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ATOMICS INTERNATIONAL ENVIRONMENTAL MONITORING AND FACILITY EFFLUENT ANNUAL REPORT 1976

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ABSTRACT

Environmental and facility effluent radioactivity monitoring at Atomics International(AI) is performed by the Radiation and Nuclear Safety Unit of the Health, Safety, and Radiation Services Department. Soil, vegetation, and surface water are routinely sampled to a distance of 10 miles from AI sites. Continuous ambient air sampling and thermoluminescent dosimetry are performed on site for monitoring airborne radioactivity and site ambient radiation levels. Radioactivity in effluents discharged to the atmosphere from AI 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 constituents in surface water discharged to unrestricted areas are determined. This report summarizes and discusses monitoring results for 1976. The results of a special soil plutonium survey performed during the year are also summarized.

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 AI 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.

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Figure 1. Atomics International Headquarters

I. INTRODUCTION

The Atomics International (AI) Division of Rockwell International Corporation has been engaged in atomic energy research and development since 1946. The Division 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 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, gasification of coal, and solid and liquid waste disposal.

The Division's modern administration, scientific research, and manufacturing facilities (Figure 1) are located in Canoga Park, California, approximately 23 miles northwest of downtown Los Angeles. Certain of the Division's 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 Co^{60} gamma irradiation facility. The 290-acre Nuclear Development Field Laboratory (NDFL), Figure 2, is located in the Simi Hills of Ventura County, approximately 29 miles northwest of downtown Los Angeles. Both Energy Research and Development Administration (ERDA) and Rockwell-owned facilities, as shown in Figure 3, share this site. The NDFL also contains facilities in which nuclear operations, licensed by NRC and the State, are conducted. The licensed facilities include: (1) the Atomics International Hot Laboratory (AIHL), 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.

Also included within the NDFL site is an 82-acre, Government-optioned area where ERDA-contract activities are conducted, primarily by the non-nuclear Liquid Metal Engineering Center (LMEC). The major operational nuclear installation within the optioned area is the Radioactive Material Disposal Facility (RMDF), Building 022. This facility is used for processing

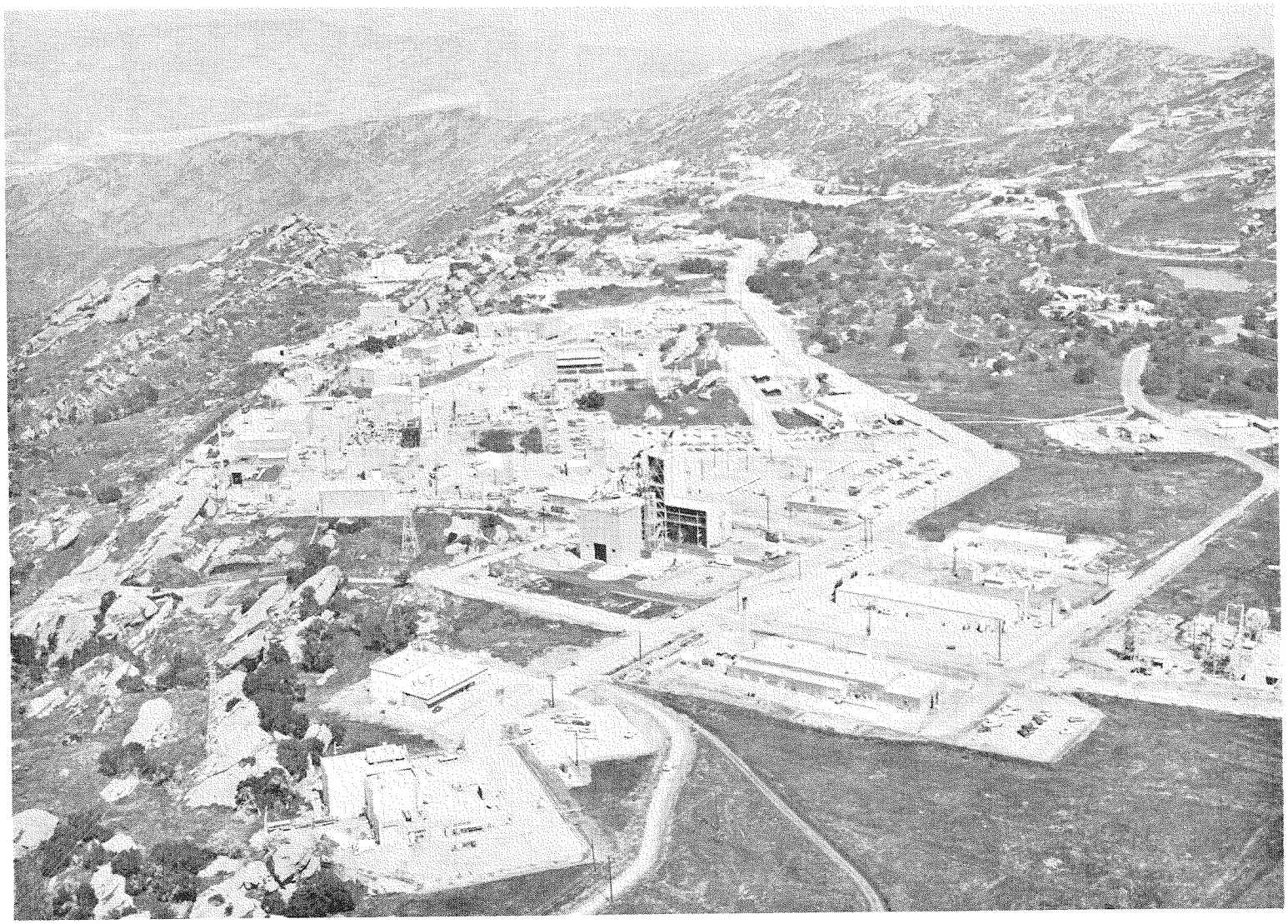

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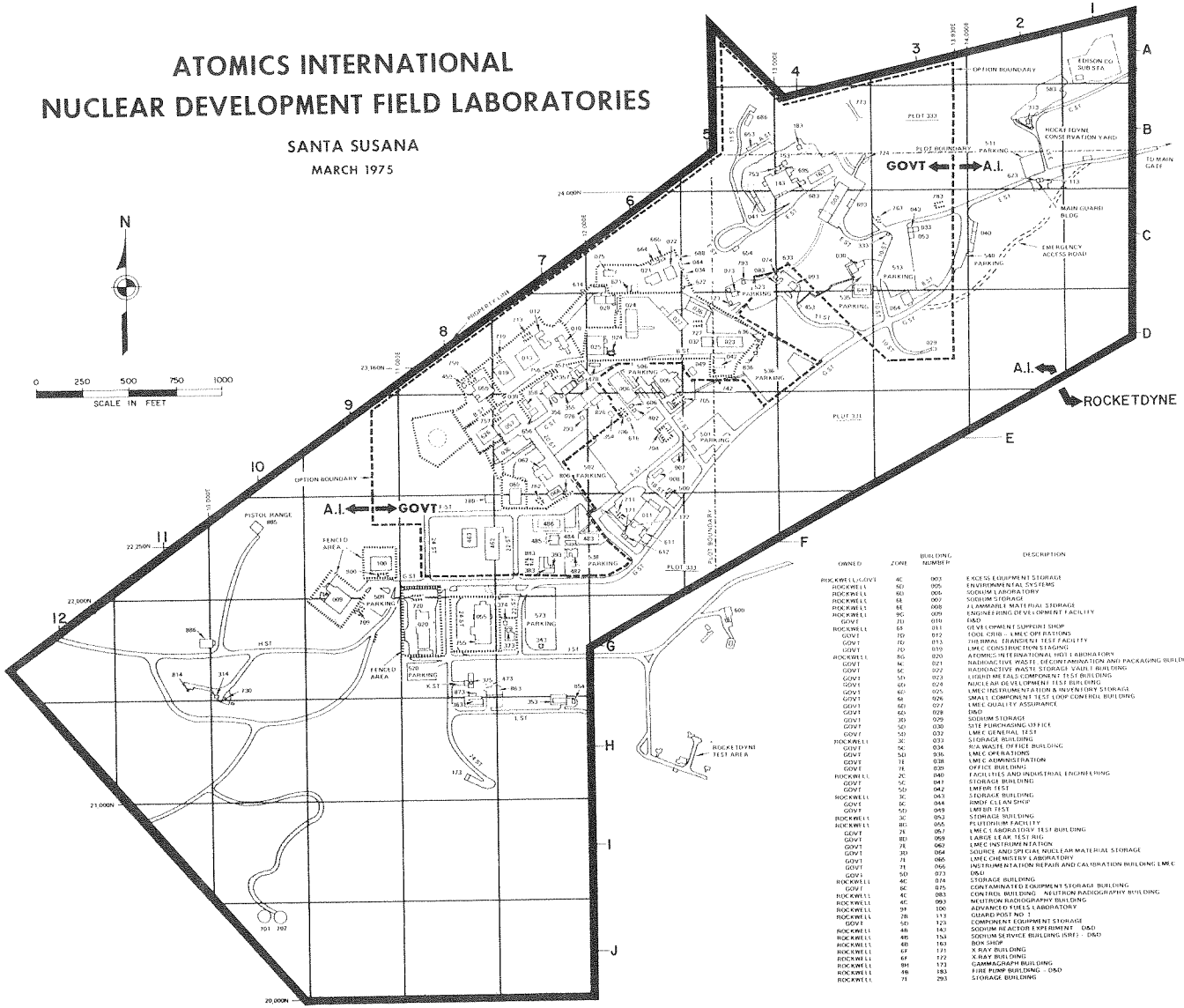
Figure 2. Atomics International Nuclear Development Field Laboratory



OWNED	ZONE	BUILDING NUMBER	DESCRIPTION
ROCKWELL/GOVT	4C	003	EXCESS EQUIPMENT STORAGE
ROCKWELL	6D	005	ENVIRONMENTAL SYSTEMS
ROCKWELL	6D	006	SODIUM LABORATORY
ROCKWELL	6E	007	SODIUM STORAGE
ROCKWELL	6E	008	FLAMMABLE MATERIAL STORAGE
ROCKWELL	9C	009	ENGINEERING DEVELOPMENT FACILITY
GOVT	7D	010	D&D
ROCKWELL	6F	011	DEVELOPMENT SUPPORT SHOP
GOVT	7D	012	TOOL CRIB - LMEC OPERATIONS
GOVT	7D	013	THERMAL TRANSIENT TEST FACILITY
GOVT	7D	019	LMEC CONSTRUCTION STAGING
ROCKWELL	8G	020	ATOMICS INTERNATIONAL HOT LABORATORY
GOVT	6C	021	RADIOACTIVE WASTE DECONTAMINATION AND PACKAGING BUILDING
GOVT	6C	022	RADIOACTIVE WASTE STORAGE VAULT BUILDING
GOVT	5D	023	LIQUID METALS COMPONENT TEST BUILDING
GOVT	6D	024	NUCLEAR DEVELOPMENT TEST BUILDING
GOVT	6C	025	LMEC INSTRUMENTATION & INVENTORY STORAGE
GOVT	6E	026	SMALL COMPONENT TEST LOOP CONTROL BUILDING
GOVT	6D	027	LMEC QUALITY ASSURANCE
GOVT	6D	028	D&D
GOVT	3D	029	SODIUM STORAGE
GOVT	5D	030	SITE PURCHASING OFFICE
GOVT	5D	032	LMEC GENERAL TEST
ROCKWELL	3C	033	STORAGE BUILDING
GOVT	5C	034	RSA WASTE OFFICE BUILDING
GOVT	5D	036	LMEC OPERATIONS
GOVT	7E	038	LMEC ADMINISTRATION
GOVT	7E	039	OFFICE BUILDING
ROCKWELL	2C	040	FACILITIES AND INDUSTRIAL ENGINEERING
GOVT	5C	041	STORAGE BUILDING
GOVT	5D	042	LMFBR TEST
ROCKWELL	3C	043	STORAGE BUILDING
GOVT	5C	044	RMDF CLEAN SHOP
GOVT	5D	049	LMFBR TEST
ROCKWELL	3C	053	STORAGE BUILDING
ROCKWELL	8G	055	PLUTONIUM FACILITY
GOVT	7E	057	LMEC LABORATORY TEST BUILDING
GOVT	8D	059	LARGE LEAK TEST RIG
GOVT	7E	062	LMEC INSTRUMENTATION
GOVT	3D	064	SOURCE AND SPECIAL NUCLEAR MATERIAL STORAGE
GOVT	7E	065	LMEC CHEMISTRY LABORATORY
GOVT	7E	066	INSTRUMENTATION REPAIR AND CALIBRATION BUILDING LMEC
GOVT	5D	073	D&D
ROCKWELL	4C	074	STORAGE BUILDING
GOVT	6C	076	CONTAMINATED EQUIPMENT STORAGE BUILDING
ROCKWELL	4C	083	CONTROL BUILDING - NEUTRON RADIOGRAPHY BUILDING
ROCKWELL	4C	093	NEUTRON RADIOGRAPHY BUILDING
ROCKWELL	9F	100	ADVANCED FUELS LABORATORY
ROCKWELL	7B	113	GUARD POST NO 1
GOVT	5D	123	COMPONENT EQUIPMENT STORAGE
ROCKWELL	4B	143	SODIUM REACTOR EXPERIMENT - D&D
ROCKWELL	4B	154	SODIUM SERVICE BUILDING (SRE) - D&D
ROCKWELL	4B	163	BOX SHOP
ROCKWELL	6F	171	X RAY BUILDING
ROCKWELL	6F	172	X RAY BUILDING
ROCKWELL	8H	173	GAMMAGRAPH BUILDING
ROCKWELL	4B	183	FIRE PUMP BUILDING - D&D
ROCKWELL	7E	293	STORAGE BUILDING

OWNED	ZONE	BUILDING NUMBER	DESCRIPTION
ROCKWELL	2B	313	CONSERVATION BUILDING
ROCKWELL	10G	314	LARGE LEAK INJECTOR DEVICE BLIDD TEST CONTROL BUILDING
ROCKWELL	3C	333	TIME CLOCK BUILDING
ROCKWELL	7G	343	TIME CLOCK BUILDING
ROCKWELL	7H	353	RESEARCH AND DEVELOPMENT LABORATORY BUILDING
GOVT	6E	354	CONTROL ELEMENT TEST STRUCTURE
GOVT	7D	355	SCTI CONTROL BUILDING
GOVT	7D	356	SODIUM COMPONENT TEST INSTALLATION
GOVT	7D	357	LMEC PUMP BEARING TEST FACILITY CONTROL BUILDING
GOVT	7E	358	CHEMICAL STORAGE BUILDING
ROCKWELL	8H	363	RESEARCH AND DEVELOPMENT LABORATORY BUILDING
ROCKWELL	7G	373	DEVELOPMENT TEST BUILDING
GOVT	7G	374	TEST LOOP ENCLOSURE
ROCKWELL	8G	375	CONTROL SHELTER BUILDING
GOVT	7F	383	LMEC CONSTRUCTION STAGING
ROCKWELL	6E	402	HYDROGEN RECOMBINER TEST
ROCKWELL	4D	453	STG NEUTRON RADIOGRAPHY STORAGE
GOVT	7D	457	PUMP BEARING TEST STRUCTURE
GOVT	8D	459	UNINTERRUPTABLE POWER SUPPLY
GOVT	8F	462	SODIUM PUMP TEST FACILITY
GOVT	8F	463	SODIUM CLEANING AND HANDLING FACILITY
ROCKWELL	8G	473	HYDRAULIC TEST INSTRUMENTATION BUILDING
GOVT	6D	478	SUPPORT TRAILER (LMEC)
GOVT	7F	482	GOVERNMENT PROJECT OFFICES
GOVT	7F	483	LMEC OFFICE COMPLEX
GOVT	7F	484	PLOT ROOM - TRAILER
GOVT	7F	485	LMEC OFFICE COMPLEX
GOVT	7F	486	LMEC OFFICE COMPLEX
ROCKWELL	6F	509	COMPRESSED GAS BOTTLE STORAGE DOCK
ROCKWELL	5E	501	PARKING LOT
ROCKWELL	7E	502	PARKING LOT
ROCKWELL	8D	506	PARKING LOT
ROCKWELL	3G	509	PARKING LOT
ROCKWELL	7B	511	PARKING LOT
GOVT	3C	513	PARKING LOT
ROCKWELL	8G	520	PARKING LOT
ROCKWELL	5E	523	PARKING LOT
GOVT	6C	526	PARKING LOT
ROCKWELL	5D	536	PARKING LOT
GOVT	6F	538	PARKING LOT
ROCKWELL	3C	540	PARKING LOT
ROCKWELL	7G	573	PARKING LOT
ROCKWELL	2B	583	CONSERVATION STORAGE YARD
ROCKWELL	5F	600	SEWAGE TREATMENT PLANT
ROCKWELL	6E	606	HYDROGEN RECOMBINER TEST
ROCKWELL	6F	611	PAINT SPRAY BOOTH
ROCKWELL	6F	612	STORAGE BUILDING
GOVT	7C	614	DRAINAGE SUMP
ROCKWELL	6E	616	COOLING TOWER
GOVT	9C	621	RADIOACTIVE ACCOUNTABLE WASTE STORAGE BUILDING
GOVT	5C	622	RADIOACTIVE WASTE CONTAINING BUILDING
ROCKWELL	2B	623	GUARD POST NO 1
GOVT	8E	626	LMEC INVENTORY STORAGE
ROCKWELL	9C	630	REACTOR COOLING WATER PAD
GOVT	5D	636	GUARD POST
GOVT	4C	641	RECEIVING & STORAGE BUILDING
GOVT	5B	653	LIQUID RADIOACTIVE WASTE VAULT - D&D
GOVT	5C	654	INTERIM RADIOACTIVE WASTE - D&D
GOVT	7E	656	SCTI COOLING TOWER
GOVT	6C	664	LOW LEVEL RADIOACTIVE WASTE PROCESSING
GOVT	6C	665	RMDF OXIDATION FACILITY
GOVT	4C	683	ELECTRICAL SUBSTATION
GOVT	5B	686	TEMPORARY HOT WASTE STORAGE - D&D
GOVT	6C	688	AUXILIARY SKID BUILDING
GOVT	4C	693	ELECTRICAL SUBSTATION NO 1
GOVT	4B	695	COLD TRAP VAULT (SRE) - D&D
ROCKWELL	10J	701	WATER TANK (DEER FLATS)
ROCKWELL	10J	702	WATER TANK (DEER FLATS)
GOVT	6F	704	ELECTRICAL SUBSTATION
ROCKWELL	6F	705	ELECTRICAL SUBSTATION
ROCKWELL	6F	706	ELECTRICAL SUBSTATION
ROCKWELL	9G	709	ELECTRICAL SUBSTATION
ROCKWELL	6F	713	ELECTRICAL SUBSTATION
GOVT	7D	713	ELECTRICAL SUBSTATION
GOVT	7D	719	ELECTRICAL SUBSTATION
ROCKWELL	8G	720	ELECTRICAL SUBSTATION
GOVT	4B	724	CONTAMINATED SODIUM CLEANING BUILDING
GOVT	5D	727	ELECTRICAL SUBSTATION
ROCKWELL	10G	730	STORAGE SHED
GOVT	5D	742	ELECTRICAL SUBSTATION
GOVT	4B	753	PRIMARY FILL TANK VAULT - D&D
ROCKWELL	8G	755	ELECTRICAL SUBSTATION
GOVT	7D	756	ELECTRICAL SUBSTATION
GOVT	8E	757	ELECTRICAL SUBSTATION
GOVT	8D	759	ELECTRICAL SUBSTATION
GOVT	7F	762	ELECTRICAL SUBSTATION
GOVT	3C	763	ELECTRICAL SUBSTATION
GOVT	4B	773	DRAINAGE CONTROL DAM
GOVT	8F	780	ELECTRICAL SUBSTATION
SCE	3C	783	ELECTRICAL SUBSTATION
GOVT	5C	793	ELECTRICAL CONTROL BUILDING
ROCKWELL	9B	800	ELECTRICAL SUBSTATION
ROCKWELL	7E	806	TIME CLOCK BUILDING
ROCKWELL	11G	814	LARGE LEAK INJECTOR DEVICE
GOVT	6F	826	SMALL COMPONENT TEST LOOP
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	887	ELECTRICAL SUBSTATION
ROCKWELL	10F	885	PISTOL RANGE
ROCKWELL	11G	886	SODIUM DISPOSAL FACILITY
GOVT	6D	924	ELECTRICAL SUBSTATION

Figure 3. Map of Nuclear Development Field Laboratory Facilities

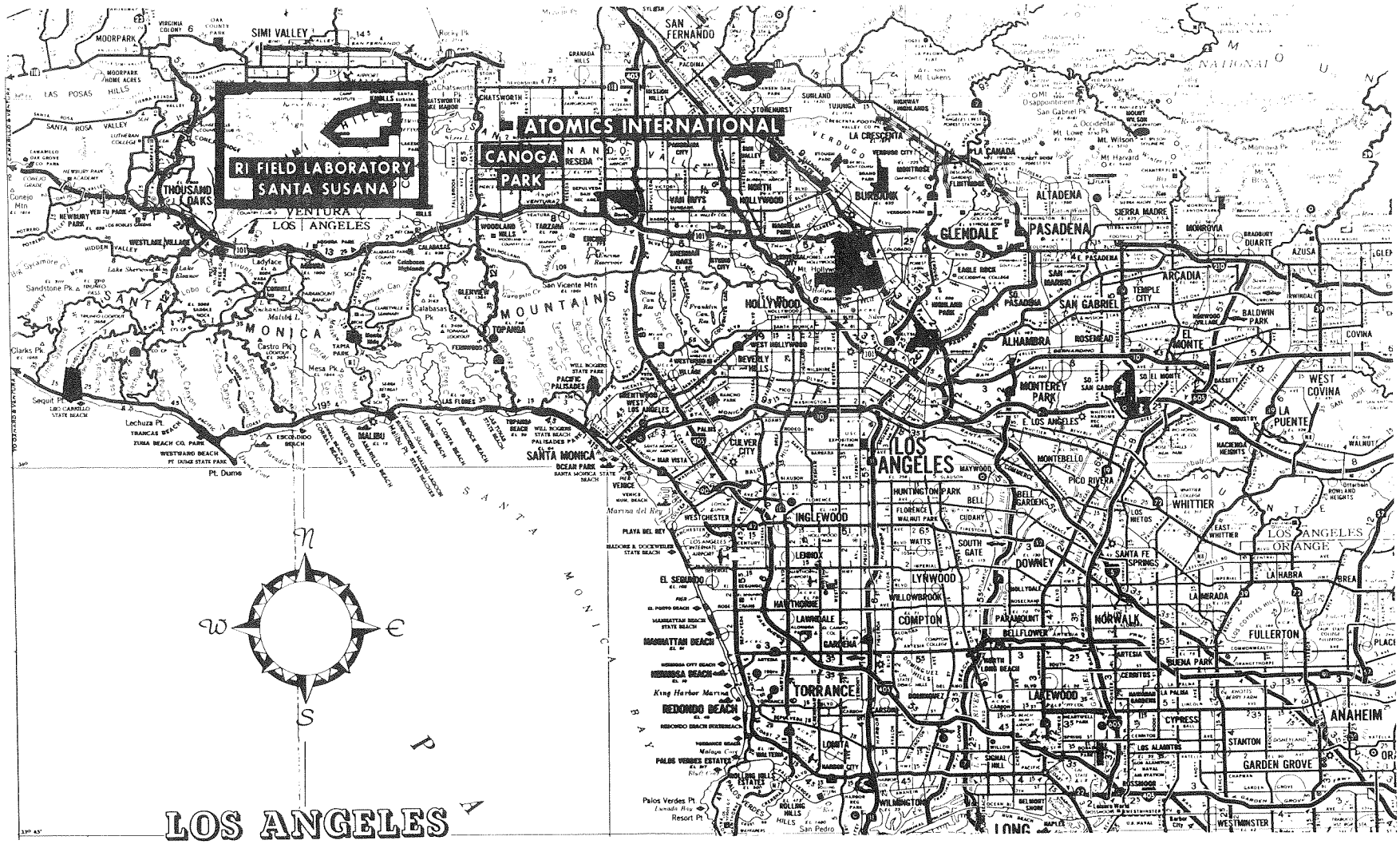


Figure 4. Map of General Los Angeles Area
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wastes generated as a result of the D&D Program, begun in 1975. Several deactivated nuclear reactor and support facilities, all within the optioned area, are affected by the D&D Program. Included are: (1) several facilities used for Systems for Nuclear Auxiliary Power (SNAP) reactor test operations, Buildings 010, 024, and 059; (2) a Shield Test and Irradiation Reactor (STIR), Building 028; and (3) a Kinetic Experiment Water Boiler (KEWB) test reactor facility, Building 073 and 083. The SRE, Building 143, is also included. There is no fissile material located at any of these facilities.

Licensed programs conducted during 1976 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 AIHL 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 normal and enriched uranium, and plutonium - uranium oxide mixing operations for carbothermic reduction to (U, Pu) C for advanced fuels development.

The basic policy for control of radiological and toxicological hazards at AI requires that adequate containment of such materials be provided, and, through rigid operational controls, that effluent releases and external radiation levels are reduced to a minimum. The environmental monitoring program provides a measure of the effectiveness of the Division's safety procedures and engineering safeguards incorporated into facility designs. Specific radionuclides in facility effluent or environmental samples, although not routinely identified due to the extremely low radioactivity levels normally detected, may 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 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 AI 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 Headquarters and NDFL facilities are sampled monthly to determine the concentration of radioactivity in typical surface soil, vegetation, and water. Similar off-site environmental samples are obtained quarterly. Continuously performed on-site ambient air sampling provides information concerning airborne long-lived particulate radioactivity. A site ambient gamma radiation monitoring program, utilizing thermoluminescent dosimetry (TLD), was begun in 1971.

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 liquid pollutants are made to unrestricted areas. Liquid waste generated at the Headquarters site is discharged into the city sewage system. Sanitary sewage from all ERDA and AI facilities at the NDFL is treated at an on-site sewage plant. The plant effluent drains into a retention pond, located at the adjoining Rocketdyne Division Santa Susana Field Laboratory (SSFL). The surface water drainage system of the NDFL is composed of catch ponds and open drainage ditches leading to the retention pond that also receives the 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 is also monitored at discharge for nonradioactive pollutants by Rocketdyne, as required by discharge permits issued to Rocketdyne by the California Regional Water Quality Control Board.

This report summarizes environmental monitoring results for 1976. A comparison of 1976 radioactivity results with previous years appears in Appendix A.

II. ENVIRONMENTAL MONITORING SUMMARY RESULTS

A. RADIOACTIVE MATERIALS – 1976

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 ambient air for 1976 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 ERDA 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. Except for ambient air radioactivity, none of the maximum observed values, which occurred randomly during this year, show a great increase over the average values beyond natural variability. The air sample data reflects a September atmospheric nuclear device detonation which resulted in a marked but transient increase in local airborne radioactivity.

The results reported in Tables 1 and 2 show no significant difference between on-site and off-site samples. 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. 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}.

Process water used at the NDFL is obtained from Ventura County Water District No. 8, which also supplies nearby communities, and is distributed on-site by the same piping system previously used when process water was obtained

TABLE 1

SOIL RADIOACTIVITY DATA – 1976

Area	Activity	No. Samples	Gross Radioactivity (μCi/g)	
			Annual Average Value (95% Confidence Level)	Maximum Observed Value*
On Site	α	144	$(5.6 \pm 1.5)\ 10^{-7}$	8.4×10^{-7}
	β	144	$(2.5 \pm 0.1)\ 10^{-5}$	3.2×10^{-5}
Off Site	α	48	$(5.6 \pm 1.5)\ 10^{-7}$	1.0×10^{-6}
	β	48	$(2.4 \pm 0.1)\ 10^{-5}$	3.0×10^{-5}

*Maximum value observed for single sample.

TABLE 2

VEGETATION RADIOACTIVITY DATA – 1976

Area	Activity	No. Samples	Gross Radioactivity (μCi/g)		
			Dry Weight Annual Average Value	Ash	
				Annual Average Value (95% Confidence Level)	Maximum Observed Value*
On Site	α	144	$(<3.1 \pm 2.6)\ 10^{-8}$	$(<1.9 \pm 1.6)\ 10^{-7}$	1.2×10^{-6}
	β	144	$(2.5 \pm 0.1)\ 10^{-5}$	$(1.70 \pm 0.03)\ 10^{-4}$	2.99×10^{-4}
Off Site	α	48	$(<4.4 \pm 3.3)\ 10^{-8}$	$(<2.2 \pm 1.7)\ 10^{-7}$	8.4×10^{-7}
	β	48	$(3.0 \pm 0.1)\ 10^{-5}$	$(1.47 \pm 0.03)\ 10^{-4}$	2.74×10^{-4}

*Maximum value observed for single sample.

from on-site wells. Conversion was completed during 1969. Pressure is provided by elevated storage tanks and storage reservoirs.

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

TABLE 3

NDFL PROCESS WATER RADIOACTIVITY DATA – 1976

Area	Activity	No. Samples	Gross Radioactivity (μCi/mℓ)	
			Average Value (95% Confidence Level)	Maximum* Observed Value
NDFL	α	24	$(<2.5 \pm 2.9)\ 10^{-10}$	4.2×10^{-10}
	β	24	$(2.0 \pm 0.7)\ 10^{-9}$	2.5×10^{-9}

*Maximum value observed for single sample

As discussed earlier, surface waters discharged from NDFL 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 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 ponds 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 supply water shows no significant variation in either alpha or beta activity.

TABLE 4

BELL CREEK AND ROCKETDYNE SSFL RETENTION POND
RADIOACTIVITY DATA – 1976

Area	Activity	No. Samples	Gross Radioactivity		
			Average Value (95% Confidence Level)	Maximum* Observed Value	% of Guide†
Bell Creek Mud No. 54 (μCi/g)	α	12	$(3.8 \pm 1.3)\ 10^{-7}$	9.1×10^{-7}	NA
	β	12	$(2.3 \pm 0.1)\ 10^{-5}$	3.0×10^{-5}	NA
SSFL Pond Mud No. 55 (μCi/g)	α	12	$(5.9 \pm 1.5)\ 10^{-7}$	7.7×10^{-7}	NA
	β	12	$(2.5 \pm 0.1)\ 10^{-5}$	2.6×10^{-5}	NA
Bell Creek Vegetation No. 54 (μCi/g ash)	α	12	$(<1.7 \pm 1.6)\ 10^{-7}$	3.2×10^{-7}	NA
	β	12	$(1.64 \pm 0.03)\ 10^{-4}$	2.51×10^{-4}	NA
Bell Creek Vegetation No. 54 (μCi/g) dry weight)	α	12	$(<3.4 \pm 3.1)\ 10^{-8}$	7.0×10^{-8}	NA
	β	12	$(3.2 \pm 0.1)\ 10^{-5}$	4.6×10^{-5}	NA
Bell Creek Water No. 16 (μCi/mℓ)	α	12	$(<2.5 \pm 2.9)\ 10^{-10}$	2.8×10^{-10}	<0.006
	β	12	$(2.2 \pm 0.8)\ 10^{-9}$	2.9×10^{-9}	0.7
SSFL Pond Water No. 6 (μCi/mℓ)	α	12	$(<2.4 \pm 2.9)\ 10^{-10}$	$<2.4 \times 10^{-10}$	<0.006
	β	12	$(4.3 \pm 0.8)\ 10^{-9}$	5.5×10^{-9}	1.4
SSFL Pond Water No. 12 (μCi/mℓ)	α	12	$(<2.8 \pm 3.0)\ 10^{-10}$	5.3×10^{-9}	<0.007
	β	12	$(4.4 \pm 0.8)\ 10^{-9}$	7.0×10^{-9}	1.5

*Maximum value observed for single sample.
†Guide: 4×10^{-6} μCi/mℓα, 3×10^{-7} μCi/mℓβ; 10 CFR 20 Appendix B.
NA – Not applicable, no Guide value having been established.

The surface water (NDFL) and the ambient air radioactivity Guide values selected for each site are the most restrictive limits for those radionuclides currently in use at AI facilities. The identity of all such radionuclides is known, irrespective of concentration. Accordingly, for NDFL surface water, the Guide value of 4×10^{-6} μCi/m$\ell\alpha$ and 3×10^{-7} μCi/m$\ell\beta$, for Pu^{239} and for Sr^{90}, respectively, is appropriate. The correspondingly most restrictive Guide value for Headquarters wastewater radioactivity discharged to the sanitary sewage system, a controlled area, is 8×10^{-4} μCi/m$\ell\alpha$ and 1×10^{-3} μCi/m$\ell\beta$, for U^{235} and Co^{60}, respectively.

The Guide value of 6×10^{-14} μCi/m$\ell\alpha$ for NDFL ambient air radioactivity is due to work with unencapsulated plutonium at this site. The Guide value of 3×10^{-11} μCi/m$\ell\beta$, for Sr^{90}, is due to the presence of fission products in irradiated nuclear fuel at the site. The Guide value of 3×10^{-12} μCi/m$\ell\alpha$ for Headquarters ambient air radioactivity is due to work with unencapsulated uranium (including depleted uranium) at this facility. The Guide value of 3×10^{-10} μCi/m$\ell\beta$ for Co^{60}, for Headquarters ambient air radioactivity is appropriate since it is the most restrictive limit for beta-emitting radionuclides present at the facility. 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 Headquarters and NDFL sites. Air is drawn through Type HV-70 filter media which are analyzed, after a minimum 120-h decay period to eliminate the radon particulate daughters, for long-lived radioactivity. The average concentrations of alpha and beta ambient air radioactivity are presented separately in Table 5.

Radioactivity levels observed in environmental samples for 1976, 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 continuing, although infrequent, foreign atmospheric nuclear tests continue to be occasionally

TABLE 5

AMBIENT AIR RADIOACTIVITY DATA – 1976

Site Location	Activity	No. Samples	Average Value (95% Confidence Level)	Maximum* Observed Value (daily)	% of Guide†
Headquarters	α§	719	$(<6.7 \pm 8.4)\ 10^{-15}$	1.4×10^{-13}	<0.22
(μCi/mℓ)	β**	719	$(<9.6 \pm 1.8)\ 10^{-14}$	3.7×10^{-12}	<0.032
NDFL	α§	2520	$(<6.5 \pm 7.2)\ 10^{-15}$	5.3×10^{-14}	<0.22
(μCi/mℓ)	β**	2520	$(<1.1 \pm 0.2)\ 10^{-13}$	3.4×10^{-12}	<0.037

*Maximum value observed for single sample.
†Guide: Headquarters, 3×10^{-12} μCi/m$\ell\alpha$, 3×10^{-10} μCi/m$\ell\beta$; 10 CFR 20 Appendix B,
NDFL, 6×10^{-14} μCi/m$\ell\alpha$, 3×10^{-11} μCi/m$\ell\beta$; 10 CFR 20 Appendix B,
§MDL = 6.2×10^{-15} μCi/mℓ – Individual daily samples with activity levels of 0 to 6.2×10^{-15} μCi/mℓ are recorded and averaged as 6.2×10^{-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.

observable in daily ambient air radioactivity levels; however, the long-term effects on surface sample radioactivity levels are not discernible. The continued relative constancy in current environmental radioactivity is due primarily to the dominance of naturally occurring radionuclides in the environment and to the longer-lived fission product radioactivity from fallout.

Site ambient radiation monitoring is performed with several types of TLD's. Each dosimeter packet includes a single calcium fluoride (CaF_2:Mn) low background, bulb-type chip dosimeter which produced the data used in this report, a single calcium fluoride (CaF_2:Mn) bare chip dosimeter, and two calcium sulfate ($CaSO_4$:Dy) low background powder-type dosimeters. The additional chip dosimeter is used for continued development of TLD dosimetry programs at AI. The powder dosimeters, supplied and evaluated by a commercial radiation dosimetry laboratory, are used as backup to the low background bulb-type dosimeter. The dosimeter sets are placed at selected locations

(Figures 6 and 7) on or near the perimeters of the Headquarters and NDFL sites. Each dosimeter, sealed in a light-proof energy compensation shield, is installed in a polyethylene container mounted at each location. The dosimeters are exchanged and evaluated quarterly. There are 10 on-site TLD monitoring locations. Three additional dosimeter sets, located off-site at locations up to 10 miles from the sites, are similarly evaluated to determine the local area ambient radiation level, which averaged 0.010 mrem/h for 1976. The average radiation dose rate and equivalent annual dose monitored at each dosimeter location are presented in Table 6.

TABLE 6

SITE AMBIENT RADIATION DOSIMETRY DATA – 1976

Dosimeter Location	Average Dose Rate (mrem/h)	Equivalent Annual Dose (mrem)
TLD-1 Headquarters	0.010	89
TLD-2 Headquarters	0.008	74
TLD-3 Headquarters	0.011	94
TLD-4 Headquarters*	0.011	99
TLD-5 NDFL	0.012	101
TLD-6 NDFL	0.013	112
TLD-7 NDFL	0.014	124
TLD-8 NDFL	0.012	107
TLD-9 NDFL	0.008	73
TLD-10 NDFL	0.010	89
TLD-11 Off-Site	0.010	86
TLD-12 Off-Site	0.012	101
TLD-13 Off-Site	0.010	86

*Excludes fourth quarter

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 100 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 AI operations.

B. NONRADIOACTIVE MATERIALS – 1976

Wastewater discharged from the NDFL 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. The discharges are normally required only as a result of excessive rainfall run-off. As a result, the NPDES concentration limits for turbidity, and suspended and settleable solids do not apply for water samples taken during rainfall-related discharges. The results of analyses for each discharge for 1976, all of which were rainfall-related discharges, are presented in Table 7.

TABLE 7

NONRADIOACTIVE CONSTITUENTS IN WASTEWATER DISCHARGED TO UNRESTRICTED AREAS– 1976

(Analysis results for wastewater discharged to Bell Creek on date indicated–Sample Station W-12)

Constituents	February 5		March 2		March 25		April 14		September 14		Limits of Detection
	Result	% of Guide	Result	% of Guide	Result	% of Guide	Result	% of Guide	Result	% of Guide	
Total Dissolved Solids (mg/ℓ)	360	36.0	470	47.0	460	46.0	355	35.5	410	41.0	0.1
Total Hardness (mg/ℓ)	153	30.6	159	31.8	130	26.0	159	31.8	153	30.6	0.1
Chloride (mg/ℓ)	50	20.0	87	34.8	60	24.0	65	26.0	NA	–	0.1
Sulfate (mg/ℓ)	78	31.2	82	32.8	68	27.2	59	23.6	83	33.2	1.1
Suspended Solids (mg/ℓ)	4	8.9	15	33.3	NA	–	28	62.2	24	53.3	0.1
Settleable Solids (mℓ/ℓ-h)	8.3	4150	ND	–	ND	–	0.3	150	0.1	50.0	1.0
BOD (mg/ℓ)	4	13.3	ND	–	25	83.3	11.0	36.7	8	26.7	0.1
Oil and Grease (mg/ℓ)	3	20	4	26.7	5	33.3	2.0	13.3	ND	–	0.1
Nitrate Nitrogen (mg/ℓ)	0.65	6.5	0.83	8.3	1.19	11.9	1.46	14.6	4.90	49.0	0.1
Color (in color units)	40	200	50	250	50	250	25	125	26	130	1
Turbidity (TU)	9.2	12.3	9	12.0	13	17.3	6	8.0	6.3	8.4	0.1
Total Chromium (mg/ℓ)	0.02	200	ND	–	ND	–	0.03	300	ND	–	0.01
Fluoride (mg/ℓ)	0.55	55.0	0.82	82.0	2.75	275.0	3.85	385.0	0.67	67.0	0.01
Boron (mg/ℓ)	0.53	53.0	ND	–	0.41	41.0	ND	–	0.48	48.0	0.01
Residual Chlorine (mg/ℓ)	ND	–	ND	–	ND	–	ND	–	Trace	–	0.01
Fecal Coliform (MPN/100 mℓ)	62	15.5	21	5.2	NA	–	4.5	1.1	NA	–	2.2
Surfactants (mg/ℓ)	0.20	40.0	0.17	34.0	0.22	44.0	0.13	26.0	0.03	6.0	0.01
pH	8.5		9.1		8.7		7.6		8.5		0.02

NA - Not available; analysis not requested or not performed.
ND - None detected; level below limit of detection.

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 AI Division 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 conducted in the Burro Flats area, southwest of SRE, where other nuclear installations are currently in operation. The Downey area survey was terminated when the Division relocated to Canoga Park in 1955. The primary purpose of the environmental monitoring program is to survey environmental radioactivity adequately to ensure that AI 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. 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. The soil samples are packaged in plastic containers, and returned to the laboratory for analysis.

Sample preparation consists of transferring the soils to Pyrex beakers, and drying in a muffle furnace at approximately 500 °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. Loose soil specific gravity ranges from approximately 1.1 to 1.4 g/mℓ, and averages 1.2 g/mℓ.

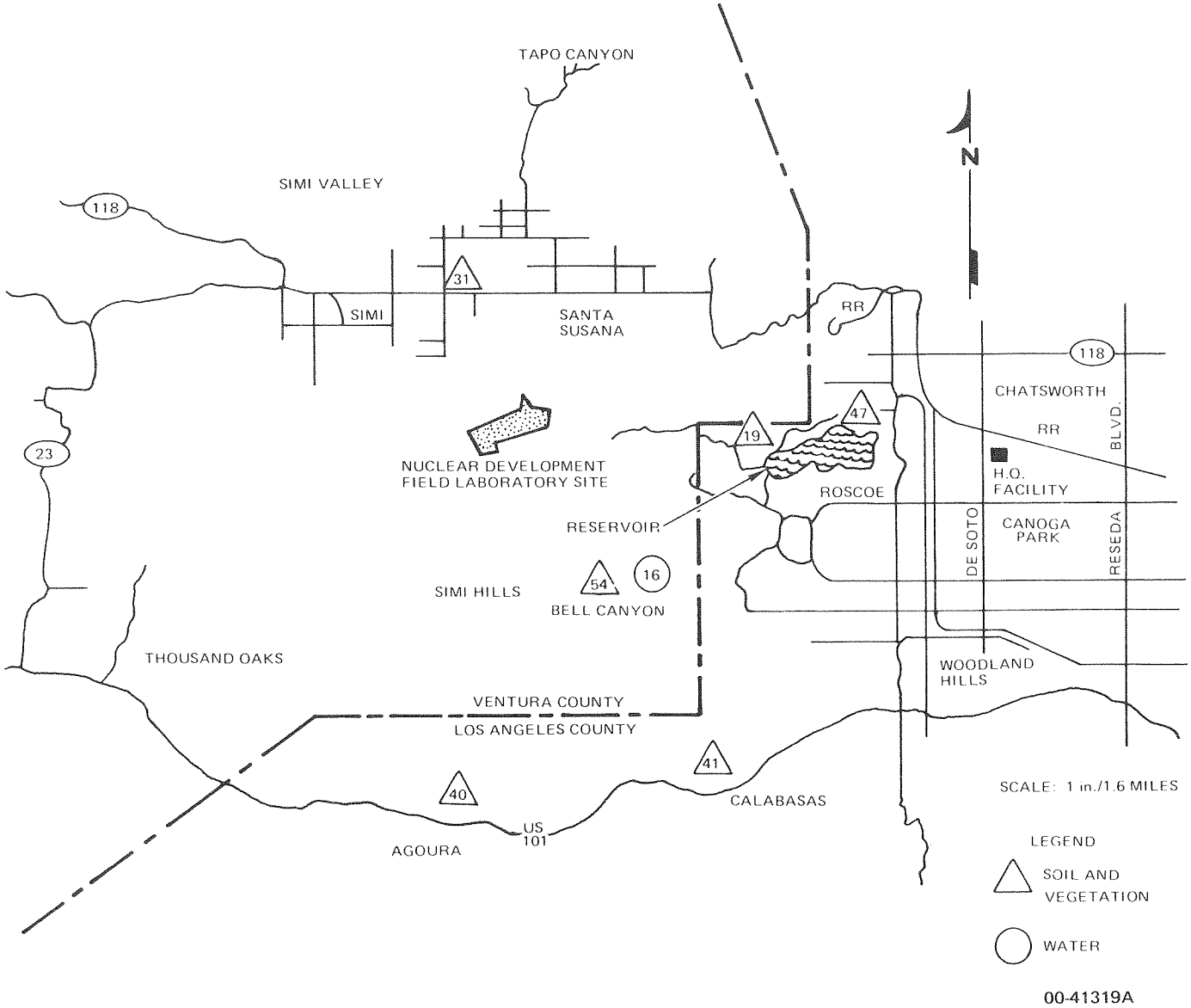

Figure 5. Map of Canoga Park, Simi Valley, Agoura and Calabasas Sampling Stations

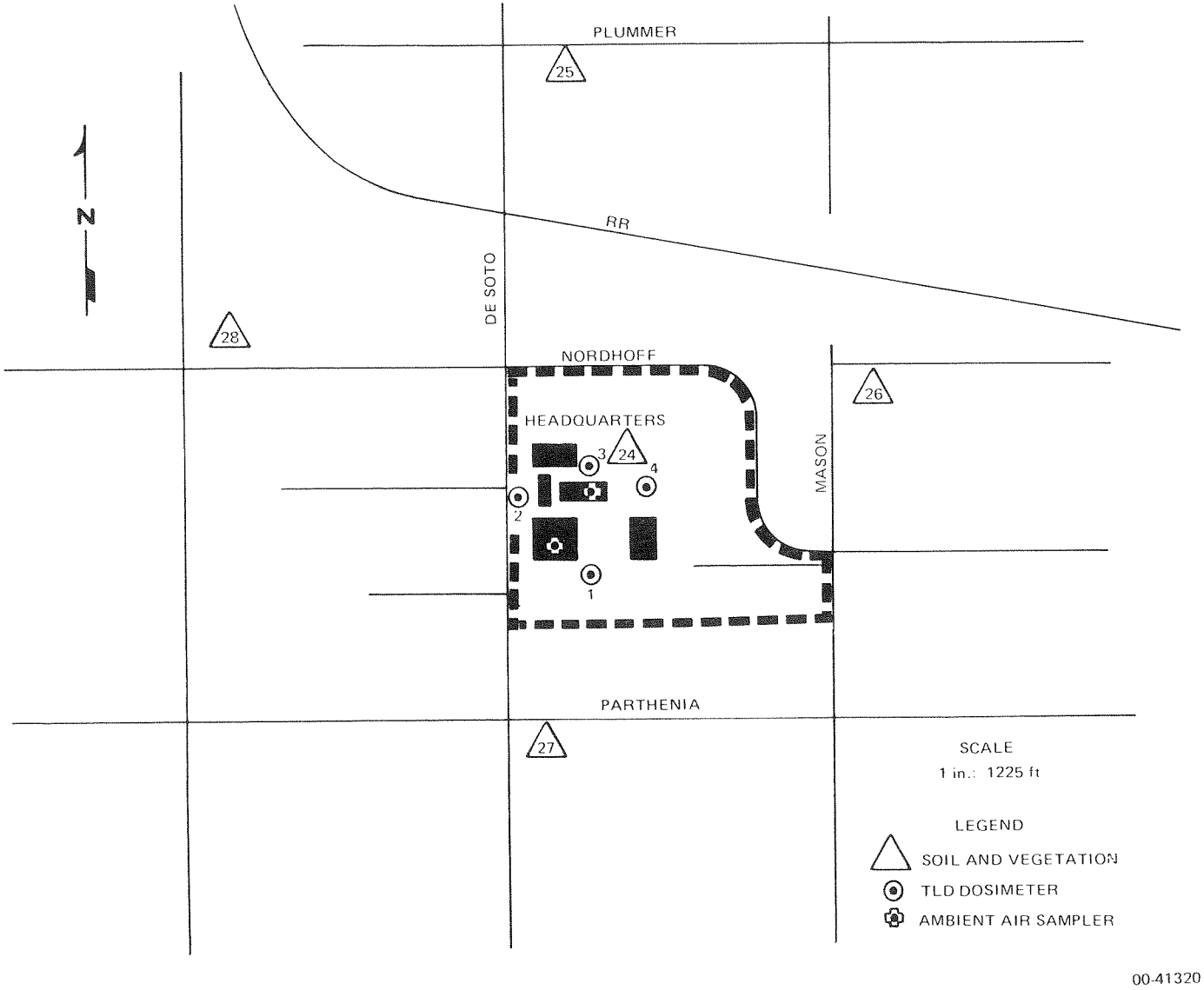

Figure 6. Map of Headquarters Vicinity Sampling Stations

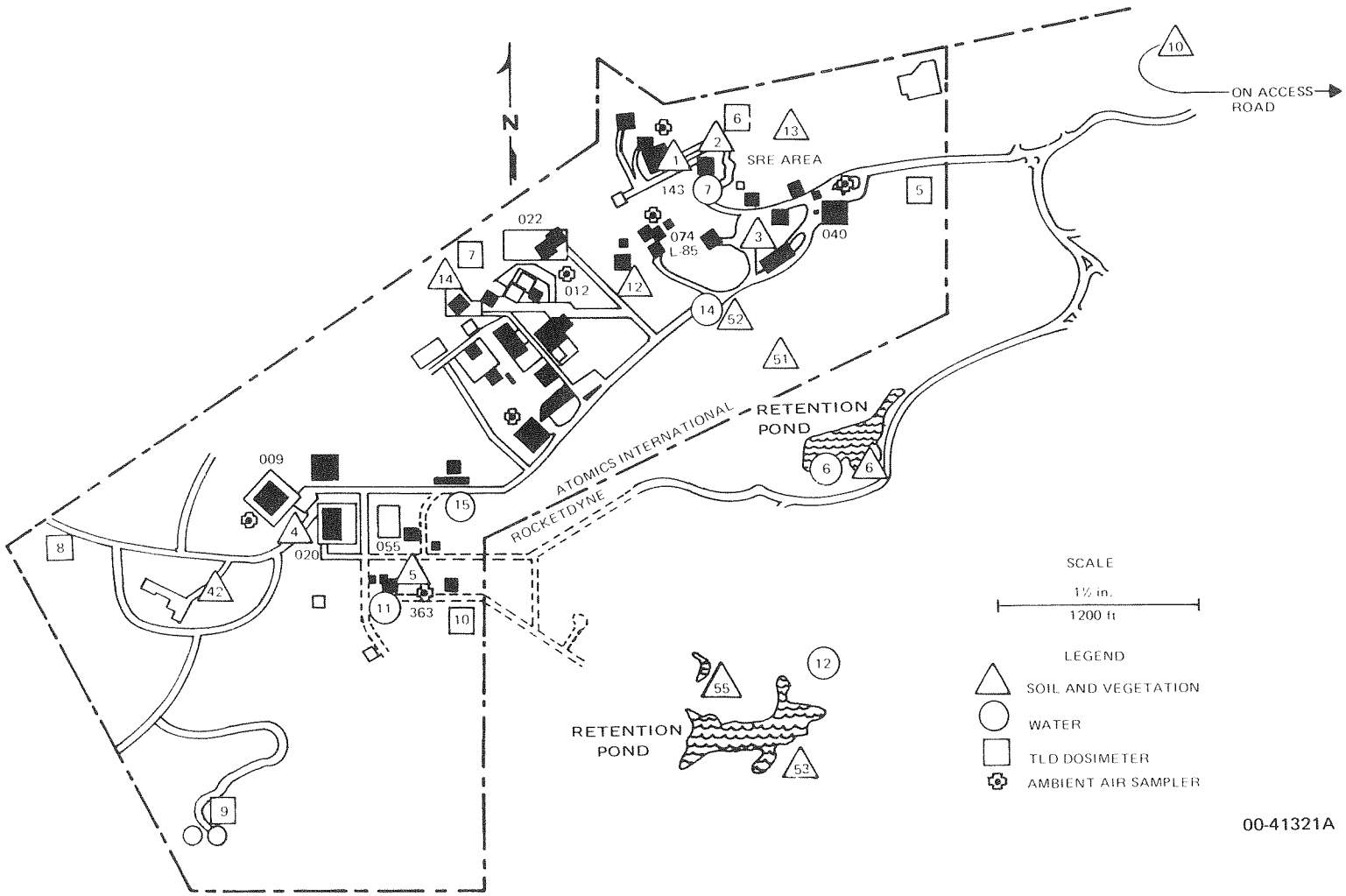

Figure 7. Map of NDFL Sampling Stations

TABLE 8

SAMPLE STATION LOCATIONS
(Sheet 1 of 2)

Station	Location
SV-1	SRE Reactor, NDFL
SV-2	SRE Perimeter Drainage Ditch, NDFL
SV-3	Bldg. 064 Parking Lot, NDFL
SV-4	Bldg. 020, NDFL
SV-5	Bldg. 363, NDFL
SV-6	Rocketdyne Retention Pond, SSFL
SV-10	Santa Susana Site Access Road
SV-12	L-85 Reactor, NDFL
SV-13	Sodium Cleaning Pad, NDFL
SV-14	Below Bldg. 022, NDFL
SV-19	Santa Susana Site Entrance, Woolsey Canyon
SV-24	Atomics International Headquarters
SV-25	DeSoto Avenue and Plummer Street
SV-26	Mason Avenue and Nordhoff Street
SV-27	DeSoto 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	Nonradioactive Materials Disposal Area, NDFL
SV-47	Chatsworth Reservoir North Boundary
SV-51	Bldg. 029, NDFL
SV-52	Burro Flats Drainage Control Pond, G Street and 17th Street, NDFL
SV-53	Top of Bell Canyon Below Rocketdyne Delta Pond Spillway, SSFL
SV-54	Bell Creek
S-55	Rocketdyne Retention Pond, SSFL

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

TABLE 8

SAMPLE STATION LOCATIONS
(Sheet 2 of 2)

Station	Location
W-6	Rocketdyne Retention Pond, SSFL
W-7	Process Water from Bldg. 003, NDFL
W-11	Process Water from Bldg. 363, NDFL
W-12	Rocketdyne Retention Pond, SSFL
W-16	Bell Creek
A-1	Atomics International Headquarters, Bldg. 001 Roof
A-2	Atomics International Headquarters, Bldg. 004 Roof
A-3	Bldg. 009, NDFL, Grade Level, West Side
A-4	Bldg. 011, NDFL, Grade Level, West Side
A-5	Bldg. 012, NDFL, Grade Level, West Side
A-6	Bldg. 040, NDFL, Grade Level, North Side
A-7	Bldg. 074, NDFL, Grade Level, South Side
A-8	Bldg. 143, NDFL, Grade Level, North Side
A-9	Bldg. 363, NDFL, Grade Level, South Side
TLD-1	Atomics International Headquarters, South of Bldg. 102 on Fence
TLD-2	Atomics International Headquarters, West of Bldg. 001 on Gate to Plant Water Supply Enclosure
TLD-3	Atomics International Headquarters, Guard Post No. 1, Bldg. 201
TLD-4	Atomics International Headquarters, East Fence Gate
TLD-5	Bldg. 113, NDFL
TLD-6	SRE Retention Pond, NDFL
TLD-7	Electric Substation No. 719, NDFL
TLD-8	Property Line Gate, West End of H Street, NDFL
TLD-9	Water Tank No. 701, NDFL
TLD-10	Bldg. 854, NDFL
TLD-11	Off Site, Northridge
TLD-12	Off Site, Simi Valley
TLD-13	Off Site, Northridge

W – Water Sample Station
A – Air Sample Station
TLD – Thermoluminescent Dosimeter Location

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 approximately 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 water samples are obtained monthly at the NDFL 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 approximately 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.

4. Ambient Air

Air sampling is performed continuously at the Headquarters and NDFL sites with automatic air samplers, operating on 24-h sampling cycles. Airborne particulate radioactivity is collected on Type HV-70 filter media, which are

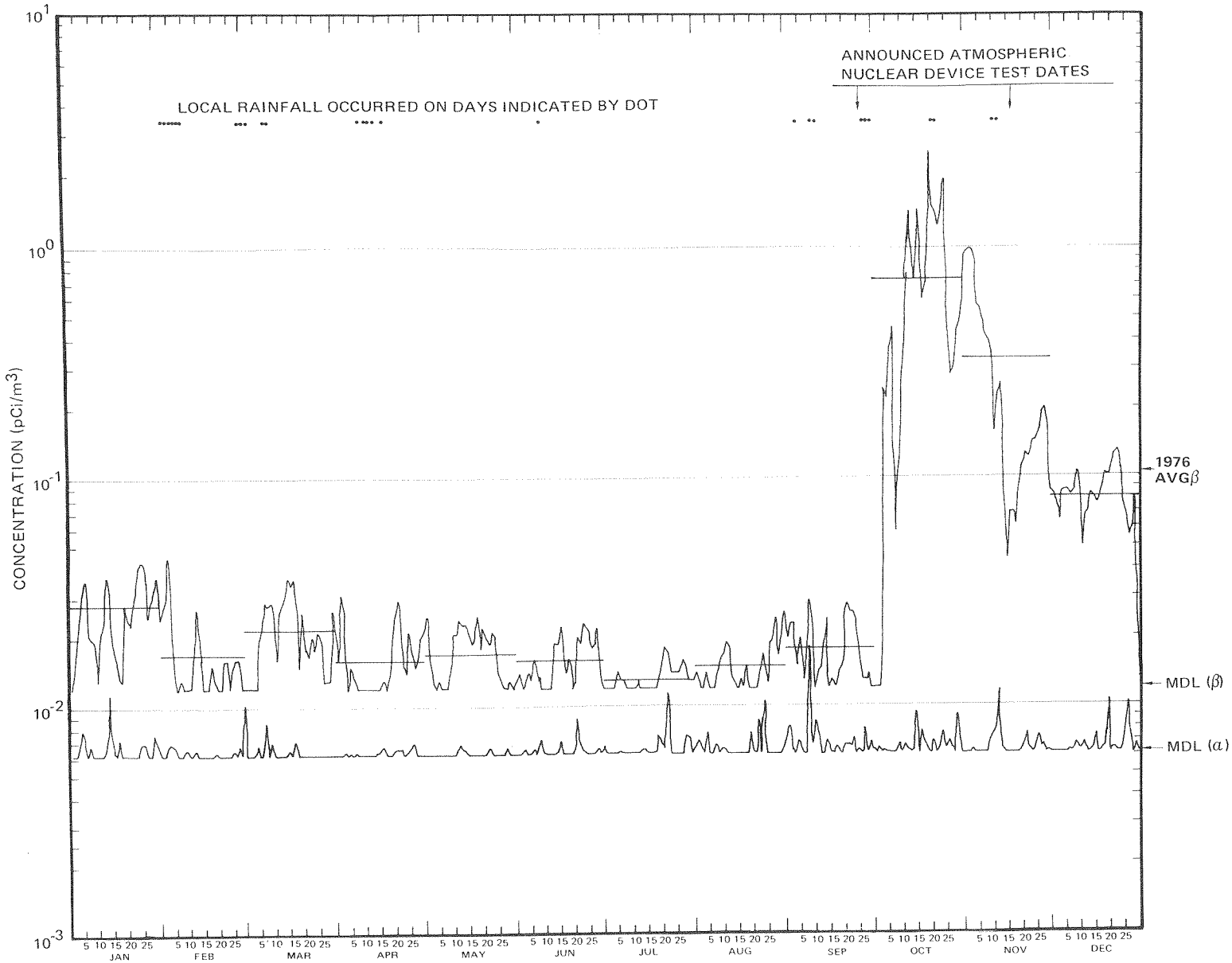

Figure 8. Daily Averaged Long-Lived Airborne Radioactivity at Headquarters and NDFL—1976

to discharge wastewater, pursuant to Section 402 of the Federal Water Pollution Control Act. The permit, NPDES No. CA0001309, became effective on December 6, 1974, and supersedes all previously held permits for wastewater discharge from the Rocketdyne Division SSFL. Discharge of up to 3,500,000 gal/day of overflow 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 from the AI NDFL. It is identified as 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 by a California State certified analytical testing laboratory. The specific constituents analyzed for, and their respective limitations in discharged wastewater, are presented in Appendix C. Wastewater originating from facilities located throughout the Santa Susana site are composited in the retention pond. Therefore, the point of origin of non-radioactive constituents found in wastewater is impossible to determine.

IV. EFFLUENT MONITORING PROGRAM

Effluents which may contain radioactive material are generated at AI facilities as the result of operations performed under contract to ERDA, under NRC Special Nuclear Materials License SNM-21, and under State of California Radioactive Material License 0015-59. The specific facilities are identified as Buildings 001 and 004 at the Headquarters site, and Buildings 020, 022, and 055 at the Santa Susana Site, NDFL.

A. TREATMENT AND HANDLING

Waste streams released to unrestricted areas are limited, in all cases, to gaseous effluents.

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, 022, and 055 provide automatic alarm capability in the event of the release of gaseous activity from Buildings 020 or 022, or 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 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, which is indicative that there are no radioactivity releases during normal facility operations.

Liquid wastes released to sanitary sewage systems, a controlled area as provided for by 10 CFR 20, are generated at the Headquarters Site only. Liquid wastes are discharged from Building 001 following analysis on a volume basis only. There is no continuous flow. Building 004 liquid chemical wastes are released to a proportional sampler installation which retains an aliquot each time a fixed volume is released to the sanitary sewage system. No liquid

TABLE 10

ATMOSPHERICALLY DISCHARGED EFFLUENT RELEASED TO UNRESTRICTED AREAS – 1976

Building	Point of Release	Approximate Effluent Volume (ft^3)	Activity Monitored	Approximate Minimum Detection Limit ($\mu Ci/m\ell$)	Annual* Average Concentration ($\mu Ci/m\ell$)	Sampling Period Maximum Observed Concentration ($\mu Ci/m\ell$)	Total Radio-Activity Released (Ci)
001	Stack Exit	2.4×10^{10}	α	1.7×10^{-16}	$<9.4 \times 10^{-14}$	8.3×10^{-13}	$<6.4 \times 10^{-5}$
			β	5.5×10^{-16}	$<2.5 \times 10^{-14}$	2.3×10^{-13}	$<1.7 \times 10^{-5}$
004	Stack Exit	6.9×10^{10}	α	4.5×10^{-16}	$<4.1 \times 10^{-15}$	9.3×10^{-14}	$<8.1 \times 10^{-6}$
			β	1.6×10^{-15}	$<4.5 \times 10^{-15}$	2.5×10^{-14}	$<8.9 \times 10^{-6}$
020	Stack Exit	2.1×10^{10}	α	9.7×10^{-17}	$<2.6 \times 10^{-16}$	1.6×10^{-15}	$<1.5 \times 10^{-7}$
			β	3.1×10^{-16}	9.8×10^{-15}	3.2×10^{-14}	5.8×10^{-6}
022	Stack Exit	1.0×10^{10}	α	3.0×10^{-16}	$<8.1 \times 10^{-16}$	8.3×10^{-15}	$<2.3 \times 10^{-7}$
			β	9.7×10^{-16}	$<3.6 \times 10^{-15}$	1.9×10^{-14}	$<1.1 \times 10^{-6}$
055	Stack Exit	1.6×10^{10}	α	2.6×10^{-16}	$<3.4 \times 10^{-16}$	7.1×10^{-16}	$<1.5 \times 10^{-7}$
						Total	$<1.1 \times 10^{-4}$

Annual average ambient air radioactivity concentration – 1976		
	α	$<6.6 \times 10^{-15}$
	β	$<1.0 \times 10^{-13}$

*Effluent radioactivity is generally less than ambient air radioactivity.

effluents are released from Santa Susana Buildings 020, 022, or 055, except as controlled liquid radioactive waste solidified for land burial. The average concentration and total radioactivity in liquid effluents discharged is shown in Table 11.

B. FACILITY DESCRIPTIONS

1. Headquarters 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 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}. No significant quantities of these radionuclides were released.

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.

TABLE 11

LIQUID EFFLUENT DISCHARGED TO SANITARY SEWER – 1976

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)
001	Retention Tank	13,500	α	1.2×10^{-9}	1.4×10^{-7}	4.4×10^{-7}	7.3×10^{-6}
			β	4.1×10^{-9}	1.1×10^{-7}	2.3×10^{-7}	5.7×10^{-6}
004	Proportional Sampler	1,253,900	α	1.2×10^{-9}	$<3.2 \times 10^{-8}$	1.4×10^{-7}	$<1.5 \times 10^{-4}$
			β	4.1×10^{-9}	$<7.3 \times 10^{-8}$	3.7×10^{-7}	$<3.3 \times 10^{-4}$
020*	–	0	–	–	–	–	0
022*	–	0	–	–	–	–	0
055*	–	0	–	–	–	–	0

*All liquid radioactive wastes are solidified and land buried as dry waste.

2. Santa Susana Site, NDFL

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. No significant quantities of these radionuclides were released.

b. Building 022 – ERDA Contract Activities

Operations at Building 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. No significant quantities of these radionuclides were released.

c. Building 055 – NRC and California State Licensed Activities

Operations at Building 055 which may generate radioactive effluents consist of fabrication of plutonium and plutonium-uranium fuel pins. 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}. No significant quantities of these radionuclides were released.

APPENDIX A
COMPARISON OF ENVIRONMENTAL RADIOACTIVITY DATA FOR 1976 WITH PREVIOUS YEARS

This section compares environmental monitoring results for the calendar year 1976 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 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 Atomics International is essentially nonexistent.

TABLE A-1

SOIL RADIOACTIVITY DATA—1957 THROUGH 1976

Year	On Site—Average (10^{-6} μCi/g)			Off Site—Average (10^{-6} μCi/g)		
	Number Samples	α	β	Number Samples	α	β
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 1976

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
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

NDFL PROCESS WATER RADIOACTIVITY DATA—
1957 THROUGH 1976

Year	Number Samples	Average α (10^{-9} μCi/mℓ)	Average β (10^{-9} μCi/mℓ)
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 SSFL RETENTION POND RADIOACTIVITY DATA – 1966 THROUGH 1976

	Samples														
	Bell Creek Mud 54			Bell Creek Vegetation 54			Bell Creek Water 16			Retention Pond No. 6 Water			Retention Pond No. 6 Water		
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
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 DATA – 1957 THROUGH 1976

Year	Headquarters Average (10^{-12} μCi/mℓ)			NDFL Average (10^{-12} μCi/mℓ)		
	Number Samples	α	β	Number Samples	α	β
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

APPENDIX B
SOIL PLUTONIUM SURVEY

On December 14, 1976, the collection of several soil samples was made at seven on-site locations near the Nuclear Materials Development Facility, Bldg. 055, at the NDFL. An additional five soil samples were taken off-site at varying distances ranging from approximately 3 to 9 miles from the facility. Three water samples and three bottom sediment samples were also obtained. Sampling locations and results are presented in Table B-1.

The samples were analyzed for Pu^{238} and for total Pu^{239} plus Pu^{240} by the Health Services Laboratory of ERDA, Idaho Falls, Idaho. The analysis results are at or below levels expected from fallout.

TABLE B-1

PLUTONIUM SOIL SAMPLE LOCATIONS AND RESULTS

Location	Results	
	Pu^{238} (μCi/g)	$Pu^{239} + Pu^{240}$ (μCi/g)
Soil		
~150 ft southwest of Building 055 exhaust stack, south side of J Street.	$(-0.07 \pm 0.08) \times 10^{-8}$	$(0.21 \pm 0.09) \times 10^{-8}$
South of Building 353, south side of L Street, 700 ft southeast of Building 055 stack exhaust.	$(0.23 \pm 0.09) \times 10^{-8}$	$(1.2 \pm 0.2) \times 10^{-8}$
~1,400 ft southeast of Building 055 exhaust stack, about 150 ft south of the Rocketdyne CTL-4 emergency building.	$(0.04 \pm 0.07) \times 10^{-8}$	$(0.8 \pm 0.1) \times 10^{-8}$
~2,000 ft of Building 055 exhaust stack, southeast head of Bell Canyon at Area II pond.	$(0.18 \pm 0.09) \times 10^{-8}$	$(1.0 \pm 0.2) \times 10^{-8}$
Northwest corner G Street and 24th Street ~50 ft northwest of Building 055 stack.	$(-0.03 \pm 0.05) \times 10^{-8}$	$(-0.01 \pm 0.06) \times 10^{-8}$
North of the intersection of F Street and 24th Street, 850 ft northwest of Building 055 stack.	$(-0.02 \pm 0.05) \times 10^{-8}$	$(0.13 \pm 0.06) \times 10^{-8}$
Dirt road extension of 24th Street, north of F Street intersection with 24th Street at excavation barrier fence (west side of fence).	$(0.10 \pm 0.06) \times 10^{-8}$	$(0.25 \pm 0.06) \times 10^{-8}$
Northwest corner of Sycamore Drive and Alamo Streets, Simi Valley.	$(-0.01 \pm 0.06) \times 10^{-8}$	$(0.48 \pm 0.07) \times 10^{-8}$
Southwest corner of Avenido de Los Arboles and Erbes Roads, Thousand Oaks.	$(0.1 \pm 0.1) \times 10^{-8}$	$(0.12 \pm 0.07) \times 10^{-8}$
~200 ft west of Kanan Road on Canwood Road, Agoura.	$(0.08 \pm 0.09) \times 10^{-8}$	$(0.03 \pm 0.07) \times 10^{-8}$
~1,000 ft west of Calabasas Parkway Road on Calabasas Road, Calabasas.	$(0.14 \pm 0.08) \times 10^{-8}$	$(0.3 \pm 0.1) \times 10^{-8}$
Northwest corner of Canoga Avenue and Nordhoff Avenue intersection, Canoga Park.	$(-0.03 \pm 0.06) \times 10^{-8}$	$(0.11 \pm 0.07) \times 10^{-8}$
Water		
West end of surface drainage ditch in ditch ~150 ft east of Building 055.	$(0.0 \pm 0.8) \times 10^{-11}$	$(0.0 \pm 0.6) \times 10^{-11}$
Area II pond, north side, at head of Bell Canyon, ~2,000 ft from Building 055 (southeast).	$(0.0 \pm 0.7) \times 10^{-11}$	$(0.3 \pm 0.7) \times 10^{-11}$
At bridge, upstream side, 1.7 miles west of Valley Circle Road on Bell Canyon Road in Bell Creek Canyon.	$(-0.2 \pm 0.8) \times 10^{-11}$	$(0.3 \pm 0.7) \times 10^{-11}$
Sediment		
West end of surface drainage ditch in ditch ~150 ft east of Building 055	$(24. \pm 1.0) \times 10^{-8}$ $(1.4 \pm 0.2) \times 10^{-8}$*	$(215. \pm 6.0) \times 10^{-8}$ $(12.8 \pm 0.6) \times 10^{-8}$*
Area II pond, north side, at head of Bell Canyon, ~2,000 ft from Building 055 (southeast).	$(0.05 \pm 0.07) \times 10^{-8}$	$(0.03 \pm 0.06) \times 10^{-8}$
At bridge, upstream side, 1.7 miles west of Valley Circle Road on Bell Canyon Road in Bell Creek Canyon.	$(0.0 \pm 0.07) \times 10^{-8}$	$(-0.02 \pm 0.05) \times 10^{-8}$

*Sampled March, 16, 1977.
NOTE: Minus (-) indicates sample value less than reagent blank.

APPENDIX C

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 C-1 is prohibited.

TABLE C-1

NPDES No. CA 0001309, EFFECTIVE DECEMBER 6, 1974

Constituent	Discharge Rate (lb/day)		Concentration Limit (mg/ℓ)	
	Maximum Daily	30-day Average	Average	Maximum
Total Dissolved Solids	29,200	29,200	—	1,000
Total Hardness (as $CaCO_3$)	14,600	14,600	—	500
Chloride	7,300	7,300	—	250
Chloride plus Sulfate	14,600	14,600	—	500
Suspended Solids	1,310	875	30	45
Settleable Solids (mℓ/ℓ-h)	—	—	(0.1)	(0.2)
BOD 20°C	875	584	20	30
Oil and Grease	438	292	10	15
Nitrate Nitrogen	292	292	—	10
Color (Color Units)	—	—	—	(20)
Turbidity (TU)	—	—	(50)	(75)
Total Chromium	0.29	0.15	0.005	0.01
Fluoride	29.2	29.2	—	1.0
Boron	29.2	29.2	—	1.0
Residual Chlorine	—	—	—	0.5
Fecal Coliform (MPN/100 mℓ)	—	—	(200)*	(400)†
Surfactants (as MBAS)	—	—	—	0.5
pH		6.5 to 9.0		

*30-day average, geometric mean

†7-day average, geometric mean

APPENDIX D
REFERENCES

1. ERDA Manual Chapter 0513
2. ERDA 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 December 6, 1974

APPENDIX E
EXTERNAL DISTRIBUTION

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