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ROCKETDYNE DIVISION
ANNUAL SITE
ENVIRONMENTAL REPORT
SANTA SUSANA FIELD LABORATORY
AND DE SOTO SITES
1994

Rockwell Aerospace

Rocketdyne

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Prepared by the Staffs of
Radiation Protection and Health Physics Services
and
Environmental Protection

30 September 1995

Rockwell Aerospace
Rocketdyne

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1.0 EXECUTIVE SUMMARY

Rocketdyne currently operates several facilities in the San Fernando Valley/Simi Valley area, for manufacturing, testing, and research and development (R&D). These operations include manufacturing liquid–fueled rocket engines, such as the Space Shuttle Main Engine (SSME); testing rocket engines, lasers, and heat–transfer systems; and R&D in a wide range of high–technology fields, such as the electrical power system for the Space Station. Previously, this work included development, fabrication, and disassembly of nuclear reactors, reactor fuel, and other radioactive materials, but this work was terminated in 1987. Subsequently, all radiological work has been directed toward decontamination and decommissioning (D&D) of the previously used nuclear facilities and associated site areas.

The 1994 results of the radiological monitoring program indicate that there are no significant releases of man–made radioactive material from Rocketdyne sites. The atmospheric discharge of radioactive materials and direct radiation exposure are the only potential exposure pathways to the general public from Rocketdyne's radiological cleanup and waste operations. All radioactive wastes are processed for subsequent disposal at Department of Energy (DOE) disposal sites. Liquid radioactive wastes are not released into the environment and do not constitute an exposure pathway. Groundwater and surface water are sampled and analyzed to assure detection of any man–made radioactivity. With the exception of low concentrations of tritium, well below Federal and State drinking water standards, only naturally occurring radioactivity has been found in this water.

Radioactivity in the facility ventilation exhaust effluents, and in the environment, is analyzed to assess any impact of the remaining radiological–related operations on the public and the environment. Little radioactivity is dispersed by these operations and very little is released to the environment, due to highly efficient filtration systems. Only small amounts of man–made radioactivity are found in the exhaust effluents. With the exception of localized areas of facility and soil contamination, only naturally occurring radioactivity can be detected in soil and vegetation samples.

Calculated radiation doses to the public, due to airborne releases and direct radiation, are a factor of thousands to millions of times lower than the applicable limits as well as natural background levels.

The nonradiological monitoring program has increased in recent years, with more extensive sampling of the groundwater at the Santa Susana Field Laboratory (SSFL). Surface discharges of water, after use in rocket–engine testing and other industrial purposes, are analyzed at least monthly for 84 analytes and quarterly for 133 analytes per discharge location.

Three existing trichloroethylene occurrences in the groundwater in the northwest part of Area IV were monitored in 1994. Nine new wells were installed in 1993 and 1994 to characterize the hydrogeology and water quality of known groundwater contamination horizontally and vertically, and in relation to the potential source areas. No new off–site plume of degraded groundwater was detected from these wells. Three extraction wells have been installed in area IV to test systems that will contain, extract, and treat degraded groundwater.

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2.0 INTRODUCTION

This annual report discusses environmental monitoring at two manufacturing and test operations sites operated in the Los Angeles area by the Rocketdyne Division of Rockwell International Corporation (Rocketdyne). These are identified as the Santa Susana Field Laboratory (SSFL) and the De Soto site. These sites have been used for manufacturing, R&D, engineering, and testing in a broad range of technical fields, primarily rocket engine propulsion and nuclear reactor technology. The De Soto site is essentially light industry with some laboratory-scale R&D and has little potential impact on the environment. The SSFL site, because of its large size (2,668 acres), warrants comprehensive monitoring to assure protection of the environment.

SSFL consists of four administrative areas used for research, development, and test operations as well as a buffer zone. The arrangement of these areas is shown in Figure 2-1.

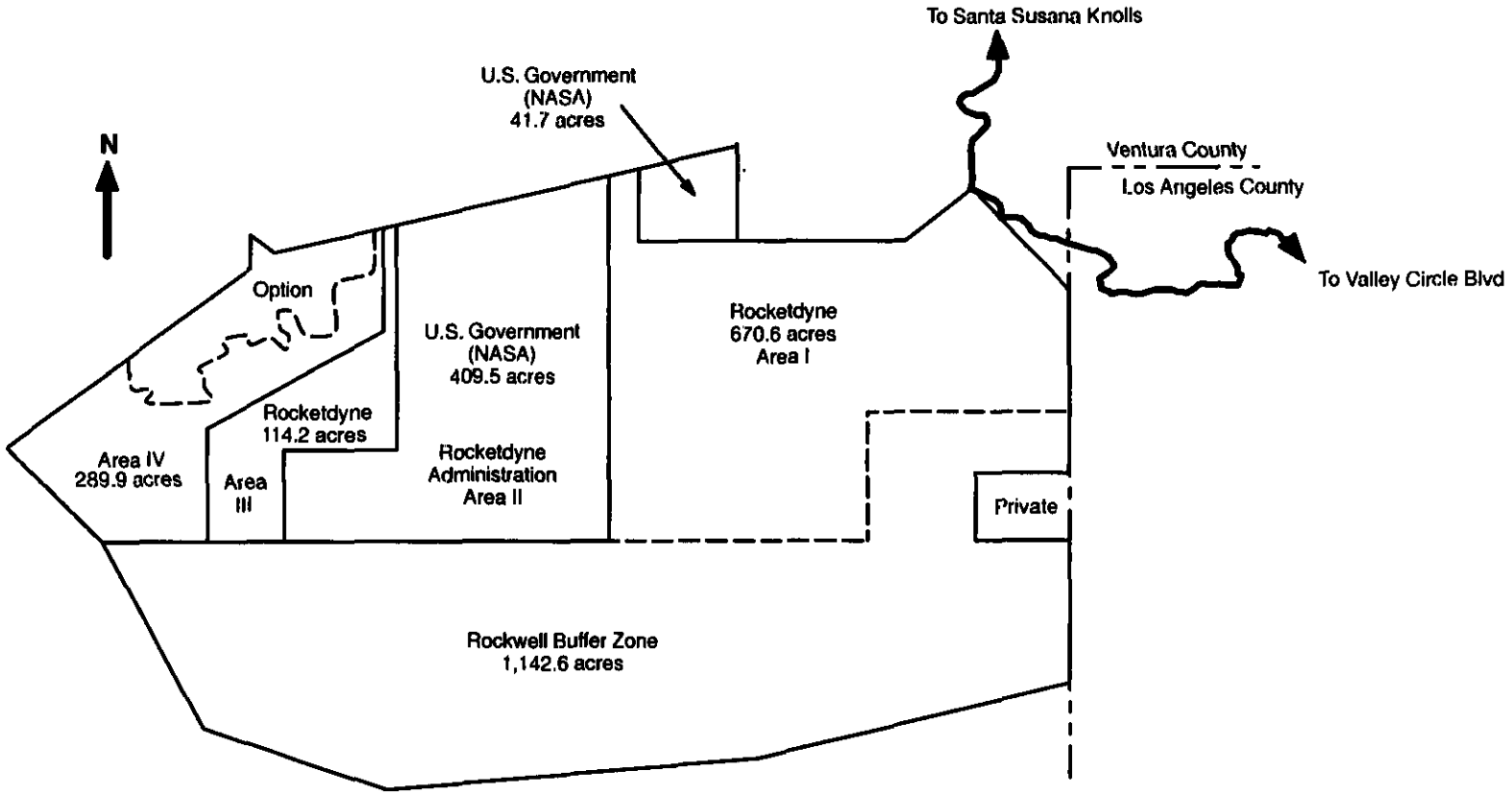
A portion of Area I and all of Area II are owned by the U.S. Government and assigned to the National Aeronautics and Space Administration (NASA). A portion of Area IV is optioned to the Department of Energy (DOE).

The purpose of this report is to present information on environmental and effluent monitoring of DOE-sponsored activities to the regulatory agencies, i.e., the U.S. DOE, the Nuclear Regulatory Commission (NRC), and the California State Department of Health Services (DHS) Radiologic Health Branch (RHB). For that reason, information concentrates on Area IV at SSFL, which is the only area where DOE activities have been performed. While the major focus of attention is radiological, this report also includes a discussion of nonradiological monitoring at SSFL.

Areas I, II, and III have been used for developing and testing rocket engines and propellants, lasers, and other energy technologies since 1954. No operations with nuclear fuel or nuclear reactors were conducted in those areas. Since 1956, Area IV has been used for work with nuclear materials, including fabricating nuclear reactor fuels, testing nuclear reactors, and disassembling used fuel elements. This work ended in 1987 and subsequent efforts have been directed toward D&D of the former nuclear facilities.

Work in nuclear energy R&D in what has become the Rocketdyne Division of Rockwell International Corporation began in 1946. During the evolution of these operations, small test and demonstration reactors and critical assemblies were built and operated, reactor fuel elements were fabricated, and used reactor fuel elements were disassembled and declad. These projects have been completed and terminated over the past 30 years. Most of this work was performed at SSFL and is described in detail in "Nuclear Operations at Rockwell's Santa Susana Field Laboratory—A Factual Perspective" (Reference 21 in the bibliography, Appendix B). No work with nuclear materials has been conducted since 1987, and the only work related to these operations during 1994 was the ongoing cleanup and decontamination of the remaining inactive nuclear facilities.

The nuclear operations have been conducted under State and Federal licenses and under contract to DOE and its predecessors. In October 1989, in response to corporate decisions to discontinue work with radioactive materials at SSFL, the 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.



Subdivisions				
Owner	Jurisdiction	Acres		Option
Rockwell	Rocketdyne – Area IV Rocketdyne Rockwell (Buffer)	289.9 784.8 1,142.6	→ 2,217.3	90.26
Government	NASA (former AFP 57) NASA (former AFP 64)	409.5 41.7	 451.2	
Total Acres			2,668.5	

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Figure 2–1. Santa Susana Field Laboratory Site Arrangement

The location of these sites in relation to nearby communities is shown in Figures 2–2 and 2–3. Undeveloped land surrounds most of the SSFL site. There is occasional cattle grazing on the southern portion and the Santa Monica Mountains Conservancy's Sage Ranch Park is at the northeastern boundary. No significant agricultural land use exists within 30 km (19 miles) of the SSFL site. While the land immediately surrounding SSFL is undeveloped, at greater distances there are suburban residential areas. For example, 2.7 km (1.7 miles) toward the northwest from Area IV is the closest residential portion of Simi Valley. The community of Santa Susana Knolls lies 4.8 km (3.0 miles) to the northeast, and a small truck farm exists approximately 7 km (4.4 miles) to the northeast. The Bell Canyon area begins about 2.3 km (1.4 miles) to the southeast, and the Brandeis–Bardin Institute is adjacent to the north. A sand and gravel quarry was operated approximately 2.4 km (1.5 miles) to the west but is now deserted.

The Los Angeles basin is a semiarid region whose climate is controlled primarily by the semipermanent Pacific high–pressure cell that extends from Hawaii to the Southern California coast. The seasonal changes in the position of this cell greatly influence the weather conditions in this area. During the summer months, the high–pressure cell is displaced to the north. This results in mostly clear skies with little precipitation. During the winter, the cell moves sufficiently southward to allow some Pacific lows with their associated frontal systems to move into the area. This produces light to moderate precipitation with northerly and northwesterly winds.

The release of airborne material at De Soto during the summer would generally be under a shallow inversion layer. Contrary to the situation at De Soto, the base and top of this inversion layer usually lie below the elevation of the SSFL site. Thus, any atmospheric release from the SSFL site during the summer would likely result in considerable atmospheric dispersion above the inversion layer prior to any diffusion through the inversion layer into the Simi or San Fernando Valleys. In the winter season, surface airflow is dominated by frontal activity moving easterly through the area. Storms passing through the area during winter are generally accompanied by rainfall. Airborne mixing varies depending on the location of the weather front relative to the site. Generally, a light to moderate southwesterly wind precedes these storms, introducing a strong onshore flow of marine air and producing slightly unstable air. Wind speeds increase as the frontal systems approach, enhancing mixing and dispersion. Locally, average wind speeds range from 0 to about 4.4 m/s, mostly from the north and northwest.

Surrounding the De Soto complex is light manufacturing, other commercial establishments, apartment buildings, and single–family houses. With the exception of the Pacific Ocean about 20 km (12 miles) south, no recreational body of water of noteworthy size is located in the surrounding area. Four major reservoirs providing domestic water to the greater Los Angeles area are located within 50 km (30 miles) of SSFL. However, the closest reservoir to SSFL (Bard Reservoir) is more than 10 km (6 miles) from Area IV. The nearest groundwater well that is used for a municipal water supply is more than 16 km (10 miles) from Area IV, north of Moorpark.

The SSFL site occupies 2,668 acres located in the Simi Hills of Ventura County, approximately 48 km (30 miles) northwest of downtown Los Angeles. The SSFL site is situated on rugged terrain which typifies mountain areas of recent geological age. Elevations of the site vary from 500 to 700 m (1,650 to 2,250 ft)

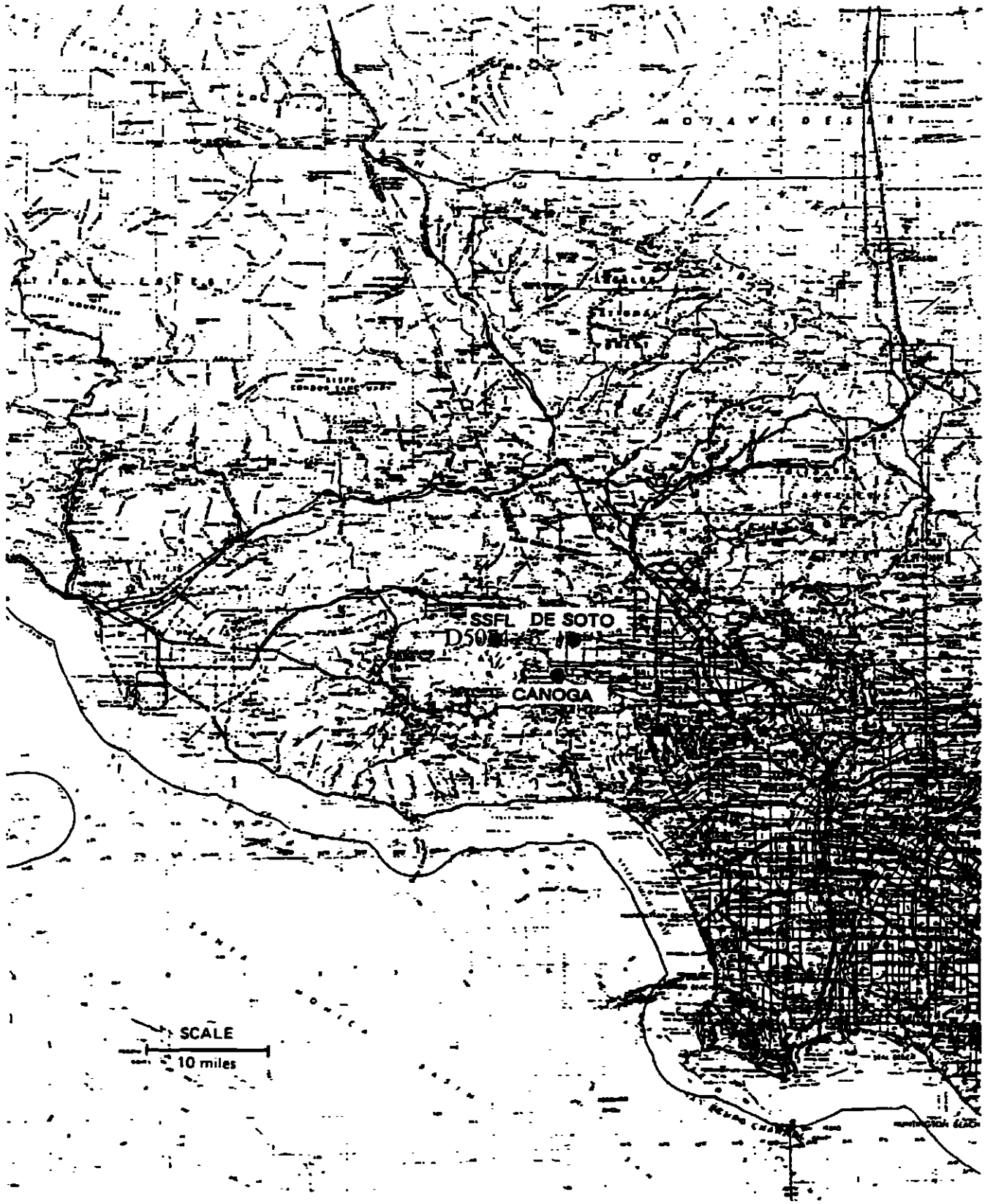

Figure 2–2. Map of General Los Angeles Area Showing Locations of Major Rocketdyne Facilities

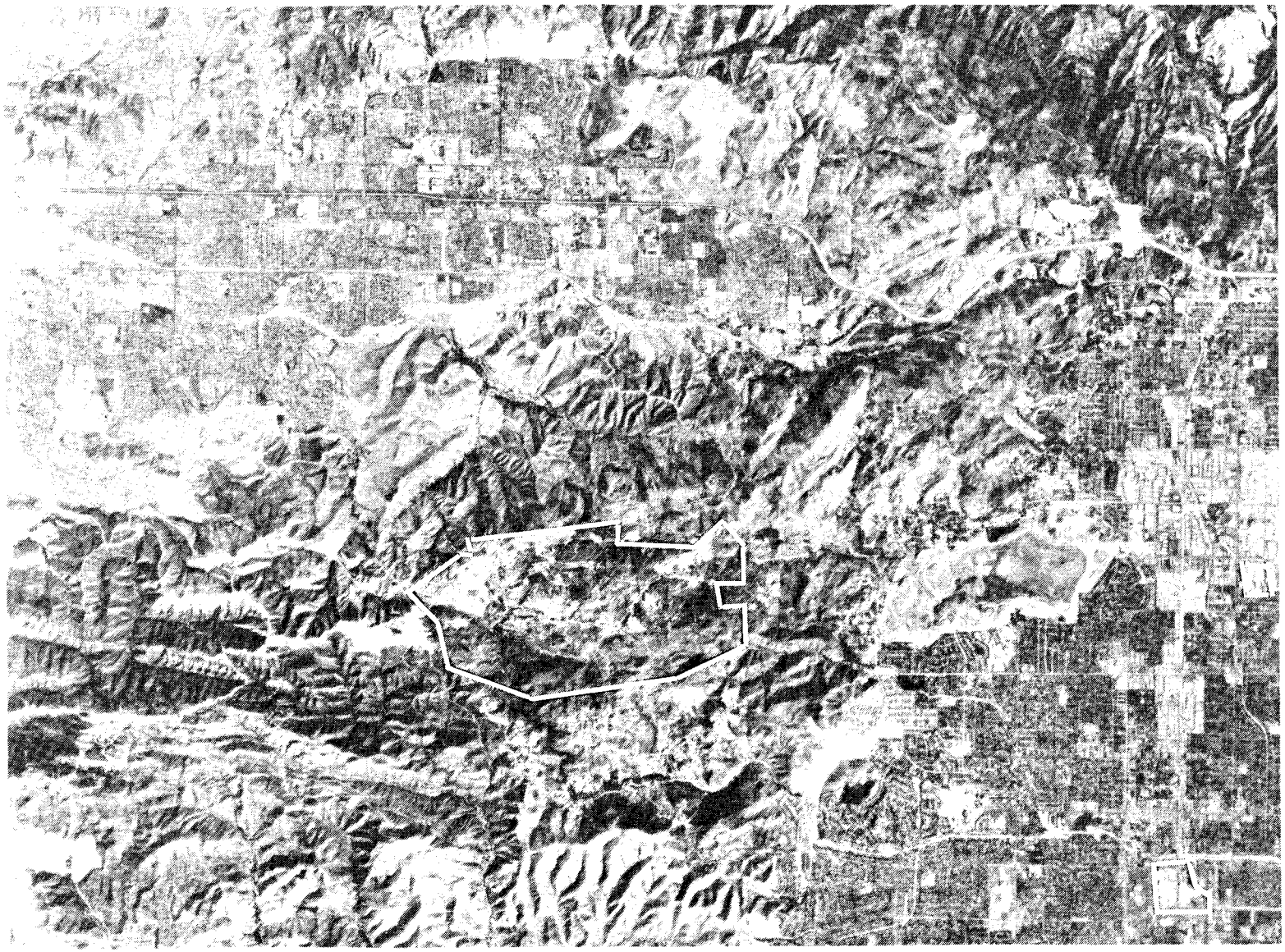

Figure 2–3. Area Surrounding SSFL (De Soto Site is Due East of SSFL, at Right Edge of Photo; Canoga Site, Lower Right Corner)

above sea level (ASL). Rockwell International– and DOE–owned facilities (Figures 2–4 and 2–5) share the Area IV portion of this site.

Within Area IV of the SSFL site is a 90–acre government–optioned area where DOE contract activities are conducted. Most of the work is performed by the Energy Technology Engineering Center (ETEC). The major operational nuclear installation within the DOE–optioned area is the Radioactive Materials Disposal Facility (RMDF). This facility has been used for storage of sealed irradiated fuel and for packaging radioactive wastes resulting from nuclear facility decommissioning operations. No nuclear fuel has been present at the RMDF since May of 1989 when the last packages of disassembled Fermi–reactor fuel were shipped to another DOE site. Radioactively contaminated water from the decontamination operations is evaporated and the sludge is dried and disposed as packaged dry waste together with other dry wastes at a DOE disposal site.

Two sealed radiation sources are used at the SCTI for process monitoring. The SSFL site also contains facilities in which operations with nuclear materials licensed by the NRC and radioactive materials licensed by the State of California were conducted. The principal licensed facilities are the Rockwell International Hot Laboratory (RIHL) (Building 020) and the radiation instrument calibration laboratory.

Licensed programs conducted during 1994 were directed toward D&D of the RIHL, which was last used for nuclear reactor fuel disassembly in 1987.

Some research licensed by the State of California using radioactive materials is conducted at the De Soto site (Figure 2–6) in the Building 104 Applied Nuclear Technology laboratories. Irradiation operations in the Gamma Irradiation Facility were terminated in 1994 and the radiation sources were shipped off–site. The De Soto location is at an altitude of 267 m (875 ft) ASL on generally flat terrain.

2.1 FACILITY DESCRIPTIONS

2.1.1 Santa Susana Field Laboratory Site

2.1.1.1 RIHL—NRC and California State–Licensed Activities

Operations at Building 020 that may have generated radioactive effluents in the past consisted of hot cell examination and decladding of irradiated nuclear fuels and examination of reactor components. Only filtered atmospheric effluents are released from the building during D&D activities. Since Building 020 was shut down in 1987, only decontamination of the facility was performed in 1994. No radioactive liquids are released from the facility. Prior radioactive material handled in unencapsulated form in this facility included the following radionuclides that are present in minor amounts as facility contamination: U, Pu, as constituents in the various fuel materials; and Cs–137, Sr–90, and Pm–147 as mixed fission products.

2.1.1.2 DOE Contract Activities

RMDF

Operations at Buildings 021 and 022 that may generate radioactive effluents consist of the processing, packaging, and temporary storage of liquid and dry radioactive waste material for disposal. Only filtered

Figure 2–4. Rocketdyne Division—Santa Susana Field Laboratory Site, Area IV

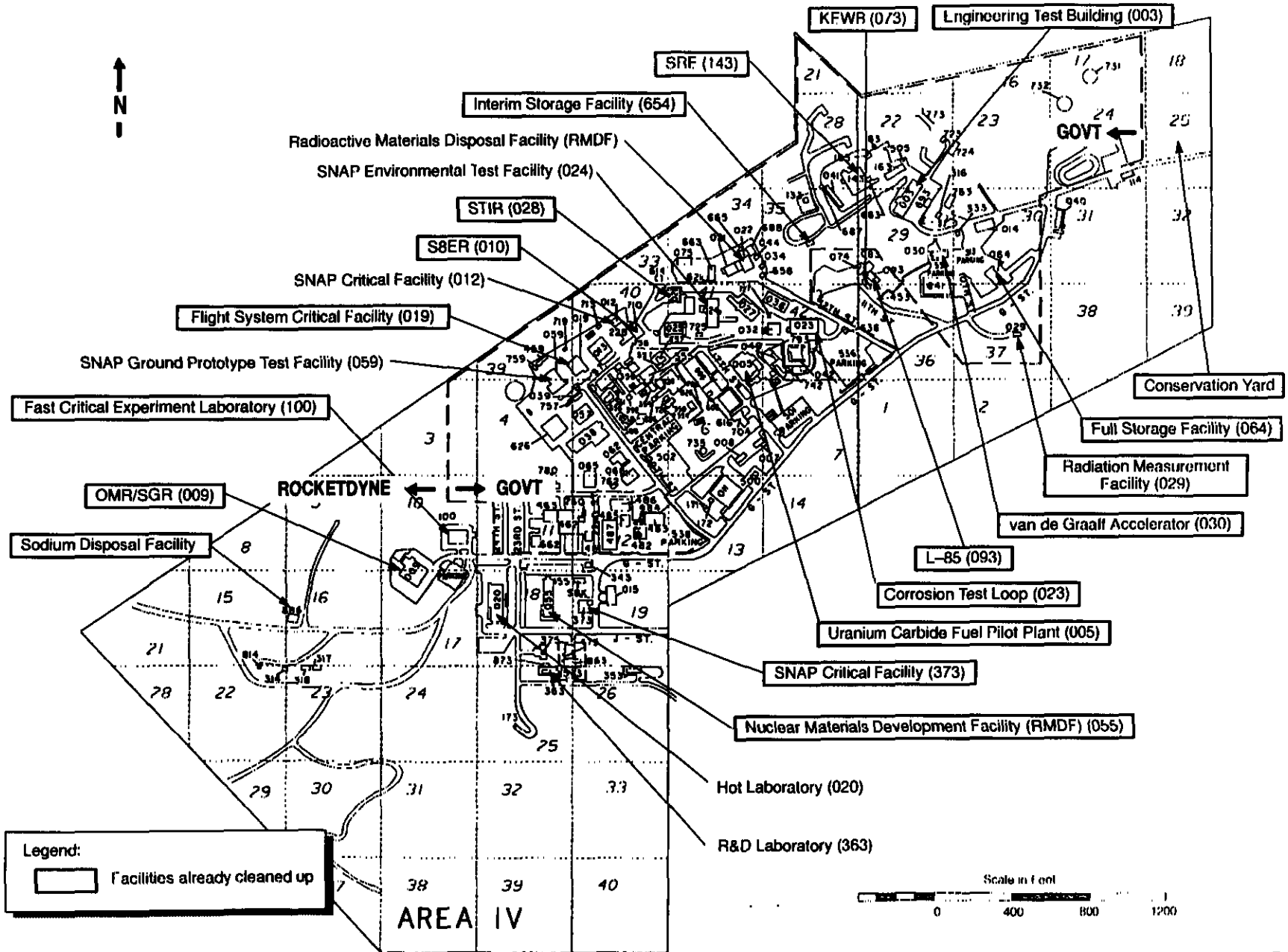

Figure 2–5. Map of Santa Susana Field Laboratory Area IV Facilities

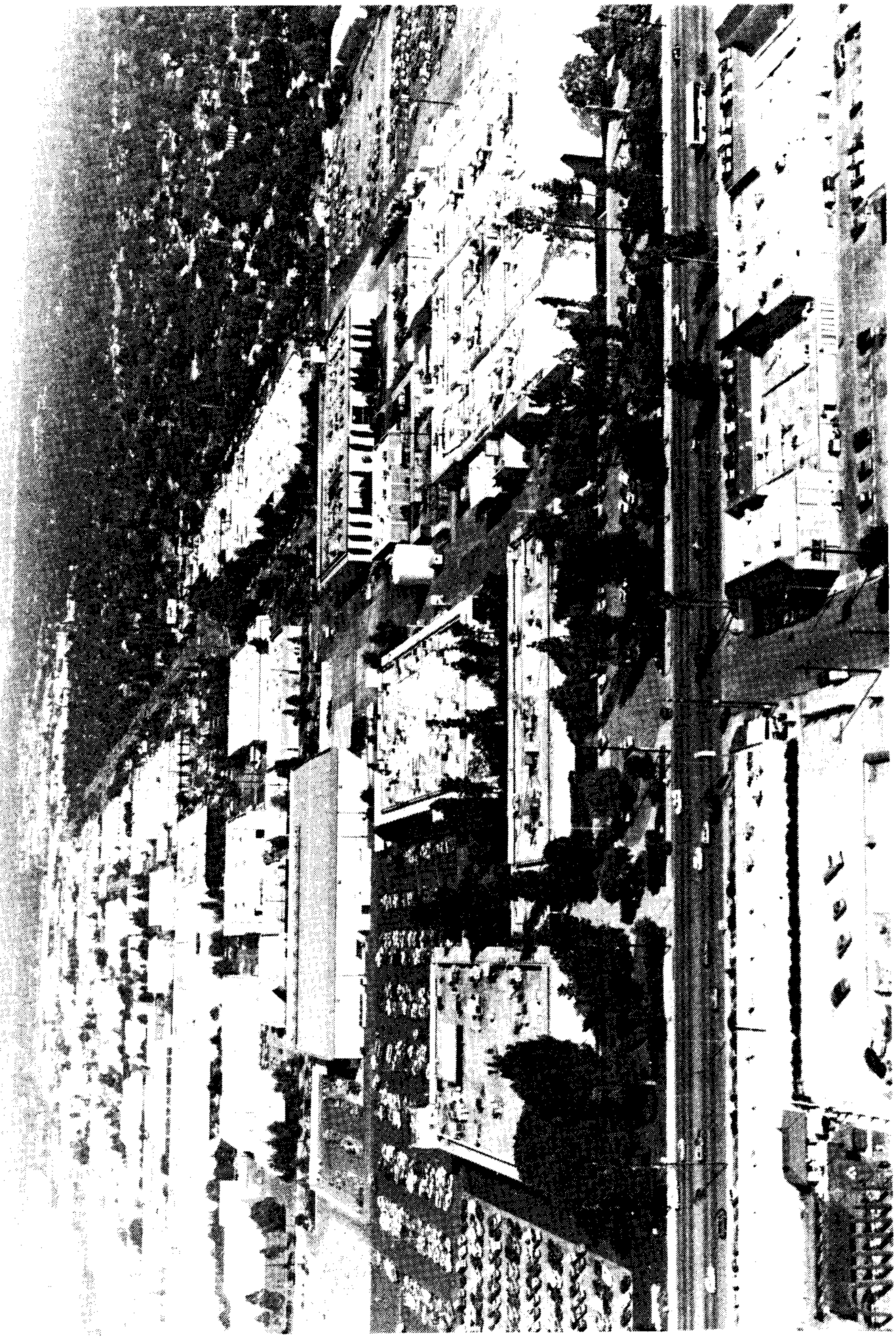

Figure 2–6. Rocketdyne Division—De Soto Site

atmospheric effluents are released from the building to uncontrolled areas. No radioactive liquids are released from the facility. Contamination from nuclear fuel and decontamination operations contains uranium and plutonium plus Cs–137, Sr–90, and Pm–147 as mixed fission products, and Co–60 and Eu–152 activation products.

Building 059

Operations at Building 059 that may generate radioactive effluents consist of removal of activated steel and concrete as part of the D&D of this former Systems for Nuclear Auxiliary Power (SNAP) reactor ground test facility. Only filtered atmospheric effluents are released from the building to uncontrolled areas. No radioactive liquid waste is released from the facility. Activation products consist primarily of Fe–55, Eu–152, and Co–60, and minimal amounts of H–3.

Buildings 005, 023, and 064

Buildings 005, 023, and 064 completed D&D activities in 1993. The Oak Ridge Institute for Science and Education performed verification surveys at Buildings 005, 023, and 064. The results confirmed ETEC survey results showing that these buildings met DOE guidelines for removal of the radioactive material management area (RMMA) designation. RMMA designation was removed by DOE in October 1994. Additionally, a request has been sent to the California Department of Health Services (DHS) Radiologic Health Branch (RHB) to release Building 005 for unrestricted use.

2.1.2 De Soto Site

2.1.2.1 Building 104—California State–Licensed Activities

Operations at Building 104 that could have generated radioactive effluents consist of research studies in applied physics and physical chemistry. Only minimal quantities of filtered atmospheric effluents are released from the building to uncontrolled areas. No liquid effluents are released. The encapsulated Co–60 sources in the Gamma Irradiation Facility were transferred to Neutron Products of Maryland and J. L. Sheperd and Associates of California in June 1994. All irradiation operations were terminated. The mass spectrometer laboratory continues to analyze low–level activated test samples for universities and national laboratories.

2.1.3 Canoga Site

Insufficient quantities of radioactive materials are used at the Canoga facility to warrant environmental monitoring. Radioactive materials at the Canoga facility are exempt quantities of C–14, Sr–90, and Ru–106. The C–14 is embedded in solid ceramic insulator tubes used in the Peacekeeper Stage IV ordnance firing unit switches. The strontium and ruthenium are encapsulated as sealed sources for a beta–backscatter analysis instrument for measuring material plating thickness.

3.0 COMPLIANCE SUMMARY

This section summarizes ETEC's compliance with federal, state, and local environmental regulations. Two main categories are discussed; Section 3.1 discusses compliance status, and Section 3.2 discusses current issues and actions.

3.1 COMPLIANCE STATUS

3.1.1 Comprehensive Environmental Response, Compensation, and Liability Act

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) regulates reporting and emergency response for hazardous substances released into the environment and for the cleanup of abandoned hazardous waste sites or other historical hazardous waste releases. Under the historical release authority of CERCLA, a Preliminary Assessment/Site Investigation (PA/SI) review of SSFL Area IV was conducted by the EPA Site Evaluation Section. A report of findings, dated 11 August 1989, was transmitted to ETEC in April 1990. Prior to ranking the facilities, the EPA had requested additional air monitoring be provided for SSFL. Rocketdyne submitted the last quarterly status report in June 1992. The EPA contracted an outside contractor, PRC Inc., to assist in the ranking of the facilities. The facility ranked below the criteria for being included on the National Priority Listing. There was no further activity on this in 1994. However, discussions with both the DOE and NASA customers have resulted in agreement to incorporate CERCLA–type protocols per DOE policy into the cleanup activities at SSFL.

The Superfund Amendments and Reauthorization Act (SARA) extended the regulatory provisions of CERCLA. SARA Title III requires extensive hazardous material reporting, community right–to–know and emergency response planning provisions. ETEC fully complies with SARA reporting requirements. The SSFL Hazardous Materials Release Response Business Plan and Inventory was issued to Ventura County Bureau of Fire Protection on 13 December 1993, addressing the following SARA Title III provisions:

1. Planning, Emergency Response
2. Reporting, Leaks and Spills
3. Reporting, Chemical Inventories.

SARA Title III also addresses reporting toxic chemical (Section 313) usage. Rocketdyne annually submits a Section 313 report to the Environmental Protection Agency (EPA) for toxic chemicals handled at ETEC facilities exceeding the reporting threshold quantity of 10,000 lb. In 1994, ETEC used ammonia and sulfuric acid exceeding the threshold quantity. Preliminary data for the toxic release inventory was submitted to the DOE. A final report was provided to the DOE by 26 June 1994. The DOE submitted the final report to the EPA by 1 July 1994.

3.1.2 Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA) gives the EPA broad authority to regulate the handling, treatment, storage, and disposal of hazardous wastes. DOE owns and ETEC operates two RCRA–permitted Treatment, Storage, and Disposal Facilities facilities. Permit numbers are listed in Section 3.2.5.

The Radioactive Materials Disposal Facility (RMDF) is operating under a Part A/California Interim Status Facility. This facility is used primarily for the handling and packaging of radioactive waste. The RCRA permit is required for the treatment and storage of small amount of mixed waste resulting from decontamination and decommissioning activities at ETEC. Final disposition of the mixed waste is being addressed under the Federal Facilities Compliance Act, Section 3.1.3.

The Hazardous Waste Management Facility (HWMF) includes a storage area (B/029) and a treatment facility (B/133) for reactive metal waste. The 5 year – RCRA Part B permit for the facility was renewed by the California Department of Toxic Substances Control (DTSC) in 1993. In February 1994 DTSC inspected the facility for compliance with the permit. No violations were noted. ETEC is in compliance with permit requirements.

RCRA also has governing authority of underground tanks which contain hazardous materials. ETEC Area IV has 14 underground storage tanks (USTs), 3 radioactive water and 11 sodium tanks. The radioactive water storage tanks are exempt from permitting by the Ventura County Environmental Health Division (VCEHD) per Article 2, Section 2621.a.11, Exemptions, California Underground Storage Tank Regulations. The California Department of Health Services and the Department of Energy are the lead agencies for tanks containing radioactive material. During 1994 one UST for radioactive water was removed as part of the D & D of the RIHL and stored at RMDF. The other two tanks are in operation at RMDF.

The 11 sodium tanks are permitted by VCEHD. During, November 1994, the VCEHD inspected the 11 sodium USTs and reviewed the Leak Detection and Monitoring Program to determine regulatory compliance status. Following this inspection, the VCEHD has required modifications with the existing program. Currently, these requirements are under review and plans are being developed for implementation of any required modifications during 1995.

During the November inspection VCEHD also reviewed ETEC for areas of compliance with RCRA generator handling requirements. No violations were noted.

3.1.3 Federal Facilities Compliance Act

ETEC is participating with the DOE Oakland Site Office (DOE–OAK) and the State of California in the Site Treatment Plans in accordance with the Federal Facilities Compliance Act (FFCA). A draft Site Treatment Plan was submitted on schedule. All known mixed wastes have been identified with a treatment plan or a storage location within the DOE complex. A small amount of waste requires additional characterization prior to determining the best repository/treatment options. The FFCA is scheduled to be finalized in 1995.

3.1.4 National Environmental Policy Act

The National Environmental Policy Act (NEPA) establishes a national policy to ensure that consideration is given to environmental values and factors in federal planning and decision–making. For those projects or actions that are expected to either affect the quality of the human environment or create controversy on environmental grounds, DOE assures that appropriate NEPA actions (Categorical Exclusion [CX],

Environmental Assessment [EA], Finding of No Significant Impact [FONSI], or Notice of Intent [NOI], draft Environmental Impact Statement [EIS], final EIS, Record of Decision [ROD]) have been incorporated into project planning documents. DOE has implemented NEPA as defined in Federal Register Volume 57, Number 80, pages 15122 through 15199.

ETEC subjectively assesses the environmental impact of each project planned for implementation. Based on the assessments, DOE is requested to issue determinations of compliance to the NEPA. In Calendar Year 1994, ETEC submitted 12 requests for NEPA determinations (see Appendix C). One request has been issued as a "Categorical Exclusion" determination and the other 11 requests are under review by DOE.

3.1.5 Clean Air Act

The Clean Air Act (CAA) resulted in federal regulations that set air quality standards and require state implementation plans, National Emissions Standards for Hazardous Air Pollutants (NESHAPs), New Source Performance Standards, and monitoring programs in an effort to achieve air quality levels beneficial to the public health and welfare. The SSFL is mainly regulated by the Ventura County Air Pollution Control District (VCAPCD) and must comply with VCAPCD Rules and Regulations. The EPA can enforce VCAPCD rules and also regulates pollutants such as ODS's under 40 CFR 82. The De Soto facility is under the jurisdiction of South Coast Air Quality Management District (SCAQMD). VCAPCD and SCAQMD Rules and Regulations incorporate, by reference, NESHAPs regulations as codified under the CAA.

3.1.5.1 Radiological

The results of radiological environmental monitoring indicate that there are no significant releases of man–made radiological material from Rocketdyne sites. Atmospheric discharge of radioactive materials and direct exposure during ETEC's environmental remediation and waste management operations are the only significant pathways to the general public.

Small amounts of radioactive materials may be released in ventilation exhaust from facilities at SSFL and De Soto, along with naturally occurring airborne radioactivity. These releases are minimized by the use of high–efficiency particulate air (HEPA) filters, and are continuously monitored by sampling the work-place air and the exhaust effluent. Radionuclide–specific analyses determine the radioactive composition of the effluents, and maximum off–site doses at the nearest residence are estimated by use of the EPA computer program CAP88–PC. The maximum individual annual exposure was estimated to be 1.8 x 10–6 mrem/yr for DOE operations at ETEC. Operations at the Rockwell International Hot Laboratory (RIHL) and the De Soto site were estimated to have resulted in 4.3 x 10–7 mrem/yr and 3.5 x 10–6 mrem/yr, respectively. All effective dose equivalents for the maximally exposed individual are far below the EPA NESHAPs limit of 10 mrem/yr, and below the action level of 1% of the limit (0.1 mrem/yr) as specified in 40 CFR 61, Subpart H (DOE facilities) and Subpart I (licensed facilities).

3.1.5.2 Nonradiological

The current VCAPCD permit, No. 0271, was issued in October 1993 and renewed for January 1994 through December 1994. In June 1994, an application was submitted to VCAPCD to permit a new Molten

Salt Oxidation Unit and to include the operation of this unit under the existing Molten Salt Test Facility. The existing permit issued on 18 October 1994 reflects the new operation.

VCAPCD Rule 74.15, sets limits for oxides of nitrogen (NOx) and carbon monoxide (CO) emissions on boilers, steam generators, and process heaters. The Sodium Component Test Installation (SCTI) completed installation of the new low–NOx burners in 1991 as well as the carbon monoxide Continuous Emissions Monitoring (CEM) system. An extended variance to the rule was applied for and granted, running through December 1992 to allow for source testing and adjusting of the H–1 and H–2 sodium heaters and the H–101 boiler to bring them into compliance. Further extensions of the variance were granted through November 1994. ETEC operated under Variance 392–3 until the amended Rule 74.15 was adopted on 8 November 1994. VCAPCD is in the process of revising permit No. 0271. ETEC has been assured by VCAPCD that ETEC is not in violation as long as VCAPCD is processing the permit renewal.

In March the VCAPCD conducted an inspection to review the CEM system calibration on H–I/H–2 heaters at SCTI and a Notice of Violation (NOV) was issued on 29 March 1994 because of an alleged calibration drift exceedance. Rocketdyne responded with a detailed letter of explanation (along with selected corrective actions) and a request for re–evaluation. VCAPCD issued a letter on 15 July 1994 accepting the Rocketdyne explanation with notification of no further action.

On 25 May the VCAPCD conducted the annual inspection for Permit No. 0271. No citations were issued from this inspection. Also, in September the VCAPCD was on–site to review the SCTI operations for amending, Rule 74.15.

Title V of the Clean Air Act requires issuance of a federal permit for the ETEC operations. VCAPCD met its initial responsibility by issuance of Rule 33, Part 70 Permits. The EPA has granted interim approval for Rule 33. A Title V permit application will be filed for ETEC 12 months after final approval of the rule by EPA.

Although ETEC has little or no ozone depleting substances (ODSs), Rocketdyne has for years maintained a Hazardous Materials Elimination Team to eliminate ODSs at Rocketdyne. This multifunctional team has as its charter to identify suitable alternatives for various toxic chemicals and has been instrumental in eliminating CFC–113 from all of Rocketdyne's Southern California manufacturing operations.

The permit application submitted to VCAPCD for an ethanol cleaning operation located at the Sodium Pump Test Facility (Building 043) was completed with the inclusion of adequate reactive organic compound (ROC) offsets. The current permit does not reflect the new ethanol cleaning operation, as the VCAPCD has yet to add it to the permit.

A permit modification application was submitted to VCAPCD on 3 June 1994 to update the permit for language changes, revisions to existing conditions and proposed operations. Included were changes to the Kalina Plant operations. The current permit reflects these changes.

3.1.6 Clean Water Act

The Clean Water Act (CWA) is the primary authority for water pollution control programs, including the National Pollutant Discharge Elimination System (NPDES) permit program. The NPDES program regulates point source discharges of surface water to drainage channels (i.e., to locations other than sewage systems), the preparation of Spill Prevention Control and Countermeasure (SPCC) plans, and the discharge of storm water runoff associated with industrial activities.

As part of the SSFL, ETEC surface water discharges are regulated under the California Water Code (Division 7) as administered by the California Regional Water Quality Control Board (CRWQCB). The existing SSFL NPDES Permit (CA0001309), which was revised and became effective 17 December 1992, is expected to remain in force through 10 November 1997.

During periods of rainfall which create adequate runoff for sampling, grab samples of surface water runoff are collected at the discharge points for the Perimeter Pond, R2A Pond, and the five storm water catch basins along the northwest slope of ETEC. When rainfall occurs more than once a week or continuously, samples are taken weekly. During non-rain event discharges from the Perimeter Pond and R2A Pond discharge locations, samples are collected during each discharge event. When discharges occur on a continual basis in excess of a month, samples are collected monthly. The sampling performed at the five northwest slope locations includes quarterly monitoring for a list of analytes referred to as "priority pollutants." There were three exceedences of permit limits, but there were no violations of the NPDES permit resulting from these analytical results.

The CRWQCB, in negotiation with the Rocketdyne staff, has eliminated existing Waste Discharge Requirements stemming from a 1959 permit for septic tanks and leach fields. Use of all septic tanks and leachfields has been discontinued.

Inland surface water quality objectives are established for effluent standards for off-site discharge of storm and industrial waste water via the SSFL water reclamation system. The revised NPDES Permit incorporated federal storm water regulations by requiring development and implementation of a site-wide Storm Water Pollution Prevention Plan (SWPPP) by 7 February 1993. This document is revised as needed and includes by reference many existing pollution prevention plans, policies, and procedures implemented at the SSFL site. Several key elements of the plan are in the process of being updated, including the required maps. These maps will be completed pending the completion of the new baseline facility topographic maps. Another key element, also in the process of being updated, is the development and implementation of Environmental Control Manual Procedure EC03.50 "SSFL Storm Water Pollution Prevention Requirements."

A program of groundwater and surface water sampling for the study of the ratios of stable isotopes of hydrogen and oxygen in Area IV and off-site northwest of Area IV commenced in October 1994. The study is intended to identify fractionated water sources that might be used for future tracer tests. Data obtained may provide information concerning isotopic variation with time, groundwater isotopic responses with time or rainfall events, and communication routes between surface and ground waters.

3.1.6.1 Radiological

All liquid radioactive wastes are processed for subsequent disposal at DOE disposal sites. Liquid radioactive wastes are not released into the environment and do not constitute an exposure pathway. Groundwater and surface water are sampled and analyzed to assure detection of any man–made radioactivity.

At SSFL, a large number of groundwater monitoring wells are sampled and analyzed periodically and no indication of man–made radioactivity has been found, with the exception of low levels of tritium in a localized area (maximum of 3,550 pCi/L), considerably below the Federal and State standard for drinking water suppliers.

The French drain at Building 059 is sampled weekly as part of the groundwater management program. This inactive facility was previously used for SNAP program reactor testing. These samples are tested for any transfer of gamma–emitting activation products from the underground reactor test vault containment into the surrounding soil by gamma spectroscopy. Activated materials include Co–60 and Eu–152, both of which are easily detected, and none have been found.

Surface water from two NPDES discharge points and five storm water runoff catch basins are also monitored. The Rocketdyne NPDES permit requires radiological measurements of gross alpha, gross beta, tritium, Strontium–90, Radium–226, and Radium–228. No NPDES samples exceeded drinking water supplier limits.

3.1.6.2 Nonradiological

Throughout Calendar Year 1994, discharges associated with the SSFL NPDES permit were for the most part in compliance with discharge standards. Three exceedances were noted as a result of 842 analyses from 29 sampling events. Zinc concentration was exceeded once and nitrate/nitrite as nitrogen was exceeded twice, but no NOVs were issued nor penalties assessed for 1994 relative to NPDES discharge requirements.

Characterization of the groundwater at the site continues. The most recent phase of the groundwater site characterization program approved by DTSC was completed in June 1994. The plan included nine new wells located in Area IV and off–site northwest of Area IV. In 1993, five of these nine wells were installed. In 1994, the four remaining monitoring wells were constructed 300 to 1,250 feet off–site and northwest of Area IV. No volatile organic compounds (VOC), including trichloroethylene (TCE) were detected in these off–site wells. TCE continues to be detected at concentrations ranging from 1.2 to 3.9 µg/L in groundwater about 75 to 250 feet off–site and northwest of Area IV. TCE and other VOCs were also detected in three areas along the northwestern property border.

3.1.7 Miscellaneous

3.1.7.1 U.S. DOE Tiger Team Assessment

ETEC has submitted a proposal to DOE to consolidate all remaining action plans as part of normal ETEC management practices. This proposal is under review by DOE. The status of the 33 action plans for which ETEC has lead responsibility is shown in Table 3–1.

Table 3–1. Status of Environmental Corrective Action Plans

Plan Number	Plan Title	Status*
AP001	Upgrade T059, T020, RMDF Stack Sampling System	W
AP002	Meteorological Data for AIRDOS–PC Code	W
AP003	Provide Compliant Ambient Air Sampling Program	E
AP004	Inadequate Physical Control of the Former Sodium Disposal Facility	C
AP005	Storm Water and Sediment Characterization – Northwest Area	C
AP006	ID and Implement Secondary Containment	C
AP007	Revisions to the SPEC and the FSCP	C
AP008	Drinking Water Monitoring	C
AP009	Sewage Collection System Investigation and Repair	F
AP010	Groundwater Protection Management Plan	C
AP011	Characterization and Monitoring of Vadose Zone Underlying B/886	C/R
AP012	Hydrogeologic Regime Characterization	C
AP013	Well Monitoring/Maintenance/Abandonment/Closure/Decommissioning	C
AP014	Decontamination of Sampling Equipment Document	C
AP015	Organic Vapor Monitoring Program	C
AP016	Waste Minimization Plan	T
AP017	Storage of Land Disposal Restricted Waste (LDR) Mixed Waste	C
AP018	Waste Verification Plan – RMDF and HWSA	F
AP019	Sewage Sludge Monitoring Plan	F
AP020	Incomplete Hazard Identification	T
AP021	Storage of Incompatible Chemicals	C
AP022	Quality Assurance Surveys of Vendor Analytical Laboratories	C
AP023	ETEC QA Surveillance and Audit of Rocketdyne Analytical Laboratory	C
AP024	Environmental Records QA	C
AP025	Pollution Prevention Awareness Program Plan	P
AP026	Development and Implementation of Environmental Monitoring Plan	E
AP027	Environmental Protection Implementation Plan Evaluation	E
AP028	Evaluation of Source Terms and Meteorological Data	C
AP029	Environmental Surveillance Plan	E
AP030	No Contingency Plan for Transuranic Waste	C
AP031	Procedure for Surveys of Radioactive Materials Shipments	C
AP032	Site Investigation/Remedial Activities Plan	C/R
AP033	Business Plan Amendment Document and Acutely HAZMAT Registration	Q

* – Status Codes
- C – Complete and closed out by DOE–OAK
- C/R – Complete and recommended for closure
- E – Will be complete upon funding of Environmental Monitoring Plan
- F – DOE funding required to complete
- P – Funding required to implement pollution prevention awareness program
- Q – Milestones complete except ongoing QA surveillance, recommended closeout
- T – Milestones complete except ongoing training, recommended closeout
- W – DOE funding required to complete, waiver of requirement recommended to DOE.

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3.1.7.2 Building 886 Former Sodium Disposal Facility Closure Order

The Building 886 Former Sodium Disposal Facility was used for removing sodium and sodium–potassium alloys from metal components. The site formerly consisted of an Upper Pond and a Lower Pond. A Clean–up and Abatement Order was issued by the Los Angeles Regional Water Quality Control Board for Closure of the Lower Pond. In compliance with the order, in 1992 roughly 7,000 yards of soil were removed from the Lower Pond, and this portion of the facilities was removed from the Toxic Pits Cleanup Act (TPCA) list. Excavation of the Upper Pond and portions of the western area was completed in 1993.

The entire site, including both the Upper and Lower Ponds is listed as a Solid Waste Management Unit (SWMU) with Cal–EPA DTSC. In May and June 1993, samples were taken from the area for chemical and radiological analysis. The chemical analysis indicated the presence of residual contaminants in the excavated region. The results from the radiological analysis showed no constituents above background levels. Although all soil has been removed, due to the residual chemical contaminants and overlapping jurisdiction in this area, additional work is being planned for closure of the entire area.

A systematic sampling of the Former Sodium Disposal Facility and surrounding area is expected to be initiated before the end of CY 1995. A health based risk assessment will then be performed. Further excavation at the facility will occur if the risk assessment determines the soils a risk to human health or the environment.

All excavated waste that contained added radioactivity and was RCRA/California hazardous was shipped to a disposal site during 1994. Currently, the low level radioactive waste is still stored at RMDF awaiting shipment in 1995.

3.1.7.3 Public Participation

Ongoing quarterly meetings of the EPA chaired SSFL Work Group, consisting of representatives of various regulatory agencies and several appointed community representatives, were supported with information regarding environmental monitoring, both radiological and nonradiological, and remediation activities. Similarly, a public permit hearing was attended and supported by appropriate staff members.

Following the 17 January 1994 Northridge earthquake, Rocketdyne sent a letter to residents surrounding the Santa Susana Field Laboratory to assure them of the structural integrity of the facility following the earthquake and subsequent aftershocks.

ETEC and Rocketdyne met with neighboring homeowner groups to provide information about current operations and environmental programs, including site monitoring and cleanup activities.

The Los Angeles Community Reuse Organization (CRO), an independent community group, was established by the Department of Energy. The charter of the CRO is to encourage greater use of the ETEC facility by private research firms in an attempt to attract new business and jobs to the region. As part of the efforts of the CRO to create awareness about the facility, ETEC hosted three community seminars. For local business, a company workshop was also held to assist area industry through information sharing.

A guided bus tour of SSFL including ETEC was provided for the public during 1994. This tour was available to interested persons by reservation and covered the entire SSFL site. A total of 90 individuals, primarily from local communities surrounding the SSFL facility, participated in this tour. The visitors were provided with a presentation about current site activities and environmental monitoring and remediation activities. Representatives from Rocketdyne's various program and functional areas were available to answer questions following the formal presentation.

Rocketdyne is working with local colleges and universities, providing field studies in environmental technology to give students an opportunity for hands–on experience with current environmental monitoring and sampling techniques. In addition, they had the opportunity to work with the chemist performing environmental analytical methods in a state–certified analytical chemistry laboratory environment.

An SSFL site–wide Public Communication Program has been prepared in draft form. This site–wide program has the goal of consistent communication regarding all aspects of the SSFL environmental restoration programs, including ETEC activities. The program includes planned activities for communication of the details of the various environmental projects at SSFL. These communication activities include fact sheets, newsletters, town hall meetings, and community neighborhood group meetings.

Rocketdyne's Environmental Communications department continues to respond to public calls concerning environmental issues and remediation activities at SSFL including the ETEC site.

3.1.7.4 Site Boundary Exposures

The external radiation exposure estimates at the maximum exposed boundary location and at the nearest residence are based on results from site ambient radiation dosimeters and several facility workplace radiation dosimeters. The external exposure from direct radiation at the maximum exposed boundary location for ETEC and the SSFL was estimated from the 1994 measurements to correspond to an average annual dose of about 7.5 mrem above natural background. A similarly calculated value of 0.00017 mrem/yr was found for the nearest residence. These values are considerably below the DOE long–term limit of 100 mrem/yr. There was no measurable man–made radiation exposure from the De Soto facility at the site boundary and the nearest neighbor. The average of the on–site dosimeters showed no statistically significant difference from that of off–site dosimeters used to determine background.

3.1.7.5 U.S. DOE Environmental Appraisals

The most recent environmental appraisal was performed by DOE in November 1993. The first of two findings stated that the ALARA (As Low As Reasonably Achievable) program did not address all factors and issues defined in the DOE Guidance on the Procedures in Applying the ALARA Process for Compliance with DOE Order 5400.5, primarily environmental considerations. The appropriate Rocketdyne document was revised 15 December 1993 and sent to DOE. The second finding, the need to develop and update procedures for laboratory analysis using the Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance (DOE/EH–0173T), is currently being addressed.

In June 1994, a waste management audit was performed by Hanford Site personnel. Rocketdyne was granted "Approved" generator status for low–level and mixed waste based on this audit.

3.2 CURRENT ISSUES AND ACTIONS

3.2.1 Environmental Monitoring and Site Characterization

The DOE–OAK self–assessment, the ETEC self–assessment, and the Tiger Team assessment acknowledged the requirement for Rocketdyne to prepare an environmental monitoring plan (for both radiological and nonradiological monitoring) and for DOE–OAK to provide funds for the preparation of such a plan to meet the requirements of DOE Orders 5400.1, 5400.5. draft 10 CFR 834 and DOE/EH–0173T. A comprehensive plan was approved by DOE on 7 March 1994. Implementation of the plan has been delayed pending issuance of the final version of 10 CFR834. Full compliance with the requirements of 10 CFR834 will be achieved within one year.

ETEC also prepared a comprehensive Radiological Characterization Plan (RCP). Procedural plans for the RCP were finalized with survey activities having begun in March 1994. Approximately 45% of the original ambient gamma survey was completed in 1994. Based on the results of the survey completed in 1994 the scope of the site survey is being re–evaluated to complete field activities in 1995.

3.2.2 Epidemiological Study

As a result of attention associated with DOE activities, the State of California legislators authorized an epidemiological study of workers. The California Public Health Foundation has been awarded DOE grant funds and in February 1993 an advisory panel selected the University of California at Los Angeles (UCLA) to perform the study. The 18–month study will cover radiological and nonradiological health effects on workers. UCLA researchers began the study January 1994 with a review of bioassay records, and compilation of external exposure records. The review of radiological exposure records and the compilation of death records have been completed. The initial scope of the study has been expanded to include non–DOE workers. As expected, historical data on chemical exposures are sparse and worker location codes are not proving useful in determining an employee's potential exposure to chemicals in specific buildings, on specific projects, or at specific times. Therefore, it is questionable whether any meaningful dose reconstruction or conclusions related to chemical exposure will be forthcoming.

3.2.3 Resource Conservation and Recovery Act

Pursuant to Health and Safety Code, Section 25187, Cal–EPA, Region 3, DTSC issued on 2 December 1992 a Stipulated Enforcement Order to Rockwell International Corporation regarding SSFL, including ETEC. The Order was issued by the State Attorney General's office and requires Rockwell to comply with specific terms and conditions, i.e., a Corrective Action.

Under the Hazardous and Solid Waste Amendments of 1984, RCRA facilities are generally brought into the corrective action process when an agency is considering a RCRA permit application for the facility or when a release justifying action under Section 3008(h) is identified. The SSFL was initially subject to the corrective action process in 1989 by EPA, Region IX. EPA partially completed the agency–conducted

RCRA Facility Assessment (RFA) and has issued an interim final on the RFA (10 July 1991). The EPA has performed the Preliminary Assessment Report (i.e., record search) and the Visual Site Inspection portions of the RFA process. However, the sampling visit step of the RFA process was not conducted by the EPA to confirm or disprove suspected releases. There are 11 SWMUs and 3 Areas of Concern (AOC) identified in Area IV.

The State of California has since obtained final RCRA authorization and has become the lead agency in implementing the corrective action process for the SSFL. ETEC has performed soil sampling at various SWMUs and AOCs that were identified in the RFA report. This activity is the equivalent of the RFA sampling visit. This has enabled ETEC to determine if further action and/or interim measures will be necessary for SWMUs to be incorporated into the RCRA Facility Investigation (RFI).

The current conditions report and a draft of the RCRA Facility Investigation Work Plan for the Area IV SWMUs were submitted to the DTSC in October 1993. Currently one SWMU, the Building 056 Landfill, has been proposed for the RFI. In 1994, DTSC issued a letter to Rocketdyne conditionally approving the draft RFI work plan. Activities are under way to respond to DTSC comments, which will be addressed in the addendum to the work plan.

The Waste Minimization Program at ETEC operations consists primarily of recycling and reusing sodium hydroxide that is generated from treatment of sodium at the HWMF. Waste minimization opportunities are currently being investigated for the SCTI operations. Waste minimization is also an integral part of planning and implementing any environmental restoration project or D&D activity.

3.2.4 Clean Water Act

Water quality objectives set forth by the current NPDES permit are being met on a consistent basis. Previous turbidity problems resulting from cracked sewage pipes that had allowed water infiltration, and problems with the control unit at the Area III Sewage Treatment Plant (servicing Area IV) have been repaired since the last summary. A large section of sewage line was replaced during 1993, and further repairs were made in 1994. Some upgrades have been completed at the Area III Sewage Treatment Plant during 1994 with future upgrades still being pursued.

The Spill Prevention Control and Countermeasure (SPCC) plan serves to identify specific procedures for handling oil and hazardous substances to prevent uncontrolled discharge into or upon the navigable waters of the State of California or the United States. The SPCC for ETEC was updated on 13 December 1993 and was submitted to all local emergency response agencies.

3.2.5 Permits and Licenses (Area IV)*

Listed below are the permits and licenses applicable to activities in Area IV.

Permit	Facility	Valid
Air (VCAPCD)		
0271	Combined permit renewal	1/1/95–12/31/95
Treatment Storage (EPA)		
CAD000629972 (93–3–TS–002)	Hazardous Waste Management Facility (B/133 and B/029)	11/30/93–11/30/03
CA3890090001	Radioactive Materials Disposal Facility (RMDF)	Part A interim status updated 4/93
NPDES (CRWQCB)		
CA0001309	Santa Susana Field Laboratory	12/7/92–11/10/97
Nuclear Regulatory Agency		
SNM–21	Rockwell International Hot Laboratory (B/020)	Amendment 8 issued 4/20/92 ongoing
State of California		
Radioactive Materials License (0015–70)	All Rocketdyne facilities	Last major revision 8/29/86. Amendment 90 issued 3/22/95. Latest application under review.
Well Permit (VCPWA)		
3455	Santa Susana Field Laboratory (Well Permits 1808, 2138, 2322, 2328, 2331, 2342, 2916, and 3359 have authorized installation of wells since 1990. Future wells will be installed under Permit 3455.)	Issued 7/1/93

*Extremely hazardous waste permits are requested and granted on an as needed basis in the state of California. The extremely hazardous waste permits are issued for a one–year duration, at which time the permit expires and a new permit must be applied for when needed. The two permits 3–920624–02 and 3–920624–06 were the only active hazardous waste permits for Area IV in 1993.

The waste discharge requirements for the sewage treatment plant in Area III that receives the Area IV sewage are included in the NPDES permit.

There were 14 underground storage tanks permitted in Area IV during 1994. A list of these tanks can be found in Table 3–2.

Table 3–2. SSFL Current Underground Storage Tanks

UST	Location	Capacity (gallons)	Tank Type	Contents
UT–7	Bldg. 022	3,000	Stainless Steel Vaulted	RA water[a]
UT–15	Bldg. 022	8,000	Stainless Steel Vaulted	RA water[a]
UT–16	Bldg. 021	200	Stainless Steel Vaulted	RA water[a]
UT–20	Bldg. 826	12,000	Stainless Steel Vaulted	Sodium
UT–21	Bldg. 826	10,000	Stainless Steel Vaulted	Sodium
UT–23	Bldg. 032	5,500	Stainless Steel Vaulted	Sodium
UT–24	Bldg. 059	12,000	Stainless Steel Vaulted	Sodium
UT–29	Bldg. 356	13,000	Stainless Steel Vaulted	Sodium
UT–30	Bldg. 356	10,000	Stainless Steel Vaulted	Sodium
UT–31	Bldg. 356	10,000	Stainless Steel Vaulted	Sodium
UT–32	Bldg. 356	10,000	Stainless Steel Vaulted	Sodium
UT–33	Bldg. 356	12,000	Stainless Steel Vaulted	Sodium
UT–34	Bldg. 462	36,000	Stainless Steel Vaulted	Sodium
UT–35	Bldg. 462	34,000	Stainless Steel Vaulted	Sodium

[a] – Regulated by U.S. Department of Energy (DOE)
RA – Radioactive

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4.0 ENVIRONMENTAL PROGRAM INFORMATION

The purpose of the environmental program is to detect and measure releases of hazardous materials and identify other undesirable impacts on the environment. It includes remediation efforts to correct or improve impacted conditions at the site and prevent off–site effects. For this purpose, the environment is sampled and monitored, effluents are analyzed, and the condition and uses of the surrounding environment are reviewed. A direct goal of this program is to demonstrate compliance with applicable regulations.

The basic policy for the control of radiological and chemical hazards requires that adequate containment of such materials be provided through engineering controls and that facility effluent releases and external radiation levels be reduced to as low as reasonably achievable through rigid operational controls. The environmental monitoring program provides a measure of the effectiveness of safety procedures and of the engineering safeguards incorporated into facility designs. Gross alpha and beta radiation analyses are performed for screening purposes, and radionuclide–specific radiochemistry analyses are performed on representative environmental samples. Facility atmospheric effluent sample filters and ambient air sample filters for 1994 were composited from each sampler for radiochemistry analysis by Teledyne Brown Engineering Environmental Services.

The radiological environmental monitoring program was initiated in 1952 for nuclear operations by North American Aviation, a predecessor to the current Rockwell International organization. At that time, a program of soil and vegetation sample collection and analysis was begun to monitor for possible environmental effects from nuclear research and development (R&D). This program was designed with the primary purpose of adequately surveying environmental radioactivity to ensure that operations would not contribute significantly to local radioactivity. Evolving program changes have reflected that primary objective. Environmental sampling was subsequently extended to the then proposed Sodium Reactor Experiment (SRE) site in the Simi Hills in May 1954. Sampling was also begun in the Burro Flats area, southwest of SRE. Other changes were made to the program as new facilities came into operation and as older facilities were closed. After review of the needs and results of the environmental monitoring program in 1986, sampling of vegetation for radioactivity analysis was terminated and soil sampling frequency was reduced to quarterly. This was based on reviews of the sampling program and the continuing reductions in the nuclear operations being conducted at the site. At that time, all nuclear reactors and the plutonium laboratory had been decommissioned. The reduced nuclear operations and the historical data led to the conclusion that quarterly sampling was adequate to detect any releases of radioactivity that might occur and that would be identified by other monitoring methods. Although the reduction in the number of on–site soil samples taken annually was significant, the number of off–site soil samples was not reduced at that time. After further review of on–site and off–site soil radioactivity data, routine off–site soil sampling was discontinued as a formal part of the environmental monitoring program. In view of the extreme reduction in radioactivity and lack of any indication of radioactive contamination spread by routine and special surveys and inspections, routine soil sampling was terminated at the end of 1989.

Occasional gamma–spectrometry analyses of bulk samples such as soil, water, and ambient air sample filters confirm that the major radionuclides present are normally those of the naturally occurring thorium

and uranium decay chains, plus other natural radionuclides such as the primordial K–40, and Be–7 produced by cosmic ray interactions in the atmosphere.

In addition to environmental monitoring, workplace air and atmospheric effluents are continuously monitored or sampled, as appropriate. This directly measures the effectiveness of engineering controls and allows remedial action to be taken before a significant release of radioactivity could occur.

5.0 ENVIRONMENTAL RADIOLOGICAL PROGRAM INFORMATION

The selection of monitoring locations was based on several site–specific parameters such as topography, meteorology, hydrology, and the location of nuclear facilities. The prevailing wind direction for the SSFL site is generally from the north and northwest, with some seasonal diurnal shifting to the southeast quadrant. Most rainfall runoff at the SSFL site flows through several natural watercourses and drainage channels and is collected in two large–capacity retention ponds. This water may be discharged off–site into Bell Canyon to the south or it may be reused for industrial purposes.

Gross alpha and beta measurements are used for screening purposes and to permit a long–term historical record of radioactivity in the environment. For water, these measurements also permit direct comparison with the screening limits established by EPA for suppliers of drinking water. Ventilation exhaust and ambient air samples are counted for gross alpha and beta radioactivity and are also analyzed for specific radionuclides. Detailed analyses of these samples permit more accurate estimates of dose for the air pathway. The following discussion presents a brief summary of pathway dose analysis results for SSFL and De Soto for 1994.

DOE Facilities at SSFL (Area IV)

The RMDF and Building 059 have continuous effluent monitoring. Buildings 005, 023, and 064 have been decontaminated and the RMMA designation was removed by DOE in October 1994. Buildings 012 and 024 are inactive with no effluent, and thus no effluent monitoring. Airborne releases from the RMDF and Building 059 are detailed in Table 5–1, sheets 1 and 3, and are shown to be below the derived concentration guides (DCGs) of DOE Order 5400.5. Airborne and direct radiation doses from RMDF and Building 059 are detailed in Table 5–12 and are shown to be below the dose limits of DOE Order 5400.5 and EPA NESHAPs limits of 40 CFR 61, Subpart H. Key results are discussed below.

At the site boundary line location nearest to the RMDF, the external annual exposure from direct radiation is estimated to correspond to an average annual dose of about 7.5 mrem above natural background, and an annual dose of 0.00017 mrem is calculated for the nearest residence. These values are below the DOE long–term limit of 100 mrem/yr as specified in DOE Order 5400.5 "Radiation Protection of the Public and the Environment" (2/8/90). The boundary–line exposure is a conservative estimate of potential dose, in that the rugged terrain at the site boundary nearest the RMDF precludes anything more than the possible rare and temporary presence of any person at that location. These values were determined by calculating the exposure expected at the boundary and nearest residence on the basis of the highest annual result for area dosimeters in place around the facility. For the nearest residence, radiation attenuation by the air reduces direct radiation to levels indistinguishable from normal background. In addition, intervening irregular rock formations and hills completely shield off–site locations from the radiation sources. Essentially only natural background radiation inherent to the residence location would be present.

Dose calculations were performed to demonstrate compliance with the NESHAPs standard. At the location of the Maximally Exposed Individual, the Effective Dose Equivalent for DOE operations during 1994 was 1.8×10^{-6} mrem. The EPA limit for a DOE site is 10 mrem/yr, as specified in 40 CFR 61, Subpart H. Potential releases from these facilities are so low that, even assuming absence of HEPA filters, estimated

doses would be below the level requiring continuous monitoring. However, continuous monitoring is still being performed as a best management practice.

In addition to the above point sources, analyses were performed to determine the maximum estimated individual dose due to potential releases from "area" sources. The area sources are the RMDF pond and the RMDF north slope. Dry sediment from the RMDF pond and soil in the RMDF north slope were subject to possible airborne suspension by the wind.

The maximum estimated individual dose due to potential releases is 8×10^{-6} mrem for 1994. Since releases from the area sources were too small and diffuse to permit accurate measurements, potential releases were estimated using the same method used in the RESRAD computer program (ANL/ES–160), for calculation of airborne radioactivity due to resuspension of soil by the wind. These estimated releases were used as input in the CAP88–PC program to perform the area source dose assessments. Releases from these sources have not been detected by on–site continuous ambient air sampling.

NRC Licensed Facility at SSFL (Area IV)—RIHL

Airborne releases from the Rockwell International Hot Laboratory (RIHL) are detailed in Table 5–1, sheet 2, and are shown to be below the maximum permissible concentrations (MPCs) of 10 CFR 20.1301 and State of California, CCR Title 17, Section 30269. Airborne and direct radiation doses at the site boundary are detailed in Table 5–13 and are shown to be less than the dose limits of 10 CFR 20.105 and State of California, CCR Title 17, Section 30253.

Direct radiation dose at the nearest site boundary is 0.018 mrem/yr and less than 2×10^{-6} mrem/yr at the nearest residence, compared to annual NRC and State of California limits of 100 mrem/yr. Airborne effluent is a factor of 10^4 less than the isotopic MPCs of the NRC and State of California. Nearest receptor dose from airborne effluent from RIHL is 4.3×10^{-7} mrem/yr, and, though not applicable to NRC licensed facilities, this compares well with the EPA NESHAPs limit of 10 mrem/yr from 40 CFR 61, Subpart H. Even in the absence of HEPA filters the dose from RIHL would still be below the level requiring continuous monitoring; however, continuous monitoring is still being performed as a best management practice.

State of California Licensed Facility at De Soto—Building 104

Airborne releases from Building 104 at the De Soto facility are detailed in Table 5–1, sheet 4, and are shown to be below the MPCs of State of California, CCR Title 17, Section 30253. Airborne and direct radiation doses at the site boundary are detailed in Table 5–14 and are shown to be less than the dose limits of State of California, CCR Title 17, Section 30253.

There was no noticeable man–made direct radiation dose from Building 104 at the site boundary and nearest neighbor. Analysis of the De Soto facility dosimetry resulted in an average value of 97.7 mrem/yr with a maximum of 106 mrem/yr. Off–site dosimetry used to estimate a background level showed the background to be 96 mrem/yr. Airborne effluent from Building 104 was a factor of 10^4 less than the isotopic MPCs for the State of California. Nearest receptor dose from airborne effluent was 3.5×10^{-6} mrem/yr, which is less than the EPA NESHAPs limit of 10 mrem/yr from 40 CFR 61, Subpart I.

In the tables that follow, the data are generally presented in an uncensored manner. That is, analytical results that were less than the procedure background value are shown as negative values and results that did not indicate the presence of a radionuclide that could have been detected by the analytical method are shown as "not detected." In showing comparative data, the negative values are included to permit a complete and balanced view of the results. Omission of the negative values would significantly bias the presentation. Censoring of the results by substituting zero for negative values would produce a misleading impression of environmental conditions, and an incorrect estimate of the average values.

5.1 *EFFLUENT MONITORING*

Workplace ventilation is provided in all areas where unencapsulated or unpackaged radioactive material is handled, such as in the RIHL decontamination project (in the hot cells) and in the decontamination and packaging rooms at RMDF (where equipment is decontaminated and radioactive waste is repackaged). This assures protection of the workers from inhalation of airborne radioactive material and prevents the spread of radioactive contamination into the adjacent clean areas. The ventilation exhaust is passed through HEPA filters before being discharged to the atmosphere, to prevent the release of airborne radioactivity. The filtered air generally contains less long–lived radioactivity than does ambient air, caused by the naturally occurring radionuclides in the atmosphere. Essentially all short–lived radioactivity in the air is caused by the naturally present radon daughters, which dominate the airborne activity.

The ventilation exhaust is sampled at several facilities to measure the effluent radioactivity. Data from this sampling is used to demonstrate compliance with NRC, State RHB, DOE, and EPA standards. The U.S. EPA regulates airborne releases of radioactivity from DOE facilities under 40 CFR 61, Subpart H (NESHAPs) and from NRC licensed facilities under 40 CFR 61, Subpart I.

Effluents that may contain radioactive material are released at the Rocketdyne Division facilities as the result of operations performed under contract to DOE, under NRC Special Nuclear Materials License SNM–21, and under the State of California Radioactive Material License 0015–70. The specific facilities are identified as RMDF, Building 059, and RIHL at SSFL, and Building 104 at the De Soto complex.

The only potential release of radioactivity to uncontrolled areas is by way of filtered discharge from the RMDF, the RIHL, Building 059, and Building 104. No contaminated liquids are discharged to uncontrolled areas.

The level of radioactivity contained in all atmospheric effluents is 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. The 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 from the RMDF, the RIHL, Building 059, and De Soto 104 are shown in Table 5–1. The total shows that no significant quantities of radioactivity were released in 1994.

Table 5–1. Atmospheric Effluents to Uncontrolled Areas
(Sheet 1 of 4)

SSFL/RMDF – 1994	
Effluent volume (m^3)	194,059,967
Lower limit of detection, LLD	
Gross alpha (μCi/mL)	3×10^{-16}
Gross beta (μCi/mL)	1×10^{-15}
Air volume sampled (m^3)	26,280
Annual average concentration in effluent	
Gross alpha (μCi/mL)	2.83×10^{-16}
Gross beta (μCi/mL)	2.16×10^{-14}
Maximum observed concentration	
Gross alpha (μCi/mL)	1.39×10^{-15}
Gross beta (μCi/mL)	1.60×10^{-13}
Activity released (μCi)	
Gross alpha	0.05
Gross beta	4.20

Radionuclide–Specific Data

Radionuclide	Half-Life (yr)	Activity Detected (pCi)	Annual Release (μCi)	Analysis LLD (pCi)	Release LLD (μCi)	Average Exhaust Concentration (μCi/mL)	DCG (μCi/mL)
Be–7	0.146	ND	0	30	0.22	0	Natural
K–40	1,260,000,000	40.1	0.30	40	0.30	1.53×10^{-15}	Natural
Co–60	5.26	83.6	0.62	3	0.022	3.18×10^{-15}	8×10^{-11}
Sr–90	27.7	26.0	0.19	2	0.015	9.89×10^{-16}	9×10^{-12}
Cs–137	30	225	1.66	2	0.015	8.56×10^{-15}	4×10^{-10}
Po–210	0.38	5.2	0.038	0.1	0.0007	1.98×10^{-16}	Natural
Th–228	1.9131	0.32	0.002	0.3	0.0022	1.22×10^{-17}	4×10^{-14}
Th–230	80,000	0.19	0.001	0.07	0.0005	7.23×10^{-18}	4×10^{-14}
Th–232	14,100,000,000	ND	0	0.1	0.0007	0	7×10^{-15}
U–234	247,000	0.12	0.001	0.3	0.0022	4.57×10^{-18}	9×10^{-14}
U–235	710,000,000	ND	0	0.3	0.0022	0	1×10^{-13}
U–238	4,510,000,000	0.04	0.003	0.3	0.0022	1.52×10^{-18}	1×10^{-13}
Pu–238	86.4	ND	0	0.07	0.0005	0	3×10^{-14}
Pu–239/240	24,390/6,580	0.68	0.005	0.07	0.0005	2.59×10^{-17}	2×10^{-14}

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

Derived concentration guides (DCGs) for exposure of the public, for most restrictive form of radionuclide as specified in DOE Order 5400.5 (2/8/90).

ND = Not detected

Table 5–1. Atmospheric Effluents to Uncontrolled Areas (Sheet 2 of 4)

SSFL/RIHL – 1994	
Effluent volume (m^3)	457,962,664
Lower limit of detection, LLD	
Gross alpha (μCi/mL)	3×10^{-16}
Gross beta (μCi/mL)	1×10^{-15}
Air volume sampled (m^3)	32,502
Annual average concentration in effluent	
Gross alpha (μCi/mL)	1.12×10^{-15}
Gross beta (μCi/mL)	6.99×10^{-15}
Maximum observed concentration	
Gross alpha (μCi/mL)	4.18×10^{-15}
Gross beta (μCi/mL)	3.62×10^{-14}
Activity released (μCi)	
Gross alpha	0.51
Gross beta	3.20

Radionuclide–Specific Data

Radionuclide	Half–Life (yr)	Activity Detected (pCi)	Annual Release (μCi)	Analysis LLD (pCi)	Release LLD (μCi)	Average Exhaust Concentration (μCi/mL)	MPC (μCi/mL)
Be–7	0.146	ND	0	20	0.28	0	Natural
K–40	1,260,000,000	ND	0	30	0.42	0	Natural
Co–60	5.26	ND	0	2	0.028	0	3×10^{-10}
Sr–90	27.7	4.6	0.065	2	0.028	1.42×10^{-16}	3×10^{-11}
Cs–137	30	29.7	0.42	2	0.028	9.14×10^{-16}	5×10^{-10}
Po–210	0.38	51.8	0.73	0.1	0.001	1.59×10^{-15}	Natural
Th–228	1.9131	ND	0	0.4	0.006	0	2×10^{-13}
Th–230	80,000	ND	0	0.07	0.001	0	8×10^{-14}
Th–232	14,100,000,000	ND	0	0.07	0.001	0	1×10^{-12}
U–234	247,000	0.09	0.001	0.08	0.001	2.77×10^{-18}	4×10^{-12}
U–235	710,000,000	ND	0	0.06	0.0008	0	4×10^{-12}
U–238	4,510,000,000	0.11	0.002	0.06	0.001	3.38×10^{-18}	3×10^{-12}
Pu–238	86.4	ND	0	0.07	0.001	0	7×10^{-14}
Pu–239/240	24,390/6,580	ND	0.0	0.07	0.001	0	6×10^{-14}

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

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

ND = Not detected

Table 5–1. Atmospheric Effluents to Uncontrolled Areas
(Sheet 3 of 4)

SSFL/T059 – 1994	
Effluent volume (m^3)	2,010,768*
Lower limit of detection, LLD	
Gross alpha (μCi/mL)	3×10^{-16}
Gross beta (μCi/mL)	1×10^{-15}
Air volume sampled (m^3)	1,401
Annual average concentration in effluent	
Gross alpha (μCi/mL)	1.98×10^{-15}
Gross beta (μCi/mL)	1.09×10^{-14}
Maximum observed concentration	
Gross alpha (μCi/mL)	1.63×10^{-14}
Gross beta (μCi/mL)	7.00×10^{-14}
Activity released (μCi)	
Gross alpha	0.004
Gross beta	0.022

Radionuclide–Specific Data

Radionuclide	Half–Life (yr)	Activity Detected (pCi)	Annual Release (μCi)	Analysis LLD (pCi)	Release LLD (μCi)	Average Exhaust Concentration (μCi/mL)	DCG (μCi/mL)
Be–7	0.146	ND	0	20	0.029	0	Natural
K–40	1,260,000,000	23.7	0.034	30	0.043	1.69×10^{-14}	Natural
Co–60	5.26	ND	0	3	0.004	0	8×10^{-11}
Sr–90	27.7	ND	0	1	0.001	0	9×10^{-12}
Cs–137	30	ND	0	2	0.003	0	4×10^{-10}
Po–210	0.38	3.9	0.006	0.1	0.0001	2.78×10^{-15}	Natural
Th–228	1.9131	ND	0	0.4	0.0006	0	4×10^{-14}
Th–230	80,000	ND	0	0.07	0.0001	0	4×10^{-14}
Th–232	14,100,000,000	ND	0	0.1	0.0001	0	7×10^{-15}
U–234	247,000	ND	0	0.2	0.0003	0	9×10^{-14}
U–235	710,000,000	ND	0	0.2	0.0003	0	1×10^{-13}
U–238	4,510,000,000	ND	0	0.2	0.0003	0	1×10^{-13}
Pu–238	86.4	ND	0	0.07	0.0001	0	3×10^{-14}
Pu–239/240	24,390/6,580	ND	0	0.07	0.0001	0	2×10^{-14}

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

Derived concentration guides (DCGs) for exposure of the public, for most restrictive form of radionuclide as specified in DOE Order 5400.5 (2/8/90).

ND = Not detected

*Stack operated for only 584 hours.

Table 5–1. Atmospheric Effluents to Uncontrolled Areas (Sheet 4 of 4)

De Soto 104 – 1994	
Effluent volume (m^3)	40,132,212
Lower limit of detection, LLD	
Gross alpha (µCi/mL)	3×10^{-16}
Gross beta (µCi/mL)	1×10^{-15}
Air volume sampled (m^3)	23,976
Annual average concentration in effluent	
Gross alpha (µCi/mL)	6.12×10^{-16}
Gross beta (µCi/mL)	5.91×10^{-15}
Maximum observed concentration	
Gross alpha (µCi/mL)	6.01×10^{-15}
Gross beta (µCi/mL)	2.40×10^{-14}
Activity released (µCi)	
Gross alpha	0.03
Gross beta	0.24

Radionuclide–Specific Data

Radionuclide	Half–Life (yr)	Activity Detected (pCi)	Annual Release (µCi)	Analysis LLD (pCi)	Release LLD (µCi)	Average Exhaust Concentration (µCi/mL)	MPC (µCi/mL)
Be–7	0.146	43.6	0.073	20	0.033	1.82×10^{-15}	Natural
K–40	1,260,000,000	ND	0	70	0.12	0	Natural
Co–60	5.26	ND	0	2	0.003	0	3×10^{-10}
Sr–90	27.7	ND	0	2	0.003	0	3×10^{-11}
Cs–137	30	ND	0	2	0.003	0	5×10^{-10}
Po–210	0.38	44.0	0.074	0.1	0.0002	1.84×10^{-15}	Natural
Th–228	1.9131	ND	0	5	0.008	0	2×10^{-13}
Th–230	80,000	ND	0	0.8	0.001	0	8×10^{-14}
Th–232	14,100,000,000	ND	0	0.8	0.001	0	1×10^{-12}
U–234	247,000	15.0	0.025	0.2	0.0003	6.26×10^{-16}	4×10^{-12}
U–235	710,000,000	0.47	0.0008	0.3	0.0005	1.96×10^{-17}	4×10^{-12}
U–238	4,510,000,000	0.23	0.0004	0.3	0.0005	9.59×10^{-18}	3×10^{-12}
Pu–238	86.4	ND	0	0.06	0.0001	0	7×10^{-14}
Pu–239/240	24,390/6,580	ND	0	0.06	0.0001	0	6×10^{-14}

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

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

ND = Not detected

The isotopic composition of the radioactivity deposited on the nuclear facility exhaust air sampling filters, composited for the year, is also presented in Table 5–1. Gamma–emitting radionuclides were measured by using a high–resolution gamma spectrometer. All others were measured by using specific chemical separations followed by alpha or beta counting. Radionuclides that were reported as less than the method detection level are shown as "not detected" (ND). The Po–210 that is collected on the RIHL filter due to the use of unfiltered bypass (ambient) air taken into the main exhaust system from the outside is a result of naturally occurring elements in the U–238 decay chain in the environment. The K–40 is due to the presence of this radionuclide in the airborne dust in the ambient air. Materials used in operations conducted at the SSFL and De Soto sites are responsible for the fission/activation product radioactivity. For each radionuclide detected, the laboratory calculates a lower limit of detection (LLD). This is the lowest activity that would be identified as "radioactive" with 95% confidence. "Radioactive" is specified as above 95% of the distribution of background results. This LLD refers to the specific sample form analyzed, in this case a composite of filters. For the purpose of comparing effluent releases, the laboratory LLD for the composited filters was converted to an equivalent annual release and is shown in the table as the release LLD. The reactivity results are also shown in Table 5–2, for comparison with ambient air. (For convenience in presenting and viewing this data, the results are presented in units of femtocuries per cubic meter [fCi/m^3], which is 10^{-15} μCi/mL.) The effectiveness of the air cleaning systems is evident from the fact that the atmospheric effluents are less radioactive than is the ambient air with respect to the ambient air radionuclides Be–7, K–40, and Po–210.

Exhaust samples are counted for gross alpha and beta activity after allowing decay of the short–lived airborne radioactivity, on a weekly basis. Composited samples are analyzed in detail at the end of the year to determine the individual radionuclide concentrations. The results of these analyses for the RMDF, the RIHL, Building 059, and De Soto are also shown in Table 5–2.

The effluent at the exhaust stack for each facility is compared with an appropriate limit for exposure of the public. The isotopic limits for DOE facilities are Derived Concentration Guides (DCGs) for exposure of the public for the most restrictive form of the radionuclide as specified in DOE Order 5400.5. Isotopic effluent limits for facilities with State of California– and NRC–licensed activities are Maximum Permissible Concentrations (MPCs) for release to an unrestricted area for the most restrictive form of the radionuclide as specified in 10 CFR 20, Appendix B, and CCR 17, Appendix A.

The most restrictive MPC or DCG for each radionuclide (from CCR 17) is shown at the head of each column of data in Table 5–2. (The natural radionuclide K–40 is so uniformly present, and so rarely present in an enriched form, that no MPC or DCG has been developed for it.) These values refer to the permissible concentrations allowed by the State of California (and the NRC) and the DOE for continuous exposure of the public. Note that, in all cases, for the exhaust air, the observed concentrations are far below the MPC and DCG. Many of the results are so low (close to zero) that the measurements are dominated by analytical and background variations, with the result that negative and inconsistent values are frequently produced. Furthermore, dilution and dispersion would occur before the material reaches an unrestricted area.

The downwind concentration of radioactive material emissions to the atmosphere during 1994 from each of the four Rocketdyne exhaust stacks has been calculated with the CAP88–PC computer code using representative input data including wind speed, directional frequency, and stability (using meteorological

Table 5–2. Filtered Exhaust and Ambient Air Radioactivity Concentrations—1994

	Activity Concentration (femtocuries per cubic meter)															
	Be–7	K–40	Co–60	Sr–90	Cs–137	Po–210	Th–228	Th–230	Th–232	U–234	U–235	U–238	Pu–238	Pu–239/ 240	Gross Alpha	Gross 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	20	10,000
Exhaust																
RMDF	ND	1.53	3.18	0.99	8.56	0.20	0.012	0.007	ND	0.005	ND	0.002	ND	0.026	0.3	21.6
RIHL	0.14	ND	ND	ND	0.91	1.59	ND	ND	ND	0.003	ND	0.003	ND	ND	1.1	7.0
DS 104	1.82	ND	ND	ND	ND	1.83	ND	ND	ND	0.626	0.020	0.010	ND	ND	0.6	5.9
059	ND	16.92	ND	ND	ND	2.78	ND	ND	ND	ND	ND	ND	ND	ND		
Ambient																
RMDF	17.91	16.61	ND	ND	ND	8.02	ND	ND	ND	0.028	ND	ND	ND	ND	3.1	28.3
RMDF Pond	16.92	16.54	ND	ND	ND	8.47	ND	0.029	0.026	0.022	ND	0.022	ND	ND	3.5	27.2
RIHI	23.01	17.78	ND	ND	ND	7.71	ND	0.043	0.022	0.008	ND	ND	ND	ND	3.4	27.4
T100 (7 day)	11.24	2.25	ND	ND	ND	8.13	0.058	0.018	ND	0.003	ND	0.006	ND	ND	1.7	24.5
T886	19.11	8.67	ND	ND	ND	7.14	0.053	0.047	0.026	0.004	ND	ND	ND	ND	3.5	25.3
DS 104	16.12	13.58	ND	ND	ND	7.62	ND	0.018	ND	0.022	ND	0.006	ND	ND	3.6	25.9
Exhaust Average	0.28	1.68	3.18	0.99	3.19	1.22	0.012	0.007	ND	0.039	0.020	0.003	ND	0.026	0.6	11.0
Ambient Average	17.3	12.5	ND	ND	ND	7.85	0.055	0.031	0.024	0.014	ND	0.003	ND	ND	3.4	26.7

ND = Not detected
The averages are calculated from reported values only, without consideration of ND samples, and values are weighted by effluent volume.

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data developed for the SSFL site by the NRC and Argonne National Laboratory [ANL]) 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 5–3. Table 5–3 shows the man–made radioactivity concentrations at the nearest boundary and residence locations. These concentrations were estimated by use of CAP88–PC and specific radionuclide releases for each facility.

Table 5–3. Annual Average Radioactivity Concentrations of Atmospheric Effluents—1994

Facility	Annual Release (μCi)	Distance (m) to		Downwind Concentration (10^{-18} μCi/mL)	
		Boundary	Residence	Boundary	Residence
DS 104	0.026	187 E	315 S	0.023	0.002
RIHL	0.84	302 NW	1,900 SE	0.14	0.009
RMDF	3.92	118 NW	2,300 SE	0.01	0.02
T059	0.0	80 NW	1,997 SSE	0.0	0.0

5.2 ENVIRONMENTAL SAMPLING

5.2.1 Air

Ambient air sampling is performed continuously at De Soto and SSFL with air samplers operating on 24–hour sampling cycles. Monitoring locations currently in use are shown in Figures 5–1 and 5–2 and listed in Table 5–4. Airborne particulate radioactivity is collected on glass fiber (Type A/E) filters that are automatically changed daily at the end of each sampling period (midnight). The samples are counted for gross alpha and beta radiation following a minimum 120–hour decay period. The volume of a typical daily ambient air sample is about 28 m^3.

Daily ambient air samples are counted for gross alpha and beta radiation with a low–background thin–window gas–flow proportional–counting system. The system is capable of simultaneously counting both alpha and beta radiation. The sample–detector configuration provides a nearly hemispherical (2π) geometry. The thin–window detector is continually purged with argon/methane counting gas. A preset time mode of operation is used for counting all samples.

Counting system efficiencies are determined routinely with Tc–99 and Th–230 standard sources. The activities of the standard sources are traceable to the National Institute of Standards and Technology (NIST).

Filter media for each sampling location are composited annually and analyzed for isotopic–specific activity. The results of the sample analyses are shown in Table 5–2 with the effluent results for comparison. As is the case with effluent air samples, the observed ambient air radionuclide concentrations were far below

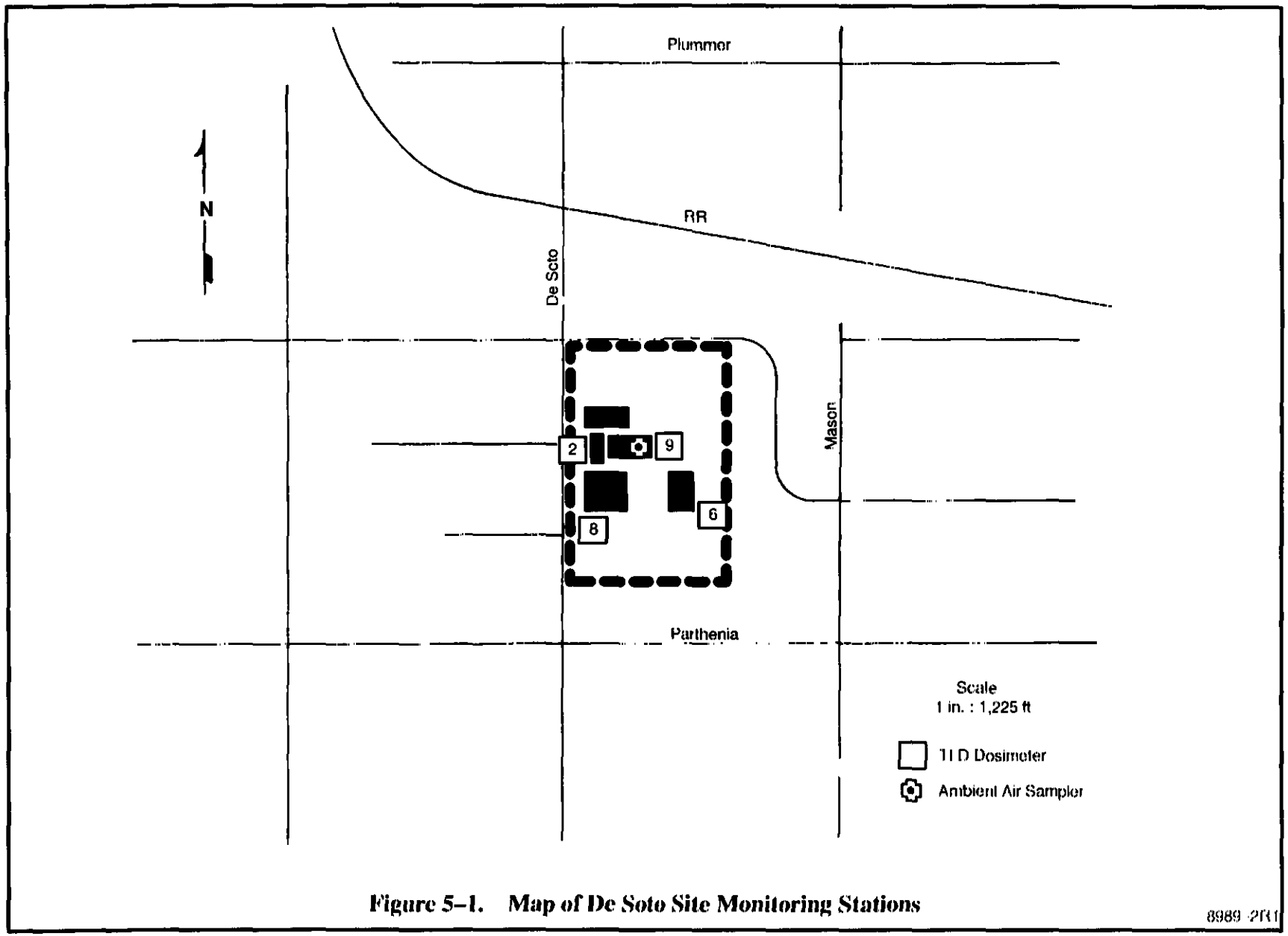

Figure 5–1. Map of De Soto Site Monitoring Stations

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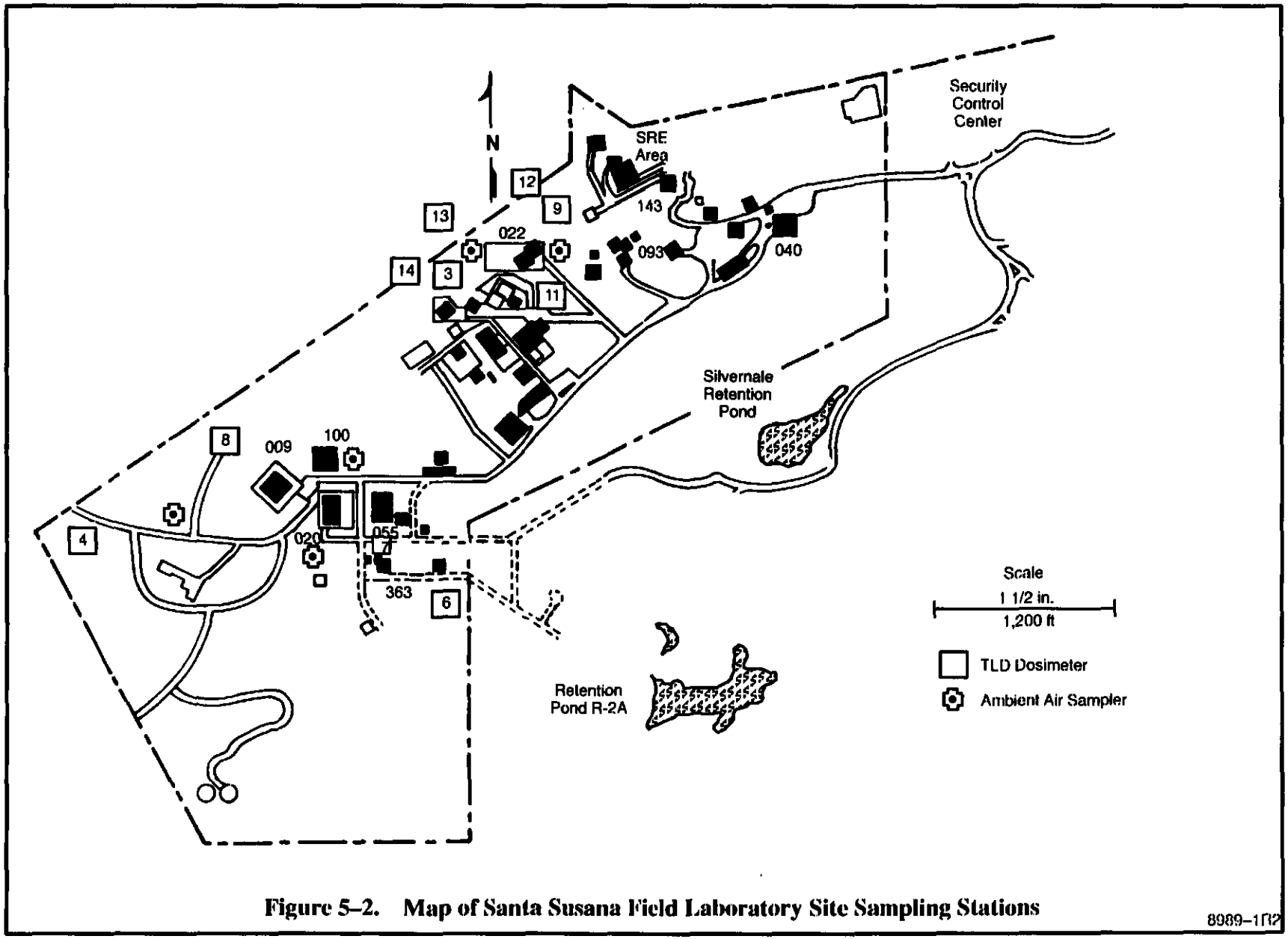

Figure 5–2. Map of Santa Susana Field Laboratory Site Sampling Stations

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Table 5–4. Sampling Location Description

Station	Location	Frequency of Sampling
Ambient Air Sampler Locations		
A–1	De Soto Site, Building 104 roof	(D)
A–2	SSFL Site, Building 020, southwest side	(D)
A–3	SSFL Site, Building 034, at main gate	(D)
A–4	SSFL Site, Building 886, Former Sodium Disposal Facility	(D)
A–5	SSFL Site, RMDF Pond, north side	(D)
A–6	SSFL Site, Building 100, east side – 7–day sampler	(W)
On–Site—De Soto – Ambient Radiation Dosimeter Locations		
DS–2	De Soto Site, northwest corner of Building 101	(Q)
DS–6	De Soto Site, east boundary, southeast corner of Building 105	(Q)
DS–8	De Soto Site Guard Post 4, southwest corner of Building 101	(Q)
DS–9	De Soto Site, southeast of Building 104	(Q)
On–Site—SSFL – Ambient Radiation Dosimeter Locations		
SS–3	SSFL Site, Electric Substation 719 on boundary fence (State of California TLD Location Number 31)	(Q)
SS–4	SSFL Site, west boundary on H Street (State of California TLD Location Number 32)	(Q)
SS–6	SSFL Site, northeast corner of Building 353 (State of California TLD Location Number 33)	(Q)
SS–7	SSFL Site, Building 363, north side (State of California TLD Location Number 34)	(Q)
SS–8	SSFL Site, Former Sodium Disposal Facility north boundary (State of California TLD Location Number 35)	(Q)
SS–9	SSFL Site, Radioactive Materials Disposal Facility, *northeast boundary at Building 133* (State of California TLD Location Number 36)	(Q)
SS–11	SSFL Site, Building 036, east side (State of California TLD Location Number 37)	(Q)
SS–12	SSFL Site, RMDF northwest property line boundary (State of California TLD Location Number 38 and 91)	(Q)
SS–13	SSFL Site, RMDF northwest property line boundary (State of California TLD Location Number 39 and 92)	(Q)
SS–14	SSFL Site, RMDF northwest property line boundary (State of California TLD Location Number 40)	(Q)
Off–Site Ambient Radiation Dosimeter Locations		
OS–1	Off–site, Chatsworth (State of California TLD Location Number 45)	(Q)
OS–5	Off–site, Simi Valley	(Q)

Code:		Location:	
A	Air Sampler Station	DS	De Soto
TLD	Thermoluminescent Dosimeter Location	SS	SSFL
D	Daily Sample	OS	Off–Site
W	Weekly Sample		
Q	Quarterly Sample		

the MPC. The measurements were dominated by analytical and background variations, with the result that negative and inconsistent values were produced.

It should be emphasized that these measurements determine only the long–lived particulate radioactivity in the air and therefore do not show radon (Rn–222) and most of its daughter radionuclides. Polonium–210 is a long–lived daughter and is detected by these analyses. It is assumed to be in equilibrium with its parent, Pb–210, whose relatively long half–life (22.3 years) provides an essentially constant level of Po–210 in the samples. Because of these effects, the ambient air, the air that is being breathed, is actually about four times as radioactive as implied in this table. Since most of the short–lived particulate radioactivity is removed from the exhaust air by the HEPA filters, these effects are not significant in the filtered effluent.

The ambient air is sampled at six locations (five at SSFL, one at De Soto). Air is drawn through glass fiber (Type A/E) filter discs for 24–hour periods (one sampler operates on a 7–day cycle) for each calendar day. The collected radioactivity is measured for gross alpha and beta radiation, after a delay of at least 120 hours to allow complete decay of the short–lived radioactivity, with a thin–window gas–flow proportional counter, as an early measure of the discharged radioactivity and environmental radioactivity.

Since the alpha and beta activity is counted relatively soon after collection, most of the natural Be–7 is detected, elevating the beta activity. The naturally occurring radionuclides, Po–210 and Ra–226 and –228, also contribute to the activity detected on the stack exhaust filter samples, particularly at the RIHL, where some unfiltered outside air is brought into the exhaust system after the HEPA filters.

A more complete list of the results from the gross alpha and gross beta counting of the ambient air samples is shown in Table 5–5.

The appropriate guide value for SSFL site ambient air alpha activity is 6×10^{-14} µCi/mL (Pu–239) due to contamination remaining from work with unencapsulated plutonium (the DOE value is 2×10^{-14} µCi/mL). The appropriate value for beta activity is 3×10^{-11} µCi/mL (Sr–90) due to the presence of Sr–90 in fission product contamination from previous work with irradiated nuclear fuel at the SSFL site (the DOE value is 9×10^{-12} µCi/mL). The appropriate guide value for De Soto ambient air alpha activity is 3×10^{-12} µCi/mL (U–238) due to prior (licensed) work with unencapsulated depleted uranium. The appropriate guide value for beta activity is for Co–60, since it is 3×10^{-10} µCi/mL (Co–60) the most restrictive limit for any beta–emitting radionuclide currently in use at De Soto.

Figure 5–3 is a graph of the weekly averaged long–lived alpha and beta ambient air radioactivity concentrations for De Soto and SSFL during 1994 as indicated by the gross alpha and gross beta counting. Generally, the ambient airborne radioactivity was relatively constant during 1994, and showed no significant disturbances.

The daily data were mathematically smoothed in a moving weekly average of daily data for the year. The activity detected in ambient air is attributed to naturally occurring radioactive materials. Radionuclides detected by gross alpha and beta analysis of air samples collected during 1994 include K–40 plus several naturally occurring radionuclides from the uranium and thorium series.

Table 5–5. Ambient Air Radioactivity Data—1994

Area	Activity	Number of Samples	Gross Radioactivity Concentrations (µCi/mL)		
			Annual Average Value and Dispersion	Maximum Value* and Date Observed	Average Percent of Guide**
De Soto Building 104	Alpha Beta	355	(3.6 ± 3.0)E-15 (25.9 ± 13.6)E-15	12.9E-15 (07/13) 75.9E-15 (09/03)	0.12 0.01
SSFL Area IV RIHL	Alpha Beta	362	(3.4 ± 2.6)E-15 (27.4 ± 14.1)E-15	13.6E-15 (08/21) 116.1E-15 (01/03)	5.7 0.09
SSFL Area IV RMDF	Alpha Beta	362	(3.1 ± 2.7)E-15 (28.3 ± 25.7)E-15	11.4E-15 (03/29) 445.0E-15 (10/19)	16 0.31
SSFL Area IV Building T886	Alpha Beta	351	(3.5 ± 2.7)E-15 (25.3 ± 17.7)E-15	13.0E-15 (12/09) 221.2E-15 (08/16)	5.8 0.08
SSFL Area IV RMDF Pond	Alpha Beta	362	(3.5 ± 3.0)E-15 (27.2 ± 18.1)E-15	16.4E-15 (07/13) 127.5E-15 (10/14)	5.8 0.09

*Maximum value observed for single sample.

**Guide De Soto Site: 3E–12 µCi/mL alpha, 3E–10 µCi/mL beta; 10 CFR 20 Appendix B, CCR 17.
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).

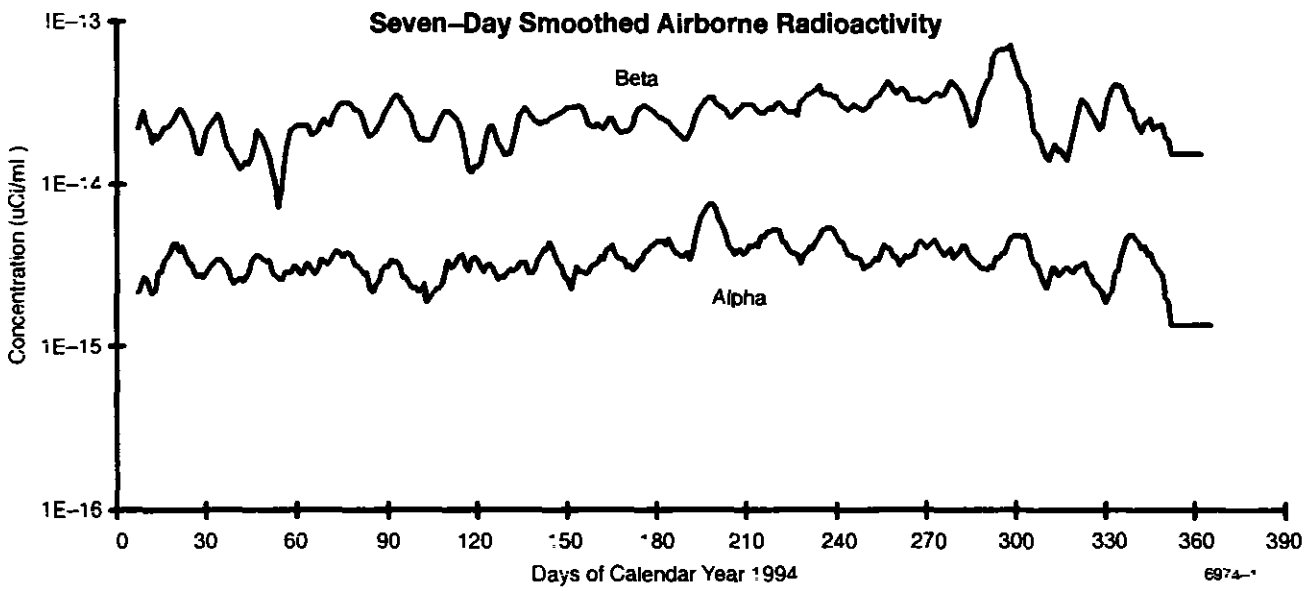

Figure 5–3. Seven–Day Smoothed and Annual Average Airborne Radioactivity at the De Soto and Santa Susana Field Laboratory Sites – 1994

A further comparison of ambient air and facility exhaust radioactivity is presented in Figure 5–4. The gross alpha and the gross beta concentrations for the ambient weekly samples are compared with the stack sample results for the RIHL, the RMDF, and Building DS104, which are also on a weekly cycle. Gaps in the plots are due to negative values resulting from air samples showing less activity than instrument background.

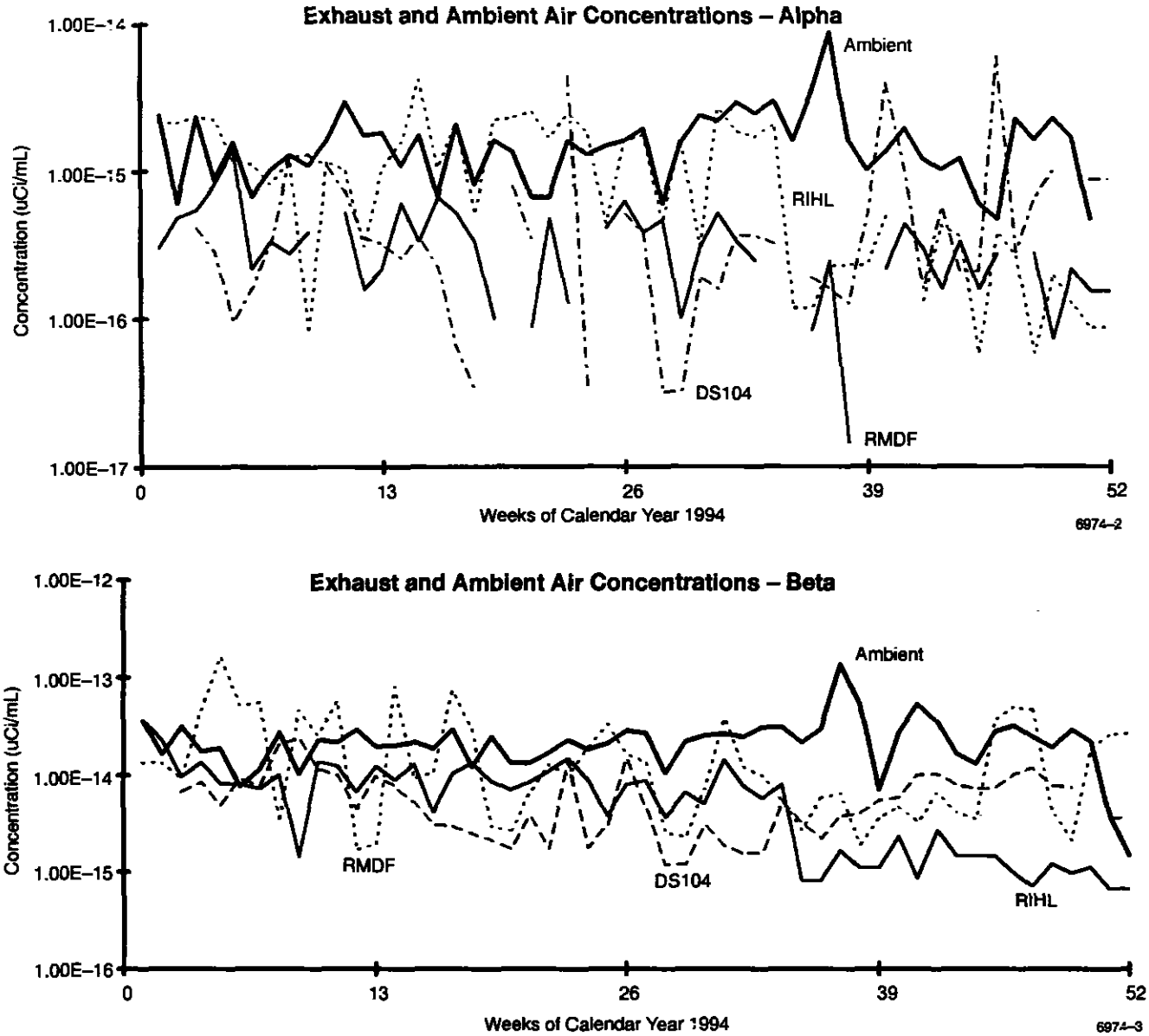

Figure 5–4. Filtered Exhaust and Ambient Air Radioactivity Concentration

5.2.2 Water

Groundwater is sampled from a large number of wells in the Chatsworth Formation and in the unconsolidated surface sediments and analyzed for radioactivity. The locations of these wells are shown in Figure 6–2. Detailed results of the analysis of groundwater samples are reported quarterly and annually. The summary results for 1994 are shown in Table 5–6 and results for groundwater around Building 059 are shown in Table 5–7. While it may be noted that in some cases the gross alpha activity has exceeded the drinking water supply limits, this activity is due predominantly to naturally occurring uranium. This is confirmed by the uranium isotopic ratios which are consistent with nonenriched natural uranium. No man–made fission products have been detected in the groundwater.

Table 5–6. Radioactivity in Groundwater at SSFL—1994

	Activity (pCi/L)												
	H–3	Sr–90	Tc–99	Cs–137	Ra	Th–228	Th–230	Th–232	U–234	U–235	U–238	Gross Alpha	Gross Beta
Maximum Permissible Concentration**	20,000*	8*	200,000	20,000	5*	7,000	2,000	2,000	30,000	30,000	40,000	15*	50*
Maximum	3,550	0.56	1.30	—	0.15	0.036	0.103	0.056	26.4	2.2	26.5	42.0	30.3
Mean	171	–0.07	1.30	ND	0.15	0.012	0.042	0.029	10.4	0.8	9.6	6.7	5.8
Minimum	ND	–0.48	1.30	—	0.15	ND	ND	ND	ND	ND	ND	ND	ND
Number of analyses***	71 (63)	24 (17)	2 (1)	68 (68)	1	3 (1)	3 (1)	3 (1)	7 (1)	7 (1)	7 (1)	73 (7)	73 (7)

*EPA limits for drinking water suppliers ND = not detected
**Above natural background
***Numbers in parentheses represent the number of analyses reported as less than the detectable limit.

Table 5–7. Building 059 Water Radioactivity Data—1994

	Activity (pCi/L)						
	H–3	Pb–210	Pb–212	Ra–224	Ac–228	U–234	U–238
Maximum Permissible Concentration*	3,000,000	200,000	20,000	5,000	90,000	30,000	40,000
Maximum	—	135	—	57	20.3	—	868
Mean	330	114	16	51	15.4	3,624	804
Minimum	—	ND	ND	ND	ND	ND	ND
Number of analyses**	1	7 (63)	1 (69)	3 (67)	2 (68)	1 (69)	2 (68)

*Maximum permissible concentration above natural background for release to unrestricted area.
**Numbers in parentheses represent the number of analyses reported as less than the detectable limit. The mean has been calculated from reported values only.

Water from three groundwater monitoring wells showed low concentrations of tritium, far below the EPA and California limits for drinking water suppliers (20,000 pCi/L). Water from well RD–23 showed an average of 675 ± 230 pCi/L, RD–28 showed 680 ± 225, and RD–34A showed 2,890 ± 390. As the one well with the highest tritium concentration, RD–34A had been sampled in each of the four calendar quarters and showed a steady decrease through 1994. The 4th quarter concentration was 1,860 ± 340 pCi/L.

Radioactivity concentration guide values used for comparisons for licensed operations are those concentration limits adopted by the NRC and the State of California as MPC values for uncontrolled areas. These values are established in 10 CFR 20 and California Code of Regulations Title 17. Where noted, limits for drinking water suppliers are also used (tritium, gross alpha, gross beta).

Most of Area IV slopes toward the southeast and rainfall runoff is collected by a series of drainage channels and accumulates in pond R–2A. This water is then used for cooling the rocket engine test stand flame buckets or, if in excess, is released to Bell Creek under the NPDES permit. Most of this water is runoff because the rain falls on building roofs and roadways. Some of Area IV slopes to the northwest and a small amount of rainfall drains toward the northwest ravines, which lead into Meier Canyon. To permit sampling this runoff, five catch basins were installed near the site boundary to accumulate runoff. Average radioactivity concentrations in the retention ponds and catch basin samples are presented in Table 5–8.

Table 5–8. NPDES Discharge Radioactivity Data—1994

	Activity (pCi/L)				
	H–3	Sr–90	Ra–226 + R–228	Gross Alpha	Gross Beta
Drinking Water Standards/ NPDES Limits	20,000	8	5	15	50
Maximum	222	2.0	2.4	9.6	11.0
Mean	60	0.7	1.2	2.3	5.5
Minimum	0	0.0	0.1	0.0	1.6
Number of Analyses*	(29)	9 (20)	12 (17)	14 (15)	20 (9)

*Numbers in parentheses represent the number of analyses reported as less than the detectable limit.

Domestic water in this area is supplied by a variety of municipal and regional organizations, including the Los Angeles Department of Water and Power, the Metropolitan Water District of Southern California, several Ventura County Waterworks Districts, and the Oxnard Public Works Department. Most of the water is imported from distant sources, such as Owens Valley, the Feather River, and the Colorado River; some water, for Oxnard and Moorpark, comes from local groundwater wells. The local water is blended with imported water and treated to assure purity and safety. Water is transported in open aqueducts and enclosed pipelines and is stored in open reservoirs and underground settling basins. The State of California requires that these suppliers routinely monitor their water for many potentially hazardous materials (and less significant quality factors, as well) and report the results of this monitoring to their customers on an annual basis. Tests for radioactivity are relatively limited, and are performed over an extended period of time, so not all parameters are reported in any one year. The results reported by local water suppliers during 1994 are shown in Table 5–9.

Comparison of the radioactivity concentrations in water from the ponds with that of the supply water (Table 5–9) shows no significant differences in either the alpha or beta activity. The values reported in Table 5–9 represent the results of analysis of water supplied from the Metropolitan Water District (MWD), by far the largest contingent of locally consumed potable water. There is some mixing of locally supplied water with the MWD water in the water districts for Simi Valley and Moorpark, located within 20 km of SSFL. Analyses of this locally supplied water from wells have found gross alpha and uranium concentrations up to 5 pCi/L and 9.5 pCi/L, respectively.

Table 5–9. Domestic Water Supplies Radioactivity Data—1994

	Activity (pCi/L)						
	H–3	Sr–90	Ra–226	Ra–228	Uranium	Gross Alpha	Gross Beta
State Maximum Contamination Level	20,000	8	5 combined		20	15	50
Maximum	ND	ND	ND	ND	4	1.0 (4.5)*	4.8 (19)
Mean					2	0.5 (2.8)	3.1 (12)
Minimum					ND	0.1 (1.5)	0.4 (6)

ND = not detected
( )* Los Angeles Aqueduct

5.2.3 Rock and Soil

The radioactivity in environmental rock and soil can serve as an indicator of any spread of contamination outside the operating facilities and other known areas of radioactive contamination. Preliminary results of sampling during the Area IV characterization survey are shown in Table 5–10. Sampling locations are shown in Figure 5–5. All results are consistent with natural background.

Table 5–10. SSFL Rock and Soil Radioactivity Data—1994

	Activity (pCi/g)											
	H–3	Be–7	K–40	Sr–90	Cs–137	Tl–208	Pb–210	Pb–212	Bi–212	Pb–214	Bi–214	Ra–224
Maximum	0.110	0.22	25	0.22	1.48	1.55	1.40	1.53	0.99	1.58	1.58	1.75
Mean	–0.014	0.22	19	0.07	0.26	1.32	0.92	1.34	0.85	0.99	0.92	1.47
Minimum	–0.110	ND	15	–0.01	ND	1.14	0.56	1.19	ND	0.75	0.68	1.21
Number of analyses*	1 (20)	1 (6)	26	21	12 (16)	7	7	7	2 (5)	7	7	7

	Activity (pCi/g)											
	Ra–226	Ac–228	Th–227	Th–228	Th–230	Th–232	Th–234	U–234	U–235	U–238	Pu–238	Pu–239
Maximum	2.25	1.35	0.22	3.84	1.00	1.40	1.71	4.29	0.11	1.71	0.005	0.012
Mean	0.92	1.14	0.15	3.53	0.87	1.15	1.12	0.92	0.05	0.83	–0.0001	0.002
Minimum	ND	0.95	ND	ND	0.69	ND	0.87	ND	0.03	ND	–0.009	–0.002
Number of analyses*	27 (1)	7	3 (4)	2 (5)	2 (7)	2 (7)	7	22 (6)	28	22 (6)	(21)	(21)

ND = not detected
*Numbers in parentheses represent the number of analyses reported as less than the detectable limit.

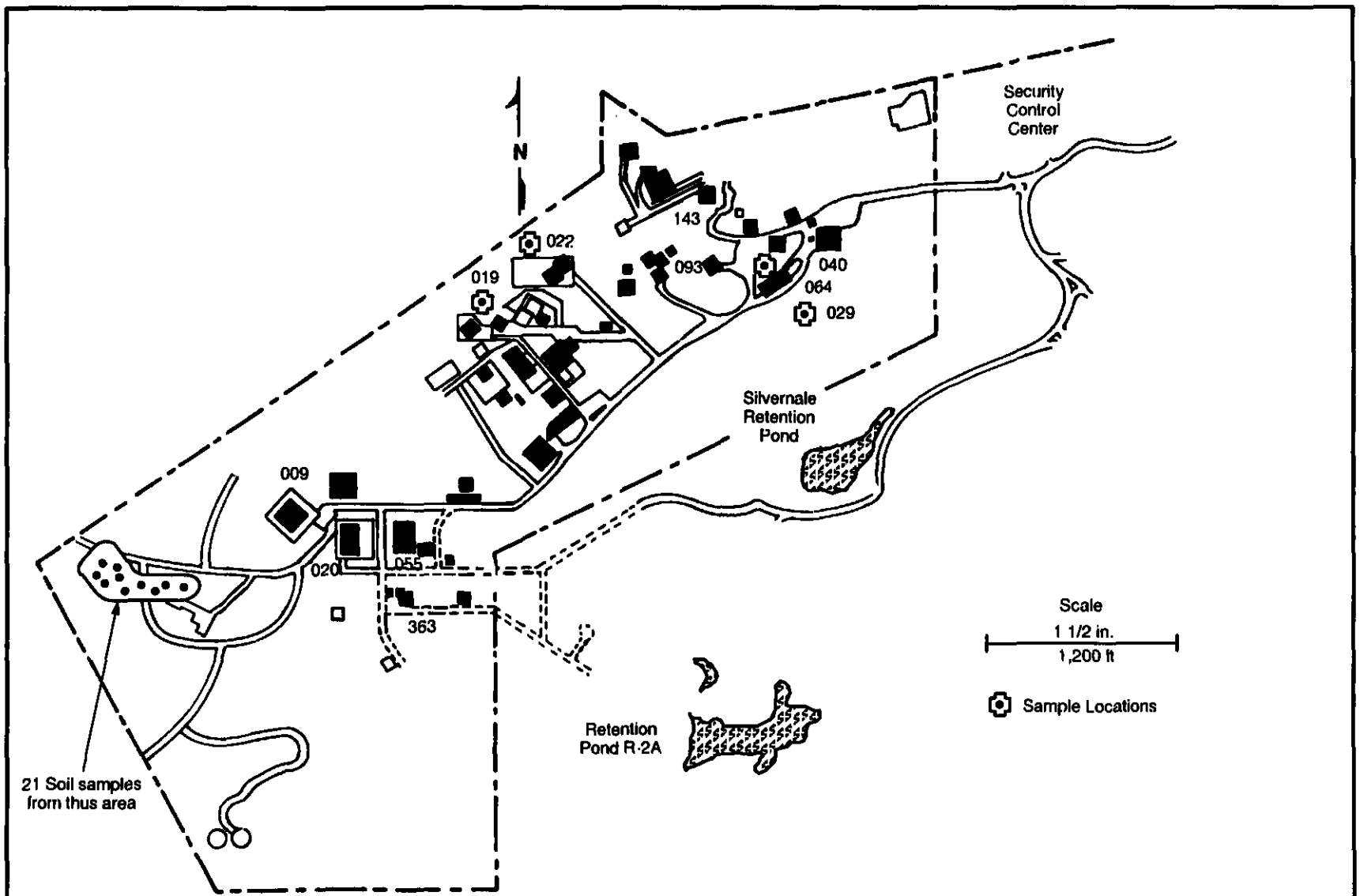

Figure 5–5. Map of Santa Susana Field Laboratory Site Soil Sampling, Area IV

69/4-10

Soil radioactivity is due to various naturally occurring radionuclides present in the environment and to radioactive fallout of dispersed nuclear weapons materials. Naturally occurring radionuclides include K–40 and the uranium and thorium series (including radon and daughters). The radionuclide composition of local area surface soil has been determined to be predominantly K–40, natural thorium. and natural uranium, both in secular equilibrium with daughter nuclides. Radioactivity in nuclear weapons test fallout consists primarily of the fission–produced Sr–90 and Cs–137. as well as Pu–239.

The natural origin of radioactive materials such as thorium and uranium has been confirmed by comparison of their activities in uncontaminated soils and the ratios of their activities to each other and to their daughter radionuclides. These analytical results indicated that the thorium and uranium are natural occurrences.

5.2.4 Vegetation

No vegetation data was collected in 1994.

5.2.5 Wildlife

No animal data was collected in 1994.

5.2.6 Ambient Radiation

Standard commercial thermoluminescent dosimeters (TLDs) using lithium fluoride (LiF) are placed at locations near the site boundaries at SSFL and De Soto, and at two off–site locations. These are processed on a quarterly basis by a contractor laboratory and the results are averaged for each location where more than one TLD is located. These results are shown in Table 5–11, and include the contributions due to natural background radiation (about 140 mrem/yr for 1994, as measured by these TLDs). The results show compliance with the annual limits of NRC and the Radiologic Health Branch (RHB) of the State of California Department of Health Services (DHS) (500 mrem/yr) and the DOE (100 mrem/yr for extended exposure), above natural background.

The State RHB provides packages containing calcium sulfate ($CaSO_4$) 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 nine Rocketdyne dosimeter locations, both on–site and off–site, are also shown in Table 5–11. 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 0.1 mrem.

Table 5–11 shows that radiation exposures and equivalent annual exposure rates monitored on–site are nearly identical to levels monitored at the two off–site locations. These data reflect natural background radiation from cosmic radiation, radionuclides in the soil, and radon and thoron in the atmosphere. The natural background radiation level as measured by these dosimeters is about 96 mrem/yr at the off–site locations. At SSFL the local background is about 132 mrem/yr, based on the data from dosimeters SS–3 through

Table 5–11. De Soto and SSFL—Ambient Radiation Dosimetry Data—1994*

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
De Soto	DS–2	24.0	24.0	24.0	24.0	96.0	11.0	N/A
	DS–6	24.0	29.0	24.0	24.0	101.0	11.5	N/A
	DS–8	24.0	24.0	24.0	24.0	96.0	11.0	N/A
	DS–9	24.0	24.0	24.0	24.0	96.0	11.0	N/A
Mean value		24.0	25.3	24.0	24.0	97.3	11.1	
SSFL	SS–3	33.0	33.0	33.0	33.0	132.0	15.1	11.2
	SS–4	33.0	33.0	33.0	33.0	132.0	15.1	12.5
	SS–6	33.0	33.0	33.0	33.0	132.0	15.1	12.7
	SS–7	33.0	33.0	33.0	33.0	132.0	15.1	13.8
	SS–8	33.0	33.0	33.0	33.0	132.0	15.1	12.7
	SS–9	33.0	33.0	33.0	33.0	132.0	15.1	13.7
	SS–11	33.0	33.0	33.0	33.0	132.0	15.1	12.4
	SS–12	33.0	43.0	33.0	33.0	142.0	16.2	15.9
	SS–13	43.0	43.0	33.0	33.0	152.0	17.3	15.1
	SS–14	33.0	33.0	33.0	33.0	132.0	15.1	13.3
Mean value		34.0	35.0	33.0	33.0	135.0	15.4	13.3
Off–site	OS–1	24.0	24.0	24.0	24.0	96.0	11.0	11.3
	OS–5	24.0	24.0	24.0	24.0	96.0	11.0	N/A
Mean value		24.0	24.0	24.0	24.0	96.0	11.0	11.3

*Includes natural background radiation of approximately 96 mrem per year.

SS–11, shown in Table 5–11. The small variability observed in the data is attributed to differences in elevation and geologic conditions at the various dosimeter locations. The altitude range for the dosimeter locations is from about 260 m (850 ft) above sea level (ASL) at the De Soto facility and the off–site locations to a maximum of about 580 m (1,900 ft) ASL at SSFL.

5.3 ESTIMATION OF PUBLIC RADIATION DOSE

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.

The 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, NRC, and the State of California.

The external exposures, above background, are based on the averaged off–site exposure measurements. The value measured by the two off–site dosimeters was 96 mrem for 1994. Boundary dose estimates assume 100% occupancy, whereas the actual presence of persons at the boundary is rare or nonexistent.

Except for the nearest boundary line exposure for the Radioactive Materials Disposal Facility (RMDF), the estimated off–site doses are extremely low compared to the maximum permissible exposures recommended for the general population in the vicinity of DOE facilities. The effective dose equivalent for any member of the public, for all pathways (combining internal and external dose), shall not exceed 100 mrem/yr for DOE facilities or for NRC and State of California licensed facilities. The RMDF boundary to the north of the facility received an estimated average "property line" exposure of about 7.5 mrem above the local background for the year. However, this does not constitute a dose to the general public since it lies within an isolated area without direct public access.

Estimates of the internal dose assume a constant unsheltered exposure, adjusted for wind direction frequency, throughout the year and therefore considerably overestimate the actual annual averaged doses near the site. Estimated internal radiation doses due to atmospheric emission of radioactive materials from De Soto and 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. For the air pathway only, for DOE operations, the standard is 10 mrem/yr for committed effective dose equivalent, as established by EPA.

Public exposure to radiation and radioactivity is shown in Tables 5–12 through 5–14. These tables present the estimated exposures in comparison to the regulatory standards and that received due to natural radioactivity in the environment.

Figure 5–6 shows the arrangement of the census tract boundaries from the 1990 census. Figures 5–7 through 5–9 show local population distribution estimates that were determined from the 1990 Federal census by Urban Decision Systems, Inc., and modified by direct observation of nearby residential areas around the SSFL site, and the occupational population at SSFL.

The general population (person–rem) dose estimates were calculated using CAP88–PC. This code uses release rate, wind speed, wind direction and frequency stability fractions, and stack height parameters as input data. Population dose estimates are 5.7×10^{-4} person–rem for the SSFL site and 1.6×10^{-4} person–rem for the De Soto site. The collective effective dose equivalent estimated for potential area sources in 1994 is 4.8×10^{-4} person–rem. Inhalation is the only potential exposure pathway likely to exist. The doses reported for SSFL site emissions are summed for all release points and nuclides.

In spite of the large number of people in the surrounding population, the population dose estimated for Rocketdyne operations is extremely small. For comparison, the dose received by the same population from naturally occurring radiation is approximately 3 million person–rem, approximately 2 billion times greater than that estimated for SSFL operations.

To account for population increases, analytical results using the 1990 census data were multiplied by 1.03. This factor was based on population increases in Los Angeles and Ventura counties.

Table 5–12. Public Exposure to Radiation and Radioactivity from DOE Operations at SSFL—1994

Radioactive Materials Disposal Facility (RMDF) and Building 059
Department of Energy (DOE, Exempt from Licensing)

1. All pathways	
a. Maximum estimated external dose to an individual	1.7×10^{-4} mrem/yr
b. Maximum estimated internal dose to an individual*	2.2×10^{-7} mrem/yr
Total	1.7×10^{-4} mrem/yr
Limit ("Radiation Protection of the Public and the Environment" DOE Order 5400.5, 2/8/90)	100 mrem/yr
2. Air pathway (reported in NESHAPs report)	1.8×10^{-6} mrem/yr
Limit (40 CFR 61, Subpart H)	10 mrem/yr

*Inhalation and ingestion exposure from CAP88–PC calculation of air pathway; NESHAPs report contains only total air pathway exposure.

Table 5–13. Public Exposure to Radiation and Radioactivity from Rocketdyne Operations at SSFL—1994

Rockwell International Hot Laboratory (RIHL)
U.S. Nuclear Regulatory Commission
Special Nuclear Material License No. SNM–21
State of California
Radioactive Material License No. 0015–70

1. Direct radiation at boundary	1.7×10^{-2} mrem/yr
Limits (10 CFR 20.1301, CCR 17 Section 30253)	100 mrem in 1 yr
2. Airborne (nonnatural radioactivity) effluent at boundary*	1.4×10^{-19} µCi/mL
Limits (10 CFR 20.1302, CCR 17 Section 30253)	2×10^{-14} µCi/mL

*Use of the EPA computer program, COMPLY, to determine the air pathway dose from the measured radionuclide concentrations for the ventilation exhaust from the RIHL at SSFL showed this facility to be in compliance with 40 CFR 61, Subpart I, at Level 1, the simplest, most conservative screening level.

Table 5–14. Public Exposure to Radiation and Radioactivity from Rocketdyne Operations at De Soto—1994

Applied Nuclear Technology Laboratory (DS104)
State of California
Radioactive Materials License No. 0015–70

1. Direct radiation at boundary	*
Limits (CCR 17 Section 30253)	100 mrem in 1 yr
2. Airborne (nonnatural radioactivity) effluent at boundary**	1.7×10^{-20} µCi/mL
Limit (CCR 17 Section 30253)	2×10^{-14} µCi/mL

*Indistinguishable from background.

**Use of the EPA computer program, COMPLY, to determine the air pathway dose from the measured radionuclide concentrations for the ventilation exhaust from the Applied Nuclear Technology Laboratories at De Soto showed this facility to be in compliance with 40 CFR 61, Subpart I, at Level 1, the simplest, most conservative screening level.

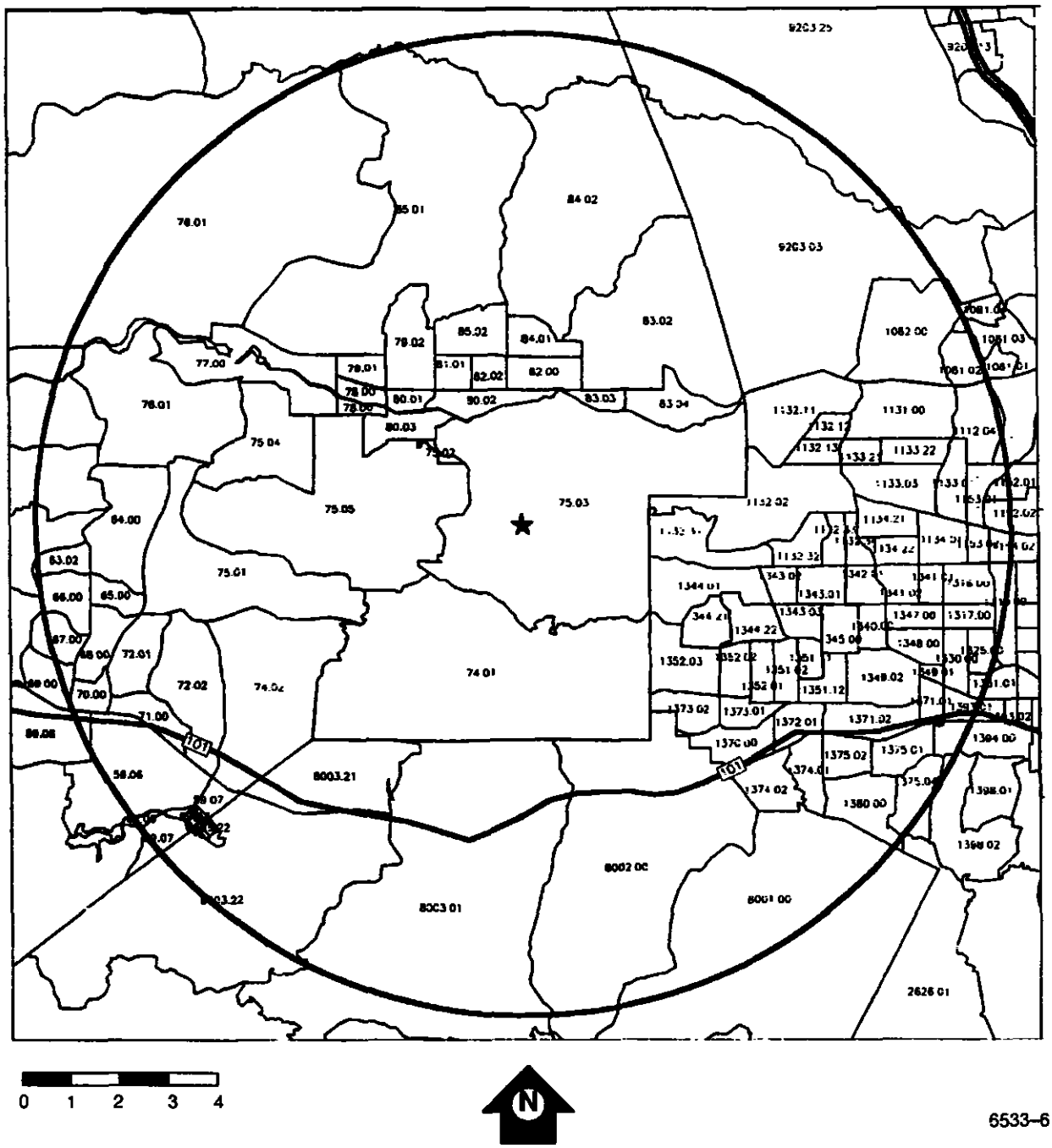

Figure 5–6. Census Tract Boundaries (1990) within 10 miles of SSFL (Individual tracts are identified by number)

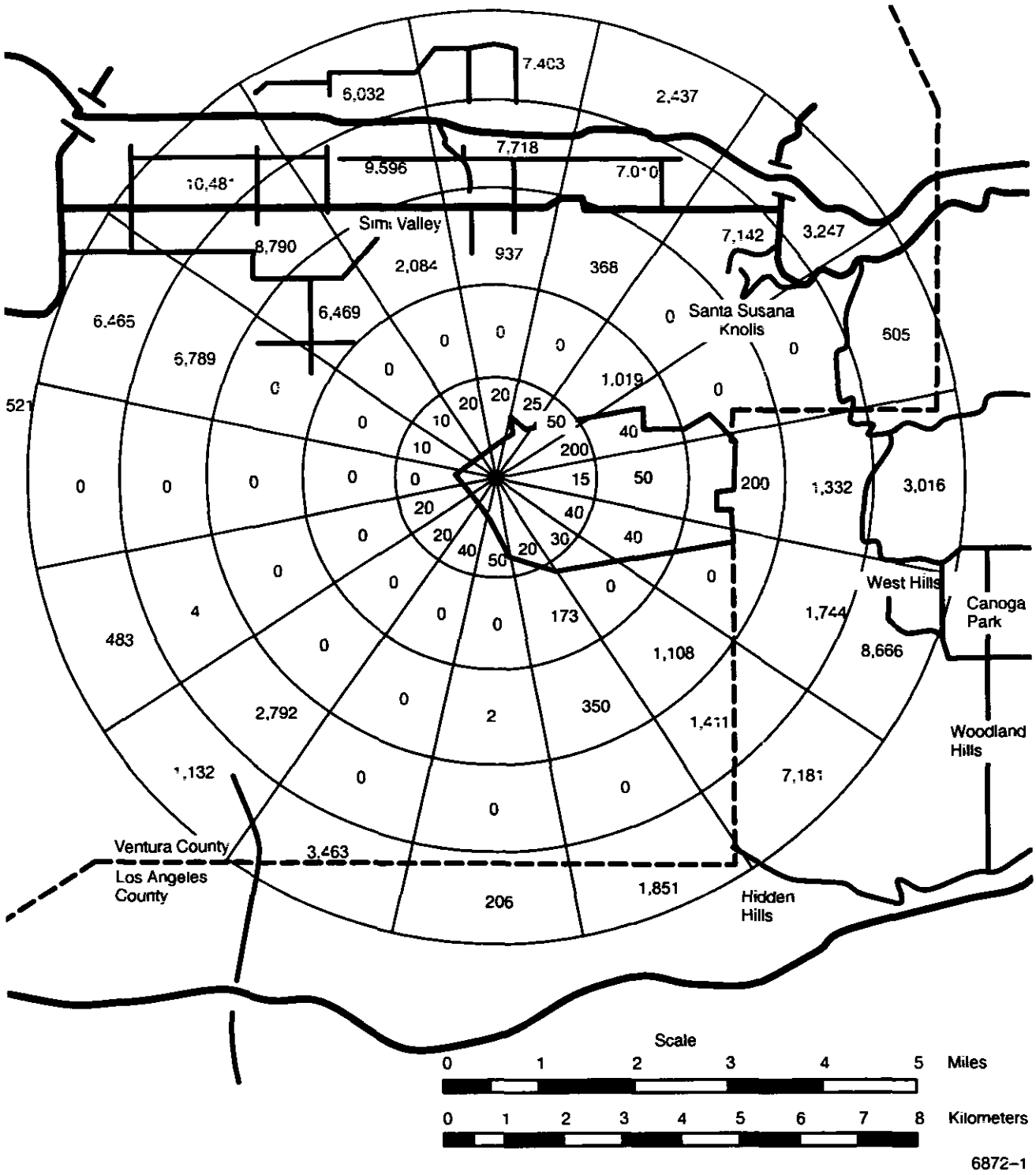

Figure 5–7. SSFL Site–Centered Demography to 8 km, Showing Number of Persons Living in Each Grid Area—1990 (Daytime Employment for SSFL)

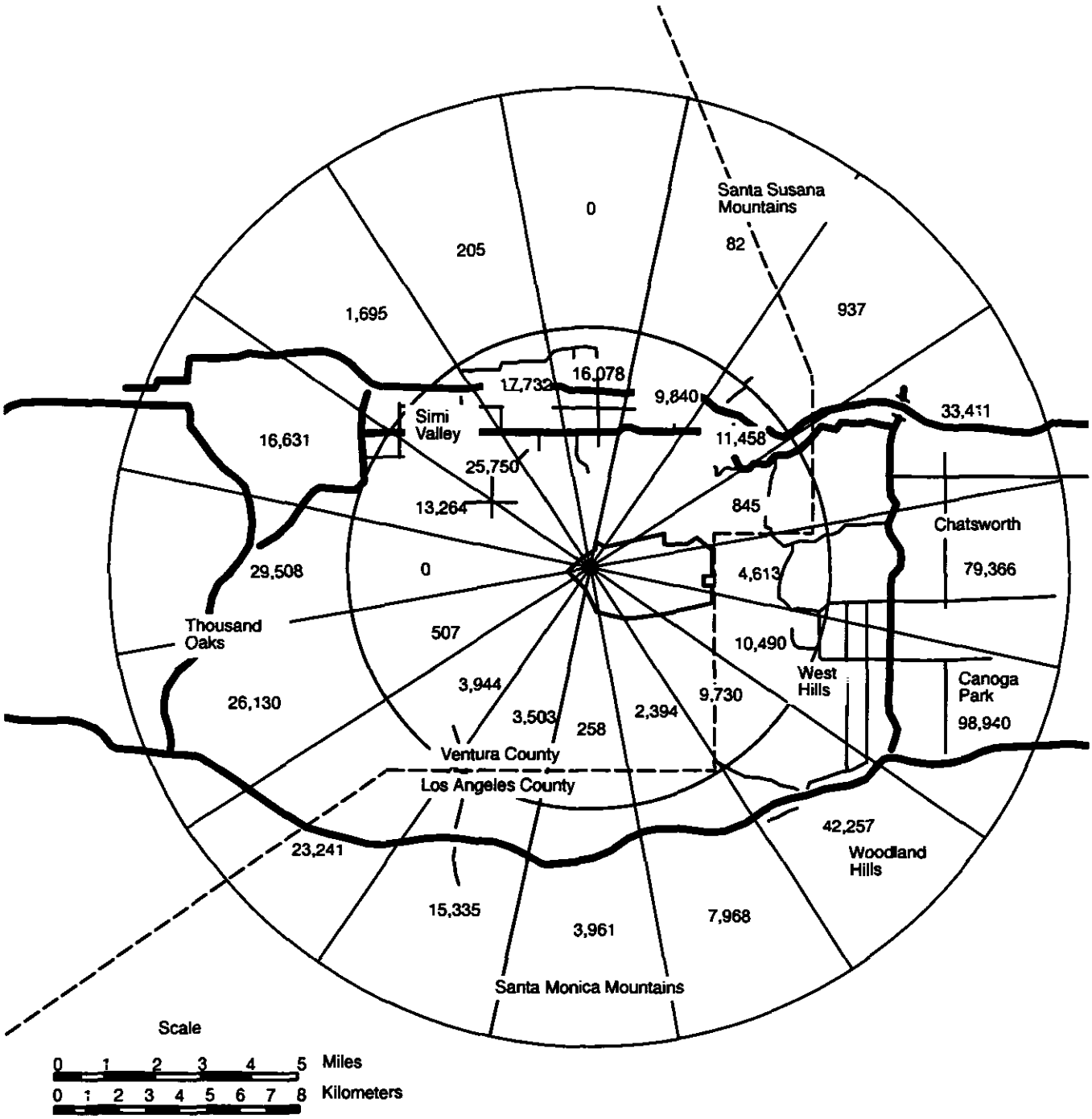

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Figure 5–8. SSFL Site–Centered Demography to 16 km, Showing Number of Persons Living in Each Grid Area—1990

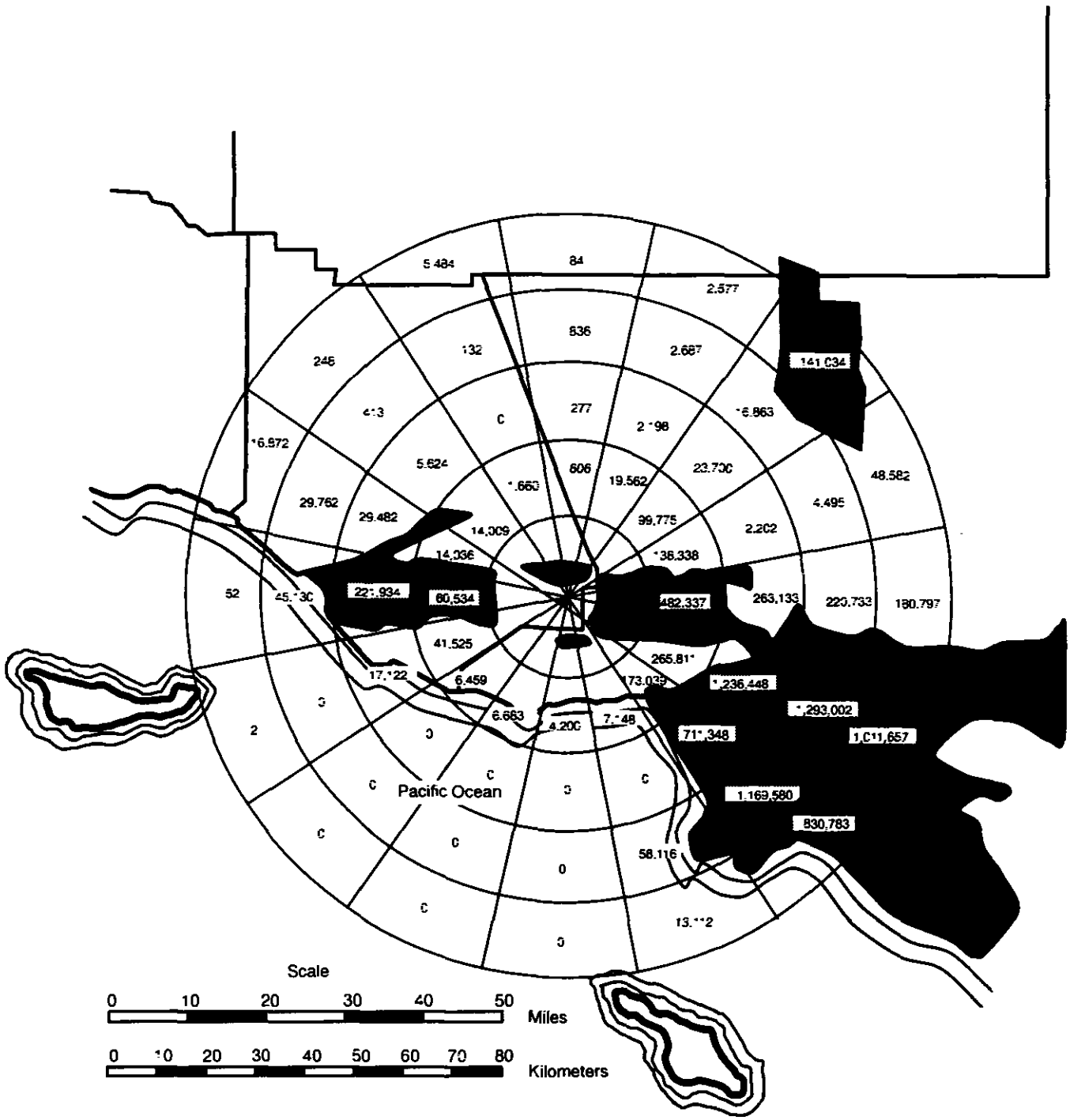

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Figure 5–9. SSFL Site–Centered Demography to 80 km, Showing Number of Persons Living in Each Grid Area—1990 (heavily populated areas are shown by shading)

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6.0 ENVIRONMENTAL NONRADIOLOGICAL PROGRAM INFORMATION

Rocketdyne maintains a comprehensive environmental program to ensure compliance with all applicable regulations, to prevent adverse environmental impact, and to restore the quality of the environment from past operations. Contamination resulting from underground storage tanks (USTs) has been remediated as tanks are removed. The majority of the storage tanks have been removed. The few remaining USTs are located within concrete vaults and equipped with automatic leak detection systems. ETEC is currently working with the Ventura County Environmental Health Division (VCEHD) to determine if additional leak detection requirements are in order for the sodium USTs. After an extensive review of past UST closures, it appeared that one tank, UT–55, a non–DOE tank located in Area IV, warranted further investigation. This determination is based on inconclusive closure documentation following remedial activities in February and March 1986. ETEC is working with the VCEHD on this matter. The environmental restoration activities at SSFL include an extensive review of past programs and historical practices to identify, characterize, and correct all areas of potential concern. An extensive groundwater remediation program has the capacity for removing solvent contamination from approximately one million gallons of groundwater per day at SSFL. The major groundwater contaminant in Area IV is trichloroethylene and its degradation products. Three pilot groundwater extraction system wells have been installed in Area IV and evaluation of their performance is in progress.

Extensive monitoring programs for both radiological and chemical contaminants in air, soil, surface water, and groundwater are in effect to assure that the existing environmental conditions do not pose a threat to the public welfare or environment.

The discharge of surface water at SSFL is usually rain induced or due to the nonutilization of treated groundwater and is regulated by the California Regional Water Quality Control Board through an NPDES permit. The majority of surface water runoff drains to the south and is collected in the water reclamation pond system. Discharges from this system are subject to effluent limitations and monitoring requirements as specified in the existing NPDES permit. A small portion of the site near Area IV generates rainfall runoff to five northwest boundary runoff channels where monitoring locations (see Figure 6–124) have been established and sampling is conducted in accordance with the northwest slope monitoring program. All discharges are periodically monitored for volatile organics, heavy metals, and applicable radionuclides, in addition to other parameters necessary to assess water quality.

All sources of air emissions at SSFL are subject to the provisions of the Clean Air Act (CAA) as administered through the California Air Resources Board and the Ventura County Air Pollution Control District (VCAPCD). The VCAPCD regulates sources of air emissions and issues permits that contain limits on pollutant levels and conditions of operation.

Soil analyses have been and are site specific according to the activities generating the analyses and potential disposition of the soil. A wide variety of analyses are conducted to determine the extent of any potential chemical contamination. All analyses conducted in Area IV at the present time are conducted per RCRA regulations.

The 1994 SARA Title III Form R (Toxic Release Inventory) submission will be sent to both the state and federal agencies by the 1 July 1995 deadline. The forms include questions regarding off–site waste

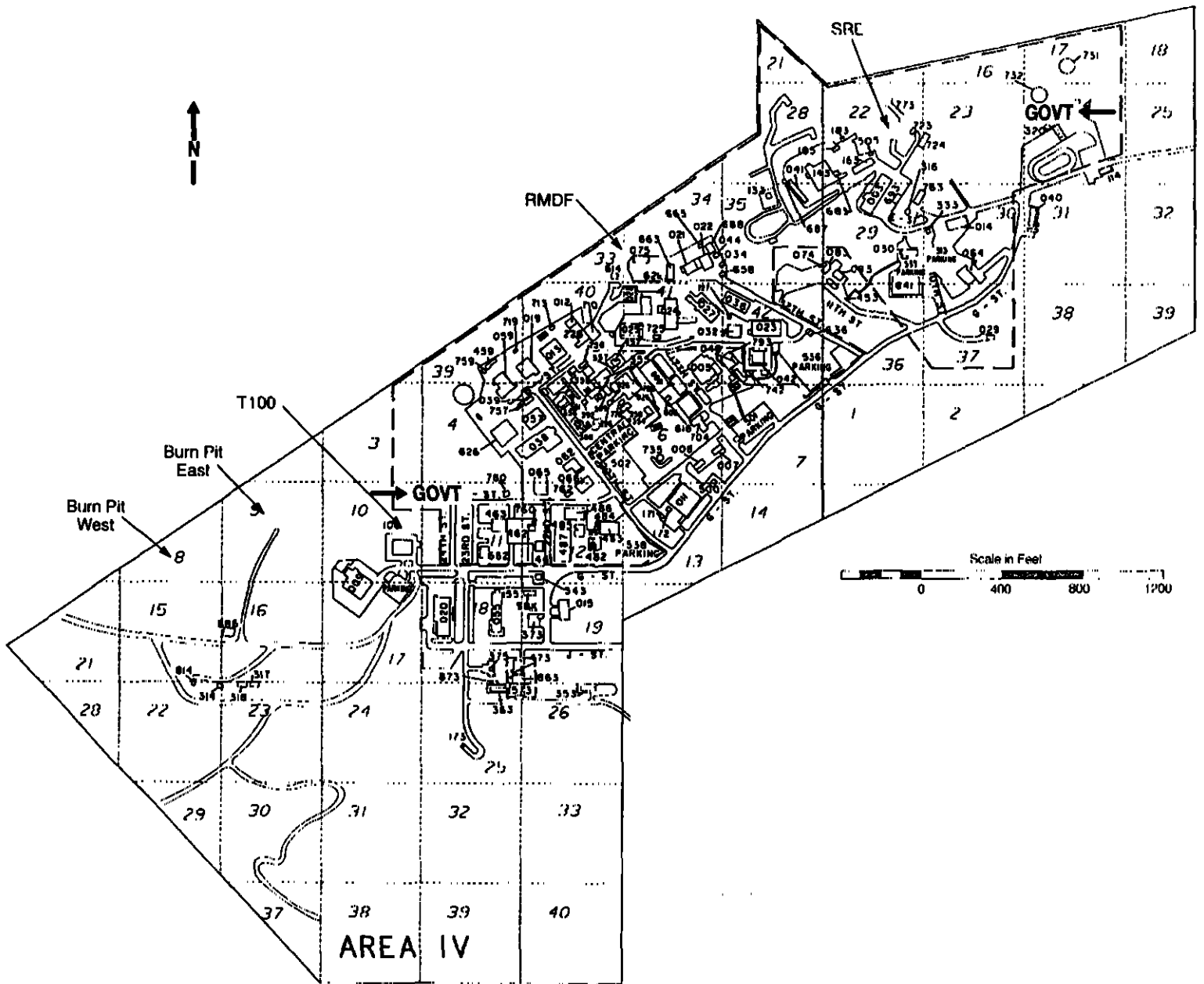

Figure 6–1. Locations of Rainfall Runoff Collectors Along Northwest Boundary of SSFL, Area IV

shipments and air emission calculations. At ETEC only two chemicals met the threshold requirements this year: ammonia and sulfuric acid.

The overall annual groundwater monitoring program at SSFL addresses collection and analysis of groundwater samples and measurement of the water levels for the 215 Rocketdyne installed wells on–site and 16 off–site private wells. The locations of these wells within and around DOE areas in Area IV are shown on the map of SSFL in Figure 6–2. Groundwater quality parameters and sampling frequency have been determined based on historical water quality data, location of known or potential sources of groundwater contamination, operational requirements of groundwater extraction and treatment systems and regulatory direction. The groundwater monitoring program includes the following parameters, all analyzed using the appropriate EPA methods: volatile organic constituents, base/neutral and acid extractable organic compounds, petroleum hydrocarbons, and trace metals and common ion constituents.

In addition to this environmental monitoring and restoration program, current operational procedures reflect Rocketdyne's commitment to a clean and safe environment. For example, solvents and oil are collected and recycled to the maximum extent possible. A comprehensive training and employee awareness program is in place. All employees working with hazardous materials are required to attend a course on hazardous materials waste management. Environmental bulletins are printed in the Rocketdyne newspaper to promote environmental awareness among all employees.

A revised Spill Prevention Control and Countermeasure (SPCC) plan was submitted as a part of the revised Spill Prevention and Response Plan to the local Administering Agency on 8 April 1994. The U.S. EPA requires the preparation of an SPCC plan by those facilities which, because of their location, could reasonably be expected to discharge oil in harmful quantities into or upon navigable waters. Additionally, an updated hazardous materials inventory was submitted as an update of the business plan on 13 December 1993. The hazardous materials disclosure fee was also submitted.

Asbestos control at Rocketdyne is conducted under the requirements of Titles 29, 40, and 49 of the Code of Federal Regulations (CFR), in addition to any state or local regulations that apply to any asbestos abatement program. Several steps in managing an asbestos program have been incorporated into facility renovation and demolition. These generally include assessment or identification of asbestos–containing materials (ACMs), abatement activities such as worker protection and surveillance, and clearance requirements such as cleanup and disposal. Within Area IV, approximately 100% of the buildings have been surveyed, and materials in question have been analyzed for asbestos. Where required, asbestos abatement will occur when renovation or demolition projects are identified.

In summary, Rocketdyne is committed to sound environmental management of all programs at our facilities and to correcting existing environmental problems before they pose a threat to our employees or the public. We have a longstanding record of our commitment to protecting the environment and will continue to strengthen that commitment in the future.

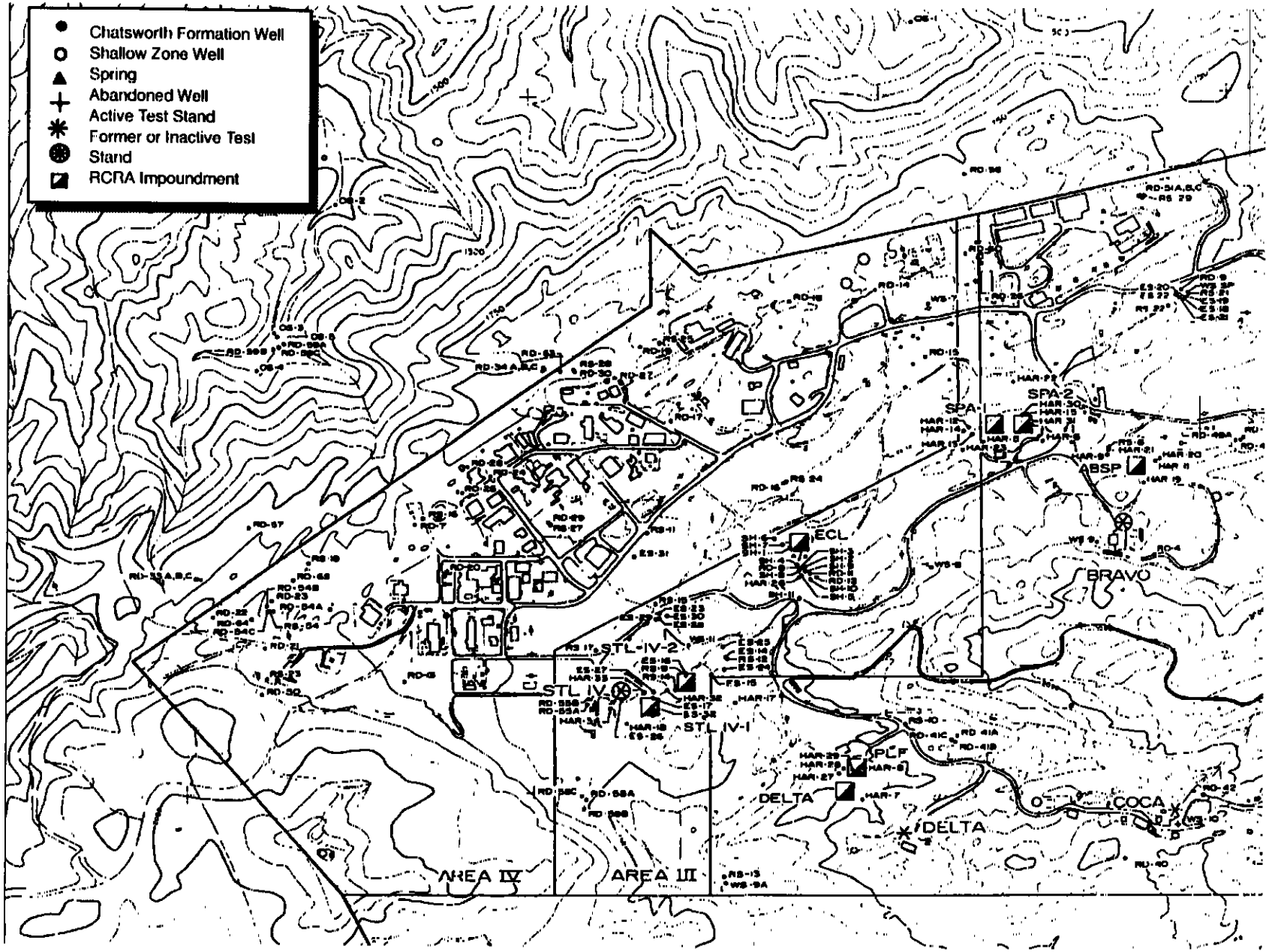

Figure 6–2. Locations of Wells Used in Groundwater Management Program

6.1 SURFACE WATER

Rocketdyne has filed a Report of Waste Discharge with the California Regional Water Quality Control Board (RWQCB) and has been granted a discharge permit pursuant to the National Pollutant Discharge Elimination System (NPDES) and Section 402 of the federal Water Pollution Control Act. The permit to discharge, NPDES No. CA0001309, initially became effective 27 September 1976. The permit was renewed with minor changes effective 17 September 1984 and has since undergone significant modifications subsequent to reissuance on 7 December 1992. This permit allows the discharge of reclaimed wastewater and storm water runoff from water retention ponds into Bell Creek, a tributary to the Los Angeles River, in addition to the discharge of storm water runoff from the northwest slope (Area IV) locations. Discharge along the northwest slope generally occurs only during and after periods of heavy rainfall (Outfalls 003 through 007). Excess reclaimed water is now discharged on a continuous basis through the R–2A outfall location (Outfall 002).

There is no sanitary sewer discharge from SSFL. Domestic sewage is treated, disinfected, and discharged to the retention ponds. Permit conditions are placed on the operation of the two treatment plants. Area IV sewage is discharged directly to the Area III Sewage Treatment Plant (STP III).

Of the two retention ponds at SSFL that discharge via the NPDES permit, only one receives influent from Area IV, and is referred to as Pond R–2A. Analytical results from 1994 surface water discharge events and storm water runoff are shown in Tables 6–1 through 6–6.

Influent to the ponds includes tertiary treated domestic sewage, cooling water from various testing operations, and storm water runoff. During periods of discharge from the ponds, grab–type samples are collected for analysis by a California State certified Testing Lab. Analyses include nonradioactive chemical constituents such as heavy metals, volatile organics, base/neutral and acid extractable, and general chemistry in addition to specified radionuclides. Toxicity testing is also conducted in the form of fish and chronic toxicity bioassays. The NPDES permit, shown as Appendix A, lists the specific constituents that are analyzed, as well as their respective effluent limits.

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 that include: the Radioactive Materials Disposal Facility watershed (Outfall 003), Sodium Reactor Experiment watershed (Outfall 004), the Former Sodium Disposal Facility (Outfalls 005 and 006), and behind Building 100 (Outfall 007). Runoff monitoring is currently conducted as set forth by the NPDES permit referenced above. Additionally, any surface water runoff program activity, i.e., Northwest Slope outfall in connection with the SWPPP implementation was accomplished by the formalization of the NPDES permit (December 1992). The SWPPP and the NPDES permits were both prepared in accordance with the current federal and state regulations.

Table 6–1. 1994 Analytical Results for NPDES Water Releases from Outfall 002 (R2A Flume)
(Sheet 1 of 9)

CONSTITUENT	UNITS	LIMITS	25-Jan	4-Feb	17-Feb	8-Mar	25-Mar
RAINFALL	INCHES	N/A	0	0.35	0.98	0	0.01
VOLUME DISCHARGED	MG	N/A	0.54	1.03	0.323	0.18	1.00
pH	S.U.	6.0 to 9.0	8.3	8	7.8	7.99	8.1
TEMPERATURE	DEG F	110 MAX	48	51	55.6	56.6	53
TURBIDITY	NTU	N/A	5.2	45	150	8.2	48
TOTAL SUSPENDED SOLIDS	MG/L	15	<2.5	42.8	108	7	17.5
SETTLEABLE SOLIDS	ML/L	0.2	0.1	<0.01	0.5	<0.1 mg/l	0.1
TOTAL DISSOLVED SOLIDS	MG/L	N/A	602	252	181	532	335
TOTAL ORGANIC CARBON	MG/L	N/A	6	8	8	4.47	4.9
CONDUCTIVITY @ 25 C	MICROMHOS/CM	N/A	667	377	232	793	587
BOD 5-DAY A@ 20 C	MG/L	10	3	4.1	6.5	2.7	2
OIL AND GREASE	MG/L	15	1.4	1.3	1.1	1.4	0.4
CHLORIDE	MG/L	250	70.5	22.3	16.4	62.8	36.9
FLUORIDE	MG/L	1.6	0.4	0.1	0.1	0.7	0.2
NITRATE AND NITRITE (AS NITROGEN)	MG/L	10	ND	0.8	0.7	4.43	3.67
SULFATE	MG/L	250	168	71	25	120	77.6
SURFACTANTS (AS MBAs)	MG/L	0.5	ND	<0.025	<0.025	0.03	<.025
RESIDUAL CHLORINE	MG/L	0.5	ND	<0.04	<0.04	<0.04	<0.04
ARSENIC	UG/L	50	2	1	2	<1	<1
BARIUM	UG/L	1,000	57	19	69	49	27
BORON	MG/L	1	0.4	<0.2	0.2	<0.2	0.2
TOTAL HARDNESS (CaCO3)	MG/L	N/A	260	116	123	304	311.5
RADIOACTIVITY							
GROSS ALPHA	PCI/L	15	4.9 +/- 3.7	2.1 +/- 1.0	2.4 +/- 1.6	1.5 +/- 3.0	1.5 +/- 3
GROSS BETA	PCI/L	15	11 +/- 4	5.5 +/- 1.8	4.4 +/- 1.9	7.8 +/- 4.5	7.8 +/- 4.5
TOTAL RADIUM-226 & RADIUM 228	PCI/L	5	1.2 +/- 1.3	0.9 +/- 1.2	2.1 +/-1.7	0.5 +/- 1.5	0.7 +/- 1.7
TRITIUM	PCI/L	20,000	5 +/- 190	50 +/- 190	60 +/- 190	60 +/- 190	50 +/- 210
STRONTIUM-90	PCI/L	8	0.5 +/- 1.7	0.8 +/- 1.5	0.5 +/- 1.3	1.3 +/- 1.4	1.3 +/- 1.4
METALS							
CADMIUM	UG/L	10	ND	<4	<4	<4	<4
CHROMIUM	UG/L	50	ND	<10	<10	<10	<10
COPPER	UG/L	1,000	ND	<5	10	<5	5
LEAD	UG/L	50	ND	<5	8	<5	<5
MERCURY	UG/L	2	ND	<0.2	<0.2	<0.2	<0.2
NICKEL	UG/L	1,000	61	<15	<15	<15	<15
SELENIUM	UG/L	50	ND	<5	<5	<5	<5
SILVER	UG/L	50	ND	<7	<7	<7	<7
ZINC	UG/L	1,000	23	19	22	292	25

Table 6–1. 1994 Analytical Results for NPDES Water Releases from Outfall 002 (R2A Flume) (Sheet 2 of 9)

CONSTITUENT	UNITS	LIMITS	26-Apr	18-May	6-Jun	11-Jul	2-Aug
RAINFALL			0.1	0.03	0	0	0
VOLUME DISCHARGED			0.49	0.54	0.26	0.75	0.75
pH			8.2	8.2	8.1	8.31	8.2
TEMPERATURE			54	55.8	65.3	72.0	68.9
TURBIDITY			1.6	7	5.2	4.4	4.7
TOTAL SUSPENDED SOLIDS			40	3.2	2.5	3.2	3.8
SETTLEABLE SOLIDS			<0.1	0.2	0.1	0.1	<0.1
TOTAL DISSOLVED SOLIDS			529	561	533	537	546
TOTAL ORGANIC CARBON			4.01	3.44	3.84	3.84	3.9
CONDUCTIVITY @ 25 C			906	902	902	880	919
BOD 5-DAY A@ 20 C			ND	ND	ND	<2	<2
OIL AND GREASE			0.61	1.5	0.8	1.1	2.2
CHLORIDE			60.6	63.9	65.2	62.6	68.7
FLUORIDE			0.1	0.5	0.4	0.4	0.4
NITRATE AND NITRITE (AS NITROGEN)			3.52	3.1	9.48	1.11	1.07
SULFATE			126	130	142	117	137
SURFACTANTS (AS MBAs)			0.04	ND	ND	ND	0.04
RESIDUAL CHLORINE			<0.04	ND	ND	ND	ND
ARSENIC			2	1	1	3	3
BARIUM			40	45	39	44	35
BORON			0.4	0.4	0.4	0.4	0.6
TOTAL HARDNESS (CaCO3)			293	321.3	248	264	304
RADIOACTIVITY							
GROSS ALPHA			2.9 +/- 2.9	6.5 +/- 4.2	2.2 +/- 2.7	1.5 +/- 3.9	1.1 +/- 3.6
GROSS BETA			4.2 +/- 3.5	10 +/- 4	5.9 +/- 2.7	3.0 +/- 3.1	3.5 +/- 2.9
TOTAL RADIUM-226 & RADIUM 228			1.3 +/- 1.7	0.8 +/-1.7	0.2 +/-1.6	2.2 +/- 2.0	1.24 +/- 1.57
TRITIUM			0 +/- 200	40 +/-200	170 +/- 200	0 +/- 200	0 +/- 210
STRONTIUM-90			0 +/- 1.1	0.0 +/- 1.3	0.3 +/- 1	1.1 +/- 1.3	0.0 +/- 1.2
METALS							
CADMIUM			<4	<4 ug/l	<4 ug/l	<4 ug/l	<4 ug/l
CHROMIUM			<10	<10 ug/l	<10 ug/l	8	<7 ug/l
COPPER			<6	<6 ug/l	<6 ug/l	<6 ug/l	<6 ug/l
LEAD			<5	<5 ug/l	<5 ug/l	<5 ug/l	<5 ug/l
MERCURY			<0.2	<0.2 ug/l	<0.2 ug/l	<0.2 ug/l	<0.2 ug/l
NICKEL			<15	<15 ug/l	<15 ug/l	<15 ug/l	<15 ug/l
SELENIUM			<5	<5 ug/l	<5 ug/l	<5 ug/l	<5 ug/l
SILVER			<7	<7 ug/l	<7 ug/l	<7 ug/l	<7 ug/l
ZINC			12	6	13	3	3

Table 6–1. 1994 Analytical Results for NPDES Water Releases from Outfall 002 (R2A Flume) (Sheet 3 of 9)

CONSTITUENT	UNITS	LIMITS	12-Sep	4-Oct	7-Nov	17-Nov	6-Dec
RAINFALL	INCHES	N.A.	0	0	0	0	0
VOLUME DISCHARGED	MG	N.A.	0.35	0.51	0.28	0.48	0.29
PH	STANDARD UNITS	6.0 TO 9.0	8.5	8.2	8.1	8.2	8.2
TEMPERATURE	DEG F	90 & 100	64.4	61.4	55.0	55.0	50.4
TURBIDITY	NTU	30	3.5	15	2.5	1.08	3.5
TOTAL SUSPENDED SOLIDS	MG/L	15	3.3	8	< 5	ND	8.5
SETTLEABLE SOLIDS	ML/L	0.3	0.1	0.1	< 0.1	ND	< 0.1
TOTAL DISSOLVED SOLIDS	MG/L	1000	586	600	526	626	685
TOTAL ORGANIC CARBON	MG/L	30	3.1	8.4	2.8	NA	2.6
CONDUCTIVITY @ 25 C	MICROMHOS	1500	1019	1003.2	1007	1022	1030
BOD 5-DAY A@ 20 C	MG/L	10	<5	NA	< 5	NA	< 5
OIL AND GREASE	MG/L	10	< 0.2	0.87	0.5	1.7	0.94
CHLORIDE	MG/L	250	70.6	72.2	92	62	59.0
FLUORIDE	MG/L	1.4	0.4	0.4	0.34	0.52	< 0.1
NITRATE AND NITRITE (AS NITROGEN)	MG/L	10	1.02	1.33	7.24	1.05	9.94
SULFATE	MG/L	250	152	180	236	161	186
SURFACTANTS (AS MBAs)	MG/L	0.5	<0.05	<0.05	<0.05	ND	< 0.05
RESIDUAL CHLORINE	MG/L	0.1	ND	ND	<0.04	ND	< 0.04
ARSENIC	UG/L	190	3	1	1	1	<1
BARIUM	UG/L	2,000	40	56	50	51	<5
BORON	MG/L	1.6	0.2	ND	0.2	0.14	< 0.2
TOTAL HARDNESS (CaCO3)	MG/L	N.A.	314.5	350	340	350	360
RADIOACTIVITY							
GROSS ALPHA	PCI/L	15	0.0 +/- 3.6	9.6 +/- 5.5	0.0 +/- 4.1	3.3 +/- 4.1	0.4 +/- 3.5
GROSS BETA	PCI/L	50	4.9 +/- 2.9	11 +/- 3.0	3.3 +/- 3.3	5.9 +/- 3.8	5.4 +/- 3.2
TOTAL RADIUM-226 & RADIUM 228	PCI/L	5	1.1 +/- 1.60	1.4 +/- 1.50	2.4 +/- 1.7	1.3 +/- 1.4	2.4 +/- 2.3
TRITIUM	PCI/L	20,000	156 +/- 203	222 +/- 206	0 +/- 245	0 +/- 195	0 +/- 195
STRONTIUM-90	PCI/L	8	1.3 +/- 1.2	1.5 +/- 0.8	0.0 +/- 1.3	0.4 +/- 1.4	0.2 +/- 1.0
METALS							
CADMIUM	UG/L	9.3	<4 ug/l	<4 ug/l	<4 ug/l	<4 ug/l	<5 ug/l
CHROMIUM	UG/L	11	<7 ug/l	<7 ug/l	<7 ug/l	<7 ug/l	<1 ug/l
COPPER	UG/L	2,000	<6 ug/l	<6 ug/l	<6 ug/l	<6 ug/l	20
LEAD	UG/L	12	<5 ug/l	<5 ug/l	<5 ug/l	<5 ug/l	<5 ug/l
MERCURY	UG/L	1.3	<0.2 ug/l	<0.2 ug/l	<0.2 ug/l	<0.2 ug/l	<1.0 ug/l
NICKEL	UG/L	470	17	<15 ug/l	<15 ug/l	<15 ug/l	130
SELENIUM	UG/L	5	<5 ug/l	<5 ug/l	<5 ug/l	<5 ug/l	<1 ug/l
SILVER	UG/L	2.3	10	<7 ug/l	<7 ug/l	<7 ug/l	20
ZINC	UG/L	170	23	<2 ug/l	9 ug/l	26 ug/l	30

Table 6–1. 1994 Analytical Results for NPDES Water Releases from Outfall 002 (R2A Flume) (Sheet 4 of 9)

CONSTITUENT	UNITS	LIMITS	25-Jan	4-Feb	17-Feb	8-Mar	25-Mar
PESTICIDES							
ALDRIN			<0.05	<0.05 ug	<0.05 ug	<0.01 ug	<0.01 ug
CHLORDANE			<0.50	<0.5 ug	<0.5 ug	<1.0 ug	<1.0 ug
DDT			<0.10	<0.1 ug	<0.1 ug	<0.01 ug	<0.01 ug
DIELDRIN			<0.10	<0.1 ug	<0.1 ug	<0.1 ug	<0.1 ug
ENDOSULFAN			<0.15	<0.05 ug	<0.05 ug	<0.1 ug	<0.1 ug
ENDRIN			<0.10	<0.1 ug/l	<0.1 ug/l	<0.05 ug/l	<0.05 ug/l
HEPTACHLOR			<0.05	<0.05 ug/l	<0.05 ug/l	<0.01 ug/l	<0.01 ug/l
HEPTACHLOR EPOXIDE			<0.05	<0.05 ug	<0.05 ug	<0.01 ug	<0.01 ug
HEXACHLOROCYCLOHEXANE-ALPHA			<0.05	<0.05 ug	<0.05 ug	<0.01 ug	<0.01 ug
HEXACHLOROCYCLOHEXANE-BETA			<0.05	<0.05 ug	<0.05 ug	<0.03 ug	<0.03 ug
HEXACHLOROCYCLOHEXANE-DELTA			<0.05	<0.05 ug	<0.05 ug	<0.01 ug	<0.01 ug
LINDANE			<0.05	<0.05	<0.05	<0.01	<0.01
METHOXYCHLOR			NA	NA	NA	<0.5	<0.5
2,4-D			<12	<12 ug/l	<12 ug/l	<0.009	<0.009
2,4,5-TP-SILVEX			<1.7	<1.7 ug/l	<1.7 ug/l	<0.003	<0.003
TOXAPHENE			<1.00	<1 ug	<1 ug	<1 ug	<1 ug
VOLITILE ORGANICS							
DICHLOROMETHANE			<1	<2	<2	<2	<2
1,1-DICHLOROETHYLENE			<1	<1	<1	<1	<1
TRANS-1,2-DICHLOROETHYLENE			<1	<1	<1	<1	<1
TRICHLOROETHYLENE			<1	<1	<1	<1	<1
1,1,2,2-TETRACHLOROETHANE			<1	<1	<1	<1	<1
TETRACHLOROETHYLENE			<1	<1	<1	<1	<1
VINYL CHLORIDE			<2	<2	<2	<2	<2
CARBON TETRACHLORIDE			<1	<1	<1	<1	<1
1,2-DICHLOROETHANE			<1	<1	<1	<1	<1
1,1-DICHLOROETHANE			<1	<1	<1	<1	<1
ETHYLBENZENE			<1	<1	<1	<1	<1
1,1,1-TRICHLOROETHANE			<1	<1	<1	<1	<1
1,1,2-TRICHLOROETHANE			<1	<1	<1	<1	<1
BENZENE			<1	<1	<1	<1	<1
CHLOROFORM			<1	<1	<1	<1	<1
BROMOFORM			<1	<1	<1	<1	<1
TOLUENE			<1	<1	<1	<1	<1
SEMI-VOLITILES							
FLUORANTHENE			<2	<2	<2	<2	<2

Table 6–1. 1994 Analytical Results for NPDES Water Releases from Outfall 002 (R2A Flume) (Sheet 5 of 9)

CONSTITUENT	UNITS	LIMITS	26-Apr	18-May	6-Jun	11-Jul	2-Aug
PESTICIDES							
ALDRIN			<0.01 ug	<0.01 ug	<0.01 ug	<0.01 ug	<0.01 ug
CHLORDANE			<1.0 ug	<1.0 ug	<1.0 ug	<1.0 ug	<1.0 ug
DDT			<0.01 ug	<0.01 ug	<0.01 ug	<0.01 ug	<0.01 ug
DIELDRIN			<0.1 ug	<0.1 ug	<0.1 ug	<0.1 ug	<0.1 ug
ENDOSULFAN			<0.1 ug	<0.1 ug	<0.1 ug	<0.1 ug	<0.1 ug
ENDRIN			<0.05 ug/l	<0.05 ug/l	<0.05 ug/l	<0.05 ug/l	<0.05 ug/l
HEPTACHLOR			<0.01 ug/l	<0.01 ug/l	<0.01 ug/l	<0.01 ug/l	<0.01 ug/l
HEPTACHLOR EPOXIDE			<0.01 ug	<0.01 ug	<0.01 ug	<0.01 ug	<0.01 ug
HEXACHLOROCYCLOHEXANE-ALPHA			<0.01 ug	<0.01 ug	<0.01 ug	<0.01 ug	<0.01 ug
HEXACHLOROCYCLOHEXANE-BETA			<0.03 ug	<0.03 ug	<0.03 ug	<0.03 ug	<0.03 ug
HEXACHLOROCYCLOHEXANE-DELTA			<0.01 ug	<0.01 ug	<0.01 ug	<0.01 ug	<0.01 ug
LINDANE			<0.01	<0.01	<0.01	<0.01	<0.01
METHOXYCHLOR			<0.5	<0.5	<0.5	<0.5	<0.5
2,4-D			<0.009	<0.009	<0.009	<0.009	<0.05
2,4,5-TP-SILVEX			<0.003	<0.003	<0.003	<0.003	<0.003
TOXIPHENE			<1 ug	<1 ug	<1 ug	<1 ug	<1 ug
VOLITILE ORGANICS							
DICHLOROMETHANE			<2	<2	<2	<2	<2
1,1-DICHLOROETHYLENE			<1	<1	<1	<1	<1
TRANS-1,2-DICHLOROETHYLENE			<1	<1	<1	<1	<1
TRICHLOROETHYLENE			<1	<1	<1	<1	<1
1,1,2,2-TETRACHLOROETHANE			<1	<1	<1	<1	<1
TETRACHLOROETHYLENE			<1	<1	<1	<1	<1
VINYL CHLORIDE			<2	<2	<2	<2	<2
CARBON TETRACHLORIDE			<1	<1	<1	<1	<1
1,2-DICHLOROETHANE			<1	<1	<1	<1	<1
1,1-DICHLOROETHANE			<1	<1	<1	<1	<1
ETHYLBENZENE			<1	<1	<1	<1	<1
1,1,1-TRICHLOROETHANE			<1	<1	<1	<1	<1
1,1,2-TRICHLOROETHANE			<1	<1	<1	<1	<1
BENZENE			<1	<1	<1	<1	<1
CHLOROFORM			<1	<1	<1	<1	<1
BROMOFORM			<1	<1	<1	<1	<1
TOLUENE			<1	<1	<1	<1	<1
SEMI-VOLITILES							
FLUORANTHENE			<2	<2	<2	<2	<2

Table 6–1. 1994 Analytical Results for NPDES Water Releases from Outfall 002 (R2A Flume)
(Sheet 6 of 9)

CONSTITUENT	UNITS	LIMITS	12-Sep	4-Oct	7-Nov	17-Nov	6-Dec
PESTICIDES							
ALDRIN			<0.01 ug	<0.01 ug	<0.01 ug	NA	<0.01 ug
CHLORDANE			<1.0 ug	<1.0 ug	<1.0 ug	NA	<1.0 ug
DDT			<0.01 ug	<0.01 ug	<0.01 ug	NA	<0.01 ug
DIELDRIN			<0.1 ug	<0.1 ug	<0.1 ug	NA	<0.1 ug
ENDOSULFAN			<0.1 ug	<0.1 ug	<0.1 ug	NA	<0.1 ug
ENDRIN			<0.05 ug/l	<0.05 ug/l	<0.05 ug/l	NA	<0.05 ug/l
HEPTACHLOR			<0.01 ug/l	<0.01 ug/l	<0.01 ug/l	NA	<0.01 ug/l
HEPTACHLOR EPOXIDE			<0.01 ug	<0.01 ug	<0.01 ug	NA	<0.01 ug
HEXACHLOROCYCLOHEXANE-ALPHA			<0.01 ug	<0.01 ug	<0.01 ug	NA	<0.01 ug
HEXACHLOROCYCLOHEXANE-BETA			<0.03 ug	<0.03 ug	<0.03 ug	NA	<0.03 ug
HEXACHLOROCYCLOHEXANE-DELTA			<0.01 ug	<0.01 ug	<0.01 ug	NA	<0.01 ug
LINDANE			<0.01	<0.01	<0.01	NA	<0.01
METHOXYCHLOR			<0.5	<0.5	<0.5	NA	<0.5
2,4-D			<0.05	<0.05	<0.05	NA	<0.05
2,4,5-TP-SILVEX			<0.05	<0.05	<0.05	NA	<0.05
TOXAPHENE			<1 ug	<1 ug	<1 ug	NA	<1 ug
VOLITILE ORGANICS							
DICHLOROMETHANE			<2	<2	<2	<2	<2
1,1-DICHLOROETHYLENE			<1	<1	<1	<1	<1
TRANS-1,2-DICHLOROETHYLENE			<1	<1	<1	<1	<1
TRICHLOROETHYLENE			<1	<1	<1	<1	<1
1,1,2,2-TETRACHLOROETHANE			<1	<1	<1	<1	<1
TETRACHLOROETHYLENE			<1	<1	<1	<1	<1
VINYL CHLORIDE			<2	<2	<2	<2	<2
CARBON TETRACHLORIDE			<1	<1	<1	<1	<1
1,2-DICHLOROETHANE			<1	<1	<1	<1	<1
1,1-DICHLOROETHANE			<1	<1	<1	<1	<1
ETHYLBENZENE			<1	<1	<1	<1	<1
1,1,1-TRICHLOROETHANE			<1	<1	<1	<1	<1
1,1,2-TRICHLOROETHANE			<1	<1	<1	<1	<1
BENZENE			<1	<1	<1	<1	<1
CHLOROFORM			<1	<1	<1	<1	<1
BROMOFORM			<1	<1	<1	<1	<1
TOLUENE			<1	<1	<1	<1	<1
SEMI-VOLITILES							
FLUORANTHENE			<2	<2	<2	<2	<2

Table 6–1. 1994 Analytical Results for NPDES Water Releases from Outfall 002 (R2A Flume)
(Sheet 7 of 9)

CONSTITUENT	UNITS	LIMITS	25-Jan	4-Feb	17-Feb	9-Mar	25-Mar
BASE/NEUTRAL/ACID EXTRACTIBLES							
1,2-DICHLOROBENZENE			<.003	<0.003	<0.003	<0.003	<0.003
1,3-DICHLOROBENZENE			<3	<3	<3	<3	<3
1,4-DICHLOROBENZENE			<3	<3	<3	<3	<3
HEXACHLOROBENZENE			<3	<3 ug	<3 ug	<3 ug	<3 ug
N-NITROSODIMETHYLAMINE			<2	NA	NA	NA	NA
PENTACHLOROPHENOL			<20	<20	<20	<20	<20
PHENOL			<5	<5	<5	<5	<5
2,4,6-TRICHLOROPHENOL			<10	<10	<10	<10	<10
2-4 DICHLOROPHENOL			NA	NA	NA	NA	NA
4-CHLORO-3-METHYLPHENOL			NA	NA	NA	NA	NA
MISCELLANEOUS							
CYANIDE			ND	ND	ND	ND	ND
PCB's (BASED ON THE CA INLAND SURFACE WATERS PLAN)			ND	ND	ND	ND	ND
PAH'S (BASED ON THE CA INLAND SURFACE WATERS PLAN)			ND	ND	ND	ND	ND
HALOMETHANES (BASED ON THE CA INLAND SURFACE WATERS PLAN			ND	ND	ND	ND	ND
TOXICITY - BIOASSAYS							
ACUTE			95%	100%	90%	100%**	100%
CHRONIC			4 & 8 **	1	1	NA	1*
PRIORITY POLLUTANTS (IN EXCESS OF ROUTINE)							
PERFORMED QUARTERLY				ND	NA	NA	NA
Beryllium			0.8				

Table 6–1. 1994 Analytical Results for NPDES Water Releases from Outfall 002 (R2A Flume)
(Sheet 8 of 9)

CONSTITUENT	UNITS	LIMITS	26-Apr	16-May	6-Jun	11-Jul	2-Aug
BASE/NEUTRAL/ACID EXTRACTIBLES							
1,2-DICHLOROBENZENE			<0.003	<0.003	<0.003	<1	<1
1,3-DICHLOROBENZENE			<3	<3	<3	<1	<1
1,4-DICHLOROBENZENE			<3	<3	<3	<1	<1
HEXACHLOROBENZENE			<3 ug	<3 ug	<3 ug	<3 ug	<3 ug
N-NITROSODIMETHYLAMINE			NA	NA	NA	<2	<2 ug/l
PENTACHLOROPHENOL			<20	<20	<20	<1	<1
PHENOL			<5	<5	<5	<5	<5
2,4,5-TRICHLOROPHENOL			<10	<10	<10	<1	<1
2,4 DICHLOROPHENOL			NA	NA	NA	NA	NA
4-CHLORO-3-METHYLPHENOL			NA	NA	NA	NA	NA
MISCELLANEOUS							
CYANIDE			<50	<50	ND	ND	ND
PCB'S (BASED ON THE CA INLAND SURFACE WATERS PLAN)			ND	ND	ND	ND	ND
PAH'S (BASED ON THE CA INLAND SURFACE WATERS PLAN)			ND	ND	ND	ND	ND
HALOMETHANES (BASED ON THE CA INLAND SURFACE WATERS PLAN			ND	ND	ND	ND	ND
TOXICITY - BIOASSAYS							
ACUTE			100%	100%	100%	100%	100%
CHRONIC			1	NA	NA	1	NA
PRIORITY POLLUTANTS (IN EXCESS OF ROUTINE)							
PERFORMED QUARTERLY		NOT STATED	ND	NA	NA	ND	NA
beryllium		NOT STATED					

Table 6–1. 1994 Analytical Results for NPDES Water Releases from Outfall 002 (R2A Flume) (Sheet 9 of 9)

CONSTITUENT	UNITS	LIMITS	12-Sep	4-Oct	7-Nov	17-Nov	6-Dec
BASE/NEUTRAL/ACID EXTRACTIBLES							
1,2-DICHLOROBENZENE			<1	<1	<1	<1	<1
1,3-DICHLOROBENZENE			<1	<1	<1	<1	<1
1,4-DICHLOROBENZENE			<1	<1	<1	<1	<1
HEXACHLOROBENZENE			<3 ug	<3 ug	<3 ug/l	<3 ug/l	<3 ug/l
N-NITROSODIMETHYLAMINE			<2 ug/l	<2 ug/l	<2 ug/l	<2 ug/l	<2 ug/l
PENTACHLOROPHENOL			<1	<1	<1	<1	<1
PHENOL			<5	<5	<5	<5	<5
2,4,6-TRICHLOROPHENOL			<1	<1	<1	<1	<1
2-4 DICHLOROPHENOL			NA	NA	<1	<1	<1
4-CHLORO-3-METHYLPHENOL			NA	NA	<1	<1	<1
MISCELLANEOUS							
CYANIDE			ND	ND	ND	ND	ND
PCB's (BASED ON THE CA INLAND SURFACE WATERS PLAN)			ND	ND	ND	NA	ND
PAHS (BASED ON THE CA INLAND SURFACE WATERS PLAN)			ND	ND	ND	ND	ND
HALOMETHANES (BASED ON THE CA INLAND SURFACE WATERS PLAN)			ND	ND	ND	ND	ND
TOXICITY - BIOASSAYS							
ACUTE			100%	100%	100%	NA	100%
CHRONIC			NA	1	NA	NA	NA
PRIORITY POLLUTANTS (IN EXCESS OF ROUTINE)							
PERFORMED QUARTERLY			NA	NA	NA	NA	ND
Beryllium							

Table 6–2. 1994 Analytical Results for NPDES Water Releases from Outfall 003 (RMDF)

CONSTITUENT	UNITS	LIMITS	17-Feb
RAINFALL	INCHES	NOT APPLICABLE	0.96
VOLUME DISCHARGED	MG	0.27	
pH	pH UNITS	6.5 TO 8.5	8
TEMPERATURE	DEG F	46.8	
TOTAL DISSOLVED SOLIDS	mg/l	579	
OIL AND GREASE	mg/l	1.2	
CHLORIDE	mg/l	12.9	
FLUORIDE	mg/l	0.1	
NITRATE AND NITRITE (AS NITROGEN)	mg/l	0.5	
SULFATE	mg/l	30.4	
RESIDUAL CHLORINE	mg/l	<0.04	
BORON	mg/l	0.2	
RADIOACTIVITY			
GROSS ALPHA	pCi/l	3.3 +/- 1.7	
GROSS BETA	pCi/l	5.6 +/- 2.0	
TOTAL RADIUM-226 & RADIUM 228	pCi/l	1.0 +/- 1.6	
TRITIUM	pCi/l	70 +/- 190	
STRONTIUM-90	pCi/l	1.8 +/- 1.4	
TOXICITY - BIOASSAYS			
ACUTE	% SURVIVAL	95%	
CHRONIC	TUC	1	
PRIORITY POLLUTANTS			
ARSENIC	ug/l	12	
CHROMIUM	ug/l	55	
COPPER	ug/l	39	
LEAD	ug/l	210	
ZINC	ug/l	240	
ALL OTHERS	ug/l	ND	

Table 6–3. 1994 Analytical Results for NPDES Water Releases from Outfall 004 (SRE)

CONSTITUENT	UNITS	LIMITS	4-Feb	17-Feb	25-Mar
RAINFALL	[illegible]	[illegible]	0.35	0.96	0.01
VOLUME DISCHARGED	[illegible]	[illegible]	0.14	0.38	0.004
pH	[illegible]	[illegible]	7.4	7.1	7.7
TEMPERATURE	[illegible]	[illegible]	50.2	52.4	47.8
TOTAL DISSOLVED SOLIDS	[illegible]	[illegible]	91	48	97
OIL AND GREASE	[illegible]	[illegible]	1.5	1.4	1.1
CHLORIDE	[illegible]	[illegible]	4.3	3.3	4.4
FLUORIDE	[illegible]	[illegible]	0.2	<0.1	0.1
NITRATE AND NITRITE (AS NITROGEN)	[illegible]	[illegible]	0.2	0.3	3.6
SULFATE	[illegible]	[illegible]	6	2.2	17.2
RESIDUAL CHLORINE	[illegible]	[illegible]	<0.04	<0.04	<0.04
BORON	[illegible]	[illegible]	<0.2	0.2	<0.2
RADIOACTIVITY					
GROSS ALPHA	[illegible]	[illegible]	2.0 +/- 1.5	1.1 +/- 1.0	1.5 +/- 1.2
GROSS BETA	[illegible]	[illegible]	4.2 +/- 2.0	3.1 +/- 1.8	3.0 +/- 2.1
TOTAL RADIUM-226 & RADIUM 228	[illegible]	[illegible]	1.1 +/- 1.3	0.9 +/- 1.7	2.4 +/- 2.7
TRITIUM	[illegible]	[illegible]	0 +/- 190	90 +/- 190	0 +/- 200
STRONTIUM-90	[illegible]	[illegible]	0.0 +/- 1.0	0.5 +/- 1.3	2.0 +/- 1.5
TOXICITY - BIOASSAYS					
ACUTE	[illegible]	[illegible]	100%	90%	100%
CHRONIC	[illegible]	[illegible]	1	NA	NA
PRIORITY POLLUTANTS					
COPPER	[illegible]	[illegible]	5	NA	NA
ZINC	[illegible]	[illegible]	13	NA	NA
ALL OTHERS	[illegible]	[illegible]	ND	ND	NA

Table 6–4. 1994 Analytical Results for NPDES Water Releases from Outfall 005 (SBP–1)

CONSTITUENT	UNITS	LIMITS	4-Feb	17-Feb	25-Mar
RAINFALL	INCHES	NOT APPLICABLE	0.35	0.96	0.01
VOLUME DISCHARGED	MG	1.44 MGD	0.14	0.39	0.004
pH	pH UNITS	6.5 TO 8.5	8.3	8.2	8.3
TEMPERATURE	DEG. F	MTL > 100	53.2	55.4	49.6
TOTAL DISSOLVED SOLIDS	mg/l	500	146	487	385
OIL AND GREASE	mg/l	15	1.7	1.3	2.3
CHLORIDE	mg/l	150	19.7	5.1	4.4
FLUORIDE	mg/l	1.6	0.1	<0.1	0.2
NITRATE AND NITRITE (AS NITROGEN)	mg/l	10	2.9	2.5	4.4
SULFATE	mg/L	250	5	3.3	96.7
RESIDUAL CHLORINE	mg/l	0.1	<0.04	<0.04	<0.04
BORON	mg/l	1.6	<0.2	<0.2	<0.2
RADIOACTIVITY					
GROSS ALPHA	PCi/l	15	1.6 +/- 1.2	1.6 +/- 1.1	2.3 +/- 1.6
GROSS BETA	PCi/l	50	2.8 +/- 1.8	1.6 +/- 1.7	4.8 +/- 2.6
TOTAL RADIUM-226 & RADIUM 228	PCi/l	5	0.2 +/- 1.4	0.9 +/-1.5	2.3 +/- 3.4
TRITIUM	PCi/l	20,000	50 +/- 190	70 +/- 190	0 +/- 200
STRONTIUM-90	PCi/l	8	0.0 +/-1.4	0.6 +/- 1.2	0.1 +/- 1.4
TOXICITY - BIOASSAYS					
ACUTE	% SURVIVAL	70% MINIMUM	100%	85%	100%
CHRONIC	TUC	1 TUC	1	NA	NA
PRIORITY POLLUTANTS					
PCB 1254	ug/l	NOT STATED	120	NA	NA
ALL OTHERS	ug/l	NOT STATED	ND	NA	NA

Table 6–5. 1994 Analytical Results for NPDES Water Releases from Outfall 006 (SBP–2)

CONSTITUENT	UNITS	LIMITS	7-Feb	17-Feb	25-Mar
RAINFALL	INCHES	NOT APPLICABLE	0.35	0.96	0.01
VOLUME DISCHARGED	MG	NO MAX	0.11	0.29	0.003
pH	pH UNITS	6.0 TO 9.0	8.1	7.9	7.4
TEMPERATURE	DEG. F	NTE 100	57.8	53.4	49.9
TOTAL DISSOLVED SOLIDS	mg/l	500	359	243	131
OIL AND GREASE	mg/l	15	1.8	1.2	1.7
CHLORIDE	mg/l	250	10.3	8.2	5.4
FLUORIDE	mg/l	1.0	<0.1	<0.1	0.2
NITRATE AND NITRITE (AS NITROGEN)	mg/l	10	2.0	1.7	6.57
SULFATE	mg/l	250	11.0	4.9	41.9
RESIDUAL CHLORINE	mg/l	0.1	<0.04	<0.04	<0.04
BORON	mg/l	1.0	<0.2	0.2	0.2
RADIOACTIVITY					
GROSS ALPHA	pCi/l	15	2.2 +/- 1.3	1.9 +/- 1.4	2.8 +/- 1.7
GROSS BETA	pCi/l	50	11 +/- 2	2.9 +/- 1.8	3.3 +/- 2.5
TOTAL RADIUM-226 & RADIUM 228	pCi/l	5	0.1 +/- 1.2	1.7 +/- 1.6	0.3 +/-2.2
TRITIUM	pCi/l	20,000	24 +/- 190	70 +/- 190	140 +/- 210
STRONTIUM-90	pCi/l	8	0.0 +/- 1.5	0.8 +/- 1.2	0.9 +/-1.4
TOXICITY - BIOASSAYS					
ACUTE	% SURVIVAL	70% MINIMUM	100%	90%	100%
CHRONIC	TUC	1	1	NA	NA
PRIORITY POLLUTANTS					
COPPER	µg/l	NOT STATED	12	NA	NA
MERCURY	µg/l	NOT STATED	0.2	NA	NA
NICKEL	µg/l	NOT STATED	22	NA	NA
ZINC	µg/l	NOT STATED	10	NA	NA
PCB 1254	µg/l	NOT STATED	92	NA	NA
ALL OTHERS	µg/l	NOT STATED	ND	NA	NA

Table 6–6. 1994 Analytical Results for NPDES Water Releases from Outfall 007 (B100)

CONSTITUENT	UNITS	LIMITS	7-Feb	17-Feb	25-Mar
RAINFALL	INCHES	NOT APPLICABLE	0.35	0.96	0.01
VOLUME DISCHARGED	MG	100 MGD	0.10	0.26	0.003
pH	pH UNITS	6.5 TO 8.5	7.1	7	6.5
TEMPERATURE	DEG. F	NTE > 100	59.8	51.6	48.6
TOTAL DISSOLVED SOLIDS	mg/l	850	110	101	159
OIL AND GREASE	mg/l	15	1.5	1.6	1.3
CHLORIDE	mg/l	150	5	0.1	4.7
FLUORIDE	mg/l	[illegible]	<0.1	<0.1	0.1
NITRATE AND NITRITE (AS NITROGEN)	mg/l	10	0.4	0.5	4.4
SULFATE	mg/l	250	<5	0.8	23.5
RESIDUAL CHLORINE	mg/l	[illegible]	<0.04	<0.04	<0.04
BORON	mg/l	1.0	<0.2	0.2	0.2
RADIOACTIVITY					
GROSS ALPHA	pCi/l	15	0.7 +/- 0.9	1.6 +/- 1.1	2.8 +/- 1.7
GROSS BETA	pCi/l	50	4.4 +/- 1.8	6.8 +/- 1.9	5.9 +/- 2.4
TOTAL RADIUM-226 & RADIUM 228	pCi/l	5	0.2 +/- 1.1	1.4 +/- 1.5	1.4 +/- 2.5
TRITIUM	pCi/l	20,000	60 +/- 190	100 +/- 190	30 +/- 210
STRONTIUM-90	pCi/l	8	0.4 +/- 1.4	0.7 +/-1.4	1.8 +/- 1.6
TOXICITY - BIOASSAYS					
ACUTE	% SURVIVAL	70% MINIMUM	100%	95%	100%
CHRONIC	TUc	1	1	NA	NA
PRIORITY POLLUTANTS					
ARSENIC	ug/l	NOT STATED	3	NA	NA
ZINC	ug/l	NOT STATED	21	NA	NA
ALL OTHERS			ND	NA	NA

6.2 AIR

In addition to the wastewater discharge limitations, atmospheric pollutant discharge limitations are imposed by VCAPCD Permit 0271 on natural gas personnel comfort space heaters, boilers in various buildings in Area IV, several natural gas/oil–fired sodium heaters operated by ETEC for component testing, and Kalina.

The current permit, No. 0271, was issued 13 October 1993 and renewed for 1 January 1994 to 31 December 1994. On 20 June 1994, an application was submitted to VCAPCD to permit a new Molten Salt Oxidization Unit and to include the operation of this unit under the existing Molten Salt Test Facility. The existing permit issued on 18 October 1994 reflects the new operation.

VCAPCD Rule 74.15, as adopted in March 1989 and revised in December 1991, sets limits for oxides of nitrogen (NOx) and carbon monoxide (CO) emissions on boilers, steam generators, and process heaters. The Sodium Component Test Installation (SCTI) finished installing the new low–NOx burners in 1991 as well as the carbon monoxide continuous emissions monitoring system. An extended variance to the rule was applied for and granted, running through 31 December 1992 to allow for source testing and adjusting of the H–1 and H–2 sodium heaters and the H–101 boiler to bring them into compliance. Further extensions of the variance were granted to 30 November 1994. ETEC operated under Variance 392–3 until the amended Rule 74.15 was adopted on 8 November 1994. VCAPCD is in the process of revising permit No. 0271. ETEC has been assured by VCAPCD that ETEC is not in violation as long as VCAPCD is processing the permit renewal.

On 25 May 1994, the VCAPCD conducted the annual inspection for Permit No. 0271. No citations were issued from this inspection. Also, on 13 September 1994, the VCAPCD was on–site to review the SCTI operations for amending Rule 74.15.

On 23 March 1994, the VCAPCD conducted an inspection to review the Continuous Emission Monitoring (CEM) system calibration on H–1/H–2 heaters at SCTI and a Notice of Violation was issued on 29 March 1994 because of an alleged calibration drift exceedance. Rocketdyne responded with a detailed letter of explanation (along with selected corrective actions) and a request for reevaluation. VCAPCD issued a letter on 15 July 1994 accepting the Rocketdyne explanation with notification of no further action.

The SCTI Data Acquisition System (DAS) malfunctioned on 21 November 1994. The DAS printer would not update CEM data on the H–1 and H–2 heaters. The DAS was shut down and restarted at which time the problem was corrected. No emission limits were exceeded during this event.

The permit application submitted to VCAPCD for an ethanol cleaning operation located at the Sodium Pump Test Facility (SPTF) (Building 043) was completed with the inclusion of adequate reactive organic compound (ROC) offsets. The current permit 0271 does not reflect the new ethanol cleaning operation as the VCAPCD has yet to add it to the permit.

A permit modification application was submitted to VCAPCD on 3 June 1994 to update the permit for language changes, revisions to existing conditions and proposed operations. Included were changes to the Kalina Plant operations that raised the permitted ammonia emissions from 9.3 tons per year and 2.12 lb per hour to 51 and 80, respectively. The current permit reflects these changes.

6.3 GROUNDWATER

A groundwater monitoring program has been in place at the SSFL site since 1984. This has been accomplished largely under the direction and guidance of the regulatory agencies, RWQCB, Los Angeles (responsible during the period 1984 through July 1989) and Cal–EPA DTSC (since August 1989). During the investigation, 231 on–site and off–site wells have been monitored. Ten off–site wells are near the northwest boundary. Ninety–three of these wells are in the Shallow Zone, and 138 (including private off–site wells) have been drilled into the Chatsworth Formation, the indurated sandstone that represents the dominant aquifer underlying the facility. In 1987, as part of the statewide requirements under the Toxic Pits Cleanup Act, Rocketdyne submitted the Hydrogeological Assessment Report (HAR) for the entire facility. In Area IV, the lower pond at the Former Sodium Disposal Facility was identified and subsurface soil samples were taken at numerous locations. Routine quarterly chemical and radiological monitoring of the wells scheduled for annual review is conducted according to the monitoring plan submitted to the lead agency for the groundwater program.

Hydrogeologic studies at SSFL describe two groundwater systems at the site: a shallow, unconfined system in the alluvium (surface mantle soils) of the Burro Flats area and along the major drainage channels, and a deeper fracture controlled groundwater system in the Chatsworth Formation sandstone (bedrock). Alluvium along the major surface drainage systems may store and transmit groundwater to the underlying Chatsworth Formation through fractures. Water levels in the alluvium respond to recharge resulting from surface flows and may vary considerably between wet and dry periods. The alluvium is composed of a heterogeneous mixture of gravel, sand, silt, and clay, which are known to have hydraulic conductivities ranging from 0.1 to 100 gal/day/ft^2.

The Chatsworth Formation is composed of well–consolidated, massively bedded sandstones with interbedded layers of siltstone and claystone. The formation may be as thick as 6,000 ft at the SSFL site. The direction of groundwater flow in the formation is probably radially off–site toward the surrounding lowlands. The permeability of the Chatsworth Formation is very low except along open fractures. Groundwater within fractures occurs under both confined and unconfined conditions.

The hydrogeologic environment at the SSFL site is a dynamic system. The groundwater system is recharged by precipitation migration through fractures and by unlined ponds and drainage channels. Because of the meager rainfall in the area and the relatively large variability in annual precipitation, groundwater recharge is low and may vary greatly from year to year. Specific pathways of possible contaminant transport along fracture zones are difficult to predict on the basis of the well data. Fracture zones vary widely in frequency and geometry from one location to the other as well as from one specific depth to another. Recharge over the area may also vary over both space and time.

The solvents found in the groundwater include trichloroethylene (TCE) and its family of degradation products. The results of the analyses of the Area IV wells have been documented in the "Area IV (Phase III) Groundwater Investigation Report" prepared for Rocketdyne by Groundwater Resources Consultants, Inc., in December 1992, as well as in the 1994 Annual Report.

The bulk of the Area IV shallow groundwater is seasonal and dependent upon rain/natural drainage patterns. The surface water sampling occurs rarely because it is rain–prompted. Documentation of these rainfall events since November 1989 has been submitted to the California RWQCB (Los Angeles area).

Three existing TCE occurrences in the northwest part of Area IV were monitored in 1994. The installation of nine new monitor wells in 1993–1994 detected no new off–site plume of degraded groundwater. TCE occurrences in groundwater are shown in Figure 6–3. Three wells were completed in 1994 for two 90–day pilot extraction tests on Area IV groundwater. The test at RMDF has been completed recently. It included installation of an extraction well, and treatment of the extracted water in a portable carbon adsorption treatment unit. The evaluation of the results of the test is in progress. Two wells were installed for the other test at Building 886. The extraction and treatment tests at the Building 886 site have not yet been completed. Additional remediation treatment options for Area IV degraded groundwater are under consideration. These include conventional methods such as an air–stripping tower unit or a portable carbon adsorption unit or newly emerging enhanced remediation technology.

Two wells within the occurrence (No. 1, Figure 6–3) northwest of RMDF, recorded a decrease in the range of TCE concentration in 1994 compared to 1993. The shallow zone well RS–28, one of the two on–site wells within the occurrence, recorded 63 to 82 µg/L TCE in 1993 compared to 47 µg/L TCE in 1994. The other well, a Chatsworth Formation well (RD–30) showed 40 to 44 µg/L TCE in 1993, and 18 to 34 µg/L TCE in 1994. Both wells were installed in 1989. RD–34A, an off–site Chatsworth Formation well (shallowest well of a three–well cluster constructed in 1991), within the same occurrence also recorded a decrease in the range of the TCE concentration. It showed 49 to 82 µg/L TCE in 1993, compared to 16 to 39 µg/L in 1994. RD–63, an extraction well installed in 1994 for the pilot extraction test in the area, recorded 5.3 to 9.2 µg/L TCE.

The Chatsworth Formation well (RD–7), the only well within the occurrence (No. 2, Figure 6–3) southwest of Building 059, also recorded a decrease in TCE concentration from 36 to 45 µg/L in 1993 to 37 to 38 µg/L in 1994. Since its construction in 1986, RD–7 generally maintained the TCE concentration in the 16 to 35 µg/L range with three peaks of 120 to 130 µg/L.

RD–25, located southwest of Building 059, continued to record perchloroethene (PCE). In 1994, the well recorded 29 to 32 µg/L PCE, compared to 20 to 39 µg/L PCE in 1993. From 1989 to 1992, the well showed less than 1 to 14 µg/L PCE.

Three wells, a Chatsworth Formation well (RD–54A, shallowest of the three bedrock well cluster constructed in 1993) and two shallow zone wells (RS–18 and RS–54) of the occurrence (No. 3, Figure 6–3) near Building 886, recorded a significant increasing trend in TCE concentration during 1993 to 1994. TCE in RD–54A increased from a 1993 range of 62 to 200 µg/L to the 1994 range of 190 to 320 µg/L. RD–54A, constructed in 1989, showed 2300 to 4500 µg/L TCE in 1994 compared to 180 to 2900 µg/L in 1993. RS–18, mostly dry since its construction in 1985 to 1991, recorded an increase in TCE from 2,700 µg/L in 1993 to 3,200 µg/L in 1994. RD–21 and RD–23, two Chatsworth Formation wells installed in 1989 recorded a decrease in TCE from 88 to 1,600 µg/L in 1994 compared to 280 to 1,800 µg/L in 1993. RD–33A, an off–site

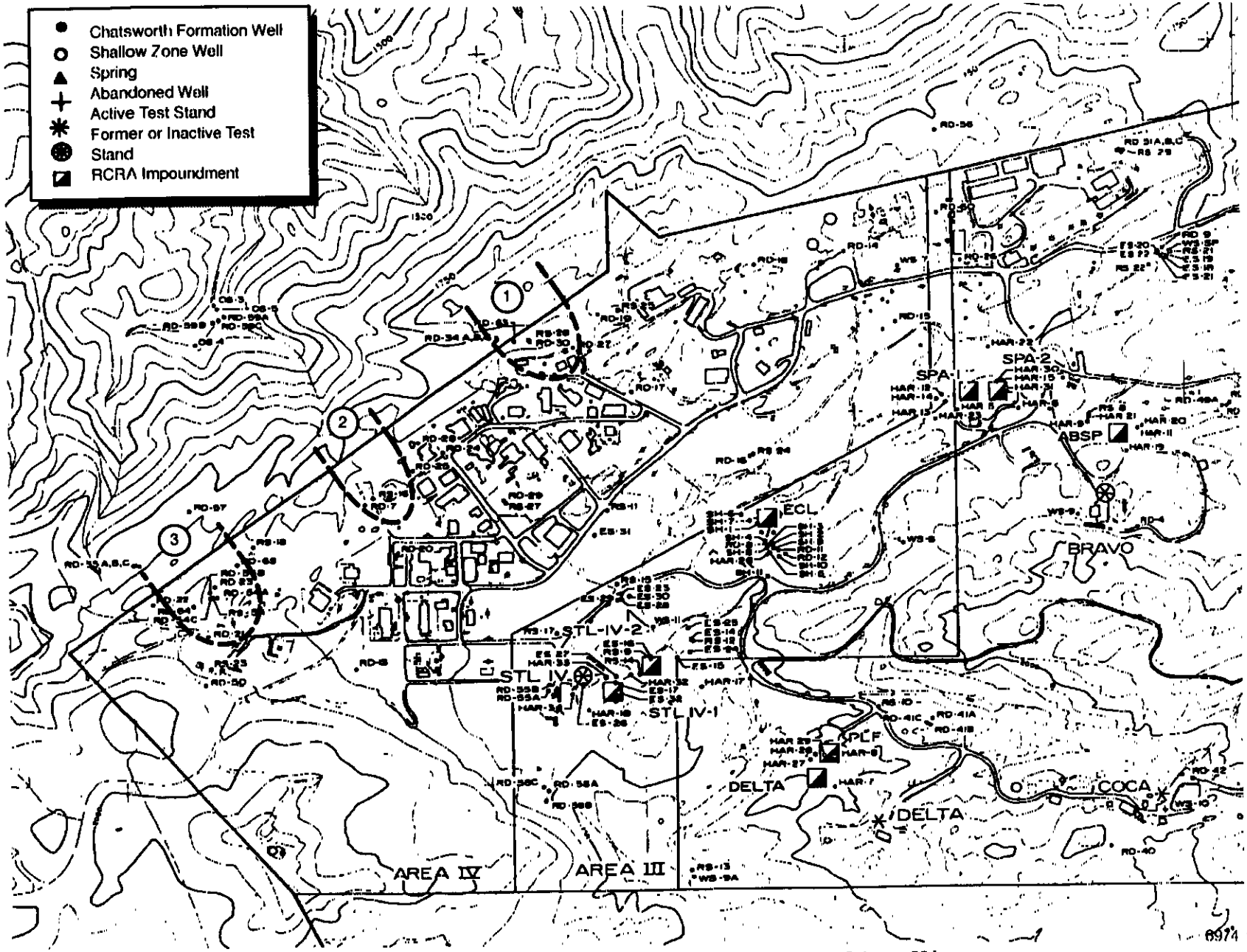

Figure 6–3. TCE Occurrences in Groundwater of Area IV

Chatsworth Formation well (shallowest well of a three–well cluster constructed in 1991) of the occurrence, showed 2.4 to 9.5 µg/L TCE in 1994, compared to 7.1 to 9.4 µg/L TCE in 1993.

The TCE concentrations had increased due to an unusually wet rainy reason in the winter of 1992–1993. The flushing effect caused by rainwater infiltration contributed to the higher values.

The Interim Well Construction Plan for the most recent phase of monitor well installation and testing at SSFL started in 1993 and was completed in 1994. The plan was approved by Cal–EPA DTSC in November 1992. Eight new Chatsworth Formation wells were constructed in Area IV and off–site northwest of Area IV with DOE funding. Six of these wells were drilled as two well clusters, each with three wells. One of these two clusters was drilled in the Building 886 area as required by the Building 886 closure. The other cluster was located off–site, down gradient and west of the RMDF area. An off–site well was also drilled down gradient of Building 886. The eighth well was drilled south of Building 886 near the Burro Flats Fault. In addition to the eight Chatsworth Formation wells, one shallow zone well (RS–54) was also completed in the Building 886 area. The new wells are designed to characterize the hydrogeology and water quality of known groundwater contamination, horizontally and vertically and in relation to the potential source areas. The drilling for the DOE–funded wells started in May 1993 and was completed in June 1994.

A proposed plan for the construction and testing of two pilot groundwater extraction systems in Area IV was submitted to DTSC in August 1993. Following the approval by DTSC, one well was installed for an extraction test at RMDF in May 1994 and two wells were installed at Building 886 in May and August 1994. All three wells were located within the Area IV boundary. The goal of the project was to develop a full–scale, long–term system needed to contain, extract, and treat degraded groundwater at Area IV. After the installation of the extraction wells, the pilot extraction test at RMDF was conducted for 90 days in 1994 and completed in January 1995. The test at RMDF included pumping of the new extraction well (RD–63) and treatment of the extracted water in a portable carbon adsorption unit, at about 2 gpm. Evaluation of the results of the test is in progress. The test at Building 886 is planned to include pumping of three wells and will be completed in 1995.

There were no draft or final environmental impact statements or reports, site assessments, or remedial action reports produced during 1994. Additionally, there were no actions taken by local authorities relative to CERCLA/SARA activities or Notices of Violation for the DOE Area.

7.0 ENVIRONMENTAL MONITORING PROGRAM QUALITY CONTROL

This section describes the quality assurance (QA) elements that are incorporated into the Rocketdyne radiological analysis program to ensure that data produced are as meaningful as possible.

The following elements of quality control are used for the Rocketdyne program:

1. Reagent Quality – Certified grade counting gas used.
2. Laboratory Ventilation – Room air supply is controlled to minimize temperature variance and dust incursion.
3. Laboratory Contamination – Periodic laboratory contamination surveys for fixed and removable surface contamination are performed. Areas are cleaned routinely and decontaminated when necessary.
4. Control Charts – Background and reference source control charts for counting equipment are maintained to evaluate stability and response characteristics.
5. Laboratory Intercomparisons – Rocketdyne participates in the DOE EML–QAP.
6. Calibration Standards – Counting standard radioactivity values are traceable to the NIST primary standards.

7.1 PROCEDURES

Procedures followed include those for sample selection; sample collection; packaging, shipping, and handling of samples for off–site analysis; sample preparation and analysis; the use of radioactive reference standards; calibration methods and instrument QA; and data evaluation and reporting.

7.2 RECORDS

Records generally cover the following processes: field sample collection and laboratory identification coding; sample preparation method; radioactivity measurements (counting) of samples, instrument backgrounds, and analytical blanks; and data reduction and verification.

Quality control records for laboratory counting systems include the results of measurements of radioactive check sources, calibration sources, backgrounds, and blanks, as well as a complete record of all maintenance and service.

Records relating to overall laboratory performance include the results of analysis of interlaboratory cross–check samples and other quality control analyses; use of standard (radioactive) reference sources; and calibration of analytical balances.

7.3 QUALITY ASSURANCE

Rocketdyne participates in the DOE Quality Assessment Program (QAP) operated by the Environmental Measurements Laboratory (EML) in New York for radiological analyses. During 1994. two sets of

samples were distributed: QAP–XL and QAP–XLI. In 1994, EML analyzed the QAP historical data for air filter, soil, vegetation, and water samples from 1982 through 1994 to generate representative control limits for the performance evaluation of analytical services. The individual data values reported by the participating laboratories were normalized to the EML reference value, and the normalized values were grouped into percentiles. The middle 70% of all historical reported values (from the 15th to 85th percentile was established as *acceptable* and the next 10% on both sides of the 70%—the 5th to 15th and 85th to 95th percentiles—as *acceptable with warning*.

Results of Rocketdyne (R/D) analyses, Teledyne Brown Engineering (TBE) analyses, and the average for all laboratories are shown in Figures 7–1 and 7–2 for QAP–XL and QAP–XLI. While these comparisons involve sample types, geometries, and analyses that are not part of the routine procedures at the Rocketdyne laboratory, review of the results and those of the other laboratories show a similar quality in most cases. An exception was the air filter samples analyzed by Rocketdyne for QAP–XL, where all Rocketdyne results were outside the acceptable and acceptable–with–warning boundaries. To improve the accuracy of the results, Rocketdyne performed several calibrations on their analysis equipment, with the result that the air filter results for QAP–XLI shows 22% acceptable and 44% acceptable with warning. All isotopic analyses for the air sample results reported in Tables 5–1 and 5–2 were performed by the Environmental Services Division of Teledyne Brown Engineering. The Teledyne air filter results for QAP–XL showed no unacceptable results and only one result (7%) outside the acceptable–with–warning limits for QAP–XLI compared to 11% for all laboratories.

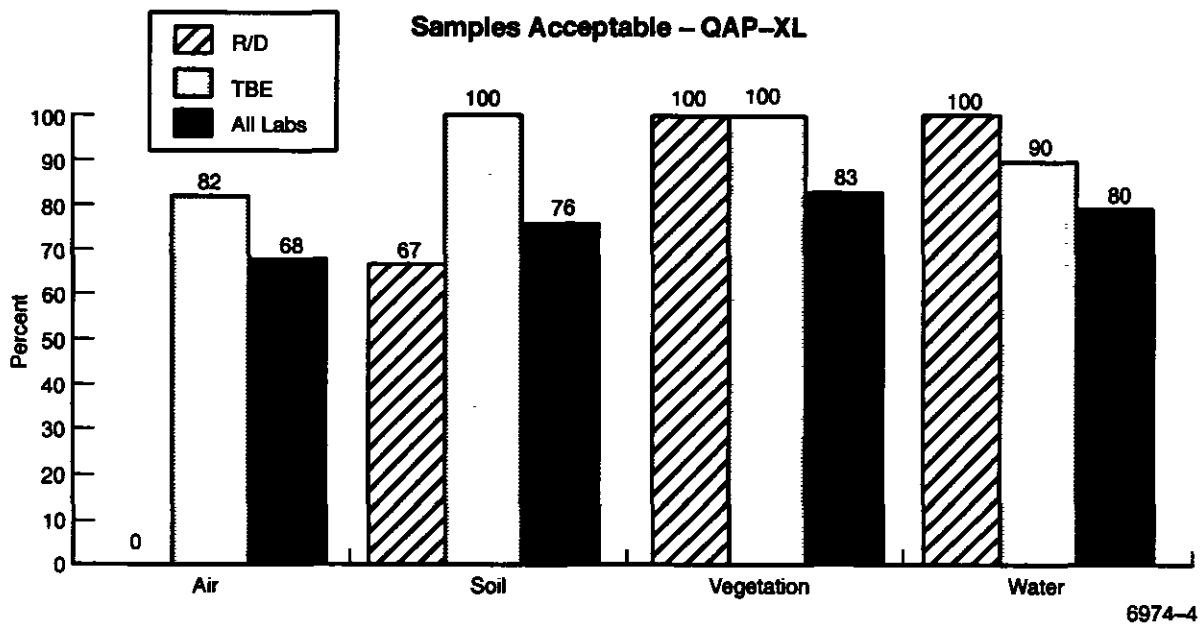

Figure 7–1. Quality Assessment Program Results for QAP–XL

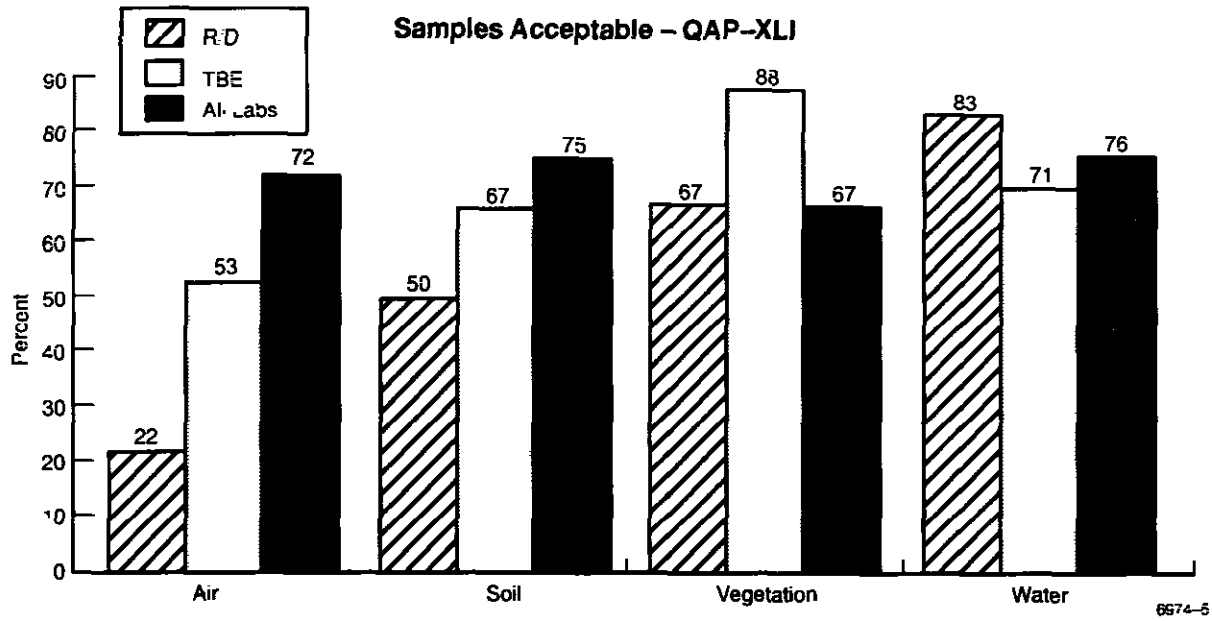

Figure 7–2. Quality Assessment Program Results for QAP – XLI

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APPENDIX A

NPDES PERMIT CA0001309

The Board has notified the discharger and interested agencies and persons of its intent to renew waste discharge requirements for this discharge and has provided them with an opportunity to submit their written views and recommendations.

The Board, in a public hearing, heard and considered all comments pertaining to the discharge and to the tentative requirements.

This Order shall serve as a National Pollutant Discharge Elimination System permit pursuant to Section 402 of the Federal Water Pollution Control Act, or amendments thereto, and shall take effect at the end of 10 days from the date of its adoption, provided the Regional Administrator, EPA, has no objections.

IT IS HEREBY ORDERED, that Rockwell International Corporation, Rocketdyne Division, in order to meet the provisions contained in Division 7 of the California Water Code and regulations adopted thereunder, and the provisions of the Federal Water Pollution Control Act and regulations and guidelines adopted thereunder, shall comply with the following:

A. Effluent Limitations for Outfalls Nos. 001, 002

1. The discharge shall be limited to filtered domestic wastewater and industrial wastewater only, as proposed.
2. The discharge of an effluent in excess of the following limits is prohibited:

Constituent	Units	Discharge Limitations Maximum
Total dissolved solids	mg/L	950
	lb/day*	1,267,680
BOD_5 20°C	mg/L	30
	lb/day*	40,032
Oil and grease	mg/L	15
	lb/day*	20,016
Chloride	mg/L	150
	lb/day*	200,160
Sulfate	mg/L	300
	lb/day*	400,320
Fluoride	mg/L	1.0
	lb/day*	1,334
Boron	mg/L	1.0
	lb/day*	1,334
Surfactants (as MBAS)	mg/L	0.5
	lb/day*	667
Residual chlorine	mg/L	0.1

*Based on a total waste flow of 160 million gal per day.

3. The daily discharge rate shall be obtained from the following calculation for any calendar day:

$$\text{Daily discharge rate} = \frac{8.34}{N} \sum_{1}^{N} Q_i \, C_i$$

in which N is the number of samples analyzed in any calendar day. Q_i and C_i are the flow rate (MGD) and the constituent concentration (mg/L), respectively, which are associated with each of the N grab samples that may be taken in any calendar day. If a composite sample is taken, C_i is the concentration measured in the composite sample and Q_i is the average flow rate occurring during the period over which samples are composited.

4. The pH of wastes discharged shall at all times be within the range 6.0 to 9.0.

5. The temperature of wastes discharged shall not exceed 100°F.

6. Wastes discharged shall not contain visible oil or grease, and shall not cause the appearance of grease, oil or oily slick, or persistent foam in the receiving waters or on channel banks, walls, inverts, or other structures.

7. Wastes discharged shall not cause the formation of sludge deposits.

8. Neither the disposal nor any handling of waste shall cause pollution or nuisance.

9. Wastes discharged shall not damage flood control structures or facilities.

10. This discharge shall not cause a violation of any applicable water quality standard for receiving waters adopted by the Regional Board or the State Water Resources Control Board as required by the Federal Water Pollution Control Act and regulations adopted thereunder. If more stringent applicable water quality standards are promulgated or approved pursuant to Section 303 of the Federal Water Pollution Control Act, or amendments thereto, the Board will revise and modify this Order in accordance with such more stringent standards.

11. Wastes discharged shall not increase the natural turbidity of the receiving waters at the time of discharge.

12. Oil, oily material, chemicals, refuse, and other wastes shall not be stored or placed where they could be picked up by rainfall and discharged to surface waters.

13. The wastes discharged shall not contain phenols, mercaptans, or other substances in concentrations that would impart taste, odors, color, foaming or other objectionable characteristics to receiving waters.

14. The wastes discharged shall not cause receiving waters to contain any substance in concentrations toxic to human, animal, plant, or fish life.

15. Radioactivity shall not exceed the limits specified in Title 17, Chapter 5, Subchapter 4, Group 3, Article 3, Section 30269 of the California Administrative Code.

16. Domestic wastes discharged to watercourses shall at all times be adequately disinfected. For the purpose of these requirements, the wastes shall be considered adequately disinfected if the median number of coliform organisms at some point in the treatment process does not exceed 2.2 per 100 milliliters and the number of coliform organisms does not exceed 23 per 100 milliliters in more than one sample within any 30–day period. The median value shall be determined from samples taken on seven sampling days each week, at least one sample per sampling day, collected at a time when wastewater flow and characteristics are most demanding on the treatment facilities and disinfection procedures.

17. Domestic wastes discharged to watercourses shall have received treatment equivalent to that of a filtered wastewater.

    Filtered wastewater means an oxidized, coagulated, clarified wastewater that had been passed through natural undisturbed soils or filter media, such as sand or diatomaceous earth, so that the turbidity as determined by an approved laboratory method does not exceed an average operating turbidity of 2 turbidity units and does not exceed 5 turbidity units more than 5 percent of the time during any 24–hour period.

    Nothing herein shall be construed to prevent the use of any alternative treatment process(es) provided that they can be demonstrated to the satisfaction of the Executive Officer to achieve compliance with the effluent limitations and requirements.

18. The average final effluent concentrations shall not exceed 15 percent by weight of the average sewage treatment plant influent concentrations of $BOD_5$20°C and suspended solids during periods of discharge.

19. Wastes discharged shall not contain heavy metals, arsenic, or cyanide in concentrations in excess of the mandatory limits contained in the current California Department of Health Drinking Water Standards.

20. The toxicity of the effluent shall be such that in a standard 96–hour static or flow–through bioassay in undiluted effluent at least 90 percent of test organisms shall survive at least 90 percent of the time with no single test producing 70 percent of survival.

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APPENDIX B

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APPENDIX C

STATUS OF NEPA COMPLIANCE ACTIVITIES—FY 1994

STATUS OF NEPA COMPLIANCE ACTIVITIES
Fiscal Year 1994

Item	Level/ DOE No.	NEPA Determination for:	Remarks/Action
1	CX ET-NE-94-07	Natural Gas Fueled Hydrogen Supply System	94ETEC-DRF-0938, 7/5/94 Approved
2	CX ET-NE-94-09	System and Component Testing for Alternative Fuel Based Transportation	94ETEC-DRF-1071, 8/1/94 In review
3	CX ET-NE-94-10	System and Component Testing of Dark Gas Solar Collectors	94ETEC-DRF-1216, 8/18/94 In review
4	CX ET-NE-94-11	Design, Fabrication, and Test of Remote D&D Handling Equipment	94ETEC-DRF-1217, 8/18/94 In review
5	CX ET-NE-94-12	Commercial Development of High Temperature, Composite Metal Purifier of Hydrogen Reformate Gas Streams	94ETEC-DRF-1334, 9/2/94 In review
6	CX ET-NE-94-13	Development of W. J. Schafer Associates, Inc. Microsphere Technology for Commercial Applications Towards Purification of Hydrogen in Gas Streams	94ETEC-DRF-1335, 9/2/94 In review
7	CX ET-NE-94-14	Testing a 15 kW Green Car Fuel Cell/Battery Hybrid Vehicle	94ETEC-DRF-1336, 9/2/94 In review
8	CX ET-NE-94-14	Testing a Lynch Engine for Several Different Hythane Mixtures	94ETEC-DRF-1342, 9/6/94 In review
9	CX ET-NE-94-16	Testing of Solar II Receiver Components	94ETEC-DRF-1401, 9/13/94 In review
10	CX ET-NE-94-17	Pilot Scale Evaluation of Super Capacitors Manufacturing Processes	94ETEC-DRF-1412, 9/4/94 In review
11	CX ET-NE-94-18	Testing of Kalina Cycle Demonstration Plant	94ETEC-DRF-1839, 11/29/94 In review
12	CX ET-EE-94-18	Testing of a Natural Gas Fueled, 24 kW, Turbogenerator	94ETEC-DRF-1895, 12/13/94 In review
CX – Categorical Exclusion, EA – Environmental Assessment			

DOE (0052.15

APPENDIX D

ACRONYMS

ACM	asbestos–containing materials
ALARA	As Low As Reasonably Achievable
ANL	Argonne National Laboratory
AOC	Areas of Concern
ASL	above sea level
ATIR	Air Toxics Inventory Report
BOD	biological oxygen demand
$BOD_5$20°C	biological oxygen demand, 5–day at 20°C
B/100	Building 100 at SSFL
CAA	Clean Air Act
CARB	California Air Resources Board
CCR	California Code of Regulations
CEM	Continuous Emission Monitoring
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CO	carbon monoxide
CRO	Community Reuse Organization
CRWQCB	California Regional Water Quality Control Board
CTC	Clemson Technical Center
CWA	Clean Water Act
CX	Categorical Exclusion
D&D	decontamination and decommissioning
DAS	Data Acquisition System
DCG	Derived Concentration Guide
DHS	Department of Health Services
DL	detectable limit
DOE	Department of Energy
DOE–OAK	Department of Energy – Oakland Office
DOE–SF	Department of Energy–San Francisco Office
DS104	Building 104 at De Soto site
DTSC	Cal–EPA Department of Toxic Substances Control
EA	Environmental Assessment
EIS	Environmental Impact Statement
EML	Environmental Measurements Laboratory
EPA	Environmental Protection Agency

ETEC	Energy Technology Engineering Center
FFCA	Federal Facilities Compliance Act
FGR	Flue Gas Recirculation
FONSI	Finding of No Significant Impact
GWRC	Groundwater Resources Consultants, Inc. (Tucson, AZ)
HAR	Hydrogeological Assessment Report
HEPA	high–efficiency particulate air
HMET	Hazardous Materials Elimination Team
HRS	Hazard Ranking System
HSWA	Hazardous and Solid Waste Amendments of 1984
HWMF	Hazardous Waste Management Facility
ICP	Inductively Coupled Plasma
LLD	lower limit of detection
MBAS	methylene blue active substances
MCL	Maximum Contamination Level
MGD	million gallons per day
MPC	maximum permissible concentration, air, or water
MSOP	Molten Salt Operation Program
MSTF	Molten Salt Test Facility
MWD	Metropolitan Water District
NASA	National Aeronautics and Space Administration
ND	not detected
NEPA	National Environmental Policy Act
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NIST	National Institute of Standards and Technology
NOD	Notice of Deficiency
NOI	Notice of Intent
NOV	Notice of Violation
NOx	oxides of nitrogen
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NSPS	New Source Performance Standards
ODS	ozone depleting substance
ORISE	Oak Ridge Institute for Science and Education
PAH	polynucleararomatic hydrocarbon
PA/SI	Preliminary Assessment/Site Investigation
PCB	polychlorinated biphenyl
PCE	perchloroethene

QA	quality assurance
QAP	Quality Assessment Program
QC	quality control
QUAP	Quality Assessment Plan
R/D	Rocketdyne
R&D	research and development
RCP	Radiological Characterization Plan
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RHB	Radiologic Health Branch
RIHL	Rockwell International Hot Laboratory
RMDF	Radioactive Materials Disposal Facility
RMMA	Radioactive Materials Management Areas
ROC	reactive organic compound
ROD	Record of Decision
ROV	Report of Violation
RWQCB	Regional Water Quality Control Board
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SBP1	Sodium Disposal Facility Burn Pit 1
SBP2	Sodium Disposal Facility Burn Pit 2
SCP	Site Characterization Plan
SCTI	Sodium Component Test Installation
SNAP	Systems for Nuclear Auxiliary Power
SNM	Special Nuclear Materials
SPCC	Spill Prevention Control and Countermeasure
SPTF	Sodium Pump Test Facility
SRE	Sodium Reactor Experiment
SRI	Stanford Research Institute
SSFL	Santa Susana Field Laboratory
SSME	Space Shuttle Main Engine
SWPPP	Storm Water Pollution Prevention Plan
STL–IV	Systems Test Laboratory, Area IV
STP	Sewage Treatment Plant
SVOC	semi–volatile organic compound
SWMU	Solid Waste Management Unit
TBE	Teledyne Brown Engineering

TCE	trichloroethylene
TLD	thermoluminescent dosimeter
TPCA	Toxic Pits Cleanup Act
TSDF	Treatment, Storage, and Disposal Facility
UCLA	University of California at Los Angeles
USEPA	United States Environmental Protection Agency
UST	underground storage tank
UV	ultraviolet
VCAPCD	Ventura County Air Pollution Control District
VCEHD	Ventura County Environmental Health Division
VCPWA	Ventura County Public Works Agency
VOC	volatile organic compound
WDR	Waste Discharge Requirement