. **Soil and Groundwater Pollution**: SLAC has conducted numerous site investigations as part of its overall Environmental Restoration Program that included extensive soil and groundwater sampling and the installation of over 100 groundwater monitoring wells. Results of these investigations indicate that soil and groundwater pollution exists at various locations within the site. Constituents of concern for soil are: volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), total petroleum hydrocarbons (TPH), polychlorinated biphenyls (PCBs), lead, and tritium. Constituents of concern for groundwater are: VOCs, SVOCs, petroleum hydrocarbons, and tritium.

   Source areas that contributed to pollutant releases include storage areas and areas where hazardous materials, including VOCs, SVOCs, PCBs, petroleum hydrocarbons, and radionuclides, were used or generated. The VOCs were used as cleaning agents and the PCBs were used in electrical transformers. PCBs are no longer used at SLAC in transformers at concentrations above 500 parts per million (ppm). All transformers with PCB concentrations above 500 ppm have been drained, flushed, and refilled with non-PCB containing oil; however, some residual PCBs remain in the transformers. Generation of radionuclides is the result of operating the LINAC for high-energy particle physics research. Several removal actions have been performed for VOCs, SVOCs, PCBs, TPH, and metals in soil and groundwater. Currently, evaluation of remedial alternatives addressing soil and groundwater pollution is ongoing.

6. **Named Discharger:** Stanford University is named as a discharger because it owns and ultimately controls the land upon which SLAC is located. As land owner, Stanford University has the ability to control the long-term uses of the property and the discharges at the site. The United States Department of Energy (DOE) is named as a discharger because it is the owner/operator of SLAC, and because pollutant discharges occurred during the time of its ownership and operation. Further, DOE has the knowledge and ability to control the discharges at the site.

7. **Regulatory Status**: In 1985, the Regional Water Board adopted Order No. 85-88, which required investigation and remediation of the Former Solvent Underground Storage Tank (FSUST) site. Since then, Regional Water Board staff has overseen investigation and cleanup activities, funded through an oversight grant with DOE. In 2005, the Regional Water Board adopted Order No. R2-2005-0022, identifying additional sites that required investigation, remediation, and monitoring of soil and groundwater pollution to achieve cleanup objectives.

   Stormwater: Discharge of stormwater into San Francisquito Creek is regulated under a general waste discharge permit issued by the State Water Resources Control Board (State Water Board). The State Water Board's General Storm Water Permit (General Industrial Activities Storm Water Permit Water Quality, Order No. 97-03-DWQ, NPDES No. CAS000001) requires visual inspection and surface water sampling at the point of discharge.

Sanitary Sewer/Wastewater: SLAC's wastewater discharges are regulated under Mandatory Wastewater Discharge Permit No. WB061216, which was issued by the South Bayside System Authority and West Bay Sanitary Sewer District. This permit covers all routine wastewater discharges from SLAC, including polluted groundwater that is extracted and treated prior to discharge.

Hazardous Waste: SLAC is a Resource Conservation and Recovery Act (RCRA) large quantity generator, but is not permitted to store hazardous waste for longer than 90 days. SLAC's hazardous waste is managed by the Hazardous Waste Management Group of the Environmental Protection Department. SLAC currently has six hazardous waste treatment units (listed below) that are operated under the State of California Tiered Permit Program using Permit-by-Rule (PBR) and Conditional Authorization permit tiers. The San Mateo County Department of Health Services is the agency responsible for inspecting these units for compliance with federal, state, and local hazardous waste laws and regulations.

- Unit 1A- Building 25 Cyanide Treatment Tanks (under PBR tier)
- Unit 1B- Building 38 Metal Finishing Pretreatment Facility (under PBR tier)
- Unit 1C- Building 38 Batch Hazardous Waste Treatment Tank (under PBR tier)
- Unit 2- Building 38 Sludge Dryer Unit (under PBR tier)
- Unit 4- Building 35 FSUST Dual Phase (Soil Vapor/Groundwater) Extraction and Treatment System (under Conditional Authorization tier)
- Unit 5- Building 15 Parking Lot FHWSA Dual Phase (Soil Vapor/Groundwater) Extraction and Treatment System (under PBR tier)

8. **Topography**: SLAC is located in the foothills of the Santa Cruz Mountains, above an alluvial plain that borders the western margin of San Francisco Bay. The maximum elevation within SLAC's boundary is approximately 375 feet above mean sea level (MSL). Jasper Ridge, located immediately southwest of SLAC's boundary, is the local topographic high at 600 feet above MSL.

9. **Hydrology**: SLAC is located within the San Francisquito Creek Watershed. The watershed encompasses an area of approximately 40 square miles, drains easterly into San Francisco Bay, and extends from the ridge of the Santa Cruz Mountains to San Francisco Bay. Creeks that are part of the watershed include San Francisquito Creek, Bear Creek, Martin Creek, Corte Madera Creek, and Los Trancos Creek. The watershed traverses five municipalities (Palo Alto, East Palo Alto, Menlo Park, Portola Valley, and Woodside), and portions of both Santa Clara and San Mateo counties. The watershed overlies the northern boundary of the Santa Clara Valley groundwater basin and the southern boundary of the San Mateo Plain groundwater basin. San Francisquito Creek is a perennial stream that flows eastward near the southern border of SLAC, and joins with Los Trancos Creek before turning northeast and eventually discharging into San Francisco Bay. The headwaters for San Francisquito Creek are found along the foothills of the Santa Cruz Mountains where several small streams coalesce. The primary source of stream flow is runoff from precipitation in the Santa Cruz Mountains. Stream flow has been measured since 1930 by the U.S. Geological Survey (USGS) at a gauging station located on San Francisquito Creek a short distance downstream from SLAC. The mean monthly stream flow varies from 20,643,361 gallons per day (gpd) in the wet months (October-May) to 387,790 gpd in the dry months (June-September).

10. **Hydrogeology**: SLAC is adjacent to the northern boundary of the Santa Clara Valley groundwater basin and straddles the western boundary of the San Mateo Plain groundwater basin. The facility is sited on the bedrock above these two alluvial groundwater basins. Groundwater beneath the eastern portion of SLAC occurs predominantly within the Ladera Sandstone, a thick sequence of marine siltstones that dominates the geology in the area. Based on topography, the regional groundwater flow direction is generally to the south and southeast toward San Francisquito Creek, with a topographic groundwater divide along Sand Hill Road. However, groundwater flow directions and gradients across the SLAC site have been modified locally due to grading and construction of the SLAC facility. Groundwater flow direction has also been strongly affected by the subdrain system constructed at the base of the LINAC tunnel about 35-40 feet below ground surface. Groundwater that infiltrates into this system discharges into the storm drainage system at an estimated rate of 2 gallons per minute (gpm). Over 100 monitoring wells have been installed on the eastern half of SLAC since the early 1960s (See Figure 2). Groundwater depth and flow direction vary across SLAC; for example, depth to groundwater at the Former Hazardous Waste Storage Area (FHWSA) ranges from 11 to 24 feet below ground surface (bgs) with an easterly and southeasterly gradient. At the Plating Shop Area (PSA), depth to groundwater ranges from 3 to 30 feet bgs with a southeasterly gradient, while depth to groundwater at the Test Lab/Central Lab (TL/CL) varies from 13 to 33 feet bgs with a southeasterly gradient (Figure 2). Groundwater is not currently used on-site at SLAC; however, five offsite groundwater wells have been identified within a one-mile radius of SLAC, three of which are currently in use (See Figure 3). The closest groundwater well is located approximately 500 feet south of SLAC near San Francisquito Creek. This well was formerly used for agricultural supply but is currently capped. Of the four other wells, one is capped, one is used for watering livestock, and two are used for residential drinking water supply.

11. **Stormwater**: Stormwater runoff from the LINAC and other parts of SLAC is discharged to San Francisquito Creek via a storm drain network. It is first collected in two major surface water channels referred to as the IR-6 and IR-8 drainage channels. The storm drain network includes surface channels and a culvert underneath property owned by Stanford University and leased to the Portola Valley Training Center (PVTC) which operates a horse track and training facility. Stormwater then flows into a sedimentation pond prior to discharging into San Francisquito Creek. The IR-6 watershed encompasses approximately 30 acres and contains approximately 7,500 linear feet of stormwater piping; this area is primarily paved or covered by buildings, and includes the Research Yard-SSRL IA. The IR-8 watershed encompasses approximately 65 acres and contains 12,000 linear feet of storm drain piping; this basin is also substantially paved and is occupied by buildings, including SLAC's campus area. Along the western portion of the LINAC, stormwater is conveyed off-property via other localized drainage ditches.

12. **Special Status Species**: No special status species have been observed within the SLAC facility boundary. However, special status species have been identified in the area surrounding SLAC and include 1) the California red-legged frog, often found in fresh water ponds and slow flowing sections of the San Francisquito Creek; 2) steelhead trout, found in San Francisquito Creek; 3) the Western Pond Turtle, found in calm water throughout the San Francisquito Creek system; and 4) the San Francisco Garter Snake, found near calm waters throughout the area.

13. **Remedial Investigations and Remediation Status:** SLAC's past operations have released pollutants into soils and groundwater at various locations within the facility. Constituents of concern for soil include VOCs, SVOCs, petroleum hydrocarbons, PCBs, tritium, and lead. Constituents of concern for groundwater include VOCs, SVOCs, petroleum hydrocarbons, and tritium. As

documented in the Remedial Investigation/Feasibility Study Work Plan (May, 2006), the facility has been divided administratively into four Operable Units (OUs) including: 1) the Groundwater Volatile Organic Compound Operable Unit (GW VOC OU), 2) the Tritium Operable Unit (Tritium OU), 3) The West SLAC/Campus Area/IR-8 Drainage Channel Operable Unit, and 4) Research Yard/SSRL/IR-6 Drainage Channel Operable Unit. Within each OU are potential source areas that are classified as either "Investigation Areas" (IAs) or as Miscellaneous Soil Sites (MSSs) and which are categorized as follows:

- ***No Further Investigation, Pending Risk Assessment*** – This category is for areas or sites where a preliminary evaluation indicates that no further investigation or evaluation is necessary. Final determination will be made upon completion of the Baseline Human Health and Ecological Risk Assessments for each Operable Unit. There are currently 22 IAs in this category.
- ***Further Investigation When Practicable*** – This category is for areas or sites that may pose an unacceptable risk to human health or the environment, but characterization and/or remediation efforts are not practicable at this time, due to on-going facility operations. Investigation and/or remediation of these "deferred areas" will occur at facility closure, or when the work becomes practicable. A protocol is to be developed that will identify how and when these areas will be re-evaluated and addressed. There are currently 40 IAs and MSSs in this category.
- ***Further Investigation*** – This category is for areas or sites that may pose an unacceptable risk to human health or the environment and where site characterization or remediation efforts are currently practicable. The IAs or MSSs in this category need to be evaluated to determine if they have been adequately characterized and if an unacceptable risk to human health or the environment exists. To this end, risk-based screening concentrations have been developed, and "data packages" have been, or are being, developed, to summarize available data for each area. There are currently 25 IAs and MSSs in this category.

Figure 4 shows the locations of each OU. Figures 5A and 5B show the locations of the IAs and MSSs. Table 1 indicates the status of IAs and MSSs that have been assigned to an OU. Table 2 contains all the IAs and MSSs designated as needing further investigation when practicable. Tables 3 and 4 provide a summary of the remedial investigation and remedial status at each of the OUs.

14. **Completed Tasks:** Following is a summary of tasks that were partially or entirely completed pursuant to Order No. R2-2005-0022:

- Task 1 - Environmental Baseline Report (EBR) – The Environmental Baseline Report was approved March 7, 2006, and included a detailed inventory of sites across the facility where contaminants may have been released. It documents preliminary determinations about whether or not further action is warranted.
- Task 2 - Proposed Land Use and Development Plan – The SLAC Long Range Development Plan (LRDP) consists of two documents: the SLAC Long Range Development Plan, dated June 2003, and the Long-Range Land Use Plan, dated August 24, 2005. The LRDP was approved on November 18, 2005 and a letter of clarification issued on January 18, 2006. The SLAC LRDP identifies the site as being zoned for residential development since the 1930s. It also identifies residential and other sensitive uses (e.g. school, hospital, day care, and ecological preserve) as potential future uses at the site and supports remediation of the site to cleanup standards for unrestricted land use.

- Task 3 - Public Participation Plan (PPP) – The PPP, dated February 1, 2006, was approved on March 1, 2006. Changes to the Public Participation Plan that were made and submitted to the Regional Water Board on June 8, 2008 are considered part of the approved PPP.
- Task 4 - Work Plan for the Remedial Investigation and Feasibility Study (RI/FS) – The RI/FS Work Plan was submitted on May 8, 2006, and approved on August 23, 2006. The RI/FS Work Plan included a Sampling and Analysis Plan and a proposed Implementation Schedule. It also grouped the EBR IAs and MSSs identified as practicable for further investigation into the four Operable Units.
- Task 5 - Remedial Investigation (RI) Report
  - *Groundwater VOC Operable Unit*: Site Characterization Reports were submitted for the FHWSA (approved June 16, 2006), Plating Shop Area (PSA) (approved September 5, 2006), FSUST (approved September 30, 2002), and Test Laboratory Central Laboratory (TL/CL) (approved September 27, 2002). These reports were approved on May 1, 2008 as being functionally equivalent to the RI report requirement in Task 5 of Order No. R2-2005-0022 for this OU.
  - *Tritium Operable Unit* – The Final RI Report for the Tritium OU was approved on June 12, 2009.
  - *West SLAC/Campus Area/IR-8 Drainage Channel Operable Unit* - The RI Report for this OU is under preparation and is now required by this Order.
  - *Research Yard/SSRL/IR-6 Drainage Channel Operable Unit* - The RI Report for this OU is under preparation and is now required by this Order.
- Task 6 – Baseline Human Health and Ecological Risk Assessment
  - *Groundwater VOC Operable Unit*: The Site Characterization Reports which satisfied the remedial investigation requirements for the GW VOC OU also included preliminary risk assessments. In a May 1, 2008 letter, the Regional Water Board indicated that this task was completed for the GW VOC OU, contingent on incorporation of Preliminary Remedial Goals (PRGs) into subsequent required submittals for this OU.
  - *Tritium Operable Unit* – Task 6 is not applicable at present for this OU.
  - *West SLAC/Campus Area/IR-8 Drainage Channel Operable Unit* – Task 6 is not complete for this OU and is now required by this Order.
  - *Research Yard/SSRL/IR-6 Drainage Channel Operable Unit* - Task 6 is not complete for this OU and is now required by this Order.
- Tasks 7-13 – Tasks 7-13 contained in Order No. R2-2005-0022 included submittal of a feasibility study report, remedial action plan (RAP), remedial design report, operations and maintenance plan, RAP implementation report, risk management plan, and five-year review reports. These tasks have not been completed and are now required by this Order.

15. **Preliminary Remediation Goals:** Site-specific risk-based human health and ecological preliminary remedial goals (PRGs) have been developed for the chemicals of concern detected in soil, soil vapor, groundwater, and sediment at SLAC. The PRGs are presented in the following documents: *Development and Use of Site-Specific Preliminary Remediation Goals for Human Health Risk Assessment* (SLAC, 2007) and *Development and Use of Site-Specific Preliminary Remediation Goals for Ecological Risk Assessment* (SLAC, 2007). The PRGs were developed to assist in the decision-making process during the investigation and remediation of impacted soil, soil vapor,

groundwater, and sediment at SLAC, and to support completion of human health and ecological risk assessments based on future unrestricted use of the site. The PRGs support the development of risk-based remedial action objectives and final soil and groundwater cleanup standards.

16. **Compliance Schedule for Task Deliverables:** In December, 2008, the Discharger submitted a proposed revision to the compliance schedule for task deliverables in Order No. R2-2005-0022. The Discharger worked in collaboration with Regional Water Board staff to resolve inconsistencies in the compliance schedule, identify attainable timelines for task deliverables, and develop a rolling milestone approach for implementation. The revised compliance schedule for task deliverables is presented in Table 5 of this Order.

17. **Basis for Cleanup Standards**

a. **General**: State Water Board Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality of Waters in California," applies to this discharge and requires attainment of background levels of water quality, or the highest level of water quality which is reasonable if background levels of water quality cannot be restored. Cleanup levels other than background must be consistent with the maximum benefit to the people of the State, not unreasonably affect present and anticipated beneficial uses of such water, and not result in exceedance of applicable water quality objectives.

State Water Board Resolution No. 92-49, "Policies and Procedures for Investigation and Cleanup and Abatement of Discharges under Water Code Section 13304," applies to this discharge. This Order and its requirements are consistent with the provisions of Resolution No. 92-49, as amended.

b. **Beneficial Uses**: The Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan) is the Regional Water Board's master water quality control planning document. It designates beneficial uses and water quality objectives for waters of the State, including surface waters and groundwater. It also includes programs of implementation to achieve water quality objectives. The Basin Plan was duly adopted by the Regional Water Board and approved by the State Water Board, U.S. EPA, and the Office of Administrative Law where required.

Regional Water Board Resolution No. 89-39, "Sources of Drinking Water", which implements State Water Board Resolution No. 88-63, defines potential sources of drinking water to include all groundwater in the region, with limited exceptions for areas of high TDS, low yield, or naturally-high contaminant levels.

Groundwater - The SLAC facility overlies two separate groundwater sub basins of the Santa Clara Valley Groundwater Basin as defined in the Basin Plan. These include the San Mateo Plain and the Santa Clara Sub Basins. The Basin Plan designates the following existing and potential beneficial uses for groundwater in these sub-basins:

- Municipal and domestic water supply (MUN)
- Industrial process water supply (PRO)
- Industrial service water supply (IND)
- Agricultural water supply (AGR)

Groundwater recharge to the surface waters of San Francisquito Creek likely occurs at different times of the year, based on measured groundwater and surface water levels. Based on water quality measurements the groundwater is considered freshwater. Therefore the groundwater beneath SLAC has the following additional existing and/or potential beneficial use as defined in the Basin Plan:

- Freshwater replenishment to surface water (FRSH)

Groundwater is not currently used on-site at SLAC; however, five offsite groundwater wells have been identified within a one-mile radius of SLAC, three of which are currently in use. The closest groundwater well is located approximately 500 feet south of SLAC near San Francisquito Creek. This well was formerly used for agricultural supply but is currently capped. Of the four other wells, one is capped, one is used for watering livestock, and two are used for residential drinking water supply.

Regional Water Board staff has not considered at this time whether or not any site-specific or facility-wide exceptions to the Regional Water Board's or State Water Board's "Sources of Drinking Water" Policies are applicable at SLAC Therefore, groundwater underlying and adjacent to the site currently qualifies as a potential source of drinking water[1, 2].

Surface Water - The Basin Plan designates the following existing and potential beneficial uses of San Francisquito Creek:

- Water contact recreation (REC1)
- Noncontact water recreation (REC2)
- Fish migration (MIGR)
- Fish spawning (SPWN)
- Wildlife habitat (WILD)
- Cold freshwater habitat (COLD)
- Warm freshwater habitat (WARM)

c. **Protection of Human and Environmental Health:** The soil and groundwater cleanup standards must be based on applicable water quality objectives necessary to protect the aforementioned beneficial uses. Cleanup standards must also be based on protection of human health and the environment considering current and reasonably foreseeable future land and water use, technical feasibility, and cost-effectiveness. The SLAC Long Range Development Plan supports remediation of the site to residential cleanup standards for unrestricted land use within a timeframe that is reasonable considering what is feasible[3].

18. **Development and Modification of Cleanup Standards:** The goal of remedial action must include restoration of beneficial uses of groundwater underlying and adjacent to the site. If full restoration of beneficial uses is not technologically or economically achievable within a reasonable period of time, then the Discharger may request modification of the cleanup standards or establishment of a

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[1] *Water Board letter from Michael Rochette to Irene Boczek, dated February 6, 2003*

[2] *Water Board Letter from Curtis Scott to Audra Richards, Rich Schassburger, and Debra Zumwalt, dated May 25, 2007*

[3] *Water Board letters, dated November 18, 2005 and January 18, 2006,respectively, approving and clarifying approval of the SLAC LRDP*

containment zone, a limited groundwater pollution zone where water quality objectives are exceeded. Conversely, if new technical information indicates that cleanup standards can be surpassed, the Regional Water Board may decide that further cleanup actions should be taken.

19. **Reuse or Disposal of Extracted Groundwater:** Regional Water Board Resolution No. 88-160 allows discharges of extracted, treated groundwater from site cleanups to surface waters only if it has been demonstrated that neither reclamation nor discharge to the sanitary sewer are technically and economically feasible.

20. **Basis for 13304 Order:** California Water Code Section 13304 authorizes the Regional Water Board to issue orders requiring the Discharger to cleanup and abate waste where the Discharger has caused or permitted waste to be discharged or deposited where it is or probably will be discharged into waters of the State and creates or threatens to create a condition of pollution or nuisance. The Discharger caused and permitted waste to be discharged or deposited where it is or probably will be discharged into waters of the State and creates or threatens to create a condition of pollution or nuisance as set forth in these findings.

21. **Cost Recovery:** Pursuant to California Water Code Section 13304, the Discharger is hereby notified that the Regional Water Board is entitled to, and may seek reimbursement for all reasonable costs actually incurred by the Regional Water Board to investigate unauthorized discharges of waste and to oversee cleanup of such waste, abatement of the effects thereof, or other remedial action, required by this Order.

22. **Failure to Submit Required Reports:** Failure to submit the required technical reports according to the compliance schedule and tasks of this Order may subject the Discharger to enforcement action, including but not limited to imposition of administrative civil liability under Water Code Sections 13268 or 13350, or referral to the attorney general for injunctive relief or civil or criminal liability.

23. **CEQA:** The site is already subject to cleanup requirements under Regional Water Board Order No. R2-2005-0022 (the baseline for purposes of environmental analysis). This Order only modifies the deadlines set forth in that order. Such changes involving new deadlines do not have the potential for significant impacts on the environment. As such, the general rule that the California Environmental Quality Act ("CEQA") only applies to projects which have the potential for causing a significant effect on the environment (the "common sense" exemption) applies and no environmental document needs to be prepared in connection with the adoption of this Order. [Cal. Code Regs., tit. 14, § 15061(b)(3)]. Furthermore, this Order does not approve any specific cleanup plan, which is generally what may result in impacts to the environment. This further supports the application of the "common sense" exemption for adoption of this Order. When a specific cleanup proposal is submitted to the Executive Officer for approval, such proposal must and will be evaluated under CEQA prior to approval.

24. **Notification:** The Regional Water Board has notified the Discharger and all interested agencies and persons of its intent under California Water Code Section 13304 to prescribe site cleanup requirements for the discharge, and has provided them with an opportunity to submit their written comments.

25. **Public Hearing:** The Regional Water Board, at a public meeting, heard and considered all comments pertaining to the proposed site cleanup requirements for the site.

IT IS HEREBY ORDERED, pursuant to Section 13304 of the California Water Code, that the Discharger (and/or its agents, successors, or assigns) must cleanup and abate the effects described in the above findings as follows:

A. PROHIBITIONS:

1. The discharge of wastes or hazardous substances in a manner that will degrade water quality or adversely affect beneficial uses of waters of the State is prohibited.

2. Further significant migration of wastes or hazardous substances through surface or subsurface transport to waters of the State is prohibited.

3. Activities associated with the subsurface investigation and cleanup that will cause significant adverse migration of wastes or hazardous substances are prohibited.

B. TASKS

Following are the tasks necessary to implement the requirements of this Order. Tasks 1-13 are identical to the tasks contained in Order No. R2-2005-0022, however the compliance dates have been updated. Tasks 1-4 are complete as indicated (see finding No. 14). Table 5, attached to this Order, provides the updated compliance schedule for task deliverables and is hereby incorporated into this Order.

1. **Environmental Baseline Report:** Task Completed (see Finding 14).

2. **Proposed Land Use and Development Plan:** Task Completed (see Finding 14).

3. **Public Participation Plan**: Task Completed (see Finding 14).

4. **Remedial Investigation / Feasibility Study (RI/FS) Workplan and Implementation Schedule**: Task Completed (see Finding 14).

5. **Remedial Investigation (RI) Report:** The Discharger must submit RI reports, acceptable to the Executive Officer, for the Research Yard-SSRL/IR-6 Drainage Channel OU and the west SLAC/Campus Area/IR-8 Drainage Channel OU as indicated in Table 5. Each RI report must present information that demonstrates site conditions are fully assessed and provides an adequate basis for conducting human health and ecological risk assessments. All locations within each OU footprint where soil or groundwater pollutants could reasonably be expected to

occur or to be discharged, including storm drain networks, must be addressed by the remedial investigation and in the RI reports. Reports must be prepared in a format, to the extent practicable, that parallels the U.S. Environmental Protection Agency's "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA," October 1988.

COMPLIANCE DATE: In accordance with Table 5

6. **Baseline Human Health and Ecological Risk Assessment**: The Discharger must conduct baseline human health and ecological risk assessments for each OU as indicated in Table 5, that meet the requirements of Health and Safety Code Sections 25356.1.5, subdivision (b), and submit baseline risk assessment reports, acceptable to the Executive Officer. Each risk assessment report must present the methodology used and the results of the human health and ecological risk assessments. Reports must be prepared consistent with U.S. EPA and California Environmental Protection Agency guidance and regulations, including as a minimum: Risk Assessment Guidance for Superfund, Volume 1; Human Health Evaluation Manual, December 1989; Superfund Exposure Assessment Manual, April 1988; Risk Assessment Guidance for Superfund, Volume 2, Environmental Manual, March 1989; and all other related or relevant policies, practices and guidelines of the California Environmental Protection Agency and policies, practices and guidelines developed by U.S. EPA pursuant to CFR 300.4000 et seq.

COMPLIANCE DATE: In accordance with Table 5

7. **Feasibility Study (FS) Report**: The Discharger must conduct feasibility studies and submit FS reports, acceptable to the Executive Officer, for each OU as indicated in Table 5 based on complete remedial investigations and risk assessments per Tasks 5 and 6 of this Order. Each FS report must present an evaluation of remedial alternatives for current and reasonably foreseeable land use scenarios consistent with the SLAC LRDP to the extent necessary to select an appropriate remedy or remedies. FS reports must also present an evaluation of remedial alternatives for areas of the site where, in the near-term, it is reasonable and practicable to cleanup to standards consistent with the sensitive future uses identified in the SLAC LRDP. Reports must be prepared in a format, to the extent practical, that parallels the U.S. Environmental Protection Agency's "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA," October 1988. The Discharger may request that the Executive Officer waive the requirement for a feasibility study for time-critical remedial actions for which funding is available and for small areas of incidental contamination identified during site maintenance and development activities where soil removal is the appropriate remedial action.

COMPLIANCE DATE: In accordance with Table 5

8. **Remedial Action Plan (RAP)**: The Discharger must submit RAPs for each OU as indicated in Table 5 for approval by the Executive Officer based on complete remedial investigations, risk assessments, and feasibility studies per Tasks 5, 6, and 7 of this Order. Each RAP must present an evaluation of alternatives identified in the FS report, summarize risk assessment results, and propose final remedial actions and cleanup standards. Each RAP must identify specific tasks and a time schedule for implementation of the proposed remedy. Each RAP must include a summary of the public review process including public comments on the RAP, responses to

comments, and any substantive changes to the RAP that were made in response to public comments.

COMPLIANCE DATE: In accordance with Table 5

9. **Remedial Design (RD) Report**: The Discharger must submit RD reports, acceptable to the Executive Officer, for each OU as indicated in Table 5. Each RD report must provide the remedial design describing the technical approach that will be used to implement the remedial actions proposed in the RAP. RD reports must contain detailed design criteria, construction details, and procedures in sufficient detail, along with a time schedule for implementation of the selected remedial actions.

COMPLIANCE DATE: In accordance with Table 5

10. **Operation and Maintenance (O&M) Plan**: The Discharger must comply with all O&M requirements in accordance with the approved final RAP and approved RD report. Discharger must submit O&M Plans, acceptable to the Executive Officer, for each OU as indicated in Table 5, which includes an implementation schedule and the funding mechanism for O&M. The Discharger must implement the plan in accordance with the approved schedule.

COMPLIANCE DATE: In accordance with Table 5

11. **RAP Implementation Report**: The Discharger must submit a RAP Implementation Report, acceptable to the Executive Officer, for each OU as indicated in Table 5. The RAP Implementation Report must certify that remedial actions have been implemented and that remedial systems have been constructed and started up in accordance with the approved RAP and Remedial Design report.

COMPLIANCE DATE: In accordance with Table 5

12. **Risk Management Plan (RMP)**: The Discharger must submit RMPs, acceptable to the Executive Officer, for each OU as indicated in Table 5. Each RMP must detail all institutional controls necessary to protect human and environmental health based on current and future land and water uses. The RMP must describe the funding mechanisms necessary to implement the institutional controls.

COMPLIANCE DATE: In accordance with Table 5

13. **Five-Year Review Report**: The Discharger must submit a technical report, acceptable to the Executive Officer, reviewing and reevaluating the remedial action after a period of five (5) years from the beginning of RAP implementation, such as completion of construction and startup, and every 5 years thereafter as long as remediation is necessary.

    The report must include at a minimum:

    - A demonstration of the effectiveness in controlling contaminant migration and protecting human health and the environment

- Comparison of contaminant concentration trends with cleanup standards
- Comparison of anticipated versus actual costs of cleanup activities
- Performance data (e.g. groundwater volume extracted, chemical mass removed, mass removed per million gallons extracted)
- Cost effectiveness data (e.g. cost per pound of contaminant removed)
- Summary of additional investigations (including results) and significant modifications to remediation system
- Additional remedial actions (including those based on new or innovative technologies) proposed to meet cleanup standards (if applicable) including time schedule
- If cleanup standards have not been met and are not projected to be met within a reasonable time, the report should assess the technical practicability of meeting cleanup standards and may propose an alternative cleanup strategy

COMPLIANCE DATE: In accordance with Table 5.

14. **Investigation, Remediation, and Closure Protocol for Newly Discovered Sites, Deferred Areas, and Land Use Changes**: The Discharger must develop a protocol, acceptable to the Executive Officer, that details how and when newly discovered sites and deferred sites will be investigated, remediated, and closed. The protocol must include at a minimum:

    - Details on how the deferred areas will be tracked
    - Triggers that will initiate review and/or change of deferred area status, (e.g., plans for renovation and demolition of site structures or excavation in connection with ongoing site operations)
    - Regional Water Board staff notification procedures for known land use changes, anticipated changes to deferred area status, and proposed site actions
    - Description of process for evaluating what additional investigation and remediation will be conducted in the event of closure of all or portions of the existing installations or partial or full redevelopment of the site and conversion to different land use(s)
    - Description of the reporting and documentation process, including:
        - Sampling and remedial work plan submittal and review
        - Revisions or addendums to previously approved RI/FS Reports, RAPs, or RAP Implementation Reports
        - Technical reports containing the Case Closure Summary documenting the results of site investigation and remediation

    COMPLIANCE DATE: In accordance with Table 5.

15. **Proposed Curtailment or Closure**: The Discharger must submit a technical report, acceptable to the Executive Officer, containing a proposal to curtail remediation or obtain Regional Water Board closure for remaining impacted sites. Curtailment includes system closure (e.g., well abandonment), system suspension (e.g., cease extraction but wells retained), and significant system modification (e.g., major reduction in extraction rates, closure of individual extraction

wells within extraction network). The report must include the rationale for curtailment or closure. Proposals for final closure must demonstrate that cleanup standards have been met, residual contaminant concentrations are stable, and residual contaminant migration potential is minimal.

COMPLIANCE DATE: 60 Days prior to Proposed Curtailment or Closure

16. **Implementation of Curtailment or Closure**: The Discharger must submit a technical report, acceptable to the Executive Officer, documenting that curtailment/closure measures have been implemented.

COMPLIANCE DATE: 60 Days after Regional Water Board staff approval of proposed curtailment or closure

17. **Evaluation of New Health Criteria**: The Discharger must submit a technical report, acceptable to the Executive Officer, evaluating the effect on the approved remedial action plan of revising one or more cleanup standards in response to revision of drinking water standards, maximum contaminant levels, or other health based criteria.

COMPLIANCE DATE: 90 Days after Request by Executive Officer

18. **Evaluation of New Technical Information**: The Discharger must submit a technical report, acceptable to the Executive Officer, evaluating new technical information, which bears upon the approved remedial action plan and cleanup standards for this site. In the case of a new cleanup technology, the report must evaluate the technology using the same criteria used in the RAP. Such technical reports will not be requested unless the Executive Officer determines that the new information is reasonably likely to warrant a revision in the approved remedial action plan or cleanup standards.

COMPLIANCE DATE: 90 days After Request by Executive Officer

19. **Delayed Compliance**: If the Discharger is delayed, interrupted, or prevented from meeting one or more of the completion dates specified for the above tasks, the Discharger must promptly notify the Regional Water Board staff.

C. PROVISIONS

1. **Self-Monitoring Program**: The Discharger must comply with the Self-Monitoring Program as attached to this Order and as may be amended or revised by the Executive Officer.

2. **No Nuisance**: The storage, handling, treatment, or disposal of polluted soil or groundwater must not create a nuisance as defined in California Water Code Section 13050(m).

3. **Good Operation and Maintenance (O&M)**: The Discharger must maintain in good working order and operate as efficiently as possible any facility or control system installed to achieve compliance with the requirements of this Order.

4. **Cost Recovery**: The Discharger is liable, pursuant to California Water Code Section 13304, to the Regional Water Board for all reasonable costs actually incurred by the Regional Water Board to investigate unauthorized discharges of waste and to oversee cleanup of such waste, abatement of the effects thereof, or other remedial action, required by this Order. If the site addressed by this Order is enrolled in a State Water Board-managed reimbursement program, reimbursement must be made pursuant to this Order and according to the procedures established in that program. Any disputes raised by the Discharger over reimbursement amounts or methods used in that program must be consistent with the dispute resolution procedures for that program.

5. **Access to Site and Records**: In accordance with California Water Code Section 13267(c), the Discharger must permit the Regional Water Board or its authorized representative:

   (a). Entry upon premises in which any pollution source exists, or may potentially exist, or in which any required records are kept, which are relevant to this Order

   (b). Access to copy any records as required to be kept under this Order

   (c). Inspection of any monitoring or remediation facilities installed in response to this Order

   (d). Sampling of any groundwater or soil which is accessible, or may become accessible, as part of any investigation or remedial action program undertaken by the Discharger

6. **Contractor / Consultant Qualifications**: All technical documents that make or present geologic or engineering interpretations or data must be signed by and stamped with the seal of a California professional geologist, a California certified engineering geologist, or a California professional registered civil engineer.

7. **Lab Qualifications**: All samples must be analyzed by State-certified laboratories or laboratories accepted by the Regional Water Board using approved EPA methods for the type of analysis to be performed. All laboratories must maintain quality assurance/quality control (QA/QC) records for Regional Water Board review. This provision does not apply to analyses that can only reasonably be performed on-site (e.g., temperature).

8. **Electronic Reporting:** In addition to print submittals, all reports submitted pursuant to this Order must be submitted as electronic files in PDF format. The Regional Water Board has implemented a document imaging system, which is ultimately intended to reduce the need for printed report storage space and streamline the public file review process. Documents in the imaging system may be viewed, and print copies made, by the public, during file reviews conducted at the Regional Water Board's office. PDF files can be created by converting the original electronic file format (e.g., Microsoft Word) and/or by scanning printed text, figures and tables.

   Upon request by Regional Water Board staff, monitoring results, including water level measurements, sample analytical results, coordinates, elevations, etc., must be provided electronically in Microsoft Excel® or similar spreadsheet format. This format facilitates data computations and/or plotting that Regional Water Board staff may undertake during their

review. Data tables submitted in electronic spreadsheet format will not be included in the case file for public review as long as a PDF version is included.

All electronic files, whether in PDF or spreadsheet format, must be submitted via the Regional Water Board's file transfer protocol (FTP) site, email (only if the file size is less than 3 MB) or on CD. CD submittals may be included with the print report. Email notification should be provided to Regional Water Board staff whenever a file is uploaded to the Regional Water Board's FTP site.

The Discharger is also required to upload reports (PDF format) and submit groundwater analytical data, surveyed locations of monitoring wells, and certain other data to the State Water Board's Geotracker database. This information is available to the public at http://www.geotracker.swrcb.ca.gov/.

9. **Document Distribution**: Copies of all correspondence, technical reports, and other documents pertaining to compliance with this Order must be provided to the following agencies. The Executive Officer may modify this distribution list as needed:

   a. County of San Mateo Health Department
   b. Cal-EPA: Department of Toxics Substances Control
   c. Cal EPA: Department of Fish and Game
   d. U.S. Environmental Protection Agency, Region 9, San Francisco

10. **Reporting of Changed Owner or Operator**: The Discharger must file a technical report on any changes in site occupancy or ownership associated with the property described in this Order.

11. **Reporting of Hazardous Substance Release**: If any hazardous or toxic substance is discharged in or on any waters of the State, or discharged or deposited where it is, or probably will be, discharged in or on any waters of the State, the Discharger must report such discharge to the Regional Water Board by calling (510) 622-2369 during regular office hours (Monday through Friday, 8:00 to 5:00). A written report must be filed with the Regional Water Board within five working days. The report must describe the nature of the hazardous substance, estimated quantity involved, duration of incident, cause of release, estimated size of affected area, nature of effect, corrective actions taken or planned, schedule of corrective actions planned, and persons/agencies notified. This reporting is in addition to any reporting to the Office of Emergency Services required pursuant to the Health and Safety Code.

12. **Rescission of Existing Order:** This Order supersedes and rescinds Order No. R2-2005-0022.

13. **Periodic Order Review**: Regional Water Board staff will review this Order periodically. When necessary, this Order may be amended or revised.

I, Bruce H. Wolfe, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, San Francisco Bay Region, on _____.

_____
Bruce H. Wolfe
Executive Officer

Attachments:
Figure 1 – SLAC Location and Site Boundary Map
Figure 2 – Groundwater Potentiometric Map
Figure 3 – Off-site Groundwater Well Locations
Figure 4 – Map of Operable Unit locations at SLAC
Figure 5a – Map of Investigation Areas at SLAC, Part 1
Figure 5b – Map of Investigation Areas at SLAC, Part 2
Table 1 – Status of Investigation Areas and Miscellaneous Soil Sites at SLAC
Table 2 – Investigation Areas and Miscellaneous Soil Sites at SLAC Requiring Further Investigation When Practicable
Table 3 – Descriptions, Remedial Investigations, and Remedial Status at the GW VOC OU
Table 4 – Descriptions, Remedial Investigations, and Remedial Status at the Tritium OU, Research Yard-SSRL/IR-6 Drainage Channel OU, and the West SLAC/Campus Area/IR-8 Drainage Channel OU
Table 5 – Compliance Schedule for Task Deliverables
Self-Monitoring and Reporting Program

Table 1 – Status of Investigation Areas and Miscellaneous Soil Sites for each Operable Unit at SLAC

IAs that Require No Further Investigation, Pending Risk Evaluation	IAs and MSSs that Require Further Investigation	IAsand MSSs that Require Further Investigation When Practicable [3]
Groundwater VOC Operable Unit		
None	• FHWSA Area (includes 1 IA, Artificial Ridge) • FSUST Area • Plating Shop Area • Test Lab/Central Lab (TL/CL) Area	• Plating Shop Area Sediment Samples and Landscape Areas[3]
Tritium Operable Unit		
None	• Beam Dump East	
Research Yard-SSRL/ IR-6 Drainage Channel Operable Unit		
• Former Substation 502 • Former Substation 504 • Former Substation 512 • Former Substation 510 • Former Substation 509 • Former Substation 501 • Substation 505	• IR-6 Drainage Channel • Research Yard - SSRL Area	
West SLAC/ Campus Area/ IR-8 Drainage Channel Operable Unit		
• Sector 6 Picnic Area • Sector 16 Storage Area • Substation 009 • Beam Switch Yard at Surface Grade • Former SLC Bone Yard • Master Substation Drainage Channel[2] • Service Area Road (Part of Beam Switch and Central Area)[2] • Cooling Tower 1202 – New Ladder[2] • New Visitor Parking Lot Extension[2] • IR-2 Drainages (IR-2 Outfall and IR-2 Drainage Swale)[2] • IR-2 Entrance Road Island[2] • Cooling Tower 101 Landscape Area[2] • Building 24 Hot Water Line Repair[2] • IR-12 Soil Relocation Area[2] • Storage Area South of the Master Substation[2] • Building 81 Area • Former Cement Plant Area • Former Substation 406 • Sector 0 Storage Area • Sector 16 Soil Relocation Area	• Bone Yard • Building 007 Area • Building 81 Area • Casting Pad & Building 18 Area • Clean Landfill • Former Cement Plant Area • Former Substation 406 • IR-8 Drainage Channel • IR-8 Fill Area • Lower Salvage Yard • Sector 0 Storage Area • Sector 16 Storage Area Drainage Channel • Sector 16 Soil Relocation Area • Sector 16 Soil Relocation Area Drainage Channel • Klystron Gallery Variable Voltage Substation Drainage Channels • Beam Switch Yard at Surface Grade (including Catch Basin Samples) • Building 24 and Building 34 Area[1] • Vacuum Assembly Building[1] • Upper Salvage Yard • IR-8 Buildings	• Collider Injector Development (CID) Area[1] • Building 27 Aerobics Facility[2] • Upper Salvage Yard[2] • Building 136 Enclosure[2] • Magnet Storage Yard[2]

1) These areas were originally identified in the EBR and the RI/FS Work Plan as requiring no further investigation, pending risk evaluation. Based on subsequent review, these areas have been re-categorized.
2) These areas were originally identified in the EBR and the RI/FS Work Plan as requiring further investigation. Based on subsequent review, these areas have been re-categorized.
3) The areas identified in this table as requiring further investigation when practicable are only those assigned to one of the four established operable units. All of the areas at SLAC that require further investigation when practicable are presented in Table 2. A protocol is to be developed that will identify how and when these areas will be addressed.

Table 2 – Investigation Areas and Miscellaneous Soil Sites at SLAC that Require Further Investigation When Practicable

IAs and MSSs that Require Further Investigation When Practicable[1]	
• Cooling Tower 1200	• Substation 514
• LINAC Tunnel	• Former 5.8 MW Power Supply
• Klystron Gallery Area	• Interaction Region 6 Buildings
• Cooling Tower 1201	• Interaction Region 12
• Positron Vault	• Substation 511
• Cooling Tower 1202	• Building 730 Area
• Centralized Hazardous Waste Management Area	• Interaction Region 2
• Master Substation	• Interaction Region 4
• Cooling Tower 101	• PEP Tunnel
• Building 28 Area	• SLC Area
• Beam Switch Yard Tunnel	• SLC Tunnel
• PEP City Substation 7	• Portola Valley Training Center
• Cooling Tower 1701 Area	• Hot Water Line Repair Area
• Building 140	• Collider Injector Development (CID) Area[2]
• Satellite Hazardous Waste Collection Area Number 10	• Building 27 Aerobics Facility[3]
• Former 1.0/1.5 MW Power Supply	• Upper Salvage Yard[3]
• Substation 507	• Building 136 Enclosure[3]
• Former 3.0 MW Power Supply	• Magnet Storage Yard[3]
• Building 108 Power Supply	• IR-8 Buildings[3]
• Former Substation 503	• Plating Shop Area Sediment Samples and Landscape Areas[3]

1) A protocol is to be developed that will identify how and when these areas will be addressed.
2) These areas were originally identified in the EBR and the RI/FS Workplan as requiring no further investigation, pending risk evaluation. Based on subsequent review, these areas have been determined to need further investigation when practicable.
3) These areas were originally identified in the EBR and the RI/FS Workplan as requiring further investigation. Based on subsequent review, these areas have been determined to need further investigation when practicable.

Table 3 – Descriptions, Remedial Investigations, and Remedial Status at the Four Plume Areas within the Groundwater VOC OU

Description/Location	Remedial Investigations	Remedial Status
Former Hazardous Waste Storage Area		
The FHWSA is located on approximately four acres immediately south of the linear accelerator. The FHWSA currently includes three buildings: Building 15, Building 426 (constructed in 2006 to house DPE treatment equipment) and Building 647. From the late 1960s to the early 1980s, the FHWSA was used as a storage site for materials including volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), and petroleum products.	Analytical results of soil and groundwater confirmed historical releases of VOCs and SVOCs, namely, 1,4-dioxane at the FHWSA. There appears to be two primary areas of release of 1,1,1- trichloroethane (1,1,1-TCA) and tetrachloroethene (PCE). The detection of 1,4-dioxane is believed to be associated with its use as a stabilizer for 1,1,1-TCA. In addition, PCBs have been detected in soil samples collected from the Artificial Ridge, a separate IA located within the southern boundary of the FHWSA IA. The presence of the LINAC subdrainage system north of the FHWSA affects groundwater flow. Based on the groundwater flow effects and the results of fate and transport modeling, it is believed that the VOCs and 1,4-dioxane present in groundwater at the FHWSA are not likely to impact downgradient offsite groundwater or surface water at detectable concentrations.	As an interim action to reduce and contain the existing underlying groundwater plume, a pilot dual phase extraction (DPE) system was installed and operated at the site since December 2003. A full scale DPE system, which incorporated the pilot system, was constructed in May, 2006 and has been in operation since. As of December 2008, the DPE treatment system removed approximately 36.2 pounds of VOCs/SVOCs from soil vapor and groundwater and has extracted approximately 947,117 gallons of groundwater. A soil removal action is being planned at the Artificial Ridge IA which is located within the FHWSA IA boundary. PCBs have been detected in soil samples collected from a portion of the artificial ridge constructed on the southern portion of the FHWSA.
Plating Shop Area		
The PSA is a four-acre facility located in the central part of the SLAC campus and is upgradient of the LINAC.	Volatile organic compounds (VOCs) are present in soil and groundwater in parts of the Plating Shop Area. The main VOCs present, in order of increasing concentrations are cis-1,2-DCE, TCE, trans-1,2-DCE, 1,1-DCE, freon 113, and 1,1-DCA. The SVOC 1,4-dioxane has also been detected in groundwater at the PSA. The maximum measured concentration of total VOCs in groundwater was detected at 24,100 µg/L. Detections of total VOC impacted soil at the site ranged from 0.2 mg/kg to 1.4 mg/kg and appear to be limited to two small areas, one of which was excavated and removed in 1998. This IA boundary also encompasses the MSS referred to as the Plating Shop Sediment Samples and Landscape Area. PCBs have been detected in samples at this MSS. No VOC contamination has been detected to date at the downgradient LINAC. At an estimated VOC migration rate of 2 to 5 feet per year, it would take approximately 50 to 125 years for VOC contaminants in the PSA monitoring wells to reach the LINAC and another 500 years to reach the San Francisquito Creek without the LINAC in place. 1-4-dioxane has been detected in groundwater monitoring wells located near the LINAC subdrain however,it has not been detected above reporting limits in samples collected from the LINAC subdrain. Tritium has been detected in two groundwater monitoring wells near the PSA at an activity of 4,530 and 1,630 picoCuries per liter (pCi/L) in MW-81 and MW-82 respectively in March 2007. For comparison, the maximum contaminant level for tritium in drinking water is 20,000 piCi/L. Tritium has not been detected in groundwater samples collected from any other wells at the PSA and its presence in MW-81 and MW-82 is believed to be a result of previous water batch discharges into a manhole and a suspected leaking sanitary sewer line. The suspected leaky sewer line was plugged with concrete and the associated manhole filled with concrete and abandoned in 2000 (Site Characterization Report for the Plating Shop Area, SLAC, 2003).	VOC impacted soil in one source area was removed in 1998. The groundwater plume and soil vapor is being monitored and the Feasibility Study is in progress. Remedial alternatives under consideration include source soil excavation and dual phase extraction.

Table 3 (continued) – Descriptions, Remedial Investigations, and Remedial Status at the Four Plume Areas within the Groundwater VOC OU

Description/Location	Remedial Investigations	Remedial Status
Test Lab/Central Lab Area		
The TL/CL Area is located on approximately seven acres of land in the central part of the SLAC campus. There are three main buildings at this area: the Test Laboratory (Building 44), the Central Laboratory (Building 40), and the Central Lab Addition (Building 84). Most areas that are not occupied by buildings or storage sheds are used as parking and are covered with asphalt or concrete pavement.	SLAC has conducted detailed investigations to determine the nature and extent of contamination at the TL/CL area. VOCs were primarily detected in soil from the area adjacent to the Test Laboratory machine shop and south of the Central Laboratory loading dock. The maximum total VOC concentration detected in soil samples was 0.64 mg/kg at a depth of 4 to 4.5 feet bgs. No SVOCs were detected. Based on available data, VOC concentrations appear to significantly decrease at depths greater than 5 feet. VOCs (1,1-DCE, 1,1-DCA, cis-1,2-DCE, and TCE) and the SVOC 1,4-dioxane have also been detected in groundwater near monitoring wells MW-61 (i.e., the delivery area of the Test Laboratory) and MW-52 (i.e., the loading dock area south of the Central Laboratory) and in soil gas underlying the TL/CL.	SLAC has performed several removal actions at the TL/CL between 1988 and 2001, involving removal of underground storage tanks, and diesel fuel and PCB impacted soils. In 2006, six soil vapor probes were installed at the TL/CL. Evaluation of the soil vapor monitoring results will be included in the Feasibility Study. Remedial alternatives under consideration include monitoring, source soil excavation, and dual phase extraction.
Former Solvent Underground Storage Tank Area		
The FSUST Area is located in the eastern portion of the facility, between the Plant Maintenance and Utilities Building (Building 35) and the General Services Building (Building 81). The 2,400-gallon underground storage tank was used to store paint shop wastes from 1967 until 1978, at which time it was abandoned in place.	In 1983, the tank, along with some impacted soil, was removed and site investigations were initiated to determine the extent of chemical contamination in soil and groundwater and to identify potential remedial alternatives. Since 1984, investigations and subsequent remediation have occurred. In 1985, the Regional Water Board adopted Waste Discharge Requirements Order No. 85-88 requiring investigation and remediation of discharges from the tank. Despite two major excavations that were performed to remove impacted soil, VOCs and SVOCs remain at concentrations greater than 1,000 mg/kg in soils and up to 600,000 ppb in groundwater. While the pollution decreases laterally over a short distance, the highest concentrations of chemicals in soil are located in the saturated zone at a depth of 8 to 18 feet below ground surface (bgs), however some soil contaminants exctend to 30 feet in the immediate vicinity of the FSUST. Other constituents detected in the soil near the former tank include bis-2-ethylhexyl phthalate (92.6 mg/kg), acetone (9.3 mg/kg), and 2-butanone (15.3 mg/kg). The chemicals appear to be migrating slowly in the groundwater. Without hydraulic control, the chemical migration rate in groundwater is about 8 feet per year. Contaminants have not entered the LINAC subdrainage system located approximately 350 feet south of the FSUST.	In 1983, removal of a 2,400-gallon underground storage tank and excavation of impacted soil was completed. In 1986, a second impacted soil excavation was completed. Groundwater at the site has been monitored since 1985. In 2002, a hydraulic control system was installed, along with an institutional controls program to prevent unauthorized digging in the area and an air monitoring program in Building 35. In 2007, the groundwater and extraction system was upgraded to a DPE system to enhance chemical mass and source removal. To date, the system has extracted approximately 640,000 gallons of groundwater and removed approximately 686 pounds of VOCs and SVOCs resulting in plume decrease. While significant VOCs likely remain in soil beneath Building 35, further remedial action other than the current hydraulic control and DPE system has been deferred until there is a change in site use or Building 35 is demolished.

Table 4 – Descriptions, Remedial Investigations, and Remedial Status at the Tritium OU, Research Yard-SSRL/IR-6 Drainage Channel OU, and the West SLAC/Campus Area/IR-8 Drainage Channel OU

Description/Location	Remedial Investigations	Remedial Status
Tritium Operable Unit		
The Beam Dump East (BDE) is the primary IA in the Tritium OU. The BDE has been used as a subsurface high-energy dissipater for the operation of the linear accelerator. Some of the high-energy physics experiments caused tritium to form in soil and groundwater.	Tritium has been routinely detected in two of the ten monitoring wells at the BDE. The detections have been in wells located in the center of the tritium groundwater plume and in close proximity to the BDE. Monitoring well EXW4 has had the highest concentrations of tritium over the years. EXW4 was installed in the 1960s and had no detectable tritium until the early 1970s. In 1991, the tritium concentration at EXW4 was detected at approximately 23,000 picoCuries per liter (pCi/L), which is the only instance at SLAC where tritium has been detected in groundwater at a level exceeding the Maximum Contaminant Level (MCL) of 20,000 pCi/L. Recently reported concentrations from this well are between 3,000 and 4,500 pCi/L and have been decreasing with time due to natural decay and attenuation.	The tritium levels in selected monitoring wells have been monitored routinely in the past and will continue to be monitored. Two additional wells were installed in the Beam Dump East IA in 2006. The Final Remedial Investigation for the Tritium OU was submitted on June 1, 2009 and approved June 12, 2009. Based on the findings of the Tritium OU Remedial Investigation, no further remedial action is proposed at this time except for long term monitoring.
ResearchYard-SSRL/IR-6 Drainage Channel Operable Unit		
The Research Yard, including the Stanford Synchrotron Radiation Laboratory (SSRL), constitutes most of the drainage area for stormwater that is conveyed to the IR-6 drainage channel. This OU includes nine IAs.	The transport of PCBs and lead in storm water run-off from the Research Yard and SSRL have historically impacted the IR-6 Drainage Channel. In 1988, preliminary investigations found PCBs and lead in sediments collected from the portions of the IR-6 drainage channel at maximum concentrations of 690 ppm for PCBs and 157 ppm for lead. The most recent sediment sampling (September 2008) detected maximum concentration of 4.1 ppm for PCBs and 52 ppm for lead. Recent sediment sampling of the drainage downstream from the IR-6 drainage channel, on property owned by Stanford University and leased to the PVTC, has detected PCBs and metals. An investigation of the extent of potential contamination resulting from operations at SLAC has not yet been completed. To compound matters, the ground cover used by the Training Center in the horse paddocks was also identified as a potential source of the PCBs and metals. Further investigation will be required to fully characterize the extent of contamination associated with operations at SLAC and PVTC and evaluate the need for remedial action.	Remediation of PCB and lead contamination has occurred in the Research Yard, including soil removal actions at the former 3.0 MW and 5.8 MW Power Supply Stations, and Former Substations 505, 507, 510, and 512. Soil and sediment removal actions in the IR-6 drainage channel occurred in 1995, and again in 2006, PCBs and lead.
West SLAC/Campus Area/IR-8 Drainage Channel Operable Unit		
The West SLAC/ Campus Area/ IR-8 Drainage Channel Operable Unit constitutes most of the drainage area for stormwater that is conveyed to the IR-8 Drainage Channel. It primarily encompasses 39 IAs and MSSs where constituents of concern (COCs) have been detected in soil. This OU includes IAs on the west end of the LINAC to aid in developing a comprehensive investigation and remedial strategy. The COCs in the IR-8 drainage channel are primarily derived from surface water run-off in the Campus Area. The IR-8 drainage channel combines with the IR-6 drainage channel just beyond the southeast boundary of the SLAC property line.	Significant investigation (including completed Data Packages) and/or remediation have already occurred at many of the 39 IAs and MSSs in this OU. Core Team decisions and removal action documentation will be presented in the upcoming remedial investigation reports or in subsequent deliverables, depending on the timing of the follow-on work. While investigations within this operable unit have primarily focused on the previously identified IAs and MSSs, there remains a concern that residual contamination can migrate from these sites and impact the downstream IR-8 Drainage Channel and surface water bodies. Therefore, all locations within the OU footprint where soil or groundwater pollutants could reasonable be expected to occur or to be discharged, including storm drain networks, must be addressed by the remedial investigation and in the RI reports or their equivalent.	"Group 1" removal actions[1] (excavation and disposal) were completed in 2007 at these IAs & MSSs: • Former Cement Plant Area • Building 81 Area • Former Substation 406 • Sector 0 Storage Area • Sector 16 Soil Relocation Area "Group 2" removal actions[1] are being planned for these IAs and MSSs: • The Clean Landfill Site • The Bone Yard – Phase 1 • Sector 16 Soil Relocation Area Drainage Channel Swale • Lower Salvage Yard • Building 24 and 34 Area • FHWSA Artifical Ridge (located in the GW VOC OU) Supplemental sampling is needed at these IAs or MSSs to determine if and what remedial actions[1] may be necessary: • Vacuum Assembly Building • Casting Pad/Building 18 • Building 27 Aerobics Facility • Service Area Road • IR-8 Buildings • Substation 009 • Cooling Tower 101 Landscape Area • Building 136 Enclosure • Building 007 Area • Upper Salvage Yard • IR-8 Fill Area • IR-8 Landscape Strip • Kylstron Gallery VVS Drainage Channels

[1] See the "Contingent Removal Action Engineering Evaluation and Cost Analysis" (EE/CA) (May 1, 2007) and the "Group 1 Removal Action Implementation Report" (December 12, 2008). Removal actions will be documented in RI reports.

Table 5 - Compliance Schedule for Task Deliverables per Order No. R2-2009-XXXX

		Due Date for Submittal of Final Report[1,2,3]			
Task	**Task Title**	**GW VOC OU**	**Tritium OU[6]**	**West SLAC Campus Area IR-8 OU**	**Research Yard/SSRL IR-6 OU[7]**
1-4	Complete				
5	Remedial Investigation (RI) Report	Complete	Complete	12 August 2010	26 June 2010
6	Baseline Human Health & Ecological Risk Assessment	Complete	N/A(P)	194 days from Task 5 approval[4]	208 days from Task 5 approval[4]
7	Feasibility Study (FS) Report	19 October 2009	N/A(P)	260 days from Task 6 approval[4]	306 days from Task 6 approval[4]
8	Remedial Action Plan (RAP)	216 days from Task 7 approval[4]	N/A(P)	216 days from Task 7 approval[4]	296 days from Task 7 approval[4]
9	Remedial Design (RD) Report	216 days from Task 8 approval[5]	N/A(P)	216 days from Task 8 approval[5]	TBD[5]
10	Operation and Maintenance Plan	526 days from Task 9 approval[4]	03 February 2010	466 days from Task 9 approval[4]	TBD
11	RAP Implementation Report	571 days from Task 9 approval[4]	N/A(P)	536 days From Task 9 approval[4]	TBD
12	Risk Management Plan	171 days from Task 11 approval[4]	N/A(P)	216 days from Task 11 approval[4]	TBD
13	5-Year Review Report	5 years from first OU Task 11 approval[4]			
14	Investigation, Remediation, and Closure Protocol for Newly Discovered Sites, Deferred Areas, and Land Use Changes	01 June 2010			

N/A(P) – Not Applicable at Present; TBD – To Be Determined

1) Due dates apply to submittal of final reports that are deemed acceptable to the Executive Officer.
2) Timelines presented in this table account for a 60-day Regional Water Board staff review and comment period for draft documents, and a 46-day comment resolution/document finalization period.
3) Task deliverables may be combined (e.g., the Final RAP and Remedial Design) where the process does not rely on a series approval relationship.
4) The approval date is the date of the Regional Water Board staff letter approving or conditionally approving the final report. Regional Water Board staff approval indicates that the final report is acceptable to the Executive Officer and that the task deliverable is deemed complete.
5) The Task 8 (RAP) approval date is the date that the Regional Water Board Executive Officer approves the RAP after any necessary CEQA review.
6) Based on the Remedial Investigation for the Tritium OU (June 1, 2009), Tasks 6-9 and 11-12 are not applicable at present for the Tritium OU.
7) The Remedial Action Plan for the Research Yard/SSRL IR-6 OU must include a time schedule for deliverables required for Tasks 9-12.

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION

SELF-MONITORING PROGRAM for:

STANFORD UNIVERSITY
UNITED STATES DEPARTMENT OF ENERGY

for the:

STANFORD LINEAR ACCELERATOR CENTER – NATIONAL ACCELERATOR LABORATORY
2575 SAND HILL ROAD
MENLO PARK, SAN MATEO COUNTY

1. **Authority and Purpose:** The Regional Water Board requests the technical reports required in this Self-Monitoring Program (SMP) pursuant to Water Code Sections 13267 and 13304. This Self-Monitoring Program is intended to document compliance with Regional Water Board Order No. R2-2009-XXXX (Site Cleanup Requirements).

2. **Monitoring Requirements:** The Discharger must perform monitoring according to SLAC's approved Self-Monitoring Program Sampling and Analysis Plan, Revision 002 (April, 2008). The Discharger may propose changes in the sampling location, frequency, analytes, or other parameters. Proposed changes are subject to Executive Officer approval.

3. **Reporting Requirements**: The Discharger must submit self monitoring reports (SMRs)to the Regional Water Board in accordance with the following schedule. The intent of the semi-annual monitoring is to capture the maximum hydrologic variation between the wet and dry seasons, which are typically from October through March, and April through September, respectively.

Reporting Frequency	Report Due Dates
Semi-Annual	**June 15, December 15**

At a minimum, each SMR must include the following information:

a. **Transmittal Letter:** A cover letter transmitting the essential points must be included with each monitoring report. The transmittal letter must discuss any violations during the reporting period and actions taken or planned to correct the problem. The letter must also certify the completion of all monitoring requirements. The letter must be signed by the Discharger's principal executive officer(s) or its duly authorized representative, and must include a statement by the official, under penalty of perjury, that the report is true and correct to the best of the official's knowledge.

b. **Graphic Presentation**: The following maps, figures, and graphs (if applicable) must be included in each SMR to visually present data collected pursuant to this SMP:

(1) Plan-view maps showing all monitoring and sampling locations, surface water bodies, and site/property boundaries
(2) Groundwater level/piezometric surface contour maps for each groundwater-bearing zone of interest showing inferred groundwater gradients and flow directions under/around each waste management unit, based upon the past and present water level elevations and pertinent visual observations
(3) Post-plot maps with analyte concentration posted adjacent to each sampling location and/or iso-concentration contour maps displaying analyte concentrations and sample locations
(4) Concentration vs. time graphs for key sampling parameters for select sampling locations and analytes
(5) Any other maps, figures, photographs, cross-sections, graphs, and charts necessary to visually demonstrate the appropriateness and effectiveness of sampling, monitoring, characterization, investigation, or remediation activities relative to the goals of this SMP.

c. **Tabular Presentation**: The following data (if applicable) must be presented in tabular form and included in each SMR to show a chronological history and allow quick and easy reference:

(1) Well designations
(2) Well location coordinates (latitude and longitude)
(3) Well construction (including top of well casing elevation, total well depth, screen interval depth below ground surface, and screen interval elevation)
(4) Groundwater depths
(5) Groundwater elevations
(6) Horizontal groundwater gradients
(7) Vertical groundwater gradients (including comparison wells from different zones), when appropriate
(8) Phase-separated product elevations
(9) Phase-separated product thicknesses
(10) Current analytical results (including analytical method and detection limits for each constituent)
(11) Select historical analytical results (including at least the past five years unless otherwise requested)
(12) Measurement dates
(13) Groundwater extraction, including:
    (a) Average daily extraction rate
    (b) Total volume extracted for monitoring period
    (c) Cumulative total volume extracted since system inception
(14) Contaminant mass removal, including:
    (a) Average daily removal rate
    (b) Total mass removed for monitoring period
    (c) Cumulative total mass removed since system inception

d. **Discussion**: Discussion of the following information, based on field and laboratory data results, must be provided in each SMR:

(1) Data Interpretations
(2) Conclusions
(3) Recommendations
(4) Newly implemented or planned investigations & remedial measures
(5) Data anomalies
(6) Variations from protocols
(7) Condition of wells
(8) Explanation why monitoring could not be performed at any required location

e. **Appendices:** The following information must be provided as appendices in electronic format (PDF format). Hard copies of the following information should be submitted only if requested otherwise by Regional Water Board staff.

(1) New boring and well logs
(2) Method and time of water level measurements
(3) Purging methods and results including the type of pump used, pump placement in the well, pumping rate, equipment and methods used to monitor field pH, temperature, and conductivity, calibration of the field equipment, pH, temperature, conductivity, and turbidity measurements, and method of disposing of the purge water
(4) Sampling procedures, field and travel blanks, number and description of duplicate samples, type of sample containers and preservatives used, the date and time of sampling, the name of the person actually taking the samples, and any other relevant observations
(5) Documentation of laboratory results, analytical methods, detection limits, and Quality Assurance/Quality Control (QA/QC) procedures for the required sampling.

4. **Violation Reports**: If the Discharger violates requirements in these Site Cleanup Requirements, then the Discharger must notify the Regional Water Board office by telephone as soon as practicable once the Discharger has knowledge of the violation. The Regional Water Board staff may, depending on violation severity, require the Discharger to submit a separate technical report on the violation.

5. **Other Reports**: The Discharger must notify Regional Water Board staff in writing prior to any site activities, such as construction or underground tank removal, which have the potential to cause further migration of contaminants or which would provide new opportunities for site investigation.

6. **Record Keeping**: The Discharger or its agent must retain data generated for the above reports, including lab results and QA/QC data, for a minimum of five years after origination and must make them available to Regional Water Board staff upon request.

7. **SMP Revisions**: Revisions to the SMP may be ordered by the Executive Officer, either on his/her own initiative or at the request of the Discharger. Prior to making SMP revisions, the Executive Officer will consider the burden, including costs, of associated self-monitoring reports relative to the benefits to be obtained from these reports.

8. **Electronic Reporting:** In addition to print submittals, all reports submitted pursuant to this SMP must be submitted as electronic files in PDF format. The Regional Water Board has implemented a document imaging system, which is ultimately intended to reduce the need for printed report storage space and streamline the public file review process. Documents in the imaging system may be viewed, and print copies made, by the public, during file reviews conducted at the Regional Water Board's office. PDF files can be created by converting the original electronic file format (e.g., Microsoft Word) and/or by scanning printed text, figures and tables.

   Upon request by Regional Water Board staff, monitoring results, including water level measurements, sample analytical results, coordinates, elevations, etc., must be provided electronically in Microsoft Excel® or similar spreadsheet format. This format facilitates data computations and/or plotting that Regional Water Board staff may undertake during their review. Data tables submitted in electronic spreadsheet format will not be included in the case file for public review as long as a PDF version is included.

   All electronic files, whether in PDF or spreadsheet format, must be submitted via the Regional Water Board's file transfer protocol (FTP) site, email (only if the file size is less than 3 MB) or on CD. CD submittals may be included with the print report. Email notification should be provided to Regional Water Board staff whenever a file is uploaded to the Regional Water Board's FTP site.

   The Discharger is also required to submit groundwater analytical data, surveyed locations of monitoring wells, and certain other data to the State Water Board's Geotracker database over the internet. This information is available to the public at http://www.geotracker.swrcb.ca.gov/.

9. **Maintenance of Written Records:** The Discharger must maintain information required pursuant to this SMP for at least 5 years. The five-year period of retention must be extended during the course of any unresolved litigation regarding this discharge or when requested by the Regional Water Board.