ER-AN-0006

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Environmental Monitoring Program Plan

Santa Susana Field Laboratory Area IV

Superceded June 30, 1993 edition

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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
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
DHS	Department of Health Services (California)
DOE	Department of Energy
DOE–SAN	Department of Energy – San Francisco Office
ECL	Engineering Chemistry Laboratory
EML	Environmental Measurements Laboratory (DOE)
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
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
PM10	Particulates of less than 10 micrometer in diameter
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, and that this plan be updated annually. 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

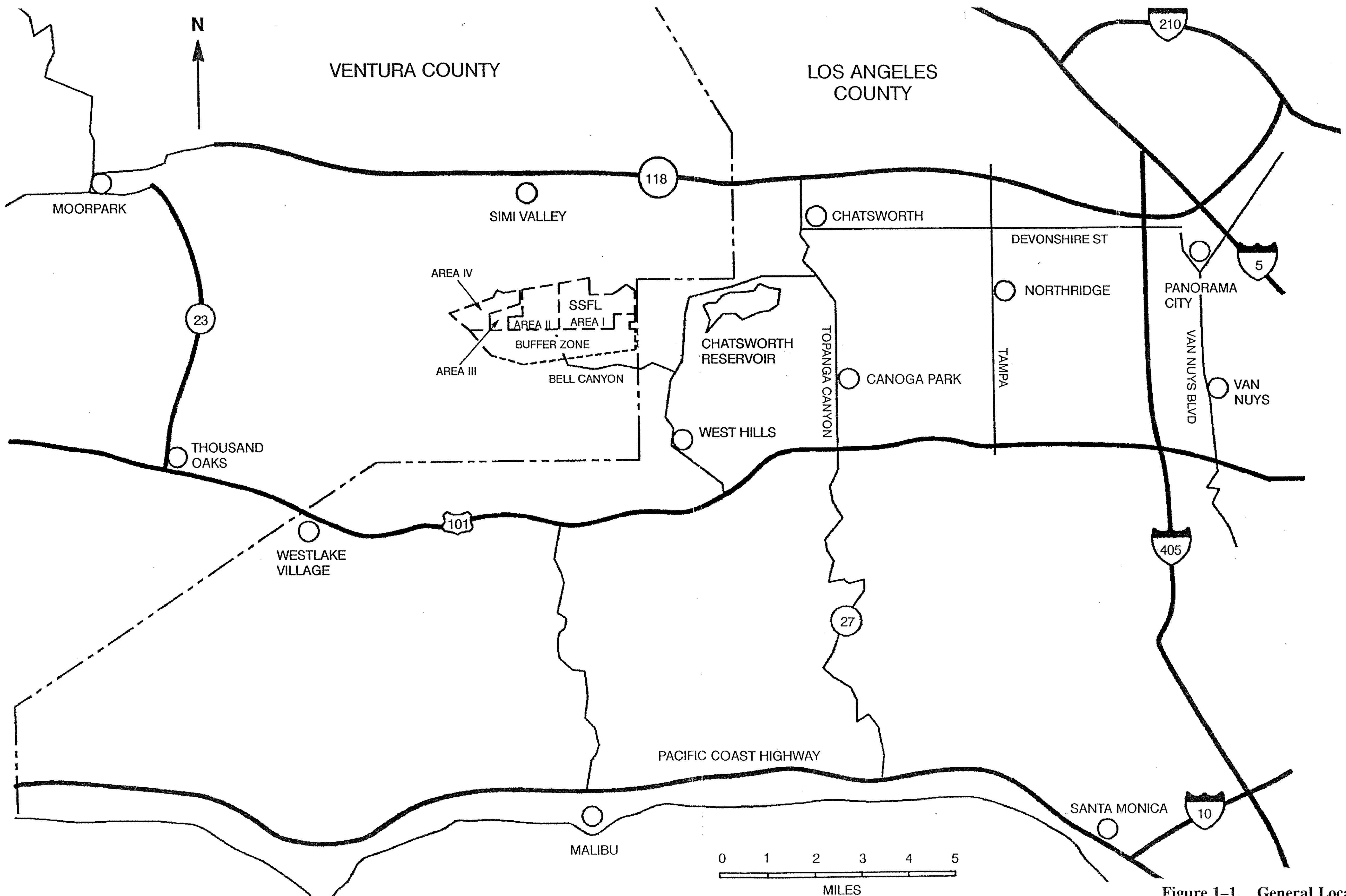

Figure 1-1. General Location of the Santa Susana Field Laboratory

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

The Simi Hills are exposures of the 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 surficial alluvium and a deeper groundwater system in the fractured Chatsworth formation.

The shallow groundwater system is present in the discontinuous pockets of alluvium, weathered sandstone, and isolated fracture zones. The shallow zone is reported to be saturated only along drainages in the southern portion of Burro Flats, and following the rainy season. The saturated portion of the shallow zone may range in thickness from 0 to 10 ft. In general, the groundwater

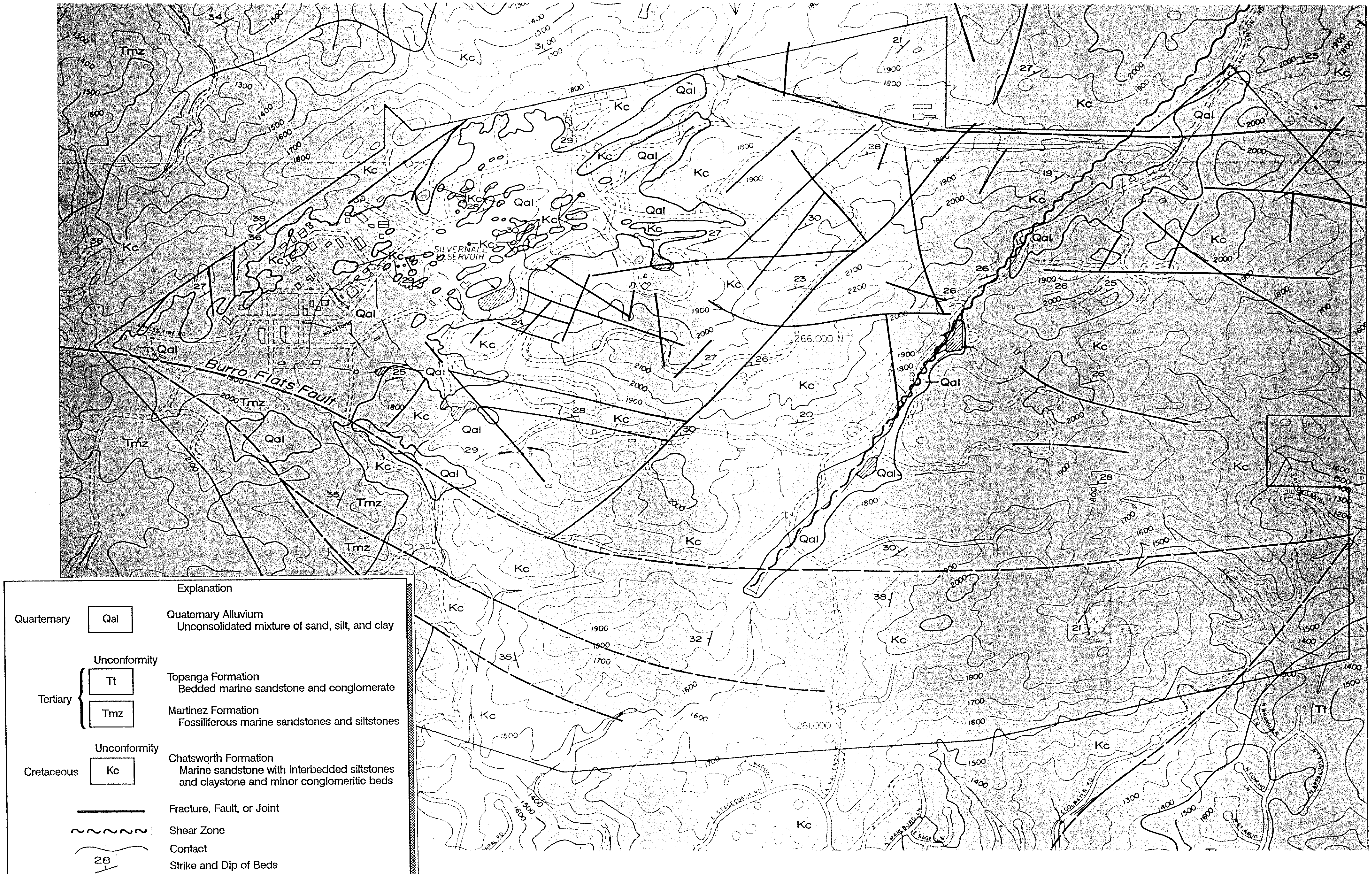

Figure 1–2. Geologic Map

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 confined and unconfined conditions, which is reflected in great variations in the depth to groundwater. The thickness of the Chatsworth aquifer is unknown, although the Chatsworth formation itself is at least 6,000 ft thick at a typical location. The deepest water supply well at SSFL reaches to a depth of 2,304 ft below the ground surface.

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 onsite. In 1991, less than 10% of the water used onsite was imported.

Before 1986, the majority of the groundwater extraction at the SSFL occurred from wells, probably located along interconnected fracture systems. Heavy pumping through the 1950's and into the 1960's 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 offsite 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 and the Pacific Ocean. The remaining 10% flows to the canyons north and northwest of the SSFL and eventually to Calleguas Creek, which drains into the Pacific Ocean. 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. Offsite surface flow is minimal except during heavy rains, since 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.

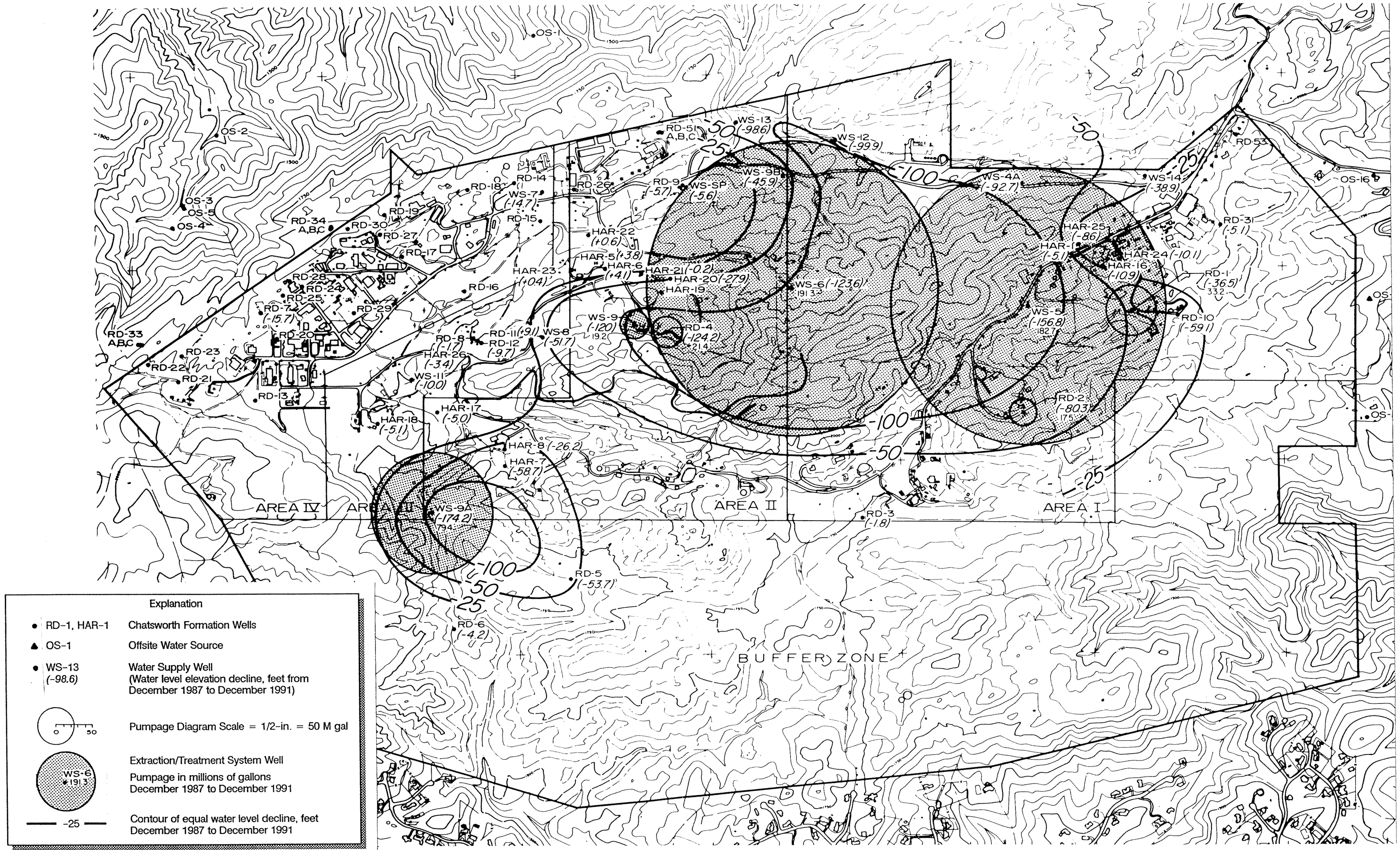

Figure 1–3. Water Level Decline and Pumpage (Chatsworth Formation Groundwater System) (1987 through 1991)

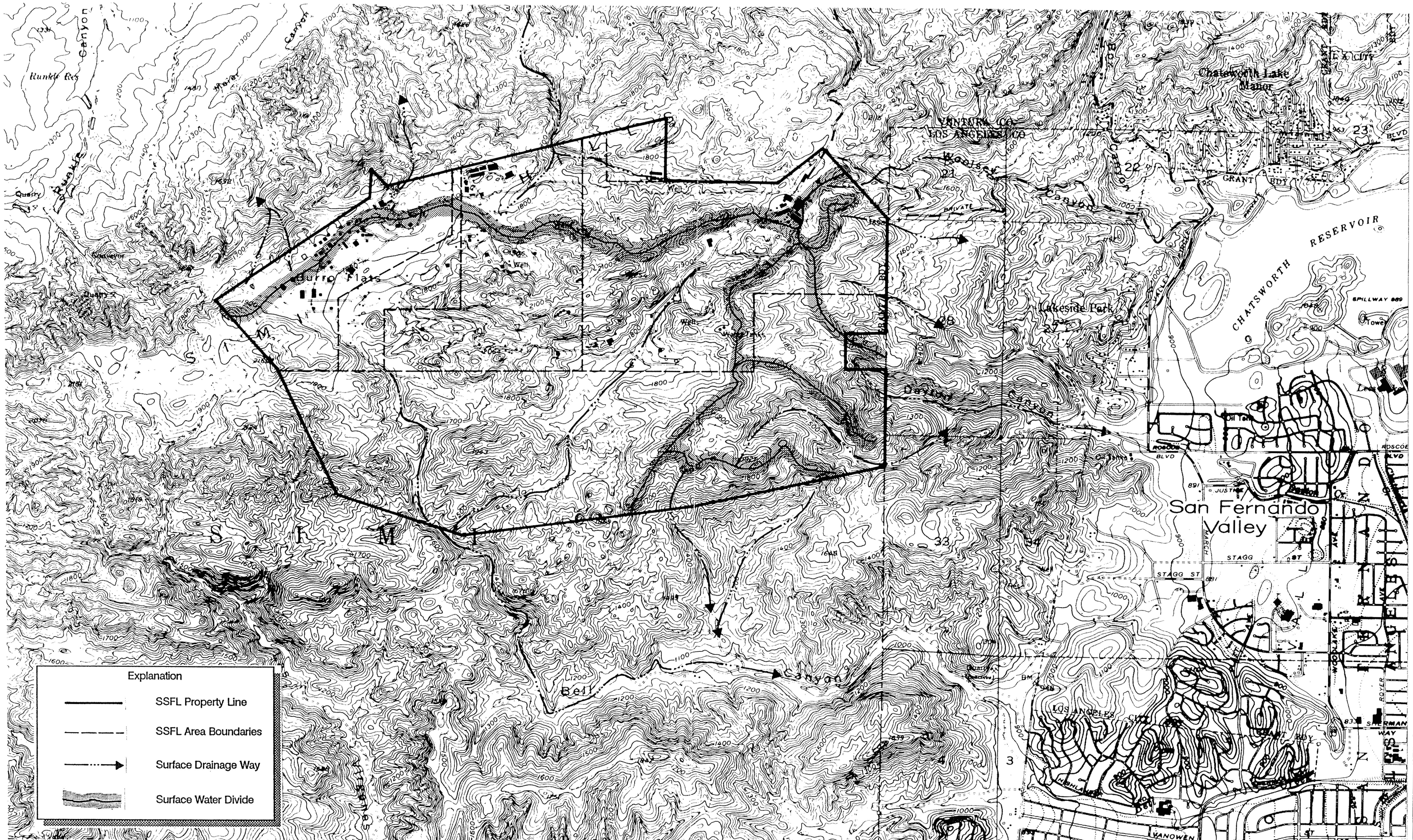

Figure 1–4. Surface Water Features

The R–2 ponds (2.6–million gal capacity) receive waters from other Rocketdyne operations, as well as all 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. Periodically, when the water storage capacity is nearly reached, water is discharged from R–2A (discharge pond) to Bell Creek. The pond water is sampled and analyzed 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.

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

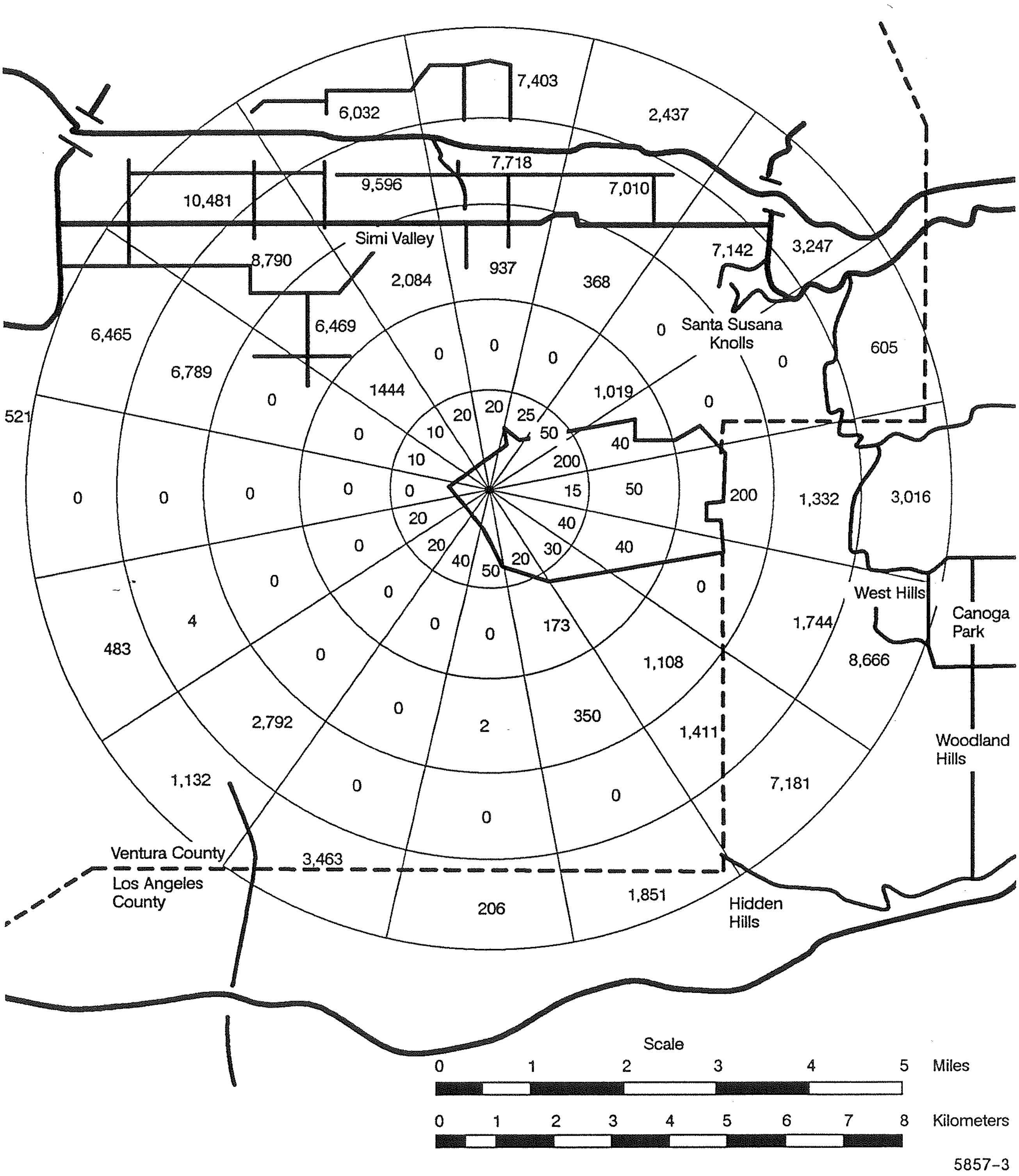

Figure 1-5. SSFL Site-Centered Demography to 8 km, Showing Number of Persons Living in Each Grid Area (Numbers within SSFL boundary indicate daytime employment.)

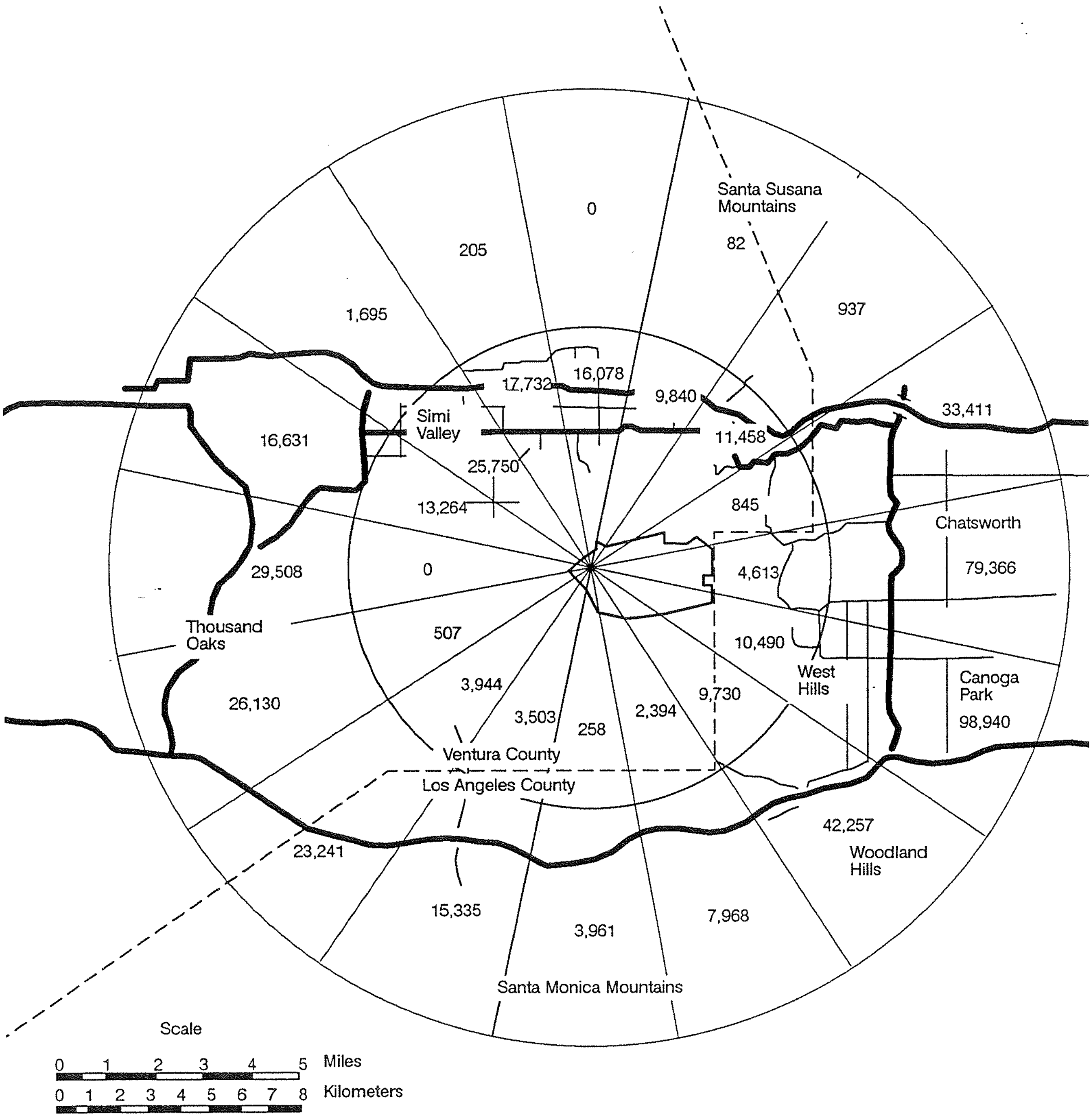

Figure 1-6. SSFL Site-Centered Demography to 16 km, Showing Number of Persons Living in Each Grid Area

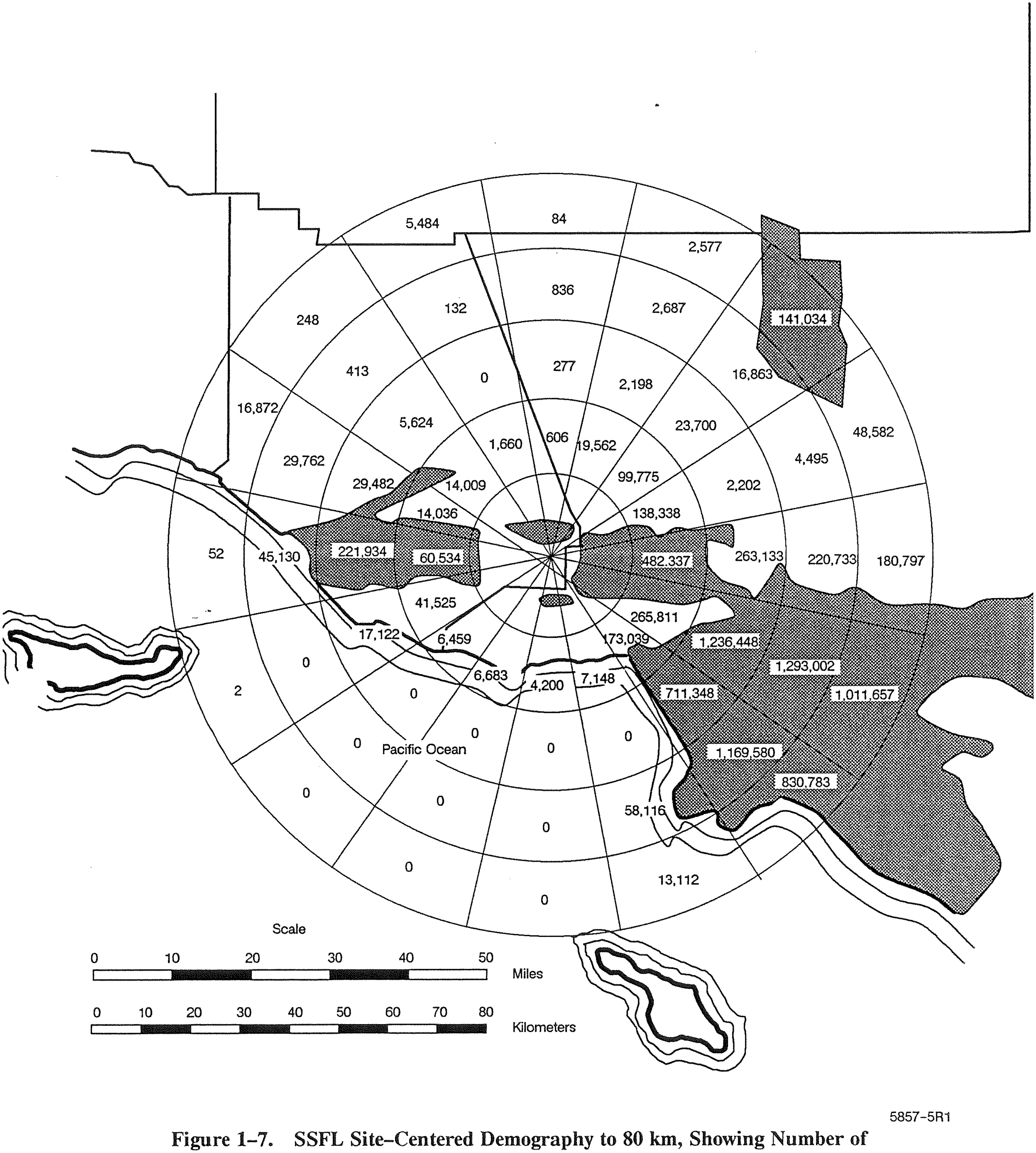

Figure 1–7. SSFL Site–Centered Demography to 80 km, Showing Number of Persons Living in Each Grid Area (heavily populated areas are shown by shading)

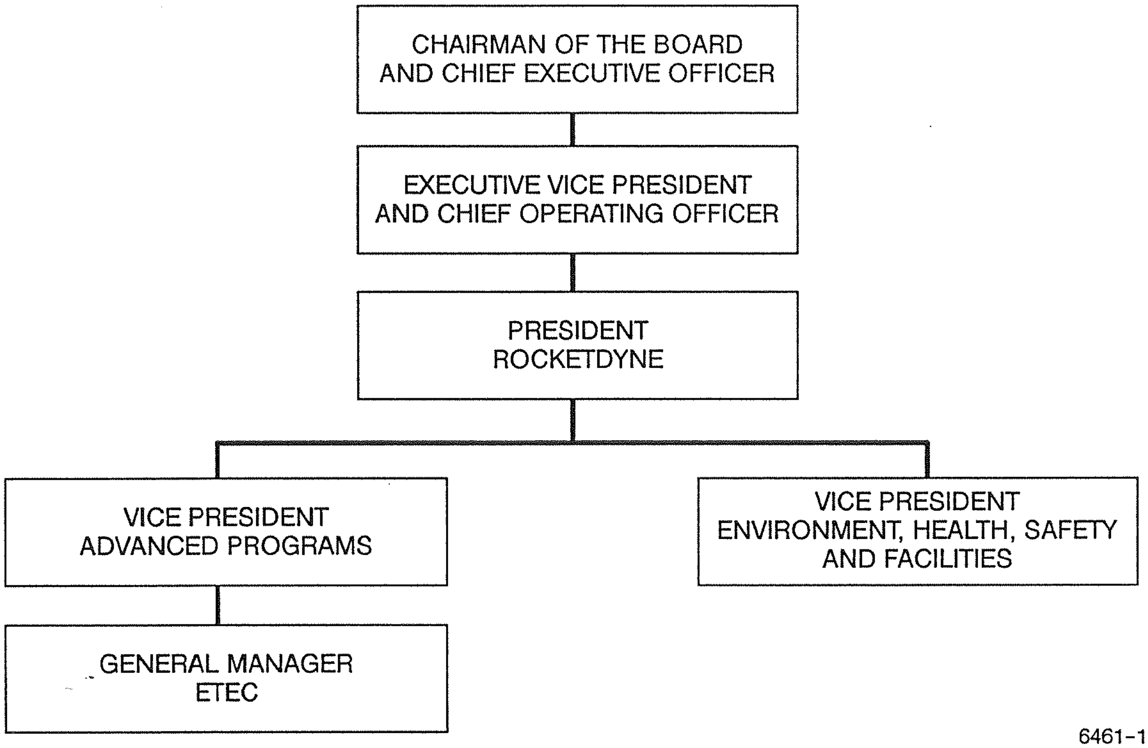

Figure 1–8. Rockwell International/Rocketdyne Organization

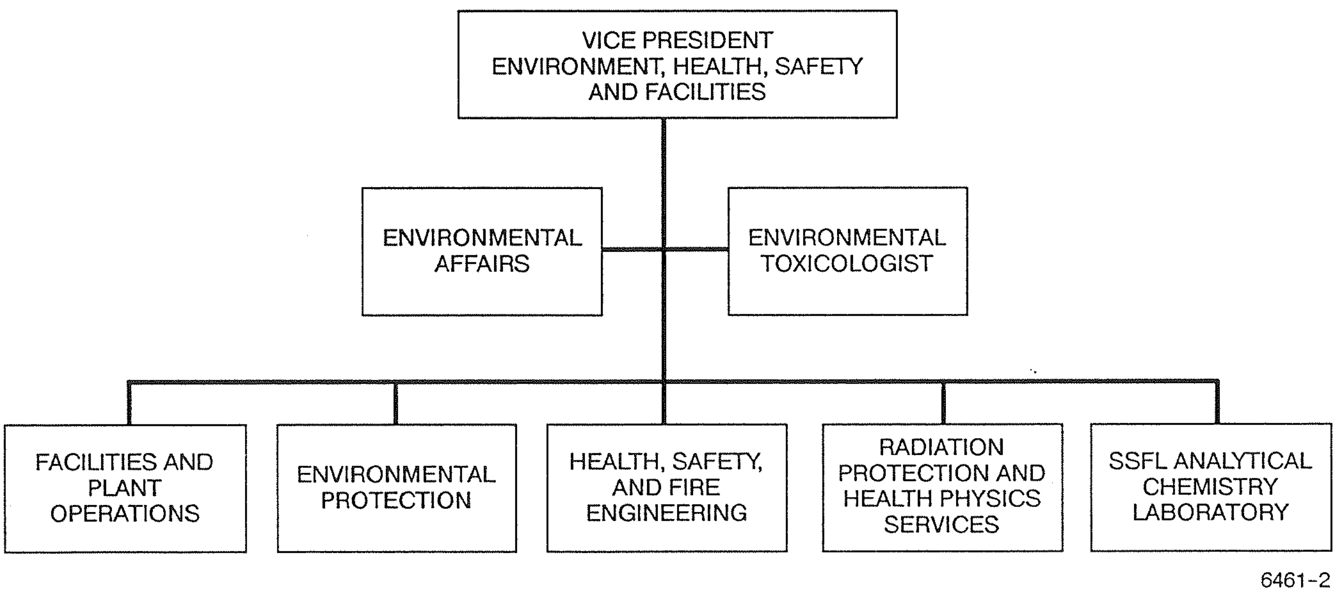

Figure 1–9. Rocketdyne Environment, Health, Safety and Facilities Organization

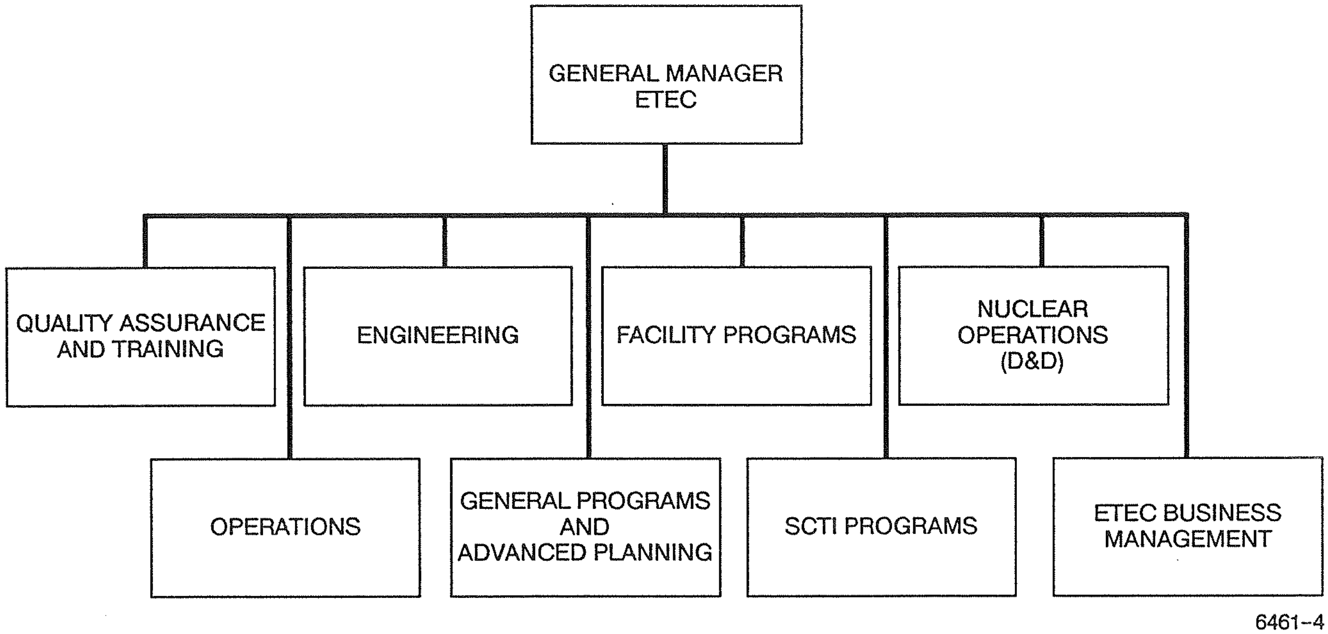

Figure 1-10. Energy Technology Engineering Center Organization

activities is contained in the 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–1950's, 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–1970's, 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.

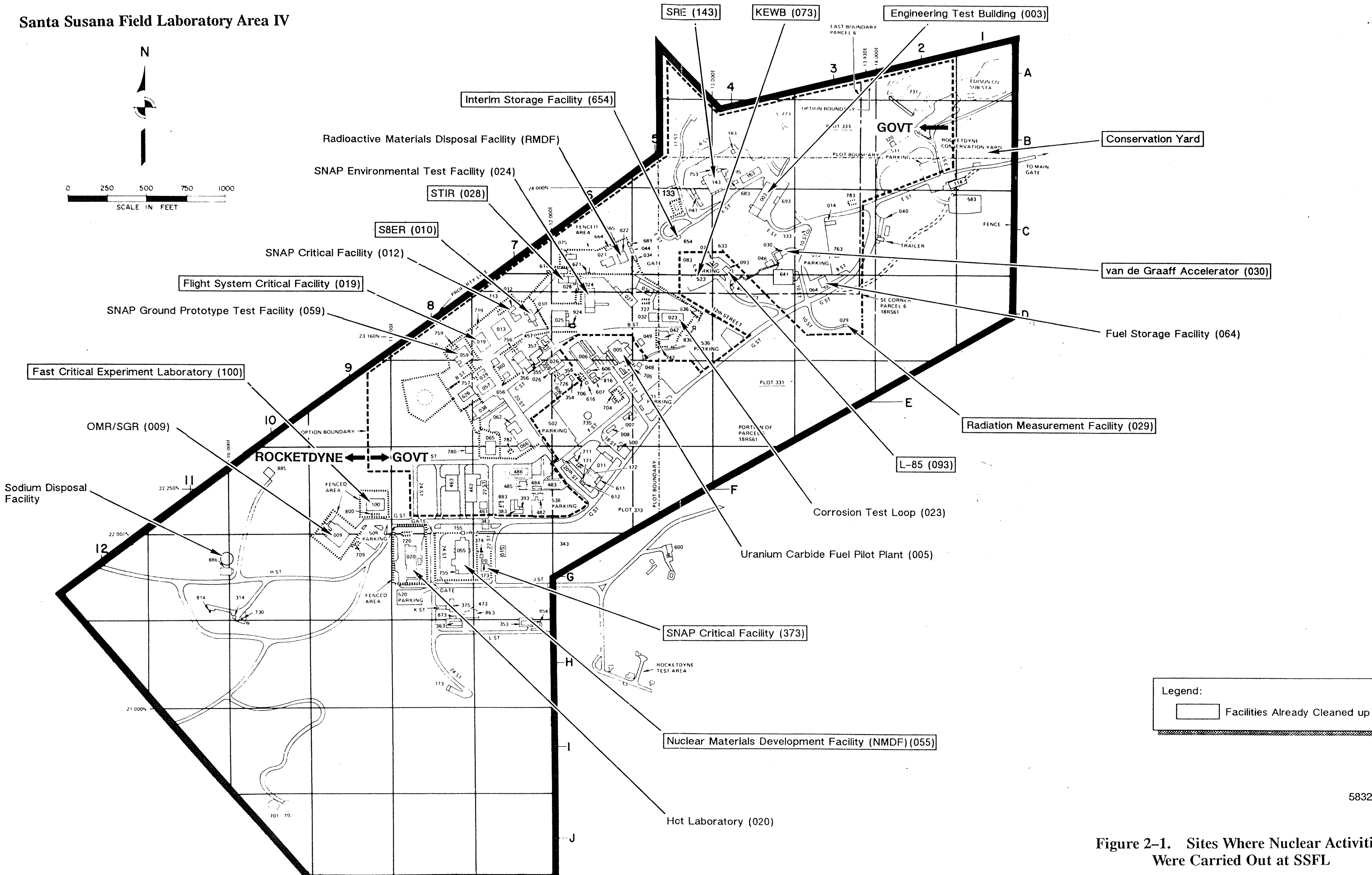


Figure 2-1. Sites Where Nuclear Activities Were Carried Out at SSFL

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) – Bldg 143
- SNAP 8 Development Reactor (S8DR) – Bldg 059
- Kinetics Experiment Water Boiler Reactor (KEWB) – Bldg 073
- L–85 (AE–6) Research Reactor – Bldg 093
- SNAP Experimental Reactor (SER), later replaced by the SNAP 8 Experimental Reactor (S8ER) – Bldg 010
- SNAP–2 Developmental Reactor (S2DR) and the SNAP–10 Flight Simulation Reactor (S10FS3) – Bldg 024
- Shield Test Reactor (STR), later modified to become the Shield Test and Irradiation Reactor (STIR) – Bldg 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 Bldgs 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) – Bldg 020
- The Radioactive Materials Disposal Facility (RMDF) – Bldgs 021, 022, 075, and 621
- Engineering Test Building (ETB) – Bldg 003
- Nuclear Materials Development Facility (NMDF) – Bldg 055
- Uranium Carbide Fuel Fabrication – Bldg 005
- Nuclear Fuel Storage Vault – Bldg 064

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

2.2 NONNUCLEAR FACILITIES

2.2.1 Sodium Disposal Facility

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 Bldg 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 concrete–lined pit has been cleaned out and resurfaced, and the downslope basins are now dry. Several areas of the contaminated basin areas have been excavated, and several small parts of scrap test components containing most of the radioactivity were found and removed. This facility is currently under a clean–up order from the California Regional Water Quality Control Board.

2.2.2 Hazardous Waste Management Facility

The HWMF consists of two buildings (029 and 133). Bldg 029 is currently used as the alkali metal waste storage building; Bldg 133 is the treatment building where alkali metals are disposed of by thermal reaction. External to Bldg 133 is a scrubber, reaction products (primarily sodium hydroxide) discharge tank, and a larger hydroxide storage tank. The scrubber stack is under a Ventura County Air Pollution Control District (VCAPCD) Air Emissions permit. After thermal reaction, alkali metal hydroxide solutions are shipped offsite to a certified disposal facility or used in chemical processes within Rocketdyne. The facility operates under a California Department of Health Services (DHS) permit and is an RCRA–permitted (Resource Conversation and Recovery Act) facility.

The HWMF was activated in 1978 and has operated intermittently since. Several hydroxide spills have occurred during operation of the facility. Operations at Bldg 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 offsite for disposal. As a result of these findings, Rocketdyne contracted GRC to characterize shallow subsurface conditions in the vicinity of Bldg 133, and wells drilled in the vicinity have become an integral part of the groundwater monitoring program.

2.2.3 Sodium Components Test Installation

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 to verify compliance with VCAPCD regulations. In 1990, both heaters were retrofitted with low–NOx burners. Tests are continuing to demonstrate compliance with the VCAPCD rules.

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–2A pond; however, addition of an ozonator has essentially eliminated the need to discharge significant quantities of water from this cooling tower.

An auxiliary 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

The molten salt gasification plant near Bldg 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 offsite. 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

The Molten Salt Test Facility (MSTF) was a general–purpose molten salt combustion pilot plant built in 1973 in Bldg 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

The low NOx–SOx burner (LNSB) was built at the north edge of the Bldg 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 Facilities

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), which is currently on standby.

2.2.7.1 Bldg 056 Excavation and Landfill

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

Table 2-1. Miscellaneous Nonnuclear Operations in Area IV

Bldg No.	Type of Operation	Status
003	5 Na loops	Operated 1953-1958
003 Annex	4 Na and NaK loops	Discontinued in early 1960's
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 1960's
013, 019, 057	NaK closed loops	Discontinued in 1960's
023	NaK loop	Operated in early 1960's
026	Small components test loop	On standby
032	Na loops	Operated from 1970's through late 1980's; presently on standby
057	Na and Li loops	Operated in the 1980's; presently on standby
059	Na-H_2O reaction studies	Operated late 1960's to early 1970's
353	Na testing	Discontinued in late 1960's
462	Na loop (SPTF)	On standby
005	Spray calciner	Ceased operating in 1990

2.2.7.2 Bldg 023

Bldg 023 housed a NaK piping loop during the SNAP program and was later used to study transport of activated elements in sodium. Some slight contamination of an inactive tank remains.

2.2.7.3 Conservation Yards

The old conservation yard, where used piping and components were held for salvage, was found to be slightly contaminated in 1988. A corner of the yard was used as a barrel storage yard. This location is a local low spot where rainwater may collect. Since radiation exposure rates were once found to be three times normal background at this location, it is suspected that a small radioactive spill occurred somewhere in the yard. The area was cleaned up and is now suitable for unrestricted use. The new conservation yard is located across the road to the south of the old yard.

2.2.7.4 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 2-2). 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 2-3).

2.2.7.5 Bldg 100 Trench

From 1960 to 1966 this trench was used for the burning of construction debris and possibly other combustible substances. The site was paved over in 1971.

2.2.7.6 Southeast Drum Storage Yard

Drums of unknown origin were stored in this location (SE 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 Other Potential Sources of Contamination

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 offsite 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 at SSFL until the mid-1960s when the use of trichloroethylene and perchlorethylene was virtually eliminated. 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

A series of facility–specific radioactivity surveys have been conducted. A survey plan for selected sites in Area IV was prepared in 1985 and implemented in 1988. Areas surveyed are shown in Figure 2–2.

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.

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).

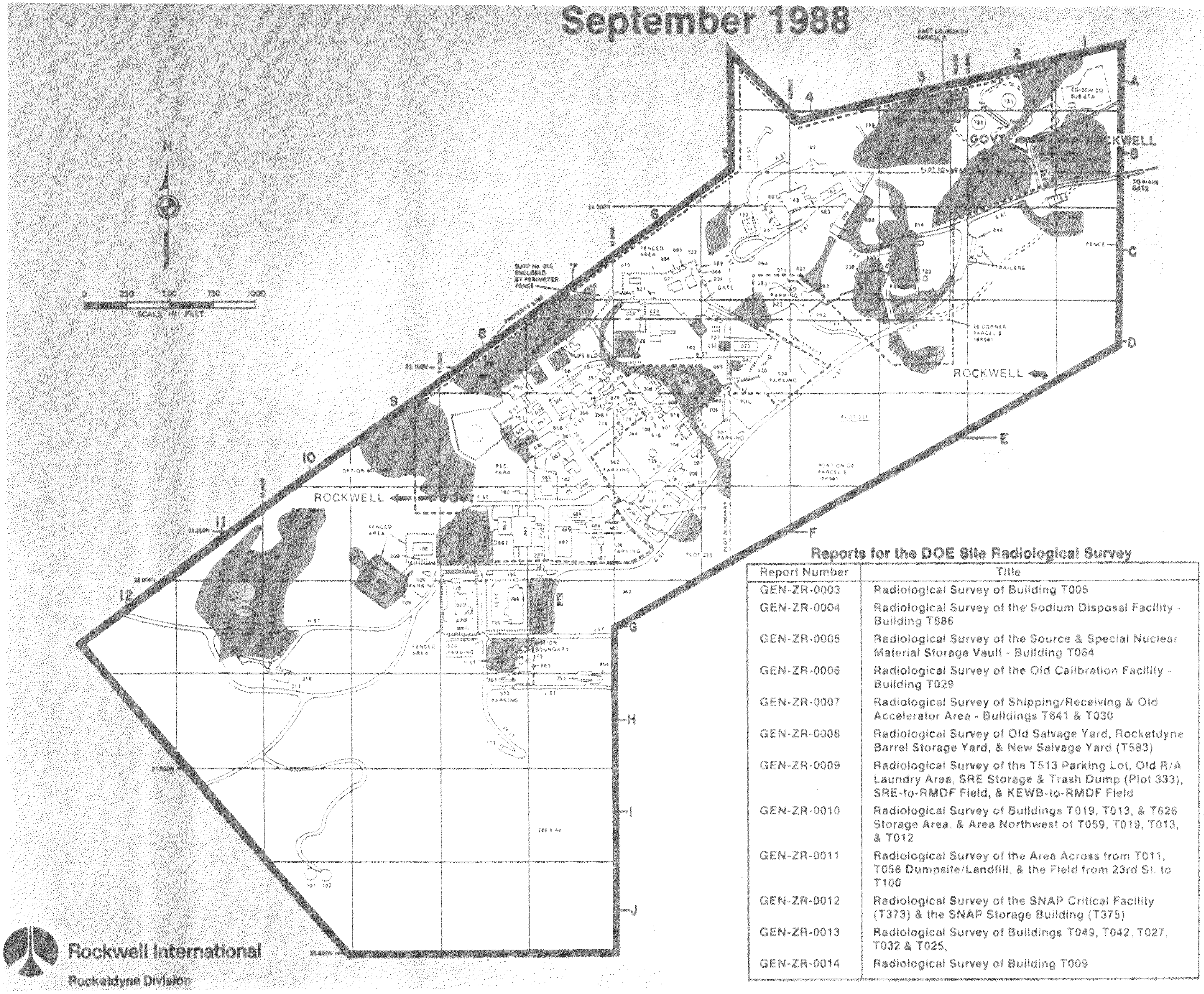
The measurements were made using portable radiation detection instruments to survey 1–m^2 grids and the insides of vents, drains, etc. Removable radioactivity was measured by wiping the area in question with cloth sampling smears and measuring the radioactivity removed from the surface.

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).

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).

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



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
(Green areas show survey boundaries.)

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

Facility	Application	Status
Bldg 003 (Engineering Test Bldg)	SRE support	Released (Ref 2-4)*
Bldg 005	Uranium carbide fuel pilot plant	Filter plenums, exhaust ducts, and drains contaminated with 1 mCi uranium*
Bldg 009	Criticality tests; inservice inspection (ISI)	Suitable for release (Ref 2-5), except for ISI*
Bldg 010	S8ER	Released (Refs 2-6 and 7)*
Bldg 012	Criticality test	10 µCi (Ref 2-43)*
Bldg 013	SNAP support	Suitable for release (Ref 2-8)
Bldg 019	SNAP critical testing	Suitable for release (Ref 2-8)
Bldg 020 (RIHL)	Remote handling of radioactive components	2.2 Ci of contamination inside cells, drain lines and ventilation system*
Bldg 023	Corrosion loop	<0.1 µCi in holding tank*
Bldg 024	SNAP ground tests	15 mCi activation in cell liners and concrete*
Bldg 025	SNAP support	Suitable for release (Ref 2-9)
Bldg 027	SNAP support	Suitable for release (Ref 2-9)
Bldg 028	STIR; UO_2 melting	Suitable for release (Refs 2-10 and 2-11) (above-grade structure removed)
Bldg 029	Calibration laboratory; alkali metal waste storage	Suitable for release (Refs 2-12 and 2-13)*
Bldg 030	Van de Graaf accelerator	Suitable for release (Ref 2-14)
Bldg 032	SNAP support	Suitable for release (Ref 2-9)
Bldg 042	Depleted uranium experiment	Suitable for release (Ref 2-9)
Bldg 049	Support for Bldg 005	Suitable for release (Ref 2-9)
Bldg 055 (NMDF)	Plutonium fuel manufacturing	Released (Ref 2-15)*
Bldg 056 landfill	Disposal site	Suitable for release (Ref 2-16)
Bldg 059	S8DR	<10 Ci activation*
Bldg 064	Fuel storage	Trace contamination inside facility, 10 µCi total*
Bldg 073	KEWB	Released (Ref 2-17)
Bldg 093	AE-6/L-85 reactor	Released (Ref 2-18)*
Bldg 100	Criticality test; radioactivity laboratory	Released (Ref 2-19); but final survey required*
Bldg 373	SNAP criticality test	Suitable for release (Ref 2-19)
Bldg 375	SNAP support	Suitable for release (Ref 2-19)
Former Sodium Disposal Facility	Removal of sodium and NaK from components	~1 µCi of contamination*
Bldg 143	SRE	Released (Refs 2-20 through 2-33)*
SRE storage	Disposal site for SRE	Suitable for release (Ref 2-34)
SRE-to-RMDF field	Holding area for SRE material and equipment	Suitable for release (Ref 2-34)
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 leach field	Former sanitary leach field	Released (Ref 2-35)

Table 2–2. Radiological Site Status
Sheet 2 of 2

Facility	Application	Status
Bldg 654	Interim Storage Facility	Released (building removed) (Ref 2-36)*
Old Conservation Yard	Storage area	Suitable for release (Refs 2-37 and 2-38)
Barrel Storage Yard	Storage area	Suitable for release (Refs 2-37 and 2-38)
New Conservation Yard and Surroundings	Storage area	Suitable for release (Ref 2-38)
513 Parking Lot and former building for processing contamination-protective clothing to laundry vendor	Access to SRE and processing protective clothing	Suitable for release (Ref 2-34)
KEWB-to-RMDF Field	None (open space between an active and formerly active facilities)	Suitable for release (Ref 2-34)
23rd Street-to-Bldg 100 Field	Storage area; trash disposal	Suitable for release (Ref 2-16)
Bldg 626 Storage Area	Storage area	Suitable for release (Ref 2-8)
Areas Northwest of Bldgs 012, 013, 019, and 059	SNAP support	Suitable for release (Ref 2-8)
*Further details provided in the following paragraphs.		

unrestricted use), or contains the contamination specified. References to reports supporting release or suitability for release are included in the status.

2.3.1 Specific Sites

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. Bldg 003

Bldg 003 was given a preliminary release in 1975 (Ref 2–4). 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 (Ref 2–4).

2. Bldg 005

This building is contaminated with about 1 mCi of uranium. A radiological survey was performed that shows that Rooms 110 and 113, and the radioactive material exhaust ducts and filter plenums, are contaminated with enriched uranium, at levels above prescribed release limits (Ref 2–39). The survey is described in Reference 2–40.

3. **Bldg 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 Bldg 009 was removed (Ref 2–41). 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 (Ref 2–42), 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 (Ref 2–5). There is some in service inspection (ISI) equipment stored in Bldg 009, which is contaminated at a very low level. This equipment is stored in locked containers.

4. **Bldg 010**

The site is released for unrestricted use based on the results of a radiological assessment conducted by Argonne National Laboratory (ANL) (Refs 2–6 and 2–7).

5. **Bldg 012**

The building contains about 10 μCi contamination (Ref 2–43). 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.

6. **Bldg 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 1994 (Ref 2–44).

7. **Bldg 023**

The building has less than 4 μCi contamination. The contaminated systems consist of a liquid holdup tank in a concrete pit located outside (east end) of the building (Ref 2–45).

8. **Bldg 024**

There is 15 mCi of confined activation radioactivity in the facility concrete (Refs 2–46 and 2–47). 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.

9. **Bldg 029**

Based on the results of a 1988 radiation survey (Ref 2–12) and a subsequent cleanup and survey (Ref 2–13), radiation and contamination levels in Bldg 029 do not exceed acceptable limits and the facility is suitable for release for unrestricted use.

10. Bldg 055

The building is released for unrestricted use. At the request of the NRC, Oak Ridge Associated Universities conducted a confirmatory radiological survey (Ref 2–15).

11. Bldg 059

Certain areas of the building contain ^{60}Co, ^{55}Fe, ^{63}Ni, and tritium. The total radioactivity is < 10 Ci. The decontamination and disposition is currently underway. The remaining radioactive areas are the reactor chamber pit, the pipe chase room, and the vacuum equipment room (Ref 2–48).

12. Bldg 064

This building is contaminated with 10 μCi. There is uranium contamination in the ventilation exhaust system and on some equipment inside the building. Radiological surveys of Bldg 064 are described in References 2–49 and 2–50.

13. Bldg 093

The building was released for unrestricted use by NRC. A survey was conducted (Ref 2–18) throughout the area to be released. The results of the survey show that Bldg 093 meets the criteria established by the U.S. NRC Regulatory Guide 1.86 and NRC Dismantling Order, Docket No. 50–375, dated February 22, 1983, for release of facilities for unrestricted use.

14. Bldg 100

The building was released for unrestricted use by NRC. Suitability for release was confirmed by an inspection by the NRC (Ref 2–41). Since the building has been used as a radiation calibration laboratory and as a radioactivity analytical laboratory subsequent to that release, a final survey will be required.

15. Former Sodium Disposal Facility

Radioactive contamination is still present at the former Sodium Disposal Facility. A 3–acre area surrounding the former basins at the Sodium Disposal Facility was characterized for radioactive contaminants. All direct measurements and soil sample analyses show the surrounding area to be free of radioactive contaminants. Previous measurements show that the basins are contaminated with radioactive material. The former Sodium Disposal Facility is currently under a cleanup order.

Radioactive contamination was detected in the two former basins in the past. From the chemical characterization performed for CERCLA Phase II in March 1987 (Ref 2–51), it has been estimated that 37,000 ft^3 of soil and debris need to be excavated from the basins and disposed of appropriately. The survey and sample reports are in References 2–52 through 2–59 and 2–60.

16. 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. An environmental evaluation study was prepared to assure further that the area was safe for any future use.

17. 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 decommissioned and decontaminated.

18. Bldg 654

The Interim Storage Facility (Bldg 654) has been removed and the area is suitable for release for unrestricted use. The site was restored to its natural state after the decommissioning was complete, with the excavation backfilled and the surface graded to match the contours of the surrounding land (Refs 2–14, 2–36, and 2–43).

2.4 CONSTRUCTION AND DEMOLITION PLANS

No new facilities are currently planned for Area IV. When new facilities are constructed, the environmental monitoring plan will be modified as necessary to include them. A modification to SCTI is presently underway. This project consists of adding four tanks and piping to be used for waste water disposal. The tanks will be below grade in a concrete pit thus creating a secondary containment system.

2.5 REPORTING

Annual environmental monitoring reports have been issued by the radiation protection group since 1972 and are currently entitled "Rocketdyne Division Environmental Monitoring Annual Report." Before 1972, reports were issued on a semiannual schedule. These reports have been distributed to various regulatory agencies including the DOE, the NRC, the EPA, the Los Angeles County Health Dept, the California Regional Water Quality Control Board (RWQCB), the Ventura County Resource Management Agency, and the California State DHS.

Quarterly Air Emission Reports are prepared for the VCAPCD covering the SCTI heaters. An annual report to the VCAPCD covers all VCAPCD–permitted facilities at SSFL.

Quarterly reports entitled "Environmental Monitoring Report" are issued by the Environmental Protection Department as three volumes: Vol 1– Air Monitoring, Vol 2 – Surface Water, Hazardous Waste Management, Remediation, and Radiological; and Vol 3 – Ground Water

Treatment and Monitoring. Results of groundwater monitoring activities are included in these reports. The reports contain all hard–copy transmissions between the regulatory agencies and Rocketdyne. Quarterly performance indicator reports are submitted to DOE, which documents environmental releases. Annual reports of National Emission Standards for Hazardous Air Pollutants (NESHAPs) are prepared. Occurrence reports are prepared in accordance with DOE Order 5000.3A.

2.6 REFERENCES

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2–3. 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)

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2–5. N704SRR990032, "Final Decontamination and Radiological Survey of Portions of Building 009" (December 16, 1990)

2–6. ESG–DOE–13237, Rockwell International, Atomics International Division Energy Systems Group. "S8ER Facilities Decommissioning Final Report" (February 28, 1979)

2–7. "Surplus Facilities Management Program Past—Remedial—Action Survey Report for SNAP–8 Experimental Reactor Facility Building 010 Site, SSFL, Rockwell International, Ventura County, CA, November 1979, October and November 1981," Argonne National Laborabory

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2–11. N001TI000322, "Building 028 Decontamination and Demolition Final Report" (June 6, 1990)

2–12. GEN–ZR–0006, "Radiological Survey of the Old Calibration Facility – Building 029" (August 19, 1988)

2–13. N704SRR990029, "Final Decontamination and Radiological Survey of Building 029" (June 28, 1990)

2–14. GEN–ZR–0007, "Radiological Survey of Shipping/Receiving and Old Accelerator Area – Building 641 and 030" (August 19, 1988)

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2–16. GEN–ZR–00011, "Radiological Survey of the Area Across from 011, 056 Dumpsite Landfill, the Field from 23rd Street to 100" (August 26, 1988)

2–17. AI–ERDA–13159, "KEWB Facilities Decontamination and Disposition Final Report" (February 25, 1976)

2–18. N001SRR140087, "Radiation Survey for Release for Unrestricted Use – L–85 (093)" (March 6, 1986)

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2–21. N704TI990028, "Radiological Survey Results – Release to Unrestricted Use, SRE Region II (Building 163, Box Shop)" (May 4, 1978)

2–22. N704TI990029, "Radiological Survey Results – Release to Unrestricted Use, SRE Region III (SRE Entrance)" (May 13, 1978)

2–23. N704TI990030, "Radiological Survey Results – Release to Unrestricted Use, SRE Region IV (West Parking Lot)" (May 4, 1978)

2–24. N704TI990031, "Radiological Survey Results – Release to Unrestricted Use, SRE Region V (Gas Storage Vault)" (November 2, 1978)

2–25. N704TI990032, "Radiological Survey Results – Release to Unrestricted Use, SRE Region VI (Water Tank Area)" (November 10, 1978)

2–26. N704TI990033, "Radiological Survey Results – Release to Unrestricted Use, SRE Region VII (Retention Pond)" (May 13, 1983)

2–27. N704TI990034, "Radiological Survey Results – Release to Unrestricted Use, SRE Region VIII (SRE Front Lot)" (May 13, 1983)

2–28. N704TI990035, "Radiological Survey Results – Release to Unrestricted Use, SRE Region IX (SRE Back Lot)" (May 31, 1983)

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2–30. N704TI990037, "Radiological Survey Results – Release to Unrestricted Use, SRE Building 041" (November 9, 1982)

2–31. N704TI990038, "Radiological Survey Results – Release to Unrestricted Use, SRE Building 143" (May 31, 1983)

2–32. N704TI990039, "Radiological Survey Results – Release to Unrestricted Use, SRE Building 163" (April 8, 1982)

2–33. N704TI990057, "Final Radiological Inspection of the Below–Grade Areas in the SRE Prior to Release for Unrestricted Use" (August 26, 1981)

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2–35. ESG–DOE–13385, "RMDF Leach Field Decontamination Final Report" (September 15, 1982)

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2–52. Internal Letter, F.H. Badger to W.R. McCurnin, "Preliminary R/A Survey of Sodium Burn Pit" (October 6, 1978)

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2–57. Internal Letter, J.D. Moore to R.R. Garcia, "Soil Analysis Report" (October 6, 1983)

2–58. Internal Letter, J.D. Moore to R.R. Garcia, "Soil Analysis Report" (November 11, 1983)

2–59. Internal Letter, F.H. Badger to R.J. Tuttle, "Radiological Information on Old Sodium Disposal Area" (April 23, 1987)

2–60. GEN–ZR–0004, "Radiological Survey of the Sodium Disposal Facility – Building 886" (March 6, 1988)

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 suspected soil and/or groundwater contamination have been identified in Area IV. These areas are:

1. Near Radioactive Materials Disposal Facility (RDMF) Leach Field
2. Old Conservation Yard
3. New Conservation Yard
4. Former Sodium Disposal Facility
5. Southeast Drum Storage Area
6. ESADA Chemical Storage Yard
7. Bldg 100 Trench
8. Hazardous Waste Management Facility (HWMF)
9. Bldg 059 Area
10. Bldg 056 Landfill
11. Rockwell International Hot Laboratory (Bldg 020)
12. Bldg 005, Various Chemical Processes
13. Various Inactive Sanitary Leach Fields
14. Alkali Metal Waste Storage (Bldg 029).

The various operations that have been conducted or are still being conducted in Area IV can generally be categorized, in terms of contaminants, as either radiological or chemical. In some cases, both categories of potential contamination have been or are present in a single location.

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). Because of the remote nature of the SSFL site in general, and Area IV in particular, the credible potential pathways are:

1. Surface water runoff
2. Groundwater movement
3. Air transport
4. Direct radiation.

Although the soil in some parts of Area IV may be slightly contaminated, the ultimate public exposure pathways will probably not involve soil transport.

All surface water releases associated with Area IV operations come from either the R–2A pond or from the various runoff points on the northwest slope. During heavy storms, most of the rainfall–induced runoff collects in the R–2A pond, an NPDES discharge point located in the southern portion of SSFL. Five catchments are used to collect samples for the current monitoring of the smaller amount of surface water runoff along the northwest slope.

3.2.1 SSFL Water Systems/Surface Water Pathways

Figure 3–1 shows a flow diagram of the surface water system at SSFL–Area IV, including the sewage plant effluent. The NPDES discharge point specifically relevant to Area IV is, as previously mentioned, the R–2A pond. All surface water discharge from Area IV is funneled through it, and the overflow discharges into the Bell Creek. Some water from the pond may be pumped to the Reclaimed Water System, which services all of the SSFL site. The physical layout of the entire SSFL sanitary sewage system is shown in Figure 3–2, and that part directly related to Area IV is shown in Figure 3–3.

As with the sewage systems, the Area IV Storm Drainage System (Figure 3–4) has been designed to funnel surface water runoff into the R–2 ponds. In this case, the R–2B pond acts as an upstream buffer, both to increase the holding capacity of the R–2 retention system and to collect possible "partially" treated effluent from the Area III Sewage Treatment Plant during emergency situations. This plant services all the needs of Area IV.

3.2.2 Groundwater Pathways

The possible groundwater exposure pathways associated with Area IV are very complex. The hydrogeology of the entire SSFL site, including that of Area IV, is only partially understood (Ref 3–1). As more data become available, the possibility of modeling groundwater movement will play a critical role in trying to understand and/or identify the exposure pathways and ultimately the exposure risk to the public. The current groundwater flow directions, as inferred from water level elevations, are shown in Figure 3–5, which also shows the approximate location of the groundwater divide.

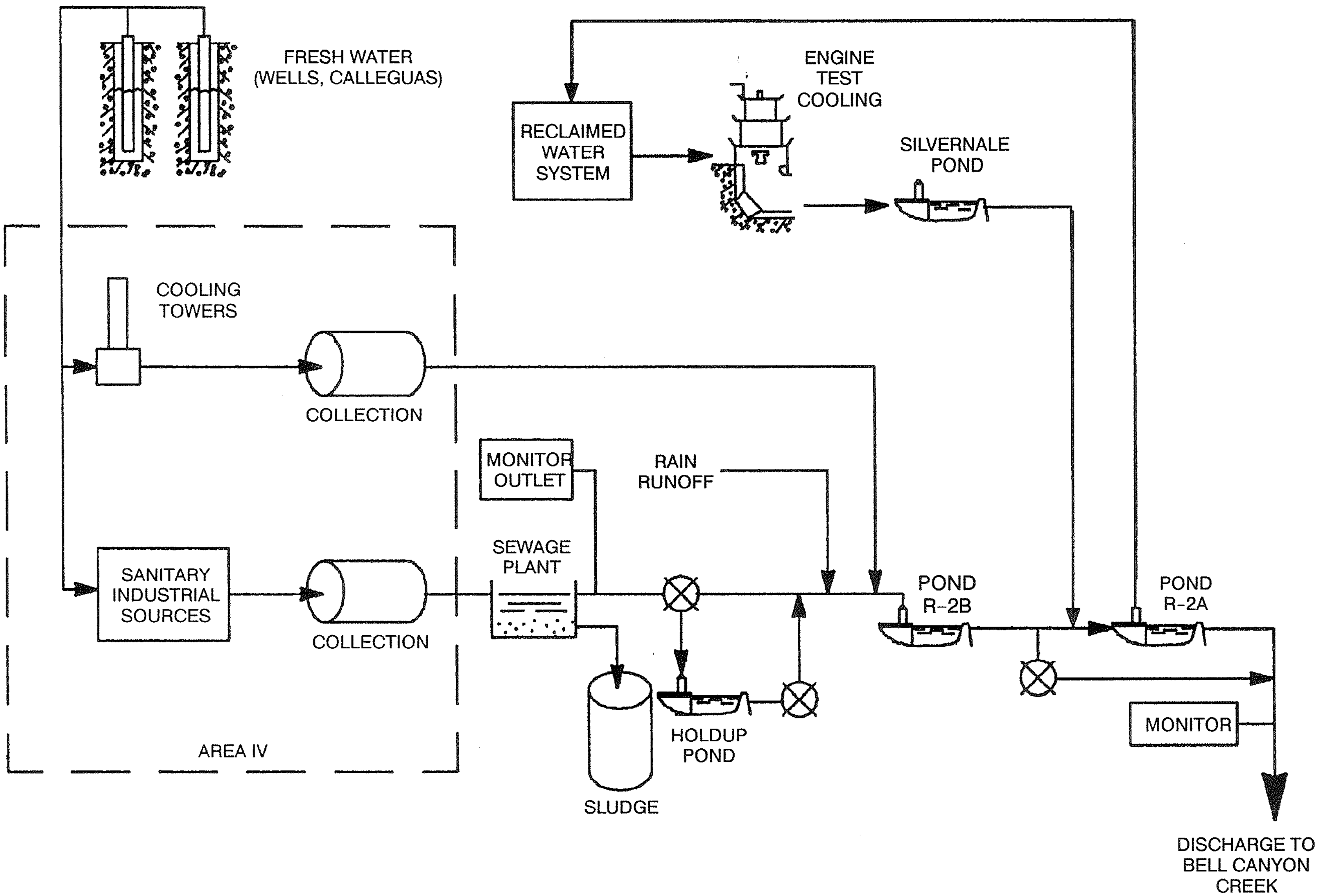

Figure 3-1. Area IV Surface Water System (Including Sewage Plant Effluent)

6586-1

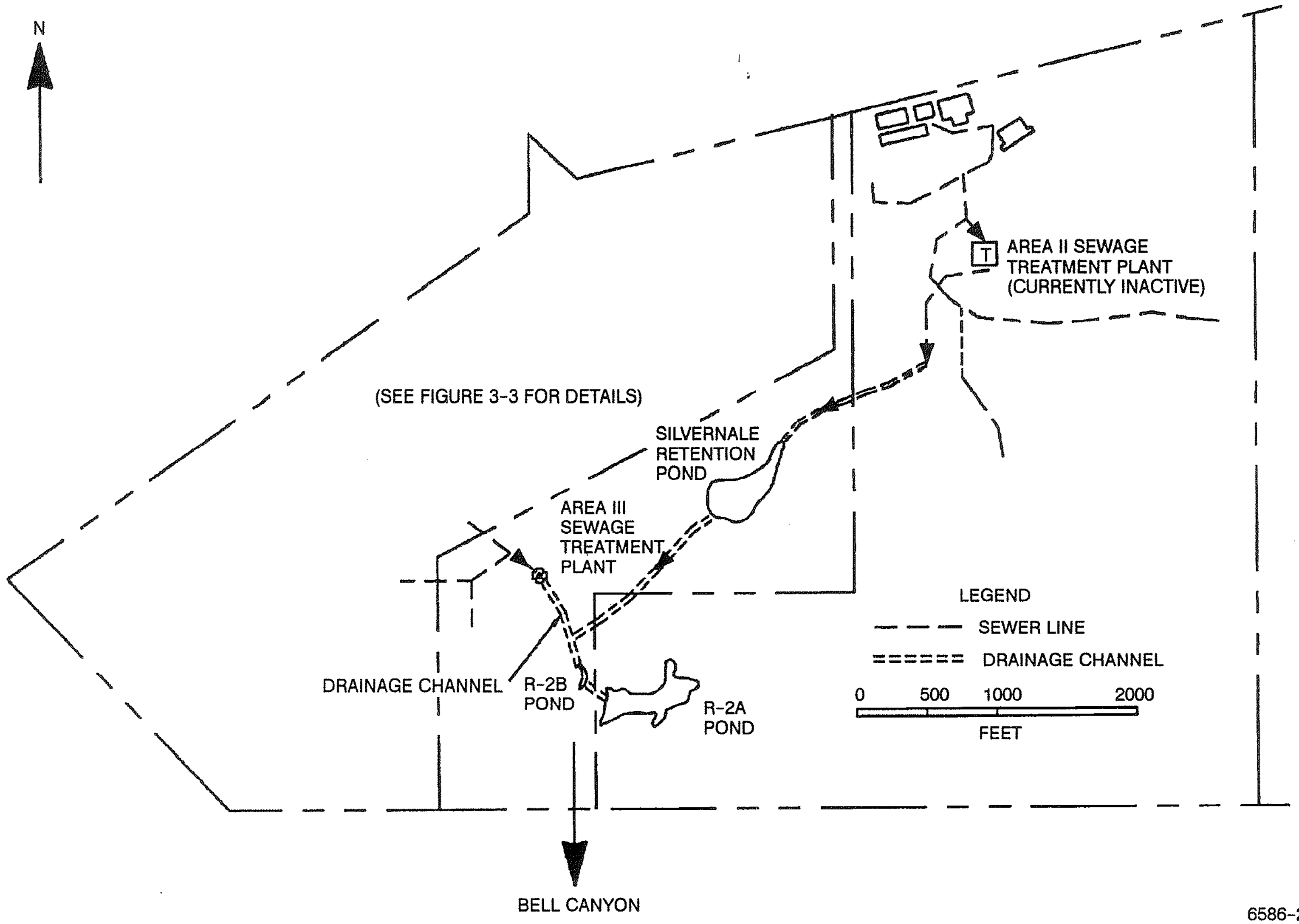

Figure 3–2. SSFL Sewage System Layout

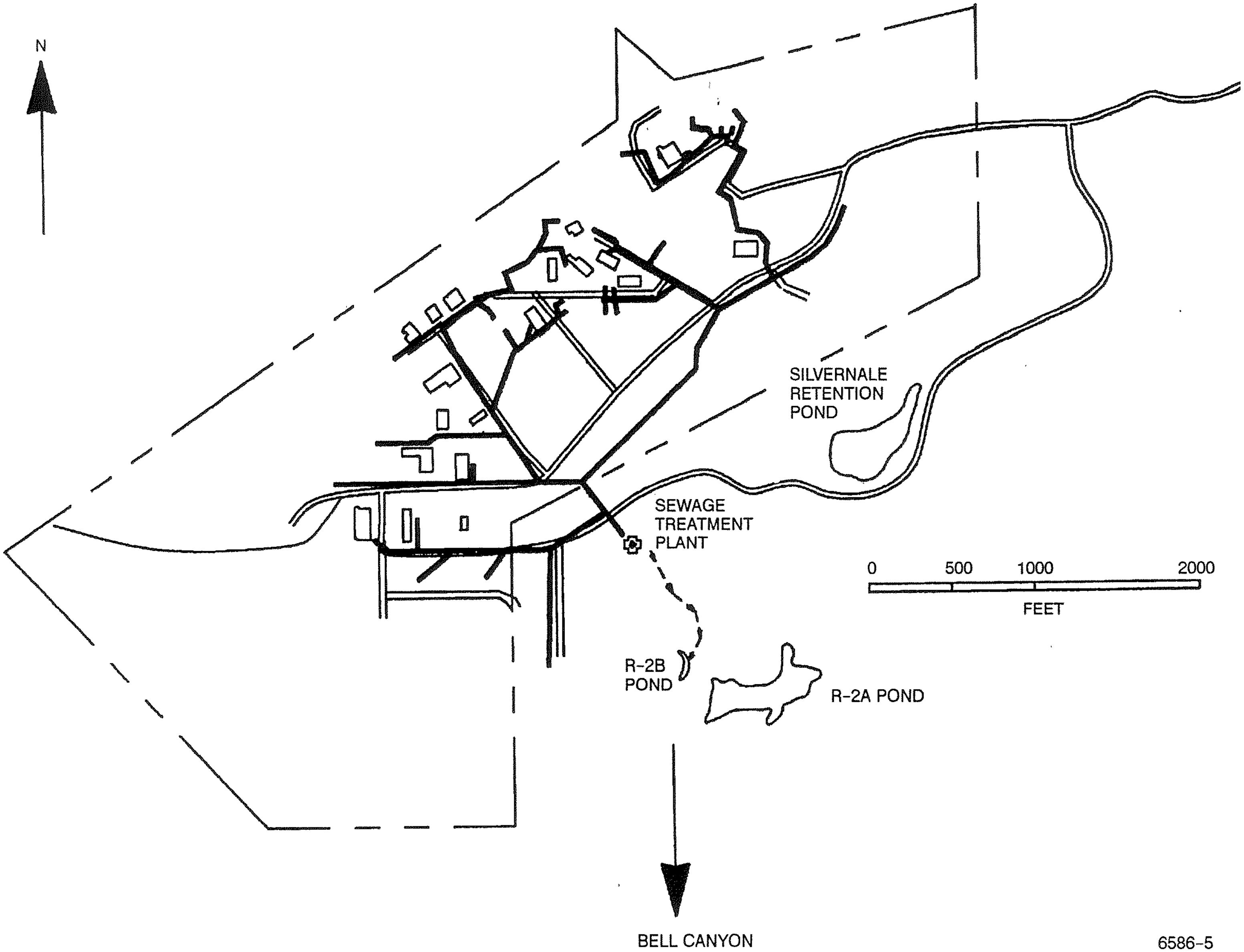

Figure 3-3. SSFL Area IV Sewage System Layout

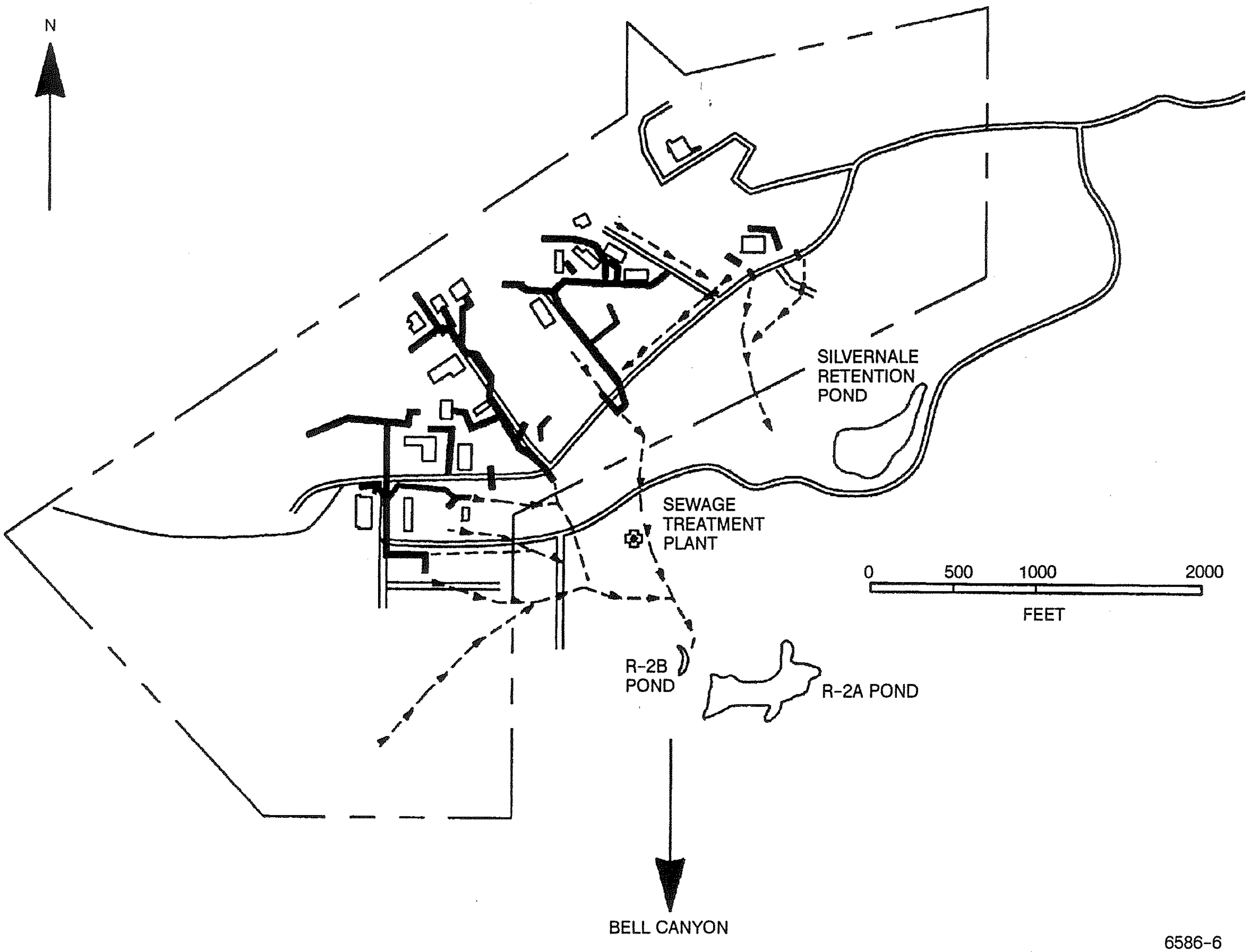

Figure 3–4. SSFL Area IV Storm Drainage Layout

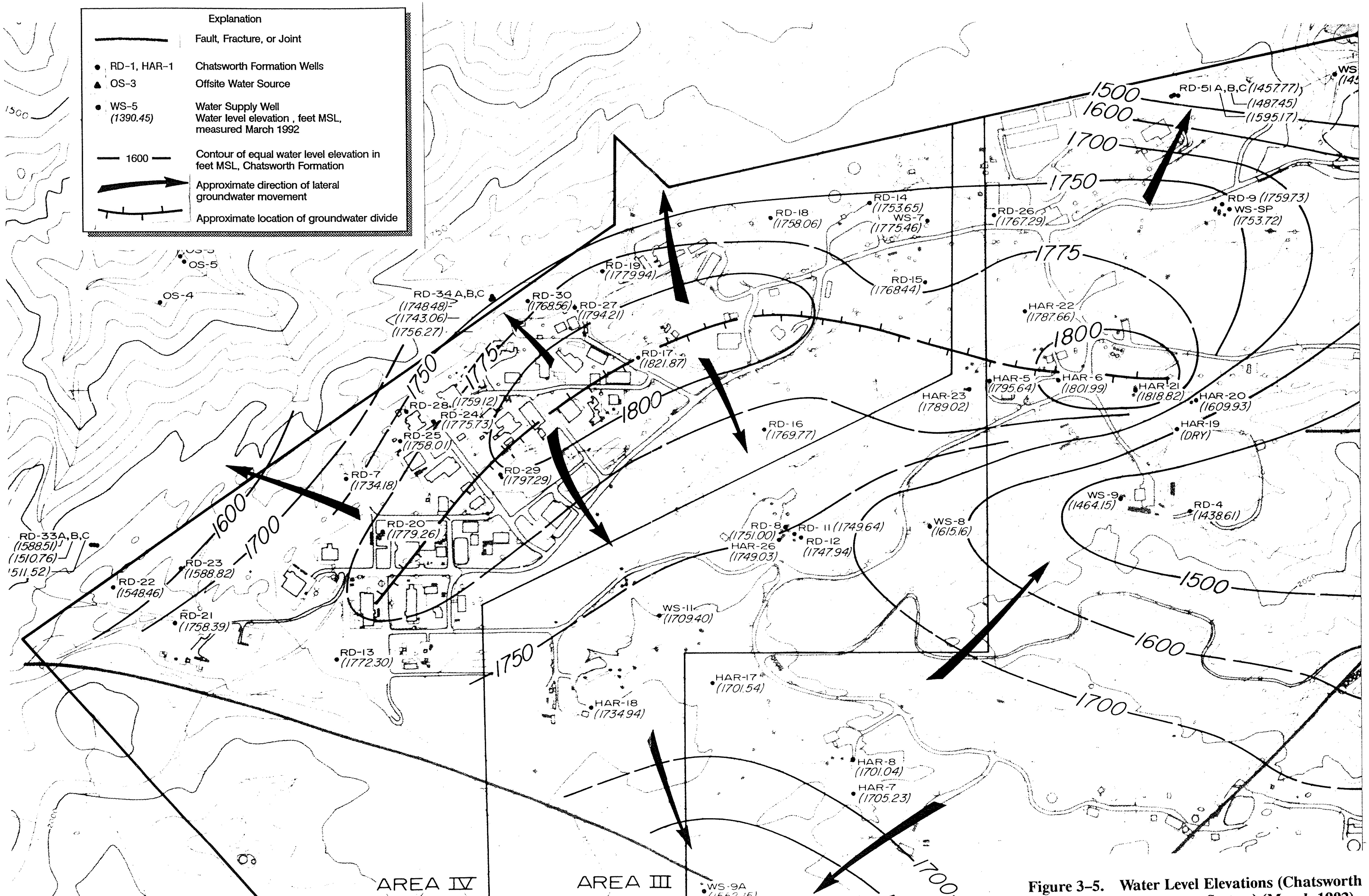

Figure 3–5. Water Level Elevations (Chatsworth Formation Groundwater System) (March 1992)

No specific modeling has been done for SSFL groundwater movement. However, appropriate codes are available from EPA's Center for Exposure Assessment Modeling, and a CAL/EPA–sponsored model is scheduled to be available in late 1992. Pertinent modeling will be considered as a part of the implementation of this plan.

3.2.3 Air Pathways

The major airborne chemical contaminant that could reach the public (albeit well below ambient air quality standards) is the NOx from the SCTI boiler emissions. The stacks at the RDMF, Bldg 020 and Bldg 059, provide radiological sources, again well below any conceivable ambient standard. Thus, the need for offsite monitoring of ambient air for either chemical or radiological contaminants does not exist. However, ambient air sampling stations are used in Area IV as an environmental surveillance tool for radiological particulates.

3.2.4 Direct Radiation Pathway

Some limited offsite direct radiation monitoring is currently being done at the site boundaries and in both the San Fernando and Simi Valleys. This has proven adequate to demonstrate that SSFL does not expose the public to radiation.

3.3 SUMMARY

The surface water discharge from Area IV occurs only from the runoff to the northwest slope and from the releases to Bell Creek from the R–2A pond. Groundwater from Area IV also appears to move either northwest or south. Data obtained to date suggests that neither the air pathway nor direct radiation has a potential to expose the public to Area IV effluents of any significance. This Environmental Monitoring Plan will, therefore, concentrate on effluent monitoring to ensure that the air pathways and surface water discharges remain under control, and environmental surveillance of groundwater pathways and direct radiation to assess potential for public exposure. Some soil surveillance with also be done, primarily to determine the potential contribution of contaminated soil to water pathways.

3.4 REFERENCES

3–1. Report 8640M–145, Groundwater Resources Consultants, Inc., Groundwater Quality Assessment Plan, Santa Susana Field Laboratory, Rockwell International Corporation, Rocketdyne Division, Ventura County, California (October 25, 1991)

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4.0 ENVIRONMENTAL MONITORING PLAN

4.1 ENVIRONMENTAL MONITORING AT SSFL, AREA IV, 1950–1990

4.1.1 Radiological Monitoring

Radiological monitoring began in 1954, when planning for construction of SRE was initiated, to measure any impact of future activities on local radioactivity — above the natural background or above the increment caused by weapons testing fallout. This program has been 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 DOE) since 1974. The State of California RHB has also been involved since 1969.

Radiological monitoring has been performed primarily by Radiation Protection and Health Physics Services (RP&HPS). In recent years radiological analysis has also been performed by contract laboratories for groundwater and surface water samples collected by the Environmental Protection Department and its contractors. The scope of the program is shown by Table 4–1, which lists the numbers of samples of each type collected annually for RP&HPS analysis. The majority of the analyses were for gross alpha and gross beta activities, while analyses in the last 3 years 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 area natural radioactivity. After termination of the weapons testing, soil radioactivity returned to a baseline level, which represents the natural background radioactivity of the area. The potential for release of radioactivity to the environment was greatly reduced in 1987 when all nuclear projects at the site were terminated. Routine soil sampling was, therefore, discontinued in 1989, although "special interest" soil sampling has continued at a reduced level.

As with soil sampling, vegetation was sampled from 1954 through the mid–1980's, at which time routine vegetation sampling was also discontinued. With the termination of nuclear activities and the lack of historical evidence that vegetation monitoring has been of value at SSFL, no further routine sampling is anticipated.No routine sampling of animal carcasses has ever been a part of the radiological monitoring program, although occasional results from road kills have been obtained. No evidence of radioactive contamination of animals has ever been found.

Onsite surface water samples were collected starting in 1959, and some offsite samples were taken starting in 1961 from the Chatsworth reservoir and from Bell Creek. Offsite sampling was discontinued in 1990, after which radiological analyses of surface water has been limited to two retention ponds discharging into Bell Creek and five catchments that collect storm water runoff on the northwest slope. (The Chatsworth reservoir has been dry since the early 1970s.)

Groundwater sampling for radiological analysis began in 1989 in conjunction with the sampling of various wells for chemical contamination. The only evidence of nonnatural radioactivity has

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

Year	Soil		Vegetation		Surface Water		Air*	Soil (Pu)		Groundwater
	Onsite	Offsite	Onsite	Offsite	Onsite	Offsite		Onsite	Offsite	
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 offsite air samples have been taken.

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been some tritium at levels well below drinking water standards. Neither groundwater nor surface water samples show levels of radioactivity significantly different from the local water supply.

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 of which is operated on a 24-hour sampling cycle. Direct radiation has also been monitored at various locations, both onsite and offsite, since the early 1960s. The maximum number of dosimeters in service was 14 onsite and 5 offsite. That was reduced to 10 onsite and 2 offsite starting in 1991.

4.1.2 Chemical Monitoring

The major early thrust of the Area IV environmental monitoring program was radiological. However, chemical monitoring of surface water has been a part of the program since 1976 in compliance with an NPDES permit for discharge of water from the R–2A pond. That permit was reissued with modifications in 1984, and a new version will probably be in force by late 1992. The 1992 reissue will include monitoring the northwest slope rainfall runoff as part of the NPDES requirements. No major contamination of SSFL surface water has been found.

Groundwater monitoring began at SSFL in 1984 using existing water supply wells. When significant amounts of organic solvents were found in water supply wells near rocket engine test stands, a major groundwater monitoring program was initiated. The groundwater monitoring network for SSFL now includes 160 wells with 14 more proposed for construction in 1992 and 1993. There are 28 onsite monitoring wells in Area IV, and 7 offsite wells serve to monitor the groundwater movement and quality as it leaves the site boundary near Area IV. The proposed new wells include 4 onsite within Area IV and 4 offsite to the northwest of Area IV. Table 4–2 provides a historical summary of the organic compounds that have been detected in the Area IV wells and the offsite wells near Area IV. Note that trichloroethylene (TCE) is the major organic contaminant.

Air monitoring for Area IV has included a program to determine particulates of less than 10 micrometer in diameter (PM10), and compliance with the atmospheric pollution discharge limitation imposed by the Ventura County Air Pollution Control District (VCAPCD) on large natural gas– or oil–fired space heaters or process heaters used for component testing. The PM10 program was terminated in early 1992, and the primary ongoing air effluent monitoring program is for the H–1 and H–2 heaters that provide heat for the SCTI operation.

4.2 EFFLUENT MONITORING

Effluent monitoring is required, as per DOE Order 5400.1, for any treated or untreated air emission or liquid discharge at a DOE site or from a DOE facility. Since surface water monitoring at Area IV is mandated by an NPDES permit, the liquid discharge from the R–2A pond will be discussed as part of the effluent monitoring plan, along with the northwest slope rainfall runoff (which will soon be part of that same permit). The additional elements of the effluent monitoring plan are air monitoring for several facilities in Area IV (both radiological and chemical), and the standard sewage plant effluent monitoring for the plant which services Area IV.

Table 4–2. Summary of Organic Compounds Detected in Area IV Wells (Sheet 1 of 3)

Site Description	Well Identification	Organic Compound	Concentration Range (μ g/l)	Max. Acceptable Level (μ g/l)*
Former Sodium Disposal Facility	RS-18[(1)]	Chloroform 1,1 - Dichloroethane 1,1 - Dichloroethylene Cis - 1,2 Dichloroethylene Trans 1,2 - Dichloroethylene 1,1,1 - Trichloroethane Trichloroethylene Toluene	<1-7 <1-24 <1-33 2[(2)] <1-10 <1-20 19-660 21[(2)]	(Total trihalomethane - 100) 5.0 6.0 6.0 10 200 5.0 100
Former Sodium Disposal Facility	RD-21	Chloroform Carbon Tetrachloride 1,1,1 - Trichloroethane Trichloroethylene Petroleum Hydrocarbons	6-30 4-13 18[(2)] 450-1900 150-600[(4)]	(Total trihalomethane-100) 0.5 200 5.0 NS
Former Sodium Disposal Facility	RD-22	Toluene Petroleum Hydrocarbon	<1-7 50-60[(4)]	100 NS
B-056 Land-fill	RD-23	Benzene 1,1 - Dichloroethane 1,2 - Dichloroethane Cis - 1,2 - Dichloroethane Trichloroethylene Toluene Petroleum Hydrocarbons	<1-2 <1-2 <1-5 2-13 38-200 2[(2)] 70-200[(4)]	1.0 5.0 0.5 6.0 5.0 100 NS
B-056 Land-fill	RD-7[(1)]	Trichloroethylene Toluene Trans - 1,2 - Dichloroethylene Trichlorofluoromethane[(4)]	16-130 <1-13 <0.4-3 13[(4)]	5.0 100 10 150
B-059	RD-24	ND	NA	NA
B-059	RD-25	Trichloroethylene	<1-11	5.0
B-059	RD-28	Tetrachloroethylene Trichloroethylene	0.4-1.5 0.3[(2)]	5.0 5.0
N.W. of ECL	RS-11	1,1,1 - Trichloroethane	0.44[(2)]	200
Burro Flats, West of STL-IV	RD-13	ND	NA	NA
S.E. of B-133	RD-17	Trichloroethylene Toluene	0.79-1.7 8[(2)]	5.0 100
N.E. of B-133	RD-18	Toluene	4[(2)]	100
Along G Street	ES-31	ND	NA	NA
S.W. of B-059	RS-16	Toluene	1[(2)]	100
South of B-886	RS-23	(5)	NA	NA
N.W. of ECL	RS-24	(5)	NA	NA
Near B-133	RS-25	(5)	NA	NA
Burro Flats	RS-27	(5)	NA	NA

Table 4–2. Summary of Organic Compounds Detected in Area IV Wells (Sheet 2 of 3)

Site Description	Well Identification	Organic Compound	Concentration Range (μ g/l)	Max. Acceptable Level (μ g/l)*
Offsite west of Area IV boundary near RMDF	RD-33A(6) (100 ft)	1,1 - Dichloroethylene Trichloroethylene Toluene	2(2) <1-8 2(2)	6.0 5.0 100
	RD-33B(6) (359 ft)	Trichloroethylene	0.76(2)	5.0
	RD-33C(6) (481 ft)	ND	NA	NA
Offsite west of Area IV boundary near former Sodium Disposal Facility	RD-34A(6) (16 ft)	1,1 - Dichloroethane 1,1 - Dichloroethylene Cis - 1,2 - Dichloroethylene Trichloroethylene	<1-2 1-5 5-9 19-31	5.0 6.0 6.0 5.0
	RD-34B(6) (179 ft)	Trichloroethylene	2-5	5.0
	RD-34C(6) (378 ft)	ND	NA	NA
RMDF Leach field	RS-28	1,1 - Dichloroethane 1,1 - Dichloroethylene Cis - 1,2 - Dichloroethylene Trans - 1,2 - Dichloroethylene Trichloroethylene Acetone Tetrahydrofuran Trichlorotrifluoroethane Freon 113	<0.20 6.8 19 - 48 <1-40(4) 57-85 210 10(3) 6-10(3) 6(2)	5.0 6.0 6.0 10 5.0 NS NS NS
RMDF Leach field	RD-27	Toluene	3-7	100
RMDF Leach field	RD-30	1,1 - Dichloroethane 1,1 - Dichloroethylene Cis - 1,2 - Dichloroethylene Trans - 1,2 - Dichloroethylene Ethylbenzene Trichloroethylene Freon 113	<0.4-3 <0.4-6 6.4-19 <1-23 0.2-2.2 15-50 5(3)	5.0 6.0 6.0 10 680 5.0 NS
Old Conservation Yard	RD-14	Trichloroethylene Branched Alkene Petroleum Hydrocarbons	2.4-13 8(3) 50(4)	5.0 NS NS
Old Conservation Yard	WS-7	Cis - 1,2 - Dichloroethylene Trichloroethylene	0.24-0.35 0.43-1.7	6.0 5.0
New Conservation Yard	RD-15	Trichloroethylene	0.29-0.53	5.0
B-133 Sodium Treatment Facility	RD-19	ND	NA	NA
S.E. Drum Storage Area	RD-16	Trichloroethylene	<0.2-3	5.0
B-100 Trench	RD-20	Trichloroethylene Petroleum Hydrocarbons	0.21(2) 70-80(4)	5.0 NS
Burro Flats, S.E. of B-059	RD-29	Trans-1,2 - Dichloroethylene Trichloroethylene	3.3(2) 1-3.1	1.0 5.0

Table 4–2. Summary of Organic Compounds Detected in Area IV Wells (Sheet 3 of 3)

Site Description	Well Identification	Organic Compound	Concentration Range (μ g/l)	Max. Acceptable Level (μ g/l)*
North of Site	OS-1	Trichlorotrifluoroethane Ethyl Acetate	1.0(4) 10(3)	NS NS
N.W. of Site	OS-2	Chloroform 1,2 - Dichloroethane	10(2) 0.39(2)	NS NS
N.W. of Site	OS-3	ND	NA	NA
N.W. of Site	OS-4	ND	NA	NA
N.W. of Site	OS-5	Chloromethane	19(2)	NS
S.W. of Site	OS-21	ND	NA	NA

Notes:

(1)1991 reports for this well show only trichloroethylene (18–35 µg/l)
(2)This compound detected in only one of several analyses.
(3)Semiquantified (nonpriority compound)
(4)Nonpriority compound
(5)Well has been dry
(6)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 4-6

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

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4.2.1 Surface Water Effluents

As indicated in Section 3.2, the only potential surface water offsite exposure pathways associated with Area IV operations are the periodic discharges from the R–2A pond and the rainfall–induced runoff along the northwest slope, which is sampled as necessary at five catchments placed in strategic locations (Figure 4–2).

4.2.1.1 Current Monitoring Program

The current surface water monitoring of the R–2A pond discharge is governed by NPDES Permit No. CA0001309, which mandates sampling and analysis whenever discharges are made into the Bell Creek. Table 4–3 gives the current discharge analyses parameters; Table 4–4 shows the results from the 1991 radiological analyses of pond grab samples and Table 4–5 shows the results of the 1991 chemical analyses of samples taken during R–2A pond discharge.

Influent to the pond includes tertiary–treated sewage, cooling water from various testing operations, and storm water runoff. During periods of discharge from the pond, grab–type samples are collected for analysis by a California certified testing lab. Analytes include nonradioactive chemical constituents such as heavy metals, volatile organics, base/neutral acid extractables, and general

Table 4-3. R-2A Pond Discharge Analyses Parameters

Analyte	Maximum Level[a]	Method/Source
pH	6.0-9.0[b]	423, Standard Method 16[d]
Temperature	100/F[b]	212, Standard Method 16[d]
Turbidity	5.0 NTU[b]	214, Standard Method 16[d]
BOD	30[c]	507, Standard Method 16[d]
Residual chlorine	0.1[c]	408C, Standard Method 16[d]
Arsenic	0.05[c]	403, Standard Method 16[d]
Radiological		
Gross alpha	15 pCi/liter	900, EPA[e]
Gross beta	50 pCi/liter	900, EPA[e]
Gross gamma	Not stated	901.1, EPA[e]
Tritium	20,000 pCi/liter	906, EPA[e]
Surfactants	0.05[c]	512B, Standard Method 16[d]
Settleable solids	0.3[c]	209E, Standard Method 16[d]
Suspended solids	Not stated	209C, Standard Method 16[d]
Total dissolved solids	950[c]	209B, Standard Method 16[d]
Chloride	150[c]	325.3, EPA[e]
Fluoride	1.0[c]	413B, Standard Method 16[d]
Oil and grease	15[c]	503, Standard Method 16[d]
Sulfate	300[c]	374.5, EPA[e]
Boron	0.2[c]	404A, Standard Method 16[d]
Fish Bioassay (Toxicity)	90% survival	810, Standard Method 16[d]
VOCs	Varies	8240, SW-846[f]

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[a]California Code of Regulations (Title 22) Drinking Water
[b]Units
[c]mg/liter
[d]Reference 4-1
[e]Reference 4-2
[f]Reference 4-3

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

	Activity (pCi/L)						
	H-3	Co-60	Cs-137	Ra-226	U-235	Gross Alpha	Gross Beta
Drinking Water Standards/MPC	20,000	30,000*	20,000*	5	30,000*	15	50
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**	1(7)	1(7)	1(7)	0(8)	2(6)	3(14)	10(7)

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*MPC for release to unrestricted area.
**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.

Table 4–5. 1991 Chemical Data for Surface Water Releases

Constituent	Limit	Pond R–2A Number of Samples	Minimum	Mean	Maximum
BOD	30	14	2	5	8.5
Boron	1	14	<0.2	0.2	0.4
Chloride	150	14	10.2	43.5	82.4
Fluoride	1	14	0.2	0.3	0.5
Grease and Oil	15	14	<0.2	1.4	3.4
Arsenic	0.05	14	<0.001	0.002	0.004
pH	6 to 9	14	7.4	8.2	8.8
Residual chlorine	0.1	14	<0.04	<0.04	<0.04
Settleable solids	0.3	14	<0.04	0.3	1.0
Sulfate	300	14	36.4	110.9	175
Suspended solids	150	14	3.2	29	59
Surfactants	0.5	14	<0.025	0.028	0.03
Temperature (°C)	37.8	14	9	14.9	25
Total dissolved solids	950	14	115	380.8	631
Toxicity*	90%	14	90%	98.5%	100%
Turbidity	***	14	5	25.8	90

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chemistry in addition to specified radionuclides. Toxicity testing is also conducted in the form of fish bioassays.

In November 1989, a storm water runoff program was developed and implemented in Area IV for runoff from the northwest portion of the site. Five monitoring locations were selected which include two near the former Sodium Disposal Facility, one behind Bldg 100, one along the north side of RMDF, and one at the SRE watershed. This monitoring program remains in effect, and the results of runoff monitoring for 1991 rain events are shown in Tables 4–6 and 4–7. As indicated earlier, this program will be covered under NPDES Permit No. CA0001309 when it is reissued in late 1992.

4.2.1.2 Surface Water Effluent Monitoring Plan

The only changes to the current surface water monitoring program that will be required are those associated with the reissued NPDES permit. It will govern both the R–2A pond discharges and the northwest slope runoff monitoring. This Environmental Monitoring Plan will comply with the reissued permit, and in so doing, will meet all known DOE monitoring requirements.

4.2.2 Air Emissions

Although both surface water discharges and sewage plant effluent are monitored for radioactivity, the primary potential release of effluent radioactivity to uncontrolled areas (i.e., the primary exposure pathway) is by way of discharge to the atmosphere. Three facilities in Area IV require venti-

Table 4–6. 1991 Chemical Data for Northwest Rainfall Runoffs (Sheet 1 of 2)

Analyses in (mg/l)

Constituent	SBP 2				SBP 2			
	Number of Samples	Minimum	Mean	Maximum	Number of Samples	Minimum	Mean	Maximum
Arsenic	7	< 0.01	0.001	0.003	7	< 0.01	0.0005	0.002
Boron	7	ND	0.14	0.3	7	ND	0.14	0.3
Chloride	7	6.0	11.8	17.6	7	ND	18.5	77.9
Dissolved beryllium	7	ND	0.003	0.02	7	ND	0.004	0.022
Dissolved cadmium	7	ND	0.0006	0.001	7	ND	0.008	0.005
Dissolved chromium	7	ND	0.004	0.03	7	ND	0.004	0.03
Dissolved copper	7	ND	0.052	0.12	7	ND	0.03	0.08
Dissolved lead	7	ND	0.002	0.004	7	ND	0.002	0.004
Dissolved mercury	5	ND	0.0007	0.004	7	ND	0.00008	0.0004
Dissolved nickel	7	ND	0.06	0.23	7	ND	0.056	0.2
Dissolved zinc	7	0.017	0.06	0.08	7	ND	0.05	0.1
Fluoride	7	0.2	0.44	1.1	7	ND	0.2	0.3
Oil and grease	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	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* 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	B/100				RMDF			
	Number of Samples	Minimum	Mean	Maximum	Number of Samples	Minimum	Mean	Maximum
Arsenic	7	ND	0.0025	0.003	7	ND	0.0007	0.002
Boron	7	ND	0.043	0.2	7	ND	0.14	0.3
Chloride	7	1.0	3.3	4.8	7	1.0	17.5	73.8
Dissolved beryllium	7	ND	0.0032	0.015	7	ND	0.003	0.016
Dissolved cadmium	7	ND	0.0012	0.008	7	ND	0.0014	0.002
Dissolved chromium	7	ND	0.0086	0.03	7	ND	0.0085	0.04
Dissolved copper	7	ND	0.04	0.07	7	ND	0.04	0.007
Dissolved lead	7	ND	0.002	0.005	7	ND	0.0017	0.007
Dissolved mercury	5	ND	0.0001	0.0004	5	ND	0.00006	0.0003
Dissolved nickel	7	ND	0.06	0.11	7	ND	0.06	0.24
Dissolved zinc	7	0.008	0.06	0.14	7	ND	0.052	0.09
Fluoride	7	0.1	0.13	0.2	7	ND	0.17	0.2
Oil and grease	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	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* 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%

*Volatile Organic Analysis showed nondetectable, except in three incidents of possible laboratory contamination.

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Table 4–6. 1991 Chemical Data for Northwest Rainfall Runoffs (Sheet 2 of 2)

Constituent	Number of Samples	Minimum	Mean	Maximum
Analyses in (mg/l)				
Arsenic	7	0.001	0.002	0.003
Boron	7	ND	0.2	0.1
Chloride	7	1.0	5.81	11.9
Dissolved beryllium	7	0.0003	0.003	0.011
Dissolved cadmium	7	0.0002	0.003	0.0059
Dissolved chromium	7	0.18	0.18	0.18
Dissolved copper	7	0.009	0.0392	0.057
Dissolved lead	7	0.001	0.00325	0.005
Dissolved mercury	5	0.0002	0.0002	0.000
Dissolved nickel	7	0.023	0.35	0.11
Dissolved zinc	7	0.039	0.0751	0.12
Fluoride	7	0.1	0.15	0.3
Oil & Grease	7	1.1	1.925	3.8
pH	7	6.9	7.5	7.8
Residual chlorine	7	ND	ND	ND
Sulfate	7	7.3	18.91	26.9
Surfactants	7	0.026	0.120	0.164
VOLATILE* ORGANICS (TOTAL)	6	ND	ND	ND
BNAs (total)	6	ND	ND	ND
Toxicity	7	> 100%	> 100%	> 100%

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*Volatile Organic Analysis showed nondetectable, except in three incidents of possible laboratory contamination.

Table 4–7. Area IV Rainfall Runoff Radioactivity Data—1991 (Five Locations, Sampled After Rainfall)

	Activity (pCi/L)			
	H-3	Gamma Spectroscopy	Gross Alpha	Gross Beta
Drinking Water Standards	20,000		15	50
Maximum	-		5.00	18.0
Mean*	511	NDA	3.60	8.23
Minimum	-		3.00	4.00
Number of analyses**	1(19)		5(20)	13(12)

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

lation exhaust monitoring because of potential radioactive emissions (RMDF, Bldg 059, and RIHL-Bldg 020). In addition, the exhaust gases from the H-1 and H-2 gas-fired heaters that serve the SCTI must be monitored to comply with chemical pollutant discharge limitations.

4.2.2.1 Current Monitoring Program

The ventilation exhaust from each of the three potential radioactive release sites is both controlled and monitored. The level of radioactivity is first reduced to the lowest practical value by passing the effluents through certified HEPA filters. The effluents 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 the release of particulate activity from the RIHL or the RMDF. The high-efficiency particulate air (HEPA) filters used for filtering atmospheric effluents are at least 99.97% efficient for particles 0.3 μm in diameter.

The average concentration and total radioactivity in atmospheric effluents to uncontrolled areas are shown in Table 4-8 through 4-10. The totals show that no significant quantities of radioactivity were released in 1991.

Emissions from the H-1 and H-2 heaters at SCTI are monitored using a continuous emission monitoring (CEM) system. 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 are 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 min. A new average is obtained every 15 min on each heater, except during periods of CEM calibration. This monitoring technique is in compliance with VCAPCD Permit 0271, which covers these and other large gas-fired heaters at Area IV.

In September 1991, Rocketdyne petitioned for and received VCAPCD variance No. 392 from rule 74.15.H.1 pertaining to boilers and steam generators. This variance was required to allow ETEC to operate during start-up and checkout of the newly installed low NOx burners on the H-1 and H-2 heaters. Problems encountered during checkout of the system necessitated a request, on 15 January 1992 for an extension of the variance, which was granted until 31 December 1992. The H-1 heater was in full compliance at the load levels 25, 50, 75, and 100% as of the H-1 source test in June 1992.

4.2.2.2 Air Emissions Monitoring Plan

As with the surface water program, the current monitoring program for air effluents is adequate to meet all existing permits and regulations. This Environmental Monitoring Plan proposes simply to continue the current program as is. Obviously, the necessity for radiological effluent monitoring of the current facilities will be eliminated when these facilities are decommissioned and/or cleaned up sufficient for release to unrestricted use.

Table 4-8. 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(1) Detected (pCi)	Annual(2) Release (µCi)	Analysis(3) LLD (pCi)	Release(4) LLD (µCi)	Average Exhaust Concentration (µCi/mL)	DCG(5) (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.

(1)Measured activity of exhaust sampling filters, yearly total.
(2)Measured activity adjusted for fraction sampled.
(3)Lowest identifiable activity at 95% confidence.
(4)Analysis LLD's adjusted for fraction sampled (result corresponds to annual release).
(5)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).

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Table 4-9. Atmospheric Effluents to Uncontrolled Areas – RIHL

SSFL/RIHL - 1991	
Effluent volume (m^3)	468 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)	33,050
Annual average concentration in effluent	
Gross alpha (μCi/mL)	1.54 x 10^{-15}
Gross beta (μCi/mL)	1.80 x 10^{-14}
Maximum observed concentration	
Gross alpha (μCi/mL)	5.71 x 10^{-15}
Gross beta (μCi/mL)	2.25 x 10^{-13}
Activity released (μCi)	
Gross alpha	0.70
Gross beta	8.22

Radionuclide-Specific Data

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

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

(1)Measured activity of exhaust sampling filters, yearly total.

(2)Measured activity adjusted for fraction sampled.

(3)Lowest identifiable activity at 95% confidence.

(4)Analysis LLD's adjusted for fraction sampled (result corresponds to annual release).

(5)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.

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Table 4-10. Atmospheric Effluents to Uncontrolled Areas - Bldg 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[1] Detected (pCi)	Annual[2] Release (μCi)	Analysis[3] LLD (pCi)	Release[4] LLD (μCi)	Average Exhaust Concentration (μCi/mL)	DCG[5] (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.

(1)Measured activity of exhaust sampling filters, yearly total.
(2)Measured activity adjusted for fraction sampled.
(3)Lowest identifiable activity at 95% confidence.
(4)Analysis LLD's adjusted for fraction sampled (result corresponds to annual release).
(5)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).

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4.2.3 Sewage Effluents

The sewage treatment plant, which services Area IV, is located in Area III. Its liquid effluent is discharged, after monitoring, to the R2–A pond. Sludge is periodically removed by a licensed contractor, transported offsite, and transferred to the Los Angeles sewage system.

4.2.3.1 Current Monitoring Program

The liquid effluent from the Area III Sewage Treatment Plant is monitored continuously for radioactivity. The monitoring system is equipped with an alarm and an automatic diverter valve, which sends the effluent to a separate holding pond if radioactive contamination is found.

Chemical monitoring of the effluent is primarily for process control. Samples of the liquid effluent are taken once per day and analyzed for chlorine, coliform, biological oxygen demand, and chemical oxygen demand. The turbidity of the effluent is monitored continuously.

No analyses are currently performed on the sludge prior to pickup by the contractor.

4.2.3.2 Sewage Effluent Monitoring Plan

No change in the current program for monitoring the liquid sewage plant effluent is necessary, particularly since that effluent discharges to the R–2A pond, which is itself monitored before discharging to Bell Creek. Continuous radioactivity monitoring is a wise precaution, which will be continued.

However, some monitoring of the sludge is necessary. Therefore, a quarterly sludge sampling program will be developed to draw a representative sample of the sludge at the Sewage Treatment Plant before disposal. The sample will be analyzed for hazardous waste characteristics as defined by 40 CFR 261 using the most appropriate analytical method. In addition, the sample will be analyzed for gross alpha radioactivity, gross beta radioactivity, gamma–emitting isotopes, and tritium contamination.

4.3 ENVIRONMENTAL SURVEILLANCE

Environmental surveillance is defined as the periodic verification that no unexpected or undetected releases occur to the environment. For Area IV, the most important media in the surveillance plan are soil, groundwater, ambient air, and direct radiation. As noted in Section 4.1, routine sampling and analysis of vegetation was dropped from the environmental monitoring program at the end of 1985 in recognition of the lack of value for surveillance of the site; therefore, no vegetation sampling will be proposed as part of this plan.

4.3.1 Soil Surveillance

Soil samples have been analyzed for radioactive contamination since 1954, both onsite and offsite. Some "special interest" samples have also been analyzed for chemical contamination, including both organic and inorganic compounds.

4.3.1.1 Current Soil Program

Routine offsite soil sampling was discontinued in 1988, and routine onsite soil sampling was discontinued in 1989. However, soil samples are still taken during cleanup operations and for surveillance of suspected contaminated areas. The isotopic analyses for 1991 are shown in Table 4–11. No noteworthy differences exist in comparison to past years.

4.3.1.2 Soil Surveillance Plan

An extensive soil characterization program will be conducted as part of a RCRA Field Investigation (RFI), the work plan for which is currently in preparation. The results from that investigation will determine, to a large extent, the scope of any ongoing soil surveillance activities. Based on current information about potential soil contamination areas, the soil surveillance program will include the sample locations listed in Table 4–12. During the first year of soil surveillance implementation, sampling and analysis will be coordinated with RFI activities to minimize duplication. The SV designations in Table 4–12 correspond to the numbering system used in previous soil sampling, thus allowing comparison with results from years past. The locations of these proposed soil surveillance samples are shown on Figure 4–1 along with other historical soil sampling sites (the plan locations are filled in). The location map also shows two unnumbered soil sampling sites: (1) the Bldg 886 Area (former Sodium Burn Pit) is currently being decontaminated and closed, and (2) the Bldg 133 area is the current sodium treatment facility.

The proposed soil sampling locations include all of the RCRA Solid Waste Management Unit and Area of Concern locations as well as selected locations where surface water contamination might be transferred to the soil. Sampling locations SV–4 and SV–51 will be analyzed only for radioactive contamination; sampling locations SV–68, -69, –70, –71, and –72 will be analyzed only for organic chemical contamination; all other sampling locations will require both types of analyses. Except for "special interest" soil samples, the routine soil surveillance samples will be taken yearly. The soil characterization program of the RFI Work Plan will provide most of the necessary soil data for the first year.

4.3.2 Groundwater Surveillance

As required by DOE Order 5400.1, a draft Groundwater Protection Management Plan has been written for SSFL, Area IV. It includes both a groundwater monitoring plan and a proposed groundwater protection and remediation program. Also, the RCRA Facility Investigation Work Plan may include some groundwater characterization. The purpose of presenting a proposed groundwater monitoring plan in this document is to indicate the minimum required scope for environmental surveillance, independent of remediation or characterization.

4.3.2.1 Current Monitoring Program

Groundwater is currently sampled and analyzed from 28 wells in Area IV and 7 offsite wells to the north and northwest of Area IV. The locations of these wells are shown in Figure 4–2, which also

Table 4–11. Area IV Rock and Soil Radioactivity Data - 1991

	Activity (pCi/g)*													
	^{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**	3(31)	34	4(30)	23(11)	1(21)	2(20)	22	21(1)	22	31(2)	22	12	19(2)	(22)

*Observed activity less than detectable entered as 0.0.
**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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shows the locations of several proposed new wells (2 onsite and 2 offsite).* The existing wells have been monitored for both radioactive and chemical contamination since 1989.

Figure 4–3 depicts the radiological results from December 1991 samples, and Table 4–13 gives the average isotopic analyses for 1991. As far as radioactive contamination is concerned, the only potential problem is an unusually high level of tritium in the wells near the RMDF. Since this tritium concentration is well below the EPA limits for drinking water, it does not pose a health hazard, but monitoring is definitely required.

The major chemical contaminant in SSFL groundwater is trichloroethylene (TCE). The approximate lateral extent of TCE contamination is shown in Figure 4–4. Three small segments of Area IV have TCE greater than 5 $\mu g/\ell$, and one location near the western edge of the site has TCE greater than 100 $\mu g/\ell$.

4.3.2.2 Groundwater Surveillance Plan

The proposed groundwater surveillance plan is summarized in Table 4–14. Major emphasis is given to the offsite wells and to those onsite wells located in the areas of maximum TCE and/or tritium concentrations. Several wells (RD–16, RS–24, ES–31) were selected because they are south of the groundwater divide and will help to assess lateral groundwater movement. One new well (RD–50) is on the Burro Flats Fault, and it will provide data to support the theory of major groundwater movement along the faults of the Chatsworth Formation. Once the groundwater characterization program of the RFI Work Plan is completed, the surveillance program may be changed slightly, but that change is likely to be an increased scope rather than any deletions in the proposed monitoring schedule.

4.3.3 Ambient Air Monitoring/Surveillance

Airborne radioactive particulates are the major source of potential public exposure by the air pathway. Ambient air monitoring in Area IV is and has been limited to particulate sampling at several key locations.

4.3.3.1 Current Monitoring Program

Five ambient air samplers are operated in locations which should be the most sensitive to current Area IV nuclear facility stack emissions. The locations are listed in Table 4–15 and shown on Figure 4–2. Each air sampler collects about 25 m^3 of air per day. They operate on a 24–h sampling interval, with the collecting filter media being changed automatically at midnight.

Ambient air particulate samples are analyzed for gross alpha activity, gross beta activity, and isotope–specific radioactivity. Filter media on which particulates are collected are counted for gross alpha and gross beta activities. Composites of filter media samples during a one–year period are analyzed for gamma–emitting radionuclides, ^{90}Sr, plutonium, and uranium. Specific radionuclides in

*Wells 54 and 59 are three well clusters.

Table 4-12. Area IV Soil Sampling Locations

Designation	Location Description
SV-4[3]	Bldg 020 (former RIHL) - west side
SV-14[1][3]	Slope below Bldg 621 (RMDF) near Bldg 024
SV-51[3]	Bldg 029 (former instrument calibration building)
SV-52[2]	Area IV drainage channel (area wetted during periods of runoff) - G Street and 17th Street
SV-53[2]	R-2A pond spillway, top of Bell Creek
SV-63[2]	Bldg 600 (Sewage Treatment Plant) diversion pond bottom
SV-66[3]	RMDF pond
SV-67[3]	Old Conservation Yard
SV-68[3]	New Conservation Yard
SV-69[4]	Southeast Drum Storage Area
SV-70[3]	ESADA Chemical Storage Yard
SV-71[3]	Bldg 100 trench
SV-72[3]	Bldg 056 landfill
SV-73[4]	Bldg 059
SV-74[3]	Bldg 005
SV-75[4]	Former Bldg 003 leach field
SV-76[4]	Former Bldg 006 leach field
SV-77[4]	Former Bldg 009 leach field
SV-78[4]	Former Bldg 011 leach field
SV-79[4]	Former Bldg 012 leach field
SV-80[4]	Former Bldg 014 leach field
SV-81[4]	Former Bldg 020 leach field
SV-82[4]	Former Bldg 023 leach field
SV-83[4]	Former Bldg 028 leach field
SV-84[4]	Former Bldg 030 leach field
SV-85[4]	Former Bldg 353 leach field
SV-86[4]	Former Bldg 363 leach field
SV-87[4]	Former Bldg 383 leach field
SV-90	Background location - southwest boundary of Area IV, at property line gate
SV-91	Background location - west boundary of Area IV, on H Street

Notes:

(1) Location SV-14 is in the path of runoff which flows south down the slope from the RMDF.

(2) Sites of potential soil contamination from surface water.

(3) RCRA Solid Waste Management Unit Location

(4) RCRA Area of Concern Location

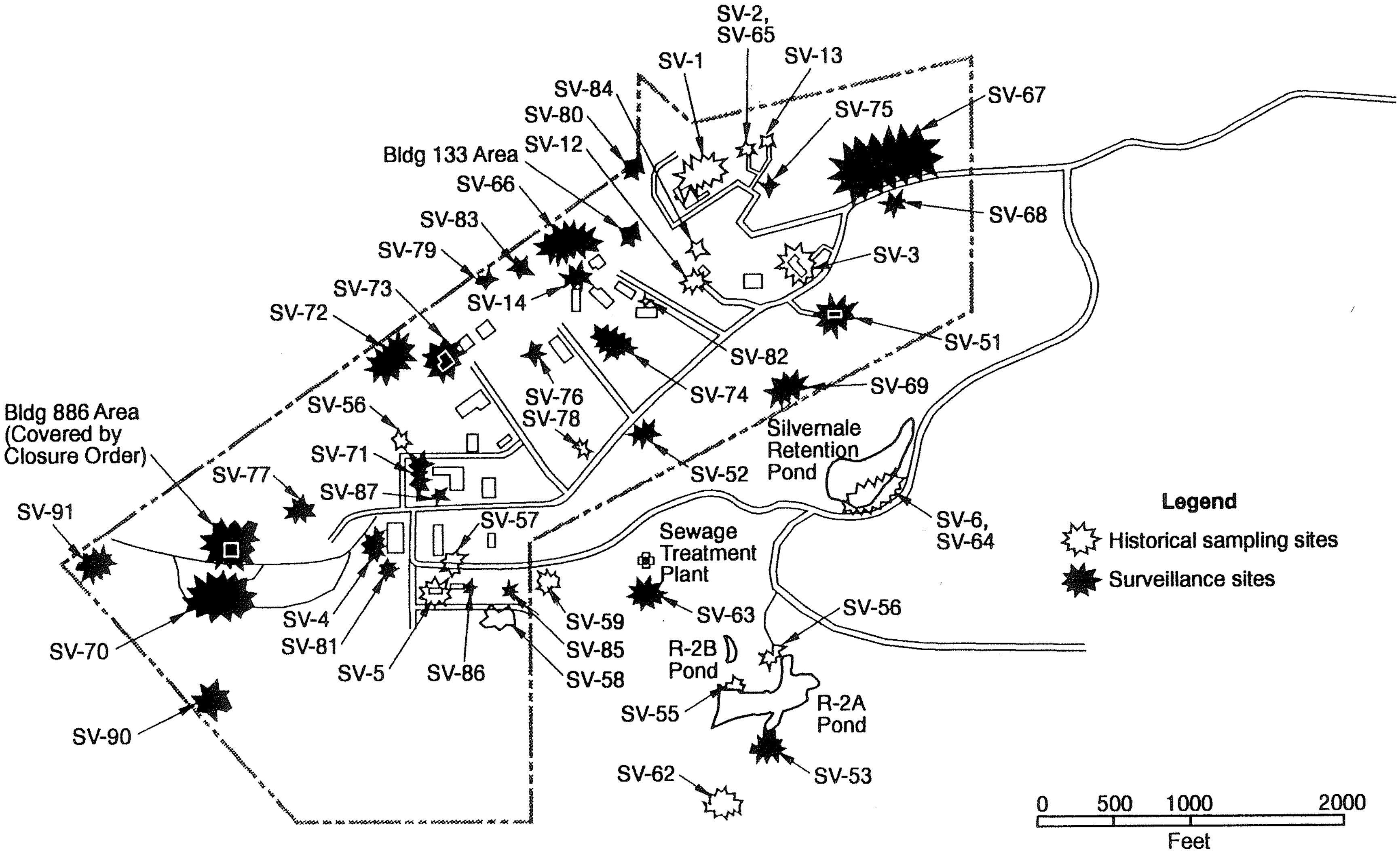

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Figure 4-1. Soil Sampling Locations for Area IV

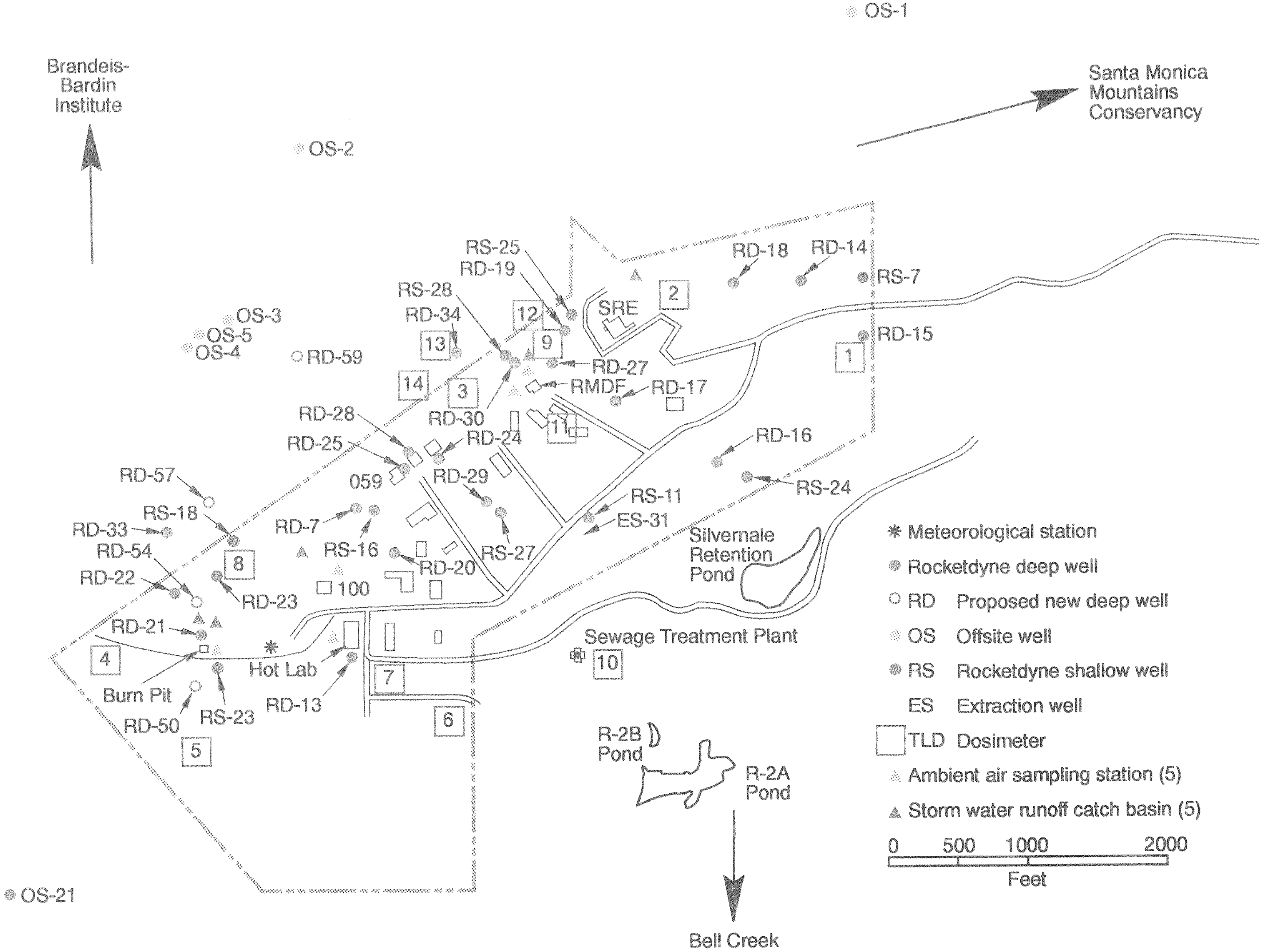

Figure 4-2. Area IV Environmental Sampling Stations

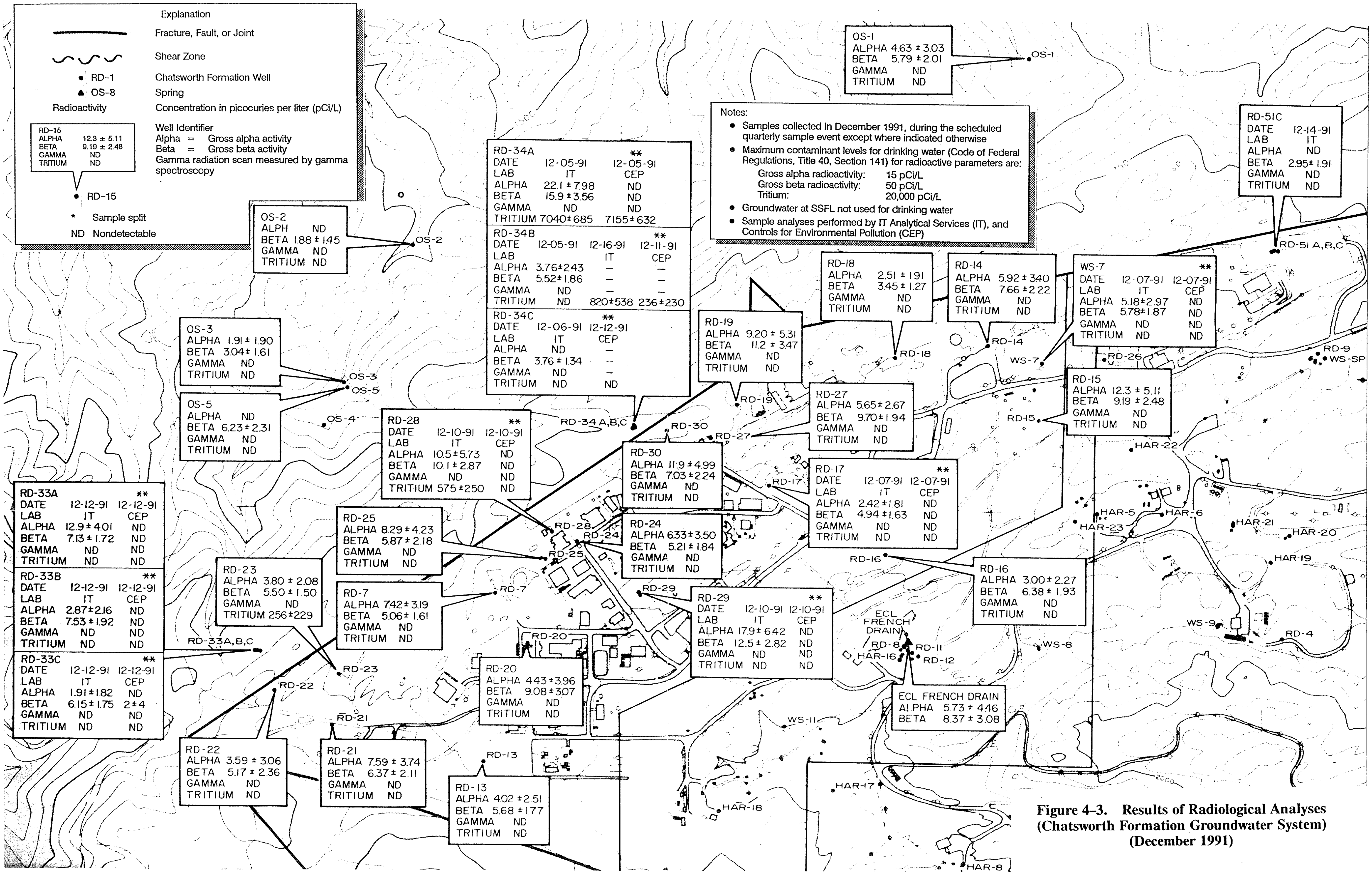

Figure 4–3. Results of Radiological Analyses (Chatsworth Formation Groundwater System) (December 1991)

Table 4-13. Radioactivity in Groundwater at SSFL - 1991

	Activity (pCi/L)																			
	^{3}H	^{60}Co	^{90}Sr	^{137}Cs	^{210}Pb	^{210}Po	^{226}Ra	^{228}Ra	^{228}Ac	^{228}Th	^{230}Th	^{232}Th	U	^{234}U	^{235}U	^{238}U	^{238}Pu	$^{239/240}Pu$	Gross Alpha	Gross Beta
Maximum Permissible Concentration	**20,000***	**30,000**	**8***	**20,000**	**100**	**700**	**Combined 5***		**90,000**	**7,000**	**2,000**	**2,000**	**20***	**30,000**	**30,000**	**40,000**	**5,000**	**5,000**	**15***	**50***
Maximum	7,155	6.19	0.02	4.72			2.66	4.15			0.002		7.57	10.4	0.376	194.0	0.002	0.003	29.1	43.1
Mean	412	2.50	-0.04	0.02	ND	ND	0.54	1.39	ND	ND	0.001	ND	1.88	2.35	0.077	39.0	0.0006	-0.0001	6.34	6.38
Minimum	-450	-1.44	-0.18	-7.56			ND	ND			ND		ND	ND	-0.001	0.03	-0.001	-0.002	-1.60	-2.53
Number of analyses**	125	7	4(3)	105	(3)	(3)	7(8)	8(2)	(3)	(8)	7(4)	(11)	6(3)	10(3)	12	15	7	7	142	142

ND = Not detected
*EPA Limits for drinking water suppliers
**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 only.

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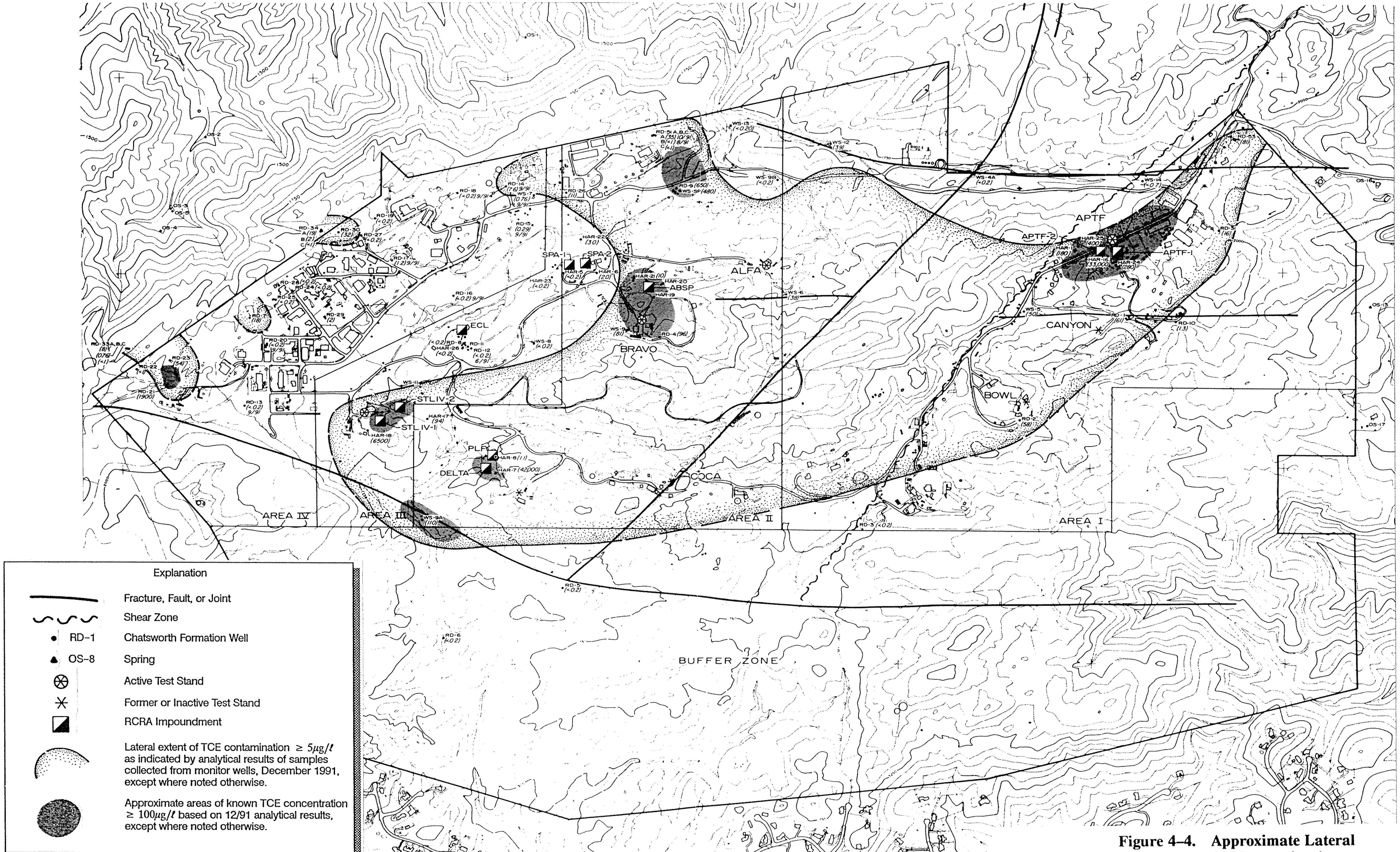

Figure 4–4. Approximate Lateral Extent of TCE Contamination (Chatsworth Formation) (December 1991)

Table 4–14. Proposed Groundwater Surveillance Schedule (Sheet 1 of 2)

Contaminants Monitored, Identified by Analysis Method (see Note)					
Well Identifier	Area	March	June	September	December
RS-16	IV	8240, 8270, 900.0, 901.1, 906.0	8240	8240	8240
RS-18	IV	8010, 900.0, 901.1, 906.0	8010, 900.0	8010, 900.0	8010
RS-23	IV	8240, 8270, 900.0, 901.1, 906.0	8240	8240	8240
RS-24	IV	8240, 8270, 900.0, 901.1, 906.0	8240	8240	8240
RS-28	IV	8010, 900.0, 901.1	8010, 900.0	8010, 900.0	8010, 900.0
ES-31	IV	8010, 900.0, 901.1, 906.0	–	8010	–
RD-7	IV	8010, 900.0, 901.1, 906.0	8010	8010	8010
RD-13	IV	8010, 900.0, 901.1, 906.0	–	8010	–
RD-14	IV	8010, 900.0, 901.1, 906.0	8010	8010	8010
RD-15	IV	8010, 900.0, 901.1, 906.0	–	8010	–
RD-16	IV	8010, 900.0, 901.1, 906.0	–	8010	–
RD-21	IV	8010, 900.0, 901.1, 906.0	8010	8010	8010
RD-22	IV	8240, 900.0, 901.1, 906.0	8240, 900.0	8240, 900.0	8240, 900.0
RD-23	IV	8010, 900.0, 901.1, 906.0	8010	8010	8010
RD-25	IV	8010, 900.0, 901.1, 906.0	–	8010	–
RD-30	IV	8010, 900.0, 901.1, 906.0	8010	8010	8010
RD-33A	Offsite	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0
RD-33B	Offsite	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0
RD-33C	Offsite	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0
RD-34A	Offsite	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0
RD-34B	Offsite	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0
RD-34C	Offsite	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0

Table 4–14. Proposed Groundwater Surveillance Schedule (Sheet 2 of 2)

Contaminants Monitored, Identified by Analysis Method (see Note)					
Well Identifier	Area	March	June	September	December
RD-50	IV	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0
RD-54A	IV	8010, 900.0, 901.1, 906.0	8010, 900.0, 901.1, 906.0	8010, 900.0, 901.1, 906.0	8010, 900.0, 901.1, 906.0
RD-54B	IV	8010, 900.0, 901.1, 906.0	8010, 900.0, 901.1, 906.0	8010, 900.0, 901.1, 906.0	8010, 900.0, 901.1, 906.0
RD-54C	IV	8010, 900.0, 901.1, 906.0	8010, 900.0, 901.1, 906.0	8010, 900.0, 901.1, 906.0	8010, 900.0, 901.1, 906.0
RD-57	Offsite	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0
RD-59A	Offsite	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0
RD-59B	Offsite	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0
RD-59C	Offsite	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0
WS-7	IV	8010, 900.0, 901.1, 906.0	–	8010	–
OS-1	Offsite	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0	8240, 900.0 901.1, 906.0	8240, 900.0 901.1, 906.0
OS-2	Offsite	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0	8240, 900.0 901.1, 906.0	8240, 900.0 901.1, 906.0
OS-5	Offsite	8240, 900.0, 901.1, 906.0	8240, 900.0, 901.1, 906.0	8240, 900.0 901.1, 906.0	8240, 900.0 901.1, 906.0

Note: Groundwater sample analyses are specified by reference to analysis methods to be used. An explanation of the referenced methods are listed below. The EPA methods are described in SW-846 (Ref 4-3). In addition to these analyses, static water levels are scheduled to be measured in all wells quarterly, and more frequently, if associated with an extraction system.

Explanation of Analyses

- 8010 = EPA Method 8010 Target, Halogenated VOCs (cis- and trans-1,2-dichloroethylene, trichloroethylene)
- 8240 = EPA Method 8240, VOCs
- 8270 = EPA Method 8270, BNAs
- 900.0 = EPA Method 900.0, Gross Alpha and Gross Beta Activity
- 901.1 = EPA Method 901.1, Gamma Emitting Radionuclides
- 906.0 = EPA Method 906.0, Tritium
- U = Isotopic Uranium, ASTM Method D3972-82
- – = Well not sampled, water level measured

Source: Reference 5-20

stack samples and ambient air samples are identified by radiochemistry methods (currently performed by IT Corp., Richland, Washington) for the annually composited air filter samples.

Data for gross alpha and gross beta for 1991 is shown in Table 4–16 The radionuclide data for 1991 is shown in Table 4–17, which also shows similar data from the Area IV stack effluent monitoring. The effectiveness of the air cleaning systems is evident from the fact that the exhaust effluents are less radioactive than is the ambient air with respect to the ambient air radionuclides ^{7}Be, ^{40}K, and ^{210}Po.

Table 4–15. Ambient Air Monitoring Locations

Sample Station	Location	Sample Frequency
A-2	Bldg 020 (RIHL), southwest side	Daily
A-3	Bldg 034 (RMDF), at main gate	Daily
A-4	Bldg 886 (former Sodium Disposal Facility)	Daily
A-5	RMDF pond, north side	Daily
A-6	Bldg 100, east side	Daily

Table 4–16. 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]
SSFL Area IV 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
SSFL Area IV 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
SSFL Area IV 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
SSFL Area IV 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.

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[b]Guide SSFL site: 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).

Table 4–17. Filtered Exhaust and Ambient Air Radioactivity Concentrations

	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	Grpss Beta
Maximum Permissible Concentration	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

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4.3.3.2 Meteorological Monitoring

To calculate potential public exposure to radioactive particulates, it is necessary to have appropriate meteorological data. Rocketdyne's Environmental Protection Department currently operates two meteorological stations on the SSFL. One is located in Area IV (see Figure 4–2), and the other is located about 2.5 miles E NE of the first in Area I. The data taken at these stations on an hourly basis include:

- Relative humidity
- Temperature
- Rainfall
- Wind direction/speed and standard deviations.

Data from the onsite stations are supplemented, as required by data from two U.S. weather stations, one located north of SSFL in the Simi Valley and the other east of SSFL in Burbank.

The downwind concentration of radioactive material emissions to the atmosphere during 1991 from each of the three Area IV exhaust stacks has been calculated with the CAP88PC computer code using representative input data including wind speed, directional frequency, and atmospheric stability plus facility-specific data such as stack heights and exhaust air velocity.

The radioactivity concentrations at the site boundary location nearest to each release point and at the nearest residence for each nuclear facility are shown in Table 4–18, which also shows the non-natural radioactivity concentrations at the nearest boundary and residence locations for effluents from the facilities. These concentrations were estimated by use of CAP88 PC and specific radionuclide releases for each facility.

Table 4–18. 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

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4.3.3.3 Ambient Air Monitoring Plan

The current monitoring of ambient air radioactive particulates will continue as described in Section 4.3.3.1. The sampling interval may be extended to weekly; the larger particulate samples from weekly intervals would result in about a factor of three increase in the minimum radioactivity level detectable.

High–volume air samplers (HVAS) will be used as an adjunct to the above air samplers. They will collect more than 250 m^3 of air per day. Their proposed locations are listed in Table 4–19. They will similarly collect particulates on filter media to detect radioactivity and will have a weekly sampling interval. Filter media will be counted for gross alpha and gross beta activity, while composites of filter media will be analyzed for gamma–emitting radionuclides, ^{90}Sr, plutonium and uranium and naturally occurring radionuclides on an annual basis.

Table 4–19. High–Volume Air Sampler Locations

Designation	Location Description
A-6	Near south boundary at Bell Creek Weir and Well 9
A-9	At SSFL east boundary, at Main Gate Security Building
A-10	At Bldg 600, Area III Sewage Treatment Plant
A-11	At Bldg 029

The air sampler locations of Tables 4–15 and 4–19 will be reviewed for appropriateness (e.g., relative to prevailing wind direction and sheltering from buildings, and the appropriate regulatory air sampling siting requirements), and changed as necessary during plan implementation.

4.3.4 Ambient Radiation Monitoring

Ambient radiation monitoring is the final element of the environmental surveillance program currently in operation at SSFL. It will be continued until all radioactive sources are removed.

4.3.4.1 Current Monitoring Program

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 4–20 and shown in Figure 4–2.

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. The 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

Table 4–20. Thermoluminescence Dosimeter Locations

Sample Station	Locations
Onsite 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 Bldg 353 (State of California TLD location)
SS-7	Bldg 363, north side (State of California TLD location)
SS-8	Former Sodium Disposal Facility north boundary
SS-9	RMDF, northeast boundary at Bldg 133
SS-11	Bldg 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
Offsite Locations	
OS-1	Chatsworth (State of California TLD location)
OS-4	Simi Valley (State of California TLD location)

dosimeters record the total radiation exposure received. The TLDs are replaced quarterly and returned to the vendor for reading to determine the exposure.

The 1991 results are shown in Table 4–21. These are total exposure results and include contributions due to 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 eight Rocketdyne dosimeter locations, both onsite and offsite, are also shown in Table 4–21. 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 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.

Table 4–21. 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 per year.

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4.3.4.2 Ambient Radiation Monitoring Plan

The current monitoring of ambient radiation using TLDs will continue as described in Section 4.3.4.1, including support for the State RHB parallel effort. In addition, a program will be initiated to monitor radiation at SSFL locations near offsite populations. High-pressure ionization chambers (HPIC) monitors will be used to monitor radiation levels at the locations listed in Table 4–22. They consist of two locations in areas nearest offsite 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 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

Table 4–22. 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	Bldg 006 (central location within Area IV)

and seasonal variations. Data will be recorded continuously and collected weekly, except during the annual HPIC removal from service for calibration.

4.3.5 Estimation of Public Radiation Dose

One of the requirements of DOE Order 5400.1 is that the Environmental Monitoring Plan shall provide an "assessment of the potential radiation dose to members of the public which could have resulted from site operations."

4.3.5.1 Current Program

Because so little radioactive material is released from the Rocketdyne facilities, and the radiation exposure is so small, it is not possible to directly measure radiation dose to the public. Hypothetical doses are estimated based on measurements at the facilities and extrapolated to occupied areas off site by well–established mathematical procedures.

External dose calculations assume that differences in 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. The estimated doses are far below the applicable limits of DOE, EPA, NRC, and the State of California.

The external exposures, above background, are based on the averaged offsite exposure measurements. The mean value for two offsite dosimeters was 70 mrem with a maximum annually observed value for a single location of 75 mrem. Boundary dose estimates assume 100% occupancy, whereas the actual presence of persons at the boundary is rare or nonexistent.

Estimates of the internal dose are based on the EPA computer program CAP88 PC. Estimated internal radiation doses because of atmospheric emission of radioactive materials from the SSFL nuclear facilities are several orders of magnitude below the radiation standards and are far below doses from internal exposure resulting from natural radioactivity in air.

An example calculation of public exposure to radiation and radioactivity is shown in Table 4–23 for the combined releases of the RMDF and Bldg T059. Table 4–24 shows calculations based on demography and meteorology for all atmospheric emissions from SSFL facilities.

4.3.5.2 Radiation Dose Estimation Plan

The ambient air sampling and ambient radiation sampling proposed in this Environmental Monitoring Plan will provide adequate data to calculate public radiation exposure. The standard CAP88 PC code will be used to calculate individual doses, and current demographic distributions will be factored in to calculate general population (person–rem) doses. Basically, this plan simply uses the same estimation methods as in the current program, but the new data from the HVASs and the HPICs will provide improved integrity for the estimate.

Table 4-23. Public Exposure to Radiation and Radioactivity from DOE Operations at SSFL—1991

Radioactive Materials Disposal Facility (RMDF) and Building T059

1. All pathways		
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 ("Radiation Protection of the Public and the Environment" DOE Order 5400.5, 2/8/90)	Short-term	500 mrem/yr
	Prolonged	100 mrem/yr
2. Air pathway		2.9×10^{-6} mrem/yr
Limit (40 CFR 61, Subpart H)		10 mrem/yr
Natural Exposure to Average Member of U.S. Public		
1. All pathways ("Health Effects of Exposure to Low Levels of Ionizing Radiation - BEIR V," National Academy Press, Washington DC, 1990)		300 mrem/yr
2. Air pathway ("Health Effects of Exposure to Low Levels of Ionizing Radiation - BEIR V," National Academy Press, Washington DC, 1990)		200 mrem/yr

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Table 4-24. 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

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4.4 METHODS, ANALYSIS, AND DATA MANAGEMENT

4.4.1 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 4.4.1.1 through 4.4.1.5.

4.4.1.1 Surface Water

Sampling of Area IV water runoff and NPDES-governed discharges will be performed by trained technicians using field sampling instructions (Refs 4–4 and 4–5) proceduralized to ensure compatibility with SW–846 (Ref 4–3) 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 4–25 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 4–26. The sample containers will be precleaned using EPA protocols.

4.4.1.2 Groundwater

Sampling of Area IV groundwater will continue to be performed in accordance with the current practices documented in Reference 4–6 and summarized in Table 4–27.

4.4.1.3 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, 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 (Ref 4–7) will be revised to implement the sampling methodology of ASTM C998 (Ref 4–8). New procedures will be prepared detailing packaging requirements for shipment to contractor analytical laboratories and sample control. Sampling log and chain-of-custody requirements will also be patterned after surface water procedures.

4.4.1.4 Air

The filters from ambient air and radioactive stack emission samples will be collected and analyzed for the radioactive materials specified in Sections 4.2.2.1 and 4.3.3.1. Changeout intervals and instructions specified in existing sampling procedures (Ref 4–7) will be followed. Sampling log and chain-of-custody procedures will be used to ensure filter control.

Table 4–25. 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 4–25. 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 hr

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 onsite 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.

Table 4–26. 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

Table 4–27. Groundwater Sampling Procedures

Procedure	Description of Contents
Field preparation	Contains presampling checklist for field notebook, sample documentation, sampling kit, and notifications for access.
Equipment calibration	Lists required checks of measurement instrument calibration status. Provides instructions for preparing pH and conductivity meters.
Water level measurement	Provides step-by-step instructions for measuring water level, recording results, and posttest instrument cleaning.
Well evacuation	Calculates volume of water to be evacuated, lists corresponding purge time and flow rate per well, provides evacuation instructions, and details initial sampling for field parameters. Initial use of sample data form.
Field parameter measurement	Contains instructions for field determination of pH and conductivity.
Sample collection	Lists specific EPA SW-846 (Ref 5-2) compatible sampling instructions by required analysis, details required quality control sampling by planned analysis method.
Sample documentation	Contains instructions for sample labeling, sealing of containers, and initiating chain-of-custody form.
Sample packaging and shipment	Step-by-step instructions for preservation and packing of samples for shipment to analytical laboratory.

4.4.1.5 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 4.3.4.2 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.

4.4.2 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 4.4.2.1 through 4.4.2.3.

4.4.2.1 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 4–28 details methods used for chemical analyses.

Table 4–28. SSFL Analytical Chemistry Laboratory Analysis Methods

Analyte	Method/Source
pH	423, Std Meth 16[a]
Temperature	212, Std Meth 16[a]
Turbidity	214, Std Meth 16[a]
BOD	507, Std Meth 16[a]
Residual chlorine	408C, Std Meth 16[a]
Arsenic	403, Std Meth 16[a]
Surfactants	512B, Std Meth 16[a]
Settleable solids	209E, Std Meth 16[a]
Suspended solids	209C, Std Meth 16[a]
Total dissolved solids	209B, Std Meth 16[a]
Chloride	325.3, EPA[b]
Fluoride	413B, Std Meth 16[a]
Oil and grease	503, Std Meth 16[a]
Sulfate	374.5, EPA[b]
Boron	404A, Std Meth 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, Std Meth 16[a]
Mercury, dissolved	303F, Std Meth 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 4-1
[b]Reference 4-2
[c]Reference 4-3

Laboratory practices defined in the existing quality assurance (Ref 4–9) and standard operating procedures (Ref 4–10) 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 4–3) and "Standard Methods for the Examination of Water and Wastewater" (Ref 4–1). To ensure consistently accurate data, a rigorous internal QA/QC program is maintained (see 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 mid-point.

A designated laboratory quality assurance (QA) coordinator ensures compliance with QA manual requirements (Ref 4–9).

For required surface water and soil (chemical) analyses outside its certification, the SSFL 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 4.4.2.3.) The contractor laboratories currently utilized are listed in Table 4–29. 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 4–3)
• Gamma radiation	EPA Method 901.1 (Ref 4–3)
• Tritium	EPA Method 906.0 (Ref 4–3)
• ^{226}Ra and ^{228}Ra	EPA Method 903.1 (Ref 4–3)
• Isotopic uranium	ASTM Method D3972.82
• ^{90}Sr	EML HASL-300 Procedures Manual (Ref 4–11) method or equivalent
• ^{129}I	EML HASL-300 Procedures Manual (Ref 4–11) method or equivalent
• ^{147}Pm	EML HASL-300 Procedures Manual (Ref 4–11) method or equivalent
• Isotopes of thorium, plutonium	EML HASL-300 Procedures Manual (Ref 4–11) method or equivalent

Table 4–29. 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

4.4.2.2 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 4–30. The existing sampling/analysis procedure (Ref 4–7) will be revised to include preservation, preparation, and packaging requirements. Standard practices as detailed in EML HASL–300 (Ref 4–11) 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.

Table 4–30. Radiochemical Laboratories in Current Use

Laboratory	Location
Controls for Environmental Pollution (CEP)	Albuquerque, NM
International Technology Corporation (IT)	Richland, WA
Tech-Ops Landauer	Glenwood, IL

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 (Refs 4–12 and 4–13).

Existing RP&HPS QA procedures (Ref 4–14) 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.

4.4.2.3 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 TLD's 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.

4.4.3 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 4–15), 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 (Ref 4–14).

Average annual dose calculations for the general public through the airborne pathway will continue to be calculated using CAP88 PC. The calculated annual offsite 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 (Ref 4–16). 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.

4.4.4 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.

4.5 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.

4.6 REFERENCES

4–1. Standard Methods for the Examination of Water and Wastewater, 16th edition, 1985.

4–2. EPA–600/4–79–020 Methods for Chemical Analysis of Water and Wastes (March 1979)

4–3. SW–846, Third Edition, *Test Methods for Evaluating Solid Waste*, published by the EPA Office of Solid Waste and Emergency Response

4–4. Rocketdyne Internal Letter 90EU–340 dated January 4, 1991, from L. A. Dinius to Those Listed, "Revision of Northwest Slope Rainfall Run–Off Monitoring Program"

4–5. Rocketdyne Environmental Control Manual Procedure EC 03.50, "SSFL Water Contamination Control and the National Pollutant Discharge Elimination System (NPDES) Permit Requirements" (March 4, 1991) (Draft)

4–6. Report 8640M–113, Groundwater Resources Consultants, Inc., "Groundwater Sampling and Analysis Plan, Santa Susana Field Laboratory, Rockwell International Corporation, Rocketdyne Division" (February 26, 1991)

4–7. RP&HPS Procedure N001DWP00008, "Radiological Environmental Monitoring Program Sampling Procedures, Analysis Procedures, and Radioactivity Measurement Methods," Rev. A (February 18, 1991)

4–8. ASTM C998–83, "Standard Method for Sampling Surface Soil for Radionuclides"

4–9. SSFL Analytical Chemistry Method 2014, "Laboratory Manual for Quality Control and Quality Assurance of Environmental Analyses" (November 1, 1989)

4–10. SSFL Analytical Chemistry Method No. 2013, "Standard Operating Procedures for Environmental Analyses" (December 1, 1989)

4–11. HASL–300, "DOE Environmental Measurements Laboratory Procedures Manual," 27th Edition

4–12. RP&HPS Procedure N001OP000027, "Quality Control Procedures for Alpha/Beta Sample Counters," Rev. NC (June 14, 1991)

4–13. RP&HPS Procedure N001OP000028, "Quality Control and General Operating Procedure for Gamma Spectroscopy Using Canberra Multichannel Analyzers," Rev. NC (June 17, 1991)

4–14. RP&HPS Procedure N001DWP000009, "Radiological Environmental Monitoring Program Quality Assurance," Rev. B (April 22, 1991)

4–15. DOE/EP–0023, "A Guide For: Environmental Radiological Surveillance at U.S. Department of Energy Installations" (July 1981)

4–16. RP&HPS Report N001SRR140115, "Recent Reviews of Rocketdyne Radiological Environmental Monitoring," Rev. A (June 28, 1991)

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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). As an adjunct to the RCRA Field Investigation (RFI) Work Plan, currently in preparation, a formal Field Sampling Plan will be written. It will contain QA requirements for all necessary field activities that support both this Environmental Monitoring Plan and the RFI Work 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 semi-annually 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

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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, 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. California–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.

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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.

During implementation, revisions to the plan will be made on an annual basis 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.

A major update of the plan will be undertaken every 3 years as per DOE Order 5400.1.

7.1 SCHEDULE

This plan consists of two major elements: effluent monitoring and environmental surveillance. A schedule for the first 5 years of implementation is shown in Figure 7-1.

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.

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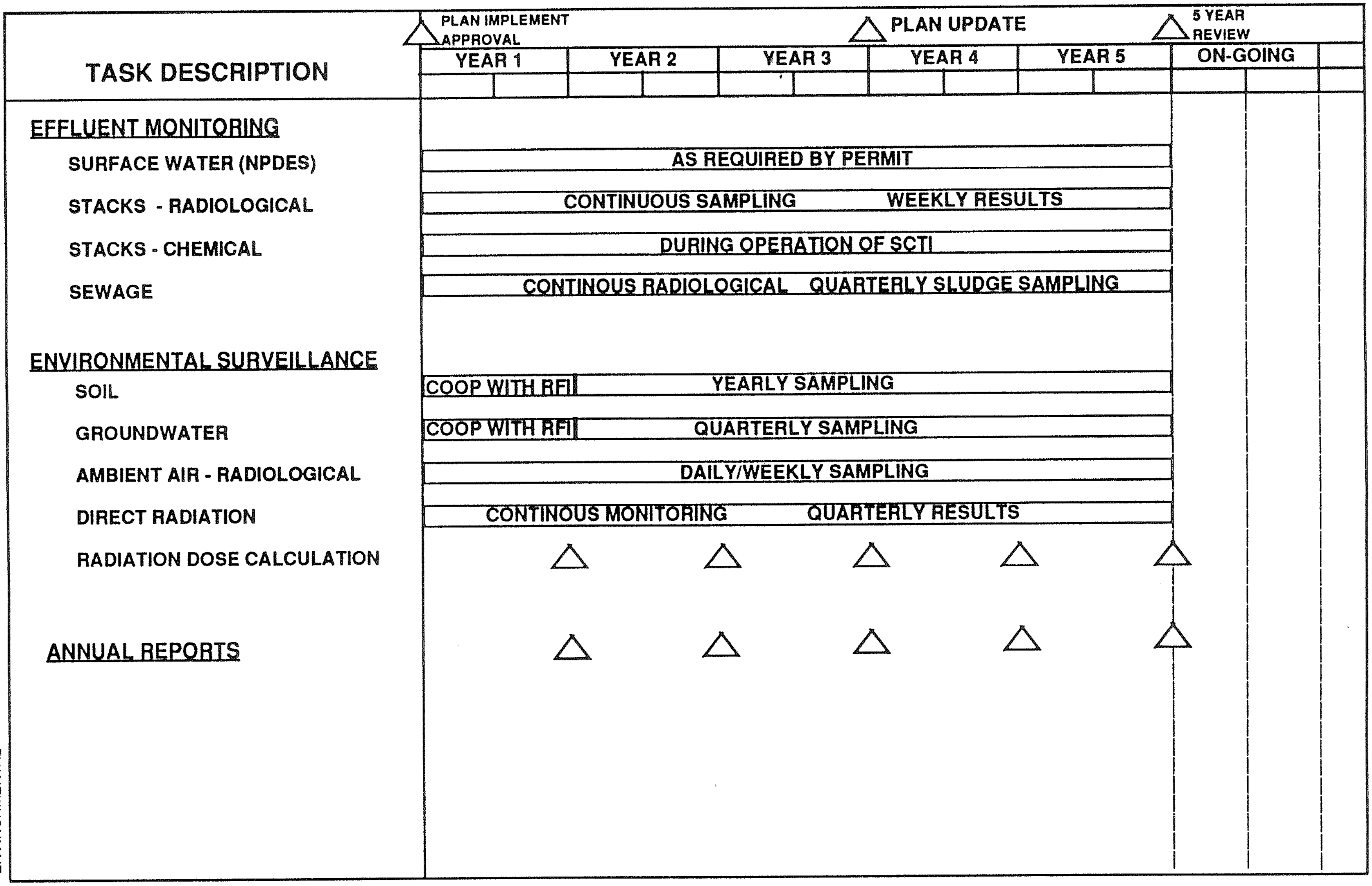

Figure 7–1. Implementation Schedule – SSFL Area IV Environmental Monitoring Program Plan

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 T059, Bldg 020).

Relevant DOE regulations include DOE Order 5400.5, draft 10 CFR 834 and DOE–EH–173T. Bldg 020, which is licensed by the NRC, is subject to the provisions of 10 CFR 20, and all three stacks must be in compliance with 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 NO_x 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, coliform levels, and radioactivity. 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 RCRA–designated SWMU's and Areas of Concern. During the first year of implementation, soil sampling and analysis will be conducted in cooperation with the RCRA Field Investigation (RFI) Work Plan. Two years of soil monitoring will follow, the scope of which will be determined by the RFI 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 10 CFR 834 and DOE EH-0173T as well as relevant RCRA provisions.

8.2.2 Groundwater

The initial year of groundwater monitoring will also be done in cooperation with the RFI Work Plan. The groundwater monitoring proposed herein is based on the requirements of RCRA, CERCLA, TSCA, and the State of California Porter-Cologne Water Quality Control Act. Although the SSFL groundwater does not intrude into drinking water supplies, its quality is compared to the federal Safe Drinking Water Act limits.

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 ambient air standards 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. Direct radiation 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 NESHAPS and DOE Order 5400.5.

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). The initial year of soil and groundwater surveillance will be done in cooperation with the RCRA Field Investigation Work Plan, now in preparation. The scope of proposed monitoring in this plan was determined, in part, by the information contained in the "Interim Final RCRA Facility Assessment Report."

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. TZ4–R09015–RN–M07933, "Interim Final RCRA Facility Assessment Report," (July 10, 1991)

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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

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 5400.xy (Draft)	Radiological Effluent Monitoring and Environment Surveillance	Establishes requirements and guides for radiological effluent monitoring and environmental surveillance in support of DOE operation and activities To be replaced 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 sub-surface 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

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.

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.

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.

A.3 AIR

The Federal CAA, as amended in 1990, is designed to protect and improve air quality and public health and welfare. Federal requirements are incorporated by reference into 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

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 6.95	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 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 226**	Permit to Operate	Permits nonradioactive stack emissions at HWMF (Bldg 133); specifies maintaining records of sodium processing operations
Permit 271	Permit to Operate	Permits nonradioactive stack emissions at SCTI (with Rules 74.15 and 103, and Variance 392), Excess Equipment Storage Building (Bldg 003), MSTF (Bldg 005) (regulated primarily under Permit 1124), Manufacturing Support Shop (Bldg 011), RIHL (Bldg 020), and SRE (Bldg 143) Specifies maintaining records of emissions of carbon monoxide, nitrogen oxides, and oxygen based on continuous emissions monitorings and amount of fuel usage on a monthly basis Authorizes operation of the Kalina Cogeneration Facility
Permit 290**	Permit to Operate	Permits nonradioactive stack effluent at Sodium Pump Test Facility [(SPTF) Bldg 462]; Rule 7415 requires recording of total gas usage Specifies maintaining records of monthly natural gas usage
Permit 1124**	Permit to Operate	Permits nonradioactive stack emissions at MSTF (Bldg 005) (one boiler is permitted under Permit 271) Limits on natural gas consumption require usage records be kept

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

**All permits are being incorporated into Permit 271, effective January 1, 1993.

Table A-5. Applicable Guidelines

Requirement/Guideline	Title	Applicable Content
Department of Energy		
DOE/EH-173T (Draft)	Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance	Summarizes DOE requirements for environmental surveillance Specifies quantification of radionuclides released from each liquid discharge point
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

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.

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 and DOE 5400.5 (expected to be upgraded to a rule by adoption of 10 CFR 834).

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 as the joint Rocketdyne, National Aeronautics and Space Administration (NASA), and DOE (SSFL) NPDES Permit No. CA0001309. The 1984 permit was issued by Order No. 84–85 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. The monitoring requirements of the permit are listed in Table A–6.

The NPDES permit renewal is in the permitting approval stage with the RWQCB. Pending changes to the current permit are generally not considered in this plan because of the uncertainty of applying requirements still under discussion. Exceptions are the cases where it is clear that monitoring will be required. An example is monitoring of rainfall runoff on the northwest slope of Area IV. This ongoing monitoring, directed by the EPA (Ref A–1) and to be included in the NPDES permit renewal, is included in the plan. When the revised permit is issued, this plan will be revised as necessary to reflect new or different permit conditions.

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

Table A-6. Surface Water Monitoring Standards of NPDES Permit

Constituent	Units	Sample Type	Minimum Frequency
Domestic Sewage			
$BOD_5$20°C	mg/L	Grab	Weekly
Suspended solids	mg/L	Grab	Weekly
Coliform	MPN/100ml	Grab	Daily
Turbidity	Turbidity units (TU)	Grab	Weekly
Effluent			
pH	ph units	Grab	The frequency of monitoring for all samples is once per discharge day. During periods of continuous discharge, no more than one sample per week need be obtained. Sampling shall be during the first hour of discharge or at the first safe opportunity.
Temperature	°F	Grab	
Total waste flow	gal/day	Grab	
Total dissolved solids	mg/L	Grab	
BOD_5 20°C	mg/L	Grab	
Oil and grease	mg/L	Grab	
Chloride	mg/L	Grab	
Sulfate	mg/L	Grab	
Fluoride	mg/L	Grab	
Boron	mg/L	Grab	
Surfactants (as MBAS)	mg/L	Grab	
Radioactivity	pCi/L	Grab	
Residual chlorine	mg/L	Grab	
Turbidity	TU	Grab	
Toxicity concentration*	% survival and TU	Grab	

*By the method specified in "Guidelines for Performing Static Acute Toxicity Fish Bioassays in Municipal and Industrial Wastewaters"

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.

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.

Groundwater monitoring guidance in 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

DOE 5400.1 specifies that the required Environmental Monitoring Plan includes an environmental surveillance activity. Environmental surveillance is the collection and analysis of samples, or direct measurements, of air, water, soil, foodstuff, biota, and other media from the site for the purpose of (1) determining compliance with applicable standards and permit requirements, (2) assessing radiation exposures of members of the public, and (3) assessing the effects, if any, on the local environment. Air and water sampling are discussed in Sections A.3 through A.5 in conjunction with effluent monitoring requirements; this section covers the remaining concerns.

The environmental surveillance requirements of DOE 5400.1 specify an environmental surveillance screening program to determine the need for a permanent surveillance program. Environmental surveillance shall be designed to satisfy one or more of the following program objectives:

1. Verify compliance with applicable environmental laws and regulations
2. Verify compliance with environmental commitments made in official documents
3. Characterize and define trends in the physical, chemical, and biological condition of the environmental media
4. Establish baselines of environmental quality
5. Provide a continuing assessment of pollution abatement programs
6. Identify and quantify new or existing environmental quality problems.

The extent of the environmental surveillance program is to be determined on a site–specific basis by the field organization to reflect facility characteristics, applicable regulations, hazard potential, quantities, and concentrations of materials released, extent and use of affected air, land, and water, and specific local public interest or concern.

The former Sodium Disposal Facility is in the closure process under California RWQCB, Los Angeles Region, Clean Up and Abatement Order No. 91–061. Characterization and monitoring of this location under the closure order supports the activities specified in this plan.

A.7 RADIATION

The concentrations of radioactive constituents of the site environment and effluents are determined by the media sampling described above. 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), and be monitored according to 40 CFR 60, Appendix A, ANSI N13.1–1969, and DOE 5400.xy (draft). EPA regulation 40 CFR 61.93, Subpart H, requires that compliance with the CAA standards be demonstrated using AIRDOS–PC or other EPA–approved models or procedures (currently CAP88PC). DOE 5400.xy (draft), Chapter IV, Section 3(d)(2), states that Gaussian models or other EPA–approved straight–line models used to demonstrate compliance with 40 CFR 61.93 should use an additional dose assessment to account realistically for temporal and spatial variations in atmospheric conditions and release rates. DOE 5400.5, Chapter II, Section 6(c) states that, if available data are not sufficient to evaluate factors germane to dose or if they are too costly to determine, the assumed parametric values must be sufficiently conservative such that it would be unlikely for individuals to actually receive a dose that would exceed the dose calculated using the values assumed.

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

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