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ROCKETDYNE DIVISION ENVIRONMENTAL MONITORING ANNUAL REPORT SANTA SUSANA FIELD LABORATORY, DE SOTO, AND CANOGA SITES 1990

Rockwell International
Rocketdyne Division

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Prepared by the Staffs of
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and
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1.0 EXECUTIVE SUMMARY

Rocketdyne currently operates three major sites 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, efforts have 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 nuclear 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, which exceed those naturally present, only natural radioactivity has been found in this water.

The nonradiological monitoring program has increased, with more extensive sampling of the groundwater at Santa Susana Field Laboratory (SSFL), and at the De Soto and Canoga 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 nuclear-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, slightly above natural levels, are found in groundwater. With the exception of localized areas of facility and soil contamination, only natural radioactivity can be detected.

Estimated doses to the public, which could be due to airborne releases and direct radiation, are far below the allowable levels, being tens-of-thousands to millions of times lower than the applicable limits.

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.

As attention has been focused on Rocketdyne operations, increasing regulatory attention has resulted in citations for a variety of administrative and technical violations related to the environment, waste handling, and monitoring procedures. Efforts have been made to communicate full explanations of the situation by using an agency/public work group and bus tours at SSFL. Legislative requests for various forms of epidemiological studies have been unresolved and remain for further action.

2.0 INTRODUCTION

This annual report discusses environmental monitoring at three manufacturing and test operations sites operated in the Southern California area by the Rocketdyne Division of Rockwell International Corporation. These are identified as the Santa Susana Field Laboratory (SSFL), the De Soto site, and the Canoga 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 and Canoga sites are essentially light industry with some laboratory-scale R&D and have 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.

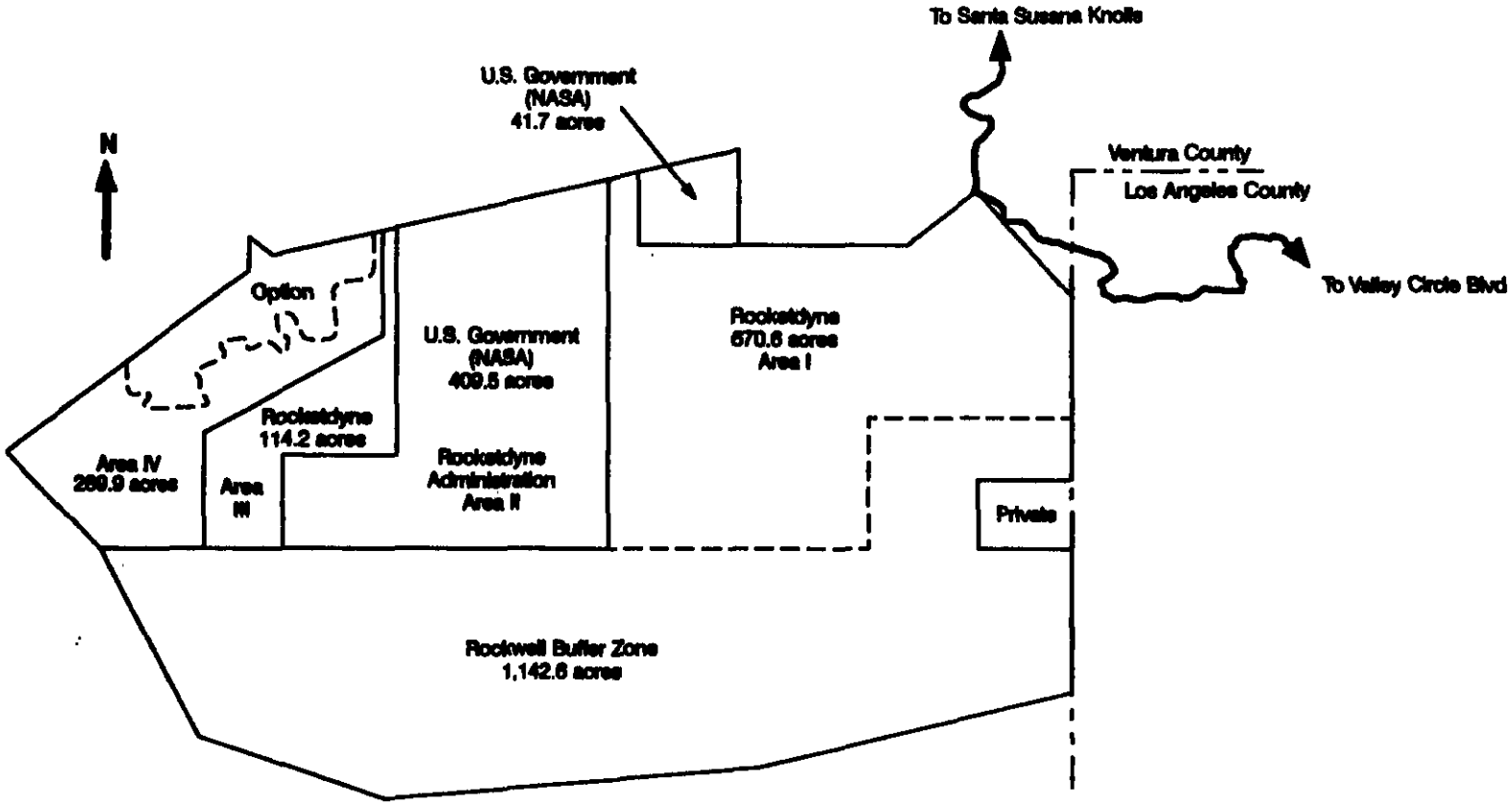
SSFL consists of four administrative areas used for research, development, and test operations as well as a buffer zone. The arrangement of these areas is shown in Figure 2-1.

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 and radioactive materials, i.e., the U.S. DOE, the U.S. Nuclear Regulatory Commission (NRC), and the California State Department of Health Services (DHS), Radiologic Health Branch (RHB). For that reason, information concentrates on Area IV at SSFL as this is the site of the former nuclear operations. While the major realm of interest is radiological, this report also includes some 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 materials 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 1990 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	

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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 orchard ranching 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 the normal 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 for summer season weather conditions would generally be under a subsidence inversion into an atmosphere that is typical of slight neutral to lapse conditions. Nocturnal cooling inversions, although present, are relatively shallow. During the summer, a subsidence inversion is present almost every day. Contrary to the situation at De Soto, the base and top of this inversion usually lie below the elevation of the SSFL site. Thus, any atmospheric release from the SSFL site under this condition would result in Pasquill Type D lofting diffusion conditions above the inversion and considerable atmospheric dispersion, prior to any diffusion through the inversion into the Simi or San Fernando Valleys. In the winter season, the Pacific high–pressure cell shifts to the south and the subsidence inversion is usually absent. The surface airflow is then dominated by frontal activity moving easterly through the area, resulting in high–pressure systems in the Great Basin region. Frontal passages through the area during winter are generally accompanied by rainfall. Diffusion characteristics are highly variable depending on the location of the front. Generally, a light to moderate southwesterly wind precedes these frontal passages, introducing a strong onshore flow of marine air and producing lapse rates that are slightly unstable. Wind speeds increase as the frontal systems approach, enhancing diffusion. The diffusion characteristics of the frontal passage are lapse conditions with light to moderate northerly winds. Locally, average wind speeds for

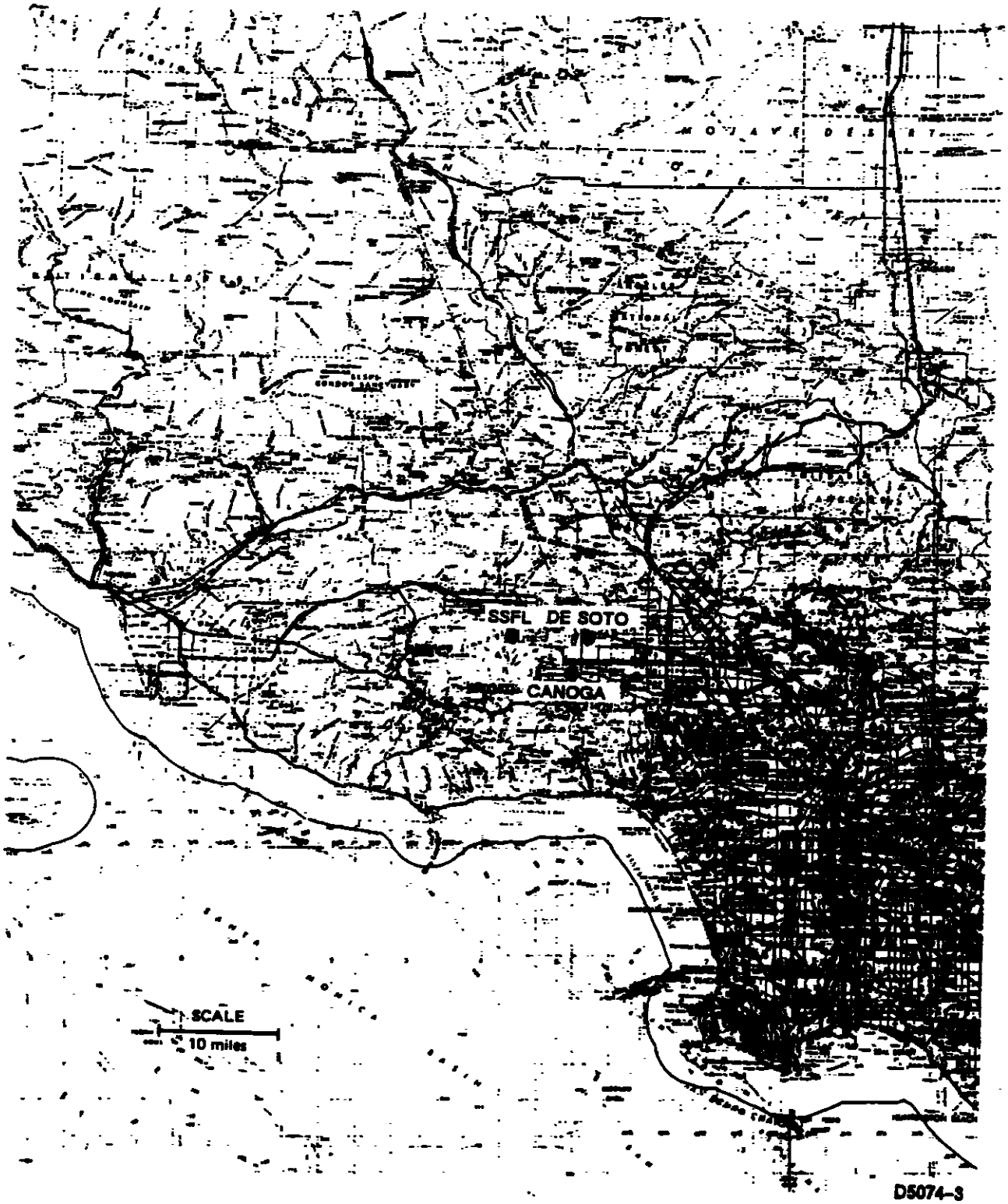

Figure 2–2. Map of General Los Angeles Area Showing Locations of Major Rocketdyne Facilities

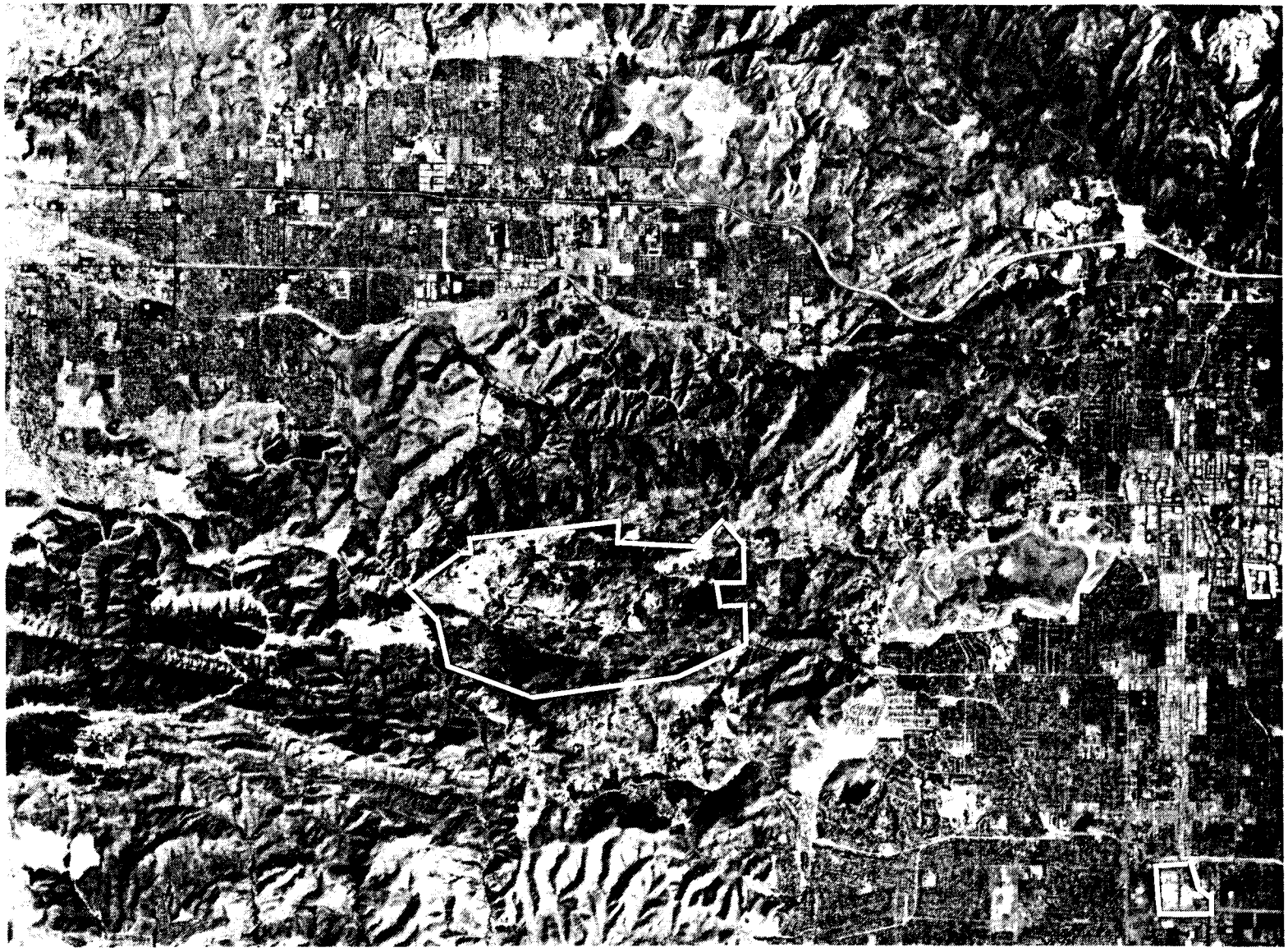

Figure 2–3. Area Surrounding SSFL (De Soto Site is Due East of SSFL, at Right Edge of Photo, Canoga Site is at Lower Right)

the various stability categories range from 0 to about 4.4 m/s with the greatest frequency occurring for winds from the north to northwest sectors.

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

The SSFL site (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 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 1990 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.

At the Canoga site (Figure 2–7), the predominant use of radiation is in industrial radiography for quality control inspection of rocket engine components using X–ray machines. Other uses of

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

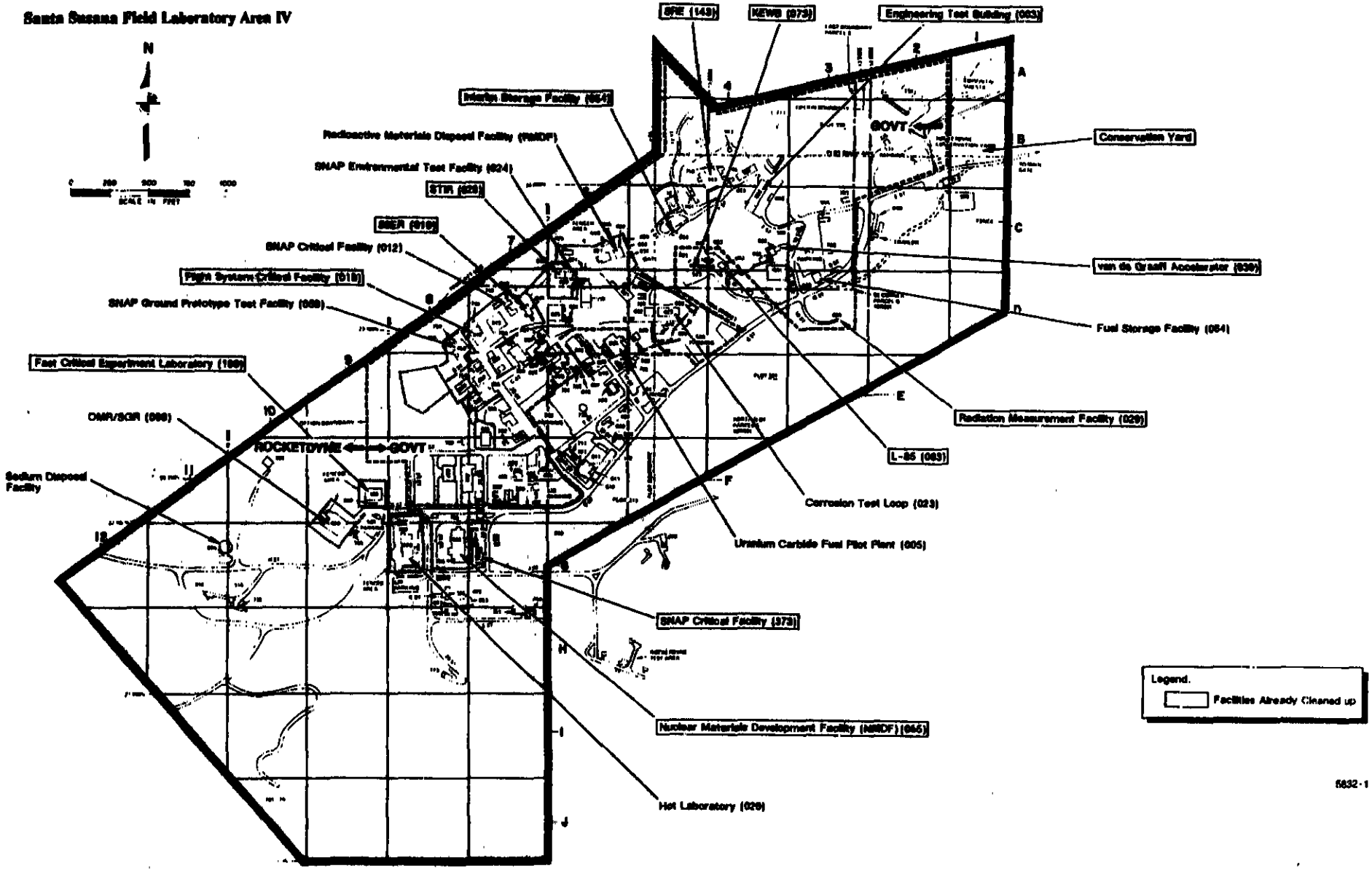

Figure 2-5. Map of Santa Susana Field Laboratory Area IV Facilities

Figure 2-6. Rocketdyne Division – De Soto Site

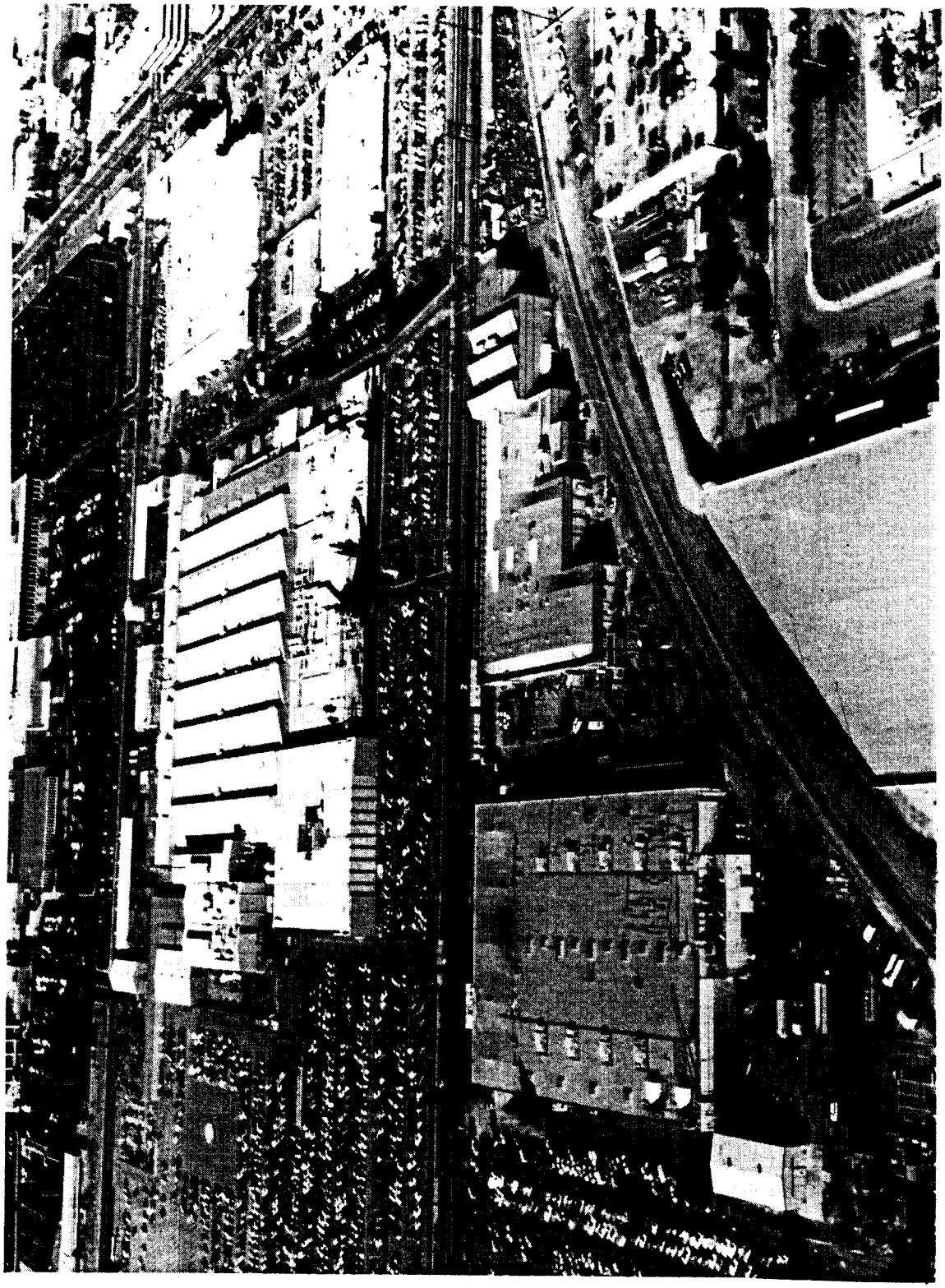

Figure 2–7. Rocketdyne Division – Canoga Site

radiation and/or radioactive materials involve R&D. These include sealed sources and alloys activated by charged-particle irradiation.

2.1 FACILITY DESCRIPTIONS

2.1.1 De Soto Site

2.1.1.1 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. Major quantities of radionuclides present are limited to Co-60 and Cs-137 in encapsulated form. (The Cs-137 sources were returned to a DOE site in March 1991).

2.1.2 Santa Susana Field Laboratory Site

2.1.2.1 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 1990, 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 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.

2.1.2.2 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.

2.1.2.3 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 Space 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, with significant amounts of Co-60, some minor amounts of Eu-152, and trivial amounts of H-3.

2.1.3 Canoga Site

2.1.3.1 Manufacturing Facilities Engaged in DOD and NASA Activities -- California State-Licensed

Manufacturing quality assurance inspection by X-ray techniques is performed at the Canoga complex. Some limited State-licensed research work requiring the incidental use of small quantities of radioactive materials including charged-particle activated steel, Cf-252, and Ru-106 is also done there. No nuclear activities are conducted at the Canoga complex.

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3.0 COMPLIANCE SUMMARY

The results of environmental monitoring indicate that there are no significant sources of nonnatural radioactive material in the vicinity of the Rocketdyne sites. The atmospheric discharge of radioactive materials and direct exposure are the only potential exposure pathways to the general public from Rocketdyne nuclear 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 artificial radioactivity. With the exception of negligible concentrations of tritium, only natural radioactivity has been found in this water.

3.1 RADIOLOGICAL

3.1.1 Compliance Status

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. Airborne pathway dose estimates were calculated by use of AIRDOS–PC for nonnatural radionuclides identified in the effluent from each nuclear facility. All estimates for the maximum hypothetical dose are far below the Environmental Protection Agency (EPA) National Emission Standards for Hazardous Air Pollutants (NESHAPs) standard. 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.

The external annual exposure resulting from operations conducted at the RMDF is estimated to correspond to a dose of about 45 mrem, above natural background, at the nearest boundary–line location and a calculated dose less than 0.0002 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 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 practically nonexistent levels. 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.

Boundary–line direct radiation exposures for the State of California and U.S. NRC–licensed operations at other Rocketdyne facilities were well below applicable dose limits. These are the NRC and State of California limits of 500 mrem/yr, 100 mrem/wk, and 2 mrem/hr.

The external annual exposure resulting from operations conducted at the NRC-licensed RIHL is estimated to correspond to a calculated dose of about 0.02 mrem at the nearest boundary-line location and a calculated dose less than 0.002 mrem for the nearest residence.

For the De Soto site, airborne pathway dose estimates at the boundary and at the nearest residence do not differ significantly from zero. Estimates of the external radiation exposure at the De Soto boundary (0 ± 0.2 mrem) and at the nearest residence (0 ± 0.1 mrem) are based on the difference between the Gamma Irradiation Facility dosimeter measurement and the average of all off-site dosimeter measurements. Therefore, doses due to these operations are not measurably different from zero.

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 AIRDOS-PC.

These doses are estimated to be 1.2E-6 mrem/yr for releases from RMDF, 6.0E-10 mrem/yr for releases from Building T059, and 1.4E-6 mrem/yr for releases from RIHL at SSFL, and 1.9E-5 mrem/yr for releases from Building 104 at De Soto. 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 and compliance with the measurement method requirements of Subpart H. Nevertheless, the sampling methods generally comply with the intent of these requirements.

The maximum boundary concentrations from RIHL and De Soto Building 104 are both less than a millionth of the maximum permissible concentrations specified in 10 CFR 20, Appendix B and CCR 17, Appendix A.

There are no airborne radioactive releases at the Canoga site and there are no operations that could result in significant public exposures.

Supply water at the SSFL site consists of water from deep wells that is blended on-site with water from the Ventura County Water District 17.

Shallow groundwater is sampled weekly at Building T059 as part of the groundwater management. These samples are tested by gamma spectroscopy for any transfer of gamma-emitting activation product radioactivity from the underground reactor test vault containment into the surrounding soil. 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, which exceed natural concentrations but are well below regulatory limits.

Other groundwater monitoring wells are sampled and analyzed intermittently and no indication of artificial radioactivity has been found, with the exception of very low levels of tritium.

3.1.2 Current Issues and Actions

Ongoing meetings of the EPA-organized SSFL Work Group, consisting of representatives of various regulatory agencies and some private citizens, were supported with information regarding radiological monitoring.

A peer review of the SSFL environmental monitoring and analytical procedures was conducted by an outside expert consultant. In response to this and several other reviews of radiological environmental conditions and monitoring practices, an internal report was prepared summarizing the findings and recommendations. The Rocketdyne report discusses the application of these recommendations to the SSFL site.

Several guided bus tours of SSFL were provided for the public. These tours were available to interested persons by reservation and covered the entire SSFL site. Information on operations, environmental conditions, and decontamination projects, and opportunity for questions and discussions with appropriate staff members, were provided to the visitors.

3.2 NONRADIOLOGICAL

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.

A cleanup project removed 100 yd^3 of soil contaminated with hydrocarbons at the Old Conservation Yard in Area IV. EPA requested Rocketdyne to cease the hydrocarbon removal operation until a workplan was approved by DHS. The workplans for assessment of several areas were submitted to DHS in October and are currently under review by DHS.

Characterization of the groundwater at the site continues. A workplan for construction of off-site wells northwest of Area IV to further define the extent of chemical contamination has been submitted to DOE and DHS for approval. The site characterization and the plans for additional wells were discussed at the SSFL Work Group meeting.

A Notice of Technical Error was received by Rocketdyne from the EPA regarding the Toxic Release Inventory (TRI) for Reporting Year 1988. The corrections were submitted to the EPA on 15 May 1990. The TRI for Reporting Year 1989 was submitted to the EPA on 30 June 1990.

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. Underground storage tanks containing petroleum products and hazardous substances are also regulated under RCRA.

There are two RCRA permitted treatment, storage, and disposal (TSD) facilities owned by DOE and operated by Rocketdyne at SSFL, the Sodium Treatment Facility (T133) and the Radioactive Materials Disposal Facility (RMDF). The RCRA permit for the Sodium Treatment Facility is undergoing renewal. These facilities are permitted for treatment and disposal only. There is no on-site disposal of waste from these facilities. As part of the renewal process, the EPA is including Area IV in a RCRA Corrective Action. The RCRA facility assessment (RFA) has been initiated with the completion of the preliminary record review (PRR) and the visual site inspection (VSI) which was conducted in September 1990.

Because of the presence of several registered surface impoundments in Areas I, II, and III, that constitute permitted land disposal units at SSFL, the Department of Health Services [DHS (Toxic Substances Control Branch)] conducted a Comprehensive Monitoring Evaluation (CME) of the groundwater monitoring program. The CME report was issued in December 1990 for these areas and provided recommendations to aid in establishing adequate groundwater monitoring for the life of the post closure period in the RCRA-registered surface impoundments in Areas I, II, and III. The DHS notified Rocketdyne that it considers the groundwater monitoring standards and conditions outlined in the evaluation to also be applicable to any groundwater monitoring activities conducted in Area IV.

The California Attorney General's Office, on behalf of the DHS, filed a complaint against Rocketdyne's SSFL and Canoga Park sites. Seven alleged violations were claimed in Area IV. An Agreement with the Attorney General's Office was signed by Rockwell International in November 1990.

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.

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, 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 (VAPCD) and must comply with VAPCD rules and regulations. VAPCD rules and regulations incorporate, by reference, NESHAPS regulations as codified under the CAA. The De Soto and Canoga facilities are under the jurisdiction of the South Coast Air Quality Management District (SCAQMD).

No violations of the CAA occurred.

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 Regional Water Quality Control Board (RWQCB). The state water discharge program incorporates the regulations and guidelines of the CWA. The waste discharge requirements under the RWQCB program serve as an NPDES permit. The facility NPDES permit (No. CA0001309) was issued in June 1982, was recently reissued to expire on 10 August 1989, but continues in effect pending RWQCB review. To date, a new permit and new waste discharge requirements have not been developed by the RWQCB.

No violations of the CWA occurred during 1990.

3.2.2 Current Issues and Actions

Epidemiological Study

As as result of the media attention associated with DOE issues, the State of California legislators called for an epidemiological study of workers and local communities. This would be an attempt to identify any health effects, regardless of the cause. The State of California funded a preliminary exposure assessment by ERC, Inc.

3.2.2.1 Resource Conservation and Recovery Act

The RCRA Part B–permitted Sodium Treatment Facility includes Building T133, where alkali metals are treated, and Building T029, where alkali metals are stored. Operations continue at the treatment facility under the old permit, which is in the renewal process.

The RMDF operates under interim status to treat and store mixed waste. The RCRA Part A Application was revised during 1990 and submitted to EPA in March. The revision provided more

specific descriptions of the waste forms to be treated and stored. California is not authorized to implement the Federal RCRA programs, but regulates hazardous waste under its own laws.

California claims regulatory authority over mixed waste under State law. Inconsistencies between the State and the Federal regulations create unresolved conflicts in the treatment of various non-RCRA, but California-regulated wastes.

3.2.2.2 Clean Air Act

Ambient air monitoring of PM10 (particulate matter with an aerodynamic diameter less than or equal to 10 μm) began in December 1989 with the installation of a sampler in Area IV and collocated samplers in Area I. In October 1990, meteorological stations were installed at the PM10 samplers.

The Sodium Component Test Installation (SCTI) has been installing low-NOx burners and a carbon monoxide continuous emission monitoring system pursuant to VAPCD requirements.

Asbestos removal projects occurring during 1990 removed and disposed of a total of 12,400 ft^2 of floor tile and mastic, 120 ft^2 of transit panels, and 176 ft^2 of boiler and pipe insulation.

3.2.2.3 Clean Water Act

The RWQCB notified Rocketdyne that the lower pond of the former Sodium Disposal Facility was determined to be a toxic pit under the Toxic Pits Cleanup Act of 1984 (TPCA). Fees were submitted to the RWQCB to register the pond under TPCA and a Hydrogeological Assessment Report (HAR) was prepared and sent to RWQCB. The assessment and cleanup of this former surface impoundment near Building T886 is regulated under TPCA.

There were minor exceedances of water quality limits in water reclamation ponds for the following reasons:

- High turbidity due to equipment malfunction at the Area III Sewage Treatment Plant.
- 9.1 pH due to algae growth in the ponds.

Surface water samples were collected from five rainfall runoff sampling stations newly installed in Area IV. The results of analyses of these samples were communicated to the RWQCB and to the DOE.

The renewal of NPDES permit CA0001309 from the RWQCB is still in the review process.

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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 analyses are performed on representative environmental samples. Facility atmospheric effluent sample filters for 1990 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, where other nuclear installations were planned and eventually built and operated. 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, routine soil sampling was terminated at the end of 1989.

Occasional gamma-spectrometry analyses of bulk samples such as soil, water, and ambient air sample filters confirm that the major radionuclides present are normally those of the naturally occurring thorium and uranium decay chains, plus other natural radionuclides such as the primordial K-40, and Be-7 produced by cosmic ray interactions in the atmosphere.

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

4.1 SAMPLING AND SAMPLE PREPARATION

Sampling and monitoring locations currently in use are shown in Figures 4-1 through 4-3 and listed in Table 4-1.

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. For most radionuclides, gross alpha and beta radioactivity measurements are adequate. However, 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. Groundwater at De Soto and Canoga is 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. 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.

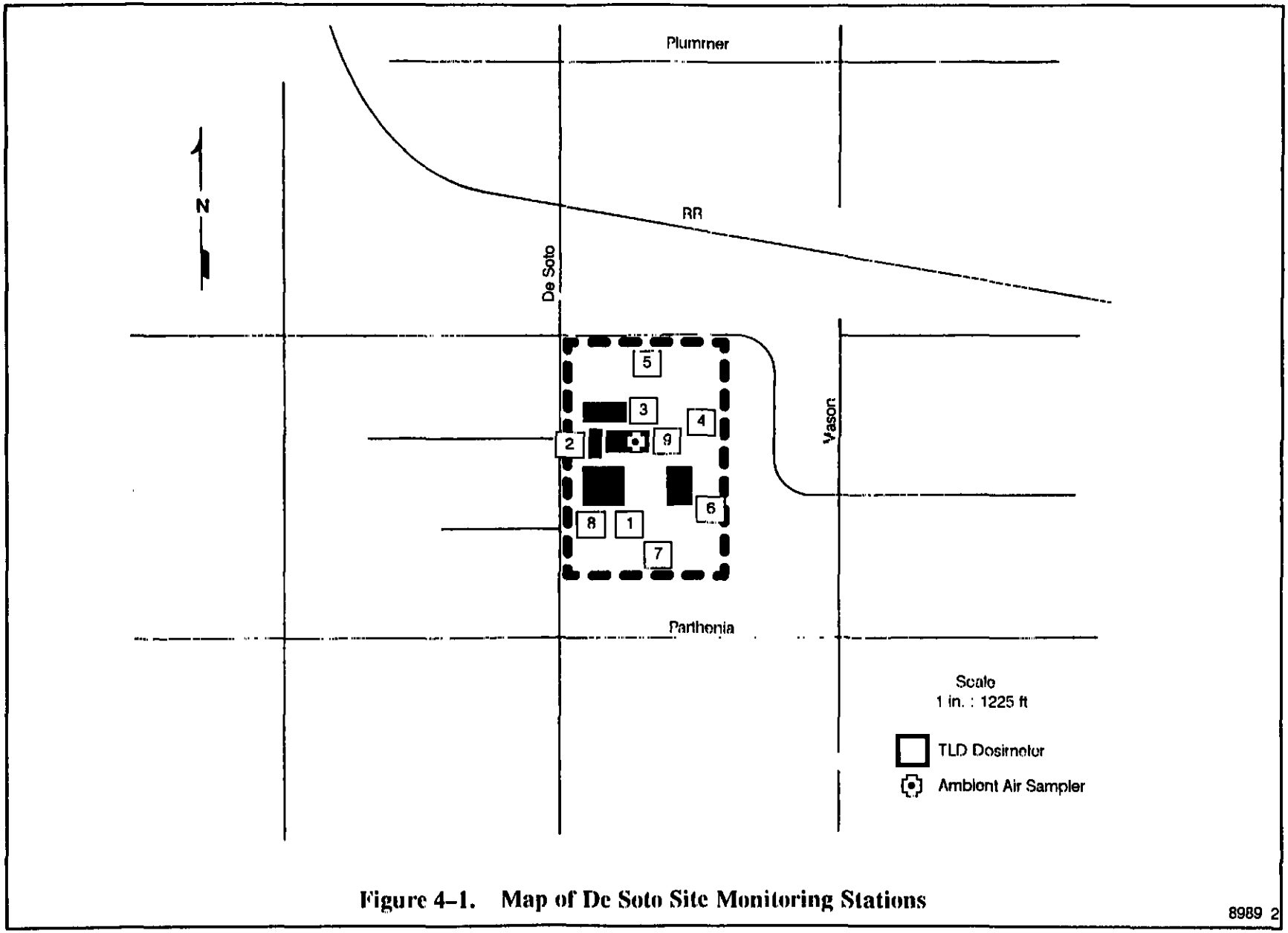

Figure 4–1. Map of De Soto Site Monitoring Stations

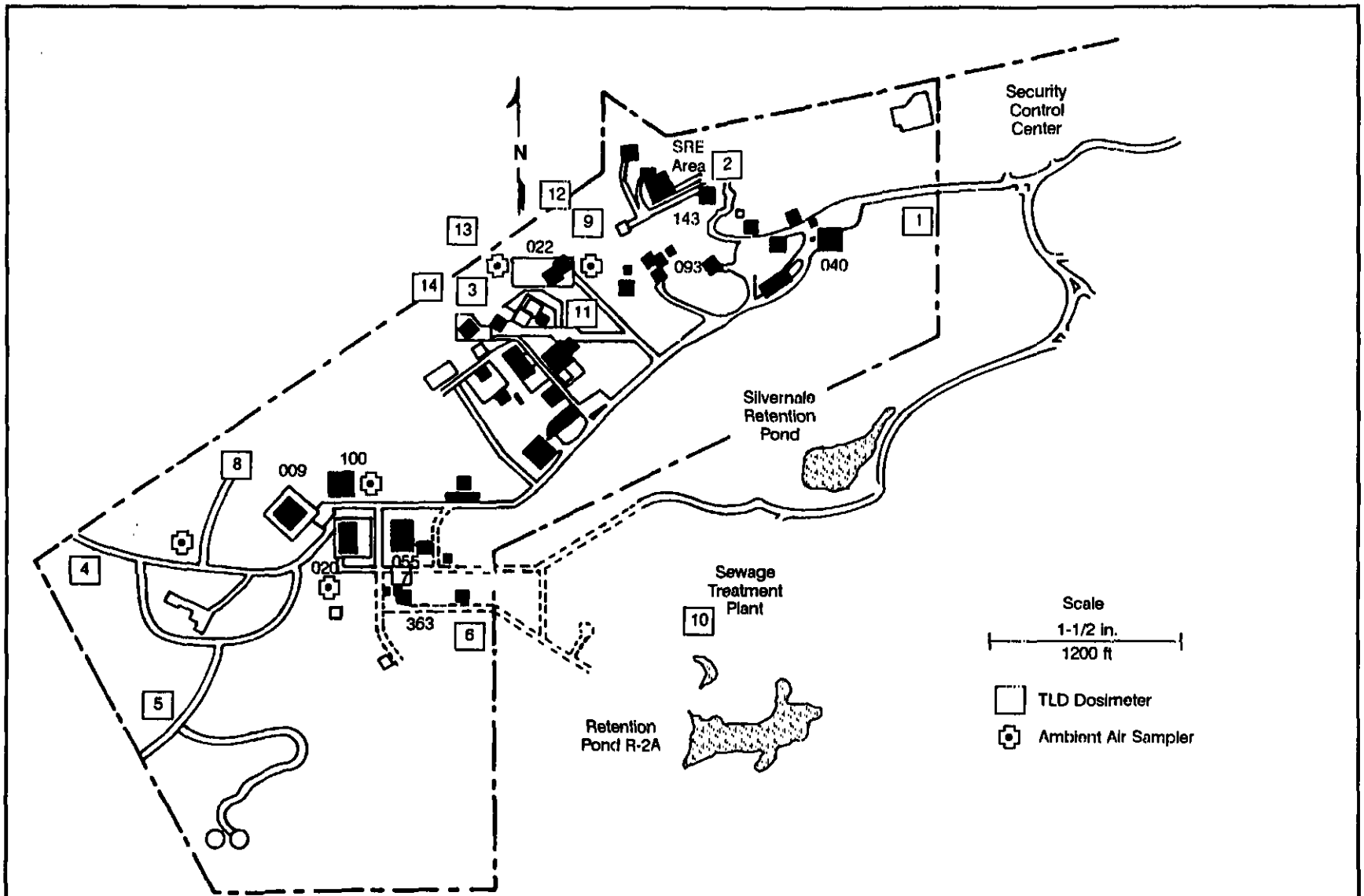

Figure 4–2. Map of Santa Susana Field Laboratory Site Sampling Stations

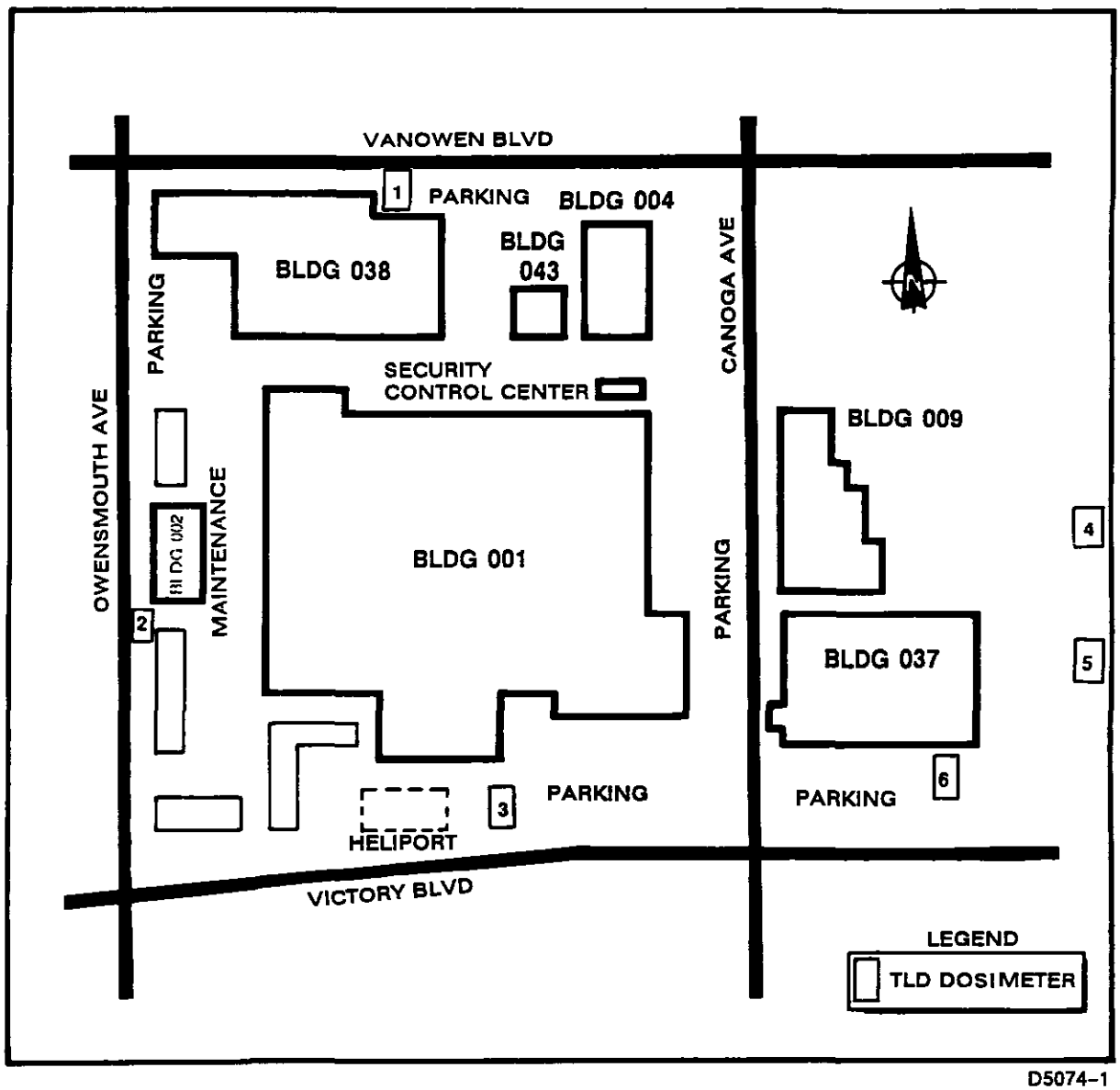

Figure 4–3. Map of Canoga Site TLD Locations

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–1	De Soto Site, south of Block House	(Q)
DS–2	De Soto Site, northwest corner of Building 101 (State of California TLD Location Number 2)	(Q)
DS–3	De Soto Site, southeast corner of Building 102	(Q)
DS–4	De Soto Site, northeast corner of SPEL II Laboratory Building 113	(Q)
DS–5	De Soto Site, northeast corner of Building 102	(Q)
DS–6	De Soto Site, east boundary, southeast corner of Building 105 (State of California TLD Location Number 1)	(Q)
DS–7	De Soto Site, north of Building 106	(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–1	SSFL Site, at Building 114	(Q)
SS–2	SSFL Site, SRE Retention Pond	(Q)
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)
SS–5	SSFL Site, southwest boundary at property line gate	(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–10	SSFL Site, Building 600, Sewage Treatment Plant	(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)
On–Site—Canoga – Ambient Radiation Dosimeter Locations		
CA–1	Canoga Site, northeast corner of Building 038	(Q)
CA–2	Canoga Site, southwest corner of Building 002	(Q)
CA–3	Canoga Site, south of Building 001 near street entrance	(Q)
CA–4	Canoga Site, east of Building 009 on boundary fence	(Q)
CA–5	Canoga Site, east of Building 037 on boundary fence	(Q)
CA–6	Canoga Site, southeast corner of Building 037	(Q)
Off–Site Ambient Radiation Dosimeter Locations		
OS–1	Off–site, Northridge, approximately Oakdale Avenue and Lassen Street (State of California TLD Location Number 5)	(Q)
OS–2	Off–site, Simi Valley, approximately Erringer Road and Royal Avenue	(Q)
OS–3	Off–site, Northridge, approximately Parthenia Street and Winnetka Avenue	(Q)
OS–4	Off–site, Simi Valley, approximately Cochran and Stearns Streets	(Q)
OS–5	Off–site, Thousand Oaks (State of California TLD Location Number 6)	(Q)

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

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

D641-0010/tab

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 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; results that did not indicate the presence of a radionuclide that could have been detected by the analytical method are shown as "not detected"; and results that were reported as zero because they were less than the detection limit are shown as zeros with an explanation. In estimating releases, physically unrealistic negative values are replaced by zero values. 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. Particle filtration efficiency increases for particulate matter above and below this size.

The average concentration and total radioactivity in atmospheric effluents to uncontrolled areas are shown in Tables 5-1A through 5-1C. The total shows that no significant quantities of radioactivity were released in 1990. (Direct sampling and analysis of effluent from T059 was not performed in 1990. The release of Co-60 to the atmosphere was estimated to be 2.2×10^{-4} μCi on the basis of work performed.)

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 5-1C. 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 table shows that the majority of the collected activity is caused by the naturally occurring radionuclides, K-40 and Po-210. 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

Table 5–1A. Atmospheric Effluents to Uncontrolled Areas

SSFL/RMDF – 1990	
Effluent volume (m^3)	282,368,000
Lower limit of detection, LLD	
Gross alpha (μCi/mL)	3×10^{-16}
Gross beta (μCi/mL)	1×10^{-15}
Air volume sampled (m^3)	32,624
Annual average concentration in effluent	
Gross alpha (μCi/mL)	1.44×10^{-16}
Gross beta (μCi/mL)	5.21×0^{-15}
Maximum observed concentration	
Gross alpha (μCi/mL)	5.28×10^{-16}
Gross beta (μCi/mL)	3.38×10^{-14}
Activity released (μCi)	
Gross alpha	0.04
Gross beta	1.47

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	0.66	0	Natural
K-40	1,260,000,000	ND	0	150	1.30	0	Natural
Co-60	5.26	57.00	0.49	11	0.10	1.75×10^{-15}	8×10^{-11}
Sr-90	27.7	3.36	0.03	6	0.05	1.03×10^{-16}	9×10^{-12}
Cs-137	30	37.70	0.33	10	0.09	1.16×10^{-15}	4×10^{-10}
Po-210	0.38	4.97	0.04	0.2	0.002	1.52×10^{-16}	Natural
U-234	247,000	0.002	1.59×10^{-5}	0.1	0.009	5.64×10^{-20}	9×10^{-14}
U-235	710,000,000	-0.019	0	0.1	0.009	0	1×10^{-13}
U-238	4,510,000,000	-0.034	0	0.1	0.009	0	1×10^{-13}
Pu-238	86.4	0.001	1.14×10^{-5}	0.2	0.002	4.05×10^{-20}	3×10^{-14}
Pu-239/240	24,390/6,580	0.29	2.51×10^{-3}	0.2	0.002	8.89×10^{-18}	2×10^{-14}
Am-241	458	0.012	1.05×10^{-10}	0.1	0.009	3.71×10^{-19}	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

SSFL/RIHL - 1990	
Effluent volume (m^3)	363,468,000
Lower limit of detection, LLD	
Gross alpha (μCi/mL)	3×10^{-16}
Gross beta (μCi/mL)	1×10^{-15}
Air volume sampled (m^3)	32,605
Annual average concentration in effluent	
Gross alpha (μCi/mL)	2.02×10^{-15}
Gross beta (μCi/mL)	1.15×10^{-14}
Maximum observed concentration	
Gross alpha (μCi/mL)	5.31×10^{-15}
Gross beta (μCi/mL)	3.04×10^{-14}
Activity released (μCi)	
Gross alpha	0.73
Gross beta	4.18

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	0.85	0	Natural
K-40	1,260,000,000	280.0	3.12	150	1.67	8.59×10^{-15}	Natural
Co-60	5.26	ND	0	11	0.12	0	3×10^{-10}
Sr-90	27.7	7.15	0.08	6	0.07	2.19×10^{-16}	3×10^{-11}
Cs-137	30	59.70	0.67	10	0.11	1.83×10^{-15}	5×10^{-10}
Po-210	0.38	54.60	0.61	0.2	0.002	1.67×10^{-15}	Natural
U-234	247,000	-0.14	0	0.1	0.001	0	4×10^{-12}
U-235	710,000,000	0.06	6.7×10^{-4}	0.1	0.001	1.85×10^{-18}	4×10^{-12}
U-238	4,510,000,000	-0.026	0	0.1	0.001	0	3×10^{-12}
Pu-238	86.4	-5.6×10^{-9}	0	0.2	0.002	0	7×10^{-14}
Pu-239/240	24,390/6,580	0.073	8.13×10^{-4}	0.2	0.002	2.24×10^{-18}	6×10^{-14}
Am-241	458	-0.002	0	0.1	0.001	0	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

De Soto 104 – 1990	
Effluent volume (m^3)	39,590,000
Lower limit of detection, LLD	
Gross alpha (μCi/mL)	3×10^{-16}
Gross beta (μCi/mL)	1×10^{-15}
Air volume sampled (m^3)	14,234
Annual average concentration in effluent	
Gross alpha (μCi/mL)	5.92×10^{-16}
Gross beta (μCi/mL)	7.78×10^{-15}
Maximum observed concentration	
Gross alpha (μCi/mL)	4.11×10^{-15}
Gross beta (μCi/mL)	5.79×10^{-14}
Activity released (μCi)	
Gross alpha	0.2
Gross beta	0.31

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	0.21	0	Natural
K–40	1,260,000,000	ND	0	150	0.42	0	Natural
Co–60	5.26	ND	0	11	0.03	0	3×10^{-10}
Sr–90	27.7	–0.45	0	6	0.2	0	3×10^{-11}
Cs–137	30	2.60	7.23×10^{-3}	10	0.03	1.83×10^{-16}	5×10^{-10}
Po–210	0.38	9.76	2.71×10^{-2}	0.2	5.56×10^{-4}	6.86×10^{-16}	Natural
U–234	247,000	11.9	3.31×10^{-2}	0.1	2.78×10^{-4}	8.36×10^{-16}	4×10^{-12}
U–235	710,000,000	0.49	1.37×10^{-3}	0.1	2.78×10^{-4}	3.46×10^{-17}	4×10^{-12}
U–238	4,510,000,000	–0.044	0	0.1	2.78×10^{-4}	0	3×10^{-12}
Pu–238	86.4	–0.011	0	0.2	5.56×10^{-4}	0	7×10^{-14}
Pu–239/240	24,390/6,580	0.007	1.94×10^{-5}	0.2	5.56×10^{-4}	4.90×10^{-19}	6×10^{-14}
Am–241	458	0.011	3.09×10^{-5}	0.1	2.78×10^{-4}	7.80×10^{-19}	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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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. In this case, negative values have been retained to permit more complete comparison of the analytical results.

Small amounts of tritium (H–3) are released to the atmosphere as a result of evaporation of water at the RMDF. A slight leak of groundwater into the Pipe Chase Room at Building T059 lead to the occasional accumulation of water. Groundwater adjacent to the concrete reactor vault in this building has extracted a low concentration of tritium produced in this concrete as a result of neutron absorption, during reactor operation, by lithium atoms naturally present in the aggregate. This tritium slowly diffuses through the concrete and exchanges with the normal hydrogen atoms ("protium") in the groundwater, producing tritiated water. Samples of groundwater taken from a french drain around the Pipe Chase Room have shown concentrations of tritium ranging from 297 (±29.7) to 1,890 (±538) pCi/L. (The State of California limit on tritium in water released to an uncontrolled area is 3,000,000 pCi/L.) Water that has accumulated in the Pipe Chase Room is collected and transferred to the RMDF for evaporation. The water vapor is exhausted through the stack but, as vapor, is not collected on the stack sample filter. The amount released (1.6 μCi) has been estimated from the average tritium concentration in the water (415 pCi/L) and the amount of water transferred from T059 to RMDF (1,050 gallons) in 1990. Tritium that is naturally present in the other water that is routinely evaporated at RMDF (a total of 9,000 gallons in 1990) resulted in the release of 0.7 μCi of natural tritium. This was not included in the air pathway exposure calculation. (This is a trivial contribution, amounting to an estimated maximum individual dose of 1E–10 mrem/yr.) There is no other artificial source of tritium at SSFL.

The downwind concentration of radioactive material emissions to the atmosphere during 1990 from each of the three major Rocketdyne nuclear facilities has been calculated with the AIRDOS–PC computer code using representative input data including wind speed, directional frequency, and stability (using meteorological data developed for the SSFL site by 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 four facilities. These concentrations were estimated by use of AIRDOS–PC and specific radionuclide releases for each facility.

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

	Activity Concentration (femtocuries per cubic meter)															
	K–40	Co–60	Sr–90	Cs–137	Po–210	Radium	Th–230	Th–232	U–234	U–235	U–238	Pu–238	Pu–239/240	Am–241	Gross Alpha	Gross Beta
Maximum Permissible Concentration	–	300,000	30,000	500,000	7,000	1,000	80	1,000	4,000	4,000	3,000	70	60	200	20	100,000
Exhaust																
RMDF	ND	1.75	0.026	1.16	0.015	0.019	0.0007	0.0002	0.00006	-0.0006	0.001	0.00004	0.009	0.0004	0.1	5.2
RIHL	8.59	ND	0.055	1.83	0.168	0.168	0.0005	0.0006	-0.004	0.0018	0.0008	0.00002	0.002	-0.0007	2.0	11.6
RIHL Glovebox	ND	ND	0.072	2.59	1.82	0.021	0.004	0.004	0.009	0.0009	0.0002	0.002	0.086	0.021	N/A	N/A
DS 104	ND	ND	-0.008	0.18	0.069	0.033	0.0005	0.001	0.84	0.035	0.003	0.0008	0.0005	0.0008	0.6	7.8
Ambient																
RMDF	ND	ND	-0.16	0.25	11.44	0.19	0.034	0.022	0.009	0.004	0.013	-0.001	-0.0005	0.003	3.7	34.1
RMDF Pond	ND	ND	-0.038	0.51	10.29	0.31	0.044	0.067	0.042	0.009	0.0009	-0.0009	0.003	0.003	3.6	34.8
RIHL	27.9	ND	0.015	2.15	10.31	0.64	0.049	0.049	0.044	0.002	0.004	-0.001	-0.00009	-0.001	3.8	35.9
T100 (7 day)	ND	ND	-0.65	1.10	9.45	0.07	0.034	0.004	0.25	0.003	0.016	-0.001	0.003	0.006	1.9	27.5
T886	ND	ND	-0.17	-0.32	6.96	0.25	0.026	0.032	0.013	0.012	0.0007	0.0009	0.005	0.001	3.0	23.6
DS 104	ND	ND	-0.08	-0.40	11.99	0.81	0.069	0.045	0.024	0.016	0.030	0.0009	0.001	0.0006	4.4	40.3
First Half 1990 Composite	191.9	ND	0.05	0.51	12.10	1.47	0.117	0.077	0.196	0.012	0.151	0.001	0.017	0.005	2.7	39.1
Exhaust Average	2.15	0.44	0.036	1.44	0.52	0.06	0.0014	0.006	0.002	0.0002	0.00005	0.0003	0.024	0.005	0.9	8.2
Ambient Average	31.4	0	-0.16	-0.22	10.36	0.53	0.373	0.042	0.034	0.004	0.023	0.001	0.004	0.003	3.3	33.6

ND = Not detected
N/A = Not analyzed

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Table 5-3. Annual Average Radioactivity Concentrations of Atmospheric Effluents—1990

Facility	Annual Release (μCi)	Distance (m) to		Downwind Concentration (10^{-18} μCi/mL)	
		Boundary	Residence	Boundary	Residence
DS 104	0.007	187 E	315 S	0.20	0.060
RIHL	0.74	302 NW	1,900 SE	6.5	0.48
RMDF	0.85	118 NW	2,300 SE	8.1	0.29
T059	0.00022	80 NW	1,997 SSE	0.0099	0.000011

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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, Pb-210/Po-210, Th, and U.

Exhaust samples and ambient air 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 most restrictive maximum permissible concentration (MPC) for each radionuclide (from CCR17) 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 has been developed for it.) These values refer to the permissible concentrations allowed by the State of California (and the NRC) for continuous exposure of the public. Note that, in all cases, for the exhaust air and for the ambient air, the observed concentrations are far below the MPC. 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.

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. Po-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. Also, because of the delay in performing the gamma-spectrometric measurements for these samples, Be-7 was not detected. 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). This reflects a rearrangement of some of the samplers compared to previous years. 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 + 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. This table also shows the changes in air sampling, with several samplers being terminated after just a few days operation in 1990.

The apprioriate 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 1990 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 less activity than instrument background. Analytical sensitivity was improved in the second half of the year by exclusive use of an instrument with a lower and more constant background.) Generally, the ambient airborne radioactivity was relatively constant during 1990, and showed no significant disturbances.

The daily data were mathematically smoothed in a moving weekly average of daily data for the year. The graph shows a decrease in airborne radioactivity during January and February, which is a result of the movement of a series of rain storms into the Southern California area. The activity detected in ambient air is attributed to naturally occurring radioactive materials and possibly to aged

Table 5–4. Ambient Air Radioactivity Data – 1990

Area	Activity	Number of Samples	Gross Radioactivity Concentrations (μCi/mL)		
			Annual Average Value and Dispersion	Maximum Value[a] and Date Observed	Average Percent of Guide[b]
De Soto Building 104	Alpha Beta	362	(4.4 ± 4.2) E-15 (40.3 ± 36.6) E-15	30.4 E-15 (7/12) 276.9 E-15 (6/25)	0.1 0.01
SSFL Area IV RIHL	Alpha Beta	187	(3.8 ± 3.2) E-15 (35.9 ± 49.3) E-15	13.0 E-15 (10/17) 201.5 E-15 (12/21)	6.3 0.40
SSFL Area IV RMDF	Alpha Beta	339	(3.7 ± 3.2) E-15 (34.1 ± 30.3) E-15	19.8 E-15 (6/25) 125.5 E-15 (11/14)	6.2 0.38
SSFL Area IV Building T011	Alpha Beta	13	(3.1 ± 2.2) E-15 (31.3 ± 15.9) E-15	7.6 E-15 (1/08) 51.0 E-15 (12/21)	5.2 0.35
SSFL Area IV Building T093	Alpha Beta	11	(2.8 ± 1.4) E-15 (37.1 ± 21.6) E-15	4.4 E-15 (1/10) 61.5 E-15 (12/21)	4.7 0.41
SSFL Area IV Building T886	Alpha Beta	348	(3.0 ± 3.4) E-15 (23.6 ± 53.0) E-15	14.5 E-15 (7/12) 545.2 E-15 (10/12)	5.0 0.26
SSFL Area IV RMDF pond	Alpha Beta	347	(3.6 ± 3.3) E-15 (34.8 ± 41.6) E-15	16.1 E-15 (11/11) 260.1 E-15 (1/27)	6.0 0.39
SSFL Area II Building 207	Alpha Beta	14	(3.2 ± 3.1) E-15 (26.2 ± 16.5) E-15	10.7 E-15 (1/12) 59.1 E-15 (11/13)	5.3 0.29
SSFL Area III Building 600	Alpha Beta	7	(3.6 ± 3.4) E-15 (27.7 ± 14.5) E-15	10.2 E-15 (1/01) 46.1 E-15 (12/21)	6.0 0.31
SSFL Area IV Building T100	Alpha Beta	14	(1.6 ± 2.0) E-15 (25.5 ± 17.0) E-15	6.0 E-15 (01/11) 52.0 E-15 (01/11)	2.7 0.28
SSFL Area IV Building T363	Alpha Beta	14	(2.9 ± 2.8) E-15 (19.1 ± 26.2) E-15	9.4 E-15 (01/03) 52.9 E-15 (01/02)	4.8 0.21

[a]Maximum value observed for single sample.

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[b]Guide De Soto Site: 3×10^{-12} μCi/mL alpha, 3×10^{-10} μCi/mL beta; 10 CFR 20 Appendix B, CCR 17. SSFL site: 6×10^{-14} μCi/mL alpha, 3×10^{-11} μCi/mL beta; 10 CFR 20 Appendix B, CCR 17, and 2×10^{-14} μCi/mL alpha, 9×10^{-12} μCi/mL beta, DOE Order 5400.5 (2/8/90).

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 1990 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 RMDF and RIHL, 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

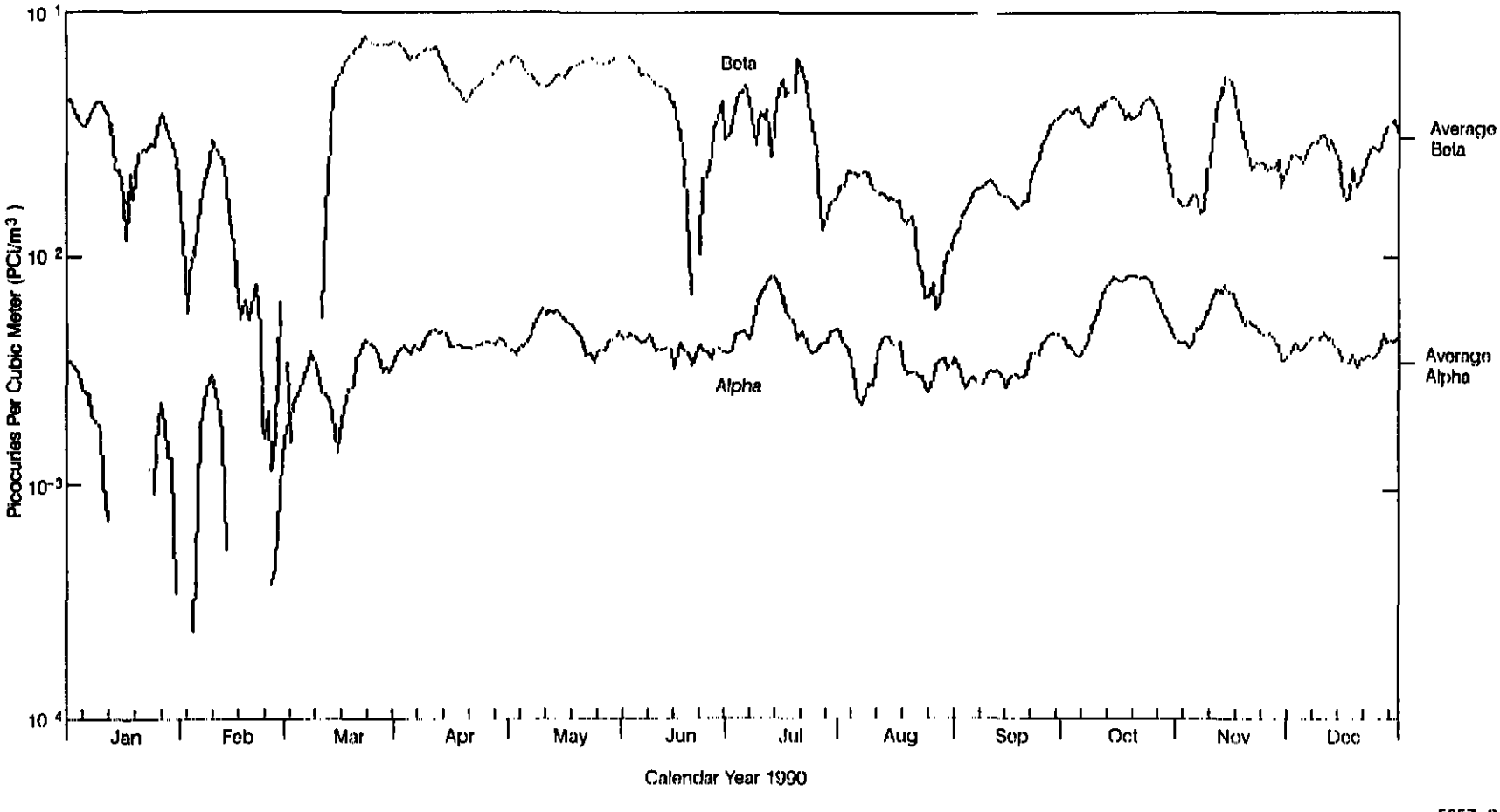

Figure 5-1. Seven-day Smoothed and Annual Average Airborne Radioactivity at the De Soto and Santa Susana Field Laboratories Sites - 1990

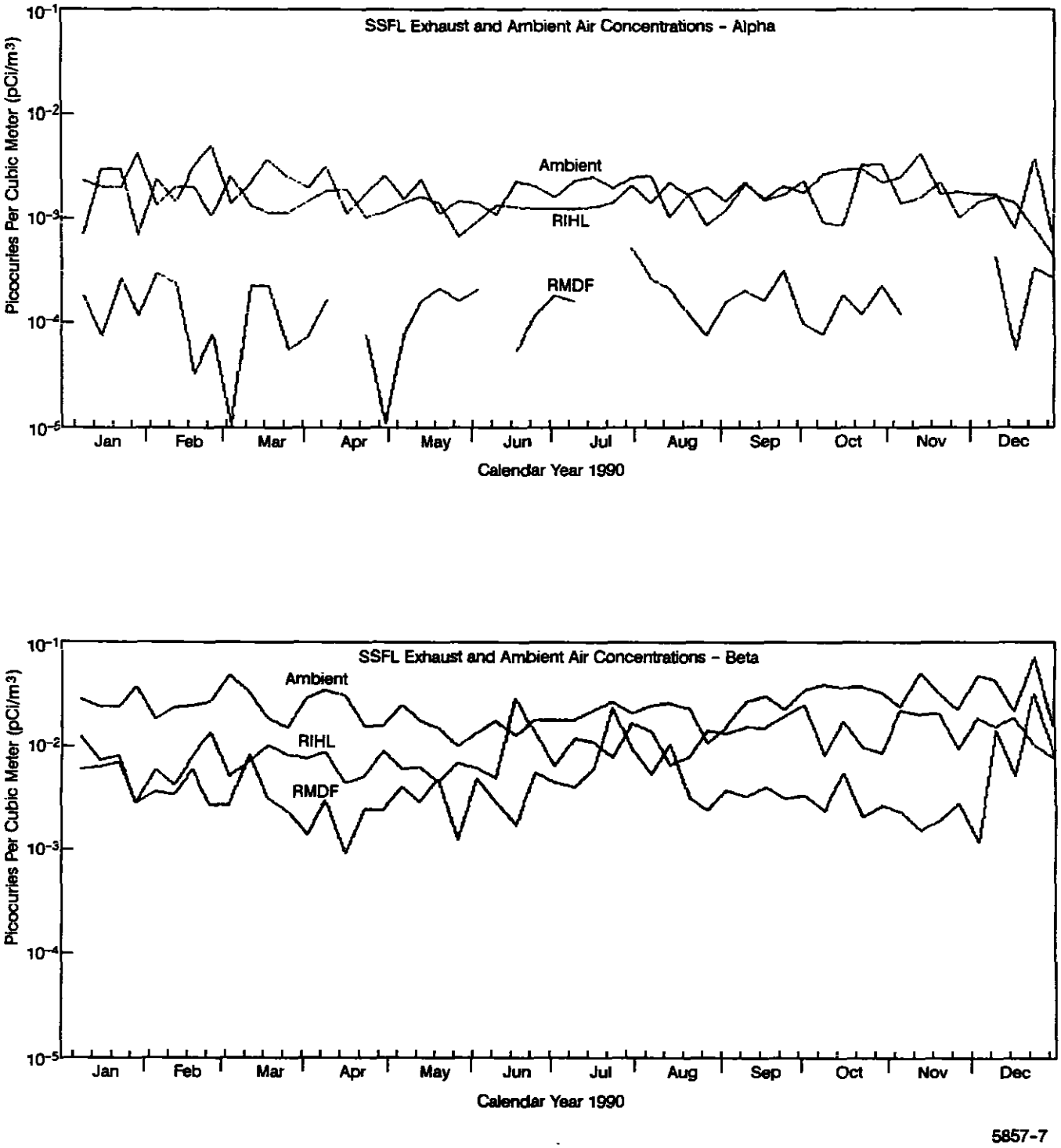

Figure 5–2. Comparison of Filtered Exhaust and Ambient Air Radioactivity

the ventilation system. At the RMDF, all the discharged air is filtered, and so the gross alpha activity is noticeably lower than in ambient air. More dispersible beta-active material is in process at the RMDF than at the RIHL, and so this difference is not so pronounced as with the alpha activity. Even here, the use of outside bypass air makes the RIHL exhaust more radioactive (with natural radionuclides) than the RMDF exhaust. Gaps in the plot of alpha activity for the RMDF are due to negative values resulting from using an instrument with higher background than was used for the ambient air and RIHL exhaust air sample analyses.

5.2.2 Water

Groundwater is sampled from a large number of shallow (alluvium) and deep (Chatsworth formation) wells and analyzed for radioactivity. The results for 1990 and (and 1989, for comparison) are shown in Table 5-5. While it may be noted that in some cases the gross alpha radioactivity has exceeded the value adopted as the MPC for this parameter, this activity is due predominantly to naturally occurring uranium, for which the MPC is considerably greater.

The results for both years (1989 and 1990) are quite similar and show no indication of contamination with nonnatural radioactivity, other than a low level of H-3, which has been thoroughly investigated. The distribution of the extreme values (maximum and minimum) is approximately equal about zero, as seen clearly for Sr-90 and 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.

A shallow standpipe, connected to a french drain at foundation level, is being used for sampling of groundwater adjacent to the underground reactor test vault in Building T059. (This standpipe was installed during a construction modification in 1964 to a currently deactivated Space Nuclear Auxiliary Power [SNAP] reactor test facility.) Water in the standpipe is sampled as part of groundwater management for the purpose of detecting any transfer of activation product radioactivity from the containment to the outside environment. A similar french drain and standpipe arrangement exists at another deactivated SNAP facility, Building T024, and provides groundwater samples, also. Results of these analyses for samples taken during 1990 are shown in Table 5-6. Here again, gross alpha activity is found to exceed the MPC for this parameter; however, the observed values are consistent with the alpha radioactivity found in water containing only natural radioactivity.

Gamma spectrometric analysis, with a minimum detection limit for Co-60 of about 30 pCi/L, has not identified any specific artificial radionuclides in the water; further, the gross beta activity is similar to that detected in domestic supply water and other water known to be not contaminated, and thus, the observed activity is attributed to dissolved radioactivity of natural origin in the water, the soil, and the foundation concrete.

Following a special inspection of SSFL Area IV by EPA Region IX in July 1989, a sample of water taken from the Building T059 french drain was reported by EPA to have shown 1,890 ± 538 (2 sigma) pCi/L of tritium (H-3). This concentration is far below the limits established by the U.S.

Table 5-5. Radioactivity in Groundwater at SSFL and Canoga – 1990 and 1989

	Activity (pCi/L)																	
	H-3	Co-60	Sr-90	Cs-137	Pb-210	Po-210	Ra-226	Ra-228	Th-228	Th-230	Th-232	Uranium	U-234	U-235	U-238	Pu-239	Gross Alpha	Gross Beta
Maximum Permissible Concentration	3,000,000	30,000	300	20,000	100	700	30	30	7,000	2,000	2,000	20,000	30,000	30,000	40,000	5,000	30	300
SSFL 1990																		
Maximum	839			5.12									-	–	–		28.70	13.10
Mean	110	ND		0.06									15.7	1.4	16.8		5.99	5.45
Minimum	-80			-5.61									-	-	–		0.28	-1.05
Number of analyses	49			37									1	1	1		60	60
SSFL 1989																		
Maximum	699	4.27		4.70	0.97	0.175	1.09	2.32	0.149	0.080	0.066	30.8	15.60	0.63	14.10	-	42.30	56.10
Mean	-1	1.28		0.55	0.39	0.049	0.60	1.29	0.051	0.015	0.022	26.5	3.93	0.13	3.43	0.002	7.64	9.61
Minimum	-258	-1.00		-4.36	0.04	0.005	0.00	0.69	0.020	0.000	0.000	22.2	0.89	0.01	0.71	–	-1.00	-0.50
Number of analyses	74	8		47	10	10	12	12	10	10	10	2	11	11	11	6	137	137
Canoga 1990																		
Maximum							0.165	0.68					28.60	1.16	28.40		45.10	17.70
Mean							0.095	0.44					21.10	0.94	21.40		32.38	13.35
Minimum							0.047	0.22					17.90	0.82	19.00		24.40	11.20
Number of analyses							4	4					4	4	4		4	4
Canoga 1989																		
Maximum			0.05	4.53			0.184	1.29					31.20	1.17	29.50		65.00	12.50
Mean			0.00	0.12			0.105	0.45					21.96	0.85	21.60		43.49	7.79
Minimum			-0.05	-3.70			0.030	0.06					14.60	0.53	14.40		20.90	4.60
Number of analyses			6	16			16	16					16	16	16		16	16

MPC values for gross alpha and beta activity are selected as the most restrictive limits for radionuclides possibly present.
ND = Not detected

Table 5–6. Radioactivity in Facility Groundwater

	Activity (pCi/L)		
	H-3	Gross Alpha	Gross Beta
Maximum Permissible Concentration	3,000,000	30	300
T059			
Maximum	1,190	55.6	21.00
Mean	757	15.0	9.09
Minimum	411	-20.6	-9.50
Number of analyses	4	62	62
T024			
Maximum	-	142.67	28.00
Mean	65	28.02	8.72
Minimum	-	-5.79	-8.90
Number of analyses	1	6	6

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NRC (10 CFR 20, Appendix B) and the State of California (CCR 17, Appendix A) for tritium in water released to an unrestricted area, 3,000,000 pCi/L, and the limit established by DOE in February 1990 (DOE Order 5400.5) of 2,000,000 pCi/L for ingested water.

The possible production of tritium in the concrete surrounding the SNAP reactor in Building T059 was considered in 1973 during the planning for decontamination of this facility. This production results from absorption of neutrons escaping from the reactor during operation and their capture in lithium that is naturally present in the granite aggregate of the concrete. The expected amounts were so low, and so low compared to other activation products, that it was not necessary to specifically analyze for tritium in this project. This decision is supported by a provision in the Federal and State regulations on radioactivity that permits a material to be considered "not present" if its concentration is less than 0.1 of the maximum permissible concentration (a concentration of 300,000 pCi/L in this case).

An investigation of the occurrence of natural radioactivity in the groundwater and soil and rock at SSFL was recently completed by Groundwater Resources Consultants, Inc. ("Area IV Radiological Investigation Report—Santa Susana Field Laboratory—Rockwell International Corporation—Rocketdyne Division," 23 March 1990). These studies addressed gross alpha and gross beta radioactivity, gamma emitters, and, in some cases, uranium and plutonium isotopes. One finding in this survey was a detection of tritium in groundwater from a deep well (RD-23) near the Building T886 former Sodium Disposal Facility, amounting to 589 ± 267 pCi/L. There is no known or suspected

source of tritium in this area. The amount found is well below the State of California regulatory limit of 3,000,000 pCi/L.

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 5-7.

Comparison of the radioactivity concentrations in water from the ponds with that of the supply water (see Table 5-9) shows no significant differences in either alpha or beta activity.

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.

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 5-7. SSFL Surface Water Radioactivity Data – 1990

	Activity (pCi/L)					
	H-3	K-40	Cs-137	Pb-212	Gross Alpha	Gross Beta
Maximum Permissible Concentration	3,000,000	-	20,000	20,000	30	300
Surface water						
Maximum	•	-	3.30	-	7.40	7.00
Mean	•	98.6	-0.18	8.04	2.55	3.96
Minimum	•	-	-3.23	-	-0.06	0.87
Number of analyses	4	1	11	1	21	21

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*Less than detection limit of 1,000 pCi/L. Reported as 0 ± 1,000 pCi/L.

Table 5–8. SSFL Rainfall Runoff Radioactivity Data – 1990 (Five Locations, Sampled After Rainfall)

	Activity (pCi/L)				
	H–3	Cs–137	Pb–212	Gross Alpha	Gross Beta
Maximum Permissible Concentration	3,000,000	20,000	20,000	30	300
Northwest Runoff					
Maximum	162	5.17	–	2.00	40.0
Mean	8	0.08	–	0.56	9.0
Minimum	–95	–3.29	22.0	–0.76	–1.0
Number of analyses	25	9	1	41	41

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The MPC/DCG values are dependent on the radionuclide and its behavior as a soluble or an insoluble material. For comparison with results of environmental and effluent monitoring, the single lowest value for the various radionuclides present is selected rather than a derived concentration limit for the mixture. Accordingly, for SSFL site surface water, the guide values of 5×10^{-6} μCi/mL (5,000 pCi/L) alpha activity corresponding to Pu–239 for licensed facilities and 3×10^{-8} μCi/mL (30 pCi/L) for DOE operations, and 3×10^{-7} μCi/mL (300 pCi/L) beta activity corresponding to Sr–90 for licensed facilities and 1×10^{-6} μCi/mL (1,000 pCi/L) for DOE operation are used. The SSFL site surface water and the ambient air radioactivity concentration guide values selected for each site are the most restrictive limits for those radionuclides currently in use at Rocketdyne facilities and should not be taken to indicate the actual identification of these radionuclides in the samples.

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 1989–90 are shown in Table 5–9. (Tritium values include results from a series of high–sensitivity tests obtained by Rocketdyne.)

Table 5–9. Domestic Water Supplies (1989–90) 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	36	–	–	–	–	7.00	11.0	24.0
Mean	–18	<2	ND	<1	<1	2.60	2.21	6.58
Minimum	–150	–	–	–	–	0.00	–5.5	0.9
Number of sources	4	10	2	9	7	8	12	10

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The message presented in the annual reports of the local suppliers of domestic water is that the water complies completely with the primary (health–related) standards, and only slightly or occasionally deviates from the secondary (aesthetic) standards.

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 5–10, with 1989 results for comparison. The 1989 results include analyses performed as part of a project to identify natural radioactivity in the environment. In 1990, the emphasis returned to analyzing for nonnatural radionuclides.

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. A minor amount presumably remains from the Chernobyl reactor accident. No atmospheric nuclear weapons tests or other releases with global effects were announced during 1990. Naturally occurring radionuclides include K–40 and the uranium and thorium series (including radon and daughters). The radionuclide composition of local area surface soil has been determined to be predominantly K–40, natural thorium, and natural uranium, both in secular equilibrium with daughter nuclides. 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 1989 samples were taken as part of a special investigation of naturally occurring radioactivity at SSFL, and areas associated with nuclear operations were deliberately avoided. The 1990 samples were taken during cleanup operations and routine surveillance of contaminated areas. Except for a slightly elevated concentration of Cs–137 in the contaminated areas, and a higher gross alpha activity for the 1990 samples, there are no noteworthy differences.

Table 5–10. SSFL Rock and Soil Radioactivity Data – 1990 and 1989

	Activity (pCi/g)																
	K–40	Sr–90	Cs–137	Pb–210	Po–210	Pb–212	Pb–214	Ra–226	Ra–228	Th–228	Th–230	Th–232	U–234	U–235	U–238	Pu–239	Gross Alpha	Gross Beta
SSFL rock and soil, 1990																		
Maximum	27.88		15.34			1.79	1.13	2.50				1.47		0.11	1.40		38.40	25.43
Mean	22.07		1.70			1.38	0.87	1.60				1.17		0.07	1.18		34.16	25.08
Minimum	16.41		0.00			1.01	0.71	0.82				0.98		0.04	1.04		30.40	24.82
Number of analyses	16		15			9	12	11				4		10	4		3	3
SSFL rock and soil, 1989																		
Maximum	26.60	-	0.64	2.23	1.77	2.23	1.36	1.23	2.31	2.16	1.63	2.28	1.53	0.09	1.74		9.01	39.80
Mean	24.10	0.17	0.10	1.48	1.32	1.48	0.98	0.96	1.45	1.67	1.35	1.54	1.22	0.04	1.25	0.00	6.45	32.05
Minimum	21.10		0.04	0.82	0.77	0.85	0.69	0.66	0.81	1.21	1.09	1.14	0.69	0.01	0.77		3.93	24.70
Number of analyses	10	1	10	11	11	11	11	11	11	11	11	11	11	11	11	1	10	10

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The natural origin of possibly nonnatural radioactive materials such as thorium and uranium is 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 indicate 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. During 1990, cattails were sampled from a marshy area watered by groundwater near Building T024. The results are shown in Table 5–11, with a summary of data from a nationwide survey of fireplace wood ash, for comparison.

Table 5–11. Vegetation Radioactivity

	Activity (pCi/g)							
	Be–7	K–40	Co–60	Cs–137	Pb–212	Pb–214	Ra–226	U–235
Vegetation								
Maximum	–	–	–	–	–	–	–	–
Mean	5.10	281.0	0.4	ND	4.60	0.60	6.8	0.32
Minimum	–	–	–	–	–	–	–	–
Number of analyses	1	1	1	1	1	1	1	1
Wood ash								
Maximum	1.45	154.3		21.10				
Mean	0.93	78.6	NR	5.97	NR	NR	NR	NR
Minimum	0.44	8.6		0.08				
Number of analyses	4	20		22				

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ND = Not detected
NR = Not reported

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 results show no indication of radioactive contamination.

5.2.6 Radiation

Standard thermoluminescent dosimeters (TLDs) using lithium fluoride (LiF) are placed, in pairs, at locations near the site boundaries at SSFL, De Soto, and Canoga, and at five off–site locations. These are processed on a quarterly basis by a contractor laboratory and the paired results are

Table 5-12. On-site Wildlife Radioactivity Data – 1990

	Activity (pCi/g)	
	K-40	U-238
Wildlife, 1990		
Maximum	1.37	0.11
Mean	1.35	0.09
Minimum	1.33	0.08
Number of analyses	5	3

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averaged for each location. These results are shown in Table 5-13, and include the contributions due to natural background radiation (about 60 mrem/yr, as measured by these TLDs). These results show compliance with the annual limits of NRC and the State RHB (500 mrem/yr) and the DOE (100 mrem/yr for extended exposure), above natural background. On the whole, data for the third quarter (Q-3) seem to be unusually high. This was due to the inadvertent omission of a "control" TLD to measure and correct for exposure of the TLDs during transit from and to the processing laboratory. A high reading (120 mrem including background) is seen for location CA-1 in the third quarter. No cause has been identified for this exposure, but it is well below the applicable limit.

The Radiologic Health Branch (RHB) of the State of California Department of Health Services (DHS) 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 5-13. The differences between exposure rates determined by Rocketdyne and the State may be due to differences in the precision with which the results are reported, and differences in gamma-radiation energy response for the two different dosimeter materials. The Rocketdyne vendor reports these results to the nearest 10 mrem, while the State vendor reports results to the 0.1 mrem.

Table 5-13 shows that radiation exposures and equivalent annual exposure rates monitored on-site are nearly identical to levels monitored at the five widely separated 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 60 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.

Table 5-13. De Soto, SSFL, and Canoga Sites—Ambient Radiation Dosimetry Data—1990*

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-1	10.0	10.0	40.0	10.0	70.0	8.0	
	DS-2	10.0	10.0	10.0	10.0	40.0	4.6	9.9
	DS-3	10.0	10.0	30.0	10.0	60.0	6.8	
	DS-4	15.0	10.0	35.0	10.0	70.0	8.0	
	DS-5	10.0	10.0	40.0	10.0	70.0	8.0	
	DS-6	20.0	10.0	15.0	10.0	55.0	6.3	9.8
	DS-7	10.0	10.0	40.0	10.0	70.0	8.0	
	DS-8	10.0	10.0	10.0	10.0	40.0	4.6	10.0
	DS-9	10.0	10.0	10.0	10.0	40.0	4.6	
Mean value		11.7	10.0	25.6	10.0	57.2	6.5	9.9
SSFL	SS-1	10.0	10.0	40.0	10.0	70.0	8.0	
	SS-2	10.0	15.0	40.0	10.0	75.0	8.6	
	SS-3	10.0	10.0	45.0	25.0	90.0	10.3	18.0
	SS-4	15.0	10.0	10.0	10.0	45.0	5.1	
	SS-5	10.0	10.0	35.0	10.0	65.0	7.4	
	SS-6	10.0	10.0	15.0	10.0	45.0	5.1	11.7
	SS-7	15.0	10.0	10.0	15.0	50.0	5.7	10.8
	SS-8	15.0	10.0	(10.0)[a]	20.0	55.0[b]	6.3	
	SS-9	10.0	10.0	10.0	20.0	50.0	5.7	
	SS-10	10.0	10.0	40.0	10.0	70.0	8.0	
	SS-11	10.0	10.0	10.0	10.0	40.0	4.6	
	SS-12	30.0	20.0	30.0	30.0	110.0	12.6	17.4
	SS-13	10.0	20.0	10.0	20.0	60.0	6.8	
	SS-14	10.0	20.0	10.0	20.0	60.0	6.8	
Mean value		12.8	11.6	25.2	15.2	62.8	7.2	14.5
Canoga	CA-1	15.0	10.0	120.0	10.0	155.0	17.7	
	CA-2	10.0	10.0	35.0	15.0	70.0	8.0	
	CA-3	15.0	10.0	35.0	10.0	70.0	8.0	
	CA-4	10.0	10.0	25.0	10.0	55.0	6.3	
	CA-5	10.0	10.0	30.0	10.0	60.0	6.8	
	CA-6	10.0	10.0	30.0	10.0	60.0	6.8	
Mean value		11.7	10.0	45.8	10.8	78.3	8.9	-
Off-site	OS-1	25.0	10.0	15.0	15.0	65.0	7.4	8.3
	OS-2	15.0	(10.0)[a]	40.0	10.0	75.0[b]	8.6	
	OS-3	10.0	15.0	35.0	10.0	70.0	8.0	
	OS-4	15.0	10.0	40.0	10.0	75.0	8.6	
	OS-5	10.0	10.0	10.0	10.0	40.0	4.6	7.7
Mean value		15.0	11.0	28.0	11.0	65.0	7.4	8.0

[a]Missing dosimeter. Assumed value in parentheses.

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[b]Adjusted to full year to compensate for missing dosimeters.

*Includes natural background radiation of approximately 60 mrem per year.

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, 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, EPA, NRC, and the State of California.

The external exposures, above background, are based on the averaged off-site exposure measurements. The mean value for five off-site dosimeters was 65 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 "property line" exposure of about 45 mrem 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 during the year.

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 5-14A through 5-14C. These tables present the estimated exposures in comparison to the regulatory standards and that received due to natural radioactivity in the environment.

Figure 5-3 shows the arrangement of the census tract boundaries from the 1980 census. Some of these tracts have been further subdivided for the 1990 census. Figures 5-4 through 5-6 show local population distribution estimates that were determined from the 1990 Federal census by Urban

Table 5-14A. Public Exposure to Radiation and Radioactivity from DOE Operations at SSFL—1990

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

1. All pathways		
a. Maximum estimated external dose to an individual		2×10^{-4} mrem/yr
b. Maximum estimated internal dose to an individual		1.2×10^{-6} mrem/yr
Total		2×10^{-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		1.2×10^{-6} mrem/yr
Limit (40 CFR 61, Subpart H)		10 mrem/yr

Natural Exposure to Average Member of U.S. Public

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

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Table 5-14B. Public Exposure to Radiation and Radioactivity from Rocketdyne Operations—1990

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		2.4×10^{-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		6.5×10^{-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 5–14C. Public Exposure to Radiation and Radioactivity from Rocketdyne Operations—1990

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

1. Direct radiation at boundary		0 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		2×10^{-19} 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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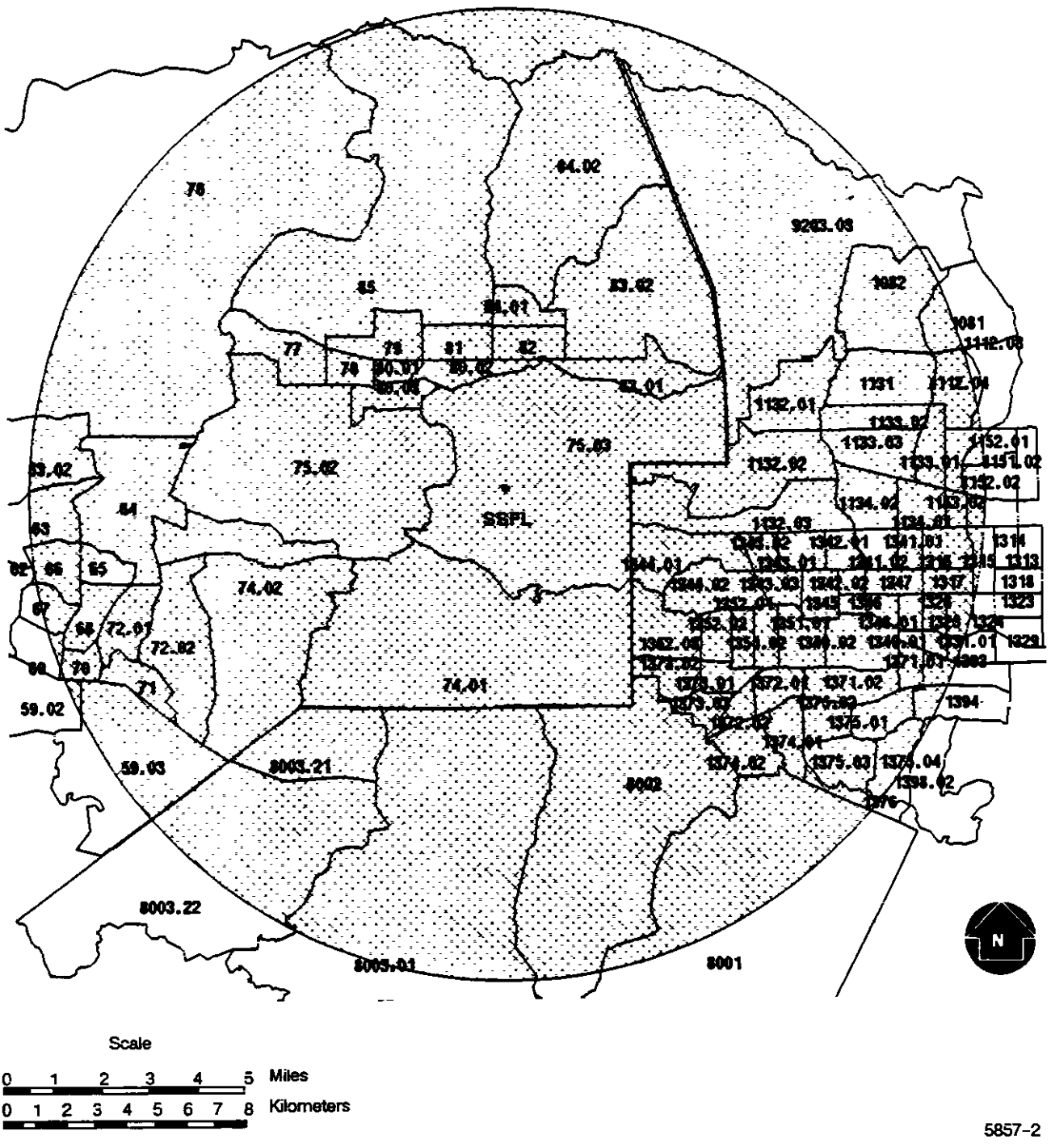

Figure 5–3. Census Tract Boundaries (1980) within 10 miles of SSFL (Individual tracts are identified by number)

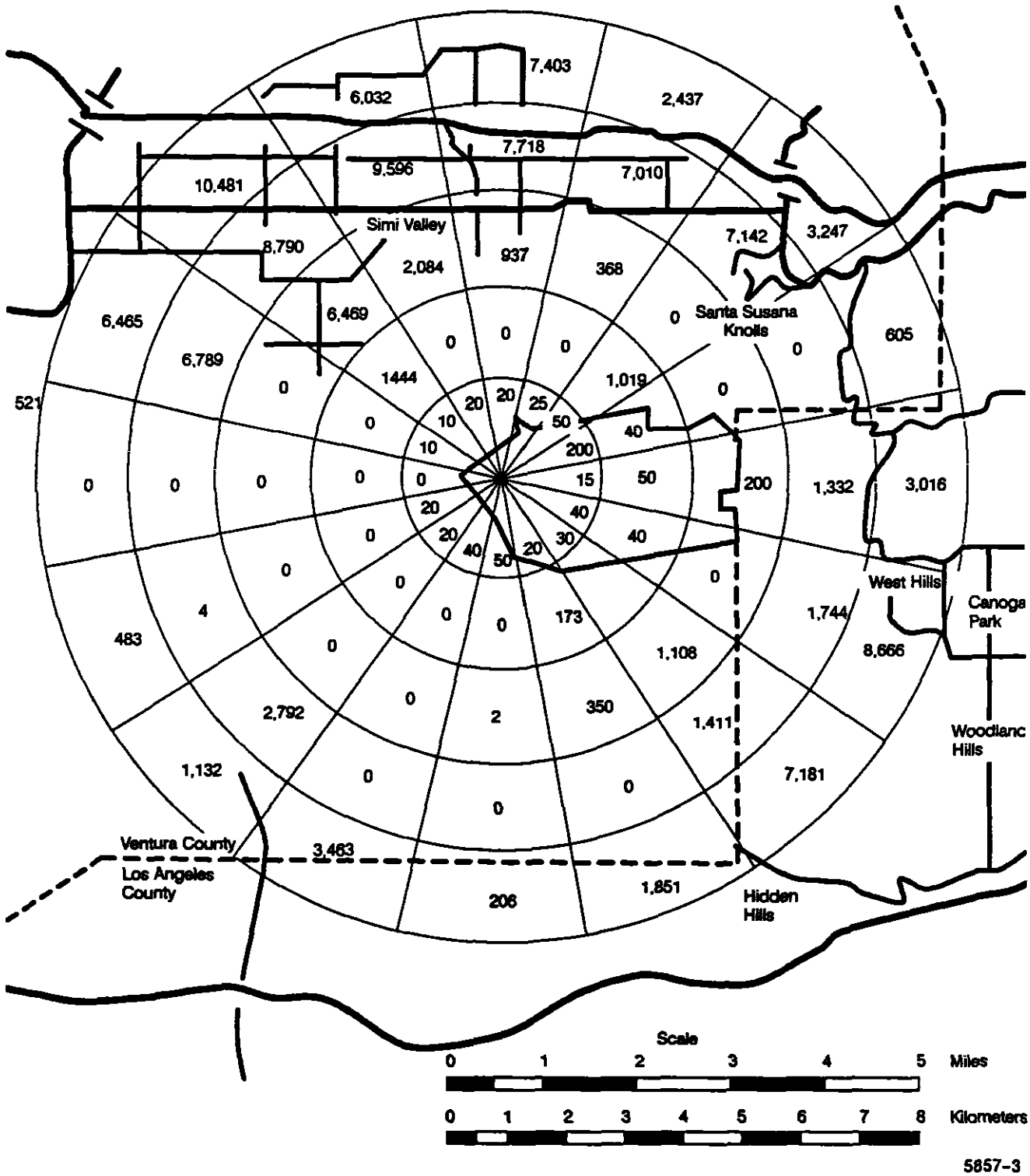

Figure 5–4. SSFL Site–Centered Demography to 8 km, Showing Number of Persons Living in Each Grid Area (Daytime Employment for SSFL)

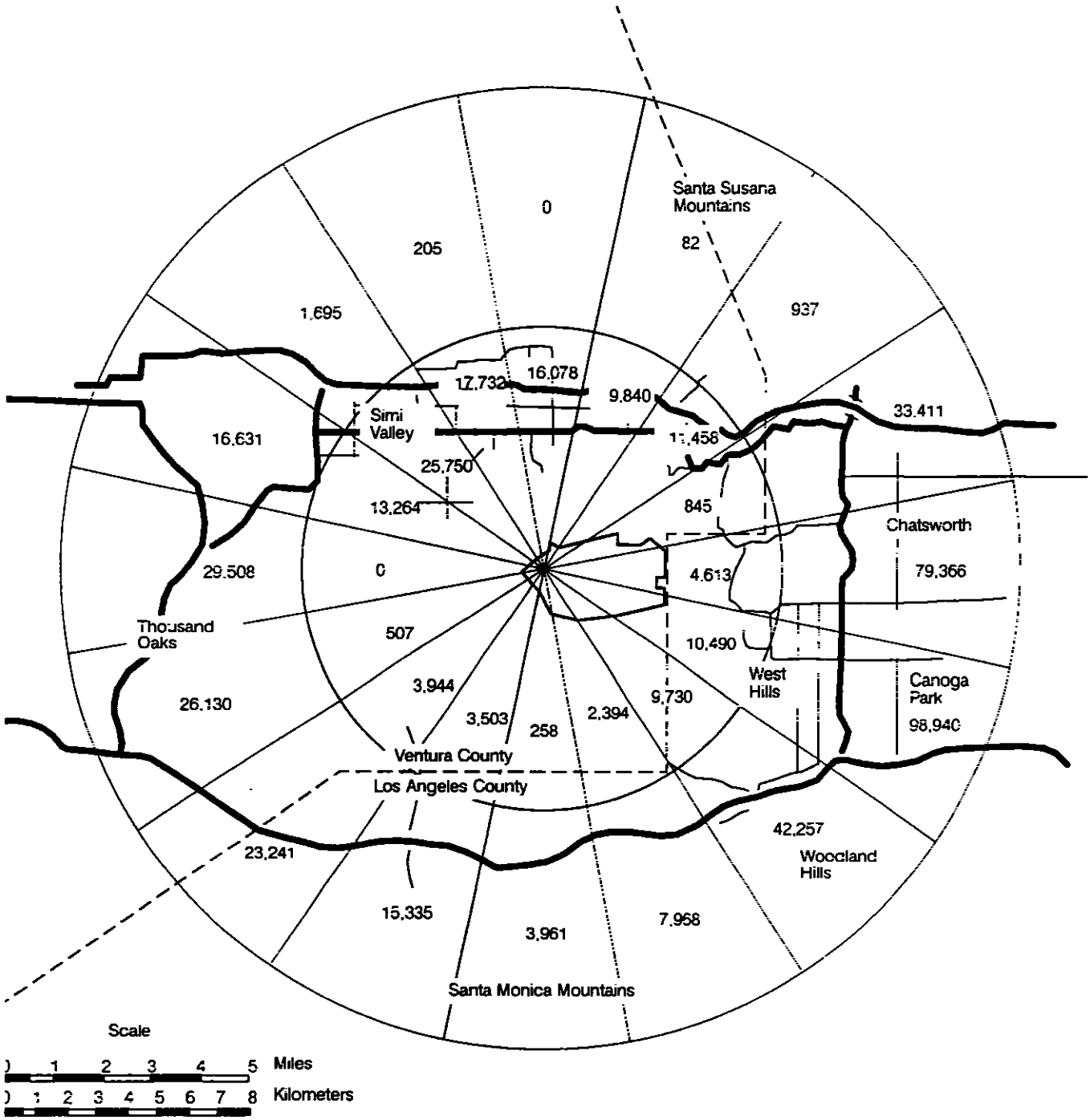

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Figure 5-5. SSFL Site-Centered Demography to 16 km, Showing Number of Persons Living in Each Grid Area

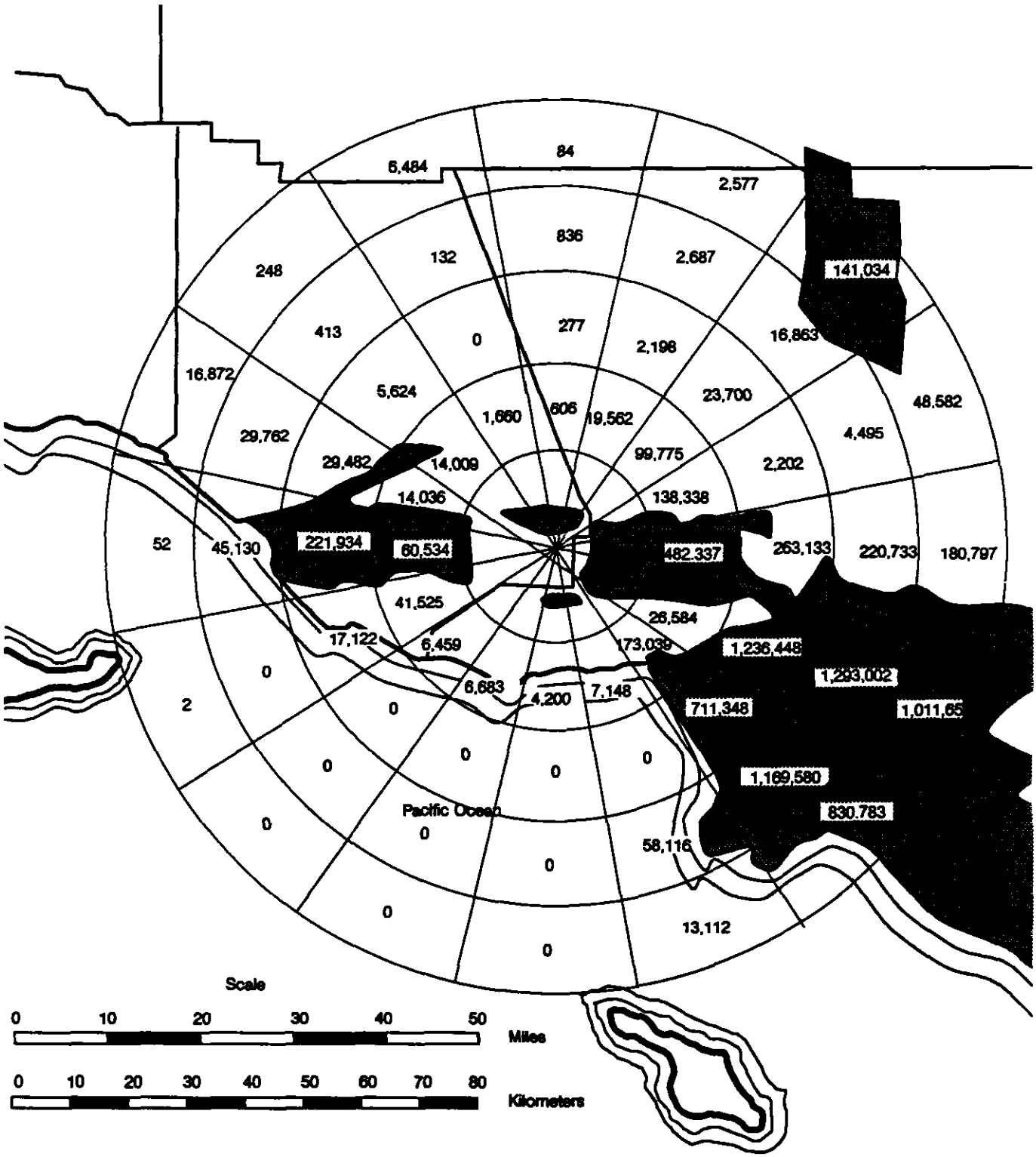

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Figure 5–6. SSFL Site–Centered Demography to 80 km, Showing Number of Persons Living in Each Grid Area (heavily populated areas are shown by shading)

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 AIRDOS-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 5-15. 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.

Table 5-15. Population Dose Estimates for Atmospheric Emissions from SSFL Facilities – 1990
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	3.6E-07	0	2.4E-09	5.0E-10	9.2E-10	6.8E-11	3.7E-07
NNE	1.6E-07	5.6E-10	4.8E-08	3.7E-09	2.5E-09	1.3E-09	2.2E-07
NE	1.1E-07	3.1E-09	1.5E-07	2.2E-08	8.9E-09	5.4E-08	3.5E-07
ENE	1.3E-08	8.8E-08	1.6E-07	1.3E-09	1.7E-09	1.3E-08	2.8E-07
E	1.5E-08	1.2E-07	3.3E-07	9.7E-08	4.8E-08	2.5E-08	6.4E-07
ESE	3.3E-07	1.7E-06	2.0E-06	4.6E-06	3.1E-06	1.6E-06	1.3E-05
SE	6.2E-07	1.4E-06	1.9E-06	5.2E-06	5.3E-06	2.5E-06	1.7E-05
SSE	5.5E-08	8.7E-08	3.7E-08	0	9.6E-08	1.8E-08	2.9E-07
S	1.2E-06	4.1E-06	2.2E-06	0	0	0	7.5E-06
SSW	4.3E-08	1.2E-07	1.9E-08	0	0	0	1.9E-07
SW	6.3E-08	1.7E-07	2.8E-08	0	0	0	2.6E-07
WSW	6.9E-09	1.5E-07	1.4E-07	2.2E-08	0	1.5E-12	3.1E-07
W	0	1.0E-07	8.3E-08	1.5E-07	2.1E-08	1.1E-11	3.5E-07
WNW	8.1E-07	4.4E-07	2.5E-07	2.1E-07	1.0E-07	3.4E-08	1.8E-06
NW	3.4E-06	1.3E-07	2.8E-07	7.9E-08	3.3E-09	9.4E-10	3.9E-06
NNW	1.3E-06	9.6E-09	2.9E-08	0	6.2E-10	1.4E-08	1.4E-06
Totals	8.5E-06	8.6E-06	7.7E-06	1.0E-05	8.6E-06	4.3E-06	4.8E-05

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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 1.9E+06 person-rem.

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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 is removing solvent contamination from approximately one million gallons of groundwater per day at SSFL. Most former surface impoundments have been closed and are in the closure approval process with the California Department of Health Services. 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 problems do not pose a threat to the public welfare or environment. Results from the monitoring program show that contamination at the SSFL is contained on-site and a continuous monitoring program ensures that the contamination does not pose any risk to employees or to the public. 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.

The overall annual groundwater monitoring program at SSFL addresses collection and analysis of groundwater samples and measurement of the water levels for the 147 on-site and 13 off-site wells. The locations of these wells are shown on the map of SSFL in Figure 6-1. Groundwater quality parameters and sampling frequency have been determined based on historical water quality data, location of known or potential sources of groundwater contamination, and operational requirements of groundwater extraction and treatment systems. The groundwater monitoring program includes the following parameters, all analyzed using the appropriate EPA methods: volatile organic constituents, base neutrals and acid extractable organic compounds, petroleum hydrocarbons, and trace metals and common ion constituents.

A recent hydrogeologic study at SSFL describes 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.

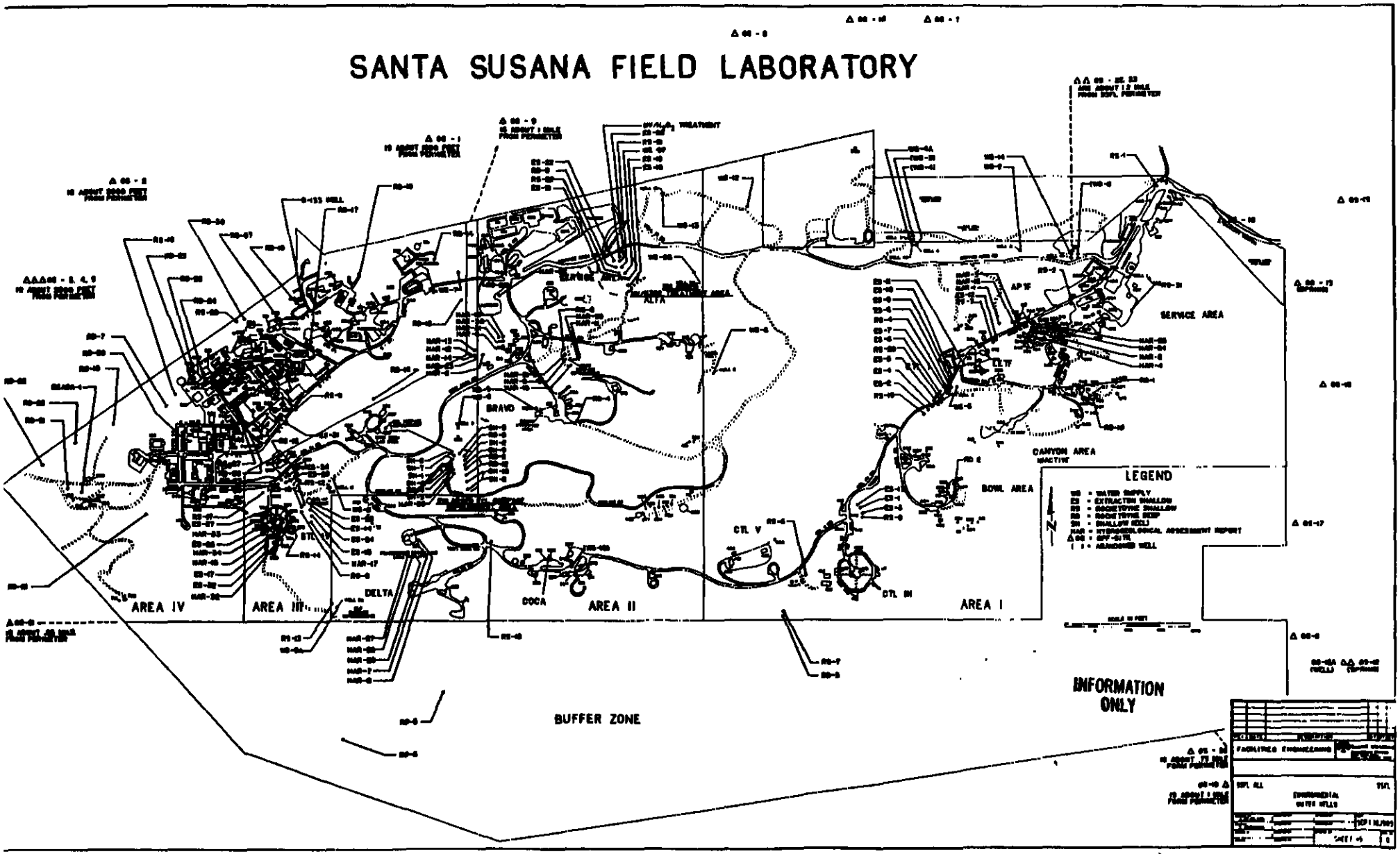

Figure 6–1. Locations of Wells Used in Groundwater Management Program

The Chatsworth formation is composed of well-consolidated, massively bedded sandstones with interbedded layers of siltstone and claystone. The layer 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 are difficult to predict on the basis of on-site well data. The most likely pathways are along fracture zones that trend off-site.

Surface water discharges are usually rain induced and analyses are conducted on samples collected in the runoff, as identified in the monitoring plan for the northwest slope of Area IV. Nearly all rainfall runoff at SSFL drains to the south and is collected in the surface water system. A very small portion of the site produces minor runoff across the northwest boundary following heavy rains. Catch basins were installed in five runoff channels in the fall of 1989. These locations are shown on the map in Figure 6-2. The analyses include the metals lead, zinc, chromium, beryllium, arsenic, cadmium, mercury, nickel, and copper (and applicable radionuclides by an outside laboratory). Surface water for the remainder of SSFL is regulated under an NPDES permit.

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.

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 biweekly newspaper to promote environmental awareness among all employees.

An update of the Spill Prevention Control and Countermeasure (SPCC) plan was started in 1988. 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. The SPCC plan for SSFL facilities, including ETEC facilities, is currently under review for updating purposes by Rocketdyne Division. Additional comments provided by the Ventura County Health Department have been included into the plan. Final approval of the plan is scheduled for TBD.

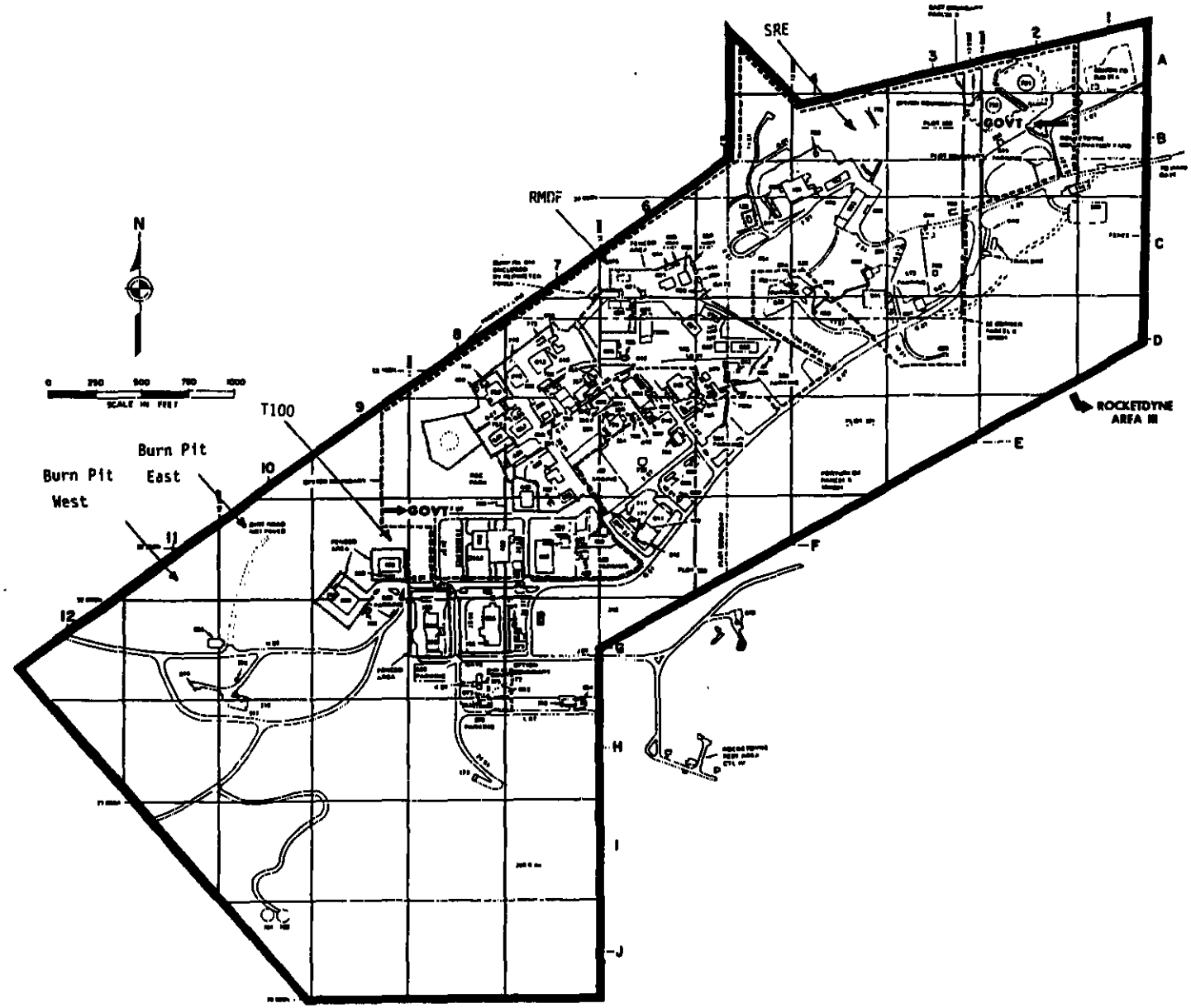

Figure 6–2. Locations of Rainfall Runoff Collectors Along Northwest Boundary of SSFL, Area IV

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

The Rocketdyne Division of Rockwell International Corporation has filed a Report of Waste Discharge with the California RWQCB and has been granted a NPDES permit to discharge waste water, pursuant to Section 402 of the Federal Water Pollution Control Act. The permit, NPDES No. CA0001309, which became effective 27 September 1976, was renewed with minor changes effective 17 September 1984. This permit covers discharge of overflow and storm runoff from water reclamation retention ponds into Bell Creek. Discharge generally occurs only during and immediately after periods of heavy rainfall or during extended periods of rocket engine testing that release large amounts of cooling water to the ponds. An application to revise the existing NPDES permit and waste discharge requirements was filed by Rocketdyne on 15 December 1988. This permit continues in effect and is shown in Appendix A. To date, a new permit and new waste discharge requirements have not been developed by the RWQCB.

Only one of the retention ponds receives influent from Area IV of the SSFL site. It is identified as retention pond R-2A in Table 6-1. The other final retention pond is identified as Perimeter Pond.

The influent includes sewage treatment plant outfall, cooling water from various testing operations, and surface runoff water. Grab-type water samples taken at the retention pond prior to a discharge are analyzed by a California State certified analytical testing laboratory for nonradioactive chemical constituents and for radioactivity. The NPDES permit, shown as Appendix A, lists specific constituents which are analyzed, as well as their respective limitations in discharged wastewater. Wastewater originating from facilities located throughout the SSFL site is collected at the retention pond. The point of origin of small amounts of most nonradioactive constituents normally found in wastewater is difficult to determine. If excessive amounts of any of these materials were found in wastewater, their origin could be determined from the knowledge of facility operations involving their use. Discharge from these ponds are sampled and analyzed to show compliance with the permit.

Table 6–1. 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	15	< 5	9.5	26	6	< 5	7.8	20
Boron	1	15	0.10	0.12	0.20	6	0.07	0.10	0.20
Chloride	150	15	13.0	52.1	77.4	6	8.4	50.9	88.2
Fluoride	1	15	0.10	0.43	0.60	6	0.10	0.40	0.50
Grease and Oil	15	15	0.10	35.1	516	6	0.20	1.0	1.6
Arsenic	0.05	15	< 0.01	0.01	0.01	6	, < 0.01	0.01	< 0.02
pH	6–9	15	7.6	8.6	9.4	6	7.6	8.4	9.1
Residual chlorine	0.1	15	< 0.04	< 0.04	< 0.04	6	< 0.04	< 0.04	< 0.04
Settleable solids	0.3	15	< 0.1	0.10	0.12	6	< 0.1	< 0.1	0.10
Sulfate	300	15	35	108.5	146	6	20	101.5	160
Suspended solids	150	15	6.5	19.6	53.0	6	8.5	15.8	31.0
Surfactants	0.05	15	< 0.02	0.09	0.50	6	< 0.02	0.04	0.10
Temperature (°C)	37.8	15	7.2	16.5	24.4	6	12.2	15.8	21.5
Total dissolved solids	950	15	143	579	680	6	116	462	654
Toxicity	90%	15	100%	100%	100%	6	100%	100%	100%
Turbidity	—	15	3	10.1	42	6	5.04	12.8	35

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A surface water runoff sampling program was developed and implemented in November 1989 for Area IV, which is the northwest portion of the SSFL. The locations selected for sampling were the runoff channels past the former Sodium Disposal Facility (SBP1 and SBP2), behind T100, along the north side of RMDF, and the SRE watershed.The results of analyses of water samples collected for several rainstorms during 1990 are shown in Table 6–2.

6.2 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 California DHS [Region 3/Burbank] as lead agency in July 1989.) During the past 5 years, a network that now consists of 147 on-site wells has been completed. There are 87 of these are in the Shallow Zone, and 60 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

Table 6-2. Analytical Results for Northwest Rainfall Runoffs (Sheeet 1 of 2)

Constituent	Limit	SBP1 Number of Samples	Minimum	Mean	Maximum	SBP2 Number of Samples	Minimum	Mean	Maximum
BOD	30	0				0			
Boron	1	4	0.10	0.10	0.10	3	0.07	0.10	0.20
Chloride	150	4	5.9	8.0	11.0	3	8.4	50.9	88.2
Fluoride	1	4	< 0.1	0.20	0.30	3	0.10	0.40	0.50
Grease and oil	15	4	< 1	< 1	< 1	3	0.20	1.0	1.6
Arsenic	0.05	4	< 0.01	< 0.01	< 0.01	3	< 0.01	0.01	< 0.02
pH	6–9	5	7.4	8.2	8.8	3	7.6	8.4	9.1
Residual chlorine	0.1	4	< 0.04	< 0.04	< 0.04	3	< 0.04	< 0.04	< 0.04
Settleable solids	0.3	0				0			
Sulfate	300	4	8	16.5	27	3	20	101.5	160
Suspended solids	150	0				0			
Surfactants	0.05	4	0.03	0.06	0.10	3	< 0.02	0.04	0.10
Temperature (°C)	37.8	0				0			
Total dissolved solids	950	0				0			
Toxicity	90%	2	100%	100%	100%	2	100%	100%	100%
Turbidity	—	0				0			

Constituent	Limit	B100 Number of Samples	Minimum	Mean	Maximum	RMDF Number of Samples	Minimum	Mean	Maximum
BOD	30	0				0			
Boron	1	4	< 0.1	0.10	0.20	4	< 0.1	< 0.1	0.10
Chloride	150	4	2.6	7.5	13.0	4	1.1	4.6	6.3
Fluoride	1	4	< 0.1	0.10	0.20	4	< 0.1	0.10	0.30
Grease and oil	15	4	< 1	< 1	< 1	4	< 1	< 1	< 1
Arsenic	0.05	4	< 0.01	< 0.01	< 0.01	4	< 0.01	< 0.01	< 0.01
pH	6–9	5	7.0	8.5	9.4	5	7.1	9.1	10.3
Residual chlorine	0.1	4	< 0.04	< 0.04	< 0.04	4	< 0.04	< 0.04	< 0.04
Settleable solids	0.3	0				0			
Sulfate	300	4	9	25.8	55	4	10	20.0	36
Suspended solids	150	0				0			
Surfactants	0.05	4	< 0.02	0.04	0.06	4	0.02	0.07	0.20
Temperature (°C)	37.8	0				0			
Total dissolved solids	950	0				0			
Toxicity	90%	2	100%	100%	100%	3	100%	100%	100%
Turbidity	—	0				0			

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

Constituent	Limit	SRE Number of Samples	Minimum	Mean	Maximum
BOD	30	0			
Boron	1	4	<0.1	<0.1	0.10
Chloride	150	4	4.6	8.2	11.0
Fluoride	1	4	<0.1	0.10	0.30
Grease and oil	15	4	<1	<1	<1
Arsenic	0.05	4	<0.01	<0.01	<0.01
pH	6-9	5	6.9	8.2	9.7
Residual chlorine	0.1	4	<0.04	<0.04	<0.04
Settleable solids	0.3	0			
Sulfate	300	4	6	25.8	60
Suspended solids	150	0			
Surfactants	0.05	4	0.03	0.08	0.20
Temperature (°C)	37.8	0			
Total dissolved solids	950	0			
Toxicity	90%	2	100%	100%	100%
Turbidity		0			

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surface impoundment closures. (There are no RCRA surface impoundments in Area IV.) Subsurface 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 six remedial water treatment systems operating. The combined treatment capacity of these systems is nearly 1,000,000 gal of solvent-contaminated water per day. The ultraviolet light/hydrogen peroxide treatment unit (UV/H_2O_2) was activated in January 1990. The five air stripping tower systems include those at the Area I Road (Bowl), Alfa, Bravo, Canyon, and Delta sites. The combined pumping total of these remediation units has resulted in treatment of 129 million gal of solvent-contaminated water since 1987. The summaries of the water quality results for the treatment systems are included in the bimonthly 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 and the contamination, to date, has been contained on-site.

In July and August 1989, 17 deep wells and 2 shallow wells were constructed in Area IV. Plans are in progress to batch the solvent-contaminated waters of these low-producing wells (about 1 gpm) and transport them to the Batch Facility UV/H_2O_2 Treatment System which is situated at the side of the Area II Service Road. The bulk of the Area IV shallow groundwater is seasonal and dependent upon rain/natural drainage patterns. Groundwater has been encountered consistently in only three shallow zone wells (RS-11, ES-31, and the newest RS well, RS-28). The surface water sampling occurs rarely because it is rain-prompted. Documentation of these rainfall events since November 1989 has been submitted to the RWQCB (Los Angeles area). Insufficient runoff was collected in 1989 to permit analysis for chemical constituents.

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. 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 1989, Rocketdyne requested permission of the Brandeis-Bardin organization to drill two additional off-site wells nearer the Area IV border, between Rocketdyne and their property. To date, none of the existing Brandeis-Bardin wells in the direction of the groundwater flow have shown any evidence of contamination. Brandeis-Bardin is considering the Rocketdyne request for more drilling on their property.

In addition to the wastewater discharge limitations, atmospheric pollutant discharge limitations are imposed by VAPCD Permit 0271 on several natural-gas/oil-fired sodium heaters operated by ETEC for component testing. The limitations for 1989 are 9.46 tons/yr for reactive organic compounds, 140.06 tons/yr for oxides of nitrogen, 3.05 tons/yr for particulates, 0.60 tons/yr for oxides of sulfur, and 37.44 tons/yr for carbon monoxide. These limits were increased by the District to reflect the results of source testing performed by KVB, Inc. on the H-1 and H-2 heaters. No operations resulted in emissions exceeding these limits. These limits may be modified during 1990 due to planned changes on hardware for H-1, H-2, and H-101 gas-fired boilers. The facility was inspected by the VAPCD in November 1989 as part of its routine semiannual inspection program. No violations were cited relative to DOE operations.

There were no draft or final environmental impact statements or reports, site assessments, or remedial action reports produced during 1988. Additionally, there were actions taken by local authorities relative to CERCLA/SARA activities or Notices of Violation.

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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 quality control samples such as analytical duplicates, interlaboratory cross-check samples and other quality control analyses; use of standard (radioactive) reference materials to prepare working standards; 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 1990, two sets of samples were distributed: QAP XXXII and QAP XXXIII. A summary of results from QAP XXXIII 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 or better quality in most cases. In this summary, the values shown for "score" are the average ratios of the analytical result determined by each laboratory relating to the reference result (EML). Ideally, this score should equal that of the reference laboratory, 1.00. The "expected variation" is the standard deviation (uncertainty) expected for the ratios, based on estimates of uncertainty for each laboratory and the reference laboratories for each analysis.

The "observed variation" is the standard deviation of the ratios for each laboratory, relative to the average ratio for that laboratory.

The results of QAP XXXIII show that the Rocketdyne laboratory was closer to the reference laboratory (EML) than 30 of the other 42 laboratories that participated. The lowest estimate produced by the Rocketdyne laboratory was 0.85 of the reference value, while the highest was 1.26. For comparison, at the extremes, one laboratory underestimated a value by a factor of one hundred (0.01) while another overestimated by a factor of 84.66.

The observed standard deviation (the variability, or "scatter," of the observed results relative to the average) of the Rocketdyne results is relatively small, ± 0.10 ($\pm 10\%$), and close to that expected from the analytical process, ± 0.07 ($\pm 7\%$).

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Table 7–1. Summary of QAP XXXIII Results

Laboratory Identifier	Number of Results	Result Compared to Reference			Observed Standard Deviation	Expected Standard Deviation	Ratio (Obs/Exp)
		Unweighted					
		Minimum	Mean	Maximum			
EE	20	0.01	0.85	1.62	0.40	0.04	9.07
BM	22	0.71	0.87	1.11	0.15	0.14	1.04
NL	10	0.42	0.90	1.23	0.27	0.43	0.63
ML	15	0.75	0.90	1.22	0.12	0.29	0.41
UK	20	0.42	0.96	1.17	0.17	0.13	1.39
CA	12	0.76	0.96	1.12	0.11	0.05	2.10
WP	18	0.74	0.96	1.20	0.14	0.26	0.54
RG	4	0.81	0.97	1.08	0.12	0.11	1.11
AN	34	0.65	0.97	1.20	0.12	0.09	1.38
BN	23	0.40	0.98	1.16	0.17	0.07	2.64
FL	29	0.62	0.98	2.49	0.33	0.09	3.62
LL	12	0.84	1.00	1.12	0.10	0.09	1.12
EML (reference)	40	1.00	1.00	1.00		0.09	
UC	9	0.88	1.00	1.16	0.09	0.15	0.60
FN	23	0.87	1.01	1.19	0.07	0.11	0.61
AC	16	0.85	1.02	1.17	0.08	0.07	1.15
WA	36	0.11	1.03	2.43	0.35	0.32	1.10
PR	7	0.97	1.03	1.08	0.03	0.06	0.60
Rocketdyne	14	0.85	1.03	1.26	0.10	0.07	1.45
KA	11	0.83	1.03	1.19	0.10	0.10	0.97
PA	11	0.84	1.03	1.25	0.13	0.19	0.70
RI	25	0.48	1.04	1.62	0.23	0.28	0.80
AR	32	0.81	1.04	1.41	0.14	0.17	0.82
GA	9	0.91	1.05	1.19	0.10	0.12	0.79
LB	13	0.87	1.06	1.15	0.10	0.13	0.75
OR	58	0.77	1.06	2.30	0.25	0.30	0.82
IN	16	0.77	1.07	1.38	0.15	0.11	1.34
BE	26	0.89	1.08	1.26	0.09	0.20	0.44
WV	31	0.76	1.08	2.03	0.23	0.26	0.90
AS	31	0.76	1.08	2.03	0.24	0.25	0.95
EP	18	0.79	1.09	1.32	0.15	0.13	1.13
IT	35	0.83	1.12	5.14	0.70	0.20	3.45
AU	31	0.79	1.13	1.76	0.22	0.26	0.84
RE	30	0.39	1.24	3.68	0.62	0.22	2.85
NJ	15	0.85	1.27	4.62	0.93	0.38	2.47
LA	23	0.80	1.28	2.13	0.39	0.20	1.93
AL	17	0.13	1.36	7.67	1.65	0.20	8.30
EN	31	0.09	1.41	12.09	2.02	0.35	5.75
SA	1	1.41	1.41	1.41		0.16	
OS	31	0.62	1.52	11.36	2.01	0.33	6.06
BP	17	0.76	2.45	26.46	6.19	0.33	18.67
IR	4	0.55	2.85	4.47	1.87	0.04	51.24
YP	4	0.14	3.14	11.64	5.67	0.33	17.41
SR	25	0.02	7.19	84.66	20.43	5.08	4.02
Minimum	Total	0.01	0.85	1.00	0.07	0.04	0.41
Mean	909	0.67	1.33	5.01	1.10	0.29	3.73
Maximum		1.41	7.19	84.66	20.43	5.08	51.24

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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 not 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

8. The discharge shall be limited to filtered domestic wastewater and industrial wastewater only, as proposed.
9. 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.

10. 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.

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

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

13. 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.

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

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

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

17. 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.

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

19. 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.

20. 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.

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

22. 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.

23. 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.

24. 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.

25. 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.

26. 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.

27. 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.

APPENDIX B

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APPENDIX C

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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	Space 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
TRUMP-S	Transuranic Management by Pyropartitioning-Separation
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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