ANNUAL ENVIRONMENTAL MONITORING REPORT
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ENVIRONMENT, SAFETY AND HEALTH DIVISION
STANFORD LINEAR ACCELERATOR CENTER
STANFORD UNIVERSITY
STANFORD, CALIFORNIA 94309

PREPARED FOR THE DEPARTMENT OF ENERGY
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1.0 Executive Summary

This report summarizes the environmental status of the Stanford Linear Accelerator Center (SLAC) for Calendar Year 1990 (CY90). It includes descriptions of SLAC's mission, the status of compliance with applicable environmental regulations, planning and activities to accomplish compliance, and a comprehensive review of environmental surveillance, monitoring, and protection programs.

1.1 Compliance.

Throughout its history, SLAC has exhibited a concern for protection of the environment. This has led to a philosophy of respecting environmental protection concerns at all stages of design and operation of the experimental and support facilities. SLAC strives to operate in compliance with DOE Orders and other Federal, State, and local environmental laws and regulations. These include the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the Clean Air Act (CAA), the Clean Water Act (CWA), the Resource Conservation and Recovery Act (RCRA), the Safe Drinking Water Act (SDWA), the Toxic Substances Control Act (TSCA), the National Environmental Policy Act (NEPA), the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), the Endangered Species Act (ESA), Executive Order 11988 "Flood Plain Management", and Executive Order 11990 "Protection of Wetlands". Accelerator operations have traditionally caused relatively little impact on the environment. The majority of SLAC's radiological and nonradiological effluents and emissions are within applicable standards. Specifically with respect to the CAA, the off-site dose equivalent due to airborne radionuclide emissions and the monitoring thereof are in compliance with 40 CFR 61, Subpart H. SLAC continues to be operated in compliance with these laws and regulations.

1.2 Environmental Program Information Summary.

Monitoring and surveillance are critical elements of an effective environmental protection program. SLAC has established and implemented comprehensive environmental monitoring and surveillance programs that ensure compliance with legal and regulatory requirements imposed by Federal, State, and local agencies and that provide for the measurement and interpretation of the impact of SLAC's operations on the public and the environment. The surveillance and monitoring activities are selected to be responsive to both routine and potential releases of penetrating radiation and liquid or airborne effluents.

1.3 Environmental Radiological Program Information.

1.3.1 Airborne Emissions.

As a result of operation of the accelerator, some airborne radionuclides are released from the target stations in the experimental areas and the Positron Source used to produce positrons. During CY90, a total of 2.7 Curies (9.99×10^{10} Bq) were released from the vent stacks in these areas. Carbon-11, nitrogen-13, chlorine-38, chlorine-39 and argon-41 have been identified in these airborne emissions resulting in a maximum dose equivalent at the site boundary due to airborne radioactivity of 1.4×10^{-2} mrem (1.4×10^{-4} mSv) on the east side of the site.

1.3.2 Penetrating Radiation.

Other sources of ionizing radiation due to accelerator operations are due to operation of fixed target experimental areas. These operations produce ionizing radiation in the form of muons. The maximum effective dose equivalent at the SLAC site boundary for CY90 would have been near the northeast corner of the site due to the operations of the End Station A fixed target program, which leads to the production of high energy photons and neutrons. At this point, the site boundary is a significant distance away from the nearest residence. At the location of the nearest residence potentially exposed to radiation from this beamline, the maximum effective dose equivalent was not able to be measured during CY90, but was likely from qualitative observation of direct radiation monitors to have been less than 2 mrem. All other SLAC operations delivered less than 1 mrem to various locations. (See Section 4.3 for details.) The measurement equipment which form the basis of this assessment of effective dose equivalent include the use of detectors sensitive to neutron particles as well as gamma rays. Although no neutron or gamma fields of environmental significance were identified during CY90 operations, operational experience indicates a potential effective dose equivalent ceiling of 2 mrem at the site boundary.

The maximum site boundary dose rate from the radioactive material stored at the Radioactive Material Storage Yard was less than 1 μrem (1×10^{-2} μSv) for CY90. The maximum site boundary dose rate from the radioactive material stored in Building 660, Interaction Area 6 (IR6), was less than 1 μrem (1×10^{-2} μSv) for CY90. These locations are all well within the fenced in controlled area near the accelerator housing. At locations more than a few feet from the items in question, the observed radiation levels were reduced to the prevalent background for this area, generally on the order of 5 μrem/hour.

The total potential radiation exposure to the general off-site population from operations during CY90 was less than 2.0 person-rem (2×10^{-2} person-Sv) (See Table IV-4). This is similar to the estimate of 1.2 person-rem (1.2×10^{-2} person-Sv) for CY89 due to the operations of the accelerator in the fixed target mode with the accompanying production of high energy photons and neutrons. Since the exposure to the off-site population is only from penetrating radiation and short-lived airborne radionuclides, the 50 year dose commitment from operations in CY90 will be the same as the effective dose equivalent received for CY90 reported here.

1.3.3 Surface Water Discharges.

Although the total off-site release of tritium (H-3) in surface water was not measured in CY90, there was evidence that a release of trace amounts of tritium may have occurred. (See a more detailed explanation in Section 4.2.) There was no indication of any releases from the site during CY89. Water left the site via the IR6/IR8 outfall areas on one documented occasion in CY90 draining to San Francisquito Creek compared to no known discharges the year before. The source of the tritium in water reaching the outfalls appears to have been from the PEP ring/BSY areas.

A summary of off-site releases of radioactive effluents in CY90 is given in Table 1.

Table 1

Summary of Radioactivity Released to the Off-site Environment in CY90

Release Point	Radionuclide	Pathway	Release in Ci	Release in Bq
Target Stations	C-11, N-13, Ar-41	Air	2.7	9.99×10^{10}
IR6/IR8 Outfalls	H-3	Water	N.A.	N.A.

1.3.4 Groundwater.

Radioactivation of soil can occur in some areas of beam targets and dumps. Samples of groundwater are taken periodically from wells onsite. There have been measurable quantities of tritium found in old well number 24 (referred to as well EXW4 on Figure 5.1), near beam dump east (End Station A area), although still within drinking water standards in most samples measured to date. There has been no measurable accelerator produced radioactivity in any of the other SLAC wells.

1.4 Environmental Nonradiological Program Information.

1.4.1 Clean Air Act (CAA).

SLAC has 33 air pollution sources permitted with the Bay Area Air Quality Management District (BAAQMD). SLAC has maintained compliance with the Rules and Regulations established by the BAAQMD to implement the Clean Air Act (CAA). This includes specific permit conditions placed on individual permitted sources operated at SLAC. There were no known instances of non-compliant emissions in CY90.

1.4.2 Clean Water Act (CWA).

SLAC has initiated a Groundwater Monitoring Program to determine the effects the facility's operations have had on the groundwater. Levels of contaminants above the State of California Drinking Water Standards have been detected. However, due to its high dissolved content, the groundwater in the area is not suitable as drinking water.

SLAC holds a NPDES Permit for surface water discharges from the facility. The surface water discharges are a combination of cooling tower blowdown, storm water, and groundwater which infiltrates into underground tunnels at the facility. SLAC obtained a new permit this year which will impose strict heavy metal limitations on discharges starting December 1, 1991. Characterization of the discharges indicates that SLAC will be unable to meet the new limits. Therefore, alternatives to surface discharges of the cooling tower blowdown waters are being investigated.

1.4.3 Industrial Wastewater.

SLAC's industrial wastewater discharges must comply with Federal Metal Finishing Pretreatment Standards. Monitoring of the discharges in CY90 indicated that SLAC continues to operate in compliance with these standards.

1.4.4 Resource Conservation and Recovery Act (RCRA).

The County of San Mateo's Department of Health Services conducted an inspection of SLAC for compliance with Federal, State, and local hazardous waste laws and regulations. The inspection report contained 110 alleged violations, primarily relating to improper labeling and storage of waste containers. A corrective action plan was prepared and submitted to the County within 30 days of receiving the report.

1.4.5 Toxic Substances Control Act (TSCA).

In July, 1990, SLAC was inspected by the Environmental Protection Agency (EPA) and the Department of Health Services for compliance with the Toxic Substances Control Act (TSCA). As a result of the inspection, they issued a Federal Facility Notice of Non-Compliance (NON). Many of the findings in the NON related to improper record keeping, which were rectified by sending EPA records that had not been available during the inspection. Other findings related to improper maintenance of PCB containing equipment. SLAC corrected the deficiencies noted, and is implementing an inspection program to assure continued compliance.

1.4.6 Releases to the Environment.

In October, 1990, a spill of approximately 25 gallons of diesel fuel was reported to the County of San Mateo's Department of Health Services. Clean-up of the soil contaminated by the spill is being coordinated with the County.

1.4.7 Environmental Restoration Activities.

In 1990, SLAC completed two restoration projects and continued or initiated work on six others. Workplans, remediation activities, and final closure is being coordinated with the County of San Mateo.

1.4.8 Other Activities.

A computerized system for tracking hazardous waste containers form "cradle-to-grave" was instituted in 1990. The first phase of SLAC's Waste Minimization Plan was completed. This included identification and enumeration of waste streams as well as evaluations of potential waste minimization activities.

1.5 Summary.

There were no known significant radiological or nonradiological releases to the environment in CY90. However, in the second quarter of 1991, SLAC reported off-site PCB soil contamination near the oil-water separator at IR-6. New sampling results and calculations in 1991 indicate a potential release greater than the reportable quantity (RQ) for PCB (the RQ for PCB is one pound). The National Response Center (NRC), other agencies and DOE were notified. A NEPA document has been filed with DOE and a contract has been awarded for remediation. We anticipate that cleanup will be completed within CY91.

2.0 Introduction

2.1 General.

The Stanford Linear Accelerator Center (SLAC) is a national facility operated by Stanford University under contract with the U.S. Department of Energy (DOE). It is located on the San Francisco Peninsula, about halfway between San Francisco and San Jose, California. The site area is in a belt of low rolling foothills, lying between the alluvial plain bordering San Francisco Bay on the east and the Santa Cruz Mountains on the west. The accelerator site varies in elevation from 53 to 114 meters (m) above sea level, whereas the alluvial plain to the east around the Bay lies less than 46 m above sea level; the mountains to the west rise abruptly to over 610 m. The SLAC site occupies 170 hectares of land owned by Stanford University and leased for fifty years in 1962 to the DOE (then AEC) for purposes of research in the basic properties of matter. The lands are part of Stanford's "academic reserve", and are located west of the University and the City of Palo Alto. The site is located in an unincorporated portion of San Mateo County. It is bordered on the north by Sand Hill Road and on the south by the San Francisquito Creek. The accelerator is sited on a roughly 300 meter wide parcel, 3.2 kilometers (km) long, running in an east-west direction. The width of the parcel extends to about 910 m at the target (east) end to allow space for buildings and experimental facilities.

The SLAC staff currently numbers roughly 1,550 employees; there are about 1,200 full-time people, 200 part-time and 150 visiting scientists. Approximately one-quarter of the staff is professional, composed of physicists, engineers, programmers and other scientific-related personnel. The balance of the staff composition is support personnel including technicians, crafts personnel, laboratory assistants, clerical and administrative employees.

2.2 Accelerators in Perspective.

Accelerators are simply tools of research enabling physicists to explore and understand the fundamental behavior of the subatomic environment. Some accelerators are linear, as is SLAC's; others are circular in geometry as are cyclotrons, synchrocyclotrons, betatrons and synchrotrons. All conventional accelerators accelerate subatomic particles (electrons, protons, positrons, alpha particles) to a high energy and bombard a target nucleus. Physicists then study the effects of the collisions in an attempt to understand precisely what happens and thereby understand the nature of the atomic nucleus. Because of the very strong forces which bind the nucleus and its constituents together, physicists need greater and greater energies in order to delve constantly deeper. Consequently, accelerators have grown in size and complexity.

One of the important components of the U.S. High Energy Physics Program is the 3.2 km long electron accelerator at SLAC. This machine is now capable of accelerating electrons to 50 billion electron volts (50 GeV), and positrons have achieved very nearly the same energy. These particle beams are utilized by an array of experimental fixed target installations, two colliding beam storage rings and the Stanford Linear Collider (SLC).

The Positron Electron Project (PEP) storage ring is a special extension of the SLAC accelerator and poses no greater environmental problems than does the existing linear accelerator (linac). The center-of-mass energy achieved by colliding beam particles together is vastly more efficient than having a single beam strike a stationary target. In a colliding-beam storage machine, the beam particles are truly "recycled", i.e, the same bunches of beam particles are brought into collision over and over again, rather than striking a target only once. For this reason, colliding-beam devices (in a fundamental way) produce very much less radiation and residual radioactivity than do conventional accelerators.

The PEP facility, completed in 1980, is a large storage ring housed in an underground tunnel at depths varying from 6-30 m, in which beams of electrons and their antimatter equivalent (positrons) circulate in opposite directions at energies up to 15 GeV. The underground ring has a diameter of about 700 m and is located at the eastern extremity of the SLAC site.

When particles of matter and antimatter meet head-on at high velocity, both are completely converted into energy. According to the formulations of Albert Einstein, energy can be transformed into matter and vice versa. In the electron-positron collisions some of the resulting energy is immediately transformed back into matter, producing a variety of particles of immense interest to physicists. Many of the design details of the PEP facility are based on the design and experience of a small existing storage ring at SLAC called the Stanford Positron Electron Asymmetric Ring (SPEAR). The SPEAR facility came into operation and began performing colliding-beam experiments in 1972. The SPEAR machine is about one-eighth the size and capable of about one-quarter the energy of the PEP facility. Although the high energy physics usefulness of SPEAR had been fully exploited in the 1980's, its success has established the feasibility and served as a prototype for PEP. SPEAR also serves as a strong source of synchrotron light for the Stanford Synchrotron Radiation Laboratory (SSRL).

In addition to the aforementioned facilities, SLAC has built a new machine, the Stanford Linear Collider (SLC). The SLC project was proposed in 1980 and finished in 1987. When fully operational, SLC provides electron-positron collisions at 100 GeV center-of-mass energy. [1] This new project has not had any additional significant environmental impact to date. It is housed in a 3 km underground tunnel having a single interaction region at the eastern end of the site.

2.3 Local Climate.

The climate in the SLAC area is Mediterranean. Winters are warm and moist, and summers are mostly cool and dry. Long term weather data describing conditions in the area have been assembled from official and unofficial weather records at Palo Alto Fire Station Number 3, 4.8 km to the east. The SLAC site is 60 to 120 m higher than the Palo Alto station and is free of the moderating influence of the city; temperatures therefore average about two degrees lower than those of Palo Alto. Daily mean temperatures are seldom below zero degrees Centigrade or above 30 degrees Centigrade.

Rainfall averages about 560 millimeters (mm) per year. The distribution of precipitation is highly seasonal. About 75% of the precipitation—including most of the major storms—occurs during the four-month period December through March. Most winter storm periods are from two days to as much as a week in duration. The storm centers are usually characterized by relatively heavy rainfall and high winds. The combination of topography and air movement produces short fluctuations in intensity which can be best characterized as a series of storm cells following one another so as to produce heavy precipitation for periods of five to fifteen minutes with lulls in between.

2.4 Site Geology.

The SLAC site is underlain by sandstone with some basalt at the far eastern end of SLAC's boundary. In general, the bedrock on which the western half of the accelerator rests is of Eocene age (over 50 million years old), and that under the eastern half is of Miocene age (over ten million years old). On top of this bedrock at various places along the accelerator alignment are found alluvial deposits of sand and gravel, generally of Pleistocene age (one million years old). At the surface is a soil overburden of unconsolidated earth materials averaging from 0.1 to 1.5 m in depth.

2.5 Site Water Usage.

Use of water by SLAC is about equally divided between accelerator and equipment cooling, and domestic uses (such as landscape irrigation, sanitary sewer and drinking water). The water consumption by SLAC for the period July 1990 through June 1991 was 9.84×10^7 gallons (3.7×10^8 liters), i.e., 2.7×10^5 gallons per day (1.02×10^6 liters per day) on the average.

Since half of the water is necessary for machine cooling, the daily consumption of this component varies directly with the accelerator running schedule, and hence also varies directly with electric power demand (the domestic water usage is relatively constant and is insensitive to the accelerator schedule). The relationship between power and water consumption can be appreciated if one considers that 85% of the power used in linac operation is finally dissipated by water evaporation, in the ratio of about 630 kilowatt-hours (kWh) per cubic meter of water. SLAC now employs five cooling water towers comprising a total cooling capacity of 79 mega-watts (MW) to dissipate the heat generated by the linear accelerator and other experimental apparatus.

Power consuming devices are directly cooled by a recycling closed loop system of low conductivity water (LCW). The LCW is piped from the accelerator (or other devices to be cooled) to the cooling towers, where the heat is exchanged from the closed system to the domestic water in the towers. A portion of the tower water is ultimately evaporated into the atmosphere. Because of this constant evaporation during operation, the mineral content of the remaining water gradually increases and eventually must be discarded as "blowdown".

The SLAC domestic water is furnished via the Menlo Park Municipal Water Department (MPWD) whose source is the City of San Francisco operated Hetch Hetchy aqueduct system from reservoirs in the Sierra Nevada. SLAC and its neighboring Sharon Heights development, including the shopping center, receive water service from a separate independent system (called "Zone 3") within the MPWD. This separate system taps the Hetch Hetchy aqueduct and pumps water up to a 7600 cubic meter reservoir west of Sand Hill Road. The Zone 3 system was constructed in 1962 under special agreements between the City of Menlo Park, the developer of Sharon Heights, Stanford University, and the DOE. The cost of construction—including reservoir, pump station and transmission lines—was shared among the various parties; each party has a vested interest in, and is entitled to, certain capacity rights in accordance with these agreements.

During current operations, roughly 45% of the water consumed by the laboratory is rejected by evaporation from the four cooling towers. The remaining 55% is disposed of as follows:

- o 26% is cooling tower blowdown to the San Francisquito Creek via the storm drains,
- o 20% is waste domestic and process water discharged via the sanitary sewers connected to the Menlo Park Sanitary District, and
- o 9% is absorbed into the ground from irrigation.

2.6 Land Use

San Mateo County has the ultimate planning responsibility with respect to University lands which are within the county, but not within an incorporated city. The San Mateo County General Plan is the primary land use regulatory tool with respect to such lands. Adherence will be made to all applicable Federal, State and local regulations, including chemical and sanitary discharges which might (directly or indirectly) adversely affect the environmental quality.

The Board of Trustees of Stanford University has the responsibility of preserving and protecting Stanford's land endowment for the use of present and future generations of students and faculty. While financial and political influences on land use policy are taken into account, the dominant and prevailing consideration is the appropriateness of those policies in the furtherance of the University's academic mission. Board policies are designed to encourage land uses consistent with the institutional characteristics and purposes of Stanford, and to discourage those uses or claims which do not relate to or support the mainstream of the University. Certainly SLAC falls into the former category.

The purpose of the Stanford land endowment is to provide adequate land for facilities and space for the instructional and research activities of the University. The use of lands is planned in a manner consistent with the characteristics of Stanford as a residential teaching and research university, and provides flexibility for unanticipated changes in academic needs. Cooperation with adjoining communities is important and the concerns of neighboring jurisdictions are considered in the planning process.

2.7 Demography.

Menlo Park is the closest incorporated city to SLAC. According to the 1980 census, the City of Menlo Park has a land area of 43.8 km^2, a population of 26,369, and a population density of 602 persons per km^2. This population has decreased by 1.7% since the 1970 census.

In 1974, a population estimate within 1.6 km of SLAC was determined by aerial photographs and type of structures revealed. The populated area surrounding SLAC is a mix of offices, schools, condominiums, apartments, single family housing and pasture land. Occupancy factors of 0.1—1.0 were assumed, depending on the type of structure. The populated area is about 1.5 km^2 or (from the 1980 census population density) about 1,000 people. The total area including open lands [2] is 8 km^2.

Preliminary discussions with Menlo Park officials have indicated that the 1990 census did not show any significant differences in population distribution for this area.

3.0 Compliance Summary

This section of the Annual Site Environmental Report provides a summary of the site's compliance with environmental laws and regulations. Specific instances of noncompliance are discussed and a description of corrective actions included. More detailed descriptions of environmental programs are presented in the Environmental Program Information Sections (see Sections 5 and 6).

Clean Air Act (CAA):

The Bay Area Air Quality Management District (BAAQMD) implements the Clean Air Act through a set of Rules and Regulations for operations or equipment which may cause air pollution. SLAC has 33 air pollution sources permitted with the BAAQMD. No permit limitations were exceeded in CY90.

The National Emission Standards for Hazardous Airborne Pollutants (NESHAP's) program requires that facilities that release radionuclides into the air report those releases to the appropriate regional office of the Environmental Protection Agency (EPA). In accordance with this requirement, SLAC prepared a report and submitted it to DOE (see Appendix C) which in turn prepared a consolidated report for the EPA that included other DOE sites. SLAC is not a large source of air pollutants and there were no known instances of noncompliant emissions in CY90.

Clean Water Act (CWA):

Groundwater Monitoring Program

In compliance with DOE Order 5400.1, SLAC initiated a groundwater monitoring program which included the installation of 10 groundwater monitoring wells. The wells were constructed in areas of the facility which historically and/or presently store, handle, or use chemicals which may pose a threat to groundwater quality. Samples collected from the wells were analyzed for a wide range of chemical constituents. Results of the analyses indicated that water in several of the wells contained levels of heavy metals and/or chlorinated solvents at or above the State of California Maximum Contaminant Levels for Drinking Water or EPA National Ambient Water Quality Criteria based on health effects. However, the general water quality from these wells, as measured by total dissolved solids (TDS) values, indicated that well water in the area is not suitable for drinking water. Further groundwater characterization is planned and will be performed in cooperation and with the approval of the County of San Mateo's Department of Health Services.

Groundwater Around Former Leaking Underground Tank

The California Regional Water Quality Control Board (RWQCB) has oversight of a Waste Discharge Order for contaminated ground water near a former leaking underground storage tank (UST). Groundwater monitoring wells surrounding the area are sampled and analyzed quarterly. Several of the down-gradient wells contain volatile organic compounds (VOC's) in excess of the State of California Maximum Contaminant Levels (MCLs) for drinking water.

In addition to monitoring of the wells, the RWQCB requested SLAC to monitor a potential groundwater seep to determine if VOC's from the UST are migrating into the subdrain. With the exception of 1.5 µg/l of chloroform in one sample, no VOC's were detected in any of the samples collected from this location. Therefore, there is no indication that VOC's from the UST site have reached the SLAC subdrain and migrated at detectable levels as far as this sampling point.

Surface Water

SLAC has a National Pollutant Discharge Elimination System (NPDES) Permit from the California Regional Water Quality Control Board (RWQCB), San Francisco Bay region. The permit regulates surface water discharges from the facility, including blowdown from five cooling towers. During 1990, analysis of samples collected as required by our permit indicated our discharge exceeded permit limits for phosphates and settleable matter on a fairly consistent basis. The problem of excess phosphate was corrected through the installation of new meter pumps. The exceedances of settleable matter were related to improper sampling techniques during periods of low flow. This was corrected through the proper training of sampling personnel. One additional permit exceedance was experienced in August, 1990. Samples collected from one sample location failed the fish bioassay test. The problem was traced to an offsite contractor who had disposed of floor wax stripper into the storm drain instead of the janitor sewer. A summary of the compliance status of SLAC's NPDES permit is provided as Table III-1.

SLAC received renewal of its NPDES Permit CA0028398, Order 90-098. The new permit expires July 18, 1995. The permit contains new discharge requirements for heavy metals. SLAC has determined through analysis that the new discharge limits are not attainable through current operations. SLAC is currently investigating and evaluating methodologies which will eliminate cooling tower blowdown to the creek. Currently, SLAC is investigating three methods:

(1) Ozonation,

(2) Chemical Treatment, and

(3) Discharge to the Sanitary Sewer.

These investigations and implementation must be completed by December 1, 1991. Failure to meet the discharge limits could result in prohibition of cooling tower discharge. This would preclude the operation of the accelerator.

<u>Industrial Wastewater</u>

SLAC has a facility for treating plating shop non-hazardous rinse waters before discharging to a Public Owned Treatment Works (POTW). The South Bayside System Authority (SBSA) monitors the effluent from the treatment facility for compliance with the metal finishing pretreatment standards under the Clean Water Act and SLAC's industrial waste water discharge permit limits. No violations of pretreatment standards or permit limits were noted during 1990.

Resource Conservation and Recovery Act (RCRA):

Section 6001 of the Solid Waste Disposal Act requires that all federal facilities comply with local and state regulations regarding management of hazardous waste. SLAC is a "generator" of hazardous waste, and does not have a permit to treat hazardous waste or store hazardous waste for longer than 90 days. The San Mateo County Department of Health Services is the regulatory agency responsible for inspecting generators of hazardous waste for compliance with Federal, State, and local hazardous waste laws and regulations. Between February 15, 1990, and April 4, 1990, inspections of SLAC were conducted by the Hazardous Materials Section of the County of San Mateo Department of Health Services regarding compliance with hazardous waste management regulations as stipulated in Division 20 of the California Health and Safety Code, Chapter 30, Title 22 of the California Code of Regulations, and Title 40 of the Code of Federal Regulations. A final report containing 110 alleged violations was received by SLAC on November 7, 1990. On November 30, 1990, SLAC submitted a compliance schedule with corrective actions for all findings and time schedules for implementing such actions.

The majority of the deficiencies identified in the report related to improper management of hazardous waste containers. This included inadequacy in labeling of containers, secondary containments, accumulation times, and provisions for storage such as centralized collection areas. Root causes for these findings have been identified as lack of training and procedures. In response, SLAC is developing training programs to educate waste generators and handlers on the requirements for handling hazardous waste in compliance with applicable laws, regulations, and best management practices. Training will begin in July, 1991 and refresher courses will be provided annually. Additionally, SLAC has drafted a Hazardous Materials Management Handbook. The Handbook defines responsibilities, goals and objectives, guidance for proper chemical/hazardous waste handling, site-wide environmental policies/procedures, and includes self-audit checklists for compliance. The Handbook will be provided to appropriate personnel during training.

Toxic Substances Control Act (TSCA):

SLAC has numerous pieces of equipment which are filled with oil or other dielectric fluids containing polychlorinated biphenyls (PCB's). Handling and disposal of PCB's is regulated by the Toxic Substances Control Act (TSCA). As defined by TSCA, SLAC has 14 PCB Transformers (greater than 500 mg/l PCB's) and 37 PCB Contaminated Transformers (greater than 50 mg/l but less than 500 mg/l PCB's).

On July 16, 1990, SLAC was inspected by the Environmental Protection Agency (EPA) Region IX and the California Department of Health Services (DHS) for compliance with the TSCA. On October 30, 1990, SLAC received a Federal Facility

Notice of Non-compliance (NON Docket No. TSCA-09-90295-01-WR) for violations noted during this inspection. SLAC submitted a corrective action response to the EPA and DHS on November 21, 1990.

Several of the alleged violations noted in the NON related to inadequate record keeping. The missing records were maintained by SLAC, however, they were not readily available during the inspection because they were boxed and in the process of being moved to another building. The documents noted to be missing were forwarded to the EPA along with the corrective action plan SLAC submitted on November 21, 1990.

Procedural problems were also noted during the inspection. This included untimely clean-up and repair of leaks from PCB transformers. Under TSCA, a drip of PCB fluid is considered a spill, and must be handled as such. In response, SLAC repaired all leaking equipment or removed from service that equipment which could not be repaired. Oil stains on transformer pads were cleaned. SLAC is in the process of formalizing monthly inspection procedures for all PCB Transformers.

Releases to the Environment:

Radiological

On June 24, 1990, outfall water in Regions IR-6 and IR-8 contained releases of radioactivity. Review of previous and subsequent water samples from these areas have not revealed any levels above the contract laboratory's minimum detectable limits. Research on drainage conditions that may have accounted for the June, 1990 results is continuing.

Non-radiological

In October, SLAC reported a spill of approximately 25 gallons of diesel fuel to the County of San Mateo Department of Health Services. The spill was located near Cooling Tower 101 and occurred during filling operations of an above ground diesel tank. Fuel was delivered to the tank at a rate which created a siphon effect in the transfer line. The fuel flowed through the transfer line and out an uncapped valve. To prevent a similar occurrence in the future, the transfer line has been terminated.

Actions to mitigate the area affected by the spill are being coordinated with the County.

Table III-1.

NPDES Summary of Compliance Status

SLAC NPDES 1990 #samples / #permit excursions

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Sample Location E001												
Settleable Matter	4/0	NF	3/0	4/0	4/0	5/0	4/0	5/0	4/0	4/2	3/2	NA
Oil & Grease	NR	NR	NR	NR	NR	NR	9/0	9/0	7/0	9/0	4/0	NA
pH	1/0	NF	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	NA
Temperature	1/0	NF	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	NA
Phosphate	NR	NR	NR	NR	NR	NR	9/6	9/0	7/1	9/0	4/0	NA
TSS	7/0	NF	5/0	9/0	7/0	9/0	9/0	9/0	7/0	9/0	4/0	NA
TDS	7/0	NF	5/0	9/0	7/0	9/0	9/0	9/0	7/0	9/0	4/0	NA
Bioassay	1/0	NF	NF	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	NA
Sample Location E002												
Settleable Matter	4/0	NF	5/0	4/0	4/0	5/0	4/0	5/0	4/0	4/0	3/0	NA
Oil & Grease	NR	NR	NR	NR	NR	NR	9/0	9/0	7/0	9/0	4/0	NA
pH	1/0	NF	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	NA
Temperature	1/0	NF	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	NA
Phosphate	NR	NR	NR	NR	NR	NR	9/3	9/0	7/0	9/0	4/0	NA
TSS	7/0	NF	5/0	9/0	7/0	9/0	9/0	9/0	7/0	9/0	4/0	NA
TDS	7/0	NF	5/0	9/0	7/0	9/0	9/0	9/0	7/0	9/0	4/0	NA
Bioassay	1/0	NF	NF	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	NA
Sample Location E003												
Settleable Matter	4/0	4/0	5/1	4/1	4/0	5/1	4/2	5/2	4/1	4/2	4/0	NA
Oil & Grease	NR	NR	NR	NR	NR	NR	9/0	9/0	7/0	9/0	4/0	3/0
pH	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0
Temperature	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0
Phosphate	NR	NR	NR	NR	NR	NR	9/0	9/0	7/0	9/0	4/0	3/0
TSS	7/0	7/0	9/0	9/0	7/0	9/0	9/0	9/0	7/0	9/0	4/0	3/0
TDS	7/0	7/0	9/0	9/0	7/0	9/0	9/0	9/0	7/0	9/0	4/0	3/0
Bioassay	1/0	1/0	1/0	1/0	1/0	1/0	1/0	2/1	1/0	1/0	1/0	3/0
Sample Location E004												
Settleable Matter	NA	NA	NA	NA	NA	5/0	4/0	5/0	4/0	4/0	3/0	NA
Oil & Grease	NA	NA	NA	NA	NA	NR	9/0	9/0	7/0	9/0	4/0	NA
pH	NA	NA	NA	NA	NA	1/0	1/0	1/0	1/0	1/0	1/0	NA
Temperature	NA	NA	NA	NA	NA	1/0	1/0	1/0	1/0	1/0	1/0	NA
Phosphate	NA	NA	NA	NA	NA	NR	9/2	9/0	7/0	9/0	4/0	NA
TSS	NA	NA	NA	NA	NA	9/0	9/0	9/0	7/0	9/0	4/0	NA
TDS	NA	NA	NA	NA	NA	9/0	9/0	9/0	7/0	9/0	4/0	NA
Bioassay	NA	NA	NA	NA	NA	1/0	1/0	1/0	1/0	1/0	1/0	NA

3/0 = 3 samples collected / 0 permit excursions
NA = not availiable
TSS= Total Suspended Solids

NF = No Flow
NR = Not required
TDS = Total Dissolved Solids

4.0 Environmental Radiological Program Information

4.1 Airborne Monitoring.

Airborne radionuclides are produced in the air volume surrounding major electron beam absorbers such as beam dumps, collimators and targets. The degree of activation is dependent upon the beam power absorbed and the composition of the parent elements. The composition of air is well known, consisting of nitrogen, oxygen, and trace quantities of carbon dioxide and argon. Induced radioactivity produced at high energies is composed of short lived radionuclides, such as oxygen-15 and carbon-11 with half-lives of 2 minutes and 20 minutes, respectively. Nitrogen-13 with a half-life of 10 minutes is also produced, but in much lower concentrations. As a consequence of water cooling and concrete shielding, both containing large quantities of hydrogen, the thermal neutron reaction with stable argon produces argon-41, which has a half-life of 1.8 hours.

We have not detected any other radionuclides including particulates in the airborne effluent exhausted from SLAC.

The accelerator, PEP, SPEAR and experimental areas are designed to transport (not absorb) high energy electrons and positrons. Radioactive gas concentrations are therefore not produced in measurable quantities. The Beam Switch Yard (BSY), Positron Source (PS) and e^-/e^+ beam dumps in the Final Focus System (FFS) represent the only portion of SLAC designed to absorb high energy particles and are the only sources of detectable gaseous radioactive emissions. These areas are not vented continuously. They are vented only for emergencies and at the end of each experimental cycle for brief periods of one hour or less.

The Derived Concentration Guides (DCG's) for airborne radioactivity appear in Ref. 3. They were derived from dose standards which require that no individual in the general population be exposed to greater than 10 mrem in one year.

Airborne radioactivity produced as the result of operations is short lived; i.e., the half-lives range from 2.1 minutes to 1.8 hours and are in gaseous (not particulate) form. These isotopes include the following:

Table IV-1.

Radioactive Gases Released to Atmosphere

Isotope	Half-Life	$\mu Ci/cm^3$
^{15}O	2.1 minutes	1.7×10^{-9} (a)
^{13}N	9.9 minutes	1.7×10^{-9} (a)
^{11}C	20.5 minutes	1.7×10^{-9} (a)
^{41}Ar	1.8 hours	1.7×10^{-9}

(a) Calculated from Ref. 5, assuming total submersion.

Since we do not routinely release airborne radioactivity while the beam is on and require a waiting period before turning on the exhausters, the only radioisotope released is argon-41. By far the greater proportion of exposure an individual may receive under any circumstances from the radionuclides listed in Table IV-1 is from whole-body immersion. Thus for an individual to receive a whole-body dose of 10 mrem annually, it would require continuous exposure to a large cloud with average concentration equal to 1.7×10^{-9} $\mu Ci/cm^3$ (Ci/m^3) for an entire year.

The BSY areas are vented by a total of five fans; the discharge point is just slightly above roof elevation. The total exhaust rate for the accelerator is 60 m^3/min, and for the BSY it is 40 m^3/min. Venting of PEP and its Interaction Regions (IRs) is accomplished by a total of 14 exhaust fans which vent just above grade level, with a total exhaust rate of 50 m^3/min. PEP is the only facility that is vented while the beam is on.

Each BSY ventilation fan is provided with a radioactive gas detector. A Geiger-Mueller (GM) detector, power supply, rate meter, input to VAX computer system, and air pump are interlocked with the ventilation fan so that they operate only when the machine is vented.

The gas monitors for the BSY collect particulate samples during venting and have revealed negative results. During this monitoring period particulate radioactivity above background was not detected.

The effluent for the PS and FFS areas are also monitored continuously while the exhausters are running. The same type of air monitoring is used as described above for the BSY.

There were no measurable releases of radioactive gases from the BSY, PS or FFS during 1990. However, the National Emission Standards for Hazardous Air Pollutants (NESHAP) requires a compliance report. The results of these calculations appear in Appendix C. They were derived by calculating the saturation activity for oxygen-15, carbon-11, nitrogen-13 and argon-41 and then releasing the radionuclides without applying decay factors.

The compliance report was generated by the required computer program, EPA Airdose-PC, Version 3.0. The results show that the annual effective dose equivalent (EDE) was less than 0.14% of the NESHAP standard.

4.2 Waste Water Monitoring.

Waste water containing radioactivity is not routinely released from the site. The only possible sources of liquid radioactive effluents are from low conductivity water (LCW) cooling systems in the BSY and certain other areas of the accelerator's housing. See Appendix G for CY90 water analysis data. In the event of leaks from the systems, water is collected in stainless steel lined sumps sized to contain the entire water volume. When necessary, the contents of the sumps are pumped to a mobile holding tank. The tank is then moved to the nearest sanitary sewer inlet and drained into the sewer after analysis is completed.

The greatest source of induced radioactivity is where the electron/positron beam is absorbed. Since water is composed of hydrogen and oxygen, the only radioisotopes produced are the short lived oxygen-15 and carbon-11, beryllium-7 (54 d), and tritium (12.3 y). Oxygen-15 and carbon-11 are too short lived to present an environmental problem in water, and the beryllium-7 is removed by the resin beds required to maintain the electrical conductivity of the water at a low level; therefore, tritium is the major radioactive element present in the water that is of environmental importance. See Appendix G for gross beta/gamma results.

Water that leaks from these systems is normally disposed of via the sanitary sewer. The concentration of tritium released is less than the Concentration Guides, see Appendix G, specified by DOE Order 5400.5, "Requirements for Radiation Protection for the Public." SLAC is also bound by the provisions in a contract for service with the West Bay Sanitary District (Permit No. WB860915-FNS). There were two measurable releases of water containing radioactivity during 1990, see Table IV-2, to surface waters.

Table IV-2.

Radionuclide Releases from SLAC Outfalls

Date	Area[a]	Tritium (pCi/l)[b]	Beta/Gamma (pCi/l)[b,c]
	EPA DW Standard	20,000	NA
	DOE SS Release	10,000,000	NA
	Storm Drain Release	ND	ND
6-22-89	IR6 Oil/Water Sep.	<500	422 +/- 88
6-24-90	IR6 Oil/Water Sep.	1547 +/- 609	1911 +/- 25
9-25-90	IR6 Oil/Water Sep.	<500	<3
9-26-90	IR6 Oil/Water Sep.	<500	106 +/- 7
1-22-91	IR6 Oil/Water Sep.	<500	5 +/- 3
6-22-89	IR8 Oil/Water Sep.	<500	58 +/- 5
6-24-90	IR8 Oil/Water Sep.	692 +/- 300	571 +/- 14
9-26-90	IR8 Oil/Water Sep.	<500	9 +/- 4
1-22-91	IR8 Oil/Water Sep.	<500	4 +/- 3

(a) DW = Drinking Water; SS = Sanitary Sewer
(b) ND = None Detectable above Background
(c) NA = Not Applicable for Gross Activity

4.3 Peripheral Monitoring Stations.

Six Peripheral Monitoring Stations (PMS) designed to provide continuously recorded data from radiation monitors located near SLAC's boundaries have been installed as direct radiation monitors. Their positions are shown in Fig. 3. During 1990 virtually every station was out of service for large parts of the year because of the tie in of their data with the DEC VAX computer used by the Main Control Center (MCC) for machine operation. One station was active most of this period, but was not fully calibrated due to intermittent operations. PMS-1, the system with the most relative data, i.e., sufficient signal history to recognize in a qualitative manner any increased radiation levels above background, is located in the most sensitive position; historically (since 1966), it has measured the highest annual dose and it is the closest location to SLAC's off-site population. Other stations also had some data for varying periods during CY90; however, problems with the new VAX system led to a loss of data without backups on a number of occasions during CY90. Programming steps to prevent the loss of data, and the echoing of data being received to terminals in the Operational Health

Physics Department had been taken late in 1990 and are continuing in the second quarter of 1991.

All PM stations have now been re-established. The response of each station is recorded in the VAX history buffer located in the Main Control Center. Each Calendar quarter a plot of the average dose rate for each 24 hour period will be generated together with the total dose from neutron and gamma radiation for that quarter. Each station will record both accelerator and natural background radiation sources. The natural background radiation levels are known since we have been measuring this source for the past twenty-six years. No significant increases above prevailing background levels for each instrument were identified that were due to radiation. Spikes were observed and were diagnosed as computer/CAMAC signal processing errors in each case.

The measured annual dose to the general population coming from accelerator operations is almost entirely from fast neutrons and is characterized as skyshine from SLAC's research area. During 1990 no measurable neutron exposures were seen, within the limitations of data collection discussed above. A shift in the experimental program to low intensity experiments (including storage ring experiments) is the primary reason for the decrease in air monitor and peripheral station measurements to background levels.

Radiation information is obtained with a GM tube for the ionizing component and a polyethylene moderated BF_3 neutron detector calibrated with a Pu-Be neutron source. The resultant sensitivities are such that a gamma exposure of 1 mR from a radioactive ^{60}Co source would be recorded as 10^4 counts per minute on the GM tube channel and a neutron dose equivalent of 1 mrem would be recorded as 10^5 counts per minute on the BF_3 channel. All signals are fed into CAMAC inputs for signal acquisition and buffering by the MCC VAX computer system. All data has been retained in a permanent history record since August 1990, some SEDEKO register data from the old system prior to activation of the new system was available for PMS-1 for the January to March 1990 period as well. As can be seen in Tables IV-3 and IV-4, fully calibrated direct radiation measurement data was not obtained during 1990. Qualitative reviews of the data received indicated a largely background pattern with the few spikes seen accounted for as VAX and signal processing errors.

To improve the continuous tracking of direct reading radiation monitoring equipment, a real time display capability will be delivered to the Radiation Physics Department during the first half of 1991. A large scale re-calibration and replacement/repair of active direct reading radiation monitors will be conducted in the first half of 1991. By the summer of 1991 passive direct reading radiation monitors (posted TLDs) will be in service at several SLAC perimeter locations.

Table IV-3.

1990 Annual Penetrating Radiation Dose Measured Near SLAC Boundaries

PMS	Gamma (mrem)			Neutron (mrem)		
No.	Total	Background	Net	Total	Background	Net
1	OS	OS	NA	OS	OS	NA
2	OS	OS	NA	OS	OS	NA
3	OS	OS	NA	OS	OS	NA
4	OS	OS	NA	OS	OS	NA
5	OS	OS	NA	OS	OS	NA
6	OS	OS	NA	OS	OS	NA

OS = Out of Service; NA = Not Applicable

Table IV-4.

Summary of Annual Effective Dose Equivalents Due to 1990 Laboratory Operations

	Maximum Dose to Laboratory Boundary[a]	Maximum Dose to an Individual[b]	Collective Dose to Population within 1.6 km of Laboratory
Dose	--	--	--
Location	--	--	--
DOE Radiation Protection Standard	--	100 mrem	--
Percentage of Radiation Protection Standard	--	--	--
Background	100 mrem	100 mrem	100 person-rem
Percentage of Background	--	--	--

(a) Maximum boundary dose not directly measured due to calibration and monitoring deficiencies involving the direct radiation monitoring equipment.

(b) Maximum individual dose not directly measured due to calibration and monitoring deficiencies involving the direct radiation monitoring equipment. Background estimated based on operational history and qualitative evaluation of analog data records for portions of 1990.

Based on a qualitative assessment of operating periods for the peripheral monitors during CY90, the work being performed for the experimental program, and the previous and following operating years (PMS 1 for CY89 = 1.2 mrem neutron; all PMS stations for CY91 were <1 mrem), it is estimated the actual exposure at the site boundary would lie between 1 and 2 mrem for CY90. The value 2 mrem was used for summary data as an upper bound estimate for CY90. See Appendix B for the historical analysis model for evaluating PMS data and calculated exposure potentials to members of the off-site population.

4.4 Radiological Media Sampling Program.

Media sampling was limited to water (the major pathway for radionuclide release to the environment) and air (direct reading air monitor system for radioactive gases). The low source terms proportionate to DOE DCG's have identified only these routes as likely pathways for any potential off-site population exposure. Limited soil sampling in past years on site has not revealed detectable levels of man made radionuclides. In future years, a planned characterization of the site through media analysis will be done to establish the naturally occurring radionuclides on site and the background levels seen at different areas as the baseline values for reference. Verification of no significant levels of man made radionuclides by laboratory radioanalytical methods will be done at the same time.

5.0 Non-Radiological Environmental Program Information

This section of the Annual Site Environmental Report provides an overview of the site's environmental activities performed in order to comply with laws and regulations, to enhance environmental quality, and/or to improve understanding of the effects of environmental pollutants from site operations. Included is a summary of non-radiological environmental monitoring, environmental permits, and significant environmental activities at the site.

Clean Air Act (CAA):

SLAC has 33 air pollution sources permitted with the Bay Area Air Quality Management District (BAAQMD). A listing of these sources and annual emissions are provided in Table V-1. Permits issued by the BAAQMD for many of SLAC's solvent sources limit the amount of solvent which can be emitted on an annual basis, and require that quarterly solvent usage records be maintained. In 1990, SLAC established a formal program for logging and tracking solvent usage as required by permit conditions. No permit limits were exceeded during 1990.

Effective January 1, 1991, the BAAQMD revoked an exemption for the requirement of safety equipment and emission control systems on solvent vapor degreasers installed prior to March 7, 1979. Most of the vapor degreasers at SLAC fell under that exception, and therefore, needed to be upgraded prior to the January 1, 1991, deadline. All of the degreasers at SLAC were evaluated, modified, and retrofitted with proper safety control equipment and emission control systems to bring them into full compliance with the new regulations.

On January 1, 1991, the BAAQMD also made effective a new regulation limiting the types of aerosol paints which can be used and sold in the Bay Area. The new regulation applied to all paints, primers, clear coats, and wood stains. The aerosol paint that SLAC was using did not meet the new regulations, therefore its use was discontinued. Alternatives were explored, complying paints identified, and their use established at the facility.

SLAC has several air pollution abatement devices associated with air pollution sources. These include items such as cyclones and baghouses to reduce particulate emissions from wood or metal cutting operations, and scrubbers to remove contaminant particles from gas streams. In 1990, SLAC instituted air pollution abatement device inspection program which requires semi-annual inspection and prompt repair of each abatement device.

Clean Water Act (CWA):

Groundwater Monitoring Program

As required by DOE 5400.1, SLAC initiated a Groundwater Monitoring Program in 1990 to determine and document the effects that SLAC has had on groundwater quality. The complexity of the geology prevents characterization of the groundwater regime over the entire facility. Therefore, the Groundwater Monitoring Program concentrated on those areas of the facility that historically and/or presently store, handle, or use chemicals which may pose a threat to groundwater quality.

Ten groundwater monitoring wells were installed for the initial phase of our Groundwater Monitoring Program. Locations of the ten wells are shown in Figure 5.1. General groundwater quality, as measured by total dissolved solids (TDS) values, ranged from 1,100 ppm (parts per million) to 11,000 ppm, and can be characterized as "brackish". Water containing more than 2,000-3,000ppm TDS is generally too salty to drink.

Groundwater samples collected from the wells were analyzed for a wide range of potential chemical constituents including heavy metals, volatile and semi-volatile organics, polychlorinated biphenyls (PCB's), total petroleum hydrocarbons as diesel (TPH), and cyanide. No PCB's, TPH, or cyanide were detected in any of the wells. Nickel, selenium, thallium, and chlorinated solvents were detected in several of the wells at or above the State of California Maximum Contaminant Levels for drinking water or EPA National Ambient Water Quality Criteria based on health effects. Results of these analyses as well as the lowest regulatory standard or requirement are presented in Table V-2. The final report on this initial phase of SLAC's groundwater investigation was submitted to the California Regional Water Quality Control Board, the Department of Energy, and the County of San Mateo Department of Health Services on January 17, 1991. A work plan for additional investigation work is being prepared to determine the extent of contamination and locate possible sources of the groundwater contamination. Additionally, a Beneficial Use Report for groundwater at SLAC will be prepared and a Fate/Transport study will be done to determine factors affecting attenuation, transport, and eventual fate of contaminants detected in the groundwater. The work plan, Beneficial Use Report, and Fate/Transport study are scheduled for completion by December 1992. The San Mateo County Department of Health Services has agreed to work with SLAC as the lead agency providing oversight for further groundwater characterization.

Groundwater Around Former Leaking Underground Tank

Groundwater monitoring wells MW-1 through MW-7 and extraction well (non-pumping) EW-1 are located in the vicinity of SLAC's Plant Maintenance building in the northwestern portion of the facility (see Figure 5.2). These wells are being used to monitor the migration of chemical constituents associated with a former underground storage tank (UST) which contained organic solvents during the period of 1967 to 1978. A pressure test performed on the UST in 1983 indicated a leak. The tank was removed in December, 1983.

The California Regional Water Quality Control Board (RWQCB) requires that SLAC monitor the wells at the former UST site on a quarterly basis (RWQCB Waste Discharge Order 85-88). Samples are collected from the wells by an outside contractor using sampling methods described in EPA SW-846. The samples are analyzed for volatile organics (EPA Methods 8010/8020) by an analytical laboratory certified by the California Department of Health Services. A summary of the organic chemical analyses, listing only those compounds which were detected, as well as applicable State of California Maximum Contaminant Levels (MCL's) are presented in Table V-3.

In addition to monitoring of the wells, the RWQCB requested SLAC to monitor a potential groundwater seep to determine if VOC's from the UST are migrating into the subdrain. The sampling point selected by the RWQCB is referred to as point E-003 and is shown in Figure 5.3. The RWQCB requested that point E-003 be sampled on a quarterly basis and analyzed for VOC's (EPA methods 8010/8020) and metals and that annually, preferably in the winter, the analysis shall use EPA Method 8240 in lieu of 8010/8020. With the exception of 1.5 μg/l of chloroform, no VOC's were detected in any of the samples collected from point E-003. Therefore, there is no indication that VOC's from the UST site have reached the SLAC subdrain and migrated at detectable levels as far as sampling point E-003.

Results of point E-003 heavy metals analyses, listing only those detected, are presented in Table V-4. The RWQCB will be evaluating the need to continue monitoring point E-003 in 1992.

Closure of Groundwater Monitoring Wells

In December 1990, SLAC destroyed ten groundwater monitoring wells (1 inch or 2 inches in diameter). The wells were originally installed to monitor groundwater levels during construction of underground tunnels at the laboratory and were no longer needed. The wells were destroyed with permission from the San Mateo County Department of Health Services using methods described in the State of California Department of Water Resources publication *Water Well Standards: State of California, Bulletin 74-81*.

Surface Water

SLAC has a National Pollutant Discharge Elimination System (NPDES) permit from the California Regional Water Quality Control Board (RWQCB), San Francisco Bay Region. The permit regulates surface water discharges from the facility, including blowdown from five cooling towers. The NPDES permits requires self monitoring of the discharges. Sampling frequencies, locations, and analytical parameters are detailed in the permit (CA0028398 Order 90-098) which expires July 18, 1995. A summary of these monitoring requirements is provided as Table V-5. Sample locations are shown in Figure 5.3. Analytical results for samples collected for the year are provided in Appendix F.

SLAC received renewal of its NPDES Permit CA0028398, Order 90-098. This permit allows blowdown discharge from five cooling towers to San Francisquito Creek. The new permit expires July 18, 1995. The permit contains new discharge limits for heavy metals which are to become effective December 1, 1991. SLAC has determined through analysis of the blowdown that the new discharge limits are not attainable using current operations. SLAC is currently investigating and evaluating methodologies which will eliminate blowdown to the creek. Currently, SLAC is investigating three methods:

1) Ozonation,

2) Chemical Treatment, and

3) Discharge to the Sanitary Sewer.

These investigations and implementation must be completed by December 1, 1991. Failure to meet the discharge limits could result in prohibition of cooling tower discharge. This would preclude the operation of the accelerator.

Industrial Wastewater

Plating Shop Pre-treatment Facility

Due to the types of processes at the site which generate industrial wastewater, SLAC must comply with the Environmental Protection Agency effluent guidelines and standards for metal finishing. SLAC has a facility for pre-treating non-hazardous plating shop rinse waters before discharge to the sanitary sewer. The South Bayside System Authority (SBSA) monitors the effluent from the treatment facility for compliance with the federal metal finishing pretreatment standards. SBSA also monitors the total sanitary sewer discharge for compliance with SLAC's permit standards established by the West Bay Sanitary District (WBSD). The standards and sampling frequencies for metal finishing pretreatment (Wastewater Discharge Permit No. WB860915-PTE) and SLAC's total sanitary sewer discharge sewer discharge limits (Wastewater Discharge Permit No. WB860915-FNS) are presented in Tables V-6 and V-7. Both permits are renewable yearly with the present permits expiring June 14, 1991. Results of analyses on samples collected by the SBSA in 1990 are provided as Table V-8. Sample locations are shown in Figure 5.4.

New Industrial Batch Wastewater Pre-treatment Facility

In 1990, SLAC initiated operation of a new industrial wastewater treatment facility. The new facility processes liquid non-hazardous wastes which do not meet the sanitary sewer discharge limits. Liquid wastes are treated through a process of sodium hydroxide precipitation followed by flocculation and sedimentation to remove heavy metals. The treated wastewater is discharged to the sanitary sewer. Prior to commencing operation of this facility, the West Bay Sanitary District reviewed the operation and determined that metal finishing pretreatment standards do not apply. Therefore, monitoring of the discharge is not required.

Resource Conservation and Recovery Act (RCRA):

SLAC is a "generator" of hazardous waste, and is not permitted to treat hazardous waste or store it for longer than 90 days. The San Mateo County Department of Health Services is the agency responsible for inspecting generators of hazardous waste for compliance with Federal, State, and local hazardous waste laws and regulations. In 1990, SLAC was inspected by the County for compliance with applicable regulations. SLAC was noted to be deficient in several areas.

Root causes for the deficiencies noted during the inspection have been identified as lack of training and lack of clear, written guidance and procedures. In response, SLAC is developing training programs to educate waste generators and handlers on the requirements for handling hazardous waste in compliance with applicable laws, regulations, and best management practices. Training will begin in July, 1991 and refresher courses will be required annually. A Hazardous Materials Management Handbook has been drafted. The Handbook defines responsibilities, goals and objectives, guidance for proper chemical/hazardous waste handling, site-wide environmental policies/procedures, and includes self-audit checklists for compliance. The Handbook will be provided to appropriate personnel during training.

Toxic Substances Control Act (TSCA):

SLAC has numerous pieces of equipment which are filled with oil or other dielectric fluids containing polychlorinated biphenyls (PCB's). Handling and disposal of PCB's is regulated by the Toxic Substances Control Act (TSCA). As defined by TSCA, SLAC has 14 PCB Transformers (greater than 500 mg/l PCB's) and 37 PCB Contaminated Transformers (greater than 50 mg/l but less than 500 mg/l PCB's).

SLAC is developing a prioritized time table for eventual elimination or retrofilling of all PCB Transformers. Plans to retrofit PCB Contaminated Transformers are being developed as well. The limiting factor for both projects is lack of funding. To assure continued compliance with TSCA regulations, PCB and PCB Contaminated Transformer inspection and maintenance procedures are being formalized and implemented.

Environmental Restoration Activities:

Locations of the restoration sites described below are shown in Figure 5.5.

SLAC completed the following remedial activities:

1) A diesel fuel distribution pump located near Building 24 contaminated surrounding soil with diesel fuel. The pump was removed and the contaminated soil excavated. Cleanup of this area was performed with oversight from the San Mateo County Department of Health Services, Office of Environmental Health, and was completed in August 1990.

2) Three PCB Contaminated Transformers at Substation 507 were discovered to be leaking. The transformers were repaired to stop the leaks. The transformer pad was cleaned and contaminated soil and rock was removed. Post cleanup sampling and analysis confirmed the action level of 5 mg/kg (ppm) was met. This project was completed in January of 1991.

The following remedial activities or characterization are in progress;

3) Four PCB Transformers were removed from the 5.8 mega-watt (MW) Power Supply in the Research Yard. Analysis of soil samples collected from below the transformers indicated PCB contamination in excess of the State of California action level of 5 mg/kg (parts-per-million, ppm). Contaminated soil will be removed and confirmation samples collected and analyzed to assure that action levels are met. This cleanup is anticipated to be completed in March, 1991.

4) The extent of PCB contamination in the soil at the Interaction Region 8 (IR-8) substation is being characterized. The contamination occurred when a PCB Transformer over-pressurized releasing PCB fluids to the soil. A preliminary assessment of the contamination was performed in 1990. Additional sampling and analysis to determine the extent of contamination and the preparation and submittal of NEPA documentation is scheduled for early 1992.

5) Characterization of PCB contamination of the surface water drainage ditch in the area of Interaction Region 6 (IR-6) is currently in progress. The contamination was first detected by the DOE Environmental Survey Sampling Team. A contract has been awarded to an outside contractor to fully determine the extent of contamination. NEPA documentation for this activity has been filed with DOE-SAN. Completion of site characterization is anticipated by the end of 1991.

6) PCB contamination of soil in the Master Substation yard and adjacent drainage ditch has been confirmed. This contamination was detected by SLAC and the DOE Environmental Survey Sampling Team. Additional samples are required to identify contamination distribution. NEPA documentation, cleanup contract award, and initiation of cleanup is anticipated for 1992.

7) At Building 26, a compressor leaked oil and contaminated the underlying soil. Clean-up of this area is part of SLAC's compliance for the San Mateo Department of Health Services hazardous waste generators inspection in 1990. This activity is on schedule with SLAC's action plan submitted to the County and DOE. NEPA documentation has been submitted, the contract for cleanup will be awarded and cleanup is anticipated to be completed by the end of 1991.

8) Mitigation of diesel contaminated soil near Cooling Tower 101 has been initiated. The contamination resulted from a spill (approximately 25 gallons) which occurred during filling operations of an above ground diesel tank. Fuel was delivered to the above-ground tank at a rate which created a siphon effect in an abandoned transfer line (which used to transfer fuel from four underground storage tanks to the above-ground tank). When the siphon was

created, the diesel fuel flowed through the transfer line and out an uncapped valve, contaminating the soil in the vicinity of the four underground storage tanks. To prevent a similar occurrence in the future, the transfer line has been terminated. Actions to mitigate the area affected by the spill are being coordinated with the County of San Mateo Department of Health Services. It is suspected that the spill contaminated the backfill material surrounding the four underground storage tanks which formerly contained diesel fuel (the tanks were officially closed with the San Mateo County Department of Health services). NEPA documentation for removal of the tanks and contaminated soil was submitted to DOE-SAN. A contract for these activities was awarded and the project is expected to be completed by June, 1991. This project is being performed with direct oversight by the County.

Other Environmental Activities:

SLAC is initiating other policies and procedures for enhancing environmental management programs.

Self-Assessment.

In September of 1990, International Technology (I.T.) Corporation conducted a safety, environmental and radiological programs audit at SLAC. In its report to SLAC, I. T. noted many of the same non-compliance issues identified by the San Mateo County Department of Health Services during their RCRA Generator Inspection, conducted February-April 1990. Though many non-compliance issues had been corrected, numerous issues were observed as continuing. The primary root causes identified were lack of training and written procedures/documentation.

In January, 1991 SLAC initiated an expanded self-assessment program. The first phase consisted of a technical safety appraisal. SLAC was assisted by a consultant, Kaiser Engineers, Incorporated. The second phase, environmental programs assessment, will begin in April of 1991. SLAC will be assisted by SAIC, a consultant firm. SLAC's final self-assessment report will be completed by August 1991.

Division of Environment, Safety and Health.

To more effectively address the issues identified by I. T. and SLAC, the Environment and Safety Office (ESO) was elevated in December 1990, to the level of a SLAC Division. The new Environment, Safety and Health Division (ES&HD) is composed of five departments: Environmental Protection and Waste Management (EP&WM), Safety and Training (S&T), Radiation Physics (RPD), Operational Health Physics (OHP) and Quality Assurance and Compliance (QA&C).

° Policy statements are being developed for lead handling, secondary containment/catch basins, used lead-acid batteries, used tires, and used/soiled cleanup rags.

° A computerized hazardous waste drum tracking system has been initiated. Hazardous waste drums are tracked from the time of being issued to the generator to the eventual disposal offsite.

° The first phase of SLAC's Waste Minimization Plan has been completed. All primary waste streams have been identified, enumerated, and evaluated relative to potential waste minimization activities. The Plan will be completed by the end of June, 1991. On-site recycling of solvents has already been initiated and will be expanded in 1992. Waste Minimization training will be incorporated into the waste generators and handlers training curriculum.

In 1990, the Director issued a Waste Minimization Policy statement and directed all personnel to actively participate in the development and implementation of a site-wide Waste Minimization program and plan.

All waste minimization certification statements and documents required by RCRA were submitted in 1990 to the appropriate Federal, State or local agencies.

Permits:

SLAC has been issued the following permits:

- o California Regional Water Quality Control Board
  San Francisco Bay Region
  NPDES Permit CA0028398, Order 90-098
  Expiration date: July 18, 1995

  Waste Discharge Order 85-88 (for groundwater contamination around former leaking underground tank)

- o West Bay Sanitary District and South Bayside System Authority
  Wastewater Discharge Permit No. WB860915-PTE
  Wastewater Discharge Permit No. WB860915-FNS
  Expiration date: June 14, 1991

- o Bay Area Air Quality Management District (BAAQMD)
  Plant No. 556, 33 permits

- o Environmental Protection Agency
  Hazardous Waste Generator EPA ID No. CA8890016126

Table V-1.

Bay Area Air Quality Management District (BAAQMD) Permits and Emissions

		Annual Average (lbs/day)[a]				
S#	Source Description	Particulates	Organics	NO_x	SO_2	CO
1	Boiler	-	-	20	7	5
2	Boiler	-	-	7	2	2
3	Degreaser	-	9	-	-	-
4	Degreaser	-	28	-	-	-
5	Spray booth	-	7	-	-	-
6	Boiler	-	-	4	16	1
7	Sandblasting booth	-	-	-	-	-
8	Sandblast room	-	-	-	-	-
9	Degreaser	-	4	-	-	-
10	Woodworking operations	-	-	-	-	-
11	Metal cutting operations	-	-	-	-	-
13	Metal grinding operations	-	-	-	-	-
14	Sandblast booth	-	-	-	-	-
16	Sandblast booth	-	-	-	-	-
17	Metal and epoxy glass grinding	-	-	-	-	-
18	Degreaser	-	3	-	-	-
21	Anodizing, pickling and bright dip operations	-	-	-	-	-
22	Degreaser	-	2	-	-	-
23	Cold cleaner	-	-	-	-	-
24	Cold cleaner	-	-	-	-	-
25	Cold cleaner	-	-	-	-	-
26	Cold cleaner	-	-	-	-	-
27	Cold cleaner	-	-	-	-	-
28	Cold cleaner	-	-	-	-	-
29	Cold cleaner	-	-	-	-	-
30	Sludge dryer	-	-	-	-	-
31	Cold cleaner	-	-	-	-	-
32	Cold cleaner	-	-	-	-	-
33	Cold cleaner	-	-	-	-	-
34	Cold cleaner	-	-	-	-	-
35	Cold cleaner	-	-	-	-	-
36	Wipe cleaning	-	-	-	-	-
37	Cold cleaner	-	5.4	-	-	-

(a) NO_x = Nitrogen oxides; SO_2 = Sulfur dioxide; CO = Carbon monoxide

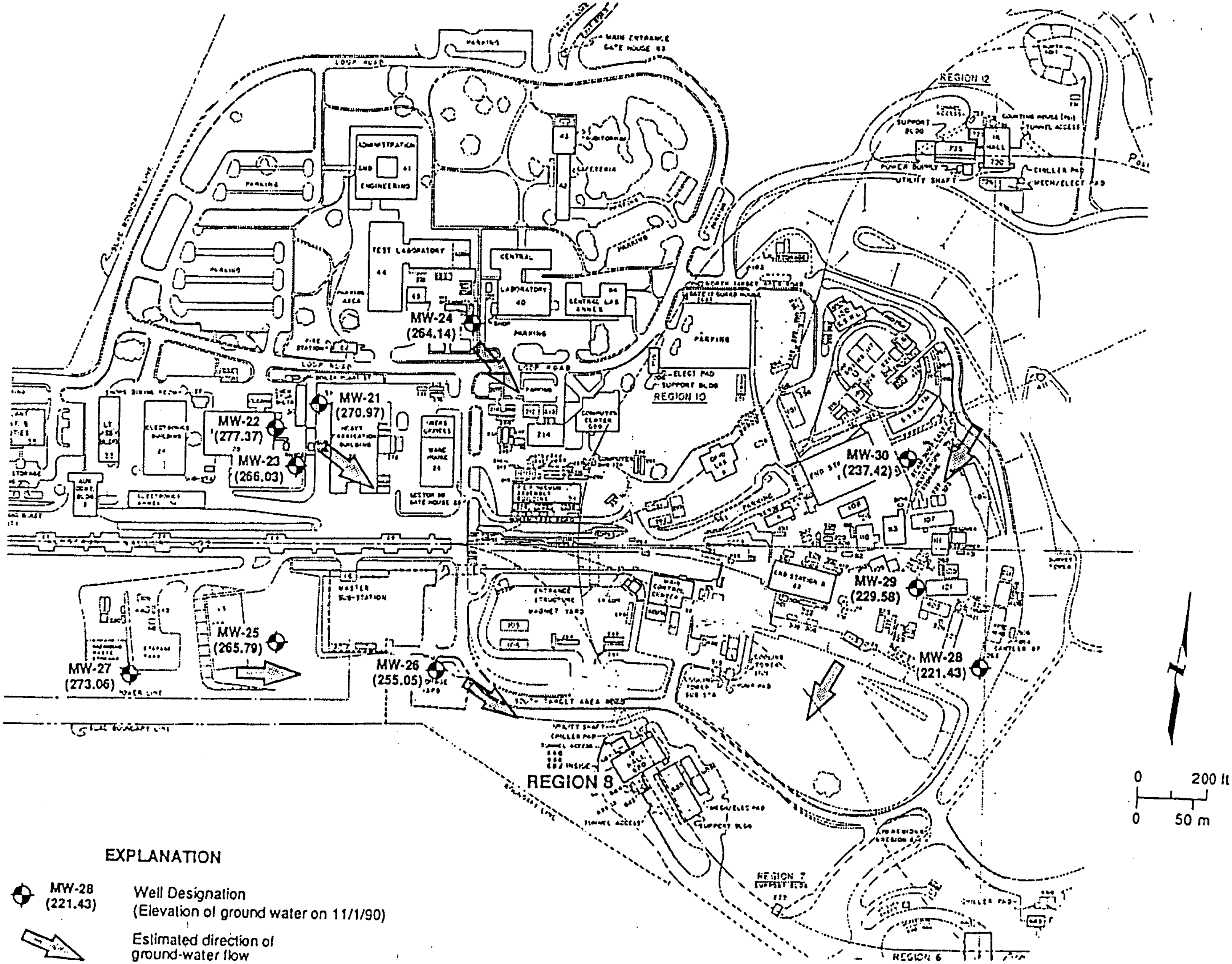

Figure 5.1. Location of ten groundwater monitoring wells installed in 1990.

Table V-2.
Compounds Detected in Groundwater Monitoring Wells

	MW-21	MW-22	MW-23	MW-24	MW-25	MW-26	MW-27	MW-28	MW-29	MW-30	
Organics (µg/l)											**Drinking Water MCL**
Trichloroethene (TCE)	30	830									5
1,1-Dichloroethene (DCE)		1000	11								6
1,1,1-Trichloroethane (TCA)											200
1,1-Dichloroethane (DCA)			11						1.3		5(proposed)
Freon*											1200(proposed)
Methylene Chloride									2.6		none
Benzoic Acid							12				none
Ethane										8	none
Metals (µg/l)											**Lowest Regulatory Standard or Requirement**
Antimony	50			80	44						146 a
Arsenic									3		50 b
Barium	30	30	30	20	35	30	100	22	15	33	1000 b
Cadmium											10 b
Chromium							36				50 b
Molybdenum		20	30	40							none
Nickel			100	110	33	30					13.4 a
Selenuim		29	16	12		10					10 b
Thallium		200	300	210							13 a
Vanadium											none
Zinc				20			12				5000 c
Total Dissolved Solids (mg/l)	9,900	5,300	9,700	11,000	3,900	3,400	1,900	6,500	1,100	1,100	not applicable

Only detected values shown
MCL = Maximum Contaminant Level
* 1,1,2-Trichloro-1,2,2-trifluoroethane
a = National Ambiant Water Quality Standard
b = Primary Maximus Contaminant Level (MCL)
c = Secondary Maximum Contaminant Level (MCL)

*NOTE: See Figure 5.1 for well locations.

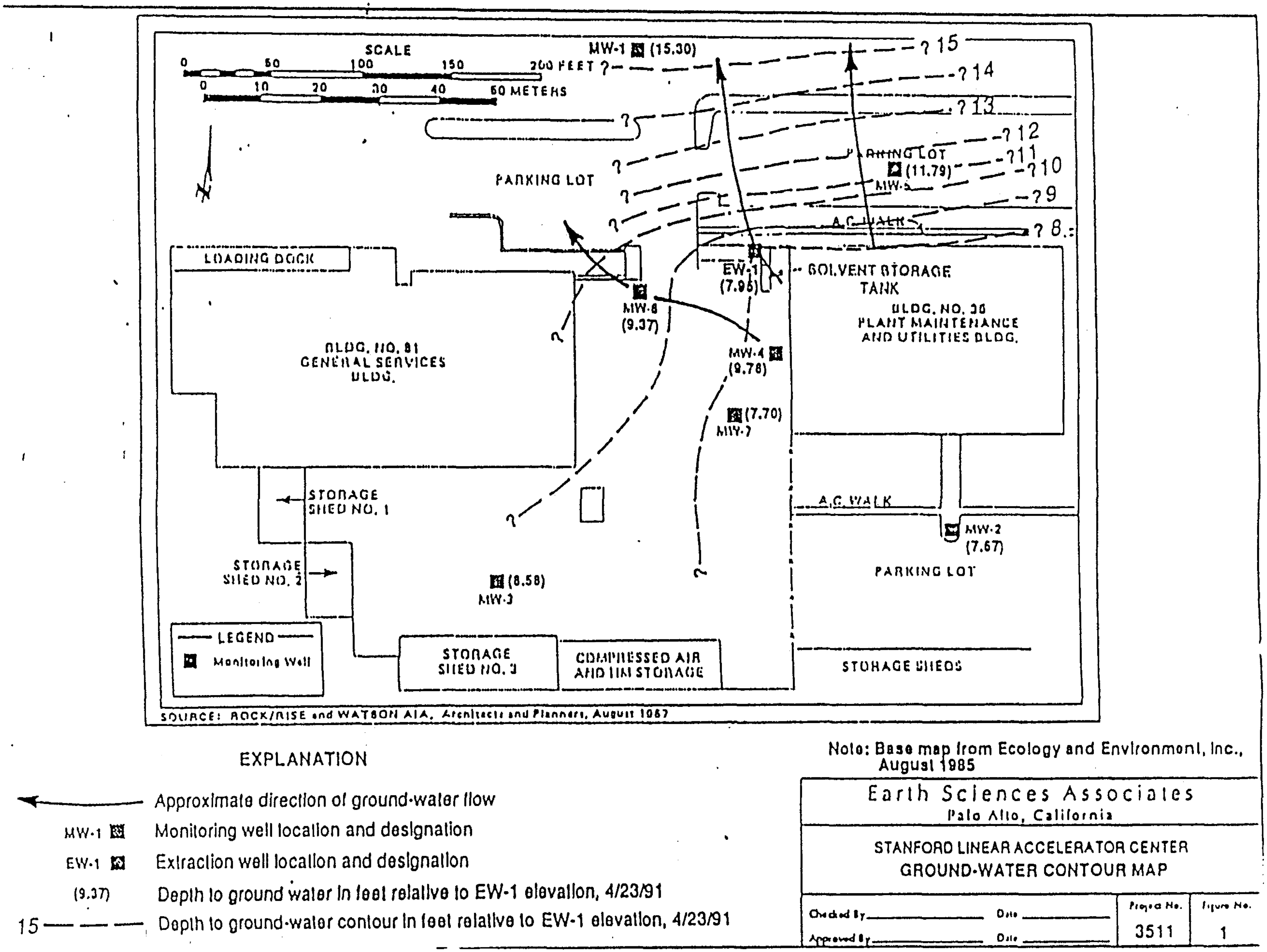

Figure 5.2. Location of groundwater monitoring wells surrounding a former leaking underground tank.

Table V-3.
Analytical Results for Monitoring Wells Around Former Leaking Underground Tank

Date Sampled	1/30/90	4/30/90	7/11/90	10/18/90	MCL (µg/l)
Monitoring Well MW-3					
Benzene (µg/l)	0.5	<0.5	<0.5	<0.5	1
Toluene (µg/l)	1.6	<1	<1	<1	none
Monitoring Well MW-4					
Toluene (µg/l)	0.6	<1	<1	<1	none
Monitoring Well MW-5					
1,1-Dichloroethane (µg/l)	0.9	7	1	2	5 (proposed)
1,1-Dichloroethene (µg/l)	1.4	8	4	4	6
Trichloroethene (µg/l)	<0.5	6	1	1	5
Monitoring Well MW-6					
1,1-Dichloroethene (µg/l)	1.4	8	3	3	6
Monitoring Well MW-7					
1,1-Dichloroethane (µg/l)	0.8	<0.5	<0.5	<0.5	5 (proposed)
1,1-Dichloroethene (µg/l)	5.2	7	3	2	6
Toluene (µg/l)	1	<1	<1	<1	none
Extraction Well EW-1					
1,1-Dichloroethane (µg/l)	dry	300	1000	dry	5 (proposed)
1,1-Dichloroethene (µg/l)	dry	200	210	dry	6
Cis-1,2-Dichloroethene (µg/l)	dry	160	<25	dry	6
1,1,1-Trichloroethane (µg/l)	dry	310	1300	dry	200
Trichloroethene (µg/l)	dry	240	240	dry	5
Tetrachloroethene (µg/l)	dry	170	<25	dry	5
Methylene Chloride (µg/l)	dry	230*	<25	dry	none

Samples were analyzed for volatile organics using EPA Methods 8010/8020; however, only those compounds which were detected are listed in this table. Wells with no detectable levels of contaminants are not shown. NOTE: No contaminants were detected in MW-1 or MW-2.

MCL = Maximum Contaminant Level   *Confirmed laboratory contaminant

NOTE: See Figure 5-2 for well locations.

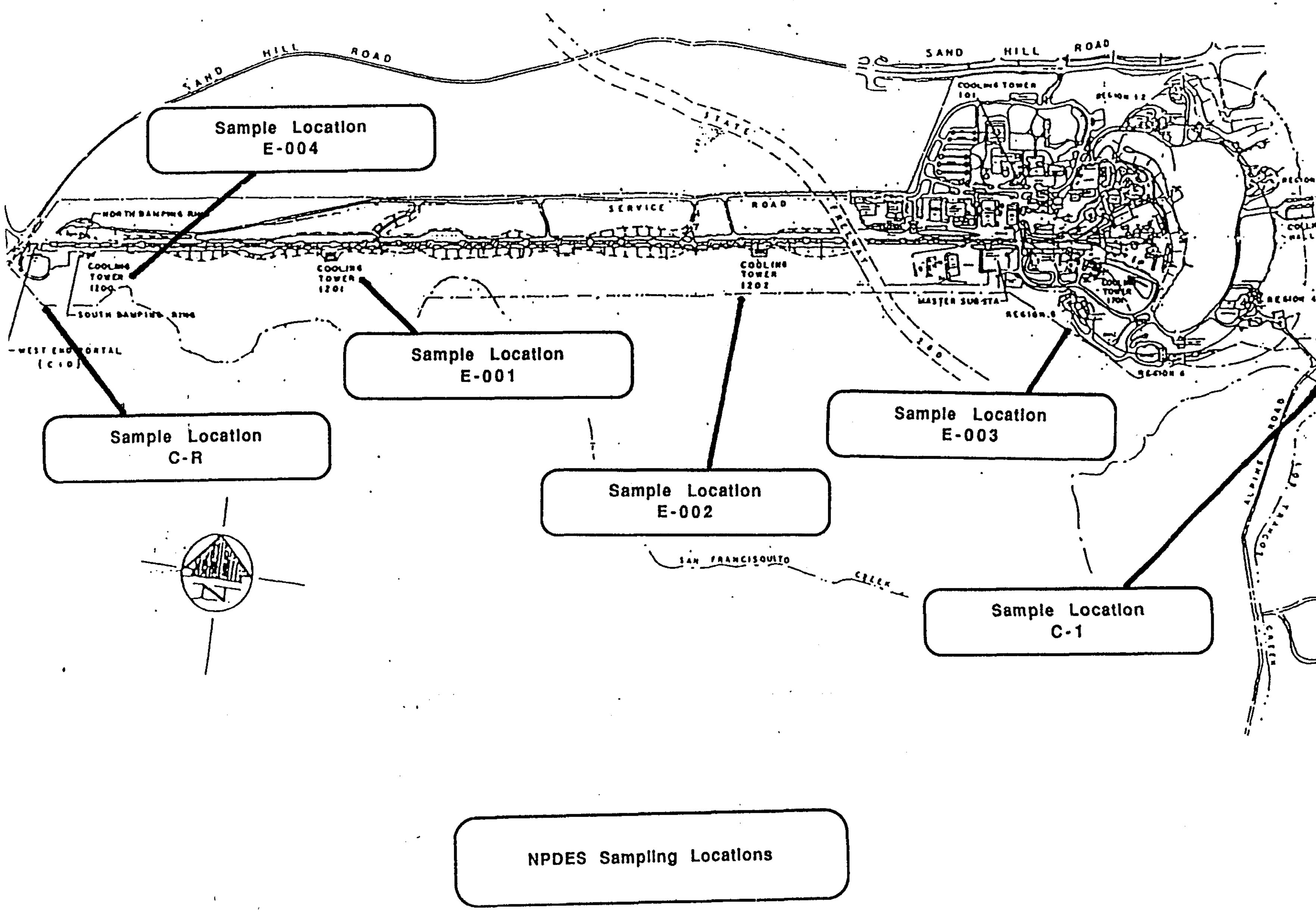

Figure 5.3. NPDES Sampling Locations.

Table V-4.

Results of Heavy Metal Analyses Performed on E-003 Samples

	3/23/90	6/20/90	9/26/90	12/11/90
Antimony (mg/l)	0.3	<0.01	<0.05	<0.05
Barium (mg/l)	NA	NA	0.04	0.04
Copper (mg/l)	0.03	0.05	0.06	0.05
Lead (mg/l)	<0.01	<0.01	0.002	0.009
Nickel (mg/l)	0.01	NA	0.05	<0.02
Zinc (mg/l)	0.05	0.09	0.11	0.21

NA = Not analyzed for that parameter.

Table V-5.

National Pollutant Discharge Elimination System (NPDES)
Sampling Requirements[a]

Sampling Stations	E-001	E-002	E-003	E-004	C-R, C-1[b]	Limit
Flow rate (gal/day)	N/A	N/A	N/A	N/A	M	NONE
Settleable matter (ml/l/hr)	M	M	M	M	N/A	0.1
Oil and grease (mg/l)	W	W	W	W	W	NONE
Total phosphate (mg/l)	W	W	W	W	W	20
Total dissolved solids (mg/l)	W	W	W	W	W	NONE
Total suspended solids (mg/l)	W	W	W	W	W	NONE
pH (units)	M	M	M	M	M	6.5-8.5
Temperature (^oC)	M	M	M	M	M	N/A
Toxicity (% survival)	M	M	M	M	N/A	90
All applicable standard observations	M	M	M	M	M	N/A
Cooling water chemicals (type and lbs/mo added)	M	M	M	M	N/A	N/A

(a) Frequency of Sampling: W = once each week
M = once each month

(b) San Francisquito Creek upstream and downstream of discharge points.

Table V-6.

Standards for Treatment Facility

Wastewater Discharge Permit No. WB860915—PTE
Monitoring Location: Pretreatment effluent outfall uncombined with other waste streams

Constituent	Allowable Maximum	Monitoring Frequency	Sample Type
Oil and grease	100 mg/l[(a)]	—	—
pH (minimum-maximum	6.0-12.5[(b)]	Continuous	Grab or composite
Temperature	150° F	—	—
Arsenic	0.1 mg/l	—	—
Cadmium	0.62 mg/l	Quarterly[(c)]	Composite
Chromium (total)	2.77 mg/l	Quarterly[(c)]	Composite
Copper	3.38 mg/l	Quarterly[(c)]	Composite
Lead	0.69 mg/l	Quarterly[(c)]	Composite
Nickel	3.38 mg/l	Quarterly[(c)]	Composite
Silver	0.43 mg/l	—	—
Zinc	2.61 mg/l	Quarterly[(c)]	Composite
Cyanide (total)	1.20 mg/l[(d)]	Quarterly[(c)]	Grab
Phenols	1.0 mg/l	—	—
Toxic organics	2.13 mg/l[(e)]	Semiannual[(c)]	Grab

(a) Oil and grease of mineral or petroleum origin.
(b) pH of pretreatment effluent continuously monitored by industrial discharger.
(c) Sampling and analysis by SBSA.
(d) Cyanide samples will be collected at the plating shop pretreatment tank uncombined with other waste streams.
(e) Compliance with toxic organics limit will be based on all compounds detected by EPA Analytical Methods 601 and 602.

Table V-7.

Sanitary Sewer Standards

Wastewater Discharge Permit No. WB860915—FNS

Monitoring Location: Flowmeter station adjacent to Sand Hill Road

Constituent	Allowable Maximum	Monitoring Frequency	Sample Type
Daily Flow	64,375 gal	—	—
Oil and grease	100 mg/l[a]	—	—
pH (Minimum-Maximum)	6.0-12.5	—	Grab or composite
Temperature	150° F	—	—
Arsenic	0.1 mg/l	—	—
Cadmium	0.2 mg/l	Quarterly[b]	Composite
Chromium (total)	0.5 mg/l	Quarterly[b]	Composite
Copper	2.0 mg/l	Quarterly[b]	Composite
Lead	1.0 mg/l	Quarterly[b]	Composite
Mercury	0.01 mg/l	—	—
Nickel	1.0 mg/l	Quarterly[b]	Composite
Silver	4.0 mg/l	—	—
Zinc	3.0 mg/l	Quarterly[b]	Composite
Cyanide (total)	1.0 mg/l	—	—
Phenols	1.0 mg/l	—	—

(a) Oil and grease of mineral or petroleum origin.
(b) Sampling and analysis by SBSA.

Table V-8.

Analytical Results of Sanitary Sewer Discharges

A. Plating Shop:

	2/7/90	4/17/90	9/25/90	11/5/90	12/5/90	Limit
Cyanide (mg/l)	<0.02	<0.01	<0.01	<0.01	n/a	1.2
pH (pH units)	8.6	8.5	7.6	8.3	n/a	12.5
Cadmium (mg/l)	<0.005	<0.005	<0.005	<0.005	n/a	0.62
Chromium (mg/l)	0.11	0.06	<0.05	<0.05	n/a	2.77
Copper (mg/l)	0.12	0.26	0.07	0.07	n/a	3.38
Lead (mg/l)	<0.05	<0.05	<0.05	<0.05	n/a	0.69
Nickel (mg/l)	0.14	0.09	0.07	0.18	n/a	3.38
Silver (mg/l)	n/a	n/a	0.02	0.02	n/a	0.43
Zinc (mg/l)	0.22	0.37	0.02	0.033	n/a	2.61
Toxic Organics (mg/l)	n/a	0.014	n/a	n/a	0.049	2.13

B. Sand Hill Road Flow Station:

	2/7/90	4/17/90	9/25/90	11/5/90	12/5/90	Limit
pH (pH units)	8.6	7.9	7.8	8.3	n/a	6 to 12.5
Cadmium (mg/l)	0.005	0.006	0.005	<0.005	n/a	0.2
Chromium (mg/l)	<0.05	0.05	<0.05	<0.05	n/a	0.5
Copper (mg/l)	0.17	0.25	0.25	0.28	n/a	2.0
Lead (mg/l)	<0.05	0.09	<0.05	0.05	n/a	1.0
Nickel (mg/l)	<0.04	0.08	<0.04	0.1	n/a	1.0
Silver (mg/l)	n/a	n/a	0.01	<0.01	n/a	4.0
Zinc (mg/l)	0.343	0.719	0.562	0.311	n/a	3.0
B.O.D. (mg/l)	200	480	420	740	n/a	NONE
T.S.S. (mg/l)	240	670	510	490	n/a	NONE
T.O.C. (mg/l)	97	140	270	470	n/a	NONE

n/a = Not analyzed for that parameter.
B.O.D. = Biological Oxygen Demand.
T.S.S. = Total Suspended Solids.
T.O.C. = Toxic Organic Carbon.

Note: Samples were collected by the South Bayside System Authority (SBSA).

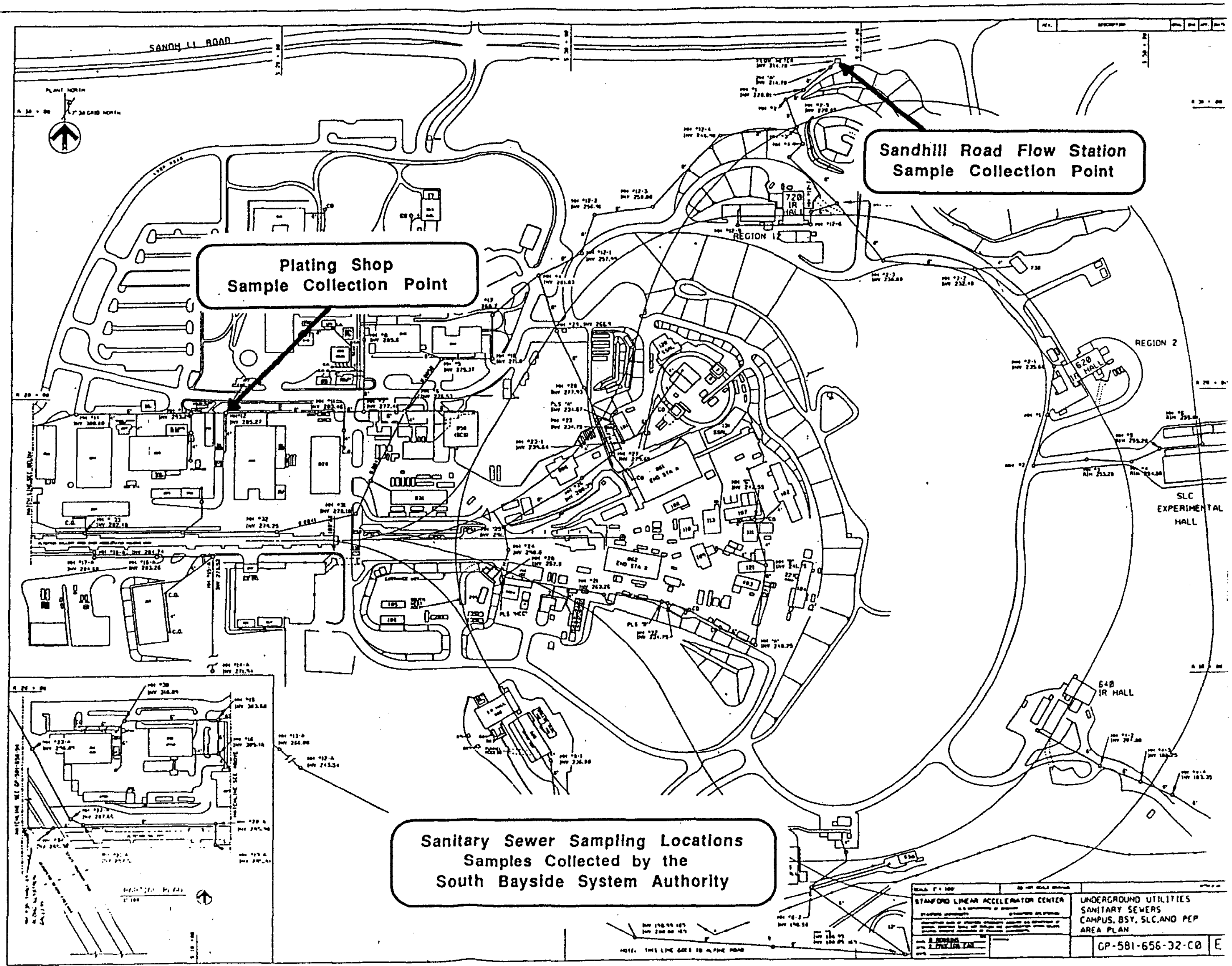

Figure 5.4. Sanitary sewer sampling locations (samples collected by the SBSA).

Areas of Remedial Action or Characterization

1 DIESEL FUEL DISTRIBUTION PUMP
2 SUBSTATION 507
3 5.8 MW POWER SUPPLY
4 INTERACTION REGION 8 SUBSTATION
5 INTERACTION REGION 6 DRAINAGE DITCH
6 MASTER SUBSTATION
7 BUILDING 26 COMPRESSOR
8 DIESEL CONTAMINATED SOIL NEAR COOLING TOWER 101

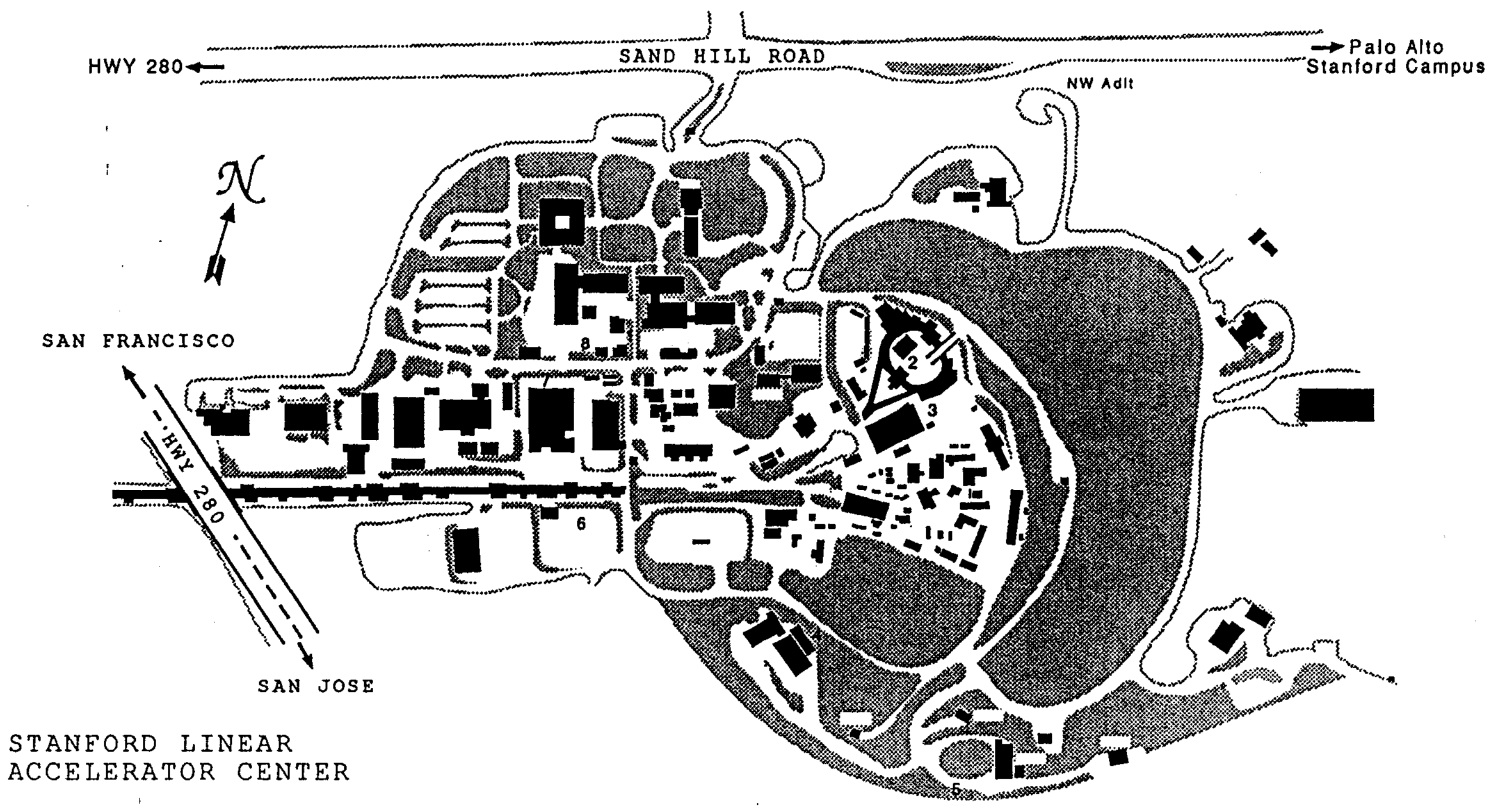

Figure 5.5. Areas of Remedial Action or Characterization.

6.0 Quality Assurance

To address the requirements of quality assurance in the environmental area, a new department, Quality Assurance and Compliance was formed in December of 1990. This organization is tasked with developing quality programs relating to areas such as environmental monitoring, hazardous and radioactive waste, and analytical work performed to support the environmental programs. The department's role will include on-site audits of laboratories performing analytical work, audits and surveillance of SLAC activities, documenting in contracts and procedures Quality Assurance requirements and activities, and developing an overall Quality Assurance program that addresses the area of Environmental Quality Assurance in general.

The Quality Assurance and Compliance department is currently being staffed to support these efforts. A plan to describe the initial six months of audits in accordance with DOE 5400.1 and other related orders is expected to be completed by June 30, 1991.

All sampling at SLAC is covered by proposed Standard Operating Procedures (SOPs) or work orders. Laboratory analyses are performed by outside laboratories that are EPA or State DHS approved for the type of analyses requested. Chain of custody forms are generally used for transmittal of samples to the laboratory.

The SLAC Operational Health Physics Department will be responsible for ensuring appropriate participation in the DOE Laboratory Quality Assurance Program for Radioactive Material.

Appendix A

Atmospheric Dispersion Model

In 1966 an independent evaluation of meteorological regimes at SLAC was performed.[6] From this study an empirical mathematical model was developed. The model that is used predicts the centerline concentration very well, but overestimates the total dosage values.

$$\frac{X^P}{Q} = \frac{G}{\mu}\left(\frac{x^{-1.75+[b(1-c)/\mu]}}{x_o}\right)$$

where:

X^P = centerline concentration (Ci/m^3)
Q = source strength (Ci/s)
G = 8 m^{-2}
μ = mean wind speed (m/s)
x = distance from source (m)
x_o = 2 m
c = fraction of sky covered by low clouds
b = 0.5 m/s day and quad b = -1.2 m/s night .

Figure 4 summarizes peak concentration per unit source strength as a function of wind speed and atmospheric stability at a fixed distance of 400 m (roughly the distance from the source to SLAC's boundaries). To characterize atmospheric stability, the degree of cloud cover is indicated for day and night time regimes. This method is based upon Pasquill's data for cloud expansion for various stability categories.

For a wind speed of 2 m/s atmospheric dilution factors—for determining centerline concentrations—range between 2 x 10^{-5} and 1.5 x 10^{-3} sec/m^3. For purposes of estimating radiation dose at the site boundary, neutral conditions are assumed and a generally conservative dilution factor of 4.5 x 10^{-4} sec/m^3 is used to calculate average concentration at the site boundary (see Fig. 4, curve 1.0).

Because of recent regulatory requirements, DOE has required the use of a computer program called AIRDOSE for calculating population dose from airborne radioactive emissions. The results are tabulated in Appendix C, and the EPA Clean Air Act Compliance Report is also reproduced in this Appendix.

Appendix B

Model For Potential Dose Assessment

According to Department of Energy orders, an assessment of whole-body man-rem dose to the general population near SLAC is required where appropriate. Our site boundary dose due to accelerator operation has generally been less than 10 mrem per year from penetrating radiation. We have estimated the population size to include individual annual doses down to 1 mrem, which corresponds to a distance of approximately 1.6 km from a central point representative of the source of neutrons. The 1 mrem value is approximately 1% of the total natural background dose and is 1% of the technical standards for the general population (DOE Order 5480.11).

There are three major pathways leading to human exposure from ionizing radiation: (1) airborne, (2) food chain and (3) direct exposure to penetrating radiation. Of these three major pathways, only direct exposure to penetrating radiation is of any measurable significance from SLAC operations. The source of this exposure is from neutrons resulting from the absorption of high-energy electrons and photons in the experimental areas creating energetic particles, some of which escape from the heavily shielded enclosures.

In order to make an accurate and realistic assessment of radiation exposure to the public at low doses, it is necessary that exposure from the natural radiation environment be known. This is true because the instruments used respond to natural radiation sources as well as man-made sources, and the portion due to natural radiation must be subtracted from the total measurement. The population exposure assessments appearing in this document are in all cases overstatements of the true impact; hence the resulting values are representative of an upper limit of the possible range.

While the annual neutron dose from accelerator operations at the site boundary has generally been measurable, it has always amounted to less than 10% of the total annual individual dose from natural background radiation. According to an EPA report, the average dose from cosmic, terrestrial and internal radiation in California is 125 mrem. For purposes of comparison, we have rounded this number to 100 mrem.[7]

Another quantity of interest is the population dose in units of man-rem. This is simply the product of average individual dose and the total population exposed. For example, if 1,000 people are exposed to an average annual background dose of 0.1 rem (100 mrem), then the population dose is 0.1 x 1000 or 100 man-rem from natural background radiation. The annual variation of exposure to natural background radiation. The annual variation of exposure to natural background radiation may vary by $\pm$ 20%, largely caused by the differences in naturally occurring uranium, thorium, and potassium present in the ground and in building materials where people live and work.

Two major problems associated with this dose assessment affect overall accuracy of the measurement. First, the conversion of neutron flux to dose requires that the spectrum of neutrons at the measurement point be known, because the quality factor (QF) is a function of neutron energy. Because of the very low neutron fluence at the SLAC boundary and beyond, it is impossible to measure the energy spectrum; therefore, we have selected a QF of ten as a conservative choice. We feel that this choice leads to an overestimate of the neutron dose-equivalent by a factor of approximately two. Until a useful experiment can be performed with neutron yields of sufficient intensity, the quality factor cannot be determined with any better precision.

A second problem is the behavior of neutrons at large distances. Most of the high energy accelerator laboratories have made measurements. They are unique to each facility because of design differences, type of machine, and surrounding topography. Here again we have chosen a conservative formula for calculating the dose at distances other than the point of measurement. Lindenbaum[8] gave a method for evaluating skyshine neutrons which was later verified by Ladu, et al.[9] using Monte Carlo techniques. Lindenbaum approximated the falloff by $(e^{-} R/\lambda)/R$ where R is distance in meters from the source and $\lambda = 250$ m. This equation fits the SLAC data fairly well, and is the one used to predict doses beyond our measuring station (see Fig. 4). We feel that the methods used and reported in this document may overestimate the true population dose by at least an additional factor of two.

The population activity close to SLAC, i.e., within 1.6 km, is a mixture of commerce and residential dwellings. The occupancy factor—the proportion of time throughout the year that these structures are occupied—is assumed to be 1/4 for business activities, and 1.0 for private dwellings. The number of people is estimated for each type of structure, multiplied by the occupancy factor and summed to estimate the total population that might be continuously present.

According to the 1980 census, the City of Menlo Park has an average population density of 602 persons per square kilometer (km^2). The populated area impacted by this source term is 1.5 km^2. The populated area impacted by this source term is 1.5 km^2. Therefore the population total is about 920 people. Previous estimates have resulted in a larger number by a factor of two, which is a function of the analytical model used. For purposes of estimating the population dose, we have rounded the calculated number to 1,000 people.

The same assumptions were used for the CY90 report using a ceiling estimate of 2 mrem to the site boundary. The 2 person-rem collection dose was estimated from this value.

Appendix C
Clean Air Act Compliance Report

40 CFR Part 61
National Emission Standards
for Hazardous Air Pollutants

U.S. Department of Energy
Air Emissions Annual Report
under Subpart H, 40 CFR 61.94
Calendar Year 1990

Site Name: **Stanford Linear Accelerator Center**

Operations Office Information

Office: Department of Energy SF

Address: 1333 Broadway
Oakland, CA 94612

Contact: John Muhlestein Phone: (415) 926-3208

Site Information

Operator: Stanford University

Address: P.O. Box 4349
Stanford, CA 94309

Contact: Gary Warren Phone: (415) 926-3614

The Stanford Linear Accelerator Center (SLAC) is a national facility operated by Stanford University under contract with the U.S. Department of Energy. It is located on the San Francisco peninsula, about halfway between San Francisco and San Jose, California. The site area is a belt of low, rolling foothills, lying between the alluvial plain bordering the San Francisco Bay on the east and the Santa Cruz Mountains on the west.

The whole accelerator site varies in elevation from 53 to 114 meters above sea level, whereas the alluvial plain to the east around the Bay lies less than 46 meters above sea level. The mountains to the west rise abruptly to 610 meters. The SLAC site occupies 170 hectares of land. The site is located in an unincorporated portion of San Mateo County. It is bordered on the north by Sand Hill Road and on the south by San Francisquito Creek.

The SLAC staff is roughly 1500 employees, temporary staff and visiting scientists. The climate in the SLAC area is Mediterranean. Winters are warm (sometimes it rains) and summers are mostly cool and dry.

Menlo Park is the closest incorporated city to SLAC. The populated area around SLAC is a mix of office, school, condominiums, apartments, single family housing and pasture. In 1974, a population estimate within 1.6 km of SLAC was determined by aerial photographs and type of structure. The populated area is about 1.5 km or about 1000 people from 1980 census population density. The total area including open lands is 8 km^2.

SLAC is a component of the U.S. high energy physics program. The laboratory uses a 3.2 km long electron accelerator to produce both electrons and positrons for basic particle physics research.

The facilities at SLAC are used to support research in accelerator technology, maintenance of the accelerator, design and construction of new detector systems.

Radioactive materials are produced by the operation of the accelerator. During the acceleration process some electrons strike accelerator components and induce radioactivity in the material. In addition, some particles interact with air molecules producing short-lived isotopes such as ^{15}O, ^{13}N, ^{11}C, ^{38}Cl and ^{39}Cl. Sealed sources are also used to calibrate radiation monitoring equipment.

The accelerator is housed in a 3.2 km long housing. The housing is located 25 feet below ground. Access to the housing is through 30 inch diameter shafts every 330 feet. These shafts are also used as intake and exhaust shafts for the accelerator housing.

Before machine operation, the housing is searched and locked. There is a cover across each manway shaft which is interlocked with the accelerator. The cover must be in place for machine operation; consequently, the housing can not be vented when the accelerator is in operation.

After the electron beam leaves the accelerator, it is guided to an area where it may interact with a stationary target or allowed to collide with a beam of positrons.

Radionuclides are produced in air in areas where the beam strikes beamline components. The major beam loss areas are the positron source, beam switchyard and the beam dumps for SLC.

Since the covers on the manways are interlocked, there is no release from these points when the machine is on. After the machine is off, the housing can be vented.

The radioactive gas concentration is very low in the accelerator housing because there is very little beam loss, as determined by the level of activation in the accelerator structure.

The positron source is located in an area separated from the accelerator housing by a thick concrete shield. The beam is deflected out of the accelerator into the positron target. The electron beam produces electron/positron pairs in the target. The positrons are separated and transported back to the beginning of the accelerator. Jenkins, et al (CN 226), have reviewed the air activation associated with the operation of the positron target. The activity calculated is listed below:

Isotope	Activity (Curies)
^{15}O	1.4
^{13}N	0.3
^{11}C	0.3
^{38}Cl	0.005
^{39}Cl	0.03

The positron source has a separate exhaust fan. The positron source is not ventilated during machine operation. There is a long pause period between beam off and ventilation (several hours to several days). The distance to nearest occupied areas off site is about 400 m.

The vents on the beam switchyard and Beam Dump East have covers. The covers are closed during beam operation.

For the past several years, SLAC has been commissioning and operating a new machine called the SLAC Linear Collider (SLC). The SLC is the upgraded linear accelerator which produces 50 GeV positrons and electrons. These beams are deflected into transport systems which guide them to an interaction point. The electrons and positrons remaining in the beam after the collision are deflected into beam dumps.

The beam dumps are located in shield rooms in the SLC arcs. The radioactivity produced in these areas has been studied by Jenkins, et al. (CN-227). The activity produced for 20 kw in the dump area is listed in the table below:

Isotope	Activity (Curies)
^{15}O	0.1
^{13}N	0.02
^{11}C	0.03
^{38}Cl	0.004
^{39}Cl	0.003

The SLC arcs and dump areas are not vented during beam operation. The distance from the north arc SLC vent to the nearest occupied area off site is 100 m.

There are four vents on the beam switchyard. If we use the activity produced in the SLC tunnel as the release from each vent, this will give a conservative estimate of the effective dose equivalent to people off site.

There are two damping rings associated with the SLC. The rings are located on the north and south sides of the accelerator at the end of Sector 1. The saturation activity produced in each ring has been calculated by Jenkins, (CN 51). The isotopes produced and the saturation activity are listed in the following table:

Isotope	Activity (Ci)
^{15}O	9×10^{-3}
^{13}N	1.6×10^{-3}
^{11}C	3×10^{-4}
^{38}Cl	1.6×10^{-6}
^{39}Cl	4×10^{-5}

The Stanford Synchrotron Radiation Laboratory has a 3 GeV booster that produces very low concentrations of radioactive gases. The isotopes and saturation activities are listed in the following table.

Isotope	Activity (Ci)
^{15}O	3.7×10^{-4}
^{13}N	6.9×10^{-4}
^{11}C	7.7×10^{-5}
^{38}Cl	1.5×10^{-6}
^{39}Cl	9.8×10^{-6}

(The activity is taken from a memo to file by R. Donahue, December 9, 1989.) The booster ring does not have forced air ventilation.

A radioactive gas monitor is provided at each vent from the BSY, positron source and SLC vent. The monitors consist of a detector unit at the vent and the pulse processing equipment located in the Main Control Room.

The detector unit is a GM tube mounted inside a nine liter volume. Gas from the vent is pulsed through the volume while the exhaust fan at the vent is on. When the exhaust fan is turned off the pump pulling air through the volume is turned off.

The GM tube is 11 inches long x 5/8 inch diameter. The wall is 50 milligrams per square centimeter. The GM tube inside the nine liter volume was calibrated using ^{85}Kr gas. The sensitivity of the equipment is 2×10^{-8} μCi/cc per count per minute.

The isotopes being monitored are beta emitters. The maximum energy of the spectrum is as follows:

Isotope	Beta Energy
^{15}O	1.74 MeV
^{13}N	1.2 MeV
^{11}C	0.97 MeV
^{41}Ar	1.79 MeV
^{38}Cl	4.8 and 1.1 MeV
^{39}Cl	1.91 MeV
^{85}Kr	0.7 MeV

Since ^{85}Kr has the lowest energy, the detector will be more sensitive to the other isotopes. The net result is that by calibrating to ^{85}Kr, SLAC is reporting a higher concentration than is actually present.

The pulses from the detector are stored in history buffers which are read out by the VAX computer. The data is analyzed to determine a concentration and total activity for each vent.

The activity used for assessing compliance is listed in the following tables: The activity was calculated using internal reports and memos to file.

Isotope	Positron Source	SLC Beam Dump	Damping Ring	Acc. Housing	Beam Switchyard	SSRL Booster Injector	Total
^{15}O	1.4	0.2	1.8×10^{-2}	0.1	0.1	3.7×10^{-4}	1.8
^{13}N	0.3	0.04	3.2×10^{-3}	0.02	0.02	7×10^{-4}	0.38
^{11}C	0.3	0.06	6×10^{-4}	0.03	0.03	8×10^{-5}	0.42
^{38}Cl	0.005	0.008	1.3×10^{-6}	0.004	0.004	1.6×10^{-6}	0.021
^{39}Cl	0.03	0.006	8×10^{-5}	0.003	0.003	4×10^{-5}	0.042
Total (Ci)	2.0	0.30	0.02	0.15	0.15	0.0012	2.7
Distance (Meters)	400	100	400	400	400	400	
EDE (mrem)	0.0061	0.0072	6.2×10^{-5}	4.7×10^{-4}	4.7×10^{-4}	3.7×10^{-6}	0.014

Use 0.0031 mrem/Ci at 400 meters, 0.013 mrem/Ci at 100 meters.

Section II. Air Emissions Data

Point Source	Type Control Efficiency	Distance to Receptor
Positron Source	Not vented during beam operation	400 m
Damping Ring	Not vented during beam operation	400 m
SLC North	Not vented during beam operation	100 m
SLC South	Not vented during beam operation	100 m

Grouped Source	Type Control - Efficiency	Distance to Receptor
Acc. Housing	Not vented during beam operation	400 m
BSY	Not vented during beam operation	400 m
SSRL Booster Synchrotron	Not vented beam operation	400 m

Radionuclide Isotope	Annual Quantity (Ci) Activity (Curies)
^{15}O	1.8
^{13}N	0.38
^{11}C	0.42
^{38}Cl	0.021
^{39}Cl	0.042
Total	2.7 Curies

Section III. Dose Assessments

Description of Dose Model

PC Air Dos Version 3.0

Summary of Input Parameters

See Attachments 1 and 2

Compliance Assessment

The assessment of the potential activity release is based on calculations of the activity produced and the immediate release of all of the activity at one time. This is a very conservative approach since ^{15}O dominates the dose calculation. ^{15}O has a two (2) minute half-life and the time between turning the beam off and venting is long (probably in excesss of an hour, which is 30 half-lives). The compliance assessment uses the computer code PC AirDos Version 3.0 to calculate the dose. Since the smallest input for distance is 300 meters, the dose at 100 meters was extrapolated using the 300 and 400 meter data points.

Effective Dose Equivalent: 0.014 mrem

Certification

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment. (See 18 U.S.C. 1001).

Name: ____

Signature: ______________________________ Date: ________

Appendix D

Calibration and Quality Assurance Procedures

The natural background radiation provides continuous verification that the monitoring equipment is connected and functioning properly. During accelerator downtime and any interrupted operation, background provides a calibration baseline as well.

A regular calibration procedure was initiated in 1984 using two small radioactive sources. The sources are placed at a measured distance to produce a known dose equivalent rate. The equipment is kept in normal operation during these checks. The data printout is marked so that the calibration data is not confused with normal measurements. This procedure will be repeated twice each year, and following equipment repair or maintenance. Response to natural background radiation provides proof that the instruments are operating properly.

Airborne Radioactive Monitoring Equipment:

A dose equivalent from gaseous radioactivity reaching the site boundary (if large enough) would be detected by the PMS, which has its own quality assurance procedures.

The separate radioactive gas monitors for each ventilation fan are inspected and calibrated at the beginning of each accelerator cycle. They are calibrated with a small radioactive source. During operation the natural background radiation response assures that they are operating properly. Extensive revisions of calibration procedures were effected in CY91.

Liquid Radiological Effluent:

All water samples are analyzed by certified analytical laboratories, which have their own documented quality assurance procedures. The CY90 analyses were performed by Controls for Environmental Pollution, Inc., Albuquerque, New Mexico, a State of California approved laboratory.

Appendix E
Compliance Assessment Summary
January—April 1, 1991

Compliance Status

CWA:

Results from subsequent sampling/analysis of groundwater confirmed previous findings that groundwater in the area is high in total dissolved solids and is slow to recharge. Volatile organic compounds at levels above state MCL's for drinking water were detected in water from several of the wells. This data was transmitted to the Regional Water Quality Control Board on January 17, 1991.

On March 25, 1991, a letter was sent to the South Bay Systems Authority requesting approval to discharge cooling tower blowdown water to the sanitary sewer rather than to San Francisquito Creek as cited in the NPDES permit.

Current Issues and Actions

Low-Level Radioactive Wastes Activities:

On March 12, 1991, 100 cubic yards of waste concrete with induced activity less than 25 picocuries/gram was sent to the Ox Mountain Land Disposal facility in San Mateo County.

Appendix F

This appendix contains the analytical results of samples collected under SLAC's National Pollutant Discharge Elimination Permit (NPDES).

Stanford Linear Accelerator Center

SAMPLE LOCATION		E-001	E-002	E-003	CK-1	CK-2
FLOW RATE (GALLONS/DAY)						
MAXIMUM		31400	20200	75900	504000	720000
AVERAGE		9079	6464	8413	N/A	N/A
MINIMUM		0	0	0	0	0
SETTLEABLE MATTER ml/1/hr	5-Jan	<0.1	<0.1	<0.1	NR	NR
	12-Jan	<0.1	<0.1	<0.1	NR	NR
	19-Jan	<0.1	<0.1	<0.1	NR	NR
	26-Jan	<0.1	<0.1	<0.1	NR	NR
OIL AND GREASE mg/l	5-Jan	<1	<1	<1	<1	<1
	8-Jan	<1	2	240	NA	NA
	12-Jan	<1	<1	7	<1	5
	19-Jan	2	<1	<1	<1	<1
	22-Jan	<1	<1	<1	NA	NA
	26-Jan	<1	<1	2	<1	5
	29-Jan	NF	NF	NF	NA	NA
THIRTY DAY AVERAGE mg/l		1.1	1.1	42.0	0.9	3.0
OIL AND GREASE lbs/day	5-Jan	NF	NF	NF	NA	NA
	8-Jan	0.05	0.10	0.60	NA	NA
	12-Jan	NF	NF	NF	NA	NA
	19-Jan	NF	NF	NF	NA	NA
	22-Jan	0.07	0.07	0.03	NA	NA
	26-Jan	0.02	0.02	0.06	NA	NA
	29-Jan	N/A	N/A	NF	NA	NA
THIRTY DAY AVERAGE lbs/day		0.05	0.06	0.23	NA	NA
TOTAL PHOSPHATES mg/l	5-Jan	15.7	13.8	5.4	0.1	0.1
	8-Jan	14.5	13.0	4.1	0.1	0.1
	12-Jan	14.5	13.0	1.5	0.0	0.4
	19-Jan	20.7	18.4	5.9	0.0	0.2
	22-Jan	17.6	17.2	0.1	0.0	0.1
	26-Jan	9.2	8.8	0.1	0.2	0.1
	29-Jan	NF	NF	NF	NA	NA
THIRTY DAY AVERAGE mg/l		15.4	14.0	2.8	0.1	0.2
TOTAL PHOSPHATES lbs/day	5-Jan	NF	NF	NF	NA	NA
	8-Jan	0.76	0.64	0.01	NA	NA
	12-Jan	NF	NF	NF	NA	NA
	19-Jan	NF	NF	NF	NA	NA
	22-Jan	1.38	1.31	0.00	NA	NA
	26-Jan	0.19	0.22	0.00	NA	NA
	29-Jan	N/A	N/A	NF	NA	NA
THIRTY DAY AVERAGE lbs/day		0.78	0.72	0.01	NA	NA

Stanford Linear Accelerator Center

SAMPLE LOCATION		E-001	E-002	E-003	CK-1	CK-2
TOTAL DISSOLVED SOLIDS						
mg/l	5-Jan	580	606	928	504	863
	8-Jan	532	552	788	462	832
	12-Jan	530	522	98	432	780
	19-Jan	522	512	920	372	568
	22-Jan	472	490	1368	432	630
	26-Jan	518	542	1355	496	734
	29-Jan	NF	NF	NF	NA	NA
THIRTY DAY AVERAGE						
mg/l		526	537	910	450	735
lbs/day		0.00	0.00	0.01	0.00	0.01
TOTAL SUSPENDED SOLIDS						
mg/l	5-Jan	5.4	3.4	1.2	1.4	1.8
	8-Jan	2.6	1.8	7.6	3.2	1.8
	12-Jan	5.4	2.2	6.2	<1	2.4
	19-Jan	3.4	1.8	1.8	1.2	3.2
	22-Jan	1.8	1.2	<1	<1	1.6
	26-Jan	2.2	2.4	1.6	1.2	1.8
	29-Jan	NF	NF	NF	NA	NA
THIRTY DAY AVERAGE						
mg/l		3.5	2.8	3.7	1.8	2.1
lbs/day		0.00	0.00	0.00	0.00	0.00
STANDARD OBSERVATIONS						
pH:		7.4	7.4	7.4	7.8	7.8
WATER TEMP. (F):		81	79	62	40	40
COLOR:		clear	clear	clear	clear	clear
ODOR		none	none	none	none	none
TOXICITY: (% Survival at 96 hours)		100%	100%	95%	NR	NR

NF= No flow NA= Not applicable NR= Not Required
Samples collected during "no-flow" or "no blow-down" periods were not used in calculating averages.

Stanford Linear Accelerator Center

SAMPLE LOCATION		E-001	E-002	E-003	CK-1	CK-2
FLOW RATE (GALLONS/DAY)						
MAXIMUM		0	0	82700	504000	720000
AVERAGE		0	0	4824	N/A	N/A
MINIMUM		0	0	0	0	0
SETTLEABLE MATTER ml/1/hr	2-Feb	NA	NA	<0.1	NR	NR
	9-Feb	NA	NA	<0.1	NR	NR
	16-Feb	NA	NA	0.2	NR	NR
	23-Feb	NA	NA	<0.1	NR	NR
OIL AND GREASE mg/l	2-Feb	NF	NF	5	<1	<1
	5-Feb	NF	NF	3	NA	NA
	9-Feb	NF	NF	<1	<1	<1
	12-Feb	NF	NF	5	NA	NA
	16-Feb	NF	NF	2	11	3
	23-Feb	NF	NF	19	2	2
	26-Feb	NF	<1	<1	NA	NA
THIRTY DAY AVERAGE mg/l		NA	NA	5.1	3.7	1.7
OIL AND GREASE lbs/day	2-Feb	NF	NF	NF	NA	NA
	5-Feb	NF	NF	NF	NA	NA
	9-Feb	NF	NF	NF	NA	NA
	12-Feb	NF	NF	0.12	NA	NA
	16-Feb	NF	NF	NF	NA	NA
	23-Feb	NF	NF	NF	NA	NA
	26-Feb	NF	NF	0.02	NA	NA
THIRTY DAY AVERAGE lbs/day		NA	NA	0.07	NA	NA
TOTAL PHOSPHATES mg/l	2-Feb	NF	NF	4.4	0.3	0.6
	5-Feb	NF	NF	0.9	0.5	1.0
	9-Feb	NF	NF	3.6	0.3	0.4
	12-Feb	NF	NF	1.3	0.2	0.4
	16-Feb	NF	NF	0.5	0.6	0.5
	23-Feb	NF	NF	0.4	0.3	0.3
	26-Feb	NF	13.0	5.0	0.2	0.3
THIRTY DAY AVERAGE mg/l		NA	NA	2.3	0.4	0.5
TOTAL PHOSPHATES lbs/day	2-Feb	NF	NF	NF	NA	NA
	5-Feb	NF	NF	NF	NA	NA
	9-Feb	NF	NF	NF	NA	NA
	12-Feb	NF	NF	0.03	NA	NA
	16-Feb	NF	NF	NF	NA	NA
	23-Feb	NF	NF	NF	NA	NA
	26-Feb	NF	NF	0.10	NA	NA
THIRTY DAY AVERAGE lbs/day		NA	NA	0.07	NA	NA

Stanford Linear Accelerator Center

SAMPLE LOCATION		E-001	E-002	E-003	CK-1	CK-2
TOTAL DISSOLVED SOLIDS						
mg/l	2-Feb	NF	NF	230	388	754
	5-Feb	NF	NF	212	316	408
	9-Feb	NF	NF	448	366	494
	12-Feb	NF	NF	368	426	548
	16-Feb	NF	NF	62	322	308
	23-Feb	NF	NF	306	440	474
	26-Feb	NF	1	1	5	3
THIRTY DAY AVERAGE						
mg/l		NA	NA	232	323	427
lbs/day		NA	NA	0.00	0.00	0.00
TOTAL SUSPENDED SOLIDS						
mg/l	2-Feb	NF	NF	4.8	1.2	1.6
	5-Feb	NF	NF	1.6	6.2	37.0
	9-Feb	NF	NF	2.4	3.6	2.8
	12-Feb	NF	NF	1.2	1.6	2.8
	16-Feb	NF	NF	45.0	117.0	119.0
	23-Feb	NF	NF	<1	6.8	3.8
	26-Feb	NF	1.2	1.2	5.4	2.8
THIRTY DAY AVERAGE						
mg/l		NA	NA	9.4	20.3	24.3
lbs/day		NA	NA	0.00	0.00	0.00
STANDARD OBSERVATIONS						
	pH:	NF	NF	7.4	7.6	7.6
	WATER TEMP. (F):	NF	NF	58	46	46
	COLOR:	NF	NF	clear	clear	clear
	ODOR	NF	NF	none	none	none
	TOXICITY: (% Survival at 96 hours)	NF	NF	100%	NR	NR

NF= No flow NA= Not applicable NR= Not Required

Samples collected during "no-flow" or "no blow-down" periods were not used in calculating averages.

Stanford Linear Accelerator Center

SAMPLE LOCATION		E-001	E-002	E-003	CK-1	CK-2
FLOW RATE (GALLONS/DAY)						
MAXIMUM		4250	0	17900	504000	720000
AVERAGE		274	0	2494	N/A	N/A
MINIMUM		0	0	10800	0	0
SETTLEABLE MATTER ml/1/hr	2-Mar	NF	0.1	0.4	NR	NR
	9-Mar	NF	<0.1	<0.1	NR	NR
	16-Mar	<0.1	<0.1	0.2	NR	NR
	23-Mar	<0.1	<0.1	<0.1	NR	NR
	30-Mar	<0.1	<0.1	<0.1	NR	NR
OIL AND GREASE mg/l	2-Mar	NF	1	2	2	1
	5-Mar	NF	1	1	NF	NF
	9-Mar	NF	<1	<1	<1	2
	12-Mar	NF	3	<1	NF	NF
	16-Mar	<1	<1	1	2	<1
	19-Mar	<1	<1	<1	NF	NF
	23-Mar	<1	<1	<1	<1	<1
	26-Mar	<1	2	2	NF	NF
	30-Mar	<1	<1	<1	<1	<1
THIRTY DAY AVERAGE mg/l		0.9	1.3	1.2	1.3	1.1
OIL AND GREASE lbs/day	2-Mar	NF	NF	NF	NA	NA
	5-Mar	NF	NF	NF	NA	NA
	9-Mar	NF	NF	NF	NA	NA
	12-Mar	NF	NF	0.01	NA	NA
	16-Mar	NF	NF	NF	NA	NA
	19-Mar	NF	NF	0.00	NA	NA
	23-Mar	NF	NF	NF	NA	NA
	26-Mar	NF	NF	0.09	NA	NA
	30-Mar	NF	NF	0.05	NA	NA
THIRTY DAY AVERAGE lbs/day		NF	NF	0.04	NA	NA
TOTAL PHOSPHATES mg/l	2-Mar	NF	12.6	1.2	0.1	0.2
	5-Mar	NF	11.3	1.0	0.2	0.1
	9-Mar	NF	1.7	13.1	<0.03	<0.03
	12-Mar	NF	13.9	1.0	<0.03	<0.03
	16-Mar	4.7	14.1	3.1	<0.03	<0.03
	19-Mar	10.6	13.8	2.1	<0.03	<0.03
	23-Mar	9.0	17.0	1.2	0.1	0.1
	26-Mar	10.0	17.0	2.4	<0.03	0.1
	30-Mar	37.0	17.0	11.0	0.1	0.1
THIRTY DAY AVERAGE mg/l		14.3	13.2	4.0	0.1	0.1
TOTAL PHOSPHATES lbs/day	2-Mar	NF	NF	NF	NA	NA
	5-Mar	NF	NF	NF	NA	NA
	9-Mar	NF	NF	NF	NA	NA
	12-Mar	NF	NF	0.01	NA	NA
	16-Mar	NF	NF	NF	NA	NA
	19-Mar	NF	NF	0.01	NA	NA
	23-Mar	NF	NF	NF	NA	NA
	26-Mar	NF	NF	0.11	NA	NA
	30-Mar	NF	NF	0.61	NA	NA
THIRTY DAY AVERAGE lbs/day		NF	NF	0.18	NA	NA

S. .ford Linear Accelerator Center

SAMPLE LOCATION		E-001	E-002	E-003	CK-1	CK-2
TOTAL DISSOLVED SOLIDS						
mg/l	2-Mar	NF	158	124	406	560
	5-Mar	NF	186	1220	424	506
	9-Mar	NF	1120	256	444	514
	12-Mar	NF	290	753	455	573
	16-Mar	170	400	248	488	536
	19-Mar	180	386	824	466	578
	23-Mar	172	408	1258	428	494
	26-Mar	210	466	1200	480	470
	30-Mar	730	464	680	438	586
THIRTY DAY AVERAGE						
mg/l		292	431	729	448	535
lbs/day		0.00	0.00	0.01	0.00	0.00
TOTAL SUSPENDED SOLIDS						
mg/l	2-Mar	NF	1.2	74.0	2.4	5.6
	5-Mar	NF	1.8	1.4	8.6	6.2
	9-Mar	NF	1.4	1.8	1.2	1.2
	12-Mar	NF	<1	5.6	1.6	<1
	16-Mar	2.4	2.2	11.0	1.4	4.8
	19-Mar	2.2	2.4	12.0	2.8	2.8
	23-Mar	1.2	1.2	2.4	2.2	1.2
	26-Mar	1.2	1.2	1.6	1.8	1.8
	30-Mar	1.8	<1	5.6	1.2	1.6
THIRTY DAY AVERAGE						
mg/l		1.8	7.9	12.8	2.6	3.2
lbs/day		0.00	0.00	0.00	0.00	0.00
STANDARD OBSERVATIONS						
	pH:	7.6	7.3	7.4	7.6	7.7
	WATER TEMP. (F):	70	71	70	51	51
	COLOR:	clear	clear	clear	clear	clear
	ODOR	none	none	none	none	none
	TOXICITY: (% Survival at 96 hours)	NF	NF	100%	NR	NR

NF= No flow NA= Not applicable NR= Not Required

Samples collected during "no-flow" or "no blow-down" periods were not used in calculating averages.

SAMPLE LOCATION		E-001	E-002	E-003	CK-1	CK-2
FLOW RATE (GALLONS/DAY)						
MAXIMUM		39220	12500	48300	432000	432000
AVERAGE		1383	987	10486	N/A	N/A
MINIMUM		0	0	27500	0	0
SETTLEABLE MATTER ml/1/hr	6-Apr	<0.1	<0.1	<0.1	NR	NR
	13-Apr	<0.1	<0.1	0.4	NR	NR
	20-Apr	<0.1	<0.1	0.1	NR	NR
	27-Apr	<0.1	<0.1	<0.1	NR	NR
THIRTY DAY AVERAGE mg/l		0.9	0.9	0.6	NR	NR
OIL AND GREASE mg/l	2-Apr	<1	<1	<1	NF	NF
	6-Apr	<1	<1	<1	<1	1
	9-Apr	1	<1	<1	NF	NF
	13-Apr	<1	<1	<1	<1	<
	16-Apr	<1	1	1	NF	NF
	20-Apr	1	3	<1	<1	<1
	23-Apr	<1	<1	<1	NF	NF
	27-Apr	<1	<1	<1	<1	1
	30-Apr	2	1	3	NF	NF
THIRTY DAY AVERAGE mg/l		1.0	1.2	1.1	0.9	1.0
OIL AND GREASE lbs/day	2-Apr	NF	NF	0.09	NR	NR
	6-Apr	NF	NF	0.15	NR	NR
	9-Apr	0.00	NF	0.05	NR	NR
	13-Apr	NF	NF	0.06	NR	NR
	16-Apr	NF	NF	0.07	NR	NR
	20-Apr	0.00	NF	0.16	NR	NR
	23-Apr	NF	NF	NF	NR	NR
	27-Apr	NF	0.09	0.20	NR	NR
	30-Apr	NF	NF	NF	NR	NR
THIRTY DAY AVERAGE lbs/day		NF	NF	0.11	NR	NR
TOTAL PHOSPHATES mg/l	2-Apr	50.0	17.0	0.8	0.1	0.1
	6-Apr	43.0	17.0	12.0	0.1	0.1
	9-Apr	33.0	17.0	0.6	0.1	0.2
	13-Apr	27.0	19.0	0.9	0.2	0.3
	16-Apr	23.0	18.0	11.0	0.2	0.6
	20-Apr	14.0	13.0	8.0	0.1	0.2
	23-Apr	12.0	32.0	8.3	0.2	0.5
	27-Apr	11.0	12.0	9.8	0.1	0.1
	30-Apr	10.0	12.0	11.0	0.1	0.2
THIRTY DAY AVERAGE mg/l		24.8	17.4	6.9	0.1	0.3
TOTAL PHOSPHATES lbs/day	2-Apr	NF	NF	0.07	NR	NR
	6-Apr	NF	NF	1.98	NR	NR
	9-Apr	0.08	NF	0.04	NR	NR
	13-Apr	NF	NF	0.07	NR	NR
	16-Apr	NF	NF	0.74	NR	NR
	20-Apr	0.01	NF	1.43	NR	NR
	23-Apr	NF	NF	NF	NR	NR
	27-Apr	NF	1.26	2.14	NR	NR
	30-Apr	NF	NF	NF	NR	NR
THIRTY DAY AVERAGE lbs/day		NF	NF	0.92	NR	NR

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SAMPLE LOCATION		E-001	E-002	E-003	CK-1	CK-2
TOTAL DISSOLVED SOLIDS						
mg/l	2-Apr	652	506	1254	430	590
	6-Apr	646	474	642	412	596
	9-Apr	460	500	1178	452	588
	13-Apr	526	568	410	468	650
	16-Apr	534	586	718	464	718
	20-Apr	488	628	674	544	636
	23-Apr	490	582	684	424	772
	27-Apr	498	586	636	422	618
	30-Apr	510	598	668	420	682
THIRTY DAY AVERAGE						
mg/l		534	559	763	448	650
lbs/day		0.00	0.00	0.01	0.00	0.01
TOTAL SUSPENDED SOLIDS						
mg/l	2-Apr	1.8	1.2	<1	2.2	2.2
	6-Apr	1.8	1.8	5.2	1.4	2.4
	9-Apr	1.6	1.4	3.6	1.8	2.2
	13-Apr	<1	<1	55.0	1.2	143.0
	16-Apr	<1	1.8	1.8	1.4	<1
	20-Apr	2.4	1.2	3.2	1.4	1.2
	23-Apr	1.8	<1	1.6	4.6	2.6
	27-Apr	1.4	1.4	3.2	3.8	3.6
	30-Apr	2.4	1.6	3.6	3.2	2.2
THIRTY DAY AVERAGE						
mg/l		1.9	5.8	9.7	2.3	19.9
lbs/day		0.00	0.00	0.00	0.00	0.00
STANDARD OBSERVATIONS						
	pH:	7.4	7.5	7.5	7.8	7.5
	WATER TEMP. (F):	75	75	74	56	56
	COLOR:	clear	clear	clear	clear	clear
	ODOR	none	none	none	none	none
	TOXICITY: (% Survival at 96 hours)	100%	100%	100%	NR	NR

NF= No flow NA= Not applicable NR= Not Required

Samples collected during "no-flow" or "no blow-down" periods were not used in calculating averages.

SAMPLE LOCATION		E-001	E-002	E-003	CK-1	CK-2
FLOW RATE (GALLONS/DAY)						
MAXIMUM		38870	49940	86560	432000	432000
AVERAGE		4089	5730	13168	N/A	N/A
MINIMUM		0	0	102100	0	0
SETTLEABLE MATTER ml/1/hr	4-May	<0.1	<0.1	<0.1	NR	NR
	11-May	<0.1	<0.1	0.1	NR	NR
	18-May	<0.1	<0.1	0.1	NR	NR
	25-May	<0.1	<0.1	<0.1	NR	NR
THIRTY DAY AVERAGE mg/l		0.9	0.9	0.5	NR	NR
OIL AND GREASE mg/l	4-May	<1	<1	<1	<1	<1
	7-May	<1	<1	<1	NF	NF
	11-May	<1	<1	<1	<1	<1
	14-May	<1	<1	<1	NF	NF
	18-May	<1	1	1	<1	<1
	21-May	2	<1	<1	NF	NF
	25-May	<1	<1	<1	1	1
THIRTY DAY AVERAGE mg/l		1.1	0.9	0.9	0.9	0.9
OIL AND GREASE lbs/day	4-May	0.00	NF	0.02	NR	NR
	7-May	0.02	NF	0.10	NR	NR
	11-May	0.00	0.00	NF	NR	NR
	14-May	0.05	0.07	0.11	NR	NR
	18-May	NF	NF	NF	NR	NR
	21-May	0.16	NF	0.15	NR	NR
	25-May	NF	NF	NF	NR	NR
THIRTY DAY AVERAGE lbs/day		NF	NF	0.10	NR	NR
TOTAL PHOSPHATES mg/l	4-May	10.0	17.0	6.9	0.1	0.3
	7-May	9.6	20.0	13.0	0.0	0.5
	11-May	5.7	19.0	12.0	<0.03	0.2
	14-May	4.6	25.0	12.0	<0.03	0.2
	18-May	4.2	24.0	31.0	<0.03	0.3
	21-May	0.3	24.0	1.1	0.2	0.1
	25-May	13.0	26.0	13.0	0.1	0.4
THIRTY DAY AVERAGE mg/l		6.8	22.1	12.7	0.1	0.3
TOTAL PHOSPHATES lbs/day	4-May	0.01	NF	0.12	NR	NR
	7-May	0.21	NF	1.50	NR	NR
	11-May	0.00	0.02	NF	NR	NR
	14-May	0.27	2.02	1.52	NR	NR
	18-May	NF	NF	NF	NR	NR
	21-May	0.02	NF	0.19	NR	NR
	25-May	NF	NF	NF	NR	NR
THIRTY DAY AVERAGE lbs/day		NF	NF	0.83	NR	NR

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SAMPLE LOCATION		E-001	E-002	E-003	CK-1	CK-2
TOTAL DISSOLVED SOLIDS						
mg/l	4-May	592	714	898	502	732
	7-May	606	756	712	502	800
	11-May	592	598	656	484	794
	14-May	500	626	662	456	844
	18-May	608	688	660	450	906
	21-May	580	766	986	474	802
	25-May	648	922	742	488	692
THIRTY DAY AVERAGE						
mg/l		589	724	759	479	796
lbs/day		0.00	0.01	0.01	0.00	0.01
TOTAL SUSPENDED SOLIDS						
mg/l	4-May	2.4	1.2	2.4	1.6	1.4
	7-May	1.8	1.4	2.2	1.4	2.4
	11-May	1.8	1.2	3.2	1.6	1.4
	14-May	1.6	<1	4.8	1.2	1.6
	18-May	1.2	<1	5.2	2.8	2.2
	21-May	1.8	<1	<1	1.4	2.8
	25-May	1.4	<1	2.2	<1	1.6
THIRTY DAY AVERAGE						
mg/l		1.7	2.6	3.3	1.7	1.9
lbs/day		0.00	0.00	0.00	0.00	0.00
STANDARD OBSERVATIONS						
	pH:	7.4	7.5	7.5	8.4	8.5
	WATER TEMP. (F):	80	80	75	60	60
	COLOR:	clear	clear	clear	clear	clear
	ODOR	none	none	none	none	none
	TOXICITY: (% Survival at 96 hours)	100%	100%	100%	NR	NR

NF= No flow NA= Not applicable NR= Not Required
Samples collected during "no-flow" or "no blow-down" periods were not used in calculating averages.

Stanford Linear Accelerator Center

		E-001	E-002	E-003	E-004	CK-1	CK-2
SAMPLE LOCATION		E-001	E-002	E-003	E-004	CK-1	CK-2
FLOW RATE (GALLONS/DAY)							
MAXIMUM		18030	37500	65100	30400	57600	72000
AVERAGE		3809	5015	11697	4700	N/A	N/A
MINIMUM		0	0	2500	0	0	0
SETTLEABLE MATTER ml/1/hr	1-Jun	<0.1	<0.1	<0.1	<0.1	NR	NR
	8-Jun	<0.1	<0.1	0.2	<0.1	NR	NR
	15-Jun	<0.1	<0.1	0.1	<0.1	NR	NR
	22-Jun	0.1	<0.1	0.1	<0.1	NR	NR
	29-Jun	<0.1	<0.1	0.6	<0.1	NR	NR
THIRTY DAY AVERAGE mg/l		0.7	0.9	0.4	0.9	NR	NR
OIL AND GREASE mg/l	1-Jun	2	1	1	2	<1	<1
	4-Jun	<1	<1	<1	<1	NF	NF
	8-Jun	<1	<1	<1	<1	<1	<1
	11-Jun	1	<1	<1	3	NF	NF
	15-Jun	<1	3	5	2	2	<1
	18-Jun	2	3	2	2	NF	NF
	22-Jun	4	<1	<1	<1	<1	<1
	25-Jun	<1	<1	<1	2	NF	NF
	29-Jun	<1	<1	<1	<1	<1	<1
THIRTY DAY AVERAGE mg/l		1.5	1.4	1.5	1.6	1.1	0.9
OIL AND GREASE lbs/day	1-Jun	0.00	NF	0.03	0.00	NR	NR
	4-Jun	0.04	NF	NF	NF	NR	NR
	8-Jun	NF	NF	NF	NF	NR	NR
	11-Jun	NF	0.19	0.11	0.00	NR	NR
	15-Jun	0.00	NF	NF	NF	NR	NR
	18-Jun	NF	NF	0.15	NF	NR	NR
	22-Jun	NF	NF	0.00	0.00	NR	NR
	25-Jun	0.00	NF	NF	0.00	NR	NR
	29-Jun	0.00	0.00	0.00	NF	NR	NR
THIRTY DAY AVERAGE lbs/day		0.01	0.10	0.06	0.00	NR	NR
TOTAL PHOSPHATES mg/l	1-Jun	20.0	13.0	10.0	9.5	0.1	0.4
	4-Jun	18.0	19.0	3.1	12.0	0.1	0.5
	8-Jun	23.0	23.0	11.0	11.0	0.2	0.4
	11-Jun	21.0	19.0	3.4	11.0	0.2	0.7
	15-Jun	24.0	21.0	9.2	8.7	0.1	0.6
	18-Jun	23.0	22.0	30.0	9.2	0.1	0.4
	22-Jun	21.0	19.0	0.8	7.9	0.1	0.6
	25-Jun	20.0	20.0	0.0	12.0	0.2	0.6
	29-Jun	19.0	17.0	2.3	10.0	0.2	0.8
THIRTY DAY AVERAGE mg/l		21.0	19.2	7.8	10.1	0.1	0.6
TOTAL PHOSPHATES lbs/day	1-Jun	0.02	NF	0.31	0.00	NR	NR
	4-Jun	0.78	NF	NF	NF	NR	NR
	8-Jun	NF	NF	NF	NF	NR	NR
	11-Jun	NF	4.06	0.40	0.00	NR	NR
	15-Jun	0.00	NF	NF	NF	NR	NR
	18-Jun	NF	NF	2.18	NF	NR	NR
	22-Jun	NF	NF	0.00	0.00	NR	NR
	25-Jun	0.03	NF	NF	0.00	NR	NR
	29-Jun	0.04	0.03	0.00	NF	NR	NR
THIRTY DAY AVERAGE lbs/day		0.17	2.04	0.58	0.00	NR	NR

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SAMPLE LOCATION		E-001	E-002	E-003	E-004	CK-1	CK-2
TOTAL DISSOLVED SOLIDS							
mg/l	1-Jun	564	526	682	792	410	552
	4-Jun	608	1290	388	892	468	650
	8-Jun	624	597	588	414	404	618
	11-Jun	572	512	1146	556	428	668
	15-Jun	624	596	694	274	516	846
	18-Jun	620	628	378	486	486	816
	22-Jun	548	470	936	142	440	578
	25-Jun	550	536	1160	296	476	770
	29-Jun	618	566	350	402	474	852
THIRTY DAY AVERAGE							
mg/l		592	636	702	473	456	706
lbs/day		0.00	0.01	0.01	0.00	0.00	0.01
TOTAL SUSPENDED SOLIDS							
mg/l	1-Jun	<1	<1	2.2	1.6	1.2	2.6
	4-Jun	1.2	<1	9.2	3.2	1.2	2.8
	8-Jun	1.2	<1	34.0	1.2	1.2	3.8
	11-Jun	<1	<	3.4	1.8	1.4	3.2
	15-Jun	1.6	1.2	5.2	1.6	1.4	1.6
	18-Jun	1.2	1.2	10.0	3.6	2.2	2.4
	22-Jun	<1	1.6	11.0	1.6	1.2	1.4
	25-Jun	<1	2.2	4.6	1.4	4.4	2.8
	29-Jun	1.4	1.6	40.0	3.4	2.2	5.8
THIRTY DAY AVERAGE							
mg/l		1.3	9.1	13.3	2.2	1.8	2.9
lbs/day		0.00	0.00	0.00	0.00	0.00	0.00
STANDARD OBSERVATIONS							
	pH:	7.5	7.4	7.8	7.3	8.0	8.2
	WATER TEMP. (F):	74	74	68	67	60	60
	COLOR:	clear	clear	clear	clear	clear	clear
	ODOR	none	none	none	none	none	none
	TOXICITY: (% Survival at 96 hours)	100%	95%	100%	95%	NR	NR

NF= No flow NA= Not applicable NR= Not Required

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Stanford Linear Accelerator Center

SAMPLE LOCATION		E-001	E-002	E-003	E-004	CK-1	CK-2
FLOW RATE (GALLONS/DAY)							
MAXIMUM		17730	27600	37700	29590	158400	28800
AVERAGE		4906	6800	9832	2576	N/A	N/A
MINIMUM		0	0	12200	0	0	0
SETTLEABLE MATTER ml/1/hr	6-Jul	<0.1	<0.1	0.1	<0.1	NR	NR
	13-Jul	<0.1	<0.1	0.3	<0.1	NR	NR
	20-Jul	<0.1	<0.1	0.1	0.2	NR	NR
	27-Jul	<0.1	<0.1	2	<0.1	NR	NR
THIRTY DAY AVERAGE mg/l		0.0	0.0	0.6	0.1	NR	NR
OIL AND GREASE mg/l	2-Jul	<1	<1	<1	<1	NR	NR
	6-Jul	2	2	1	<1	<1	<1
	9-Jul	<1	<1	<1	<1	NR	NR
	13-Jul	<1	2	<1	<1	<1	<1
	16-Jul	<1	<1	<1	<1	NR	NR
	20-Jul	<1	<1	<1	<1	1	<1
	23-Jul	2	<1	<1	<1	NR	NR
	27-Jul	<1	<1	1	<1	<1	<1
	30-Jul	1	2	1	1	NR	NR
THIRTY DAY AVERAGE mg/l		1.2	1.3	0.9	0.9	0.9	0.9
OIL AND GREASE lbs/day	2-Jul	0.08	0.13	0.08	NF	NR	NR
	6-Jul	NF	NF	NF	NF	NR	NR
	9-Jul	NF	NF	0.01	0.01	NR	NR
	13-Jul	NF	NF	0.00	0.00	NR	NR
	16-Jul	0.01	0.04	0.04	0.02	NR	NR
	20-Jul	NF	NF	NF	0.00	NR	NR
	23-Jul	0.00	0.05	0.00	0.01	NR	NR
	27-Jul	NF	NF	NF	0.00	NR	NR
	30-Jul	0.04	0.15	0.06	0.01	NR	NR
THIRTY DAY AVERAGE lbs/day		0.03	0.09	0.03	0.01	NR	NR
TOTAL PHOSPHATES mg/l	2-Jul	26.0	22.0	1.5	22.0	0.2	0.3
	6-Jul	29.0	26.0	4.6	15.0	0.0	0.5
	9-Jul	27.0	26.0	2.3	19.0	0.2	0.7
	13-Jul	29.0	19.0	3.1	17.0	0.2	0.9
	16-Jul	18.0	15.0	11.0	20.0	0.7	1.0
	20-Jul	26.0	24.0	1.2	28.0	0.2	1.2
	23-Jul	22.0	21.0	0.8	28.0	0.3	0.6
	27-Jul	26.0	29.0	24.0	19.0	0.3	0.8
	30-Jul	21.0	14.0	2.3	18.0	0.0	1.1
THIRTY DAY AVERAGE mg/l		24.9	21.8	5.6	20.7	0.2	0.8
TOTAL PHOSPHATES lbs/day	2-Jul	2.17	3.20	0.13	NF	NR	NR
	6-Jul	NF	NF	NF	NF	NR	NR
	9-Jul	NF	NF	0.03	0.13	NR	NR
	13-Jul	NF	NF	0.01	0.00	NR	NR
	16-Jul	0.19	0.60	0.52	0.40	NR	NR
	20-Jul	NF	NF	NF	0.01	NR	NR
	23-Jul	0.01	1.20	0.00	0.45	NR	NR
	27-Jul	NF	NF	NF	0.01	NR	NR
	30-Jul	0.83	1.08	0.14	0.27	NR	NR
THIRTY DAY AVERAGE lbs/day		0.80	1.52	0.14	0.18	NR	NR

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SAMPLE LOCATION		E-001	E-002	E-003	E-004	CK-1	CK-2
TOTAL DISSOLVED SOLIDS							
mg/l	2-Jul	586	582	1172	604	464	884
	6-Jul	616	594	696	412	484	1012
	9-Jul	636	692	354	542	478	942
	13-Jul	620	578	334	682	512	1078
	16-Jul	580	566	678	578	524	1058
	20-Jul	614	572	674	722	508	834
	23-Jul	562	524	4036	568	496	932
	27-Jul	638	588	362	700	500	924
	30-Jul	568	528	432	546	508	974
THIRTY DAY AVERAGE							
mg/l		602	580	971	595	497	960
kg/l		0.00	0.00	0.00	0.00	0.00	0.00
TOTAL SUSPENDED SOLIDS							
mg/l	2-Jul	1.2	1.2	10.0	7.8	4.4	4.2
	6-Jul	1.6	<1	6.8	11.0	2.6	5.0
	9-Jul	2.4	2.2	11.0	2.8	6.2	2.4
	13-Jul	1.2	<1	3.8	2.4	13.0	3.2
	16-Jul	1.2	<1	2.8	<1	14.0	8.0
	20-Jul	2.2	1.4	3.4	5.2	15.0	3.4
	23-Jul	1.6	<1	9.8	1.8	4.4	3.0
	27-Jul	6.8	<1	63.0	3.8	124.0	2.8
	30-Jul	1.2	1.4	3.8	1.4	1.4	32.0
THIRTY DAY AVERAGE							
mg/l		2.2	9.3	12.7	4.5	20.6	7.1
kg/l		0.00	0.00	0.00	0.00	0.00	0.00
STANDARD OBSERVATIONS							
	pH:	7.5	7.5	7.6	7.5	7.6	7.3
	WATER TEMP. (F):	75	74	74	74	74	60
	COLOR:	clear	clear	clear	clear	clear	clear
	ODOR	none	none	none	none	none	none
	TOXICITY: (% Survival at 96 hours)	100%	95%	100%	90%	NR	NR

NF= No flow NA= Not applicable NR= Not Required

Samples collected during "no-flow" or "no blow-down" periods were not used in calculating averages.

Stanford Linear Accelerator Center

		E-001	E-002	E-003	E-004	CK-1	CK-2
SAMPLE LOCATION		E-001	E-002	E-003	E-004	CK-1	CK-2
FLOW RATE (GALLONS/DAY)							
MAXIMUM		32090	27700	84500	10800	2880	14400
AVERAGE		6539	8974	15052	3414	N/A	N/A
MINIMUM		0	0	0	0	0	0
SETTLEABLE MATTER ml/l/hr	3-Aug	<0.1	0.1	0.1	<0.1	NR	NR
	10-Aug	<0.1	<0.1	0.5	<0.1	NR	NR
	17-Aug	<0.1	<0.1	0.5	<0.1	NR	NR
	24-Aug	<0.1	<0.1	<0.1	<0.1	NR	NR
	31-Aug	<0.1	<0.1	0.2	1.4	NR	NR
MONTHLY AVERAGE mg/l		0.0	0.0	0.3	0.3	NR	NR
OIL AND GREASE mg/l	3-Aug	3	2	<1	<1	<1	<1
	6-Aug	<1	<1	<1	<1	NR	NR
	10-Aug	1	<1	<1	<1	<1	1
	13-Aug	2	1	<1	1	NR	NR
	17-Aug	1	<1	<1	<1	<1	<1
	20-Aug	<1	1	11	4	NR	NR
	24-Aug	<1	1	<1	<1	<1	<1
	27-Aug	<1	<1	<1	<1	NR	NR
	31-Aug	<1	<1	<1	<1	<1	<1
MONTHLY AVERAGE mg/l		1.3	1.1	2.0	1.3	0.9	0.9
OIL AND GREASE lbs/day	3-Aug	NF	NF	NF	0.00	NR	NR
	6-Aug	0.04	0.04	0.33	0.02	NR	NR
	10-Aug	NF	NF	NF	0.00	NR	NR
	13-Aug	0.11	0.08	0.07	0.04	NR	NR
	17-Aug	0.10	0.10	0.26	0.05	NR	NR
	20-Aug	0.01	0.06	0.14	0.06	NR	NR
	24-Aug	0.02	0.04	NF	0.00	NR	NR
	27-Aug	0.00	0.08	0.02	0.02	NR	NR
	31-Aug	NF	NF	0.00	0.00	NR	NR
MONTHLY AVERAGE lbs/day		0.05	0.06	0.14	0.02	NR	NR
TOTAL PHOSPHATES mg/l	3-Aug	21.0	22.0	0.4	23.0	0.1	0.8
	6-Aug	18.0	19.0	6.9	18.0	0.0	2.1
	10-Aug	18.0	22.0	0.4	16.0	0.2	2.1
	13-Aug	17.0	19.0	0.4	19.0	0.1	4.3
	17-Aug	14.0	16.0	0.8	9.6	0.0	4.5
	20-Aug	15.0	15.0	3.1	8.4	0.1	3.5
	24-Aug	13.0	18.0	0.4	12.0	0.1	2.8
	27-Aug	14.0	16.0	0.4	13.0	0.2	1.4
	31-Aug	15.0	15.0	2.3	16.0	0.2	1.4
MONTHLY AVERAGE mg/l		16.1	17.8	1.7	15.0	0.1	2.5
TOTAL PHOSPHATES lbs/day	3-Aug	NF	NF	NF	0.00	NR	NR
	6-Aug	0.74	0.81	2.04	0.41	NR	NR
	10-Aug	NF	NF	NF	0.01	NR	NR
	13-Aug	0.97	1.49	0.03	0.69	NR	NR
	17-Aug	1.46	1.73	0.22	0.52	NR	NR
	20-Aug	0.23	0.84	0.04	0.13	NR	NR
	24-Aug	0.26	0.58	NF	0.00	NR	NR
	27-Aug	0.00	1.45	0.01	0.36	NR	NR
	31-Aug	NF	NF	0.01	0.00	NR	NR
MONTHLY AVERAGE lbs/day		0.61	1.15	0.39	0.24	NR	NR

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SAMPLE LOCATION		E-001	E-002	E-003	E-004	CK-1	CK-2
TOTAL DISSOLVED SOLIDS							
mg/l	3-Aug	638	580	658	700	514	1026
	6-Aug	592	584	786	585	524	1012
	10-Aug	628	580	680	656	484	940
	13-Aug	584	534	1308	544	500	926
	17-Aug	568	572	272	402	538	900
	20-Aug	620	560	356	512	504	944
	24-Aug	572	596	1228	718	<26	912
	27-Aug	518	518	1220	538	478	1066
	31-Aug	634	628	542	716	516	1010
MONTHLY AVERAGE							
mg/l		595	572	783	597	507	971
lbs/day		0.00	0.00	0.01	0.00	0.00	0.01
TOTAL SUSPENDED SOLIDS							
mg/l	3-Aug	1.6	1.2	1.4	1.8	1.4	3.0
	6-Aug	<1	<1	3.2	<1	1.2	3.4
	10-Aug	1.2	<1	104.0	3.0	1.6	2.6
	13-Aug	<1	<1	5.2	1.2	2.2	2.8
	17-Aug	<1	1	15.0	<1	5.4	1.8
	20-Aug	1.0	<1	14.0	<1	1.6	5.6
	24-Aug	1.0	1.2	2.6	<1	3.2	641.4
	27-Aug	<1	2.0	2.4	1.2	3.0	2.2
	31-Aug	1.0	<1	<1	<1	<1	<1
MONTHLY AVERAGE							
mg/l		1.2	13.8	18.5	1.8	2.5	82.9
lbs/day		0.00	0.00	0.00	0.00	0.00	0.00
STANDARD OBSERVATIONS							
pH:		7.5	7.5	7.4	7.4	7.6	7.8
WATER TEMP. (F):		75	75	75	74	68	68
TOXICITY(8/20):		100%	100%	0%	95%	NR	NR
(% Survival at 96 hours)				8/24=100%			

NF= No flow NA= Not applicable NR= Not Required

Samples collected during "no-flow" or "no blow-down" periods were not used in calculating averages.

SAMPLE LOCATION		E-001	E-002	E-003	E-004	CK-1	CK-2
FLOW RATE (GALLONS/DAY)							
MAXIMUM		27950	38300	56300	10580	0	0
AVERAGE		8040	10816	16803	4439	N/A	N/A
MINIMUM		0	0	0	0	0	0
SETTLEABLE MATTER							
ml/l/hr	7-Sep	<0.1	<0.1	<0.1	<0.1	NR	NR
	14-Sep	<0.1	<0.1	0.3	<0.1	NR	NR
	21-Sep	<0.1	<0.1	<0.1	<0.1	NR	NR
	28-Sep	<0.1	<0.1	0.4	<0.1	NR	NR
MONTHLY AVERAGE ml/l/hr		0.0	0.0	0.2	0.0	NR	NR
OIL AND GREASE							
mg/l	7-Sep	<1	<1	<1	<1	<1	<1
	10-Sep	<1	<1	2	2	NR	NR
	14-Sep	2	<1	<1	<1	<1	<1
	17-Sep	<1	1	2	2	NR	NR
	21-Sep	<1	<1	<1	<1	<1	<1
	24-Sep	<1	<1	2	<1	NR	NR
	28-Sep	2	<1	<1	<1	<1	<1
MONTHLY AVERAGE mg/l		0.6	0.1	0.9	0.6	0.0	0.0
OIL AND GREASE							
lbs/day	7-Sep	0.0	0.0	0.0	0.0	NR	NR
	10-Sep	0.0	0.0	0.4	0.1	NR	NR
	14-Sep	0.0	0.0	0.0	0.0	NR	NR
	17-Sep	0.0	0.2	0.5	0.1	NR	NR
	21-Sep	0.0	0.0	0.0	0.0	NR	NR
	24-Sep	0.0	0.0	0.4	0.0	NR	NR
	28-Sep	0.0	0.0	0.0	0.0	NR	NR
MONTHLY AVERAGE lbs/day		0.00	0.03	0.18	0.03	NR	NR
TOTAL PHOSPHATES							
mg/l	7-Sep	16	19	14	15	0	2
	10-Sep	3	3	1	1	0	2
	14-Sep	19	15	8	18	0	2
	17-Sep	14	11	9	20	0	2
	21-Sep	29	17	15	18	0	2
	24-Sep	20	17	5	18	0	1
	28-Sep	18	14	2	18	7	1
MONTHLY AVERAGE mg/l		16.9	13.8	7.7	15.5	1.1	1.6
TOTAL PHOSPHATES							
lbs/day	7-Sep	0.0	0.0	0.0	0.0	NR	NR
	10-Sep	0.1	0.0	0.2	0.1	NR	NR
	14-Sep	0.0	0.0	0.0	0.0	NR	NR
	17-Sep	2.3	2.1	2.4	0.9	NR	NR
	21-Sep	0.0	0.0	0.2	0.0	NR	NR
	24-Sep	1.8	1.3	0.8	0.6	NR	NR
	28-Sep	0.0	0.0	0.0	0.0	NR	NR
MONTHLY AVERAGE lbs/day		0.61	0.49	0.51	0.22	NR	NR

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SAMPLE LOCATION		E-001	E-002	E-003	E-004	CK-1	CK-2
TOTAL DISSOLVED SOLIDS							
mg/l	7-Sep	590	582	612	725	452	950
	10-Sep	600	652	1062	502	476	896
	14-Sep	548	550	406	728	466	1008
	17-Sep	500	462	1234	488	518	1040
	21-Sep	560	574	806	608	478	932
	24-Sep	588	528	336	530	466	952
	28-Sep	616	602	1116	790	530	960
MONTHLY AVERAGE							
mg/l		572	564	796	624	484	963
lbs/day		0.00	0.00	0.01	0.01	0.00	0.01
TOTAL SUSPENDED SOLIDS							
mgl/l	7-Sep	<1	<1	3.2	<1	1.2	3.4
	10-Sep	2.2	1.6	3.4	1.4	7.6	1.6
	14-Sep	2.2	2.4	38.0	4.4	2.8	2.8
	17-Sep	2.6	1.8	1.8	2.0	7.0	2.0
	21-Sep	1.6	1.6	2.8	4.4	2.4	2.6
	24-Sep	<1	<1	4.4	2.6	30.0	2.5
	28-Sep	1.4	<1	29.0	2.4	27.0	2.8
MONTHLY AVERAGE							
mg/l		2.0	8.2	11.8	2.9	11.1	2.5
lbs/day		0.00	0.00	0.00	0.00	0.00	0.00
STANDARD OBSERVATIONS							
	pH:	7.4	7.4	7.3	7.4	7.3	NA
	WATER TEMP. (F):	75	75	75	74	68	68
	TOXICITY(8/20): (% Survival at 96 hours)	95%	85%	95%	95%	NR	NR

NF= No flow NA= Not applicable NR= Not Required

SAMPLE LOCATION		E-001	E-002	E-003	E-004	CK-1	CK-2
FLOW RATE (GALLONS/DAY)							
MAXIMUM		45690	38100	40200	10820	50400	0
AVERAGE		10087	10842	12194	4202	N/A	N/A
MINIMUM		0	0	0	0	0	0
SETTLEABLE MATTER ml/l/hr	5-Oct	<0.1	<0.1	0.6	<0.1	NR	NR
	12-Oct	<0.1	<0.1	<0.1	<0.1	NR	NR
	19-Oct	<0.1	<0.1	<0.1	<0.1	NR	NR
	26-Oct	<0.1	<0.1	0.4	<0.1	NR	NR
MONTHLY AVERAGE ml/l/hr		0.0	0.0	0.3	0.0	NR	NR
OIL AND GREASE mg/l	1-Oct	<1	<1	2	3	NR	NR
	5-Oct	10	1	<1	1	<1	1
	8-Oct	<1	<1	21	<1	NR	NR
	12-Oct	<1	<1	<1	<1	<1	<1
	15-Oct	<1	<1	<1	<1	NR	NR
	19-Oct	<1	<1	<1	<1	3	3
	22-Oct	3	4	7	4	NR	NR
	26-Oct	<1	<1	<1	<1	<1	<1
	29-Oct	<1	<1	2	<1	NR	NR
MONTHLY AVERAGE mg/l		1.9	0.7	4.3	1.1	1.0	1.3
OIL AND GREASE lbs/day	1-Oct	0.0	0.0	0.3	0.1	NR	NR
	5-Oct	0.0	0.0	0.0	0.0	NR	NR
	8-Oct	0.0	0.0	2.0	0.0	NR	NR
	12-Oct	0.0	0.0	0.0	0.0	NR	NR
	15-Oct	0.0	0.0	0.1	0.0	NR	NR
	19-Oct	0.0	0.0	0.0	0.0	NR	NR
	22-Oct	0.3	0.5	0.9	0.1	NR	NR
	26-Oct	0.0	0.0	0.0	0.0	NR	NR
	29-Oct	0.0	0.0	0.2	0.0	NR	NR
MONTHLY AVERAGE lbs/day		0.04	0.07	0.47	0.04	NR	NR
TOTAL PHOSPHATES mg/l	1-Oct	17	13	10	15	4	1
	5-Oct	17	13	14	19	0	1
	8-Oct	16	13	0	16	0	1
	12-Oct	10	10	15	11	0	1
	15-Oct	17	14	3	17	0	1
	19-Oct	17	14	16	18	0	1
	22-Oct	16	13	16	16	0	2
	26-Oct	16	12	1	15	0	2
	29-Oct	10	6	0	16	1	1
MONTHLY AVERAGE mg/l		15.7	12.9	10.7	16.0	0.7	1.2
TOTAL PHOSPHATES lbs/day	1-Oct	1.3	1.4	1.5	0.7	NR	NR
	5-Oct	0.0	0.0	0.0	0.0	NR	NR
	8-Oct	1.3	1.0	0.0	0.3	NR	NR
	12-Oct	0.0	0.4	0.1	0.0	NR	NR
	15-Oct	1.3	1.5	0.4	0.6	NR	NR
	19-Oct	0.0	0.0	0.0	0.0	NR	NR
	22-Oct	1.4	1.5	1.9	0.5	NR	NR
	26-Oct	0.0	0.0	0.0	0.0	NR	NR
	29-Oct	0.6	0.6	0.0	0.7	NR	NR
MONTHLY AVERAGE lbs/day		0.77	0.82	0.56	0.29	NR	NR

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SAMPLE LOCATION		E-001	E-002	E-003	E-004	CK-1	CK-2
TOTAL DISSOLVED SOLIDS							
mg/l	1-Oct	544	498	1052	466	566	980
	5-Oct	598	564	628	784	522	1006
	8-Oct	546	526	1072	546	536	1004
	12-Oct	612	612	656	716	522	976
	15-Oct	556	528	1422	528	498	972
	19-Oct	638	592	556	742	492	898
	22-Oct	504	496	764	516	488	944
	26-Oct	626	558	1484	738	508	932
	29-Oct	502	478	1316	500	486	944
MONTHLY AVERAGE							
mg/l		571	545	879	614	518	969
lbs/day		0.00	0.00	0.01	0.01	0.00	0.01
TOTAL SUSPENDED SOLIDS							
mgl/l	1-Oct	1.2	<1	<1	2.8	48.0	3.2
	5-Oct	1.4	<1	38.0	2.0	37.0	1.4
	8-Oct	1.8	1.2	2.2	2.2	55.0	37.0
	12-Oct	2.6	1.6	1.8	2.0	7.0	2.0
	15-Oct	1.6	1.6	2.8	4.4	2.4	2.6
	19-Oct	<1	<1	4.4	2.6	30.0	2.5
	22-Oct	2.4	1.2	1.8	<1	2.8	3.8
	26-Oct	3.8	3.2	<1	4.4	19.0	12.0
	29-Oct	2.2	2.6	1.8	1.6	145.0	2.4
MONTHLY AVERAGE							
mg/l		1.8	5.7	8.5	2.7	26.0	7.5
lbs/day		0.00	0.00	0.00	0.00	0.00	0.00
STANDARD OBSERVATIONS							
pH:		7.4	7.5	7.7	7.5	7.8	7.2
WATER TEMP. (F):		74	83	69	82	56	54
TOXICITY(8/20): (% Survival at 96 hours)		100%	100%	100%	100%	NR	NR

NF= No flow NA= Not applicable NR= Not Required

SAMPLE LOCATION		E-001	E-002	E-003	E-004	CK-1	CK-2
FLOW RATE (GALLONS/DAY)							
MAXIMUM		52660	50300	73000	36110	50400	0
AVERAGE		15214	19823	10826	7534	N/A	N/A
MINIMUM		0	0	0	0	0	0
SETTLEABLE MATTER							
ml/l/hr	6-Nov	<0.1	<0.1	<0.1	<0.1	NR	NR
	13-Nov	<0.1	<0.1	<0.1	<0.1	NR	NR
	20-Nov	<0.1	<0.1	<0.1	<0.1	NR	NR
	30-Nov	NF	NF	<0.1	NF	NR	NR
MONTHLY AVERAGE ml/l/hr		0.0	0.0	0.0	0 0	NR	NR
OIL AND GREASE							
mg/l	6-Nov	<1	<1	<1	<1	7	9
	13-Nov	<1	<1	<1	<1	<1	<1
	20-Nov	<1	<1	<1	<1	NF	<1
	27-Nov	0	0	2	0	NF	3
MONTHLY AVERAGE mg/l		0.0	0.0	0.5	0.0	3.5	3.0
OIL AND GREASE							
lbs/day	6-Nov	0.0	0.0	0.1	0.0	NR	NR
	13-Nov	0.0	0.0	0.0	0.0	NR	NR
	20-Nov	0.0	0.0	0.0	0.0	NR	NR
	27-Nov	0.0	0.0	0.1	0.0	NR	NR
MONTHLY AVERAGE lbs/day		0.00	0.00	0.06	0.00	NR	NR
TOTAL PHOSPHATES							
mg/l	6-Nov	9	9	3	15	1	2
	13-Nov	9	8	3	10	2	3
	20-Nov	10	11	11	7	NF	1
	27-Nov	0	0	0	0	NF	1
MONTHLY AVERAGE mg/l		7.1	7.2	4.6	8.2	1.3	1.7
TOTAL PHOSPHATES							
lbs/day	6-Nov	2.0	2.5	0.5	1.5	NR	NR
	13-Nov	0.7	2.7	0.0	1.1	NR	NR
	20-Nov	2.0	2.8	0.5	0.7	NR	NR
	27-Nov	0.0	0.0	0.0	0.0	NR	NR
MONTHLY AVERAGE lbs/day		1.18	2.03	0.27	0.82	NR	NR
TOTAL DISSOLVED SOLIDS							
mg/l	6-Nov	526	490	1128	510	500	946
	13-Nov	604	604	1622	634	476	892
	20-Nov	692	770	788	706	NF	1000
	27-Nov	NF	NF	1566	NF	NF	540
MONTHLY AVERAGE mg/l		607	621	1276	617	488	845
lbs/day		0.01	0.01	0.01	0.01	0.00	0.01
TOTAL SUSPENDED SOLIDS							
mgl/l	6-Nov	1.4	<1	1.2	<1	102.0	2.2
	13-Nov	1.0	<1	<1	<1	217 0	4.4
	20-Nov	1.6	<1	1.4	1.2	NF	3.8
	27-Nov	NF	NF	1.4	NF	4 0	2.0
MONTHLY AVERAGE mg/l		1 3	1 3	1 3	1 2	107 7	3 1
lbs/day		0 00	0 00	0 00	0 00	0 00	0 00

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STANDARD OBSERVATIONS						
pH:	7.6	7.5	7.4	7.4	7.8	NA
WATER TEMP. (F):	82	84	68	74	53	NA
TOXICITY(8/20): (% Survival at 96 hours)	100%	100%	95%	85%	NR	NR

NF= No flow NA= Not applicable NR= Not Required

Stanford Linear Accelerator Center

SAMPLE LOCATION		E-001	E-002	E-003	E-004	CK-1	CK-2
FLOW RATE (GALLONS/DAY)							
MAXIMUM		0	0	10600	0	57600	0
AVERAGE		0	0	1916	0	N/A	N/A
MINIMUM		0	0	0	0	0	0
SETTLEABLE MATTER							
ml/l/hr	Dec	NF	NF	NA	NF	NR	NR
OIL AND GREASE							
mg/l	4-Dec	NF	NF	3	NF	NF	6
	11-Dec	NF	NF	7	NF	NF	5
	18-Dec	NF	NF	<1	NF	NF	<1
MONTHLY AVERAGE mg/l		NF	NF	3.3	NF	NF	3.7
OIL AND GREASE							
lbs/day	4-Dec	NF	NF	0.0	NF	NR	NR
	11-Dec	NF	NF	0.1	NF	NR	NR
	18-Dec	NF	NF	0.0	NF	NR	NR
MONTHLY AVERAGE lbs/day		NF	NF	0.05	NF	NR	NR
TOTAL PHOSPHATES							
mg/l	4-Dec	NF	NF	1	NF	NF	1
	11-Dec	NF	NF	1	NF	NF	1
	18-Dec	NF	NF	1	NF	NF	1
MONTHLY AVERAGE mg/l		NF	NF	1.1	NF	NF	0.9
TOTAL PHOSPHATES							
lbs/day	4-Dec	NF	NF	0.0	NF	NR	NR
	11-Dec	NF	NF	0.0	NF	NR	NR
	18-Dec	NF	NF	0.0	NF	NR	NR
MONTHLY AVERAGE lbs/day		NF	NF	0.01	NF	NR	NR
TOTAL DISSOLVED SOLIDS							
mg/l	6-Nov	NF	NF	1810	NF	NF	966
	13-Nov	NF	NF	346	NF	NF	422
	20-Nov	NF	NF	106	NF	NF	384
MONTHLY AVERAGE mg/l		NF	NF	754	NF	NF	591
lbs/day		NF	NF	0.01	NF	NF	0.00
TOTAL SUSPENDED SOLIDS							
mgl/l	6-Nov	NF	NF	4.4	NF	NF	8.6
	13-Nov	NF	NF	9.0	NF	NF	17.0
	20-Nov	NF	NF	<1	NF	NF	9.0
MONTHLY AVERAGE mg/l		NF	NF	4.5	NF	NF	11.5
lbs/day		NF	NF	0.00	NF	NF	0.00

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STANDARD OBSERVATIONS

pH:	NF	NF	8.2	NF	NF	NA
WATER TEMP. (F):	NF	NF	41	NF	NF	41
TOXICITY(8/20): (% Survival at 96 hours)	NF	NF	100%	NF	NR	NR

NF= No flow   NA= Not applicable   NR= Not Required

Appendix G

This appendix contains the analytical results of samples taken from SLAC's LCW systems and sumps. The following codes are used in the table:

Media (All Water)	Analysis (Radioactivity)
C = Concrete	A = Gross Al
M = Metal (Fe, Al, Cu, Pb)	B = Gross Be
O = Oil	G1 = Gross Gamma
R = Resin	ABG1 = Gross Alpha/Beta/Gamma Analysis
S = Soil	BG1 = Gross Beta/Gamma Analysis
W = Water	G2 = Gamma Scan (Co-57, 58, 60; Mn-54, Na-22)
	T = Tritium by LS

DP = Discharge Point

0 = None
1 = Discharge to Sanitary Sewer
2 = Discharge to Storm Drain (Not normally done--pumped to hold-up tank for discharge to sanitary sewer. Automatic sump pumps disconnected.)
NA = Not Applicable

The information in Table IV-2 in Section 4 was reported at the same time.

Analysis Report Received: 08/22/1991 By UPS from CEP, Inc.; Albuquerque, NM.

California Drinking Water Limits:

Tritium 20,000 pCi/l

Derived Concentration Guide (DCG), DOE Order 5400.5:

Tritium (water) 2,000,000 pCi/l

As noted in this report, ground water at SLAC is not potable. The volumes of these systems requiring discharge are normally limited to the volumes of the collection sumps and or hold-up tanks. Concentrations approaching those in sumps and systems are not commonly seen due to the very large discharge volumes leaving the site. See Section 2.

STANFORD LINEAR ACCELERATOR CENTER

Radioactivity Analysis Report

Sample I.D. No.	System Name	Analysis	Tritium pCi/l	Tritium Detection Limit pCi/l	Beta/Gamma pCi/l	Beta/Gamma Detection Limit pCi/l	Discharge Point
W901001-01	BAS II Return	BG1, T	84300+/-1940	500	581+/-103	3	1
W900110-02	Sector 20 Sys	BG1, T	<500	500	873+/-126	3	1
W900215-01	Carboy 4	BG1, T	<500	500	59+/- 56	3	0
W900215-02	Carboy 7	BG1, T	1.30E7+/-0.19%	500	3.07E5+/-0.76%	3	0
W900215-03	Carboy 5	BG1, T	926+/- 300	500	8503+/-291	3	0
W900221-01	Resin Rinse	BG1, T	7.69E5+/-2%	500	396+/- 52	3	1
W900221-02	Resin Rinse	BG1, T	6.68E6+/-1.9%	500	1640+/-104	3	1
W900227-01	Resin Rinse	BG1, T	2.86E5+/-2.1%	500	816+/-385	3	1
W900227-02	Resin Rinse	BG1, T	3730+/- 644	500	1460+/-644	3	1
W900227-03	Resin Rinse	BG1, T	1630+/- 598	500	3070+/-32	3	1
W900227-04	Resin Rinse	BG1, T	90000+/-2010	500	2810+/-44	3	1
W900529-01	BDE Sump	BG1, T	16400+/- 814	500	1770+/-814	3	1
W900617-01	Station 12 SS	BG1, T	833+/- 300	500	30+/- 5	3	2*
W900709-01	e+ Cooling Sys	BG1, T	2549+/- 582	500	791+/ -17	3	1
W900719-01	Slit 10/30 Sump	BG1, T	63200+/-1480	500	<3	3	1
W900916-01	Station 12 SS	BG1, T	<500	500	<3	3	1
W901204-01	BSY Coll Sump	BG1, T	5650+/-663	500	340+/- 11	3	1
W901204-02	PS11 Sump	BG1, T	<500	500	83+/- 6	3	2
W901211-01	RSY Sump	BG1, T	<500	500	20+/- 4	3	2
W901211-02	RSY Sump	BG1, T	<500	500	90+/- 6	3	2
W901211-03	ABD Sys	BG1, T	75900+/-1750	500	494+/- 13	3	1
W901215-01	Station 12 SS	BG1, T	<500	500	12+/- 4	3	1
W901217-01	RAS Sump	BG1, T	<500	500	6+/- 4	3	2
W901220-01	RSY Sump	BG1, T	<500	500	54+/- 6	3	2
W901220-02	BSY Coll Sump	BG1, T	9194+/-679	500	25+/- 4	3	1

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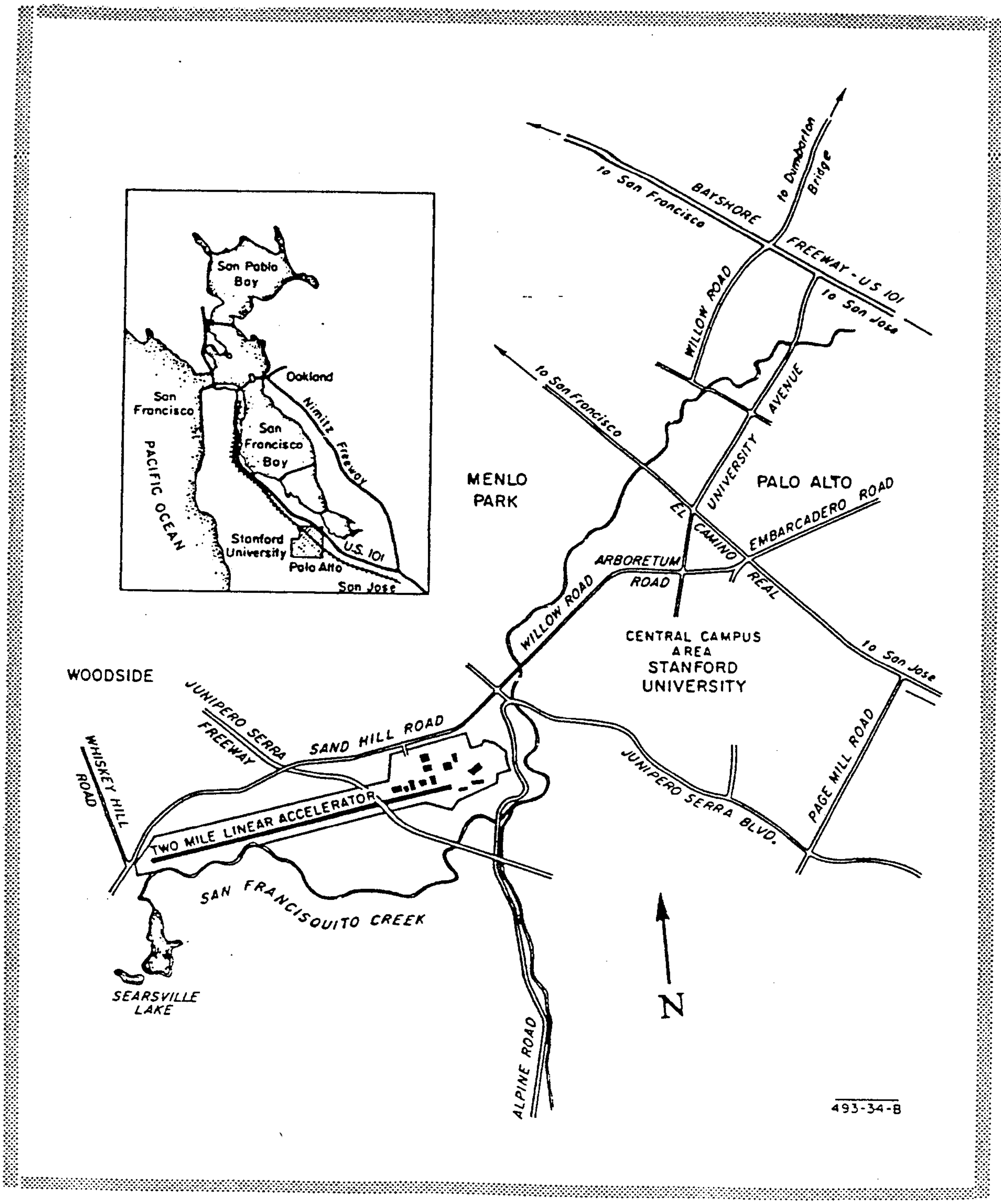

Figure 1. SLAC site location.

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Figure 2. Air view of SLAC site showing the two-mile accelerator, the research facility, and the principal laboratories and shops. Also shown is the SLAC Linear Collider. The PEP Interaction Regions can be seen in the foreground, connected by the circumferential road.

5027B2

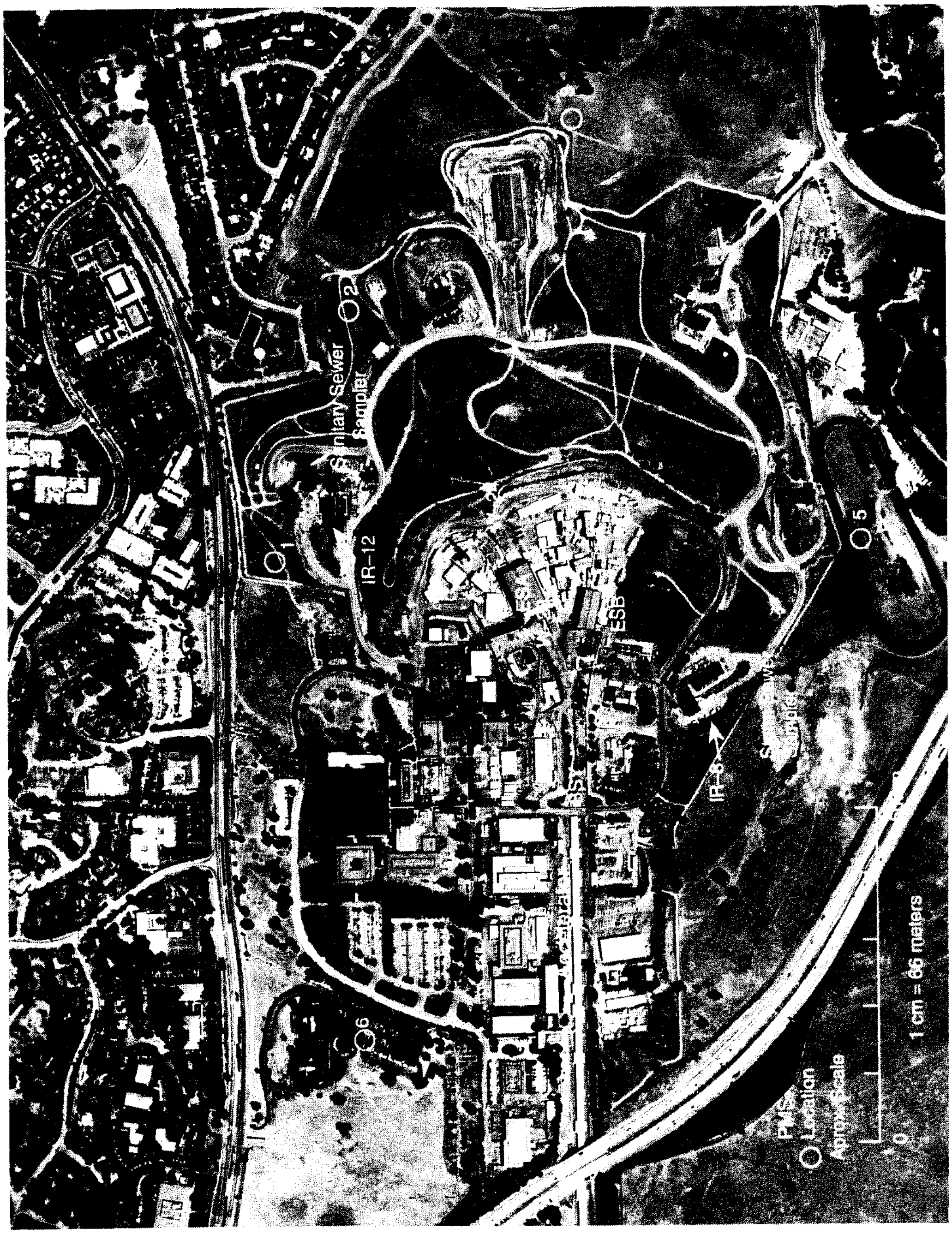

Figure 3. SLAC research yard and the surrounding community.

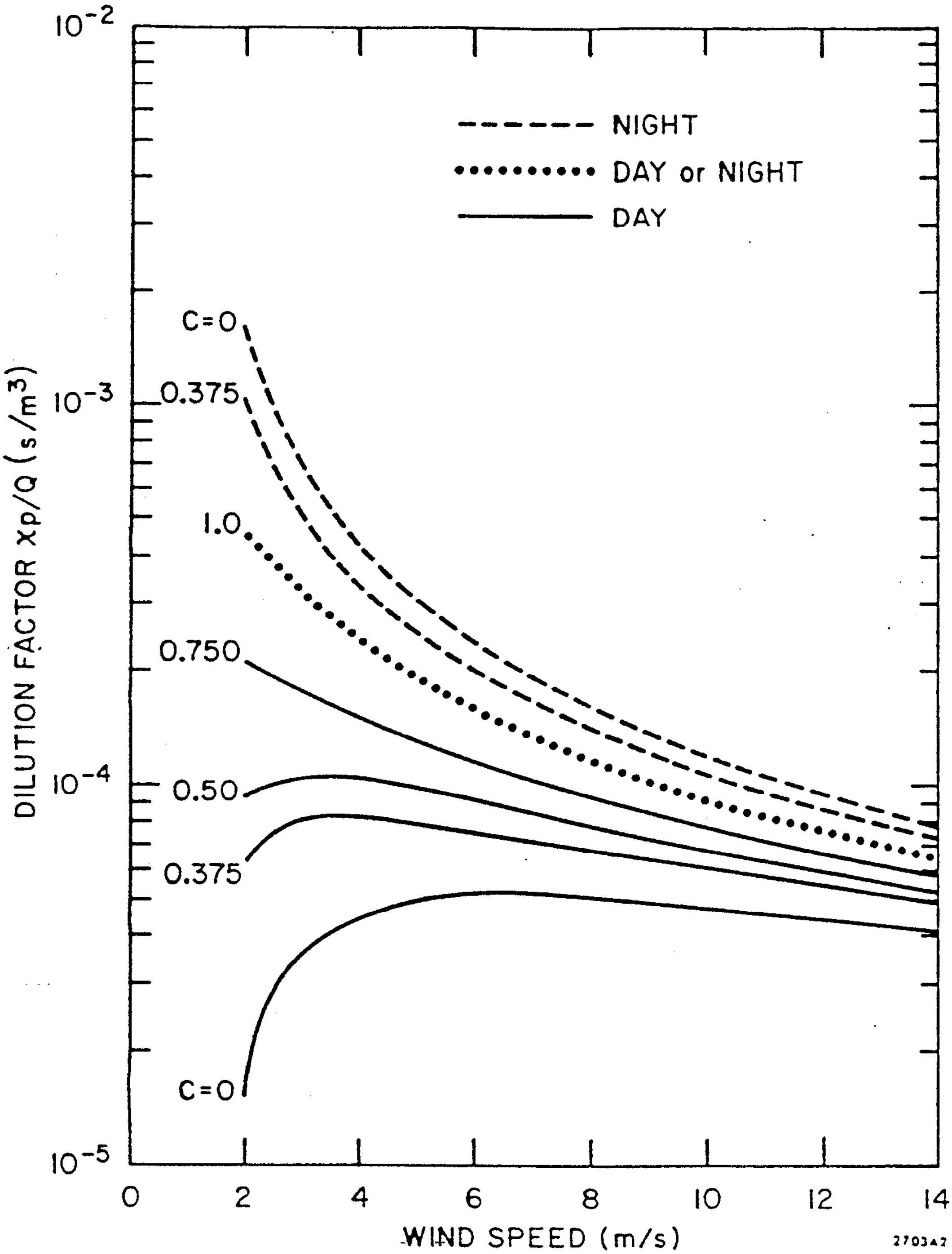

Figure 4. Centerline dilution factor for various atmospheric conditions as a function of wind speed.

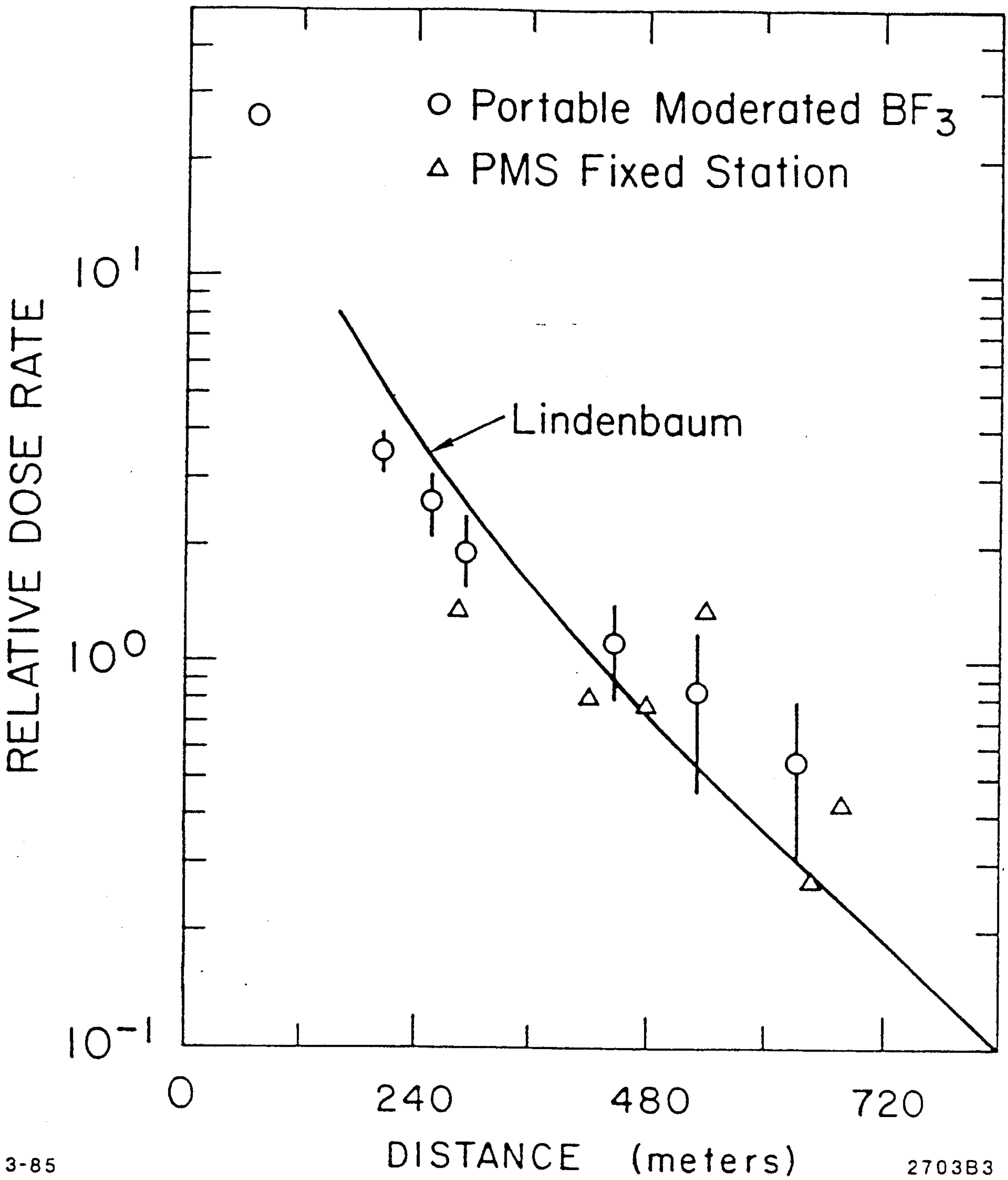

Figure 5. Measurements made along a line between ESA and the site boundary.