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Environment, Safety and Health
Office of Environmental Audit

Environmental Survey
Preliminary Report

DOE Activities at
Santa Susana Field Laboratories
Ventura County, California

February 1989

PREFACE
TO
THE DEPARTMENT OF ENERGY
SANTA SUSANA FIELD LABORATORIES
ENVIRONMENTAL SURVEY PRELIMINARY REPORT

This report contains the preliminary findings based on the first phase of an Environmental Survev at the U.S. Department of Energy (DOE) activities at the Santa Susana Field Laboratories Site (SSFL), located at Ventura County, California. The Survey is being conducted by DOE's Office of Environment, Safety and Health.

The Survey is a portion of the larger, comprehensive DOE Environmental Survey encompassing all major operating facilities of DOE. The DOE Environmental Survey is one of a series of initiatives announced on September 18, 1985, by Secretary of Energy. John S. Herrington, to strengthen the environmental, safety, and health programs and activities within DOE. The purpose of the Environmental Survey is to identify, via a "no-fault" baseline Survey of all the Department's major operating facilities, environmental problems and areas of environmental risk. The identified problem areas will be prioritized on a Department-wide basis in order of importance in 1989.

The preliminary findings are subject to modification based on comments from the San Francisco Operations Office concerning their technical accuracy. The modified findings will be incorporated into the Environmental Survey Summary Report.

February, 1989
Washington, D.C.

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Introduction

This report presents the preliminary findings from the first phase of the Environmental Survey of the United States Department of Energy (DOE) activities at the Santa Susana Field Laboratories Site (DOE/SSFL), conducted May 16 through 26, 1988.

The Survey is being conducted by an interdisciplinary team of environmental specialists, led and managed by the Office of Environment, Safety and Health's Office of Environmental Audit. Individual participants for the Survey team are being supplied by a private contractor. The objective of the Survey is to identify environmental problems and areas of environmental risk associated with DOE activities at SSFL. The Survey covers all environmental media and all areas of environmental regulation. It is being performed in accordance with the DOE Environmental Survey Manual. This phase of the Survey involves the review of existing site environmental data, observations of the operations performed at SSFL, and interviews with site personnel.

Site Description

The Santa Susana Field Laboratories Site (SSFL) is located in southeastern Ventura County near the crest of the Simi Hills at the western border of the San Fernando Valley. This location is about 47 kilometers (29 miles) northwest of downtown Los Angeles. The site occupies 1,080 hectares (2,668 acres) situated in rugged terrain typical of mountain areas of recent geological age. SSFL is situated on a plateau approximately 1,000 feet above the floor of the west San Fernando Valley. The nearest communities are in the Simi Valley, which is about 2.7 kilometers (1.7 miles) northwest of the site. Administrative and scientific activities also take place at the DeSoto, Plumber, and Canoga Avenue locations.

The DOE programs are conducted primarily in Area IV of the SSFL Site. Area IV (290 acres) includes a 90-acre DOE optioned area that houses the Energy Technology Engineering Center (ETEC). Rockwell International Corporation and its predecessor organizations have been the operating contractors for DOE programs and facilities since the early 1950s. These facilities have included ETEC as well as a number of other research and development facilities. In Areas I to III of the SSFL Site, Rockwell conducts operations for NASA and the Air Force. Area II is owned by the National Aeronautical and Space Administration (NASA) and operated by Rockwell.

Representatives of SSFL, DOE San Francisco Operations Office, and the Survey team met with five representatives of state and local agencies on April 6, 1988, at SSFL to discuss their concerns. The questions from the attendees were general in nature, and no major issues, environmental or otherwise, were raised.

Summary of Findings

The major preliminary findings of the Environmental Survey of DOE activities at SSFL are as follows:

- There are approximately 10 areas at SSFL Area IV where hazardous and/or radioactive substances resulting from DOE activities have or may have been disposed of, spilled, or released. These constitute actual and potential sources of soil and/or groundwater contamination. The full nature and extent of contamination is not known.

- There are at least three areas of groundwater contamination at Area IV that appear to be related to past DOE activities. The contaminants are chlorinated organics in the parts-per-billion range. Some of the concentrations exceed the California Action Levels.

- Due to an insufficient number of groundwater monitoring wells, the groundwater monitoring program is not capable of: accurately determining direction of groundwater flow; characterizing the nature and extent of groundwater contamination at known and potential source areas; and detecting off-site groundwater contamination.

Overall Conclusions

The Survey found no environmental problems at SSFL that represent an immediate threat to human life. The preliminary findings identified by the Survey do indicate that a few areas are actual or potential sources of soil and/or groundwater contamination and that inadequacies in the groundwater monitoring system make it difficult to characterize the nature and extent of contamination.

The environmental problems described in this report vary in terms of their magnitude and risk. A complete understanding of the significance of some of the environmental problems identified requires a level of study and characterization that is beyond the scope of the Survey. Actions currently under way or planned at the site will contribute toward meeting this requirement.

Transmittal and Follow-up of Findings

The preliminary findings of the Environmental Survey of DOE/SSFL were shared with the San Francisco Operations Office and the site contractor at the Survey closeout briefing held May 26, 1988. By September 29, 1988, the San Francisco Operations Office had developed a draft action plan to address the Survey preliminary findings. A final action plan addressing all the Survey findings cited herein will be prepared by the San Francisco Operations Office within 45 days of receiving this Preliminary Report. Those problems that involve extended studies and multi-year budget commitments will be the subject of the Environmental Survey Summary Report and the DOE-wide prioritization.

Within the Office of the Assistant Secretary for Environment, Safety and Health, the Office of Environmental Guidance and Compliance has immediate responsibility for monitoring environmental compliance and the status of the DOE/SSFL Survey findings. The Office of Environmental Audit will continue to assess the environmental problems through a program of systematic environmental audits that will be initiated toward the conclusion of the DOE Environmental Survey in 1989.

1.0 INTRODUCTION

The purpose of this report is to present the preliminary findings made during the Environmental Survey conducted May 16 through 26, 1988, of U.S. Department of Energy activities at the Santa Susana Field Laboratories Site (DOE/SSFL) in Ventura County, California. Actvities under contract to DOE are conducted at SSFL by Rockwell International - Rocketdyne Division. This report reflects conditions during the Survey and does not include remedial actions initiated since that time. Although "SSFL" is used throughout the report, the Survey included only DOE activities at SSFL. As a Preliminary Report, the contents are subject to revision. Revisions to the preliminary findings, based on San Francisco Operations Office technical review, will be incorporated into the Environmental Survey Summary Report.

The DOE/SSFL Survey is part of the larger, comprehensive DOE Environmental Survey effort announced by Secretary John S. Herrington on September 18, 1985. The purpose of the Environmental Survey is to identify, via a "no fault" baseline Survey of all the Department's major operating facilities, existing environmental problems and areas of environmental risk. The identified problem areas will be prioritized in 1989 on a Department-wide basis in order of importance. The prioritization will enable DOE to more effectively address environmental problems and allocate the resources necessary to correct these problems. Because the Survey is "no fault" and is not an "audit," it is not designed to identify specific, isolated incidents of noncompliance or to analyze environmental management practices. Such incidents and/or management practices are, however, used in the Survey as a means of identifying existing and potential environmental problems and risks.

The DOE/SSFL Environmental Survey is being conducted by an interdisciplinary team of environmental specialists headed and managed by the Office of Environment, Safety, and Health's Office of Environmental Audit. A complete list of Survey participants and their affiliations is included in Appendix A.

The Survey team focused on all environmental media, using Federal, state, and local environmental statutes and regulations, accepted industry practices, and professional judgment to make the preliminary findings included in this report. The team carried out its activities in accordance with the guidance and protocols in the DOE Environmental Survey Manual. Substantial use of existing information and of interviews with knowledgeable field office and site-contractor personnel accounted for a large part of the on-site effort. A summary of the site-specific Survey activities is presented in Appendix B, and the Survey Plan is presented in Appendix C.

The preliminary Survey findings are presented in Chapters 3 and 4 in the form of existing and potential environmental problems. Chapter 3 includes those findings that pertain to a specific environmental medium (e.g., air or soil) whereas Chapter 4 includes those that are non-media specific (e.g., waste management, radiation, and quality assurance). Because the findings vary greatly in terms of magnitude, risk, and characterization and consequently require different levels of management attention and response, they are further divided into four categories within each of the sections in Chapters 3 and 4.

The criteria for placing a finding into one or more of the four categories are as follows:

Category I includes only those findings which, based upon the information available to the Team Leader, involve immediate threat to human life. Findings of this type shall be immediately conveyed to the responsible Environmental Safety and Health personnel at the scene or in control of the facility or location in question for action. Category I findings are those environmental problems where the potential risk is highest, the confidence in the finding, based on the information available, is the strongest, and the appropriate response to the finding is the most restrictive in terms of alternatives.

Category II findings encompass one or more of the following situations:

- Multiple or continuing exceedances, past or present, of a health-based environmental standard where there is immediate potential for human population exposure, or a one-time exceedance where residual impacts pose an immediate potential for human population exposure.

- Evidence that a health-based environmental standard may be exceeded, as discussed in the preceding situation, within the time frame of the DOE-wide Survey.

- Evidence that the likelihood is high for an unplanned release due to, for example, the condition or design of pollution abatement or monitoring equipment or other management practices.

- Noncompliance with significant regulatory procedures (i.e., those substantive technical regulatory procedures designed to directly or indirectly minimize or prevent risks, such as inadequate monitoring or failure to obtain required permits).

Category II findings include those environmental problems where the risk is high but the definition of risk is broader than in Category I. The information available to the Team Leader is adequate to identify the problem but may be insufficient to fully characterize it. Finally, in this category, more discretion is available to the Operations Offices and Program Offices as to the appropriate response; however, the need for that response is such that management should not wait for the completion of the entire DOE-wide Survey to respond. Unlike Category I findings, a sufficient, near-term response by the Operations Office may include further characterization prior to any action taken to rectify the situation.

Category III findings encompass one or both of the following criteria:

- The existence of pollutants or hazardous materials in the air, water, groundwater, or soil resulting from DOE operations that pose or may pose a hazard to human health or the environment.

- The existence of conditions at a DOE facility that pose or may pose a hazard to human health or the environment.

Category III findings are those environmental problems for which the broadest definition of risk is used. As in Category II, the information available to the Team Leader may not be sufficient to fully characterize the problem. Under this category, the range of alternatives available for response, and the corresponding time frames for response, are the greatest. Environmental problems included within this category will typically require lengthy investigation and remediation phases, as well as multi-year budget commitments. These problems will be included in the DOE-wide prioritization effort to ensure that DOE's limited resources are used effectively.

In general, the levels of pollutants or materials that constitute a hazard or potential for hazard are those that exceed some Federal, state, or local regulations for release of, contamination by, or exposure to such pollutants or materials. However, in some cases, the Survey may determine that the presence of some nonregulated material is in a concentration that presents a concern for local populations or the environment and is therefore sufficient to be included as an environmental problem. Likewise, the presence of regulated materials in concentrations, even though below those established by regulatory authorities, that nevertheless present a potential for hazard or concern may be classified as an environmental problem. In general, however, conditions that meet regulatory or other requirements, where such exist, should not present a potential hazard and will not be identified as an environmental problem.

Conditions that pose or may pose a hazard are generally those which are violations of regulations or requirements (e.g., improper storage of hazardous chemicals in unsafe tanks). Such conditions present a potential hazardous threat to human health and the environment and should be identified as an environmental problem. Additionally, potentially hazardous conditions are those where the likelihood of the occurrence of release is high.

The definition of the term environmental problem is broad and flexible to allow for the wide differences among the DOE sites and operations. Therefore, a good deal of professional judgment must be applied to the identification of environmental problems.

Category IV findings include instances of administrative noncompliance and management practices that are indirectly related to environmental risk, but are not appropriate for inclusion in Categories I–III. Such findings can be based upon any level of information available to the Team Leader, including direct observations by the team members. Findings in this category are generally expected to lend themselves to relatively simple, straightforward resolution without further evaluation or analysis. These findings, although not part of the DOE-wide prioritization effort, will be passed along to the Operations Offices and appropriate Program Office for appropriate action.

Based on the professional judgment of the Team Leader, the findings within categories are arranged in order of relative significance. Comparing the relative significance of one finding to another, either between categories within a section or within categories between sections, is neither appropriate nor valid. The categorization and listing of findings in order of significance within this report is only the first step in a multi-step iterative process to prioritize DOE's problems.

The next phase of the Survey process is sampling and analysis (S&A). The results generated by the S&A effort are used to assist the Survey team in further defining the existence of environmental problems and risks identified during the Survey. However, based on the on-site DOE/SSFL Survey and site sampling plans, no Survey-related sampling needs were identified.

It is clear that the findings and observations in this report are highly varied in terms of magnitude, risk, and characterization. Consequently, the priority, magnitude, and timeliness of near-term responses requires careful planning to ensure appropriate and effective application. The information in this Preliminary Report, albeit preliminary, will assist the San Francisco Operations Office in the planning of these near-term responses.

The San Francisco Operations Office submitted a draft action plan dated September 29, 1988, in response to the preliminary findings presented at the conclusion of the on-site Survey activities and summarized in the DOE/SSFL Survey Status Report dated June 30, 1988. The draft action plan for addressing findings from the DOE/SSFL Survey has been reviewed by the Office of Environmental Guidance and Compliance (OEG), which has immediate responsibility for monitoring the status and overseeing the adequacy of corrective actions taken by the Operations Office in response to the Survey findings.

As required in the December 2, 1987, memorandum from the Assistant Secretary for Environment, Safety and Health to the Operations Office Manager, entitled "Follow-up of Environmental Survey Findings," the San Francisco Operations Office will prepare and submit a final action plan to the Deputy Assistant Secretary (DAS) for Environment within 45 days of receiving this Preliminary Report. The final action plan for the DOE/SSFL Survey will address all of the preliminary findings cited herein and incorporate OEG's comments on the draft action plan.

2.0 GENERAL SITE INFORMATION

2.1 Site Setting

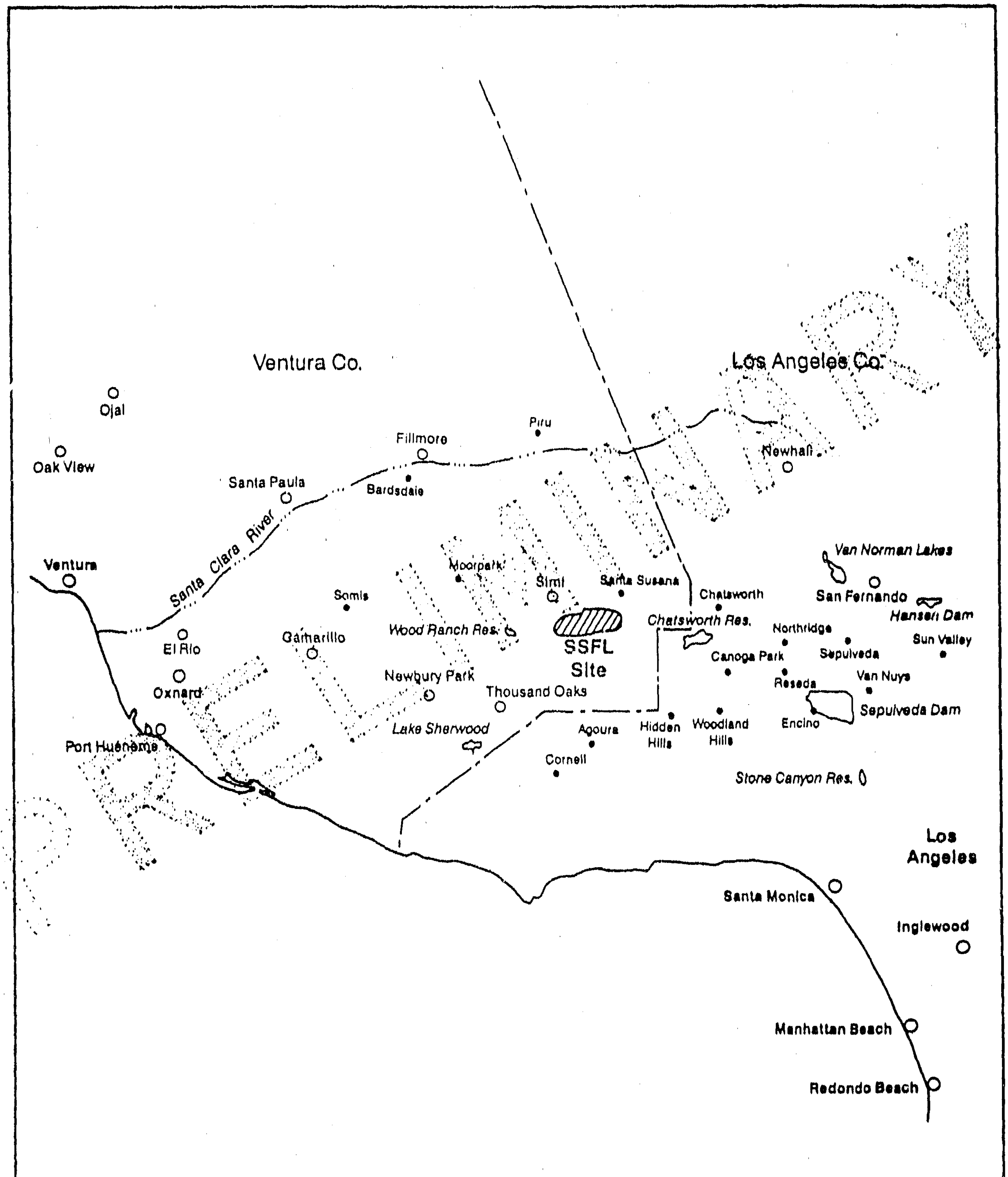
The Santa Susana Field Laboratories Site (SSFL) is located in southeastern Ventura County near the crest of the Simi Hills at the western border of the San Fernando Valley. This location is about 47 kilometers (29 miles) northwest of downtown Los Angeles. The site occupies 1,080 hectares (2,668 acres) situated in rugged terrain typical of mountain areas of recent geological age. SSFL is situated on a plateau approximately 1,000 feet above the floor of the west San Fernando Valley. The nearest communities are in the Simi Valley, which is about 2.7 kilometers (1.7 miles) northwest of the site. Figure 2-1 depicts the location of the SSFL site in the Los Angeles area.

Figure 2-2 shows the Area IV section of the SSFL complex, where almost all of the DOE activities have been conducted. Area IV includes a 90-acre (ETEC) government-optioned area, which houses the Energy Technology Engineering Center (ETEC).

Access to SSFL is by two offsite roads: Woolsey Canyon Road and Black Canyon Road. Both roads are maintained by the contractor. Woolsey Canyon Road is the main access road to the site and was constructed by the contractor. It was designed to allow negotiation by all types of trucks and has served as the access road for all construction activities, equipment, and chemical deliveries since the inception of SSFL in 1948. Black Canyon Road provides access to SSFL from Simi Valley.

In the region surrounding SSFL, the greatest population density occurs to the east of the site in the San Fernando Valley. The 23 communities in the Valley had a reported population of approximately 1,618,900 in 1980 (Stafford et al., 1984). The estimated 1980 population distribution within 80 kilometers (50 miles) of the SSFL site includes approximately 8,056,000 persons. About 110,000 persons are estimated to live within an 8 kilometer (5 miles) radius of the site, the closest resident lives about 2.1 kilometers (1.3 miles) to the south southeast (NRC, 1981).

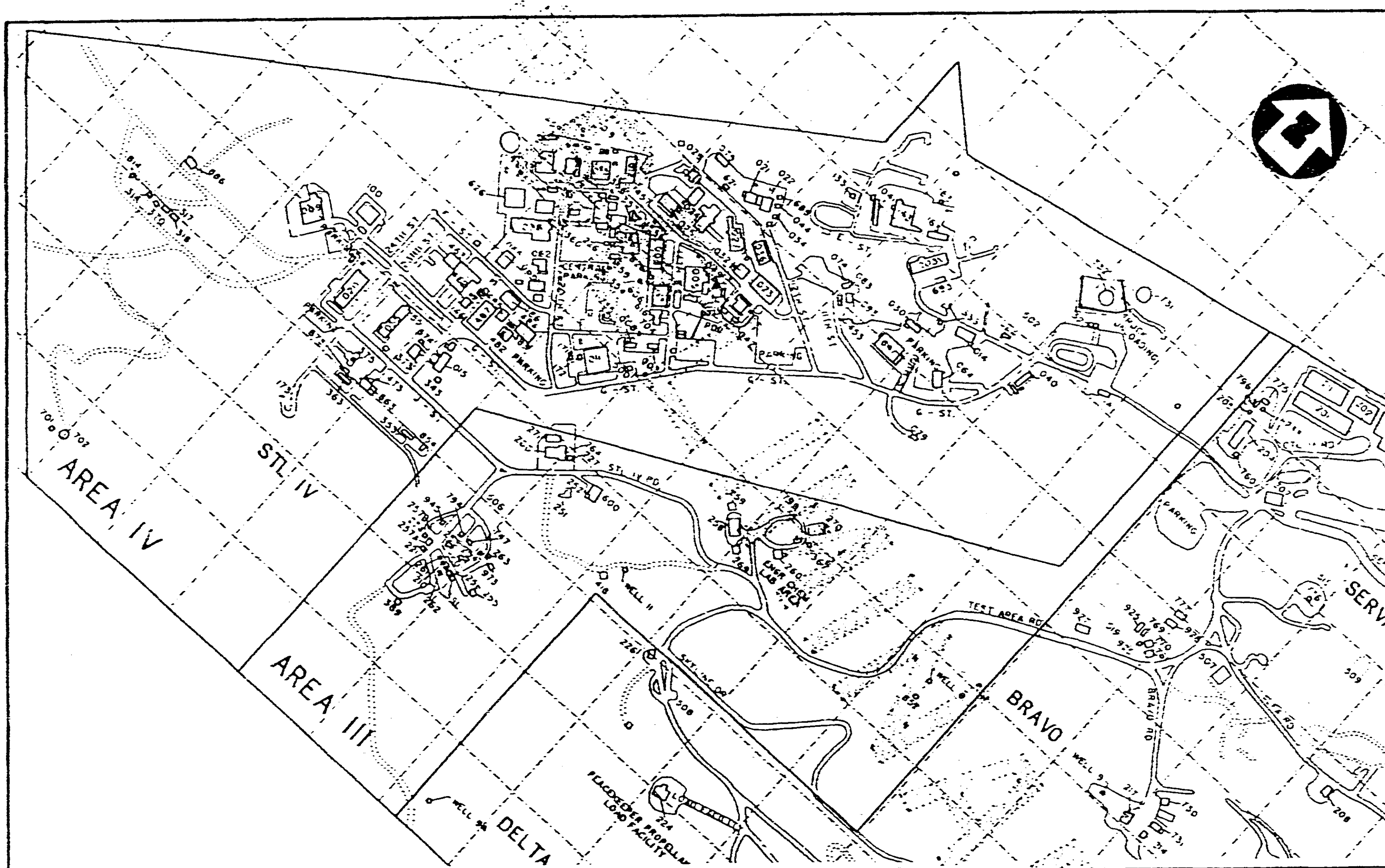
The neighboring lands to the north and west of SSFL have been zoned Rural-Agricultural Five Acres or, under a 10-year contract between Ventura County and the landowner, Agricultural Exclusive. The areas immediately south of the Rockwell buffer zone have been zoned Rural Exclusive One Acre (Stafford et al., 1984).



Source: BCD, 1988

FIGURE 2–1

LOCATION OF SANTA SUSANA FIELD LABORATORIES
SSFL–VENTURA COUNTY, CALIFORNIA



Source: Boyles, 1984.

FIGURE 2–2

AREA IV
SSFL–VENTURA COUNTY, CALIFORNIA

Reservoirs existing near the site are used primarily for irrigation, flood control, and recreation. Chatsworth Reservoir is located at 6.4 kilometers (4 miles) east of Building 055 but is no longer used for storing water and has been dry since 1970. There are no plans to ever use it for storing water. Supplemental city water supplies are drawn from the Van Norman Reservoir (12.88 kilometers east-northeast) and the Encino Reservoir (12.8 kilometers southeast) (RI, 1976b).

This area is part of the Southern California Coastal Region, which falls into the Mediterranean subclassification of subtropical-type climate. Thus, the climate of the site is typical of a semiarid region. The monthly mean temperature ranges from near 50°F for the cold months to the upper 70s in the warmest ones. The weather patterns are controlled principally by the position of the semipermanent Pacific high-pressure cell located off the west coast of North America. The average mean rainfall is 44.8 cm (17.4 inches), with 95 percent of the total falling between November and April. Although precipitation usually occurs in the form of rain, on a few occasions snow has fallen. The last significant snow was recorded in January 1962, when 5 inches of snow was measured and lasted for about 48 hours. On the average, a 1-inch snow fall can be expected every 8 years and a 5-inch snow fall every 23 years. Because of the climate, flow in streams is seasonal, and precipitation runoff is controlled by the use of storm drains and channels.

SSFL is located primarily within the Bell Creek drainage system, a tributary of the Los Angeles River (Moore, 1974). Discharge from the facility includes treated sewage effluent and surface runoff. Surface water moves via a system of drainage ditches and catch basins to two major retention ponds. The treated sewage effluent is discharged to the retention ponds. Water in the retention pond is largely reused as process water; however, occasional overflow is discharged into Bell Creek. Additionally, during periods of excessive runoff, some runoff flows into the Simi Valley through normally dry channelways (RI, 1975).

During the months from April through October, the wind pattern is consistent due to the infrequent passage of storm fronts. The resultant unequal heating of the land mass and adjacent ocean leads to the generation of an almost daily wind of 5 to 10 knots from the northwest that occurs from about noon to an hour or so after sunset. The rest of the day the wind speeds are less than 5 knots, generally from an east to southeasterly direction.

From November to March a similar pattern occurs, but the northwest wind speeds tend to be less than 6 knots. The passage of weather fronts interrupt the wind pattern with flow from the south to southeast before each storm, followed by northerly winds. Over this time period, the development of Santa Ana winds are common. These winds occur from the northeast and have average speeds of 18 to 25 knots with occasional gusts to 40 knots (Stafford et al., 1984).

SSFL is located within the east-west trending structures that comprise the Transverse Ranges of California (Thornbury, 1965). The mountains and hills in this area resulted from the folding and faulting of Tertiary and Cretaceous marine sediments. An alluvial fill of Quaternary age covers the valley floors and portions of SSFL.

Local relief at the site is approximately 200 m (600 feet). However, the laboratory facilities are located in a relatively level area. Unconsolidated surficial material in the area generally consists of a 3.3- to 10-m (10- to 30-foot) deposit of alluvium (RI, 1976b). Beneath the alluvium is the Chatsworth Formation, an undifferentiated, well-cemented sandstone containing occasional thin beds of shale (RI, 1976b). Fractures and faults are common within the Chatsworth Formation and are characteristic of the tectonic activity which produced the Simi Hills. The rhombic fault pattern is most common, and the fault planes extend in the east-west and northeast-southwest direction.

Groundwater movement is controlled by the geologic conditions of the underlying Chatsworth Formation. Cementation results in a porosity of about 1 percent, and water generally occurs along the fault plains, fractures, and joints within the formation (RI, 1976b). Apparently, the groundwater is contained under perched conditions with minimal movement through the formation. Any movement of groundwater from the site would likely be toward the Simi Valley.

The site is located within a seismically active region. However, no earthquakes have originated along minor faults in the immediate vicinity of the site (RI, 1976b). Major active faults in the region include the San Andreas Fault, Santa Ynez Fault, San Gabriel Fault, and the Inglewood Fault, all of which are some distance away from the site. Historically, four minor (approximately 3.3 Richter) and five major (greater than 6 Richter) earthquakes have been recorded along these faults within 96 kilometers (60 miles) of the site (RI, 1976b). The 1971 San Fernando earthquake occurred along the San Gabriel Fault and registered a magnitude of 6.6 on the Richter scale.

2.2 Overview of Major Site Operations

Rockwell International Corporation, and its predecessor organizations, have conducted programs for the U.S. Department of Energy (formerly Atomic Energy Commission and Energy Research and Development Agency) since the early 1950s. The programs have included engineering, research and development and manufacturing functions primarily concerned with nuclear reactor development and applications.

During the 1950s and 1960s, SSFL conducted research and development on many nuclear reactor subsystems, including the Sodium Reactor Experiment (SRE) 1957–1964 and Space Nuclear Auxiliary Power (SNAP) series of compact liquid metal nuclear reactors 1957–1973. The SNAP-10A, launched from Vanderberg Air Force Base in 1965, was the first and only U.S. demonstration of an operating reactor in space orbit. On-site nuclear reactor development and testing was later discontinued, and SSFL began a program of radioactive decontamination and decommissioning (D&D) of select operations. The major operational nuclear installations within Area IV are the Radioactive Material Disposal Facility (RMDF) and the Hot Laboratory (BT 020). The Hot Laboratory has been used in recent times primarily for decladding fuel elements. The RMDF facility is used for storage of irradiated fuel and for packaging radioactive wastes generated as a result of the decommissioning and fuel-decladding operations.

In 1966, the Energy Technology Engineering Center was chartered to provide engineering, development, and testing of components for the Liquid Metal Fast Breeder Reactor Program. The ETEC complex contains the world's largest facilities for testing liquid metal steam generators and pumps, a unique facility for testing the effects of enduring severe thermal transients on various types of power plant components and a unique seismic facility with the capability to cause failures in full-size piping systems and several multi-purpose test facilities.

ETEC primarily conducts programs for DOE and, with DOE's approval, other organizations. Although liquid metal technology constitutes the majority of the activities, alternative programs take advantage of the staff expertise and facilities in energy development areas and have included programs in solar, fossil, geothermal, conservation, fission, and fusion. These activities have been conducted for the Nuclear Regulatory Commission, Department of Defense, Western Area Power Administration, Bonneville Power Administration, DOE National Laboratories and Engineering Centers, and private corporations which are primarily government contractors.

2.3 State and Federal Concerns

During the pre-Survey visit to the site, a meeting was held on April 6, 1988, at SSFL with representatives of DOE's San Francisco Operations Office, SSFL staff, and representatives from the California Department of Health Services and the Ventura County Fire Department. The U.S. Environmental Protection Agency did not send a representative.

The purpose of this meeting was to explain the purpose and scope of the Survey to the various agencies and to identify any environmental concerns they might have. Representatives were asked to express their concerns about SSFL so that these concerns could be reviewed during the Survey. The representatives did not identify any existing environmental problems or raise any major environmental concerns about SSFL.

3.0 MEDIA-SPECIFIC SURVEY FINDINGS AND OBSERVATIONS

The discussions in this section pertain to existing or potential environmental problems in the air, soil, water, and groundwater media. The discussions include a summary of the available background environmental information related to each medium, a description of the sources of pollution and control techniques, a review of the environmental monitoring program specific to each medium, and a categorization and explanation of the environmental problems that the Survey team found which related to each medium.

3.1 Air

3.1.1 Background Environmental Information

Air pollution controls and permits at SSFL are regulated by the Ventura County Air Pollution Control District (VCAPCD). This district is part of the south central coast air basin, which is composed of Ventura, Santa Barbara, and San Luis Obispo Counties. This basin has generally achieved a better air quality than its neighboring county (Los Angeles) to the south. However, Ventura County is a part of the larger South Coast Air Quality Management District but shares many of the concerns of neighboring counties with respect to ozone and smog formation.

Ventura County has achieved attainment status with respect to sulfur dioxide, carbon monoxide, and nitrogen oxides (NOx). (The only non-attainment area in the state with respect to NOx is the Los Angeles area.)

With respect to ozone, the southern half of Ventura County (in which SSFL is located) still has a non-attainment designation. It appears that this status will continue for the foreseeable future and that the VCAPCD will continue to address all aspects of smog-ozone formation, including hydrocarbon and NOx emissions.

The southern half of Ventura County is still listed as having a non-attainment status for total suspended particulates. However, with respect to the new inhalable particulate standard, the entire county is included in Category 3, the category most likely to be in compliance.

Air quality standards for California (and Federal standards for comparison) are shown in Table 3-1. Ventura County has no problems with attainment of the visibility, lead, hydrogen sulfide, or vinyl chloride standards.

TABLE 3-1

COMPARISON OF FEDERAL AND CALIFORNIA AIR QUALITY STANDARDS
SSFL - VENTURA COUNTY, CALIFORNIA

Averaging Time	Federal Standards Primary	Federal Standards Secondary	California Standard	Objective
OZONE				
1-Hour	0.12 ppm 240 µg/m³	Same –	0.10 ppm 200 µg/m³	To prevent eye irritation, breathing difficulties.
CARBON MONOXIDE				
8-Hour	9.3 ppm 10 mg/m³	Same	9.0 ppm 10 mg/m³	To prevent carboxyhemoglobin levels greater than 2 percent.
1-Hour	35 ppm 40 mg/m³	Same	20 ppm 23 mg/m³	
NITROGEN DIOXIDE				
Annual	0.05 ppm 100 µg/m³	Same	–	To prevent health risk and improve visibility.
1-Hour	–	–	0.25 ppm 470 µg/m³	
SULFUR DIOXIDE				
Annual	0.03 ppm 80 µg/m³	–	–	To prevent increase in respiratory disease, plant damage, and odor.
24-Hour	0.14 ppm 365 µg/m³	–	0.05 ppm 131 µg/m³	
3-Hour	–	0.5 ppm 1,310 µg/m³	–	
1-Hour	–		0.25 ppm 655 µg/m³	
SULFATES				
24-Hour	–	–	25 µg/m³	To improve visibility and prevent health effects.

TABLE 3-1
COMPARISON OF FEDERAL AND CALIFORNIA AIR QUALITY STANDARDS
SSFL - VENTURA COUNTY, CALIFORNIA
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Averaging Time	Federal Standards		California Standard	Objective
	Primary	Secondary		
PARTICULATE				
Annual Geometric Mean 24-Hour Average	75 μg/m^3 260 μg/m^3	60 μg/m^3 150 μg/m^3	30 μg/m^3 PM_{10}* 50 μg/m^3 PM_{10}*	To improve visibility and prevent health effects.
VISIBILITY REDUCING PARTICLES				
State Standard:	One observation. Insufficient amount to reduce the prevailing visibility to less than 10 miles when the relative humidity is less than 70 percent.			
LEAD				
30-Day	–	–	1.5 μg/m^3	To prevent health problems.
Calendar Quarter	1.5 μg/m^3	Same		
HYDROGEN SULFIDE				
1-Hour	–	–	0.03 ppm 42 μg/m^3	To prevent health problems.
VINYL CHLORIDE (CHLOROETHENE)				
24-Hour	–	–	0.010 ppm 26 μg/m^3	To prevent health problems.

Source: EPA, 1987 and California, 1987.
*PM_{10} = Particulate matter ten microns or less in size.
ppm = parts per million.

Meteorology

Because the upper winds (above 4,000 feet) above the site have been presumed to be similar to the upper winds at the Burbank Airport (BAP), 22 miles east of the site, SSFL has for many years used BAP wind rose information in calculations of estimated dose. In addition this data would be utilized in predicting downwind effects of any unscheduled release. This practice has been assumed to be adequate even though it has been acknowledged that: "Upper wind flow plays little or no role in the transport of any effluent from the site. This is due to the fact that, although some incidents might be accompanied by thermal effects, none can be postulated which would provide enough heat to cause cloud rises more than 1,500 feet above ground" (Ashley, 1962).

During 1960–1961 information was gathered from a meteorological tower located in Area II. "Only wind speed and direction data are available. Wind direction frequencies from this 1960–1961 data are shown in Table 3-2 (Ashley, 1962). In addition data from this time are shown for the summer and winter seasons. For comparison, data from the Burbank Airport are shown in Table 3-3 (Moore, 1988a).

Although data for the two locations are somewhat similar, there are considerable differences, especially when the seasonal differences are considered. For example, data for the NNW through NE quadrant (that is the sum of the frequencies from the NE, NNE, N, and NNW segments) indicates that the wind is from that direction 41.7 percent of the time at BAP but varies from 33.8 percent (winter) to 12.0 percent (summer) at SSFL, averaging 22.8 percent annually.

It must be acknowledged that the above data at SSFL are sparse and out of date. A study made in the 1960-61 period did show that a "very good correlation existed" between the above (Area II) data and wind data from Atomics International (i.e., Area IV) wind instruments, "although a detailed and lengthy statistical analysis was not performed" (Ashley, 1962). The absence of an on-site meteorological tower is discussed in Finding 3.1.4.4.1.

Radiological Air Quality

Air quality for particulate radioactivity is determined at eight sampling stations on or near the SSFL. The sampling station locations are shown in Figure 3-1. Methodology is discussed in Section 3.1.3. Particulates are examined for alpha and beta radioactivity.

Annual averages for 1968 through 1987 are shown in Table 3-4. The data in the table reflects a change in the averaging procedure after 1981. Before 1982, DOE instructions were to replace any

TABLE 3-2

WIND DIRECTIONS AT SSFL
SSFL - VENTURA COUNTY, CALIFORNIA

Wind From	Annual	Frequency (Percent)	
		Summer Only	Winter Only
N	10.1	5.2	15.2
NNW	6.8	4.0	9.7
NW	23.1	30.0	16.8
WNW	5.7	5.7	5.8
W	2.2	1.7	2.7
WSW	0.6	0.3	0.9
SW	0.6	0.5	0.7
SSW	0.3	0.3	0.4
S	1.7	1.4	1.9
SSE	1.5	1.4	1.6
SE	6.8	6.5	7.2
ESE	10.2	11.7	8.8
E	9.9	14.5	5.3
ENE	1.2	1.5	0.8
NE	2.9	1.9	3.8
NNE	3.0	0.9	5.1

Source: Ashley, 1962.

TABLE 3-3

WIND DIRECTION FREQUENCIES
BURBANK AIRPORT
SSFL - VENTURA COUNTY, CALIFORNIA

Wind From	Frequency (%) Annual
N	18.8
NNW	11.8
NW	8.5
WNW	13.1
W	5.3
WSW	2.4
SW	1.7
SSW	2.1
S	4.3
SSE	5.9
SE	5.2
ESE	4.6
E	3.0
ENE	2.2
NE	3.4
NNE	7.7

Source: Moore, 1988a.

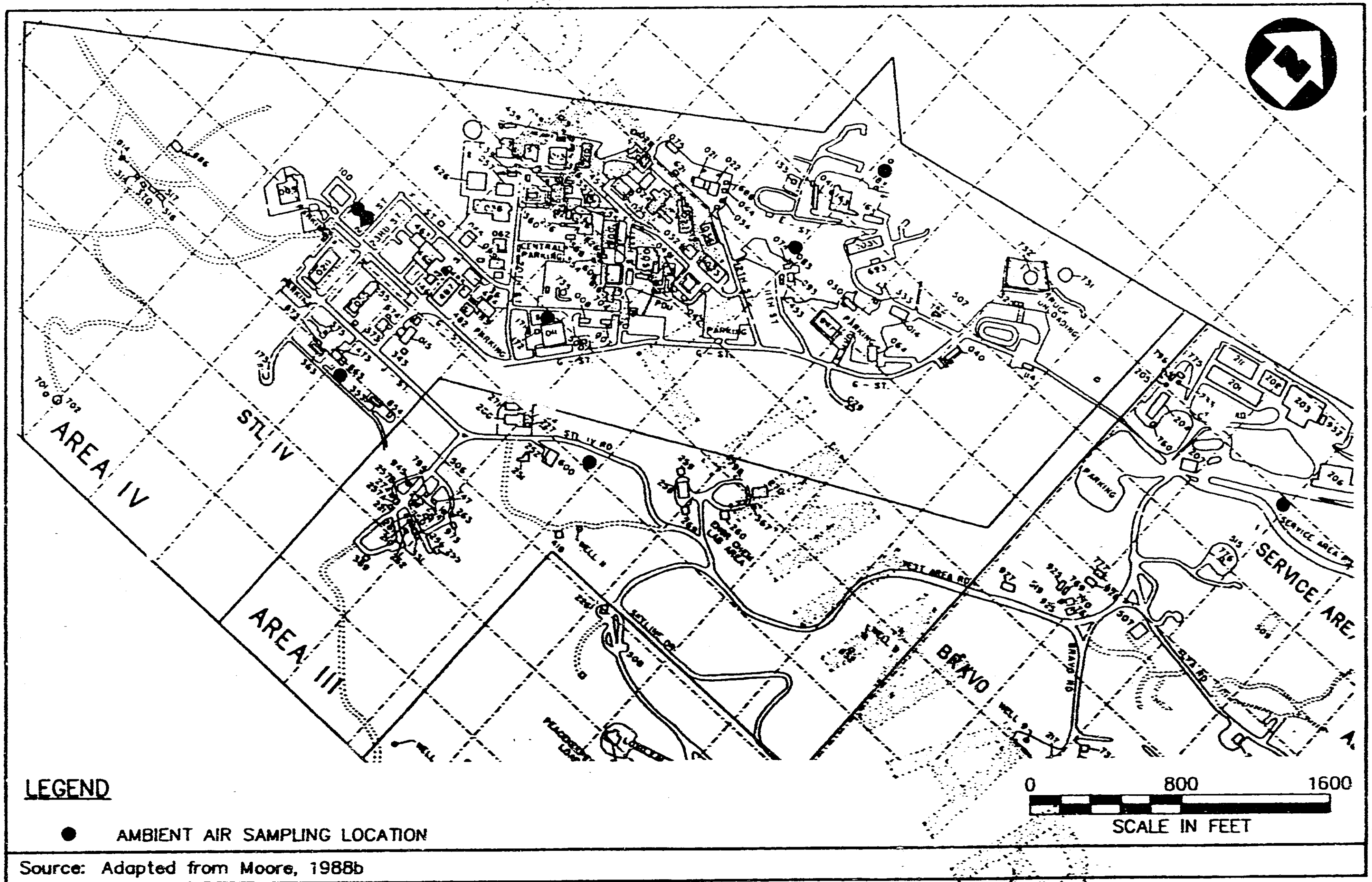


FIGURE 3-1

LOCATION OF RADIONUCLIDE PARTICULATE AMBIENT AIR SAMPLING STATIONS
SSFL—VENTURA COUNTY, CALIFORNIA

TABLE 3-4

AMBIENT AIR RADIOACTIVITY CONCENTRATION DATA
1968 THROUGH 1987
SSFL - VENTURA COUNTY, CALIFORNIA

Year	SSFL Site Average (10^{-12} µCi/ml)		
	Number of Samples	Alpha	Beta
1987	2,460	0.0019	0.027
1986	2,415	0.0028	0.061
1985	2,450	0.0020	0.040
1984	2,461	0.0014	0.024
1983	2,328	0.0010	0.023
1982	2,347	0.0013	0.022
1981	2,518	0.0068	0.12
1980	2,342	0.0064	0.035
1979	2,519	0.0065	0.020
1978	2,402	0.0072	0.088
1977	2,438	0.0066	0.17
1976	2,520	0.0065	0.11
1975	2,450	0.0060	0.073
1974	2,477	0.0057	0.16
1973	2,311	0.0072	0.038
1972	2,430	0.0086	0.14
1971	2,476	0.0086	0.33
1970(a)	2,434	---	0.36
1969	2,364	---	0.26
1968	2,157	---	0.32

Source: Moore, 1988b.

(a) Ambient air alpha radioactivity values were included in the beta values and not reported separately prior to 1971.

values that were below MDL with values equal to the MDL. This resulted in averages that were biased on the high side. As expected, both alpha and beta radioactivity have generally decreased during this period. Although phase-out of older facilities and decreased levels of operation of existing facilities are partly responsible, current controls have played an important role in this decrease. Controls are discussed in Section 3.1.2.

3.1.2 General Description of Pollution Sources and Controls

There are relatively few permits issued by the VCAPCD to SSFL. This is largely because VCAPCD ordinarily issues a permit to cover a group of sources with a common location or function. Current permits are shown in Table 3-5. Several of these have expiration dates in the next few years. Several have expired and must be renewed if future operation is contemplated. Natural gas capacities of the combustion sources are shown along with permissible emissions in pounds per hour. All the combustion sources have limitations on the quantities of natural gas used. When No. 2 diesel oil firing is allowed (only during natural gas curtailment), its firing rate and maximum hours of use are stipulated. The sources have additional emission limits expressed in tons per year. This has the effect of limiting the number of hours of operation per year.

Many of the additional stipulated restrictions are intended to minimize the impact of combustion sources on smog formation nearby or in downwind areas. For example, operation of the Babcock & Wilcox (B & W) sodium heater requires contact with the air quality reporting section of the VCAPCD to determine if a smog alert has been forecast for the start up day. If a smog alert is forecast, the testing must be postponed. Another restriction limits simultaneous use of combustion sources. The Keeler boiler cannot be operated when the B&W sodium heater and the Coen heater are operating near capacity.

A further restriction requires continuous NOx monitoring of the stack gas from the Coen heater. Monitoring is described in Section 3.1.3.

Another restriction limits the B&W heater to a maximum concentration of 80.7 ppm of NOx in the waste gas. At the maximum firing rate this is equivalent to about 11.5 pounds per hour, which is well below an allocated share of the 58.31 pounds per hour allowed for the boilers covered by Permit No. 1124. This additional restriction is based on measurements made during tests conducted during December 1983, which showed this concentration to be normally attainable. Limited testing conducted in 1987 indicates that this limitation may not be easily achieved during future operation.

TABLE 3-5

PERMITTED AIR SOURCES
SSFL - VENTURA COUNTY, CALIFORNIA

Permit Number	Expiration Date	Source	Natural Gas Capacity (BTU/hour x 10^{-6})	Permitted Emissions (Pounds per Hour)				
				ROC	NO_X	TSP	SO_X	CO
1124	12/31/88	• Molten salt test reactor	—	0.07	3.51	4.31	10.06	3.20
		• Product gas combustor (baghouse)	5.4	0.07	3.51	4.31	10.06	3.20
		• Cleaver Brooks boiler	8.39	0.07	3.51	4.31	10.06	3.20
		• Portable preheat boiler	4.0	0.07	3.51	4.31	10.06	3.20
		• Low NO_X/SO_X combustor (baghouse)	—	0.07	3.51	4.31	10.06	3.20
		• Air heater	1.86	0.07	3.51	4.31	10.06	3.20
		• Coal storage, transfer, and crushing facility	—	0.07	3.51	4.31	10.06	3.20
00863		• Coal liquefaction reactor evaluation system	—					
00346-8		• R&D coal liquefaction process	—					
0290	06/30/90	• Eclipse Mark IV 100 steam boiler (1)	1.0	0.01	0.14	0.01	0.51	0.04
0271	12/31/88	• B&W heater (1)	200	0.66	58.31	9.40	157.28	16.93
		• Coen heater (1)	240	0.66	58.31	9.40	157.28	16.93
		• Keelen steam boiler	25.2	0.66	58.31	9.40	157.28	16.93
		• Five space heaters	8.71	0.66	58.31	9.40	157.28	16.93
0226	09/30/87	• Sodium burn facility				1.0		
0230	06/30/87	• Vapor Corporation heater (No. 2 fuel oil fired)	4.3	0.03	0.67	0.06	2.20	0.15
0229	06/30/87	• Coal liquification reactor evaluation systems		0.01	2.38	0.01	12.40	0.01
		TOTAL SITE	498.86	0.78	64.93	14.79	182.45	20.33

Source: Assembled from SSFL files by Survey team.
(1) May be fuel-oil fired during natural gas curtailment.
(2) Total site permitted emissions are less than the sum of source emissions because of restrictions on simultaneous use of sources.

Radionuclide Sources

Radionuclide emissions at SSFL from 1985 to 1987 are summarized in Table 3-6. At present, the principal source of radionuclide air emissions at SSFL is the Radioactive Material Disposal Facility (RMDF).

The RMDF accounted for 7.2, 9.0, and 76.7 percent of the radioactive air emissions from SSFL in 1985, 1986, and 1987, respectively. The increase in the fraction of emissions in 1987 was the result of a decrease in the total emissions following shutdown of other facilities (Building 055 and Building 020). Since no activity is anticipated in Building 020 in 1988, the majority of radionuclide SSFL emissions will be from the RMDF.

The RMDF consists of four buildings in which handling and storage activities occur:

- Building 021 in which decontamination and packaging is conducted.
- Building 022 in which high-level radioactive materials are stored pending shipment off-site.
- Building 075 in which lower level radioactive materials are stored pending shipment.
- Building 621 in which radioactive sources utilized in research activities are stored when not in use.

Other buildings at the RMDF are office and storage buildings and Building 665, which housed decontamination units that have been shut down and are scheduled for demolition (Chapman, 1986).

The only air emissions at RMDF are from activities at Buildings 021 and 022. (Buildings 075 and 621 contribute to direct radiation, which is discussed in Section 4.3.) These emissions consist principally of particulate matter removed from the surfaces of objects during decontamination. The surface particles result from handling and storage activities in Building 022 and decontamination processing and packaging activities in Building 021. Particulate matter contains uranium and plutonium plus ^{137}Cs, ^{90}Sr, ^{85}Kr, and ^{147}Pm as mixed fission products and CO^{60} and Eu^{152} as activiation products. Control of air emission consists of filtration by high efficiency particulate air (HEPA) filters.

TABLE 3-6

ATMOSPHERIC RADIOACTIVE EMISSIONS
SSFL - VENTURA COUNTY, CALIFORNIA

Building	Emissions Volume (M^3)			Total Radioactivity Released (Ci)					
				Alpha			Beta		
	1985	1986	1987	1985	1986	1987	1985	1986	1987
020	2.5×10^8	5.0×10^8	5.4×10^8	4.5×10^{-7}	1.3×10^{-7}	1.8×10^{-7}	9.0×10^{-5}	2.2×10^{-3}	3.7×10^{-6}
021-022	2.3×10^8	3.3×10^8	2.4×10^8	3.9×10^{-8}	4.6×10^{-8}	2.5×10^{-7}	9.0×10^{-6}	1.3×10^{-5}	1.22×10^{-5}
055	2.2×10^8	1.1×10^8		5.3×10^{-8}	4.1×10^{-8}	—	1.5×10^{-6}	4.0×10^{-6}	—
SSFL Total	7.0×10^8	9.4×10^8	7.8×10^8	5.42×10^{-7}	2.17×10^{-7}	4.3×10^{-7}	10.0×10^{-5}	3.9×10^{-5}	1.59×10^{-5}

Source: Assembled from Rocketdyne Annual Monitoring Reports (1985–1987) by DOE Survey team.

A schematic diagram for the HEPA filter system used to control air emissions from the RMDF is shown in Figure 3-2. Air flow from the storage vaults in Building 022 is provided by two 11-brake horsepower (BHP) blowers with a capacity of 10,400 cubic feet per minute (cfm) each. An emergency 19-BHP blower with a capacity of 17,680 cfm is also available. In the event of a blower failure, an emergency diesel generator (EDG) provides power for the emergency blower. The emergency blower is powered by the EDG, regardless of the electrical supply conditions.

If the facility loses off-site power, the EDG starts automatically and is capable of bringing the emergency blower to full speed within 10 seconds. If either of the vault blowers malfunctions, the EDG must be started manually.

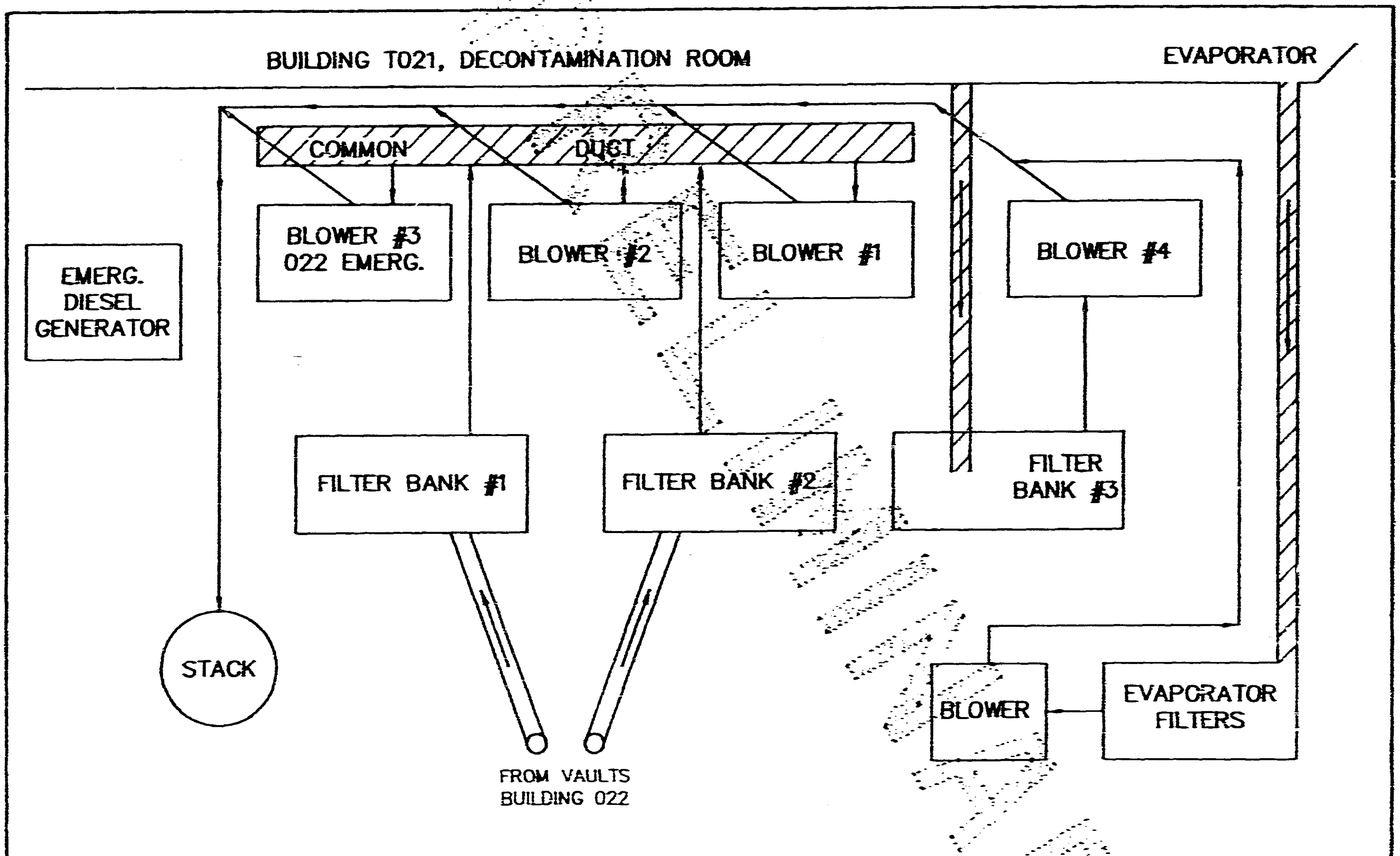
A separate exhaust system is provided for Building 021. This consists of a 19-BHP blower with a capacity of 17,680 cfm. Air flow within the building (as with the flow in Building 022) is arranged from areas of lower contamination to areas of high contamination. An emergency blower is not provided at Building 021 since, during an emergency, control of emissions by rapid shutdown of operations is practical.

A separate blower is provided for exhaust air (about 5,000 cfm) from the evaporator and adjacent areas. This exhaust air passes through a water separator followed by a prefilter and then a heater to prevent condensation, prior to filtration by HEPAs.

The air removed from the vault area of Building 022 is processed through 2 banks of filters, as shown in Figure 3-2. Each bank consists of a set of 10 prefilters and 10 HEPA filters. The banks are separated into five chambers, each containing 2 prefilters and 2 HEPAs. Each chamber can be isolated from the exhaust flow for servicing. Moreover, each chamber can be independently monitored for pressure drop or be tested for efficiency using dioctyl sebacate (DOS).

Annual testing was changed from dioctyl phthalate to DOS in 1982 on advice from DOE-San Francisco Operations Office (Jackson, 1981). Standard operating procedures at RMDF require DOS testing after each change of filters or after 1 year in service. SOPs also require replacement of filters when the pressure drop across filters exceeds 3 inches of water with an absolute maximum of 6 inches.

Air flow from Building 021 (other than the air from the evaporator mentioned above) is processed through banks of 14 prefilters and 14 HEPAs. The banks are separated into banks of 2 prefilters and 2 HEPAs, which can be isolated for servicing, monitoring, or testing. SOPs are identical to those cited above for Building 022.



Source: Adapted from Chapman, 1986

FIGURE 3-2

RMDF AIR HANDLING SYSTEM
SSFL-VENTURA COUNTY, CALIFORNIA

After the flow from the evaporator hood is conditioned, to remove moisture as mentioned above, it is filtered through a bank of 4 prefilters and 4 HEPA filters.

The combined flow from the four banks of filters is transferred by the several blowers, as shown in Figure 3-2, to the exhaust stack. This stack is 3 feet in diameter and 130 feet tall. Under conditions where all blowers (not including the emergency blower) are operating at full capacity, the stack would carry about 43,000 scfm. Under normal conditions, however, the vault area is evacuated at a rate of 15,000 scfm and the air flow from the decontamination area is about 8,500 scfm. When combined with the normal flow of about 2,500 cfm from the evaporator, a total flow of 26,000 cfm is transferred to the stack. This flow yields an escape velocity of about 60 feet per second at the top of the stack, which provides for excellent dispersion.

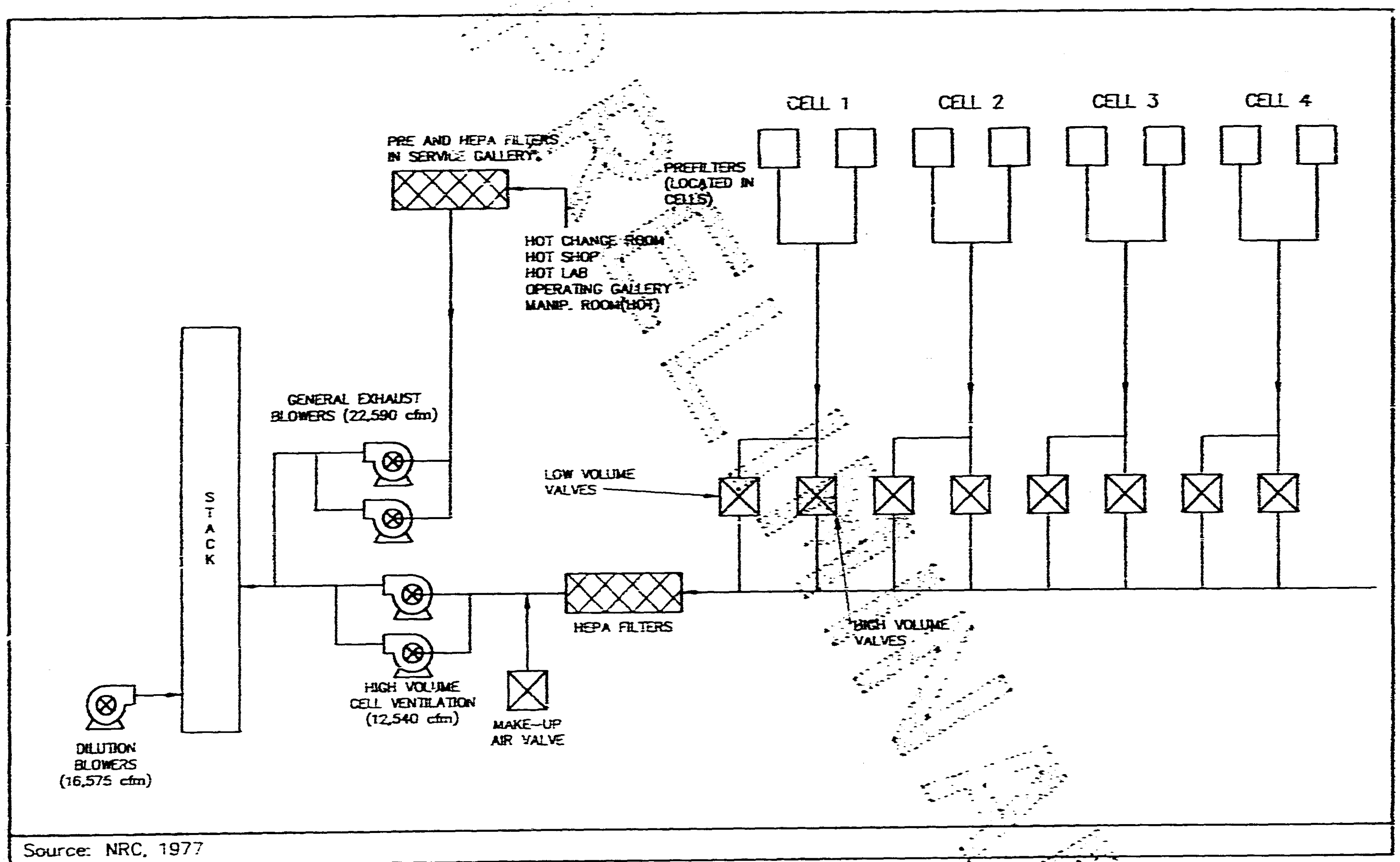
Hot Laboratory

Prior to 1988, emissions from the Hot Laboratory (Building 020) were a significant fraction of the total SSFL radioactive air emissions. Emissions in 1988 are anticipated as near zero because of extensive reconstruction work in progress.

The Hot Laboratory is used principally to examine irradiated reactor fuel, to prepare irradiated fuel for reprocessing, and to perform other operations requiring handling of highly radioactive specimens. Work is performed in cells isolated from operating areas through extensive use of remote controls and periscopes. Air flow follows the traditional concept of flowing from areas of lower contamination to higher contamination. In addition, leakage around cell doors is essentially eliminated. Since the cells are the areas of highest contamination, these are evacuated by an independent system (NRC, 1977).

A schematic diagram of air flows, valves, and filters is shown in Figure 3-3. The flexibility of ventilation is excellent. Any number of cells can be exhausted at either a high or low rate. Independently, the remainder of the building can be exhausted at any of several rates, depending on which areas are in use. At low rates, make-up air can be added prior to the cell blowers, and additional air can be added at the base of the stack to improve escape velocity.

As shown in Table 3-6, emissions from the Hot Laboratory can be a major portion of the total SSFL emissions, which ranged from near zero in 1988 to as high as 90 percent in 1985. Other major sources of radionuclide particulate emissions at SSFL have been limited to the Nuclear Materials Development Facility (NMDF), Building 055. THE NMDF was constructed for research and



Source: NRC, 1977

FIGURE 3-3

HOT LABORATORY AIR PARTICULATE CONTROL
SSFL-VENTURA COUNTY, CALIFORNIA

development and production work with alpha emitting and/or highly radioactive fuels. Air emissions were primarily radioactive particulates and were controlled by HEPA filtration. This facility, which had become a minor contributor to SSFL emissions (e.g., Table 3-6 shows 10 percent of SSFL 1986 emissions were from the NMDF), was permanently shut down in July 1986.

Nonradionuclide Emissions

Major sources of nonradionuclide emissions are the permitted sources shown in Table 3-5. As discussed previously, these sources are limited not only in emission rates per hour (shown in Table 3-5) but also in tons per year, in amount of fuel burned, and in simultaneous operation of several sources. These restrictions and the intermittent operation of most facilities result in very low emissions of permitted parameters annually.

All permitted facilities are conventional units, with the exception of the coal gasification unit, the sodium heaters, the low NOx/SOx combustor, and the sodium burn facility.

The coal gasification unit was a research operation which gasified coal to form a low BTU (90–100 BTU per cubic foot) gas. Operations were completed in early 1982 and limited operation, if any, is expected in the future.

The low NOx/SOx unit was tested to study coal combustion under conditions designed to give low concentrations of both sulfur oxides and nitrogen oxides. Essentially the low sulfur oxides were obtained by use of limestone injection and the low nitrogen oxides were obtained by quenching partly combusted gas prior to completing combustion. Studies were completed in early 1988. Limited operation in the future is possible.

The sodium burn facility (Building 133) is designed for reaction of waste materials containing metallic sodium. Wastes containing impurities such as sodium-potassium alloys and hydrides of alkali metals can also be handled. Conditions of heating are sufficient to react all the materials. Reaction takes place in a pan heated with natural gas fuel. Reaction products are prevented from release by a venturi scrubber. Removal of particulates is sufficiently efficient that compliance with the emission limitation of 1.0 pounds per hour is routine.

The aqueous discharge from the venturi scrubber and the reaction pan is essentially a high-quality, dilute, sodium hydroxide solution which can be used to replace normally purchased sodium hydroxide.

Although the burn facility has not been used since April 1987, it is available for use in the future.

Utilization of chlorinated solvents and freons is small. During a 1987 survey (Remley, 1987), annual use of methyl chloroform was estimated to be about 630 pounds per year. This survey also estimated annual use of freons (mostly freon-12 and freon-22 in air conditioning) to be about 1,450 pounds per year.

3.1.3 Environmental Monitoring Program

Ambient Air Monitoring

SSFL operates a network of eight ambient air samplers (see Figure 3-1), which collect particulate samples continuously. Seven samplers (A-3 to A-9) are located near major sources or downwind. These collect a sample every 24 hours on a 37 mm diameter filter at a flow rate of 25 cubic meters per day. A somewhat unique arrangement of hardware allows air flow to be switched to a fresh filter each midnight. Seven samples are collected each week, one sample representative of each of the preceding 7 days. An eighth sample (A-10) is collected adjacent to the sampler near Building 100 (A-3). This sample is collected over a 7-day period. Thus, in total, about 2,500 samples are collected each year. Samples are counted for alpha and beta radiation following a 120-hour delay to allow for decay of radon and thoron daughters.

Many of the daily samples are near or below the method detection limits (MDL). For example, in 1987, 99 percent of the alpha measurements and 64 percent of the beta measurements were below MDL. Although the 7-day sampler provides information which serves many purposes, it provides an excellent quality control check on the daily sampler. In recent years there has been excellent agreement between the daily and 7-day samples. For example, in 1987, the daily samples showed an average (see Table 3-4) of 0.0019×10^{-12} uCi/ml for alpha radioactivity and 0.027×10^{-12} uCi/ml for beta. During 1987, the average of 7-day samples showed 0.0015×10^{-12} uCi/ml for alpha and 0.0289×10^{-12} uCi/ml for beta. Typically, 68 percent of the alpha measurements and 0 percent of the beta measurements are below MDL for the 7-day samples.

Stack Sampling

All stacks known to contain any significant quantity of radionuclides are continuously monitored at SSFL. During 1987, this included only Building 020 and the stack serving Buildings 021 and 022. Prior to July 1986, Building 055 was also monitored. During 1988 (including the on-site portion of the

Environmental Survey), Building 020 was essentially inactive. This presented the opportunity to perform maintenance on the sampling and analytical equipment employed at Building 020.

Sampling at Buildings 021–022 consists of continuously collecting a sample of gas withdrawn from the stack. A flow rate of 62 liters per minute provides sampling that is approximately isokinetic. A filter with 5 micron porosity is changed weekly. A detector mounted nearby would alarm at any rapid build-up of radioactive material on the filter. Additional precautions to prevent large discharges from the stack come as a result of frequent monitoring of the pressure drop across the HEPA filters and monitoring (primarily for employee health purposes) conducted within the two buildings.

Emissions from the RMDF complex have been low for many years. Recent results are summarized in Table 3-7. Better precision results, because fewer measurements are close to detection limits than with ambient air measurements. In 1987, 31 percent of the alpha measurements and none of the beta measurements were below MDLs.

The annual monitoring report usually contains a statement such as: "The effectiveness of the air cleaning systems is evident from the fact that the atmospheric effluents are less radioactive than is the ambient air" (Moore, 1988b). In 1987, this was correct for the emissions from Building 020 and for the DeSoto buildings. Table 3-7 shows, however, that emissions from Buildings 021–022 were higher than the equivalent ambient air. Nevertheless, controls are effective and the total radioactivity release is low. In 1987, the total released was less than 1 percent (0.17 percent alpha, 0.17 percent beta) of the appropriate DOE guideline.

Modeling by AIRDOS-EPA is used to estimate doses to the general population. Doses are not substantially different from zero. For example, the average individual dose to a person living within an 80-km radius was 9.6×10^{-7} mrem in 1987. The total dose from all sources, including natural background, is about 180 mrem. Total dose from SSFL, including direct radiation, will be discussed more fully in Section 4.3.

TABLE 3-7

RMDF ATMOSPHERIC EMISSIONS
SSFL - VENTURA COUNTY, CALIFORNIA

Year	Total Radioactivity Released (Ci)		Annual Average Concentration Beta (μCi/ml)	Average Ambient Air Concentration Beta (μCi/ml)*
	Alpha	Beta		
1987	2.5×10^{-7}	1.2×10^{-5}	51×10^{-15}	29×10^{-15}
1986	4.6×10^{-8}	1.3×10^{-5}	40×10^{-15}	73×10^{-15}
1985	3.9×10^{-8}	9.0×10^{-6}	39×10^{-15}	35×10^{-15}
1984	7.4×10^{-8}	3.7×10^{-6}	1.1×10^{-15}	33×10^{-15}
1983	4.7×10^{-8}	1.1×10^{-6}	3.4×10^{-15}	32×10^{-15}
1982	2.4×10^{-8}	0.61×10^{-6}	1.8×10^{-15}	42×10^{-15}
1981	$< .87 \times 10^{-8}$	4×10^{-6}	12×10^{-15}	$< 120 \times 10^{-15}$

Source: Adapted from Rocketdyne Annual Monitoring Reports (1981–1987) by DOE Survey Team.

* 7-day samples at SSFL Building 100 from 1985 to 1988; at DeSoto Site from 1981 to 1984.

3.1.4 Findings and Observations

3.1.4.1 Category I

None.

3.1.4.2 Category II

None.

3.1.4.3 Category III

None.

3.1.4.4 Category IV

1. Lack of Meteorological Tower. Lack of a meteorological tower could result in inaccurate dose assessment in the event of an unscheduled release. Without a meteorological tower providing current wind speed and direction data, it is not possible to accurately predict the area of impact of an unscheduled release. In addition, annual calculations of the air pathway dose to the population using the AIRDOS-EPA computer model may be in error, since old and inappropriate information from the Burbank Airport (BAP) is used.

   It has been assumed that the BAP information is adequate because upper winds above the site are similar to upper winds at BAP, 22 miles east of the site. However, data taken from a meteorological tower that was operated in Area II during 1960–1961 shows some differences. For example, data for the NNW through NE quadrant (that is, the sum of the frequencies from the NNW, N, NNE, and NE segments) indicates that the wind is from that direction 41.7 percent of the time at BAP but varies from 33.8 percent of the time (winter) to 12.0 percent (summer) at SSFL.

3.2 Soils

3.2.1 Background Environmental Information

Naturally occurring soils at SSFL have formed through weathering and erosion of the geologic formations present at the facility. The soil consists of recently deposited (in geologic time) unconsolidated sand, silt, and clay referred to as Quaternary Alluvium. The Burro Flats area contains the most continuous soil zone at the site; as much as 6.6 meters (20 ft.) in depth. Other areas of the site exhibit shallow soils, often discontinuous laterally, where outcrops of the Cretaceous Chatsworth Formation sandstone form cliffs or rock knobs protruding from the surface (Refer to Section 3.4.1 for information on the site geology). Within the weathered rock zone, soil seams occupy joints, fractures, and faults in the rock mass where the sandstone has been decomposed in place by water infiltrating from the surface along these features.

Background levels of radioactivity in soil and vegetation at SSFL were initially measured in 1954 prior to any on-site activity with radioactive materials. Both on-site and off-site regional soil and vegetation monitoring for radioactivity has been performed since that time. Generally, on-site values of gross alpha and gross beta have been similar to off-site values. Both on-site and off-site values also show a gradual increase in gross alpha and gross beta since initial sampling, reported by SSFL to be due mostly to global nuclear weapons test fallout. The most recent soil radioactivity data (see Section 3.2.3) shows average values of 27.1 pCi/g for gross alpha, and 25 pCi/g for gross beta from 48 on-site samples. The average values from 48 off-site samples for the same period were 25.7 pCi/g for gross alpha and 24 pCi/g for gross beta (Moore, 1988). Vegetation analyses, when last reportedly sampled in 1985, shows a similar relationship with on-site average values of 3.8 pCi/g for gross alpha, and 135 pCi/g for gross beta from 48 samples. The average values from 48 off-site samples for the same period were 4.7 pCi/g for gross alpha and 133 pCi/g for gross beta (Moore, 1986b). Additional information and data from the environmental monitoring program are presented in Section 3.2.3.

There are no Federal or state regulations that limit the concentration of uranium in soils. However, there is guidance available from both the U.S. Nuclear Regulatory Commission (NRC) and the U.S. Department of Energy (DOE). The NRC, in a memorandum pertaining to a Branch Technical Position on the disposal or on-site storage of residual thorium or uranium, established derived concentration limits for various disposal options (NRC, 1981). One of these options applies to wastes with sufficiently low concentrations of uranium or thorium that they would present no health risk and may be disposed of in any manner. The acceptable concentrations for this disposal option were derived by the NRC using radiation dose guidelines recommended by the Environmental Protection

Agency for protection against transuranium elements present in the environment (EPA, 1977). The derived concentration limits are natural uranium, 10 pCi/g; depleted uranium, 35 pCi/g; and enriched uranium, 30 pCi/g. The concentration limit for natural uranium is based on the assumption that all the daughter products are present in secular equilibrium.

The DOE has established guidelines for residual radioactivity at Formerly Utilized Sites Remedial Action Program (FUSRAP) and remote Surplus Facilities Management Program (SFMP) sites (DOE, 1985 and Gilbert et al., 1985). The guidelines specify concentrations for thorium-232 & 230, and radium-228 & 226 only. For other radionuclides or mixtures, the soil concentration guidelines must be derived, on a site-specific basis, using a basic dose limit of 100 mrem/yr to an individual, from all pathways.

There are no Federal regulatory standards for nonradiological contaminant concentrations in soil as there are for drinking water supplies or air except for PCBs in soil (40 CFR 761.125). A determination of "safe" or "acceptable" levels in soil depends on contaminant migration pathways (e.g., wind or water erosion or leaching to the groundwater) and potential human exposure routes (e.g., ingestion of soil by children or farm animals, ingestion of contaminated groundwater, or inhalation of fugitive dust containing contaminants). Therefore, Federally acceptable levels for most contaminants must be determined on a site-specific and chemical-specific basis.

California has legislated threshold limit concentrations for several substances, mostly known or suspected carcinogens, that, if exceeded in a material (i.e., soil, etc.), render it to be a hazardous waste. There are two such limits--Soluble Threshold Limit Concentration (STLC) and Total Threshold Limit Concentration (TTLC)--as defined in Title 22 of the California Administrative Codes. In addition, the State Water Resources Control Board is organized on a regional basis to allow specific regional or local needs to be addressed that would not apply to other areas of the state. The regional boards have authority to regulate, and as such, the Los Angeles Regional Water Quality Control Board has entered into a memorandum of understanding (Resolution 85-26) with the Resource Management Agency of the County of Ventura that requires cleanup of contaminated soils. Therefore, state and county standards for contamination of soils are in effect at SSFL, and are limited to STLCs, TTLCs, and background levels.

3.2.2 General Description of Pollution Sources and Controls

Soils can become contaminated by air emissions, runoff, disposal activities, spills, and resuspension of contaminated materials from other areas. Because on-site soil sampling at SSFL typically has been limited in terms of areas sampled and constituents analyzed, the Survey team in some cases utilized process information and field observation to identify a number of potential soil contamination sources and to verify areas of known soil contamination.

Actual and potential sources of soil contamination consisting of diffuse and/or large areas where soils have been contaminated from research operations and airborne emissions are not apparent at SSFL. Discrete areas of soil contamination, resulting from isolated small spills or inadvertent releases have occurred and are addressed in Section 4.5.2.3. Soil contamination associated with storage areas and with inactive waste disposal sites is addressed as part of Sections 4.1.2 and 4.5.2.3., respectively, and in the findings dealing with the particular disposal sites.

Areas of known soil contamination are described briefly as follows:

Old Sodium Burn Pit (B-886) - The area referred to as the Old Sodium Burn Pit or the "Burn Pit" occupies approximately 4,650 square meters (50,000 sq. ft.) on the north side of Building 886 (see Figure 4-3). The facility consisted of a treatment area with a concrete sump, an upper pond, a lower pond, and the nearby surrounding area that was used for "laydown" or burial. It was used extensively during the 1960-1970s time period for disposal of combustible materials such as sodium, NaK, and kerosene (Olson et al., 1987). Investigative trenching used as a part of a Phase II CERCLA investigation performed by a consultant to the site, revealed soil contamination consisting of organic solvents, diesel fuel, and oil and grease, PCBs, PCTs, terphenyls, and biphenyls (Olson et al., 1987). Concentrations in the soil for organic solvents ranged from 3100 mg/kg for Freon-TF to 22 mg/kg for trans-1,2-dichloropropane. Other organic solvents encountered were carbon tetrachloride; 1,1-dichloroethane; 1,1-dichloroethylene; ethyl benzene; tetrachloroethylene; toluene; 1,1,1- trichloroethane; and trichloroethylene. Concentrations in the soil for PCBs and PCTs were reported to be as high as 12 and 1.4 mg/kg respectively, and terphenyls and biphenyls ranged from nondetectable to 880 and 102 mg/kg respectively (Olson et al., 1987).

Sodium Reactor Experiment (SRE) Watershed - Surface water runoff from the SRE Watershed area which was sampled and analyzed once, was found to contain asbestos at a concentration of approximately 226 million chrysotile structures per liter (EMSI, 1987). The SRE Watershed area contained buildings constructed with transite siding (an asbestos-containing product) and asbestos roofing; asbestos insulation was used on the sodium piping. In addition, the SRE cooling tower, which contained asbestos-based "Munters Fill," was destroyed by fire in approximately 1972. Although many of the asbestos-bearing materials have been removed from the area, the more recent sampling of surface-water runoff indicates that a source of asbestos exists in the area. SSFL has not investigated the area to determine the source of the asbestos.

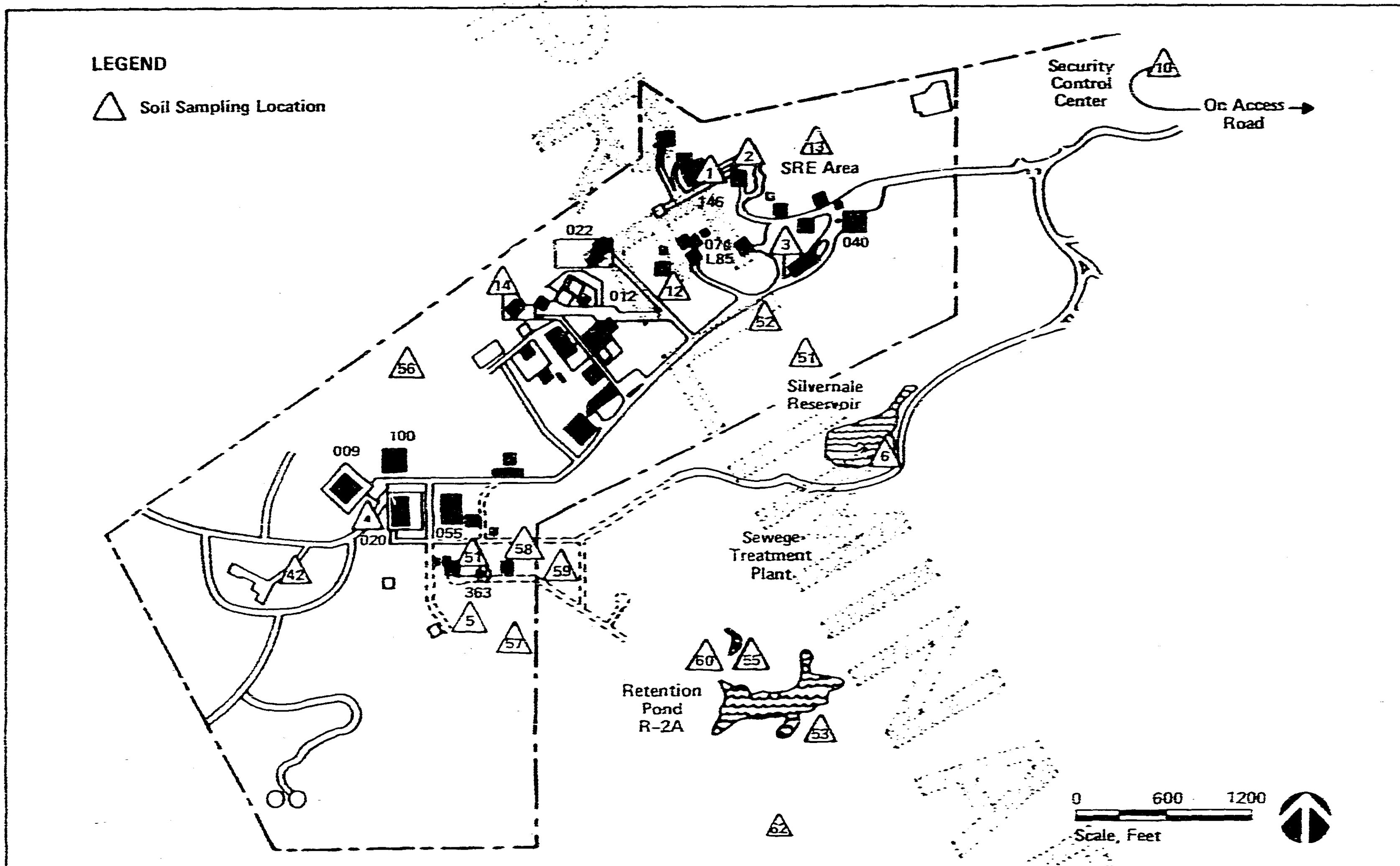
3.2.3 Environmental Monitoring Program

Environmental monitoring of soil and vegetation for radioactivity was initiated in 1954 at SSFL and has continued to the present. The current program is directed and performed by the Radiation and Nuclear Safety Group of the Health, Safety, and Environment Department. The intent of the program is to adequately survey environmental radioactivity to ensure that nuclear operations do not contribute significantly to environmental radioactivity (Moore, 1988). The locations selected for on-site sampling were selected in the mid-1950s (prior to SRE construction), based on the planned locations for reactor experiments. The locations for monitoring have not significantly changed since the original selections were made, although site operations have changed relative to potential radioactive sources for contamination (see Finding 3.2.4.4.1).

The current program of soil monitoring consists of collecting 48 samples from on-site and off-site locations up to 16 kilometers (10 miles) from the facility on a quarterly basis (Moore, 1984; Moore, 1986). Figures 3-4 and 3-5 show on-site and off-site sampling locations. Samples are collected from an undisturbed area within 15 meters (50 feet) of the location listed in the Radiological Environmental Monitoring Program document (Moore, 1986). No sample location markers are used in the field to define the area to be sampled. The sample is collected by scooping up approximately 100 grams of soil from the top 2.5 cm (1 inch) of soil using a plastic scoop. The sample is prepared by drying, sieving on a 0.6 mm Coors crucible, and spreading with alcohol on a copper planchet. Analyses are performed by counting for 100 minutes for gross alpha and gross beta at an on-site laboratory. The balance of the raw sample and the furnaced sample are then composited and gamma scanned. Data analyses are reviewed by four site personnel. The samples are collected and analyzed by the same person, and the samples do not leave the sampler's possession. No formal chain-of-custody is used. Semiannually, samples are collected by SSFL and analyzed off-site for plutonium by an independent laboratory according to NRC guidelines.

Vegetation monitoring for radioactivity, which was conducted with monthly soil monitoring, was discontinued after 1985 when SSFL also decided to reduce soil monitoring from monthly to quarterly intervals.

Compilations of soil and vegetation monitoring data are presented in Tables 3-8 and 3-9, respectively. As previously discussed in Section 3.2.1, the average of on-site radioactivity analytical values for soil and vegetation are similar to the average of off-site values.



Source: Moore, 1988b

FIGURE 3–4

ON–SITE SOIL SAMPLING LOCATIONS
SSFL–VENTURA COUNTY, CALIFORNIA

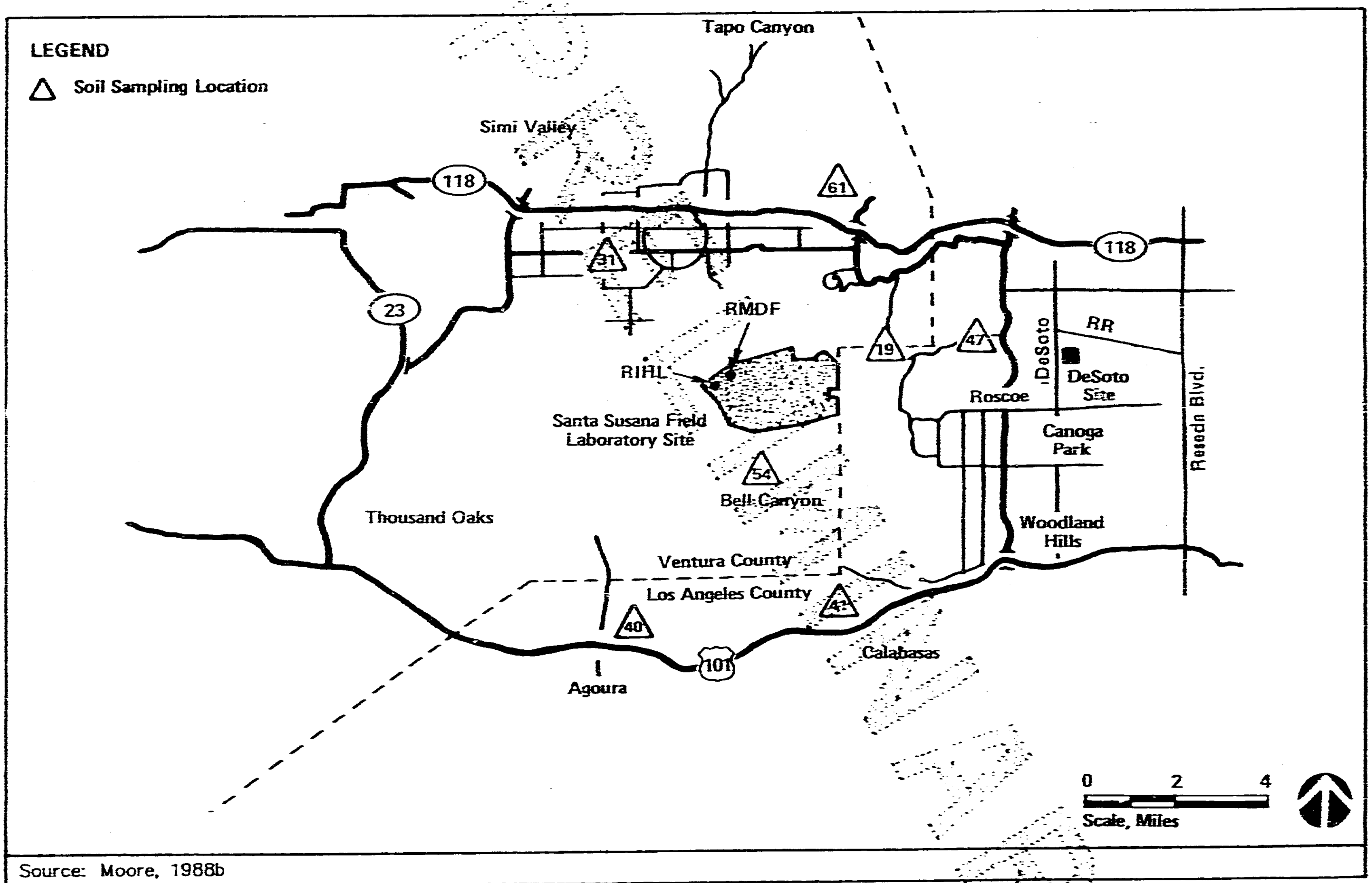


FIGURE 3–5

OFF–SITE SOIL SAMPLING LOCATIONS
SSFL–VENTURA COUNTY, CALIFORNIA

TABLE 3-8

SOIL RADIOACTIVITY DATA 1987-1957
SSFL - VENTURA COUNTY, CALIFORNIA

Year	On-Site Average or Range (pCi/g)			Off-Site Average or Range (pCi/g)		
	Number of Samples	Alpha	Beta	Number of Samples	Alpha	Beta
1987a	48	27.1	25	48	25.7	24
1986a	48	26.7	26	48	25.1	25
1985a	144	25.2	24	48	26.3	24
1984a	144	25.8	24	48	26.2	23
1983	144	0.61	24	48	0.59	23
1982	144	0.69	25	48	0.68	23
1981	144	0.69	25	48	0.64	23
1980	144	0.60	24	48	0.58	23
1979	144	0.64	25	48	0.50	23
1978	144	0.63	24	48	0.51	24
1977	144	0.56	24	48	0.53	23
1976	144	0.56	25	48	0.56	24
1975	144	0.60	25	48	0.58	24
1974	144	0.60	25	48	0.54	24
1973	144	0.57	25	48	0.51	24
1972	144	0.56	25	48	0.57	24
1971	144	0.55	25	8	0.53	23
1970	144	0.47	27	48	0.48	25
1969	144	0.42	27	48	0.42	25
1968	144	0.47	26	48	0.48	26
1967	144	0.41-0.42	28	48	0.38-0.39	24
1966	144	0.40-0.41	29	48	0.43-0.44	25
1965	144	0.46	36	142	0.46-0.47	29
1964	152	0.44-0.46	32	299	0.40-0.44	26

TABLE 3-8
SOIL RADIOACTIVITY DATA 1987-1957
SSFL - VENTURA COUNTY, CALIFORNIA
PAGE TWO

Year	On-Site Average or Range (pCi/g)			Off-Site Average or Range (pCi/g)		
	Number of Samples	Alpha	Beta	Number of Samples	Alpha	Beta
1963	156	0.41-0.43	45	455	0.38-0.42	42
1962	147	0.42-0.44	48	453	0.35-0.41	47
1961	120	0.30-0.37	34	458	0.24-0.33	23
1960	115	0.34-0.41	23	362	0.27-0.37	19
1959	107	0.43	15	377	0.32	14
1958	80	0.27	21	309	0.26	10
1957	64	0.32	11	318	0.35	10

Source: Adapted from Moore, 1987, and Moore, undated.

a The change in alpha activity after 1983 is the result of an improved calibration method that provides a true measure of alpha activity in thick samples rather than the relative values used previously. Values for 1987 using the prior method would be 0.87 for the on-site average and 0.83 for the off-site average.

TABLE 3-9

VEGETATION RADIOACTIVITY DATA, 1985-1957
SSFL - VENTURA COUNTY, CALIFORNIA

Year	On-Site Average or Range (pCi/g-ash)			Off-Site Average or Range (pCi/g-ash)		
	Number of Samples	Alpha	Beta	Number of Samples	Alpha	Beta
1985[a]	144	3.8	135	48	4.7	133
1984[a]	144	4.0	136	48	5.9	136
1983	144	0.18	149	48	0.24	143
1982	144	0.16	140	48	0.17	130
1981	144	0.20	137	48	0.21	129
1980	144	0.25	160	48	0.19	142
1979	144	0.24	139	48	0.23	134
1978	144	0.24	166	48	0.24	143
1977	144	0.22	162	48	0.21	142
1976	144	0.19	170	48	0.22	147
1975	144	0.21	155	48	0.21	141
1974	144	0.20	152	48	0.27	141
1973	144	0.24	155	48	0.24	142
1972	144	0.23	145	48	0.36	125
1971	144	0.24	165	48	0.31	132
1970	144	0.33	159	48	0.30	142
1969	144	0.40	165	48	0.36	144
1968	144	0.51	158	48	0.51	205
1967	144	0.62	286	48	0.39	413
1966	144	0.37	169	48	0.37	123
1965	144	0.55-0.56	162	142	0.61	138
1964	152	0.49-0.50	211	293	0.50-0.51	181

TABLE 3-9
VEGETATION RADIOACTIVITY DATA, 1987-1957
SSFL - VENTURA COUNTY, CALIFORNIA
PAGE TWO

Year	On-Site Average or Range (pCi/g-ash)			Off-Site Average or Range (pCi/g-ash)		
	Number of Samples	Alpha	Beta	Number of Samples	Alpha	Beta
1963	156	0.43-0.44	465	456	0.36-0.37	388
1962	147	0.44-0.45	500	453	0.42-0.44	406
1961	120	0.32-0.35	224	459	0.26-0.29	246
1960	115	0.31-0.35	137	362	0.21-0.25	136
1959	96	0.29	212	293	0.18	168
1958	65	0.57	683	250	0.39	356
1957	58	1.1	208	304	0.89	200

Source: Adapted from Moore, 1987, and Moore, undated.

a The change in alpha activity after 1983 is the result of an improved calibration method that provides a true measure of alpha activity in thick samples rather than the relative values used previously. Values for 1985 using the prior method would be 0.19 for the on-site average and 0.23 for the off-site average.

3.2.4 Findings and Observations

3.2.4.1 Category I

None.

3.2.4.2 Category II

None.

3.2.4.3 Category III

1. Known and potential on-site soil contamination. There are at least two areas where soil is known to be or may be contaminated with radionuclides, organics, metals, or other hazardous substances. A description of each area and the known or suspected contamination is presented below.

   a. Old Sodium Burn Pit/Building 886 - The operation of this facility during the 1960-1970s time period for cleaning and disposal of sodium-contaminated components, disposal of other activated metal equipment, and disposal of various organic compounds has resulted in soil contamination at and near the facility. Recent investigation of the area for the CERCLA Program, Phase II - Site Characterization (Olson et al., 1987) revealed soil contamination in the shallow subsurface soils in an area covering approximately 4,650 sq. meters (50,000 sq. ft.). The soil contamination was found to be principally volatile organic compounds, metals, oil and grease, PCTs, PCBs, terphenyls, and biphenyls. Table 3-10 lists soil sample concentrations resulting from that investigation. Because of the possibility that radioactive wastes may have been buried there, soil samples were screened in the field for radioactivity.

   Any samples indicating radioactivity were not taken to the laboratory for analysis. During a previous investigation and cleanup attempt in 1980, one area was found to be radioactively contaminated by a piece of buried equipment which was removed from the site. The piece of "pipe-like junk" registered greater than 3000 μR/hr (Lang, 1980) at the surface. Other meter readings taken of a dark sediment layer in the lower pond area generally ranged from 20 to 50 μR/hr. A later study for radioactivity was performed by

TABLE 3-10

SOIL SAMPLE ANALYSES - SODIUM BURN PIT
SSFL - VENTURA COUNTY, CALIFORNIA

Compound	Volatile Organic Compounds Concentration mg/kg	
	Low	High
Carbon tetrachloride	nd	500
1,1-Dichloroethane	nd	430
1,1-Dichloroethylene	nd	90
trans-1,2-Dichloroethylene	nd	22
Ethyl benzene	nd	44
[illegible]eon-TF	nd	3100
Tetrachloroethylene	nd	1200
Toluene	nd	800
1,1,1-Trichloroethane	nd	1840
Trichloroethylene	nd	740
Trichlorofluoromethane	nd	7.8
Metal	**Metals Concentration mg/kg**	
	Low	High
Cadmium	1	6
Chromium	10	710
Copper	16	159
Lead	10	864
Mercury	nd	3.0
Nickel	13	129
Compound/Analyte	**Other Concentration mg/kg**	
	Low	High
Oil and Grease	24	3600
Diesel Fuel	nd	375
PCBs	nd	12
PCTs	nd	1.4
Biphenyls	nd	35
Terphenyls	nd	48
pH	7.1	10.4

Source: Adapted from Olson et al., 1987.
nd = None detected.

taking gamma readings at one-meter above ground on a three meter grid spacing to locate potential hot-spots for soil sampling. The results of that study had not been finalized at the time of the on-site portion of the Survey.

b. Sodium Reactor Experiment (SRE) Watershed - Soil in the vicinity of the former cooling tower, and storm water impoundment may be contaminated with asbestos. A one-time sampling of storm water runoff from this area revealed levels of asbestos fibers and structures in excess of 220 million per liter (EMSI, 1987). There are several potential sources of asbestos in the area, in particular a fire which destroyed the cooling tower for the SRE contained "Munters Fill" which is composed of asbestos. Discussion of the surface water sampling is discussed in Section 3.3.3.

3.2.4.4 Category IV

1. Soil monitoring program deficiencies. There are deficiencies in the soil monitoring program which make it inadequate for current site conditions. The deficiencies include:

a. Sampling locations for monitoring soil radioactivity, as well as other types of contaminants, do not reflect current operations. Past operations at the site which included approximately ten experimental reactors, storage of radioactive fuel, and radioactive waste handling required a specific monitoring program relative to the location of operations during that period. The current operations at the facility are different than the past, but soil radioactivity is still monitored at the same locations.

b. Field sampling locations are not identified by markers. The lack of permanent field markers at soil sample collection locations could result in errantly located samples from substitute samplers, or new samplers replacing the current personnel. The lack of a repetitive sample location could invalidate the evaluation of annual changes in soil radioactivity at a specific location.

3.3 Surface Water

3.3.1 Background Environmental Information

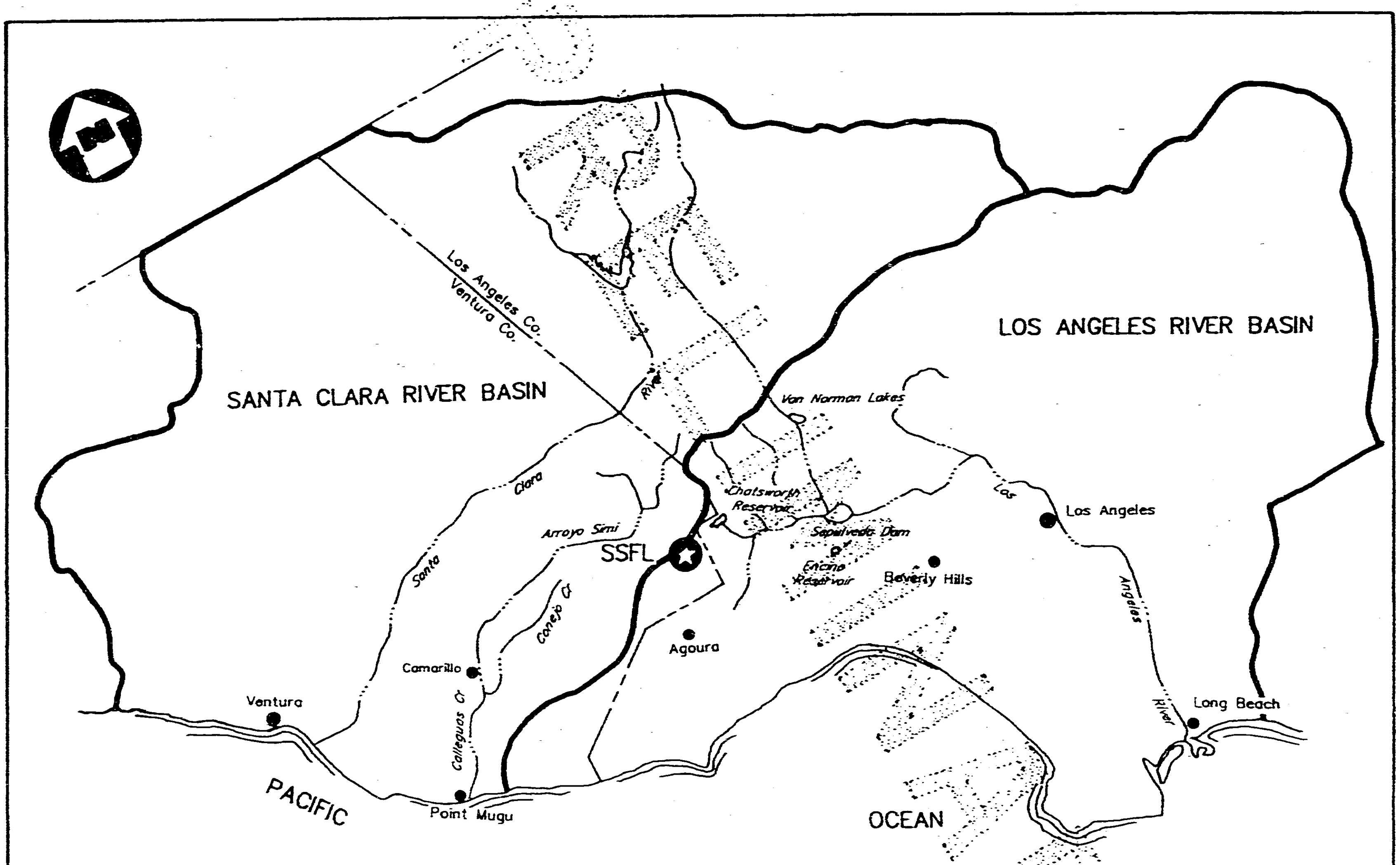
The Santa Susana Field Laboratory (SSFL) lies across the ridge which separates the Santa Clara River basin from the Los Angeles River basin, so there are two natural surface water drainage patterns associated with the site. Refer to Figure 3-6. The primary pattern, accounting for more than 90 percent of the total surface water run-off from SSFL, flows south to Bell Canyon Creek, which joins the Los Angeles River channel just west of Canoga Park. The combined streams flow east into the Sepulveda Flood Control Basin, then south through Los Angeles, eventually reaching the Pacific Ocean at Long Beach.

The secondary runoff pattern conveys less than 10 percent of the total SSFL run-off toward the north and northwest via Meier and Runkle Canyons toward Arroyo Simi or Conejo Creek. Both of these surface water streams merge near Camarillo to form Calleguas Creek, which then flows southwest to the Pacific Ocean at Point Mugu. Normally there is no flow from SSFL toward the north, but during storm conditions runoff leaves the site through a system of normally dry creek beds.

Sources of potable water nearest the site include two reservoirs - Van Norman Lakes, 22 km (13.7 mi) ENE from the site, and the Encino Reservoir, 21 km (13.0 mi) ESE from the site. These reservoirs are not affected by any surface-water flows from SSFL. Because of its proximity, Chatsworth Reservoir, 5.6 km (3.5 mi) east of the site, would have been more likely to show possible impact from SSFL operations, but that reservoir has been completely drained, and there are no plans to use it for storing potable water again (RI, 1976).

Surface water patterns on-site show predominantly southerly flow through open channels and culverts to a series of catch ponds and retention basins. The majority of these features are man-made, and serve to provide much-needed water for use as flame bucket coolant to all rocket testing facilities in Areas I, II, and III. Area IV, where DOE operations are centered, has surface-water drainage ditches to convey runoff and single-pass cooling water to the collection system in Area II, where it may be retained and reused as part of the R-2A Pond Reclaim Water System. Refer to Figure 3-7 for an overview of the SSFL surface drainage system.

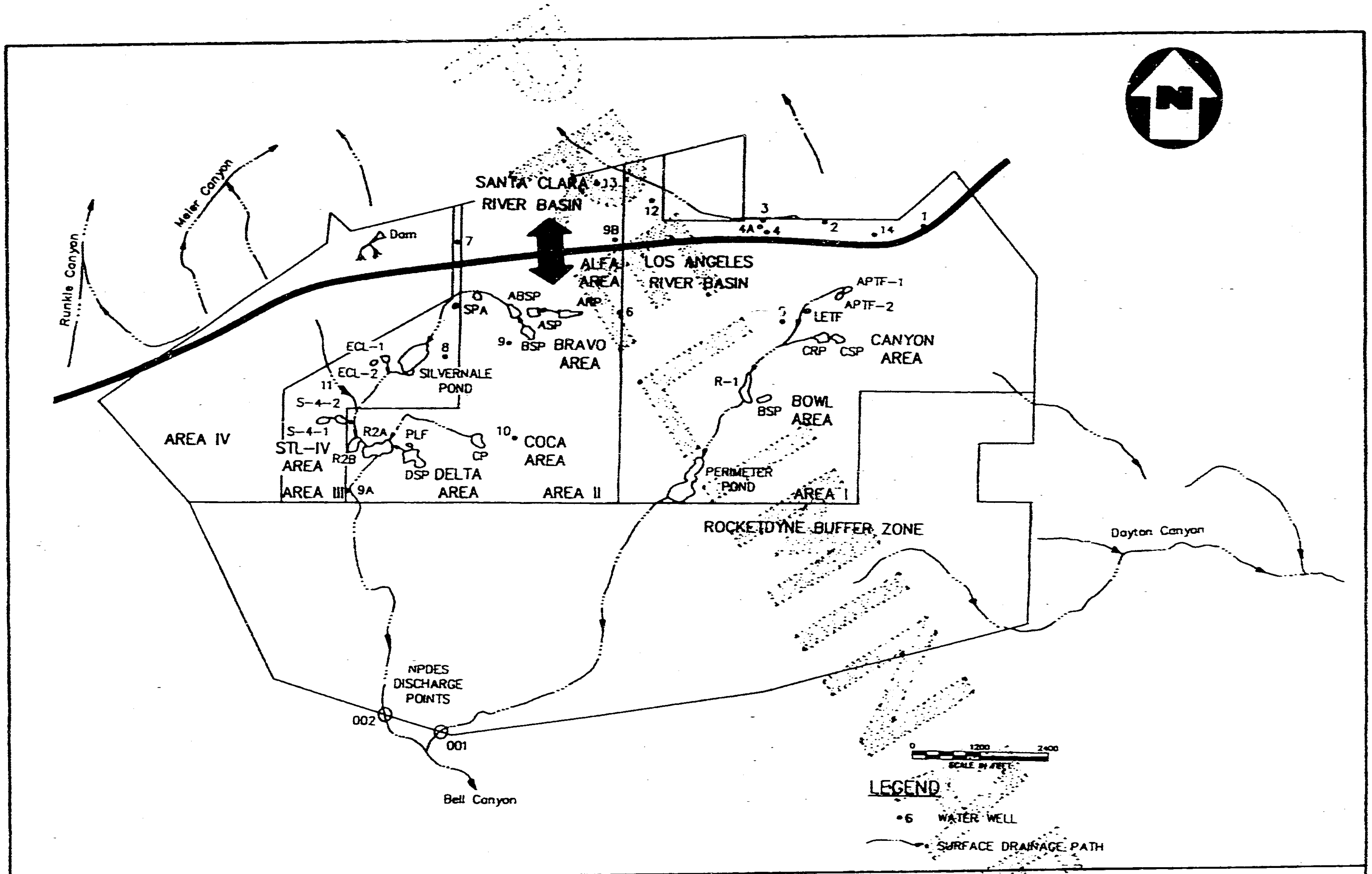
An integral part of the surface drainage system is the site-wide Reclaim Water System, which recovers most of SSFL's industrial water, rainfall, and treated sewage treatment plant effluents from all four areas. There are two parallel, interconnected loops within this system. Refer to Figure 3-8. The first serves operations in Area I (the Bowl Area and the Canyon Area) by recycling settled water



Source: Evans et al., 1987

FIGURE 3-6

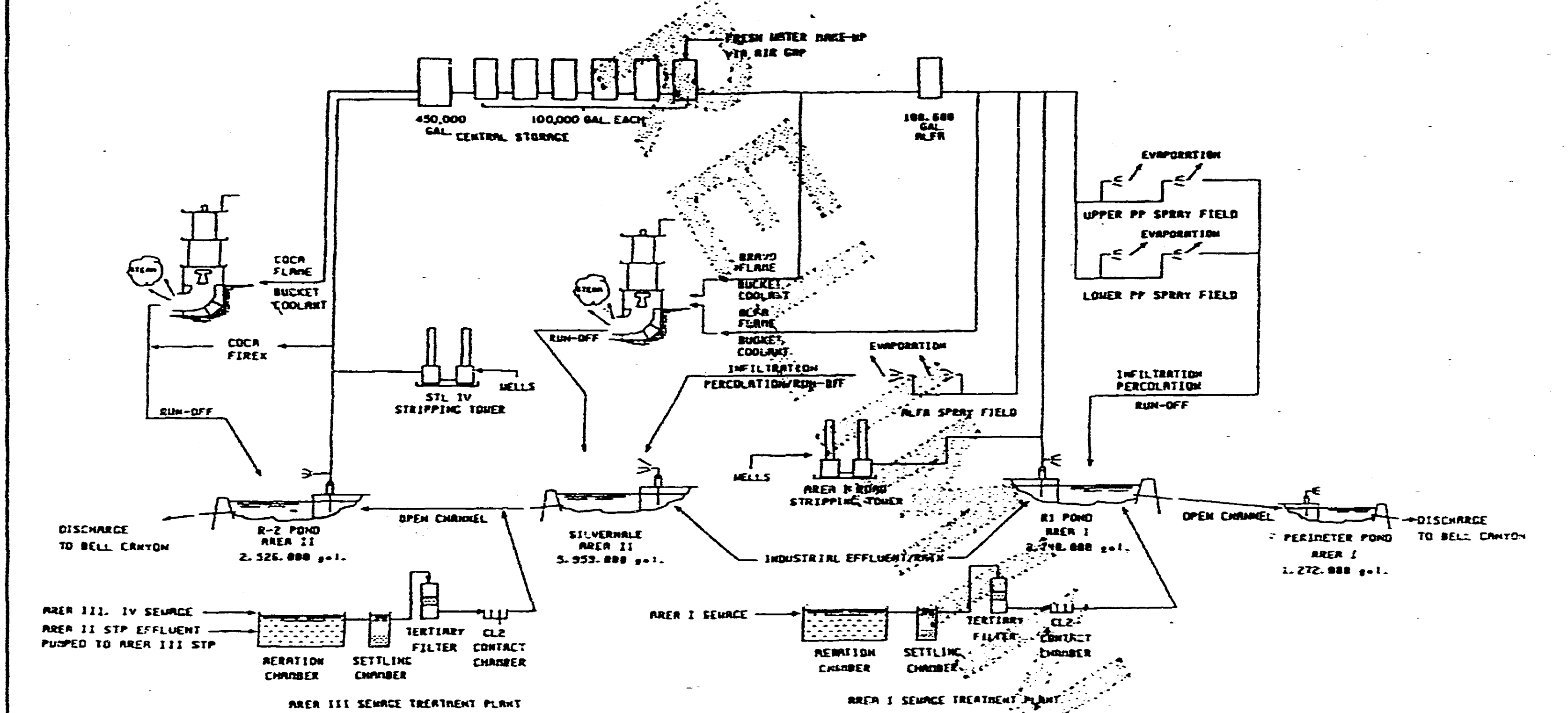
PRINCIPAL FEATURES OF THE SANTA CLARA AND LOS ANGELES RIVER BASINS
SSFL-VENTURA COUNTY, CALIFORNIA



Source: Adapted from Hargis & Associates, Inc., 1985

FIGURE 3-7

SURFACE DRAINAGE SYSTEM
SSFL-VENTURA COUNTY, CALIFORNIA



Source: SSFL Watermaster's files.

FIGURE 3-8

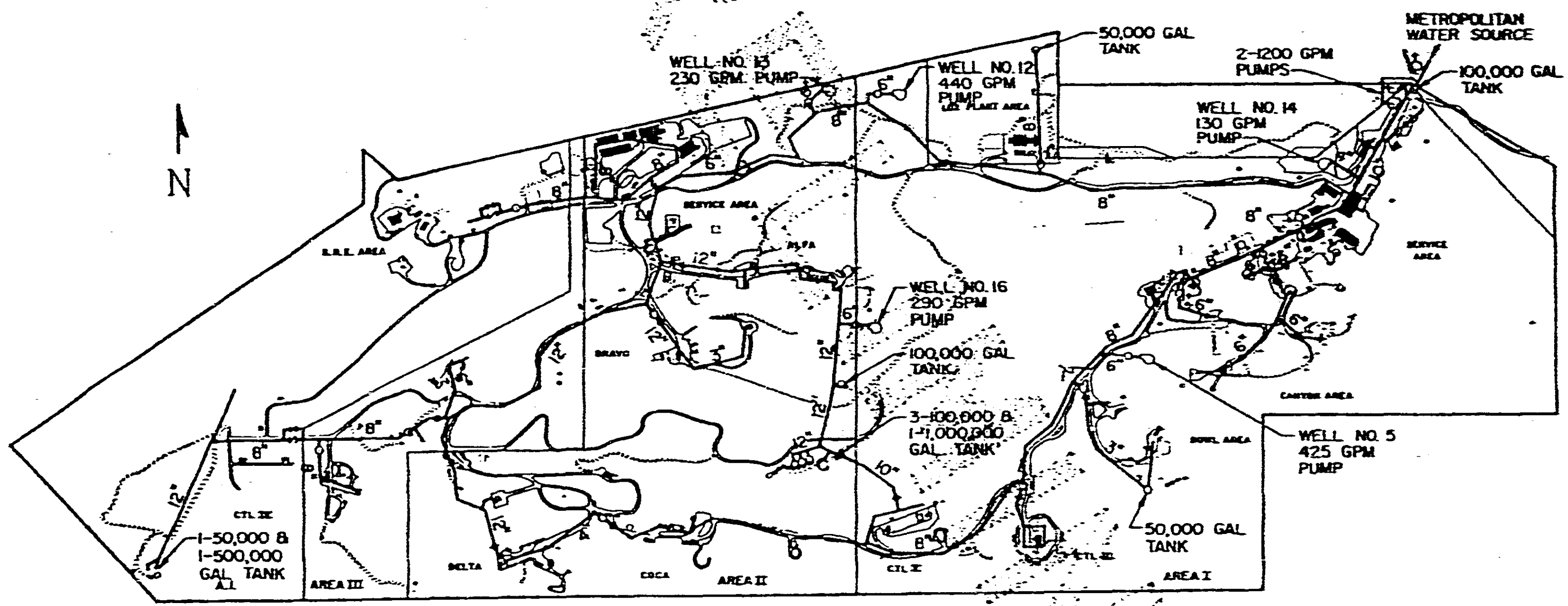
RECLAIM WATER SYSTEM
SSFL-VENTURA COUNTY, CALIFORNIA

from a 14.2 million-liter (3.75 million gallon) pond, identified as R-1 in Figure 3-7. As the supply of water in this part of the system exceeds demand, Pond R-1 overflows to a smaller 4.8 million-liter (1.27 million gallon) pond, identified as Perimeter Pond. A few times a year, Perimeter Pond discharges treated effluents and collected runoff water to Bell Canyon Creek through NPDES discharge point 001 after sampling and analysis to ensure that contaminants are below specified limits. Treatment consists of neutralization and settling.

The second loop within the Reclaim Water System serves Areas II, III, and IV. Besides individual catch basins and retention ponds adjacent to rocket test stands at Alfa, Bravo, Coca, and Delta Areas, there are two large containment basins serving this loop - the 22.5-million-liter (5.9 million gallon) Silvernale Pond in Area III, and the 9.5-million-liter (2.5 million gallon) R-2 Pond (really two ponds, R-2A and R-2B) in Area II. Industrial flows and runoff from Area IV (the DOE area) enter this loop at a point in between Silvernale Pond and R-2B Pond. About five or six times a year some water is released from the R-2A Pond to Bell Canyon Creek through NPDES discharge point 002 after sampling and analysis. Refer to Figure 3-7 for the geographic layout of the ponds and discharge points and to Figure 3-8 for a schematic diagram showing their interrelationships.

Fresh water enters the Reclaim Water System at the central storage area as make-up to one of the storage tanks. Although SSFL has 17 water wells scattered about the site, industrial water sources in recent years have been limited to two principal on-site wells and to off-site water purchased from Ventura County Waterworks District No. 17. This purchased water enters via a 380,000-liter (100,000-gallon) transfer tank at the northeast boundary of the site in Area I. The main storage reservoir is located in Area II and consists of one 3.8-million-liter (1.0 million gallon) tank plus three 380,000-liter (100,000 gallon) tanks maintained at 666 meters (2,185 feet) above sea level. A gravity-fed distribution system serves all of SSFL from this source. There is also a 1.89 million-liter (0.5 million gallon) storage tank in Area IV at an elevation of 652 meters (2,140 feet), which serves as a reserve supply for peak demands and for fire protection for the DOE facilities. Refer to Figure 3-9 for details.

The major on-site well currently in use is Well No. 5 in the central part of Area I. This well has supplied up to 38 million liters (10 million gallons) of water per month and has been gradually increasing its total annual pumping rate since overhaul in early 1985. Well No. 13, along the northern site boundary in Area II, had provided up to 17.7 million liters (4.68 million gallons) per month until it was shut off in January 1987. SSFL has gradually increased the volume of on-site well water used in the fresh water system, while gradually reducing water purchased from District 17. Table 3-11 summarizes water usage rates for the three principal sources for the years 1984 through 1987. Note that over the 4-year period, purchased water has declined from 45.8 percent of the total water use to 31.2 percent.



Source: Stafford, 1984a

FIGURE 3-9

FRESH WATER DISTRIBUTION SYSTEM
SSFL-VENTURA COUNTY, CALIFORNIA

TABLE 3-11

SUMMARY OF WATER USAGE
SSFL - VENTURA COUNTY, CALIFORNIA

Year	District 17 Purchased Water	Well No. 5	Well No. 13	Total Water Use	% Purchased from District 17
1984	148,336,845 l (39,190,712 gal)	122,453,834 l (32,352,400 gal)	52,779,554 l (13,944,400 gal)	323,570,233 l (85,487,512 gal)	45.8
1985	95,226,739 l (25,158,980 gal)	21,736,120 l (5,742,700 gal)	95,377,080 l (25,198,700 gal)	212,339,939 l (56,100,380 gal)	44.8
1986	85,170,388 l (22,502,084 gal)	134,863,714 l (35,631,100 gal)	23,346,637 l (6,168,200 gal)	243,380,739 l (64,301,384 gal)	35.0
1987*	65,556,806 l (17,320,160 gal)	144,464,896 l (38,167,740 gal)	(0l) (0 gal)	210,021,702 l (55,487,900 gal)	31.2

Source: SSFL Watermaster's Files.

* Usage for 1987 based on data for first 9 months of the year, extrapolated upward using average usages for 3 prior years. Well No. 13 was known to have been shut down for all of 1987.

Site topography, natural drainage, and a maximum expected extreme precipitation rate of no more than 46 cm (18 in.) per month during the rainy season all tend to minimize any threat due to flooding at SSFL (Cleveland, 1985). No SSFL facilities are located in the flood plain, and all active areas of the site are well drained to control storm water run-off. Elevations of the active areas vary from 550 to 640 meters (1,800 to 2,100 feet). During major storm events which produce heavy runoff, bypass culverts on-site are opened to divert stormwater flows around the R-1 Pond and the Silvernale Pond. Flows thus diverted are then impounded at the Perimeter Pond and the R-2A Pond respectively.

Area IV, where the DOE operations are based, has had no problems with flooding. All industrial waters and most of the stormwater runoff are drained through open channels and culverts to the large retention ponds R-2A and R-2B in Area II. A small portion of stormwater drains toward the north and west toward Meier and Runkle Canyons through eroded channels. The slopes are steep enough that flooding is not a problem, even during the severest storms. However, diversion dikes designed to convey stormwater run-on away from areas where hazardous wastes have been buried were breached during preliminary clean-up efforts and have not been replaced. As a consequence, storm-water running downslope through this area passes through the burn pits and burial site on its way off-site. For further discussion of this problem, refer to Section 3.3.3.

Drinking Water Sources

Although site personnel at SSFL conduct extensive monitoring of on-site well waters and file regular reports with the California State Department of Health Services' Sanitary Engineering Branch, none of the well water or water purchased from District 17 is used for drinking water. The total use for these waters is industrial (Bulan, 1987a). Since 1976, drinking water has been purchased as bottled water from several different sources, licensed to provide this service to the public. Multiple suppliers are used so that adequate quantities can be made available during periods of water shortage when individual suppliers may be forced to reduce deliveries. At current levels of activity, the entire SSFL Site is consuming an average of 1,154 units of bottled water per month. Based on 19-liter (5-gallon) units, an average population of 900 people per day, and an average of 22 working days per month, this rate of consumption provides 1.1 liters (2.3 pints) per day per person.

3.3.2 General Description of Pollution Sources and Controls

One of the largest sources of industrial wastewaters under DOE control is the Sodium Components Test Installation (SCTI), located at Building 356. This facility is used for performance evaluation of large heat exchangers, steam generators, and their in-line components (e.g., valves, seals, expansion joints). Extensive cooling arrangements are involved, with up to 10 forced draft cooling towers on-line to provide heat removal from the water-cooled condenser system and boiler feed pump seal coolers, lube oil coolers, and air compressors. In addition to this circulating cooling-water system, a treated-water system is installed to provide makeup water to the steam and feedwater system, and to filter and demineralize the full condensate flow from air-cooled and water-cooled condenser systems. This treated-water system must have tight control of feedwater purity, pH, and dissolved oxygen content.

The demineralizer regeneration is accomplished using strong sulfuric acid and sodium hydroxide solutions to condition the six mixed-bed ion-exchange resin columns. Regeneration is necessary every 5 days of operation for the typical resin column and produces about 45,000 liters (12,000 gallons) of spent regenerants for disposal from the system. Separate batches of spent acids and caustic solution rinses are released slowly at the same time, yielding nearly neutral wastewaters. These wastewaters then flow by gravity to Pond R-2B, where this small flow mixes with other wastewaters from Areas II and III. The SCTI also utilizes a nine-tube reverse osmosis (RO) unit to lower the total dissolved solids content of the feedwater. The brines from this RO are also released to Pond R-2B for reclaim.

During the Survey, progress on a new cogeneration plant being erected adjacent to the SCTI was observed. This unit, designated as the ETEC Power Pak, will produce electricity from steam generated during component testing at the SCTI. Up to 360,000 kg-cal/minute (25,000 KW), enough to light more than 5,000 homes, will be generated and sold to the local utility. The only wastewater originating at the Power Pak will be steam condensates and blowdown from the recirculating cooling water systems. Both of these wastewaters will be released to the channel that conveys SCTI flows to Pond R-2B in Area II.

SSFL has used several different methods for cleaning and decontaminating system components after experiments shut down, or during active periods of component repair and reuse. Formerly, steam-cleaning lances were used to remove sodium at two primary locations: an area immediately east of Building 143 (the former graphite-moderated sodium reactor experiment facility) and in the westernmost part of the site at Building 886 (the sodium disposal facility) (Adler et al., 1986). This practice is no longer used at SSFL. More recently, cleaning and decontamination operations were accomplished at Building 463, the Component Handling and Cleaning Facility (CHCF). Here, all cleaning was accomplished by using ethanol in place of water and thus eliminating this source of contaminated wastewaters. However, prior to this change, soils in the B-886 burn pit area had become contaminated with heavy metals, organics, and low-level radioactivity, principally cesium-137. Refer to Finding 3.3.4.2.1 for additional information regarding this problem.

Intrusion of groundwater into Building 059 produced wastewaters contaminated with radioactivity from induced activity in the basement sand. Some of this water remains in the basement of the building, mixed with sand. A standpipe which drains three sides of the building via French drains shows measurable levels of chlorinated organics in the parts per billion (ppb) range. A positive hydraulic head is maintained outside the basement to prevent any outward migration of radioactivity or other contaminants. No radionuclides have been detected in the standpipe or in the groundwater outside the building. Refer to Sections 3.4.4.3 and 4.5.2.3 for additional information on this long-term problem. More recently, Building 059 has served as a Large Leak Test Rig (LLTR). A limited amount of relatively clean wastewater has been generated during hydraulic testing of components. When sodium is used in experiments, the cleaning operation utilizes ethanol instead of water, much as is done at the CHCF.

Another former operation that generated wastewaters was a coal gasification experiment which ran in Building 005, the old molten salt test facility. Up to 907 kg (1 ton) of coal was converted to gas, ash, and a hazardous aqueous waste each hour of operation to produce low BTU, low sulfur gas. Tests ran for 4 years, from 1977 to 1981. During this run, a total volume of 300,000 liters (80,000 gal) of aqueous wastes were generated and disposed of as hazardous liquid wastes through commercial disposal contractors. Ash sluice water was passed through a clarifier and filtered before release. Noncontact cooling waters were released to the drainage ditch for transfer to Pond R-2B and the Reclaim Water System.

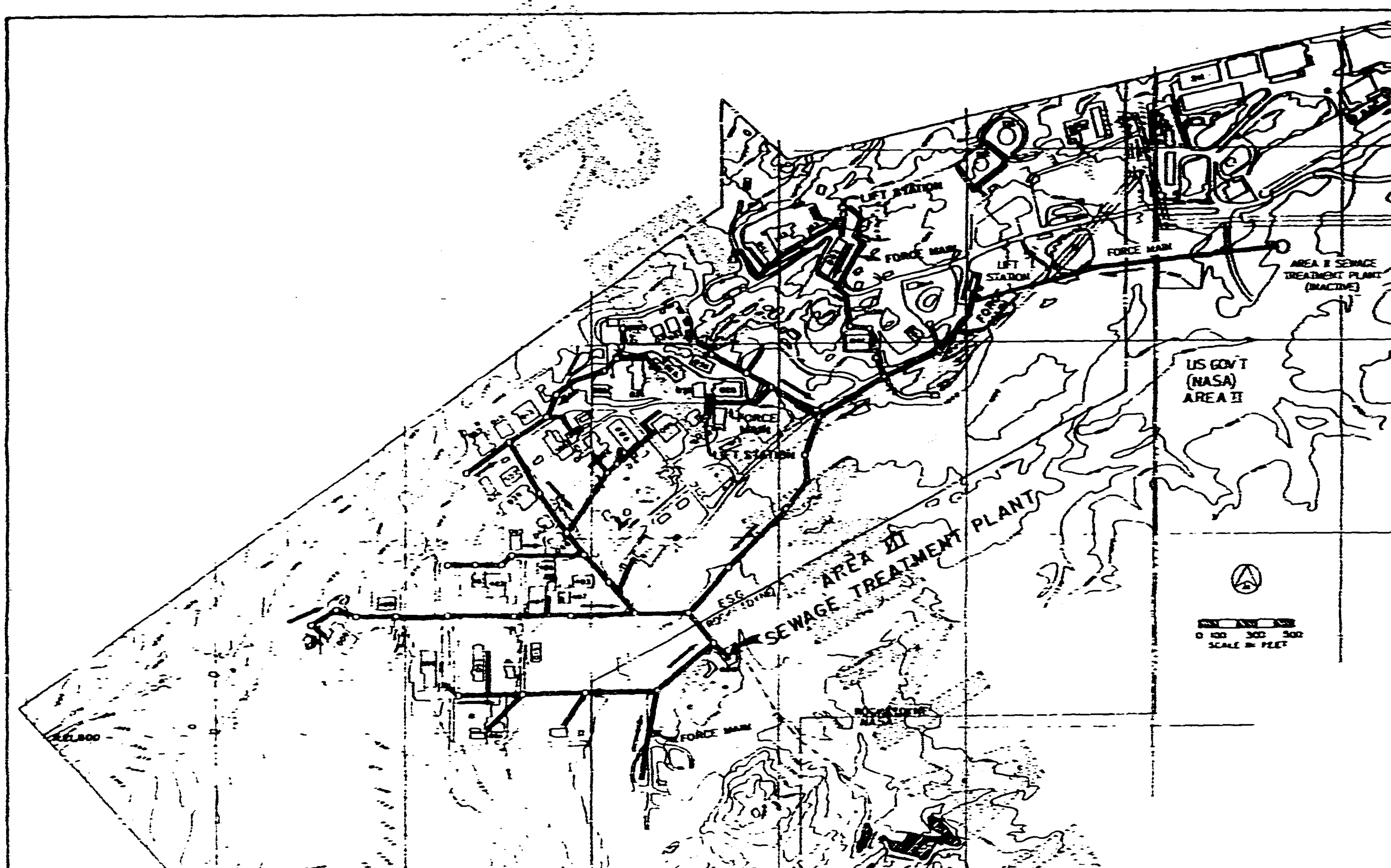
A small generator of wastewater is the Hydraulic Test Facility (HTF) which currently conducts experiments at Building 863. Typical tests involve the addition of dilute sodium hydroxide (80 mg/l) and phenolphthalein (6.8 mg/l) to one stream, and 80 mg/l of acetic acid to another stream. When the two streams are blended, the mixing of the two flows is studied visually to assess the effectiveness of various configurations or physical inducements to enhance mixing. After use in tests, test water is purified by passage through activated carbon columns, then reused in subsequent tests or released to the ground. HTF wastewater has been sent to independent test labs for fish bioassay testing, and found to be non-toxic. The maximum volume of storage available for test waste mixtures is about 28,000 liters (7,400 gal), and monthly losses from the system range between 7,500 and 15,000 liters (1,980 and 3,960 gallons). A small part of this total may reach the drainage ditch serving Area IV, but most of the flow will percolate into the ground (Corugedo, 1988).

In addition to the large cooling towers associated with active operations at the SCTI and its adjacent Power Pak, there are a number of smaller cooling towers scattered among buildings in Area IV. Half of these function as comfort (air-conditioning) towers, whereas the remainder are related to test operations. In all of SSFL there are about 20 towers which are principally air-conditioning and 12 which serve test programs. In Area IV only three of seven towers are active. A typical comfort tower serves Building 032, the Liquid Metals Development Laboratory. A typical test loop tower serves Building 065, the ETEC Chemistry Laboratory's chilled water supply. Inactive test towers are located at Buildings 005 (Molten Salt Test Facility), 006 (Sodium Laboratory), and 059 (the LLTR). All towers at SSFL are serviced monthly to ensure proper operation. Cooling water recirculates, and the pH of the recirculating water is controlled by adding a commercial solution of polyacrylic acid known as KP-1 cooling water treatment. Specific conductance readings are taken during the monthly inspection to help maintain operations at 3 to 4 cycles of concentration. All Area IV towers release their blowdown to the drainage ditch, which eventually leads to Pond R-2B. The tower at Building 065 was observed to be flooding during the Survey, and water was running off to the paved area adjacent to the building. All of the water evaporated before leaving the paved area. The problem was corrected the following day by adjusting a float level at the base of the tower.

At a few other SSFL facilities, liquids are handled but are never released to any surface water system. For example, radioactive liquids are collected at Building 020, the Hot Laboratory, and transferred to the Radioactive Material Disposal Facility (RMDF) for evaporation. Only atmospheric effluents are ever released from this building to uncontrolled areas. No radioactive liquids are released at any time. Also, Buildings 021 and 022 in the RMDF conduct operations (processing, packaging, and temporary storage of liquid and dry solid radioactive waste material for disposal) that may generate atmospheric releases. Again, no radioactive liquid wastes are ever released to the environment. Facilities of this type have hold-up tanks for retaining all liquids until proper decontamination and/or disposal can be provided (Moore, 1987).

Domestic sewage from all buildings in Area IV is released to a sanitary sewer collection system and transferred to Building 600, the sewage treatment plant (STP) serving Areas II, III, and IV. Formerly there were about 15 septic tanks and leach beds serving Area IV buildings, but at present all buildings have been connected to the sanitary sewer system. Certain remote sites in Areas I and II are still served by septic tanks and leach beds, but none of these are associated with DOE activities. Refer to Figure 3-10 for an outline of the sanitary sewage system serving Areas II, III, and IV.

The Area III STP is a package-type aeration plant with sewage purification accomplished using an aerobic digestion process, followed by alum and polymer addition, filtration using anthracite coal as the filter medium, and chlorination of the filtrate prior to release from the STP. The normal sludge



Source: Stafford, 1984a

FIGURE 3–10

SANITARY SEWER SYSTEM–AREAS II, III & IV
SSFL–VENTURA COUNTY, CALIFORNIA

recycle rate is 100 percent. Spent sludge is drawn off and transferred once a month to a public sewage treatment facility at Cucamonga in the Chino Sanitation District. The sludge has been tested and certified as nonhazardous waste material. The STP has been designed to handle up to 115 lpm (30 gpm) or about 160,000 liters (42,000 gallons) per day. Currently, the average volume of sewage treated by this facility is about 63,600 liters (16,800 gallons) per day, with 45,000 liters (12,000 gallons) of that total originating with the day shift. Thus, the system is operating at only about 40 percent of its design flow rate.

The treated effluents from the Area III STP flow by gravity to the R-2B pond to become part of the Reclaim Water System. To prevent the unwanted release of radioactivity via this path, the effluent from the STP's chlorine contact chamber is continuously monitored for radioactivity. If the alarm goes off, all flow is diverted to an adjacent retention basin and is held there until sampling and analysis can be completed. There have been no instances when this has become necessary. Once analyses of the impounded water is complete, it may be released to the reclaim system (if analyses so indicate), held for decay, or hauled off-site for proper disposal at an approved facility. Continuous, 24-hour strip charts record flow rates, turbidity, and radioactivity. Similar arrangements exist at the Area I STP, Building 543, except that its effluent becomes part of the reclaim water at Pond R-1 rather than part of the R-2 system.

Sewage treatment plant treated effluents comprise about 15 percent of the total water in the Reclaim Water System at any given time. The bulk of this reclaim water consists of industrial effluents from single-pass cooling towers, blowdowns from recycled water cooling systems, rinses from cleaning operations and other processes, and flame bucket coolant overflows from the rocket test stands. These sources combine to produce about 70 percent of the reclaimed water. The remaining 15 percent of the total comes from rainfall or is added, when needed, from the fresh water distribution system.

SSFL has taken extensive measures to isolate the freshwater and reclaimed water systems through the use of backflow prevention devices throughout the site, wherever the two water systems come in contact. As of February 1988, 91 devices were in use on reclaimed water and fire suppression systems to prevent any of these waters from entering the fresh water distribution lines. A local outside contractor provides routine inspection services twice a year, but SSFL's Utilities Department is also in the field daily checking on all aspects of the water supply systems. In the event of problems, the contractor guarantees service within a day's notice of the finding of a problem. SSFL also collects fresh water samples from nine locations scattered throughout the site to track the presence of bacteria in the system. This should provide notice of bacterial contamination from sources outside the fresh water distribution system. SSFL also routinely analyzes its wells for radioactivity and volatile organics. In fact, increases in organic content led to shutdown of Well 13.

Except for a small portion falling north of the divide between the Los Angeles and Santa Clara River basins, all stormwater run-off is channeled into the Reclaim Water System. As a result, the Perimeter Pond and R-2A Pond must occasionally release some water from the site to the creek draining Bell Canyon. Pond water quality is first determined.

Then, if all parameters are at proper levels, a measured volume of water is released through either of two NPDES discharge points. Recent practice has required five to seven releases per year from each of the two retention ponds. In prior years, releases occurred 8-12 times from each source, but incremental volumes released tended to be smaller. The major reasons for release are the amount of rainfall and the frequency of rocket testing on-site. For the R-2A Pond, which receives wastewaters from the DOE area, there were only four releases in 1985, with a total annual volume of 60,000 m^3 (16,000,000 gallons), whereas in 1986 there were six releases with a total volume of 97,100 m^3 (25,650,000 gallons). SSFL's NPDES permit allowances are based on total combined waste flows of 605,600 m^3 (160,000,000 gallons) from both ponds, so the total annual release from each source is still a small fraction of the permit basis flow.

As described in Section 3.3.1, a small portion (< 10 percent) of the stormwater runoff flows off-site at the northern boundary. Most of this flow is purely rainwater, but there are a few locations where rainwater may be eroding soils that have been contaminated by prior operations at SSFL. One such condition occurs at Building 886, the sodium disposal facility's burn pit (see Finding 3.3.4.2). The area was used extensively during the 1960s and 1970s for cleaning and disposal of components from DOE-sponsored nuclear programs (SRE, SNAP, OMRE, and others). Components were steam cleaned and rinsed in a concrete pool, then set into one of two bermed ponds where any residual sodium reacted with water. Many components were left in these ponds, which eventually were drained, but the silt (and components) remained. Partial cleanup of the area was conducted in 1980, but the task was not completed. Prior to the cleanup effort, dikes and diversion ditches had been installed to channel stormwater away from the contaminated areas, but these were breached during cleanup. As a result, stormwater is now free to run onto the site and potentially carry off contaminated soils or sediments. Refer to Figure 4-3 in Section 4.5.2.3.1.a for a diagram of the sodium burn pit area adjacent to Building 886.

Two formerly used process and cooling-water catch basins were located north of the divide, but their collected waters were pumped uphill to ditches that eventually reached the R-2B Pond. These were located near Building 143 (the former SRE) in the northeast corner of Area IV, and near Building 028 in the central portion of Area IV. During extremely heavy downpours, these basins would occasionally overflow and follow natural drainage channels toward the north. Building 143's basin is no longer in use, so the discharge valve is left open to drain off storm water. The basin at Building 028 continues to serve as a catch basin for runoff from the RMDF area. It is equipped with a radiation monitor connected to an alarm system to provide warning of any radioactive contaminants. Thus, there should be no possibility of off-site releases of contaminated wastewaters from this source.

3.3.3 Environmental Monitoring Program

SSFL has been issued an NPDES Permit to release "filtered domestic wastewater and industrial wastewater" from its two principal retention basins (R-2A Pond and Perimeter Pond), subject to criteria listed in Table 3-12. Total flows are combined to calculate discharge loads for comparison with criteria. There are also a number of additional requirements which pertain to SSFL's two sewage treatment plants (see Table 3-13). Monitoring requirements are spelled out in detail in SSFL's NPDES permit, as are notification and reporting requirements.

Since SSFL can control the release of its wastewaters and provide complete analysis of pond water prior to release, it can almost always provide whatever wastewater treatment or hold-up time is necessary to attain compliance with discharge requirements. As a result, its compliance record is exemplary, consistently achieving compliance 99+ percent of the time. A recurring violation of permit limitations, though rare, is the inability to achieve an average final effluent concentration of 15 percent by weight of the average sewage treatment influent concentrations of BOD_5 and total suspended solids (TSS). During extended periods of low activity on-site, incoming concentrations of BOD and TSS in the raw sewage are so low that the 85 percent removal requirement is very difficult to achieve. For example, even though an average influent BOD_5 concentration of 43 mg/l was reduced to an average monthly effluent concentration of 9 mg/l (30 percent of the effluent concentration limit), the net removal was only 79 percent of the inlet flow. Therefore, the mandated 85 percent removal requirement was not achieved. Similarly, incoming concentrations of 27 mg/l of TSS were treated and filtered down to only 6 mg/l TSS in the effluent. However, because of the low incoming load, this removal was only 78 percent. The effluent therefore failed to achieve the 85 percent removal requirement. Whenever the incoming raw sewage is more representative of normal loads, the two treatment plants consistently achieve 94-96 percent removal and are in compliance with all requirements.

Each release from the Perimeter Pond and R-2A Pond to Bell Canyon is monitored and reported to the Regional Water Quality Control Board. A review of NPDES monitoring reports showed that SSFL

TABLE 3-12

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD CRITERIA FOR DISCHARGING NONRADIOACTIVE CONSTITUENTS FROM ROCKETDYNE DIVISION NPDES NO. CAOO-0001309, ORDER 84-85, EFFECTIVE SEPTEMBER 17, 1984 SSFL - VENTURA COUNTY, CALIFORNIA

Constituent	Discharge Rate (lb/day)	Concentration Limit (mg/liter)
	30-Day Average	Maximum
Total dissolved solids	1,267,680	950
Chloride	200,160	150
Sulfate (as S)	400,320	300
Suspended solids[a]	53,376	40
Settleable solids[a] (ml/l)	Monitor only	0.3
BOD_5	40,035	30
Oil and grease	20,020	15
Fluoride	1,340	1.0
Boron	1,340	1.0
Residual chlorine	-	0.1
Surfactants (as MBAS)	667	0.5
Temperature (degrees C)	Monitor only	37.8 max.
Turbidity (NTU)	Monitor only	No increase
96-Hour Static Bioassay	-	-

Source: Moore, 1987.

a Not applicable to discharges containing rainfall runoff during or immediately after periods of rainfall.

b At least 90% of test organisms must survive at least 90% of the time, with no single test producing less than 70% survival.

* Based on a total waste flow of 160 x 10^6 gal/day.

TABLE 3-13

SEWAGE TREATMENT PLANT EFFLUENT LIMITATIONS
NPDES NO. CA00-0001309, ORDER 84-85, EFFECTIVE SEPTEMBER 17, 1984
SSFL-VENTURA COUNTY, CALIFORNIA

Constituent	30-Day Average	Daily Maximum	Frequency of Analysis
Turbidity	2 NTU	5 NTU*	Continuous
BOD_5 (Influent)	Monitor only	Monitor Only	Once/8 days
BOD_5 (Effluent)	--	30 mg/l	Weekly
BOD_5 (% Removal)	85%	-	Calculated
TSS (Influent)	Monitor Only	Monitor Only	Weekly
TSS (Effluent)	Monitor Only	Monitor Only	Weekly
TSS (% Removal)	85%	-	Calculated
Coliform, Total	2.2 MPN/100 ml. (median)	23 MPN/100 ml	Daily

Source: Ghirelli, 1984.

* The daily maximum turbidity limit shall not be exceeded more than 5% of the time during any 24-hour period.

is achieving nearby total compliance with all requirements. Moreover, this compliance is being achieved by a wide margin, since most concentration-limited constituents are being released at less than 25 percent of their 30-day average and maximum concentrations. For load-based requirements compliance is perfect, and the typical release rate for the eight load-based limits (including flow rate) is only 1 to 2 percent of the limit. The only controlled wastewater characterisitc that occasionally approaches its maximum limits is temperature, which sometimes reaches 24°C (72°F). Since water is only released between November and May in most years, this requirement is not likely to be exceeded either.

In compliance with the California Safe Drinking Water and Toxic Enforcement Act of 1986, otherwise known as Proposition 65, SSFL conducted a study of site runoff waters. A list of potential toxic substances regulated under Proposition 65 was used to identify possible problem areas where runoff waters may come in contact with listed substances. A knowledge of past engineering and test operations was also used to identify possible problem areas. An outside contractor was charged with the necessary sampling and analytical tasks to complete the study. Nine SSFL locations were identified as candidates for sampling, and potential chemical substances were designated for analysis. Fourteen of these were organic substances and the remaining five were inorganics.

Of the nine SSFL locations identified, two were in Area I, one in Area III, and three each in Areas II and IV. Locations are described more fully in Table 3-14, which also provides analytical data for those chemicals identified as present in site runoff. All samples were collected during the first few hours of measurable rain at the beginning of runoff on March 21, 1987. This was done to avoid the dilution effects of continued rainfall on the samples (EMSI, 1987). A separate compilation of analytical data for asbestos is provided in Table 3-15.

The locations most affected by DOE activities are identified as RD-4, RD-6, and RD-9, since they are all in Area IV. To a lesser extent, locations RD-3 and RD-7 may also show impacts, since most natural runoff from Area IV arrives there and mixes with a larger volume of runoff waters from sites in Area II and III. A review of results shown in Table 3-14 indicates that recommended primary drinking water standards for arsenic were exceeded at all locations draining Area IV except for RD-7, the R-2B Pond inlet. For chromium, the standard was exceeded only at RD-9, while the lead standard was exceeded for points RD-7 and RD-9. No Area IV source was detected for thorium. Comparison with drinking water standards is done for information only, since there is no indication that runoff waters from any of these areas ever reaches a point where they may be used as a drinking water supply source. For all metals except thorium, highest concentrations occurred at RD-9, the east drainage to Meier Canyon from the sodium disposal facility runoff. With respect to organics, impacts were less significant. Given a California Department of Health Services action level of 0.040 mg/l for

TABLE 3-14

CHARACTERIZATION OF RUNOFF WATERS
SSFL - VENTURA COUNTY, CALIFORNIA

	All concentrations are in mg/L								
	RD-1	RD-2	RD-3	RD-4	RD-5	RD-6	RD-7	RD-8	RD-9
Inorganics									
Arsenic	<0.1	0.16	0.10	0.17	0.12	0.14	<0.1	0.19	0.34
Chromium	<0.03	0.11	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.14
Lead	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.09	<0.05	0.21
Thorium	<0.1	0.18	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Organics									
Chloroform	ND	ND	ND	ND	0.0013	ND	ND	ND	ND
Methylene Chloride	0.15	ND	0.45	0.15	ND	ND	ND	0.40	ND

Source: Adapted from EMSI, 1987.
ND - None detected.
Key to Sampling Locations:

- RD-1 Well 13 Canyon in Area II.
- RD-2 Perimeter Pond in Area I.
- RD-3 R-2A Pond in Area II.
- RD-4 Area behind Building 163 in Area IV, draining to Meier Canyon.
- RD-5 R-1 Pond in Area I.
- RD-6 Building 886 in Area IV East drainage in Meier Canyon Location 2.
- RD-7 R-2B Pond Inlet in Area II.
- RD-8 Silvernale Pond in Area III.
- RD-9 Building 886 in Area IV East, draining to Meier Canyon Location 3.

TABLE 3-15

ASBESTOS IN RUNOFF WATERS
SSFL - VENTURA COUNTY, CALIFORNIA

Fiber Types and Units	RD-1	RD-2	RD-3	RD-4	RD-5	RD-6	RD-7	RD-8	RD-9
Million Structures/l	156	0	0	225	0	0	110	18.5	0
Million Chrysotiles/l:									
Fiber	136	0	0	165	0	0	86	17.3	0
Bundle	0	0	0	23	0	0	12	1.2	0
Matrix	20	0	0	37	0	0	12	0	0
Million Chrysotiles >5 µm/l:									
Fiber	2.9	0	0	6.6	0	0	0	0	0
Bundle	0	0	0	6.6	0	0	0	0	0
Matrix	0	0	0	3.3	0	0	0	0	0
Mass Concentration µg/l	1,430	0	0	4,546	0	0	1,623	186	0
Chrysotiles, µg/l:									
Fiber	1,139	0	0	1,765	0	0	686	121	0
Bundle	0	0	0	2,224	0	0	698	65	0
Matrix	291	0	0	557	0	0	239	0	0
Chrysotiles >5 µm, µg/l:									
Fiber	32.4	0	0	257	0	0	0	0	0
Bundle	0	0	0	1,500	0	0	0	0	0
Matrix	0	0	0	47	0	0	0	0	0

Source: Adapted from EMSI, 1987.

Key to Sampling Locations:

RD-1 Well 13 Canyon in Area II.
RD-2 Perimeter Pond in Area I.
RD-3 R-2A Pond in Area II.
RD-4 Area behind Building 163 in Area IV, draining to Meier Canyon.
RD-5 R-1 Pond in Area I.
RD-6 Building 886 in Area IV East draining in Meier Canyon Location 2.
RD-7 R-2B Pond Inlet in Area II.
RD-8 Silvernale Pond in Area III.
RD-9 Building 886 in Area IV East drainage to Meier Canyon Location 3.

methylene chloride (Rogers, 1986), runoffs RD-3 and RD-4 indicate that there may be some carryout of this organic from Area IV. Similar concentrations at locations RD-1 and RD-8 are not likely to be related to DOE operations, because of their distance from any DOE installations.

There may be a problem with other contaminants in the north-bound runoff. Since this runoff is not routinely monitored as part of any ongoing SSFL/Area IV surface water monitoring program, undetected release of contaminants may be occuring. Inadequate characterization of surface-water runoffs prevents SSFL from identifying potential problems (refer to Finding 3.3.4.4.1). For example, asbestos data in Table 3-15 show highest measurements in two locations that drain northward from SSFL. Sample RD-4 from the area behind Building 163 contained the single highest mass concentration of asbestos at 4,546 mg/l. Structure counts were read at 225 million structures per liter, of which 165 million were chrysotile fibers (EMSI, 1987). California had proposed a "significant risk level" for ingesting asbestos from drinking water of 140 million fibers per day, so the RD-4 runoff fiber content was at 118 percent of the proposed level. However, it is extremely unlikely that any of the asbestos in the runoff toward Meier Canyon could ever affect water supplies in the Simi Valley.

Even though SSFL uses bottled water as its sole potable water source, the freshwater distribution system is routinely analyzed for radioactivity and bacteriological parameters. Samples for radioactivity measurements are collected monthly from two widely separated sources on-site. In 1986, the average gross alpha measurement was 6.55 ± 9.09 pCi/l and the corresponding average gross beta measurement was 3.58 ± 0.95 pCi/l for the 24 samples. Individual supply wells are also analyzed twice a year. For the three most used wells, the following average values were reported for 1986 and 1987:

Well	Year	Activity in pCi/l	
		Gross Alpha	Gross Beta
WS-5	1986	11.34 ± 1.84	4.53 ± 0.38
WS-5	1987	4.06 ± 3.50	3.96 ± 0.63
WS-12	1986	7.79 ± 0.25	4.93 ± 0.07
WS-12	1987	12.97 ± 5.19	3.70 ± 1.21
WS-13	1986	9.72 ± 0	4.34 ± 0
WS-13	1987	3.99 ± 2.08	4.01 ± 0.32

All average measurements were below the recommended levels for drinking water, although an occasional individual gross alpha reading exceeds the 15 pCi/l recommended level for drinking water. The bacteriological analyses are uniformly reported at coliform counts of <2.2 MPN total coliform per 100 ml of sample, a count common to all 99 samples taken in 1987. Samples were collected twice monthly from two storage tanks (central storage and the westernmost tank) and from Well WS-13, whereas Wells WS-5 and WS-12 were sampled monthly. Other locations in scattered buildings were sampled once a year. From all available data, the freshwater system's quality with respect to radioactivity and bacteriological considerations is uniformly acceptable. Data on non-radioactive chemical parameters is not routinely collected, since the system does not serve as a drinking water supply.

Sediment sampling programs for radioactivity are conducted monthly for selected locations, including several which could be affected by DOE activities. These locations include mud from the bottom of the R-2A Pond and from sediments deposited in the drainage ditch leading to Bell Canyon. Data for 1985 and 1986 are presented in Table 3-16. Water samples covering the same periods are also presented for comparison. In 1986 beta activity in sediments and water for both locations was slightly higher by 3 to 7 percent. Alpha activities presented a different pattern. Both locations showed a 20-30 percent decline from 1985 to 1986 in sediment activity, but a 35-50 percent gain in water activity. All measurements indicated relatively low levels of gross radioactivity well below the drinking water criteria for radioactivity, with no serious deposition of activity in on-site or off-site sediments.

Very little data on nonradioactive parameters exists for on- or off-site locations, possibly because all data on radioactivity indicate minimal likelihood of problems with off-site migration of contaminants from SSFL and/or DOE operations. Monitoring requirements imposed by the site's NPDES permit and Proposition 65 appear to be the full extent of surface water measurements at the site. Other sampling appears to be related to special events, such as spills, leaks or the need to characterize new test solutions.

3.3.4 Findings and Observations

3.3.4.1 Category I

None.

TABLE 3-16

RADIOACTIVITY IN SELECTED SEDIMENT SAMPLES
SSFL - VENTURA COUNTY, CALIFORNIA

Location	Activity	Unit	Gross Radioactivity Measurement	
			1985	1986
Pond R-2A:				
Sediment	Alpha	pCi/g	31.4 ± 6.0	24.9 ± 1.9
	Beta	pCi/g	24.0 ± 1.1	24.8 ± 0.5
Water	Alpha	pCi/l	3.07 ± 1.94	4.18 ± 2.70
	Beta	pCi/l	3.49 ± 0.76	3.58 ± 1.14
Bell Canyon Drainage Ditch:				
Sediment	Alpha	pCi/g	21.9 ± 6.5	15.4 ± 4.4
	Beta	pCi/g	22.7 ± 1.1	24.2 ± 1.2
Water	Alpha	pCi/l	1.38 ± 7.09	2.02 ± 2.08
	Beta	pCi/l	2.49 ± 0.75	2.60 ± 0.52

Source: Moore, 1986a and 1987.

3.3.4.2 Category II

1. B-886 Sodium Disposal Facility Runoff. There is a potential for the release of contaminated runoff from the B-886 Sodium Disposal Facility due to inadequate control of stormwater run-on and runoff. Soils within the burn pit areas of the facility are contaminated with chlorinated organics, heavy metals, and low levels of radioactivity, principally cesium-137. Although the limited amount of testing of runoff has not indicated that elevated levels of contaminants are migrating downslope, the existing diversion structure may allow stormwater from areas upslope from B-886 to enter and leave the area. Sampling done in compliance with Proposition 65 at points downslope from the B-886 area indicated that there was some transport of arsenic, chromium, and lead, albeit at low concentrations (between 0.14 and 0.34 mg/l). Refer to Findings 3.2.4.3 and 4.5.2.3 for additional information regarding this problem.

3.3.4.3 Category III

None.

3.3.4.4 Category IV

1. Surface Water Monitoring Program. The current SSFL/Area IV surface water monitoring program does not include any periodic sampling (e.g., during rainfall events) of runoff leaving the site and entering Meier or Runkle Canyons to the north of Area IV. This could result in undetected releases of contaminants off-site. For example, the single attempt to collect runoff during the Proposition 65 sampling and analysis program did indicate that asbestos contamination in surface water runoff from location RD-4 (the area behind Building 163, the Box Shop) was as high as 225 million structures per liter, of which 165 million were chrysotile fibers. The State of California had listed a "significant risk level" for such fibers as 140 million per day when ingested as potable water. While it is unlikely that the present release could affect water supplies in the Simi Valley downslope of SSFL, the fact that the release was occurring undetected until Proposition 65 required SSFL to consider runoff sampling raises questions about the adequacy of the monitoring program.

3.4 Hydrogeology

3.4.1 Background Environmental Information

3.4.1.1 Geology

SSFL is located in the Simi Hills, the central part of the Transverse Ranges which divides the Simi Valley to the north, from the San Fernando Valley to the south. The Simi Valley is a broad synclinal depression and the Simi Hills form the southern flank of the syncline (Dickens et al., 1987). The Simi Hills are composed of two principal units (the Chatsworth Formation and Alluvium), and two minor geologic units (the Tertiary Martinez Formation and Topanga Formation) at the site. These four units are described from oldest to youngest as follows:

Chatsworth Formation: The upper Cretaceous age Chatsworth Formation underlies most SSFL. It is composed primarily of well-consolidated, massively bedded sandstone (Facies A) with interbeds of siltstone and claystone (Facies B). The sandstone facies is primarily arkosic with carbonate cement. At the site, the bedding generally dips to the northwest at approximately 20 to 30 degrees. Well-developed fractures and joints are visible in the outcrops. The Chatsworth Formation weathers to form cliffs (Dickens et al., 1987).

Martinez Formation: The Paleocene Martinez Formation overlies the Chatsworth Formation and is exposed to the north and northwest of SSFL, and south of Burro Flats. It is composed of bedded marine sandstones and shales with a basal conglomerate. Bedding dips measured north of SSFL are approximately 30 to 35 degrees to the northwest. The Martinez Formation weathers to form slopes (Dickens et al., 1987).

Topanga Formation: The Tertiary Topanga Formation, younger than the Martinez Formation, is composed of bedded marine sandstone with a basal conglomerate. It is exposed to the southeast of SSFL. Like the Martinez Formation, it also weathers to form slopes (Dickens et al., 1987, and Dickens and Hawkins, 1986).

Alluvium: The surface drainages and Burro Flats are mantled by a thin discontinuous layer of Quaternary alluvium consisting of a mixture of unconsolidated sand, silt, and clay. Drill hole data indicate that in some areas, the alluvium may be as thick as 6 meters (20 feet). The alluvium is underlain in some place by a zone of Chatsworth Formation which has been weathered in place (Dickens and Hawkins, 1986, and Dickens et al., 1987).

There are several faults and a shear zone in the SSFL area which offset Paleocene and Upper Cretaceous rock units. One of these faults, the Burro Flats Fault, trends northwest-southeast and passes through the southwestern portion of the facility. The southwestern block of this fault appears to be down-thrown relative to the northeast block. It is not known if there has been strike-slip movement along this fault (Dickens et al., 1987). There appears to have been movement along a shear zone which trends northeast-southwest through the facility. The shear zone is characterized by contorted bedding and breccia. The direction of movement is not known (Dickens et al., 1987). There are no discussions in the hydrogeologic reports for the site concerning the capability of the faults at SSFL. Other off-site faults in the area are active. The epicenter for the 1971 San Fernando earthquake, located on the San Gabriel Fault, is approximately 32 km (20 miles) from the site (NRC, 1977).

Fracture patterns at the facility have been mapped, and display two predominant trends; north 45 degrees east and north 70 degrees west to east-west (Dickens et al., 1987). Jointing is common, with three main orientations present, northwest-southeast, northeast-southwest, and east-west. A subsidiary set of joints trending approximately north-south is also present. Measurement of dip angles on the outcrops indicates that the northeast-southwest trending joints generally dip to the southeast and the northwest-southeast trending joints tend to dip to the southwest. The other joint systems tend to be vertical or exhibit high angle dips (Dickens et al., 1987).

3.4.1.2 Groundwater Regime and Use

Groundwater occurs in two zones at SSFL. A shallow system occurs in the alluvium and closely underlying zones of weathered sandstone and siltstone, and isolated shallow fracture systems. A deeper system occurs within the fractures of the Chatsworth Formation. In some parts of the facility, the two systems appear to be hydraulically connected (Dickens et al., 1987). These two systems are described as follows:

Shallow Zone: The Shallow Zone is composed primarily of unconsolidated sand, silt, and clay which has been eroded from the surrounding Chatsworth and Martinez Formations. The weathered portion of the Chatsworth Formation and isolated shallow fracture systems in the unsaturated portion of the Chatsworth Formation are also included in this zone. The Shallow Zone is discontinuous. The shallow zone is normally saturated only during and immediately following the wet season. It may also be saturated along ephemeral drainages and in the southern part of Burro Flats (Dickens et al., 1987).

Water level data from wells indicate that the surface of the saturated portion of the Shallow Zone is generally a subdued expression of the topographic surface. Groundwater occurs under unconfined conditions with the saturated thickness ranging from less than 0.3 meters (one foot) to as much as 3 meters (10 feet). Water primarily moves laterally and also downward into the underlying Chatsworth Formation (Dickens et al., 1987).

The shallow groundwater system is largely influenced by seasonal fluctuations in rainfall, and as such, gradients, flow rates, and direction are not constant throughout the year. Since information on these physical conditions is also difficult to accurately measure and quantify, and the shallow zone is not the dominant groundwater system at SSFL, efforts to investigate and develop an extensive data base on the physical conditions have not been performed in Area IV.

Chatsworth Formation: The fracture systems associated with the bedding planes, joints, and faults are the principal water bearing system at SSFL. The porosity and permeability of the formation are secondary, and result from the dissolution of detrital feldspars and carbonate cement in the rock matrix, and from open fractures. Rocks from Chatsworth Formation exposures in the Simi Hills have porosities estimated to be less than five percent (from petrographic analyses of thin sections), but some samples have apparent secondary porosities as high as 14 percent (Dickens et al., 1987).

Groundwater within fractures of the Chatsworth Formation occurs under both unconfined and confined conditions. The depth to groundwater in wells completed in the Chatsworth Formation Groundwater System range from about 3.7 meters (12 feet) to in excess of 90 meters (300 feet). The full saturated thickness is unknown (Dickens et al., 1987).

Analyses of aquifer testing revealed calculated permeabilities ranging from approximately 5×10^{-7} to 5×10^{-2} cm/sec (1.3×10^{-3} to $1.3 \times 10^{+1}$ feet per day). Since the secondary porosity controls permeability, the major fracture systems and faults have been found to also be the areas where the greatest well yields have been observed (Dickens and Hawkins, 1986). The wide range of calculated permeability values and the fracture dominated flow system also indicates that even in areas where gradients are known, calculated groundwater velocities and flow times will have a high degree of uncertainty.

Groundwater withdrawal at SSFL commenced in October 1948, and has continued until the present. Wells have been added as needed to satisfy demand, and cope with water level decline due to withdrawal exceeding recharge. The principal use has been for industrial processes. Water use records are incomplete, but recent use has averaged about 225 million liters (58.3 million gallons) per year since 1984 (Dickens et al., 1987). Groundwater extraction for individual wells since 1984 has ranged from 21.9 to 124.6 million liters (5.7 to 32.4 million gallons). Currently, approximately 40 percent of water required by SSFL is supplied from off-site sources by the Calleguas Municipal Water District.

Groundwater use has caused a depression of the groundwater levels in excess of 30 meters (100 feet) in the main SSFL site area. The use of imported water has greatly decreased the water demand on the aquifer since 1964, however, water levels remain depressed. The depression has resulted in a man-made groundwater divide trending northeast-southwest in Area IV. Since there are few sources of piezometric data in Area IV, the exact location of the groundwater divide, and the associated gradients in that area are not well known. Groundwater levels, and inferred flow directions shown in Figure 3-11 indicate groundwater flow from Area IV is generally off-site to the northwest, and toward the center of SSFL to the east and southeast.

3.4.2 General Description of Pollution Sources and Controls

This section discusses the actual and potential sources of groundwater contamination, and the controls used by SSFL to inhibit or reduce impacts to the groundwater quality from those sources. Although this section focuses on the sources of groundwater contamination, the Findings in Section 3.4.4 focus on the extent to which these sources have actually impacted the groundwater. Additional details and findings related to the physical characteristics of the actual and potential sources of groundwater contamination discussed below can be found in Sections 3.2, 3.3, 4.1, and 4.5.

Known and potential sources of groundwater contamination are described as follows:

Old Sodium Burn Pit (B-886) - The area referred to as the Old Sodium Burn Pit or the "Burn Pit" occupies approximately 4,650 square meters (50,000 sq. ft.) on the north side of Building 886. The facility consisted of treatment area with a concrete sump, an upper pond, a lower pond, and the nearby surrounding area which was used for lay-down or burial. It was used extensively during the 1960-1970 time period for disposal of combustible materials such as sodium, NaK, and kerosene (Olson et al., 1987). Investigative trenching as part of a Phase II CERCLA investigation performed by a consultant to the site, revealed soil contamination consisting of organic solvents, diesel fuel, and oil and grease, PCBs, PCTs, Terphenyls, and Biphenyls (Olson et al., 1987).

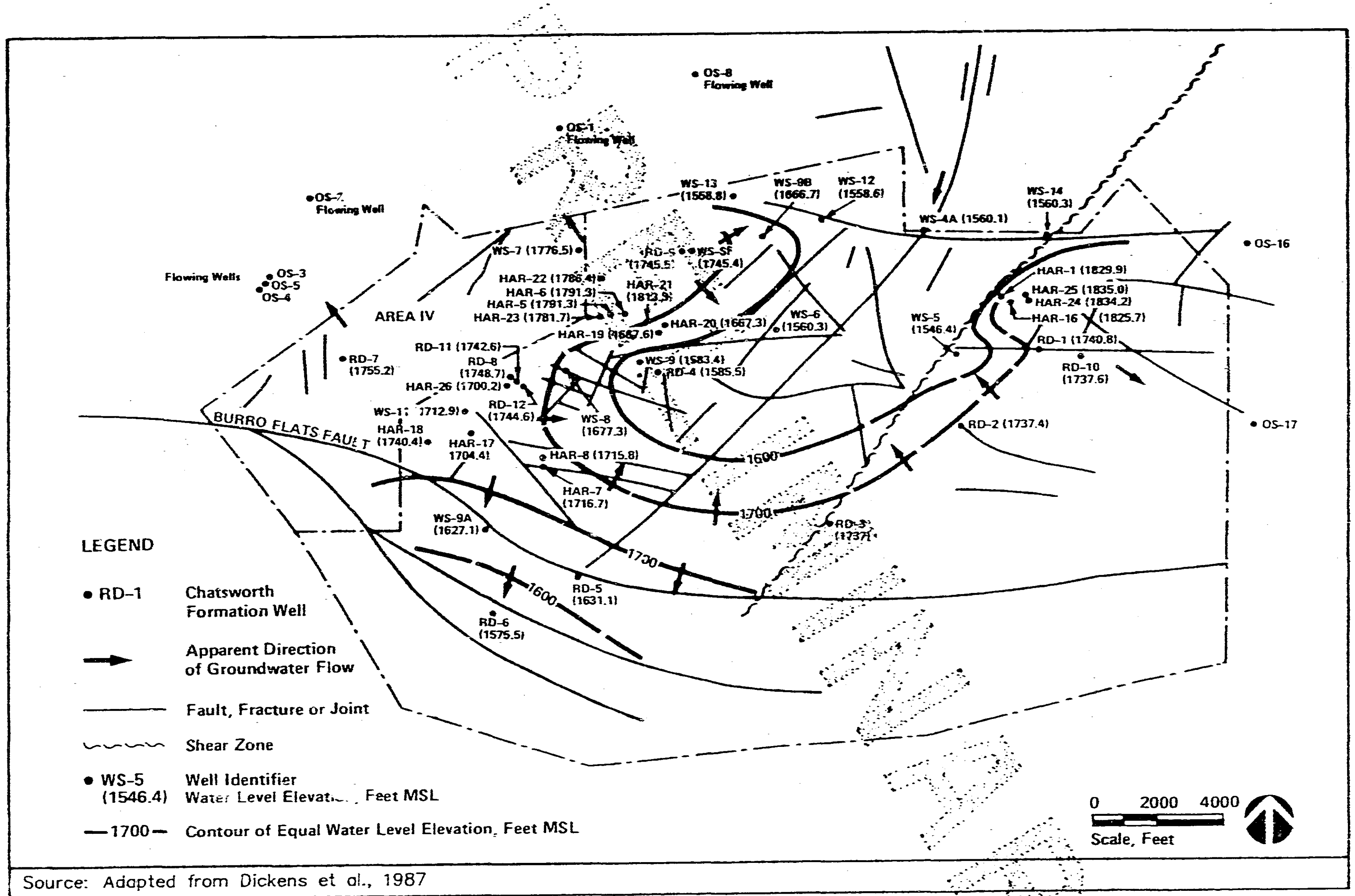


FIGURE 3-11

GROUNDWATER CONTOURS, INFERRED FLOW DIRECTIONS, AND MAJOR STRUCTURAL DISCONTINUITIES SSFL-VENTURA COUNTY, CALIFORNIA

There has not been a groundwater investigation performed for this facility, however, one monitoring well installed in 1985, RS-18 located approximately 105 meters (350 feet) northeast of the facility, revealed the presence of volatile organic compounds in December 1987 (the only time the well was observed to contain water). Three of the compounds detected: 1,1- dichloroethane, 1,1-dichloroethylene, and trichloroethylene exceed California State Action Levels of 20, 6, and 5 µg/l respectively. No other groundwater wells or data are available for this facility. It is likely that groundwater contamination exists as a result of previous disposal practices at this facility. See Findings 3.4.4.3.2.a and 4.5.2.3.1.a for details concerning this facility.

Building 059 Area - The subterranean levels of the 059 building formerly housed the SNAP Prototype Reactor, and presently contain Co-60 contaminated sand and a large stainless steel duct that are in contact with groundwater that seeps into the building. Upon termination of operation in 1969, parts of the reactor system were removed. Subsequent decommissioning in 1978 resulted in removal of all contaminated items except for an estimated 45,350 kg (50 tons) of activated sand, a 150 cm (60-inch) diameter stainless steel duct, and other activated material (Stafford, 1987).

During an inspection in 1983, groundwater that had seeped into the building was found to be contaminated with Co-60 (Stafford, 1987). Since that time, a water management program has controlled and minimized seepage into the building through lowering groundwater levels around the building by pumping. At the same time, the water level outside the building was maintained slightly above the level inside the building in order to cause an inward flow gradient. Although sampling in 1983 did not reveal radioactive contaminants outside the building, it is probable that the sampling program was not rigorous enough to ascertain if contamination existed directly below the building. There are no monitoring wells at the facility. The only source of groundwater data is the standpipe connected to the french drain system that extends around three sides of the building. The Co-60 within the building represents a potential source of groundwater contamination in an area that is presently incompletely characterized.

Although SSFL has not detected Co-60 in the french drain discharge, analysis of the standpipe discharge water first performed in 1986 revealed volatile organic compound contamination. The California State Action Level for tetrachloroethylene, and trichloroethylene of 4, and 5 µg/l respectively have been exceeded. The source and extent of the volatile organic compound contamination are presently unknown. See Findings 3.4.4.3.2.a and 4.5.2.3.1.b.

Well RD-7 Area - The groundwater in the area near Well RD-7 is contaminated with volatile organic compounds. The extent of the contamination is unknown and uncharacterized. The California State Action Level for trichloroethylene of 5 µg/l has been exceeded. Although there is an old landfill near Well RD-7, the area has not been investigated well enough to determine if it is the source. There is also an abandoned excavation for Building 056 nearby that could also represent a potential source for the contamination. See Finding 3.4.4.3.2.c. Other potential sources also exist nearby in Area IV, and are discussed in Finding 4.5.2.3.

There are five areas of the site that are potential sources of groundwater contamination. The areas that are potential sources of groundwater contamination are as follows:

Old Landfill - An old landfill approximately 90 meters (300 feet) west of the Building 056 excavation was used for temporary storage of drummed wastes, and burial of other undocumented materials and spoil from the Building 056 excavation. Although Well RS-16 near this area has typically been dry, a deep well nearby, Well RD-7, has revealed groundwater contamination by volatile organic compounds. The source of the contamination is unknown, and may be the landfill. See Finding 4.5.2.3.1.e for details concerning this area.

RMDF Leach Field - An accidental release of radioactively contaminated water containing principally Sr-90 and Y-90 to the soil in and beneath a sanitary sewer leach field for the RMDF occurred sometime in late 1962 or early 1963 (Bradbury, 1978). Subsequently, the area was excavated and contaminated soil was replaced with clean soil. Contamination was traced during the excavation, and found to extend downward into joints and fractures in the Chatsworth Formation. The contaminated joint material was excavated as far as readily accessible with hand-held pneumatic tools, then sealed with asphalt. Decontamination efforts stopped at that point. There is high probability that contaminants reached the groundwater through infiltration from the leach field. This groundwater in the area of this potential source of contamination has not been investigated. See Finding 4.5.2.3.1.c for details concerning this potential source of groundwater contamination.

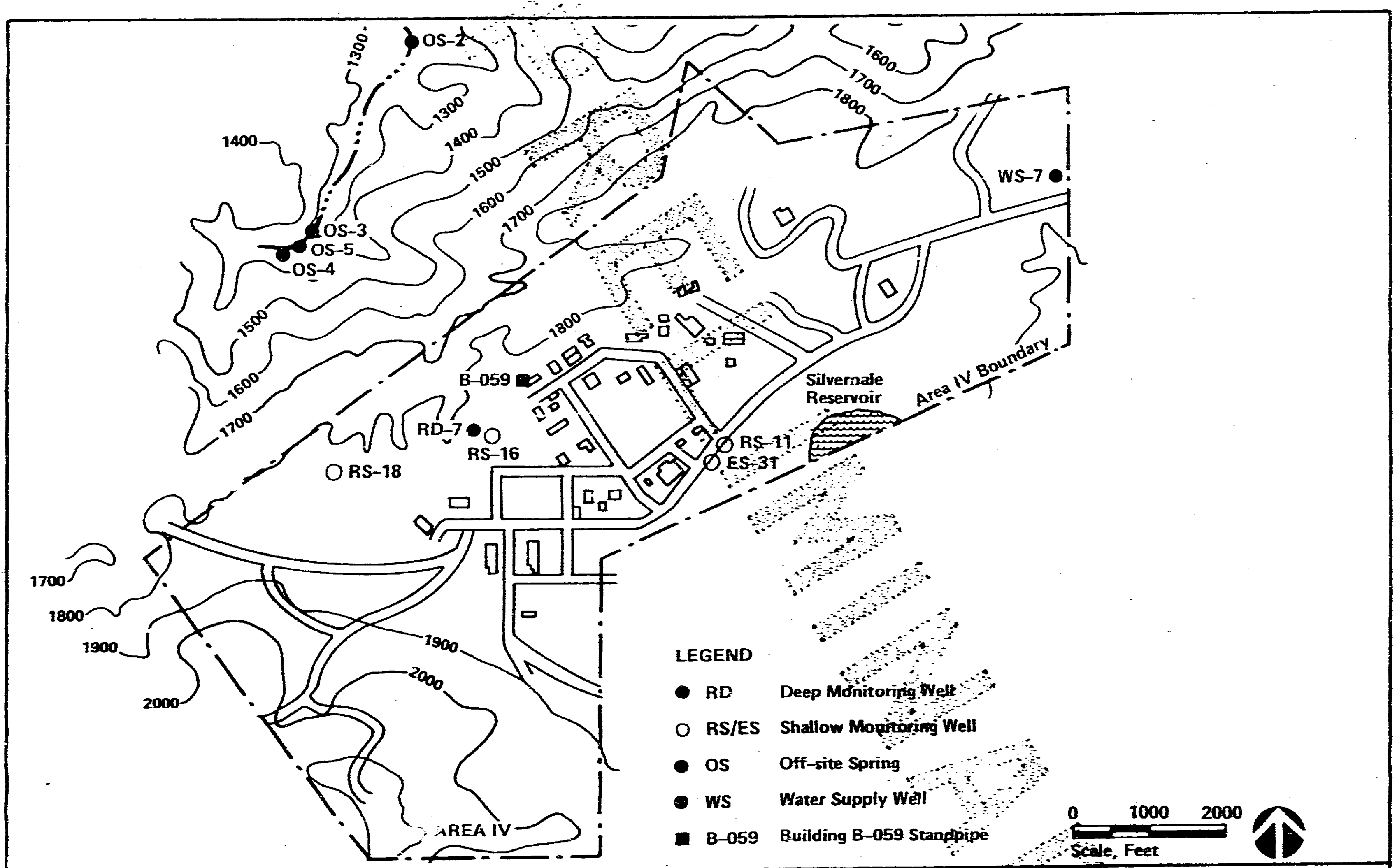
Old Conservation Yard - The area referred to as the Old Conservation Yard was used for storage of equipment and wastes. The area was cleared of materials, and regraded in the early 1980s. The storage of wastes in this area represented a potential for spills to have occurred along with subsequent groundwater contamination. No groundwater investigation has been performed in this area. See Finding 4.5.2.3.1.d for details concerning this potential source of groundwater contamination.

B/100 Trench - A trench located east of the B/100 Building was used for disposal of construction debris and possibly hazardous substances that represents a potential source of groundwater contamination. The trench, observed on aerial photographs, was approximately 7.6 meters (25 feet) wide by 22.9 meters (75 feet) long. The trench appears in aerial photos from approximately 1961 to 1967. Several drums adjacent to the trench are visible on some of the photographs. There are no records available to the Survey concerning the operation of this disposal area, and no groundwater investigation has been performed. See Finding 4.5.2.3.1.g for details concerning this potential source of groundwater contamination.

3.4.3 Environmental Monitoring Program

There is no formal groundwater monitoring program on the DOE optioned land at SSFL. The Environmental Control Unit, contained within the Operations Division of Rocketdyne, has been responsible for performing the site- wide monitoring program and investigations relative to closure of approximately 10 ponds at the SSFL site. Although none of these ponds are in Area IV, five monitoring wells were installed in Area IV. None of the monitoring wells are on DOE optioned land. However, some of the wells are near facilities that may have been impacted by DOE activities. These wells were observed during the Survey to evaluate construction quality. Well construction records were also reviewed. In addition, there are four springs located off-site to the northwest. These were sampled as part of the Hydrogeologic Assessment Report (Dickens et al., 1987). These springs, located on private property, were not accessible during the Survey, thus were not observed. Their construction is unknown. Figure 3-12 shows the locations of the Building 059 Standpipe, wells, and springs on and near Area IV.

The wells on the SSFL site observed during the Survey typically had identification signs mounted on posts adjacent to the well, or numbers inscribed in the concrete surface pad. Surface completion was either in a flush mounted valve box, or a steel protective casing for the shallow wells, and a steel casing for the deep wells. The shallow wells were constructed of PVC casing and records indicated they were sealed with cement grout, and that no bentonite seals were used (Dickens et al., 1987). Deeper wells used steel casing, and were installed as an open-hole well, thus not sealed in a specifically restricted zone below the bottom of the surface casing (Dickens et al., 1987). The deeper wells also had dedicated centrifugal pumps installed (Dickens et al.,1987). Problems associated with well construction are discussed in Finding 3.4.4.4.1.



Source: Adapted from Dickens et al., 1987

FIGURE 3-12

GROUNDWATER MONITORING LOCATIONS NEAR AREA IV
SSFL-VENTURA COUNTY, CALIFORNIA

Sample collection was not scheduled during the field portion of the Survey, and thus was not observed. Procedures provided by the groundwater consultant for SSFL, Groundwater Resources Consultants, Inc. are presented in their 1987 Hydrogeologic Assessment Report in Appendix O (Dickens et al., 1987). The procedures were reviewed as part of the Survey. The procedures contain instructions on measuring water levels, purging practices, sample collection, handling, shipping, and chain-of-custody. The procedures also include sections explaining rationale for sampling location, schedules, and analytical testing to be performed from each sample round.

The monitoring wells installed in Area IV, although some are near suspected sources of contamination, are not sufficient in number or location to provide enough data to fully characterize site or facility hydrogeologic conditions, the extent of known contamination, or the presence of suspected contamination. There are presently three areas of known contamination, and four areas of suspected contamination as previously discussed in Section 3.4.2. Only three of the five wells installed in Area IV are within the proximity of the seven areas of known or suspected groundwater contamination. Of the five wells, only one is deep enough to provide data on the Chatsworth Formation system (Well RD-7). The one deep well is not, in itself, capable of providing conclusive data on gradient, inferred flow directions, and flow rates for the seven areas. These inadequacies in the groundwater monitoring program made it difficult to reliably monitor and accurately characterize groundwater contamination (see Finding 3.4.4.3.1).

Groundwater monitoring was previously performed in the area of the Sodium Reactor Experiment. Three wells ranging in depth from 12.2 meters (40 feet) to 21.4 meters (70 feet) in depth were installed there in 1971 or 1972 (Breeze, 1988). The wells consisted of 7.5 cm (3 inch) diameter perforated casing (Heine, 1973). Samples collected from the wells were typically analyzed for alpha and beta radioactivity, and on at least one occasion for water quality. Typical values reported for radioactivity were approximately 10^{-7} uCi/ml. Gamma spectroscopy analysis indicated that Cs-137 was the principal emitter present (Heine, 1974). Monitoring was perfomred from 1973 through 1981. A search for the wells during the Survey was performed, but none were found. SSFL personnel believed that well No. 1 was destroyed during cleanup of the RMDF Leach Field, but the other wells still existed (Breeze, 1988). These wells are not being used in the current groundwater monitoring program, and no record of abandonment was furnished by SSFL (see Finding 3.4.4.4.2).

3.4.4 Findings and Observations

3.4.4.1 Category I

None.

3.4.4.2 Category II

None.

3.4.4.3 Category III

1. The groundwater monitoring program is inadequate at known or suspected sources of contamination. The groundwater monitoring program has a number of inadequacies that make it difficult to reliably monitor or accurately characterize groundwater contamination. The Survey identified the following deficiencies:

   a. Inadequate characterization of site hydrogeology (i.e., the vertical and horizontal flow rates and direction of groundwater is not well defined) at the known or suspected areas of contaminated groundwater. The presence of a groundwater divide in Area IV is apparent, but its location relative to the individual known or suspected sources of contamination has not been determined. In addition, only one deep well (Well RD-7) exists that can be used for investigating the physical characteristics of the Chatsworth Formation in Area IV. One well is not capable of providing comprehensive data on horizontal groundwater flow rates and groundwater gradients at all of the known or suspected areas of contamination.

   b. Insufficient number of wells to characterize the actual and potential sources of groundwater contamination. The five monitoring wells (one deep, four shallow) installed in Area IV were not located with respect to the seven known or suspected areas of groundwater contamination. Although three of the wells and the standpipe at Building B 059 have indicated groundwater contamination, characterizations at each of the areas is not possible with the one or two wells at the known areas of contamination and none at the suspected sites. The groundwater monitoring locations near each known source of groundwater contamination are: Old Sodium Burn Pit, RS-18; Well RD-7 Area, Wells RD-7 and RS-16; and Building B 059, B 059 Standpipe. There are no wells near any of the four potential areas of groundwater contamination.

c. Off-site groundwater contamination may exist, but be undetected at the off-site sampling locations. The four off-site monitoring locations northwest of Area IV consist of artesian springs or wells of unknown construction. These wells, although convenient, were not designed, constructed, or located to be monitoring wells. Their location, unknown depth, and probable lack of proper construction materials and methods makes them indefensible as adequate sampling points.

2. Groundwater contamination. Based on the available groundwater monitoring data there are at least three areas of groundwater contamination in Area IV. These areas appear to be related to past DOE activities. The areas are discussed below.

a. Old Sodium Burn Pit - The groundwater near the Old Sodium Burn Pit appears to be contaminated with volatile organic compounds. Well RS-18, (which has been dry at the time of quarterly sampling attempts until December, 1987) located approximately 105 meters (350 feet) northeast of the facility has revealed shallow groundwater to be contaminated by chloroform, 7 µg/l; 1,2-dichloroethane, 24 µg/l; 1,1- dichloroethylene, 33 µg/l; trans-1,2-dichloroethylene, 10 µg/l; 1,1,1-trichloroethane, 20 µg/l; and trichloroethylene, 660 µg/l (GWRC, 1988). No analyses for radioactivity were performed. The Old Sodium Burn Pit is suspected by the Survey team to be the source. Three of the compounds detected: 1,1-dichloroethane, 1,1-dichloroethylene, and trichloroethylene exceed California State Action Levels of 20, 6, and 5 µg/l respectively.

The area referred to as the Old Sodium Burn Pit or the "Burn Pit" occupies approximately 4,650 square meters (50,000 sq. ft.) on the north side of Building 886. The facility consisted of a treatment area with a concrete sump, an upper pond, a lower pond, and the nearby surrounding area which was used for lay-down or burial. It was used extensively during the 1960-1970 time period for disposal of combustible materials such as sodium, NaK, and kerosene (Olson et al., 1987). Investigative trenching as part of a Phase II CERCLA investigation performed by a consultant to the site, revealed soil contamination consisting of organic solvents, diesel fuel, and oil and grease, PCBs, PCTs, Terphenyls, and Biphenyls (Olson et al., 1987). See Finding 4.5.2.3.1.a.

b. Well RD-7 Area - The groundwater in the vicinity of Well RD-7 is contaminated with volatile organic compounds. Analyses of groundwater samples collected from Well RD-7 revealed contamination from trans-1,2-dichloroethylene, 3 µg/l; trichloroethylene, 130 µg/l (maximum); and toluene, 13 µg/l (maximum) (Dickens et al., 1987). No analyses for radioactivity have been performed. The California State Action Level for trichloroethylene of 5 µg/l has been exceeded.

The source of the groundwater contamination has not been investigated. Although a shallow well nearby, Well RS-16, has shown 1 µg/l of toluene on only one occasion, there is not conclusive physical or contaminant data to suggest a relationship between these wells or the old landfill located adjacent to them. Other nearby potential sources exist that are discussed in Finding 4.5.2.3.1.

c. Building 059 Standpipe Area - The groundwater in the vicinity of the Building 059 is contaminated with volatile organic compounds. Analyses of groundwater samples collected from the standpipe indicates the contaminants are principally tetrachloroethylene, 540 µg/l (maximum); trichloroethylene, 19 µg/l (maximum); and trans-1,2-dichloroethylene, 68 µg/l (maximum) (Analytical Chemistry [SSFL], Various Dates). Radioactivity has not been detected at levels considered above background for the groundwater. The California State Action Level for tetrachloroethylene, and trichloroethylene of 4, and 5 µg/l respectively have been exceeded. The detection of tetrachloroethylene is peculiar to this location, as it does not occur at other monitoring wells either in Area IV.

The source of the volatile organic contamination is unknown for this area, and has not been investigated. See Finding 4.5.2.3.b for additional information on potential sources for this facility.

3.4.4.4 Category IV

1. Monitoring well construction inadequacies. There are inadequacies in construction of the monitoring wells that may result in questionable data for the following reasons:

a. Wells installed in shallow soil zones are not sealed with bentonite seals as per industry accepted practice and Federal guidelines. The lack of a water-tight seal may allow surface runoff to enter the well by flowing down along the casing and into the well screen and filter area. A consequence of this would be possible cross contamination of the groundwater being sampled, particularly for these shallow wells that reflect seasonal water table changes thus occasionally yield only small volumes of water.

b. Deep wells that monitor the Chatsworth Formation use dedicated centrifugal vane type pumps that can cause off-gassing of the volatile organic compounds dissolved in the water. The consequence of using this type of pump is that concentrations analyzed for these analytes may have been reduced during the sampling process. Off- gassing becomes more likely when groundwater is subjected to large temperature and/or pressure changes such as from deep water levels at the site.

2. Lack of well abandonment. Old groundwater monitoring wells which are not going to be integrated into the SSFL groundwater monitoring program may provide a direct conduit for accidental or intentional contamination of groundwater. Three wells in the vicinity of the SRE which were installed in approximately 1971 or 1972 and last monitored in 1981, have not been properly abandoned. One well was reportedly destroyed (Breeze 1988), and the other two could not be located although they were thought to exist.

4.0 NON-MEDIA-SPECIFIC FINDINGS AND OBSERVATIONS

This section discusses findings and observations pertaining to waste management, toxic and chemical materials, radiation, quality assurance, and inactive sites and releases. These discussions do not include a background environmental section because the areas addressed are not necessarily tied to one medium, as was the case with discussions in Section 3.0. These discussions include an environmental monitoring section where appropriate and the information was available. The findings for hazardous, radioactive, mixed, and solid waste management are summarized in a section addressing waste management.

4.1 Waste Management

The section on Santa Susana Field Laboratory (SSFL) waste management describes sources of wastes; handling procedures for wastes; treatment, storage, and disposal (TSD) areas for wastes; and regulatory concerns regarding waste management. Issues relating to decontamination and decommissioning (D&D) of nuclear facilities are discussed in Section 4.1.1.2 of the Pollution Sources and Control section. Findings related to waste management are described in Section 4.1.2. The wastes evaluated include hazardous, radioactive, polychlorinated biphenyl (PCB), mixed (radioactive plus hazardous and/or PCB), and solid (nonradioactive and nonhazardous) wastes.

U.S. Department of Energy (DOE) Order 5480.2, titled Hazardous and Radioactive Waste Management, issued December 13, 1982 (rescinded October 5, 1987, but still serving as guidance), and DOE Order 5820.2, titled Radioactive Waste Management, issued December 6, 1984, are the principal DOE orders used in evaluating waste management at DOE sites. The Resource Conservation and Recovery Act (RCRA) of 1976, the 1984 RCRA amendments, and associated regulations issued by the U.S. Environmental Protection Agency (EPA) establish the standards used by the Survey for evaluating hazardous and mixed waste handling facilities. California hazardous waste regulations are similar to those of EPA. However, California is more stringent in areas of waste characterization, waste listing, and regulation of regulated substances tanks. At the time of the Survey, California did not have RCRA primacy. Solid waste regulations of California regulate solid waste facilities of SSFL. "Good Management" techniques, which are practices not specifically required by regulation or DOE orders, are also used by the Survey, when appropriate.

4.1.1 General Description of Pollution Sources and Controls

4.1.1.1 Hazardous Waste

Current DOE activities at the SSFL consist of large-scale experiments related to energy technology. Relatively small quantities of hazardous waste are generated. These wastes consist principally of lubricating oils, ethanol, alkali metals (Na, NaK, Li), and small quantities of laboratory chemicals. Waste oils are a California-listed hazardous waste, and alkali metals are hazardous due to their reactive properties. Table 4-1 describes the wastes generated from DOE activities at SSFL. Alkali metals are generated from tests involving experimental equipment that would be used in sodium cooling of nuclear reactors.

SSFL does not dispose of any hazardous wastes on-site. Storage and treatment of reactive alkali metals takes place on-site at two locations. Storage of hazardous wastes other than reactive alkali metals takes place at the Area II National Aeronautics and Space Administration (NASA) hazardous waste storage facility.

B-029 Reactive Metal Storage

Reactive metals, including sodium, potassium, sodium-potassium, zirconium hydride, and lithium metal, are stored in B-029. At the time of the Survey, thirty-five 55-gallon drums of material were in storage. The area is a permitted, RCRA, long-term storage area and meets RCRA technical requirements for storage areas.

Twenty cold traps containing reactive sodium metal are in storage outside B-029. These cold traps are inside the fenced area and lie along the path leading to B-029. The area where the traps are stored is not part of the permitted RCRA storage area that is described in RCRA permit submittals. SSFL intends to cut the traps and remove the sodium. At the time of the Survey, SSFL was encountering difficulty in cutting the traps to gain access to the sodium. Torches were ineffective, since the sodium contained within the traps acted as a heat sink. Because normal saws were not able to cut the traps, SSFL was experimenting with various techniques to cut the traps. Although the traps are in an unpermitted storage area, releases of sodium are unlikely due to the integrity of the traps (see Finding 4.1.2.4.2).

TABLE 4-1

WASTE STREAMS
SSFL - VENTURA COUNTY, CALIFORNIA

Waste	Composition	Annual Generation Rate	T.S.D. Methods
Laboratory Oil	Waste Laboratory Oils	1,000 pounds	Off-site Recycle
Ethanol/Dowanol	Sodium/Water	16,000 gallons	Off-site Recycle
Sodium	Sodium Metal	1,620 gallons	On-site Treatment
Lubricating Oils	Waste Cutting Oil	660 gallons	--
Asbestos Building Materials	--	25 cubic yards	Off-site Landfill

Source: Lewis, 1987.

B-133 Sodium Burn Facility

Sodium metal is treated at the B-133 Sodium Burn Facility, which is also a permitted RCRA facility. The treatment takes place by oxidizing the sodium in an enclosed burn pan to produce sodium oxide. The sodium oxide fumes are absorbed by a liquid scrubbing system to produce sodium hydroxide. This sodium hydroxide is used by other Rockwell facilities as a treatment chemical. At the time of the Survey, SSFL was developing techniques for treating lithium hydride at the B-133 facility.

Drainage from the scrubber contained sodium hydroxide, was conducted to an underground storage tank (UST) in a pit. In early 1987, when the UST was being replaced, it was found that the soil in the pit was highly akaline. The alkalinity was attributed to leakage containing sodium hydroxide (see Finding 4.1.2.3.1). The burn facility was shut down at that time. SSFL intends to remove the contaminated soil, line the pit with concrete, and install a tank for collecting the sodium hydroxide effluents from the scrubber.

Area II Hazardous Waste Storage Facility

Nonreactive hazardous wastes generated by DOE activities at SSFL are either stored at the Area II hazardous waste storage facility or directly removed from the point of generation to an off-site facility (such as oil). This storage facility is in the NASA area, which is also managed by Rockwell. It was estimated by Rockwell that approximately 10 percent of the wastes stored at Area II are DOE waste, with the remaining 90 percent originating from NASA activities. Operational and permitting activities pertaining to the Area II hazardous waste storage area are the responsibility of Rockwell under its contract with NASA.

The Area II hazardous waste storage facility is not roofed and is exposed to the elements. The storage area did not have sufficient diked and paved storage area to allow proper segregation of incompatible wastes and sufficient aisle space for unrestricted access to containers. Site personnel reported that equipment used to move containers of hazardous waste was not adequate and that containers had been dropped while being moved. It was also reported that the dike was not impervious, as indicated by leakage of accumulated precipitation from some dikes. The surface area where drums are staged prior to movement to the proper storage compartment is not paved. The lack of a roof has lead to swelling of drums containing volatile organic wastes as a result of heating due to exposure. Site personnel stated that NOVs (Notices of Violation) regarding secondary containment integrity and storage capacity have been received from EPA and the State Department of Health Services. Rockwell has requested funding from NASA to build a new hazardous waste storage area (see Finding 4.1.2.4.3).

Bowl Area. The Bowl Area was the site of a pilot test for the gasification of coal. This experiment has been terminated. All liquid wastes and readily accessible solid wastes have been removed. However, the process equipment still contains various hazardous wastes, including char oil, tars, and light oils. Closure of the Bowl Area (removal of hazardous wastes and decontamination) has not been initiated, as discussed in the Closure Plan (see Finding 4.1.2.4.4). Table 4-2 describes the wastes remaining in the process equipment. This is a DOE-Morgantown program.

B-005 Coal Gasification

An experimental coal gasification facility at B-005 is no longer in operation. This process resulted in the generation of "green liquor" wastewater, which contained organics, sulfur compounds, and ash. At one time, approximately 80,000 gallons of green liquor were in storage. The liquid portion was removed and taken to an off-site hazardous waste facility. The tanks in which the liquor were stored still contain residual "heels" of "green liquor" solids. Other process residuals may still be in process lines. DOE-Morgantown is negotiating a contract to Rockwell for the demolition of the experimental coal-gasification facility. All process equipment will be decontaminated and waste residues removed as part of the demolition project.

El Segundo Air Fluidized-Bed Combustion (AFBC) Facility

Rockwell operates a DOE-owned, AFBC test facility at its El Segundo Plant in Los Angeles County. Fluidized-Bed Combustion is used to reduce sulfur dioxide and nitrogen oxide emissions. The facility is used to test heat exchangers. Approximately 1.5 barrels of ash are produced during each hour or operation. Fly ash is a California state listed hazardous waste. The mixture of spent bed, ash, and baghouse fly ash is considered a hazardous waste. The ash was sent for final disposal at the time of the Survey to a facility at Casmalia, California. Disposal at this facility may not be in compliance with DOE's policy regarding off-site disposal of hazardous wastes. This policy limits off-site disposal of nonradioactive and CERCLA wastes to facilities identified by EPA or by state regulation agencies as suitable for treatment, storage, or disposal of wastes (Walker, 1986). In 1986, the Casmalia facility was not eligible for disposal of such wastes (Davis, 1986).

TABLE 4-2

BOWL AREA PROCESS EQUIPMENT WASTE - DOE/MORGANTOWN
SSFL - VENTURA COUNTY, CALIFORNIA

Item	Contents	Waste Quantity		Remarks
		Liquid (gallons)	Solid	
1. Heavy oil flash tank	Solid, heavy oil, tar	--	1/3 drop box	Hazardous waste - scrap
2. Heavy oil separator and accumulator	Solid, heavy oil, tar	--	1/3 drop box	Hazardous waste - scrap
3. Interconnecting piping to 1 and 2	Solid, heavy oil, tar	--	1/3 drop box	Hazardous waste - scrap
4. Heavy oil condenser	Traces of tar	--	1/2 drop box	Hazardous waste - scrap
5. Reactor pressure shell	Char-water wash	200	1/3 drop box	Hazardous waste - scrap
6. Reactor pressure shell quench piping	Char-water wash	200	1/3 drop box	Hazardous waste - scrap
7. Reactor pressure shell char receiver	Char-water wash	200	1/3 drop box	Hazardous waste - scrap
8. Cyclone 1 and 2, No. 2	Char-water wash	200	1 drop box	Hazardous waste - scrap
9. High-pressure coal feeder (cylindrical tank, 5 feet x 20 feet high)	Rinse tank out, coal dust, pulverized-clean with fire hose	500	--	
10. Outlet from cyclone 2-pipe to top of light oil condenser	Will contain wet black oils	--	1/2 drop box	Hazardous waste - scrap
11. Light oil condenser	Traces of oil and char	--	1/2 drop box	Hazardous waste - scrap
12. Beneath light oil condenser is light oil separator and accumulator	Will contain light oils and char	--	1/2 drop box	Hazardous waste - scrap
13. Light oil flash drum and piping (water jacketed)	Will contain light oils and char (small quantity)	--	1/2 drop box	Hazardous waste - scrap
14. From light oil condenser is a line, goes to BTX adsorber tank	Inspect and flush	200	--	Hazardous liquid waste

TABLE 4-2
BOWL AREA PROCESS EQUIPMENT WASTE - DOE/MORGANTOWN
SSFL - VENTURA COUNTY, CALIFORNIA
PAGE TWO

Item	Contents	Waste Quantity		Remarks
		Liquid (gallons)	Solid	
15. BTX adsorber to BTX condenser and collector	Inspect and flusn	500	--	Hazardous liquid waste
16. Sodium hydroxide scrubber tank (6 feet x 25 feet, full of SS packing), pump, too	Traces of caustic soda (flush)	2,000	--	Hazardous liquid waste
17. Low-pressure char receiver tank next to VTS II stand (12 feet x 16 feet)	Contains some char (flush)	500	--	Hazardous liquid waste
18. Cyclone/char receiver (18 inches x 12 feet)	Contains char-water wash	500		Hazardous liquid waste
19. Cyclone 2 char receiver	Contains a little tar and char	500	1 drop box	Hazardous waste - scrap
20. Dust collector	Check bags, etc. (flush)	100	1/2 drop box	Hazardous waste
21. Low-pressure light oil tank	Light oil and maybe char	--	1/2 drop box	Hazardous waste - scrap
22. 18 inch x 8 foot vertical tank (high pressure)	Coal and char dust - flush out	500	--	Hazardous liquid waste
23. Low-pressure coal hopper - below first deck	Contains coal dust - flush	500	--	Hazardous liquid waste
24. VTS I tank, glass tank, and test hardware	Tars, coal	--	1/2 drop box	Hazardous waste - scrap
25. Miscellaneous piping (approximately 200 feet)	Tars, light oils, char	--	1 drop box	Hazardous waste - scrap
26. Tank	Contains asbestos insulation	--	15 ft^3	Hazardous waste

Source: Schmidt, 1987.

Underground Storage Tanks – Regulated Substances

Section 280 of RCRA regulations required the registration of all underground storage tanks (USTs) containing regulated substances such as gasoline, oil, and chemicals. California law and regulations required leak and/or integrity testing of all USTs. SSFL had 12 USTs at one time. With the advent of new regulatory requirements on the state and Federal level, SSFL has phased out the use of USTs for regulated substances. At the time of the Survey, all USTs containing regulated substances had been taken out of service and all but two had been removed. The final two were scheduled for removal.

RCRA Permit Status

Rockwell International Energy Systems Group was issued a final Hazardous Waste Facilities Permit dated February 14, 1984, for SSFL by California. Hazardous waste operations described in the permit included storage in containers and treatment involving burning of sodium metal wastes. The permit requires conformance with conditions described in the Operational Plan submitted to the state by SSFL, which included a closure plan. Treatment and storage areas described in the Closure Plan are Building 029 (Reactive Metal Storage), and the Building 133 Sump (Sodium Burn Facility).

4.1.1.2 Radioactive Wastes

DOE Order 5480.2 defines radioactive waste as "solid or fluid materials of no value containing radioactivity, discarded items such as clothing, containers, equipment, rubble, residues or soils contaminated with radioactivity, or soils, rubble, equipment or other items containing induced radioactivity such that the levels exceed safe levels for unconditional release."

Radioactive waste at SSFL consists of both high-activity and low-level wastes. These radioactive wastes are composed of sections of irradiated cladding removed during decladding of reactor fuel elements; solidified liquid generated during irradiated-fuel-recovery cleaning operations; building rubble consisting of wood, steel, plaster, plastic, glass, concrete, dirt, etc., generated during decontamination and decommissioning operations; and contaminated equipment. High-activity wastes generally contain activation products, primarily Co-60 plus MFP from fuel contact. Process operations generate low-level waste contaminated with uranium, thorium, or plutonium. A small quantity of by-product wastes is generated from research programs. Drumload quantities of TRU wastes are generated during some building cleanup operations.

The generation of both high activity and low-level waste depends upon project activity. High-activity wastes are usually generated only during fuel-decladding operations. Low-level wastes are generated from decladding operations and decontamination and decommissioning projects. In FY 1988, approximately 260 cubic feet of high-activity wastes were projected to be generated (Schaubert, 1987). Quarterly shipment of low-level radioactive waste ranges in quantity from 3,000 to 9,000 cubic feet per quarter. Solid wastes from decladding of spent reactor fuel are sent in sealed drums to the DOE-owned facility for handling and shipment for disposal.

The following is a description of those activities generating radioactive wastes and the facilities used to handle radioactive wastes.

Sodium Burn Pit

The Sodium Burn Pit was used during the 1960–1970 period for disposal of combustable materials, including NaK and kerosene from several programs relating to sodium reactors and component testing of sodium reactors. The area consisted of a concrete pad next to a concrete water pool, upper and lower pond areas both downslope from the pool, and an area adjacent to and west of the upper pond area used for storage and burial of materials. A CERCLA, Phase II, site characterization has been prepared (see Section 4.5.1 for more details). It has been estimated that 28,640 cubic feet of radioactive waste, 14,400 cubic feet of chemical (hazardous waste), and 11,025 cubic feet of mixed hazardous waste will be generated by cleanup activities (Stafford, 1987).

Building 059

Building 059 (SNAP Ground Prototype Test Facility) is no longer in service. However, the vacuum vessel and associated structures are highly contaminated with induced activity. The pipe chase room is filled with activated sand. During routine yearly surveillance it was found that 30,000 gallons of groundwater had leaked into the room and became radioactively contaminated. SSFL installed an ion-exchange column to decontaminate the water. Currently groundwater is being pumped from outside the building to maintain a low-head sufficient to minimize inflow but prevent outflow from the pipe chase room. SSFL intends to remove the sand from the room and seal the walls to prevent groundwater infiltration into the room. The sand will be handled as radioactive waste. Sections 3.2.1, and 4.5.1 have additional discussions on Building 059.

Building 020 – Hot Cell

The Rockwell International Hot Laboratory (RIHL) operations are carried out in Building 020. These activities consist of the examination of irradiated reactor fuel and the preparation of irradiated fuel for eventual reprocessing by removal of the metal cladding and thermal bonding material, cleaning and repackaging of the fuel slugs, and shipment of the fuel for reprocessing.

Radioactively contaminated liquid wastes are collected in a 3,000-gallon waste tank in the Holdup Tank building. Most highly contaminated liquid wastes would be absorbed or solidified in the cells at the time of generation. Thus, most of the tank's contents would consist of water used during contamination. A weir box collects large particles prior to their entering the holdup tank. In Cell I, highly acidic and basic solutions are used. Coarse particles from this cell are separated in a 5-gallon tank prior to release to the holdup tank. All liquid wastes from the holdup tank are sent to the RMDF (Radioactive Materials Disposal Facility) for solidification, storage, and packaging for shipment for disposal at off-site facilities.

At the time of the Survey, the Hot Lab was inactive and decontamination was being planned. Decontamination was to take place in such a manner that the facility could be reactivated. Surface contamination will be removed by techniques such as electropolishing of internal surfaces of pipes to allow equipment to be decontaminated but still left in place for possible future use.

Radioactive Materials Disposal Facility (RMDF)

Handling of both high-activity and low-level radioactive wastes and materials, including treatment and storage, takes place at the RMDF. The RMDF consists of a complex of buildings, including

- Building 021, Radioactive Waste Processing and Packaging, and Equipment Decontamination.
- Building 022, Radioactive Material Storage Vault.
- Building 034, Administration and Engineering Offices.
- Building 044, Health Physics Services.
- Building 075, Packaged Radioactive Waste Ready for Off-site Shipment.
- Building 621, Radioactive Source Storage.
- Building 665, Emergency Supplier Storage.

- Building 068, Open, Covered Building for Temporary Storage of Chemicals and Equipment.

- Building 658, Hardened Security Post.

- RMDF Drainage Pond.

These buildings are all within a fenced and secured area.

Waste treatment at the RMDF consisting of solidification of liquid radioactive wastes and evaporation of low-level liquid radioactive waste takes place in B-021. Evaporation of liquid wastes takes place in a hooded rectangular tank (4 feet by 6 feet by 1 foot) using an electric immersion system operating at 180°F. Vapors are passed through a HEPA filter and exhausted through a 130-foot stack. Liquid wastes evaporated are collected from SSFL and stored in an 8,000-gallon tank at the RMDF and fed from the tank into the evaporator. The evaporator is capable of processing 2,000 gallons per week. However, a typical weekly processing load might be a few hundred gallons; actual loads would depend on project activity. High-activity wastes from the B-020 Hot Lab are not treated. Floor drains in B-021 lead into a 200-gallon, double lined with leak detection UST installed in 1987.

Sludge from the evaporator is periodically removed and dried in a pail on a hot plate. The pail is then crushed and placed in a 55-gallon drum for shipment to an off-site radioactive waste disposal facility. The amount of dried sludge shipped in each pail is determined by the radioactivity content of the sludge. Based on their knowledge of the wastes evaporated, site personnel said that the sludge would not contain metals (hence it is not a RCRA or mixed waste). In 1987, thirty-eight 5-gallon and 10-gallon pails of dried sludge were generated. However, formal procedures are not in place to determine whether evaporator sludge should be tested for hazardous characteristics if the influent to the evaporator changes (see Finding 4.1.2.4.1).

High-activity materials such as irradiated fuel elements and high-activity waste resulting from dissections of irradiated fuel and reactor components at the Hot Lab (B-020) are stored in the seven below-grade vaults at B-022. These below-grade vaults have floor plugs constructed of magnetite concrete and are fitted with steel support racks to hold canisters containing fuel elements or high-activity waste.

Low-level waste and equipment are stored in B-075 and B-621. The backwall of B-075 is lead-lined on the side facing the site boundary to reduce off-site direct radiation. At the time of the Survey, 11 drums containing Transuranic (TRU) wastes were in storage.

All runoff from the RMDF is directed toward the RMDF pond. This pond is 20 feet by 30 feet by 5 feet deep, is fenced and has a radiation monitor, and pumps with water level controls. The RMDF pond is sealed with coated asphalt to prevent seepage. Sloping of the pavement around B-021, B-022, B-655, B-075, and B-621 prevents water from running into these buildings. Collected runoff from the RMDF pond is discharged to surface drainage unless the radiation monitor alarms (see Section 3.3.2 for further details).

TRU Wastes

TRU wastes are not routinely generated at SSFL. Those wastes that are generated usually will result from cleanup activities. This would include the 11 drums of TRU wastes in storage at B-075, from B-055 (Plutonium Facility). In the future, 1–15 drums of TRU wastes may be generated from cleanup activities at the B-020 Hot Cell. TRU wastes are packaged for shipment to off-site facilities at the RMDF, with interim storage also taking place at the RMDF.

Mixed Wastes

Mixed wastes (radioactive and hazardous) are not routinely generated at SSFL. In FY 1988, 1 liter of radioactively-contaminated mercury and 5 cubic inches of beryllium oxide were in storage awaiting disposal (Schaubert, 1987).

4.1.2 Findings and Observations

4.1.2.1 Category I

None.

4.1.2.2 Category II

None.

4.1.2.3 Category III

1. Sodium Burn Facility Sump. Releases of a caustic solution from the scrubber in the sump at the B-133 Sodium Burn Facility have contaminated the soil. The sodium burn facility is a permitted hazardous waste facility. The facility contains a tank that served as a reservoir for alkali metal hydroxide solutions from the scrubber of emissions from the burn-pan. During installation of a new tank, soil samples collected from beneath the old tank revealed high pH levels in the soil. Plans have been formulated for the removal of the contaminated soil in accordance with RCRA requirements. The sump will be rebuilt and a new tank installed with secondary containment.

4.1.2.4 Category IV

1. Waste Characterization Procedures. Formal procedures are not in place to determine whether evaporator sludge should be tested for hazardous characteristics if the influent to the evaporator changes. Currently, influent to the evaporator consists of decontamination solutions from the Hot Cell (when operating) and of radioactively contaminated groundwater infiltrating into the B-059 pipe chase room. RMDF personnel have decided not to test evaporator sludge for hazardous characteristics based on their judgment that the processes generating the radioactive wastewaters, which are evaporated, do not generate hazardous constituents. However, if characteristics of the radioactive wastewaters differed in the future from the existing streams, or if the existing waste stream characteristic changed due to process changes, the presence of hazardous constituents could be undetected. The slurry would become hazardous (hence a mixed waste) and thus inappropriately disposed of in a facility not suited for mixed waste disposal.

2. B-029 Cold Trap Storage. Cold traps containing sodium metal, which is hazardous because of the reactivity of sodium metal, are being stored in a non-permitted hazardous waste storage area. The traps are stored outside B-029, which is the RCRA-permitted reactive metals storage area. The sodium metal is contained and is not likely to be released to the environment. However, storage outside the permitted hazardous waste storage area is a technical violation of RCRA regulations. The outdoor storage is expected to take place only until sawing techniques are developed so as to cut the traps and allow the reactive sodium metals to be removed and/or treated.

3. Area II Hazardous Waste Storage. Inadequacies in the Area II hazardous waste storage facility may result in the improper storage or release of DOE-generated hazardous wastes. The Area II hazardous waste storage facility is owned by NASA and is operated by Rockwell principally for NASA wastes. Approximately 10 percent of the wastes in storage at one time may consist of DOE wastes. The hazardous waste storage facility does not contain sufficient impervious paved area with impervious dikes to allow proper segregation of incompatible wastes or adequate aisle spacing for unimpeded access to containers for inspection and movement. Waste containers are stored on unpaved surfaces. According to site personnel, the dikes in certain areas may not be impervious, as indicated by leakage of accumulated rainfall. Equipment used by site personnel for container movement is not adequate and, on occasion, waste containers have been dropped during movement. Since the storage facility is not roofed, these waste containers can be heated up by solar radiation. Facility personnel have reported that drums of solvents have bulged as a result of heating by the sun. Site personnel said that regulatory agency personnel have noted these deficiencies during inspections. Rockwell has requested funding from NASA to build a larger hazardous waste storage area and to utilize the existing site, after modification, for the initial storage and staging of hazardous waste containers.

4. Facility Closure. Closure of the Bowl Area and the Process Demonstration Unit (PDU) facility (removal of hazardous wastes and decontamination) has not been initiated according to the closure plan in the operations plan of the hazardous waste permit. The closure plan in the RCRA permit gives a schedule for closure of buildings and test facilities, beginning with submission of the closure plan to the permitting agency. The facilities in the Bowl Area and the PDU facility have been closed for more than 90 days. All liquid wastes and readily accessible solid wastes have been removed. However, there is no evidence that a closure plan has been prepared and final closure initiated.

4.2 Toxic and Chemical Materials

4.2.1 Toxic Substance Management

The management of toxic substances associated with DOE activities at the Santa Susana Field Laboratory (SSFL) was reviewed to assess compliance with existing Federal and state regulations, DOE Orders, and good industrial practices. The Survey evaluated the use, handling, and disposal of bulk chemicals, industrial solvents, liquid fuels, polychlorinated biphenyls (PCBs), pesticides, and asbestos.

The Rocketdyne Division has established programs to meet its responsibilities to employees and to protect the environment. The Health, Safety and Environment (HS&E) Department has the responsibility for a major part of this program. HS&E ensures that employees handling hazardous materials are provided the necessary information and training to allow working with these substances in a safe manner. The following are the major features of the hazard communication program:

- Evaluating the hazards of materials used in the workplace and communicating to management and users any new data on materials in use at the site.
- Conducting or arranging for employee training on the use, handling, and storage of hazardous materials in their work area.
- Compiling and maintaining an inventory list of hazardous materials at SSFL and updating this inventory as required.
- Maintaining a file of Material Safety Data Sheets (MSDS) for all hazardous materials.
- Providing information on labeling of hazardous materials and furnishing the user with appropriate labels.
- Reviewing all purchasing requisitions for hazardous substances, providing management and requisitioner with toxicity information, and recommending whether to obtain the material for use at SSFL.

The HS&E Department has more than 4,500 MSDS on file with a computer-based index for rapid retrieval of information. This Department also provides assistance on regulations for transportation of the materials and proper storage.

Other departments share in the responsibility for proper hazardous material management. For example, the Environmental Control Unit (ECU) conducts a compliance audit on a monthly basis. The substances subject to survey and audit include chemicals, fuels, gases, products, materials in process, or waste substances. Any discrepancies observed during an audit are reported to the pertinent operating department management, and a work order is initiated to correct the problem. A letter report of all deficiencies observed is also sent to the specific area management. Follow-up inspections are conducted at the next audit period.

ETEC Procedure No. 4-05 delineates the criteria for the procurement, transportation, storage, and use of hazardous materials (ETEC, 1987). The procedure outlines the responsibilities of HS&E, Industrial Security, F&IE (Environmental Control Unit), Protective Services, the Packaging and Transportability Engineer, the appropriate ETEC manager, and the requisitioner/user. Radioactive materials are not included, since they are discussed in a separate procedure.

Similar procedures are available for other SSFL programs, including other DOE activities. These are described in the Health, Safety, and Environment Procedure Manual 572-L-1 (Rockwell International, undated).

4.2.2 Toxic Chemical Use and Storage

Many hazardous substances are in use; however, most of these materials are used in relatively small quantities (e.g., reagents in the analytical laboratories). This discussion will emphasize those substances used in appreciable quantities.

4.2.2.1 Bulk Liquid Chemicals and Fuels Storage Areas

Some hazardous materials are stored in large quantities at several locations throughout the DOE program area of SSFL. The substances stored in aboveground storage tanks include fuel oil, diesel fuel, gasoline, lubricating oil, sulfuric acid, and sodium hydroxide solution. During the Survey, these tanks were visually inspected for leaks, adequate secondary containment, appropriate labeling, and other potential deficiencies. A description of six of these tanks and the deficiencies observed are presented in Finding 4.2.6.4.1.

4.2.2.2 Low-Volume Storage Areas

Approximately 70 drums containing various types of oils, a microbiocide, lithium hydride, various solvents, and other chemicals are stored in Buildings 007 and 008. Most of these substances have been stored for many years in metal and fiber drums at sites that are exposed to the elements and lack secondary containment. As a result, many of these drums are deteriorating, and there is evidence of past leaks or spills (see Finding 4.2.6.2.1).

Several 55-gallon drums containing solvents were on dispensing racks at four locations. These drums did not have drip pans to catch spills or leaks and could be a source of release of hazardous substances to the environment (see Finding 4.2.6.4.1).

4.2.2.3 Solvent and Chemical Storage Cabinets

Many solvent and chemical storage cabinets are located adjacent to buildings. Some of these cabinets were not adequately maintained and could result in the release of hazardous substances to the environment. In many cases, the cabinets were in a deteriorating condition, and the containers inside the cabinets were badly corroded or lacked labels. Some of the cabinets did not appear to have been used for several years (see Finding 4.2.6.4.2).

4.2.2.4 Improper Storage of Batteries

Two pallets of nickel-cadmium batteries were improperly stored. One pallet was stored outside B-143 and the second pallet was near B-100. The condition of the plastic casings indicates that these batteries had been exposed to the weather for some time (see Finding 4.2.6.4.3).

4.2.3 Polychlorinated Biphenyls

Written procedures for the disposal, storage, and labeling of polychlorinated biphenyls (PCBs) are included in the Rocketdyne Environmental Control Manual (Rocketdyne, 1986). These procedures define the management's policy and assign specific responsibilities concerning the use, storage, handling, identification, inspection, transportation, and disposition of PCBs. These procedures are designed for the Rocketdyne facility to be in compliance with the TSCA regulations (40 CFR 761).

All of the PCB and PCB-contaminated equipment have been retrofitted (fluid removed and flushed) or removed from the DOE facilities at SSFL. The last of the PCB items were retrofitted or removed by an outside contractor before the close of the 1987 calendar year. However, most of the retrofitting of transformers was done during the 1986 calendar year. The retrofitted transformers were sampled and analyzed after 90 days of operation by the contractor. If the fluid concentration was found to contain more than 5 ppm of PCBs (the California standard), the fluid was removed and the transformer was rinsed and then refilled with the non-PCB coolant fluid. This process was continued until the PCB concentration in the fluid remained below 5 ppm.

The waste PCB fluids and rinsates were disposed of (incinerated) by Rollins Environmental (Deer Park, Texas), the capacitors were shredded and incinerated by U.S. Ecology Corporation (Beatty, Nevada), and those transformers that were removed were triple rinsed and then landfilled. The ECU staff conducts an annual audit of the TSD facilities that Rocketdyne utilizes for disposal of its hazardous wastes.

The last of the PCB materials removed from DOE facilities were placed in storage in B-231, which is a small building that is part of the CTL-2 (B-206) complex. The PCB storage area is 6 by 8 feet, has a concrete floor, a 6-inch dike, and adequate protection from the elements. At the time of the Survey, the storage area contained some PCB wastes such as capacitors, wipes, and a 55-gallon drum. However, the origin of this material was not known.

The storage area and the building were properly marked with PCB warning labels. This area is reported to be inspected on a weekly basis.

4.2.4 Asbestos

Asbestos and asbestos-containing materials (ACMs) have been used at SSFL facilities in the past. The major asbestos and ACMs include transite (cementitous asbestos); vinyl/asbestos floor and ceiling tile; insulation on piping, equipment, tanks, valves, etc.; various structural support members such as pipe hangers, tank pedestals, equipment supports, etc.; pump and valve packing; and gasket materials. Normally these materials are not friable and are not regulated by the EPA or the Occupational Safety and Health Administration (OSHA). However, during demolition renovation, or during repair of facilities, they become broken, hammered, sawed, or drilled and are then considered to be friable.

All asbestos removal activities are conducted in compliance with OSHA (29 CFR Parts 1910 and 1926), EPA (40 CFR Part 61, Subparts A and B, 1973), and the National Emission Standards for Hazardous Air Pollutants. The procedures to be used in removing, handling, and packaging the friable asbestos during facility renovations or demolition activities are described in a Rocketdyne Operating Procedure (Schmidt, 1988).

Current policy is to contract asbestos remediation jobs to EPA-approved/California-licensed contractors. The facilities containing ACMs at SSFL have been identified; however, the material is not removed unless it is friable or it is to be renovated or replaced. Replacement insulation, when required, usually consists of calcium silicate.

Rockwell does have a person on the staff trained in the procedures to remove asbestos and certified by the State of California. Management plans to utilize this person's services for asbestos removal projects that cannot be handled by outside contractors.

Some sites where asbestos has been removed include the SCTI facility, B009, and B006. The removed asbestos is double bagged and disposed of in a Class 1 landfill (U.S. Pollution, Inc., Clive, Utah).

4.2.5 Pesticides

All herbicides and pesticides are applied at SSFL (including the DOE-optioned area) by an outside contractor. The Dewey Pest Control Company of Van Nuys, California, is certified by the State of California and has the contract to apply pesticides both inside buildings and in the required outdoor areas. The pesticides in use at SSFL are listed in Table 4-3. There is only one herbicide on the list, since generally mechanical methods are used to control vegetation at this facility.

Pesticides and herbicides are not stored on-site. The contractor brings the types and amounts required for each of the weekly applications, and the crew removes any unused chemicals as well as empty containers when they leave.

4.2.6 Findings and Observations

4.2.6.1 <u>Category I</u>

None.

TABLE 4-3

PESTICIDES USED AT SSFL
SSFL – VENTURA COUNTY, CALIFORNIA

Pesticide	Target Application	Target Area	Annual Usage	Dose Rate	FIFRA* Registered
Round Up	Weeds (Broadleaf)	Parking Lot		1 gallon/acre	Yes
Diazinon R 4E	Exterior Pests	Where Needed	As Required	4 oz/3 gallons	Yes
Knox Out 2 FRM	Exterior Pests (Bees)	Where Needed	As Required	5 tbs/gallon	Yes
Purge CB40	Interior Pests	Where Needed	As Required	Fog	Yes
Dursban L.O.	Interior Pests (Roaches, Ants)	Where Needed	As Required	2 oz/gallon	Yes
Ficam W	Interior Pests (Ants)	Where Needed	As Required	2-3 tsps/gallon	Yes

Source: Adapted from Rocketdyne Division, 1988.
* Federal Insecticides, Fungicide, and Rodenticide Act.

4.2.6.2 Category II

1. Deficiencies at Chemical Product Storage Sites. There is the potential for the release of hazardous substances to the soil due to deficiencies in the chemical product storage Buildings 007 and 008. The Survey team observed the following deficiencies.

   a. Long-term storage - Some chemicals have been in storage for more than 10 years in metal and fiber drums containing a variety of hazardous chemicals in an area that is exposed to the elements. The utility of some of the chemicals as a product is questionable. See Tables 4-4 and 4-5 for the chemicals in storage, the quantity of each chemical, and the date purchased.

   b. Deteriorated drums - Several of the metal and fiber drums have deteriorated and one drum (the microbiocide) has corroded. There is also evidence of past spills at Building 008.

4.2.6.3 Category III

None.

4.2.6.4 Category IV

1. Deficiencies in Bulk Chemical and Fuel Storage Facilities. There is the potential for release of hazardous materials from bulk chemical and fuel storage tanks, as well as chemical dispensing sites. Although not regulatory violations, the Survey team identified deficiencies at the following storage and dispensing sites.

TABLE 4-4

CHEMICALS STORED IN BUILDING 007
SSFL – VENTURA COUNTY, CALIFORNIA

Chemical	Quantity	Purchase Date
LiH Shields Aluminum Clad	11 (3,470 pounds)	1978
LiH	14 each – 55 gallon drums 1 each – 30 gallon drum 1 each – 20 gallon drum 2 each – 5 gallon drums	1978 1978 1978 1978
Sodium Hydride Powder	100 pounds	1985
Ion Exchange Resins	6 each – 55 gallon drums	1986
Denatured Alcohol	2 each – 55 gallon drums	1985
Water Softener Salt	2,000 pounds	Jan. 88
Pulverized Limestone	2,000 pounds	Jan. 88
Poly Wax	100 pounds	May 88
Refractory Cement	2,000 pounds	Jan. 88

Source: Schmidt, 1988

TABLE 4-5

CHEMICALS STORED IN BUILDING 008
SSFL – VENTURA COUNTY, CALIFORNIA

Chemical	Quantity	Purchase Date
BUILDING 008		
Hydrazine	7 each – 35 gallon drums 2 each – 15 gallon drums	1986 1986
Amerzine	9 each – 55 gallon drums	1986
Lubricating Oils	19 each – 55 gallon drums	Between 1977 – 1988
Automatic Transmission Fluid	16 each – 55 gallon drums	1987 – Present
Morpholine	5 each – 55 gallon drums	1988
Triton X-100	2 each – 55 gallon drums	Greater than 10 years old
Resins (Permuted)	35 containers (7 cubic feet each)	1985
Flake Caustic	2 each – 55 gallon drums	Greater than 10 years old
Microbiocide	1 each – 55 gallon drum	Greater than 10 years old
Sodium Nitrite	5 each – 5 gallon size	Greater than 10 years old
BUILDING 008 SOUTH – MIDDLE BAY		
Mobilect 45	7 each – 55 gallon drums	All items listed have been in Building 8 for at least 2–3 years.
Mobil DTE Medium	1 each – 55 gallon drum	
Mobil DTE 26	1 each – 55 gallon drum	
Mobil DTE 25	3 each – 55 gallon drums	
Acetone	2 each – 55 gallon drums	
Triton X-100	2 each – 55 gallon drums	
Formula One SAE 10 W	9 each – 5 gallon cans	

Source: Moore and Wells, 1988.

Area	Material	Capacity (gallons)	Problem
356	Sulfuric Acid	1,500	No secondary containment
356	Sodium Hydroxide, 20% Solution	1,500	No secondary containment
T-735	Fuel Oil	86,000	Soil dike
T-731	Fuel Oil	1,500,000	Soil dike
T-732	Fuel Oil	1,500,000	Soil dike
B/057	Fuel Oil	500	No label
B/358	Sodium Nitrite	55	No drip pan*
Plant Serv.	Kerosene	55	No drip pan*
Paint Shop	Paint Thinner	5-55	No drip pan*
B/457	Unknown	2-55	No drip pan & no label*
B/008	Various Chemicals and Oils**	79-55	No secondary containment and evidence of past spills

* 55-gallon drums were on dispensing racks.
** See Table 4-5.

2. Deficiencies with Chemical Storage Cabinets. The deteriorating condition of many of the solvent and chemical storage cabinets could result in the release of hazardous substances to the environment or a fire. These cabinets are rusted and without labels. Some of the cabinets do not appear to have been used for several years (e.g., cabinet at B-886). See Table 4-6 for a list of some cabinets, their location, and the deficiencies observed.

3 Improper Storage of Batteries. The improper storage of two pallets of nickel-cadmium batteries can result in the release of acid to the environment. A pallet of nickel-cadmium batteries was stored outside of B-143, and the other pallet was stored east of B-100. The plastic casings were extremely brittle from long-term exposure to the weather and cracked easily.

TABLE 4-6

DEFICIENCIES WITH OUTDOOR CHEMICAL STORAGE CABINETS
SSFL – VENTURA COUNTY, CALIFORNIA

Cabinet Location*	Deficiencies Observed
B-027	No label on some containers; container cracked; containers badly corroded.
B-032	No label on some containers; some containers corroded.
B-057	One container leaked.
B-062	Labels on containers in poor shape.
B-133	No label on one container; labels peeling; container corroded.
B-163	No label on a container.
B-826 (2 cabinets)	Appears abandoned; no labels on some containers; labels peeling; containers corroded.
B-463 (3 cabinets)	Containers corroded.
B-886	Containers corroded.
SCTI Building (3 cabinets)	Containers corroded; no label on some containers; door ajar on one cabinet.
Plant Services Building	Oil leaked from two containers; no label on one container.

Source: Survey team observations.
* Cabinets located outside of building indicated.
Note: This list is not intended to be comprehensive.

4.3 Radiation

4.3.1 Background Environmental Information

The potential sources of radiation at the SSFL Site can be described by assessing individual media (i.e., air, soils, surface waters, and hydrogeology). Each of these primary pathways is responsible for radionuclide transport and potential contamination of ambient air, soils, drinking water, groundwater, vegetation, and food.

Ambient radiation in the vicinity of SSFL is a consequence of both natural and man-made sources. These sources include cosmic radiation, natural radioactive materials in the soils and building materials, fallout from past atmospheric weapons detonations, and releases of radioactive materials from nuclear power plants and other facilities handling radioactive materials worldwide. These releases can result in public dose from the intake of or exposure to radioactive materials in air, drinking water, and food. The most significant of these exposures is that to the lungs from background levels of radon. The annual average effective dose equivalent for natural background in the United States is approximately 189 millirem/year (mrem/year) (United Nations, 1982). This dose is detailed in Table 4-7. About one-half of the dose equivalent is attributable to the inhalation of radon-222 and its decay products. Previously accepted estimates of background doses did not include the radon contribution and were at levels of about 100 mrem/year.

The data in Table 4-7 were derived in accordance with the approach recommended by the International Commission for Radiation Protection (ICRP) in ICRP Reports 26 and 30. This approach allows direct comparison of the effective dose for various organs by reflecting the distribution of and organ sensitivity to various radionuclides. This is accomplished by applying "weighting factors" to the doses received by individual organs. The weighting factors are expressed as the fraction of the total risk for the entire body attributable to the organ. The sum of the dose equivalent for the individual organs provides an estimate of the total effect of the radiation on the whole body.

The EPA reports gamma radiation exposure rates on a quarterly basis for select locations throughout the United States in Environmental Radiation Data (EPA, 1987). Although a considerable distance from the site, measured exposure rates equivalent to an annual dose of approximately 65 mrem ± 7 mrem were reported for the Berkeley, California, monitoring location during the reporting period of April through June, 1987.

TABLE 4-7

U.S. AVERAGE ANNUAL EFFECTIVE DOSE EQUVALENT TO HUMANS FROM NATURAL BACKGROUND RADIATION

Organ	Annual Effective Dose Equivalent (mrem)
Gonads	24
Breast	14
Lung (Total)	100
Red Bone Marrow	13
Bone Surfaces	6
Thyroid	3
Other	29
TOTAL(1)	**189**

Source: United Nations, 1982.

(1) Total represents the major product of the appropriate weighting factor times the annual dose equivalent for pulmonary, trachial/bronchial, and mean doses.

As required by DOE Order 5484.1, Chapter III, 4d2d1-3, SSFL conducts an annual "assessment and reporting of potential dose to the public." In 1985, DOE adopted an interim radiation protection standard for environmental activities to be implemented in calendar year 1985 (Vaughan, 1985). It is DOE policy to follow the guidance of the National Council on Radiation Protection and Measurements (NCRP) to the extent practicable with respect to radiation protection standards. A comprehensive revision of previous NCRP recommendations on a basic radiation protection is still under development. However, current NCRP guidance is available regarding protection of the public in its September 18, 1984, advice to the Environmental Protection Agency published under the title "Control of Air Emissions of Radionuclides." In this document, the NCRP endorses the recommendation of the International Commission on Radiological Protection (ICRP) to limit the continuous exposure to any member of the public from other than medical sources and natural background to 100 mrem per year whole-body dose-equivalent. The previously recommended limit of 500 mrem per year is retained for noncontinuous exposures. This recommendation is now adopted as an interim standard for DOE environmental activities for the sum of all exposure pathways.

Radiation exposures are received from external sources and from radionuclides taken into the body by inhalation of air and ingestion of water and foodstuffs. Radionuclides taken into the body will continuously irradiate the body until they are removed through either radioactive decay or metabolic processes. Consequently, internal dose estimates are calculated as "50 year dose commitments." These are obtained by integrating the total dose received by an individual's body over an assumed remaining lifetime of 50 years. The doses to the various major organs are considered for various exposure pathways. The radiation doses received by a specific organ are weighted and summed to determine the total dose.

4.3.2 General Description of Pollution Sources and Controls

During the 1950s and 1960s, SSFL conducted research and development on many nuclear reactor projects. These projects include the Sodium Reactor Experiment (1957–1964), the Space Nuclear Auxiliary Power (SNAP) reactor, and critical experiments (1957–1973). Some of these programs or portions thereof were licensed under Nuclear Regulatory Commission (NRC) and predecessor agencies, while others were under the auspices of the Department of Energy (DOE) and its predecessor agencies. As funding for various programs decreased, SSFL began a program of radioactive Decontamination and Decommissioning (D&D) of select operations under the Surplus Facilities Management Program (SFMP). Criteria for Environmental Analyses of at least seven of these facilities are outlined in Berger, et al., 1979. The current D&D status of former nuclear operations at SSFL is shown in Table 4-8. Source documents for listed D&D activities were numerous

TABLE 4-8

CURRENT DECONTAMINATION AND DECOMMISSIONING (D&D)
STATUS OF FORMER NUCLEAR OPERATIONS
SSFL – VENTURA COUNTY, CALIFORNIA

Building No.	Facility	Approximate Years of Operation(1)	D&D Status	Nuclear Regulatory Commission (NRC) Status
003	Hot Cave	1954-1973	Building dismantled - non salvaged equipment sent to Beatty, Nevada (UREDA, 1976). Released for unrestricted use (Lanni, 1984).	N.A.
005	Uranium Carbide pilot fuel fabrication	1966-1967	Rooms 110 and 113, exhaust ducts and filter plenums need to be decontaminated (Chapman, 1987).	N.A.
009	Sodium graphite reactor (SGR) organic moderated reactor (OMR)	1959-1969 1959-1969	Conditionally released to unrestricted use (Owens, undated).	N.A.
010	Systems for nuclear auxilliary power • SNAP 8ER • SNAP 2SER	 1962-1963 1959-1960	Facility razed and shipped to Beatty, Nevada (Stelle, 1979).	N.A.
012	SNAP critical	1962-1973	Areas in the concrete building will require monitoring during D&D (Begley, 1985).	N.A.
024	SNAP Environmental Test Facility (SETF) S2DR, S10FS-3, SCA-4B, Snaptran-1	1960-1971	Released to conditional unrestricted use (Speights, 1978).	N.A.
028	Shield Test Irradiation Reactor (STIR)	1961-1973	"The facilities were decontaminated to levels which were as low as practicable, but in all cases to levels below the limits described as acceptable for future unrestricted use" (UREDA, 1976).	N.A.
055	Nuclear Materials Development Facility (NMDF)	1965-1979	Meets requirements for unrestricted use (Chapman, 1986) and criteria in Dismantling Plan.	Released and Removed from SNM-21 license (Rouse, 1987)
059	SNAP 8DR	1962-1969	D&D not complete - Pipe chase remediation project is under way (Meyer, 1988).	N.A.

TABLE 4-8
CURRENT DECONTAMINATION AND DECOMMISSIONING (D&D)
STATUS OF FORMER NUCLEAR OPERATIONS
SSFL – VENTURA COUNTY, CALIFORNIA
PAGE TWO

Building No.	Facility	Approximate Years of Operation(1)	D&D Status	Nuclear Regulatory Commission NRC Status
073	Kinetics experiment water boiler (KEWB) also includes Buildings 643,123 and 793	1956-1966	All structures and foundations razed except for the floor and foundation of Building 73 (Ureda, 1976).	N.A.
093	AE-6/L-85 Reactor also includes Building 83, 74 and 453	1956-1980	Meets criteria for release of facilities for unrestricted use (Begley, 1986) and in Dismantling Plan.	Released and R-118 license terminated (Wenslawski, 1987)
100	Advanced epithermal thorium reactor (AETR) fast critical experimental laboratory (FCEL)	1960-1972	Meets criteria in dismantling plan (Remley, 1980).	CX-17 License terminated (Reid, 1980)
143	Sodium reactor experiment (SRE) includes Buildings 41, 724, 686, 163, 695, 723, 753, 453, 653, 654, 773 (drainage control)	1957-1964	D&D 1974-1983 released for unrestricted use (Lanni, 1984 and Baublitz, 1983).	N.A.
373	SNAP critical assembly (unshielded)	1957	No D&D documents available.(2)	N.A.

Source: DOE Survey team.

(1) Dates provided by Dr. Marlin Remley.
(2) Survey Report on Building 373 in preparation as part of overall DOE Site Survey.

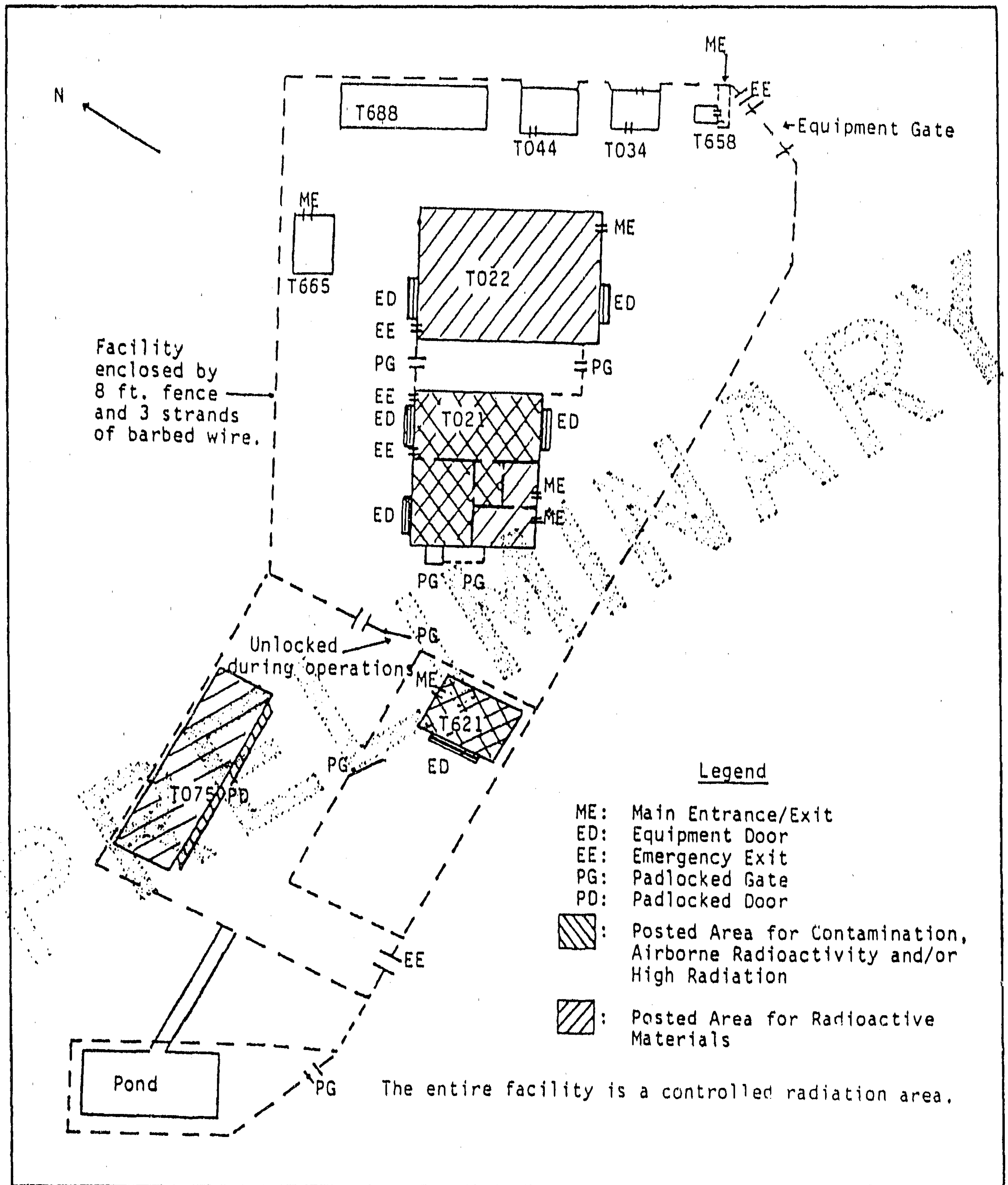
and spanned many years. Principal radioactive contaminants of concern over the entire period of operation at SSFL have primarily been mixed fission products.

In addition to the SFMP D&D activities, SSFL proposed a radiological survey plan and is now conducting these surveys for the purpose of determining "if radioactive contamination exists to such an extent that further surveying or decontamination is warranted...." (Badger and Tuttle, 1985) for facilities outside the SFMP decommissioning program. This program will help to further characterize or identify additional radioactive sources.

The two major sources of SSFL radioactive material use are the Hot Lab (Building 020) and the Radioactive Materials Disposal Facility (RMDF). The first is a facility that is designed for fuel decladding and other activities requiring hot cell facilities. It is licensed under Special Nuclear Materials License SNM-21 issued by the NRC (Page, 1984). Spent DOE-owned fuel elements have been decladded for further reprocessing at other facilities; however, no such activities were being conducted during the on-site survey. A diagram (Figure 3-3) and discussion of airborne radionuclide emission control equipment is provided in Section 3.1. Process liquid effluents are piped to a hold-up tank, which is analyzed and processed at the RMDF for ultimate disposal.

The principal source of potential radiation dose to the public from SSFL activities is the RMDF. The term "Disposal" in the RMDF name is rather misleading, since only decontamination and packaging for ultimate disposal take place at this facility. The RMDF consists of the following areas (see Figure 4-1):

- Building T021, Radioactive Waste Processing and Packaging, and Equipment Decontamination.
- Building T022, Radioactive Material Storage Vault.
- Building T034, Administrative and Engineering Offices.
- Building T044, Health Physics Services.
- Building T075, Packaged Radioactive Waste Ready for Transport Off-Site.
- Building T621, Radioactive Source Storage.
- Building T665, Emergency Supplies Storage.
- Building T688, open, covered building for temporary storage of chemicals and equipment.
- Building T658, hardened security post at the main gate.
- RMDF drainage pond.



Source: Adapted from Chapman, 1986

FIGURE 4–1

SECURITY AND RADIATION AREA ACCESS PROVISIONS
SSFL–VENTURA COUNTY, CALIFORNIA

Airborne effluent controls for the RMDF are shown in Figure 3-2 and discussed in Section 3.1.2. Airborne dose assessments of this facility may be imprecise, as described in Finding 4.3.4.4.3, because of AIRDOS computer modeling difficulties. Process liquid effluents from the RMDF itself as well as from other on-site radioactive liquid effluents are concentrated in the evaporator located in Building 021 and then packaged for off-site disposal.

Building T-075 is the principal direct radiation source of environmental concern. Radioactive waste materials that have been packaged for off-site shipment are stored here, frequently in concentrated form. Despite added shielding, this building continues to be of concern from the standpoint of potential public exposure to direct radiation (see Finding 4.3.4.4.1).

4.3.3 Environmental Monitoring Program

Environmental monitoring for the purpose of determining site-related increases in environmental radioactivity is conducted for various media, including air, water, and soil. Airborne radioactivity is monitored in process stack effluents at the RMDF and the Hot Lab. Ambient air is also monitored for radioactivity, as described in Section 3.1.3. Surface water at SSFL is only monitored following rainfall, as there are no continuously flowing discharges as described in Section 3.3.3. As already discussed in Section 3.2, soil monitoring has been conducted at SSFL since 1954. Representative monitoring data have already been presented in these sections and will not be repeated here.

Airborne particulate emissions from the RMDF are well controlled, as described in Section 3.1. Particulate emissions from the RMDF are shown in Table 3-7 for the period 1981 to 1987. Dose to the general population is extremely low, as evidenced from the calculated total dose to the receptor population living within 80 km. In recent years this dose has ranged from a low of 0.0029 person-rem in 1982 to a high of 0.017 person-rem in 1985. The majority of emissions of airborne particulates occurs from the 130-foot stack located between Buildings 021 and 022 (see Figure 4-1).

Environmental soil, water, and ambient air samples are counted for alpha and beta radiation with a low-background, gas-flow, proportional counting system. The system is capable of simultaneously counting both alpha and beta radiation. Because the observed radioactivity in environmental samples primarily results from natural sources and is at low concentrations, constituent radionuclides are not identified for each sample. Dose calculations are performed conservatively, assuming that all alpha activity is plutonium-239 and all beta activity is strontium-90. Collected samples are also composited for gamma spectrometry of accumulated sample materials. The detection of significant levels of radioactivity would lead to an investigation of the radioactive material involved, the sources, and the possible causes (Moore, 1988).

In addition to the significant quantities of transient direct radiation from materials being processed in Buildings 021 and 022, wastes packaged for transport off-site and stored in Building 075 are also a source of direct radiation. Sealed sources (well-shielded) are stored in Building 621, and temporary storage of larger moderate concentration material occurs in the fenced areas nearby B-075 and B-621. Numerous devices are in use to provide continuous monitoring of direct radiation from these sources.

SSFL uses Victoreen, manganese-activated, calcium fluoride, glass-bulb, thermoluminescent dosimeters (TLD) for measuring direct radiation. As discussed in the previous section and in Finding 4.3.4.4.1, direct radiation measurements at the property boundary north of the RMDF are greatly influenced by quantities of packaged waste materials stored in Building T075. Additionally, the perimeter radiation monitoring program has deficiencies, as discussed in Finding 4.3.4.4.2.

4.3.4 Findings and Observations

4.3.4.1 Category I

None.

4.3.4.2 Category II

None.

4.3.4.3 Category III

None.

4.3.4.4 Category IV

1. North Boundary Penetrating Radiation Doses. Although many improvements have been made to reduce radiation exposure rates, because of changing operations involving radioactive materials handling at the RMDF, these exposure rates may exceed the DOE guideline of 100 mrem/year for continuous exposure from all pathways at the property boundary north of the RMDF. This guideline is intended to prevent members of the public from unknowingly receiving excessive exposure as a result of DOE operations. However, long-

term exposure to a member of the public is unlikely due to the rugged terrain along the north boundary and daily security patrols.

2. Penetrating Radiation Monitoring Program. The perimeter penetrating radiation monitoring program is deficient because formally approved and updated procedures are not available. Specific areas of concern include the following:

   a. Environmental TLD (Victoreen, glass-bulb type) handling procedures do not correspond to existing written procedures. For example, the calibration source currently used is not the one described in the written procedure, and the annealing furnace referenced in the procedure is no longer used.

   b. Calculations, assumptions, and other supporting data used to determine boundary dose and dose to the nearest resident are not formally documented. For example, source term, inverse square, and air attenuation calculations to determine the boundary dose are not presented in the environmental monitoring report or summarized in a report outlining these assumptions. Written integration of the site's Landauer (film badge) dosimetry program (for the purpose of measuring perimeter radiation), including QA requirements, has not taken place.

3. AIRDOS Calculations. AIRDOS-modeled population exposure and estimated dose information may be imprecise because of computer code difficulties. Specifically, the AIRDOS-version SSFL used at the time of the Survey would not run multiple source terms for all 80 km sectors and would not accept multiple dose conversion factors. Because of these deficiencies, site personnel must run the code repeatedly for various nuclides and sum the calculated doses external to the computer code. The Survey team believes site personnel are currently taking a conservative approach in favor of public safety, and doses are well below guidelines. However, multiple calculations external to the computer code increase the potential for errors in final calculated dose estimates (see Finding 3.1.4.4.1).

4.4 Quality Assurance/Quality Control

4.4.1 General Description of Data-Handling Procedures

Three analytical chemistry laboratories at SSFL perform analyses of environmental samples from the DOE programs: the Rocketdyne Chemistry Laboratory in Building 300, the Radiation Measurements Laboratory in Building 100, and the Chemistry and Metallurgical Laboratory in Building 065. In addition, off-site laboratories are used extensively for the overflow environmental samples and some special projects such as the Proposition 65 sampling and analysis program conducted in 1987 by Environmental Monitoring & Services, Inc., a subsidiary of Combustion Engineering.

Outside laboratories are required to have adequate QA/QC programs. Water samples for chemical analyses are sent only to those laboratories which are approved by the State of California and are required to maintain adequate QA/QC programs.

Radiological Monitoring

The Radiological Environmental Monitoring Program is the responsibility of the Radiation and Nuclear Safety Group of the Health, Safety, and Environment Department. The purpose of the program is to evaluate the effectiveness of the safety procedures and of the engineering safeguards included into facility designs, to ensure that SSFL operations do not increase radiation levels in any significant amount. This monitoring program is conducted by the Radiological Measurements Laboratory with a staff of two experienced analysts.

The laboratory monitors radioactivity levels in on-site and off-site samples of ambient air, surface soil, surface water, groundwater, and ambient radiation levels. The details concerning the specific sampling location, sampling frequency, and type of analyses performed are presented in Sections 3.1.3, 3.2.3, 3.3.3, 3.4.3, and 4.3.3.

A written quality assurance procedure for the radiological measurements program is available at SSFL (Moore, 1984). This Rockwell International Department includes a laboratory quality control program that is intended to help ensure the accuracy and precision of the results generated in the laboratory and to continuously monitor the quality of laboratory data. The essential elements for analytical quality control are presented as follows:

- Use of high-quality reagents
- Low-level radiation in laboratory air supply

- Controls to minimize laboratory contamination
- Use of reagent and sample blanks
- Use of control charts
- Use of standard reference materials
- Use of blind replicates
- Use of spiked samples
- Participation in laboratory intercomparison programs
- Use of calibration standards

In general, the laboratory utilizes these quality control techniques with one exception: Spiked field samples were not being used at the time of the Survey (see Finding 4.4.2.4.1).

Spiked samples provide a measure of the accuracy of the analytical measurements and are an important aspect of a laboratory's quality assurance program. Although the laboratory participates in the DOE interlaboratory comparison program, a more frequent measure of the analytical accuracy is required than once every 6 months. Also, spiked samples provide information concerning any specific sample matrix effects on the analytical results. However, the laboratory is generating good quality data, as is demonstrated by the results of the semiannual DOE Environmental Measurement Laboratory Program and the biennial DOE Radiation Dosimetry Intercomparison Project.

Another shortcoming of the quality control program is the lack of procedures for confirming the analyst's calculations and entry of the results into the computer data base. This deficiency could result in errors becoming a permanent part of the data base and thereby decrease its reliability (see Finding 4.4.2.4.1).

The Rocketdyne Analytical Chemistry Laboratory

The Rocketdyne Analytical Chemistry Laboratory is certified by the State of California for the analysis of NPDES and hazardous waste samples. Most of the workload consists of environmental samples (75 percent), and the remaining analyses (25 percent) are in support of the test stands and engineering operations.

The laboratory has established an extensive quality assurance/quality control program based on the EPA guidelines (EPA Quality Assurance Management Staff Guidelines, QAMS Document, December 20, 1980, and the Handbook for Analytical Quality Control in Water and Wastewater Laboratories) that is designed to produce results that are scientifically valid, defensible, and of documented precision and accuracy.

The laboratory uses one-on-one, and on-the-job training for new personnel or new procedures. The manufacturer's manuals are relied on for instrument operating procedures.

This laboratory is part of an engineering group in the Materials Engineering and Technology Organization, which operates within the Engineering and Test Department of Rocketdyne.

The main elements of the quality control program include the use of internal standards, external standards, working standards, spiked samples, duplicate samples, appropriate blanks, use of quality control charts, and participation in the EPA laboratory assessment program. The quality control samples make up 10–20 percent of the samples analyzed by the laboratory. These samples are tracked by a computer, which flags any unacceptable results. Such results are evaluated to determine their cause, and appropriate corrective action is taken.

The laboratory's operation procedures are described in the Rocketdyne publication (MPR 82-0229), "Water Analysis Laboratory Operation and Procedures Manual." This document contains information on certification, quality assurance outline, laboratory organization, personnel qualifications, personnel responsibilities, records, sampling procedures, instruments and methods, statistical control, education, NPDES permit, and legal aspects.

The laboratory has written analytical procedures for each analyte measured. These procedures are consistent with EPA protocols, are reviewed frequently, and are revised as required. Written procedures were also available that describe sampling, sample containers, holding times, and storage. Chain-of-custody procedures are followed for all NPDES samples, and these samples are kept in a locked refrigerator prior to analysis.

<u>The Chemical and Metallurgical Laboratory</u>

The Chemical and Metallurgical Laboratory serves a very limited function for environmental analysis. The analysis of materials for asbestos is the only environmental monitoring function of interest to the Survey team. Materials are analyzed for friable asbestos by low-and high-power optical microscopy.

An inspection of the three laboratories demonstrated that they are equipped with state-of-the-art instruments and equipment for the monitoring function required of each. The laboratories were clean and well organized. Discussions with individual analysts indicated the appropriate expertise required for the analyses assigned to each of them. The laboratory staff maintains appropriate sample logs, and analytical notebooks, as well as calibration and instrument maintenance records. The maintenance of the analytical balances and the infrared spectrophotometer is managed through service contracts. All standards and limited-life reagents are dated when received.

4.4.2 Findings and Observations

4.4.2.1 Category I

None.

4.4.2.2 Category II

None.

4.4.2.3 Category III

None.

4.4.2.4 Category IV

1. Deficiencies in QA Procedures for Radiological Monitoring. Environmental monitoring data may be less defensible as a result of the following quality assurance deficiencies observed at the Radiological Measurements Laboratory at the SSFL Site:

   a. Lack of formalized procedures for confirming the analyst's calculations and entry of results into the computer data base.

   b. No use of spiked samples on a routine basis for internal quality control (although the laboratory participates in the external test program of DOE/EML).

4.5 Inactive Waste Sites and Releases

4.5.1 General Description of Pollution Sources and Controls

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) established (1) notification requirements, (2) liability standards, and (3) response authority for dealing with releases of hazardous substances to the environment. Also known as "Superfund," CERCLA's scope is expansive. The EPA and state agencies can undertake or order study or cleanup when there is a release or the substantial threat of a release of a hazardous substance to the environment.

Superfund was substantially expanded by the Superfund Amendments and Reauthorization Act of 1986 (SARA). In addition to significantly increasing the size of the fund to finance cleanups, SARA creates a response authority for petroleum underground storage tank releases (technically an amendment to RCRA) and mandates community right-to-know and emergency preparedness programs (Title III). SARA also obligates Federal facilities to comply with the same regulations and policies as other entities. Hence, except for certain limited national security waivers, Federal facility cleanup plans for sites on the National Priorities List must undergo EPA review and concurrence.

In addition to CERCLA/SARA, a second Federal cleanup authority was created with the passage of the Hazardous and Solid Waste Amendments (HSWA) of 1984. Included in the amendments to RCRA was a Section 3004(u) known as the "Continuing Release" provisions, which required that facilities address ongoing releases from their existing and former Solid Waste Management Units (SWMUs) as a condition of granting a final operating or post-closure permit. The implication of this provision is to establish a parallel RCRA-based cleanup program, whereby facilities seeking a permit for a new or ongoing operation must obtain approval for cleanup plans of their old waste units prior to getting a new permit.

The history of DOE-supported activities that are now conducted at SSFL spans three decades and at least three locations since the early 1950s in southern California. The first location was in Downey, California, in Los Angeles County approximately 15 miles directly east of the Los Angeles International Airport, and approximately 15 miles south of Pasadena. At Downey, the Water Boiler Neutron Source was assembled by Atomics International (AI), in a section of the building then occupied by its parent company, North American Aviation. This small physics experiment operated at approximately 1/2 watt, until it was dismantled in 1956 and moved to the Santa Susana Field Laboratory location (SSFL), where it was upgraded to 3 kilowatts (Remley, 1985). No records were available of the decontamination and decommissioning of the Downey facility.

The second location for nuclear power research began in Canoga Park, California at the Vanowen Facility in December 1955. With growth of the activities during the late 1950's, new facilities (the DeSoto complex) were constructed and activated during 1959 and 1960. No operational or decontamination and decommissioning records were available regarding the Vanowen Facility.

As funding for research and development and manufacturing activities declined in the early 1980's, the activities were consolidated with ongoing projects in the SSFL. The nuclear facilities at the DeSoto complex were decontaminated, decommissioned, and released for unrestricted use. They have since been completely refurbished and are now used for other Rocketdyne programs. Extensive records are available on the decontamination and release of the DeSoto facilities.

The first energy-related activity at the SSFL site began in April 1955 with the construction of the "Sodium Reactor Experiment" (SRE), which first achieved criticality in April 1957 and was shut down in 1964. This was one of five nuclear power reactor designs selected for research by the Atomic Energy Commission (AEC). The AEC then sponsored the construction of a full-scale (75 MWe) sodium-graphite reactor in Hallam, Nebraska, with the design and construction supervision by AI. The Hallam Reactor first reached full power in July 1963 and was shut down in September 1964 because of operational problems. The SRE building (B/143) is still standing in the northeastern section of the SSFL Area IV.

The Energy Technology Engineering Center (ETEC) was established at SSFL as the Liquid Metals Engineering Center to provide engineering, development, and non-nuclear test support to DOE's Liquid Metal Fast Breeder Reactor (LMFBR) program.

SSFL personnel produced two primary CERCLA documents: a Phase I Installation Assessment report (Adler et al., 1986) and a Phase II Site Characterization report (Olson, 1987). In addition, a brief Preliminary Assessment was completed in 1987 (Remley, 1987). The Phase I report (Adler et al., 1986) concluded that a landfill area at B/056 (see Finding 4.5.2.3.1.d) was "the only site on the ETEC premises that would qualify as a potential CERCLA site under the DOE Order (Ibid.). The Phase II CERCLA report, however, identified one other site: the B/886 Sodium Burn Pit. The landfill area and the Sodium Burn Pit were identified as sites for cleanup at SSFL (Olson et al., 1987). In addition, the Phase II report investigated several other potential CERCLA sites which are discussed in Section 4.5.2. Phase I and II reports were prepared specifically in response to the guidelines given in DOE Order 5480.14.

The Phase I and II reports focused on disposal sites for RCRA wastes in accordance with direction from DOE, rather than considering in detail all potential hazardous substance release locations. The lack of a complete CERCLA investigation is discussed in Finding 4.5.2.4.1.

This section introduces the actual and potential sources of hazardous substance releases to the environment. Section 4.5.2 provides more detail on these sources, which are listed in Table 4-9 and illustrated in Figure 4-2.

Little information was available on the historical waste generation and disposal practices at SSFL. A summary prepared in 1962 (Ferreri, 1962) indicated that Atomics International (AI) generated "213,000 gallons of radioactive (R/A) waste requiring special means of disposal" annually. The types of wastes generated by AI in 1962 are listed in Table 4-10. The 3,750 gallons of combustible oils appear to have been excluded from the 213,000 gallons tallied in the Interoffice Letter (Ferreri, 1962). The wastes were all disposed of off-site by Nuclear Engineering Company (NEC) for a total of $165,910 or an average of $0.78 per gallon. Approximately 3,750 gallons of combustible oil generated annually by AI were sent to the radioactive materials disposal facility (RMDF, described further in Section 4.3) at SSFL for disposal by NEC. (Despite its name, the RMDF does not dispose of radioactive waste, but rather concentrates aqueous wastes using evaporation equipment.) No information was available on whether the oil was treated at the RMDF or merely stored for disposal. Another SSFL document from November 1986 (Heine, 1966) indicated that oil was used on roads for dust suppression. The Radiation Safety standard established in 1966, however, set very strict limits on the permissible level of radioactivity in the oil spread on roads for dust control. The standard essentially prohibited the use of oil with any radioactivity greater than background. No information was available, however, on the activity prior to this 1966 standard.

The waste generation rate at SSFL has decreased significantly since the 1960s through the 1970s when activity at SSFL was at its peak. Table 4-10 shows the volume of waste generated during a period of higher activity at SSFL than present. No specific information is available, however, on nonradioactive hazardous waste such as solvents and PCBs.

4.5.1.1 B/886 Former Sodium Burn Pit Area

The B/886 Former Sodium Burn Pit was used from the early 1960s through the 1970s for disposal of chemical waste, including solvents, metals (including Na and NaK), and some radioactive wastes. Flammable chemicals were poured into open pits and burned. Reactive metals were placed into a concrete pit of water or washed and reacted on a steel-plated pad using a steam lance. Unauthorized radioactively contaminated equipment was buried in trenches and placed on the

TABLE 4-9

ACTUAL AND POTENTIAL HAZARDOUS SUBSTANCE RELEASE LOCATIONS
SSFL - VENTURA COUNTY, CALIFORNIA

Location Name	Soil[1] Contamination	GW[1,2] Contamination
a. B/886 Former Sodium Burn Pit	A	A
b. B/059 Former SNAP[3]/Facility	--	A
c. B/021, 022 RMDF[4] Leachfield	--	P
d. Old Conservation Yard	P	P
e. B/056 Landfill	--	P
f. ESADA[5] Chemical Storage Area	P	--
g. B/100 Trench	P	--
h. S.E. Drum Storage Area	P	--
i. New Conservation Yard	P	--
j. Area of 3133 Sodium Burn Facility	A	--

Source: DOE Survey team.

1 "A" = Actual; "P" = Potential; "--" = unlikely or not present (based on data available in May 1988).
2 GW = Ground Water.
3 SNAP = Space Nuclear Auxiliary Power.
4 RMDF = Radioactive Materials Disposal Facility.
5 ESADA = Empire State Atomic Development Authority.

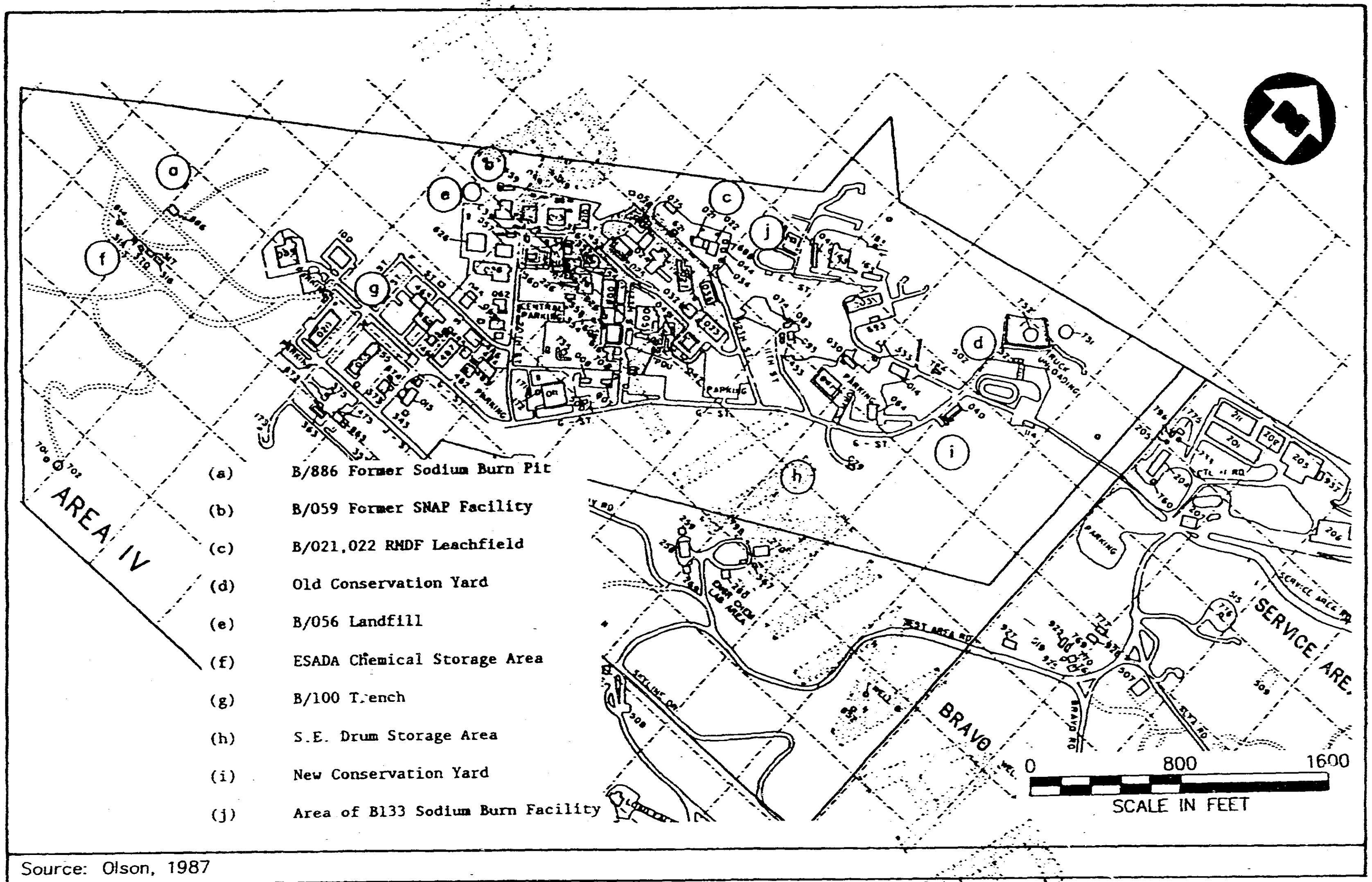


FIGURE 4–2

LOCATIONS OF ACTUAL AND POTENTIAL HAZARDOUS SUBSTANCE RELEASE LOCATIONS
SSFL–VENTURA COUNTY, CALIFORNIA

TABLE 4-10

RADIOACTIVE WASTE GENERATED - 1962
SSFL - VENTURA COUNTY, CALIFORNIA

Waste Description	Quantity[a] (gallons)
Noncombustible liquid waste	71,250
Combustible dry waste	120,000
Noncombustible dry waste	14,000
Combustible organic waste	7,750
Total	213,000
R/A liquids (oil = 3,750)	75,000

Source: Ferreri, 1962.
(a) Quantity generated annually by Atomics International programs in Canoga Park and at SSFL in 1962.

surface. Exploratory trenches have been dug, and most contaminated equipment has been removed from the ground surface. Groundwater and soil contamination has been detected.

4.5.1.2 B/059 Former SNAP Facility

The basement of the B/059 SNAP facility is a potential source of groundwater contamination. The basement contains sand and water contaminated with Co-60. Water in a french drain surrounding B/059, sampled through a standpipe, contains chlorinated organics, including trichloroethylene (TCE) and tetrachloroethylene (PCE).

4.5.1.3 B/021, 022 RMDF Leachfield

The RMDF leachfield was contaminated with radionuclides in the early 1960s when a tank valve was accidentally opened. The tank contained radioactive wastewater being held for treatment and solidification. In 1978, the leachfield was excavated to bedrock and backfilled. Residual radioactivity was found in the bedrock cracks, presumably from wastewater percolation, and the cracks were filled with asphaltic tar. No nonradioactive parameters were analyzed during the cleanup. No groundwater monitoring has been performed.

4.5.1.4 Old Conservation Yard

Aerial photographs of the Old Conservation Yard shows that hundreds of drums and equipment were stored there through the 1960s and 1970s. No analytical or inventory information was available on the contents of the drums. Leaks and spills were likely in an area with no containment and no protection.

4.5.1.5 B/056 Landfill

The B/056 Landfill is a potential source of groundwater contamination because of the disposal of drums of wastes, some of which were hazardous. These drums were found on the top of the landfill and at the bottom of the slope. No inventory is available on the waste placed in the landfill, but approximately 90 drums were removed from the surface of the landfill in the 1980s, and several dozen empty drums were found at the toe of the landfill slope. (The previous history of these drums is unknown.) The landfill was used as a loose fill area from construction and excavation activities, according to SSFL personnel. A single groundwater monitoring well (RD-7), presumably located upgradient of the landfill, is contaminated with up to 130 ppb of trichloroethylene (TCE) and other volatile organics.

4.5.1.6 ESADA Chemical Storage Yard

Approximately 50–100 drums were stored in the ESADA Area in the 1970s. SSFL personnel indicated that at times drums of alcohols and drums of sodium were stored there. No records other than aerial photographs are available on the material stored there.

4.5.1.7 B/100 Trench

The trench was used during the 1960s for disposal of construction debris and possibly hazardous substances. No information was available on this trench except from photos.

4.5.1.8 Southeast Drum Storage Yard

Photos from the early 1960s show an area on the southeast side of Area IV where approximately 50 drums were present.

4.5.1.9 New Conservation Yard

The New Conservation Yard is across the Service Area Road to the south of the Old Conservation Yard and has been used for storage of used equipment and drums since the late 1970s. Prior to salvage of stored materials, leaks and spills of hazardous substances may have caused soil contamination.

4.5.1.10 Area of B/133 Sodium Burn Facility

Equipment was stored at the current B/133 sodium facility for 20 years during the 1960s and 1970s, according to aerial photos and interviews with SSFL personnel. Recent soil analyses shows a pH of 10–11 at B/133. No other analysis has been performed yet.

In addition to these actual and potential hazardous-substance release locations, identified in 4.5.1.1 through 4.5.1.10, one additional area at SSFL appears to have received waste and flammable solvents and waste oils (for fire training exercises) from DOE-sponsored activities. This area is the Area I Burn Pit, located in the Eastern Section of SSFL near the CTL III test stand. This area is not on DOE controlled property. Rockwell performed a surface cleanup of this area in 1983. No site specific groundwater monitoring has been performed. According to SSFL personnel interviewed, Area IV waste rarely went to Area I, except for occasional fire training prior to the merger of AI and Rocketdyne Protective Services Department (including Fire Department) in 1970. After 1970 when there was only one fire department on the Hill, waste from Areas I - III sometimes went to the B/886 Sodium burn pit, and Area IV waste sometimes went to Area I.

4.5.2 Findings and Observations

4.5.2.1 Category I

None.

4.5.2.2 Category II

None.

4.5.2.3 Category III

1. There are approximately 10 areas at SSFL/Area IV where hazardous and/or radioactive substances resulting from DOE-related activities have or may have been disposed of, spilled, or released. These areas constitute actual and potential sources of soil and/or groundwater contamination. None of the areas have been adequately characterized.

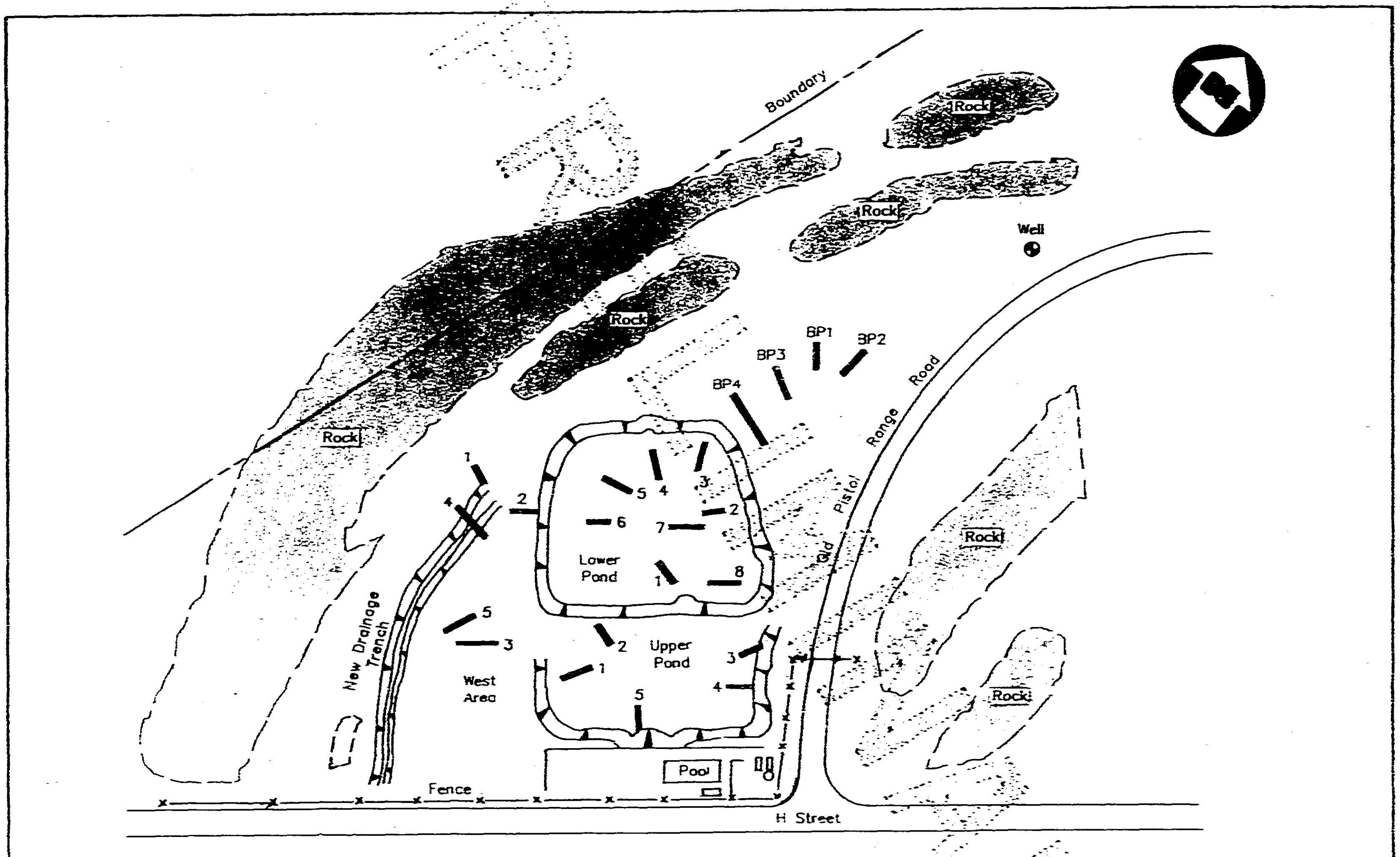
   Each of these areas is discussed below.

   a. B/886 Former Sodium Burn Pit Area. The B/886 Former Sodium Burn Pit is a potential source of surface water and groundwater contamination and an actual source of soil contamination. It was used from the early 1960s through the 1970s for disposal of chemical waste, including solvents, metals (including Na and NaK), and some radioactive wastes. The Former Burn Pit Area is located in the Northwestern edge of Area IV outside the DOE-optioned land and occupies approximately one acre. Flammable chemicals were poured into open pits and burned. Reactive metals were placed into a concrete pit of water or washed and reacted on a steel-plated pad using a steam lance. Unauthorized radioactively-contaminated equipment was buried in trenches and scattered on the surface. In addition, according to the Phase II report, "occasionally, firearms were used on vessels to 'safely' open containers to the atmosphere" (Olson et al., 1987, p. 10). Although this method may have allowed workers to remain at a safe distance from the containers containing reactive substances when they were opened, it did not facilitate capturing the contents. These contents appeared to have included reactive metals (e.g., Na and NaK), and solvents (e.g., TCE).

The Burn Pit area, which is bounded on the south and east by dirt access roads and on the north and west by large rock outcroppings, covers approximately 1 acre (50,000 ft^2) (see Figure 4-3). There are four major sections of the Burn Pit area: (1) pool area, (2) upper disposal pond, (3) lower disposal pond, and (4) west burial site. The "pool area" was used for the initial staging of wastes and contaminated equipment. The pool is a 42-foot by 12-foot, 15-foot deep concrete pit. Adjacent to the pool is a 2-foot by 15-foot steel pad and a 15-foot by 6-foot blast shield made of 3/4-inch-thick steel. The blast shield was installed to provide protection to workers while removing sodium and NaK from equipment using steam lances. The steel pad protected the concrete from damage from the violent reactions of the sodium and NaK. Although the Burn Pit was surrounded by chain-link fence with a padlocked gate, the fence was partially torn down and there was easy access through a large hole in the side.

Exploratory trenches have been dug, and most contaminated equipment has been removed from the ground surface. Equipment retrieved from the test trenches was not completely removed from the site, and equipment found lying on the surface was not completely removed due to lack of resources. Groundwater and soil contamination has been detected. Some waste was removed in early 1980s (1980–1981), after the new sodium burn facility (B/133) was opened in 1978. No information was available on the amount or type of waste removed, when it was removed, to which location it was removed to, or on what basis the removal was initiated or ceased. Soil was sampled for radioactivity only, but not metals or organics. Cesium-137 was the most prevalent radionuclide at up to 700 picocuries/g. Approximately 20 cubic yards of contaminated soil were removed from one basin. This soil was not analyzed for hazardous constituents.

The only written documentation available regarding the 1980 activities at the B/886 Sodium Burn Pit is an Internal Letter from December 1980, which summarizes the radiation survey, soil sampling, and excavation (Lang, 1980). This letter refers to B/886 as the "old hazardous materials burn pit." According to Lang, "The contamination appeared to be stratified in a layer 8 inches below the surface in a block [sic] tar type substance. The dirt was excavated down to 2 feet after the removal of a piece of pipe-like material that appeared to be the source that was reading >3,000 μR/hour. Readings in the dark layer ranged to 100 μR/hour but were generally in the 20-50 μR/hour range. On December 4, 1980, after 1 inch of rain, the excavation completely filled and the dam between the upper and lower pond washed out allowing the run-off from the upper pond to run through the excavated area across the lower pond, and out into the road to follow



Source: DOE Survey team

FIGURE 4–3

T–886 SODIUM BURN PIT AREA LAYOUT AND TEST TRENCH LOCATIONS
SSFL–VENTURA COUNTY, CALIFORNIA

its natural run-off pattern." Residual water from the excavation was analyzed and found to be within "allowable limits" (Lang, 1980). Background radioactivity was generally 5-10 μR/hour.

The Burn Pit area was used most extensively from 1960–1970 for disposal of combustible materials such as sodium, NaK, kerosene, and solvents. The two ponds, upper and lower, located below the pool, were used to react sodium-contaminated equipment. Several large pieces of equipment were left in the ponds and were covered with silt over the years. When some of these large pieces of equipment were retrieved, they were found to contain unreacted sodium; and the remaining equipment is assumed to be similarly contaminated. The earthen ponds were constructed by bulldozing a crude berm around a low-lying area, and cutting trenches through the berm to facilitate runoff.

The Burn Pit West area was located to the west of the disposal pool. Used components from the SNAP, OMRE, and SRE programs were found buried in the area to the west of the disposal pool during partial cleanup in the early 1980's.

Some preliminary removal and decontamination work has been performed. While scrap was being removed in 1980, nearby soil and the concrete disposal pool were found to be "radiologically contaminated above acceptable release limits" (Stafford, 1987, p. 2). At that time, the concrete disposal pool was drained and the walls were decontaminated. The pool has subsequently become partially filled with water. At the time of the Survey in May 1988 the pit was approximately 1/3 filled with brownish water. No information was available regarding the relative contribution from infiltration into the pit from perched groundwater through cracks in the sides and bottom compared to the contribution from runoff entering the top of the pit had been determined. If cracks in the concrete lining could allow water to seep in, then water could also seep out and cause groundwater contamination. No information was available on the water quality in the pit. After the 1980 findings, SSFL personnel subsequently found radioactively contaminated soil "over a large area of an unpaved section adjacent to the disposal pool" (Stafford, 1987, p. 2). A more extensive soil survey was being planned at the time of the Survey. The contamination discovered prior to the Survey was found to extend below the soil surface, but was not believed to be deeper than 2 feet. Until a more detailed soil survey could be completed, soil removal was limited to "hot spots." No radioactive contamination was found in surface runoff samples, but the samples were analyzed only for radioactivity and not for organics and metals.

For 3 days between March 31–April 2, 1986, SSFL personnel dug 23 test trenches in the Sodium Burn Pit area (4 in the slope below the ponds, 8 in the lower pond, 6 in the upper pond, and 5 in the west area). This site characterization, consisting of exploratory trenches and soil sampling, revealed the presence of buried radioactive, chemical, and mixed hazardous wastes. The results of this sampling were presented in the May 1987 Phase II Site Characterization Report (Olson et al., 1987). The trenches dug, sampled, or analyzed are listed in Table 4-11 and illustrated in Figure 4-3. Samples were collected but not analyzed from three trenches (BP-2, BP-3, BP-4). No samples were collected from two trenches (BPU-1 and BPW-1). Of the remaining 18 trenches where the Phase II report suggested implicitly that soil samples had been analyzed, results were presented for 5 trenches. No analytical information was available regarding the remaining thirteen trenches. The Phase II report did not state clearly that these samples had been analyzed but suggested it implicitly by noting which selected samples were not analyzed.

The sampling at the Burn Pit was biased to avoid sampling contaminated areas, a method which thereby systematically underestimated contamination at the Burn Pit. According to the Phase II report, "radiologically 'hot' areas were avoided to assure that the samples could be handled in the Chemistry Laboratory" (Olson et al., 1987, p. 12). Because radioactive and non-radioactive wastes were probably buried and released together, by avoiding radioactive areas, the sampling program probably also avoided non-radioactive areas. There is no evidence that radioactive and non-radioactive wastes were physically segregated at the Burn Pit or that they were randomly associated and disassociated. In those cases where radioactively contaminated soil was inadvertently sampled, cesium-137 was the most predominant radionuclide.

The rationale for determining whether or not samples would be analyzed was unclear. The decision appeared to have been based on (1) field detection of radioactivity; (2) visual evidence of possible contamination; and (3) odors. In several cases, SSFL noted, "Samples were collected but not analyzed because there were no debris and no unusual odors" (Olson et al., 1987, p. 48).

TABLE 4-11

SODIUM BURN PIT TEST TRENCHES,
SAMPLING AND ANALYSES
SSFL - VENTURA COUNTY, CALIFORNIA

Test Trench	No. of Soil Samples	Data Presented for Sample Depth (feet)
BP-1	4	None
BP-2	0	None
BP-3	0	None
BP-4	0	None
BPL-1	4	0.5-1'
BPL-2	5	1-5'; 3.5-4'; 5.5-6'
BPL-3	4	None
BPL-4	4	None
BPL-5	4	None
BPL-6	2	None
BPL-7	2	None
BPL-8	2	3-3.5'
BPU-1	0	None
BPU-2	1	None
BPU-3	5	None
BPU-4	2	None
BPU-5	1	None
BPU-6	1	None
BPW-1	0	None
BPW-2	3	None
BPW-3	3	0.5-1'; 4.5
BPW-4	0	None
BPW-5	2	3-3.5'

Source: Olson et al., 1987.

Reliance on odor to select sampling sites is not effective and may have resulted in undetected contamimation. Some contaminants such as heavy metals (e.g., mercury, lead, and chromium) do not have detectable odors. Also, for those contaminants that do produce odor, "olfactory saturation" and "overload" may result in inurement causing odors to be undetected. This phenomenon occurs when an individual who is exposed to odors becomes unable to smell because of an overloaded or saturated olfactory (sense of smell) system.

A Miran portable air analyses was used to monitor air contamination in and around the test trenches (except hydrazine, for which a draeger tube was used). SSFL personnel selected nine compounds for field analysis, based on the probability of detecting the compounds. According to the SSFL Phase II Report, "The relative likelihood of finding these compounds at either site was based on personnel accounts of personnel familiar with the operations of these areas while actively used." No records or information was available, however, on these "personnel accounts" (e.g., interview notes). In trench BPL-2, the following concentrations of the nine selected contaminants were detected:

Compound Analyzed	Level Detected (ppm)
Ammonia	40
Toluene	68
Tetrahydrofuran	40
1,1,1-trichloroethane	N.D.
Trichloroethylene	N.D.
Methylene chloride	N.D.
Ethanolamine	22
Carbon tetrachloride	10
Hydrazine	0.5*

* The hydrazine level was detected using a Draeger colorimetric tube and is likely the result of positive interference from ammonia.

The soil analysis for volatile organic compounds (VOCs) in test trench BPL-2 showed the highest concentrations at a depth of 3.5 to 4.0 feet (see Tables 3-10 and 4-12). SSFL personnel observed high concentrations of carbon tetrachloride (500 mg/kg), 1,1-dichloroethane (430 mg/kg), 1,1-dichloroethene (90 mg/kg), Freon-TF (3,100 mg/kg), tetrachloroethene (1,200 mg/kg), toluene (800 mg/kg), 1,1,1-trichloroethane (1,840 mg/kg) and trichloroethene (740 mg/kg). The soil pH was very basic (9.5). The oil and grease concentration was found to be 3,600 mg/kg. At a depth of 5.5 to 6 feet in this trench, the soil pH was 10.4.

TABLE 4-12

SOIL ANALYSIS FOR VOCs - BURN PIT TEST TRENCH BPL-2
(3.5-4.0 FT)
SSFL - VENTURA COUNTY, CALIFORNIA

Volatile Organic Compound	Results, mg/kg
Acetone	ND[1] < 600
Benzene	ND < 15
Bromodichlormethane	ND < 15
Bromoform	ND < 15
Bromomethane	ND < 15
Carbon Tetrachloride	500
Chlorobenzene	ND < 15
Chloroethane	ND < 15
2-Chloroethylvinyl ether	ND < 15
Chloroform	ND < 15
Chloromethane	ND < 15
Dibromochlormethane	ND < 15
1,2-Dichlorobenzene	ND < 15
1,3-Dichlorobenzene	ND < 15
1,4-Dichlorobenzene	ND < 15
1,1-Dichloroethane	430
1,2-Dichloroethane	ND < 15
1,1-Dichloroethene	90
trans 1,2-Dichloroethene	22
1,2-Dichloropropane	ND < 15
cis-1,3-Dichloropropene	ND < 15
trans-1,3-Dichloropropene	ND < 15
Ethyl benzene	44
Freon-TF	3100
Isopropanol	ND < 600

TABLE 4-12
SOIL ANALYSIS FOR VOCs - BURN PIT TEST TRENCH BPL-2
(3.5-4.0 FT)
SSFL - VENTURA COUNTY, CALIFORNIA
PAGE TWO

Volatile Organic Compound	Results, mg/kg
Methylene Chloride	ND<15
1,1,2,2-Tetrachloroethane	ND<15
Tetrachloroethane	1200
Toluene	800
1,1,1-Trichloroethane	1840
1,1,2-Trichloroethane	ND<15
Trichloroethene	740
Trichlorofluoromethane	ND<15
Vinyl chloride	TR[2]<15

Source: Olson et al., 1987.

This sample was analyzed by the Purge and Trap-GC/MS techniques found in the second edition of SW-846, Methods 5030 and 8240.

1) ND means the pollutant was not detected above the background level and hence not quantified using EPA approved methodology.
2) TR means the pollutant was detected but was below the quantification level for Method 8240.

Soil analysis showed an elevated lead concentration (864 mg/kg) in trench BPW-3. This concentration is higher than the mean lead concentration between 7-700 mg (kg) listed by the State of California for the western United States (Department of Health Services, 1986). Dragun (1988) estimated the mean for the entire United States to be 10 mg/kg (Dragun, 1988).

The existing Total Threshold Limit Concentration (TTLC) for soil in California is 500 mg/kg, but D.H.S. has proposed to increase this lead TTLC to 3,000 mg/kg.

In test trench BPL-3, SSFL personnel found "some zirconium hydride sacrificial slugs, contaminated on the ends with 93 percent enriched uranium from the SNAP (Space Nuclear Auxiliary Power) program." No information was available on the soil contamination resulting from these radioactive components because no soil samples were analyzed in BPL-3, despite this finding. The reference to 93 percent enriched uranium does not presumably mean that 93 percent of the slug was composed of enriched uranium, but rather that the slug was contaminated with uranium and that 93 percent of this uranium was composed of the U-235 isotope and not the more commonly occurring U-238 isotope. Naturally occurring uranium contains only 0.7 percent U-235, and commercial reactor grade uranium contains 4 percent.

A "white, crystalline substance" (Olson et al., 1987, p. 50) was observed in test trenches BPU-3, BPU-4, and BPW-2 where five, two, and three samples were collected, respectively. No analytical results from any of these three test trenches were presented in the Phase II report. No information was available on the results of these analyses.

A monitoring well located down hill, and presumably downgradient, from the Burn Pit Area ("RS-18"), indicated contamination with several volatile organics, including 660 µg/l of trichloroethylene. See Section 3.4 for more details on groundwater monitoring and results. According to a recent DOE appraisal (Lavagnino, 1987), artesian wells used to supply water to cattle are located downslope of the Burn Pit, and a youth camp is located further east.

b. <u>B/059 Former SNAP Facility</u>. The basement of the B/059 SNAP facility is a potential source of groundwater contamination and has sand and water contaminated with Co-60 (see Finding 3.4.4.3.2.c).

The B/059 building is located in the north central section of Area IV. A Space Nuclear Auxiliary Power (SNAP) nuclear reactor was removed from the basement of B/059. In 1978, SSFL personnel began decommissioning and decontaminating the building by removing approximately 60 percent of the sand, which had been poured into the basement to provide radiation shielding around the vacuum duct during reator operations. In September 1983, SSFL personnel informed DOE that groundwater was leaking into the pipe chase room of the basement and was radioactively contaminated from contact with the activated sand.

There are two groundwater contamination issues at the B/059 building: (1) radionuclides from the basement; and (2) organic solvents from the outside groundwater. As discussed in Finding 3.4.4.3.2.c, the water level in the B/059 basement is pumped to maintain a lower water level than the outside in order to prevent radioactively contaminated water from leaking into the outside groundwater. The water in the french drain on three sides of B/059 was found to be contaminated with up to 540 ppb PCE and 110 ppb TCE, compared to state action levels of 4 ppb for PCE and 5 ppb for TCE. The water from the basement is sent to the RMDF for evaporation. The organics contaminated water from the french drain is passed through a carbon filter, stored and analyzed, before being discharged to the surface drainage. In the winter it may reach the Area III pond.

c. B/021, 022 RMDF Leachfield. The RMDF leachfield, which was contaminated with radionuclides in the early 1960s when a tank valve was accidentally opened, is a potential source of groundwater contamination. The RMDF is located in the north central portion of SSFL/Area IV. The tank contained radioactive wastewater being held for treatment and solidification. In 1978, the leachfield was excavated to bedrock and backfilled. Residual radioactivity was found in the bedrock cracks, presumably from wastewater percolation or flow, and the cracks were filled with tar. No nonradioactive parameters were analyzed during the cleanup. No groundwater monitoring has been performed.

d. Old Conservation Yard. The Old Conservation Yard is a potential source of soil and groundwater contamination.

The Old Conservation Yard is located in the northeast section of SSFL/Area IV. Aerial photographs of the Old Conservation Yard show that hundreds of drums and pieces of equipment were stored there through the 1960s and 1970s. No analytical or inventory information was available on the contents of the drums. Leaks and spills may have occurred in an area with no containment and no protection. One aerial photograph

(No. SS-9) of the Old Conservation Yard, taken on January 27, 1961, shows that the area was relatively clear and free of debris. An aerial photograph (No. SS-55) taken on March 14, 1962, however, shows a significant amount of debris and equipment located randomly around the site, with several drums prominent in the foreground. By April 23, 1963, when aerial photograph No. 121 was taken, the Conservation yard was composed of several areas of debris, equipment, and drums extending from the Service Area Road to beyond the north west border of SSFL. The next aerial photographs available (No. 529CN), taken on January 22, 1978, showed a much smaller area covered with debris, one of the two existing large oil-storage tanks built, and a new yard started across the street on the south side of the Service Area Road.

According to the Phase I report (Adler, 1986, p. 34), "the area was cleaned up in 1983." No records were available to document the activity.

e. B/056 Landfill. The B/056 Landfill is a potential source of groundwater contamination because of the disposal of drums of waste, some of which were hazardous, on the surface of the landfill. The landfill occupies less than 1/4 acre (10,000 ft^2) on the northwestern edge of SSFL property, approximately 300 feet west of B/059. SSFL personnel deposited soil there from the excavation for the planned B/056 SNAP facility and the SCTI facility. The landfill is immediately northwest of the large hole that was excavated for the B/056 SNAP facility. The B/056 excavation has sheer vertical rock sides and is now partially filled with water. Aerial photographs show that the hole has been surrounded with a chain-link fence since its construction, and therefore, waste disposal into this hole is unlikely.

The 1987 Phase II report characterized the B/056 landfill as a "former temporary drum storage area." But, an aerial photograph (No. SS419-CN) of the site taken on June 30, 1975, shows at least two dozen drums piled at the bottom of a 30-foot-deep ravine visible at the edge of the landfill. These drums are completely rusty and appear to have been there for an extended period. Because of their location at the bottom of the slope, retrieval of these stored drums would be extremely difficult. No information was available on the content (or former contents) of these rusty drums. In another aerial photograph (SS448CN) taken January 29, 1975, a white staketruck is visible. The rear of this truck is overhanging the edge of the landfill. Again, material deposited over the edge of the landfill would be very difficult to retrieve if temporary storage were attempted.

In 1980 and 1981, 89 drums of waste were removed from the top of landfill. SSFL personnel found that these drums contained oils, alcohols, sodium and sodium reaction products, grease, phosphoric acid, and asbestos. Because of the potential for groundwater contamination at the landfill, SSFL installed a groundwater monitoring well 4 years later in 1985 south of the landfill. The location of this well is probably upgradient of the landfill, and is therefore probably not useful for monitoring groundwater contamination from the landfill (see Section 3.4.2). This well was found to be contaminated with up to 130 ppb of TCE.

The text of the Phase II report says that "the landfill soil samples appear to be essentially free of contamination" (Olson et al., 1987, p. 18). However, a review of the analytical laboratory printouts included in an appendix revealed that oil and grease were found in the soil samples up to 1,100 mg/kg. This sample (LFR-3) was taken at the bottom of the slope of the landfill in a ravine. It was the furthest downstream away from the landfill of three samples taken at the bottom of the slope. Six test trenches were dug at the top of the landfill, but no analytical results were presented from these samples. The presence of odors appears to have been used as a criterion for whether or not to sample. The prudence and effectiveness of using this criterion are discussed in Finding 4.5.2.3.1.a.

During the trenching operation at the landfill, the air was monitored for nine selected contaminants using a Miran portable air analyzer (see Finding 4.5.2.3.1.a). No "significant air levels" of these nine contaminants were found in any of the test trenches at the landfill (Olson et al., 1987, p. 75).

f. ESADA Chemical Storage Yard. Approximately 50-100 drums were stored in the ESADA Area in the 1970s. The ESADA area is located on the western edge of SSFL/Area IV. SSFL personnel indicated that these drums contained alcohols and other products. No records other than aerial photographs are available on the material stored there. The site is currently used for a pistol target practice range.

g. B/100 Trench. The trench was used during the 1960s for disposal of construction debris and possibly hazardous substances. No file information was available on the inventory of wastes disposed of in this trench. According to SSFL personnel interviewed by the Survey team, the trench was used by on-site contractors for burning construction rubble and demolition debris. The B/100 trench is located in the west-central portion of SSFL/Area IV.

The only documentation available on this trench is from aerial photographs. The trench east of the B/100 building is visible in aerial photographs for at least six years, from 1961 until 1967. On January 27, 1961, a series of aerial photographs was taken showing the trench east of B/100 (photos numbers SS A-4, SS A-6, SS A-10, SS-E, SS-I, SS-J, and SS-S). These photos show the trench to be stained a dark color compared to the surrounding soil. Construction debris is visible above the edge of the trench in these photos. An aerial photograph taken on September 14, 1962 (No. SS-113), shows drums in and alongside the trench. A high-altitude photograph taken in 1966 by Aero Services, Inc., and displayed in the conference room of the Plant Services/Maintenance Building (B/204) was used to determine the size of the trench. Using known building dimensions as well as the scale provided on the photo, the trench was estimated to be an oval approximately 75 feet long and 25 feet wide at its widest point. The trench had been backfilled and graded by April 29, 1969, when an aerial photograph (No. SS-283) was taken showing three tanks at the former trench location. By January 28, 1972 (No. SS-448CN), when a tower had been erected as part of the construction of the B/462,3 building, 23rd Street and 24th Street had been built on the former trench location.

h. S.E. Drum Storage Yard. Historic storage of drums in the southeast section of SSFL/Area IV may have resulted in releases of hazardous substances from leaking, spilled, or rusted-through drums exposed to the elements. Two aerial photographs (Nos. SS-60T and SS-35N) taken on March 14, 1962, show an area on the southeast side of the site where approximately 50 drums were stored. No other information was available on this drum storage area. The drums were not necessarily generated by DOE or DOE-predecessor agency activities. Although the storage area is clearly located in Area IV, it is relatively close to Area II, to which it is connected by dirt roads and not separated by fences.

The Survey team walked around the former drum storage location and found the remnants of what appeared to be an organized storage facility. Rusted steel fence posts surrounded the area. Several pallets were found lying on the ground in the weeds. A gulley ran along the south side of the former storage area, immediately north of the dirt access road. Several pieces of broken prefabricated concrete were found on the gulley, along with several steel pipes (1-inch I.D.) and a 5-gallon bucket half filled with a dried resin or paint.

i. New Conservation Yard. The New Conservation Yard may be a source of soil contamination. This yard, across the Service Area Road to the south of the Old Conservation Yard, has been used for storage of used equipment and drums since the late 1970s, prior to salvage. Leaks and spills of hazardous substances may have resulted in soil contamination. During the Survey, small areas of stained soil and dead vegetation were visible near the gate and near the edge of the fence on the inside perimeter.

j. Area of B/133 Sodium Burn Facility. The B/133 Sodium Burn Facility Area is a source of soil and potential groundwater contamination. Equipment was stored at the current B/133 sodium facility during the 1960s and 1970s. Recent soil analyses show a pH of 10–11 at B/133. No other analysis has been performed yet. The B/133 Facility is a RCRA-permitted facility built in 1978 (see Section 4.1.1.1). The B/133 facility is located in the northeast section of Area IV.

4.5.2.4 Category IV

1. The Site Has Not Performed a Complete CERCLA Investigation. Failure to perform a comprehensive investigation may result in undetected contamination. SSFL personnel produced two primary CERCLA documents. These reports focused on disposal sites for hazardous wastes, in accordance with the guidance in the DOE Order. A more complete CERCLA investigation would include all potential hazardous substance release locations. During the two-week Survey, several new areas of potential contamination were discovered (e.g., the B/100 trench and the southeast drum storage area) by a cursory review of aerial photographs and files and by conducting a few interviews with veteran SSFL workers. Further systematic inquiry (review of aerial photos and records, and interviews with site personnel) may reveal information on other areas or more data on known areas of contamination.

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APPENDIX A

SURVEY PARTICIPANTS

APPENDIX A

SURVEY PARTICIPANTS

Larry Weiner	DOE Headquarters	DOE Team Leader
Susan Barisas	DOE Headquarters	DOE Assistant Team Leader
Russell Roberts	DOE, SAN	SAN Survey Representative
Joseph Crist	NUS Corporation	Air
Joseph Boros	NUS Corporation	Surface Water
Douglas Detman	NUS Corporation	Groundwater/Soil
Ralph Basinski	NUS Corporation	Waste Management
S. Charles Caruso	NUS Corporation	Toxic and Chemical Materials/Quality Assurance
Mark Francis*	NUS Corporation	Radiation
James Werner	ICF Corporation	Inactive Waste Sites and Releases

* NUS Coordinator
SAN San Francisco Operations Office

APPENDIX B

SITE-SPECIFIC SURVEY ACTIVITIES

APPENDIX B

SITE-SPECIFIC SURVEY ACTIVITIES

B.1 Pre-Survey Preparation

The U.S. Department of Energy (DOE) Office of Environmental Audit, Assistant Secretary for Environment, Safety and Health, selected a Survey team for the Santa Susana Field Laboratories in June 1986. Mr. Lawrence A. Weiner was designated the DOE Team Leader, with Ms. Susan Barisas serving as the Assistant Team Leader. Mr. Russell Roberts was the San Francisco Operations Office (SAN) Survey team representative during the on-site phase of the survey. The remainder of the team was composed of contractor specialists from the NUS Corporation and its subcontractor, ICF. These specialists and their fields of expertise are presented below.

Specialty	Name
Air	Joseph Crist
Surface Water	Joseph Boros
Waste Management	Ralph Basinski
Inactive Waste Sites	James Werner
Hydrogeology	Douglas Detman
Radiation	Mark Francis*
QA Toxics	S. Charles Caruso

* NUS Coordinator

Survey team members began reviewing SSFL general environmental documents and reports in April 1988.

Mr. Weiner, Ms. Barisas, and Messrs. Francis and Basinski conducted a pre-Survey site visit on April 4–6, 1988, to gain familiarity with key DOE and site personnel. They toured the facility and completed a cursory review of the documents assembled in response to an information request submitted on February 5, 1988. The request listed environmental documents and reports required by the Survey team for survey planning purposes. During the pre-Survey visit, a meeting was held with representatives of the DOE San Francisco Operations Office, SSFL, as well as with representatives from the California Department of Health Services and the Ventura County Fire Department. The purpose of this meeting was to review environmental issues of concern and to explain the scope of the Survey.

The Survey team carefully reviewed the information received during the pre-Survey site visit and prepared a Survey Plan (see Appendix C) for the SSFL site. This plan describes the specific approach to the Survey for each of the technical disciplines and includes a proposed schedule for the on-site activities. A Health and Safety Plan was also prepared for use by the Survey team.

B.2 On-Site Activities

The on-site phase of the Survey was conducted during the period of May 16 through May 26, 1988. The opening meeting was held on May 16 at SSFL and was attended by representatives from DOE headquarters, the San Francisco Operations Office, SSFL, NUS Corporation, and ICF Corporation. Discussion during this meeting primarily concerned the purpose of the Survey, logistics at SSFL, and an introduction of the key personnel involved in the Survey.

During the Survey, team members reviewed pertinent file documents, including permits and applications, background studies, engineering drawings, accident reports, and chemical releases and spills, as well as various operating logbooks. The production process was thoroughly analyzed to identify existing and potential pollutants. Site operations and monitoring procedures were observed, where possible. Extensive interviews were held with SSFL personnel concerning environmental controls, operations, monitoring and analysis, regulatory permits, waste management, and hazardous substance management.

The Survey team members met daily to report observations, discuss findings, and evaluate progress. These meetings were also useful for planning schedule changes, if required, to meet the overall objectives of the Survey.

A site close-out briefing was held on May 26, 1988, at which the DOE Team Leader presented the Survey team's preliminary findings and observations. The findings were considered preliminary pending additional research and review.

B.3 Sampling and Analysis

The next phase of the Survey process is sampling and analysis (S&A). The results generated by the S&A effort are used to assist the Survey team in further defining the existence of environmental problems and risks identified during the Survey. However, based on the on-site DOE/SSFL Survey and site sampling plans, no Survey-related sampling needs were identified.

B.4 Report Preparation

The Environmental Survey Preliminary Report for the SSFL will be prepared for DOE review. Comments received from this review will be incorporated into the report, which will be issued as an Interim Report.

APPENDIX C

ENVIRONMENTAL SURVEY PLAN
FOR THE U.S. DEPARTMENT OF ENERGY ACTIVITIES AT
SANTA SUSANA FIELD LABORATORIES

MAY 16-26, 1988

SANTA SUSANA, CALIFORNIA

MAY, 1988

ENVIRONMENTAL SURVEY PLAN

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ENVIRONMENTAL SURVEY PLAN

DOE ACTIVITIES AT SANTA SUSANA FIELD LABORATORIES

MAY 16 - 26, 1988

SANTA SUSANA, CALIFORNIA

1. INTRODUCTION

The Survey of DOE activities at the Santa Susana Field Laboratories (DOE/SSFL) is part of the larger Department of Energy (DOE)-wide Environmental Survey effort announced by Secretary John S. Herrington on September 18, 1985. The purpose of this effort is to identify, via "no fault" baseline Surveys, existing environmental problems and areas of environmental risk at DOE facilities, and to rank them on a DOE-wide basis. This ranking will enable DOE to more effectively establish priorities for addressing environmental problems and allocate the resources necessary to correct these problems. Because the Survey is "no fault" and is not an "audit," it is not designed to identify specific isolated incidents of noncompliance, or to analyze environmental management practices. Such incidents and/or management practices will, however, be used in the Survey as a means of identifying existing and potential environmental problems.

The DOE/SSFL Survey will be conducted in accordance with the protocols and procedures contained in the August, 1987, Environmental Survey Manual.

2.0 SURVEY IMPLEMENTATION

The Environmental Survey of DOE Activities at SSFL will be managed by the Team Leader, Larry Weiner and the Assistant Team Leader, Susan Barisas from the Office of Environmental Audit (OEV). Mr. Russ Roberts will serve as the San Francisco Operations Office (SAN) representative on the Environmental Survey team. Technical support is provided by NUS Corporation and ICF personnel as follows:

Joseph Crist	Air/TSCA (Toxic Materials)
Doug Detman	Soil/Hydrogeology
Joseph Boros	Surface Water/Drinking Water
Ralph Basinski	RCRA (Solid, Hazardous, and Radioactive Wastes)
Charles Caruso	QA/TSCA
Mark Francis	NUS Coordinator/Radiation
James Werner (ICF)	CERCLA (Inactive Sites)

2.1 Pre-Survey Activities

Pre-Survey activities began in January 1988, when Survey team members submitted requests for information to the Team Leader for materials needed to prepare for the Survey. This was followed by a February 5, 1988, memorandum from Lawrence A. Weiner (OEV) to James T. Davis (SAN) announcing the pre-Survey site visit and requesting Survey-related information.

The pre-Survey site visit, April 5 and 6, 1988, was conducted by Mr. Weiner, Ms. Barisas, and Messrs. Basinski and Francis. The purpose of the visit was to become familiar with the site, identify potential areas of concern for the purpose of the Survey, review documents collected by SSFL and identify documents not yet collected, meet with regulatory agency personnel and coordinate plans for the upcoming Survey with SSFL and SAN personnel. Idaho National Engineering Laboratory (INEL) will conduct the sampling and analysis portion of the Survey, if required. During the pre-Survey visit the team also met with representatives of the California Department of Health Services and the Ventura County Fire Department. Team representatives toured the facility and reviewed documents assembled in response to the information request memorandum, identifying these documents not yet provided. The documents were transferred to NUS in Pittsburgh during March for use by team members during the planning phase of the Survey. The additional information requested during the pre-Survey visit was received in late April. This Survey plan is based on information available to team members as of May 6, 1988.

2.2 On-Site Activities and Survey Reports

The on-site portion of the Environmental Survey will be conducted from May 16 - 26, 1988. Tentative agendas for each of the Survey team members are provided as attachments. It is expected that modifications to these agendas will be made as appropriate to minimize disruption of site activities, and to enhance Survey efficiency and effectiveness. All modifications to agendas will be coordinated with site personnel designated as Survey contacts.

The on-site activities of the Survey team will consist of discussions with, among others, environmental, safety, operations, waste management, purchasing, and warehousing personnel; a review of files and documents (including classified documents, if any) unavailable prior to the on-site portion of the Survey; and process-specific and area-specific tours of the facility.

The Preliminary Report for the DOE/SSFL Survey will be prepared from information gathered by Survey team members prior to, during, and after on-site activities. Each team member in addition to identifying environmental problems and areas of environmental risk will also be gathering information from which they will write the following sections of the Preliminary Report:

- Background Environmental Information
- General Description of Pollution Sources and Controls
- Environmental Monitoring Program

A closeout briefing will be conducted on Thursday, March 26, to describe the preliminary findings of the Survey team. A copy of the closeout notes will be left with SAN and SSFL. A Preliminary Report of the DOE/SSFL Survey will be prepared within 2 to 3 months from the conclusion of the Survey. The Preliminary Report will be sent to SAN and SSFL for review and comment. The report will also be sent to several congressional committees and the U.S. Environmental Protection Agency.

Approximately 3 months after the results are available from the sampling and analyses (S&A) portion of the Survey, if any, (discussed below) an Interim Report will be prepared by the Survey team. The Interim Report will incorporate comments to the Preliminary Report and data from S&A results (if any). The Interim Report will be made available to the public, upon request.

Upon completion of the Environmental Survey effort, a Summary Report will be prepared and will contain a DOE-wide list of environmental problems. The report will be used as an information base for the ranking of DOE's environmental problems.

2.3 Sampling and Analysis

Based on available site environmental information and the results of the on-site Survey activities, the Survey team will identify Survey-related sampling needs, if any. Implementation of the S&A phase of the DOE/SSFL Survey would begin approximately four months after the completion of the on-site Survey activities. If Survey-related sampling is necessary, Idaho National Engineering Laboratory (INEL) will provide the field sampling and analytical support.

3.0 AIR

3.1 Issue Identification

The air-related Survey activities will involve an assessment of the air emissions at the site, the administrative and emission controls applied to the sources, and the ambient air monitoring systems. The emphasis of the Survey will be on operational and procedural practices associated with the emission sources and the emission control equipment, as well as fugitive emission sources, both within and outside the buildings, and mitigative procedures applied to fugitive emission sources including recently shut down facilities. Close liaison will be maintained with the radiation team member because of the importance of air-rad issues. Close liaison will also be maintained with the QA/TSCA team member because of the interaction of several TSCA regulations and air regulations.

The general approach to the Survey will include a review of existing air permits, pending applications, and standard operating procedures. Processes and control equipment will be inspected for compliance with DOE ALARA requirements for radionuclide emissions. The Survey will also review the nonradiological air contaminants from the different buildings at the site, evaluate any existing controls applied to the air emissions, and assess the need for additional monitoring or emission controls to characterize or reduce the environmental consequences of the emissions. This review will include the various shops and storage areas.

The ambient air monitoring system will be evaluated to assess the adequacy of the existing monitoring program to characterize environmental impacts of the air emissions from the facility. The activities involved in this part of the Survey will include the inspection of the ambient air quality samplers, the meterological tower, a review of documentation applicable to the ambient air data acquisition, and an evaluation of the processing procedures used to assure the accuracy of the data.

Areas of particular interest will include emissions of the criteria pollutants (e.g., sulfur oxides, nitrogen oxides, hydrocarbons, carbon monoxide and lead) as well as regulated hazardous air pollutants (e.g., radioactive-bearing particulates, beryllium, and asbestos). Although not currently listed as hazardous air pollutants, chlorinated solvents, and freons will be included in this review.

The use of all organic solvents will be assessed as a potential or actual sources of emissions to determine if they are adequately characterized, monitored, and controlled. The non-radionuclide emissions assessment will focus on those substances that the EPA intends to list as hazardous or toxic air pollutants (e.g., methylene chloride, trichloroethylene, perchloroethylene). Non-organic air emissions will also be included (e.g., ammonia, chlorine, chromium, and sulfuric acid).

Fugitive emissions from the resuspension of contaminated soils will be evaluated as a potential contributor to the airborne release of radionuclides and hazardous materials from the facility. Consideration will be given to historical and current operations to determine the potential for soil contamination and windborne releases.

Several areas of specific interest have been identified during a review of available documentation:

- o Control and record keeping for solvent usage, e.g., in vapor degreasers and parts cleaners.
- o Past and present control and monitoring of radionuclides and organic emissions.
- o Control of chromium emissions, if any, from cooling towers currently in operation.
- o Emission potential of fugitive dust sources such as roads.
- o Design of controls and administrative procedures in the operation of the Rad handling facilities.
- o Potential for asbestos emissions during building decontamination or demolition.
- o Effluent sampling and monitoring operations.

Throughout the Survey, emphasis will be placed on assessing the available data to characterize the overall environmental impact of plant operations.

3.2 Records Required

Files will be reviewed as part of the Survey, including documents not yet reviewed or received (e.g., classified documents, individual files, documents not yet identified). Specific documents and files to be reviewed as part of the Survey include, but will not be limited to, the following:

- o PSD ledger
- o Air effluent sampling and QA procedures
- o Ambient air sampling and QA procedures
- o Contractor stack test results
- o Effluent sampling results
- o Laboratory records on TSP analyses (ambient)
- o Preliminary drafts of SARA 313 reports
- o Any other documents pertinent to air emissions from SSFL buildings

4.0 HYDROGEOLOGY AND SOILS

4.1 Issue Identification

The hydrogeology/soils portion of the Survey will examine the physical and chemical character of the subsurface materials relative to the environmental impact--actual and potential--that the site activities have on these two media. The result of operations at other nearby facilities has apparently contributed to groundwater contamination at the SSFL facility. The past and present use of radioactive materials at some facilities has contributed to known and potential sources of contamination.

Each of the potential source areas where materials have been disposed of, stored, treated for disposal, or spilled will be visited during the site Survey. Since many of these potential sources are also related to RCRA, CERCLA, surface water, and radiation disciplines; visits will be coordinated with the team members specializing in those fields. Areas to be visited include:

- o Building 059: SNAP Ground Prototype Test Facility
- o Sodium Burn Pit
- o RMDF Leach Field
- o Interim Storage Facility
- o Groundwater Treatment Facilities
- o Holding Ponds and Basins

In addition to examining the actual and potential contaminant source areas, an evaluation of the monitoring systems for those areas will be performed. This evaluation will involve: reviewing the hydrogeologic and subsurface characterizations performed by the site, the well system (location and construction), and data analysis.

Information relative to the site geology and surface soils, groundwater regime, and environmental monitoring programs and data will be reviewed at the site, prior to, and after the site Survey visit.

4.2 Records Required

Documents and files that provide information concerning the presence of contamination, or the monitoring system for the groundwater and soils will be reviewed as part of the Survey. A general list of documents and records to be reviewed includes:

- o Geologic and geohydrologic reports
- o Groundwater and soil monitoring plans and procedures
- o Environmental monitoring reports
- o Monitoring well locations and as-built records
- o Disposal area operation and closure plans
- o Groundwater and soil analytical data
- o Environmental compliance audit reports
- o Unpublished, in-progress, or planned groundwater studies

5.0 SURFACE WATER/DRINKING WATER

5.1 Issue Identification

The focus of the surface water/drinking water portion of the DOE/SSFL Survey will be on the potential for release of polluted or contaminated wastewaters to surface waters draining the site or to groundwater aquifers underlying SSFL. Pathways for off-site migration of pollutant may include:

- o Releases (accidental or planned) to the sanitary sewers, retention basins, or to the storm drains.

- o Spills or leaks into permeable soil areas.

- o Exfiltration of sanitary wastewaters into soils or groundwater.

- o Contaminated surface run-offs into storm drains, retention basins, the Bell Creek Canyon, or, to a lesser extent, the Simi Valley.

A review of available information indicates that considerable attention has been paid to control of radiological releases. The Survey will assess the potential for future contamination of wastewaters, as well as review present conditions of wastewater control and collection systems. Liquid waste sources, processes, collection and handling equipment will be examined and records of operation will be reviewed.

The Survey will include identification of potential discharges to surface waters, or to the on-site sanitary treatment facility at the Area III complex, which may not be addressed in operating permits or other documents. The site will be investigated for evidence of possible breaks or obstructions in the sewer systems which could result in releases of wastewater to the environment. The Survey will also address the possibility of cross-contamination of the SSFL water piping system by either the sanitary or storm drainage systems. Measures taken to prevent back-flow of process wastewater or sanitary sewer flows into the water distribution system will be reviewed.

With respect to wastewater monitoring and treatment systems, copies of standard operating procedures will be reviewed. Operating logbooks and maintenance records will also be checked. Actual procedures put in normal practice by SSFL personnel will be observed to determine how closely SOP's are being followed. Interviews with managers and operators of monitoring systems will be conducted in order to understand modifications or significant deviations, if any, from written SOPs.

A walk-through of selected buildings will be made to observe normal routines, including maintenance activities which generate wastewaters. Discharge and monitoring points will be reviewed, and sampling and analytical procedures in use will be observed in action. Emphasis will be placed on the major contributors to wastewater generation, for example:

- o Cleaning and decontamination operations as practiced at SSFL.

- o The steam generator and ancillary equipment at the SCTI complex.

- o The sewage treatment and disposal plant and ancillary equipment at the Area III.
- o The service water and potable water treatment distribution systems.
- o Miscellaneous potential wastewater sources, such as the LLTR water systems, the HTF deaeration tank and test sections, heat exchangers, and cooling towers associated with SCTI, and other cooling operations.

Wastewater collection, holding and transfer systems will be evaluated under normal operating conditions, as will the effluent monitoring stations. Site surface drainage characteristics, such as culverts, ditches and basins will also be examined, along with the man-made efforts to control surface run-on and run-off.

5.2 Records Required

Files will be reviewed as part of the Survey including documents not yet reviewed or received (e.g., classified documents, individual files, documents not yet identified). Specific documents and files to be reviewed as part of the Survey include, but will not be limited to, the following:

- o Documentation of ongoing NPDES permit compliance.
- o Recent analytical data on wastewater releases to the receiving stream(s).
- o Notices of violations relating to wastewater releases, if any.
- o Operators logbooks and monitoring reports.
- o Standard operating procedures for wastewater collection, holding and transfer.
- o Progress reports for ongoing improvements and studies, e.g., upgrade of the water monitoring system; improving the quality of flow measurements; data on stormwater run-off characteristics.
- o Sampling protocols and logbooks.
- o Monitoring equipment maintenance records.
- o Detailed drawings of the sanitary and fire protection water supply, storage and distribution systems.
- o Additional information on the sediment sampling program, data handling and correlation with surface water quality.
- o Records of drinking water quality.
- o Internal memos or correspondence relating to surface water/drinking water problems, e.g., back-flow prevention measures.
- o Other records as determined on-site.

6.0 SOLID/HAZARDOUS/MIXED/RADIOACTIVE WASTE

6.1 Issue Identification

The solid/hazardous/mixed/radioactive waste Survey will be carried out by evaluating all activities generating such wastes, and the facilities used for their accumulation, storage, processing, treatment and disposal, including treatment and/or disposal at off-site facilities and wastes received from off-site facilities.

The management of all solid waste streams including mixed wastes, hazardous wastes, radioactive wastes, and non-hazardous non-radioactive wastes will be surveyed. The Survey will consist of several activities: 1) Physical facilities where wastes are generated, accumulated, stored, treated, recycled, processed or disposed will be evaluated; 2) Management and operations personnel involved in these activities will be interviewed; and 3) Documents pertaining to wastes will be reviewed. Based on these activities, the potential for releases that may contaminate the environment will be evaluated.

SSFL generates a variety of solid wastes, with all wastes currently generated originating from maintenance, laboratory, experimental and decontamination operations. Waste generating and processing facilities that will be evaluated.

Personnel from divisions with waste management responsibilities will be interviewed in order to give a detailed understanding of waste management practices. This includes personnel with line operations responsibilities and those responsible for the overall administration of SSFL environmental programs including Rocketdyne environmental staff members with responsibilities at SSFL DOE facilities. This will include the experimental facilities and the RMDF.

The SSFL site has historically been the site for a number of DOE experimental reactors. Several of the experiments and the buildings housing them have already been terminated and decontamination and decommissioning carried out. Several buildings remain which must be decommissioned and/or decontaminated. This includes buildings B-009, 024, 028, 059, and 665. Groundwater intruding into B-059 has been radioactively contaminated. Issues relating to decontamination and decommissioning will be evaluated.

Large scale experimental programs relating to synthetic fuels were conducted at the Bowl Area. Although these experiments have been finished, residues remain within the process equipment which have to be disposed. The Burn Pit and possibly other old disposal areas contain wastes which will have to be disposed as part of a cleanup program. Both the Bowl Area and old disposal areas will be evaluated for potential cleanup wastes (both radioactive and hazardous).

Rocketdyne facilities handling DOE wastes, including the hazardous waste storage area and the sewerage treatment plant will also be evaluated.

The solid waste Survey will be coordinated with the CERCLA Survey to identify past and present waste management practices that may result in releases of contaminants to the environment (e.g., Burn Pit); the radiation Survey to identify problems with wastes containing radioactive constituents (e.g., Decommissioning Issues); the surface water/drinking water Survey since water and wastewater treatment produce solid wastes; the air Survey to identify any solid wastes produced by air pollution control devices; the TSCA Survey to identify any problems with PCB wastes and underground storage tanks for hazardous substances; and the hydrogeological and soil Surveys to identify groundwater and soil contamination resulting from the accumulation, storage, treatment and disposal of solid wastes and contaminated facilities (e.g., B-059).

6.2 Records Required

Files will be reviewed as part of the Survey, including documents not yet reviewed or received (e.g., classified documents, individual files, documents not yet identified). Specific documents and files to be reviewed as part of the Survey include, but will not be limited to, the following:

- Part A and Part B Application related correspondence and associated NODs.
- Underground tank storage notification and associated records, and studies.
- Audit and/or inspection records (state, local, and federal DOE and SSFL).
- Groundwater monitoring, sampling, and analytical documentation.
- Release notification and/or occurrence records.
- Biannual Hazardous Waste Generation Report, Annual Report of Hazardous Waste activities.
- Waste inventory documentation.
- Solid Waste Management Unit Studies and Documents.
- Enforcement action documents.
- Correspondence with regulatory agencies on solid waste.
- Records dealing with the reuse/recycling of wastes.
- Training records.
- Decommissioning Plans, Studies, etc.

7.0 TOXIC SUBSTANCES

7.1 Issue Identification

The toxic substances Survey will review the use, handling, storage, and disposal of polychlorinated biphenyls (PCBs), asbestos, pesticides, and other hazardous substances used on the SSFL site. The control, tracking, and management of toxic substances will be evaluated through interviews with appropriate personnel, tours of facilities, as well as a review of documents such as purchase and usage records. The primary objective will be to assess the potential for releasing these materials to the environment.

The Survey will assess inventory control of any PCB-containing and PCB-contaminated electrical, lubrication, and hydraulic equipment still utilized at the plant. The condition of this equipment, its potential for leakage, and the quantity of PCB fluids contained will be considered. Obsolete, stored, or used PCB equipment will be inspected for proper containment and adequate storage protection (e.g., B-231, Area II). Handling, removal, and disposal practices will be reviewed for current and previous inventories to establish the method of disposal and location of disposal sites. Conformance to TSCA reporting regulations for PCB transformers and spills will be evaluated. In addition, a review of any PCB spills and cleanups will be conducted. A review of the phase out of PCB transformers and other PCB equipment will be conducted.

The use of asbestos will be determined and procedures concerned with its removal, handling, monitoring, and disposal will be reviewed to identify any potential pathways of environmental contamination. This will include its use as construction material, for heat insulation, in cooling towers (e.g., Munter's Fill), and other miscellaneous uses. Some areas where friable asbestos has been removed or its removal is planned will be visited.
Since some pesticides are used at the SSFL, the purchase records, application procedures and frequency, personnel training, storage and disposal practices, as well as monitoring program will be reviewed to determine the potential for environmental contamination.

Hazardous substances are utilized and stored throughout the SSFL. The Laboratory utilizes bulk chemical and bulk fuel storage areas for many of these materials. Some of the larger storage tanks containing hazardous materials include sites 005, 022, 064, 356, 360 (SCTS), 462, etc. In addition, many substances are stored in small or moderate quantities in or near the areas in which they are used. Typically, these are stored in quantities of 55 gallons or less. Some of these areas include buildings 023, 065, 206 (CTL-2), 360, 435, as well as appropriate warehouses. The management and handling of these and other dangerous materials to prevent or minimize releases to the environment will be evaluated.

7.2 Records Required

As part of the Survey, files will be reviewed including documents not previously received or reviewed (e.g., classified documents, individual files, documents not previously identified). Specific documents and files to be reviewed as part of the Survey include, but will not be limited to, the following:

- Toxic substances labeling and tracking system.
- Procedures for handling, control, and management of toxic substances.
- Inventory of toxic substances and purchasing records of chemical substances.
- PCB annual inventory documents (1978 to 1987).
- Inventory of current PCB-contaminated electrical equipment.
- Records of inspections of PCB transformers (1981 to present).
- PCB handling, storage, and disposal procedures.
- Correspondence with fire department on PCB transformers.
- Locations of buildings containing asbestos, including usage.
- Asbestos disposal records, including method and location of disposal sites.
- Asbestos handling, removal, disposal procedures, and environmental monitoring.
- Records of asbestos use in process equipment and support facilities including the steam plant.
- Pesticide training, handling, storage, disposal records, and environmental monitoring.
- Standard operating procedures for pesticides.
- Special procedures involving handling, storage, use and disposal of chlorofluoroalkanes (freons) and chloroorganic solvents.
- Other records as determined on-site.

8.0 RADIATION

8.1 Issue Identification

Radiological issues to be addressed during the Environmental Survey will center around the air, soil, surface water, and groundwater media. Each of the above mentioned media will be evaluated for radiation concerns by collecting background information and data (including ambient data), identifying existing and decommissioned radiation pollution sources and associated controls, and finally by reviewing environmental monitoring programs designed to gather data on identified pollution sources.

The Survey will also evaluate rad-waste management practices, direct radiation exposure issues, dose assessment methodologies, and radiochemistry quality assurance programs for environmental monitoring data. Review of rad-waste programs including management practices for low-level, transuranic, rad-hazardous (mixed), and adherence to SSFL procedures will be a major focus of the radiation portion of the Survey. A more detailed discussion of this subject is provided in Section 6.0 of the work plan. The radiological evaluations will be closely coordinated with the other specialists on the Survey team.

Because radiation issues cut across all media evaluated during the Survey, the attached daily agenda has been organized in an attempt to overlap the other specialists' activities when they are evaluating radiation issues. Some inefficiencies are to be expected as a result of this dual coverage approach, however, every effort has been made to minimize duplication. To improve the effectiveness of radiation evaluations, Mr. Francis will rely heavily on the expertise and assistance of various SSFL personnel for accomplishing Survey objectives and pointing out where work plan inefficiencies exist. Discussions with operating and supervisory personnel will also be utilized to provide needed information critical for complete evaluation. Reports, records, and other data associated with continuous, intermittent, and any accidental or unscheduled releases should be readily accessible for review.

8.2 Records Required

Files will be reviewed as part of the Survey, including documents not yet reviewed or received (e.g., classified documents, individual files, documents not yet identified). Specific documents and files to be reviewed as part of the Survey include, but will not be limited to, the following:

- o NRC license and supporting information documents.

- o California license and supporting information documents.

- o Radiation-related ambient air quality information.

- o Background radiation data for soil, surface water, and groundwater.

- o Inventories of air, soil, surface water, and groundwater radionuclide release points and quantities.

- o Vegetation radionuclide monitoring data.

- o Unscheduled or accidental release reports.
- o Radioanalytical quality assurance programs and procedures.
- o Dose assessment methodologies, including assumptions, calculations, reporting, etc.
- o Building plot plans with process and equipment locations.
- o Description of radiation monitoring equipment practices and procedures (e.g., calibration, maintenance, etc.).
- o Reports or recommendations for upgrading radiation monitoring systems.
- o Reports prioritizing new radiation monitoring installations.
- o Off-site and on-site radionuclide sampling point criteria.
- o Rad-waste management practices, policies, procedures, and communication mechanisms.
- o NESHAPS/DOE Subpart H 61.90-61.98 reports.
- o Information regarding employee radiation exposure data.
- o Historical rad-waste disposal activity logs and locations.
- o State, County and local radiation regulations.

9.0 QUALITY ASSURANCE

9.1 Issue Identification

The quality assurance phase of the Environmental Survey will be primarily an evaluation of the sampling and analytical capabilities at the SSFL. The objective will be to review and verify the quality assurance procedures for obtaining process effluent and environmental samples, performing the analyses to measure the concentration of pollutants, and the handling and reporting of the data. All aspects of the quality assurance program relating to environmental management of DOE activities at the Santa Susana Field Laboratories will be reviewed including: operator training; equipment and instrument calibration/maintenance; precision and accuracy evaluation; blank, split, and spiked sample analyses; sample handling and chain-of-custody procedures; data reduction and validation; data reporting and documentation; as well as the review of calculations and logbooks.

The procedures used for sampling and analysis will be monitored to ensure proper implementation and conformance with accepted practices. The quality assurance program will be reviewed for the sampling and analytical activities, and also for any internal quality assurance audits that have been conducted. Furthermore, the interlaboratory test programs participated in by the environmental analytical laboratories, as administered by the DOE's Environmental Measurements Laboratory and the Environmental Protection Agency will be evaluated. The quality assurance procedures of any off-site sampling and/or analytical laboratories utilized by the plant will also be reviewed in this Environmental Survey.

9.2 Records Required

Part of the Survey will consist of a review of pertinent files. This will include documents not previously reviewed or received, such as classified documents (if any), individual files, and documents which have not been identified at this time. Some specific documents and files to be reviewed in this phase of the Survey include, but will not be limited to, the following:

- Environmental sampling and analysis quality assurance programs of the Analytical Chemistry laboratories (Chem. and Met. Lab, SSFL Analytical Laboratory, and radiological measurements laboratory) and Environmental Control Unit.
- Quality assurance audits of the analytical laboratories and sampling program.
- Analytical and sampling procedures manuals.
- DOE and EPA quality assurance results of performance evaluation samples.
- Quality assurance reports for the Analytical Chemistry laboratories conducting environmental analyses.
- Training policy and records for the sample collection and analytical laboratory personnel.

- Maintenance and calibration records for the analytical laboratory and sampling instruments/equipment.
- Laboratory notebooks, data reporting forms, chain-of-custody procedures, and sampling logbooks.

10.0 INACTIVE WASTE SITES/RELEASES (CERCLA)

10.1 Issue Identification

The Survey will attempt to identify environmental problems and potential risks associated with the historical handling, storage and disposal of hazardous substances at SSFL. This aspect of the Survey will be coordinated with the RCRA and hydrogeology team members. The Survey will focus on current and future risks related to the following:

- o Past land disposal practices (on and off-site);
- o Past spills/releases from tanks, pipes, pits, trenches;
- o Potential for future spills/releases; and
- o On-going remedial action program.

Facilities that have handled or are currently handling hazardous, mixed, and low-level radioactive substances at SSFL will be evaluated.

The following areas identified in SSFL documents will be evaluated:

- RMDF B/021, 022
- No Burn Pit B/886
- Landfill B/059
- Salvage Yard
(Rocketdyne Classification Yard)
- CHCF B/463
- SRE B/143
- B/003 Hot Cave
- STIR B/028
- ERTF B/010
- GPTF B/059
- KEWB B/073

The status of activities undertaken pursuant to DOE Order 5480.14 and SARA Section 120 will be assessed. Records of past off-site disposal from SSFL will be reviewed.

Sites that have undergone or are undergoing remediation will be addressed. Records and analytical data in support of the site cleanup will be reviewed. Also, inactive tanks or containers that may have held hazardous substances will be identified and their status assessed. Former storage areas and staging locations will be included in this effort. The team will also want to review the environmental records pertaining to the past management, disposal (on-site and off-site), clean-up, and regulatory compliance.

Contacts for this portion of the Survey will include personnel from Facilities & Industrial Engineering, and Environmental Control & Engineering.

10.2 Records Required

Files will be reviewed as part of the Survey, including documents not yet reviewed or received (e.g., classified documents, individual files, documents not yet identified). Specific documents and files to be reviewed as part of the Survey include, but will not be limited to, the following:

- Past waste management plans.
- SOPs regarding management of hazardous substances, disposal area and storage areas.
- Hazardous substances inventories.
- Listing of areas used for hazardous substances storage, receiving and shipping, and disposal.
- Historical files on past operations and processes, substances used, and methods of handling and disposal.
- Files on past off-site waste handling and disposal.
- Records of facility expansion and building rubble disposal.
- Descriptions and Notifications of inactive waste sites and potential areas of contamination.
- Description of all waste management facilities, including burial tanks and structures (existing and removed).
- Historical aerial and surface photographs of the facility.
- "Interview files" (18 persons) for the draft Phase I Installation Assessment report (Adler et.al, 1986).
- Files pertaining to any radiometric surveys of the site grounds.
- Documents pertaining to past, current, and proposed remedial actions (e.g., RMDF Leach Field) at SSFL.
- Environmental records pertaining to past facility responses to hazardous substance spills and releases.

AIR/TSCA - J. CRIST

MONDAY, MAY 16	TUESDAY, MAY 17	WEDNESDAY, MAY 18	THURSDAY, MAY 19	FRIDAY, MAY 20
-Introductory Briefings & Site Orientation -Air Permits Review	-Tour Rad and Other Emission Sources: 021, 022, 020, 023, 024, 025, 026, 055, 057, 059, 062, 065 (w/M. Francis)	-Tour Non-Rad Emissions Sources: 006, 007, 008, 011, 029, 030, 032	-Review Permitted Sources at Buildings 355-361 -Tour Molten Salt Test Facility (w/J. Boros) -Review Fuel Uses -Review Asbestos Projects (w/C. Caruso)	-Visit Ambient Air Monitors -Review Air Sources: 100, 114, 133 -Findings Forms Due For 1st Week
MONDAY, MAY 23	**TUESDAY, MAY 24**	**WEDNESDAY, MAY 25**	**THURSDAY, MAY 26**	
-Inspect PCB Records Equipment & Storage for Disposal Area (231 in Area II) (w/C. Caruso)	-Review Hydraulic Test Instrumentation: 473, 863, 074, 075 -Revisits	-Informal Debriefing with SSFL Staff to Review Findings -Writing -Detailed Report Outline & Findings Forms Due	-Assist Team Leaders in preparing for Final Close-out Debriefing -Final Close-out Debriefing for SSFL Management	

GROUNDWATER/SOILS - D. DETMAN

MONDAY, MAY 16	TUESDAY, MAY 17	WEDNESDAY, MAY 18	THURSDAY, MAY 19	FRIDAY, MAY 20
-Introductory Briefings & Site Orientation -Tour Site Area to Observe Groundwater Monitoring Well Construction & Locations, & Recovery Well Locations & Systems	-Tour ..MDF Surface Impoundments, & Retention Basins (w/J. Boros) -Observe Monitoring Well Construction & Locations with Respect to Surface Impoundments	-Tour Building B/059 (w/M. Francis) -Tour Sodium Burn Pit and Interim Storage Facility	-Review Groundwater Monitoring Data -Organize Findings thus far	-Meet with Site Groundwater Consultant Staff to Discuss Program Implementation in Past, Present, and Future (may be scheduled May 23 if more convenient) -Findings Forms Due For 1st Week
MONDAY, MAY 23	**TUESDAY, MAY 24**	**WEDNESDAY, MAY 25**	**THURSDAY, MAY 26**	
-Tour Soil and Vegetation Sampling Locations (may be scheduled for May 20 if necessary to suit Groundwater Consultant availability) -Review Soil and Vegetation Sampling Data	-Catch-up Day for Revisits, Tours of Other Areas as needed, or writing -Review Additional Findings with Team Leaders	-Informal Debriefing with SSFL Staff to Review Findings -Revisits, as needed, or writing -Detailed Report Outline & Findings Forms Due	-Assist Team Leaders in preparing for Final Close-out Debriefing -Writing -Final Close-out Debriefing for SSFL Management	X

SURFACE WATER/DRINKING WATER - JOE BOROS

MONDAY, MAY 16	TUESDAY, MAY 17	WEDNESDAY, MAY 18	THURSDAY, MAY 19	FRIDAY, MAY 20
-Introductory Briefings & Site Orientation -Tour Sewage Collection System (Area IV) & Sewage Treatment Plant (Area III)	-Tour RMDF, Surface Impoundments & Retention Basins (w/D. Detman) -Observe NPDES Monitoring Stations, Stormwater Run-off Systems & Other Parts of Water Reclamation	-Observe Surface Water Sampling Activities, includ. Delivery of Samples to Analytical Laboratories -Tour Cooling Towers (e.g., 616) & Water Tanks (701 & 702)	-Tour Molten Salt Test Facility (w/J. Crist) -Review Service Water (on-site wells plus potable water from Ventura County Waterworks District 17) Distribution System	-Review Sources using Septic Tanks & Leach Fields, e.g., RMDF Leach Field -Tour Large Leak Test Rig - Bldg 059 -Findings Forms Due For 1st Week
MONDAY, MAY 23	**TUESDAY, MAY 24**	**WEDNESDAY, MAY 25**	**THURSDAY, MAY 26**	
-Tour SCTI, Bldg. 356 (w/R. Basinski) -Discuss Drinking Water Distribution & Control Systems with SSFL Staff -Review and Observe Back-Flow Prevention Measures -Review Data	-Tour Hydraulic Test Facilities 473, 863 & 873 (w/J. Crist) -Catch-up Day for Revisits -Organize Additional Findings -Review Spill Prevention & Countermeasures Plan w/ SSFL Staff	-Informal Debriefing with SSFL Staff to Review Findings -Review & Revisit as Needed -Detailed Report Outline & Findings Forms Due	-Assist Team Leaders in preparing for Final Close-out Debriefing -Writing -Final Close-out Debriefing for SSFL Management	

RCRA - R. BASINSKI

MONDAY, MAY 16	TUESDAY, MAY 17	WEDNESDAY, MAY 18	THURSDAY, MAY 19	FRIDAY, MAY 20
-Introductory Briefings & Site Orientation -Tour Building 020 Hot Lab	-Visit RMDF 021, 022 (w/M. Francis) -Visit 044 RMDF Clean Shop -Tour Labs and Shops at 062, 065, 066, 163	-Tour Inactive Facilities at 009, 012, 024, 059, 064, 374, 453, 457, 614, 665	-Tour Storage Areas & Buildings: 015, 025, 030, 041, 171, 459, 500, 583, 626 (w/M. Francis)	-Visit Storage Areas & Buildings 008, 029, 075 -Tour Decon Trailer Bldg 114 -Visit Sodium Burn Facility - 133 -Findings Forms Due For 1st Week
MONDAY, MAY 23	**TUESDAY, MAY 24**	**WEDNESDAY, MAY 25**	**THURSDAY, MAY 26**	
-Tour Sodium & Liquid Metal Facilities: 006, 007, 014, 013, 032, 057, 314, 355, 356, 357, 358, 360, 361, 462, 463, 320, 600, 610, 656	-Tour X-ray and Rad Labs and Facilities 172, 173, 185, 473, 621	-Informal Debriefing with SSFL Staff to Review Findings -Revisits -Detailed Report Outline & Findings Forms Due	-Assist Team Leaders in preparing for Final Close-out Debriefing -Final Close-out Debriefing for SSFL Management	

QA/TSCA - C. CARUSO

MONDAY, MAY 16	TUESDAY, MAY 17	WEDNESDAY, MAY 18	THURSDAY, MAY 19	FRIDAY, MAY 20
-Introductory Briefings & Site Orientation -Review of Analytical Labs: general requirements, organization, records required (ETEC Chem & Met. Lab)	-Evaluate organic & inorganic labs incld policies, manuals, chain-of-custody, data management, calibration, training, use of spikes, blanks, duplicates, etc. (SSFL Analytical Lab)	-Review Toxic Substance Management, Storage, Use, Disposal, etc. -Review Bulk Chemical & Fuel Storage. Visit Sites 005, 022, 064, 360 (SCTS), 462, etc. (Plant Services) -Water Quality Monitoring (w/J. Boros)	-Review of Asbestos Program incld. use, training, handling, removal, storage, disposal, etc. (Health, Safety and Environment) -Review Ground Water Sampling	-Radiation Labs (QA/QC) incld.: policies, manuals, sample tracking, data mgmt, calibration, training, use of spikes, blanks, duplicates, etc. Building 100 (w/M. Francis) -Findings Forms Due For 1st Week
MONDAY, MAY 23	**TUESDAY, MAY 24**	**WEDNESDAY, MAY 25**	**THURSDAY, MAY 26**	
-Review PCB Records & Facilities incld. transformer & PCB materials storage area (B231) (w/J. Crist)	-Review of Pesticide Program incld: use, handling, storage, training, disposal, etc. (Plant Services) -Review small quantity chemical storage areas, bldgs 206 (CTL-2), 360, 435, 023, 065, etc.	-Informal Debriefing with SSFL Staff to Review Findings -Writing and/or revists -Detailed Report Outline & Findings Forms Due	-Assist Team Leaders in preparing for Final Close-out Debriefing -Writing and/or revists -Final Close-out Debriefing for SSFL Management	

RADIATION - M. FRANCIS

MONDAY, MAY 16	TUESDAY, MAY 17	WEDNESDAY, MAY 18	THURSDAY, MAY 19	FRIDAY, MAY 20
-Introductory Briefings & Site Orientation -Review Facility Radiological Survey Plan and Results to Date	-Tour RMDF (follow process flow) B/021 & 022 (w/J. Werner) -Review Stack Monitoring, HEPA Program, Decon, Hot & Cold Change Rooms (w/J. Crist) -Discuss Rad Monitoring Systems	-Tour Building B/059 (w/D. Detman) -Tour Bldg. 020	-Tour Storage Areas, e.g., B/015, B/025, B/030, B/041 and Others (w/R. Basinski) -Tour Sodium Burn Pit & Interim Storage Facility -Review Rad Data	-Visit Radiation Lab -Review Current Status of Radiological Survey Programs and Plans (observe techniques, if possible) -Findings Forms Due For 1st Week
MONDAY, MAY 23	**TUESDAY, MAY 24**	**WEDNESDAY, MAY 25**	**THURSDAY, MAY 26**	
-Review Perimeter Monitoring Program -Review Direct Sources at B/022 & 021 incld. Spent Fuel Assemble Evaporator Sludges Source Materials B/621 Packaged Waste B/075	-Review Dose Assessment Procedures: Pathways, Maximally Exposed, Population, Methodologies -Catch-up Day for Revisits, Tours of Other Areas as needed -Writing and Organizing Findings	-Informal Debriefing with SSFL Staff to Review Findings -Revisits as Needed -Detailed Report Outline & Findings Forms Due	-Assist Team Leaders in preparing for Final Close-out Debriefing -Final Close-out Debriefing for SSFL Management	

CERCLA - J. WERNER

MONDAY, MAY 16	TUESDAY, MAY 17	WEDNESDAY, MAY 18	THURSDAY, MAY 19	FRIDAY, MAY 20
-Introductory Briefings & Site Orientation -Review Document Archive Index -Request Documents -Review Historical DOE Activities & Tour Selected Sites	-Visit RMDF B/021 & 022, & Sodium Burn Pit B/886 -E-9/F-3 Disposal Storage Areas -Review Files	-Visit: Salvage Yard/ Rocketdyne Conservation Yard -SRE B/143 NW Landfill at B/059 -Review Files	-Tour RCRA Surface Impoundments, CHCF B/463 -Review Files	-Tour and Review Records for B/003 Hot Cave, B/028 STIR, B/010 ERTF, B/059 GPTF, B/073 KEWB -Review Files -Findings Forms Due For 1st Week

MONDAY, MAY 23	TUESDAY, MAY 24	WEDNESDAY, MAY 25	THURSDAY, MAY 26	
-Revisits as Needed -Review Files	-Revisits as Needed -Review Files	-Informal Debriefing with SSFL Staff to Review Findings -Revisits -Writing -Detailed Report Outline & Findings Forms Due	-Assist Team Leaders in preparing for Final Close-out Debriefing -Final Close-out Debriefing for SSFL Management	

APPENDIX D

CHEMICAL SYMBOLS, ABBREVIATIONS, AND ACRONYMS

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CHEMICAL SYMBOLS, ABBREVIATIONS, AND ACRONYMS

ACM	Asbestos Containing Materials
AEC	Atomic Energy Commission
AIRDOS	Estimation of radiation dose caused by airborne radionuclides in areas surrounding nuclear facilities
AI	Atomics International
ALARA	As Low as Reasonably Achievable
a.m.	Ante-Meridiem (before noon)
ARAC	Atmospheric Release Advisory Capability
Avg.	Average
BOD	Biochemical Oxygen Demand
BOD_5	Biochemical Oxygen Demand (5-day)
°C	Degrees Celsius (or centigrade)
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CG	Concentration Guide
CHCF	Component Handling and Cleaning Facility
Ci	Curie(s)
cm	Centimeter(s)
CN	Cyanide
CO	Carbon Monoxide
COD	Chemical Oxygen Demand
Cr	Chromium
Cr^{+6}	Hexavalent chromium
Cs-137 or ^{137}Cs	Cesium, isotope 137
CTL	Component Test Laboratory
Cu	Copper
cu. ft.	Cubic feet
cu. yd.	Cubic yard(s)
DCG	Derived Concentration Guide
D&D	Decontamination and Decommissioning

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CHEMICAL SYMBOLS, ABBREVIATIONS, AND ACRONYMS
PAGE TWO

DOD	Department of Defense
DOE	Department of Energy
DOT CL	Department of Transportation Classification
DPM	Disintegrations per minute
ECU	Environmental Control Unit
ENE	East-Northeast
e.g.	(exampli gratia) for example
EPA	Environmental Protection Agency
ESADA	Empire State Atomic Development Authority
ESE	East-Southeast
et al.	(et alii, aliae, or alia) and others
ETEC	Energy Technology Engineering Center
°F	Degrees Fahrenheit
FFTF	Fast Flux Test Facility
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
ft.	Feet, foot
FTS	Facility Test System
FUSRAP	Formerly Utilized Sites Remedial Action Program
g	Gram(s)
gpd	Gallons per day
gpm	Gallons per minute
Gal.	Gallon(s)
hr	hour
ha.	Hectare(s)
HEPA	High Efficiency Particulate Air
HP	Horse power
HS&E	Health, Safety and Environmental
HTF	Hydraulic Test Facility
ICRP	International Commission on Radiological Protection
i.e.	(id est) that is

APPENDIX D
CHEMICAL SYMBOLS, ABBREVIATIONS, AND ACRONYMS
PAGE THREE

in.	inch(es)
Inc.	Incorporated
kg	Kilogram(s)
kg-cal	Kilogram-calorie(s)
km	Kilometer(s)
KP-1	Cooling water treatment chemical
KW	Kilowatt
l	Liter(s)
LA	Los Angeles
lbs.	Pounds
LLTR	Large Leak Test Rig
LMFBR	Liquid Metal Fast Breeder Reactor
lpd	Liters per day
lpm	Liters per minute
m	Meter(s)
Max.	Maximum
µCi	Microcurie(s)
mCi	Millicurie(s)
Med.	Median
µg	Microgram(s)
Mg	Magnesium
mg	Milligram(S)
mg/l	Milligrams per liter
mi.	Mile(s)
Min.	Minimum
mgd, MGD	Million Gallons per Day
ml	milliliter(s)
mld, MLD	Million Liters per Day
mm	Millimeter(s)
µm	Micrometers

APPENDIX D
CHEMICAL SYMBOLS, ABBREVIATIONS, AND ACRONYMS
PAGE FOUR

MPN	Most Probable Number
mrem	Millirem(s)
mrem/yr	Millirem(s) per year (10^{-3} roentgen equivalent man/year)
MSDSs	Material Safety Data Sheets
MW	Megawatt
N	North; nitrogen
Na	Sodium
NA	Not Analyzed
NASA	National Aeronautical Space Administration
NCRP	National Council on Radiation Protection and Measurements
ND	None detected
NE	Northeast
NEC	Nuclear Engineering Company
NESHAPs	National Emission Standards for Hazardous Air Pollutants
ng	Nanograms
NNE	North-Northeast
NNW	North-Northwest
No.	Number(s)
NOS	Not Otherwise Specified
NO_2	Nitrogen dixoide; nitrite
NO_3	Nitrogen trioxide; nitrate
Np-237 or ^{237}Np	Neptunium, Isotope 237
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
NTU	Nephelometric Turbidity Units
NW	Northwest
O_3	Ozone
OSHA	Occupational Safety and Health Administration
PCB	Polychlorinated biphenyl

PCT	Polychlorinated terphenyl
pCi	Picocurie(s)
pH	Negative logarithm of the hydrogen ion concentration
PM_{10}	Particulate matter 10 microns or less in diameter
ppb	Parts Per Billion
ppm	Parts Per Million
Pu-239 or ^{239}Pu	Plutonium, Isotope 239
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RCW	Recirculating Cooling Water
RFI	RCRA Facility Investigation
RMDF	Radioactive Material Disposal Facility
ROC	Reactive Organic Compounds
s	Second(s)
S	South; sulfur
S&A	Sampling and Analysis
SARA	Superfund Amendments and Reauthorization Act of 1986
SCTI	Sodium Components Test Installation
SCTL	Sodium Components Test Loop
SDWA	Safe Drinking Water Act
sec.	Second(s)
SFMP	Surplus Facilities Management Program
SNAP	Space Nuclear Auxiliary Power
SO_2	Sulfur Dioxide
SO_4	Sulfate
SOP	Standard Operating Procedure(s)
SPCCC	Spill Prevention, Control, Countermeasures, and Contingency
SPTF	Sodium Pump Test Facility

sq. ft.	Square feet
sq. mi.	Square mile(s)
Sr	Strontium
SRE	Sodium Reactor Experiment
SSFL	DOE activities at the Santa Susana Field Laboratory
SSTF	Static Sodium Test Facility
SSW	South-Southwest
Std.	Standard
STLC	Soluble Threshold Limit Concentration
STP	Sewage Treatment Plant
s.u.	Standard units
SW	Southwest
Temp	Temperature
Th-230 or ^{230}Th	Thorium, Isotope 230
TRC	Total Residual Chlorine
TRU	Transuranic
TSCA	Toxic Substances Control Act
TSP	Total Suspended Particulates
TSS	Total Suspended Solids
TTF	Thermal Transient Facility
TTLC	Total Threshold Limit Concentration
U	Uranium
U-235 or ^{235}U	Uranium, Isotope 235
U-238 or ^{238}U	Uranium, Isotope 238
U.S.	United States
VCAPCD	Ventura County Air Pollution Control District
VOC	Volatile Organic Compounds
W	West, tungsten
WAA	Waste Accumulation Area(s)
WNW	West-northwest
WSW	West-southwest
Y^3	Cubic yard(s)
Yr	Year(s)

α	Alpha
β	Beta
σ	Sigma
%	Percent
′	Minute(s)
″	Second(s)
~	Approximately
>	Greater than
<	Less than
#	Number
&	And (and per se and = ampersand)
/	Per
±	Plus or minus

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