ER–AN–0006

Environmental Monitoring Program Plan

Santa Susana Field Laboratory
Area IV

Rocketdyne Division
Rockwell International Corporation

ENERGY TECHNOLOGY ENGINEERING CENTER

Operated for the U. S. Department of Energy

Rocketdyne Division, Rockwell International

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Page 1 of 147

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-APPROVALS-

Originator [signature]

Manager [signature]

RP&HPS [signature] Phil Rutherford

Rev.	Revision	Approval/Date
NC	Initial issue. Issues as a separate document the monitoring plan from the combined characterization and monitoring plan draft.	On File
A	Revise to incorporate responses to DOE comments on Rev. NC.	On File
B	Revise to incorporate DOE-approved responses to DOE comments on Rev. A. Update to reflect completed activities. Delete reference to plan for separate chemical characterization. Revise to incorporate responses to comments by Environmental Protection.	[signature] 3/22/94 [signature] 3/23/94 Phil Rutherford 3/23/94

CONTENTS

CONTENTS

CONTENTS

TABLES

FIGURES

ACRONYMS

ABHP	American Board of Health Physics
AEC	Atomic Energy Commission
AI	Atomics International
AMS	Aerial Monitoring System
ANL	Argonne National Laboratory
ANSI	American National Standard Institute
BBI	Brandeis–Bardin Institute
BNA	Base Neutral and Acid Extractable Organic Compound
BOD	Biological Oxygen Demand
CAA	Clean Air Act
Cal–EPA	California Environmental Protection Agency
CARB	California Air Resources Board
CEM	Continuous Emission Monitoring
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMWD	Calleguas Municipal Water District
CFR	Code of Federal Regulations
D&D	Decontamination and Decommissioning
DCE	Dichloroethane
DCG	Derived Concentration Guide
DHS	Department of Health Services (California)
DOE	Department of Energy
DOE–SAN	Department of Energy – San Francisco Office
DTSC	Cal–EPA Department of Toxic Substances Control
ECL	Engineering Chemistry Laboratory
EML	Environmental Measurements Laboratory (DOE)
EMP	Environmental Monitoring Plan
EP	Rocketdyne Environmental Protection Department
EPA	Environmental Protection Agency
ERDA	Energy Research and Development Agency
ESADA	Empire State Atomic Development Association
ES&H	Environmental, Safety, and Health
ESG	Energy Systems Group
ETB	Engineering Test Building
ETEC	Energy Technology Engineering Center
FUSRAP	Formerly Utilized Sites – Remedial Action Program

GOCO	Government–Owned, Contractor–Operated
GRC	Groundwater Resources Consultants, Inc.
HASP	Health and Safety Plan
HEPA	High–Efficiency Particulate Air (Filters)
HPIC	High–Pressure Ionization Chamber
HP	Hewlett Packard
HVAS	High–Volume Air Sampler
HWMF	Hazardous Waste Management Facility
IR&D	Independent Research and Development
ISI	Inservice Inspection
KEWB	Kinetics Experiment Water Boiler
LMEC	Liquid Metal Engineering Center
LNSB	Low NOx–SOx Burner
MPC	Maximum Permissible Concentration
MSTF	Molten Salt Test Facility
NAA	North American Aviation
NaK	An Alloy of Sodium and Potassium
NASA	National Aeronautics and Space Administration
NDFL	Nuclear Development Field Laboratory
NESHAPS	National Emission Standards for Hazardous Air Pollutants
NIST	National Institute of Standards and Technology
NMDF	Nuclear Materials Development Facility
NOx	Oxides of Nitrogen
NPDES	National Pollution Discharge Elimination System
NRC	Nuclear Regulatory Commission
NRDC	National Resources Defense Council
NRRPT	National Registry of Radiation Protection Technologists
NSPS	New Source Performance Standards
NVLAP	National Voluntary Laboratory Accreditation Program
OMR/SGR	Organic Moderated Reactor/Sodium Graphite Reactor Critical Assemblies
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
PAH	Polynuclear Aromatic Hydrocarbon
PCB	Polycholorinated Biphenyl
PCT	Polychlorinated Terphenyl
PDU	Process Development Unit
QA	Quality Assurance

QAP	Quality Assessment Program
QAPI	QA Program Index
QAPP	Quality Assurance Program Plan
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Field Investigation
RHB	Radiologic Health Branch of the DHS
RIHL	Rockwell International Hot Laboratory
RMDF	Radioactive Materials Disposal Facility
RP&HPS	Radiation Protection and Health Physics Services
RWQCB	Regional Water Quality Control Board (California)
S&M	Surveillance and Maintenance
S2DR	SNAP 2 Developmental Reactor
S8DR	SNAP 8 Developmental Reactor
S8ER	SNAP 8 Experimental Reactor
S10FS3	SNAP 10 Flight Simulation Reactor
SARA	Superfund Amendments and Reauthorization Act
SCTI	Sodium Components Test Installation
SER	SNAP Experimental Reactor
SFMP	Surplus Facility Management Program
SMMC	Santa Monica Mountains Conservancy
SNAP	Systems for Nuclear Auxiliary Power
SPTF	Sodium Pump Test Facility
SRE	Sodium Reactor Experiment
SSFL	Santa Susana Field Laboratory
STIR	Shield Test and Irradiation Reactor
STR	Shield Test Reactor
TCE	Trichloroethylene
TEGD	Technical Enforcement Guidance Document
TLD	Thermoluminescent Dosimeter
TS	Test Statistic
TU	Turbidity Unit
UST	Underground Storage Tanks
VCAPCD	Ventura County Air Pollution Control District
VOC	Volatile Organic Compound

1.0 Introduction

1.0 INTRODUCTION

1.1 OBJECTIVE

The objective of this document is to provide a comprehensive plan for environmental monitoring of Area IV of the Rocketdyne Santa Susana Field Laboratory (SSFL). The U.S. Department of Energy (DOE) requires that each field organization prepare a plan for implementing DOE Orders 5400.1, General Environmental Protection Program, and 5400.5, Radiological Protection of the Public and Environment. DOE Order 5400.1 requires that environmental monitoring plans also consider the needs for nonradiological (i.e., chemical) monitoring in compliance with applicable federal, state, and local environmental regulations. Appendix A provides a summary of those regulations as well as the pertinent DOE Orders.

1.2 SITE DESCRIPTION

This section provides an overview of the physical (topographic, hydrogeologic, and climatological), operational and demographic character of the SSFL and surrounding areas. These factors are important in determining the potential release of chemical or radioactive materials into the environment, the pathways and locations to which these materials may migrate, and the population groups that may be impacted.

1.2.1 Geographic Location

The total area of the SSFL is approximately 2,668 acres, including a buffer zone to the south, and is located in the Simi Hills of eastern Ventura County, California (Figure 1–1). The SSFL is located in mountainous terrain at approximately 1,700 to 2,200 ft above mean standard sea level. The Simi Hills are bordered to the north by Simi Valley, to the east by the communities of the San Fernando Valley, and to the southwest by the Thousand Oaks area. Each area has a population that exceeds 100,000 persons.

1.2.2 Description

The SSFL has been divided into four areas based on ownership and the operations conducted there. In addition, there is a 1,143–acre buffer zone, which occupies nearly the entire southern half of the 2,668–acre site. This plan is specifically concerned with Area IV, which encompasses the northwest section of the site.

Area IV consists of the Burro Flats area in the 290–acre westernmost portion of the SSFL. This area is dominated by alluvium overlying the Chatsworth Formation and is relatively flat compared to Areas I, II, and III.

Area IV was historically used to support government–sponsored programs for developing and testing reactors, fabricating nuclear reactor fuels, and decladding irradiated nuclear fuel assemblies. Research conducted in Area IV also included alternative energy resources such as coal gasification and solar energy development. Area IV is currently used for energy system and component testing in nonradioactive environments.

1.2.3 Hydrogeology

Early hydrogeology studies were primarily for the purpose of determining where to drill wells for process water. More recently, the hydrogeology of the SSFL has been extensively investigated by Rocketdyne subcontractors Hargis and Associates, Inc. in 1985 and Groundwater Resource Consultants Inc. (GRC) from 1986 to the present. This section provides a brief overview of the hydrogeologic conditions at the SSFL.

1.2.3.1 Geologic Formations

SSFL is located in the Simi Hills of eastern Ventura County, California. The Simi Hills are in the northern part of the Transverse Range geomorphic province and separates the Simi Valley from the western part of the San Fernando Valley. The Simi Valley is a broad east/west trending synclinal depression and the Simi Hills form the southern flank of the syncline.

The Simi Hills are exposures of the Upper Cretaceous Chatsworth Formation, which is a marine formation composed primarily of sandstone with interbedded shales and minor lens–shaped conglomerate. Exposures of the formation are characterized by massive sandstone beds, which dip to the northwest at approximately 20 to 30 deg. The Chatsworth Formation has well–developed fractures and joints in portions of the SSFL, and is overlain in some areas by a thin layer of discontinuous Quaternary alluvium, primarily in the Burro Flats area and along the ephemeral drainages. The alluvium in some areas may be as much as 20 ft thick. The alluvium consists of unconsolidated sand, silt, and clay. The topography of the site is characterized by a series of branching canyons in the eastern and central portion of the site and by the Burro Flats area in the western portion of the site.

The Tertiary Martinez Formation overlies the Chatsworth Formation northwest of the SSFL boundary and south of the Burro Flats Fault in the southwestern section of the Facility. It is composed of bedded marine sandstones and shales with a basal conglomerate. North of SSFL, the Martinez Formation dips to the northwest at approximately 30 to 35 degrees. The Tertiary Topanga Formation is exposed southwest of the Facility boundary. It is composed of bedded marine sandstone with a basal conglomerate. Both the Topanga and Martinez Formations weather to form slopes, while the Chatsworth Formation is a very resistant unit that erodes along fracture or fault traces.

A geologic map of the SSFL site is given in Figure 1–2, which shows topography as well as the known faults and fractures.

1.2.3.2 Water Bearing Formations

The water bearing formations under the SSFL are characterized by a shallow discontinuous groundwater system in the Quarternary alluvium and a deeper groundwater system in the fractured Chatsworth Formation.

The shallow groundwater system is present in the discontinuous pockets of alluvium and weathered sandstone which make up the Shallow Zone hydrogeologic unit. The Shallow Zone may be saturated along drainage channels (which contain water only during periods of rainfall) and in the southern portion of Burro

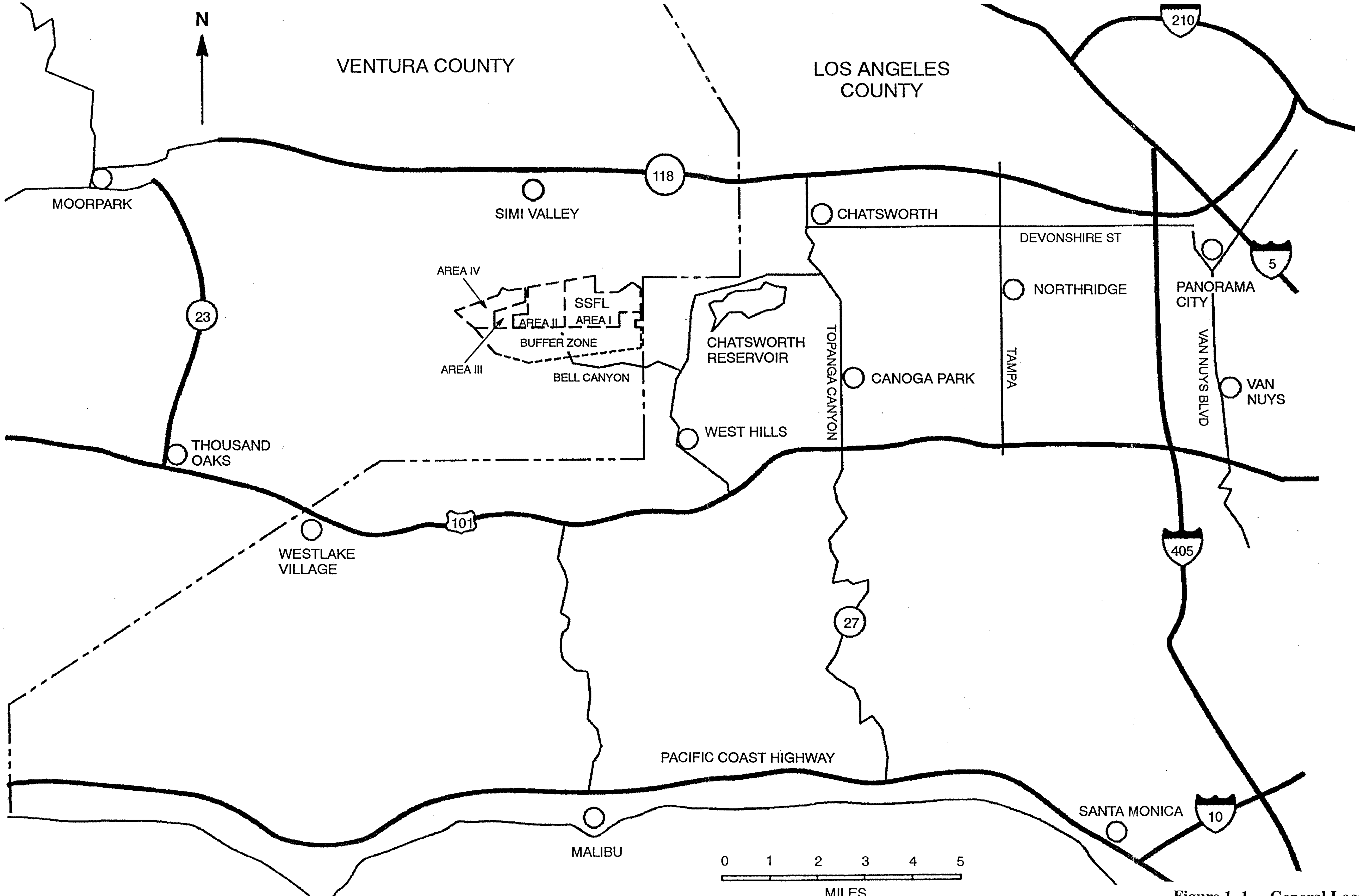

Figure 1-1. General Location of the Santa Susana Field Laboratory

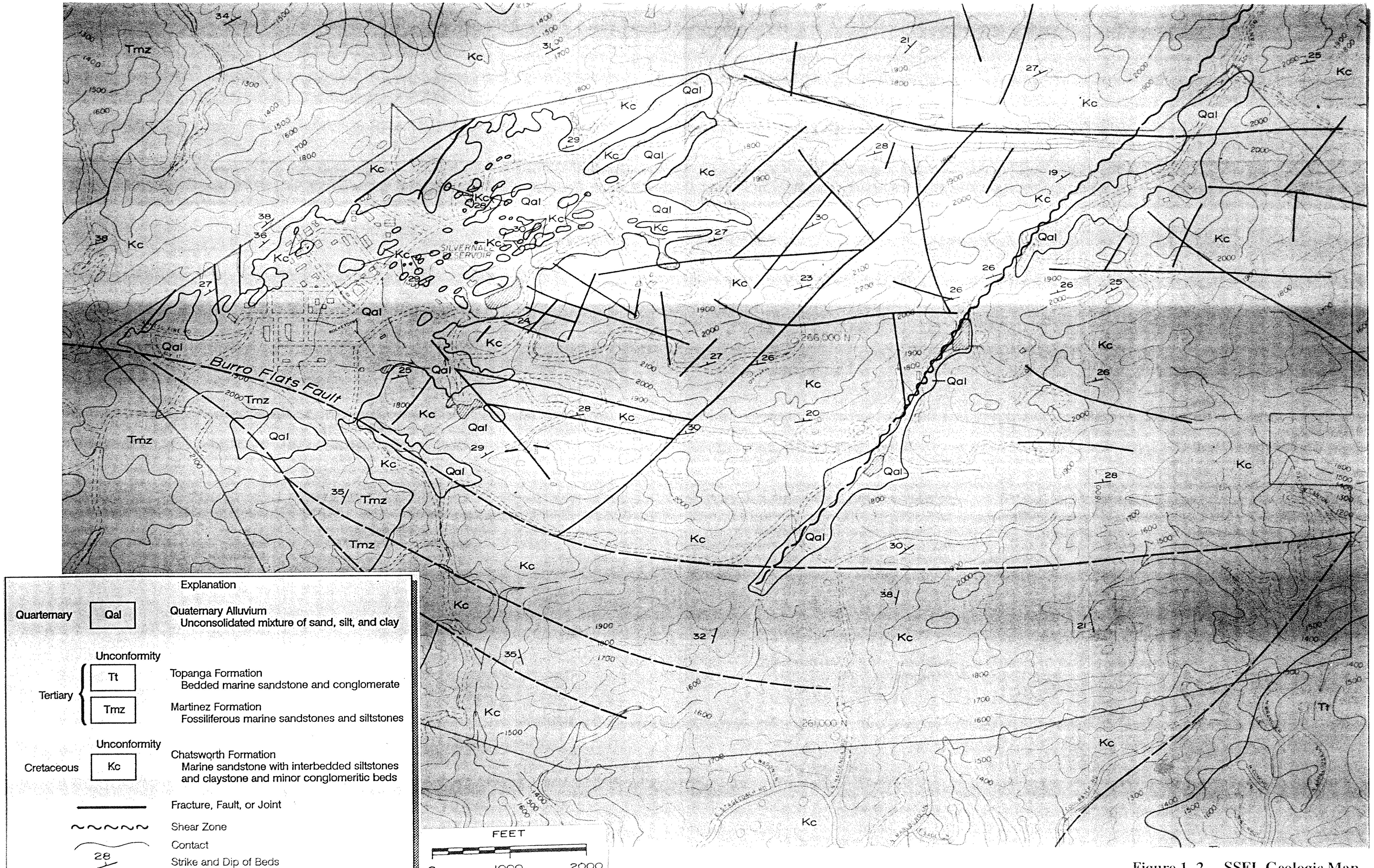

Figure 1-2. SSFL Geologic Map

Flats. Some portions are saturated only during and immediately following the rainy season. The saturated portion of the Shallow Zone may range in thickness from 0 to 10 ft. Groundwater in the Shallow Zone occurs under unconfined conditions. In general, the groundwater movement in the shallow system is a reflection of the topography, although the Shallow Zone is believed to be hydraulically connected to the deeper Chatsworth Formation in some locations.

The deeper Chatsworth Formation groundwater system is the principal water bearing formation and is associated with the fracture systems. The permeability of the unfractured Chatsworth Formation is reported to be very low. Groundwater movement is dominated by the flow through open fracture systems.

Groundwater in the Chatsworth Formation may occur under both confined and unconfined conditions, which is reflected in great variations in the depth to groundwater. The thickness of the Chatsworth Formation aquifer is unknown, although the Chatsworth Formation itself is at least 6,000 ft thick at a typical location.

Chatsworth Formation groundwater is pumped from supply wells. It is used at SSFL for industrial purposes. One of these supply wells (WS–7) is located in the northeast part of Area IV as shown in Figure 1–3. In the adjacent Runkle Ranch, a well 1/2–mi. southwest of Area IV supplies water for a small herd of cattle. Other wells exist which were used to supply ranching operations in the area prior to the beginning of SSFL activities. The smaller single well of this type in Area IV (northwest of the Sodium Reactor Experiment facility) has been formally abandoned in accordance with regulatory requirements. Such wells in adjacent areas are not used for water supply, but samples are collected to monitor their water quality as part of the SSFL groundwater program. The deepest water supply well at SSFL reaches to a depth of 2,304 ft below the ground surface. The depth of well WS–7 is 700 ft.

Groundwater levels in the Chatsworth Formation have been depressed in some wells as much as 150 ft since 1948 when groundwater extraction began. To offset diminishing groundwater supplies, some existing wells were deepened, industrial process water recycling was implemented, and water was imported from Calleguas Municipal Water District (CMWD) starting in 1964. From 1984 to 1988, CMWD water accounted for approximately 40% of the water used on–site. In 1991, less than 10% of the water used on–site was imported.

It was reported in 1984 that water from SSFL water supply wells contained trichloroethylene (TCE). TCE had been used extensively as a rocket engine degreaser in conjunction with engine testing. This use was in Areas I, II, and III. The areas of major groundwater contamination do not extend into Area IV, although some areas of organic solvent concentrations above regulatory units occur in Area IV groundwater (Section 4.1.1.3.2).

Before 1986, the majority of the groundwater extraction at the SSFL occurred from wells probably located along interconnected fracture systems. Heavy pumping through the 1950s and into the 1960s is believed to have led to the formation of a groundwater depression in the central portion of the facility. Several groups of wells are now being pumped extensively for the groundwater remediation program. Significant pumping depressions are believed to have influenced the direction of groundwater movement east of Area

IV. The pumping–induced depressions appear to have prevented the off–site migration of groundwater in some areas. Figure 1–3 shows the extent to which pumping has influenced groundwater elevations.

1.2.4 Surface Water

The natural surface water features at the SSFL consist of ephemeral drainages. Approximately 90% of the surface runoff flows south into Bell Creek drainage. Bell Creek eventually discharges to the Los Angeles River which drains to the Pacific Ocean at Long Beach. The remaining 10% flows to the canyons north and northwest of the SSFL and eventually to Calleguas Creek, which drains into the Pacific Ocean at Point Mugu. The surface drainage ways and surface water divides are shown on Figure 1–4 (note that the Chatsworth Reservoir, shown in that figure, has been dry since 1971). No naturally occurring perennial surface water features (lakes, streams, or rivers) exist on or within 1 mile of SSFL. Natural surface water flow off–site is minimal except during heavy rains. The majority of the surface water is captured in a series of surface water retention ponds from which the water is reclaimed. The reclaimed water is pumped to storage tanks and is used for various industrial purposes.

The R–2 ponds (2.6–million gal capacity) receive waters from other Rocketdyne operations, as well as Area IV rainfall, discharges from operations in Area IV, and the wastewater treatment unit that serves Areas II, III, and IV. Water is pumped back to the Reclaimed Water System tanks from R–2A. Excess water is discharged continuously from R–2A to Bell Creek at a rate determined by reclaimed water usage and wastewater generation. Release rates range from 100,000 to 300,000 gal/day, with a peak rate over 1–million gal in a day that had heavy rainfall. The pond water is sampled for analysis and released in accordance with a National Pollution Discharge Elimination System (NPDES) permit to ensure water quality limits are not exceeded.

1.2.5 Climate

The climate of the SSFL falls within the Mediterranean subclassification of a subtropical–type climate. Monthly mean temperatures range from 50°F during winter months to 70°F during summer months. The annual mean precipitation is 18 inches, with 95% of the total falling between November and April. Precipitation is normally in the form of rain, although snow has fallen during winter months. From April through October, a consistent landward wind pattern develops from the unequal heating of the land mass and adjacent ocean. These northwest daily winds range from 5 to 10 knots and occur between noon and sunset. From November to March this wind pattern is interrupted by the passage of weather fronts.

1.2.6 Demographics

The demographics of the immediate area surrounding the SSFL site are illustrated in Figures 1–5, 1–6, and 1–7. These figures show local population distribution estimates determined from the 1990 federal census. The estimates are used for calculations of general population radiation dose estimates (Section 4.2).

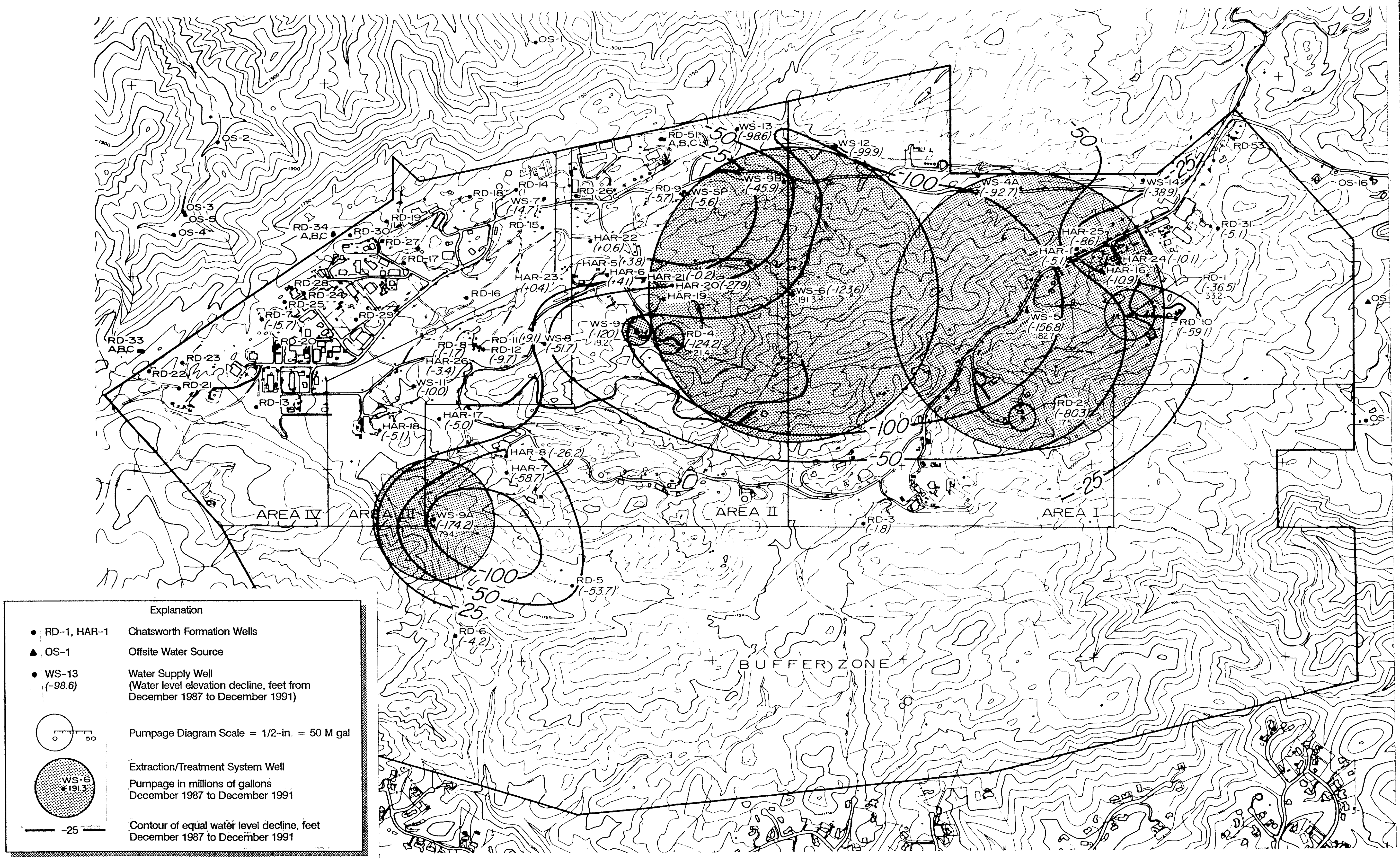

Figure 1-3. Water Level Decline and Pumpage (Chatsworth Formation Groundwater System) (1987 through 1991)

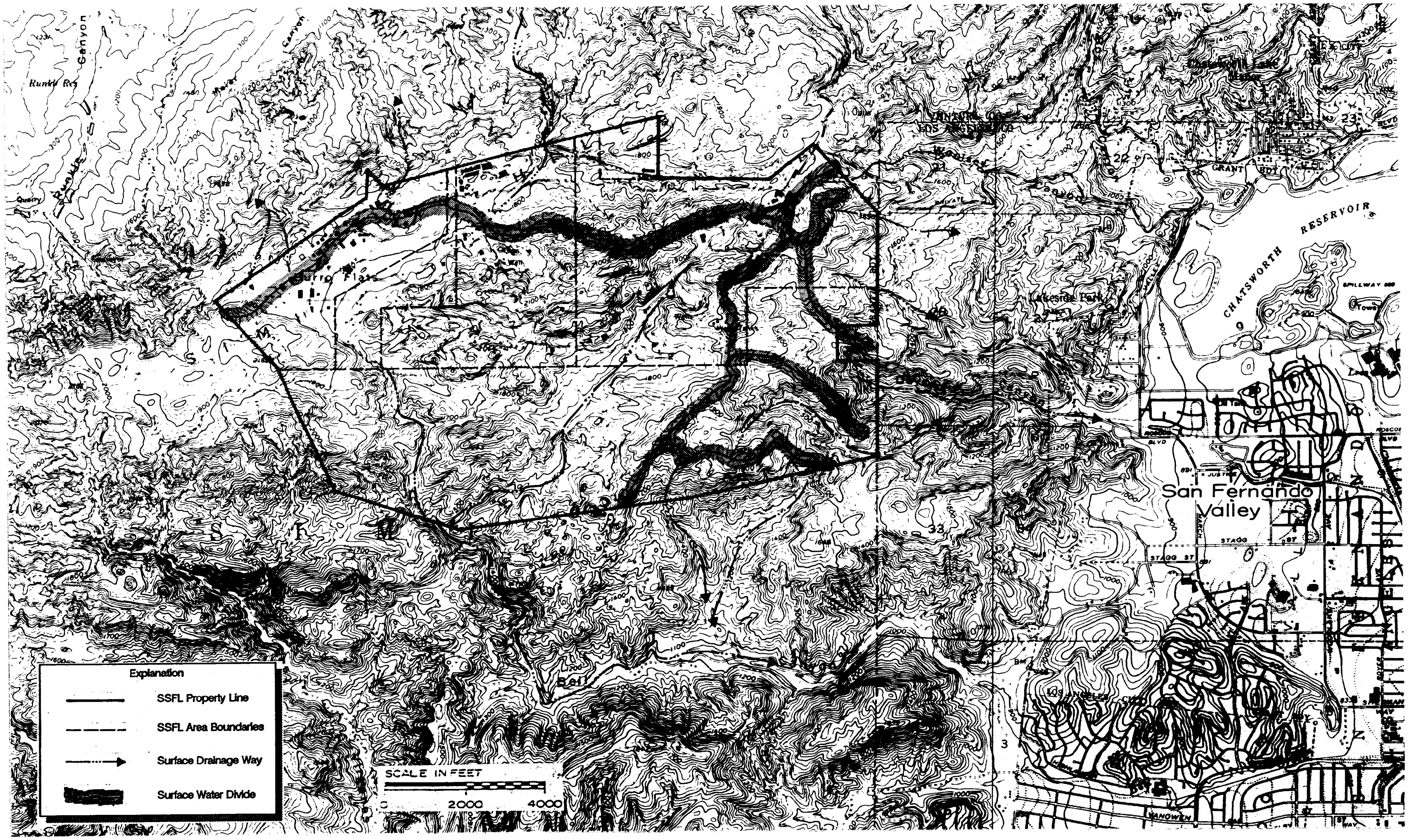

Figure 1-4. Surface Water Features

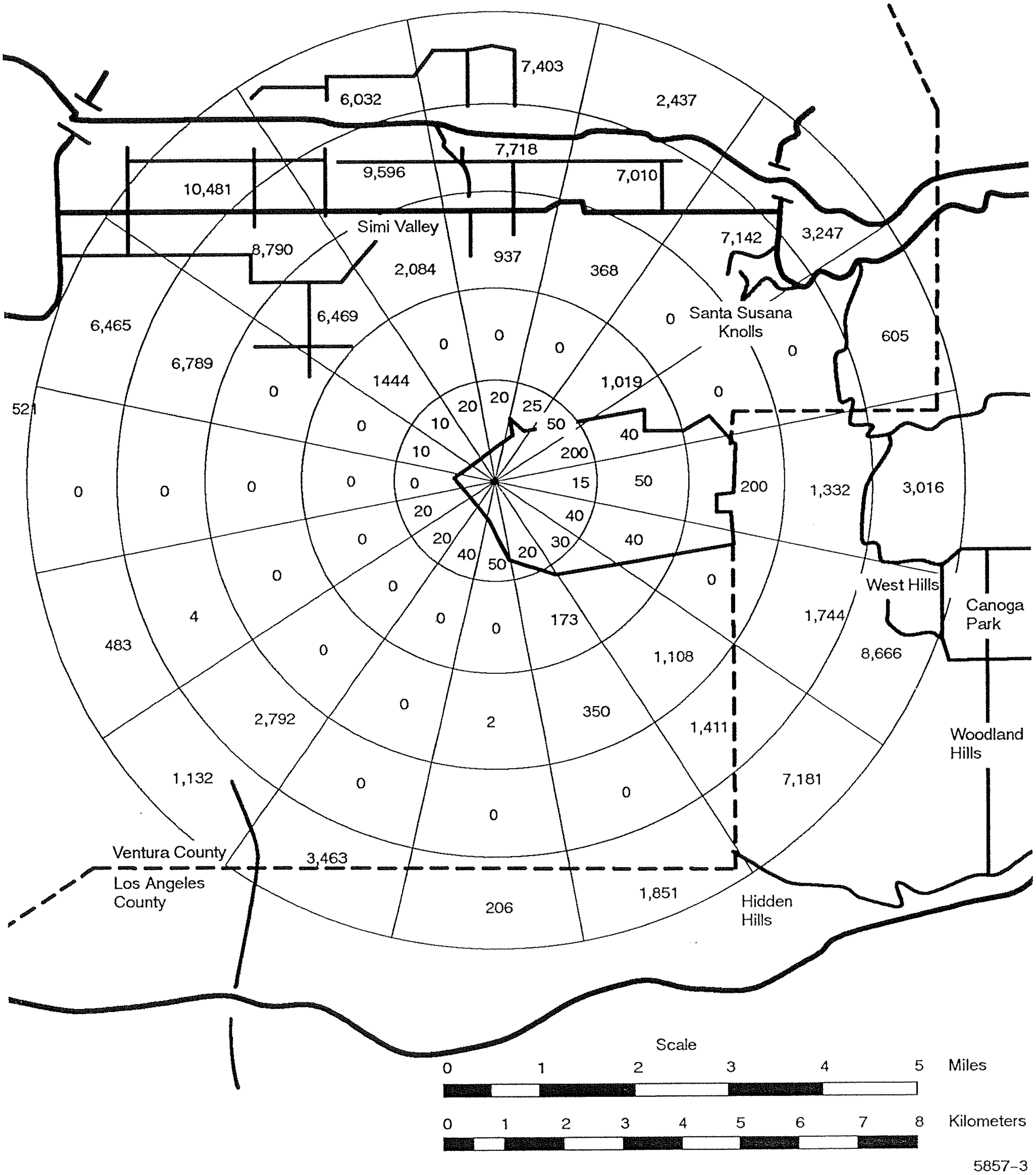

Figure 1-5. SSFL Site-Centered Demography to 8 km, Showing Number of Persons Living in Each Grid Area (Numbers within SSFL boundary indicate daytime employment.)

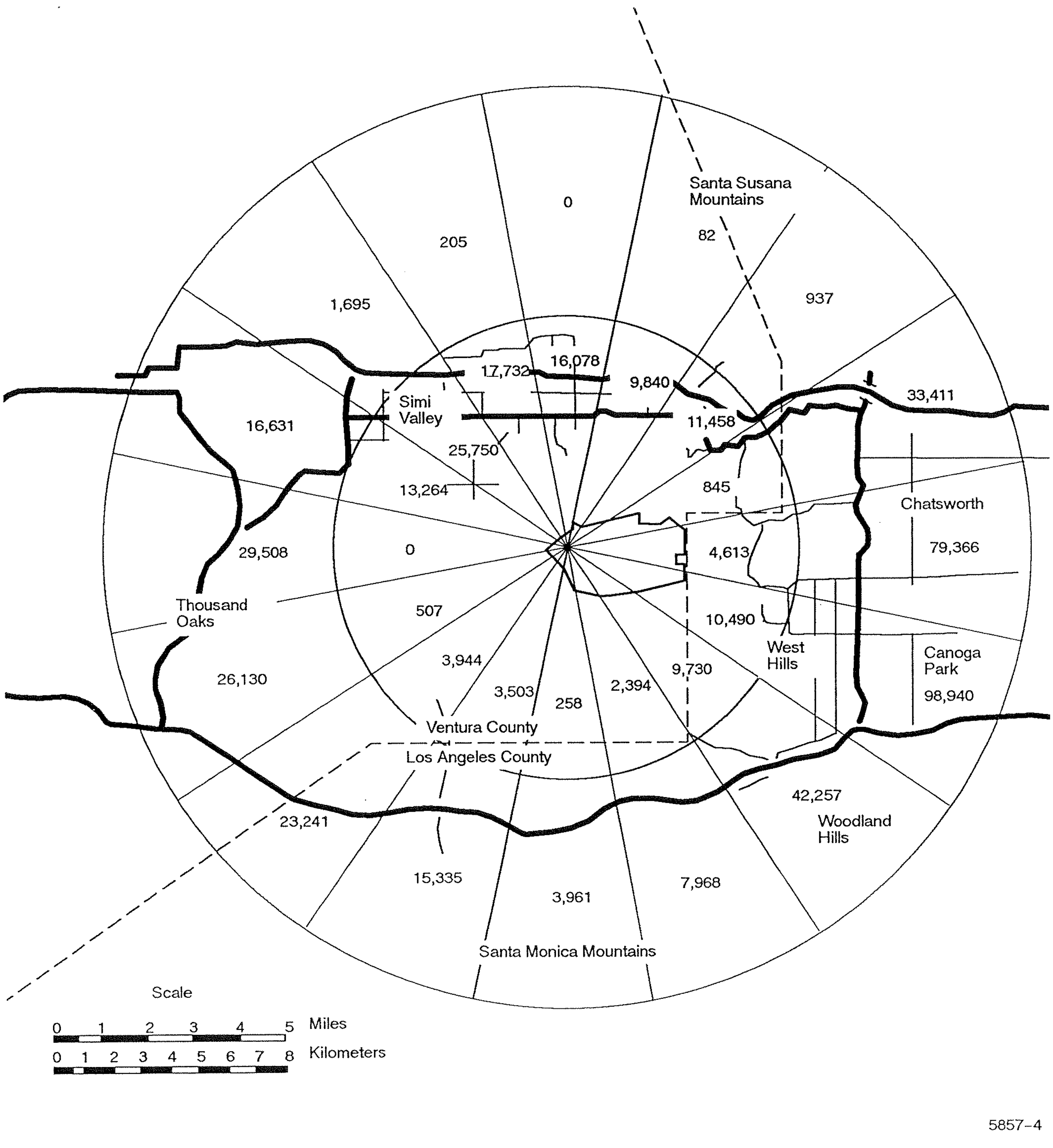

Figure 1-6. SSFL Site-Centered Demography to 16 km, Showing Number of Persons Living in Each Grid Area

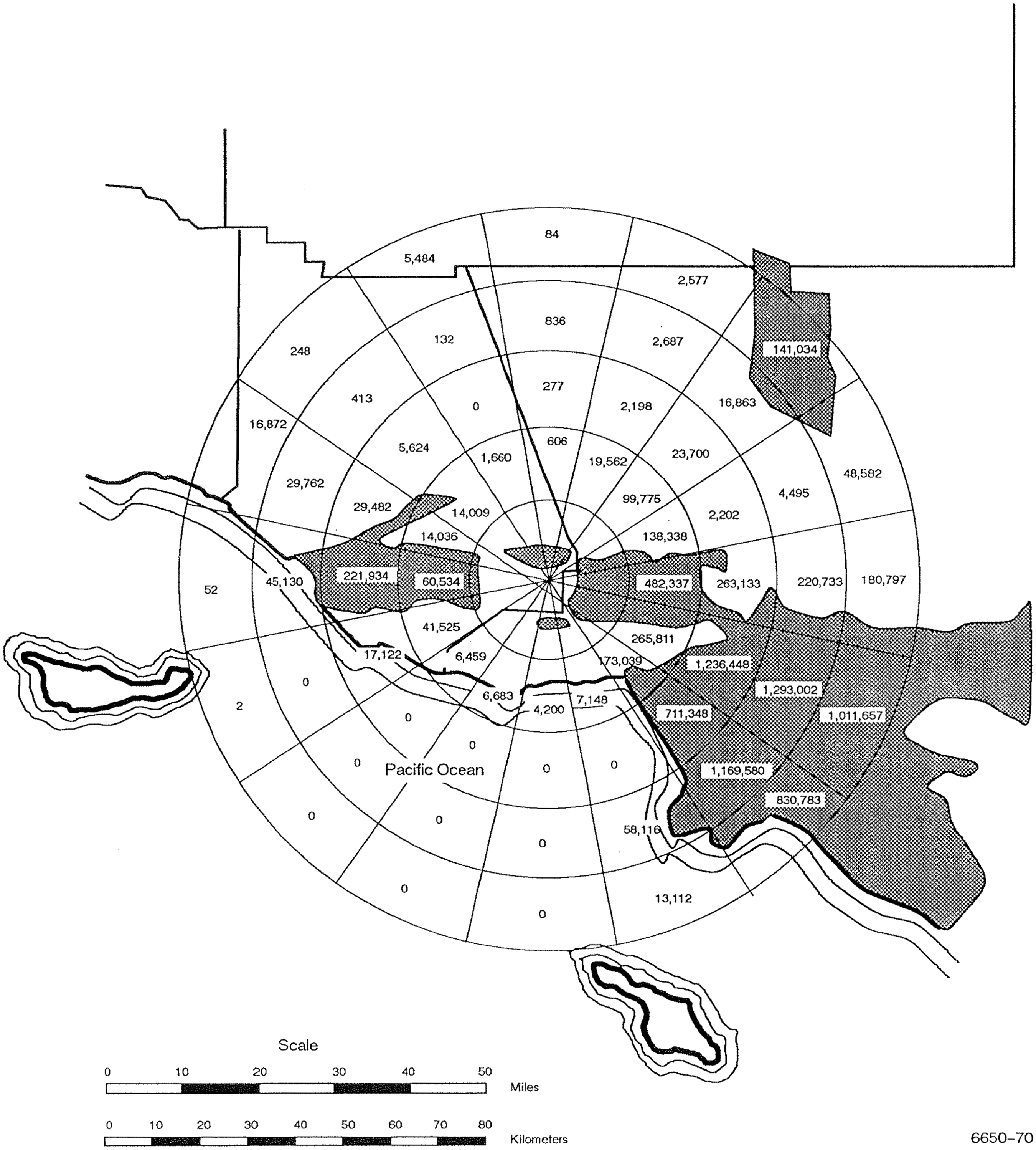

Figure 1-7. SSFL Site-Centered Demography to 80 km, Showing Number of Persons Living in Each Grid Area (heavily populated areas are shown by shading)

1.3 PROGRAM MANAGEMENT

The Rockwell management structure responsible for operation of the Energy Technology Engineering Center (ETEC) and for environmental support is shown in the organization charts (Figures 1–8 through 1–10) on the following pages. The office of Rocketdyne vice president, Environment, Health, Safety and Facilities, reporting directly to the president of Rocketdyne, was recently created reflecting Rocketdyne's increased emphasis on environmental protection. This organization incorporated existing environmental protection organizations to provide a coordinated, focused responsibility for environmental issues. It supports ETEC, and other Rocketdyne operations at SSFL and other locations, in environmental disciplines (facility and site environment characterization, environmental surveillance, effluent monitoring, and regulatory agency interfacing). Both the Environmental Protection director and Radiation Protection and Health Physics Services (RP&HPS) manager report directly to the vice president, as do the offices of Environmental Affairs and the Environmental Toxicologist. The primary, although not exclusive function of the SSFL Analytical Chemistry Lab is to support the Environmental Protection Department.

The general manager, ETEC, reports to the Rocketdyne Advanced Programs vice president. ETEC programs are now the major activities being conducted in Area IV. Environmental protection at ETEC is administered in accordance with ETEC Procedure 1-20, Environmental Protection Program, and is supported by the Environmental Protection director. Administration of support activities is contained in the

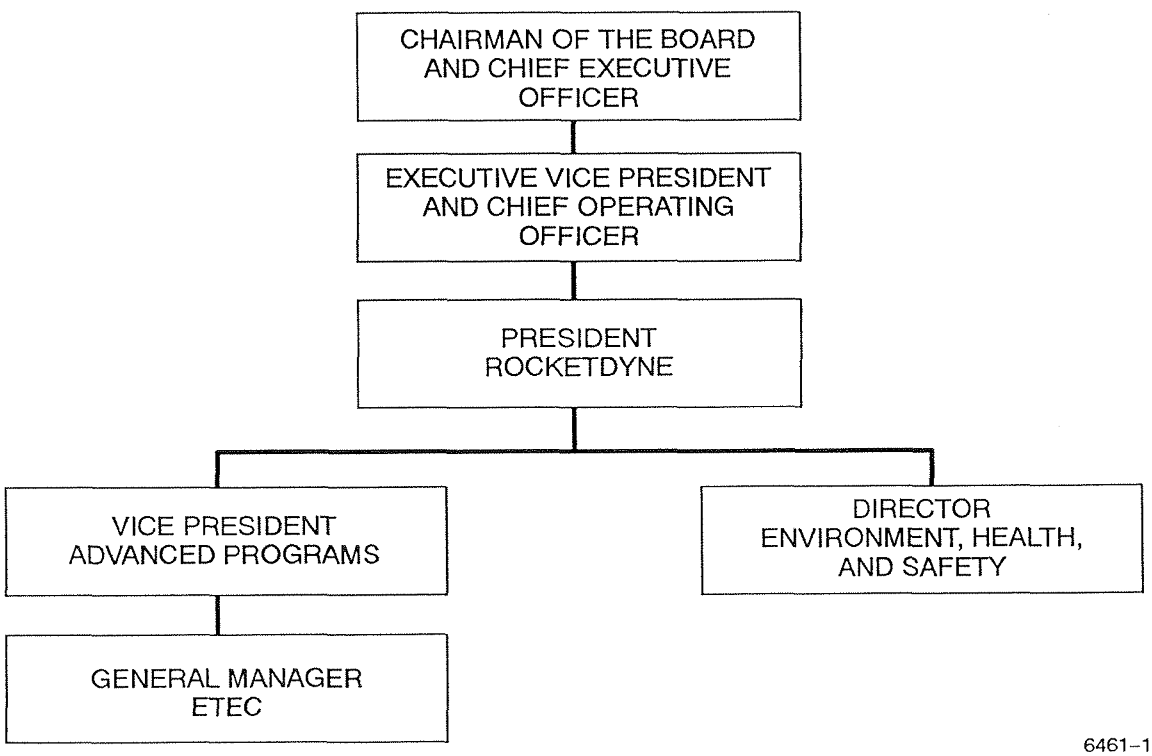

Figure 1-8. Rockwell International/Rocketdyne Organization

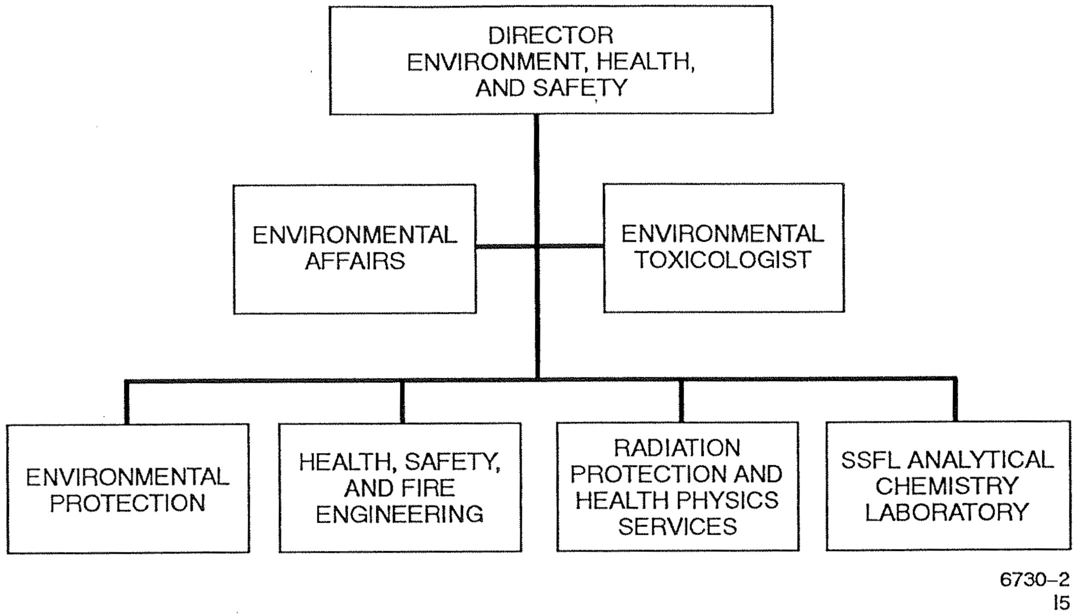

Figure 1-9. Rocketdyne Environment, Health, and Safety Organization

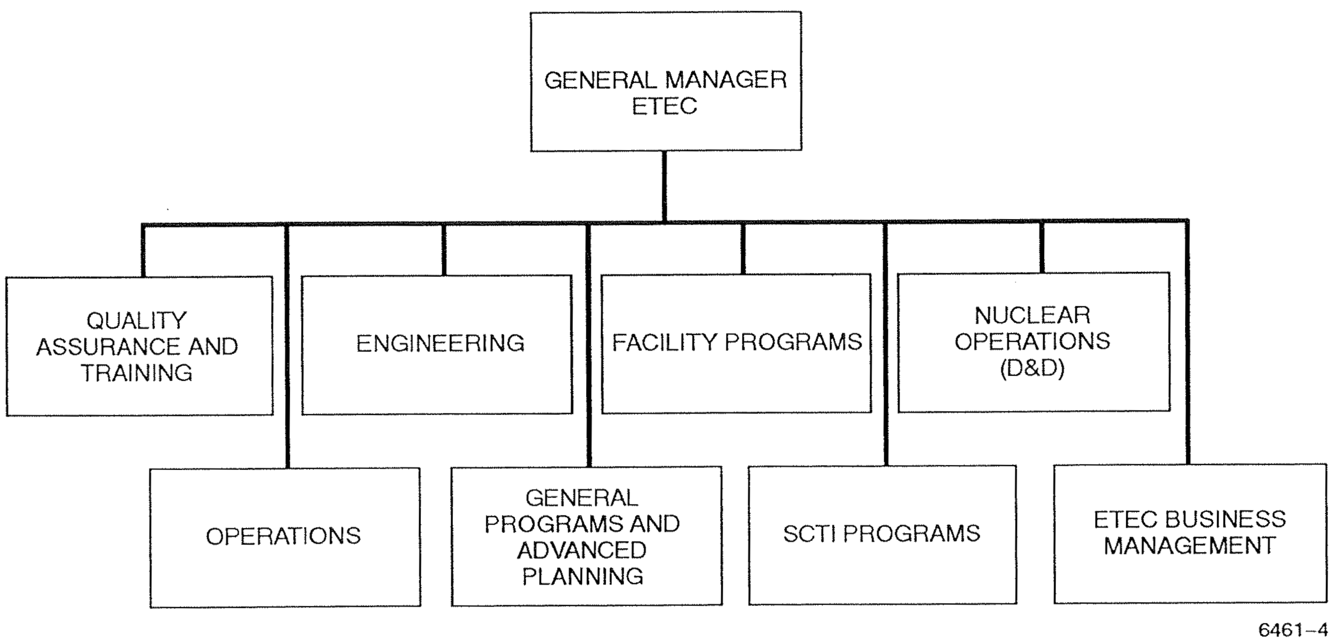

Figure 1-10. Energy Technology Engineering Center Organization

Rocketdyne Environmental Control Manual and in the Rocketdyne Health, Safety and Environment Procedures Manual. The Environmental Restoration and Waste Management program manager (shown on Figure 1-10 as Facility Programs) provides program direction and funding to maintain compliance.

The Quality Assurance and Training manager, who reports to the ETEC general manager, has responsibility for all Quality Assurance (QA) activities supporting DOE programs. The ETEC Environment, Safety and Health (ES&H) coordinator maintains proficiency with environmental regulations, DOE Orders, and company procedures; and together with the Environmental Protection group is responsible for reviewing practices and documentation and advising the program manager accordingly.

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2.0 History and Status of Area IV Operations at SSFL

2.0 HISTORY AND STATUS OF AREA IV OPERATIONS AT SSFL

Shortly after the passage of the Atomic Energy Act in 1946, North American Aviation, Inc. (NAA) began to investigate business opportunities in the peaceful uses of atomic energy. In the meantime, NAA had purchased a large tract in the Simi Hills, primarily for the purpose of testing rocket engines. This tract became the Santa Susana Field Laboratory (SSFL). When the Atomics International Division (AI) of NAA was formed in 1955, a remote site was needed for nuclear reactor development and testing. AI took over the portion of SSFL that is now designated as Area IV. In the early days, the AI portion of the field laboratory was often called the Nuclear Development Field Laboratory (NDFL). In 1966, NAA and Rockwell merged to form North American Rockwell Corporation. The name of the corporation was later changed to Rockwell International, Inc.

In the late–1950s, AI activities at SSFL were primarily sodium–cooled nuclear power plant development. The major focus of this activity was the construction of a sodium–cooled nuclear power plant at the SSFL called the Sodium Reactor Experiment (SRE), which was in operation until 1964. A space power program called Systems for Nuclear Auxiliary Power (SNAP) grew into an experimental program in 1957, culminating in the launching of a SNAP reactor into orbit on April 3, 1965. The SNAP program was very large, employing the bulk of the peak 3,800–person labor force at AI at the time.

In 1966, the Liquid Metal Engineering Center (LMEC) was organized at Area IV by the Atomic Energy Commission (AEC) to perform developmental work with liquid metals (primarily sodium) as heat transfer media for advanced nuclear reactors. The LMEC was operated by AI for the AEC, so that Area IV was shared by AI and LMEC. The LMEC developmental work consisted of nonnuclear testing of components. All nuclear operations and special–purpose SNAP facilities were retained by AI. In 1978, the charter of the LMEC was expanded to cover general energy–related technology (e.g., solar and geothermal energy) and it was renamed the Energy Technology Engineering Center (ETEC). About the same time, AI was reorganized and renamed the Energy Systems Group (ESG). In 1984, ESG (including ETEC) was merged into the Rocketdyne Division of Rockwell International. Rocketdyne now operates all parts of SSFL.

By the mid–1970s, operations had ended at all nuclear reactors and most other nuclear facilities; LMEC nonnuclear work then dominated Area IV. The first integrated nuclear facilities decontamination and decommissioning (D&D) plan for Area IV was released in January 1975. The plan covered eight facilities, primarily (1) the SRE and associated facilities and (2) old facilities associated with the by–then–discontinued SNAP programs. Also, as environmental concerns developed, tasks to treat and dispose of nonradioactive hazardous wastes were added to the remediation plan.

The last nuclear fuel materials were shipped from the site in May 1989. In October 1989, the Nuclear Regulatory Commission (NRC) Special Nuclear Materials License was amended to permit only a minor amount of nuclear material for research purposes. Since then, the license has been further amended to permit only decommissioning operations. The location of sites where nuclear activities were carried out is shown in Figure 2–1.

2.1 NUCLEAR FACILITIES

2.1.1 Nuclear Reactors

In the early 1960s, with the activation of several SNAP facilities together with the experimental facilities in support of power plant programs, AI had the following operating reactor facilities in Area IV:

- Sodium Reactor Experiment (SRE) – Building 143 (Facility support buildings included Buildings 041, 163, and 654)
- SNAP 8 Development Reactor (S8DR) – Building 059
- Kinetics Experiment Water Boiler Reactor (KEWB) – Building 073
- L–85 (AE–6) Research Reactor – Building 093
- SNAP Experimental Reactor (SER), later replaced by the SNAP 8 Experimental Reactor (S8ER) – Building 010
- SNAP–2 Developmental Reactor (S2DR) and the SNAP–10 Flight Simulation Reactor (S10FS3) – Building 024
- Shield Test Reactor (STR), later modified to become the Shield Test and Irradiation Reactor (STIR) – Building 028.

None of these reactors were operated after the mid–1960s. A further description and operating history is given in Reference 2–1.

2.1.2 Criticality Tests

Various critical assembly tests (self–sustaining neutron chain reactions, but with no heat generation) were conducted in Buildings 009, 012, 019, 100, and 373.

2.1.3 Radioactive Material Handling Facilities

The other facilities at which nuclear materials were handled are the following:

- Rockwell International Hot Lab (RIHL) – Building 020
- The Radioactive Materials Disposal Facility (RMDF) – Buildings 021, 022, 075, and 621
- Engineering Test Building (ETB) – Building 003
- Nuclear Materials Development Facility (NMDF) – Building 055
- Uranium Carbide Fuel Fabrication – Building 005
- Nuclear Fuel Storage Vault – Building 064.

A further, more detailed description of these facilities is included in Reference 2–1.

2.1.4 Other Nuclear Facilities

Building 030 was a particle accelerator facility. A Van de Graaf accelerator using a tritium target was used from 1960 through 1964. Contamination from the target was removed, and the facility was cleared for other uses. The building is now used for offices and warehousing.

Building 626 is used mainly for nonnuclear materials; however, palletized barrels of neutron–activated sand from Building 059 were stored in the adjacent fenced yard in 1978. There was no release of radioactivity from the barrels.

2.2 NONNUCLEAR FACILITIES

2.2.1 Sodium Disposal Facility (Bldg 886 and Associated Area)

The former Sodium Disposal Facility was used to clean sodium (or NaK) from components. The facility consisted of a large, rectangular, concrete-lined pit filled with water, and surrounded by a concrete pad, plus two water-filled basins, a small building (now designated as Building 886), and steam lance cleaning equipment. The facility was also used in the 1960s to dispose of combustible wastes such as oils by burning the waste in the atmosphere. By the late 1970s, the Facility was no longer in use, having been replaced by the Hazardous Waste Management Facility (HWMF).

The Los Angeles Regional Water Quality Control Board served Rocketdyne with a Toxic Pits Cleanup Act (TPCA)-authorized cleanup and abatement order for the Building 886 lower pond on 30 April 1991. Following the removal of over 7,000 yd^3 of soil from the lower pond, the RWQCB officially closed the lower pond under TPCA on 28 December 1992.

The California Environmental Protection Agency (Cal–EPA) now has jurisdiction for the closure of the facility as a Solid Waste Management Unit (SWMU). Closure activities are governed by a project management plan (Ref. 2–2) and a closure plan (Ref. 2–3). Rocketdyne has removed soils suspected of being contaminated from the facility upper pond and western areas. A systematic soil sampling for chemical and radiological contamination will be completed in 1994. Chemical and radioisotope levels within regulatory limits will support SWMU closure. If higher levels are found, a health–based risk assessment will be done to support SWMU closure or indicate the need for further remediation.

2.2.2 Hazardous Waste Management Facility (Bldgs 029 and 133)

The HWMF consists of two buildings (029 and 133). Building 029 is currently used as the alkali metal waste storage building; Building 133 is the treatment building where alkali metals (primarily sodium) are disposed of by thermal reaction. External to Building 133 is a scrubber, reaction products (primarily sodium hydroxide) discharge tank, and a larger hydroxide storage tank. The scrubber removed hydroxide entrained in the burn room air before its exhaust to the atmosphere. Its operation during reaction of alkali metals is required as a facility operating condition by the Ventura County Air Pollution Control District (VCAPCD) permit to operate. It is a wet scrubbing system consisting of a venturi scrubbing section (in which exhaust air passes through a water spray which removes the hydroxide), separator section, and water recirculation system. The system is 97.5% efficient at 5,000 scfm with 35 in. of H_2O internal pressure drop. Flow through the scrubber is maintained by an up–blast discharge fan with a capability of 5,000 scfm. After thermal reaction, alkali metal hydroxide solutions are shipped off–site to a certified disposal facility or used in chemical processes within Rocketdyne. The facility operates under a Cal–EPA Department of Toxic Substance Control (DTSC) Resource Conversation and Recovery Act (RCRA) permit.

The HWMF was activated in 1978 and has operated intermittently since. Several hydroxide spills have occurred during operation of the facility. Operations at Building 133 were temporarily halted in April 1987 to replace the single–wall sodium hydroxide tank with a double–wall tank. Soil samples collected from under the tank indicated high pH, indicative of sodium hydroxide contamination. The DHS was notified, and with their concurrence, the contaminated soil was removed and transported off–site for disposal. As a result of these findings, Rocketdyne contracted GRC to characterize shallow subsurface conditions in the vicinity of Building 133, and wells drilled in the vicinity have become an integral part of the groundwater monitoring program.

2.2.3 Sodium Components Test Installation (Bldg 356 and Associated Buildings)

The major test facility now operated by ETEC is the Sodium Components Test Installation (SCTI), a sodium–heated steam generator test facility. Construction of the SCTI was completed in the early 1960s. The facility was then rated at 35 MWt and the sodium was heated by a natural gas–fired heater referred to as H–1. In 1975, the facility heating capacity was expanded to 70 MWt by adding a second natural gas–fired heater (H–2). Stack emissions from the two gas–fired heaters have been monitored by in–stack continuous emission monitors (CEMs) for NOx and CO to verify compliance with VCAPCD regulations. In 1990, both heaters were retrofitted with low–NOx burners. Tests were completed in 1992 to demonstrate compliance with the VCAPCD rules.

Water from the SCTI cooling tower (E–5) is discharged through the storm drain system to the R–2 ponds. A continuous blowdown is maintained at a rate controlled to maintain conductivity (indicator for total dissolved solids) and sulfates within process and NPDES discharge limits.

In 1986, construction was begun on a cogeneration plant (Power Pak) near SCTI using steam from the SCTI boiler to generate electricity, which is transmitted to Southern California Edison. Power Pak operation was inaugurated in 1988. Water from the cooling tower at Power Pak was originally discharged to the R–2 ponds; however, addition of an ozonator has allowed water recirculation and eliminated the need to discharge water from this cooling tower. The water is sampled and analyzed three times per week for pH, conductivity, chlorides, sulfates, hardness (calcium carbonate), and total dissolved solids. Spent (high salt) water is removed by truck by a contractor for process use.

An auxiliary cogeneration plant rated at 3.2 MWe has recently been added to the SCTI. The Kalina Demonstration Plant uses exhaust gas from SCTI heater H–1 to heat ammonia solution as the working fluid. A trench and sump were constructed to contain the ammonia at the site in the event of a spill or leak. All relief valves are vented into a common header, which directs any vented ammonia vapor into a water–filled tank. The water scrubs the ammonia from the vent system. There is also an external ammonia detection system with an alarm.

2.2.4 Process Development Unit (PDU) – Molten Salt Coal Gasification (Bldg 005)

The molten salt gasification plant near Building 005 was designed and operated by Rockwell for DOE to demonstrate the technical feasibility of producing sulfur–free, low Btu product gas by partial combustion of Illinois No. 6 coal in a sparged bed of molten, sodium carbonate salt. Make–up salt, together with coal, was continuously fed to a refractory lined combustion vessel, and a small stream of the molten salt bed was continuously removed and water quenched to control the concentration of absorbed sulfur and ash. The product gas was ducted out of the vessel to an aqueous particulate scrubber/cooler and then burned in a waste gas incinerator. The quenched salt, which contained sulfur and ash from the coal, formed a "green liquor" similar to that formed in a Kraft paper mill. This liquor (a 2 to 3 gpm stream) was filtered and then processed to regenerate sodium carbonate for recycle to the gasifier. The facility was first started in November 1978 and was operated for a total of nine test runs until final shutdown in June 1981. The total operating time was approximately 1,500 h at an average coal feedrate of 0.25 tons/h. After testing, the aqueous plant equipment was flushed with clean water to remove green liquor and salt residues, and all bulk quantities of sodium carbonate and coal were disposed of off-site. In 1991, a commercial demolition company completed disposal of all plant equipment and foundations and returned the site to its original condition.

2.2.5 Molten Salt Test Facility (Bldg 005)

The Molten Salt Test Facility (MSTF) was a general-purpose molten salt combustion pilot plant built in 1973 in Building 005 to permit investigation of new and novel processes using engineering scale equipment. Testing was concluded at the facility in July, 1986. Over the years the facility was utilized, approximately 25 test campaigns were conducted for a total of about 1,000 h of operation. Testing was done under contract to the DOE, the Environmental Protection Agency (EPA), and the Department of the Navy in addition to Rockwell-funded independent research and development (IR&D) projects. Analysis of residual salts remaining in the main combustion vessel show some trace concentrations of heavy metals.

2.2.6 Low NOx-SOx Burner (Bldg 005)

The low NOx-SOx burner (LNSB) was built at the north edge of the Building 005 site in 1982 to investigate the possibility of burning high sulfur coal with reduced emissions of NOx and sulfur dioxide. The unit was operated intermittently until 1988 when all testing efforts were stopped. A total of 48 test runs were completed during this period. A test run was typically 6 to 9 hours in duration. The unit was capable of burning coal at rates up to 1 ton/h. The site has been partially remediated by removing bulk quantities of coal and fly ash and securing the hardware. Using a large water softener at the facility resulted in routine discharges of regeneration brine to the natural water course ending at the R-2 ponds. Blow down from the facility waste heat boiler was directed to the SSFL sanitary treatment plant.

2.2.7 Other Nonnuclear Facilities

Many buildings and facilities have been constructed in Area IV for the programs that have been carried out there, as indicated in Figure 2-1. This section describes those that do not contain nuclear activities, but whose activities involved hazardous materials. Buildings that contained neither nuclear nor hazardous materials (e.g., offices) are not addressed, since monitoring is not needed for them.

2.2.7.1 Small Test Loops

Starting as early as 1953, Area IV has had numerous alkali metal test loops (sodium, sodium/potassium, lithium) as well as a few molten salt loop operations. Also, extensive test programs were conducted to characterize alkali metal/water reactions. A spray calciner was operated in the late 1980s to prepare superconductor precursor powder (thallium, barium, copper, calcium). In general, all alkali metals, various salts used in molten salt processes, and the superconductor precursor were contained within buildings; therefore, these operations were/are unlikely to provide measurable contamination external to the buildings.

Table 2–1 provides a listing of the various loops and other related test installations, the facilities in which they were housed, and their status. The largest of the sodium test loops is the Sodium Pump Test Facility (SPTF).

Table 2–1. Miscellaneous Nonnuclear Operations in Area IV

Building No.	Type of Operation	Status
003	5 Na loops	Operated 1953–1958
003 Annex	4 Na and NaK loops	Discontinued in early 1960s
006	4 Na and NaK loops	1959–1992 (one still in operation)
007	Na storage	No longer used for Na storage
010	NaK loop	Operated in early 1960s
013, 019, 057	NaK closed loops	Discontinued in 1960s
023	NaK loop	Operated in early 1960s
026	Small components test loop	On standby
032	Na loops	Operated from 1970s through late 1980s; presently on standby
057	Na and Li loops	Operated in the 1980s; presently on standby
059	Na–H_2O reaction studies	Operated late 1960s to early 1970s
353	Na testing	Discontinued in late 1960s
462	Na loop (SPTF)	On standby
005	Spray calciner	Ceased operating in 1990

2.2.7.2 SNAP Support Buildings

Several buildings were used for nonnuclear activities that were part of the SNAP program. Two of these buildings (Bldgs 013 and 032) are listed in Section 2.2.7.1 as containing small test loops. Other SNAP support buildings were Buildings 025, 027, 042, 375, and 626.

2.2.7.3 Building 056 Excavation and Landfill

An excavation was made for construction of a building designated as Building 056. Although the building was never built, the excavation remains and retains water the year around. The area designated as the Building 056 landfill is located adjacent to the excavation approximately 300 ft west of Building 059. The soil excavated for the planned building was discarded there. Soil from other ETEC construction projects was also discarded there. The area was also used for disposal of general nonradioactive waste materials. During 1980 and 1981, 89 barrels which had been stored there, were removed and sent to hazardous waste disposal sites. Analysis by the ETEC Chemistry Laboratory indicated that the barrels contained such materials as oils, alcohols, sodium and sodium reaction products, grease, phosphoric acid, and asbestos.

2.2.7.4 Building 023

Building 023 housed a NaK piping loop during the SNAP program and was later used to study transport of activated elements in sodium.

2.2.7.5 Conservation Yards

The Old Conservation Yard, where used piping and components were held for salvage, was found in 1988 to be slightly contaminated with radioactivity in a corner of the yard once used as a barrel storage yard. This location is a local low spot where rainwater collects. Since radiation exposure rates were found to be three times normal background at this location, it is suspected that a small radioactive spill somewhere in the yard was concentrated there. The area was cleaned up and is now suitable for unrestricted use.

A diesel oil spill occurred in 1982 in a part of the Old Conservation Yard which had been converted to an oil tank farm. The oil was removed from the surface, but local hydrocarbon contamination of soil was measured in 1988. Initial excavation for remediation has been done, but completion is awaiting further study (site characterization and remediation study).

The New Conservation Yard, located across the road to the south of the Old Conservation Yard, has had no indications of contamination.

2.2.7.6 Burro Flats Area IV Borrow Site

An undeveloped area in the southern portion of Area IV was used as the source of soil for backfilling surface impoundments in Area II following removal of contaminated soil (Ref. 2–4). The area, referred to as the Burro Flats Area IV Borrow Site, is located in the southwestern part of Zone H–10 in Figure 2–1 (Ref. 2–5).

2.2.7.7 Building 100 Trench

From 1960 to 1966, a trench near Building 100 was used for the burning of construction debris and possibly other combustible substances. The site has been filled in and part of the area has been paved. Hydrocarbon contamination was found in the soil in 1988. The area will be investigated as part of the Area IV characterization to determine the need for monitoring or remediation.

2.2.7.8 Southeast Drum Storage Yard

Drums of unknown origin were stored in this location (southeast section of Area IV) in the early 1960s. No information is available on the contents of these drums, which were removed from the site about 30 years ago.

2.2.8 Miscellaneous

Two radioactive items have been lost during operation of the SSFL: (1) A radioactive source, containing 1.57 mCi of ^{90}Sr was missing from the Hot Lab in 1986. An investigation concluded that it was inadvertently included in radioactive waste during a cleanup, and shipped off–site and disposed of as radioactive waste. (2) In the 1960s, during tests to determine the depth to which falling simulated radioisotope heat sources would penetrate the soil, a 1 kg depleted uranium slug was lost after being dropped from a helicopter. Despite several searches, the slug was never recovered. There is only about 1 mCi of radioactivity in the uranium and radioactive decay products.

Two noteworthy spills of dilute radioactive liquids occurred at RMDF. The first was an accidental diversion of radioactive liquid into the adjacent sanitary system septic tank leach field. The valve that connected the radioactive system to the leach field has been removed and the leach field has been cleaned up and released for unrestricted use. The second spill was from the flocculation tower, which overflowed and spilled some liquid down the north slope of the RMDF perimeter. This spill was also cleaned up, but small amounts of soil contamination remain.

Using cleaning solvents such as trichloroethylene, perchloroethylene, and trichloroethane was a common practice in Area IV operations in the early years. The use of trichloroethylene and perchloroethylene has been virtually eliminated and handling practices have changed. The use of trichloroethane continued in small machine shops and in assembly and construction areas. These and other organic solvents have been identified as groundwater contaminants in recent monitoring tests.

Many 55-gal drums of Dowanol, an organic solvent (glycol ether and methoxy propanol) used for cleaning sodium from components, were stored to the south of the former Sodium Disposal Facility in an area known as the Empire State Atomic Development Association (ESADA) storage area; the area was named for a previous test at the site. The Dowanol had been used to clean sodium components, but had become saturated with sodium reaction compounds and was no longer effective for removing sodium. There were perhaps 100 drums, which were removed in 1983.

2.3 RADIOLOGICAL SURVEYS OF SSFL–AREA IV

2.3.1 Area IV Radiological Survey

The Area IV Radiological Survey investigated selected sites in Area IV. A survey plan was prepared in 1985 and implemented in 1988. Areas surveyed are shown in Figure 2–2. Buildings containing radioactivity contamination were included in the D&D program. Contaminated areas outside buildings (a portion of the Old Conservation Yard and an area near Building 064) were decontaminated.

2.3.2 Surveys After Nuclear Operations

Radiological surveys have been conducted in Area IV since the beginning of nuclear operations. As nuclear operations were terminated at facilities, surveys were made of the facilities and associated areas to characterize the facility radiation and contamination status, to guide D&D, and to verify adequate decontamination at the conclusion of cleanup efforts. The post–nuclear operation surveys were designed to measure residual radioactive material to show compliance with limits specified by DOE 5400.5 for release of property from restricted status.

2.3.3 Survey Approach

Many of the locations surveyed were old facilities consisting of buildings and related structures, with associated ventilation systems and drains, while others were simply areas of open ground. Where buildings and structures were involved, the following measurements were made:

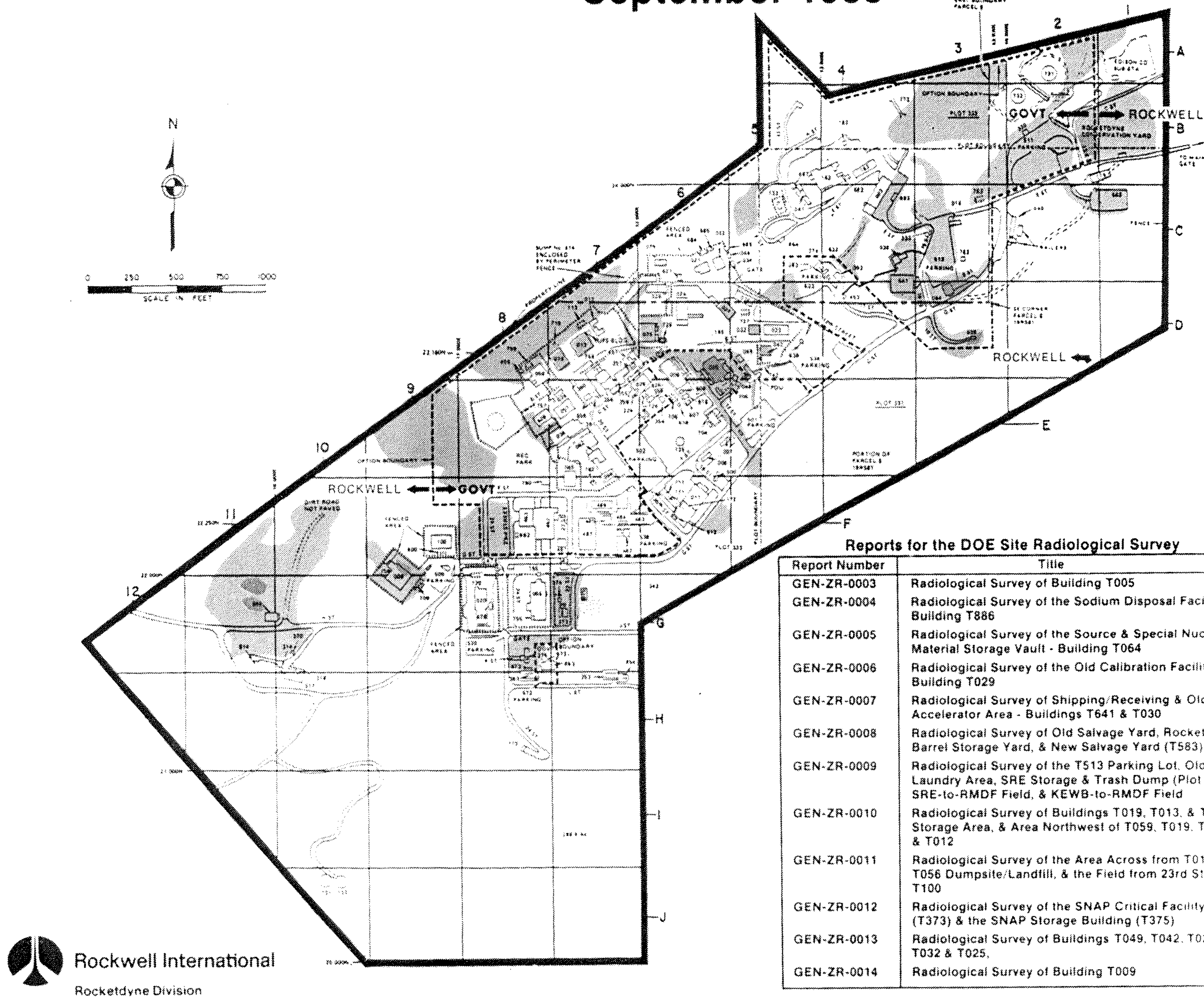
- Total surface alpha radioactivity
- Removable alpha radioactivity
- Total surface beta radioactivity
- Removable surface beta radioactivity
- Surface gamma radiation rate
- Ambient gamma radiation exposure rate (one meter above surface).

The measurements were made using portable radiation detection instruments to survey 1–m^2 grids and the insides of vents, drains, etc. Removable radioactivity was measured by wiping the area in question with cloth sampling smears and measuring the radioactivity removed from the surface.

Surveys conducted for areas of open ground consisted of the following measurements:

- Soil alpha radioactivity
- Soil beta radioactivity
- Soil gamma radioactivity
- Ambient gamma radiation (one meter above surface).

September 1988



Reports for the DOE Site Radiological Survey

Report Number	Title
GEN-ZR-0003	Radiological Survey of Building T005
GEN-ZR-0004	Radiological Survey of the Sodium Disposal Facility - Building T886
GEN-ZR-0005	Radiological Survey of the Source & Special Nuclear Material Storage Vault - Building T064
GEN-ZR-0006	Radiological Survey of the Old Calibration Facility - Building T029
GEN-ZR-0007	Radiological Survey of Shipping/Receiving & Old Accelerator Area - Buildings T641 & T030
GEN-ZR-0008	Radiological Survey of Old Salvage Yard, Rocketdyne Barrel Storage Yard, & New Salvage Yard (T583)
GEN-ZR-0009	Radiological Survey of the T513 Parking Lot, Old R/A Laundry Area, SRE Storage & Trash Dump (Plot 333), SRE-to-RMDF Field, & KEWB-to-RMDF Field
GEN-ZR-0010	Radiological Survey of Buildings T019, T013, & T626 Storage Area, & Area Northwest of T059, T019, T013, & T012
GEN-ZR-0011	Radiological Survey of the Area Across from T011, T056 Dumpsite/Landfill, & the Field from 23rd St. to T100
GEN-ZR-0012	Radiological Survey of the SNAP Critical Facility (T373) & the SNAP Storage Building (T375)
GEN-ZR-0013	Radiological Survey of Buildings T049, T042, T027, T032 & T025,
GEN-ZR-0014	Radiological Survey of Building T009

Figure 2-2. Area IV Radiological Surveys
(Shaded areas show survey boundaries.)

The measurements were made by collecting soil from the area, preparing a representative counting sample, and counting the activity with a gas–flow proportional counter (alpha and beta activity) or a spectrometer (gamma activity).

2.3.4 Site Characterization Study

A comprehensive characterization of Area IV radiological contamination has been planned (Ref. 2–6). The study will include investigation of specific areas of potential contamination. The specific–site component will be supplemented by a systematic survey of all of Area IV to assure that contaminants are not overlooked, even in the case of unexpected migration.

Chemical characterization is addressed as part of the RCRA regulatory process for SSFL under the regulatory authority of DTSC (Ref. 2–7).

2.3.5 Facility Status

The status of facility or area radioactivity contamination in Area IV is given in Table 2–2. The status of each facility or area is either released for unrestricted use, suitable for release for unrestricted use, or contains the contamination specified.

The summary in Table 2–2 of the radiological status of Area IV facilities and areas is supplemented below where additional information is desirable.

1. **Building 003**

Building 003 was given a preliminary release in 1975. A survey by ANL in 1981 showed some residual contamination, which was removed in February and March 1982. In addition, ANL analysis indicated suspect contamination located in the building sanitary sewer line. The sewer line was removed from the cold sink to the sewage sump tank. After sewer line removal, the building was surveyed and released for unrestricted use.

2. **Building 009**

The building is suitable for release for unrestricted use, except for continuing use of contaminated inservice inspection (ISI) equipment within the building. A radiologically contaminated drainage system from the east side of Building 009 was removed. This included the drainage lines beneath the floor at the east end of the building and the holdup tank and transfer lines external to the building. After initial surveys, excavation, removal, and disposal of selected items, the area was resurveyed, determined to be suitable for release for unlimited use, and the trenches backfilled and resurfaced. There is some inservice inspection (ISI) equipment stored in Building 009, which is contaminated at a very low level. This equipment is stored in locked containers.

3. **Building 012**

The building contains about 10 μCi contamination. Radioactive waste is expected to consist of material from the concrete building only: all light fixtures, air conditioning system, electrical panel boxes, some conduit and pipes, floor tiles, and the radioactive exhaust system. Removal of the remaining radioactivity is scheduled to be done in 1995 as part of the Area IV D&D program.

Table 2-2. Radiological Site Status (Sheet 1 of 2)

Facility	Application	Status
Building 003 (Engineering Test Bldg)	SRE support	Released by DOE for unrestricted use*
Building 005	Uranium carbide fuel pilot plant	D&D and final Rockwell survey completed; independent verification survey to be completed in 1994
Building 009	Criticality tests; inservice inspection (ISI)	Suitable for release, except for ISI*
Building 010	S8ER	Released by DOE for unrestricted use
Building 012	Criticality test	10 μCi*; D&D to be completed in 1995
Building 013	SNAP support (NaK loop)	Suitable for release
Building 019	SNAP critical testing	Suitable for release
Building 020 (RIHL)	Remote handling of radioactive components	<2 Ci of contamination inside cells, drain lines and ventilation system*; D&D continuing – to be completed in 1997
Building 023	SNAP support (NaK loop); Na loop for corrosion study	D&D and final Rockwell survey completed; independent verification survey to be completed in 1994
Building 024	SNAP ground tests	15 mCi activation in cell liners and concrete*
Building 025	SNAP support (remote handling mockup)	Suitable for release
Building 027	SNAP support (mechanical testing)	Suitable for release
Building 028	STIR; UO_2 melting	Suitable for release (above-grade structure removed)
Building 029	Calibration laboratory; alkali metal waste storage	Suitable for release
Building 030	Van de Graaf accelerator	Suitable for release
Building 032	SNAP support (environmental testing); Na loops	Suitable for release
Building 042	SNAP support (LiH casting; sodium aerosol tests; depleted uranium experiment	Suitable for release
Building 049	Support for Building 005	Suitable for release
Building 055 (NMDF)	Plutonium fuel manufacturing	Released by NRC for unrestricted use
Building 056 landfill	Disposal site	Suitable for release
Building 059	S8DR	<3 Ci activation; D&D to be completed in 1995
Building 064	Fuel storage	D&D and final Rockwell survey completed; independent verification survey to be completed in 1994
Building 073	KEWB	Released by DOE for unrestricted use
Building 093	AE-6/L-85 reactor	Released by NRC for unrestricted use
Building 100	Criticality test; radioactivity laboratory	Released by NRC for unrestricted use, but final survey required*
Building 373	SNAP criticality test	Suitable for release
Building 375	SNAP support (control rod testing)	Suitable for release
Former Sodium Disposal Facility	Removal of sodium and NaK from components	D&D complete; final survey by contractor and California DHS to be completed in 1994
Building 143 and associated buildings	SRE facility	Released by DOE for unrestricted use*
SRE storage field	SRE support (disposal site)	Suitable for release

Table 2-2. Radiological Site Status (Sheet 2 of 2)

Facility	Application	Status
SRE-to-RMDF field	SRE support (holding area for material and equipment)	Suitable for release
RMDF	Radioactive material processing and storage area	<100 mCi contamination, excluding sources and waste stored and in process* (see also Section 2.3.1)
RMDF leachfield	Former sanitary leachfield	Released by DOE for unrestricted use
Building 654	Interim Storage Facility	Released by DOE for unrestricted use (building removed)
Old Conservation Yard	Storage area	Suitable for release
Barrel Storage Yard	Storage area	Suitable for release
New Conservation Yard and surroundings	Storage area	Suitable for release
513 Parking Lot and former building for processing contamination-protective clothing to laundry vendor	SRE support (access to SRE and processing protective clothing)	Suitable for release
KEWB-to-RMDF Field	None (open space between an active and formerly active facilities)	Suitable for release
23rd Street-to-Building 100 Field	Storage area; former disposal area (Bldg 100 trench)	Suitable for release
Building 626 storage area.	SNAP support (storage area); barrel storage	Suitable for release
Areas northwest of Buildings 012, 013, 019, and 059	None (open space adjacent to SNAP facilities)	Suitable for release

*Further details provided in Section 2.3.5, items 1 through 13.

4. Building 020

There is a total of 2.2 Ci of contamination in the drain system, ventilation exhaust system, and inside the cells, plus traces of contamination on the building interior walls and surroundings. The unconfined radioactivity (outside) was cleaned up in 1990. Cleanup activities are in progress and are scheduled for completion in CY 1998.

5. Building 024

There is 15 mCi of confined activation radioactivity in the facility concrete. The building is being periodically surveyed. D&D of the facility is not included in the current planning cycle for the DOE environmental remediation and waste management 5-year plan.

6. Building 100

The building has been released for unrestricted use by NRC. Since it has been used as a radiation calibration laboratory and as a radioactivity analytical laboratory subsequent to that release, a final survey will be required.

7. SRE (Bldg 143 and Surrounding Area)

Final radiological surveys were conducted to verify that the SRE site was decontaminated to levels that allow unrestricted facility use. An independent party, ANL, conducted a survey to verify that the objectives were met and the facility was released by DOE.

8. RMDF

Sealed radioactive sources are stored at the RMDF. When the sealed sources are removed, about 100 mCi of fission products remain in a liquid waste holding tank, plus small amounts of radioactivity in solid wastes being stored for shipment. There is less than 100 mCi of radioactive contamination within the facility and on the northwest slope. The contamination is in the soil of the hillside and in the pavement and in a drainage sump. The remaining radioactivity will be removed when the RMDF is decontaminated and decommissioned. Near-term D&D activities will be directed to decontamination of outside areas and buildings not needed for ongoing use of the RMDF. Final D&D will be the last environmental restoration activity in Area IV since the facility is needed to handle wastes from other cleanup activities. The RMDF cleanup date will be determined by the schedule for other facilities.

2.4 CONSTRUCTION AND DEMOLITION PLANS

A facility is planned for development of a molten salt hazardous waste treatment system. The Metal Vessel Project, a sparged bed molten salt oxidizer project to be located near Building 005, will begin operation in 1993 or early 1994.

Planned demolition activities are only those of the D&D program.

2.5 REPORTING

The reports currently issued to present environmental monitoring data are listed in Table 2-3.

Table 2-3. Current Environmental Reporting
(Sheet 1 of 2)

Report Title	Frequency	Prepared*		Remarks
		By	For	
Rocketdyne Division Annual Site Environmental Monitoring Report, Santa Susana Field Laboratory and De Soto Sites	Annual	RP&HPS and EP		Issued annually by RP&HPS since 1972 and as a semiannual earlier.
U.S. Department of Energy Air Emissions Annual Report (40 CFR 61, Subpart H), DOE Operations at Santa Susana Field Laboratory	Annual	RP&HPS	EPA	"NESHAPS Report."
U.S. Department of Energy Radioactive Effluent/On-site Discharge/Unplanned Releases	Annual	RP&HPS	DOE (EGG)	Reports total annual releases from the RMDF and Building 059 ventilation exhaust stacks.
Performance Indicators Report	Quarterly	ETEC Engineering	DOE	Report (required by DOE Order 5480.26) includes radionuclide and hazardous substance/regulated pollutant effluents, environmental incidents, and solid low-level waste generated, as well as non-environmental performance indicators. The environmental information is prepared by RP&HPS.
Quarterly Emission Report	Quarterly	ETEC Engineering	VCAPCD	Reports operation of the SCTI H-1 and H-2 sodium heaters. It is transmitted by Environmental Protection. It is required by VCAPCD Rule 103.
Annual Emission Summary, Area IV Permit 0271	Annual	EP	VCAPCD	
Air Toxic Emission Inventory Report	Biennial	EP	Cal- EPA	
SARA Title III Section 312	Annual	EP	EPA Cal-EPA	Reports inventory of hazardous materials.
SARA Title III Section 313	Annual	EP	EPA Cal-EPA	Reports emissions/releases above the thresholds of hazardous materials.
Discharge Monitoring Report	Monthly	EP	RWQCB	Required by NPDES permit.
Discharge Monitoring Report	Annual	EP	RWQCB	Required by NPDES permit.
Annual Groundwater Monitoring Report, Santa Susana Field Laboratory	Annual	GRC	Cal-EPA DTSC	Provides descriptions of groundwater monitoring system and groundwater reclamation system operation, and tabulations of groundwater level elevations and quality data through the end of the year.
Groundwater Monitoring Quarterly Report, Santa Susana Field Laboratory	Quarterly	GRC	Cal-EPA DTSC	Provides results of groundwater monitoring during the period.
Correspondence Manifest	Monthly	EP	Cal-EPA DTSC	Provides (by letter) a list of regulatory correspondence during the period.
Annual Hazardous Waste Report	Annual	EP	Cal-EPA DTSC	
Biennial Hazardous Waste	Biennial	EP	EPA	

Table 2-3. Current Environmental Reporting
(Sheet 2 of 2)

Report Title	Frequency	Prepared*		Remarks
		By	For	
DOE Quarterly Waste Report	Quarterly	EP	DOE	
Environmental Monitoring Report	Quarterly	EP	SSFL Work Group	Consists of all correspondence between regulatory agencies and Rocketdyne, and the results of groundwater monitoring.
Business Plan, SSFL	Annual	EP	(RCRA, CWA, SARA) Cal-EPA	Contains hazardous material inventory, spill prevention control and countermeasure plan, and facility spill contingency plan.
*EGG is the name of a consultant to DOE. Acronyms are defined in the list of acronyms following the table of contents in this plan.				

2.6 REFERENCES

2–1. N001ER000017, Rev. C, "Nuclear Operations at Rockwell's Santa Susana Field Laboratory – A Factual Perspective" (September 6, 1991)

2–2. 886–AN–0001, Rev. A, "Sodium Disposal Facility Closure – Project Management Plan" (March 5, 1992)

2–3. Ebasco Document, "Former Sodium Disposal Facility (SSFL) Closure Plan" (July 1991) (ETEC–DTR–24835)

2–4. TZ4–R09015–RN–M07933, Science Applications International Corporation, Interim Final RCRA Facility Assessment Report for Rockwell International Corporation, Rocketdyne Division, Santa Susana Field Laboratory, Ventura County, California (July 10, 1991)

2–5. Report, EMCON Associates, "Closure Report, Rockwell International Corporation, Rocketdyne Division, Santa Susana Field Laboratory, EPA ID Number CAD093365435, and EPA ID Number CA1800090010, Surface Impoundments" (September 1989)

2–6. A4CM–AN–0003, "Radiological Characterization Plan, Santa Susana Field Laboratory Area IV"

2–7. Report, ICF Kaiser Engineers, "Current Conditions Report and Draft RCRA Facility Investigation Work Plan, Area IV, Santa Susana Field Laboratory" (October 1993)

3.0 Sources and Exposure Pathways

3.0 SOURCES AND EXPOSURE PATHWAYS

3.1 POTENTIAL SOURCES OF CONTAMINATION

The potential sources of environmental contamination from Area IV operations were briefly discussed from a historical perspective in Section 2.0 of this document. Those indicated as active, and/or those inactive sites that have not been fully decontaminated, are of primary concern. Several areas of known or suspected contamination have been identified as solid waste management units (Ref. 3–1). These areas and their potential type of contamination are:

1. Radioactive Materials Disposal Facility (RDMF) (Bldgs 021, 022, 025, and 621) (chemical, radioactivity)
2. Rockwell International Hot Lab (RIHL) (Bldg 020) (chemical, radioactivity)
3. Old Conservation Yard (chemical, radioactivity)
4. New Conservation Yard (chemical)
5. Former Sodium Disposal Facility (Bldg 886 and associated area) (chemical, radioactivity)
6. Process Development Unit – Molten Salt Coal Gasification (Bldg 005) (chemical)
7. ESADA Chemical Storage Yard (chemical)
8. Building 100 Trench (chemical)
9. Hazardous Waste Treatment Facility (HWTF) (Bldg 133) (chemical)
10. Hazardous Waste Storage Facility (Bldg 029) (chemical)
11. Building 056 Landfill (chemical).

Other areas have been identified as areas of concern (Ref. 3–1). These areas and their potential type of contamination are:

1. Former SNAP Ground Prototype Test Facility (Bldg 059) (chemical, radioactivity)
2. Inactive sanitary leachfields (chemical, radioactivity)
3. Southeast Drum Storage Yard (chemical).

The nature and extent of radiological contamination in these areas will be further investigated during the Area IV radiological characterization (Ref. 3–2). This characterization also includes a systematic radiological survey of all of Area IV to locate any additional sources, if any exist, and to show that all contamination has been characterized. Chemical characterization of the solid waste management units will be addressed as needed under the RCRA Corrective Action (Ref. 3–3).

3.2 EXPOSURE PATHWAYS

Exposure pathways are the means through which an individual may come into contact with a contaminant in the environment. Exposure pathways are determined by environmental conditions (e.g., groundwater, vegetative cover, prevailing wind direction), potential for the contaminant to move from one medium (e.g., soil, water, or air) to another, and by the general life styles and/or work activities of the potentially exposed population (e.g., gardening, construction, office work). The types of pathways are:

1. Surface water transport
2. Groundwater transport
3. Atmospheric transport
4. Biotic transport
5. Direct radiation.

These transport mechanisms are described in Sections 3.2.1 through 3.2.5.

3.2.1 Surface Water Transport

Area IV surface water consists of industrial process water and sanitary waste sources and rainfall runoff. Part of the rainfall runoff (that northwest of the surface water divide running through Area IV) flows off-site directly along natural drainage channels. The majority of the rainfall runoff and the sources are controlled by the SSFL surface water control system. A flow diagram of this system is shown in Figure 3–1. The system controls water from Areas II and III as well as from Area IV. The related part of the SSFL sewage system is shown in Figure 3–2. The sewage treatment plant, which services Area IV, is located in Area III. Its liquid effluent is monitored during release to the R–2B Pond. Its sludge is removed periodically by a licensed contractor, who transports it off-site and transfers it to the sewage system of the city of Los Angeles. The Area IV sewage system is shown in Figure 3–3. The Area IV storm drainage system is shown in Figure 3–4.

The surface water control system is designed to collect the surface water in the R–2A Pond. From there it is either transferred to the reclaimed water system for industrial use, or, when the inflow to the pond exceeds the need for water use and pond storage capacity, is discharged from the pond into Bell Creek.

Surface water discharges and runoff from Area IV are governed by Rocketdyne's NPDES permit, described in Appendix A, Section A.4. The permit specifies maximum allowable concentrations of contaminants allowable in surface water effluents. Monitoring requirements are specified to verify that the limits are met (releases from the R–2A pond) or to identify any exceedances (northwest slope runoff). Mercury concentrations exceeding drinking water standards have occasionally been found in the northwest slope runoff; however, measured concentrations are generally within the limits. Therefore, surface water transport is not normally a significant pathway.

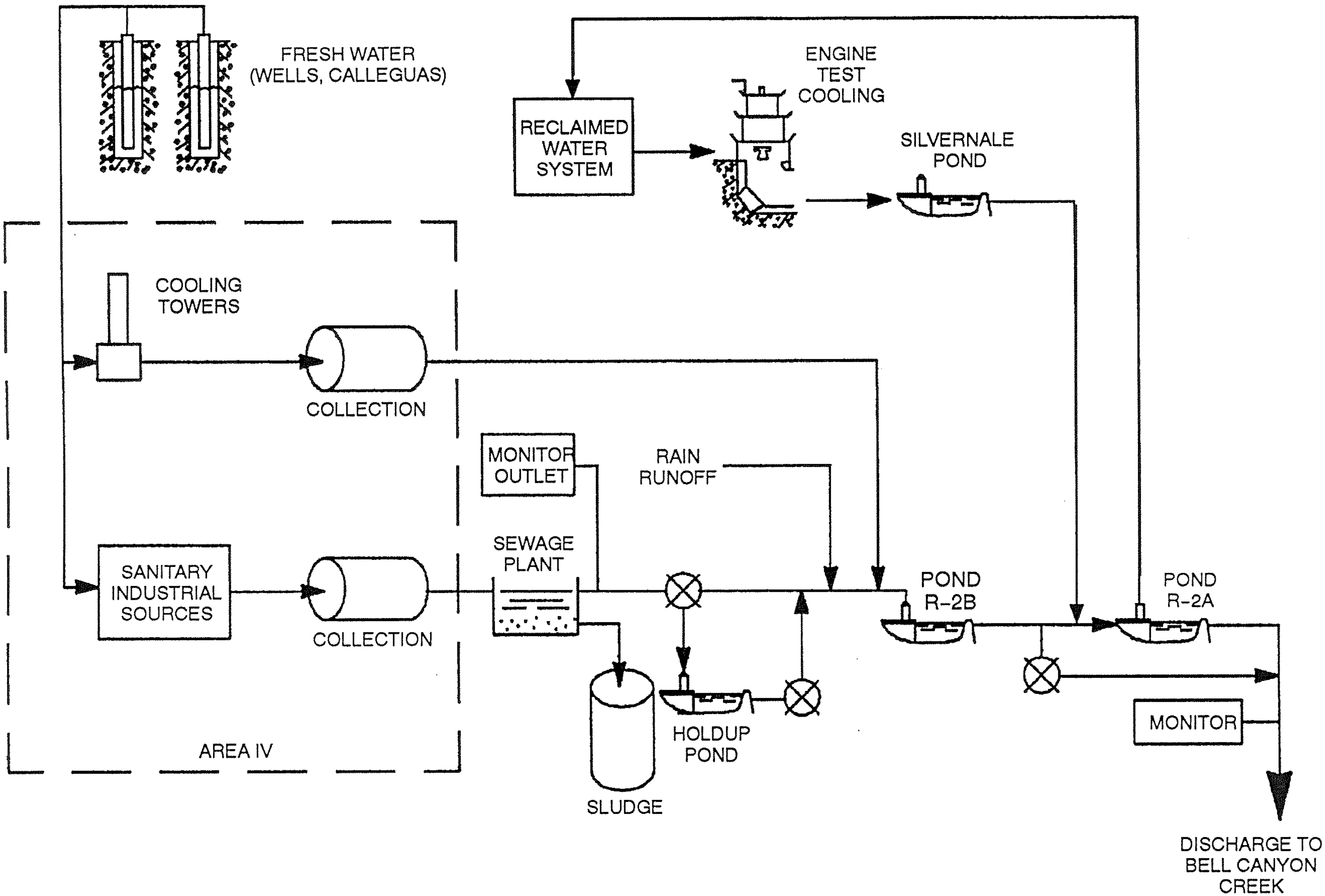


Figure 3-1. Area IV Surface Water System (Including Sewage Plant Effluent)

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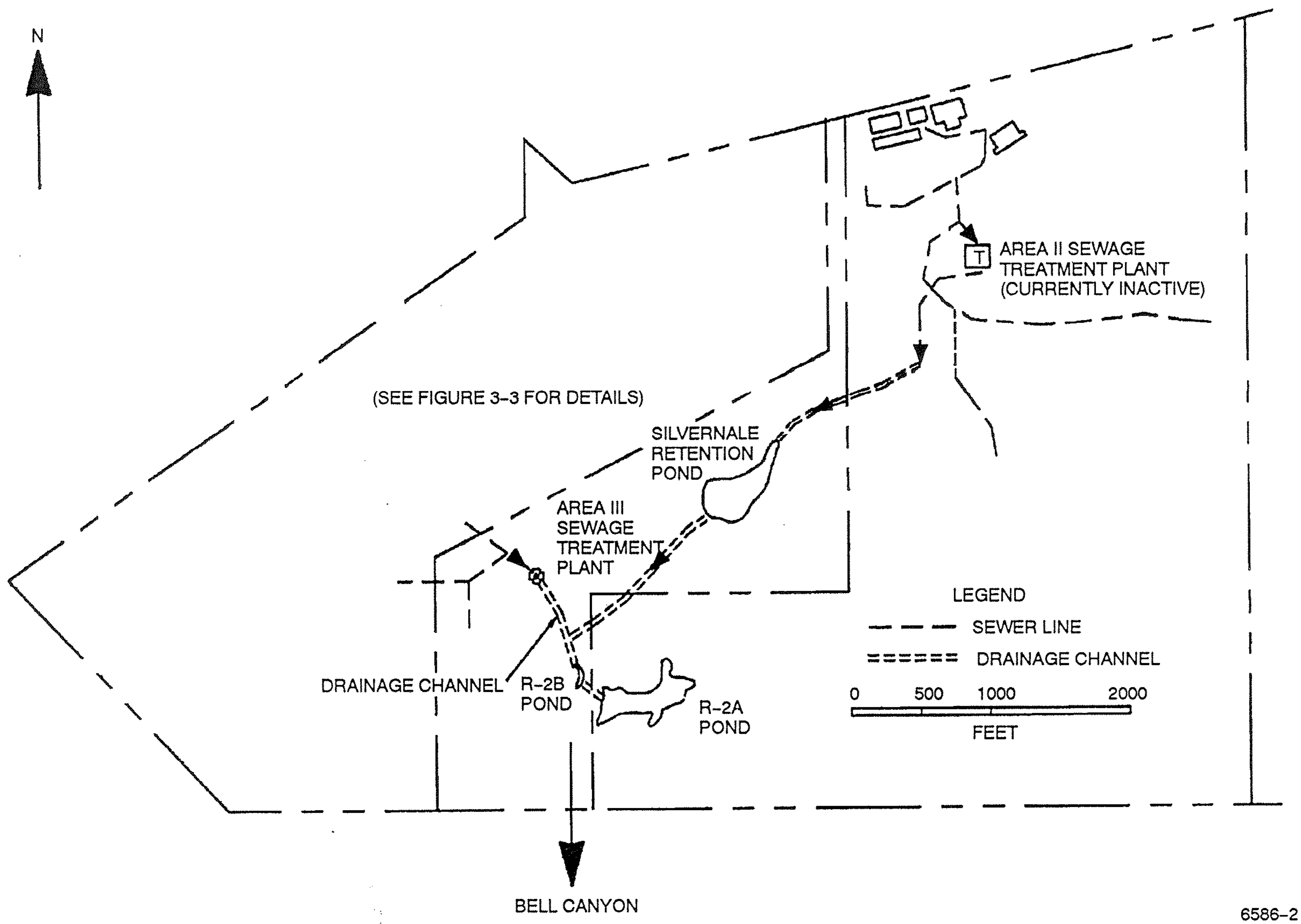

Figure 3–2. SSFL Sewage System Layout

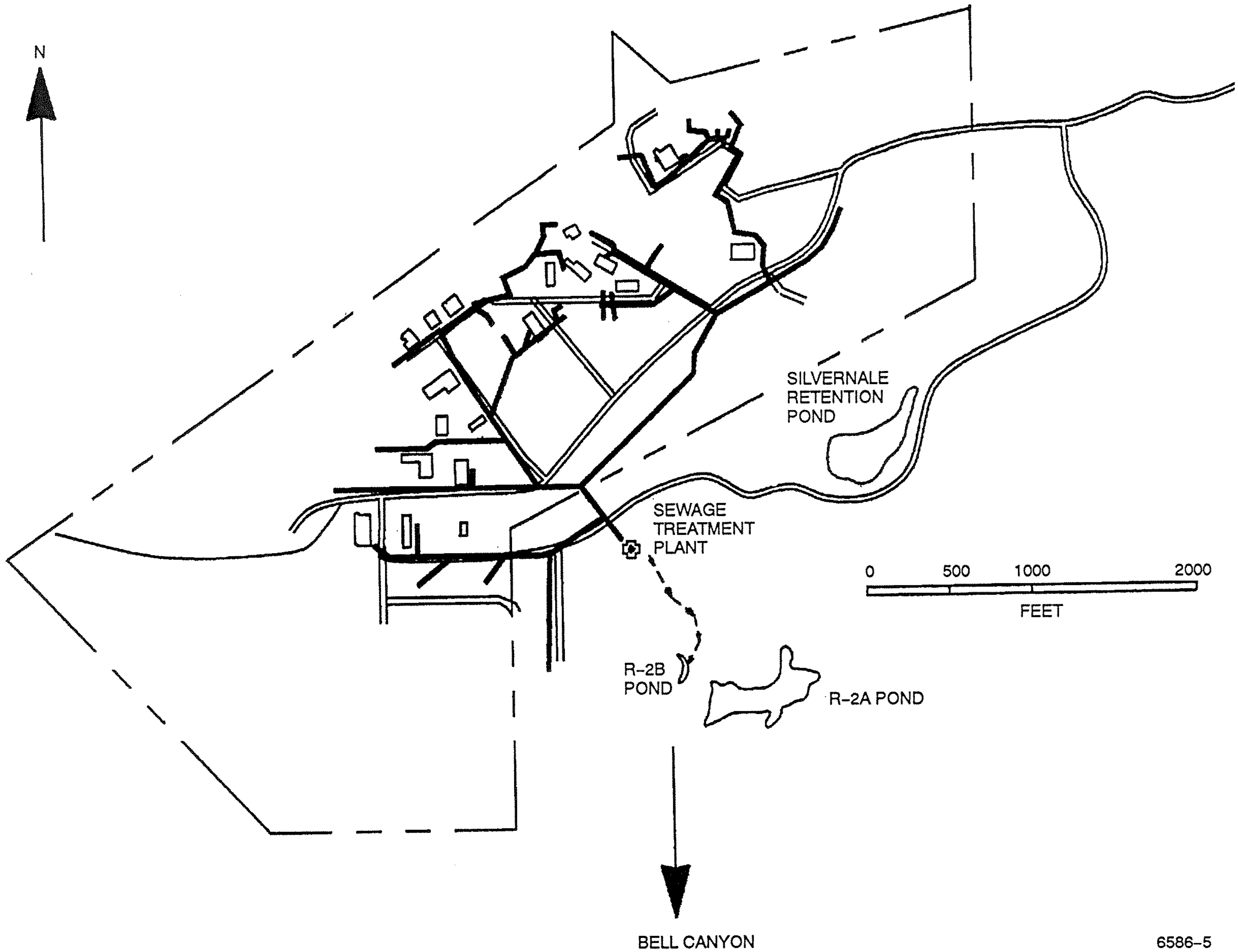

Figure 3-3. SSFL Area IV Sewage System Layout

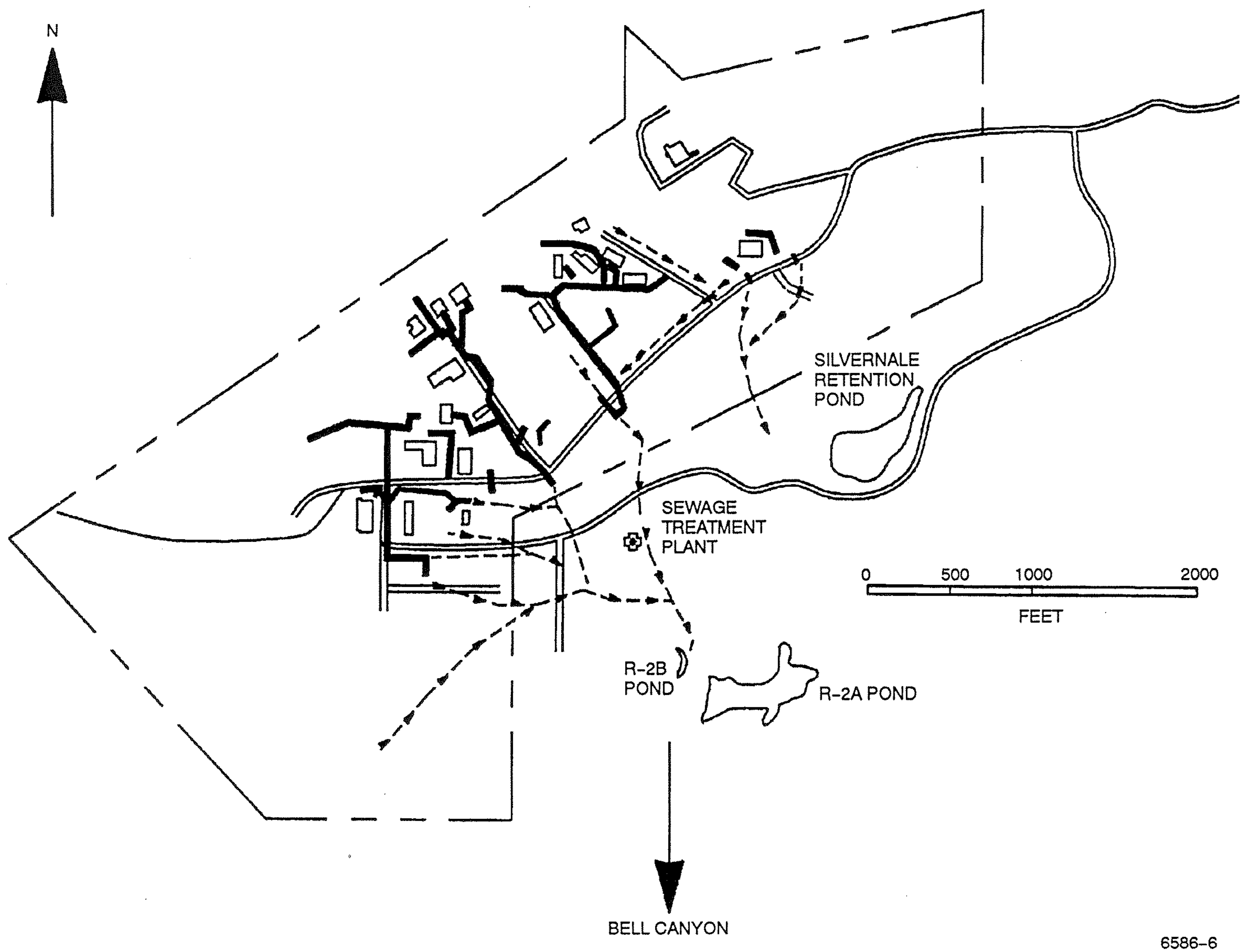

Figure 3-4. SSFL Area IV Storm Drainage Layout

3.2.2 Groundwater Transport

Groundwater transport is not a significant exposure pathway because groundwater is not used as a source of drinking water. Groundwater from Area IV wells is used only for industrial purposes. The only use off–site is for watering a small herd of cattle. This well is not in the direction of groundwater transport from SSFL, and contaminants have not been detected in it.

Area IV groundwater is part of the SSFL groundwater system. It occurs as both shallow–zone water in the alluvium (up to about 10 ft thick) overlying the rock of the Chatsworth Formation (at least 6,000 ft thick), and deep–zone water in the Chatsworth Formation. Shallow–zone groundwater occurs under unconfined conditions within discontinuous pockets of the alluvium. The water is generally seasonally and follows surface water runoff paths.

Deep–zone groundwater occurs under both confined and unconfined conditions. Occurrence and movement of this water is primarily within and along fractures in the impervious rock. Quantitative predictive techniques applicable to fracture–dominated flow systems do not exist, so the Chatsworth Formation structure does not permit detailed predictions of groundwater movement by modeling its movement. Concentrations and distribution of contaminants in this groundwater must rely on sample analysis data. The current groundwater movement directions inferred from water–level elevations are shown in Figure 3–5. A groundwater divide is shown running through Area IV. Potential public exposure to contaminants is monitored by periodic sampling and analysis of groundwater at off–site locations. These measurements are part of the separate SSFL groundwater characterization and monitoring program, which is included in this monitoring plan only by reference.

3.2.3 Atmospheric Transport

The major airborne chemical contaminant that could reach the public (albeit well below ambient air quality standards) is NOx from the SCTI natural gas–fired boiler emissions. The stacks at the RDMF, Building 020 and Building 059, provide radiological sources, which also are well below ambient standards but are continuously monitored at the stack outlet. There is no need for off–site monitoring of ambient air for either chemical or radiological contaminants; however, ambient air sampling stations are used in Area IV for environmental surveillance for radiological particulates.

3.2.4 Biotic Transport

Biotic transport does not contribute to the effective dose of radiation and exposure to chemical contamination of the population in the vicinity of Area IV. These is no significant commercial production of foodstuffs in the vicinity of Area IV. A small herd of cattle is maintained on the Runkle Range west of Area IV, but the scale is too small to be a significant pathway. Other foodstuff production in the area consists only of private gardens. There is no hunting allowed in SSFL so that consumption of wildlife is not a pathway.

3.2.5 Direct Radiation

Off–site direct radiation monitoring is currently conducted at the site boundaries and in both the San Fernando and Simi Valleys. This has demonstrated that SSFL does not expose the public to radiation.

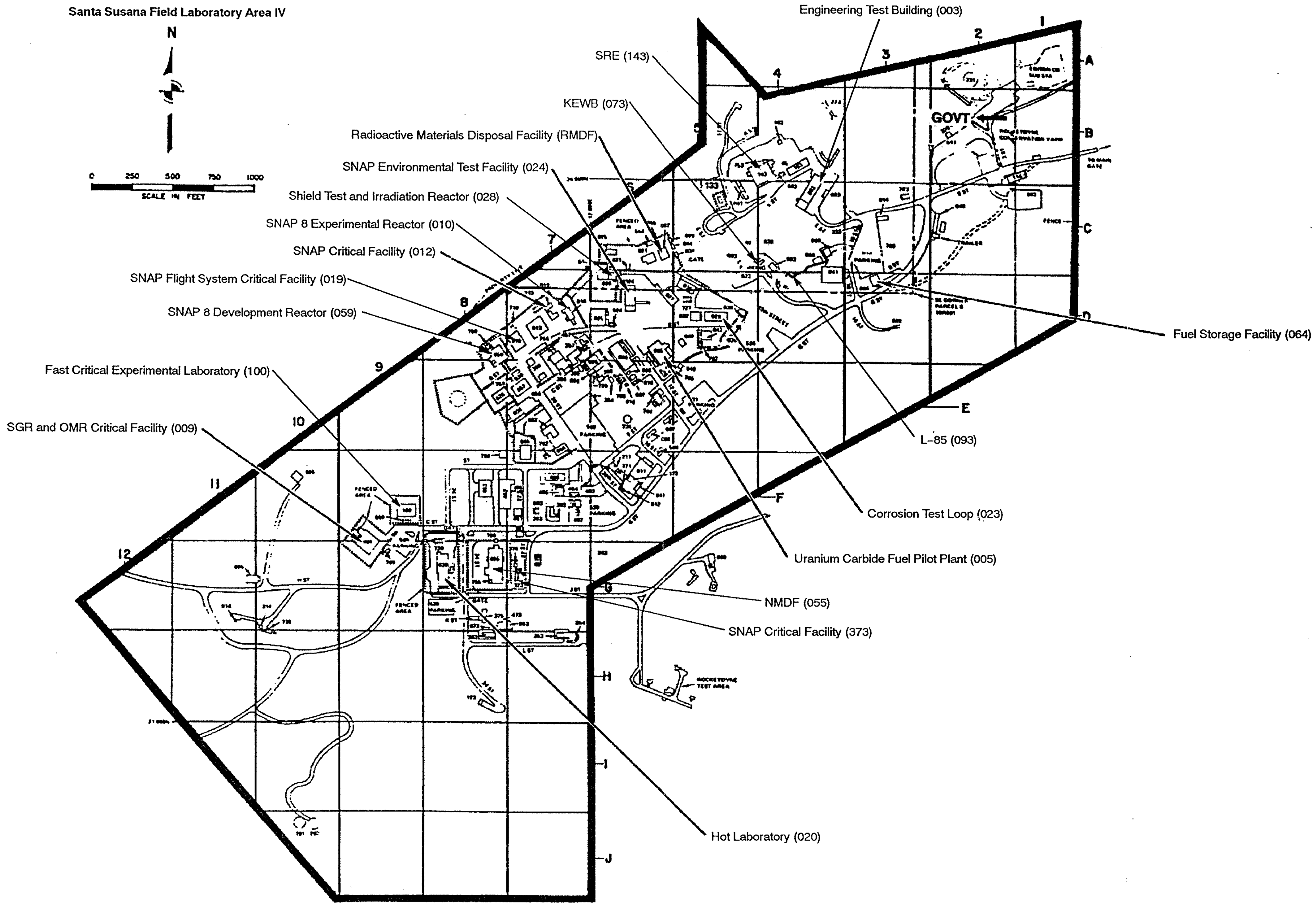

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Figure 2-1. Sites Where Nuclear Activities Were Carried Out at SSFL

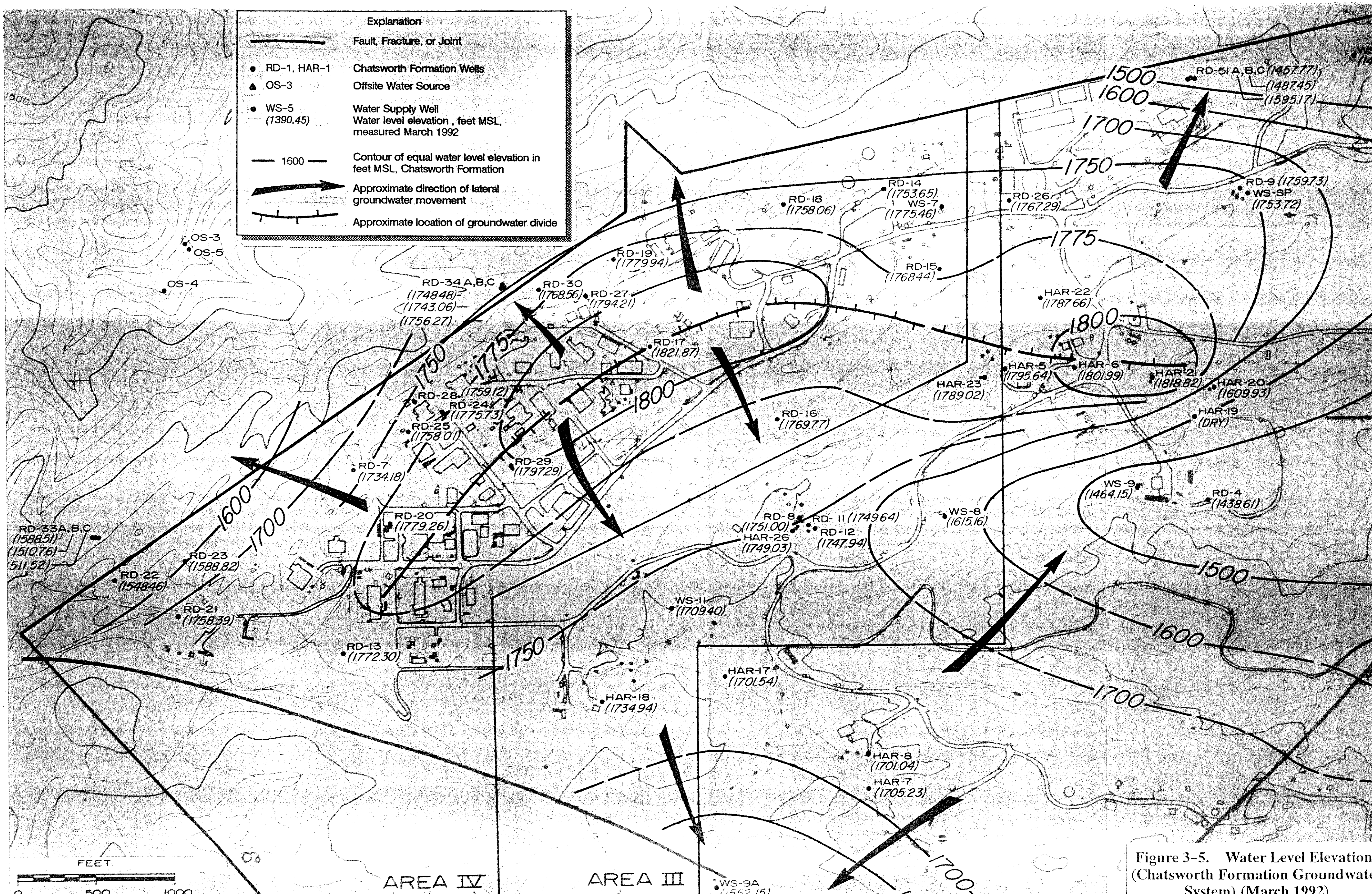

Figure 3-5. Water Level Elevations (Chatsworth Formation Groundwater System) (March 1992)

3.3 SUMMARY

The preceding paragraphs show that only the atmospheric and direct radiation pathways have the potential for exposure of the public to contaminants. Surface water contamination levels are generally below levels acceptable for drinking water. Monitoring activities in this plan will verify that these levels are maintained. Groundwater is not a source of public drinking water and therefore is not a pathway for public exposure to contaminants. Biotic transport of contaminants does not present a significant potential for public exposure.

Calculations to determine the atmospheric and direct radiation pathways public radiation exposures are described in Section 4.2. The calculations will be based on measurements made as part of this plan.

3.4 REFERENCES

3–1. TZ4–R09015–RN–M07933, "Interim Final RCRA Facility Assessment Report for Rockwell International Corporation Rocketdyne Division Santa Susana Field Laboratory, Ventura County, California (Prepared for U.S. EPA by Science Applications International Corporation)

3–2. A4CM–AN–0003, "Radiological Characterization Plan, Santa Susana Field Laboratory Area IV"

3–3. Report, ICF Kaiser Engineers, "Current Conditions Report and Draft RCRA Facility Investigation Work Plan, Area IV, Santa Susana Field Laboratory" (October 1993)

4.0 Environmental Monitoring Plan

4.0 ENVIRONMENTAL MONITORING PLAN

4.1 ENVIRONMENTAL MONITORING

Environmental surveillance and effluent monitoring are the two components of environmental monitoring. Environmental surveillance is the collection and analysis of samples of air, water, soil, foodstuffs, biota, and other media from on–site and off–site locations, and measurement of external radiation to demonstrate compliance with applicable standards, assess radiation exposures to members of the public, and assess effects, if any, on the local environment. Effluent monitoring is the collection and analysis of samples, or measurements of liquid, gaseous, or airborne effluents, for the purpose of characterizing and quantifying contaminants and process stream characteristics, assessing radiation exposures to members of the public, and demonstrating compliance with applicable standards. This section describes prior, current, and planned activities at Area IV for each of these components and each environmental medium (soil, surface water, groundwater, air, direct radiation, vegetation, and animals). Recent monitoring results are included to support the selections of planned monitoring activities. Estimation of public radiation exposures is described in Section 4.2.

4.1.1 Environmental Surveillance

Environmental surveillance at Area IV began in 1954, when planning for construction of the SRE was initiated. Since the contaminant of concern was radioactivity, the early program was carried out to measure any impact future activities would have on local radioactivity (the combination of natural background and radioactive fallout from nuclear weapons testing). This program was subjected to oversight and inspection by the operational and licensing branches of the AEC between 1956 and 1974, and to inspection by NRC and Energy Research and Development Agency (now incorporated into DOE) since 1974. The California RHB has been involved since 1969. The scope of the radiological program is shown in Table 4–1, which lists the numbers of samples of each type collected annually for RP&HPS analysis.

Surveillance for chemical contamination has been a part of the program since 1976. Surveillance of surface water began after issuance at that time of a NPDES permit for discharge of water from the R–2A Pond. Groundwater surveillance began in 1984 using existing water supply wells. When significant amounts of organic solvents were found in the groundwater near rocket engine test stands (in Areas I and II of SSFL), a major groundwater program was initiated throughout SSFL.

Surveillance for radiological contamination has been performed primarily by Radiation Protection and Health Physics Services (RP&HPS) and its predecessor organizations. Surveillance for chemical and radiological contamination of soil (special studies), surface water effluents, and groundwater has been performed by the Environmental Protection Department (and predecessor organizations) and its contractors.

Table 4-1. Annual Samples Collected by Media Type for RP&HPS Radiological Analysis

Year	Soil		Vegetation		Surface Water		Air*	Soil (Pu)		Groundwater
	On-site	Off-site	On-site	Off-site	On-site	Off-site		On-site	Off-site	
1954	5	44	5	44						
1955	60	201	60	199						
1956	65	356	65	341						
1957	72	348	72	348						
1958	84	318	84	318						
1959	107	379	107	380	18		257			
1960	115	362	115	362	22		44			
1961	120	458	120	459	24	48	176			
1962	147	453	147	453	24	53	314			
1963	156	455	156	456	24	49	292			
1964	146	293	154	299	23	30	0			
1965	144	142	144	142	24	23	1,062			
1966	142	51	144	51	24	44	2,205			
1967	144	60	144	60	24	58	2,400			
1968	144	59	144	59	24	55	2,157			
1969	144	60	144	60	24	55	2,364			
1970	144	60	144	60	24	48	2,434			
1971	144	60	144	60	24	44	2,476			
1972	144	60	144	60	48	24	2,430			
1973	144	60	144	60	48	24	2,311			
1974	144	60	144	60	24	36	2,477			
1975	144	60	144	60	24	36	2,450			
1976	144	60	144	60	24	36	2,520			
1977	144	60	144	60	24	36	2,438			
1978	144	60	144	60	24	36	2,402	10		
1979	144	60	144	60	24	36	2,519	10		
1980	144	60	144	48	24	36	2,342	10		
1981	144	60	144	48	24	36	2,518	10		
1982	144	60	144	48	24	36	2,347	10	2	
1983	144	60	144	48	24	36	2,328	10	2	
1984	144	48	144	48	24	24	2,461	10	2	
1985	144	48	144	48	24	24	2,450	10	2	
1986	48	48			24	24	2,415	10	2	
1987	48	48			24	24	2,460	10	2	
1988	48	48			24	24	2,397	10	2	
1989	56				24	24	2,404	10	2	237
1990	16		1		21		1,294			63

*No off-site air samples have been taken.

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4.1.1.1 Soil Surveillance

4.1.1.1.1 Prior Surveillance

Routine soil sampling and analysis for radioactivity was part of the initial Area IV environmental monitoring program begun in 1954. Samples were collected periodically from approximately 50 selected locations. Most were within Area IV to provide monitoring of potential sources to detect any contamination from nuclear activities, while several were from surrounding areas to provide background measurements for comparison. During the period of major nuclear activity each location was sampled monthly (on–site) or quarterly (off–site), except for semiannual sampling at six locations selected to monitor specifically for releases from the Nuclear Materials Development Facility (NMDF).

Monthly sampling was reduced to quarterly in 1986 after a review of the needs and results of the sampling program was made. Reduction in nuclear operations and the results from the sampling program led to the conclusion that quarterly sampling was adequate to confirm any releases of radioactivity identified by other monitoring methods.

Routine soil sampling was terminated in 1989 in view of the reduction in radioactivity in Area IV and the absence of any indication from the routine surveys that radioactive contamination had been spread. Soil sampling and analysis for radioactivity analysis continued, however, with special–interest sampling to support decontamination activities and to characterize suspect areas.

Routine soil samples were analyzed for gross alpha and gross beta radioactivities, with plutonium analysis added for NMDF samples. Since 1989, soil analyses have included isotope–specific gamma spectroscopy.

The level of radioactivity in early soil samples was greatly affected by atmospheric testing of nuclear weapons, with fallout often dominating local natural radioactivity. After termination of weapons testing, soil radioactivity returned to a baseline level which represents the natural background radioactivity of the area. This level is shown in the results summarized in Table 4–2 for 1984 through termination of the program in 1989. The routine samples analyzed for plutonium also showed no radioactivity from Area IV operations.

Table 4–2. Routine Soil Sampling Radioactivity Data

Year	No. of Samples	Alpha Radioactivity (pCi/g)		Beta Radioactivity (pCi/g)	
		Average and Dispersion	Maximum/ Month Observed	Average and Dispersion	Maximum/ Month Observed
Area IV					
1989	56	29.7 ± 7.6	51.0/Oct	26.9 ± 2.2	32.3/Oct
1988	48	29.1 ± 6.2	53.6/Oct	26.0 ± 2.8	31.4/Oct
1987	48	27.1 ± 7.7	40.1/Dec	25.4 ± 2.1	30.7/Apr
1986	48	26.7 ± 6.6	40.1/Apr	26.1 ± 2.2	32.2/Apr
1985	144	25.2 ± 7.3	48.36/Apr	24.2 ± 1.9	32.7/Sep
1984	144	25.8 ± 6.0	43.35/May	24.2 ± 2.0	30.1/Dec
Non–Area IV					
1988	48	25.6 ± 6.2	39.6/Oct	24.4 ± 2.7	29.6/Apr
1987	48	25.7 ± 7.7	55.1/Apr	23.9 ± 3.5	29.1/Apr
1986	48	25.1 ± 5.9	39.0/Jul	24.2 ± 1.3	30.4/Apr
1985	48	26.3 ± 7.8	46.0/Jul	23.9 ± 3.3	30.2/Apr
1984	48	26.2 ± 7.2	51.31/Jul	23.3 ± 2.9	28.2/Jan

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In addition to routine and special–interest sampling, special studies of soil contamination have been made in specific areas. In these, soil samples have been analyzed for chemical as well as radiological constituents. The studies (and areas studied) included the CERCLA Phase II Study (former Sodium Disposal Facility and Building 056 Landfill), Area IV Soil and Shallow Groundwater Study (Old Conservation Yard, New Conservation Yard, Southeast Drum Storage Yard, Building 100 Trench, ESADA Drum Storage Area, RMDF leachfield, and Hazardous Waste Treatment Facility), Pond Sediment Study (SRE Pond), and RCRA Corrective Action (all of Area IV/SSFL).

Soil sampled in the special studies was analyzed for volatile organic compounds, metals, pH, hydrocarbons, and radioactivity. Contaminants found were solvent volatile organic compounds (former Sodium Disposal Facility and SRE Pond), pH (Hazardous Waste Treatment Facility), hydrocarbons (Old Conservation Yard, Building 100 Trench, and SRE Pond), oil and grease (Building 056 Landfill), and beta radioactivity (RMDF leachfield and Hazardous Waste Treatment Facility).

4.1.1.1.2 Current Surveillance

Current soil sampling is only of special–interest samples (e.g., to support decontamination activities or to investigate an area identified as potentially contaminated). The results during a recent year (1991) are given in Table 4–3. Samples were collected at the upper and lower ponds of the former Sodium Disposal Facility, RMDF, and the Southern California Edison substation adjacent to the Old Conservation Yard. There were no noteworthy concentration differences from the results of previous years. The radioisotopic compositions of the samples were those of local area surface soil – predominantly ^{40}K, natural uranium, and natural thorium, the latter two in secular equilibrium with their daughter nuclides.

4.1.1.1.3 Planned Surveillance

The soil environmental surveillance program will monitor for contaminant releases from potential sources (active and inactive facilities containing contaminants and areas in which environmental contamination may exist), and for the presence of radiological contaminants in unsuspected locations throughout Area IV. These components of the program are described below. Soil sampling locations are summarized in Table 4–4. The first three of the types of areas listed below will be sampled annually until they no longer are potential sources of contamination. Samples from these areas will be analyzed for contaminants potentially present. The locations specified for the fourth set of areas will be sampled annually throughout the duration of the monitoring program. Samples will be analyzed for gamma–emitting isotopes and pH. Chemical contamination will be addressed under the RCRA Corrective Action.

1. Active facilities which are potential sources for release of contaminants are the RMDF and the Hazardous Waste Treatment Facility. The RMDF is used to store, package, and ship radioactive materials, and contains some radioactive contamination. Termination of activities and completion of D&D is scheduled for 2000. Until then, the area around it will be sampled and analyzed to detect any spread of radioactivity. The Hazardous Waste Treatment Facility reacts liquid metals (principally sodium) and handles the hydroxide reaction products. The area around the facility will be sampled as necessary and analyzed for pH to detect any spill of the hydroxide solution.

2. The inactive facility which needs to be monitored for release of contamination is the Rockwell International Hot Laboratory (RIHL). Monitoring of the inactive Building 024 is not

Table 4-3. Area IV Rock and Soil Radioactivity Data - 1991

	Activity (pCi/g)[a]													
	^{7}Be	^{40}K	^{60}Co	^{137}Cs	^{152}Eu	^{154}Eu	^{208}Tl	^{212}Pb	^{214}Pb	^{226}Ra	^{228}Ac	^{228}Th	^{235}U	^{241}Am
Maximum	0.05	24.6	0.02	4.68	0.09	0.03	0.87	3.25	1.08	2.29	2.66	1.75	0.16	
Mean	0.004	20.8	0.001	0.30	0.004	0.002	0.37	1.45	0.79	1.34	1.37	1.23	0.06	ND
Minimum	ND	14.0	ND	ND	ND	ND	0.19	ND	0.41	ND	0.74	0.74	ND	
Number of analyses[b]	3(31)	34	4(30)	23(11)	1(21)	2(20)	22	21(1)	22	31(2)	22	12	19(2)	(22)

[a]Observed activity less than detectable entered as 0.0.
[b]Analyses were of special-interest samples collected at the upper and lower ponds of the former Sodium Disposal Facility, RMDF, and the Southern California Edison Substation adjacent to the Old Conservation Yard. Numbers in parentheses represent the number of analyses indicating a less than detectable amount. The mean has been calculated from values above the detection limit.

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Table 4–4. Soil Monitoring Areas

Area	Type of Analysis
RMDF	Radioactivity
Hazardous Waste Treatment Facility	pH
RIHL	Radioactivity
Areas of contamination in the environment (includes any such areas found during the Area IV site characterization program)	Contaminants identified in the area
Randomly selected on–site and off–site locations; the off–site locations will include the locations of three additional air samplers to be installed outside Area IV	Radioactivity, pH, volatile organic compounds

D026–0005–15

needed because the contained reactivity is confined within the building concrete. All other contaminated inactive facilities are scheduled for completion of D&D in 1993. The RIHL (Building 020) has been undergoing D&D since 1989. Until completion, scheduled for 1998, the area will be monitored for radioactivity releases.

3. Areas in which radiological contamination exists would be locations of past releases to the environment. None are presently identified. Any areas in this category would be identified during the Area IV environmental characterization. An extensive soil characterization program will be conducted as part of the Area IV Radiological Characterization Program (Ref. 4–1). If any areas are found in which contamination exceeds the limits for uncontrolled release, they will be included in the monitoring program until remediation has been completed.

4. Locations at which no contamination is known or suspected will be sampled and analyzed to supplement surveillance of suspect locations. Twelve locations will be sampled and analyzed, both on–site and off–site, during each annual investigation. Different on–site locations will be selected at random each year. The locations off–site will be in other areas of SSFL and in publicly accessible areas adjacent to SSFL. They will include the locations of three additional air samplers to be installed outside Area IV (Section 4.1.1.4.3).

4.1.1.2 Surface Water Surveillance

4.1.1.2.1 Prior Surveillance

Area IV surface water surveillance sampling for radioactivity analysis began in 1959. Off–site sampling of the Chatsworth reservoir and Bell Creek for radioactivity analysis began in 1961. Off–site sampling was discontinued in 1990 as part of the radioactivity monitoring reduction which reflected reduced use and inventory of radioactive materials. The prior surveillance had shown no contamination of the surface waters.

Sampling and analysis of the R–2 Ponds for concentrations of chemical contaminants has been done periodically to assure maintenance of water quality for reuse for industrial purposes or for discharge.

4.1.1.2.2 Current Surveillance

Environmental monitoring of surface water is only the effluent monitoring specified by the NPDES permit, which is described in Section 4.1.2.1. This includes monitoring of effluent from the Area III Sewage Treatment Plant, although it is discharged to the R–2 Ponds rather than being discharged directly off–site. Periodic sampling of the R–2 Ponds continues as a routine verification of water quality.

4.1.1.2.3 Planned Surveillance

Environmental monitoring of surface water is only effluent monitoring, which is described in Section 4.1.2.1. The periodic sampling and analysis of the R–2 Ponds, which will be continued as support of operation of the SSFL reclaimed water system, is not considered part of this environmental monitoring plan. There is no surface water in Area IV other than the Building 056 pit, SRE Pond (seasonal), RMDF runoff catch basin, and temporary accumulations in low areas during infrequent rainy periods.

4.1.1.3 Groundwater Surveillance

4.1.1.3.1 Prior Surveillance

Groundwater characterization and surveillance at SSFL began with analysis of water from supply wells for chemical contaminants. When analyses showed the groundwater to be contaminated, an extensive hydrogeologic investigation was begun by the Rocketdyne Environmental Protection Department, with guidance and direction by regulatory agencies. The investigation was originally concentrated in Areas I, II, and III, where volatile organic compounds resulting from rocket engine testing activities were the initial contaminants discovered. Monitoring in Area IV was expanded in the late 1980s with the installation of additional wells. In 1989, analysis was expanded to include radioactivity analysis.

SSFL groundwater is periodically analyzed for organic compounds, metals, gross alpha and beta radioactivity, and tritium. The prevalent contaminants found in groundwater have been organic solvents. The major constituents which have exceeded drinking water standards are trichloroethylene and cis–1,2–dichloroethylene. The only radioactivity detected at levels above background has been tritium, found in some Area IV and off–site wells adjacent to the northwestern boundary of Area IV. Tritium concentrations have been far below the limit for drinking water.

4.1.1.3.2 Current Surveillance

Groundwater surveillance continues at SSFL using the network of the original supply wells and monitoring wells installed as part of the monitoring program. At the end of 1992, the network included 170 wells. There were 34 Area IV monitoring wells (including 6 in 3–well clusters just outside the Area IV boundary), and 6 off–site wells to monitor groundwater quality near Area IV. Planned new wells included 4 within Area IV and 4 off–site northwest of Area IV. Each set of 4 includes 3 in a 3–well cluster. Locations of new and planned wells are shown in Figure 4–1.

Recent status of Area IV groundwater quality is shown in Figures 4–2 and 4–3 and Table 4–5. The information is results published in the 1992 groundwater monitoring report (Ref. 4–2). The figures are maps which show the results of radiological analyses at Area IV wells, and the lateral extent in SSFL of TCE

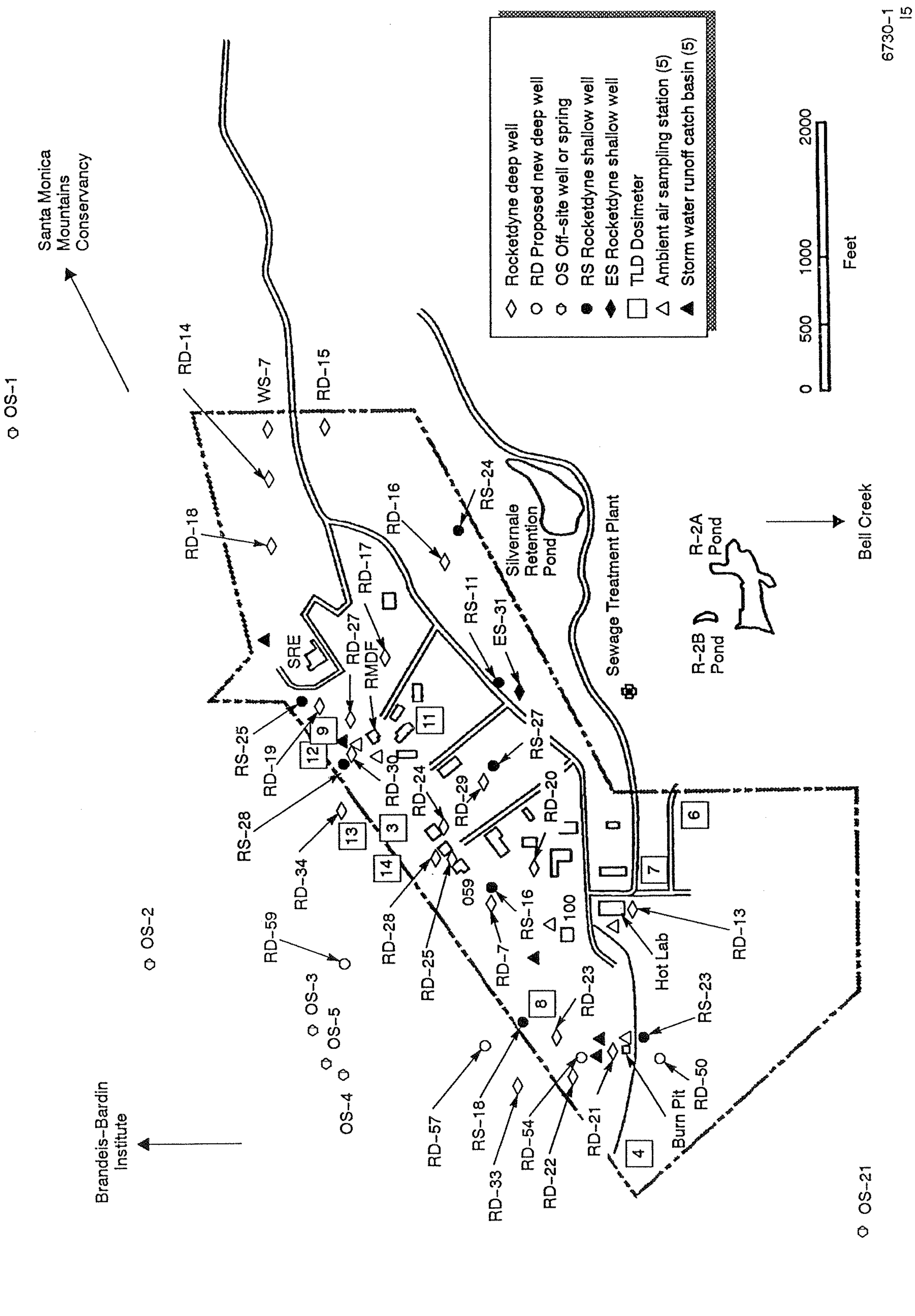

Figure 4-1. Area IV Environmental Sampling Stations

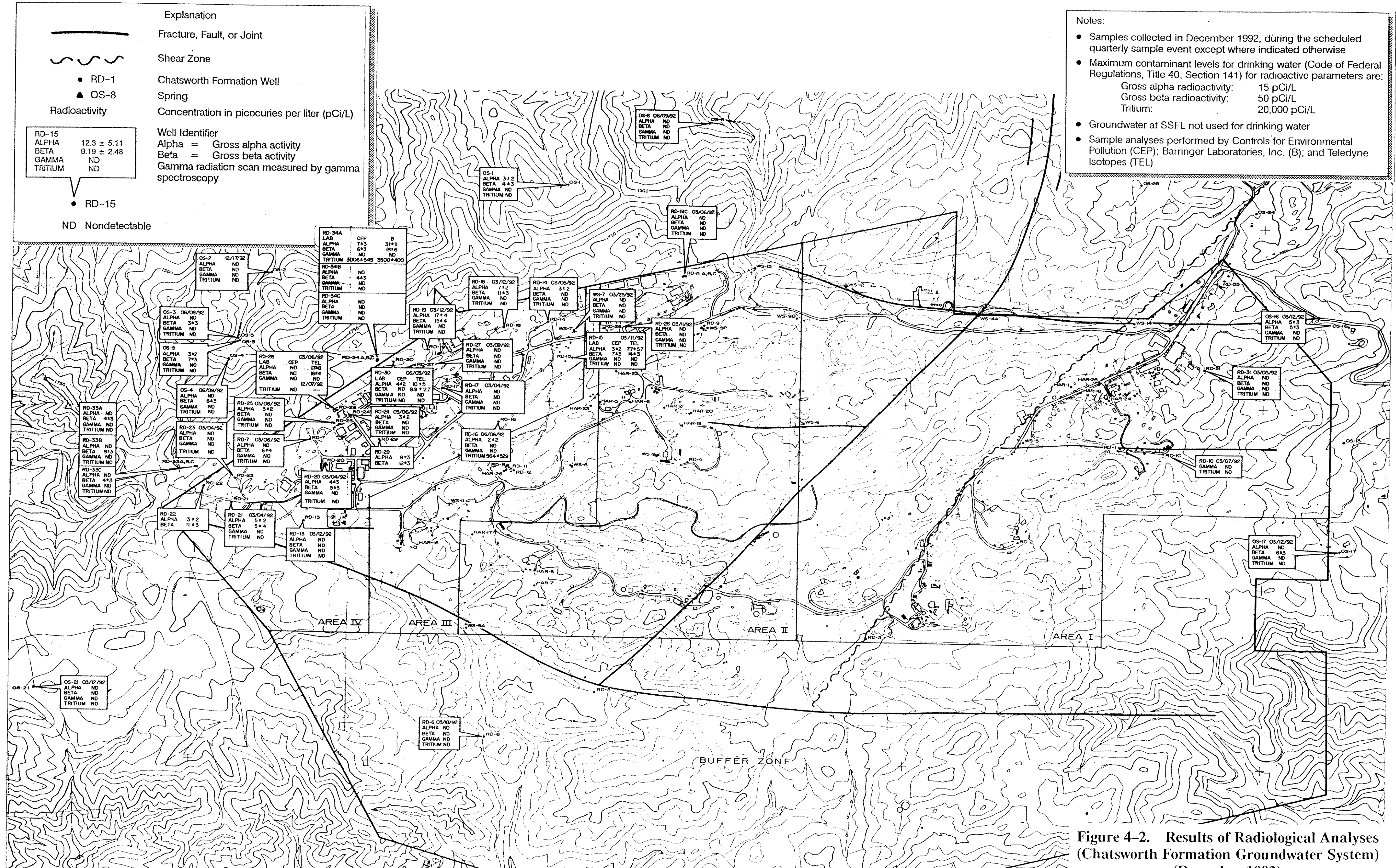

Figure 4–2. Results of Radiological Analyses (Chatsworth Formation Groundwater System) (December 1992)

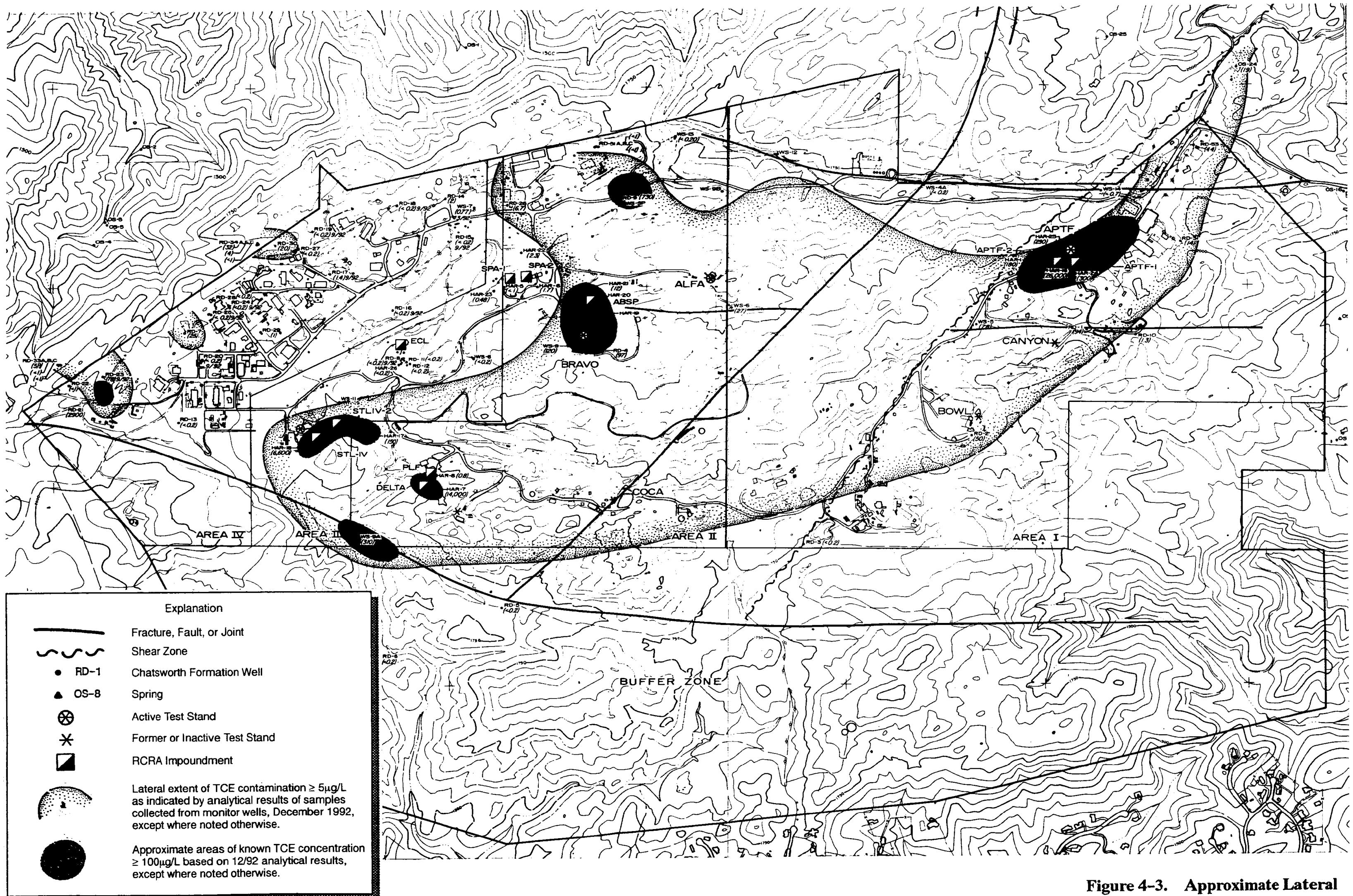

Figure 4-3. Approximate Lateral Extent of TCE Contamination (Chatsworth Formation) (December 1992)

Table 4-5. Summary of Organic Compounds Detected in Area IV Wells - 1992 (Sheet 1 of 2)

Site Description	Well Identification	Organic Compound	Concentration (μ g/L)	Max. Acceptable Level (μ g/L)*
Former Sodium Disposal Facility	RS-18	1,1 - Dichloroethane 1,1 - Dichloroethylene 1,1,1 - Trichloroethane Trichloroethylene	65. 78 64 1900	5.0 6.0 200 5.0
Former Sodium Disposal Facility	RD-21	Trichloroethylene	2900	5.0
Former Sodium Disposal Facility	RD-22	ND	NA	NA
B/056 Land-fill	RD-23	1,2 - Dichloroethane Cis - 1,2 - Dichloroethylene Trichloroethylene	2.9 6.8 78	0.5 6.0 5.0
B/056 Land-fill	RD-7	Trichloroethylene Cis - 1,2 - Dichloroethylene	25 1.1	5.0 6.0
B/059	RD-24	ND	NA	NA
B/059	RD-25	Cis - 1,2 - Dichloroethylene Tetrachloroethylene	0.78 14	6.0 5.0
B/059	RD-28	Tetrachloroethylene	0.61	5.0
NW of ECL	RS-11	ND	NA	NA
Burro Flats, West of STL-IV	RD-13	ND	NA	NA
SE of B/133	RD-17	Trichloroethylene	1.4	5.0
NE of B/133	RD-18	ND	NA	NA
Along G Street	ES-31	ND	NA	NA
SW of B/059	RS-16	ND	NA	NA
South of B/886	RS-23	a	NA	NA
NW of ECL	RS-24	a	NA	NA
Near B/133	RS-25	a	NA	NA
Burro Flats	RS-27	ND	NA	NA
Off-site west of Area IV boundary near RMDF	RD-33A[b] (100 ft)	Trichloroethylene	5	5.0
	RD-33B[b] (359 ft)	ND	NA	NA
	RD-33C[b] (481 ft)	ND	NA	NA
Off-site west of Area IV boundary near former Sodium Dis-posal Facility	RD-34A[b] (16 ft)	1,1 - Dichloroethane 1,1 - Dichloroethylene Cis - 1,2 - Dichloroethylene Trichloroethylene	2 7 11 36	5.0 6.0 6.0 5.0
	RD-34B[b] (179 ft)	1,1 - Dichloroethylene Cis - 1,2 - Dichloroethylene Trichloroethylene	1 2 4	6.0 6.0 5.0
	RD-34C[b] (378 ft)	ND	NA	NA

Table 4-5. Summary of Organic Compounds Detected in Area IV Wells - 1992 (Sheet 2 of 2)

Site Description	Well Identification	Organic Compound	Concentration (μg/L)	Max. Acceptable Level (μg/L)*
RMDF leachfield	RS-28	1,1 - Dichloroethane 1,1 - Dichloroethylene Cis - 1,2 - Dichloroethylene Trichloroethylene Trichlorotrifluoroethane	1.8 3.7 11 60 6.7	5.0 6.0 6.0 5.0 NS
RMDF leachfield	RD-27	ND	NA	NA
RMDF leachfield	RD-30	1,1 - Dichloroethane 1,1 - Dichloroethylene Cis - 1,2 - Dichloroethylene Trichloroethylene Trichlorotrifluoroethane	1.7 1.6 7.5 38 7.5	5.0 6.0 6.0 5.0 NS
Old Conservation Yard	RD-14	Trichloroethylene	2.0	5.0
Old Conservation Yard	WS-7	Cis - 1,2 - Dichloroethylene Trichloroethylene	0.21 0.77	6.0 5.0
New Conservation Yard	RD-15	ND	NA	NA
B/133 Sodium Treatment Facility	RD-19	ND	NA	NA
SE Drum Storage Area	RD-16	ND	NA	NA
B/100 Trench	RD-20	ND	NA	NA
Burro Flats, SE of B/059	RD-29	Trichloroethylene	1	5.0
North of site	OS-1	ND	NA	NA
NW of site	OS-2	ND	NA	NA
NW of site	OS-3	ND	NA	NA
NW of site	OS-4	ND	NA	NA
NW of site	OS-5	ND	NA	NA
SW of site	OS-21	ND	NA	NA

Notes:

[a]Well has always been dry
[b]RD-33 and RD-34 are clusters of three wells having the different depths indicated with the well identification.
ND - No organic compounds detected
NA - Not applicable
NS - Not stated

Source: Reference 4-2

*California Code of Regulations Title 22 (drinking water standards)

D026-0005-15

contamination above the drinking water standard. The tables list the measured (most recent 1992 values) and limit concentrations of organic compounds. Trichloroethylene and cis–1,2–dichloroethylene concentrations exceed their limits most frequently. The quality of natural groundwater is summarized in Table 4–6.

4.1.1.3.3 Planned Surveillance

There is no groundwater surveillance included in the Area IV Environmental Monitoring Program defined by this report; however, groundwater monitoring is continuing as a separate, though related, program. The Area IV portion of that program is defined by the ETEC Groundwater Management Plan (Ref. 4–3). The near–term monitoring program is defined as part of the Area IV monitoring procedures document (Ref. 4–4).

4.1.1.4 Air Surveillance

4.1.1.4.1 Prior Surveillance

Ambient air sampling was initiated in 1959, with eight sampling stations active between 1966 and 1989. The number of sampling stations was reduced to five in 1990. Each was operated on a 24–h cycle. The locations of these samplers are listed in Table 4–7. Each air sampler drew about 25 m^3 of air through a glass fiber filter disk each day to collect airborne particulates. The samplers operated on a 24–h sampling interval, with the collecting filter being changed automatically at midnight.

Ambient air particulate samples were analyzed for gross alpha and gross beta radioactivity. Composites of filter samples during a 1–year period were analyzed for gamma–emitting radionuclides, ^{90}Sr, and isotopes of plutonium and uranium. Only naturally occurring radioactivity and fission products from atmospheric tests of nuclear devices and other events such as Chernobyl were found.

4.1.1.4.2 Current Surveillance

Ambient air sampling continues as described in Section 4.1.1.4.1 with the five air samplers listed in Table 4–7. The results during a recent year (1991) for the four samplers with daily filter change are given in Table 4–8. (Gross alpha radioactivity results for the more heavily loaded filter changed weekly are not comparable and are not included in Table 4–8.) The analysis of results for composites of filters from all five locations for a 1–year period (1991) are given in Table 4–9. The activity detected is attributed to naturally occurring radionuclides and possibly to aged fission products from past atmospheric tests of nuclear devices or other events, such as the Chernobyl accident.

4.1.1.4.3 Planned Surveillance

The current monitoring of ambient air radioactive particulates will continue with the modifications described below.

1. The procedure described in the previous sections will be modified by extending the filter changeout frequency from daily to weekly. The higher total radioactivity collected in the larger particulate samples during the increased sampling time will result in an improved

Table 4-6. Groundwater Quality Background Levels

Constituent	Concentration
EPA priority volatile organic compounds	Below limit of detection[a]
EPA priority base/neutral organic compounds	Below limit of detection[b]
EPA priority acid organic compounds	Below limit of detection[c]
Nonpriority and semi-quantified organic compounds	Below limit of detection[b,c]
Common ions[b]	
Calcium	62 mg/L
Magnesium	17 mg/L
Sodium	41 mg/L
Potassium	4.3 mg/L
Carbonate	<2.6 mg/L
Bicarbonate	295 mg/L
Chloride	25.8 mg/L
Sulfate	44 mg/L
Nitrate	0.4 mg/L
Fluoride	0.4 mg/L
Boron	<0.1 mg/L
Silica	20 mg/L
Total dissolved solids	355 mg/L
Electrical conductivity	602 μmho/cm
pH	8.9
Trace Metals[b]	
Manganese	0.019 mg/L
Strontium	0.191 mg/L
Zinc	1.837 mg/L
Others	Below limit of detection
Radioactivity	
Gross Alpha[d]	
Shallow zone	2.0–14.6 pCi/L
Chatsworth Formation	0–8.2 pCi/L
Gross Beta[d]	
Shallow zone	0.7–8.1 pCi/L
Chatsworth Formation	0.3–9.7 pCi/L
Tritium[e]	0–50 pCi/L

[a] Well RD-18 sampling and analyses from 9-15-89 to 9-12-92 (8 samples). Toluene (4 micrograms per liter, vs. 0.1 microgram per liter limit of detection) was measured in the first sampling (9-15-89); however, the concentration was below the limit of detection in 10-26-89. No subsequent toluene analysis has been reported.

[b] Well RD-18 sampling and analysis on 9-15-89 (no subsequent sampling has been done).

[c] Carbon disulfide (4 micrograms per liter) was detected in Well RD-18; however, it has not been detected in any other Area IV well and is not considered a background constituent.

[d] Radioactivity measured in investigation of naturally occurring radionuclides in groundwater at SSFL. The predominant groundwater radioactivity is from naturally occurring ^{238}U and its daughters ^{234}U and ^{226}Ra, and from ^{228}Ra, daughter of naturally occurring ^{232}Th.

[e] Tritium in water was determined (Ref. 4-5) from measurements of concentrations from various sources: surface water (including Area IV ponds), groundwater (including Area IV Chatsworth Formation wells), drinking water (tap and bottled), rainfall, and "dead water" (aged water from deep wells, where the water had been isolated throughout several half lives of tritium). Tritium concentration values in 30 samples had a Gaussian distribution with a mean of 14.1 pCi/L, 1-sigma uncertainty of 6.5 pCi/L, and maximum of 42.9 $\pm$ 9.0 pCi/L. Although this is based on more than just groundwater, it is considered representative of "natural" water and valid as an estimate of the magnitude of background concentration of tritium. This background was determined by use of electrolytic environment methods, and is well below the 500 pCi/L minimum detection level of the normally used EPA Method 906.0. Because of differences in water from different sources, use of a range of 0-50 pCi/L is suggested.

D026-0003-I5

Table 4-7. Ambient Air Monitoring Locations

Sample Station	Current Location	Sample Frequency	New Location
A-2	Building 020 (RIHL), southwest side	Daily	Area IV/Area III boundary at L Street
A-3	Building 034 (RMDF), at main gate	Daily	Area IV boundary, northwest of RMDF
A-4	Building 886 (former Sodium Disposal Facility)	Daily	Same as current location
A-5	RMDF pond, north side	Daily	Same as current location
A-6	Building 100, east side	Weekly	Area IV boundary, northwest of Building 100

D026-0005-I5

Table 4-8. Ambient Air Radioactivity Data - 1991

Area	Activity	Number of Samples	Gross Radioactivity Concentrations (μCi/mL)		
			Annual Average Value and Dispersion	Maximum Value[a] and Date Observed	Average Percent of Guide[b]
RIHL	Alpha Beta	327	(2.3 ± 3.3) E-15 (48.3 ± 22.6) E-15	12.9 E-15 (12/31) 155.3 E-15 (02/03)	3.8 0.16
RMDF	Alpha Beta	356	(2.0 ± 3.5) E-15 (45.5 ± 29.1) E-15	15.7 E-15 (04/14) 206.4 E-15 (04/14)	10.0 0.51
Building T886	Alpha Beta	354	(2.2 ± 3.2) E-15 (48.0 ± 27.7) E-15	11.2 E-15 (12/22) 160.0 E-15 (09/25)	3.7 0.16
RMDF pond	Alpha Beta	342	(2.4 ± 3.1) E-15 (49.3 ± 28.2) E-15	11.4 E-15 (01/29) 173.8 E-15 (02/03)	4.0 0.16

[a]Maximum value observed for single sample.
[b]Guide: 6E-14 μCi/mL alpha, 3E-11 μCi/mL beta; 10 CFR 20 Appendix B, CCR 17, and 2E-14 μCi/mL alpha, 9E-12 μCi/mL beta, DOE Order 5400.5 (02/08/90).

D026-0005-I5

signal-to-noise ratio. This will increase the minimum radioactivity level detectable by about a factor of three. Considering the low levels of airborne radioactivity historically found and small inventory of radioactivity now at Area IV, the tradeoff of time resolution for increased sensitivity will be an improvement.

2. Existing sampling locations will be changed as necessary to provide effective coverage and separation from obstructions. The new locations are identified in Table 4-7.

3. Additional air samplers will be used as an adjunct to the above air samplers. Their locations are listed in Table 4-10. As with the existing air samplers, they will collect particulates on filters to allow detection of radioactivity. They will have a weekly sampling interval.

Table 4-9. Filtered Exhaust and Ambient Air Radioactivity Concentrations - 1991

	Activity Concentration (femtocuries per cubic meter)																
	^{7}Be	^{40}K	^{60}Co	^{90}Sr	^{137}Cs	^{210}Po	^{228}Th	^{230}Th	^{232}Th	^{234}U	^{235}U	^{238}U	^{238}Pu	$^{239/240}Pu$	^{241}Am	Gross Alpha	Gross Beta
Limit*	40,000,000	–	300,000	30,000	500,000	7,000	200	80	1,000	4,000	4,000	3,000	70	60	200	20	100,000
Exhaust																	
RMDF	ND	4.25	2.94	0.31	5.67	0.26	0.004	0.009	0.0006	0.04	0.01	0.02	0.0005	0.03	0.001	0.4	11.8
RIHL	59.9	1.70	ND	2.01	9.78	2.86	0.010	0.004	ND	0.09	0.01	0.06	0.004	0.25	0.011	1.5	18.0
T059	ND	3.74	2.73	ND	0.17	0.90	0.008	0.001	ND	0.07	ND	0.08	0.00004	0.04	0.002	1.8	16.4
Ambient																	
RMDF	386.0	56.8	ND	-0.13	0.44	17.10	0.022	0.007	0.034	-0.001	-0.001	0.056	-0.0013	-0.0001	ND	2.0	47.6
RMDF Pond	ND	54.3	ND	-0.17	0.62	16.40	0.028	0.022	0.015	0.09	0.001	0.053	-0.0009	0.0007	ND	2.4	51.4
RIHL	421.9	165.4	ND	-0.11	3.30	18.18	0.019	0.030	0.023	0.06	0.027	0.082	0.0002	0.0010	ND	2.3	50.4
T100 (7 day)	451.8	7.2	ND	-0.07	-0.08	17.81	0.030	0.236	0.010	0.78	0.013	-0.010	0.0001	0.0009	ND	2.3	47.2
T886	535.5	125.3	ND	-0.13	-0.73	18.18	0.047	0.020	0.016	0.11	-0.014	0.081	0.0017	-0.0001	ND	2.2	50.1
Exhaust Average	20	3.2	1.9	0.77	5.2	1.3	0.007	0.005	0.000	0.07	0.01	0.05	0.002	0.11	0.005	1.2	15
Ambient Average	359	82	0	-0.12	0.71	18	0.029	0.063	0.020	0.21	0.005	0.052	0	0.0005	0	2.2	49

ND = not detected

*The limit is the most restrictive maximum permissible concentration (MPC) or derived concentration guide (DCG) for each radionuclide (from the California Code of Regulations, CCR 17). These values refer to the permissible concentrations allowed by the State of California (and the NRC) and the DOE for continuous exposure of the public.

D026-0005-15

Table 4-10. Additional Air Sampler Locations

Designation	Location Description
A-7	At Area IV boundary, northwest of Building 059
A-9	Near Area III Security Building
A-10	At Building 600, Area III Sewage Treatment Plant
A-11	At Building 029
A-12	Northeast of Building 143 (SRE)

D026-0005-I5

Filters will be counted for gross alpha and gross beta radioactivity. Composites of filters collected in a year will be analyzed for gamma-emitting radionuclides, ^{90}Sr, and isotopes of plutonium and uranium.

4.1.1.5 Direct Radiation Surveillance

4.1.1.5.1 Prior Surveillance

Direct radiation has been monitored at various locations, both on-site and off-site, since the early 1960s. The maximum number of dosimeters in service was 14 on-site and 5 off-site. That was reduced in 1991 to 10 on-site and 2 off-site.

4.1.1.5.2 Current Surveillance

The penetrating radiation of interest in Area IV is gamma radiation, since there are no longer any sources of neutron radiation at the site. Thermoluminescence dosimeters (TLDs) are used to measure the integrated gamma radiation exposure at selected locations. The TLD locations are listed in Table 4-11 and shown in Figure 4-1.

The TLDs used for this monitoring are lithium fluoride (LiF) dosimeters supplied by the same vendor who provides personnel radiation dosimetry services for Area IV. LiF dosimeters respond to a wide range of gamma radiation energy (generally 0.02 to 10 Mev) in a variety of environmental conditions. Their sensitivity threshold is only about 10 mrem integrated exposure; however, the measured radiation usually ranges from 20 to 40 mrem per exposure period. The exposed dosimeters record the total radiation exposure received. The TLDs are replaced quarterly and returned to the vendor for reading to determine the exposure.

The results during a recent year (1991) are shown in Table 4-12. These are total exposure results and include contributions from natural background of about 70 mrem/yr. These results indicate compliance with the pertinent NRC and DOE regulations.

The Radiologic Health Branch (RHB) of the State of California Department of Health Services (DHS) provides packages containing calcium sulfate dosimeters for independent monitoring of radiation levels at SSFL and in the surrounding area. These dosimeters are placed with the Rocketdyne TLDs. The State dosimeters are returned to the RHB for evaluation by their vendor laboratory. Data for these TLDs, placed at six Rocketdyne dosimeter locations, both on-site and off-site, are also shown in Table 4-12. The differences between exposure rates determined by Rocketdyne and the State may be due to differences in the precision with which the results are reported, and differences in gamma-radiation energy response for the

Table 4-11. Thermoluminescence Dosimeter Locations

Sample Station	Locations[a]
On-site Locations	
SS-3	Electric substation 719 on boundary fence (State of California TLD location)
SS-4	West boundary on H Street
SS-6	Northeast corner of Building 353 (State of California TLD location)
SS-7	Building 363, north side (State of California TLD location)
SS-8	Former Sodium Disposal Facility north boundary
SS-9	RMDF, northeast boundary at Building 133
SS-11	Building 036, east side
SS-12	RMDF northwest property line boundary (State of California TLD location)
SS-13	RMDF, northwest property line boundary
SS-14	RMDF, northwest property line boundary
Off-site Locations	
OS-1	Chatsworth (State of California TLD location)
OS-4	Simi Valley (State of California TLD location)

[a]Locations indicated "State of California TLD Location" contains both Rocketdyne and California DHS dosimeters.

D026-0005-15

two different dosimeter materials. The Rocketdyne vendor reports these results to the nearest 10 mrem, while the State vendor reports results to the nearest 0.1 mrem.

4.1.1.5.3 Planned Surveillance

The current monitoring of ambient radiation using TLDs will continue as described in Section 4.1.1.5.2, including support for the parallel effort by the California DHS. The DHS is currently transferring responsibility for its TLD program from the RHB to the Environmental Management Branch. In addition, a program will be initiated to monitor radiation at SSFL locations near off-site populations. High-pressure ionization chambers (HPIC) will be used to monitor radiation levels at the locations listed in Table 4-13. They consist of two locations in areas nearest off-site populations (at the SSFL site entrance, which is adjacent to a residence at the east end of the site, and near Bell Creek at the south buffer zone boundary with the developed Bell Canyon) and one location centrally located in Area IV. These locations provide the source of reliable power needed for operation of the HPICs.

The HPIC monitoring will supplement the integrated dose measurements of the TLDs. The HPICs measure background gamma radiation doses over an energy range (0.07 to 8 MeV) which is nearly as wide as

Table 4-12. Ambient Radiation Dosimetry Data - 1991

TLD Location		Quarterly Exposure (mrem)				Annual* Exposure (mrem)	Annual Average Exposure Rate (μR/h)	
		Q-1	Q-2	Q-3	Q-4		Rocketdyne	State DHS
SSFL	SS-3	10.0	30.0	30.0	15.0	85.0	9.7	11.0
	SS-4	15.0	30.0	30.0	10.0	85.0	9.7	
	SS-6	10.0	30.0	30.0	10.0	80.0	9.1	12.0
	SS-7	20.0	35.0	30.0	10.0	95.0	10.8	11.3
	SS-8	10.0	40.0	40.0	15.0	105.0	12.0	
	SS-9	20.0	40.0	40.0	20.0	120.0	13.7	
	SS-11	10.0	35.0	30.0	20.0	95.0	10.8	
	SS-12	20.0	50.0	50.0	20.0	140.0	16.0	19.2
	SS-13	40.0	50.0	40.0	30.0	160.0	18.3	
	SS-14	60.0	20.0	10.0	20.0	110.0	12.6	
Mean value		21.5	36.0	33.0	17.0	107.5	12.3	13.4
Off-site	OS-1	10.0	40.0	15.0	10.0	75.0	8.6	8.9
	OS-5	10.0	30.0	15.0	10.0	65.0	7.4	7.9
Mean value		10.0	35.0	15.0	10.0	70.0	8.0	8.4

*Includes natural background radiation of approximately 70 mrem/yr.

D026-0005-I5

Table 4-13. Area IV Ion Chamber Direct Radiation Monitor Locations

Designation	Location Description
HPC-1	Near south boundary at Bell Creek Weir and Well 9
HPC-2	At east boundary at Main Gate Security Building
HPC-3	Building 006 (central location within Area IV)

D026-0005-I5

for the TLDs. The major benefit of the HPICs is that they record the dose rate continuously. This provides a record of instantaneous dose rates and gives information on diurnal and seasonal variations. Data will be recorded continuously and collected weekly, except during the annual HPIC removal from service for calibration.

4.1.1.6 Vegetation Surveillance

4.1.1.6.1 Prior Surveillance

Vegetation was sampled and analyzed for radioactivity as an adjunct to routine soil sampling and analysis. It was part of the initial Area IV environmental monitoring program begun in 1954. Samples were collected at the same locations and frequencies used for soil surveillance (Section 4.1.1.1.1). This sampling was terminated in 1986 following a review of prior vegetation analysis data, which indicated that the measurements were not contributing significantly to evaluation of the environmental impact of Area IV operations.

None of the vegetation adjacent to the area was significantly involved in any food chain. Soil and water data from the on–site stations were adequate to determine environmental effects of Area IV activities and the effectiveness of environmental controls in effect. Since 1986, vegetation sampling and analysis has been only of special–interest samples.

Routine vegetation samples were analyzed for gross alpha and gross beta radioactivities. Special interest samples since 1989 have been analyzed using isotopic–specific gamma spectroscopy. The results for the last 2 years of routine sampling are summarized in Table 4–14. There are no significant differences between the radioactivities at on–site and off–site locations.

A special study done in a contaminated area showed that vegetation sampling can identify the presence of contamination. In 1966, vegetation was collected from the RMDF area and analyzed for gross beta–gamma activity. The measured activities are given in Table 4–15. (The types of plants sampled are not known.) The activities show significant activities in vegetation from the RMDF leachfield, which was later remediated by removal of the affected soil. Vegetation sampling in 1989, after soil removal, showed no contamination. These results are also given in Table 4–15.

4.1.1.6.2 Current Surveillance

Current vegetation sampling is only of special–interest samples to investigate areas of interest. The results during a recent year (1991) are given in Table 4–16. Samples were collected at the former Sodium Disposal Facility.

4.1.1.6.3 Planned Surveillance

Natural vegetation will be collected annually in conjunction with the soil sampling at on–site randomly selected locations and at off–site locations. They will be analyzed for gamma–emitting isotopes.

Table 4–14. Routine Vegetation Sampling Radioactivity Data

Year	No. of Samples	Alpha Radioactivity (pCi/g)			Beta Radioactivity (pCi/g)		
		Dry	Ash		Dry	Ash	
		Average ± Dispersion	Average ± Dispersion	Maximum/ Month Observed	Average ± Dispersion	Average ± Dispersion	Maximum/ Month Observed
Area IV							
1985	144	0.49 ± 0.58	3.76 ± 4.44	22.0/Dec	18.5 ± 9.0	134.8 ± 3.4	268.9/Oct
1984	144	0.57 ± 0.76	3.97 ± 3.78	20.4/Nov	23.1 ± 11.3	136.2 ± 47.1	253.5/Dec
Non–Area IV							
1985	48	1.05 ± 1.73	4.68 ± 6.25	25.3/Jan	26.2 ± 13.7	132.8 ± 49.2	242.4/Jan
1984	48	0.94 ± 1.13	3.97 ± 4.53	30.8/Jul	30.9 ± 12.0	136.0 ± 44.6	278.2/Jan

D026–0005–15

Table 4-15. Vegetation Radioactivity in RMDF Area

Sample Location	Plant Type	Gross Beta-Gamma Activity (pCi/g)	
		Ash	Dry
1966			
1. North of fence, west of angle in fence	Not reported	428	NM
2. North of fence, just east of northwest corner	Not reported	195	NM
3. On slope north of fence, just east of angle in fence	Not reported	486	NM
4. On slope north of fence, north of Building 664	Not reported	161	NM
5. On slope north of fence, north of northeast corner fencepost	Not reported	785	NM
6. East side of leachfield plateau, north of northeast corner fencepost	Not reported	173	NM
7. In leachfield (southwest of No. 6 and northeast of No. 8)	Not reported	70,680	NM
8. In leachfield (southwest of No. 7)	Not reported	22,050	NM
9. On slope north of fence, near midpoint of east-west fence section	Not reported	234	NM
10. On slope north of fence, east of northeast corner fencepost	Not reported	273	NM
11. By water drain pipe at north fence, near No. 4	Not reported	409	NM
12. Ravine below Building 022 in runoff stream bed	Not reported	18,700	NM
1989			
1. Leachfield plateau, north of Building 022	Acacia	355	30
2. Leachfield plateau, north of northeast corner fence post	Mulefat	211	16
3. Near leachfield, north of northeast corner fencepost	"Green & Furry"	185	20
4. Northwest shoulder of leachfield plateau	California Laurel Sumac	98	14
5. Near north edge of leachfield plateau	Wire Bush	69	7
6. On leachfield plateau	Little Green Lace	180	15
7. On leachfield plateau, north of northeast fencepost	Wire Bush	105	11
8. On leachfield plateau, north of northeast fencepost	Creosote	160	15
9. Near west shoulder with northeast fence	Toyon	137	22

D026-0005-15

Table 4-16. Vegetation Radioactivity - 1991

	Activity (pCi/g)										
	^{3}H	^{7}Be	^{40}K	^{60}Co	^{125}Sb	^{137}Cs	^{208}Tl	^{212}Pb	^{214}Bi	^{228}Ac	^{235}U
Maximum	–	0.65	32.6	0.02	–	0.10	0.98	–	0.27	0.15	–
Mean	0.1	0.36	10.6	0.02	0.06	0.07	0.63	0.02	0.10	0.11	0.11
Minimum	–	0.11	2.46	0.01	–	0.03	0.14	–	0.02	0.03	–
Number of analyses[a]	1(2)	11(9)	19(1)	2(18)	1(11)	2(18)	5(7)	1(11)	7(5)	4(8)	1(11)

[a]Analyses were of special-interest samples collected at the former Sodium Disposal Facility. Numbers in parentheses represent the number of analyses reported as less than the detectable limit (<DL). The mean has been calculated from reported values only.

D026-0005-15

4.1.1.7 Animal Surveillance

Animal surveillance is not an important part of Area IV surveillance for contamination or for estimating the public radiation dose. SSFL has a variety of native wildlife, as a result of the generally protected wilderness condition of the site, assisted by artificial ponds which make water available where the area would normally be dry, and by the somewhat enhanced food supply resulting from workers' meals and deliberate feeding of the animals. Access of these animals to contamination is minimal. There are no sources of significantly contaminated water, and only small areas of contaminated soil that do not supply significant forage for the animals. Thus, there is little, if any, chance that wildlife would be contaminated. Further, since the wildlife are not a part of the local human food chain, they would not provide a pathway for exposure to the public.

4.1.1.7.1 Previous Surveillance

Surveillance of animals for evidence of contamination has not been a part of the Area IV routine surveillance program; however, some dead animals have been collected and analyzed by gamma spectroscopy. These have included a dead deer found in 1989 and roadkill rabbits and squirrels. There has been no evidence of radioactivity other than from naturally occurring isotopes. Also, trapped mice have been analyzed, but their mass is too small to provide adequate radioactivity for detection.

4.1.1.7.2 Current Surveillance

Samples of opportunity are analyzed for radioactivity, but there is no formal surveillance program.

4.1.1.7.3 Planned Surveillance

The Area IV Environmental Monitoring Program will not include animal surveillance; however, the past and current practice of radioactivity analysis of occasional samples of opportunity will continue.

4.1.2 Effluent Monitoring

Area IV effluent monitoring addresses contaminant transfer off-site through the surface water and air media. Surface water effluents are limited to discharges from the R-2A Pond, which receives Area IV effluents, and rainfall runoff down the northwest slope of Area IV. Both of these effluents are governed by the NPDES permit. Air effluents are emissions from sources in Area IV. Sources containing radioactivity are the exhaust stacks of Buildings 020 and 059, and the RMDF. Sources not containing radioactivity are principally the various heaters in Area IV and are governed by VCAPCD rules and permits.

Other media are not included in the effluent monitoring portion of the program.

1. Transport of soil contamination from Area IV would be through one of the other media, so soil is not addressed as an effluent. The off-site component of soil surveillance will provide monitoring for the occurrence of transport of soil contamination.

2. On the basis of results of the hydrogeologic program, there is not significant groundwater transport off-site, because of the small amount of shallow groundwater, and the nature of the Chatsworth Formation (low permeability rock with potential transport paths only through a network of small cracks, which are not necessarily connected). The groundwater surveillance program off-site will provide the evidence needed to evaluate potential transport of contaminants across the Area IV boundary.

3. Monitoring for the magnitude of exposure to direct radiation is covered by the direct radiation surveillance program (Section 4.1.1.5).

4. There is not a significant potential for transport of contamination from Area IV by vegetation and animals for the same reasons given in Section 3.2.4 for their not being a significant pathway for public exposure to contamination.

4.1.2.1 Surface Water Effluent Monitoring

4.1.2.1.1 Prior Monitoring

Effluent monitoring of surface water began in 1976, in compliance with the initial issue of NPDES Permit No. CA0001309, which included requirements for sampling and analysis of discharges from the R–2A Pond. Another monitoring program was developed and implemented in 1989 for storm water runoff from the northwest portion of Area IV. The NPDES permit was reissued with modifications in 1984 and again in 1992, when the modifications included incorporation of the northwest slope runoff monitoring.

Sampling of discharges from the R–2A Pond has been collection of grab samples of pond water at the times of discharge. Sampling of northwest slope runoff has been collection of samples from five collection basins during periods of rainfall. The monitoring locations are downstream of areas which were potential sources of runoff contamination: former Sodium Disposal Facility (two locations), behind Building 100, RMDF, and the SRE area. Water samples have been analyzed for volatile organic compounds, base/neutral acid extractable compounds, heavy metals, general chemical parameters, fish bioassays for toxicity testing, gross alpha radioactivity, and gross beta radioactivity. Samples of northwest slope runoff have also been analyzed for tritium and gamma–emitting isotopes. No significant contamination has been found.

The 1992 revision of the NPDES permit added a domestic sewage treatment monitoring program (Appendix A, Table A–11). This program is a continuation of existing periodic monitoring of sewage treatment plant effluent chemical parameters and continuous monitoring of the effluent turbidity, primarily for process control. In addition to the permit program for chemical monitoring, the liquid effluent from the Area III Sewage Treatment Plant has been monitored continuously for radioactivity. The monitoring system includes an alarm and automatic diverter valve to send the effluent to a separate holding pond if radioactivity contamination is detected.

4.1.2.1.2 Current Monitoring

Current monitoring of surface water effluent is continuation of the sampling described in Section 4.1.2.1.1, with the list of analytes modified in accordance with the 1992 revision of the NPDES permit. The current analytes and their concentration limits are listed in Appendix A, Tables A–6 through A–12.

The results of recent surface water effluent monitoring (in 1991) are summarized in Tables 4–17 through 4–20. They list the measured concentrations of chemical constituents and radioactivity for R–2A Pond water and for northwest slope runoff. They show that water quality is generally in compliance with contaminant limits, showing only minor exceedances related to turbidity and alkalinity, both of which seem to be natural effects. With the exception of tritium concentrations well below the drinking water standard, only natural radioactivity was found in the water.

Table 4–17. Chemical Data for R–2A Pond Discharges - 1991

Constituent	NPDES Permit Limit	Number of Samples	Minimum	Mean	Maximum
BOD	30 mg/L	14	2	5	8.5
Boron	1.0 mg/L	14	<0.2	0.2	0.4
Chloride	150 mg/L	14	10.2	43.5	82.4
Fluoride	1.0 mg/L	14	0.2	0.3	0.5
Grease and oil	15 mg/L	14	<0.2	1.4	3.4
Arsenic	0.005 mg/L	14	<0.001	0.002	0.004
pH	6 to 9	14	7.4	8.2	8.8
Residual chlorine	0.1 mg/L	14	<0.04	<0.04	<0.04
Settleable solids	0.3 mL/L	14	<0.04	0.3	1.0
Sulfate	300 mg/L	14	36.4	110.9	175
Suspended solids	150 mg/L	14	3.2	29	59
Surfactants	0.5 mg/L	14	<0.025	0.028	0.03
Temperature	37.8°C	14	9	14.9	25
Total dissolved solids	950 mg/L	14	115	380.8	631
Toxicity	>90% survival	14	90%	98.5%	100%
Turbidity	–	14	5	25.8	90

D026-0005-15

Table 4-18. 1991 Chemical Data for Northwest Rainfall Runoffs (Sheet 1 of 2)

Analyses in (mg/L)

Constituent	NPDES Permit Limit	Sodium Disposal Facility-1				Sodium Disposal Facility-2			
		No. of Samples	Min	Mean	Max	No. of Samples	Min	Mean	Max
Arsenic	0.05 mg/L	7	<0.01	0.001	0.003	7	<0.01	0.0005	0.002
Boron	1 mg/L	7	ND	0.14	0.3	7	ND	0.14	0.3
Chloride	150 mg/L	7	6.0	11.8	17.6	7	ND	18.5	77.9
Dissolved beryllium	b	7	ND	0.003	0.02	7	ND	0.004	0.022
Dissolved cadmium	b	7	ND	0.0006	0.001	7	ND	0.008	0.005
Dissolved chromium	b	7	ND	0.004	0.03	7	ND	0.004	0.03
Dissolved copper	b	7	ND	0.052	0.12	7	ND	0.03	0.08
Dissolved lead	b	7	ND	0.002	0.004	7	ND	0.002	0.004
Dissolved mercury	b	5	ND	0.0007	0.004	7	ND	0.00008	0.0004
Dissolved nickel	b	7	ND	0.06	0.23	7	ND	0.056	0.2
Dissolved zinc	b	7	0.017	0.06	0.08	7	ND	0.05	0.1
Fluoride	1.0 mg/L	7	0.2	0.44	1.1	7	ND	0.2	0.3
Oil and grease	15 mg/L	7	ND	1.3	1.9	7	ND	0.83	1.8
pH	–	7	7.8	8.2	8.9	7	ND	7.5	8.3
Residual chlorine	–	7	ND	ND	ND	7	ND	0.011	0.08
Sulfate	250 mg/L	7	19.2	34.7	74.4	7	ND	43.7	173.0
Surfactants	–	7	ND	0.010	0.04	7	ND	0.004	0.025
Volatile[a] Organics (Total)	–	6	ND	0.6	3.7	6	ND	0.52	3.1
BNAs (total)	–	6	ND	ND	ND	6	ND	ND	ND
Toxicity	–	7	100%	100%	100%	7	100%	100%	100%

Constituent	NPDES Permit Limit	Building 100				RMDF			
		No. of Samples	Min	Mean	Max	No. of Samples	Min	Mean	Max
Arsenic	0.05 mg/L	7	ND	0.0025	0.003	7	ND	0.0007	0.002
Boron	1	7	ND	0.043	0.2	7	ND	0.14	0.3
Chloride	150	7	1.0	3.3	4.8	7	1.0	17.5	73.8
Dissolved beryllium	b	7	ND	0.0032	0.015	7	ND	0.003	0.016
Dissolved cadmium	b	7	ND	0.0012	0.008	7	ND	0.0014	0.002
Dissolved chromium	b	7	ND	0.0086	0.03	7	ND	0.0085	0.04
Dissolved copper	b	7	ND	0.04	0.07	7	ND	0.04	0.007
Dissolved lead	b	7	ND	0.002	0.005	7	ND	0.0017	0.007
Dissolved mercury	b	5	ND	0.0001	0.0004	5	ND	0.00006	0.0003
Dissolved nickel	b	7	ND	0.06	0.11	7	ND	0.06	0.24
Dissolved zinc	b	7	0.008	0.06	0.14	7	ND	0.052	0.09
Fluoride	1.0 mg/L	7	0.1	0.13	0.2	7	ND	0.17	0.2
Oil and grease	15 mg/L	7	ND	1.3	3.0	7	ND	0.71	2.1
pH	–	7	7.2	7.5	8.3	7	7.0	7.6	9
Residual chlorine	–	7	ND	0.04	0.3	7	ND	ND	ND
Sulfate	250 mg/L	7	16.3	17.9	25.9	7	16.9	48.1	159.5
Surfactants	–	7	ND	0.03	0.055	7	0.045	0.015	0.064
Volatile[a] Organics (Total)	–	7	ND	0.1	0.7	7	ND	ND	ND
BNAs (total)	–	5	ND	ND	ND	6	ND	ND	ND
Toxicity	–	7	>100%	>100%	>100%	7	>100%	>100%	>100%

D026-0005-15

Table 4-18. 1991 Chemical Data for Northwest Rainfall Runoffs (Sheet 2 of 2)

Analyses in (mg/L)					
Constituent	NPDES Permit Limit	SRE Area			
		No. of Samples	Min	Mean	Max
Arsenic	0.05 mg/L	7	0.001	0.002	0.003
Boron	1 mg/L	7	ND	0.2	0.1
Chloride	150 mg/L	7	1.0	5.81	11.9
Dissolved beryllium	b	7	0.0003	0.003	0.011
Dissolved cadmium	b	7	0.0002	0.003	0.0059
Dissolved chromium	b	7	0.18	0.18	0.18
Dissolved copper	b	7	0.009	0.0392	0.057
Dissolved lead	b	7	0.001	0.00325	0.005
Dissolved mercury	b	5	0.0002	0.0002	0.000
Dissolved nickel	b	7	0.023	0.35	0.11
Dissolved zinc	b	7	0.039	0.0751	0.12
Fluoride	1.0 mg/L	7	0.1	0.15	0.3
Oil and grease	15 mg/L	7	1.1	1.925	3.8
pH	–	7	6.9	7.5	7.8
Residual chlorine	–	7	ND	ND	ND
Sulfate	250 mg/L	7	7.3	18.91	26.9
Surfactants	–	7	0.026	0.120	0.164
Volatile[a] Organics (Total)	–	6	ND	ND	ND
BNAs (total)	–	6	ND	ND	ND
Toxicity	–	7	>100%	>100%	>100%

[a]Volatile organic analysis showed none detectable, except in three incidents of possible laboratory contamination.
[b]Limit for total dissolved solids is 850 mg/L.

D026-0005-I5

Table 4-19. SSFL Surface Water Radioactivity Data - 1991

	Activity (pCi/L)						
	^{3}H	^{60}Co	^{137}Cs	^{226}Ra and ^{228}Ra	^{235}U	Gross Alpha[b]	Gross Beta
NPDES Permit Limit/	20,000	–	–	5	–	15	50
MPC[a]	–	30,000	20,000	–	30,000	–	–
Maximum	–	–	–	–	31.0	8.00	21.0
Mean	606	20.0	22.2	N/D	26.5	4.67	11.4
Minimum	–	–	–	–	21.9	3.00	5.00
Number of analyses[c]	1(7)	1(7)	1(7)	0(8)	2(6)	3(14)	10(7)

[a]Maximum permissible concentration for release to unrestricted use.
[b]The gross alpha activity limit excludes the radon and uranium activities.
[c]Numbers in parentheses represent the number of analyses reported as less than the detectable limit (<DL). The mean has been calculated from reported values only.
ND - Not detected.

D026-0005-I5

Table 4-20. Area IV Rainfall Runoff Radioactivity Data - 1991 (Five Locations, Sampled After Rainfall)

	Activity (pCi/L)			
	^{3}H	Gamma Spectroscopy	Gross Alpha	Gross Beta
NPDES Permit Limit	20,000	–	15	50
Maximum	–		5.00	18.0
Mean[a]	511	NDA	3.60	8.23
Minimum	–		3.00	4.00
Number of analyses[b]	1(19)		5(20)	13(12)

[a]Average of values greater than detection limit.
[b]Numbers in parentheses represent the number of analyses reported as less than the detectable limit (<DL). The mean has been calculated from reported values only.
NDA = Nondetectable activity

D026-0005-15

4.1.2.1.3 Planned Monitoring

The surface water effluent monitoring program will be that required to comply with the NPDES permit. The requirements are summarized in Appendix A, Section A.4. They include chemical monitoring of the effluent of the Area III Sewage Treatment Plant. In addition, monitoring of that effluent for radioactivity contamination will continue.

The sludge remaining at the Area III Sewage Treatment Plant following processing of sewage wastes will be sampled and analyzed quarterly. A representative sample will be collected from the sludge blanket prior to its disposal. The sample will be analyzed for hazardous waste characteristics as defined by 40 CFR 261 using the most appropriate analytical method. In addition, it will be analyzed for gross alpha and gross beta radioactivity, gamma-emitting isotopes, and tritium. The procedure for carrying out this sampling program is being prepared as part of a separate program. The periodic sludge monitoring will be accomplished as part of the Area IV Environmental Monitoring Program.

4.1.2.2 Air Emissions Monitoring

4.1.2.2.1 Prior Monitoring

Area IV facility areas containing unencapsulated or unpackaged radioactive material have been ventilated to control the potentially contaminated air in the areas. Air flow has been through an exhaust system to prevent spread of contamination to adjacent clean areas. The ventilation exhaust has been passed through high-efficiency particulate air (HEPA) filters before being discharged to the atmosphere. After filtering, the air has been monitored to measure radioactivity in the effluent. Data from this monitoring has demonstrated compliance with DOE, EPA (40 CFR 61, Subpart H, NESHAPS), NRC, and California RHB standards.

Nonradioactive emissions from Area IV facilities have been controlled in accordance with requirements of the VCAPCD. Compliance with permitted emission levels is provided for most sources by satisfying operating conditions specified in permits issued by the VCAPCD. Monitoring of emissions has been required only for the SCTI H–1 and H–2 natural gas–fired heaters.

The SCTI H–1 and H–2 heaters have been monitored using a continuous emission monitoring (CEM) system, which is still in service. The CEM is self–contained and able to extract and condition samples, analyze samples for desired constituents, and provide signal outputs and alarm functions. Samples have been analyzed for oxides of nitrogen, carbon monoxide, and oxygen. The CEM consists of one probe filter assembly for each heater and a corresponding number of sample interface enclosures, which are located at each sample tap. The CEM has a single set of sensors, which is time–shared between the two heaters. Using time–sharing, the averaging interval is 7 minutes. A new average is obtained every 15 minutes on each heater, except during periods of CEM calibration.

4.1.2.2.2 Current Monitoring

There are currently three Area IV facilities which are potential radioactivity release sites that require ventilation control and exhaust monitoring. These facilities are the RMDF, Building 059, and the RIHL (Bldg 020). Their emissions are passed through HEPA filters and are sampled for particulate radioactive materials by means of continuously operating stack exhaust samplers at the point of release. In addition, stack monitors installed at the RIHL and the RMDF provide automatic alarm capability in the event of release of particulate activity. The results during a recent year (1991) are shown in Tables 4–21 through 4–23. They show that no significant quantities of radioactivity were released. The tables include both gross alpha and gross beta radioactivity measured by continuously operating samplers, and radionuclide concentrations measured by gamma spectrometry of the composite of filters from a 1–year period. For non–gamma–emitting isotopes, the composited filters were analyzed by alpha and beta counting following chemical separation. The isotopic data is also shown with the ambient air monitoring results in Table 4–9. The effectiveness of the air cleaning systems is evident from the fact that the atmospheric effluents are less radioactive than is the ambient air with respect to the ambient air radionuclides ^{7}Be, ^{40}K, and ^{210}Po.

Emissions from the SCTI H–1 and H–2 heaters continue to be monitored using the CEM. They are in compliance with VCAPCD permit requirements except during low–load operations. A variance issued by the VCAPCD is in effect to allow these operations, which occur only during transitions to and from full–load operation. The variance is described in Appendix A, Section A–3.

4.1.2.2.3 Meteorological Information

Meteorological parameters appropriate for Area IV are needed for calculation of the radioactivity exposure doses to individuals as a result of Area IV activities. The individual doses are used with the demographic distribution to estimate the general population exposure dose from airborne particulates originating at Area IV. Meteorological parameters applicable to a range of possible Area IV atmospheric conditions have been defined on the basis of prior wind data so that further meteorological monitoring is not required.

Table 4-21. Atmospheric Effluents to Uncontrolled Areas – RMDF

SSFL/RMDF – 1991

Effluent volume (m^3)	215×10^{6}
Lower limit of detection (LLD)	
Gross alpha (µCi/mL)	3×10^{-16}
Gross beta (µCi/mL)	1×10^{-15}
Air volume sampled (m^3)	32,150
Annual average concentration in effluent	
Gross alpha (µCi/mL)	4.34×10^{-16}
Gross beta (µCi/mL)	1.18×10^{-14}
Maximum observed concentration	
Gross alpha (µCi/mL)	3.30×10^{-15}
Gross beta (µCi/mL)	1.32×10^{-13}
Activity released (µCi)	
Gross alpha	0.09
Gross beta	2.54

Radionuclide-Specific Data

Radionuclide	Half-Life (yr)	Activity[a] Detected (pCi)	Annual[b] Release (µCi)	Analysis[c] LLD (pCi)	Release[d] LLD (µCi)	Average Exhaust Concentration (µCi/mL)	DCG[e] (µCi/mL)
^{7}Be	0.146	ND	0	76	0.51	0	Natural
^{40}K	1,260,000,000	136.6	0.91	150	1.00	4.25×10^{-15}	Natural
^{60}Co	5.26	94.6	0.63	11	0.07	2.94×10^{-15}	8×10^{-11}
^{90}Sr	27.7	10.1	0.07	6	0.04	3.15×10^{16}	9×10^{-12}
^{137}Cs	30	182.3	1.22	10	0.07	5.67×10^{-15}	4×10^{-10}
^{210}Po	0.38	8.38	0.06	0.2	0.001	2.61×10^{-16}	Natural
^{234}U	247,000	1.34	0.009	0.1	6.68×10^{-4}	4.16×10^{-17}	9×10^{-14}
^{235}U	710,000,000	0.42	0.003	0.1	6.68×10^{-4}	1.30×10^{-17}	1×10^{-13}
^{238}U	4,510,000,000	0.54	0.004	0.1	6.68×10^{-4}	1.69×10^{-17}	1×10^{-13}
^{238}Pu	86.4	0.015	1.02×10^{-4}	0.2	0.001	4.73×10^{-19}	3×10^{-14}
$^{239/240}Pu$	24,390/6,580	0.85	0.006	0.2	0.001	2.64×10^{-17}	2×10^{-14}
^{241}Am	458	0.035	2.37×10^{-4}	0.1	6.68×10^{-4}	1.10×10^{-18}	2×10^{-14}

Naturally occurring radionuclides are included for information. These activities have not been used in dose estimates.

[a]Measured activity of exhaust sampling filters, yearly total.
[b]Measured activity adjusted for fraction sampled.
[c]Lowest identifiable activity at 95% confidence.
[d]Analysis LLDs adjusted for fraction sampled (result corresponds to annual release).
[e]Derived concentration guides (DCG) for exposure of the public, for most restrictive form of radionuclide as specified in DOE Order 5400.5 (2/8/90).

D026-0005-15

Table 4-22. Atmospheric Effluents to Uncontrolled Areas - RIHL

SSFL/RIHL - 1991	
Effluent volume (m^3)	468×10^{6}
Lower limit of detection (LLD)	
Gross alpha (µCi/mL)	3×10^{-16}
Gross beta (µCi/mL)	1×10^{-15}
Air volume sampled (m^3)	33,050
Annual average concentration in effluent	
Gross alpha (µCi/mL)	1.54×10^{-15}
Gross beta (µCi/mL)	1.80×10^{-14}
Maximum observed concentration	
Gross alpha (µCi/mL)	5.71×10^{-15}
Gross beta (µCi/mL)	2.25×10^{-13}
Activity released (µCi)	
Gross alpha	0.70
Gross beta	8.22

Radionuclide-Specific Data

Radionuclide	Half-Life (yr)	Activity[a] Detected (pCi)	Annual[b] Release (µCi)	Analysis[c] LLD (pCi)	Release[d] LLD (µCi)	Average Exhaust Concentration (µCi/mL)	MPC[e] (µCi/mL)
^{7}Be	0.146	1980.	28.06	76	1.08	5.99×10^{-14}	Natural
^{40}K	1,260,000,000	56.1	0.80	150	2.13	1.70×10^{-15}	Natural
^{60}Co	5.26	ND	0	11	0.16	0	3×10^{-10}
^{90}Sr	27.7	66.4	0.94	6	0.09	2.01×10^{-15}	3×10^{-11}
^{137}Cs	30	323.3	4.58	10	0.14	9.78×10^{-15}	5×10^{-10}
^{210}Po	0.38	94.6	1.34	0.2	0.003	2.86×10^{-15}	Natural
^{234}U	247,000	3.07	0.04	0.1	0.001	9.29×10^{-17}	4×10^{-12}
^{235}U	710,000,000	0.49	0.007	0.1	0.001	1.47×10^{-17}	4×10^{-12}
^{238}U	4,510,000,000	2.14	0.03	0.1	0.001	6.46×10^{-17}	3×10^{-12}
^{238}Pu	86.4	0.12	0.002	0.2	0.003	3.60×10^{-18}	7×10^{-14}
$^{239/240}Pu$	24,390/6,580	8.35	0.12	0.2	0.003	2.53×10^{-16}	6×10^{-14}
^{241}Am	458	0.35	0.005	0.1	0.001	1.05×10^{-17}	2×10^{-13}

Naturally occurring radionuclides are included for information. These activities have not been used in dose estimates.

[a]Measured activity of exhaust sampling filters, yearly total.

[b]Measured activity adjusted for fraction sampled.

[c]Lowest identifiable activity at 95% confidence.

[d]Analysis LLDs adjusted for fraction sampled (result corresponds to annual release).

[e]Maximum permissible concentrations (MPC) for release to unrestricted area for most restrictive form of radionuclide as specified in 10 CFR 20, Appendix B and CCR 17, Appendix A.

D026-0005-15

Table 4-23. Atmospheric Effluents to Uncontrolled Areas - Building 059

SSFL/T059 - 1991

Effluent volume (m^3)	29.6 X 10^6
Lower limit of detection (LLD)	
Gross alpha (μCi/mL)	3 x 10^{-16}
Gross beta (μCi/mL)	1 x 10^{-15}
Air volume sampled (m^3)	20,224
Annual average concentration in effluent	
Gross alpha (μCi/mL)	1.80 x 10^{-15}
Gross beta (μCi/mL)	1.64 x 10^{-14}
Maximum observed concentration	
Gross alpha (μCi/mL)	6.79 x 10^{-14}
Gross beta (μCi/mL)	5.74 x 10^{-13}
Activity released (μCi)	
Gross alpha	0.02
Gross beta	0.17

Radionuclide-Specific Data

Radionuclide	Half-Life (yr)	Activity[a] Detected (pCi)	Annual[b] Release (μCi)	Analysis[c] LLD (pCi)	Release[d] LLD (μCi)	Average Exhaust Concentration (μCi/mL)	DCG[e] (μCi/mL)
^{7}Be	0.146	ND	0	76	0.11	0	Natural
^{40}K	1,260,000,000	75.7	0.11	150	0.22	3.74 x 10-15	Natural
^{60}Co	5.26	55.2	0.08	11	0.02	2.73 x 10^{-15}	8 x 10^{-11}
^{90}Sr	27.7	ND	0	6	0.009	0	9 x 10^{-12}
^{137}Cs	30	3.53	0.005	10	0.01	1.75 x 10^{-16}	4 x 10^{-10}
^{210}Po	0.38	18.3	0.03	0.2	2.92 x 10^{-4}	9.04 x 10^{-16}	Natural
^{234}U	247,000	1.48	0.002	0.1	1.46 x 10^{-4}	7.34 x 10^{-17}	9 x 10^{-14}
^{235}U	710,000,000	ND	0	0.1	1.46 x 10^{-4}	0	1 x 10^{-13}
^{238}U	4,510,000,000	1.63	0.002	0.1	1.46 x 10^{-4}	8.07 x 10^{-17}	1 x 10^{-13}
^{238}Pu	86.4	0.0008	1.16 x 10^{-16}	0.2	2.92 x 10^{-4}	3.91 x 10^{-20}	3 x 10^{-14}
$^{239/240}Pu$	24,390/6,580	0.77	0.001	0.2	2.92 x 10^{-4}	3.78 x 10^{-17}	2 x 10^{-14}
^{241}Am	458	0.03	4.67 x 10^{-5}	0.1	1.46 x 10^{-4}	1.58 x 10^{-18}	2 x 10^{-14}

Naturally occurring radionuclides are included for information. These activities have not been used in dose estimates.

[a]Measured activity of exhaust sampling filters, yearly total.
[b]Measured activity adjusted for fraction sampled.
[c]Lowest identifiable activity at 95% confidence.
[d]Analysis LLD's adjusted for fraction sampled (result corresponds to annual release).
[e]Derived concentration guides (DCG) for exposure of the public, for most restrictive form of radionuclide as specified in DOE Order 5400.5 (2/8/90).

D026-0005-15

Population dose estimate calculations are done using the EPA–approved computer program CAP88–PC. Data needed by this code are the demographic distribution, release rates, stack height, and meteorological parameters (wind speed, wind direction, and frequency stability fractions). The demographic distribution is determined from census data (Section 1.2.6). Release rates are estimated from the results of stack monitoring, which are reported in an annual site environmental report (e.g., Ref. 4–6). Stack heights for potential radioactivity release facilities are known characteristics of the facilities.

Meteorological parameters were developed by the Nuclear Regulatory Commission (NRC) in 1980 (Ref. 4–7). Wind speed and direction distributions were determined from measurements throughout 1976 at an above–grade location on the ridge line of the Simi Hills about 2 miles east of Area IV. The resulting data set provided wind direction and speed frequencies assigned to eight compass directions. No on-site measurement of atmospheric stability was available on which to base frequency stability fractions, so a stability classification was developed by meteorologists from NRC, Argonne National Laboratory, and Rockwell International to provide an estimate of dispersion.

A comparison of past dose analyses using differing meteorological assumptions, and a sensitivity analysis including conservative meteorological assumptions, have shown that the meteorological parameters developed in 1980 are adequate for Area IV off–site dose analysis. The support studies are documented in Reference 4–8.

Evaluation of the impact of any nonroutine airborne releases requiring decisions on emergency response will use current wind data measured at meteorological stations at SSFL. Two such stations, in Area I and in Area IV, are operated by Environmental Protection. The stations are in compliance with EPA requirements. Both include wind speed and direction among the parameters measured hourly and entered automatically into a computer database. The information is available as needed from the database.

4.1.2.2.4 Planned Monitoring

As with the surface water monitoring program, the current air emission monitoring program is adequate to verify compliance with all existing permits and regulations. The Area IV Environmental Monitoring Plan is simply to continue the current program. Obviously, the necessity for radiological effluent monitoring of the current facilities will be eliminated when these facilities are decommissioned and/or cleaned sufficiently for release to unrestricted use.

4.2 ESTIMATION OF PUBLIC RADIATION DOSE

4.2.1 Current Program

Public radiation doses from Area IV sources are calculated for exposures through the atmospheric and direct radiation transport mechanisms. The other transport mechanisms are less significant contributors to public radiation doses, as described in Section 3.2.

4.2.1.1 Atmospheric Transport

Public exposure to radioactivity by atmospheric transport is calculated using the CAP88–PC computer code. This code calculates downwind concentrations of radioactive material in emissions from the three ventilation exhaust stacks in Area IV (Section 4.1.2.2), and determines the equivalent individual and population radiation doses.

Downwind concentrations of radionuclides from each of the exhaust stacks are calculated using representative input data, which include isotopic release rates described in Section 4.1.2.2, meteorological parameters (wind speed, wind direction frequency, and frequency stability fractions), and facility–specific data (stack heights, exhaust air velocity, etc.).

Meteorological parameters used for CAP88–PC calculations are a data set (frequency table) developed in 1980 by NRC, ANL, and Rockwell from wind speed and direction (eight compass points) records for 1976. The set includes a synthetic stability–class table, and frequencies interpolated between the 8 compass points and the 16 sectors for needed entry into the Stability Array (STAR) file.

The calculated non–natural radioactivity annual release and downwind concentrations (summed for all isotopes) at the Area IV boundary and at the nearest residence are shown in Table 4–24 for recent (1991) emissions from each Area IV exhaust stack.

Estimated public internal dose rates from the calculated downwind concentrations are calculated by CAP88–PC. The calculations assume a constant unsheltered exposure, adjusted for wind direction frequency, throughout the year and, therefore, considerably overestimate the actual annual averaged doses near the site. The resulting public exposures for the emissions from DOE operations during 1991 are shown in Table 4–25. The table includes for comparison the applicable regulatory standards for radiation doses and the doses received from natural radioactivity.

General population dose (person–rem) estimates are calculated from the demographic distribution (Section 1.2.6) and individual doses generated by CAP88–PC. Population dose estimates centered on the SSFL site are presented in Table 4–26. Inhalation is the only potential exposure pathway likely to exist. The doses reported for Area IV emissions are summed for all release points and nuclides.

Table 4–24. Annual Average Radioactivity Concentrations of Atmospheric Effluents – 1991

Facility	Annual Release (μCi)	Distance (m) to		Downwind Concentration (10^{-18} μCi/mℓ)	
		Boundary	Residence	Boundary	Residence
RIHL	5.75	302 NW	1,900 SE	1.6	0.099
RMDF	1.46	118 NW	2,300 SE	0.009	0.016
T059	0.082	80 NW	1,997 SSE	0.26	0.0042

D026–0005–I5

Table 4-25. Public Exposure to Radiation and Radioactivity from DOE Operations at SSFL - 1991

Radioactive Materials Disposal Facility (RMDF) and Building T059

Calculated Exposures from RMDF and Building 059	
1. Atmospheric and direct radiation transport	
a. Maximum estimated external dose to an individual	3×10^{-4} mrem/yr
b. Maximum estimated internal dose to an individual	2.9×10^{-6} mrem/yr
Total	3×10^{-4} mrem/yr
Limits[a]	
Short-term exposure	500 mrem/yr
Prolonged exposure	100 mrem/yr
2. Atmospheric transport	2.9×10^{-6} mrem/yr
Limit[b]	10 mrem/yr
Natural Exposure to Average Member of U.S. Public	
1. All pathways[c]	300 mrem/yr
2. Air pathway[c]	200 mrem/yr

[a]From DOE Order 5400.5, Radiation Protection of the Public and the Environment, 2/8/90.
[b]From 40 CFR 61, Subpart H.
[c]From "Health Effects of Exposure to Low Levels of Ionizing Radiation - BEIR V," National Academy Press, Washington DC, 1990).

D026-0005-I5

4.2.1.2 Direct Radiation

Public dose estimates from direct radiation use the dose rates measured by TLDs as part of environmental surveillance (Section 4.1.1.5.2). It is assumed that TLD readings represent true differences in local exposure. These differences are extrapolated to the boundary and nearest residence using an inverse square distance relation from an assumed source of radiation, and accounting for air attenuation of the radiation.

Exposures from direct exposures are determined by subtracting the part of the TLD readings caused by naturally occurring radioactivity. The background value used is the average exposure of the two off-site TLDs. The average exposure is 70 mrem, with maximum annually observed value for a single location being 75 mrem. Boundary dose estimates assume 100% occupancy, whereas the actual presence of persons at the boundary is rare or nonexistent.

The calculated public radiation exposures are included in Table 4-25. The table includes the exposures from atmospheric transport and, for comparison, the applicable regulatory standards for radiation doses and the doses received from natural radioactivity. The estimated doses are far below the applicable limits of DOE, EPA, NRC, and the State of California.

Table 4-26. Population Dose Estimates for Atmospheric Emissions from Area IV Facilities - 1991

Direction	Dose to Population (person-rem)						
	0-8 km	8-16 km	16-32 km	32-48 km	48-64 km	64-80 km	Total
N	4.2E-06	0	3.1E-08	6.4E-09	1.0E-08	7.0E-10	4.2E-06
NNE	2.5E-06	9.8E-09	8.4E-07	6.4E-08	4.1E-08	2.4E-08	3.5E-06
NE	3.0E-06	9.1E-08	4.1E-06	6.0E-07	2.1E-07	1.2E-06	9.2E-06
ENE	3.6E-07	3.4E-06	6.0E-06	4.6E-08	5.4E-08	3.7E-07	1.0E-05
E	8.1E-07	7.0E-06	1.8E-05	5.0E-06	2.3E-06	1.1E-06	3.4E-05
ESE	4.8E-06	2.5E-05	2.9E-05	6.6E-05	4.3E-05	2.2E-05	1.9E-04
SE	7.6E-06	1.8E-05	2.4E-05	6.4E-05	6.6E-05	3.2E-05	2.1E-04
SSE	1.3E-06	2.3E-06	9.5E-07	0	1.8E-06	3.4E-07	6.8E-06
S	1.3E-07	5.7E-07	2.9E-07	0	0	0	9.9E-07
SSW	9.1E-07	2.6E-06	3.9E-07	0	0	0	3.9E-06
SW	1.2E-06	3.3E-06	5.4E-07	0	0	0	5.0E-06
WSW	1.5E-07	3.4E-06	3.0E-06	4.5E-07	0	2.6E-11	7.0E-06
W	0	3.1E-06	2.5E-06	4.5E-06	6.7E-07	3.5E-10	1.1E-05
WNW	1.0E-05	5.5E-06	3.2E-06	2.7E-06	1.4E-06	4.6E-07	2.3E-05
NW	3.7E-05	1.5E-06	3.3E-06	9.0E-07	3.9E-08	1.2E-18	4.3E-05
NNW	1.5E-05	1.1E-07	3.5E-07	0	7.4E-09	1.7E-07	1.5E-05
Totals	8.8E-05	7.6E-05	9.7E-05	1.4E-04	1.2E-04	5.8E-05	5.8E-04

D026-0005-I5

4.2.2 Planned Program

The ventilation exhaust stack emission monitoring and direct radiation measurements included in the Area IV Environmental Monitoring Program will provide adequate data for calculation of public radiation exposure. The program will include continuation of estimation of public exposure doses from air emissions and direct radiation as described in Section 4.2.1.

4.3 METHODS, ANALYSIS, AND DATA MANAGEMENT

4.3.1 Sample Collection

Controlled collection of representative environmental samples is essential to produce meaningful site data. Media-specific sample collection practices which will be implemented are detailed below in Sections 4.3.1.1 through 4.3.1.5.

4.3.1.1 Surface Water

Sampling of Area IV water runoff and NPDES–governed discharges will be performed by trained technicians using field sampling instructions proceduralized to ensure compatibility with SW–846 (Ref. 4–9) requirements. Sample request and chain–of–custody forms will be initiated to maintain sample control. Sample kits containing sample containers, blue ice, sample request and chain–of–custody forms, and container seals will be used to collect samples. Specific sample containers will be provided with preservatives added, where appropriate, to meet SW–846 testing and preservative requirements. Table 4–27 lists current lab preparatory practices for chemical analysis of water and soil samples. Additional sampling requirements for bioassay and radionuclide analyses are shown in Table 4–28. Sample containers will be precleaned using EPA protocols.

4.3.1.2 Groundwater

Sampling of Area IV groundwater will continue to be performed in accordance with the current practices documented in Reference 4–4, which describes procedures for field preparation, equipment calibration, equipment decontamination, and field work consisting of organic vapor monitoring, water level measurement, well evacuation, field parameter measurement, sample collection, sample documentation, and sample packaging and shipment.

4.3.1.3 Soil

Sampling of Area IV soil will be performed by trained technicians. Current sampling practices consistent with SW–846 method requirements will be proceduralized. The existing sample request, sampling log, chain–of–custody, and sample kit preparation practices used for surface water will be followed. Commensurate with the detailed characterization/monitoring program defined, the existing soil sampling procedure for radiological analysis will be revised to implement the sampling methodology of ASTM C998 (Ref. 4–10). New procedures will be prepared detailing packaging requirements for shipment to contractor analytical laboratories and sample control.

4.3.1.4 Air

The filters from ambient air and radioactive stack emission samples will be collected and analyzed for the radioactive materials specified in Sections 4.1.1.5.3 and 4.1.2.2.3. Changeout intervals and instructions specified in existing sampling procedures will be followed. Sampling log and chain–of–custody procedures will be used to ensure filter control.

4.3.1.5 Ambient Radiation

TLD detectors are both supplied and processed on a quarterly basis. Detector locations and monitoring intervals are controlled by written procedures, and will be revised as necessary in the ongoing program.

Setup, periodic monitoring, and data retrieval (strip chart) from the HPICs proposed in Section 4.1.1.5.3 will be performed by written procedures to provide consistent setup and functioning of the units. Calibrations of the HPICs will be performed annually by the manufacturer.

Table 4-27. Requirements for Sample Containers, Preservation Procedures, and Maximum Holding Times of Samples for Chemical Analysis (Sheet 1 of 2)

Analyte	Bottle	Preservative[b]	Maximum Hold Time[c]
Alkalinity/acidity	500 mL G[a] or P[a]	Cool, 4°C	14 days
Ammonia	500 mL G or P	Cool, 4°C H_2SO_4 to pH <2	28 days
Anions	8 oz G or P		28 days
BOD	1,000 mL (1 qt) G	Cool, 4°C	48 hours
Chlorine, total residual	500 mL G or P	None required	Immediately
Cyanide	1,000 mL (1 qt) P	Cool, 4°C, NaOH to pH >12	14 days
Diesel fuel, soil	8 oz G jar	Cool, 4°C	--
Flash point	8 oz G or P		--
Inorganics	8 oz P	--	28 days
Metals[e]	1,000 mL G or P	HNO_3 to pH <2	6 months
Chromium	1,000 mL G or P	Cool, 4°C	24 hours
Mercury	1,000 mL G or P	HNO_3 to pH <2	28 days
Metals in soil	1,000 mL G jar	--	6 months
Except metals above	1,000 mL G or P	HNO_3 to pH <2	6 months
Organic compounds[f]			
Including base/neutrals and acid fraction	1,000 mL G (Teflon-lined cap)	Cool, 4°C 0.008% $Na_2S_2O_3$[d]	7 days until extracted 30 days after extraction
Extractable phenols	1,000 mL G (Teflon-lined cap)	Cool, 4°C, to pH <2 with (H_2SO_4) 0.008% $Na_2S_2O_3$[d]	7 days until extracted 30 days after extraction
Purgeables, VOAs (halocarbons and aromatics)	2-40 mL G vials	Cool, 4°C, HCl to pH <2[g]	14 days
Oil and grease	1,000 mL (1 qt) G	Cool, 4°C, H_2SO_4 to pH <2	28 days
PCBs in water	1,000 mL (1 qt) G	--	7 days until extracted 30 days after extraction
PCBs in oil	4 oz G	--	7 days until extracted 30 days after extraction
PCBs in soil	4 oz G	--	7 days until extracted 30 days after extraction
pH	8 oz G or P	--	Immediately
Phenols	1,000 mL (1 qt) G	Cool, 4°C, H_2SO_4 to pH <2	28 days

Table 4-27. Requirements for Sample Containers, Preservation Procedures, and Maximum Holding Times of Samples for Chemical Analysis (Sheet 2 of 2)

Analyte	Bottle	Preservative[b]	Maximum Hold Time[c]
Residue, total	500 mL G or P	Cool, 4°C	7 days
Residue, filterable	500 mL G or P	Cool, 4°C	7 days
Residue, nonfilterable	500 mL G or P	Cool, 4°C	7 days
Residue, settleable	1,000 mL G or P	Cool, 4°C	7 days
Residue, volatile	500 mL G or P	Cool, 4°C	7 days
Settleable solids	1,000 mL G or P	Cool, 4°C	7 days
Specific conductance	4 oz G or P	Cool, 4°C	28 days
Sulfide	8 oz G or P	Cool, 4°C, 2 mL zinc acetate, NaOH to pH >9	7 days
Surfactants	1,000 mL (1 qt) G	Cool, 4°C	24 hours
Temperature	1,000 mL G or P	Determine on site	Immediately
Turbidity	500 mL G or P	Cool, 4°C	48 hours

Notes:
[a]Polyethylene (P) or glass (G)
[b]Sample preservation should be performed immediately upon sample collection. For composite samples, each aliquot should be preserved at the time of collection if possible. Aliquots of the composite, which would require multiple preservatives, should be preserved only by maintaining at 4°C, until compositing and sample splitting is completed.
[c]Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid. Samples may be held for longer periods only if the permittee, or monitoring laboratory, has data on file to show that the specific types of samples under study are stable for the longer period of time.
[d]Required if residual chlorine is present.
[e]Samples should be filtered immediately on-site before adding preservative for dissolved metals.
[f]Guidance applies to samples to be analyzed by gas chromatography (GC), liquid chromatography (LC), or gas chromatography/mass spectroscopy (GC/MS) for specific organic compounds.
[g]Recommended for aromatics only.

D026-0005-I5

Table 4-28. Requirements for Sample Containers and Preservation Procedures for Bioassay and Radionuclide Analyses

Analysis	Bottle	Preservative
Fish bioassay	5 gal plastic or glass	None
Gross alpha/beta	1 liter plastic	1N HNO_3 to bring sample to pH<2
Gamma radiation	1 liter plastic	1N HNO_3 to bring sample to pH<2
Tritium	1 liter amber glass	None
Isotopic uranium	1 liter plastic	1N NHO_3 to bring sample to pH<2

4.3.2 Sample Preparation and Analysis

Sample analyses will be done by the SSFL Analytical Chemistry Laboratory, the RP&HPS Laboratory, and by subcontracted laboratories. Responsibilities of these laboratories are detailed below in Sections 4.3.2.1 through 4.3.2.3.

4.3.2.1 SSFL Analytical Chemistry Laboratory

The SSFL Analytical Chemistry Laboratory or their designee will be responsible for analysis of surface water and soil samples (chemical). The lab is certified by the DHS for a wide range of environmental chemistry tests. All analytical procedures used for environmental samples are those developed, approved, or adopted by DHS. Table 4–29 details methods used for chemical analyses.

Laboratory practices defined in the existing quality assurance and standard operating procedures manuals will be followed. Practices for sample segregation and control, including sample logbook preparation, use of chain–of–custody and sample request forms, storage requirements, and designation of a sample custodian are defined in these manuals. Specific analytical methods are detailed by analyte, along with instrument requirements, changes to method, and/or special requirements. Primary sources for analytical methods are SW–846 (Ref. 4–9) and "Standard Methods for the Examination of Water and Wastewater" (Ref. 4–11). To ensure consistently accurate data, a rigorous internal QA/QC program is maintained (Section 5.0). Specific QA/QC practices are:

- Establishment of statistically based control limits for each method of analysis
- Use of duplicate and spiked samples on a daily and batch (10%) basis
- Overcheck of data for consistency and accuracy
- Crosscheck of lab standards with independently prepared standards
- Verification of calibration curves with secondary independent standards at the midpoint.

A designated laboratory QA coordinator ensures compliance with QA manual requirements.

For required surface water and soil (chemical) analyses outside its certification, the SSFL Analytical Chemistry Laboratory will act as the sample collection center/transit point. Special handling and monitoring for sample shipment is not required due to the low activity levels. Contractor labs utilized for chemical analysis will have certification by the DHS for the required methods. (Requirements for laboratories performing radiochemical analyses but not regulated by the DHS are defined in Section 4.3.2.3.) The contractor laboratories currently utilized are listed in Table 4–30. Internal QA/QC practices will be documented and manuals supplied for SSFL laboratory review/approval. All contractor labs will be subject to inspection/audit by ETEC Quality Assurance and Training personnel. Specific methods to be followed by contractors for radionuclide analysis are:

- Gross alpha and beta concentration — EPA Method 900.0 (Ref. 4–9)
- Gamma radiation — EPA Method 901.1 (Ref. 4–9)

Table 4-29. SSFL Analytical Chemistry Laboratory Analysis Methods

Analyte	Method/Source
pH	423, Standard Method 16[a]
Temperature	212, Standard Method 16[a]
Turbidity	214, Standard Method 16[a]
BOD	507, Standard Method 16[a]
Residual chlorine	408C, Standard Method 16[a]
Arsenic	403, Standard Method 16[a]
Surfactants	512B, Standard Method 16[a]
Settleable solids	209E, Standard Method 16[a]
Suspended solids	209C, Standard Method 16[a]
Total dissolved solids	209B, Standard Method 16[a]
Chloride	325.3, EPA[b]
Fluoride	413B, Standard Method 16[a]
Oil and grease	503, Standard Method 16[a]
Sulfate	374.5, EPA[b]
Boron	404A, Standard Method 16[a]
Beryllium, dissolved	200.7, EPA[b]
Cadmium, dissolved	200.7, EPA[b]
Chromium, dissolved	200.7, EPA[b]
Copper, dissolved	200.7, EPA[b]
Lead, dissolved	304, Standard Method 16[a]
Mercury, dissolved	303F, Standard Method 16[a]
Nickel, dissolved	200.7, EPA[b]
Zinc, dissolved	200.7, EPA[b]
VOCs	8240, SW-846[c]
BNAs	8270, SW-846[c]

[a]Reference 4-11
[b]Reference 4-12
[c]Reference 4-9

Table 4-30. DHS-Certified Analytical Laboratories in Current Use

Laboratory	Location
Analytical Technologies, Inc.	San Diego, CA
Pacific Spectrochemical	Los Angeles, CA
Pat Chem Laboratories	Simi Valley, CA

- Tritium — EPA Method 906.0 (Ref. 4–9)
- ^{226}Ra and ^{228}Ra — EPA Method 903.1 (Ref. 4–9)
- Isotopic uranium — ASTM Method D3972.82
- ^{90}Sr — EML HASL–300 Procedures Manual (Ref. 4–13) method or equivalent
- ^{129}I — EML HASL–300 Procedures Manual (Ref. 4–13) method or equivalent
- ^{147}Pm — EML HASL–300 Procedures Manual (Ref. 4–13) method or equivalent
- Isotopes of thorium, plutonium — EML HASL–300 Procedures Manual (Ref. 4–13) method or equivalent

4.3.2.2 RP&HPS Laboratory

The RP&HPS laboratory will measure radioactivity of air filters, and act as the sample collection/preparation center for subsequent shipment of air filters and TLDs to contractor laboratories. Contractor laboratories currently used are listed in Table 4–31. The existing sampling/analysis procedure will be revised to include preservation, preparation, and packaging requirements. Standard practices as detailed in EML HASL–300 (Ref. 4–13) will be used as a basis for these requirements. A chain–of–custody procedure will be implemented for sample control. A new sample logging system will be implemented, to include a program–specific sample identification system, location of sample site, time of sampling, identity of technician, description of sample taken, and analyses required.

Upon collection, but after a minimum 72–hr decay period, ambient air sample filters will be counted for alpha and beta radiation with a low–background, thin–window gas flow proportional–counting system. Preset time mode of operation is to be used for all samples. The filters will be composited after counting and shipped to a contractor laboratory for radiochemical analysis. Counting equipment use and calibration, and gamma spectroscopy capabilities and practices, including required calibrations, will be controlled by existing written procedures.

Table 4–31. Radiochemical Laboratories in Current Use

Laboratory	Location
Controls for Environmental Pollution (CEP)	Albuquerque, NM
Tech–Ops Landauer	Glenwood, IL
Teledyne Isotopes	Westwood, NJ
TMA Norcal	Richmond, CA

Existing RP&HPS QA procedures will be revised to address the revised sample control system. The laboratory will continue to participate in the DOE Quality Assessment Program (QAP) for radiological analyses operated by the New York Environmental Measurements Laboratory (EML). To ensure high quality data, contractor radiological laboratories will be required to submit internal QA/QC manuals to Rocketdyne for review/approval. As an overcheck, contractor participation in the EML–run DOE QAP will be required. Specific methods to be followed by contractors for radionuclide analysis are defined in Section 4.4.2.1.

4.3.2.3 Contract Laboratories

Contract laboratories are used to supplement the capabilities of the Rocketdyne laboratories. These laboratories will be certified by the DHS, although laboratories performing radiochemistry analysis may instead be participants in the EPA interlaboratory comparison program. Laboratories reading TLDs will be participants in the DOE National Voluntary Laboratory Accreditation Program (NVLAP). All contractor laboratories will be subject to inspection and audit by ETEC Quality Assurance and Training personnel.

Preparation and analysis of groundwater samples are currently performed by GRC, a hydrogeology contractor. Laboratories used by the contractor carry DHS laboratory certification for the analyses performed and participate in EPA performance evaluation programs. Specific analytical methods will be performed in accordance with SW–846 criteria. Analytical requirements for precision, accuracy, and holding and detection limits (when specified) will be followed according to method protocol. The chain–of–custody and sample identification system initiated during sampling will be maintained through the final reporting of results.

Analytical reports will continue to include the analytical method and the dates of sampling, extraction, and analyses for each set of sample results. Per present practice, results of laboratory QC samples (reagent blanks, spike samples, and duplicate samples) will be reported with sample data. Contractor data are evaluated on receipt to ensure proper documentation and adherence to planned QA/QC practices.

4.3.3 Data Interpretation

Analytical results from the SSFL Analytical Chemistry Laboratory will continue to be given a final check by lead personnel for consistency and accuracy, including control chart review, before transmittal to the Water/Waste Programs unit of the Environmental Protection Department. Experienced personnel within this unit process the data for compliance with permit requirements.

Analytical results from groundwater samples will be reviewed by trained hydrogeologists before transmittal to the Water/Waste Programs unit. In addition to detailing sample results, quarterly summary reports will contain water level and water quality hydrographs on a “per well” basis for use in trend analysis and evaluation of pumping effectiveness. Indications of migration will be reported, along with recommendations for enhanced (frequency and/or location) monitoring.

Radionuclide analytical results will be evaluated by RP&HPS personnel. This includes radiological analysis results initially reported to the Water/Waste Programs Unit. Precision of results will be reported as a range, a variance, a standard deviation, a standard error, and/or a confidence interval. Current statistical data evaluation techniques, consistent with practices such as those defined in "A Guide for Environmental Radiological Surveillance at U.S. Department of Energy Installations" (Ref. 4–14), will be documented. Examination of outliers for cause and possible exclusion from the database will be included in this evaluation. Gross activity and radionuclide specific results will be compared and correlations used in the interpretation of historical gross activity data. Overchecks of statistical evaluations and dose calculations will be incorporated into the RP&HPS QA manual.

Average annual dose calculations for the general public through the airborne pathway will continue to be calculated using CAP88–PC. The calculated annual off–site dose via the airborne pathway (0.0000012 mrem in 1990) has been substantially below regulatory limits, and has shown acceptable variability with differing meteorological assumptions. The RESRAD model will be applied for calculations related to releasing land for unrestricted use. Assumptions, data inputs, and default values for both the CAP88–PC and RESRAD models will be documented to ensure consistent application and support QA overcheck.

4.3.4 Data Management

To date, data management practices have been largely directed towards satisfying individual permit requirements of data reporting and records retention. As a result, existing environmental databases are maintained by the functional units responsible for permit compliance. For purposes of the Area IV environmental monitoring program, two databases will be established. Data on chemical contamination will be maintained by the Environmental Protection Department. Data on radioactive contamination will be maintained by the RP&HPS unit. In addition to analytical results, the following records will be retained:

- Sample analysis request forms
- Chain–of–custody forms
- Analysis reports
- Laboratory QA records (quality control sample results, instrument calibration records)
- Data reduction/preparation records (including dose assessment model results).

The recordkeeping system will permit easy retrievability of analytical results for supplemental processing (e.g., trend analysis) with redundancy (e.g., hard copy or disc) to prevent irretrievable loss of data. A data management plan will be prepared to implement these requirements.

4.4 HEALTH AND SAFETY ISSUES

The collection and handling of samples as proposed in this plan will require proper attention to health and safety issues. Rocketdyne (and ETEC) prepares, as a matter of policy, a health and safety plan (HASP) before the implementation of any field investigation or monitoring activity (e.g., drilling and soil sampling, monitoring well installation and sampling, surface soil sampling, and runoff water sampling).

For implementation of the plan proposed in this document, detailed HASPs will be prepared before commencement of field work. The provisions of these HASPs will be mandatory for all personnel engaged in the field work (note that the laboratories have their own HASP), if that work involves any potential health and safety hazards. The contents of that HASP, as well as any of the HASPs that will be written to implement the plan proposed herein, cover such subjects as personnel, site or facility history, contamination, hazard assessment, training, monitoring and safety procedures, and emergencies.

4.5 REFERENCES

4-1. A4CM-AN-0003, "Radiological Characterization Plan, Santa Susana Field Laboratory Area IV"

4-2. 8640-190, Groundwater Resources Consultants, Inc., "Annual Groundwater Monitoring Report, Santa Susana Field Laboratory, 1992" (February 24, 1993)

4-3. SSGA-AN-0001, Groundwater Program Management Plan (December 17, 1992)

4-4. Report 8640M-193, Groundwater Resources Consultants, Inc., "Groundwater Monitoring Procedures, Area IV, Santa Susana Field Laboratory"

4-5. RI/RD92-186, "Tritium Production and Release to Groundwater at SSFL" (December 1, 1992)

4-6. RI/RD92-138, "Rocketdyne Division Annual Site Environmental Report, Santa Susana Field Laboratory and De Soto Sites, 1991" (September 30, 1992)

4-7. NRC letter dated May 7, 1980, Leland C. Rouse to Rockwell International, Atomics International Division, Docket No. 70-25, Project M-3

4-8. ETEC letter, "Meteorological Tower for SSFL," P. Rutherford to R. LeChevalier, dated April 28, 1992

4-9. SW-846, Third Edition, *Test Methods for Evaluating Solid Waste*, published by the EPA Office of Solid Waste and Emergency Response

4-10. ASTM C998-83, "Standard Method for Sampling Surface Soil for Radionuclides"

4-11. Standard Methods for the Examination of Water and Wastewater, 16th edition, 1985

4-12. EPA-600/4-79-020 Methods for Chemical Analysis of Water and Wastes (March 1979)

4-13. HASL-300, "DOE Environmental Measurements Laboratory Procedures Manual," 27th Edition

4-14. DOE/EP-0023, "A Guide For: Environmental Radiological Surveillance at U.S. Department of Energy Installations" (July 1981)

D026-0005-15

5.0 Quality Assurance

5.0 QUALITY ASSURANCE

5.1 QUALITY ASSURANCE PROGRAM PLAN

The ETEC Quality Assurance and Training department will be responsible for QA functions for this plan. Current ETEC QA functions are specified by the ETEC QA Program Plan (Ref. 5–1). The QA Program Plan (QAPP) embodies the 10 quality criteria of DOE Order 5700.6C. It also applies the 18 criteria of ASME NQA–1, adopted as the ETEC Quality Standard. The implementing procedures for the ASME NQA–1 criteria are provided in the ETEC Quality Assurance Program Index (QAPI) in Appendix A of Ref. 5–1.

A QAPP similar to the existing ETEC QAPP will be prepared for this environmental monitoring program. The QAPP will apply the 10 quality criteria of DOE 5700.6C and the 18 criteria of ASME NQA–1 for the expanded ETEC QA scope for this plan. The QAPP will also incorporate QA requirements specified in this plan.

Operational procedure audits will include review of QA requirements of the plan (replication samples, sample collection documentation, and chain–of–custody records). Quality control procedure audits will include review of records of radiation measuring equipment calibration (including traceability to NIST calibration standards), training documentation, and laboratory certification documentation. The audits will be carried out by personnel who do not have direct responsibility for performing the activities being audited.

Audits of the RP&HPS group will be reviewed for concurrence by a person certified by the American Board of Health Physics (ABHP) or National Registry of Radiation Protection Technologists (NRRPT). Auditors will use written procedures or checklists prepared in advance as the basis of the audits. Audit results will be documented, reported to, and reviewed by responsible management. Follow–up actions will be assigned to responsible management and progress to completion will be tracked.

5.2 QUALITY ASSURANCE FOR FIELD ACTIVITIES

Sampling of the various media is currently done in accordance with media–specific field sampling instructions that have been proceduralized to conform to SW–846 (Ref. 5–2). A Field Sampling Plan will be written to document the procedures applicable to the Environmental Monitoring Plan. It will contain QA requirements for all necessary field activities that support this plan.

5.3 QUALITY ASSURANCE FOR CHEMICAL LABORATORIES

Analytical chemistry services are performed by the SSFL Analytical Chemistry Laboratory. In addition, DHS–certified contract laboratories are used for analysis when the SSFL Laboratory is not certified for a particular analysis, the workload exceeds the capacity of the laboratory, or for analysis of samples collected by contractors. The laboratory has established an internal quality assurance/quality control (QA/QC) program based on EPA guidelines. The QA program includes the use of internal and external standards, spikes, duplicates, blanks, and QC control charts, and participates in performance evaluation analyses for EPA laboratory assessment programs. A computer tracking system flags unacceptable results, which are then evaluated to determine the cause and corrective action to be taken. Written procedures are followed for chain-of-custody and sample storage. Procedures are included in the SSFL Analytical Chemistry Laboratory Manual for Quality Control and Quality Assurance of Environmental Analyses.

Samples are received at the SSFL Analytical Chemistry Laboratory by the sample custodian and are assigned an identification number. They are recorded in the database with complete descriptions as provided by the sampler following the protocols in the SW-846 (Ref. 5-2). Sample integrity is verified by the sample custodian at the time the sample is logged into a chain-of-custody log book. Samples are stored in a large locked refrigerator. When the samples are removed from the refrigerator for analysis, the analyst receives an independent verification of sample identity before proceeding. Samples are then analyzed within the time frames specified to meet SW-846 requirements.

Maintenance and analyses logs required for each analytical instrument are routinely inspected. All analyses are reviewed by the appropriate lead engineer and lab manager before results are issued. Following analysis, samples are disposed of in accordance with regulatory criteria and accepted practices.

The SSFL Analytical Chemistry Laboratory manager is responsible for audits of contract laboratories. A procedure for scheduling and performing such audits will be prepared. During implementation of this plan all audits will be coordinated with ETEC QA.

5.4 QUALITY ASSURANCE FOR RADIOLOGICAL LABORATORIES

The RP&HPS group monitors radiation levels both onsite and offsite. In addition to the in-house capabilities, RP&HPS currently uses support contractors for radiochemical analyses. The dosimetry services of a contractor who is accredited under the NVLAP program, is used for radiation level monitoring. RP&HPS also reviews and interprets results from all contractors for all sample media.

RP&HPS and radiological contractors participate in the DOE-EML interlaboratory comparison program twice per year, which involves analyses of a variety of blind samples.

Periodic servicing and electronic calibration of nuclear instrumentation is the responsibility of the Radiation Instrument Services unit. Radiation measuring equipment is calibrated at least semiannually with NIST standards for both Rocketdyne and contractors.

Records necessary to document the radiological environmental monitoring program are retained for at least the time periods specified in DOE records retention schedules. Instrument calibration records are retained by the Radiation Instrument Services Laboratory. The records are as follows:

1. Field sample collection documentation and descriptions
2. Laboratory receipt and coding
3. Sample preparation records
4. Radioactivity measurements data
5. Instrument operating parameters and calibration records

6. Analyses of blanks, replicate and split samples, and instrument calibration data
7. Data reduction and preparation of summary data
8. Interlaboratory cross-check records.

5.5 TRAINING

Implementation of this plan will use the training programs in place at Rocketdyne, which include training in hazardous waste management and handling, radiological safety, and respiratory protection. These training programs are documented in in-house training plans and procedures and are given to all workers, as appropriate. Personnel are not allowed to perform these functions until the appropriate training has been received and a passing grade obtained in tests. Periodic retraining (usually annually) is required and is tracked by Rocketdyne training department.

5.6 REFERENCES

5-1. ETEC Quality Assurance Department Directive QADD-9, "Quality Assurance Program Plan"

5-2. SW-846, Third Edition, Test Methods for Evaluating Solid Waste, published by the EPA Office of Solid Waste and Emergency Response

6.0 Emergency Response to an Environmental Incident

6.0 EMERGENCY RESPONSE TO AN ENVIRONMENTAL INCIDENT

6.1 REPORTING AND NOTIFICATION SYSTEMS

As outlined in Rocketdyne's Operating Policies (M–501, Emergency Incidents) and the Rocketdyne Master Emergency Plan, reporting of all emergencies will be made immediately to the Industrial Security Control Center. Reports can be made by verbal communication to the Control Center operator, the automatic emergency alarm signal that sounds at the Control Center, or manual activation of an emergency alarm signal. All phones have the emergency phone number attached to them. Notification of an emergency to affected departments and personnel will be made by Industrial Security using one of the following means: (1) Public Address System, (2) Mobile Public Address, (3) verbal instruction from area supervision, or (4) megaphones.

Copies of the Master Emergency Plan are kept with the Control Center operator, ETEC Library, DOE Site Office, the Environmental Protection director, and the RP&HPS manager. Actions to be taken in the event an environmental emergency incident are specified in the Hazardous Materials Response Business Plan and Inventory, Section 6.0, the Spill Prevention and Response Plan [a combined Spill Prevention Control and Countermeasure (SPCC) plan and Facility Contingency Plan (FSCP)], and in accordance with Environmental Control Manual procedure EC06.00, Hazardous Material Spill Control Team. An emergency incident is defined as an actual or potential major condition resulting from a natural or man–made circumstance that may have the effect of causing death or serious injury requiring immediate medical attention, endangering the health or safety of persons on company–owned or controlled property, resulting in significant loss or damage to company–owned or controlled property, disrupting normal work schedules, causing significant pollution to the environment, or causing evacuation of a significant number of personnel. Equipment breakdown, control system failure, or human error resulting in unplanned or uncontrolled discharges of pollutants into the air, surface or groundwater, storm drains or sewers, or spills onto the ground must be reported immediately on discovery.

An on–scene manager may serve as the acting emergency coordinator until arrival of the emergency coordinator, as designated in the Spill Prevention and Response Plan. The emergency coordinator assumes responsibility at the site for isolating the affected area and for implementing abatement procedures in accordance with the Master Emergency Plan and the Spill Prevention and Response Plan.

The Control Center operator will notify the Environmental Protection director, Rocketdyne Communications, Corporate Environmental Control, and Corporate Legal, as appropriate. Environmental Protection is responsible for any necessary reporting to environmental regulatory agencies, and Communications is responsible for informing the public and the news media.

6.2 RESPONSIBILITIES

The Industrial Security director assumes overall authority during periods of emergency and will determine when emergency action is to terminate. The director will also have overall responsibility for providing protective services for fire prevention/suppression, security protection, rescue, personnel evacuations, and emergency communications. The director is also responsible for the training of all emergency response personnel.

The Control Center operator, operating under instructions contained in the Master Emergency Plan, will notify the following, as appropriate:

1. Shift commander
2. The Medical director, who will commit medical personnel as needed and will coordinate such activity with Industrial Security
3. Plant Services
4. Environmental Protection
5. Appropriate law enforcement agencies, as required
6. Health, Safety, and Fire Engineering
7. The Rocketdyne Human Resources and Communications vice president, or the Communications director, will have responsibility for recommending the course of action for dissemination of public and internal information.

Radiation Protection and Health Physics Services will notify the following, in accordance with the Master Emergency Plan:

1. U.S. Nuclear Regulatory Commission
2. Radiologic Health Branch, California Department of Toxic Substances Control
3. Department of Energy.

Environmental Protection, pursuant to the Spill Prevention and Response Plan and the Master Emergency Plan, will notify the following, as appropriate:

1. National Response Center
2. Office of Emergency Services
3. Regional Water Quality Control Board
4. Ventura County Fire Protection District
5. Resource Management Agency
6. Cal-EPA, Department of Toxic Substance Control
7. Ventura County Air Pollution Control District.

Health and Safety assumes overall responsibility for specifying the evacuation area and determining when the area may be released for occupancy. Environmental Protection provides directions for containing the spill, monitoring for contaminants and hazardous situations, collecting and removing spilled material, and for cleaning, repairing, and replacing spill control equipment.

In the event of a chemical spill, an Environmental Control Specialist will be appointed by the Environmental Protection director to assume responsibility for:

1. Evaluating containment measures to prevent or reduce the spread of materials
2. Determining methods and levels of cleanup and conduct of such cleanups
3. Determining reportable quantities and making appropriate notification to outside agencies (as indicated previously)
4. Evaluating routes of discharge and devising prevention
5. Ensuring proper disposal of spill and cleanup materials.

Environmental Protection maintains a spill control cart in a state of readiness for environmental spill incidents. The cart is audited monthly. A log is maintained to assure that the cart is in a state of readiness.

7.0 Implementation Approach

7.0 IMPLEMENTATION APPROACH

The implementation approach for environmental monitoring of Area IV of the SSFL depends on the following major factors:

1. Adequate funding by DOE to implement the approved plan
2. An organizational structure capable of implementing and managing the plan
3. A realistic schedule that considers both the needs of the site and the diverse constraints imposed by the various regulatory agencies involved.

As a practical matter, the implementation of any reasonable plan will require a careful matching of funding and schedule. The existing organization structures (Section 1.3) are appropriate to manage the program. The plan will be implemented using detailed, documented procedures prepared after plan approval.

The plan will be reviewed annually and updated every 3 years to:

1. Reflect changes required by the data taken
2. Reflect recalculated or revised values of previously reported data
3. Reflect any regulatory or operational changes.

Revisions will be made using the ETEC procedure for revision of Class 1 (DOE approval required) documents.

7.1 PLAN ACTIVITIES

The activities that comprise the Area IV Environmental Monitoring Program are summarized in Table 7-1. The status of each as a new or continuing activity is identified.

7.2 REPORTING REQUIREMENTS

Environmental monitoring reports will be submitted to the DOE annually. Other related reports will be submitted, as required, to the various cognizant regulatory agencies involved in Area IV. Copies of those reports will also be provided, upon request, to the DOE.

D026-0005-15

Table 7-1. Summary of Area IV Environmental Monitoring Activities
(Sheet 1 of 2)

Activity	Reference Section	Status	Estimated Resources and Status	Completion Date
Environmental Surveillance				
Soil Collect and analyze soil samples annually	4.1.1.1.3	New	$30K. Not funded.	Duration uncertain.[a]
Surface Water None (effluent monitoring only)	4.1.1.2.3	–	Not applicable.	Not applicable.
Groundwater None (covered by a separate program)	4.1.1.3.3	–	Not applicable.	Not applicable.
Air Relocate existing air samplers Monitor ambient air particulate radioactivity Install and operate additional air samplers	4.1.1.4.3	New Existing New	$7K. Not funded. (Tiger Team Action Plan AP003) $13K annually. Funded. $34K initial and $13K annually. Not funded. (Tiger Team Action Plan AP003)	FY94.[b] Duration uncertain.[a] Installation FY94,[b] operation duration uncertain.[a]
Direct Radiation Monitor ambient radiation with TLDs Install and operate high-pressure ionization chambers	4.1.1.5.3	Existing New	$5K annually. Not funded. $18K. Not funded.	Duration uncertain.[b] Installation FY94,[b] operation duration uncertain.[a]
Vegetation Collect and analyze native vegetation samples annually	4.1.1.6.3	New	$5K annually. Not funded.	Duration uncertain.[b]
Animal Collect and analyze roadkills	4.1.1.7.3	Existing	$1K annually. Not funded.	Duration uncertain.[b]
Effluent Monitoring				
Surface Water Collect and analyze rainfall runoff samples Collect and analyze samples of Area III Sewage Treatment Plant sludge	4.1.2.1.3	Existing New	$250K annually (for rainfall as in 1991-92 and 1992-93). Not funded. Planning funded. Sampling and analysis $13K annually. Not funded. (Tiger Team Action Plan AP019)	Duration uncertain.[b] Duration uncertain.[b]
Air Monitor ventilation exhaust emissions which may contain radioactivity Monitor emissions as required by VCAPCD permit	4.1.2.2.4	Existing Existing	$13K annually. $10K annually is funded. $250K annually. Funded as part of SCTI Operation funding.	Duration uncertain.[b] Duration uncertain.[b]
Other Transport Mechanisms None (not significant exposure potential)	4.1.2	–	Not applicable.	Not applicable.
Public Radiation Dose Estimation Estimate radiation dose from radioactive ventilation exhaust stack emissions Estimate direct radiation dose from ambient radiation	4.2.2	Existing Existing	$5K annually. Funded.	Duration uncertain.[b]

Table 7-1. Summary of Area IV Environmental Monitoring Activities (Sheet 2 of 2)

Activity	Reference Section	Status	Estimated Resources and Status	Completion Date
Other				
Establish environmental monitoring databases	4.3.4	New	$40K first year, then $10K annually. Not funded.	Establish FY94,[b] duration uncertain.[a]
Prepare a health and safety plan	4.4	New	$25K. Not funded. Part of EMP implementation.	FY94.[b]
Prepare and implement a quality assurance program plan	5.1	New	$25K. Not funded. Part of EMP implementation.	FY94.[b]
Prepare a field sampling plan	5.2	New	$30K. Not funded. Part of EMP implementation.	FY94.[b]
Prepare and distribute the annual environmental report	7.2	Existing	$40K annually. Funded.	May of following year.

[a] Environmental monitoring will continue until there are no activities or sources in Area IV which could result in release of contamination. Radiological monitoring will extend beyond the year 2000, based on the anticipated completion of D&D activities (concluding with decommissioning of the RMDF). Chemical monitoring will continue at least throughout the same period, and will extend further if operations at that time provide possible sources of contamination. As facilities complete D&D or cease operation, environmental monitoring activities related specifically to them will be terminated.

[b] Completion of activities in FY94 as indicated is contingent on funding in that year.

D026-0005-I5

8.0 Compliance Summary

8.0 COMPLIANCE SUMMARY

The Environmental Monitoring Plan was written to comply with DOE Order 5400.1, which stipulates that the plan must also comply with other relevant federal, state, and local regulations.

8.1 EFFLUENT MONITORING

8.1.1 Surface Water Effluent

Surface water monitoring will be performed, as required by NPDES Permit No. CA0001309, on the periodic discharges from the R-2A Pond into Bell Creek and the runoff along the northwest slope. Compliance with the NPDES provisions of the Clean Water Act is under the jurisdiction of the California Regional Water Quality Board.

8.1.2 Radioactive Stack Emissions

Area IV has three stacks which discharge very small amounts of radioactive particulates (RMDF, Bldg 059, and Bldg 020).

Relevant DOE regulations include DOE Order 5400.5, draft 10 CFR 834, and DOE/EH-173T. Building 020, which is licensed by the NRC, is subject to the provisions of 10 CFR 20. All three stacks must be in compliance with 40 CFR 61 and CCR 17 of the State of California. Continuous monitoring of these stacks will assure compliance with the above regulations.

8.1.3 Heater Stack Emissions

Emissions from the stacks of the H-1 and H-2 heaters (SCTI facility) are regulated by the Ventura County Air Pollution Control District in accordance with provisions of the federal Clean Air Act. These stacks are monitored for the gaseous pollutants CO and NOx and operated under VCAPCD Permit No. 0271.

8.1.4 Sewage Effluents

Sewage effluents (liquid) are also covered by NPDES Permit No. CA0001309, which sets limits on turbidity, biological oxygen demand, and coliform levels. The tertiary-treated liquid effluent is monitored for these constituents before discharge to the R-2A Pond. A new monitoring program for the sewage sludge will also be performed on a quarterly basis.

8.2 ENVIRONMENTAL SURVEILLANCE

8.2.1 Soil

The proposed plan for soil surveillance is predicated on monitoring both facilities which are potential sources of contamination and contaminated areas found during the Area IV site characterization program. Soil sampling and analysis will initially be coordinated with the characterization plan. The scope of later surveillance will be determined by the site characterization results. An update of the Environmental

Monitoring Plan, required by DOE Order 5400.1, will be used to scope longer–term soil surveillance (if any). Soil surveillance will comply with provisions of DOE Order 5400.5 and DOE/EH–0173T.

8.2.2 Groundwater

The groundwater monitoring proposed herein is part of the SSFL groundwater monitoring program, which is based on the requirements of RCRA, CERCLA, TSCA, and the State of California Porter–Cologne Water Quality Control Act.

8.2.3 Ambient Air

The proposed ambient air monitoring will be conducted in accordance with applicable DOE regulations (i.e., DOE/EH–0173T), and the data will be compared to the appropriate derived concentration guides (DCG) or maximum permissible concentrations (MPC) for unrestricted areas of DOE Order 5400.5, 10 CFR 20, Appendix B, or CCR 17 of the State of California. Area IV ambient air is monitored only for radioactive particulates.

8.2.4 Ambient Radiation

Current ambient radiation monitoring is in compliance with DOE Order 5400.5 as shown by calculations that consider the recommendations of DOE/EH–0173T. Direct radiation levels at the site boundaries are compared against the NRC–related provisions of 10 CFR 20 and CCR 17 of the State of California. The new HPIC monitors proposed in this plan will provide data above and beyond regulatory requirements.

8.2.5 Radiation Dose Estimation

The data from environmental surveillance, in conjunction with meteorological data, will be used to calculate radiation doses to the public in compliance with 10 CFR 61 (NESHAPS), DOE Order 5400.5, and DOE/EH–0173T.

8.3 RELATED DOCUMENTATION

This Environmental Monitoring Plan is designed to support the D&D activities of the Environmental Restoration Program Management Plan (Ref 8–1) as well as the requirements of the Environmental Protection Implementation Plan (Ref 8–2). It will be coordinated with the Area IV Radiological Characterization Plan (Ref 8–3) until the activities of that plan are complete.

8.4 REFERENCES

8–1. ER–AN–0002, "ETEC Environmental Restoration Program Management Plan" (October 25, 1991)

8–2. GEN–AT–0022, Rev B, "ETEC Environmental Protection Implementation Plan" (April 1992)

8–3. A4CM–AN–0003, "Radiological Characterization Plan, Santa Susana Field Laboratory Area IV"

D026–0005–15

Appendix A
Summary of Key Orders and Regulations

APPENDIX A
SUMMARY OF KEY ORDERS AND REGULATIONS

A.1 GENERAL

This appendix summarizes the Federal, State of California, and Ventura County orders and regulations that govern environmental activities for Area IV of the SSFL. Section A.2 addresses applicable DOE Orders, which are the documents providing requirements for DOE operations. For this document, these operations include ETEC and, by DOE assignment of responsibility for environmental monitoring, the rest of the SSFL Area IV. Subsequent sections discuss the applicable regulations for the categories of environmental concern: air, surface water, groundwater, and hazardous waste.

The applicable orders and regulations are summarized in Tables A–1 through A–5. Each table identifies the order or regulation by number and title, and summarizes the applicable content. Table A–1 lists applicable DOE Orders. Table A–2 lists applicable mandatory Federal regulations identified in DOE 5400.1 as implementing applicable requirements. Table A–3 lists applicable California statutes and regulations. Table A–4 lists applicable Ventura County air pollution control rules and permits. Table A–5 lists guidelines which supplement the regulations.

A.2 DOE ORDERS

DOE Orders applicable to ETEC specify both radiological and nonradiological environmental protection, and identify applicable statutes and regulations. The applicable DOE Orders are listed in Table A–1.

The central DOE Order for environmental protection is DOE 5400.1, General Environmental Protection Program. This Order defines standards in three categories: (1) those imposed by Federal statutes, regulations, and requirements; (2) those imposed by State and local statutes, regulations, and requirements applicable to DOE; and (3) those imposed by DOE directives. The following categories of major Federal requirements are listed in the Order and are applicable to Area IV:

1. Clean Air Act
2. Clean Water Act
3. Safe Drinking Water Act
4. Comprehensive Environmental Response, Compensation, and Liability Act of 1980
5. Resource Conservation and Recovery Act of 1976
6. Toxic Substances Control Act
7. Radiation Protection.

Applicable Federal regulations referenced in DOE 5400.1 for each category are described in Table A–2. The draft regulation for radiation protection is also described.

Table A-1. DOE Orders Applicable to Environmental Monitoring (Sheet 1 of 3)

Order	Title	Applicable Content
DOE 5400.1	General Environmental Protection Program	Establishes environmental protection program requirements, authorities, and responsibilities for DOE operations for assuring compliance with applicable federal, state, and local environmental protection laws and regulations, executive orders, and internal DOE policies. Defines more specifically the environmental protection requirements established generally in DOE 5480.1B.
DOE 5400.3	Hazardous and Radioactive Mixed Waste Program	Establishes DOE hazardous and radioactive mixed waste policies and requirements, and implements requirements of Resource Conservation and Recovery Act (RCRA) within the framework of environmental programs established under DOE 5400.1. Directs heads of field organizations to develop and implement program to assure that subject wastes are managed in accordance with Atomic Energy Act and RCRA requirements.
DOE 5400.4	Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Requirements	Establishes and implements DOE CERCLA policies and procedures within the framework of environmental programs established under DOE 5400.1. Directs heads of field organizations to oversee their organization response actions to hazardous substance releases, and to gather information with respect to releases and potentially imminent releases.
DOE 5400.5	Radiological Protection of the Public and the Environment	Establishes standards and requirements for operations of DOE and DOE contractors with respect to protection of members of the public and the environment against undue risk from radiation. Specifies limits for radiation doses to the public from all exposure modes from DOE activities; drinking water dose impacts meet standards of 40 CFR 141. To be upgraded to a rule by 10 CFR 834 (draft issued 1/10/91).
DOE 5480.1B	Environmental, Safety, and Health Program for Department of Energy Operations	Establishes ES&H program for DOE operations. Heads of field organizations are responsible for assuring operations are consistent with ES&H practices and orders.
SAN MD No. 5480.1A	Environmental Protection, Safety, and Health Protection Program for DOE operations	Implements DOE 5480.1B for SF contractors.
DOE 5480.4	Environmental Protection, Safety, and Health Protection Standards	Specifies requirements for application of mandatory environmental protection, safety, and health standards applicable to DOE and DOE contractor operations. Provides listing of mandatory and reference ES&H standards.

Table A-1. DOE Orders Applicable to Environmental Monitoring (Sheet 2 of 3)

Order	Title	Applicable Content
DOE 5482.1B	Environment, Safety, and Health Appraisal Program	Establishes the ES&H Appraisal program for DOE.
SAN MD No. 5482.1	Environment, Safety, and Health Appraisal Program	Implements provisions of DOE 5482.1. Managements at SF GOCO facilities to comply with approved DOE ES&H orders and directives formally transmitted, develop and implement an internal review system, and initiate corrective actions in response to findings/recommendations from SF appraisals and reviews.
DOE 5484.1	Environmental Protection, Safety, and Health Protection Information Reporting Requirements	Establishes requirements and procedures for reporting information protection, safety, or health protection significance for DOE operations.
SAN MD No. 5484.1	Environmental Protection, Safety, and Health Protection Information Reporting Requirements	Implements DOE 5484.1. SF contractors shall comply with requirements of DOE 5484.1, assure all required reportable information is submitted to SF at the earliest practicable time, and submit proposed releases of public statements on occurrences to SF for review and approval before release.
SAN MD No. 5484.1 Ch. III	Effluent and Environmental Monitoring Program Requirements	Implements DOE Order 5484.1, Chapter III, and establishes Effluent and Environmental Monitoring Program requirements for SF contractors. Directs SF contractors to maintain Environmental and Effluent Monitoring Programs as required by DOE 5484.1, an On-site Discharge Monitoring Program, and a Quality Assurance Program within the overall Environmental Monitoring Program.
DOE 5700.6C	Quality Assurance	Establishes quality assurance requirements for DOE.
SAN MD No. 5700.6B	Quality Assurance	Implements provisions of DOE 5700.6B and sets forth the SF objectives to assure that quality assurance and reliability exist as integral parts of programs and projects. Directs SF contractors to develop, implement, and maintain quality assurance and reliability programs responsive to DOE 5700.6B, obtain approvals from SF of detailed quality assurance and reliability requirements, and provide to SF reports of conditions adverse to achievement of quality and reliability goals.
DOE 5820.2A	Radioactive Waste Management	Establishes policies, guidelines, and minimum requirements by which DOE manages its radwaste, mixed waste, and contaminated facilities. Heads of field organizations are responsible for all activities that affect treatment, storage, or disposal of waste in facilities under their jurisdiction.

Table A-1. DOE Orders Applicable to Environmental Monitoring (Sheet 3 of 3)

Order	Title	Applicable Content
DOE 5820.2A (cont)	Radioactive Waste Management	Requires environmental monitoring program that conforms with DOE 5484.1 and is 1. Designed to measure operational effluent releases, migration of radionuclides, disposal unit subsidence, and changes in disposal facility and site parameters that may affect long-term performance 2. Based on characteristics of the facility being measured; may include monitoring surface soil, air, surface water, and subsurface soil and water in the saturated and unsaturated zones 3. Capable of detecting changing trends in performance to allow corrective action before exceeding performance objectives.

DOE 5400.1 specifies that a written environmental monitoring plan shall be prepared and is the general requirement for preparing such a plan for Area IV. It also references DOE Orders in the 5400 series dealing with radiation protection of the public and the environment. Through reference in one of these (DOE 5400.5), DOE/EH-0173T (Table A-5) is specified for radiation protection.

DOE 5484.1 and DOE 5820.2A require that an environmental monitoring program be maintained and specify reporting of monitoring results. They describe general guidelines for monitoring (sampling locations, type, and frequency) to determine compliance with requirements of DOE 5484.1 (defined more specifically in DOE 5400.1).

DOE 5482.1B and DOE 5700.6C specify quality assurance requirements to be included in an environmental monitoring plan. DOE 5700.6C establishes the general quality assurance requirements for DOE. DOE 5482.1B establishes the DOE appraisal program. Appraisal requirements for the environmental monitoring plan are provision of internal monitoring and responding to findings and recommendations resulting from external audits.

Table A-2. Applicable Mandatory Federal Environmental Protection Regulations (Sheet 1 of 3)

Regulation	Title	Applicable Content
Clean Air Act		
40 CFR 50	National Primary and Secondary Ambient Air Quality Standards	Sets forth national primary and secondary ambient air standards for sulfur dioxide, particulate materials, carbon monoxide, ozone, nitrogen dioxide, and lead Provides methods for determining pollutants in ambient air
40 CFR 51	Requirements for Preparation, Adoption, and Submittal of Implementation Plans	Requires States to develop programs to assure reasonable progress toward meeting the national goal of preventing future, and remedying any existing, man-made aid pollution impairment of Class I Federal areas Applies to fossil-fuel boilers with greater than 250 x 10^6 Btu/h heat input
40 CFR 52	Approval and Promulgation of Implementation Plans	Sets forth the Administrator's approval and disapproval of State plans Includes Administrator's actions on The State of California Implementation Plan for Achieving and Maintaining the National Ambient Air Quality Standards
40 CFR 58	Ambient Air Quality Surveillance	Contains criteria and requirements for ambient air quality monitoring and requirements for reporting ambient air quality data and information Applicable to state and local air pollution control agencies and to owners or operators of proposed sources
40 CFR 60	Standards of Performance for New Stationary Sources	Establishes performance test and monitoring requirements for new or modified source facilities
Appendix A	Test Methods	Provides test methods for emission measurements
40 CFR 61	National Emission Standards for Hazardous Air Pollutants	Identifies substances designated as hazardous air pollutants and those published with consideration of serious health effects from ambient air exposure to them
Subpart H	National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities	Requires determining radionuclide emission rates and showing that the effective dose equivalent to a member of the public is no greater than 10 mrem/yr
Clean Water Act		
40 CFR 112	Oil Pollution Prevention	Requires preparation of a Spill Prevention Control and Countermeasures Plan Recommends secondary containment for tanks containing petroleum products
40 CFR 116	Designation of Hazardous Substances	Lists substances defined as hazardous
40 CFR 117	Determination of Reportable Quantities for Hazardous Substances	Sets reportable quantities for hazardous substances defined in 40 CFR 116 (Note that the regulation does not apply to discharges in compliance with a permit under Section 402 of The Clean Water Act.)

Table A-2. Applicable Mandatory Federal Environmental Protection Regulations (Sheet 2 of 3)

Regulation	Title	Applicable Content
Clean Water Act (continued)		
40 CFR 122	EPA Administered Permit Programs: The National Pollutant Discharge Elimination System	Contains provisions for the National Pollutant Discharge Elimination System Program, which requires permits for discharge of pollutants from any point source into waters of the United States
40 CFR 125	Criteria and Standards for the National Pollutant Discharge Elimination System	Establishes criteria and standards in various categories for imposition of requirements in permits Criteria and standards are for imposing technology-based treatment requirements; determining fundamentally different factors; granting economic variances from best available technology (reserved); granting water quality variances (reserved); determining alternative effluent limitations; extending compliance dates, best management practices; and imposing conditions for disposal of sewage sludge (reserved)
40 CFR 136	Guidelines Establishing Test Procedures for the Analysis of Pollutants	Prescribes procedures to be used when a listed waste constituent is to be measured for a discharge under NPDES Specifies sample preservation procedures, container materials, and maximum allowable holding times
Safe Drinking Water Act		
40 CFR 141	National Primary Drinking Water Regulations	Establishes primary drinking water regulations (includes concentration limits for ^{226}Ra, ^{228}Ra, gross alpha activity, tritium, and ^{90}Sr; and dose limits from beta particle and photon radioactivity)
40 CFR 144	Underground Injection Control Program	Establishes minimum requirements for underground injection (well injection) control programs Prohibits underground injection except as authorized by permit or rule
Comprehensive Environmental Response, Compensation, and Liability Act		
40 CFR 300	National Oil and Hazardous Substances Pollution Contingency Plan	Provides organizational structures and procedures for preparing for and responding to discharges of oil and releases of hazardous substances, pollutants, and contaminants Hazardous substance response requirements include environmental sampling
40 CFR 302	Designation, Reportable Quantities, and Notification	Designates hazardous substances, identifies reportable quantities, and sets forth notification requirements for releases
Resource Conservation and Recovery Act		
40 CFR 260	Hazardous Waste Management System: General	Provides definition of terms, general standards, and overview information applicable to Parts 260-265 and 268 of 40 CFR
40 CFR 261	Identification and Listing of Hazardous Waste	Identifies solid waste subject to regulation as hazardous wastes under Parts 262-265, 268, 270, 271, and 124 of 40 CFR, and which are subject to notification requirements of RCRA

Table A-2. Applicable Mandatory Federal Environmental Protection Regulations (Sheet 3 of 3)

Regulation	Title	Applicable Content
Resource Conservation and Recovery Act (continued)		
40 CFR 262	Standards Applicable to Generators of Hazardous Waste	Establishes standards for generators of hazardous waste: pre-transport requirements, and recordkeeping and reporting requirements
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	Establishes minimum national standards, which define acceptable management of hazardous waste treatment, storage, and disposal facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	Establishes minimum national standards that define acceptable management of hazardous waste during the period of interim status and until certification of final closure on (if applicable) until postclosure responsibilities are fulfilled Establishes requirements for groundwater monitoring
40 CFR 270	EPA Administered Permit Programs: The Hazardous Waste Permit Program	Establishes provisions for the Hazardous Waste Permit Program
40 CFR 280	Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST)	Establishes requirements for USTs
Toxic Substances Control Act		
40 CFR 761	Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions	Establishes prohibitions of, and requirements for, the manufacture, processing, distribution in commerce, use, disposal, storage, and marking of PCBs and PCB items
Radiation Protection		
10 CFR 834	Radiological Protection of the Public and the Environment	Establishes standards and requirements for operations of DOE and DOE contractors with respect to protection of members of the public and the environment against undue risk from radiation Specifies limits for radiation doses to the public from all exposure modes from DOE activities; drinking water dose impacts meet standards of 40 CFR 141. Establishes requirements and guides for radiological effluent monitoring and environmental surveillance in support of DOE operation and activities

Table A-3. Applicable California Statutes and Regulations

Statute/Regulation	Title	Applicable Content
California Water Code Division 7, Chapter 5.5	The Porter-Cologne Water Quality Control Act Water Quality Compliance with the Provisions of the Federal Water Control Act as amended in 1972	Gives the State Water Resources Control Board and RWQCBs authority and responsibility to regulate discharges to surface and groundwater, to regulate waste disposal sites, and to require cleanup of discharges of hazardous materials and other pollutants Directs the State and regional boards to issue permits for waste discharge requirements as required or authorized by the Clean Water Act
California Health and Safety Code Chapter 6.6 §§25249.5–25249.13	Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65)	Places prohibition on contaminating drinking water (by knowingly discharging or releasing chemicals known to cause cancer or reproductive toxicity into, or where they will probably migrate into, drinking water) Requires businesses to warn individuals before exposing them to significant amounts of any listed chemical
Chapter 6.67	Aboveground Storage of Petroleum	Requires monitoring of tanks, filing of tank information statement each 2 years, payment of fee based on facility storage capacity, and notification of spills.
Chapter 6.95	Hazardous Materials Release Response Plans and Inventory	Establishes business and area plans relating to handling and release of hazardous materials: basic information on location, type, quantity, and health risks of hazardous materials handled, used, stored, or disposed of, which could be accidentally released into the environment
Chapter 1543	Toxic Pits Cleanup Act of California	Requires a hydrogeologic assessment report of surface impoundments – report to include an analysis for pollutants in the vadose zone Requires demonstration that the monitoring system and methods used can detect any seepage before hazardous waste constituents in the impoundment can enter the waters of the state
California Code of Regulations		
Title 17, Division 1	Public Health State Department of Health Services	
Chapter 5,	Sanitation (Environmental)	
Subchapter 4, Group 3 Article 3,	Radiation Standards for Protection Against Radiation Dose Limits, Permissible Levels and Concentrations	
Section 30269	Concentrations in Effluents to Uncontrolled Areas	Prohibits release into air or water in any uncontrolled area of any concentration of radioactive material which, when averaged over any year, exceeds limits specified in Appendix A, Table II
Appendix A, Table II	Concentration in Air and Water Above Natural Background	Lists by isotope the allowable concentrations in air and water
Title 23, Division 3,	Waters State Water Resources Control Board	
Chapter 1	General Provisions	Establishes state and regional board procedures
Chapter 9	Waste Discharge Reports and Requirements	Sets fees (Article 1) Directs issuance, in accordance with federal regulations for the NPDES program, of waste discharge requirements (permits) for discharges from point sources to navigable waters
Chapter 16	USTs	Establishes monitoring requirements for USTs, and uniform standards for release reporting

Table A-4. Applicable Ventura County Air Pollution Control District Rules and Permits

Rule*/Regulation	Title	Applicable Content
VCAPCD Rule 74.15		Prohibits discharge into the atmosphere of emissions containing oxides of nitrogen in excess of 40 ppm (volume) and carbon monozide in excess of 400 ppm (volume) from sources of specified (large) size
VCAPCD Rule 103		Governs installing, operating, and reporting of a continuous monitoring system to measure oxides of nitrogen, carbon monoxide, and oxygen
Permit 0271	Permit to Operate	Permits operation of the following: Sodium Component Test Installation (SCTI) Hazardous Waste Treatment Facility (Bldg. 133) Molten Salt Test Facility (MSTF; Bldg. 005) Low NOx/SOx Combustor Kalina Cogeneration Facility Wipe Cleaning Operations Specifies permitted emission quantities for reactive organic compounds, nitrogen oxides, particulate matter, sulfur oxides, carbon monoxide, and ammonia. Specifies operating limits on which the emission quantities are based. Specifies monitoring emissions of SCTI heaters H-1 and H-2 for content of NOx and CO using a time-shared continuous emission monitor. Specifies monitor calibration procedures and data reporting in compliance with Rule 103. Specifies records of operating parameters to be maintained and made available to VCAPCD on request.

*The VCAPCD rules listed are the two which have the most significance for Area IV. Other rules are also applicable.

Table A-5. Applicable Guidelines

Requirement/Guideline	Title	Applicable Content
Department of Energy		
DOE/EH-173T	Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance	Establishes elements of a radiological effluent monitoring and environmental surveillance program acceptable to DOE, in support of DOE Order 5400.5 and DOE Order 5400.1.
Office of Solid Waste and Emergency Response (OSWER) Directives		
Directive 9283.1-2	Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites	Provides guidance for making key decisions in developing, evaluating, and selecting groundwater remedial actions at Superfund sites Provides guidelines for using groundwater monitoring data to evaluate remedial performance Refers to OSWER Directive 9950.1 for detailed information on technical aspects of groundwater monitoring
Directive 9355.3-01	Guidance on Conducting Remedial Investigations and Feasibility Studies Under CERCLA	Outlines remedial investigation and feasibility study process established by the Superfund program for characterizing the risks from uncontrolled hazardous waste sites and for evaluating potential remedial options
Directive 9950.1	RCRA Ground-Water Monitoring Technical Enforcement Guidance Document (TEGD)	Describes what EPA deems the essential components of a groundwater monitoring system that meets the goals of RCRA Discusses six subjects: 1. Characterization of site hydrogeology 2. Location and number of monitoring wells 3. Design, construction, and development of monitoring wells 4. Content and implementation of sampling and analysis plan 5. Statistical analysis of monitoring data 6. Content and implementation of the assessment plan
American National Standards Institute		
ANSI N13.1-1969	Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities	Provides methods for determining actual radioactive emissions if continuous monitoring is required

A.3 AIR

The Federal Clean Air Act, as amended in 1990, is designed to protect and improve air quality and public health and welfare. Federal requirements are incorporated by reference into Ventura County Air Pollution Control District (VCAPCD) rules and regulations. Sampling methods are specified in 40 CFR 60, Appendix A, and in ANSI N13.1–1969.

VCAPCD-permitted facility heaters and boilers used in SSFL Area IV are fired with natural gas. Only the H–1 and H–2 sodium heaters and the H–101 boiler at the SCTI exceed 5 x 10^6 Btu/h and, thus, must comply with VCAPCD Rule 74.15. This rule controls stack emissions of carbon monoxide and oxides of nitrogen to 400 parts per million (ppm) volume and 40 ppm volume, respectively. The testing method required for verification of compliance with VCAPCD Rule 74.15 is CARB 100, "Procedures for Continuous Gaseous Emission Stack Sampling," and is applicable for determining emissions of oxides of nitrogen, carbon monoxide, and oxygen from stationary source flowing gas streams in ducts, stacks, and flues.

The H–1 and H–2 heaters at SCTI must also comply with VCAPCD Rule 103, since they are rated at greater than 40 x 10^6 Btu/h. The H–101 boiler is not required to meet this rule. Rule 103 requires a continuous emission monitoring (CEM) system to measure the oxides of nitrogen, carbon monoxide, and oxygen. It also identifies the permanent records from the CEM that must be made available to the CARB or VCAPCD on request. The installation, calibration, operation, and maintenance of the CEM system must comply with the requirements of 40 CFR 51, Appendix P.

Source testing has demonstrated compliance with Rule 74.15 at all load levels required by the Authority to Construct; however, compliance has not been achieved at H–1 and H–2 sodium heater load levels below 25% (during start-up, shutdown, and standby periods; predominantly when operating on pilot burners only). Operation is continuing under VCAPCD Variance Order 392 until the low-load problem is resolved. The VCAPCD Hearing Board has granted an extension of the variance until November 30, 1993, or until Rule 74.15 is modified. The basis for modification of the rule is that cost-effective control technology does not currently exist for the low-load conditions. In granting the extension, the Hearing Board imposed an annual limit of 0.1 tons on total excess emissions when the H–1 and H–2 sodium heaters are operating at less than 25% load.

The primary DOE requirements for monitoring radioactive particulate emissions from stacks and vents are provided in 40 CFR 61, Subpart H, National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities. The requirements for evaluating and monitoring all radioactive sources are contained in DOE 5400.1, DOE 5400.5 (expected to be upgraded to a rule by adoption of 10 CFR 834), and DOE/EH–0173T.

A.4 SURFACE WATER

Surface water discharges at SSFL have been regulated since 1958 under a waste discharge permit issued by the Regional Water Quality Board. This permit evolved into an NPDES permit issued in 1976 and renewed in 1984 and 1992 as the joint Rocketdyne, National Aeronautics and Space Administration (NASA), and DOE (SSFL) NPDES Permit No. CA0001309. The 1992 permit was issued by Order No. 92–092 of the California Regional Water Quality Control Board (RWQCB), Los Angeles Region. This permit specifies requirements that meet the provisions of the California Water Code, the Federal Water Pollution Control Act (the Clean Water Act), and associated regulations and guidelines. Discharge limitations are listed in Tables A–6 through A–8. Monitoring requirements of the permit are listed in Tables A–9 through A–12.

Federal regulations identify hazardous substances and define sampling, analysis, and allowable concentration requirements for these substances in discharges of surface waters and provide NPDES permitting requirements for these discharges.

California statutes and regulations applicable to Area IV surface water monitoring are listed in Table A–3. The federal Clean Water Act places with the states the primary responsibility for control of water pollution. California implements its responsibilities under the Clean Water Act and associated regulations through the Porter–Cologne Water Quality Act of 1970 (California Water Code §§13000–13999.16). The Act assigns to State and RWQCBs the authority to define waste discharge requirements and to issue permits in accordance with federal regulations. On this basis, the RWQCB has issued the SSFL NPDES permit which specifies water discharge requirements.

Table A-6. Discharge Limitations – R-2A Pond (Sheet 1 of 3)

Constituent	Unit	Discharge Limitations[1/]		
		30-day Avg	Daily Avg	Instantaneous Maximum
Total suspended solids[2/]	mg/L lb/day	15 20,016	-- --	75 100,080
Settleable solids[2/]	mL/L	0.1	--	0.3
Total dissolved solids	mg/L lb/day	-- --	-- --	950 1,267,680
$BOD_5 20°C$	mg/L lb/day	-- --	-- --	30 40,032
Oil and grease	mg/L lb/day	-- --	-- --	15 20,016
Chloride	mg/L lb/day	-- --	-- --	150 200,160
Fluoride	mg/L lb/day	-- --	-- --	1.0 1,334
Nitrate and nitrite as nitrogen	mg/L lb/day	-- --	-- --	8 10,675
Sulfate	mg/L lb/day	-- --	-- --	300 400,320
Boron	mg/L lb/day	-- --	-- --	1.0 1,334
Surfactants (as MBAs)	mg/L lb/day	-- --	-- --	0.5 667
Residual chlorine	mg/L lb/day	-- --	-- --	0.1 133
Radioactivity – Gross alpha Gross beta	 pCi/L pCi/L	 -- --	 -- --	 15 50
Combined ^{226}Ra and ^{228}Ra	pCi/L	--	--	5
Tritium	pCi/L	--	--	20,000
^{90}Sr	pCi/L	--	--	8
Arsenic (As)	µg/L	5.0	190	360
Cadmium (Cd)	µg/L	10	b	b
Chromium (VI)[3/] (Cr^{+6})	µg/L	50	11	16
Copper (Cu)	µg/L	1,000	c	c
Lead (Pb)	µg/L	50	d	d
Mercury (Hg)	ng/L	12	e	2,400
Nickel (Ni)	µg/L	600	e	e
Selenium (Se)	µg/L	10	5	20
Silver (Ag)	µg/L	50	g	f
Zinc (Zn)	µg/L	5,000	--	g
Barium (Ba)	µg/L	--	--	1,000
Aldrin	pg/L	130	--	--
Methoxychlor	µg/L	--	--	100

Table A-6. Discharge Limitations – R-2A Pond (Sheet 2 of 3)

Constituent	Unit	Discharge Limitations[1/]		
		30-day Avg	Daily Avg	Instantaneous Maximum
2,4-D	µg/L	--	--	0.1
2,4,5-TP-Silvex	µg/L	--	--	10
1,1-dichloroethylene	µg/L	--	--	6
Trans-1,2-dichloroethylene	µg/L	--	--	10
Trichloroetheylene	µg/L	--	--	5
1,1,2,2,-tetrachloroethane	µg/L	--	--	1
Tetrachloroethylene	µg/L	--	--	5
Vinyl chloride	µg/L	--	--	5
Carbon tetrachloride	µg/L	--	--	0.5
1,2-dichloroethane	µg/L	--	--	0.5
1,1-dichloroethane	µg/L	--	--	5
Ethylbenzene	µg/L	--	--	680
1,1,1-trichloroethane	µg/L	--	--	200
1,1,2-trichloroethane	µg/L	--	--	32
Pentachlorophenol	µg/L	--	--	1
N-nitrosodimethylamine	µg/L	--	--	0.02
Cyanide	µg/L	--	--	22
1,2-dichlorobenzene	mg/L	2.7	--	--
1,3-dichlorobenzene	µg/L	400	--	--
1,4-dichlorobenzene	µg/L	9.9	--	--
2,4,6-trichlorophenol	µg/L	0.34	--	--
4-chloro-3-methylphenol	µg/L	3,000	--	--
2,4-dichlorophenol	µg/L	0.30	--	--
Benzene	µg/L	0.34	--	--
Bromoform	µg/L	100	--	--
Chlordane[4/]	ng/L	0.08	4.3	--
Chloroform	µg/L	100	--	--
DDT[4/]	ng/L	0.59	1.0	--
Dieldrin	ng/L	0.14	1.9	--
Endosulfan[4/]	ng/L	900	56	220
Endrin[4/]	ng/L	800	2.3	180
Halomethanes[4/]	µg/L	100	--	--
Heptachlor	pg/L	160	3,800	--
Heptachlor epoxide	pg/L	70	--	--
Hexachlorobenzene	pg/L	660	--	--
Hexachlorocyclohexane				
alpha	ng/L	3.9	--	--
beta	ng/L	14	--	--
gamma	ng/L	19	80	--

Table A-6. Discharge Limitations – R-2A Pond (Sheet 3 of 3)

Constituent	Unit	Discharge Limitations[1/]		
		30-day Avg	Daily Avg	Instantaneous Maximum
PAHs[4/]	ng/L	2.8	--	--
PCBs[4/]	pg/L	70	14,000	--
Pentachlorophenol	µg/L	0.28	h	h
Toluene	mg/L	10	--	--
Toxaphene	pg/L	670	--	730,000
Fluoranthene	µg/L	42	--	--
Phenol	µg/L	300	--	--
Dichloromethane	µg/L	4.6	--	--
Tributyltin	ng/L	--	40	60

1/ Based on the maximum discharge flow rate of 160 million gallons per day.

2/ The effluent limitations for total suspended solids and settleable solids are not applicable for discharges during rainfall events.

3/ Discharger may, at their option, meet this limitation as total chromium.

4/ As defined in the California Inland Surface Waters Plan, 1991.

b–g: Objectives for these metals are expressed by the following formulas, where H = ln (Hardness) in mg/L as $CaCo_3$.

b: $(\text{Daily Average})_{Cd} = e^{0.7852H-3.490}$;
$(\text{Instantaneous Maximum})_{Cd} = e^{1.128H-3.828}$.

c: $(\text{Daily Average})_{Cu} = e^{0.8545H-1.465}$;
$(\text{Instantaneous Maximum})_{Cu} = e^{0.9422H-1.464}$.

d: $(\text{Daily Average})_{Pb} = e^{1.273H-4.705}$;
$(\text{Instantaneous Maximum})_{Pb} = e^{1.273H-1.460}$.

e: $(\text{Daily Average})_{Ni} = e^{0.846H+1.645}$;
$(\text{Instantaneous Maximum})_{Ni} = e^{0.846H+3.3612}$.

f: $(\text{Instantaneous Maximum})_{Ag} = e^{1.72H-6.52}$.

g: $(\text{Daily Average})_{Zn} = e^{0.8473H+0.7614}$;
$(\text{Instantaneous Maximum})_{Zn} = e^{0.8473H+0.8604}$.

h: $(\text{Daily Average})_{Pentachlorophenol} = e^{1.005(pH)-5.290}$;
$(\text{Instantaneous Maximum})_{Pentachlorophenol} = e^{1.005(pH)-4.830}$.

D026-0005-15

Table A-7. Discharge Limitations – Area IV Northwest Slope

Constituent	Units	Daily Maximum*
Total dissolved solids	mg/L	850
Oil and grease	mg/L	15
Chloride	mg/L	150
Fluoride	mg/L	1.0
Nitrate and nitrite as nitrogen	mg/L	10
Sulfate	mg/L	250
Boron	mg/L	1.0
Radioactivity –		
Gross Alpha	pCi/L	15
Gross Beta	pCi/L	50
Combined ^{226}Ra and ^{228}Ra	pCi/L	5
Tritium	pCi/L	20,000
^{90}Sr	pCi/L	8

*The discharge rate mass limitations in lb/day shall be determined using the tabulated concentration limits and the discharge flow rate.

D026-0005-I5

Table A-8. Other Discharge Limitations

No.	Description
1.	The toxicity of the effluent shall be such that the average survival in undiluted effluent for any three consecutive 96-h static or continuous flow bioassay tests shall be at least 90%, with no single test producing less than 70% survival.
2.	The chronic toxicity of the effluent shall not exceed 1.0 TUc, as measured by the tests contained in Table 4, Chapter III.C. of the California Inland Surface Waters Plan, adopted by the State Water Resources Control Board.
3.	Radioactivity of the wastes discharged shall not exceed the limits specified in Title 22, Chapter 15, Article 5, Section 64443, of the California Code of Regulations, or subsequent revision.
4.	Domestic wastes discharged to watercourses shall at all times be adequately disinfected. For the purpose of this requirement, the wastes shall be considered adequately disinfected if the median number of total coliform organisms at some point in the treatment process does not exceed 2.2 per 100 mL and the number of total coliform organisms does not exceed 23 per 100 mL in more than one sample within any 30-day period. The median value shall be determined from samples taken on five sampling days each week, at least one sample per sampling day, collected at a time when wastewater flow and characteristics are most demanding on the treatment facilities and disinfection procedures.
5.	Domestic wastes discharged to watercourses shall have received treatment equivalent to that of a filtered wastewater. Filtered wastewater means an oxidized, coagulated, clarified wastewater which had been passed through natural undisturbed soils or filtered media, such as sand or diatomaceous earth, so that the turbidity as determined by an approved laboratory method does not exceed an average operating turbidity of 2 turbidity units and does not exceed 5 turbidity units more than 5% of the time during any 24-h period.

D026-0005-I5

Table A-9. Routine Effluent Monitoring Program - R-2A Pond (Sheet 1 of 2)

Constituent	Units	Type of Sample	Minimum Frequency of Analysis
Rainfall	inches	—	Daily
Total waste flow	gal/day	—	Once per discharge event
pH	pH units	Grab	Once per discharge event
Temperature	°F	Grab	Once per discharge event
Turbidity	TU	Grab	Once per discharge event
Suspended solids	mg/L	Grab	Once per discharge event
Settleable solids	mL/L	Grab	Once per discharge event
Total dissolved solids	mg/L	Grab	Once per discharge event
Total organic carbon	µg/L	Grab	Once per discharge event
Conductivity at 25°C	µmhos/cm	Grab	Once per discharge event
$BOD_5$20°C	mg/L	Grab	Once per discharge event
Oil and grease	mg/L	Grab	Once per discharge event
Chloride	mg/L	Grab	Once per discharge event
Fluoride	mg/L	Grab	Once per discharge event
Nitrate and nitrite (as nitrogen)	mg/L	Grab	Once per discharge event
Sulfate	mg/L	Grab	Once per discharge event
Boron	mg/L	Grab	Once per discharge event
Surfactants (as MBAS)	mg/L	Grab	Once per discharge event
Residual chlorine	mg/L	Grab	Once per discharge event
Radioactivity–gross alpha, beta	pCi/L	Grab	Once per discharge event
Combined ^{226}Ra and ^{228}Ra	pCi/L	Grab	Once per discharge event
Tritium	pCi/L	Grab	Once per discharge event
^{90}Sr	pCi/L	Grab	Once per discharge event
Lindane	µg/L	Grab	Once per discharge event
Methoxychlor	µg/L	Grab	Once per discharge event
2,4–D	µg/L	Grab	Once per discharge event
2,4,5–TP–Silvex	µg/L	Grab	Once per discharge event
1,1–dichloroethylene	µg/L	Grab	Once per discharge event
Trans–1,2–dichloroethylene	µg/L	Grab	Once per discharge event
Trichloroethylene	µg/L	Grab	Once per discharge event
1,1,2,2–tetrachloroethane	µg/L	Grab	Once per discharge event
Tetrachloroethylene	µg/L	Grab	Once per discharge event
Vinyl chloride	µg/L	Grab	Once per discharge event
Carbon tetrachloride	µg/L	Grab	Once per discharge event
1,2–dichloroethane	µg/L	Grab	Once per discharge event
1,1–dichloroethane	µg/L	Grab	Once per discharge event
Ethylbenzene	µg/L	Grab	Once per discharge event
1,1,1–trichloroethane	µg/L	Grab	Once per discharge event
1,1,2–trichloroethane	µg/L	Grab	Once per discharge event
Pentachlorophenol	µg/L	Grab	Once per discharge event
N–nitrosodimethylamine	µg/L	Grab	Once per discharge event
Cyanide	µg/L	Grab	Once per discharge event
Arsenic	µg/L	Grab	Once per discharge event
Cadmium	µg/L	Grab	Once per discharge event
Chromium	µg/L	Grab	Once per discharge event
Copper	µg/L	Grab	Once per discharge event
Lead	µg/L	Grab	Once per discharge event
Mercury	µg/L	Grab	Once per discharge event
Nickel	µg/L	Grab	Once per discharge event
Selenium	µg/L	Grab	Once per discharge event
Silver	µg/L	Grab	Once per discharge event
Zinc	µg/L	Grab	Once per discharge event

Table A-9. Routine Effluent Monitoring Program - R-2A Pond (Sheet 2 of 2)

Constituent	Units	Type of Sample	Minimum Frequency of Analysis
Barium	µg/L	Grab	Once per discharge event
Aldrin	pg/L	Grab	Once per discharge event
1,2-dichlorobenzene	µg/L	Grab	Once per discharge event
1,3-dichlorobenzene	µg/L	Grab	Once per discharge event
1,4-dichlorobenzene	µg/L	Grab	Once per discharge event
2,4,6-trichlorophenol	µg/L	Grab	Once per discharge event
Benzene	µg/L	Grab	Once per discharge event
Bromoform	µg/L	Grab	Once per discharge event
Chlordane[b]	ng/L	Grab	Once per discharge event
Chloroform	µg/L	Grab	Once per discharge event
DDT[b]	ng/L	Grab	Once per discharge event
Dieldrin	ng/L	Grab	Once per discharge event
Endosulfan[b]	ng/L	Grab	Once per discharge event
Endrin	ng/L	Grab	Once per discharge event
Halomethanes[b]	µg/L	Grab	Once per discharge event
Heptachlor	pg/L	Grab	Once per discharge event
Heptachlor epoxide	pg/L	Grab	Once per discharge event
Hexachlorobenzene	pg/L	Grab	Once per discharge event
Hexachlorocyclohexane–			
Alpha	ng/L	Grab	Once per discharge event
Beta	ng/L	Grab	Once per discharge event
Gamma	ng/L	Grab	Once per discharge event
PAHs[b]	ng/L	Grab	Once per discharge event
PCBs[b]	pg/L	Grab	Once per discharge event
TCDD equivalents[b,c]	ng/L	Grab	Once per discharge event
Toluene	µg/L	Grab	Once per discharge event
Toxaphene	pg/L	Grab	Once per discharge event
Fluoranthene	µg/L	Grab	Once per discharge event
Phenol	µg/L	Grab	Once per discharge event
Dichloromethane	µg/L	Grab	Once per discharge event
Tributyltin[d]	ng/L	Grab	Once per discharge event
Toxicity–			
Acute	% survival	Grab	Once per discharge event
Chronic	TUc	Grab	Quarterly
Priority pollutants (listed in Table A-12)[e]	µg/L	Grab	Quarterly

[a]During periods of discharge, whenever rainfall is greater than 0.1 in., no more than one sample per week needs to be obtained. During dry weather flow, whenever R-2A Pond is discharging, the minimum sampling frequency shall be once per month.

[b]See Appendix I of the California Inland Surface Waters Plan for definition of terms.

[c]No analysis is required if discharger certifies that TCDD equivalents are not used or stored on site.

[d]No analysis is required if discharger certifies that tributyltin is not used or stored on site.

[e]Exclude the constituents listed herein.

Table A-10. Storm Water Runoff Monitoring Program Santa Susana Field Laboratory Area IV Northwest Slope

Constituent	Units	Type of Sample	Minimum Frequency of Analysis[a]
Rainfall	inches	—	Daily
Discharge flow[b]	gal/day	—	Once per discharge event
Temperature	°F	Grab	Once per discharge event
pH	pH units	Grab	Once per discharge event
Total dissolved solids	mg/L	Grab	Once per discharge event
Oil and grease	mg/L	Grab	Once per discharge event
Chloride	mg/L	Grab	Once per discharge event
Fluoride	mg/L	Grab	Once per discharge event
Nitrate and nitrite as nitrogen	mg/L	Grab	Once per discharge event
Sulfate	mg/L	Grab	Once per discharge event
Boron	mg/L	Grab	Once per discharge event
Residual chlorine	mg/L	Grab	Once per discharge event
Radioactivity-gross alpha, beta	pCi/L	Grab	Once per discharge event
Combined ^{226}Ra and ^{228}Ra	pCi/L	Grab	Once per discharge event
Tritium	pCi/L	Grab	Once per discharge event
^{90}Sr	pCi/L	Grab	Once per discharge event
Priority pollutants (Table A-12)	µg/L	Grab	Quarterly
Toxicity –			
Acute	% survival	Grab	Once per discharge event
Chronic	TUc	Grab	Quarterly

[a]Discharge event is greater than 0.1-in. rainfall. No more than one sample per week need be obtained.

[b]Discharge flow for each outfall shall be measured for the area drained by each outfall.

[c]Monitoring of runoff from the former Sodium Disposal Facility will not be required upon final closure and certification of the facility.

Table A-11. Domestic Sewage Monitoring Program Santa Susana Field Laboratory

Sampling station(s) shall be established at the headworks and outlet of each sewage treatment plant on the facility where representative samples of sewage influent and effluent can be obtained. Monitoring is required during the time of operation for the Area III sewage treatment plant. The following shall constitute the domestic sewage monitoring program:

Constituent	Units	Type of Sample	Minimum Frequency of Analysis[a]
pH	units	Grab	Weekly
$BOD_5$20°C	mg/L	Composite	Weekly
Oil and grease	mg/L	Grab	Weekly
Suspended solids	mg/L	Composite	Weekly
Coliform*	MPN/100 mL	Grab	Daily
Turbidity*	TU	Continuous	Daily

*Samples shall be obtained at a time when wastewater flow and characteristics are most demanding on the treatment facilities and disinfection procedures. Influent monitoring for coliform and turbidity is not required.

Table A-12. Priority Pollutants

Metals	Base/Neutral Extractibles (EPA Method 625)	Acid Extractibles (EPA Method 625)
Antimony Arsenic Beryllium Cadmium Chromium Copper Lead Mercury Nickel Selenium Silver Thallium Zinc **Miscellaneous** Cyanide Asbestos* *Not required unless specifically requested. **Pesticides (SW-846, Method 8080)** Aldrin Chlordane Dieldrin 4,4'-DDT' 4,4'-DDE 4,4'-DDD Alpha Endosulfan Beta Endosulfan Endosulfan Sulfate Endrin Endrin Aldehyde Heptachlor Heptachlor Epoxide Alpha BHC Beta BHC Gamma BHC Delta BHC Toxaphene PCB 1016 PCB 1221 PCB 1232 PCB 1242 PCB 1248 PCB 1254 PCB 1260	Acenaphthene Benzidine 1,2,4-Trichlorobenzene Hexachlorobenzene Hexachloroethane Bis (2-Chloroethyl) Ether 2-Chloronaphthalene 1,2-Dichlorobenzene 1,3-Dichlorobenzene 1,4-Dichlorobenzene 3,3'-Dichlorobenzidine 2,4-Dinitrotoluene 2,6-Dinitrotoluene 1,2-Diphenylhydrazine Fluoranthene 4-Chlorophenyl Phenyl Ether 4-Bromophenyl Phenyl Ether Bis (2-Chloroisopropyl) Ether Bis (2-Chloroethoxy) Methane Hexachlorobutadiene Hexachlorocyclopentadiene Isophorone Naphthalene Nitrobenzene N-Nitrosodimethylamine N-Nitrosodi-n-Propylamine N-Nitrosodiphenylamine Bis (2-Ethylhexyl) Phthalate Butyl Benzyl Phthalate Di-n-Butyl Phthalate Di-n-Octyl Phthalate Diethyl Phthalate Dimethyl Phthalate Benzo (a) Anthracene Benzo (a) Pyrene Benzo (b) Fluoranthene Benzo (k) Fluoranthene Chrysene Acenaphthylene Anthracene 1,12-Benzoperylene Fluorene Phenanthrene 1,2,5,6-Dibenzanthracene Indeno (1,2,3-cd) Pyrene Pyrene TCDD	2,4,6-Trichlorophenol p-Chloro-m-Cresol 2-Chlorophenol 2,4-Dichlorophenol 2,4-Dimethylphenol 2-Nitrophenol 4-Nitrophenol 2,4-Dinitrophenol 4,6-Dinitro-o-Cresol Pentachlorophenol Phenol **Volatile Organics (EPA Method 624)** Acrolein Acrylonitrile Benzene Carbon Tetrachloride Chlorobenzene 1,2-Dichloroethane 1,1,1-Trichloroethane 1,1-Dichloroethane 1,1,2-Trichloroethane 1,1,2,2-Tetrachloroethane Chloroethane Chloroform 1,1-Dichloroethylene 1,2-TransDichloroethylene 1,2-Dichloropropane 1,3-Dichloropropylene Ethylbenzene Methylene Chloride Methyl Chloride Methyl Bromide Bromoform Bromodichloromethane Dibromochloromethane Tetrachloroethylene Toluene Trichloroethylene Vinyl Chloride 2-Chloroethyl Vinyl Ether

A.5 GROUNDWATER

Area IV groundwater quality requirements are specified by Federal statutes [Safe Drinking Water Act, Resource Conservation and Recovery Act (RCRA), CERCLA, and the Toxic Substances Control Act] and the California Porter–Cologne Water Quality Control Act. The SSFL groundwater monitoring program has been under the direction and guidance of responsible regulatory agencies. During the period from the beginning of the program in 1984 through July 1989, the Los Angeles Region of the California RWQCB was responsible. In July 1989, EPA appointed Cal–EPA DTSC (Region 3/Burbank) as lead agency. Plans for SSFL groundwater characterization, monitoring, and remediation are submitted to DTSC for approval.

Groundwater monitoring guidance is given in SW–846, Test Methods for Evaluating Solid Waste (Ref. A–2). (Despite the implication of the document name, SW–846 is applicable to groundwater because EPA has defined solid waste covered by RCRA to include solids, water, and contained gases.) SW–846 was published by the EPA to provide a unified, up–to–date source of information on sampling and analysis related to compliance with RCRA regulations. It is based on the concepts of the TEGD, and provides the methodology for collecting and testing representative samples of waste and other materials to be monitored.

The Safe Drinking Water Act addresses groundwater quality to prevent possible contamination of drinking water sources. The applicable regulation (40 CFR 144) establishes minimum requirements for underground injection control programs. Underground injection is well injection only (i.e., excludes percolation from the surface). Underground injection is prohibited except as authorized by a permit or rule. Rocketdyne has no injection wells, so that the only application of this statute would be through inadvertent introduction of a contaminant through a source or monitoring well.

DOE 5400.1 specifies the preparation of a groundwater protection management program that includes (1) documentation of the groundwater regime with respect to quantity and quality, and (2) design and implementation of a groundwater monitoring program to support resource management and comply with applicable environmental laws and regulations.

A.6 SOIL, SEDIMENT, AND BIOTA

Soil, sediment, and biota are the environmental media not covered in Sections A.3 through A.5. Their monitoring is required as part of the DOE general environmental protection program (DOE Order 5400.1). Monitoring is specified by the written environmental monitoring plan prepared for the site in accordance with the DOE Order. Requirements for environmental monitoring of radioactive materials are given in DOE Orders in the 5400 series, as referenced in DOE Order 5400.1. DOE Order 5400.5 specifies verification of compliance with its requirements by radiation dose rate calculations supported by measurements made in accordance with DOE/EH–0173T.

A.7 RADIATION

The concentrations of radioactive constituents of the site environment and effluents are determined by the media sampling described above and by direct radiation measurements. In addition, the dose limit to the public must be evaluated considering all exposure modes from all DOE activities, including remedial actions required by DOE 5400.5. DOE 5400.1 specifies that the public dose component attributable to airborne releases of radioactivity must comply with CAA standards set forth in 40 CFR 61, Subpart H (Table A–3). It also specifies that requirements for environmental monitoring of radioactive materials are given in DOE Orders in the 5400 series. DOE 5400.5 specifies requirements for radiation protection of the public and the environment. It requires verification of compliance with its requirements by performance of dose rate calculations supported by measurements meeting the requirements of DOE/EH–0173T.

A.8 REFERENCES

A–1. Santa Susana Field Laboratory Site Report, Ventura County, California, Report for Congressman Elton Gallegly prepared by U.S. Environmental Protection Agency, Region IX, San Francisco (July 31, 1989)

A–2. SW–846, Third Edition, Test Methods for Evaluating Solid Waste, published by the EPA Office of Solid Waste and Emergency Response

D026–0005–I5