ENVIRONMENTAL MONITORING

SEMIANNUAL REPORT

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by

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ABSTRACT

Environmental monitoring at Atomics International is performed by the Radiation Safety Unit of the Health, Safety, and Radiation Services Department. Soil, vegetation, water, and air are routinely sampled up to a distance of 10 miles from Atomics International property. Average radioactivity concentrations measured during the first six months of 1966 generally decreased slightly from 1965 averages.

Figure 1. Atomics International World Headquarters

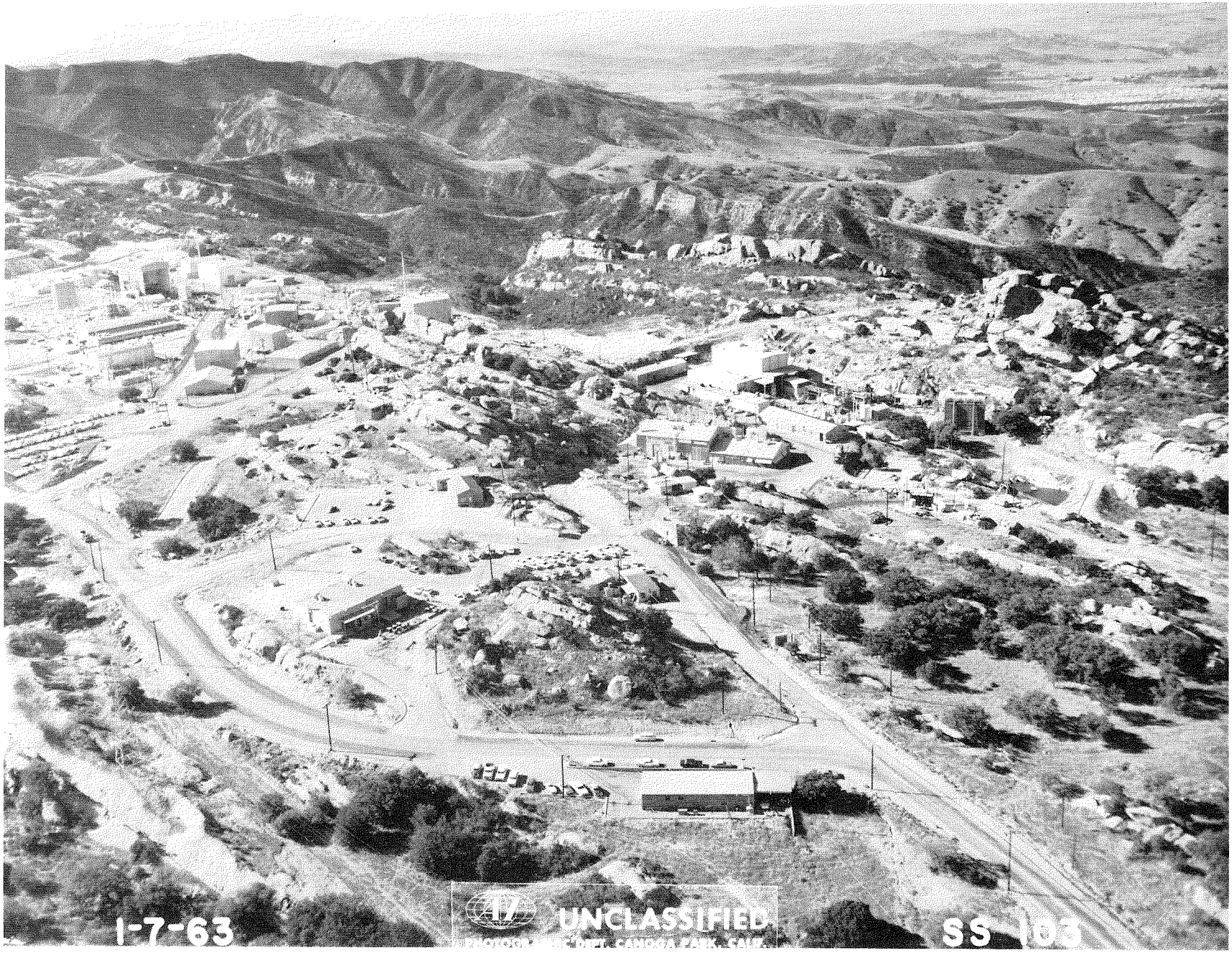

Figure 2. Atomics International Nuclear Development Field Laboratory

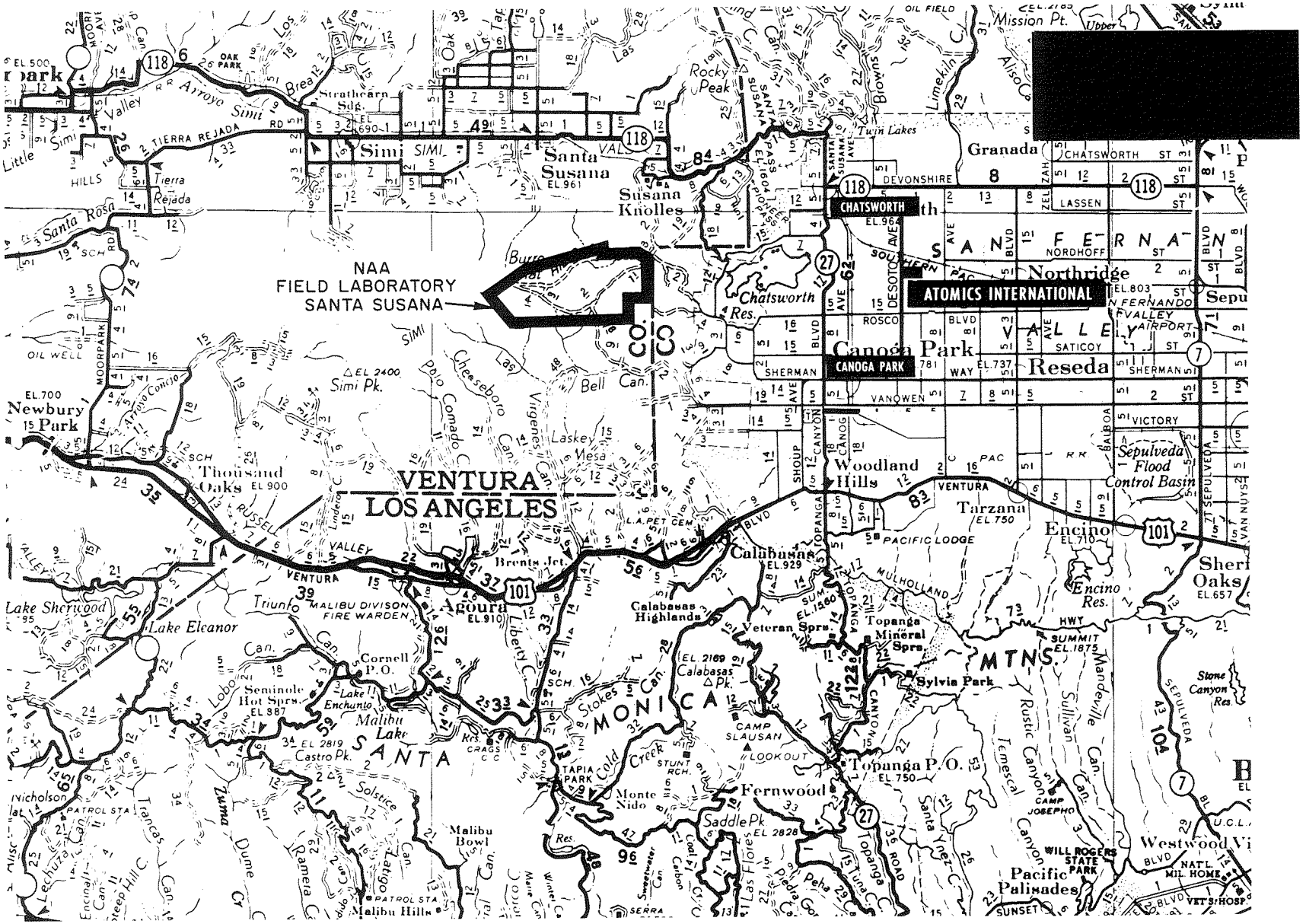

Figure 3. Map of Headquarters and Nuclear Development Field Laboratory Environs

I. SUMMARY

Atomics International, a Division of North American Aviation, Incorporated, has been engaged in atomic energy research and development since 1946. The Company designs, develops, and constructs nuclear reactors for central station and compact power plants and for medical, industrial, and scientific applications.

The Company occupies modern facilities in Canoga Park, California, approximately 23 miles northwest of downtown Los Angeles (Figure 1). The 290-acre Nuclear Development Field Laboratory (Figure 2), equipped with extensive facilities for the support of advanced nuclear studies, is located in the Simi Hills of Ventrua County approximately 23 miles northwest of downtown Los Angeles. The location of the sites in relation to nearby communities is shown in Figure 3.

The basic concept of radiological hazards control at Atomics International requires the total containment of radioactive materials and, through rigid operational controls, minimizes effluent releases and external radiation levels. The environmental monitoring program provides a measure of the effectiveness of the Company's radiological safety procedures and of engineering safeguards incorporated into facility design.

Environmental sampling stations located within the boundaries of Atomics International's sites are referred to as "on-site" stations. The remaining stations, located within a 10-mile radius of the sites, are referred to as "off-site" stations. The on-site environs of Atomics International's Headquarters and Nuclear Development Field Laboratory (NDFL) facilities are sampled monthly to determine the concentration of radioactivity in typical surface soil, vegetation, and water samples. The off-site environs are also sampled monthly, however, beginning in January, 1966, analyses of off-site soil and vegetation will only be performed quarterly. Also, continuous on-site environmental air monitoring provides information concerning long-lived airborne particulate radioactivity. This report summarizes environmental monitoring results for the first six months of 1966.

A. ENVIRONMENTAL RADIOACTIVITY DATA

The average radioactivity concentration in soil and vegetation samples are presented in Tables I and II.

TABLE I
SOIL RADIOACTIVITY DATA

Area	Activity	1965		First Half - 1966	
		No. Samples	Average uuc/gram	No. Samples	Average uuc/gram
On Site	α	144	0.46	72	0.38 to 0.39
	β-γ	144	36	72	31
Off Site	α	142	0.46 to 0.47	24	0.44 to 0.45
	β-γ	142	29	24	25

TABLE II
VEGETATION RADIOACTIVITY DATA

Area	Activity	1965		First Half - 1966	
		No. Samples	Average uuc/gram/ash	No. Samples	Average uuc/gram/ash
On Site	α	144	0.55 to 0.56	72	0.39 to 0.40
	β-γ	144	162	72	176
Off Site	α	142	0.61	24	0.38 to 0.39
	β-γ	142	138	24	130

Process water used at the NDFL is obtained from wells and stored in two 50,000 gallon capacity tanks. Potable water is delivered to the site by a vendor and is not analyzed. Well water is sampled monthly from the supply line at two locations. The average well water radioactivity concentration is presented in Table III.

TABLE III
WELL WATER RADIOACTIVITY DATA

Location	Activity	1965		First Half - 1966	
		No. Samples	Average uuc/liter	No. Samples	Average uuc/liter
NDFL	α	24	0.21 to 0.22	12	0.11
	β-γ	24	5.9 to 6.0	12	5.9

Soil, vegetation, and water are sampled monthly at the Chatsworth Reservoir, which is owned and operated by the Los Angeles City Department of Water and Power. Soil and vegetation radioactivity data for the reservoir are averaged into the data presented in Tables I and II. Normally, one water sample is obtained from the lake surface and a second sample is obtained from the reservoir water supply inlet located on the north side of the lake. The average radioactivity concentration in lake surface and supply water is presented in Table IV.

TABLE IV
CHATSWORTH RESERVOIR WATER RADIOACTIVITY DATA

Sample Type	Activity	1965		First Half - 1966	
		No. Samples	Average uuc/liter	No. Samples	Average uuc/liter
Lake Surface	α	11	0.65	6	0.35
	β-γ	11	8.7	6	6.6
Supply Inlet	α	12	0.61	6	0.47
	β-γ	12	8.8 to 9.1	6	6.9

Monitoring of environmental air for long-lived particulate radioactivity is performed continuously at both the Headquarters and NDFL sites. Air is drawn through a filter which is counted, after a 72-hour decay period, for long-lived radioactivity. The average concentration of long-lived beta radioactivity is presented in Table V.

TABLE V
AIRBORNE RADIOACTIVITY DATA

Location	Activity	1965		First Half - 1966	
		No. Samples	Average uuc/M^3	No. Samples	Average uuc/M^3
Head-quarters	β-γ	483	0.83	360	0.14
NDFL	β-γ	1062	0.21	1178	0.16

Some of the data presented in Tables I, II, III, and IV are presented as a range within which lies the true average. This is necessary when one or more of the samples contains an "undetectable" amount of radioactivity In these instances, two values are determined. The lowest value assumes that the "undetectable" samples contain no radioactivity; the highest value assumes that these samples contain radioactivity equal to the appropriate minimum detection limit specified in Table VII.

Tables I and II show a decrease, during the first six months, in alpha and beta-gamma radioactivity in soil and vegetation. An exception is on-site vegetation which shows a moderate increase in beta-gamma radio-activity. Table III shows a significant decrease in well water alpha radioactivity and no significant change in well water beta-gamma radioactivity. Table IV shows decreases in Chatsworth Reservoir lake surface and supply inlet water alpha and beta-gamma radioactivity. Table V shows significant decreases in averaged airborne radioactivity during the first six months of 1966. This decrease is attributed to a continued reduction in fallout from nuclear weapons testing.

II. ENVIRONMENTAL MONITORING PROGRAM

A. GENERAL DESCRIPTION

Soil and vegetation sample collection and analysis were initiated in 1952 in the Downey, California area where the Company was initially located. Environmental sampling was subsequently extended to the proposed Sodium Reactor Experiment (SRE) site in May of 1954. In addition, sampling was conducted in the Burro Flat area, southwest of SRE, where many radiological installations are currently in operation. The Downey area survey was terminated when the Company relocated to Canoga Park. The primary purpose of the environmental monitoring program is to survey environmental radioactivity adequately to ensure that Atomics International operations do not contribute measurably to environmental radioactivity.

A recent study of past data showed that this purpose could be achieved with a less extensive environmental monitoring program than that which existed until July 1964. Therefore, beginning with that month, the number of sampling stations was reduced considerably, as indicated in the data tables of this report. In addition, beginning in January 1966, off-site environmental survey samples will be analyzed quarterly, on-site samples will continue to be analyzed monthly. The location of sampling stations is shown in Figures 4, 5, 6, and 7, and in Table VI.

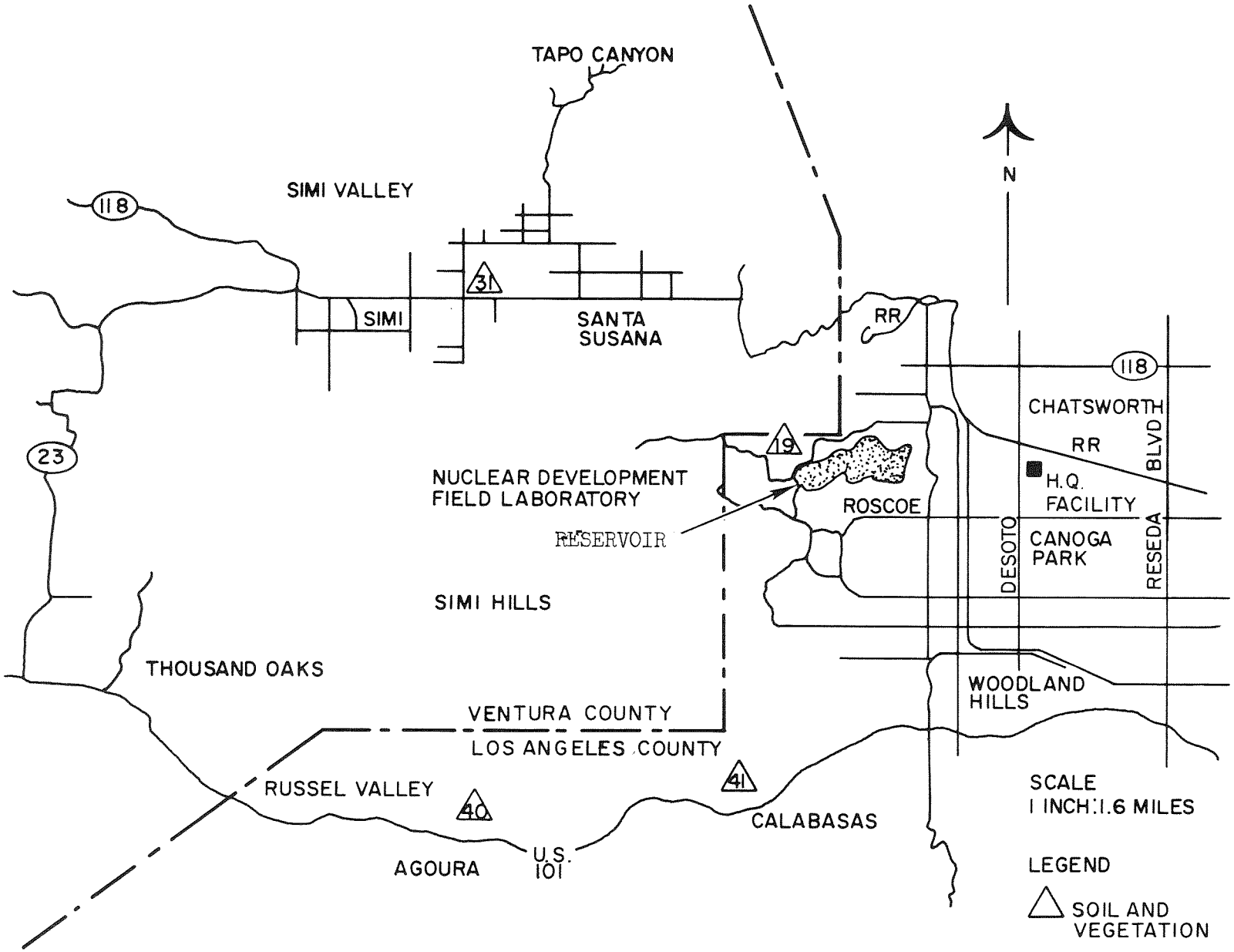

Figure 4. Map of Canoga Park, Simi Valley, Agoura, and Calabasas Sampling Stations

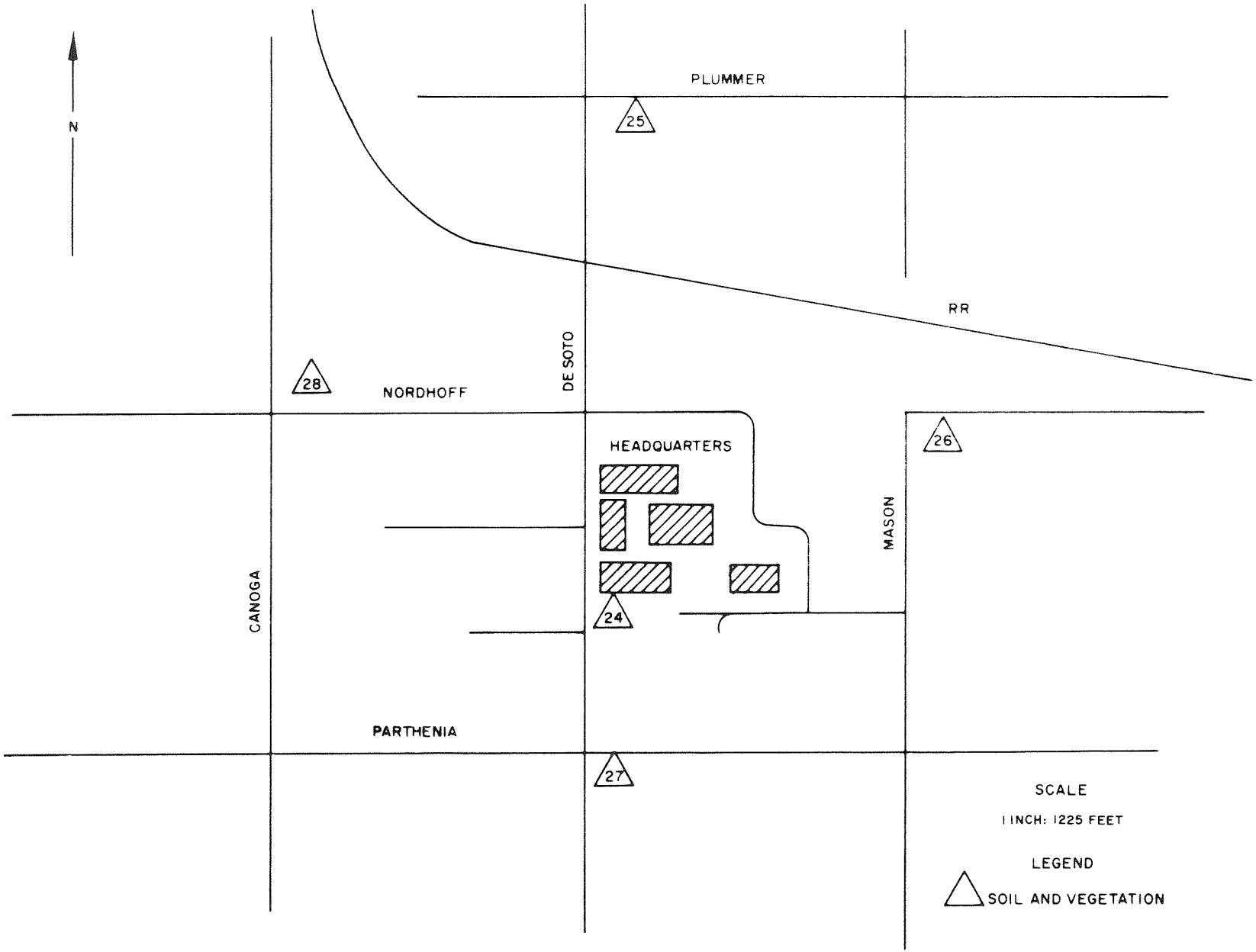

Figure 5. Map of Headquarters Vicinity Sampling Stations

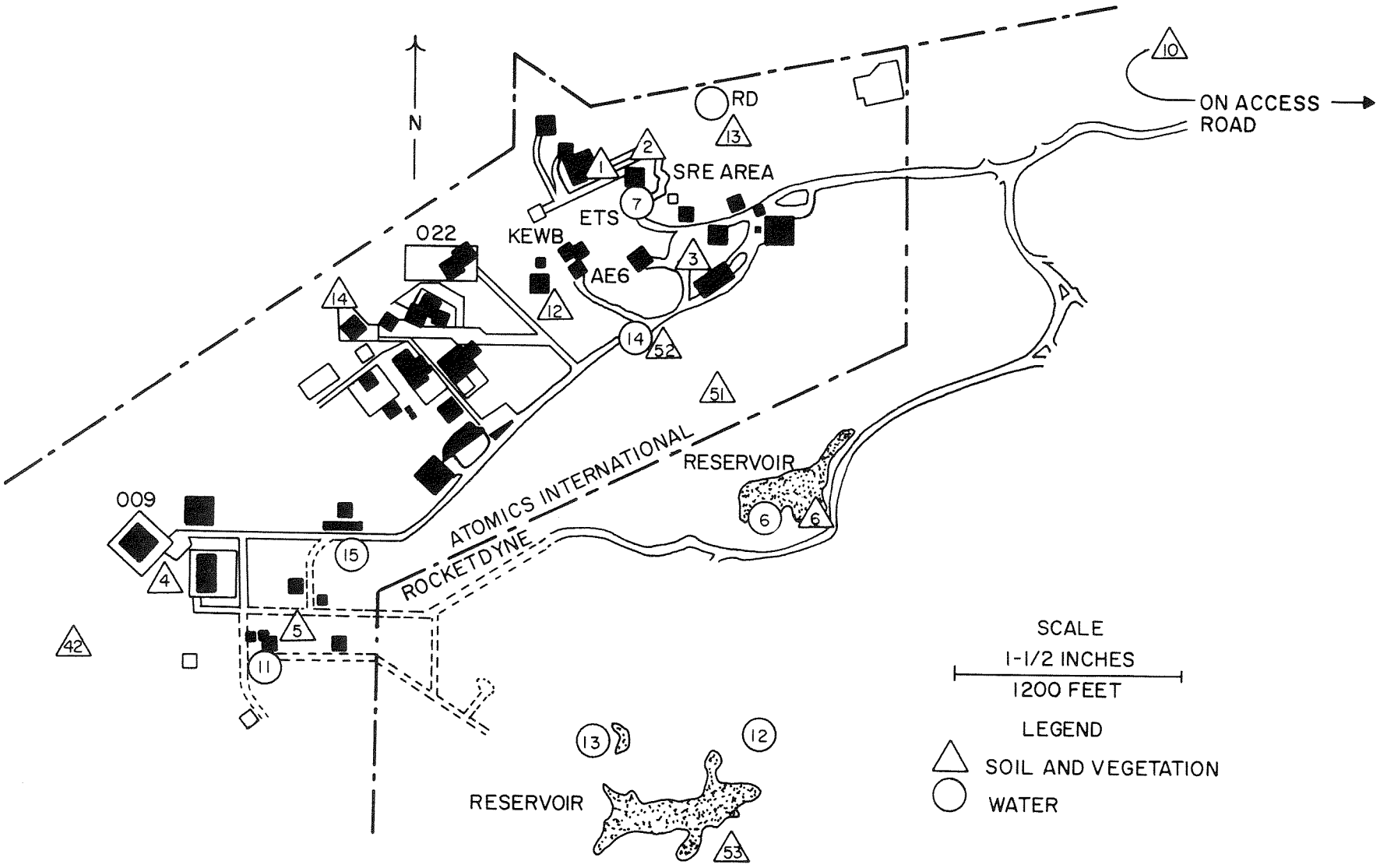

Figure 6. Map of NDFL Sampling Stations

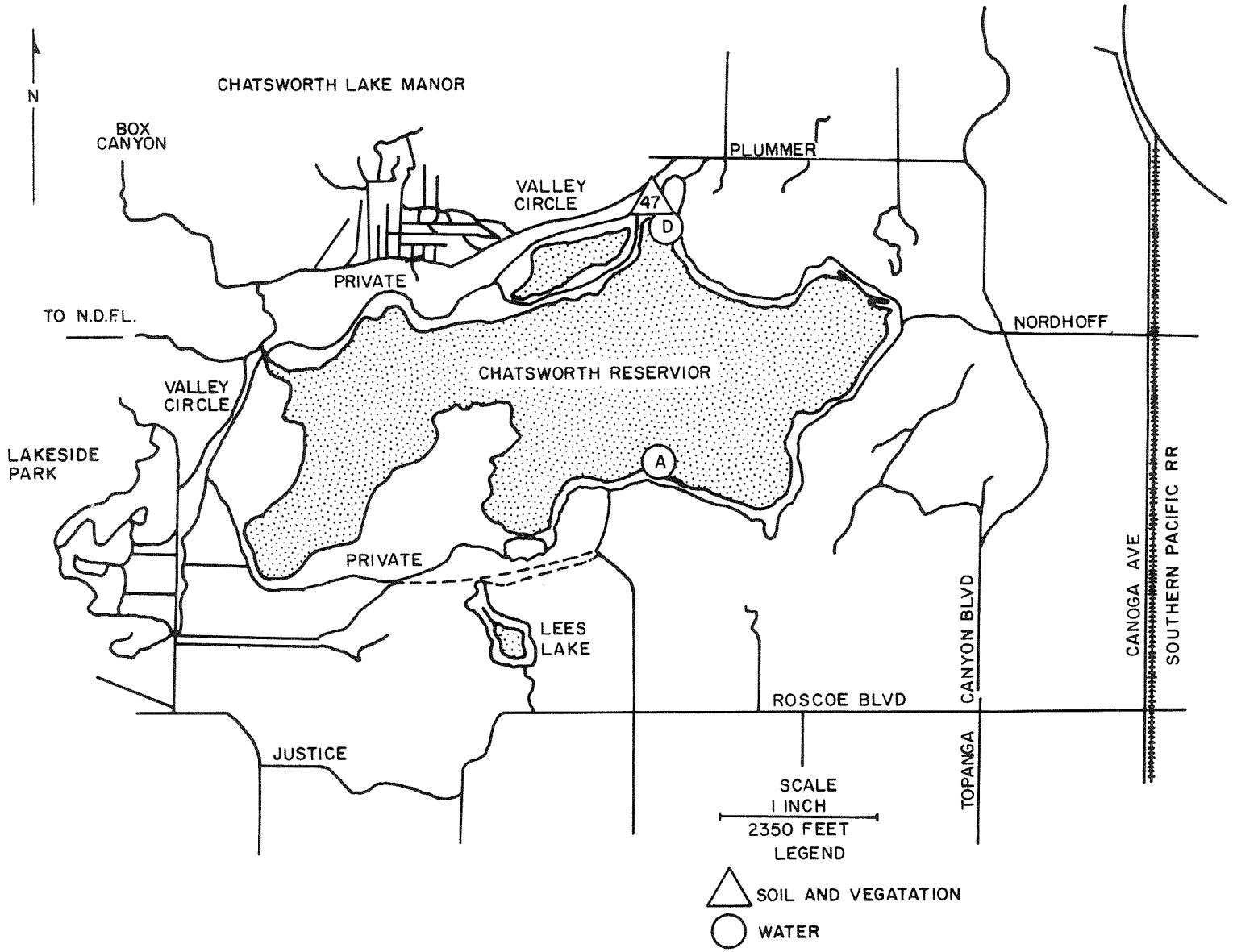

Figure 7. Map of Chatsworth Reservoir Sampling Stations

TABLE VI

SAMPLE STATION LOCATIONS

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. 0363, NDFL
SV-6	Rocketdyne, PFL
SV-10	Santa Susana Site Access Road
SV-12	KEWB Reactor, NDFL
SV-13	Sodium Cleaning Pad, NDFL
SV-14	Canyon Below Bldg. 022, NDFL
SV-19	Santa Susana Site Entrance
SV-24	Headquarters
SV-25	DeSoto Avenue and Plummer Street
SV-26	Nordhoff Street and Mason Avenue
SV-27	DeSoto Avenue and Parthenia Street
SV-28	Canoga Avenue and Nordhoff Street
SV-31	Simi Valley, Los Angeles Avenue and Sycamore Road
SV-40	Agoura
SV-41	Calabasas
SV-42	Non-Radioactive Materials Disposal Area, NDFL
SV-47	Chatsworth Reservoir - North Side
SV-51	Adjacent to Bldg. 029, NDFL
SV-52	Burro Flat Drainage Control Pond G. St. and 17th ST., NDFL
SV-53	Top of Bell Canyon Below Rocketdyne Delta Pond Spillway, PFL
W R.D.	SRE Retention Dam, NDFL
W 6	Rocketdyne Retention Reservoir, PFL
W 7	Well Water From E. T. B., NDFL
W 11	Well Water from Bldg. 363, NDFL
W 12	Rocketdyne Retention Reservoir, PFL
W 13	Rocketdyne Retention Reservoir, PFL

STATION	LOCATION
W 14	Burro Flat Drainage Control Pond, G. Street and 17th Street, NDFL
W 15	Burro Flat Drainage Channel Adjacent to Bldg. 383. (Collects drainage from Bldg. 009, 020, and 100 areas)
W A	Chatsworth Reservoir, South Side
W D	Chatsworth Reservoir, Supply Inlet

B. SAMPLING AND SAMPLE PREPARATION METHODS

SOIL

Surface soil types available for sampling range from decomposed granite to clay and loam. Samples are taken from the top 1/2-inch layer of ground surface. The soil samples are packaged and sealed 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 500°C for approximately eight hours. After cooling, the soil is sieved to obtain uniform particle size. One-gram aliquots of the sieved soil are weighed and transferred to stainless-steel planchets. The soil is wetted in the planchet with acetone, agitated to obtain uniform sample thickness, re-dried, and counted.

VEGETATION

Vegetation samples obtained in the field are of the same plant type wherever possible, generally sunflower or wild tobacco leaves. These types maintain a more active growth rate during the dry season than does most natural vegetation indigenous to the local area. Vegetation leaves are stripped from plants and sealed in ice cream cartons for transfer to the laboratory for analysis. Plant root systems are not normally analyzed.

Vegetation samples are first washed with tap water to remove foreign matter, and then thoroughly rinsed with distilled water. Washed vegetation is placed in porcelain crucibles and ashed in a muffle furnace at 500°C for approximately eight hours, producing a completely burned ash. Three-hundred milligram aliquots of pulverized ash from each crucible are weighed and transferred to stainless-steel planchets for counting.

WATER

Samples of well water are obtained monthly at the NDFL and water is also obtained from the Chatsworth Reservoir. The water is drawn into one-liter polyethylene bottles and transferred to the laboratory.

Five-hundred ml. of water are evaporated to dryness in crystallizing dishes at approximately 90°C. The residue salts are transferred to stainless-steel planchets, wetted with distilled water to produce a uniform sample distribution, re-dried under infra-red lamps, and counted.

AIR

Environmental air sampling is conducted continuously at the Headquarters and NDFL sites with automatic air samplers operating on 24-hour sampling cycles. Airborne particulate radioactivity is collected on HV-70 filter paper which is automatically changed at the end of each sampling period. The filters are removed from the sampler and counted after the radioactivity has decayed for at least 72 hours. The volume of a typical daily environmental air sample is approximately 20 cubic meters. The minimum detection limit, calculated at 2 σ counter background is on the order of 0.04 uuc/m^3.

When abnormally high airborne radioactivities are observed, the radioactivity decay data is plotted to determine the presence of short-lived isotopes other than naturally occurring radon, thoron, and daughters. If fall-out is suspected, the decay characteristics are observed. If the radioactivity decays as a function of $t^{-1.2}$, the data curve is extrapolated in order to determine the date of origin. This date is compared with the dates of publicized nuclear detonations to determine if the abnormal airborne radioactivity was caused by such detonations.

A graph of averaged long-lived airborne radioactivity concentrations detected at the Headquarters and NDFL facilities during the first half of 1966 is presented in Figure 8. The graph shows relatively low airborne radioactivity concentrations during the first three months of the reporting period, followed by an increase in the incidence of transient peaks accompanied by a slightly higher baseline radioactivity concentration level.

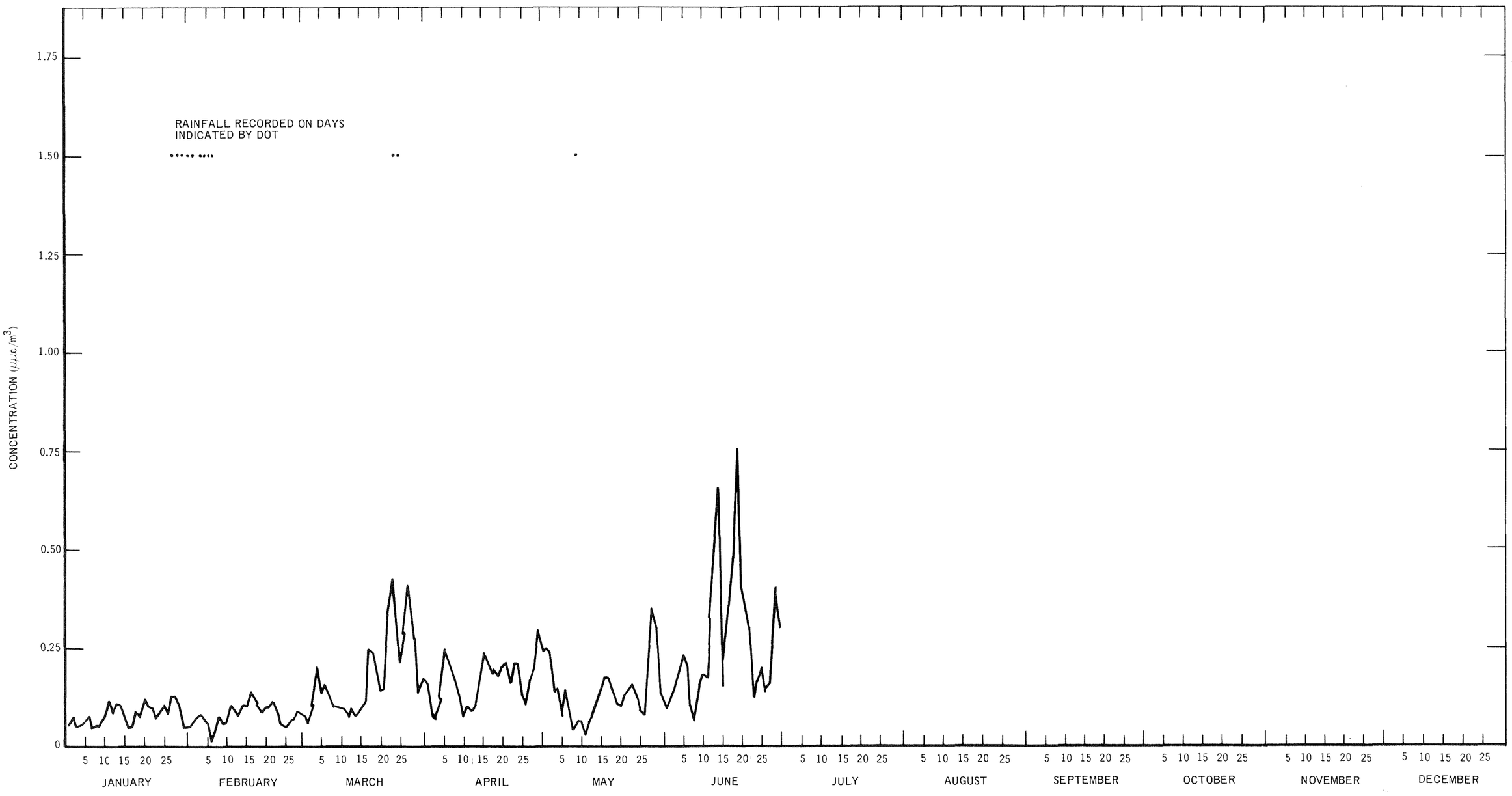

Figure 8. Long-Lived Airborne Particulate Radioactivity Atomics International Headquarters and NDFL - 1966

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C. COUNTING AND CALIBRATION PROCEDURES

Environmental soil, vegetation, air, and water samples are counted for alpha and beta-gamma radioactivity in automatic proportional counting systems. The sample-detector configuration provides nearly a 2π geometry. The detector has a thin window and is continually purged with a 90% argon, 10% methane counting gas. A pre-set count mode of operation is used for all samples; however, an overriding pre-set time is also used for alpha counting to prevent the unnecessarily long counting of samples with extremely low activities. The minimum detection limits shown in Table VII were determined by using typical values for pre-set count, pre-set time, system efficiencies, background count rates (approximately 0.03 cpm α and 12 cpm β-γ), and sample size.

TABLE VII

MINIMUM DETECTION LIMITS

SAMPLE	ACTIVITY	MINIMUM DETECTION LIMITS*
Soil	α	0.19 $\pm$ 0.038 (uuc/gram)
	β-γ	6.9 $\pm$ 1.1 (uuc/gram)
Vegetation	α	0.064 $\pm$ 0.076 (uuc/gram ash)
	β-γ	13.8 $\pm$ 2.1 (uuc/gram ash)
Water	α	0.038 $\pm$ 0.046 (uuc/liter)
	β-γ	2.5 $\pm$ 1.3 (uuc/liter)

* Standard error

Counting system efficiencies are determined routinely using Ra D + E + F (with and without alpha absorbers) and K^{40}. Potassium-40, in the form of standard reagent grade KCl, is used to simulate soil and vegetation samples for purposes of calibration. It has a compound specific activity of approximately 830 dpm per gram KCl and a beta energy of 1.33 mev. Its ad-

vantages are purity, long half-life, crystalline form, and low cost. A seeming disadvantage is its beta energy which is somewhat higher than that expected in environmental samples; however, the error introduced by this higher energy has been determined to be insignificant.

In practice, KCl is sieved and divided into aliquots, increasing each in 100-milligram increments from 100 to 1200 milligrams. These aliquots are placed in stainless-steel planchets of the type used for soil and vegetation samples and counted in the proportional counting system. The ratio of sample activity to observed net counting rate for each aliquot is plotted as a function of aliquot weight (see Figure 9). The correction factor (ratio) corresponding to each soil or vegetation sample weight is obtained from this graph. The product of the correction factor and the net sample counting rate yields the sample activity (dpm). This method has been proved usable by applying it to variously sized aliquots of uniformly mixed environmental samples and observing that the resultant specific activities fall within the expected statistical counting error.

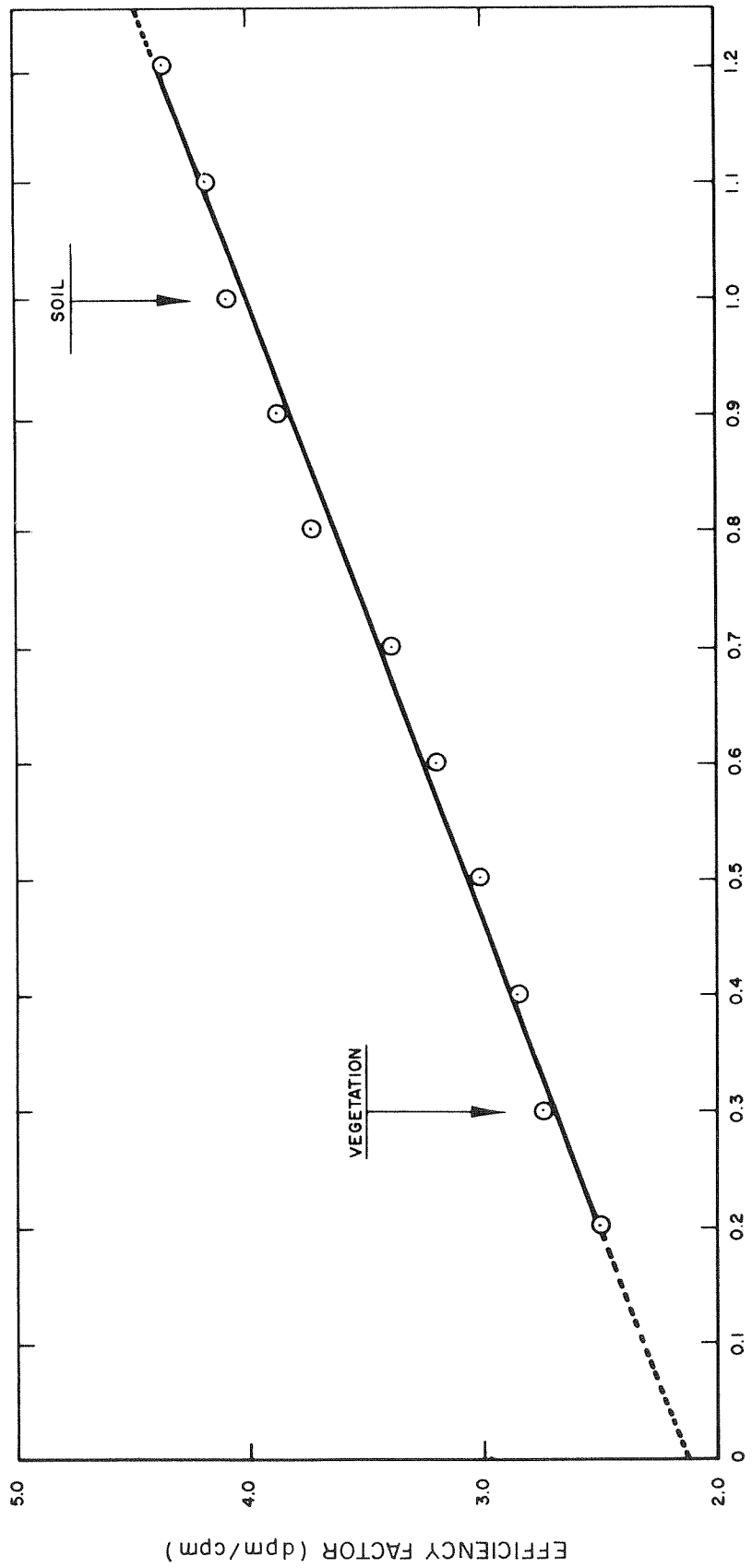

Figure 9. Self-Absorption Correction Graph