ESG-80-7

8005200274

ENERGY SYSTEMS GROUP ENVIRONMENTAL MONITORING AND FACILITY EFFLUENT ANNUAL REPORT 1979

BY

J. D. MOORE

APPROVED: R J Tuttle

R. J. TUTTLE
Manager
Radiation and
Nuclear Safety

Rockwell International

Energy Systems Group
8900 De Soto Avenue
Canoga Park, California 91034

ISSUED: APRIL 25, 1980

CONTENTS

TABLES

FIGURES

ABSTRACT

Environmental and facility effluent radioactivity monitoring at the Energy Systems Group (ESG) of Rockwell International (California operations) is performed by the Radiation and Nuclear Safety Group of the Health, Safety and Radiation Services Department. Soil, vegetation, and surface water are routinely sampled to a distance of 10 miles from ESG sites. Continuous ambient air sampling and radiation monitoring by thermoluminescent dosimetry are performed on-site for measuring airborne radioactivity concentrations and site ambient radiation levels. Radioactivity in effluents discharged to the atmosphere from ESG facilities is continuously sampled and monitored to ensure that levels released to unrestricted areas are within appropriate limits, and to identify processes which may require additional engineering safeguards to minimize radioactivity levels in such effluents. In addition, selected nonradioactive constituent concentrations in surface water discharged to unrestricted areas are determined. This report summarizes and discusses monitoring results for 1979.

The random variations observed in the environmental monitoring data indicate that no local source of unnatural radioactive material exists in the environs. Additionally, the similarity between on-site and off-site results further indicates that the contribution to general environmental radioactivity due to operations at the ESG is essentially nonexistent.

The environmental radioactivity reported herein is attributed to natural sources and to fallout of radioactive material from foreign atmospheric testing of nuclear devices.

1. INTRODUCTION

The Energy Systems Group (ESG) of Rockwell International Corporation has been engaged in nuclear energy research and development since 1946. ESG is currently working on the design, development, fabrication, and testing of components and systems for central station power plants, on the fabrication of nuclear fuel for test and research reactors, and on the Decontamination and Disposition of Facilities (D&D) Program. Other programs include the development and fabrication of systems for stack gas SO_2 control, production of gaseous and liquid fuels from coal, and solar and ocean thermal energy development.

The administration, scientific research, and manufacturing facilities (Figure 1) are located in Canoga Park, California, approximately 23 miles northwest of downtown Los Angeles. The site is level, typical of the San Fernand Valley floor. Certain nuclear programs, under licenses issued by the Nuclear Regulatory Commission (NRC) and the State of California, are conducted here. These include: (1) Building 001 containing uranium fuel production facilities, and (2) Building 004 containing analytical chemistry laboratories, and a gamma irradiation facility. The 290-acre Santa Susana Field Laboratories site (SSFL), Figure 2, is located in the Simi Hills of Ventura County, approximately 23 miles northwest of downtown Los Angeles. The SSFL site is situated in rugged terrain typical of mountain areas of recent geological age. The site may be described as an irregular plateau sprinkled with outcroppings above the more level patches and with peripheral eroded gullies. Elevations of the site vary from 1650 to 2250 ft above sea level. The surface mantle consists of sand and clay soil on sandstone. Both Department of Energy (DOE) and ESG owned facilities share this site, shown in Figure 3. The SSFL also contains facilities in which nuclear operations licensed by NRC and the State, are conducted. The licensed facilities include: (1) the Rockwell International Hot Laboratory (RIHL), Building 020; (2) the Nuclear Materials Development Facility (NMDF), Building 055; (3) a neutron radiography facility containing the L-85 nuclear examination and research reactor, Building 093; and (4) several X-radiography inspection facilities. The location of these sites, in relation to nearby communities, is shown in Figure 4.

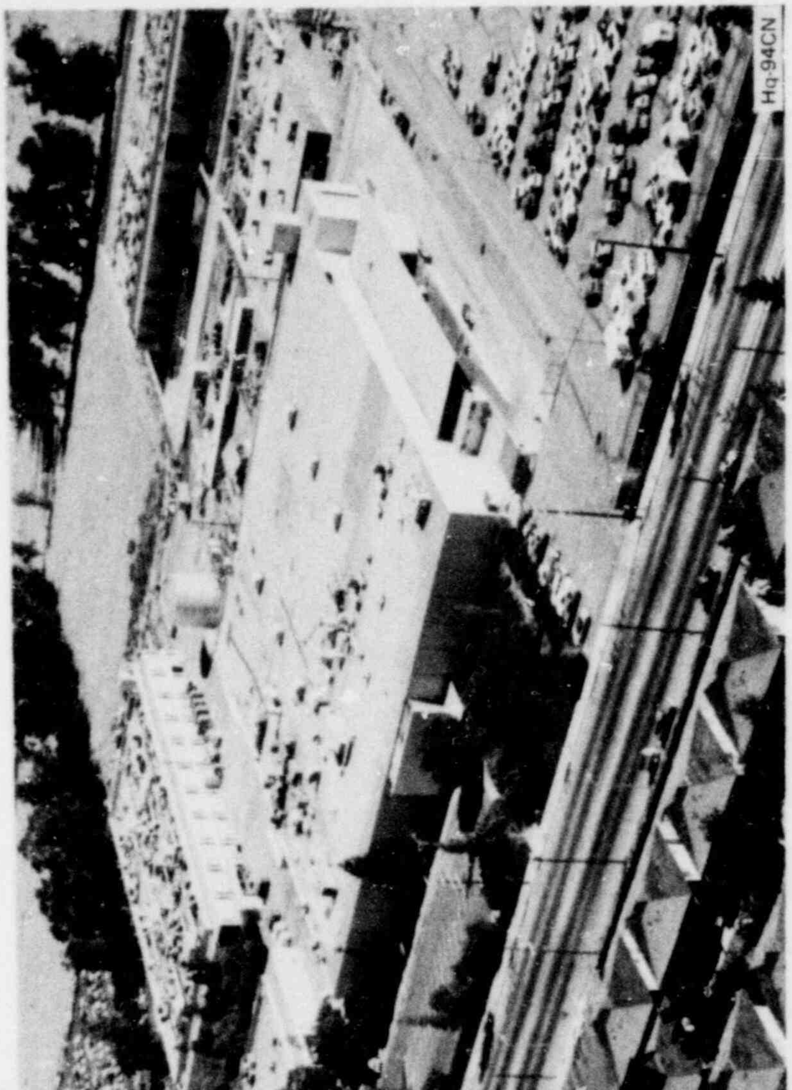


Figure 1. Energy Systems Group — De Soto Site

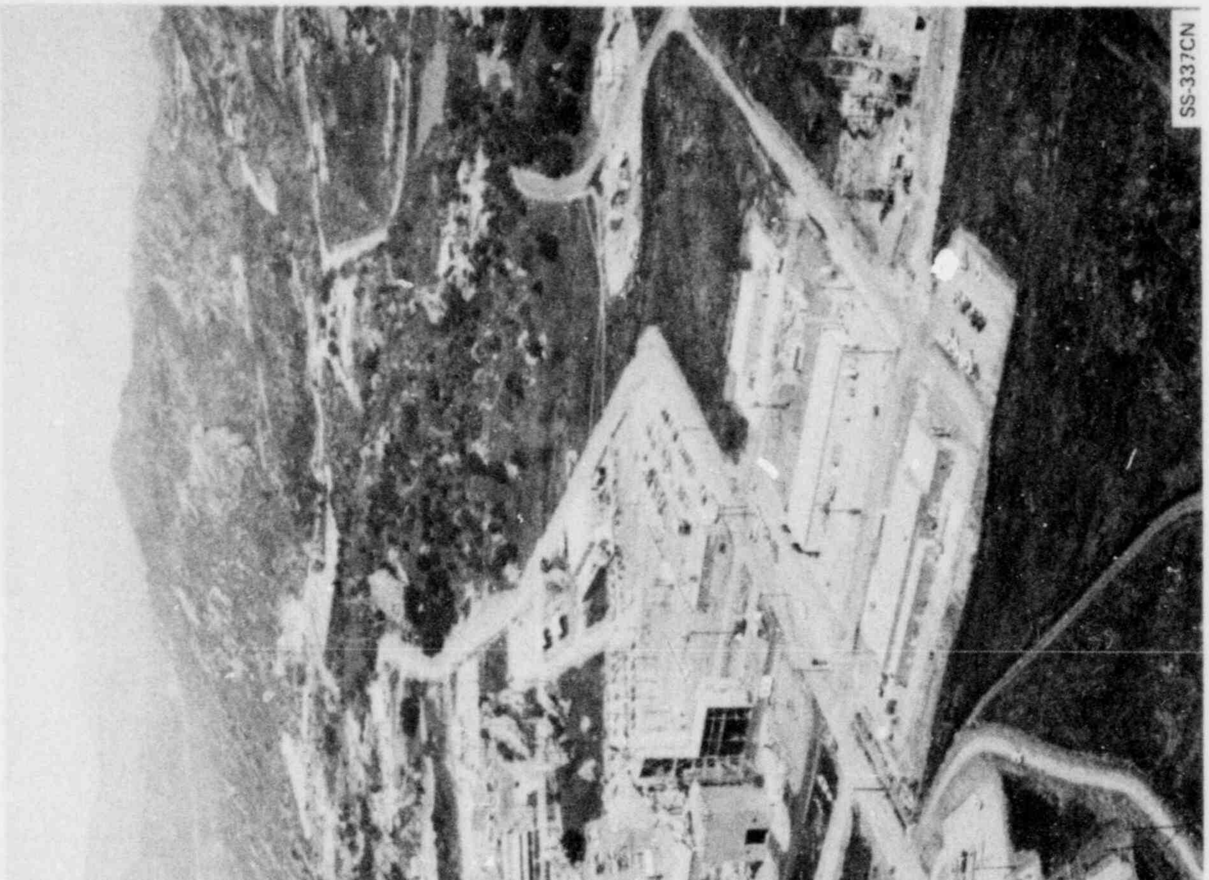
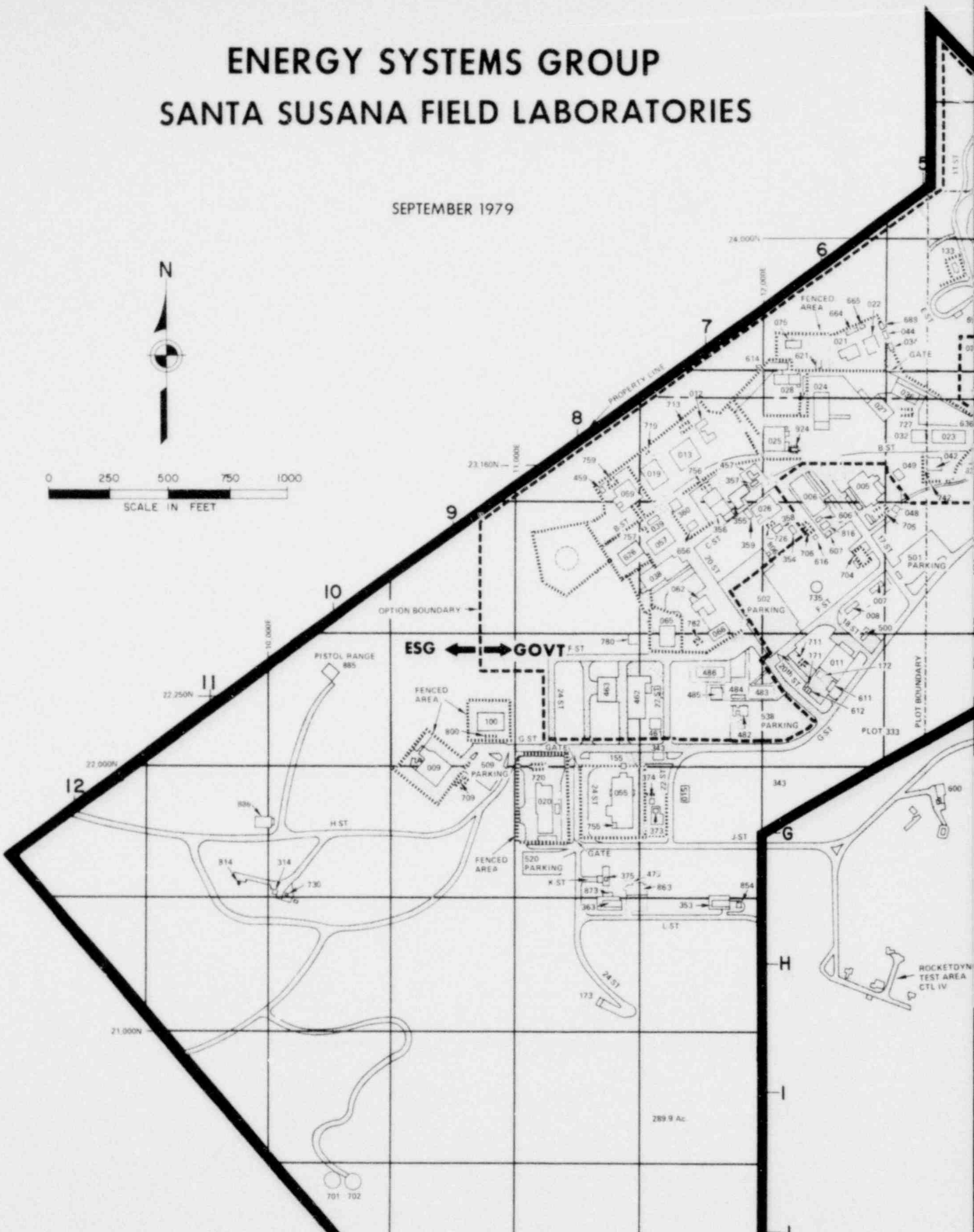


Figure 2. Energy Systems Group — Santa Susana Field Laboratories Site

ENERGY SYSTEMS GROUP
SANTA SUSANA FIELD LABORATORIES

SEPTEMBER 1979



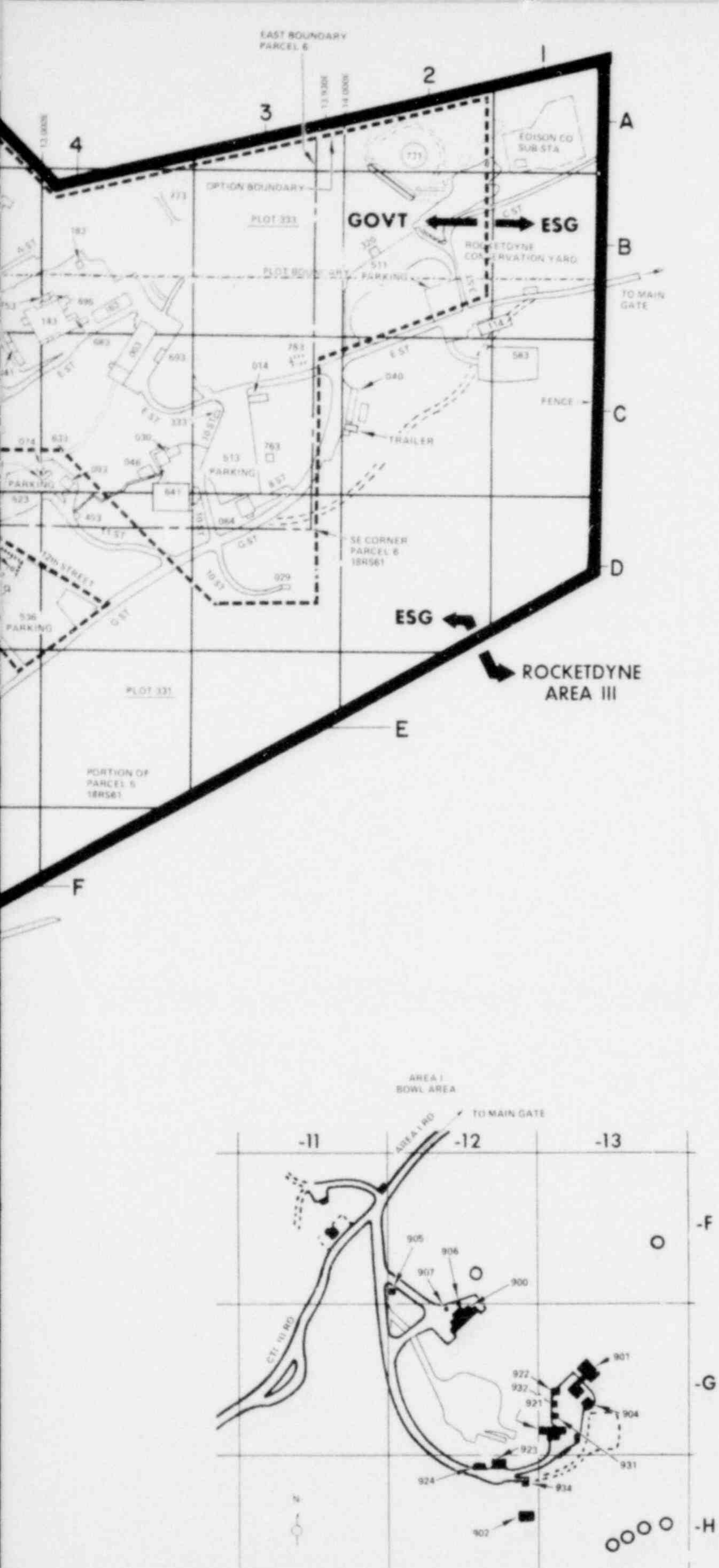


Figure 3. Map of Santa Susana Field Laboratories Site Facilities (Sheet 1 of 2)

OWNED	ZONE	BUILDING NUMBER	DESCRIPTION	OWNED	ZONE
ROCKWELL/GOVT.	4C	003	EXCESS EQUIPMENT STORAGE	GOVT.	7F
ROCKWELL	6D	005	ENVIRONMENTAL SYSTEMS	ROCKWELL	4D
ROCKWELL	6D	006	SODIUM LABORATORY	GOVT.	7D
ROCKWELL	6E	007	SODIUM STORAGE	GOVT.	8D
ROCKWELL	6E	008	FLAMMABLE MATERIAL STORAGE	GOVT.	7F
ROCKWELL	9G	009	ENGINEERING DEVELOPMENT FACILITY	GOVT.	8F
GOVT.	7D	010	D&D	GOVT.	8F
ROCKWELL	6F	011	MANUFACTURING SUPPORT SHOP	ROCKWELL	8G
GOVT.	7D	012	TOOL CRIB – ETEC OPERATIONS	GOVT.	7F
GOVT.	7D	013	THERMAL TRANSIENT FACILITY	GOVT.	7F
GOVT.	3C	014	SODIUM STORAGE BUILDING	GOVT.	7F
ROCKWELL	7G	015	SUPPLEMENTARY STORAGE BUILDING	GOVT.	7F
GOVT.	7D	019	ETEC CONSTRUCTION STAGING	GOVT.	7F
ROCKWELL	8G	020	ENERGY SYSTEMS GROUP HOT LABORATORY	GOVT.	
GOVT.	6C	021	RADIOACTIVE WASTE, DECONTAMINATION AND PACKAGING BUILDING	GOVT.	
GOVT.	6C	022	RADIOACTIVE WASTE STORAGE VAULT BUILDING	ROCKWELL	6F
GOVT.	5D	023	LIQUID METALS CHEMISTRY LABORATORY	ROCKWELL	5E
GOVT.	6D	024	DEVELOPMENT TEST BUILDING	ROCKWELL	7E
GOVT.	6D	025	ETEC INSTRUMENTATION & INVENTORY STORAGE	ROCKWELL	9G
GOVT.	6E	026	SMALL COMPONENT TEST LOOP CONTROL BUILDING	ROCKWELL	2B
GOVT.	6D	027	ETEC QUALITY ASSURANCE	GOVT.	3C
GOVT.	6D	028	LMFBR FUEL SAFETY	ROCKWELL	8G
GOVT.	3D	029	SODIUM STORAGE	ROCKWELL	5C
GOVT.	4C	030	SITE PURCHASING OFFICE	ROCKWELL	5D
GOVT.	5D	032	ETEC GENERAL TEST	GOVT.	6F
GOVT.	5C	034	R/A WASTE OFFICE BUILDING	ROCKWELL	7G
GOVT.	5D	036	ETEC OPERATIONS	ROCKWELL	2B
GOVT.	7E	038	ETEC ADMINISTRATION	ROCKWELL	5F
GOVT.	7E	039	OFFICE BUILDING	ROCKWELL	6E
ROCKWELL	2C	040	FACILITIES AND INDUSTRIAL ENGINEERING	ROCKWELL	6F
GOVT.	5C	041	STORAGE BUILDING	ROCKWELL	6F
GOVT.	5D	042	LMFBR TEST	GOVT.	7C
GOVT.	6C	044	RMDF CLEAN SHOP	ROCKWELL	6E
ROCKWELL	4C	046	MATERIAL OFFICE ANNEX	GOVT.	6C
ROCKWELL	6E	048	PDU INSTRUMENTATION BUILDING	ROCKWELL	2B
GOVT.	5D	049	PDV CONTROL ROOM	GOVT.	8E
ROCKWELL	8G	055	PLUTONIUM FACILITY	ROCKWELL	4C
GOVT.	7E	057	ETEC LABORATORY	GOVT.	5D
GOVT.	8D	059	LARGE LEAK TEST RIG	GOVT.	4C
GOVT.	7E	062	ETEC INSTRUMENTATION	GOVT.	5C
GOVT.	3D	064	SOURCE AND SPECIAL NUCLEAR MATERIAL STORAGE	GOVT.	7E
GOVT.	7E	065	ETEC CHEMISTRY LABORATORY	GOVT.	6C
GOVT.	7E	066	INSTRUMENTATION REPAIR AND CALIBRATION BUILDING ETEC	GOVT.	6C
ROCKWELL	4C	074	STORAGE BUILDING	GOVT.	4C
GOVT.	6C	075	CONTAMINATED EQUIPMENT STORAGE BUILDING	GOVT.	6C
ROCKWELL	4C	083	CONTROL BUILDING – NEUTRON RADIOGRAPHY BUILDING	GOVT.	4C
ROCKWELL	4C	093	NEUTRON RADIOGRAPHY BUILDING	GOVT.	4B
ROCKWELL	9F	100	ADVANCED FUELS LABORATORY	ROCKWELL	10J
ROCKWELL	5B	114	DECON TRAILER	ROCKWELL	10J
ROCKWELL	5C	133	SODIUM BURN FACILITY	GOVT.	6E
ROCKWELL	4B	143	SODIUM REACTOR EXPERIMENT – D&D	ROCKWELL	6E
GOVT.	8G	155	CONTROL CENTER	ROCKWELL	6E
ROCKWELL	4B	163	BOX SHOP	ROCKWELL	9G
ROCKWELL	6F	171	X-RAY BUILDING	ROCKWELL	6F
ROCKWELL	6F	172	X-RAY BUILDING	GOVT.	7D
ROCKWELL	8H	173	GAMMAGRAPH BUILDING	GOVT.	7D
ROCKWELL	4B	183	FIRE PUMP BUILDING – D&D	ROCKWELL	8G
ROCKWELL	10G	314	LARGE LEAK INJECTOR DEVICE (LLID) TEST CONTROL BUILDING	GOVT.	7D
GOVT.	2B	320	FUEL OIL CONTROL BUILDING	GOVT.	6D
ROCKWELL	3C	333	TIME CLOCK BUILDING	ROCKWELL	10G
ROCKWELL	7G	343	TIME CLOCK BUILDING	GOVT.	2A
ROCKWELL	7H	353	RESEARCH AND DEVELOPMENT LABORATORY BUILDING	GOVT.	6E
GOVT.	6E	354	CONTROL ELEMENT TEST STRUCTURE	GOVT.	5D
GOVT.	7D	355	SCTI SUPPORT BUILDING	GOVT.	4B
GOVT.	7D	356	SODIUM COMPONENT TEST INSTALLATION	ROCKWELL	8G
GOVT.	7D	357	ETEC PUMP BEARING TEST FACILITY CONTROL BUILDING	GOVT.	7D
GOVT.	6E	358	SCTI SUPPORT BUILDING	GOVT.	8E
GOVT.	7E	359	COMPRESSOR BUILDING	GOVT.	8D
GOVT.	7E	360	CHEMICAL STORAGE BUILDING	GOVT.	7F
ROCKWELL	8H	363	RESEARCH AND DEVELOPMENT LABORATORY BUILDING	GOVT.	3C
ROCKWELL	7G	373	DEVELOPMENT TEST BUILDING	GOVT.	4B
GOVT.	7G	374	TEST LOOP ENCLOSURE	GOVT.	8F
ROCKWELL	8G	375	CONTROL SHELTER BUILDING	SCE	3C

BUILDING NUMBER	DESCRIPTION
383	ETEC CONSTRUCTION STAGING
453	STG. NEUTRON RADIOGRAPHY STORAGE
457	PUMP BEARING TEST STRUCTURE
459	UNINTERRUPTIBLE POWER SUPPLY
461	MOTOR GENERATOR BUILDING
462	SODIUM PUMP TEST FACILITY
463	CHCF
473	HYDRAULIC TEST INSTRUMENTATION BUILDING
482	GOVERNMENT PROJECT OFFICES
483	ETEC OFFICE COMPLEX
484	REST ROOM – TRAILER
485	ETEC OFFICE COMPLEX
486	ETEC OFFICE COMPLEX
487	ETEC OFFICE COMPLEX
488	REST ROOM TRAILER
500	COMPRESSED GAS BOTTLE STORAGE DOCK
501	PARKING LOT
502	PARKING LOT
509	PARKING LOT
511	PARKING LOT
513	PARKING LOT
520	PARKING LOT
523	PARKING LOT
536	PARKING LOT
538	PARKING LOT
573	PARKING LOT
583	CONSERVATION STORAGE YARD
600	SEWAGE TREATMENT PLANT
606	HYDROGEN RECOMBINER TEST
611	PAINT SPRAY BOOTH
612	STORAGE BUILDING
614	DRAINAGE SUMP
616	COOLING TOWER
621	RADIOACTIVE ACCOUNTABLE WASTE STORAGE BUILDING
623	GUARD POST NO. 1
626	ETEC INVENTORY STORAGE
633	REACTOR COOLING WATER PAD
636	GUARD POST
641	RECEIVING & STORAGE BUILDING
654	INTERIM RADIOACTIVE WASTE – D&D
656	SCTI COOLING TOWER
664	LOW LEVEL RADIOACTIVE WASTE PROCESSING
665	RMDF OXIDATION FACILITY
683	ELECTRICAL SUBSTATION
688	AUXILIARY SKID BUILDING
693	ELECTRICAL SUBSTATION NO. 1
695	COLD TRAP VAULT (SRE) – D&D
701	WATER TANK (DEER FLATS)
702	WATER TANK (DEER FLATS)
704	ELECTRICAL SUBSTATION
705	ELECTRICAL SUBSTATION
706	ELECTRICAL SUBSTATION
709	ELECTRICAL SUBSTATION
711	ELECTRICAL SUBSTATION
713	ELECTRICAL SUBSTATION
719	ELECTRICAL SUBSTATION
720	ELECTRICAL SUBSTATION
726	ELECTRICAL SUBSTATION
727	ELECTRICAL SUBSTATION
730	STORAGE SHED
731	1.5M FUEL OIL STORAGE TANK
735	86K FUEL OIL STORAGE DAY TANK
742	ELECTRICAL SUBSTATION
753	PRIMARY FILL TANK VAULT – D&D
755	ELECTRICAL SUBSTATION
756	ELECTRICAL SUBSTATION
757	ELECTRICAL SUBSTATION
759	ELECTRICAL SUBSTATION
762	ELECTRICAL SUBSTATION
763	ELECTRICAL SUBSTATION
773	DRAINAGE CONTROL DAM
780	ELECTRICAL SUBSTATION
783	ELECTRICAL SUBSTATION

OWNED	ZONE	BUILDING NUMBER	DESCRIPTION
ROCKWELL	9F	800	ELECTRICAL SUBSTATION
ROCKWELL	7E	805	TIME CLOCK BUILDING
ROCKWELL	11G	814	LARGE LEAK INJECTOR DEVICE
ROCKWELL	6E	816	RECOMBINER CANOPY
ROCKWELL	5D	836	TIME CLOCK BUILDING
GOVT.	7H	854	TEST STRUCTURE
ROCKWELL	7H	863	HYDRAULIC TEST LOOP
ROCKWELL	8G	873	HYDRAULIC TEST LABORATORY
ROCKWELL	7F	883	ELECTRICAL SUBSTATION
ROCKWELL	10F	885	PISTON RANGE
ROCKWELL	11G	886	SODIUM DISPOSAL FACILITY
GOVT.	6D	924	ELECTRICAL SUBSTATION
			BOWL AREA
ROCKWELL	H-13	306	PUMP HOUSE NO. 1
ROCKWELL	H-12	307	PUMP HOUSE NO. 2
ROCKWELL	G-12	308	CONTROL CENTER
ROCKWELL	G-13	320	POWER CONTROL
ROCKWELL	H-12	334	V.T.S. – 3 OPERATIONS AND WORKSHOP
ROCKWELL	H-12	391	V.T.S. – 3 WORKSHOP
ROCKWELL	H-12	393	PLUME STUDY BLDG.
ROCKWELL	G-12	401	INSTRUMENT AND WORKSHOP
ROCKWELL	H-12	405	STEAM PLANT BLDG.
ROCKWELL	G-13	416	ELECTRICAL BLDG.
ROCKWELL	G-13	437	PRE-TEST – BOWL
ROCKWELL	F-11	964	SEWAGE TREATMENT PLANT BLDG.

Figure 3. Map of Santa Susana Field Laboratories Site Facilities (Sheet 2 of 2)

Figure 4. Map of General Los Angeles Area
(Reproduced by permission of Automobile Club of Southern California)

Also included within the SSFL site is an 82-acre Government-optioned area where DOE-contract activities are conducted, primarily by the non-nuclear Energy Technology Engineering Center (ETEC). The major operational nuclear installation within the optioned area is the Radioactive Material Disposal Facility (RMDF), Buildings 021 and 022. This facility is used for packaging of wastes generated as a result of the D&D Program, begun in 1975. Several deactivated nuclear reactor and support facilities, all within the optioned area, are affected by the D&D Program. Currently involved are several facilities that had been used for SNAP, Systems for Nuclear Auxiliary Power, reactor test operations, Buildings 010, 024, and 059, and the SRE, Building 143. There is no fissile material located at any of these facilities.

Licensed programs conducted during 1979 included: (1) commercial operation of the L-85 reactor for central station power plant operator training and for neutron radiography inspection of precision forgings, castings, and electronic and explosive devices for manufacturing defects; (2) the operation of the RIHL for nuclear reactor fuel and system component examination and the fabrication of sealed radiation sources; and (3) the operation of nuclear fuel manufacturing facilities for the production of experimental and test reactor fuel involving enriched uranium, and development of processes for fabrication of advanced fuels.

The basic policy for control of radiological and chemical hazards at ESG requires that through engineering controls adequate containment of such materials be provided, and through rigid operational controls, that facility effluent releases and external radiation levels are reduced to a minimum. The environmental monitoring program provides a measure of the effectiveness of the Group safety procedures and of the engineering safeguards incorporated into facility designs. Specific radionuclides in facility effluent or environmental samples, are not routinely identified due to the extremely low radioactivity levels normally detected, but would be identified by analytical or radiochemistry techniques if significantly increased radioactivity levels were observed.

In addition to environmental monitoring, work area air and atmospherically discharged effluents are continuously monitored or sampled, as appropriate. This provides a direct measure of the effectiveness of engineering controls and allows remedial action to be taken before a significant release of hazardous material can occur.

Environmental sampling stations that are located within the boundaries of ESG sites are referred to as "on-site" stations; those located within a 10-mile radius of the sites are referred to as "off-site" stations. The on-site environs of the De Soto and SSFL sites are sampled monthly to determine the concentration of radioactivity in typical surface soil, vegetation, and water. Soil is also sampled on-site semiannually for plutonium analysis. Similar off-site environmental samples, except for plutonium analysis, are obtained quarterly. Continuous on-site and off-site ambient air sampling provides information concerning long-lived airborne particulate radioactivity. A site ambient radiation monitoring program, utilizing thermoluminescent dosimetry (TLD), begun in 1971, measures radiation levels in the environs of both the De Soto and SSFL sites.

Nonradioactive wastes released to unrestricted areas are limited to liquids released to sanitary sewage systems and to surface water drainage systems. No intentional releases of any liquid pollutants are made to unrestricted areas. Liquid wastes generated at the De Soto site are discharged into the city sewage system. This effluent is sampled for determination of radioactivity. Sanitary sewage from all DOE and ESG facilities at the SSFL site is treated at an on-site sewage plant. The plant effluent drains into a retention pond, located on the adjoining Rocketdyne Division site. The surface water drainage system of the SSFL is composed of catch ponds and open drainage ditches leading to the Rocketdyne retention pond. This pond also receives the ESG site sewage plant effluent. Water from the pond may be reclaimed as industrial process water, or it may be released off site into Bell Creek, a tributary of the Los Angeles River. The pond was also monitored at discharge for radioactive and nonradioactive pollutants by Rocketdyne Division as required by discharge permits issued to Rocketdyne by the California Regional Water Quality Control Board.

This report summarizes environmental monitoring results for 1979. A comparison of 1979 radioactivity results with previous years appears in Appendix A.

TABLE 1-A

SOIL RADIOACTIVITY DATA — 1979

Area	Activity	No. Samples	Gross Radioactivity (μCi/g)	
			Annual Average Value (95% Confidence Level)	Maximum Observed Value* and Month Observed
On Site	α	144	$(6.4 \pm 1.5)\ 10^{-7}$	10.9×10^{-7} (June)
	β	144	$(2.5 \quad 0.1)\ 10^{-5}$	9.7×10^{-5} (November)
Off Site	α	48	$(5.0 \pm 1.4)\ 10^{-7}$	8.1 x 10-7 (January)
	β	48	$(2.3 \pm 0.1)\ 10^{-5}$	2.9×10^{-5} (January)

*Maximum value observed for single sample

TABLE 1-B

SOIL PLUTONIUM RADIOACTIVITY DATA — 1979

Sample Location	June 23, 1979 Survey Results		December 17, 1979 Survey Results	
	Pu^{238} (μCi/g)	Pu^{239} + Pu^{240} (μCi/g)	Pu^{238} (μCi/g)	Pu^{239} + Pu^{240} (μCi/g)
S-56	$(1.4 \pm 2.7)10^{-9}$	$(9.9 \pm 3.9)\ 10^{-9}$	$(-0.6 \pm 2.2)\ 10^{-9}$	$(6.0 \pm 3.5)\ 10^{-9}$
S-57	$(1.5 \pm 3.0)10^{-9}$	$(2.5 \pm 2.4)\ 10^{-9}$	$(-1.9 \pm 2.0)\ 10^{-9}$	$(4.5 \pm 3.0)\ 10^{-9}$
S-58	$(-1.1 \pm 2.1)10^{-9}$	$(2.2 \pm 2.2)\ 10^{-9}$	$(3.3 \pm 5.3)\ 10^{-9}$	$(18.9 \pm 8.7)\ 10^{-9}$
S-59	$(-2.0 \pm 1.9)10^{-9}$	$(4.2 \pm 3.1)\ 10^{-9}$	$(2.3 \pm 4.5)\ 10^{-9}$	$(18.6 \pm 8.0)\ 10^{-9}$
S-60	$(-2.8 \pm 1.9)10^{-9}$	$(0.3 \pm 1.6)\ 10^{-9}$	$(0.2 \pm 2.9)\ 10^{-9}$	$(3.3 \pm 3.1)\ 10^{-9}$

Note: Minus (-) indicates sample value less than reagent blank.

II. ENVIRONMENTAL MONITORING SUMMARY RESULTS

A. RADIOACTIVE MATERIALS — 1979

The sampling and analytic methods used in the environmental monitoring program for radioactive materials are described in Section III.

The average radioactivity concentrations in local soil, vegetation, surface water, and in ambient air for 1979 are presented in Tables 1 through 5. In calculating the averaged concentration value for the tables, those individual samples having radioactivity levels less than their minimum detection levels (MDL) are assumed to have a concentration equal to the MDL. This method of data averaging, required by DOE Manual Chapter 0513, affords a significant level of conservatism in the data, as evident in the tables, in that most radioactivity concentrations are reported as "less than" (<) values. Thus, for measurements in which some apparent radioactivity concentrations are below the MDL, the true averaged value is actually somewhat less than the value reported.

The maximum level of radioactivity detected for a single sample is reported because of its significance in indicating the existence of a major episode or area-wide location of radioactive material deposition. None of the maximum observed values, which occurred randomly during the year as shown in the tables, show a great increase over the average values beyond natural variability. The ambient air sampling data show no greatly increasing or decreasing trends for the year and can be described as generally constant levels with only very minor transient increases in local airborne radioactivity levels.

The results reported in Tables 1-A and 2 show no significant difference between on-site and off-site samples. Table 1-B shows no significant variations in soil plutonium concentrations for the 1979 sample sets. The detected activity is due to a variety of naturally occurring radionuclides, and to radioactive fallout resulting from dispersal of nuclear weapons materials and fission products by atmospheric testing although no atmospheric tests in the northern hemisphere were announced during 1979. Naturally occurring radionuclides include Be^{7}, K^{40}, Rb^{87}, Sm^{147}, and the uranium and thorium series (including the inert gas radon and its radioactive daughters). Radioactivity from fallout consists primarily of the fission products Sr^{90} - Y^{90}, Cs^{137}, and Pm^{147}, and also U^{235} and Pu^{239}.

TABLE 2

VEGETATION RADIOACTIVITY DATA — 1979

Area	Activity	No. Samples	Gross Radioactivity ($\mu Ci/g$)			% of Samples with Activity <MDL
			Dry Weight Annual Average Value	Ash		
				Annual Average Value (95% Confidence Level)	Maximum Value* and Month Observed	
On Site	α	144	$(<5.2 \pm 3.5)\ 10^{-8}$	$(<2.4 \pm 1.6)\ 10^{-7}$	1.4×10^{-6} (December)	35
	β	144	$(2.6 \pm 0.04)\ 10^{-5}$	$(1.39 \pm 0.02)\ 10^{-4}$	2.48×10^{-4} (May)	0
Off Site	α	48	$(<6.3 \pm 4.4)\ 10^{-8}$	$(<2.3 \pm 1.6)\ 10^{-7}$	8.6×10^{-7} (April)	35
	β	48	$(3.0 \pm 0.04)\ 10^{-5}$	$(1.34 \pm 0.02)\ 10^{-4}$	2.30×10^{-4} (July)	0

*Maximum value observed for single sample

Domestic water used at the SSFL site is obtained from Ventura County Water District No. 17, which also supplies nearby communities, and is distributed on site by the same piping system previously used when all facility process water was obtained from on-site wells. Two on-site water wells were operated during 1979 to reduce consumption of Ventura County domestic water. The well water proportion in the blend averaged about 69% for the year for a total well water consumption of approximately 7.9×10^7 gal. Pressure for the water system is provided by elevated storage tanks.

Water from the system is sampled monthly at two widely separated SSFL site locations. The average domestic water radioactivity concentration is presented in Table 3.

As discussed earlier, surface waters discharged from SSFL facilities and the sewage plant effluent drain southward into a retention pond on Rocketdyne property. When full, the pond may be drained into Bell Creek, a tributary of

TABLE 3

SSFL SITE — DOMESTIC WATER RADIOACTIVITY DATA — 1979

Area	Activity	No. Samples	Gross Radioactivity (μCi/mℓ)	
			Average Value (95% Confidence Level)	Maximum* Value and Month Observed
ESG-SSFL	α	24	$(<2.3 \pm 2.7)\ 10^{-10}$	$<2.3 \times 10^{-10}$ (100% <MDL)
	β	24	$(1.8 \pm 0.7)\ 10^{-9}$	3.9×10^{-9} (July)

*Maximum value observed for single sample

the Los Angeles River in the San Fernando Valley, Los Angeles County. Pursuant to the requirements of Los Angeles Regional Water Quality Control Board Resolution 66-49 of September 21, 1966, a sampling station for evaluating environmental radioactivity in Bell Canyon was established in 1966. It is located approximately 2.5 miles downstream from the southern Rockwell International Corporation boundary. Samples, obtained and analyzed monthly, include stream bed mud, vegetation, and water. Average radioactivity concentrations in Rocketdyne and Bell Creek samples are presented in Table 4.

Comparison of the radioactivity concentrations in water from the ponds and from Bell Creek with that of the domestic water supply shows no significant variation in either alpha or beta activity.

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 ESG facilities. Radioactivity concentration guide values are those concentration limits adopted by the Department of Energy, the Nuclear Regulatory Commission, and the State of California as maximum permissible concentrations (MPC). The MPC values are dependent upon the radionuclide and its behavior as a soluble or an insoluble material. For comparison with results of the environmental and effluent monitoring, the lowest MPC value for the various radionuclides present is selected. Accordingly, for SSFL site surface water, the Guide value of 5×10^{-6} μCi/mℓ alpha activity corresponding to Pu^{239} and 3×10^{-7} μCi/mℓ beta activity corresponding to Sr^{90} are appropriate.

TABLE 4

BELL CREEK AND ROCKETDYNE SITE RETENTION POND RADIOACTIVITY DATA — 1979

Area	Activity	No. Samples	Gross Radioactivity Concentration: Average Value (95% Confidence Level)	Maximum* Value and Month Observed	% of Guide†	% of Samples with Activity <MDL
Bell Creek Mud No. 54 (μCi/g)	α	12	$(4.6 \pm 1.3)\ 10^{-7}$	6.2×10^{-7} (July)	NA	0
	β	12	$(2.3 \pm 0.1)\ 10^{-5}$	2.7×10^{-5} (April)	NA	0
Pond R-2A Mud No. 55 (μCi/g)	α	12	$(7.1 \pm 1.6)\ 10^{-7}$	1.1×10^{-6} (June)	NA	0
	β	12	$(2.5 \pm 0.1)\ 10^{-5}$	3.3×10^{-5} (March)	NA	0
Bell Creek Vegetation No. 54 (μCi/g ash)	α	12	$(<2.6 \pm 1.7)\ 10^{-7}$	7.6×10^{-7} (April)	NA	25
	β	12	$(1.36 \pm 0.02)\ 10^{-4}$	2.08×10^{-4} (November)	NA	0
Bell Creek Vegetation No. 54 (μCi/g) dry weight	α	12	$(<7.5 \pm 4.8)\ 10^{-8}$	3.3×10^{-7} (April)	NA	25
	β	12	$(3.0 \pm 0.1)\ 10^{-5}$	7.2×10^{-5} (November)	NA	0
Bell Creek Water No. 16 (μCi/mℓ)	α	12	$(<2.3 \pm 2.7)10^{-10}$	2.4×10^{-10} (July)	<0.005	91.7
	β	12	$(3.2 \pm 0.9)\ 10^{-9}$	8.2×10^{-9} (August)	1.1	0
Pond Water No. 6 (μCi/mℓ)	α	12	$(<2.5 \pm 2.8)10^{-10}$	5.5×10^{-10} (May)	<0.005	91.7
	β	12	$(3.1 \pm 0.8)\ 10^{-9}$	4.7×10^{-9} (May)	1.0	0
SSFL Pond R-2A Water No. 12 (μCi/mℓ)	α	12	$(<2.3 \pm 2.7)10^{-10}$	2.5×10^{-10} (November)	<0.005	91.7
	β	12	$(4.5 \pm 0.8)\ 10^{-9}$	1.0×10^{-8} (September)	1.5	0

*Maximum value observed for single sample.

†Guide: 5×10^{-6} μCi/mℓα, 3×10^{-7} μCi/mℓβ; 10 CFR 10 Appendix B, CAC 17, DOE Manual Chapter 0524.

NA — not applicable, no Guide value having been established.

The correspondingly most restrictive Guide value for De Soto site wastewater radioactivity discharged to the sanitary sewage system, a controlled area, is 8×10^{-4} μCi/mℓ alpha activity corresponding to U^{235} and 1×10^{-3} μCi/mℓ beta activity corresponding to Co^{60}. These values are established in 10 CFR 20, California Administrative Code Title 17, and DOE Manual Chapter 0524.

The Guide value of 6×10^{-14} μCi/mℓ for SSFL site ambient air alpha activity is due to work with unencapsulated plutonium. The value of 3×10^{-11} μCi/mℓ for beta activity is due to the presence of Sr^{90} in fission products in irradiated nuclear fuel at the SSFL site. The Guide value of 3×10^{-12} μCi/mℓ for De Soto ambient air alpha activity is due to work with unencapsulated uranium (including depleted uranium). The Guide value of 3×10^{-10} μCi/mℓ is for Co^{60} for which the ambient air beta activity Guide is appropriate since it is the most restrictive limit for beta-emitting radionuclides present at the De Soto site. Guide value percentages are not presented for soil or vegetation data since no concentration Guide values have been established.

Ambient air sampling for long-lived particulate alpha and beta radioactivity is performed continuously with automatic sequential samplers at both the De Soto and SSFL sites. Air is drawn through Type HV-70 filter media which are analyzed for long-lived radioactivity, after a minimum 120-h decay period that eliminates the naturally occurring short lived particulate radioactivity. The average concentrations of ambient air alpha and beta radioactivity are presented separately in Table 5.

Radioactivity levels observed in environmental samples for 1979, reported in Tables 1 through 5, compare closely with levels reported for recent years. Local environmental radioactivity levels, which result primarily from beta-emitting radionuclides and had shown the effect of fallout during past extensive atmospheric testing of nuclear devices, have decreased, and have been generally constant during the past several years. The effects of foreign atmospheric nuclear tests continue to be occasionally observed in daily ambient radioactivity levels, although this effect was not readily discernible during 1979. The long-term effects of airborne radioactivity on surface sample radioactivity levels are also not discernible in recent years. The continuing relative constancy in environmental radioactivity levels is due primarily to the dominance of naturally occurring radionuclides in the environment and to the longer-life fission product radioactivity from aged fallout.

TABLE 5

AMBIENT AIR RADIOACTIVITY DATA — 1979

Site Location	Activity	No. Samples	Average Value (95% Confidence Level)	Maximum* Value and Date Observed	% of Guide†	% of Samples with Activity <MDL
De Soto On Site (μCi/mℓ)	$\alpha^{§}$	702	$(<6.6 \pm 7.8)\ 10^{-15}$	4.5×10^{-14} (06/28)	<0.28	88.6
	β^{**}	702	$(<2.1 \pm 1.3)\ 10^{-14}$	1.0×10^{-13} (02/25)	<0.030	36.7
SSFL On Site (μCi/mℓ)	$\alpha^{§}$	1793	$(<6.5 \pm 7.6)\ 10^{-15}$	4.0×10^{-14} (04/19	<12.0	91.0
	β^{**}	1792	$(<2.1 \pm 1.3)\ 10^{-14}$	1.1×10^{-13} (03/07)	<0.29	38.3
SSFL Sewage Treatment Plant Off Site (μCi/mℓ)	$\alpha^{§}$	362	$(<6.2 \pm 7.4)\ 10^{-15}$	2.0×10^{-14} (09/29)	<12.2	92.0
	β^{**}		$(<2.0 \pm 1.3)\ 10^{-14}$	1.1×10^{-13} (02/25)	<0.28	41.4
SSFL Control Center Off Site (μCi/mℓ)	$\alpha^{§}$	364	$(<6.2 \pm 8.4)\ 10^{-15}$	3.4×10^{-14} (08/31)	<11.8	90.6
	β^{**}		$(<1.8 \pm 1.5)\ 10^{-14}$	1.0×10^{-13} (03/06)	<0.30	49.4

*Maximum value observed for single sample.

†Guide: De Soto site, 3×10^{-12} μCi/mℓα, 3×10^{-10} μCi/mℓβ; 10 CFR 20 Appendix B, SSFL site, 6×10^{-14} μCi/mℓα, 3×10^{-11} μCi/mℓβ; 10 CFR 20 Appendix B, CAC 17, and DOE Manual Chapter 0524

§MDL = 6.1×10^{-15} μCi/mℓ — Individual daily samples with activity levels of 0 to 6.1×10^{-15} μCi/mℓ are recorded and averaged as 6.1×10^{-15} μCi/mℓ

**MDL = 1.2×10^{-14} μCi/mℓ — Individual daily samples with activity levels of 0 to 1.2×10^{-14} μCi/mℓ are recorded and averaged as 1.2×10^{-14} μCi/mℓ. Indicated average values are upper limits, since some data were below the minimum detection levels.

Site ambient radiation monitoring is performed with thermoluminescent dosimeters. Each dosimeter contains two calcium fluoride (CaF_2:Mn) low background, bulb-type chip dosimeters. The dosimeter sets are placed at selected locations (Figure 6 and 7) on or near the perimeters of the De Soto and SSFL sites. Each dosimeter, sealed in a light-proof compensation shield, is installed in a polyethylene container which is mounted ~1 meter above ground at each location. The dosimeters are exchanged and evaluated quarterly. There were 13 on-site TLD monitoring locations used during the year. Three additional dosimeter sets, located at locations up to 10 miles from the ESG sites, are similarly evaluated to determine the local area off-site ambient radiation level, which averaged 0.015 mrem/h for 1979. The average radiation dose rate and equivalent annual dose monitored at each dosimeter location are presented in Table 6.

TABLE 6

DE SOTO AND SSFL SITES — AMBIENT RADIATION DOSIMETRY DATA — 1979

TCD	Average Dose Rate (mrem/h)	Equivalent Annual Dose (mrem)
1 De Soto	0.016	140
2 De Soto	0.015	131
3 De Soto	0.014	123
4 De Soto	0.016	140
5 De Soto	0.016	140
6 De Soto	0.017*	149
7 De Soto	0.016†	140
1 SSFL	0.017	149
2 SSFL	0.018	158
3 SSFL	0.022	193
4 SSFL	0.021	184
5 SSFL	0.016	140
6 SSFL	0.016	140
1 Off-Site Control	0.014	123
2 Off-Site Control	0.016	140
3 Off-Site Control	0.015	131

*Excludes first quarter data due to missing dosimeter.
†Excludes second quarter data due to missing dosimeter.

TABLE 7

NONRADIOACTIVE CONSTITUENTS AND TRITIUM IN WASTEWATER DISCHARGED TO UNRESTRICTED AREAS — 1979
(Analysis Results for Wastewater Discharged from Pond R-2A to Bell Creek on Date Indicated — Sample Station W-12)

Constituents	January 5*		January 15*		January 31*		February 14*	
	Result	% of Guide	Result	% of Guide	Result	% of Guide	Result	% of Guide
Total Dissolved Solids (mg/ℓ)	283	29.8	328	34.5	160	16.8	339	35.7
Chloride (mg/ℓ)	31	20.7	35	23.3	16	10.7	31	20.7
Sulfate (mg/ℓ)	61	20.3	138	46.0	33	11.0	71	23.7
Suspended Solids§ (mg/ℓ)	132	88.0	101	67.3	16	10.7	34	22.7
Settleable Solids§ (mℓ/ℓ)	0.2	66.7	0.1	33.3	<0.1	<33.3	0.1	33.3
BOD (mg/ℓ)	7	11.7	6	10.0	2	3.3	5	8.3
Oil and Grease (mg/ℓ)	1.2	8.0	1.2	8.0	1	6.7	1	6.7
Turbidity (TU)	46	—	74	—	14	—	32	—
Chromium (mg/ℓ)	0.015	150.0	0.016	160.0	0.003	30.0	0.006	60.0
Fluoride (mg/ℓ)	0.3	30.0	0.4	40.0	0.2	20.0	0.4	40.0
Boron (mg/ℓ)	<0.2	<20.0	<0.2	<20.0	<0.1	<10.0	0.1	10.0
Residual Chlorine (mg/ℓ)	<0.04	<40.0	<0.04	<40.0	<0.04	<40.0	<0.04	<40.0
Fecal Coliform (MPN/100 mℓ)	<2.2	<9.5	<2.2	<9.5	<2.2	<9.5	NA	—
Surfactants (mg/ℓ)	0.09		0.04		0.08		0.06	
pH	8.2		8.0		7.8		8.4	
Tritium† (μCi/mℓ)	$<1.1 \times 10^{-5}$	<0.37	$<1.1 \times 10^{-5}$	<0.37	$<1.1 \times 10^{-5}$	<0.37	$<1.1 \times 10^{-5}$	<0.37
Rainfall (in.)	3.7		2.2		2.0		1.5	
Estimated Rainfall Runoff (gal)	8.9×10^7		5.2×10^7		4.8×10^7		3.6×10^7	
Release Volume (gal)	1.5×10^6		2.0×10^6		1.3×10^6		1.2×10^6	

Constituents	February 21*		March 1*		March 14*		March 27*	
	Result	% of Guide	Result	% of Guide	Result	% of Guide	Result	% of Guide
Total Dissolved Solids (mg/ℓ)	331	34.8	378	39.8	462	48.6	287	30.2
Chloride (mg/ℓ)	36	24.0	31	20.7	54	36.0	25	16.7
Sulfate (mg/ℓ)	69	23.0	104	34.7	103	34.3	55	18.3
Suspended Solids§ (mg/ℓ)	153	102.0	31	20.7	13	8.7	94	62.7
Settleable Solids§ (mℓ/ℓ)	<0.1	<33.3	<0.1	<33.3	<0.1	<33.3	0.2	66.7
BOD (mg/ℓ)	4	6.7	4	6.7	6	10.0	4	6.7
Oil and Grease (mg/ℓ)	<1	<6.7	0.6	4.0	1	6.7	2	13.3
Turbidity (TU)	42	—	26	—	4	—	88	—
Chromium (mg/u)	0.006	60.0	0.011	110.0	0.004	40.0	0.016	160.0
Fluoride (mg/ℓ)	0.5	50.0	0.4	40.0	0.4	40.0	0.8	80.0
Boron (mg/ℓ)	0.2	20.0	0.2	20.0	<0.1	<10.0	0.08	8.0
Residual Chlorine (mg/ℓ)	<0.04	<40.0	0.07	70.0	<0.04	<40.0	<0.04	<40.0
Fecal Coliform (MPN/100 mℓ)	<2.2	<9.5	<2.2	<9.5	16	69.5	NA	—
Surfactants (mg/ℓ)	0.02		<0.01		0.04		0.02	
pH	8.0		7.8		8.3		8.1	
Tritium† (μCi/mℓ)	$<1.1 \times 10^{-5}$	<0.37	$<1.1 \times 10^{-5}$	<0.37	$<1.1 \times 10^{-5}$	<0.37	$<1.1 \times 10^{-5}$	<0.37
Rainfall (in.)	2.3		0.7		1.4		3.3	
Estimated Rainfall Runoff (gal)	5.4×10^7		1.8×10^7		3.4×10^7		7.9×10^7	
Release Volume (gal)	1.3×10^6		1.3×10^6		8.0×10^5		1.1×10^6	

Constituents	April 17		October 23*		November 8*		December 21*	
	Result	% of Guide	Result	% of Guide	Result	% of Guide	Result	% of Guide
Total Dissolved Solids (mg/ℓ)	435	45.8	604	63.6	445	46.8	608	64.0
Chloride (mg/ℓ)	51	34.0	75	50.0	62	4[illegible].3	76	50.7
Sulfate (mg/ℓ)	111	37.0	174	58.0	132	44.0	170	56.7
Suspended Solids§ (mg/ℓ)	18	12.0	6	4.0	165	1[illegible].0	32	21.3
Settleable (Solids§ (mℓ/ℓ)	<0.1	<33.3	<0.1	<33.3	<0.1	<33.3	<0.1	<33.3
BOD (mg/ℓ)	8	13.3	7	11.7	12	20.0	4	6.7
Oil and Grease (mg/ℓ)	<1	<6.7	2	13.3	<1	<6.7	<1	<6.7
Turbidity (TU)	3	—	7	—	130	—	17	—
Chromium (mg/ℓ)	0.003	30.0	0.004	40.0	0.014	140.0	0.004	40.0
Fluoride (mg/ℓ)	0.3	30.0	0.7	70.0	0.7	70.0	1.0	100.0
Boron (mg/ℓ)	0.2	20.0	0.3	30.0	0.3	30.0	0.2	20.0
Residual Chlorine (mg/ℓ)	<0.004	<4.0	<0.04	<40.0	<0.04	<40.0	0.04	<40.0
Fecal Coliform (MPN/100 mℓ)	NA	—	<2.2	<9.5	<2.2	<9.5	2.2	9.5
Surfactants (mg/ℓ)	0.03		0.04		0.03		0.01	
pH	8.8		8.1		8.8		8.4	
Tritium† (μCi/mℓ)	$<1.1 \times 10^{-5}$	<0.37	NA		NA		NA	
Rainfall (in.)	0		0.5		1.2		1.0	
Estimated Rainfall Runoff (gal)	0		1.2×10^7		2.9×10^7		2.4×10^7	
Release Volume (gal)	1.5×10^5		2.4×10^6		1.9×10^6		1.8×10^6	

NA = Not Available; analysis not requested or not performed.
* = Rainfall related discharge.
† = Tritium minimum detection limit: $(1.1 \pm 1.1)\ 10^{-5}$ μCi/mℓ.
§ = Not applicable to discharges containing rainfall runoff during or immediately after periods of rainfall.
Note: Pond R-2A capacity — 2.5×10^6 gal

The table shows that radiation dose rates and equivalent annual doses monitored on site are nearly identical to levels monitored at three widely separated off-site locations. These data include the natural background radiation component which exists as a consequence of cosmic radiation, radionuclides in the soil, and radon and thoron in the atmosphere, in addition to radioactive fallout from nuclear weapons tests. Locally, this is approximately 135 mrem/year. The small variability observed in the data is attributed to differences in elevation and geologic conditions at the various dosimeter locations. Since the data for the on-site and off-site locations are nearly identical, no measurable radiation dose to the general population or to individuals in uncontrolled areas resulted from ESG operations.

B. NONRADIOACTIVE MATERIALS — 1979

Processed wastewater and most collected surface runoff discharged from the SSFL site drains to Retention Pond R-2A, operated by Rocketdyne. Water samples are taken from the pond and analyzed for various constituents, as required by the Regional Water Quality Control Board for each discharge to Bell Canyon. Tritium monitoring of discharged waste water was permanently discontinued during the fourth quarter of 1979 in conformance with a condition permitting this action in NRC License - SNM-21. The discharges are normally required only as a result of excessive rainfall run-off. During such releases, the NPDES permit concentration limits for turbidity, and for suspended and settleable solids do not apply. The results of analyses for each discharge for 1979, most all of which were rainfall-related discharges, are presented in Table 7.

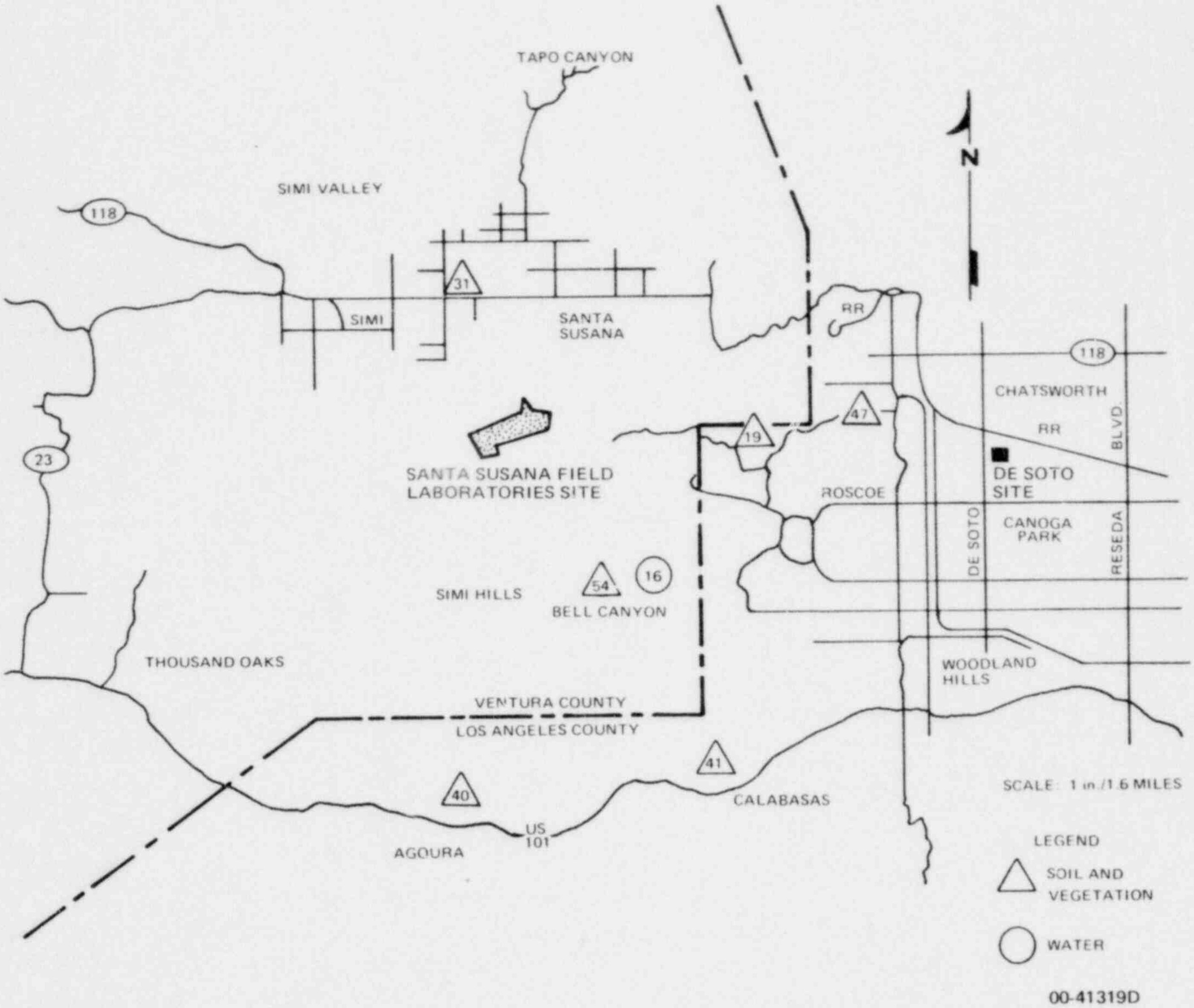


Figure 5. Map of Canoga Park, Simi Valley, Agoura and Calabasas Sampling Stations

III. ENVIRONMENTAL MONITORING PROGRAM

A. GENERAL DESCRIPTION

Soil and vegetation sample collection and analysis for radioactivity were initiated in 1952, in the Downey, California area, where the Energy Systems Group was initially located. Environmental sampling was subsequently extended to the proposed SRE site in the Simi Hills in May of 1954. In addition, sampling was begun in the Burro Flats area, southwest of SRE, where other nuclear installations were planned and are currently in operation. The Downey area survey was terminated when the Group relocated to Canoga Park in 1955. The primary purpose of the environmental monitoring program is to survey environmental radioactivity adequately to ensure that ESG operations do not contribute significantly to environmental radioactivity. The locations of sampling stations are shown in Figures 5 through 7 and listed in Table 8.

B. SAMPLING AND SAMPLE PREPARATION

1. Soil

Soil is analyzed for radioactivity to monitor for any significant increase in radioactive deposition by fallout 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. The data are monitored for increases beyond the natural variability of this background.

Surface soil types available for sampling range from decomposed granite to clay and loam. Samples are taken from the top 1/2-in. layer of undisturbed ground surface for gross radioactivity analysis and to a depth of 5 cm for plutonium analysis. The soil samples are packaged in plastic containers, and returned to the laboratory for analysis.

Sample preparation for gross radioactivity determination consists of transferring the soils to Pyrex beakers, and drying in a muffle furnace at $\sim 500^{o}C$ for 8 h. After cooling, the soil is sieved to obtain uniform particle size. Two-gram aliquots of the sieved soil are weighed, and transferred to copper planchets. The soil is wetted in the planchet with alcohol, evenly distributed to obtain uniform sample thickness, dried, and counted for alpha and beta radiation. Plutonium in soil analysis is performed according to the guidelines specified in

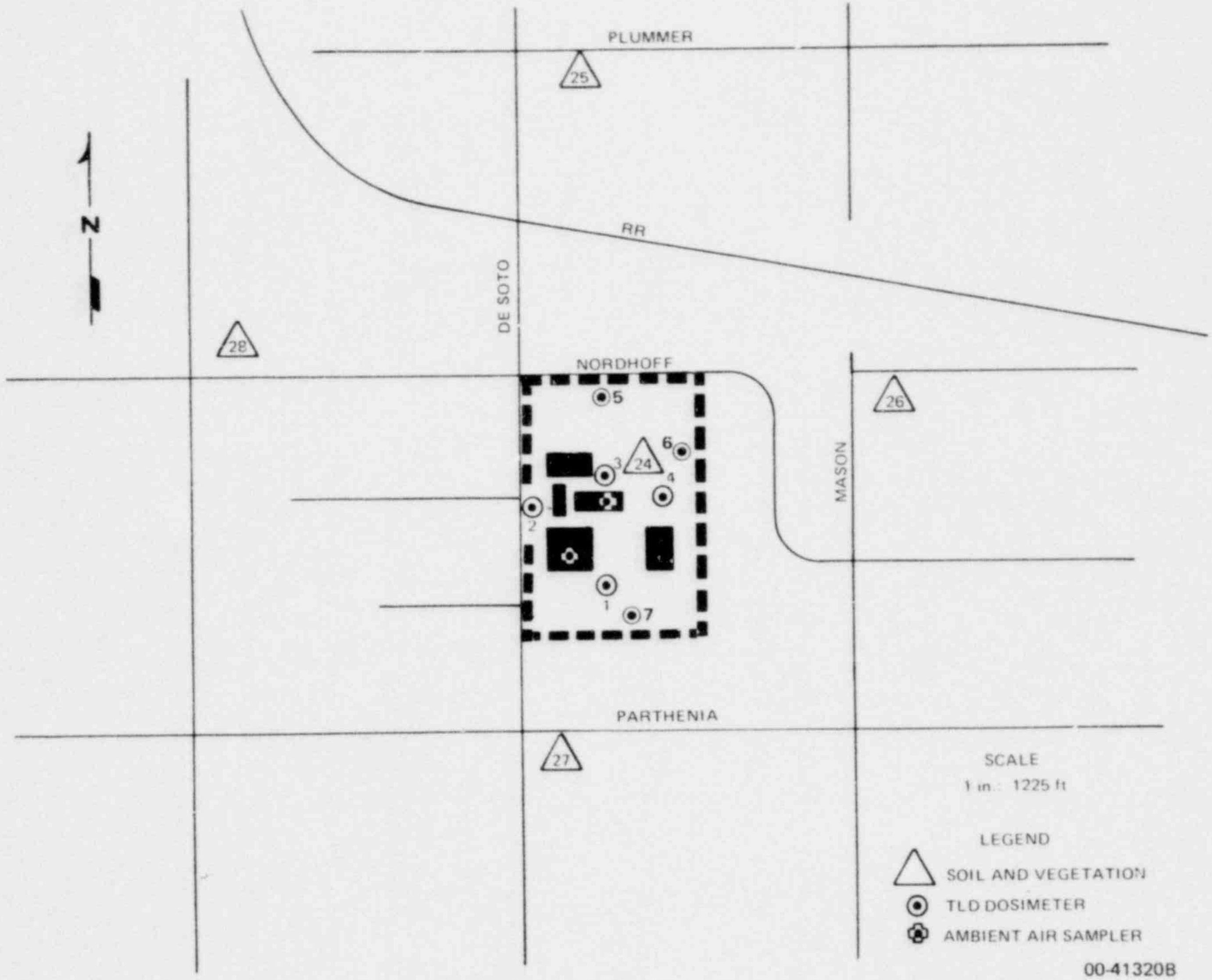


Figure 6. Map of De Soto Site and Vicinity Sampling Stations

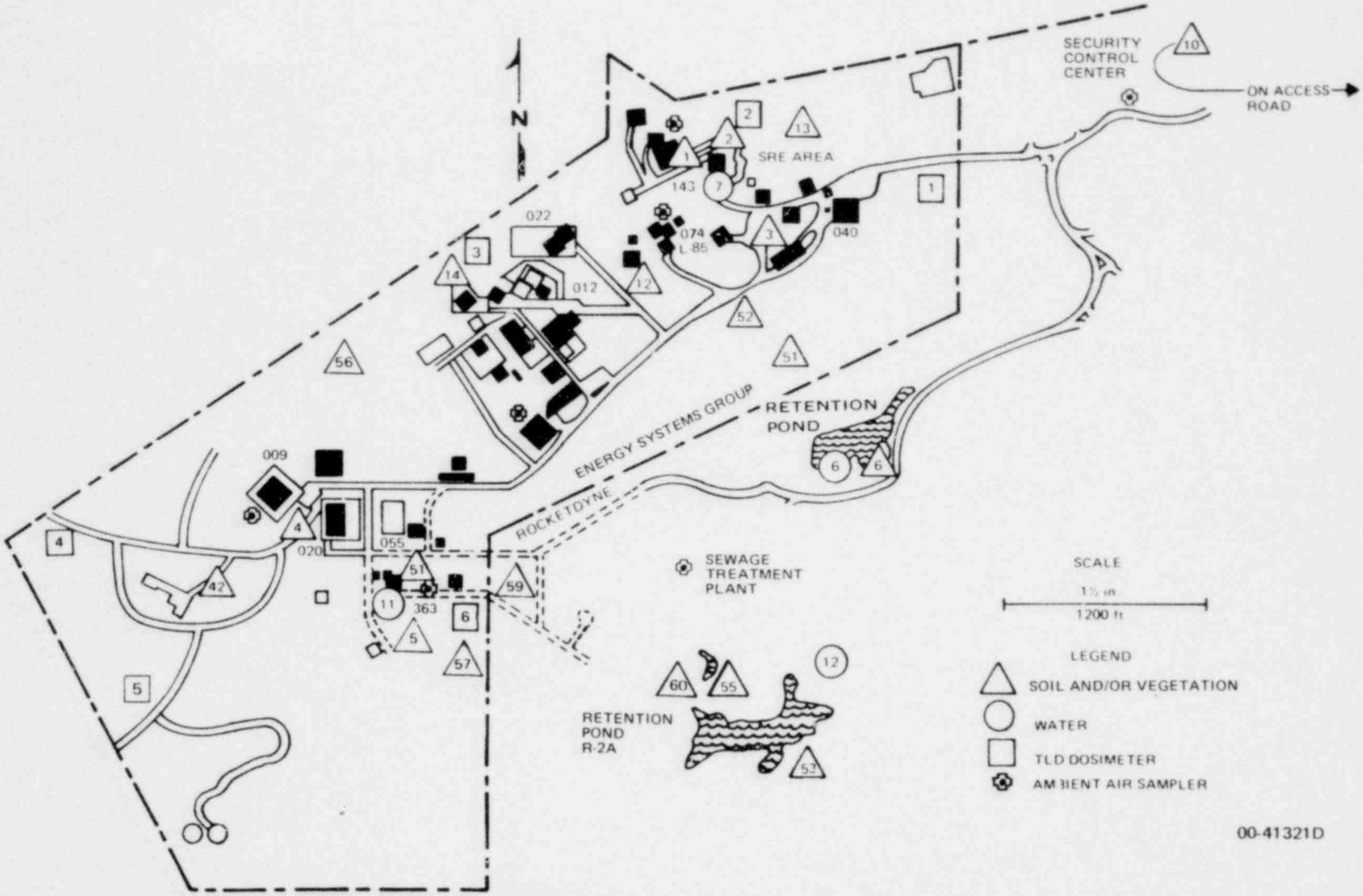


Figure 7. Map of Santa Susana Field Laboratories Site Sampling Stations

TABLE 8

SAMPLE STATION LOCATIONS
(Sheet 1 of 3)

Station	Location
SV-1	SSFL Site, Bldg. 143
SV-2	SSFL Site, Bldg. 143 Perimeter Drainage System
SV-3	SSFL Site, Bldg. 064
SV-4	SSFL Site, Bldg. 020
SV-5	SSFL Site, Bldg. 363
SV-6	Rocketdyne Site Interim Retention Pond
SV-10	SSFL Site Access Road
SV-12	SSFL Site, Bldg. 093 (L-85 Reactor)
SV-13	SSFL Site, at SRE Water Retention Pond
SV-14	SSFL Site, Bldg. 028
SV-19	SSFL Site Entrance, Woolsey Canyon
SV-24	De Soto Site, Bldg. 004
SV-25	De Soto Avenue and Plummer Street
SV-26	Mason Avenue and Nordhoff Street
SV-27	De Soto Avenue and Parthenia Street
SV-28	Canoga Avenue and Nordhoff Street
SV-31	Simi Valley, Alamo Avenue and Sycamore Road
SV-40	Agoura – Kanan Road and Ventura Freeway
SV-41	Calabasas – Parkway Calabasas and Ventura Freeway
SV-42	SSFL Site, Bldg. 886
SV-47	Chatsworth Reservoir North Boundary
SV-51	SSFL Site, Bldg. 029
SV-52	SSFL Site, Burro Flats Drainage Control Pond, G Street and 17th Street
SV-53	Rocketdyne Site Pond R-2A Spillway, Head of Bell Canyon
SV-54	Bell Creek
S-55	Rocketdyne Site Retention Pond R-2A (Pond Bottom Mud)
S-56	SSFL Site, F Street and 24th Street

SV – Soil and Vegetation Sample Station
S – Soil Sample Station

TABLE 8

SAMPLE STATION LOCATIONS
(Sheet 2 of 3)

Station	Location
S-57	SSFL Site, J Street at Bldg. 055
S-58	SSFL Site, Bldg. 353
S-59	Rocketdyne Site Test Area CTL 4
S-60	Rocketdyne Site Retention Pond R-2A
W-6	Rocketdyne Site Interim Retention Pond (drains to Pond R-2A)
W-7	SSFL Site Domestic Water, Bldg. 003
W-11	SSFL Site Domestic Water, Bldg. 363
W-12	Rocketdyne Site Area II Final Retention Pond R-2A
W-16	Bell Creek
A-1	De Soto Site, Bldg. 001 Roof
A-2	De Soto Site, Bldg. 004 Roof
A-3	SSFL Site, Bldg. 009, West Side
A-4	SSFL Site, Bldg. 011, West Side
A-5	Rocketdyne Site, Bldg. 600, North Side
A-6	Rocketdyne Site, Bldg. 207, North Side
A-7	SSFL Site, Bldg. 074, South Side
A-8	SSFL Site, Bldg. 143, West Side
A-9	SSFL Site, Bldg. 363, West Side
TLD-1	De Soto Site, South of Bldg. 102
TLD-2	De Soto Site, West Boundary
TLD-3	De Soto Site, Guard Post No. 1, Bldg. 201
TLD-4	De Soto Site, East Fence
TLD-5	De Soto Site, North Boundary
TLD-6	De Soto Site, East Boundary
TLD-7	De Soto Site, South Boundary
TLD-1	SSFL Site, Bldg. 114

S — Soil Sample Station
W — Water Sample Station
A — Air Sampler Station
TLD — Thermoluminescent Dosimeter Location

TABLE 8

SAMPLE STATION LOCATIONS
(Sheet 3 of 3)

Station	Location
TLD-2	SSFL Site, SRE Water Retention Pond
TLD-3	SSFL Site, Electric Substation No. 719
TLD-4	SSFL Site, West Boundary on H Street
TLD-5	SSFL Site, at Southwest Boundary
TLD-6	SSFL Site, Bldg. 854
TLD-1	Off Site, Northridge
TLD-2	Off Site, Simi Valley
TLD-3	Off Site, Northridge

TLD — Thermoluminescent Dosimeter Location

U.S. NRC Regulatory Guide 4.5 titled "Measurements of Radionuclides in the Environment-Sampling and Analysis of Plutonium in Soil" by a certified independent testing laboratory.

2. Vegetation

The analysis of vegetation is performed as an adjunct to the soil analysis and is done to determine the uptake of radioactivity by plants. These plants do not contribute to the human food chain, nor is there significant agriculture or grazing in the immediate neighborhood of either site.

Vegetation samples obtained in the field are of the same perennial plant types, wherever possible; these are usually sunflower or wild tobacco leaves. Vegetation leaves are stripped from plants, and placed in ice cream cartons for transfer to the laboratory for analysis. Ordinarily, plant root systems are not analyzed.

Vegetation samples are first washed with tap water to remove foreign matter, and then thoroughly rinsed with distilled water. Washed vegetation is dried in tared beakers at 100°C for 24 h for dry weight determination, then ashed in a muffle furnace at ~500°C for 8 h, producing a completely burned ash. One-gram aliquots of pulverized ash from each beaker are weighed, and transferred to copper planchets. The vegetation ash is wetted in the planchet with alcohol, evenly distributed to obtain uniform sample thickness, dried, and counted for alpha and beta radiation. The dry/ash weight ratio is used for the determination of the equivalent dry weight gross radioactivity concentration value.

3. Water

Surface and domestic supply water samples are obtained monthly at the SSFL site and from Bell Creek. The water is drawn into 1-liter polyethylene bottles, and transferred to the laboratory.

Five-hundred-milliliter volumes of water are evaporated to dryness in crystallizing dishes at ~90°C. The residual salts are redissolved into distilled water, transferred to copper planchets, dried under heat lamps, and counted for alpha and beta radiation.

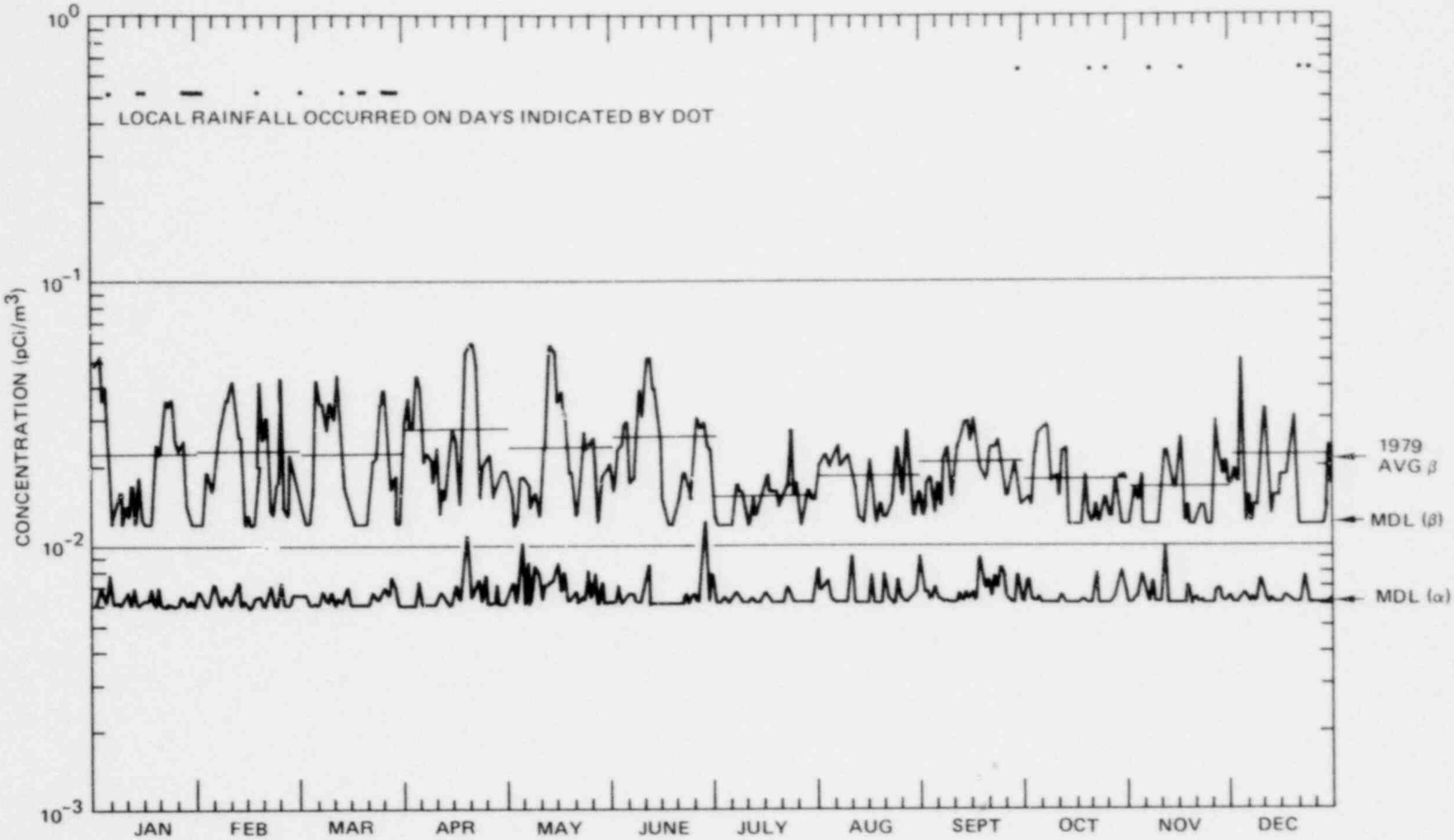


Figure 8. Daily Averaged Long-Lived Airborne Radioactivity at the De Soto and Santa Susana Field Laboratories Sites — 1979

4. Ambient Air

Air sampling is performed continuously at the De Soto and SSFL sites with automatic air samplers, operating on 24-h sampling cycles. Airborne particulate radioactivity is collected on Type HV-70 filter media, which are automatically changed daily at the end of each sampling period. The samples are counted for alpha and beta radiation following a minimum 120-h decay period. The volume of a typical daily ambient air sample is approximately 25 m^3.

Figure 8 is a graph of the daily averaged long-lived alpha and beta ambient air radioactivity concentrations for the De Soto and SSFL sites during 1979. The average beta concentration for each month is also indicated by horizontal bars. The graph shows that no prominent peaks occurred during the year, and that radioactivity concentrations were essentially constant through the year.

C. COUNTING AND CALIBRATION

Environmental soil, vegetation, water, and ambient air samples are counted for alpha and beta radiation with a low-background gas flow proportional counting system, capable of the simultaneous counting of both alpha and net beta radiation. The sample-detector configuration provides a nearly 2π geometry. The thin-window detector is continually purged with methane counting gas. A preset time mode of operation is used for all samples. The minimum detection limits shown in Table 9 were determined by using typical values for counting time, system efficiencies for detecting alpha and beta radiation, background count rates (approximately 0.05 cpm α and 1.0 cpm β) and sample size. For the table, the minimum statistically significant amount of radioactivity, irrespective of sample configuration, is taken as that amount equal in count rate to three times the standard deviation of the system background count rate.

Counting system efficiencies are determined routinely with Ra-D+E+F (with alpha absorber), Cl^{36}, Th^{230}, U^{235}, and Pu^{239} standard sources, and with K^{40}, in the form of standard reagent grade KCl, which is used to simulate soil and vegetation samples. Self-absorption standards are made by dividing sieved KCl into samples, increasing in mass by 200-mg increments, from 100 to 3000 mg. The samples are placed in copper planchets, of the type used for environmental samples,

TABLE 9

MINIMUM RADIOACTIVITY DETECTION LIMITS (MDL)

Sample	Activity	Minimum Detection Limits
Soil	α	5.7×10^{-8} μCi/g
	β	2.3×10^{-7} μCi/g
Vegetation	α	1.1×10^{-7} μCi/g ash
	β	3.6×10^{-7} μCi/g ash
Water	α	2.3×10^{-10} μCi/mℓ
	β	6.3×10^{-10} μCi/mℓ
Air	α	6.1×10^{-15} μCi/mℓ
	β	1.2×10^{-14} μCi/mℓ

and counted. The ratio of sample activity to the observed net count rate for each sample is plotted as a function of sample weight. The correction factor (ratio) corresponding to sample weight may be obtained from the graph. The product of the correction factor and the net sample count rate yields the sample activity (dpm). This method has been proved usable by applying it to various-sized aliquots of uniformly mixed environmental samples and observing that the resultant specific activities fall within the expected statistical counting error.

Since the observed radioactivity in environmental samples results primarily from natural and weapons-testing sources, and is at such low concentrations, an effort is not made to identify individual radionuclides. The detection of significant levels of radioactivity would lead to an investigation of the radioactive material involved, the sources and possible causes.

D. NONRADIOACTIVE MATERIALS

Rockwell International Corporation, Rocketdyne Division, has filed a Report of Waste Discharge with the California Regional Water Quality Control Board, and has been granted a National Pollutant Discharge Elimination System permit to discharge wastewater, pursuant to Section 402 of the Federal Water Pollution Control Act. The permit, NPDES No. CA0001309, became effective on September 27, 1976, and supersedes all previously held permits for wastewater discharge from the Rocketdyne Division SSFL. Discharge of overflow and storm runoff only is permitted into Bell Creek from water reclamation retention ponds. Discharge generally occurs only during and immediately after periods of heavy rainfall or during extended periods of rocket engine testing.

Only one of the retention ponds receives influent directly from the ESG SSFL site. It is identified as retention pond R-2A, Water Sample Station W-12 in Table 8. The influent includes sewage treatment plant effluent and surface runoff water. Grab-type water samples, taken at the retention pond prior to a discharge, are analyzed for non-radioactive chemical constituents and for radioactivity by a California State certified analytical testing laboratory. The specific constituents analyzed for, and their respective limitations in discharged wastewater, are presented in Appendix B. Wastewater originating from facilities located throughout the SSFL site is composited in the retention pond. The point of origin of nonradioactive constituents normally found in wastewater is impossible to determine; however, in the event of excessive amounts of any of these materials in wastewater, the origin may be determined from the knowledge of facility operations involving their use. A total of twelve off-site discharges of wastewater from Pond R-2A occurred during 1979.

TABLE 10

ATMOSPHERICALLY DISCHARGED EFFLUENT RELEASED TO UNRESTRICTED AREAS — 1979

Building	Approximate Effluent Volume (ft^3)	Activity Monitored	Approximate Minimum Detection Limit (µCi/mℓ)	Annual Average Concentration (µCi/mℓ)	Sampling Period Maximum Observed Concentration (µCi/mℓ)	Total Radio-activity Released (Ci)	% of Guide†	% of Samples with Activity <MDL
001 De Soto	2.5×10^{10}	α	1.7×10^{-16}	$<2.9 \times 10^{-14}$	2.8×10^{-13}	$<2.1 \times 10^{-5}$	<0.99	41.7
		β	5.4×10^{-16}	$<8.1 \times 10^{-15}$	5.8×10^{-14}	$<5.8 \times 10^{-6}$	<0.003	45.8
004 De Soto	3.3×10^{10}	α	3.5×10^{-16}	$<1.2 \times 10^{-15}$	5.2×10^{-15}	$<1.1 \times 10^{-6}$	<0.04	41.3
		β	10.7×10^{-16}	$<6.1 \times 10^{-15}$	1.3×10^{-13}	$<5.7 \times 10^{-6}$	<0.002	49.3
020 SSFL	1.5×10^{10}	α	0.9×10^{-16}	$<4.2 \times 10^{-16}$	1.1×10^{-15}	$<1.8 \times 10^{-7}$	<0.70	4.2
		β	2.9×10^{-16}	1.0×10^{-13}	4.0×10^{-13}	4.4×10^{-5}	0.34	0
021-022 SSFL	1.1×10^{10}	α	2.0×10^{-16}	$<2.6 \times 10^{-16}$	5.9×10^{-16}	$<3.5 \times 10^{-8}$	<0.45	75.0
		β	6.4×10^{-16}	$<8.4 \times 10^{-15}$	3.9×10^{-14}	$<2.7 \times 10^{-6}$	<0.03	8.3
055 SSFL	6.1×10^{9}	α	2.8×10^{-16}	$<3.1 \times 10^{-16}$	1.1×10^{-15}	$<5.3 \times 10^{-8}$	<0.51	86.0
		β	8.2×10^{-16}	$<1.2 \times 10^{-15}$	9.2×10^{-15}	$<2.1 \times 10^{-7}$	<0.04	50.0
					Total	$<8.1 \times 10^{-5}$		

Annual average ambient air radioactivity concentration — 1979		
	α	$<6.4 \times 10^{-15}$
	β	$<2.0 \times 10^{-14}$

†Guide: De Soto site, 3×10^{-12} µCi/mℓ alpha, 3×10^{-10} µCi/mℓ beta, 10 CFR 20 Appendix B.
SSFL site, 6×10^{-14} µCi/mℓ alpha, 3×10^{-11} µCi/mℓ beta, 3×10^{-12} µCi/mℓ beta (055 only); 10 CFR 20 Appendix B, CAC-17, and DOE Manual Chapter 0524.

Note: All release points are at the Stack Exit

IV. EFFLUENT MONITORING PROGRAM

Effluents which may contain radioactive material are generated at ESG facilities as the result of operations performed under contract to DOE, under NRC Special Nuclear Materials License SNM-21, and under State of California Radioactive Material License 0015-70. The specific facilities are identified as Buildings 001 and 004 at the De Soto site, and Buildings 020, 021, 022, and 055 at the Santa Susana site, SSFL.

A. TREATMENT AND HANDLING

Waste streams released to unrestricted areas are limited in all cases, to gaseous effluents. No contaminated liquids are discharged to unrestricted areas.

The level of radioactivity contained in all atmospherically discharged effluents is reduced to the lowest practicable values by passing the effluents through certified, high efficiency particulate air (HEPA) filters. These effluents are sampled for particulate radioactive materials by means of continuous stack exhaust samplers at the point of release. In addition, stack monitors installed at Buildings 020 and 055 provide automatic alarm capability in the event of the release of gaseous or particulate activity from Building 020 and particulate activity from Building 055. The HEPA filters used for filtering gaseous effluents are 99.97% efficient for particles of 0.3-μm diameter. Particle filtration efficiency increases for particles above and below this size.

The average concentration and total radioactivity in gaseous effluent released to unrestricted areas is shown in Table 10. The effectiveness of the air cleaning systems is evident from the fact that in most cases, the gaseous effluent released is less radioactive than the ambient air. The table shows that no significant quantities of radioactivity was released for 1979.

Liquid wastes released to sanitary sewage systems, a controlled area as provided for by CAC 17 and 10 CFR 20, are generated at the De Soto site only. Liquid wastes are discharged from Building 001 following analysis for radioactivity concentration. There is no continuous flow. Building 004 chemical wastes are released to a proportional sampler installation which retains an aliquot each

TABLE 11

LIQUID EFFLUENT DISCHARGED TO SANITARY SEWER — 1979

Building	Point of Release	Approximate Effluent Volume (gal)	Activity Monitored	Approximate MDL (μCi/mℓ)	Annual Average Concentration (μCi/mℓ)	Sample Maximum Observed Concentration (μCi/mℓ)	Total Radioactivity Released (Ci)	% of Guide†
001	Retention Tank	54,000	α	1.2×10^{-9}	1.5×10^{-7}	1.2×10^{-6}	3.0×10^{-5}	0.02
			β	3.7×10^{-9}	1.1×10^{-7}	6.5×10^{-7}	2.2×10^{-5}	0.01
004	Proportional Sampler	1,641,000	α	1.2×10^{-9}	$<1.1 \times 10^{-8}$§	7.0×10^{-8}	$<6.9 \times 10^{-5}$	<0.001
			β	3.7×10^{-9}	$<3.1 \times 10^{-8}$§	1.4×10^{-7}	$<1.9 \times 10^{-4}$	<0.003
020*	—	0	—	—	—	—	—	
021 - 022*	—	0	—	—	—	—	—	
055*	—	0	—	—	—	—	—	

*All liquid radioactive wastes are solidified and land buried as dry waste.
†Guide: 8×10^{-4} μCi/mℓ alpha, 1×10^{-3} μCi/mℓ beta; 10 CFR 20 Appendix B, CAC-17
§% of samples <MDL: 56.9% alpha activity, 11.8% beta activity

time a fixed volume is released to the sanitary sewage system. No radioactive liquid effluents are released from the Santa Susana Buildings 020, 021, 022, or 055. Liquid radioactive waste generated at SSFL is solidified for land burial. The average concentration and total radioactivity in effluents discharged is shown in Table 11.

B. ENERGY SYSTEMS GROUP FACILITY DESCRIPTIONS

1. De Soto Site

a. Building 001 – NRC and California State Licensed Activities

Operations at Building 001 which may generate radioactive effluents consist of production operations associated with the manufacture of enriched uranium fuel elements. Only atmospherically discharged effluents are released from the building to uncontrolled areas. Following analysis for radioactivity concentration, liquid wastes are released to the sanitary sewage system, which is considered a controlled area, as provided by CAC 17 and 10 CFR 20. Nuclear fuel material handled in unencapsulated form in this facility contains the uranium isotopes U^{234}, U^{235}, U^{236}, and U^{238}.

b. Building 004 – NRC and California State Licensed Activities

Operations at Building 004 which may generate radioactive effluents consist of research studies in physics and chemistry, and the chemical analysis of small quantities of fuel materials, usually limited to a few grams. Only atmospherically discharged effluents are released from the building to uncontrolled areas. Liquid laboratory wastes are released to a proportional sampler installation which retains an aliquot of wastewater each time a fixed volume is released to the facility sanitary sewage system. The aliquots are composited and analyzed for radioactivity. Nuclear fuel material handled in unencapsulated form in this facility contains the uranium isotopes U^{234}, U^{235}, U^{236}, and U^{238}. Major quantities of other radionuclides in encapsulated form include Co^{60} and Pm^{147}. No significant quantities of these radionuclides were released. The monitoring of De Soto site sewage effluent for tritium commenced during December 1977 continued on the basis of a monthly analysis of a daily composited sample of total facility effluent collected at the point of discharge into the municipal sewerage until the first calendar quarter of 1979 when it was terminated in accordance with the NRC license.

2. Santa Susana Field Laboratories Site

a. Building 020 — NRC and California State Licensed Activities

Operations at Building 020 which may generate radioactive effluents consist of hot cell examination of irradiated nuclear fuels and reactor components. Only atmospherically discharged effluents are released from the building to uncontrolled areas. The effluent may contain particulate material, as well as radioactive gases, depending on the operations being performed and the history of the irradiated fuel and other material. The chemical form of such materials may be U metal, UO_2, UC, mixed fission products, and various activation products. No radioactive liquid waste is released from the facility. Radioactive material handled in unencapsulated form in this facility includes the following radionuclides: Th^{232}, U^{233}, U^{234}, U^{235}, U^{236}, and U^{238} as constituents in the various fuel materials; and Cs^{137}, Sr^{90}, Kr^{85}, and Pm^{147} as mixed fission products.

b. Buildings 021 and 022 — DOE Contract Activities

Operations at Buildings 021 and 022 which may generate radioactive effluents consist of the processing, packaging, and temporary storage of liquid and dry radioactive waste material for disposal. Only atmospherically discharged effluents are released from the building to uncontrolled areas. No radioactive liquid waste is released from the facility. Nuclear fuel material handled in encapsulated or unencapsulated form contains the uranium isotopes U^{234}, U^{235}, U^{236}, U^{238}, plus Cs^{137}, Sr^{90}, and Pm^{147} as mixed fission products.

c. Building 055 — NRC and California State Licensed Activities

Operations at Building 055 which may generate radioactive effluents consist of fabrication of depleted uranium carbide fuel pellets. Only atmospherically discharged effluents are released from the facility to uncontrolled areas. No radioactive liquid waste is released from the facility.

The various fuel materials (depleted and enriched uranium and plutonium) contain the following radionuclides: U^{234}, U^{235}, U^{236}, U^{238}, Pu^{238}, Pu^{239}, Pu^{240}, Pu^{241}, and Am^{241}.

C. ESTIMATION OF GENERAL POPULATION DOSE

Release of airborne material at the De Soto site for summer season weather conditions would generally be under a subsidence inversion into an atmosphere that is typical of slight neutral to lapse conditions. Although nocturnal cooling inversions are present they are relatively shallow in extent. During the summer season the subsidence inversion is present almost every day. The base and top of this inversion for the most part lie below the elevation of the SSFL site. Thus, any atmospheric release under this condition from the SSFL site would result in Pasquill Type D lofting diffusion conditions above the inversion and considerable atmospheric dispersion prior to diffusion (if any) 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 for the most part is missing. The surface air flow is dominated by frontal activity moving through the area or to the east. Frontal passages through the area during this season are generally accompanied by precipitation. Diffusion characteristics are highly variable depending upon the frontal location. Generally, a light to moderate southwesterly wind precedes these frontal passages introducing strong onshore flow of marine air, and lapse rates are slight neutral to lapse. Wind speeds increase with the approach of the frontal systems, enhancing diffusion. The diffusion characteristics of the frontal passage are lapse conditions with light to moderate northerly winds. A summary of surface wind conditions for the local area is presented in Table 12.

TABLE 12

SURFACE WIND CONDITIONS

	Summer	Winter
Prevailing afternoon direction	WNW	NW
Prevailing early morning direction	ESE	ESE
Average daytime speed	8 mph	6 mph
Average nighttime speed	3 mph	3 mph

The population distributions around the De Soto and SSFL sites used to estimate population doses in this section are based on the 1970 census data projected for 1980. The projections were based on an average growth rate of 5.17%/yr for this area. For population distribution at distances >5 miles out to 50 miles, a single distribution centered on 34°14'25" north and 118°39'00" west is used. This location is between the two ESG sites which are ~6 miles apart. This population distribution is also based on the 1970 census data, with the 1980 projection based on the average growth rate of 5.17 %/yr.

The calculated downwind concentration of radioactive material discharged during 1979 from each of the four major ESG nuclear facilities is presented in Table 13. The Type B stability parameter coefficients and a mean wind speed of 2.2 m/s were used for the calculations.

TABLE 13

DOWNWIND CONCENTRATION OF GASEOUS EFFLUENTS — 1979

Facility	Q (Ci/s)	Meters to		Type B Stability(σ_y)			Type B Stability(σ_z)			χ Downwind($\mu Ci/cm^3$)†		
		Boundary	Residence	Boundary	Residence	80 km	Boundary	Residence	80 km*	Boundary	Residence	80 km
B/001	8.4×10^{-13}	110 W	171 SW	18	27	6800	12	18	10^6	5.6×10^{-16}	2.5×10^{-16}	1.8×10^{-23}
B/020	1.4×10^{-12}	305 NW	1900 SE	50	290	6800	33	350	10^6	1.2×10^{-16}	2.0×10^{-18}	3.0×10^{-23}
B/022	8.8×10^{-14}	350 NW	2300 SE	55	310	6800	38	500	10^6	6.1×10^{-18}	8.2×10^{-20}	1.9×10^{-24}
B/055	8.4×10^{-15}	400 NW	1830 SE	68	260	6800	44	320	10^6	4.1×10^{-19}	1.5×10^{-20}	1.8×10^{-25}

*σ_z Type B Stability Category Linear Extrapolation to 80 km
†Assume $\bar{u}$ = 2.2 m/s average wind speed, constant direction, full year

The general population man-rem dose estimates calculated from demography data and the concentrations calculated for atmospherically discharged effluent data are presented in Table 14. It should be noted that these estimates assume level surrounding terrain and ignore the effect of the mountains that completely encircle the sites at distances of about 10 km. The air turbulence and changes in elevation associated with actual terrain would result in much lower concentrations than those calculated.

The off-site doses are extremely low compared to the maximum permissible exposures recommended for the general population. These values are 3 rem/year for bone, and 1.5 rem/year for the lung for an individual, and are one-third of

TABLE 14

POPULATION DOSE ESTIMATES FOR ATMOSPHERIC DISCHARGED EFFLUENTS

Sector	Dose to Receptor Population Segment — Man-rem						
	0-8 km	8-16 km	16-32 km	32-48 km	48-64 km	64-80 km	Total
N-NNE	2.6E-4	1.3E-7	2.5E-6	4.4E-8	2.4E-8	9.8E-9	2.6E-4
NNE-NE	3.4E-4	1.5E-7	1.8E-6	5.4E-8	1.6E-7	1.3E-7	3.4E-4
NE-ENE	1.6E-2	[illegible] 3E-5	1.2E-5	4.8E-8	6.8E-9	1.6E-8	1.6E-2
ENE-E	1.5E-2	6.1E-5	2.3E-5	3.5E-6	9.0E-7	2.7E-7	1.5E-2
E-ESE	3.1E-2	7.0E-5	3.7E-5	1.8E-5	6.3E-6	2.0E-6	3.1E-2
ESE-SE	3.6E-2	3.5E-5	2.8E-5	2.3E-5	7.9E-6	2.2E-6	3.6E-2
SE-SSE	3.2E-2	1.9E-5	1.0E-5	2.6E-6	2.1E-6	1.4E-7	3.2E-2
SSE-S	3.1E-2	2.2E-6	6.0E-7	0	1.6E-9	0	3.1E-2
S-SSW	4.2E-5	1.6E-6	2.5E-7	0	0	0	4.4E-5
SSW-SW	1.3E-4	2.3E-6	6.7E-7	0	0	0	1.3E-4
SW-WSW	9.8E-5	8.5E-7	3.5E-6	1.6E-7	5.6E-8	0	1.0E-4
WSW-W	8.2E-4	1.6E-6	1.8E-6	1.5E-6	9.5E-7	1.3E-9	8.2E-4
NW-WNW	4.9E-3	2.8E-5	6.8E-7	4.9E-7	1.8E-7	3.7E-9	4.9E-3
WNW-NW	1.3E-2	2.6E-6	7.8E-7	3.3E-9	1.3E-9	3.1E-10	1.3E-2
NW-NNW	5.0E-3	6.2E-8	4.6E-8	1.6E-9	4.0E-10	4.7E-9	5.0E-3
NNW-N	2.6E-4	3.0E-8	2.4E-7	7.0E-9	2.3E-9	9.4E-11	2.6E-4
	1.9E-1	2.6E-4	1.2E-4	4.9E-5	1.9E-5	4.8E-6	1.9E-1

1. Average rem/man dose = 1.5E-8 rem for the 80 km segment average population.
2. Total 80 km man-rem dose estimate from naturally occurring airborne radioactivity dose to the lung of ~0.1 rem/year = 1,300,000 man-rem for the 80 km radius area population.

these values for the general population. From Table 14, it may be seen that the highest total segment dose is for the 0-8 km segment equivalent to an average dose/man-year of 0.0008 mrem equivalent to 0.00005% of the maximum permissible exposure for an individual and 0.00016% of the general population recommended average exposure. Estimated radiation doses due to atmospheric discharges from ESG facilities are a small fraction of the recommended limits and are far below doses due to internal deposition of natural radioactivity in air which are ~50 to 100 mrem per year.

APPENDIX A

COMPARISON OF ENVIRONMENTAL RADIOACTIVY DATA FOR 1979 WITH PREVIOUS YEARS

This section compares environmental monitoring results for the calendar year 1979 with previous annual data.

The data presented in Tables A-1 through A-5 summarize all past annual average radioactivity concentrations. These data show the effects of both the short-lived and long-lived radioactive fallout from nuclear weapons tests superimposed on the natural radioactivity inherent in the various sample types.

Over the considerable period of time that the environmental program has been in operation, evolutionary changes have been made in order to provide more effective data. In some cases this is readily apparent in the data. For example, in Table A-1, a small but abrupt increase in the alpha activity reported for soil is seen to occur in 1971. This increase is observed in both the on-site and the off-site samples and resulted from use of an improved counting system with a thinner sample configuration. The thinner sample increases the sensitivity of the detector to alpha-emitting radionuclides in the sample, thus producing a higher measured specific activity.

Similarly, prior to 1971, gross activity in ambient air was measured, including both alpha and beta activity. In 1971, measurements were begun which allowed separate identification of these two types of activity.

The types of random variations observed in the data indicate that there is no local source of unnatural radioactivity in the environment. Also, the similarity between on-site and off-site results further indicate that the contribution to general environmental radioactivity due to operations at ESG is essentially nonexistent.

TABLE A-1

SOIL RADIOACTIVITY DATA — 1957 THROUGH 1979

Year	On Site-Average (10^{-6} μCi/g)			Off Site - Average (10^{-6} μCi/g)		
	Number Samples	α	β	Number Samples	α	β
1979	144	0.64	25	48	0.50	23
1978	144	0.63	24	48	0.51	24
1977	144	0.56	24	48	0.53	23
1976	144	0.56	25	48	0.56	24
1975	144	0.60	25	48	0.58	24
1974	144	0.60	25	48	0.54	24
1973	144	0.57	25	48	0.51	24
1972	144	0.56	25	48	0.57	24
1971	144	0.55	25	48	0.53	23
1970	144	0.47	27	48	0.48	25
1969	144	0.42	27	48	0.42	25
1968	144	0.47	26	48	0.48	26
1967	144	0.42	28	48	0.39	24
1966	144	0.41	29	48	0.44	25
1965	144	0.46	36	142	0.47	29
1964	152	0.46	32	299	0.44	26
1963	156	0.43	45	455	0.42	42
1962	147	0.44	48	453	0.41	47
1961	120	0.37	34	458	0.33	23
1960	115	0.41	23	362	0.37	19
1959	107	0.43	15	377	0.32	14
1958	80	0.27	21	309	0.26	10
1957	64	0.32	11	318	0.35	10

TABLE A-2

VEGETATION RADIOACTIVITY DATA — 1957 THROUGH 1979

Year	On Site — Average (10^{-6} μCi/g ash)			Off-Site — Average (10^{-6} μCi/g ash)		
	Number Samples	α	β	Number Samples	α	β
1979	144	<0.24	139	48	<0.23	134
1978	144	<0.24	166	48	<0.24	143
1977	144	<0.22	162	48	<0.21	142
1976	144	<0.19	170	48	<0.22	147
1975	144	<0.21	155	48	<0.21	141
1974	144	<0.20	152	48	<0.27	141
1973	144	<0.24	155	48	<0.24	142
1972	144	0.23	145	48	0.36	125
1971	144	0.24	165	48	0.31	132
1970	144	0.33	159	48	0.30	142
1969	144	0.40	165	48	0.36	144
1968	144	0.51	158	48	0.51	205
1967	144	0.62	286	48	0.39	413
1966	144	0.37	169	48	0.37	123
1965	144	0.56	162	142	0.61	138
1964	154	0.50	211	293	0.51	181
1963	156	0.44	465	456	0.37	388
1962	147	0.45	500	453	0.44	406
1961	120	0.35	224	459	0.29	246
1960	115	0.35	137	362	0.25	136
1959	96	0.29	212	293	0.18	168
1958	65	0.57	683	250	0.39	356
1957	58	1.1	208	304	0.89	200

TABLE A-3

SSFL SITE DOMESTIC WATER RADIOACTIVITY DATA — 1957 THROUGH 1979

Year	Number Samples	Average α (10^{-9} μCi/mℓ)	Average β (10^{-9} μCi/mℓ)
1979	24	<0.23	2.8
1978	24	<0.26	3.0
1977	24	<0.25	2.5
1976	24	<0.25	2.0
1975	24	<0.24	2.3
1974	24	<0.24	2.7
1973	24	<0.26	3.4
1972	24	0.22	3.7
1971	24	0.28	4.9
1970	24	0.18	5.3
1969	24	0.11	5.0
1968	24	0.16	5.0
1967	24	0.13	6.1
1966	24	0.13	4.6
1965	24	0.22	6.0
1964	23	0.18	5.3
1963	24	0.18	7.0
1962	24	0.21	12.0
1961	24	0.08	2.9
1960	22	0.08	1.9
1959	18	0.08	1.6
1958	13	0.16	4.7
1957	17	—	13.0

TABLE A-4

BELL CREEK AND ROCKETDYNE DIVISION RETENTION POND RADIOACTIVITY DATA — 1966 THROUGH 1979

	Samples														
	Bell Creek Mud 54			Bell Creek Vegetation 54			Bell Creek Water 16			Interim Retention Pond Water 6			Final Retention Pond R-2A Water 12		
Year	No. Samples	Average (10^{-6} μCi/g)		No. Samples	Average (10^{-6} μCi/g ash)		No. Samples	Average (10^{-9} μCi/mℓ)		No. Samples	Average (10^{-9} μCi/mℓ)		No. Samples	Average (10^{-9} μCi/mℓ)	
		α	β		α	β		α	β		α	β		α	β
1979	12	0.46	23.	12	<0.26	136.	12	<0.23	3.2	12	<0.25	3.1	12	<0.23	4.5
1978	12	0.42	23.	12	<0.26	156.	12	<0.24	2.5	12	<0.25	4.3	12	<0.25	4.6
1977	12	0.29	22.	12	<0.19	155.	12	<0.24	1.8	12	<0.24	4.3	12	<0.25	5.2
1976	12	0.38	23.	12	<0.17	164.	12	<0.25	2.2	12	<0.24	4.3	12	<0.28	4.4
1975	12	0.29	22.	12	<0.19	123.	12	<0.22	2.4	12	<0.24	4.2	12	<0.31	4.5
1974	12	0.32	22.	12	<0.16	142.	12	<0.21	2.5	12	<0.22	4.2	12	<0.21	4.5
1973	12	0.34	24.	12	<0.17	147.	12	<0.21	2.7	12	<0.23	4.5	12	<0.37	5.6
1972	12	0.32	22.	12	0.12	139.	12	0.20	2.5	12	0.22	5.3	12	0.22	5.5
1971	12	0.36	23.	12	0.19	128.	12	0.15	3.8	12	0.18	6.2	12	0.16	6.4
1970	12	0.44	24.	12	0.23	165.	12	0.15	3.7	12	0.15	6.9	12	0.12	7.4
1969	12	0.35	27.	12	0.28	166.	12	0.04	4.0	12	0.07	5.9	11	0.10	5.7
1968	11	0.32	24.	11	0.39	170.	8	0.05	4.6	11	0.23	8.1	12	0.33	7.7
1967	12	0.40	24.	12	0.38	180.	12	0.07	5.8	12	0.19	6.6	10	0.17	7.0
1966	3	0.39	25.	3	1.1	108.	3	0.75	2.5	9	0.11	5.8	8	1.1	6.3

TABLE A-5

AMBIENT AIR RADIOACTIVITY CONCENTRATION DATA — 1957 THROUGH 1979

Year	DeSoto Site Average (10^{-12} μCi/mℓ)			SSFL Site Average§ (10^{-12} μCi/mℓ)		
	Number Samples	α	β	Number Samples	α	β
1979	697	<0.0066	<0.021	2519	<0.0065	<0.020
1978	713	<0.0084	<0.091	2402	<0.0072	<0.088
1977	729	<0.0066	<0.17	2438	<0.0066	<0.17
1976	719	<0.0067	<0.096	2520	<0.0065	<0.11
1975	709	<0.0063	<0.076	2450	<0.0060	<0.073
1974	663	<0.0056	<0.16	2477	<0.0057	<0.16
1973	715	<0.0075	<0.041	2311	<0.0072	<0.038
1972	708	0.0085	0.14	2430	0.0086	0.14
1971*	730	0.0087	0.30	2476	0.0086	0.33
1970	668	—	0.34	2434	—	0.36
1969	687	—	0.27	2364	—	0.26
1968	650	—	0.32	2157	—	0.32
1967	712	—	0.39	2400	—	0.41
1966	706	—	0.18	2205	—	0.17
1965	483	—	0.83	1062	—	0.21
1964	355	—	2.7	—		†
1963	360	—	6.6	292	—	4.7
1962	343	—	7.3	314	—	5.6
1961	313	—	4.2	176	—	3.6
1960	182	—	0.24	44	—	0.44
1959	215	—	2.5	257	—	0.93
1958	366	—	4.9	164	—	2.7
1957	63	—	1.6	141	—	2.7

*Ambient air alpha radioactivity values were included in the beta values and not reported separately prior to 1971

†Insufficient data

§Includes Rocketdyne Site Air Sampler Data

APPENDIX B

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD CRITERIA FOR DISCHARGING NONRADIOACTIVE CONSTITUENTS FROM ROCKETDYNE DIVISION, SSFL

The discharge of an effluent in excess of the following limits given in Table B-1 is prohibited.

TABLE B-1

NPDES NO. CA00-01309, EFFECTIVE SEPTEMBER 27, 1976

Constituent	Discharge Rate (lb/day)	Concentration Limit (mg/ℓ)	
	30-day Average	30-day Average	Maximum
Total Dissolved Solids	1,267,680	-	950
Chloride	200,160	-	150
Sulfate	400,320	-	300
Suspended Solids*	66,720	50	150
Settleable Solids*	-	0.1	0.3
BOD 20°C	26,690	20	60
Oil and Grease	13,350	10	15
Chromium	6.67	0.005	0.01
Fluoride	1,340	-	1.0
Boron	1,340	-	1.0
Residual Chlorine	-	-	0.1
Fecal Coliform (MPN/100 mℓ)	-	-	23.0
Surfactants (as MBAS)	667	-	0.5
pH			6.0-9.0

*Not applicable to discharges containing rainfall runoff during or immediately after periods of rainfall.

APPENDIX C
REFERENCES

1. DOE Manual Chapter 0513
2. DOE Manual Chapter 0524, Appendix
3. Code of Federal Regulations, Title 10, Part 20
4. California Radiation Control Regulations, California Administrative Code, Title 17, Public Health
5. California Regional Water Quality Control Board, Los Angeles Region, Order No. 74-379, NPDES No. CA0001309, Effective September 27, 1976
6. Meteorology and Atomic Energy — 1968, TID 24190
7. Report of Committee II on Permissible Dose for Internal Radiation (1959), ICRP Publication 2
8. Deposition and Retention Models for Internal Dosimetry of the Human Respiratory Tract, ICRP Committee II Task Group on Lung Dynamics
9. Document TI #N001TI000-046 titled "Method of Estimating General Population Radiation Dose Attributable to Atmospheric Discharge of Radioactivity from ESG Nuclear Facilities," J. D. Moore

APPENDIX D
EXTERNAL DISTRIBUTION

1. Radiologic Health Section, State Department of Public Health, California
2. Radiological Health Division, Los Angeles County Health Department California
3. Resources Management Agency, County of Ventura, California
4. U.S. Department of Energy, San Francisco Operations Office
5. U.S. Nuclear Regulatory Commission, Division of Reactor Licensing
6. Gordon Facer, Division of Military Applications, DOE
7. Andrew J. Pressesky, Reactor Research and Development, DOE
8. James Miller, Division of Biomedical and Environmental Research, DOE
9. DOE-Headquarters Library, Attention: Charles Sherman