RI/RD92-138

ROCKETDYNE DIVISION
ANNUAL SITE
ENVIRONMENTAL REPORT
SANTA SUSANA FIELD LABORATORY
AND DE SOTO SITES
1991

Rockwell International

Rocketdyne Division

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

3 December 1992

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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 Space Station Freedom. Previously, this work included development, fabrication, and disassembly of nuclear reactors, reactor fuel, and other radioactive materials, but this work was essentially 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 results of environmental monitoring indicate that there are no significant sources of unnatural radioactive material in the vicinity of the 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 operations. All liquid 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 artificial radioactivity. With the exception of negligible concentrations of tritium, below Federal and State drinking water standards, only natural radioactivity has been found in this water.

The nonradiological monitoring program has increased in recent years, with more extensive sampling of the groundwater at Santa Susana Field Laboratory (SSFL), and at the De Soto sites. Extraction of volatile organic compounds from contaminated groundwater at SSFL is continuing and is effective in reducing remaining contamination levels and in impeding the migration of this contaminated water off-site. Surface discharges of this water, after use in rocket-engine testing and other industrial purposes, are analyzed and show only minor exceedances related to turbidity and alkalinity, both of which seem to be natural effects.

Radioactivity in the facility ventilation exhausts, 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 effective filtration systems. Only small amounts of nonnatural radioactivity are found in the exhaust effluents and only minor concentrations of tritium, below drinking water standards, are found in groundwater. With the exception of localized areas of facility and soil contamination, only natural radioactivity can be detected in soil and vegetation samples.

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

The radiological monitoring program, which had been developed, and had evolved, in response to nuclear reactor testing and reactor fuel fabrication and disassembly, has been correspondingly reduced to measuring facility exhaust effluent and specific or special environmental conditions.

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. 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), warranted comprehensive monitoring to assure protection of the environment.

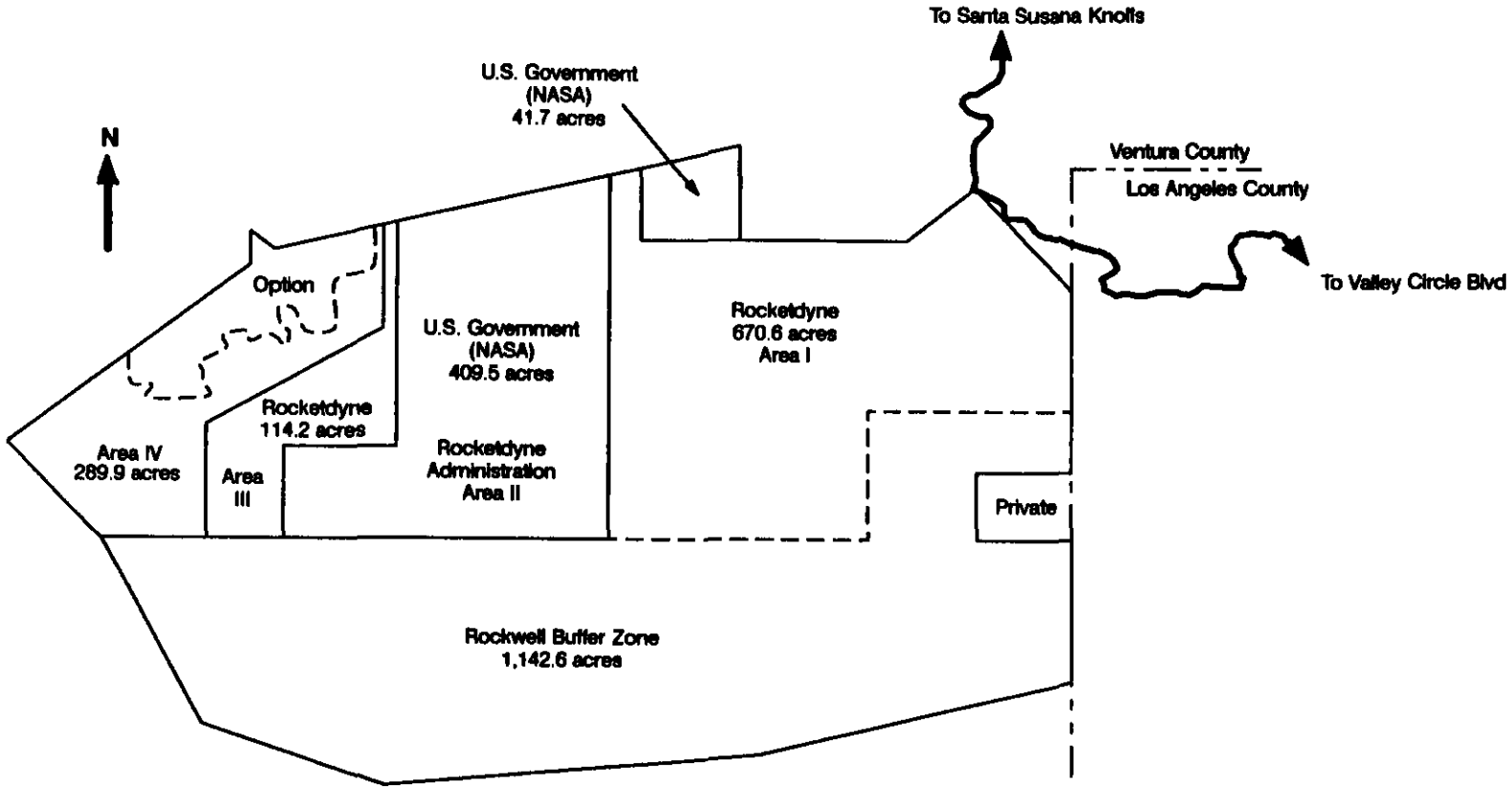
SSFL consists of four administrative areas used for research, development, and test operations as well as a buffer zone. The arrangement of these areas is shown in Figure 2-1.

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 primarily for the regulatory agencies involved in controlling operations with nuclear fuel or nuclear reactors, i.e., the U.S. DOE and the California State Department of Health Services (DHS), Radiologic Health Branch (RHB). For that reason, information concentrates on Area IV at SSFL as this is the site of the former nuclear operations. While the major area of interest 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" (refer to the bibliography, Appendix B). No work with nuclear materials has been conducted since 1987, and the only work related to these operations during 1991 was the ongoing clean-up of the Rockwell International Hot Laboratory (RIHL) and continuing decontamination of the remaining nuclear facilities.



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	

5857-1

Figure 2–1. Santa Susana Field Laboratory Site Arrangement

The nuclear operations have been conducted under State and Federal licenses and under contract to DOE and its predecessors. In October 1989, 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.

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 some avocado groves 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 2.9 km (1.8 miles) 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

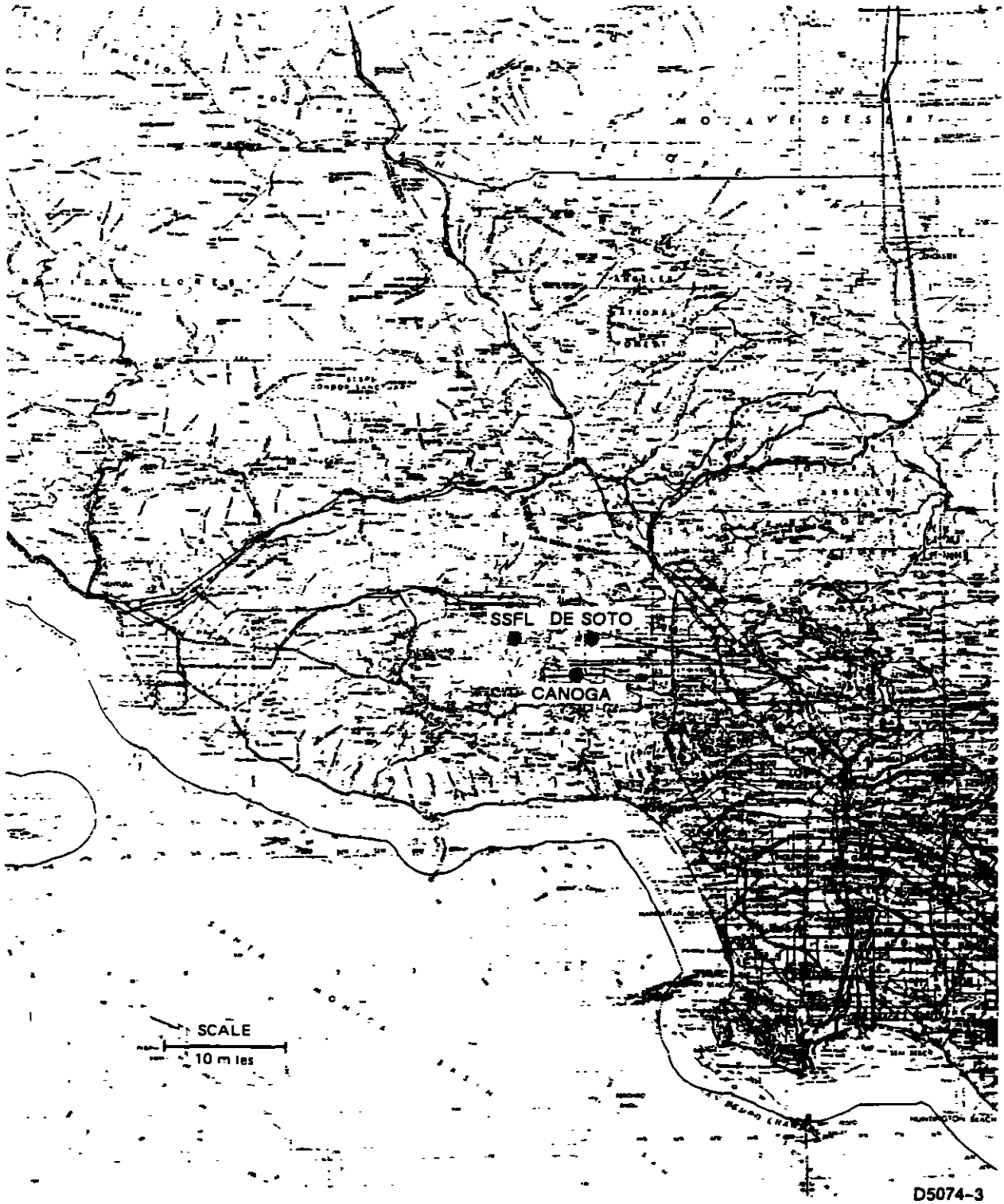


Figure 2–2. Map of General Los Angeles Area Showing Locations of Major Rocketdyne Facilities

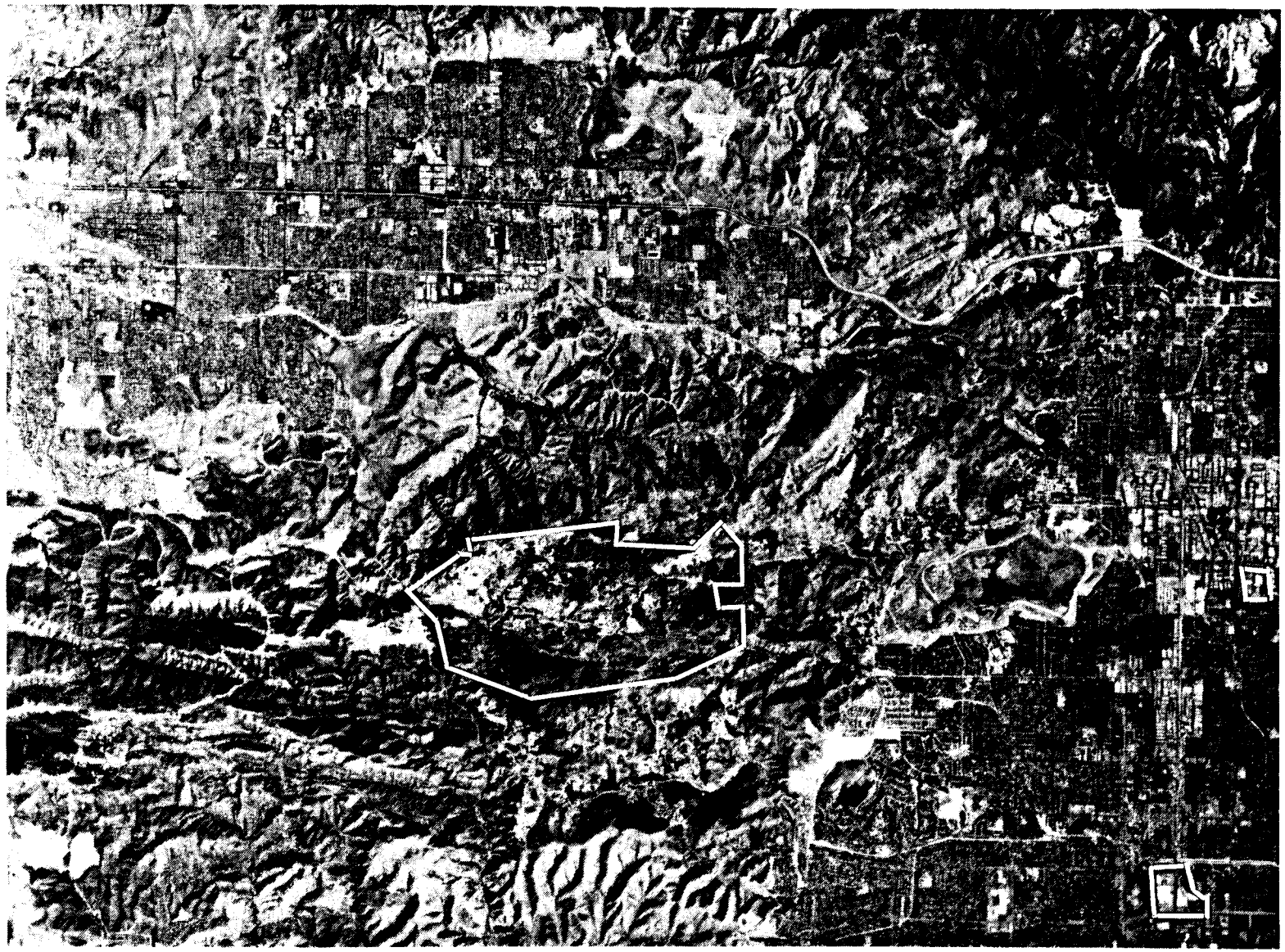


Figure 2–3. Area Surrounding SSFL (De Soto Site is Due East of SSFL, at Right Edge of Photo; Canoga Site, Lower Right Corner)

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 (Figure 2–4) 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) above sea level (ASL). Rockwell International– and DOE–owned facilities (Figure 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. Work proceeds on removal of the last significant amounts of radioactive material, in the form of activated steel and concrete, in the reactor test vault of Building T059.

Sealed radiation sources are used at several facilities 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 RIHL (Building 020) and the radiation instrument calibration laboratory.

Licensed programs conducted during 1991 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 and in the Gamma Irradiation Facility. The De Soto location is at an altitude of 875 ft ASL.

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 atmospheric effluents are released from the building to uncontrolled areas. During 1991, only decontamination of the facility was done. No radioactive liquid waste is released from the facility. Prior radioactive material handled in unencapsulated form in this facility included the

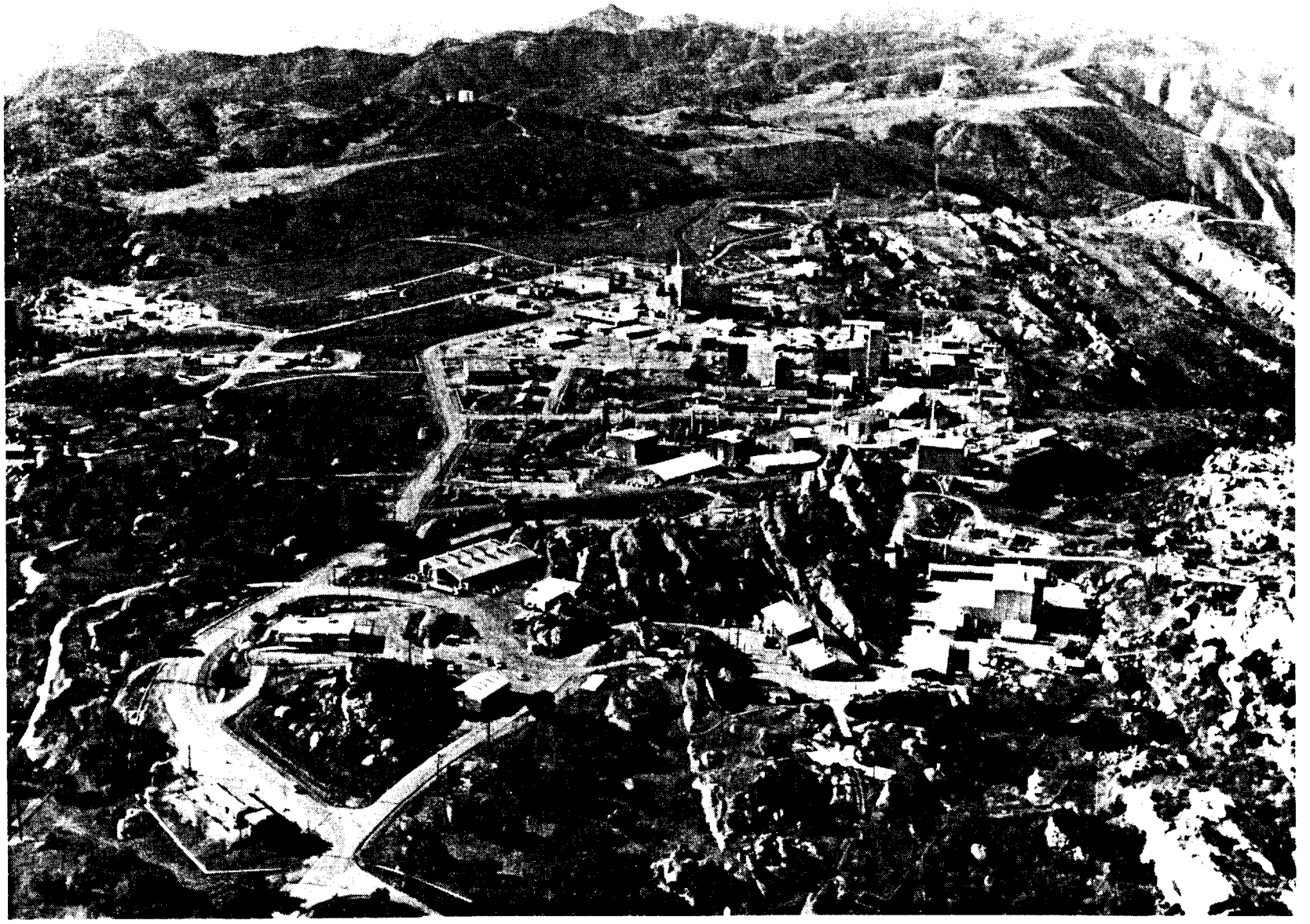


Figure 2–4. Rocketdyne Division – Santa Susana Field Laboratory Site, Area IV

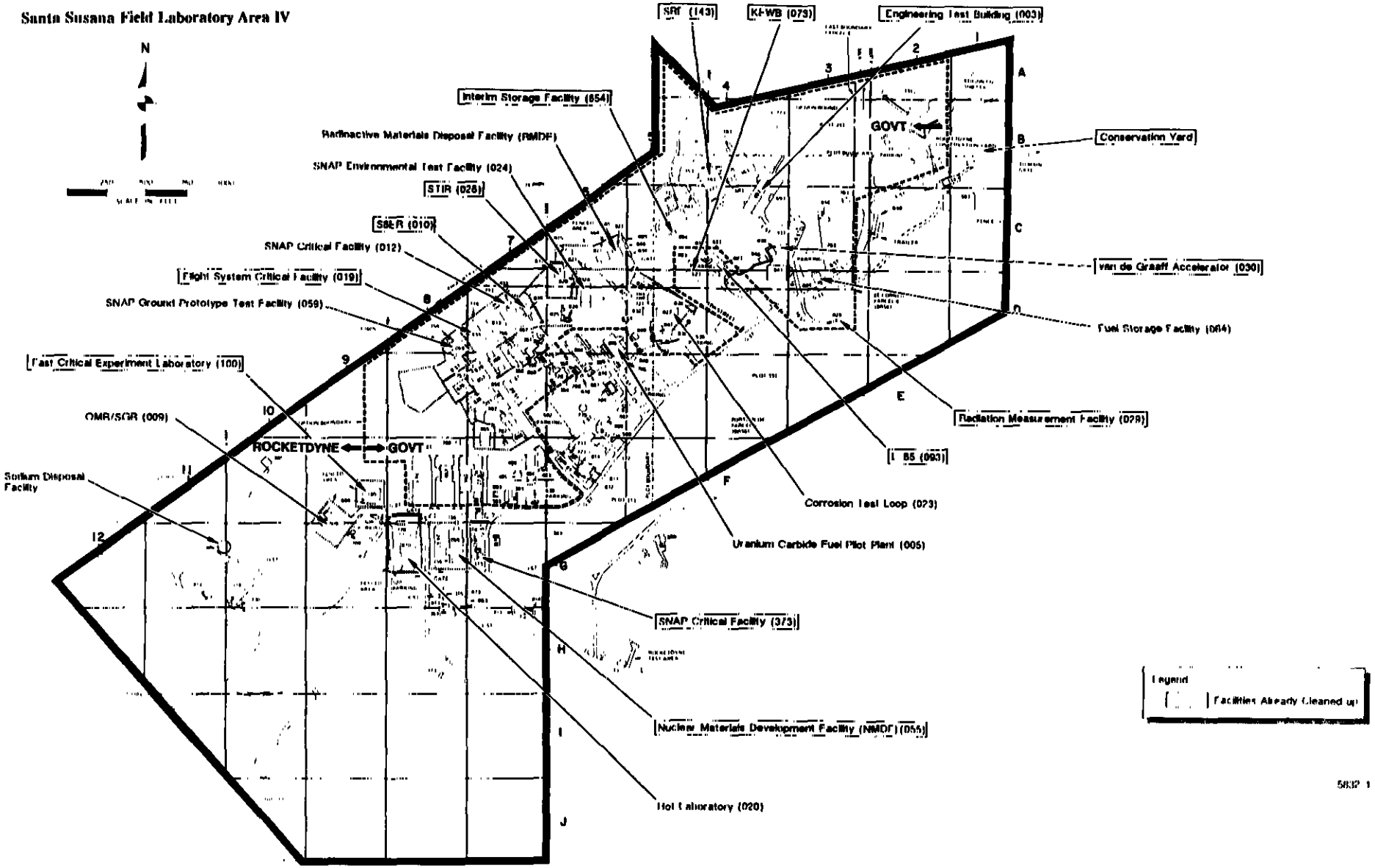


Figure 2–5. Map of Santa Susana Field Laboratory Area IV Facilities

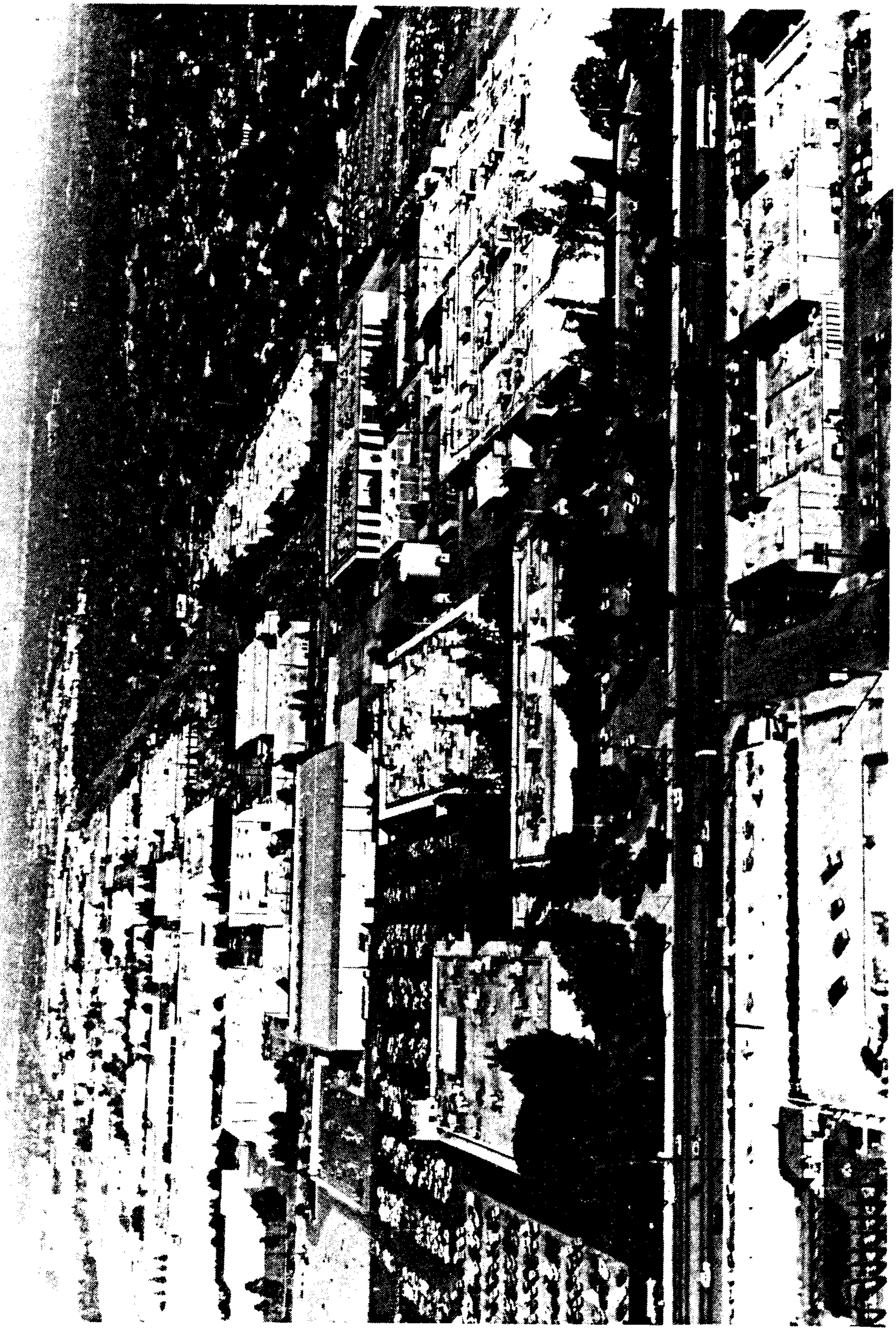


Figure 2-6. Rocketdyne Division – De Soto Site

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 RMDF – DOE Contract Activities

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 atmospheric effluents are released from the building to uncontrolled areas. No radioactive liquid waste is 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.

2.1.1.3 Building T059 – DOE Contract Activities

Operations at Building T059 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 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 and Co–60, some minor amounts of Eu–152, and trivial amounts of H–3.

2.1.2 De Soto Site

2.1.2.1 Building 104 – California State–Licensed Activities

Operations at Building 104 that may generate radioactive effluents consist of research studies in applied physics and physical chemistry. Only minimal quantities of atmospheric effluents are released from the building to uncontrolled areas. No liquid effluents are released. Radionuclides present are limited to Co–60 in encapsulated form.

2.1.3 Canoga Site

Insufficient quantities of radioactive materials are used at the Canoga facility to warrant environmental monitoring.

3.0 COMPLIANCE SUMMARY

This section summarizes Rocketdyne's compliance with federal, state, and local environmental regulations. Two main categories are discussed; Section 3.1 discusses radiological compliance, and Section 3.2 discusses nonradiological compliance.

A major review of ETEC's environmental management was performed as part of the Department of Energy (DOE) "Tiger Team" assessment, conducted in March and April 1991. The Environmental Subteam identified 39 findings in its assessment of the DOE activities within the Santa Susana Field Laboratory. None of the findings reflect situations that present an immediate risk to public health and the environment. Twenty-two findings reflect problems involving compliance with DOE orders or Site Contractor standard operating procedures. Seventeen findings represent conditions in which best management practices were not employed. These findings have been addressed in an ETEC Corrective Action Plan. All funded milestones from the Corrective Action Plan are being completed on schedule and Action Plans closed out following review by DOE/SF.

3.1 RADIOLOGICAL COMPLIANCE

3.1.1 Compliance Status

The results of radiological environmental monitoring indicate that there are no significant releases of man-made radioactive material from Rocketdyne sites. Atmospheric discharge of radioactive materials and direct exposure are the only potential exposure pathways to the general public from Rocketdyne's environmental remediation and waste management operations. 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. With the exception of negligible concentrations of tritium (below Federal and State drinking water supply limits), only natural radioactivity has been found in this water.

Small amounts of radioactive materials may be released in ventilation exhaust from facilities at SSFL and at De Soto, along with naturally occurring airborne radioactivity. These releases are minimized by the use of high-efficiency particulate air (HEPA) filters, and are monitored by sampling the workplace 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 exposures estimated for persons at the site boundaries and also at nearby residences are small when compared with natural radiation and with all applicable guidelines (see Sections 3.1.1.1 to 3.1.1.4). All estimates for the maximum hypothetical dose are far below the Environmental Protection Agency (EPA) National Emission Standards for Hazardous Air Pollutants (NESHAPs) standard. Offsite doses were even below the NESHAPs threshold of 0.1 mrem/yr for required effluent monitoring, with the assumption of no air pollution control equipment.

The external radiation exposure estimates at the maximum exposed boundary location and at the nearest residence are based on results for site ambient radiation dosimeters and several facility workplace radiation dosimeters.

Measured airborne effluents and doses and direct radiation doses continued to be in compliance with applicable dose and release limits. Specific results for individual sites and facilities are compared to specific regulatory limits in the following sections.

3.1.1.1 DOE Facilities at SSFL (Area IV) - RMDF and Building T059

Airborne releases from the RMDF and Building T059 are detailed in Tables 5-1A and 5-1C of Section 5 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 T059 are detailed in Table 5-12A of Section 5 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 dose of about 65 mrem, above natural background, at the nearest boundary-line location and a calculated dose less than 0.0003 mrem 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.

Airborne effluent from the RMDF and Building T059 is a factor of 10^3 to 10^6 lower than the DOE isotopic DCGs. Nearest receptor doses from airborne effluent are 2.2E-6 mrem/yr for releases from RMDF and 6.6E-7 mrem/yr for releases from Building T059. The applicable limit for RMDF and T059 (combined) 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.

3.1.1.2 NRC Licensed Facility at SSFL (Area IV) - RIHL

Airborne releases from the Rockwell International Hot Laboratory (RIHL) are detailed in Table 5-1B of Section 5 and are shown to be below the maximum permissible concentrations (MPCs) of 10 CFR 20.106 and State of California, CCR Title 17, Section 30269. Airborne and direct

radiation doses at the site boundary are detailed in Table 5-12B of Section 5 and are shown to be less than the dose limits of 10 CFR 20.105 and State of California, CCR Title 17, Section 30269.

Direct radiation dose at the nearest site boundary is 0.07 mrem/yr and less than 6×10^{-6} mrem/yr for the nearest residence, compared to annual NRC and State of California limits of 500 mrem/yr. Airborne effluent is a factor of 10^2 to 10^5 less than the isotopic MPCs of the NRC and State of California. Nearest receptor dose from airborne effluent from RIHL is 1.4×10^{-5} 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.

3.1.1.3 State of California Licensed Facility at De Soto – Building 104

Airborne releases from Building 104 at the De Soto facility are detailed in Table 5-1D of Section 5 and are shown to be below the MPCs of State of California, CCR Title 17, Section 30269. Airborne and direct radiation doses at the site boundary are detailed in Table 5-12C of Section 5 and are shown to be less than the dose limits of State of California, CCR Title 17, Section 30268.

Direct radiation dose from Building 104 at the site boundary is 0.5 mrem/yr above background compared to the state's dose limit of 500 mrem/yr. Direct radiation dose at the nearest residence is 0.35 mrem/yr. These estimates are based on the difference between the Building 104 dosimeter measurement and the average of all offsite dosimeter measurements. Airborne effluent from Building 104 ranges from a factor of 10^4 to 10^6 less than the isotopic MPCs for the State of California. Nearest receptor dose from airborne effluent is 5.6×10^{-6} mrem/yr, which is less than the EPA NESHAPs limit of 10 mrem/yr from 40 CFR 61, Subpart H.

3.1.1.4 Surface Water and Groundwater at SSFL

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 very low levels (maximum of 7,155 pCi/L) of tritium, below the Federal and State standard for drinking water suppliers (20,000 pCi/L).

Shallow groundwater is sampled weekly at Building T059 as part of the groundwater management program. These samples are tested for any transfer of gamma-emitting activation product radioactivity 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 has been found. Very low concentrations of tritium have been found (471 pCi/L in January 1992), which exceed natural concentrations but are well below Federal and State limits for drinking water suppliers (20,000 pCi/L).

Surface water from the NPDES discharge points and five storm water run-off catch basins were also monitored for gross alpha, gross beta, gamma-emitting radionuclides, and tritium. No man-made radioactivity has been found.

3.1.2 Current Issues and Actions

3.1.2.1 Environmental Monitoring Plan

The DOE-SF 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-SF to provide funds for the preparation and implementation of such a plan to meet the requirements of DOE Orders 5400.1, 5400.5, draft 10 CFR 834, and DOE/EH-0173T. Funding arrangements were completed and preparation of a comprehensive plan was begun. A draft plan was submitted to DOE September 30, 1992.

3.1.2.2 Stack Effluent Monitoring

Issues relating to stack effluent monitoring for radionuclides were discussed in DOE-SF site visits in January 1991, in the ETEC Self-Assessment of March 1991, in the Tiger Team Assessment of March/April 1991, and the EPA inspection of March 1992. These issues centered on:

1. Stack monitoring systems do not comply exactly with stack monitoring designs recommended in ANSI N13.1.
2. Calculation of potential sampling errors due to compromises in the system construction had not been formally evaluated.
3. Releases from Building T059 in 1989 had not been included in the NESHAPs evaluation for that year.

Resolution of these issues has been addressed in the ETEC Corrective Action Plan. Several responses have been completed:

1. Calculations were made during the Tiger Team visit to show that the potential releases (even with no HEPA filters) from T059, RIHL, and RMDF are less than 1% of the 10 mrem/yr standard, and thus, the exhausts are not required to be measured by the methods prescribed by 40CFR61 Subpart H.
2. Theoretical analyses and isotopic analyses of material deposition in the long sampling lines have shown that the stack samples have underestimated releases by at most 30–40% for RIHL and RMDF.
3. The Building T059 exhaust sampling system was modified to comply with the recommendations of ANSI N13.1.
4. The long sampling lines at RIHL and RMDF have been modeled by an NRC computer program and it was found that these lines have minor potential for material deposition.
5. Detailed evaluation of the potential for releases from the various facilities was performed. Measurements need to be performed for NESHAPs only if this potential

exceeds 1% of the standard, and this study has shown that releases are well below this.

Evaluation of potential sources of airborne radioactivity were conducted to estimate likely and maximum potential public radiation doses due to these sources. Sampling and analysis methods and the sensitivity of the dose assessment program to meteorological and demographic data were also considered. These studies showed that predicted doses, with the assumption that filtration equipment is absent, were below 1% of the EPA NESHAPs standard. Doses above this 1% level are considered of sufficient concern to warrant compliance with detailed monitoring requirements and recommended meteorological data gathering. A review team from EPA Region 9 and DOE–SF visited SSFL at the end of March 1992 to consider these matters relative to compliance with Subpart H of 40 CFR 61 (NESHAPs for radionuclides at DOE facilities). The team concluded that the studies and the results of the monitoring, analysis, and interpretation were adequate to demonstrate compliance.

3.1.2.3 Public Participation

Ongoing meetings of the EPA–organized SSFL Work Group, consisting of representatives of various regulatory agencies, several EPA–appointed local residents, and the Committee to Bridge the Gap, were supported with information regarding radiological monitoring.

Five guided bus tours of SSFL were provided for the public during 1991. These tours were available to interested persons by reservation and covered the entire SSFL site. A total of 711 people from Los Angeles area participated in these tours. Information on operations, environmental conditions, and decontamination projects, and opportunity for questions and discussions with appropriate staff members, were provided to the visitors.

3.1.2.4 DHS Cancer Study

The California DHS has completed the follow–up work on the cancer incidence report. The findings are consistent with the earlier DHS report in that men living near SSFL in Los Angeles County had a higher incidence of bladder cancers than men living elsewhere; however, this was not observed in Ventura County men. Men living near SSFL in Ventura County had a higher incidence of lung cancers than men living elsewhere; however, this was not observed in Los Angeles County men. Lack of an increase in the most strongly radiosensitive cancers together with the lack of a pattern in bladder and lung cancer rates, is not consistent with a community–wide environmental exposure to radiation. This follow–up study concluded that people living in the vicinity of SSFL are not at increased risk for developing cancers associated with radiation exposure.

3.1.2.5 Epidemiological Study

As a result of the media attention associated with DOE activities, the State of California legislators called for an epidemiological study of workers and local communities. The California Public Health Foundation has been awarded DOE grant funds, an advisory panel has been selected and

contractor selection is in progress. The 18-month study is projected to start in late 1992 and will cover radiological and nonradiological health effects on workers.

3.2 NONRADIOLOGICAL COMPLIANCE

3.2.1 Compliance Status

3.2.1.1 Comprehensive Environmental Response, Compensation, and Liability Act

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) provides for the cleanup and emergency response for hazardous wastes released into the environment. The Superfund Amendments and Reauthorization Act (SARA) extended and revised CERCLA. SARA provides for emergency planning and preparedness, community right-to-know reporting, and toxic chemical release reporting. SARA requires a facility owner or operator to report hazardous substance releases to specific authorities, depending on the materials.

A Preliminary Assessment/Site Investigation (PA/SI) review of Area IV dated 11 August 1989 and transmitted to ETEC on 9 April 1990 was conducted by the EPA Site Evaluation Section. EPA is currently preparing the Hazard Ranking System (HRS) score for the site.

Characterization of the ground water at the site continues. Monitoring wells were recently constructed less than 200 feet off-site and northwest of Area IV which indicate the presence of TCE at concentrations exceeding the drinking water standard. Elevated levels of tritium were also found but at concentrations below drinking water limits.

Rocketdyne submitted the Sampling and Analysis Plan (SAP) for the SSFL ground water monitoring program to Cal-EPA Department of Toxic Substances Control (DTSC) on 1 March 1991. On 11 March 1991, Rocketdyne received two Reports of Violations (ROVs) concerning the ground water monitoring program for Areas I and III (Rockwell-owned) and Area II (NASA-owned) from Cal-EPA DTSC. Rocketdyne was advised by DTSC that Area IV ground water monitoring activities are subject to the same regulations.

In response to the ROVs, a Site Characterization Plan (SCP) was prepared and submitted to Cal-EPA DTSC on 6 June 1991. Cal-EPA approved the Site Characterization Plan on 6 August 1991. The SSFL ground water Quality Assessment Plan (QUAP) was prepared and submitted to Cal-EPA in response to the ROVs on 30 October 1991.

3.2.1.2 Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA) gives the EPA broad authority to regulate the treatment, storage, and disposal of hazardous wastes. The fourteen underground storage tanks in Area IV containing petroleum products and hazardous substances are permitted through the Ventura County Environmental Health Division.

There are two RCRA-permitted Treatment, Storage and Disposal Facilities (TSDF) owned by DOE and operated by Rocketdyne at SSFL. The Hazardous Waste Management Facility (Building 133 and Building 029) is a fully permitted facility with a Part B renewal having been submitted, EPA ID Number CAD000629972, and the Radioactive Materials Disposal Facility (RMDF), an interim status facility, EPA ID Number CA3890090001.

The Part B renewal was submitted for Buildings 133 and 029 to Cal-EPA DTSC. A Notice of Deficiency (NOD) was issued to Rocketdyne (letter dated 27 June 1991) on the Part B. Each of the items referenced in the NOD were addressed and the Part B NOD response was resubmitted 28 August 1991. These facilities are permitted for reactive materials treatment and storage only. There is no on-site disposal of waste from these facilities.

3.2.1.3 National Environmental Policy Act

The National Environmental Policy Act (NEPA) requires federal agencies to assess the environmental impact of implementing their major programs and actions early in the planning process. For those projects or actions that are either expected to significantly affect the quality of the human environment or create controversy on environmental grounds, the proponent agency is required to file a formal environmental impact statement.

ETEC reviews the environmental impact of each program planned for implementation. Based on these reviews, DOE is requested to issue determinations of compliance to the NEPA, such as either Categorical Exclusion (CX) or Finding of No Significant Impact (FONSI). ETEC has received or requested DOE's concurrence for all programs currently planned at ETEC.

3.2.1.4 Clean Air Act

The Clean Air Act (CAA) resulted in federal regulations which set air quality standards and require state implementation plans, National Emissions Standards for Hazardous Air Pollutants (NESHAPs), New Source Performance Standards (NSPS), and monitoring programs in an effort to achieve air quality levels which improve the public health and welfare. The SSFL is regulated by the Ventura County Air Pollution Control District (VCAPCD) and must comply with VCAPCD rules and regulations. VCAPCD rules and regulations incorporate, by reference, NESHAPs regulations as codified under the CAA.

The Hazardous Waste Management Facility permit number 0226, Sodium Pump Test Facility permit number 0290, Molten Salt Test Facility permit number 1124, and Sodium Component Test Installation permit number 0271 were renewed in 1991. Emission offsets were obtained from Chevron Corporation for the Steam Accumulator Blowdown Evaluation Rig (SABER) in 1991.

The four air quality permits issued and renewed in 1991 as well as the offsets for Area IV are being combined into one permit. The new permit was issued 27 May 1992, valid 1 January 1992 to 31 December 1992. This permit will also include the solvent hand wipe cleaning. Solvent hand wipe cleaning without a permit was the only violation of the CAA during 1991, VCAPCD's Notice of

Violation No. 14249 was issued on 30 April 1991. VCAPCD issued a temporary Permit to Operate for the Kalina facility on 6 November 1991. This temporary permit is in effect until incorporated into the combined permit.

VCAPCD Rule 74.15, as adopted in March of 1989 and revised in December 1991, sets limits for NOX and CO emissions on boiler, 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. A 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.

Asbestos removal projects occurring during 1991 removed and disposed of a total of 860 square feet of floor tile and mastic, 535 square feet of pipe insulation, transite and merimet block, and one boiler contaminated with asbestos.

3.2.1.5 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, which regulates point source discharges to navigable waters and the preparation of Spill Prevention Control and Countermeasure (SPCC) plans.

SSFL wastewater discharges are regulated under the California Water Code (Division 7) as administered by the California RWQCB. The state water discharge program incorporates the regulations and guidelines of the CWA. The waste discharge requirements under the California RWQCB program serve as an NPDES permit. The current facility NPDES permit (No. CA0001309), issued in September 1984, was to expire on 10 August 1989, but continues in effect pending California RWQCB review of the permit renewal. On 18 December 1991, the California RWQCB issued a draft of the revised NPDES permit with increased waste discharge requirements for the discharge of surface waters from SSFL.

There were minor exceedances of NPDES quality limits in 1991 for the following reasons:

- Low BOD percent removal rates at the Area I and Area III Sewage Treatment Plants due to relatively low influent BOD
- Fecal coliform exceedances due to equipment malfunctions at the Area I and Area III Sewage Treatment Plants
- 9.1 pH due to algae growth in the ponds (pH limit 6–9).

Surface water samples were collected from the five northwest slope runoff sampling stations installed in Area IV. The results of analyses of these samples were communicated to the California RWQCB and to DOE-SF.

The Building 886 Former Sodium Disposal Facility was used for removing solid sodium and sodium–potassium alloys from various metal components. The site consists of two earth–bermed impoundments, the Upper and Lower Ponds, and a concrete pad and pit area. The site is listed as a Solid Waste Management Unit (SWMU) with the Cal–EPA. This site is also considered a Toxic Pit under the Toxic Pits Cleanup Act by the California RWQCB. On 30 April 1991, the California RWQCB issued Cleanup and Abatement Order 91–061 to Rockwell International Corporation and the Department of Energy, for whom the site was operated. This order requires the closure of the Lower Pond surface impoundment and the issuance of a plan for post closure care and ground water monitoring by 31 December 1992.

A closure plan, as required as part of this order, was prepared and submitted to both the Cal–EPA and the California RWQCB on 31 July 1991. Comments were received from both agencies on 1 November 1991 on the closure plan, and these comments were addressed and responded to in a letter from Rocketdyne on 3 January 1992. Both agencies sent final clarification letters and agreements on 11 February 1992 which would allow approval of the plan and permission to begin remedial activities at the site if concurred with by Rocketdyne. Letters of concurrence were sent to each agency from Rocketdyne on 20 February 1992. The Cal–EPA also sent two further letters of clarification on 19 February and 10 March 1992. The contents of the Closure Plan and these letters constitute an approved plan for closure of the site.

3.2.1.6 U. S. DOE Tiger Team Assessment

The U. S. Department of Energy conducted a Tiger Team Assessment of ETEC from 18 March to 12 April 1991, using a team composed of DOE staff, contractors, and consultants. The April 1991 Tiger Team Assessment Report identified thirty–nine environmental findings. Twenty–two findings were generally in compliance with Federal and State of California environmental regulations; however, noncompliance exists with regard to DOE's environmental order requirements. Seventeen findings represent conditions in which best management practices were not being employed. A Corrective Action Plan presenting the organizational structure, management systems, and specific responses, including milestone dates and funding requirements, was submitted 1 October 1991.

3.2.2 Current Issues and Actions

3.2.2.1 Resource Conservation and Recovery Act

The EPA has initiated the Resource Conservation and Recovery Act (RCRA) corrective action process in Area IV and all of SSFL. The EPA has developed a draft RCRA Facility Assessment (RFA) with the purpose of determining the areas of past, present, and potential releases of hazardous waste and hazardous constituents. The RFA's findings still need to be confirmed through a sampling visit. The results from this sampling visit will then be incorporated into a final RFA report. The next step in the corrective action process will consist of a RCRA Facility Investigation (RFI). During the RFI stage Rockwell will be addressing the RFA's findings by conducting further investigations and cleanup.

3.2.2.2 Clean Water Act

To date, the renewal of NPDES permit Number CA0001309 and response to comments received are still in the review process. Tentative waste discharge requirements and effluent limitations (draft NPDES permit) were issued on 18 December 1991 and distributed for public comment.

3.2.2.3 B/886 Former Sodium Disposal Facility

The cleanup of the B/886 former Sodium Disposal Facility began with excavation of soil in a pilot study area of the Lower Pond on March 9, 1992. The California RWQCB specified the area for the pilot study and allowed cleanup of this region ahead of the rest of the site. Excavation of soils and buried objects from the pilot study region continued through May 7, 1992, when all site activities ceased due to the land disposal restrictions placed on mixed wastes as of May 8, 1992. Negotiations with the regulatory agencies regarding the generation and storage of mixed wastes are still being conducted. An approval of the Closure Plan for the site, and thus approval to begin cleanup outside the pilot study area, was received from the California Environmental Protection Agency (Cal-EPA), Department of Toxic Substances Control (DTSC) on June 5, 1992. However, until the issue of the land disposal of restricted wastes is resolved, no cleanup of the radioactively contaminated areas will be allowed at the site.

3.2.2.4 Permits (Area IV)

Air (VCAPCD)

Permit	Facility	Valid
0271	New combined permit	1/1/92 - 12/31/92

Treatment/Storage (EPA)

CA000629972	Hazardous Waste Management Facility (B/133 and B/029)	Part B renewal submitted 8/29/91
CA3890090001	Radioactive Materials Disposal Facility (RMDF)	Part A interim status

NPDES (RWOCB)

CAD0001309	Santa Susana Field Laboratory	Review permit renewal 8/10/89

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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 a minimum 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 for 1991 were composited for radiochemistry analysis by IT Analytical 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 study 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 confirm 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, the elimination of routine off-site soil sampling as a formal part of the environmental monitoring program was done. In view of the extreme reduction in radioactivity and lack of any indication of radioactive contamination spread by routine and special surveys and inspections, the majority of routine soil sampling was terminated at the end of 1989. During 1991, a number of special interest soil samples were taken, especially at the location of the Sodium Disposal Facility.

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.

4.1 SAMPLING AND SAMPLE PREPARATION

4.1.1 Soil

Soil is analyzed for any significant increase in radioactive deposition from airborne radioactivity. Since soil is naturally radioactive and has been contaminated by atmospheric testing of nuclear weapons, a general background level of radioactivity exists. Specific radionuclide analyses were performed to more fully characterize the environmental radioactivity. For all cases in which radioactive contamination is known or suspected, the specific radionuclides are analyzed. This may involve gamma-spectrometry, radiochemistry, or liquid scintillation counting.

4.1.2 Water

Samples of groundwater are taken from deep (Chatsworth formation) and shallow-zone (alluvium) wells at SSFL on a routine sampling basis. Privately owned off-site wells are occasionally sampled. Surface water is sampled from several ponds and from rainfall-runoff catch-basins.

4.1.3 Ambient Air

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 4-1 , 4-2 and listed in Table 4-1. Airborne particulate radioactivity is collected on glass fiber (type A/E) filters which are automatically changed daily at the end of each sampling period (midnight). The samples are counted for alpha and beta radiation following a minimum 120-hour decay period. The volume of a typical daily ambient air sample is about 25 m^3.

Ambient air samples are counted for 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).

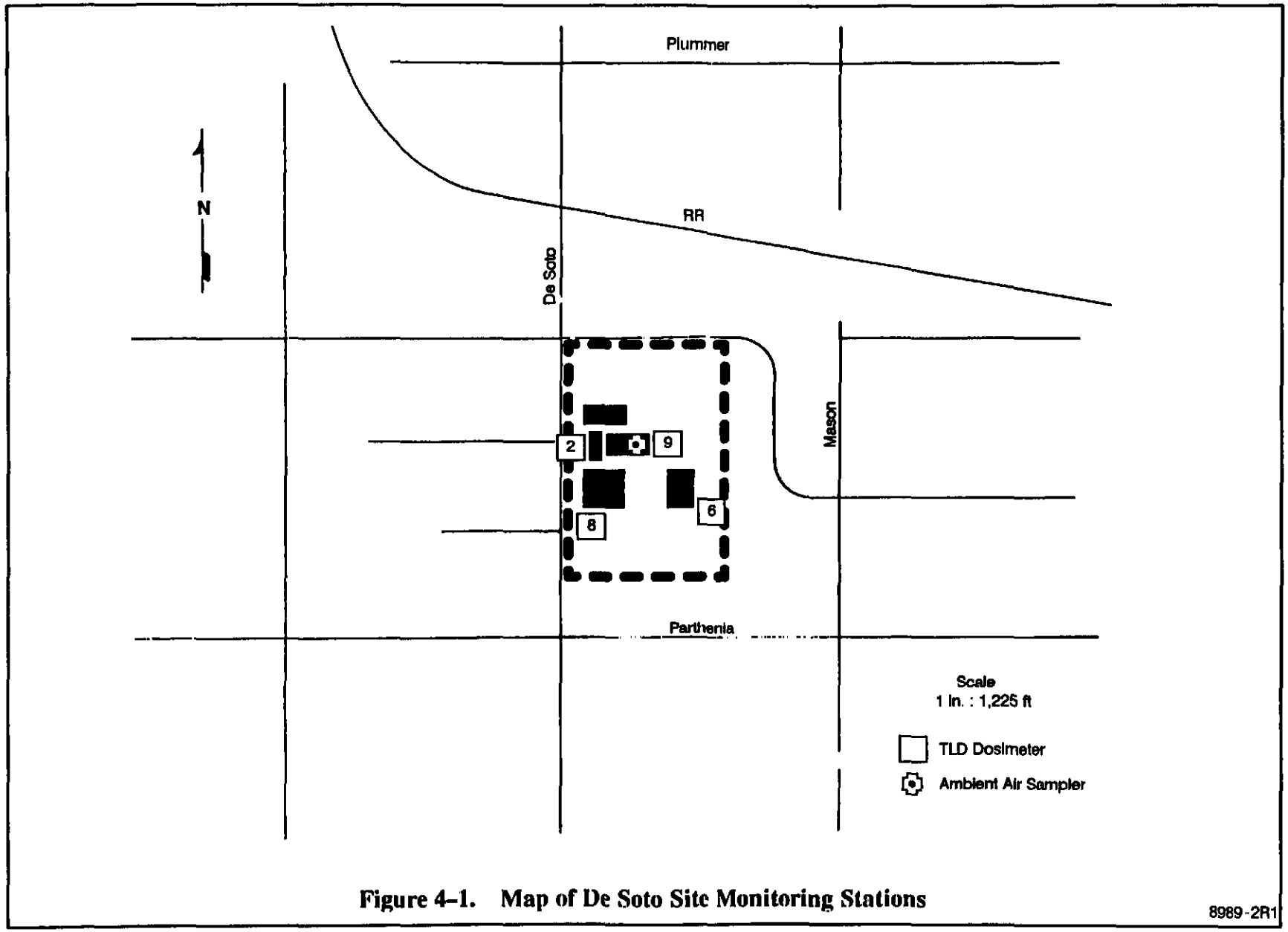

Figure 4–1. Map of De Soto Site Monitoring Stations

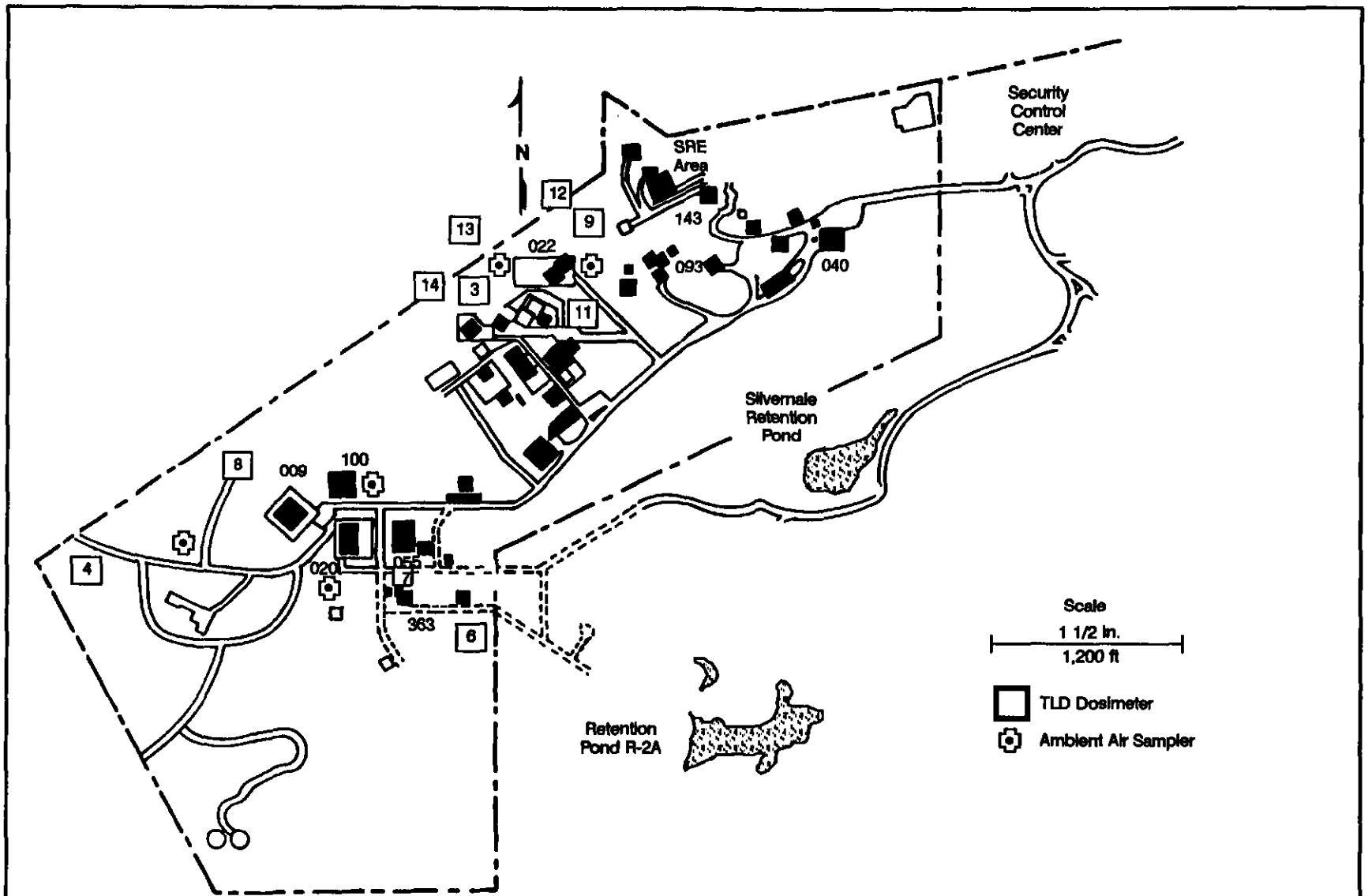

Figure 4–2. Map of Santa Susana Field Laboratory Site Sampling Stations

Table 4–1. Sampling Location Description
(Sheet 1 of 2)

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 (State of California TLD Location Number 2)	(Q)
DS–6	De Soto Site, east boundary, southeast corner of Building 105 (State of California TLD Location Number 1)	(Q)
DS–8	De Soto Site Guard Post 4, southwest corner of Building 101 (State of California TLD Location Number 7)	(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 3)	(Q)
SS–4	SSFL Site, west boundary on H Street	(Q)

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Table 4–1. Sampling Location Description
(Sheet 2 of 2)

Station	Location	Frequency of Sampling
SS–6	SSFL Site, northeast corner of Building 353 (State of California TLD Location Number 4)	(Q)
SS–7	SSFL Site, Building 363, north side (State of California TLD Location Number 8)	(Q)
SS–8	SSFL Site, former Sodium Disposal Facility north boundary	(Q)
SS–9	SSFL Site, Radioactive Materials Disposal Facility, northeast boundary at Building 133	(Q)
SS–11	SSFL Site, Building 036, east side	(Q)
SS–12	SSFL Site, RMDF northwest property line boundary (State of California TLD Location Number 10)	(Q)
SS–13	SSFL Site, RMDF northwest property line boundary	(Q)
SS–14	SSFL Site, RMDF northwest property line boundary	(Q)
Off–Site Ambient Radiation Dosimeter Locations		
OS–1	Off–site, Chatsworth (State of California TLD Location Number 5)	(Q)
OS–5	Off–site, Simi Valley (State of California TLD Location Number 6)	(Q)

Code:

A	Air Sampler Station
TLD	Thermoluminescent Dosimeter Location
D	Daily Sample
W	Weekly Sample
Q	Quarterly Sample

Location:

DS	De Soto
SS	SSFL
OS	Off–Site

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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.

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 high-efficiency particulate air (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).

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, T059, 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 discharge to the atmosphere. No contaminated liquids are discharged to unrestricted 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 from the RIHL and the RMDF. 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 are shown in Tables 5–1A through 5–1D. The total shows that no significant quantities of radioactivity were released in 1991.

The isotopic composition of the radioactivity deposited on the nuclear facility exhaust air sampling filters, composited for the year, is also presented in Tables 5–1A through 5–1D. 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. Those analytical results that were less than the procedure background are shown as negative values. In calculating the releases and concentrations, these negative values were treated as zero. Radionuclides that could have been detected, if present, but were not reported, 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 site 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. These 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.

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

SSFL/RMDF - 1991	
Effluent volume (m^3)	214,647,501
Lower limit of detection, LLD	
Gross alpha (μCi/mL)	3×10^{-16}
Gross beta (μCi/mL)	1×10^{-15}
Air volume sampled (m^3)	32,150
Annual average concentration in effluent	
Gross alpha (μCi/mL)	4.34×10^{-16}
Gross beta (μCi/mL)	1.18×10^{-14}
Maximum observed concentration	
Gross alpha (μCi/mL)	3.30×10^{-15}
Gross beta (μCi/mL)	1.32×10^{-13}
Activity released (μCi)	
Gross alpha	0.09
Gross beta	2.54

Radionuclide-Specific Data

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

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

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

ND = Not detected

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

SSFL/RIHL - 1991	
Effluent volume (m^3)	468,326,922
Lower limit of detection, LLD	
Gross alpha (μCi/mL)	3×10^{-16}
Gross beta (μCi/mL)	1×10^{-15}
Air volume sampled (m^3)	33,050
Annual average concentration in effluent	
Gross alpha (μCi/mL)	1.54×10^{-15}
Gross beta (μCi/mL)	1.80×10^{-14}
Maximum observed concentration	
Gross alpha (μCi/mL)	5.71×10^{-15}
Gross beta (μCi/mL)	2.25×10^{-13}
Activity released (μCi)	
Gross alpha	0.70
Gross beta	8.22

Radionuclide-Specific Data

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

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

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

ND = Not detected

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

SSFL/T059 - 1991	
Effluent volume (m^3)	29,561,169
Lower limit of detection, LLD	
Gross alpha (μCi/mL)	3×10^{-16}
Gross beta (μCi/mL)	1×10^{-15}
Air volume sampled (m^3)	20,224
Annual average concentration in effluent	
Gross alpha (μCi/mL)	1.80×10^{-15}
Gross beta (μCi/mL)	1.64×10^{-14}
Maximum observed concentration	
Gross alpha (μCi/mL)	6.79×10^{-14}
Gross beta (μCi/mL)	5.74×10^{-13}
Activity released (μCi)	
Gross alpha	0.02
Gross beta	0.17

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	76	0.11	0	Natural
K-40	1,260,000,000	75.7	0.11	150	0.22	3.74 x 10-15	Natural
Co-60	5.26	55.2	0.08	11	0.02	2.73×10^{-15}	8×10^{-11}
Sr-90	27.7	ND	0	6	0.009	0	9×10^{-12}
Cs-137	30	3.53	0.005	10	0.01	1.75×10^{-16}	4×10^{-10}
Po-210	0.38	18.3	0.03	0.2	2.92×10^{-4}	9.04×10^{-16}	Natural
U-234	247,000	1.48	0.002	0.1	1.46×10^{-4}	7.34×10^{-17}	9×10^{-14}
U-235	710,000,000	ND	0	0.1	1.46×10^{-4}	0	1×10^{-13}
U-238	4,510,000,000	1.63	0.002	0.1	1.46×10^{-4}	8.07×10^{-17}	1×10^{-13}
Pu-238	86.4	0.0008	1.16×10^{-16}	0.2	2.92×10^{-4}	3.91×10^{-20}	3×10^{-14}
Pu-239/240	24,390/6,580	0.77	0.001	0.2	2.92×10^{-4}	3.78×10^{-17}	2×10^{-14}
Am-241	458	0.03	4.67×10^{-5}	0.1	1.46×10^{-4}	1.58×10^{-18}	2×10^{-14}

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

Derived concentration guides (DCG) for release to unrestricted area, for most restrictive form of radionuclide as specified in DOE Order 5400.5 (2/8/90).

ND = Not detected

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

De Soto 104 - 1991	
Effluent volume (m^3)	39,589,884
Lower limit of detection, LLD	
Gross alpha (μCi/mL)	3×10^{-16}
Gross beta (μCi/mL)	1×10^{-15}
Air volume sampled (m^3)	23,652
Annual average concentration in effluent	
Gross alpha (μCi/mL)	3.97×10^{-16}
Gross beta (μCi/mL)	4.03×10^{-15}
Maximum observed concentration	
Gross alpha (μCi/mL)	4.62×10^{-15}
Gross beta (μCi/mL)	5.23×10^{-14}
Activity released (μCi)	
Gross alpha	0.01
Gross beta	0.15

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	76	0.003	0	Natural
K-40	1,260,000,000	6.96	0.01	150	0.005	2.94×10^{-16}	Natural
Co-60	5.26	ND	0	11	3.68×10^{-4}	0	3×10^{-10}
Sr-90	27.7	-0.87	0	6	2.01×10^{-4}	0	3×10^{-11}
Cs-137	30	4.23	0.007	10	3.35×10^{-4}	1.79×10^{-16}	5×10^{-10}
Po-210	0.38	33.80	0.06	0.2	6.70×10^{-6}	1.43×10^{-15}	Natural
U-234	247,000	4.53	0.008	0.1	3.35×10^{-6}	1.92×10^{-16}	4×10^{-12}
U-235	710,000,000	0.42	7.05×10^{-4}	0.1	3.35×10^{-6}	1.78×10^{-17}	4×10^{-12}
U-238	4,510,000,000	0.47	7.82×10^{-4}	0.1	3.35×10^{-6}	1.97×10^{-17}	3×10^{-12}
Pu-238	86.4	-0.005	0	0.2	6.70×10^{-6}	0	7×10^{-14}
Pu-239/240	24,390/6,580	0.02	3.08×10^{-5}	0.2	6.70×10^{-6}	7.78×10^{-19}	6×10^{-14}
Am-241	458	0.0008	1.29×10^{-6}	0.1	3.35×10^{-6}	3.26×10^{-20}	2×10^{-13}

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

Maximum permissible concentrations (MPC) for release to uncontrolled area, for most restrictive form of radionuclide as specified in CCR 17, Appendix A.

ND = Not detected

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

	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	Am-241	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	200	20	100,000
Exhaust																	
RMDF	ND	4.25	2.94	0.31	5.67	0.26	0.004	0.009	0.0006	0.04	0.01	0.02	0.0005	0.03	0.001	0.4	11.8
RIHL	59.9	1.70	ND	2.01	9.78	2.86	0.010	0.004	ND	0.09	0.01	0.06	0.004	0.25	0.011	1.5	18.0
DS 104	ND	0.29	ND	-0.04	0.18	1.43	0.006	0.003	0.001	0.19	0.02	0.02	-0.0002	0.0008	0.00003	0.4	4.0
T059	ND	3.74	2.73	ND	0.17	0.90	0.008	0.001	ND	0.07	ND	0.08	0.00004	0.04	0.002	1.8	16.4
Ambient																	
RMDF	386.0	56.8	ND	-0.13	0.44	17.10	0.022	0.007	0.034	-0.001	-0.001	0.056	-0.0013	-0.0001	ND	2.0	47.6
RMDF Pond	ND	54.3	ND	-0.17	0.62	16.40	0.028	0.022	0.015	0.09	0.001	0.053	-0.0009	0.0007	ND	2.4	51.4
RIHL	421.9	165.4	ND	-0.11	3.30	18.18	0.019	0.030	0.023	0.06	0.027	0.082	0.0002	0.0010	ND	2.3	50.4
T100 (7 day)	451.8	7.2	ND	-0.07	-0.08	17.81	0.030	0.236	0.010	0.78	0.013	-0.010	0.0001	0.0009	ND	2.3	47.2
T886	535.5	125.3	ND	-0.13	-0.73	18.18	0.047	0.020	0.016	0.11	-0.014	0.081	0.0017	-0.0001	ND	2.2	50.1
DS 104	433.2	166.9	ND	-0.07	0.22	18.52	0.034	0.026	0.018	0.12	-0.018	0.054	-0.0017	-0.0001	ND	2.6	50.0
Exhaust Average	15.0	2.50	1.42	0.57	3.95	1.36	0.007	0.004	0.000	0.10	0.01	0.045	0.001	0.08	0.004	1.0	12.6
Ambient Average	371.4	96.0	0.00	-0.11	0.63	17.70	0.030	0.057	0.019	0.19	0.001	0.053	-0.0003	0.0004	0.000	2.3	49.4

ND = not detected

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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 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 (DCG) 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 (MPC) 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. (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 1991 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 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 non-natural radioactivity concentrations at the nearest boundary and residence locations for effluents from the four facilities. These concentrations were estimated by use of CAP88-PC and specific radionuclide releases for each facility.

A comparison of 1991 data with 1990 data shows an inconsistency between concentrations for the given releases. Concentration data for 1991 was calculated by CAP88-PC. This data for 1990 was backcalculated from AIRDOS-PC dose calculation results using what was considered the dominant radioisotope dose conversion factors. Data for 1991 is consistent with pre-1990 results, χ/Q, when AIRDOS-EPA and other methods were used (not AIRDOS-PC).

Table 5–3. Annual Average Radioactivity Concentrations of Atmospheric Effluents – 1991

Facility	Annual Release (μCi)	Distance (m) to		Downwind Concentration (10^{-18} μCi/mL)	
		Boundary	Residence	Boundary	Residence
DS 104	0.017	187 E	315 S	0.003	0.002
RIHL	5.75	302 NW	1,900 SE	1.6	0.099
RMDF	1.46	118 NW	2,300 SE	0.009	0.016
T059	0.082	80 NW	1,997 SSE	0.26	0.0042

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5.2 ENVIRONMENTAL SAMPLING

5.2.1 Air

Ambient air samples placed at several locations in SSFL Area IV, and at De Soto, provide information of radioactivity in the atmosphere. This consists predominantly of Be–7, K–40, Cs–137, Pb–210/Po–210, Th, and U.

Ambient air samples are counted for gross alpha and beta activity in the same manner as effluent samples. The results of the analyses are shown in Table 5–2 with the effluent results for comparison.

As the case with effluent air samples, the observed ambient air radionuclide concentrations were far below 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, to determine gross alpha and gross beta activity, 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 5-4.

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

Figure 5-1 is a graph of the weekly averaged long-lived alpha and beta ambient air radioactivity concentrations for De Soto and SSFL during 1991 as indicated by the gross alpha and gross beta counting. (Gaps in the record shown in this figure are due to negative results from samples showing

Table 5-4. Ambient Air Radioactivity Data—1991

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	340	(2.6 ± 3.2) E-15 (47.9 ± 29.5) E-15	15.1 E-15 (03/19) 188.0 E-15 (01/13)	0.1 0.02
SSFL Area IV RIHL	Alpha Beta	327	(2.3 ± 3.3) E-15 (48.3 ± 22.6) E-15	12.9 E-15 (12/31) 155.3 E-15 (02/03)	3.8 0.16
SSFL Area IV RMDF	Alpha Beta	356	(2.0 ± 3.5) E-15 (45.5 ± 29.1) E-15	15.7 E-15 (04/14) 206.4 E-15 (04/14)	10.0 0.51
SSFL Area IV Building T886	Alpha Beta	354	(2.2 ± 3.2) E-15 (48.0 ± 27.7) E-15	11.2 E-15 (12/22) 160.0 E-15 (09/25)	3.7 0.16
SSFL Area IV RMDF pond	Alpha Beta	342	(2.4 ± 3.1) E-15 (49.3 ± 28.2) E-15	11.4 E-15 (01/29) 173.8 E-15 (02/03)	4.0 0.16

*Maximum value observed for single sample.

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**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).

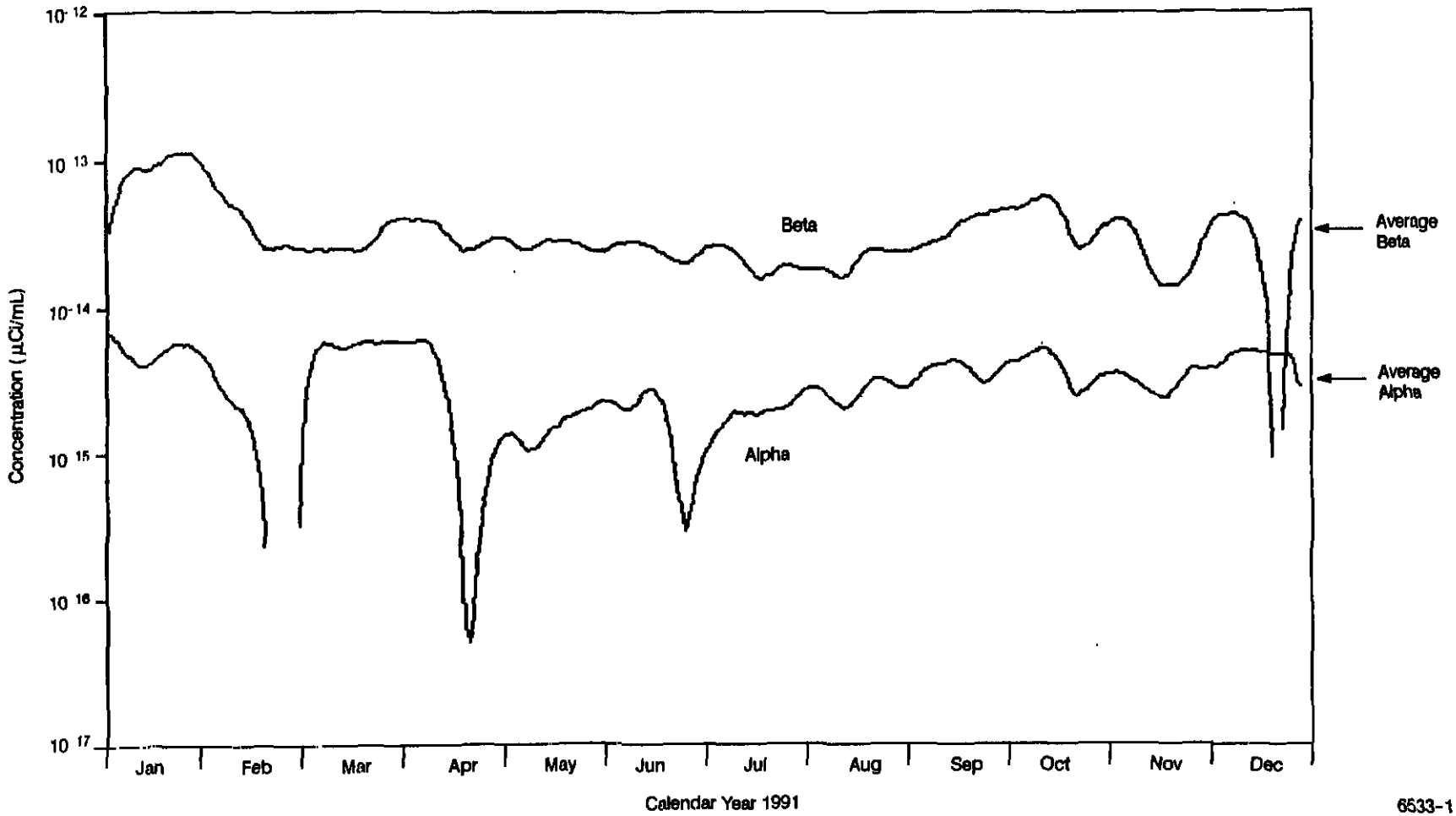

Figure 5–1. Seven–day Smoothed and Annual Average Airborne Radioactivity at the De Soto and Santa Susana Field Laboratory Sites – 1991

less activity than instrument background.) Generally, the ambient airborne radioactivity was relatively constant during 1991, 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 and possibly to aged fission products from past atmospheric tests of nuclear devices or other events such as the Chernobyl accident. Radionuclides detected by gross alpha and beta analysis of air samples collected during 1991 include K–40 plus several naturally occurring radionuclides from the uranium and thorium series.

A further comparison of ambient air and facility exhaust radioactivity is presented in Figure 5–2. 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, Building T059, and Building DS104, which are also on a weekly cycle. For both alpha and beta activity, the concentration in the RIHL exhaust is close to that in ambient air, largely due to the use of unfiltered outside air to bypass the HEPA filter system to control suction pressure in the ventilation system. At the RMDF and buildings T059 and DS104, all the discharged air is filtered, and so the gross alpha and beta activities are generally lower than in ambient air. Gaps in the plots are due to negative values resulting from air samples showing less activity than instrument background.

5.2.2 Water

Groundwater is sampled from a large number of shallow (alluvium) and deep (Chatsworth Formation) wells 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 by Groundwater Resources Consultants of Tuscon, Arizona. The summary results for 1991 are shown in Table 5–5. 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.

The results are quite similar to previous years and show no indication of contamination with nonnatural radioactivity, other than a low level of H–3 below drinking water standards which has been thoroughly investigated. The distribution of the extreme values (maximum and minimum) is approximately equal to about zero, as seen clearly for Cs–137, and shows that the observed results are just random variations. With the exception of the gross alpha results, which are elevated due to the presence of natural uranium, no results approach the applicable limits.

Surface waters discharged from SSFL facilities and the sewage plant outfall drain southward into Rocketdyne retention pond R–2A. When the pond is full, the water may be discharged into Bell Creek, a tributary of the Los Angeles River in the San Fernando Valley, Los Angeles County. Average radioactivity concentrations in two retention ponds and upper Bell Creek samples are presented in Table 5–6.

Comparison of the radioactivity concentrations in water from the ponds with that of the supply water (see Table 5–7) shows no significant differences in either alpha or beta activity.

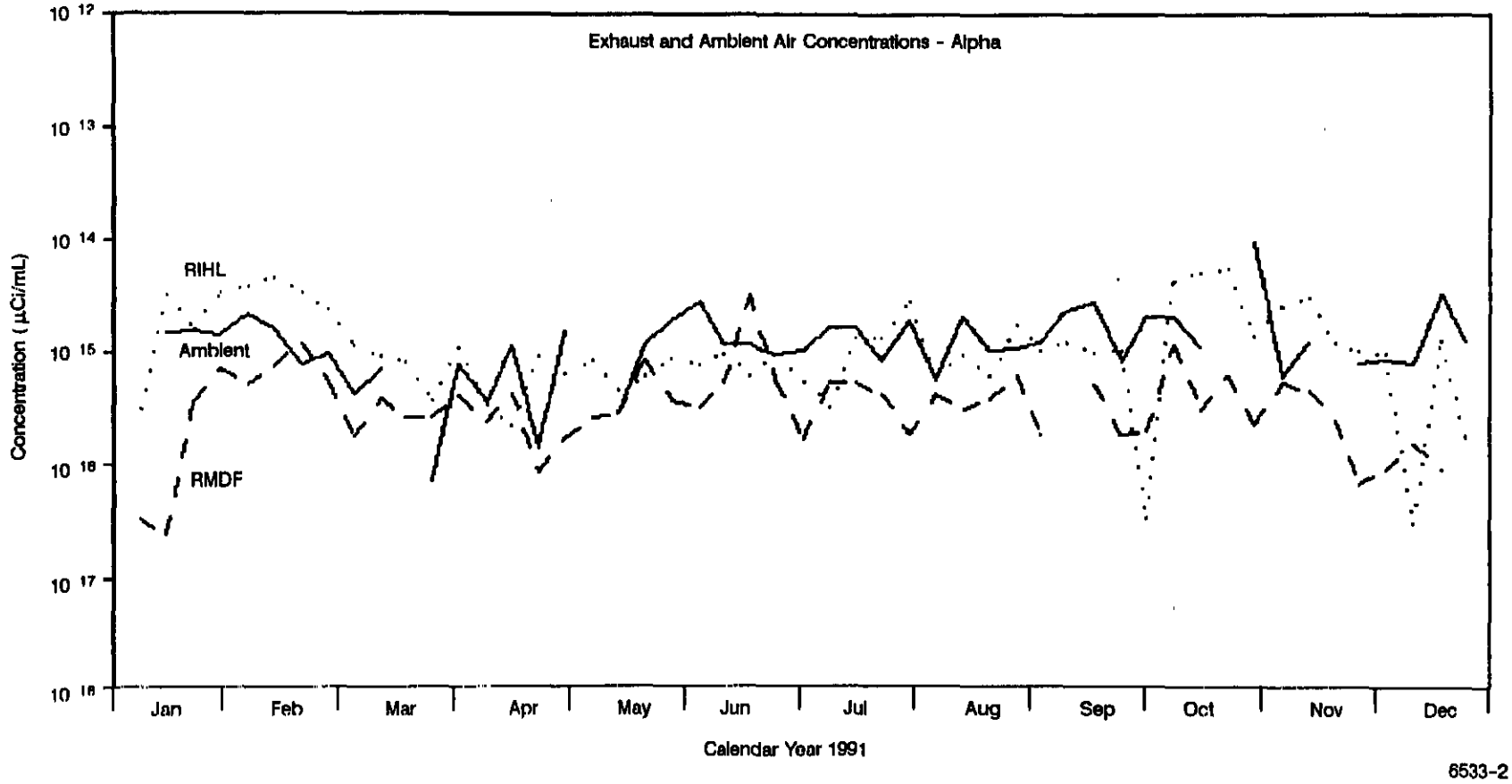

Figure 5–2. Filtered Exhaust and Ambient Air Radioactivity Concentrations (Sheet 1 of 4)

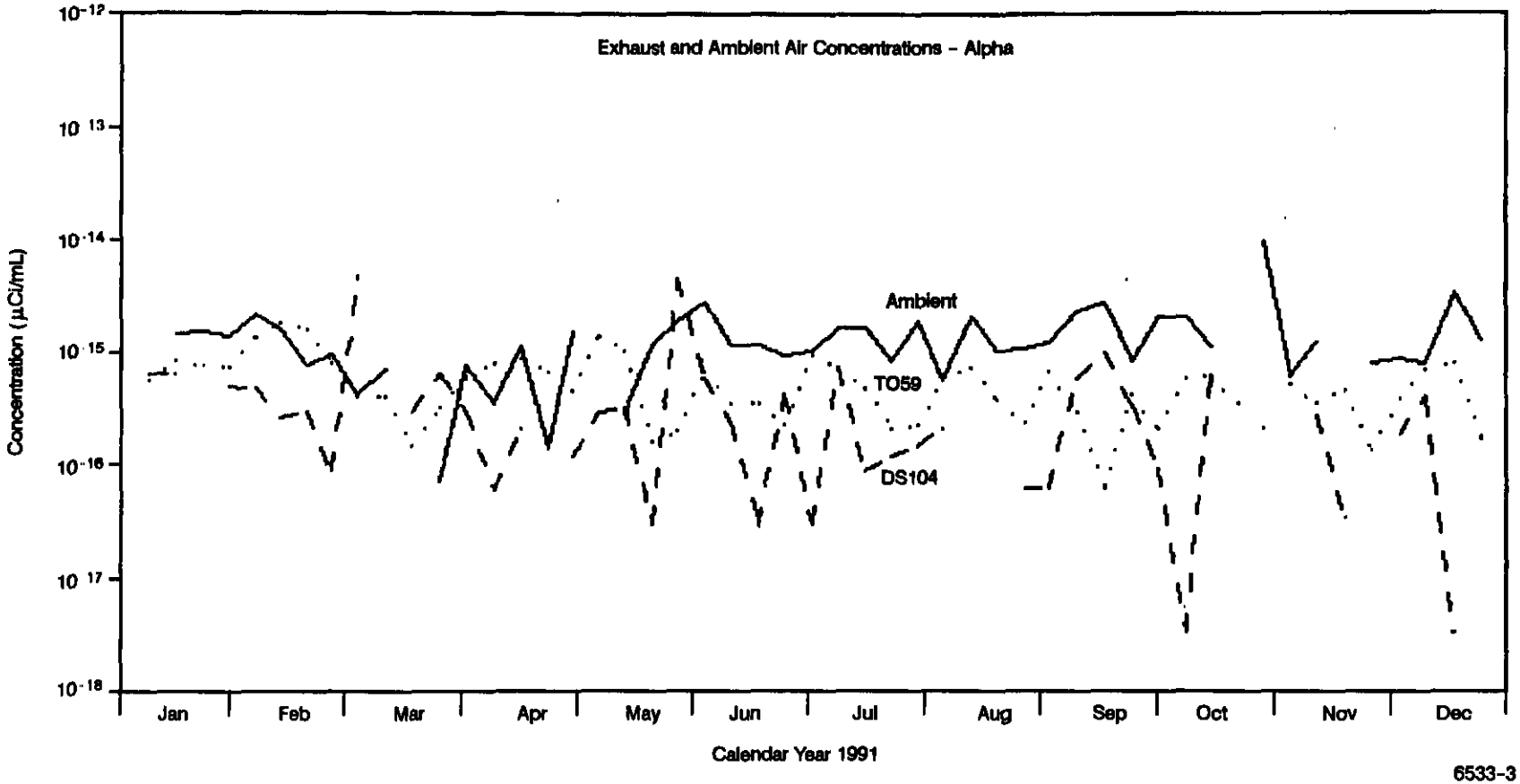

Figure 5–2. Filtered Exhaust and Ambient Air Radioactivity Concentrations (Sheet 2 of 4)

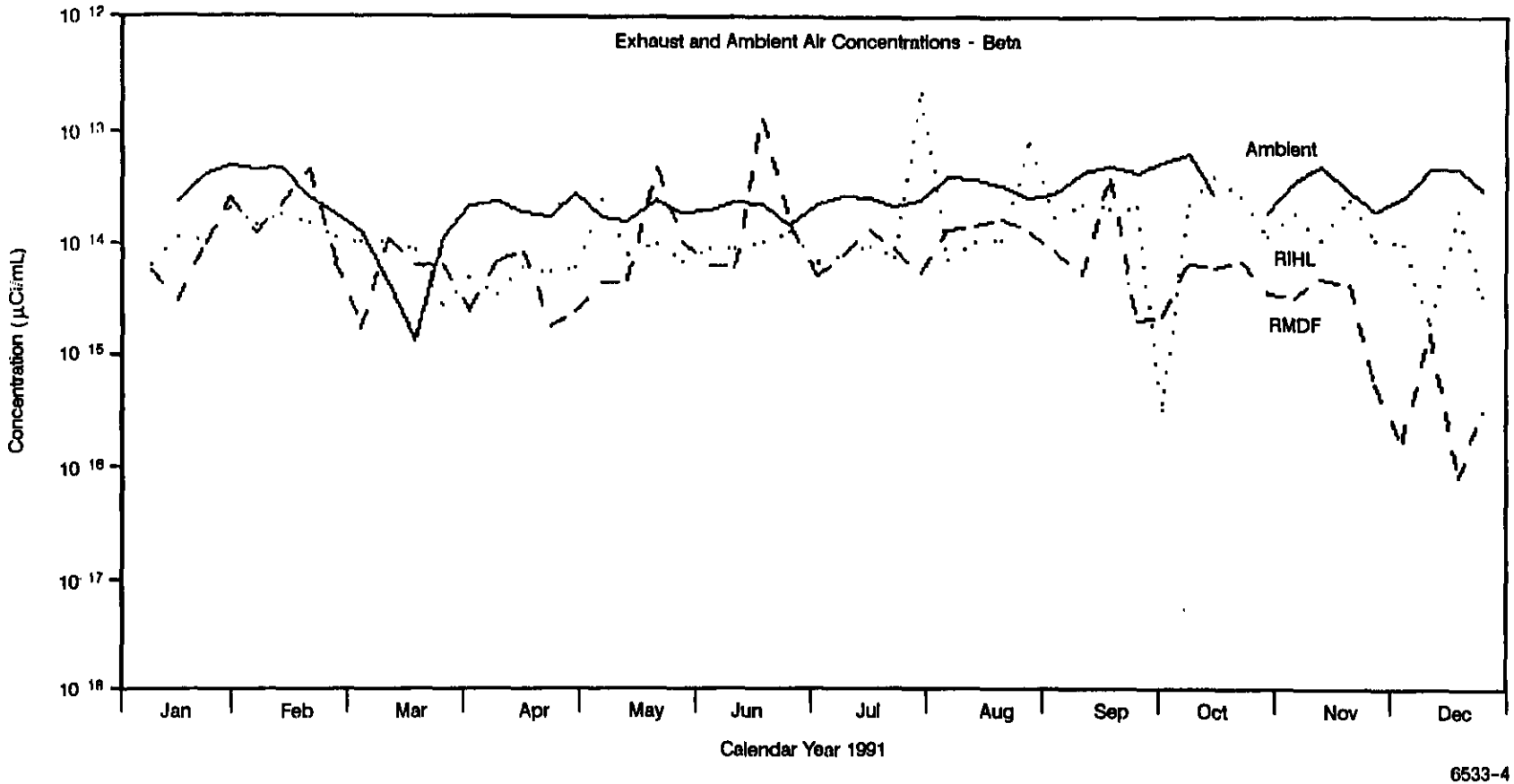

Figure 5–2. Filtered Exhaust and Ambient Air Radioactivity Concentrations (Sheet 3 of 4)

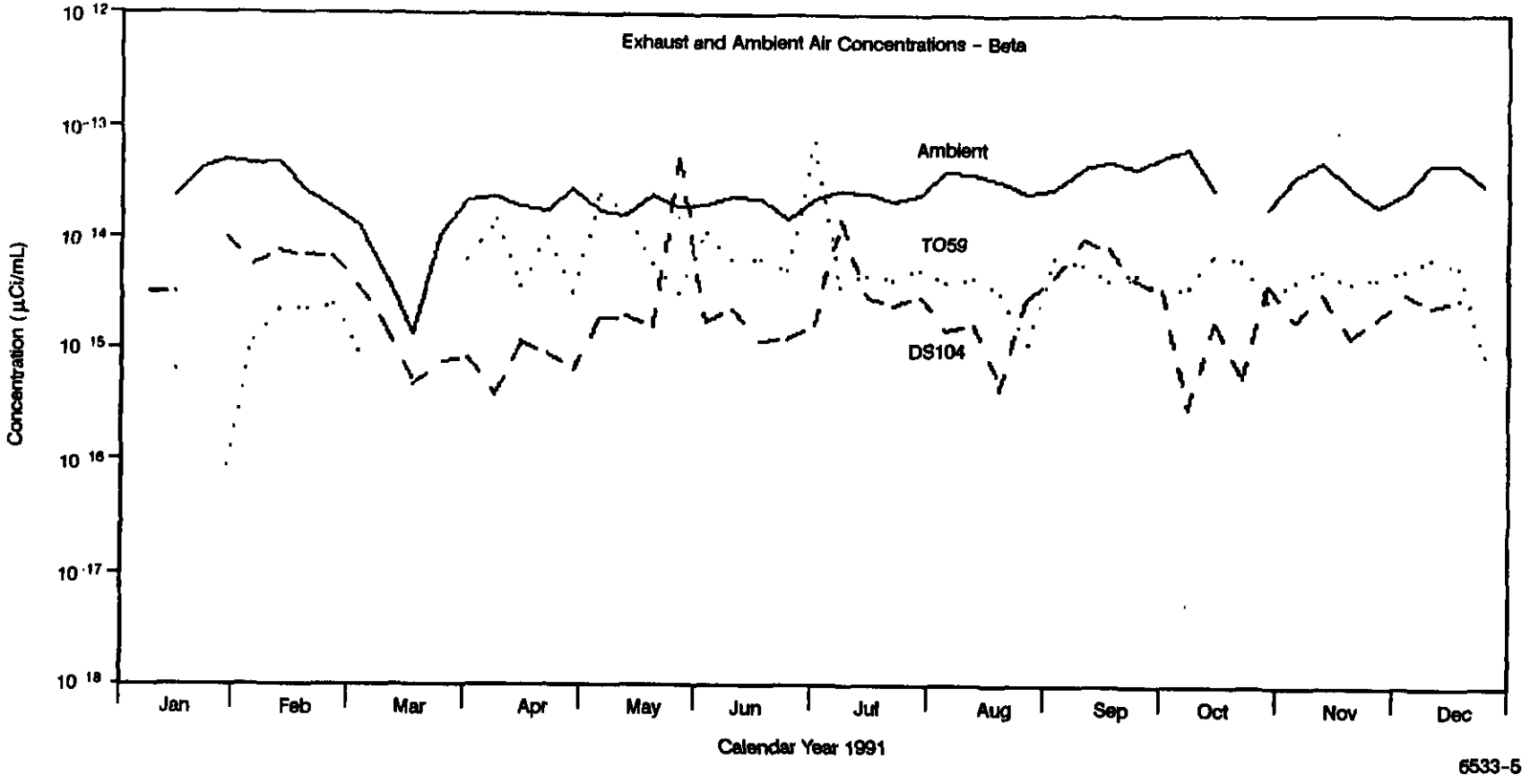

Figure 5–2. Filtered Exhaust and Ambient Air Radioactivity Concentrations (Sheet 4 of 4)

Table 5–5. Radioactivity in Groundwater at SSFL – 1991

	Activity (pCi/L)																		
	H-3	Co-60	Sr-90	Cs-137	Pb-210	Po-210	Ra-226	Ra-228	Ac-228	Th-228	Th-230	Th-232	Uranium	U-234	U-235	U-238	Pu-238	Pu-239/-240	Gross Alpha	Gross Beta
Maximum Permissible Concentration	20,000*	30,000	8*	20,000	100	700	Combined 5*		90,000	7,000	2,000	2,000	20*	30,000	30,000	40,000	5,000	5,000	15*	50*
Maximum	7,155	6.19	0.02	4.72			2.66	4.15			0.002		7.57	10.4	0.376	194.0	0.002	0.003	29.1	43.1
Mean	412	2.50	-0.04	0.02	ND	ND	0.54	1.39	ND	ND	0.001	ND	1.88	2.35	0.077	39.0	0.0006	-0.0001	6.34	6.38
Minimum	-450	-1.44	-0.18	-7.56			ND	ND			ND		ND	ND	-0.001	0.03	-0.001	-0.002	-1.60	-2.53
Number of analyses**	125(22)	7	4(3)	105	(3)	(3)	7(8)	8(2)	(3)	(8)	7(4)	(11)	6(3)	10(3)	12	15	7	7	142	142

ND = Not detected
*EPA Limits for drinking water suppliers
**Numbers in parentheses represent the number of analyses reported as less than the detectable limit (< DL). The mean has been calculated from reported values only.

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Table 5–6. SSFL Surface Water Radioactivity Data – 1991

	Activity (pCi/L)					
	H-3	Co-60	Cs-137	U-235	Gross Alpha	Gross Beta
Drinking Water Standards/MPC	20,000	30,000*	20,000*	30,000*	15	50
Maximum	-	-	-	31.0	8.00	21.0
Mean	606	20.0	22.2	26.5	4.67	11.4
Minimum	-	-	-	21.9	3.00	5.00
Number of analyses**	1(7)	1(7)	1(7)	2(6)	3(14)	10(7)

*MPC for release to unrestricted area.

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**Numbers in parentheses represent the number of analyses reported as less than the detectable limit (< DL). The mean has been calculated from reported values only.

Table 5–7. Domestic Water Supplies (1989–1991) Radioactivity

	Activity (pCi/L)							
	H-3	Sr-90	Rn-222	Ra-226	Ra-228	Uranium	Gross Alpha	Gross Beta
State Maximum Contamination Level	20,000	8	-	5 combined		20	15	50
Maximum	48	-	-	-	-	7.00	11.0	24.0
Mean	-5	< 2	ND	< 1	< 1	2.50	1.99	6.0
Minimum	-150	-	-	-	-	0.00	-5.5	0.9
Number of sources	5	12	-	11	9	10	14	12

ND = not detected

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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. For comparisons related to the DOE operations, the DCG for ingested water presented in DOE Order 5400.5 are used. 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. Little of the rainfall actually runs off, since most is absorbed by the soil. To permit sampling this runoff, five catch basins were installed near the site boundary to accumulate runoff. The results of analyses for radioactivity in this water are shown in Table 5–8.

Table 5–8. SSFL Rainfall Runoff Radioactivity Data – 1991 (Five Locations, Sampled After Rainfall)

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

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

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 several of the local water suppliers during 1989–91 are shown in Table 5–7. (Tritium values include results from a series of high–sensitivity tests obtained by Rocketdyne.)

5.2.3 Rock and Soil

While not considered by any regulations, 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. The results for occasional samples, in conjunction with routine sampling and special studies, are shown in Table 5–9. Sampling locations are shown in Figure 5–3.

The detected gross radioactivity in soil is due to various naturally occurring radionuclides present in the environment, to radioactive fallout of dispersed nuclear weapons materials, and to fission product radioactivity produced by past atmospheric tests of nuclear weapons. No atmospheric nuclear weapons tests or other releases with global effects were announced during 1991. Naturally

Table 5–9. SSFL Rock and Soil Radioactivity Data – 1991

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

*Observed activity less than detectable entered as 0.0.
**Numbers in parentheses represent the number of analyses reported as less than the detectable limit (< DL). The mean has been calculated from reported values only.

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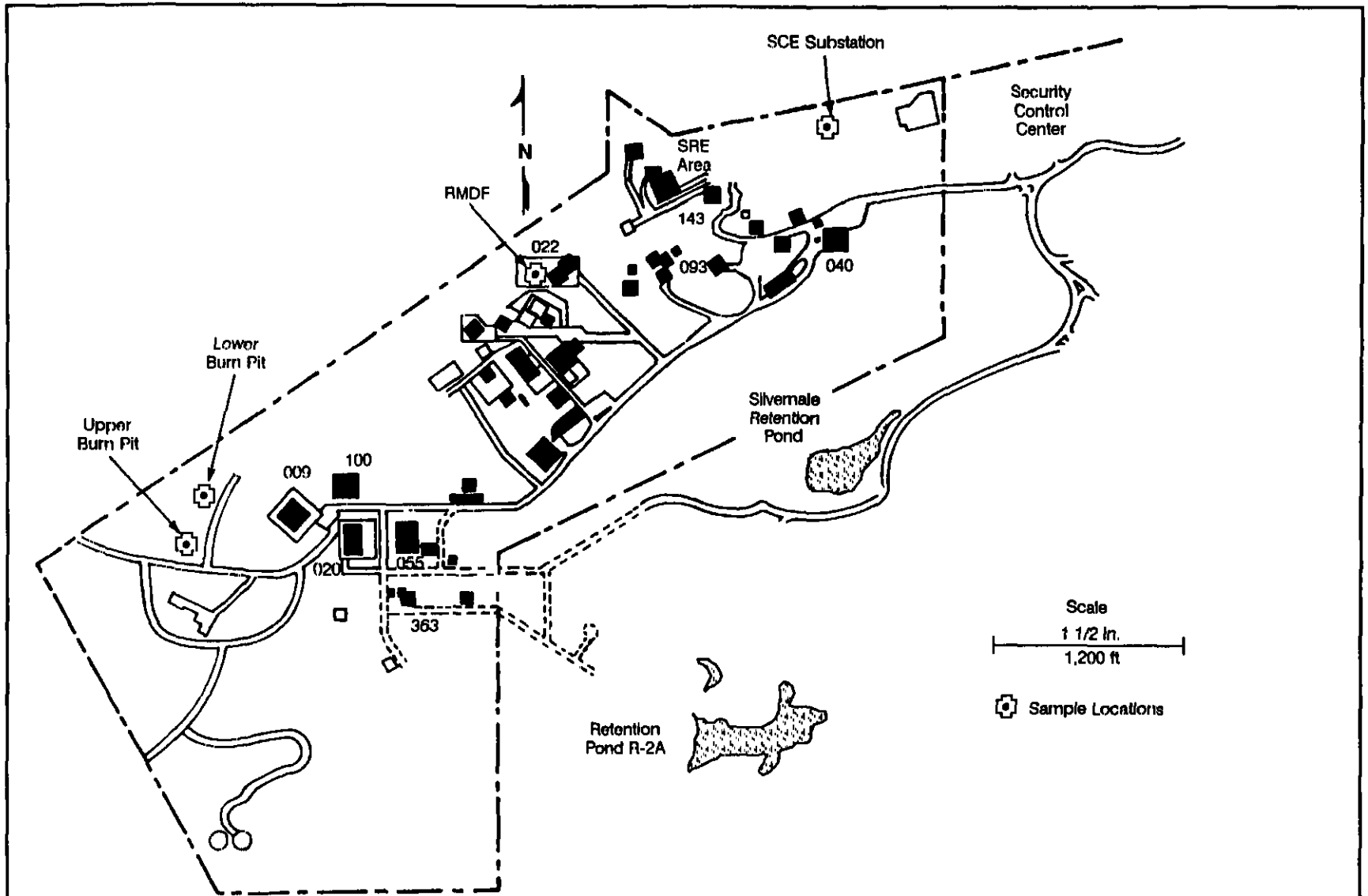

Figure 5-3. Map of Santa Susana Field Laboratory Site Soil Sampling, Area IV

6533-7

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. Fission–produced radionuclides, principally Cs–137 and Sr–90, are rarely detected in the environment. Radioactivity in aged nuclear weapons test fallout consists primarily of the fission–produced Sr–90, Cs–137, and Pm–147, as well as U–234 and Pu–239.

The 1991 samples were taken during cleanup operations and routine surveillance of contaminated areas. There are no noteworthy concentration differences from past years.

The natural origin of possibly nonnatural 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

Although routine sampling and analysis of native vegetation was dropped from the environmental monitoring program at the end of 1985, in recognition of its lack of value at the SSFL site, some occasional analyses are performed. The results of the 1991 samples from Building 886 (former Sodium Disposal Facility) ponds are shown in Table 5–10.

Table 5–10. Vegetation Radioactivity—1991

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

*Numbers in parentheses represent the number of analyses reported as less than the detectable limit (< DL). The mean has been calculated from reported values only.

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5.2.5 Wildlife

Since no hunting is permitted at SSFL, wildlife is abundant. Occasional samples are collected as the result of road–kills and analyzed for radioactivity. The most commonly found radionuclide is the natural activity, K–40. These analyses showed no indication of radioactive contamination.

5.2.6 Radiation

Standard commercial thermoluminescent dosimeters (TLDs) using lithium fluoride (LiF) are placed, in pairs, 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 paired results are averaged for each location. These results are shown in Table 5–11, and include the contributions due to natural background radiation (about 70 mrem/yr for 1991, as measured by these TLDs). These 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 eight 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

Table 5–11. De Soto and SSFL—Ambient Radiation Dosimetry Data—1991*

TLD Location		Quarterly Exposure (mrem)				Annual Exposure (mrem)	Annual Average Exposure Rate (μR/h)	
		Q–1	Q–2	Q–3	Q–4		Rocketdyne	State DHS
De Soto	DS–2	15.0	40.0	30.0	10.0	95.0	10.8	9.8
	DS–6	10.0	35.0	30.0	10.0	85.0	9.7	10.4
	DS–8	10.0	10.0	30.0	10.0	60.0	6.8	9.2
	DS–9	20.0	40.0	40.0	20.0	120.0	13.7	
Mean value		13.8	31.3	32.5	12.5	90.0	10.3	9.8
SSFL	SS–3	10.0	30.0	30.0	15.0	85.0	9.7	11.0
	SS–4	15.0	30.0	30.0	10.0	85.0	9.7	
	SS–6	10.0	30.0	30.0	10.0	80.0	9.1	12.0
	SS–7	20.0	35.0	30.0	10.0	95.0	10.8	11.3
	SS–8	10.0	40.0	40.0	15.0	105.0	12.0	
	SS–9	20.0	40.0	40.0	20.0	120.0	13.7	
	SS–11	10.0	35.0	30.0	20.0	95.0	10.8	
	SS–12	20.0	50.0	50.0	20.0	140.0	16.0	19.2
	SS–13	40.0	50.0	40.0	30.0	160.0	18.3	
	SS–14	60.0	20.0	10.0	20.0	110.0	12.6	
Mean value		21.5	36.0	33.0	17.0	107.5	12.3	13.4
Off-site	OS–1	10.0	40.0	15.0	10.0	75.0	8.6	8.9
	OS–5	10.0	30.0	15.0	10.0	65.0	7.4	7.9
Mean value		10.0	35.0	15.0	10.0	70.0	8.0	8.4

*Includes natural background radiation of approximately 70 mrem per year.

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materials. The Rocketdyne vendor reports these results to the nearest 10 mrem, while the State vendor reports results to the 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, radon and thoron in the atmosphere, and local radioactive fallout. Locally, the natural background radiation level as measured by these dosimeters is about 70 mrem/yr. 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 850–ft ASL (above sea level) at the Canoga facility to a maximum of about 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 mean value for two off–site dosimeters was 70 mrem with a maximum annually observed value for a single location of 75 mrem. Boundary dose estimates assume 100% occupancy, whereas the actual presence of persons at the boundary is rare or nonexistent.

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 500 mrem/yr for short–term exposures, and 100 mrem/yr for prolonged periods of exposure. The RMDF boundary to the north of the facility received an estimated average "property line" exposure of about 65 mrem above 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. No members of the general public have ever been observed to be present at the site boundary.

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 for committed effective dose equivalent, as established by EPA.

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

Figure 5–4 shows the arrangement of the census tract boundaries from the 1990 census. Figures 5–5 through 5–7 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.

The general population (person–rem) dose estimates are calculated from the demographic distribution and the individual doses generated by 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 centered on the SSFL site are presented in Table 5–13. 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 airborne radioactivity is approximately 1.9 million person–rem, approximately 3 billion times greater than that estimated for SSFL operations.

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Table 5–12A. Public Exposure to Radiation and Radioactivity from DOE Operations at SSFL – 1991

Radioactive Materials Disposal Facility (RMDF) and Building T059
Department of Energy (DOE, Exempt from Licensing)

1. All pathways		
a. Maximum estimated external dose to an individual		3×10^{-4} mrem/yr
b. Maximum estimated internal dose to an individual		2.9×10^{-6} mrem/yr
Total		3×10^{-4} mrem/yr
Limit ("Radiation Protection of the Public and the Environment" DOE Order 5400.5, 2/8/90)	Short-term	500 mrem/yr
	Prolonged	100 mrem/yr
2. Air pathway		2.9×10^{-6} mrem/yr
Limit (40 CFR 61, Subpart H)		10 mrem/yr

Natural Exposure to Average Member of U.S. Public

1. All pathways	300 mrem/yr
("Health Effects of Exposure to Low Levels of Ionizing Radiation – BEIR V," National Academy Press, Washington DC, 1990)	
2. Air pathway	200 mrem/yr
("Health Effects of Exposure to Low Levels of Ionizing Radiation – BEIR V," National Academy Press, Washington DC, 1990)	

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Table 5–12B. Public Exposure to Radiation and Radioactivity from Rocketdyne Operations at SSFL – 1991

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		6.8×10^{-2} mrem/yr
Limits (10 CFR 20.105, CCR 17 Section 30268)	Annual	500 mrem in 1 yr
	Weekly	100 mrem in 7 days
	Hourly	2 mrem in 1 h
2. Airborne (nonnatural radioactivity) effluent at boundary		1.6×10^{-18} µCi/mL
Limits (10 CFR 20.106, CCR 17 *Section* 30269)		2×10^{-14} µCi/mL
Natural Exposure to Average Member of U.S. Public		
1. *Direct radiation* ("Health Effects of Exposure to Low Levels of Ionizing Radiation – BEIR V," National Academy Press, Washington DC, 1990)		100 *mrem/yr*
2. Airborne (natural) radioactivity (Estimated by De Soto site measurements of gross alpha and beta radioactivity concentrations in ambient air.)		4.5×10^{-14} µCi/mL

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Table 5-12C. Public Exposure to Radiation and Radioactivity from Rocketdyne Operations at De Soto – 1991

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

1. Direct radiation at boundary		5.2×10^{-1} mrem/yr
Limits (CCR 17 Section 30268)	Annual	500 mrem in 1 yr
	Weekly	100 mrem in 7 days
	Hourly	2 mrem in 1 h
2. Airborne (nonnatural radioactivity) effluent at boundary		3×10^{-21} μCi/mL
Limit (CCR 17 Section 30269)		2×10^{-14} μCi/mL

Natural Exposure to Average Member of U.S. Public

1. Direct radiation ("Health Effects of Exposure to Low Levels of Ionizing Radiation - BEIR V," National Academy Press, Washington DC, 1990)	100 mrem/yr
2. Airborne (natural) radioactivity (Estimated by De Soto site measurements of gross alpha and beta radioactivity concentrations in ambient air.)	4.5×10^{-14} μCi/mL

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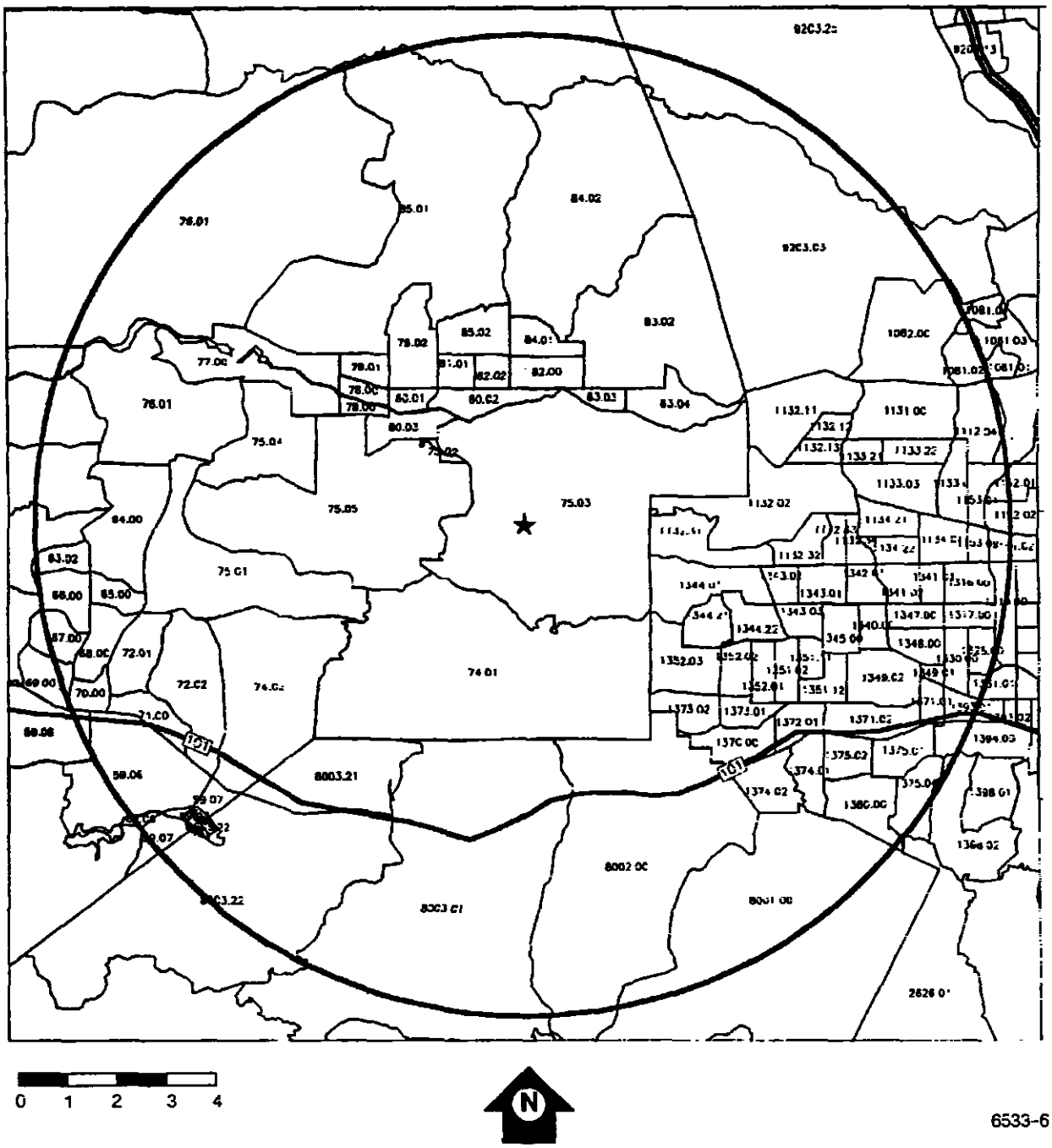

Figure 5–4. Census Tract Boundaries (1990) within 10 miles of SSFL (Individual tracts are identified by number)

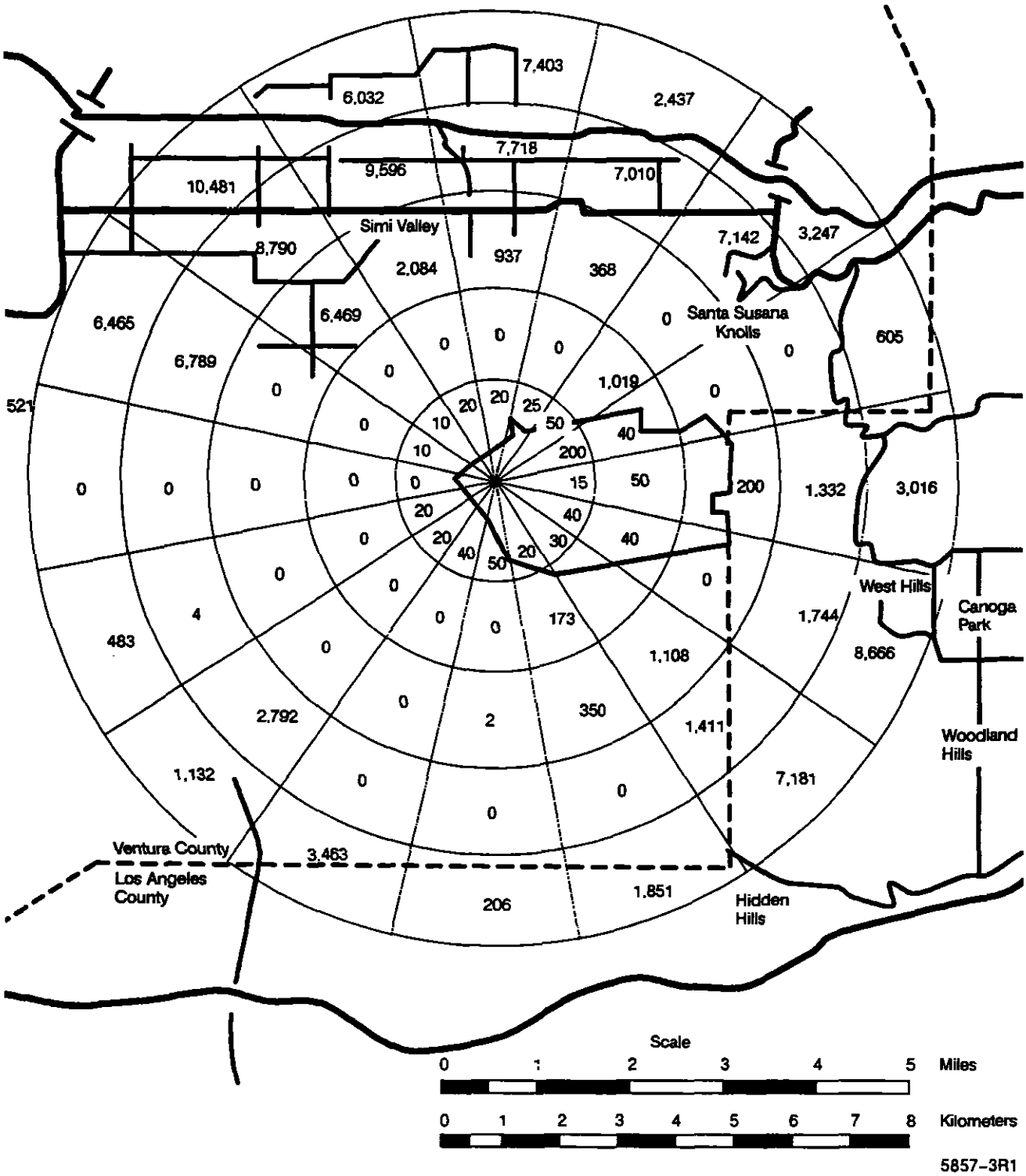

Figure 5-5. SSFL Site-Centered Demography to 8 km, Showing Number of Persons Living in Each Grid Area (Daytime Employment for SSFL)

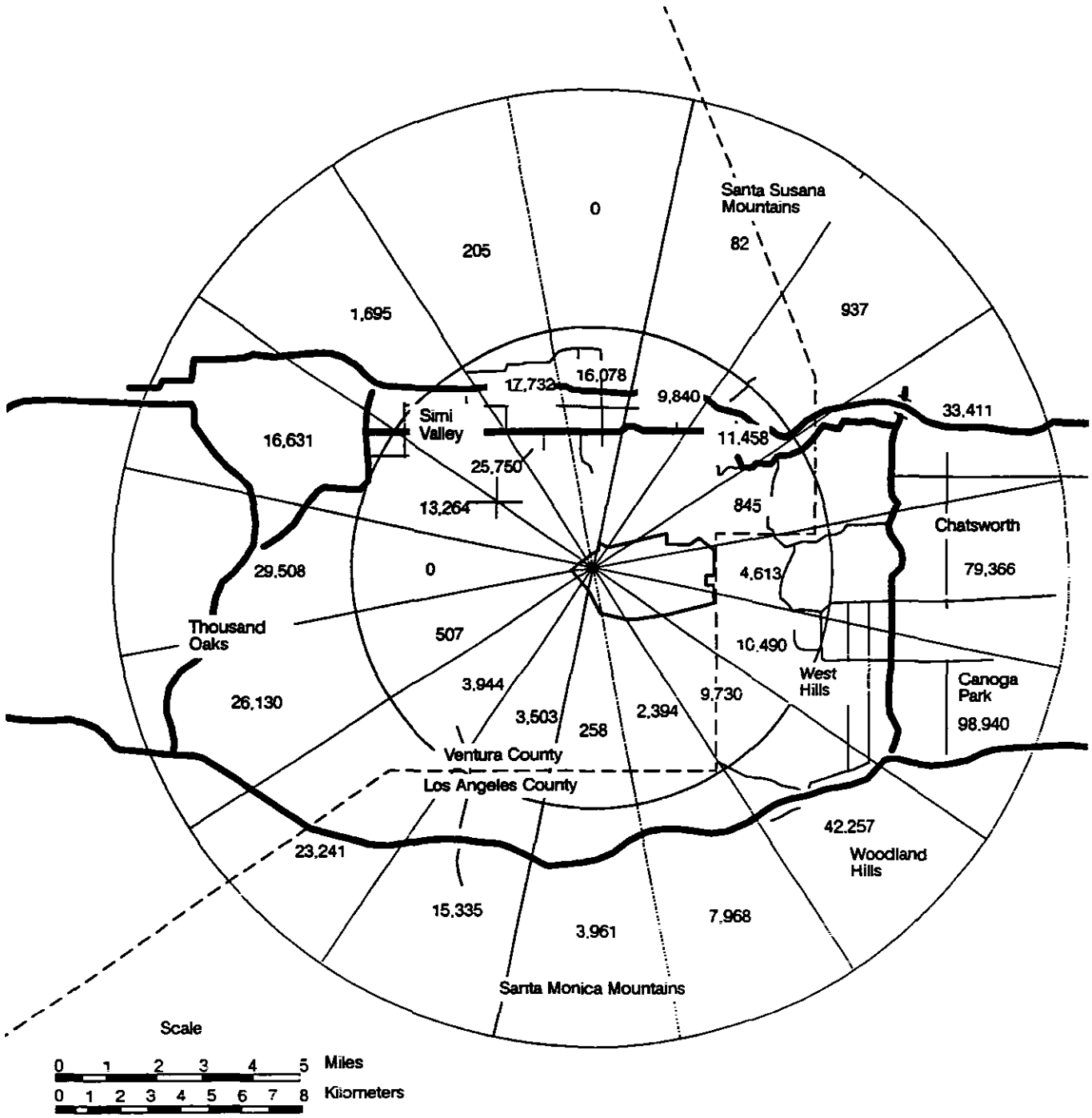

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Figure 5-6. SSFL Site-Centered Demography to 16 km, Showing Number of Persons Living in Each Grid Area

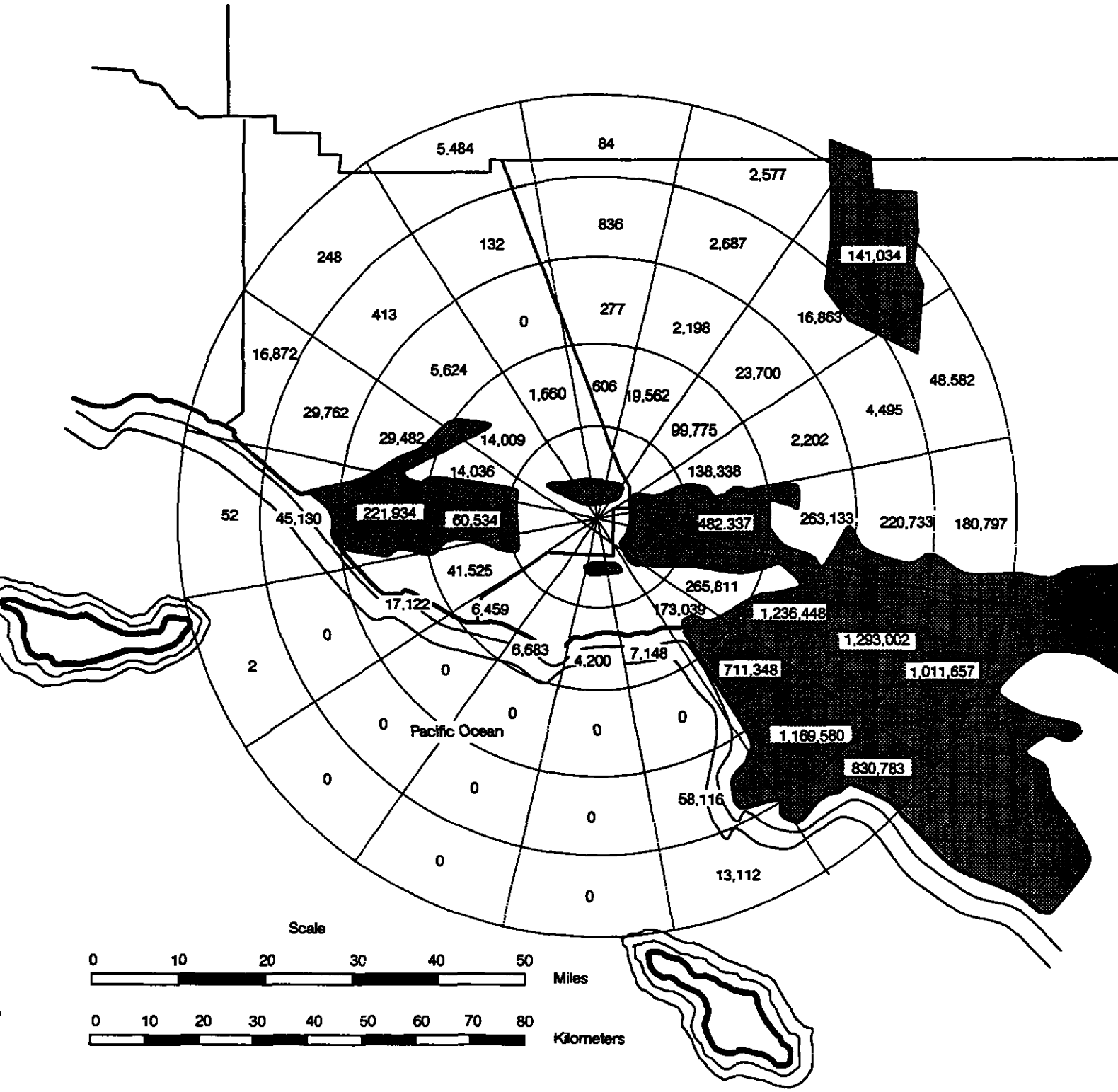

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Figure 5–7. SSFL Site–Centered Demography to 80 km, Showing Number of Persons Living in Each Grid Area (heavily populated areas are shown by shading)

Table 5–13. *Population Dose Estimates for Atmospheric Emissions from SSFL Facilities – 1991*
Dose to Population (person-rem)

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

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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. As a part of this program, Rocketdyne is currently involved in an extensive groundwater remediation program and has the capacity for removing solvent contamination from approximately one million gallons of groundwater per day at SSFL. All former surface impoundments have been closed and are in the closure approval process with the Cal-EPA Department of Toxic Substance Control (DTSC). Contamination resulting from underground storage tanks (USTs) has been remediated, and the majority of the storage tanks have been removed. The few remaining USTs are equipped with automatic leak detection systems in compliance with Ventura County UST ordinances. 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.

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 and special monitoring program for the northwest slope of Area IV. 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 6-1) have been established and sampling is conducted in accordance with the northwest slope monitoring program. All discharges are 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 (VAPCD). The VAPCD regulates sources of air emissions and issues permits that generally contain limits on pollutant levels and conditions of operation.

Soil analyses have been and are site specified 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.

The 1992 SARA Title III Form R (Toxic Release Inventory) submission was sent to both the state and federal agencies by the July 1 deadline. The information for the SSFL facility was a composite report using information for Rocketdyne, DOE, and NASA. The Forms include questions regarding off-site waste shipments and air emission calculations. Only two chemicals met the threshold

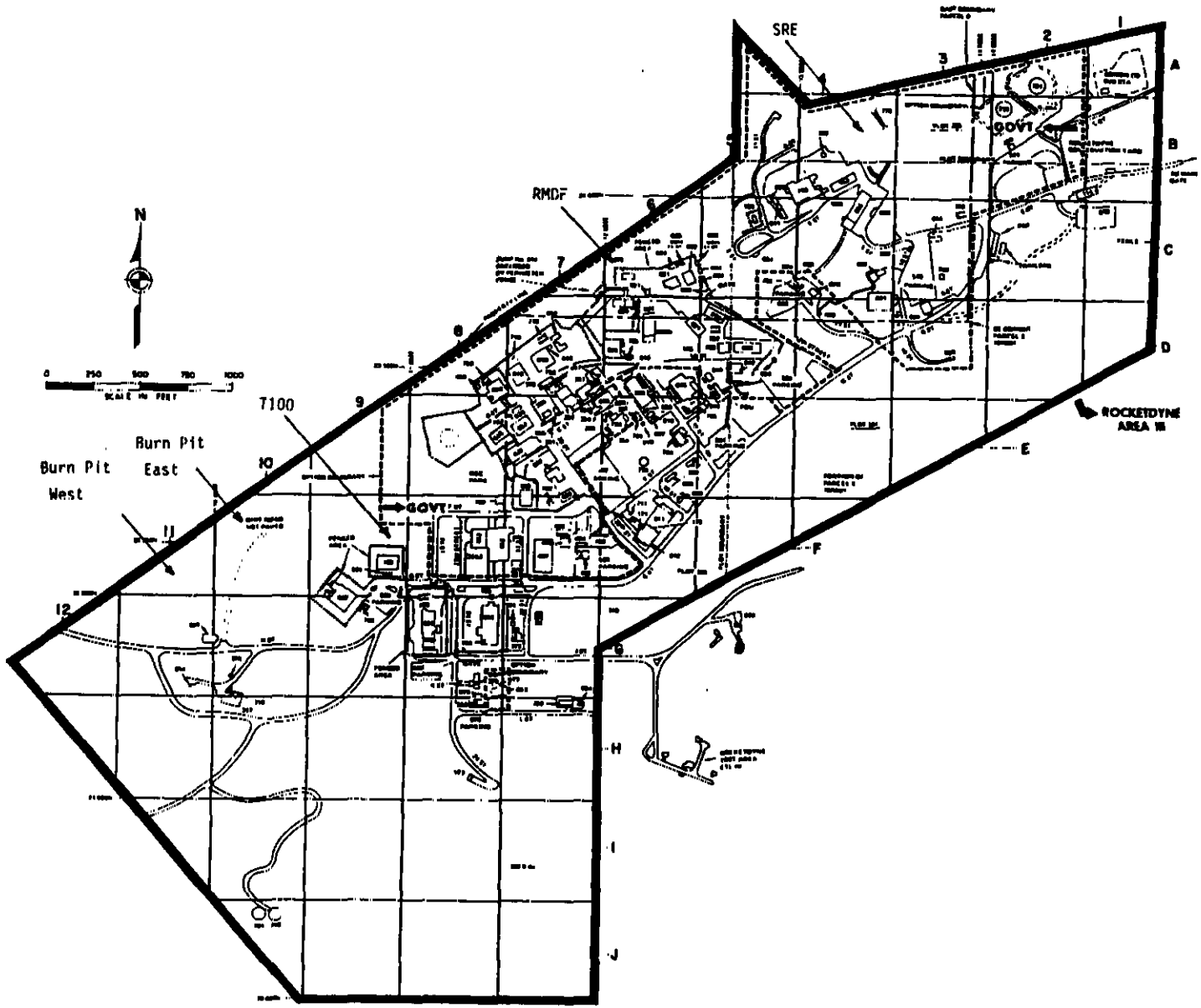

Figure 6–1. Locations of Rainfall Runoff Collectors Along Northwest Boundary of SSFL, Area IV

requirements this year: 1,1,1-Trichloroethane (CAS No.:71-55-6) and Trichloroethylene (CAS No.:79-01-6).

The overall annual groundwater monitoring program at SSFL addresses collection and analysis of groundwater samples and measurement of the water levels for the 160 on-site and 16 off-site wells. The locations of these wells 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/neutrals and acids extractable organic compounds, petroleum hydrocarbons, and trace metals and common ion constituents.

Hydrogeologic studies at SSFL describe two groundwater systems at the site: a shallow, unconfined system in the alluvial surface mantle (soils) of the Burro Flats area and along the major drainage channels, and a deeper groundwater system in the fractured Chatsworth sandstone (rock). 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, composed of a heterogeneous mixture of gravel, sand, silt, and clay, has estimated hydraulic conductivities ranging from 0.1 to 1,000 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 and is probably controlled by fracture zones.

The hydrogeologic environment at the SSFL site is a dynamic system. Groundwater is recharged at the site, moves through the aquifers, and discharges to the surface or to other aquifers down-gradient of the site. The groundwater system is recharged by precipitation 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 may vary greatly from year to year. Specific pathways of possible contaminant transport along fracture zones are difficult to predict on the basis of on-site well data.

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 circulated in the Rocketdyne newspaper to promote environmental awareness among all employees.

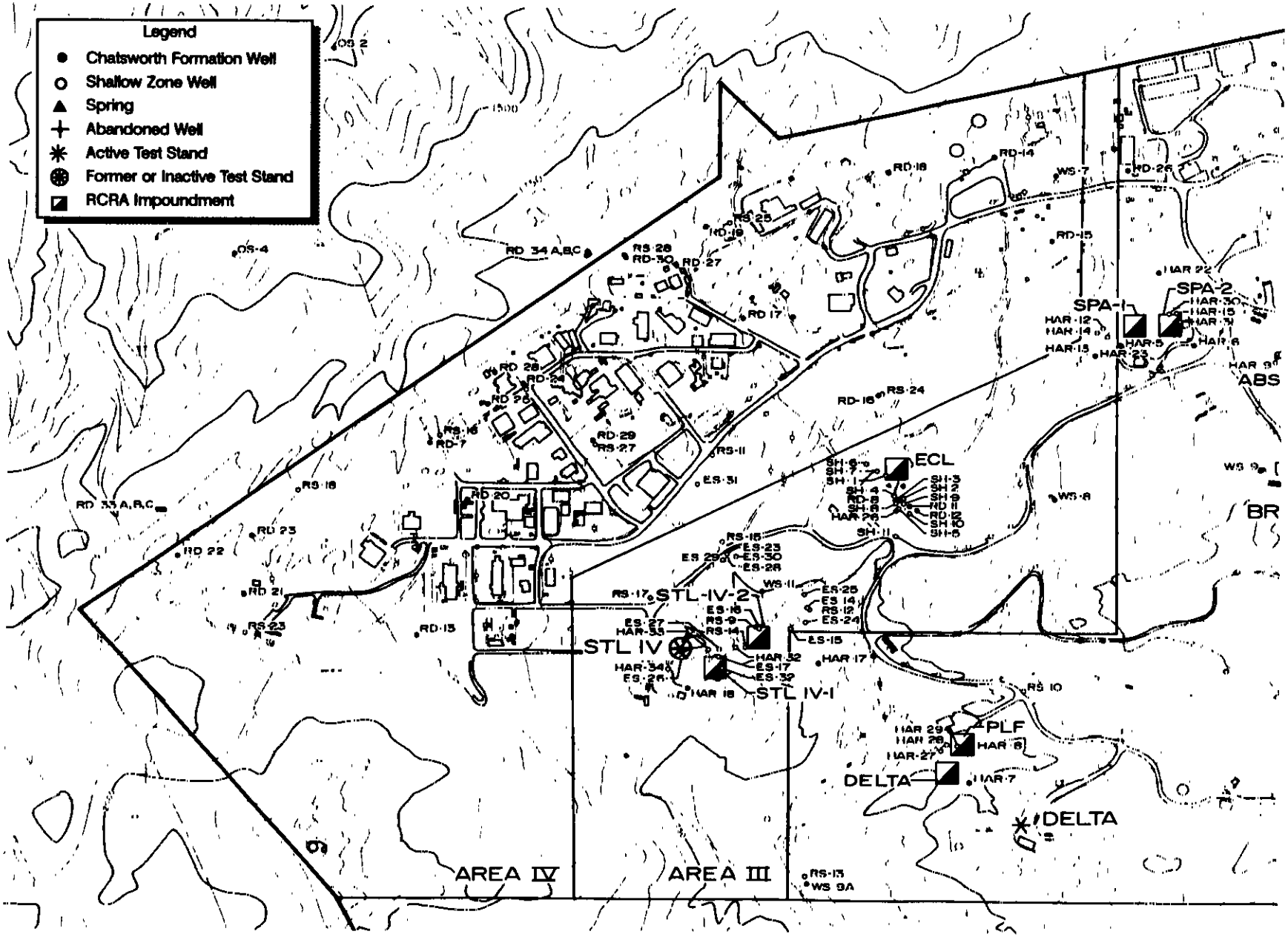

Figure 6–2. Locations of Wells Used in Groundwater Management Program

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 26 March 1992. 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 1 February 1992.

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. With 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.

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, became effective 27 September 1976 and was renewed with minor changes effective 17 September 1984. 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. Discharge generally occurs only during and after periods of heavy rainfall which cause the retention ponds to overflow. Periodically, dry weather discharges are necessary due to nonutilization of treated groundwater for engine testing purposes.

There is no sanitary sewer discharge from SSFL. Domestic sewage is treated and then pumped to the retention ponds.

An application to renew the existing permit was filed by Rocketdyne on 15 December 1988. To date, the existing permit remains in effect, however, a tentative draft permit was issued by the California RWQCB on 18 December 1991. The tentative draft permit contained significant modifications and has yet to be finalized by the California RWQCB.

Of the two retention ponds at SSFL which discharge via the NPDES permit, only one receives influent from Area IV, as is referred to as Pond R-2A. The remaining pond is identified as Perimeter Pond. Analytical results from 1991 surface water discharge events are shown in Table 6-1.

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. Analytes include nonradioactive chemical constituents such as heavy metals, volatile organics, base/neutral acid extractables, and general chemistry in addition to specified radionuclides. Toxicity testing is also conducted in the form of fish bioassays. The NPDES permit, shown as Appendix A, lists the specific constituents which 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 which include: the former Sodium Disposal facility (SBP1 and SBP2), behind T100, along the north side of

Table 6-1. 1991 Analytical Results for Surface Water Releases

Constituent	Limit	Pond R-2A Number of Samples	Minimum	Mean	Maximum	Perimeter Pond Number of Samples	Minimum	Mean	Maximum
BOD	30	14	2	5	8.5	6	2	5.2	7.3
Boron	1	14	<0.2	0.2	0.4	6	0.2	0.18	0.2
Chloride	150	14	10.2	43.5	82.4	6	14.7	21.4	27
Fluoride	1	14	0.2	0.3	0.5	6	0.2	0.2	0.2
Grease and Oil	15	14	<0.2	1.4	3.4	6	<0.2	1	2
Arsenic	0.05	14	<0.001	0.002	0.004	6	0.001	0.002	0.003
pH	6 to 9	14	7.4	8.2	8.8	6	7.4	8	9.1
Residual chlorine	0.1	14	<0.04	<0.04	<0.04	6	<0.04	0.05	0.1
Settleable solids	0.3	14	<0.04	0.3	1.0	6	<0.04	0.11	0.2
Sulfate	300	14	36.4	110.9	175	6	30.2	50.7	78
Suspended solids	150	14	3.2	29	59	6	10.5	22.5	33
Surfactants	0.05	14	<0.025	0.028	0.03	6	<0.025	0.024	0.02
Temperature (°C)	37.8	14	9	14.9	25	6	10	18.6	50
Total dissolved solids	950	14	115	380.8	631	6	144	187.6	216
Toxicity*	90%	14	90%	98.5%	100%	6	100%	100%	100%
Turbidity	***	14	5	25.8	90	6	17.5	41.1	90

*Reference item #26 on page A-3.

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RMDF, and the SRE watershed. This monitoring program remains in effect and the results of runoff monitoring for 1991 rain events is shown in Table 6–2.

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, and boilers in various buildings in Area IV and several natural gas/oil–fired sodium heaters operated by ETEC for component testing. The permitted air emissions for 1991 were: 9.47 tons/yr for reactive organic components, 136.87 tons/yr for oxides of nitrogen, 3.06 tons/yr for particulates, 0.64 tons/yr for oxides of sulfur, and 32.41 tons/yr for carbon monoxide. These limits were increased, from the 1990 limits, by the District to reflect the results of source testing performed on the York Shiply boiler in the Bowl Area firing propane.

In September 1991, Rocketdyne petitioned for and received a VCAPCD variance No. 392 from rule 74.15.H.1 pertaining to boilers and steam generators. This variance was required to allow ETEC to operate during startup and checkout of the newly installed low NOX burners in H–1, H–2, and H–101 boilers and heaters. Problems encountered during checkout of the system necessitated the request, on 15 January 1992 for an extension of the variance which was granted (No. 392–1) until 31 December 1992. The H–1, H–2, and H–101 heaters and boiler are in full compliance at the load levels 25%, 50%, 75%, and 100% as of the H–1 source test in June 1992.

VCAPCD held a routine inspection on 18 February 1992, no violations were cited related to DOE Operations. On 27 May 1992 the VCAPCD issued consolidated permit to operate No. 0271 for the permit period from 1 January 1992 through 31 December 1992. The new permit consolidated permits No. 0271 Sodium Component Test Installation (SCTI), No. 0226 Hazardous Waste Management Facility (HWMF), No. 0290 Sodium Pump Test Facility (SPTF) and No. 1124 Molten Salt Test Facility (MSTF). The new permit emissions are listed 9.65 tons/yr for reactive organic compounds, 138.44 tons/yr for oxides of nitrogen, 5.68 tons/yr for particulates, 3.89 tons/yr for oxides of sulfur, and 33.58 tons/yr for carbon monoxide.

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 agency responsible during the period 1984 through July 1989, the Los Angeles office of the California RWQCB. (The EPA appointed the Cal–EPA DTSC [Region 3/Burbank] as lead agency in July 1989.) During the past five years, a network that now consists of 160 on–site wells has been completed. Ninety–one of these are in the Shallow Zone, and 69 have been drilled into the Chatsworth Formation, the indurated sandstone that represents the uppermost 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 while addressing the 10 RCRA–permitted surface impoundment closures. (There are no RCRA surface impoundments in Area IV.) Subsurface

Table 6–2. 1991 Analytical Results for Northwest Rainfall Runoffs (Sheet 1 of 2)

Analyses in (mg/l)								
Constituent	SBP #1 Number of Samples	Minimum	Mean	Maximum	SBP #2 Number of Samples	Minimum	Mean	Maximum
Arsenic	7	<0.01	0.001	0.003	7	<0.01	0.0005	0.002
Boron	7	ND	0.14	0.3	7	ND	0.14	0.3
Chloride	7	6.0	11.8	17.6	7	ND	18.5	77.9
Dissolved beryllium	7	ND	0.003	0.02	7	ND	0.004	0.022
Dissolved cadmium	7	ND	0.0006	0.001	7	ND	0.008	0.005
Dissolved chromium	7	ND	0.004	0.03	7	ND	0.004	0.03
Dissolved copper	7	ND	0.052	0.12	7	ND	0.03	0.08
Dissolved lead	7	ND	0.002	0.004	7	ND	0.002	0.004
Dissolved mercury	5	ND	0.0007	0.004	7	ND	0.00008	0.0004
Dissolved nickel	7	ND	0.06	0.23	7	ND	0.056	0.2
Dissolved zinc	7	0.017	0.06	0.08	7	ND	0.05	0.1
Fluoride	7	0.2	0.44	1.1	7	ND	0.2	0.3
Oil & Grease	7	ND	1.3	1.9	7	ND	0.83	1.8
pH	7	7.8	8.2	8.9	7	ND	7.5	8.3
Residual chlorine	7	ND	ND	ND	7	ND	0.011	0.08
Sulfate	7	19.2	34.7	74.4	7	ND	43.7	173.0
Surfactants	7	ND	0.010	0.04	7	ND	0.004	0.025
VOLATILE* ORGANICS (TOTAL)	6	ND	0.6	3.7	6	ND	0.52	3.1
BNAs (total)	6	ND	ND	ND	6	ND	ND	ND
Toxicity**	7	100%	100%	100%	7	100%	100%	100%

Constituent	B/100 Number of Samples	Minimum	Mean	Maximum	RMDF Number of Samples	Minimum	Mean	Maximum
Arsenic	7	ND	0.0025	0.003	7	ND	0.0007	0.002
Boron	7	ND	0.043	0.2	7	ND	0.14	0.3
Chloride	7	1.0	3.3	4.8	7	1.0	17.5	73.8
Dissolved beryllium	7	ND	0.0032	0.015	7	ND	0.003	0.016
Dissolved cadmium	7	ND	0.0012	0.008	7	ND	0.0014	0.002
Dissolved chromium	7	ND	0.0086	0.03	7	ND	0.0085	0.04
Dissolved copper	7	ND	0.04	0.07	7	ND	0.04	0.007
Dissolved lead	7	ND	0.002	0.005	7	ND	0.0017	0.007
Dissolved mercury	5	ND	0.0001	0.0004	5	ND	0.00006	0.0003
Dissolved nickel	7	ND	0.06	0.11	7	ND	0.06	0.24
Dissolved zinc	7	0.008	0.06	0.14	7	ND	0.052	0.09
Fluoride	7	0.1	0.13	0.2	7	ND	0.17	0.2
Oil & Grease	7	ND	1.3	3.0	7	ND	0.71	2.1
pH	7	7.2	7.5	8.3	7	7.0	7.6	9
Residual chlorine	7	ND	0.04	0.3	7	ND	ND	ND
Sulfate	7	16.3	17.9	25.9	7	16.9	48.1	159.5
Surfactants	7	ND	0.03	0.055	7	0.045	0.015	0.064
VOLATILE* ORGANICS (TOTAL)	7	ND	0.1	0.7	7	ND	ND	ND
BNAs (total)	5	ND	ND	ND	6	ND	ND	ND
Toxicity**	7	>100%	>100%	>100%	7	>100%	>100%	>100%

*Volatile Organic Analysis showed nondetectable, except in three incidents of possible laboratory contamination.
**Reference item #26 on page A-3.

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Table 6–2. 1991 Analytical Results for Northwest Rainfall Runoffs (Sheet 2 of 2)

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

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soil sampling at over 150 locations has been accomplished. 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.

At the facility, Rocketdyne has eight remedial water treatment systems operating in Areas I, II, and III. The combined treatment capacity of these systems is nearly 1,000,000 gal of solvent–contaminated water per day. Two of the systems are ultraviolet light/hydrogen peroxide treatment units (UV/H_2O_2). The six air stripping tower systems include those at the Area I Road, Alfa, Bravo, Canyon, STL–IV, and Delta sites. The combined pumping total of these remediation units has resulted in treatment of 615 million gal of solvent–contaminated water since 1987. The summaries of the water quality results for the treatment systems are included in the quarterly groundwater program reports submitted to the regulatory agencies. Although seasonal variations exist, examination of the results has revealed that there has been substantial progress in groundwater remediation via the treatment technologies utilized by Rocketdyne. Notably, the contamination levels have dropped significantly.

Plans are in progress to batch the solvent–contaminated waters of two new extraction wells (to be constructed in the fall of 1992) and transport them to the STL–IV Stripping Towers Treatment System. One well will be located northwest of the RMDF. The second well will be drilled at Building T886, the former Sodium Disposal Facility.

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).

The solvents found in the groundwater include trichloroethylene and its family of decomposition 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 1989, as well as in the Annual Reports. Additional treatment options are being considered, pending DOE funding. These include an air stripping tower unit or a UV/H_2O_2 unit on-site in Area IV, or newer technologies (treatment using solar radiation) being proposed under DOE contracts.

During 1991, two cluster wells (of three wells each) were drilled on the adjacent Brandeis-Bardin property northwest of Area IV. Results of sampling these wells indicate that solvents are present above drinking water standards only in the upper portions of the saturated zone in these areas. In 1991, a Groundwater Sampling and Analysis Plan and a groundwater Quality Assessment Plan were submitted to Cal-EPA DTSC. A Site Characterization Plan was also submitted and approved by Cal-EPA DTSC.

There were no draft or final environmental impact statements or reports, site assessments, or remedial action reports produced during 1991. 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 – Reagent–grade chemicals and 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 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 1991, two sets of samples were distributed: QAP XXXIV and QAP XXXV. A summary of results is shown in Table 7-1. While these comparisons involve sample types, geometries, and analyses that are not part of the routine procedures at the Rocketdyne laboratory, review of these results and those of the other laboratories shows a similar quality in most cases. In this summary, the values shown are the average ratios of the analytical result determined by each laboratory relating to the reference result (EML). Ideally, these should equal that of the reference laboratory, 1.00.

The results of QAP XXXIV and QAP XXXV indicate that the Rocketdyne laboratory radiological analysis program is performing as well as most other laboratories. The range between the minimum and the maximum is typical of the better performing laboratories.

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Table 7–1. Summary of QAP–XXXIV and –XXXV Results (Sheet 1 of 2)

Laboratory Identifier	Number of Results	Result Compared to Reference		
		Unweighted		
		Minimum	Mean	Maximum
YP	8	0.60	0.82	1.18
IS	16	0.55	0.85	1.14
UC	35	0.51	0.89	1.34
ML	23	0.67	0.93	1.37
GE	2	0.56	0.94	1.31
BP	49	0.28	0.94	2.46
AS	59	0.43	0.97	1.61
PI	9	0.91	0.97	1.11
AC	64	0.03	0.97	1.65
LB	16	0.42	0.98	1.45
TM	71	0.17	0.98	1.57
PA	20	0.63	0.98	1.78
IT	76	0.53	0.98	1.35
UY	41	0.01	0.99	1.52
HS	118	0.61	0.99	1.39
AN	70	0.27	1.00	2.68
EML (reference)	83	1.00	1.00	1.00
OS	36	0.10	1.01	2.75
CA	24	0.79	1.01	1.69
EP	29	0.90	1.01	1.16
RG	8	0.97	1.02	1.08
BN	97	0.64	1.03	1.64
BE	53	0.73	1.03	1.69
SR	83	0.32	1.04	4.98
FL	53	0.37	1.04	1.73
PR	18	0.90	1.04	1.13
SC	6	0.73	1.04	1.27
UK	41	0.23	1.06	4.53
SK	15	0.94	1.06	1.22
CP	23	0.36	1.07	2.41
KA	27	0.90	1.07	1.23
GA	43	0.62	1.08	2.60
OR	70	0.35	1.08	10.00
WA	76	0.52	1.08	10.03
EE	21	0.28	1.09	1.44
AP	30	0.60	1.09	2.77
EG	30	0.94	1.10	1.81
BA	22	0.42	1.11	1.46
AZ	18	0.98	1.13	1.42
PC	8	0.76	1.13	1.93
RI	42	0.70	1.13	2.47

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Table 7-1. Summary of QAP-XXXIV and -XXXV Results (Sheet 2 of 2)

Laboratory Identifier	Number of Results	Result Compared to Reference		
		Unweighted		
		Minimum	Mean	Maximum
LA	60	0.68	1.13	7.75
AR	67	0.45	1.14	4.82
FN	48	0.93	1.14	4.10
LL	18	0.57	1.15	2.56
AU	68	0.19	1.18	5.56
WP	36	0.84	1.23	6.58
IN	15	1.09	1.27	1.44
NJ	31	0.86	1.27	3.20
Rocketdyne	35	0.74	1.28	2.70
WI	7	0.62	1.34	2.19
EN	65	0.42	1.41	10.96
ET	79	0.06	1.56	14.85
RF	38	0.67	1.57	11.42
WV	53	0.25	2.06	51.47
CL	16	0.02	2.26	19.68
BR	52	0.01	2.35	38.66
BM	33	0.80	5.53	36.51
NL	19	0.10	6.17	44.14
RE	56	0.59	23.75	1040.70
Minimum	Total	0.01	0.82	1.00
Mean	2429	0.55	1.68	23.33
Maximum		1.09	23.75	1040.70

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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

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

		Discharge Limitations
Constituent	Units	Maximum
Total dissolved solids	mg/L	950
	lb/day*	1,267,680
BOD_5 20°C	mg/L	30
	lb/day*	40,035
Oil and grease	mg/L	15
	lb/day*	20,020
Chloride	mg/L	150
	lb/day*	200,160
Sulfate	mg/L	300
	lb/day*	400,320
Fluoride	mg/L	1.0
	lb/day*	1,340
Boron	mg/L	1.0
	lb/day*	1,340
Surfactants (as MDAS)	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.

9. 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 which 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.

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

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

12. 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.

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

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

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

16. 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.

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

18. 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.

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

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

21. 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.

22. 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.

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

    Filtered wastewater means an oxidized, coagulated, clarified wastewater which had been passed through natural undisturbed soils or 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.

24. 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.

25. 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.

26. 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

EXTERNAL DISTRIBUTION

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APPENDIX D

ACRONYMS

ACM	asbestos-containing materials
ANL	*Argonne National Laboratory*
ASL	above sea level
CAA	Clean Air Act
CCR	California Code of Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CME	Comprehensive Monitoring Evaluation
CWA	Clean Water Act
D&D	decontamination and decommissioning
DCG	Derived Concentration Guide
DHS	Department of Health Services
DOE	Department of Energy
EML	Environmental Measurements Laboratory
EPA	Environmental Protection Agency
ETEC	Energy Technology Engineering Center
HAR	Hydrogeological Assessment Report
HEPA	high-efficiency particulate air
LLD	*Lower Limit of Detection*
MBAS	methylene blue active substances
MGD	million gallons per day
MPC	maximum permissible concentration, air, or water
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NIST	National Institute of Standards and Technology
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NSPS	New Source Performance Standards
NTU	Nephelometric Turbidity Unit
PA/SI	Preliminary Assessment/Site Investigation
PP	Perimeter Pond

PRR	preliminary record review
QA	quality assurance
QAP	Quality Assessment Program
R&D	research and development
RHB	Radiological Health Branch
RCRA	Resource Conservation and Recovery Act
RFA	RCRA facility assessment
RIHL	Rockwell International Hot Laboratory
RMDF	Radioactive Materials Disposal Facility
RWQCB	Regional Water Quality Control Board
SARA	Superfund Amendments and Reauthorization Act
SCAQMD	South Coast Air Quality Management District
SCTI	Sodium Component Test Installation
SNAP	Systems for Nuclear Auxiliary Power
SPCC	Spill Prevention Control and Countermeasure
SRE	Sodium Reactor Experiment
SSFL	Santa Susana Field Laboratory
SSME	Space Shuttle Main Engine
TLD	thermoluminescent dosimeter
TRI	Toxic Release Inventory
TPCA	Toxic Pits Cleanup Act
TSD	treatment, storage, and disposal (facility)
UST	underground storage tank
UV	ultraviolet
VAPCD	Ventura County Air Pollution Control District
VSI	visual site inspection

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