ENVIRONMENTAL MONITORING

SEMIANNUAL REPORT

JULY 1, 1962 TO DECEMBER 31, 1962

and

ANNUAL REPORT

1962

ATOMICS INTERNATIONAL

A DIVISION OF NORTH AMERICAN AVIATION, INC.

ENVIRONMENTAL MONITORING

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by

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Approved

ABSTRACT

Environmental monitoring at Atomics International is performed by the Laboratory Unit of the Health and Safety Section. Soil, vegetation, water, and air are routinely sampled up to a distance of 10 miles from Atomics International property. Data indicates that alpha and beta-gamma radioactivity generally increased during the last half of 1962 and that the average environmental radioactivity levels during 1962 were generally higher than in previous years. The increase in environmental radioactivity is attributed to nuclear weapons tests and to naturally occurring fluctuations; and not to Atomics International operations.

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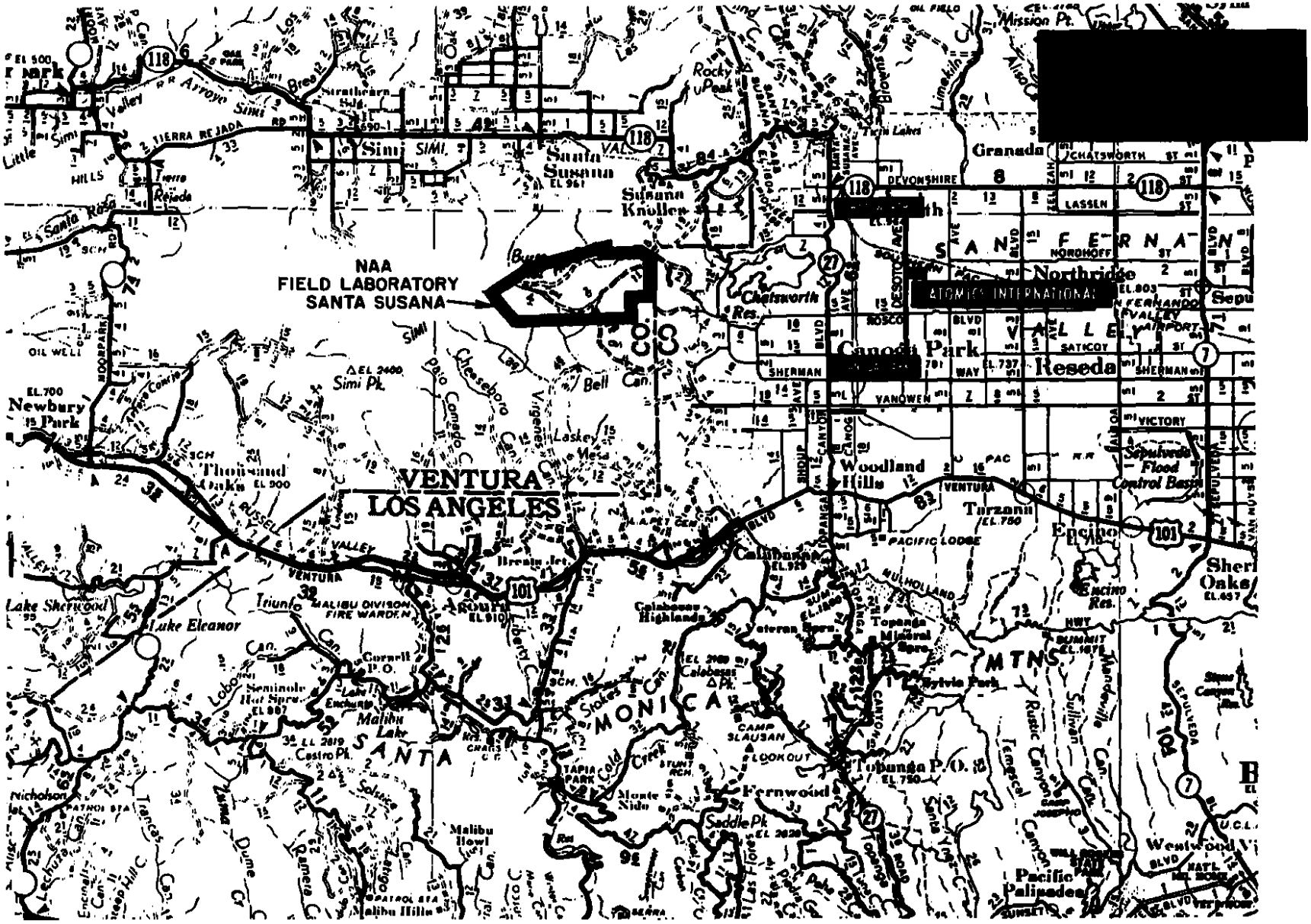


Figure 3. Map of Headquarters and Nuclear Development Field Laboratory Environs

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 a modern plant in Canoga Park, California, located approximately 23 miles northwest of downtown Los Angeles (Figure 1). The 290-acre Nuclear Development Field Laboratory (Figure 2), equipped with extensive testing facilities for the support of advanced nuclear studies, is located in Ventura County in the Simi Hills approximately 29 miles northwest of downtown Los Angeles. The location of the above sites in relation to nearby communities is shown in Figure 3.

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

The environs of Atomics International Headquarters and Nuclear Development Field Laboratory (NDFL) are periodically surveyed to determine the concentration of radioactivity in typical surface soil, vegetation, and water samples. In addition, continuous environmental air samples taken at the sites provide information concerning airborne particulate radioactivity. This report summarizes environmental monitoring results for the last six months of 1962 and also compares 1962 data with previous years.

Soil and vegetation are sampled monthly at 51 locations. Thirteen sampling stations are located within the boundaries of Atomics International's sites and are referred to as "on-site" stations. The remaining 38 stations, located within a 10-mile radius of the sites, are referred to as "off-site" stations.

A. ENVIRONMENTAL RADIOACTIVITY DATA - 1962

The average radioactivity in 608 soil and vegetation samples is presented in Tables I and II.

TABLE I
SOIL RADIOACTIVITY DATA - 1962
I.a-SEMIANNUAL AVERAGES

Area	Activity	First Half - 1962		Last Half - 1962	
		No. Samples	Average uuc/gram	No. Samples	Average uuc/gram
On Site	δ	69	0.40 to 0.42	78	0.44 to 0.46
	$\beta-\gamma$	69	43	78	52
Off Site	δ	227	0.31 to 0.38	226	0.39 to 0.44
	$\beta-\gamma$	227	42	226	53

I.b-MONTHLY AVERAGES
uuc/gram

	Activity	J	F	M	A	M	J	J	A	S	O	N	D
On Site	δ	0.59 to 0.63	0.44	0.34 to 0.39	0.31 to 0.38	0.36	0.38	0.30 to 0.36	0.35 to 0.37	0.36 to 0.38	0.43	0.44	0.76
	$\beta-\gamma$	35	34	43	53	52	38	39	53	51	65	54	48
Off Site	δ	0.37 to 0.40	0.45 to 0.49	0.28 to 0.36	0.29 to 0.36	0.25 to 0.36	0.26 to 0.33	0.19 to 0.30	0.29 to 0.34	0.31 to 0.35	0.33 to 0.35	0.54 to 0.56	0.72 to 0.73
	$\beta-\gamma$	28	39	48	52	44	40	42	52	52	68	54	50

TABLE II
VEGETATION RADIOACTIVITY DATA-1962
II.a-SEMIANNUAL AVERAGES

Area	Activity	First Half - 1962		Last Half - 1962	
		No. Samples	Average uuc/gram/ash	No. Samples	Average uuc/gram/ash
On Site	δ	69	0.37 to 0.39	78	0.49 to 0.51
	$\beta-\gamma$	69	702	78	321
Off Site	δ	227	0.30 to 0.32	226	0.54 to 0.55
	$\beta-\gamma$	227	558	226	253

II.b. - MONTHLY AVERAGES
uuc/gram ash

	Activity	J	F	M	A	M	J	J	A	S	O	N	D
On Site	α	0.42	0.43	0.71	0.24 to 0.26	0.36 to 0.40	0.18 to 0.20	0.20 to 0.25	0.38 to 0.39	0.47 to 0.48	0.31 to 0.34	1.0	0.60
	β-γ	1000	832	1390	742	250	255	223	248	320	268	520	351
Off Site	α	0.45 to 0.47	0.32	0.34 to 0.35	0.30 to 0.32	0.20 to 0.23	0.20 to 0.22	0.17 to 0.23	0.41 to 0.42	0.36	0.62	1.0	0.65
	β-γ	653	566	1247	399	287	196	141	199	204	181	415	386

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

TABLE III
WELL WATER RADIOACTIVITY DATA - 1962
III.a. - SEMIANNUAL AVERAGES

Location	Activity	First Half - 1962		Last Half - 1962	
		No. Samples	Average uuc/liter	No. Samples	Average uuc/liter
NDFL	α	12	0.09 to 0.11	12	0.30 to 0.32
	β-γ	12	3.1 to 3.2	12	20

III.b. - MONTHLY AVERAGES
uuc/liter

Activity	J	F	M	A	M	J	J	A	S	O	N	D
α	0.12	0.17	0.06 0.08	0.12	0.04 0.07	0.04 0.06	0.24 0.26	0.04 0.07	0.09 0.11	0.14 0.16	0.15	1.2
β-γ	1.7 to 3.0	4.2	4.1	4.2	0 to 2.5	3.7	8.1	9.7	18	12	60	14

Soil, vegetation, and water are sampled monthly at Chatsworth Reservoir which is operated by the Los Angeles City Department of Water and Power. Soil and vegetation radioactivity

data for the reservoir is averaged into data presented in Tables I, II, VI, and VII. Normally, four water samples are obtained from the lake surface and a fifth sample is obtained from the reservoir supply inlet located on the north side of the lake. The average radioactivity for both surface and supply water samples is presented in Table IV.

TABLE IV
CHATSWORTH RESERVOIR WATER RADIOACTIVITY DATA - 1962
IV-a. - SEMIANNUAL AVERAGES

Sample Type	Activity	First Half - 1962		Last Half - 1962	
		No. Samples	Average uuc/liter	No. Samples	Average uuc/liter
Lake Surface	α	21	0.46 to 0.47	20	0.88
	β-γ	21	20	20	17
Supply Inlet	α	6	0.50	6	0.50
	β-γ	6	12	6	14

IV-b. - MONTHLY AVERAGES
uuc/liter

	Activity	J	F	M	A	M	J	J	A	S	O	N	D
Lake Surface	α	0.15	0.39	0.69	0.23 to 0.24	0.76	0.33	1.1	0.65	0.81	0.98	0.89	*
	β-γ	19	14	36	21	10	18	4.4 to 5.0	16	20	23	22	*
Supply Inlet	α	0.48	0.56	0.55	0.57	0.51	0.30	0.32	0.37	0.57	0.61	0.88	0.26
	β-γ	6.9	12	14	24	8.2	6.2	0 to 2.5	14	15	18	18	21

* No Samples

Sampling of environmental air for 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 emitters is presented in Table V.

TABLE V
AIRBORNE RADIOACTIVITY DATA - 1962
SEMIANNUAL AVERAGE

Location	Activity	First Half - 1962		Last Half - 1962	
		No. Samples	Averages uuc/m^3	No. Samples	Averages uuc/m^3
Head-quarters	β-γ	163	8.5	180	6.2
NDFL	β-γ	148	6.3	166	4.9

Table I shows an increase, during the last six months of 1962, in both "on-site" and "off-site" soil radioactivity. Increases in "on-site" sample radioactivity are matched by corresponding increases in those samples obtained up to a distance of 10 miles from the NDFL. Since this is a general increase throughout the local area, it is not attributed to Atomics International operations.

Table II shows that vegetation alpha radioactivity increased somewhat and beta-gamma radioactivity decreased markedly during the last six months. The monthly vegetation radioactivity pattern parallels that of soil. It is noted that the higher radioactivity concentrations were prevalent during periods of rainfall, diminishing during subsequent dry periods. Since the activity levels during any given month were of constant magnitude over the entire local area, they are not attributed to Atomics International operations.

Table III shows that well water radioactivity increased during the last six months of the year. Table IV shows that alpha radioactivity in Chatsworth Reservoir surface water increased and that beta-gamma radioactivity decreased slightly during the same period. Supply inlet water shows no change in alpha and a slight increase in beta-gamma radioactivity. Supply water originates as run-off from the Sierra Mountains and is transported to the Los Angeles area through a system of rivers, lakes, aqueducts, and tunnels. This water originates at a considerable distance from the local area, and, since both NDFL well water and reservoir supply water radioactivity concentrations are similar, the radioactivity in well water is not attributed to Atomics International operations.

Table V shows decreases in airborne radioactivity at both the Headquarters and NDFL sites during the last six months. Decay analysis has shown the activity to be fission products produced after September 1, 1961 by nuclear detonations.

B. COMPARISON OF ENVIRONMENTAL RADIOACTIVITY DATA WITH PREVIOUS YEARS

This section summarizes the environmental monitoring results for the calendar year 1962. Also, the annual averages for the years 1957 through 1961 are included for comparison. The averaged annual radioactivity in soil and vegetation is presented in Tables VI and VII.

TABLE VI
SOIL RADIOACTIVITY DATA - 1957 THROUGH 1962
VI.a. - ALPHA RADIOACTIVITY

	On Site		Off Site	
Year	No. Samples	Average uuc/gram	No. Samples	Average uuc/gram
1962	147	0.42 to 0.44	453	0.35 to 0.41
1961	120	0.30 to 0.37	458	0.24 to 0.33
1960	115	0.34 to 0.41	362	0.27 to 0.37
1959	107	0.43	377	0.32
1958	80	0.27	309	0.26
1957	64	0.32	318	0.35

VI.b. - BETA-GAMMA RADIOACTIVITY

	On Site		Off Site	
Year	No. Samples	Average uuc/gram	No. Samples	Average uuc/gram
1962	147	48	453	47
1961	120	34	458	23
1960	114	23	360	19
1959	107	15	379	14
1958	84	21	318	10
1957	72	11	354	10

TABLE VII
VEGETATION RADIOACTIVITY DATA - 1957 THROUGH 1962
VII.a. - ALPHA RADIOACTIVITY

Year	On Site		Off Site	
	No. Samples	Average uuc/gram Ash	No. Samples	Average uuc/gram Ash
1962	147	0.44 to 0.45	453	0.42 to 0.44
1961	120	0.32 to 0.35	459	0.26 to 0.29
1960	115	0.31 to 0.35	362	0.21 to 0.25
1959	96	0.29	293	0.18
1958	65	0.57	250	0.39
1957	58	1.1	304	0.89

VII.b. - BETA-GAMMA RADIOACTIVITY

Year	On Site		Off Site	
	No. Samples	Average uuc/gram Ash	No. Samples	Average uuc/gram Ash
1962	147	500	453	406
1961	120	224	459	246
1960	113	137	358	136
1959	107	212	380	168
1958	84	683	318	356
1957	70	208	351	200

The annual radioactivity average in NDFL well water is presented in Table VIII.

TABLE VIII
WELL WATER RADIOACTIVITY DATA - 1957 THROUGH 1962

Year	Alpha		Beta - Gamma	
	No. Samples	Average uuc/liter	No. Samples	Average uuc/liter
1962	24	0.20 to 0.21	24	12
1961	24	0.06 to 0.09	24	2.2 to 3.6
1960	22	0.06 to 0.09	22	1.0 to 2.7
1959	18	0.08	16	1.6
1958	13	0.16	18	4.7
1957	-	-	17	13

The annual radioactivity average in Chatsworth Reservoir water is presented in Table IX.

TABLE IX
CHATSWORTH RESERVOIR WATER RADIOACTIVITY DATA - 1961 AND 1962

Year	Lake Surface			Supply Inlet		
	No.Samples	Average uuc/liter		No.Samples	Average uuc/liter	
		α	β-γ		α	β-γ
1962	41	0.66 to 0.67	19	12	0.50	13
1961*	38	0.52	11	10	0.28	7.7 to 8.0

* The gross annual average excludes January and February since the Reservoir water sampling stations indicated in Table XI were established in March 1961.

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

The annual average concentration of airborne radioactivity at Headquarters and the NDFL is presented in Table X.

TABLE X
AIRBORNE RADIOACTIVITY DATA - 1957 THROUGH 1962

Year	Headquarters		NDFL	
	No. Samples	Average uuc/m^3	No. Samples	Average uuc/m^3
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

Significant increases in radioactivity concentrations in all sample types during 1962 are apparent from Tables VI, VII, VIII, and X. Radioactivity concentrations of similar magnitude in samples taken during 1957 and 1958 reflected the contribution of radioactivity to the environment by nuclear weapons tests conducted during that period when extensive nuclear facilities at the NDFL were non-existent. As indicated in the discussion of data for the last half of 1962, this general increase is not attributed to Atomics International operations. It is felt that the increased radioactivity detected during 1962 was produced after September 1, 1961 by nuclear detonations.

The resumption of nuclear weapons testing on September 1, 1961 resulted in the release of fresh fission products to the atmosphere of the northern hemisphere. The beta-gamma radioactivity increases in all sample types reflects this contamination to the environment. The contamination is most readily apparent in vegetation and well water radioactivity concentrations, although reservoir water and airborne radioactivity increases are also significant.

Considerable rainfall occurred in the Los Angeles area during the first quarter of 1962. A total of 16.3 inches was recorded at the Headquarters weather station, with 17.8 inches recorded at the NDFL weather station during this period. Rainwater radioactivity averaged 668 uuc/liter beta-gamma. Soil contamination from fallout and raincut may be less apparent than vegetation contamination, because normal soil radioactivity is comparatively high and the surface area to volume ratio of soil samples, which are removed to a depth of ½ inch, is small. The percentage of increase in soil radioactivity during 1962 is somewhat less than in vegetation; however, it is considerably greater than in the corresponding 1960 - 1961 period, especially in "offsite" samples. This is probably due to rain-out percolation into the ground early in the year (see Table I, Soil Radioactivity by Month).

Atomics International does not release radioactivity into the environment in concentrations in excess of the established permissible values. The continued increased level of environmental radioactivity, noted throughout the local area, is due to fission debris produced by nuclear testing and is not attributed to Atomics International operations.

II. ENVIRONMENTAL MONITORING PROGRAM

A. GENERAL DESCRIPTION

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

Due to the effect of topography on environmental radioactivity, comparison between widely-spread, individual sampling locations is difficult. Useful information can be obtained, however, by observing the trend of individual or closely related groups of sampling locations. For this reason, samples are collected monthly in six general survey areas including the West San Fernando Valley (Canoga Park and Reseda areas), Simi Hills, Simi Valley, Russel Valley and vicinity, and the Chatsworth Reservoir. Fifty-one soil and vegetation sampling stations are currently established within the indicated areas. The maximum sampling station distance from the Nuclear Development Field

Laboratory at Santa Susana is approximately ten miles, and the total survey area comprises approximately 150 square miles. Sampling station locations are indicated on Figures 4, 5, 6, 7, and in Table XI.

During each annual reporting period approximately 610 soil, 610 vegetation, 85 water, and 720 environmental air samples are obtained and analyzed by the Health and Safety Laboratory for gross alpha and/or beta-gamma radioactivity. Since environmental radioactivity levels are low and there is seldom any evidence of contribution by Atomics International, specific isotopic analyses are not routinely performed on environmental samples. Such analyses would be performed if warranted.

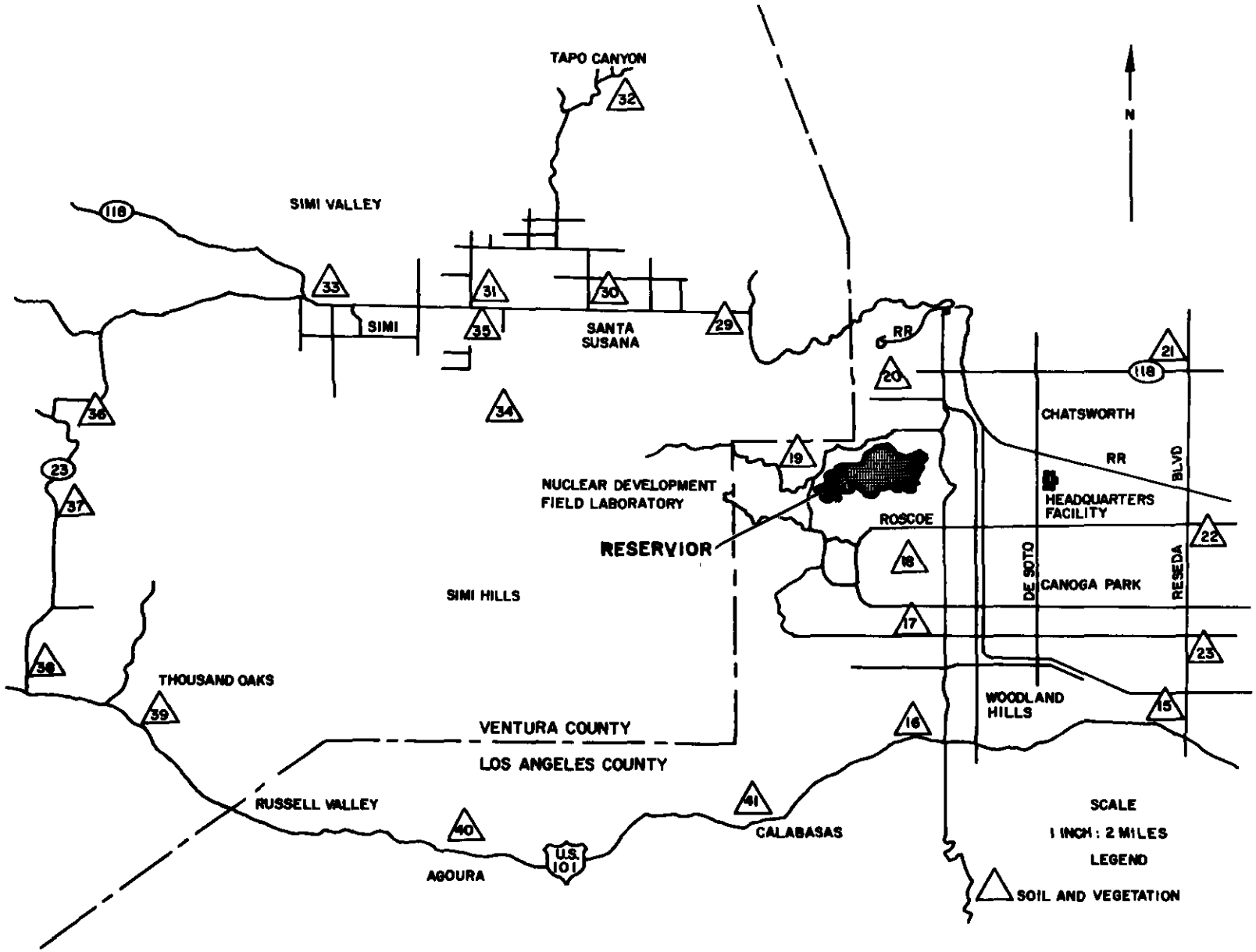


Figure 4. Map of Reseda, Canoga Park, Simi Valley, and Russell Valley Sampling Stations

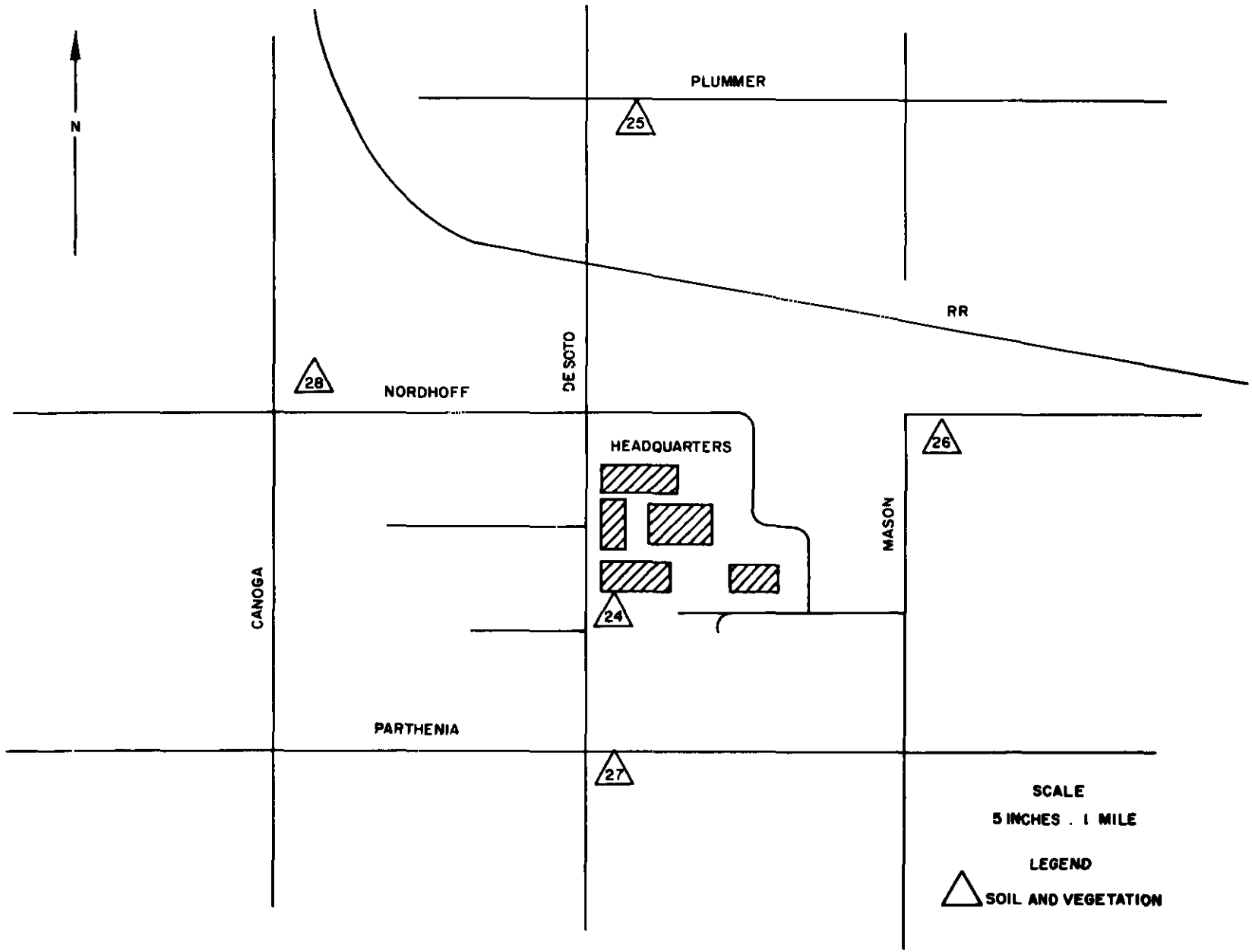


Figure 5. Map of Headquarters Vicinity Sampling Stations

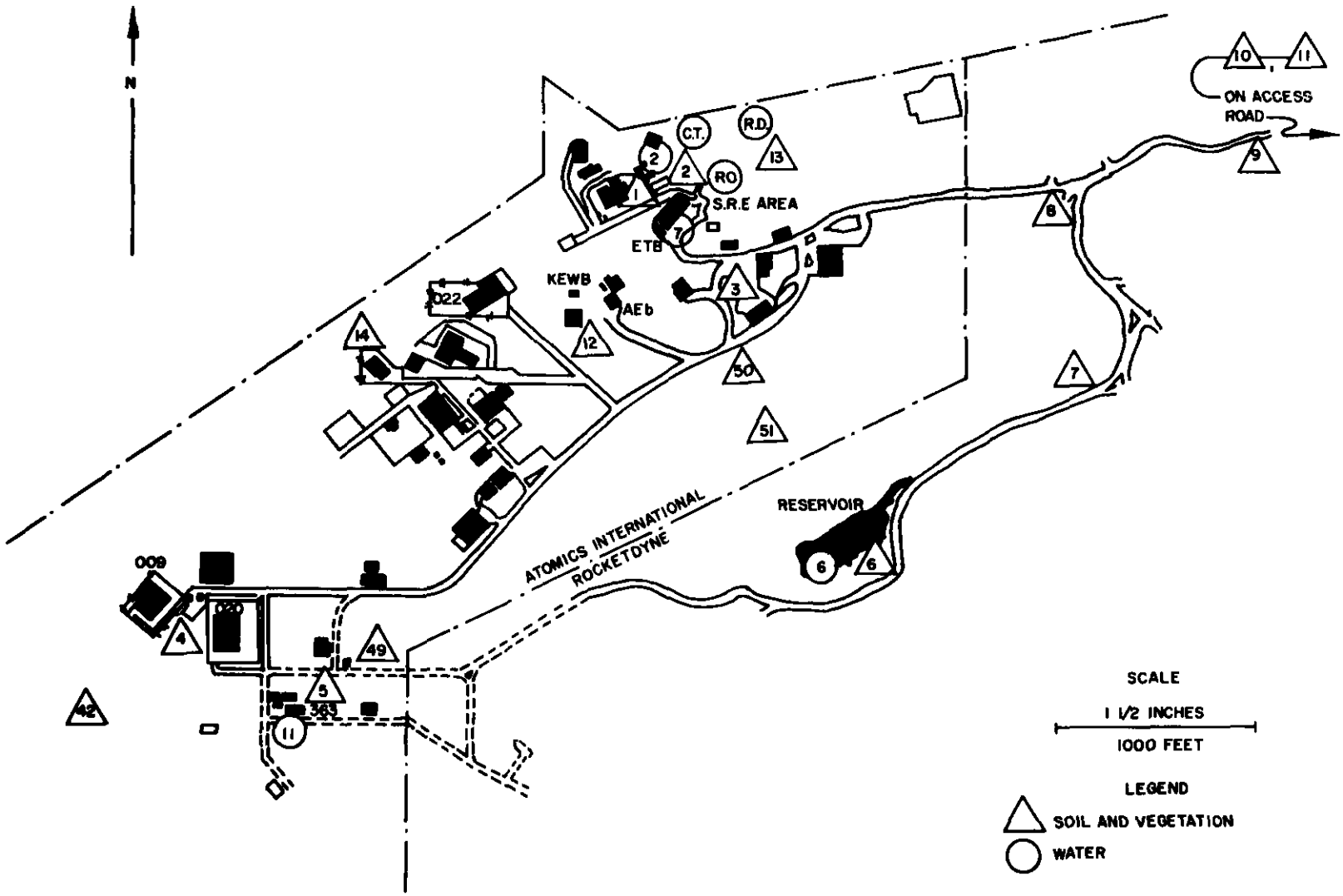


Figure 6. Map of NDFL Sampling Stations

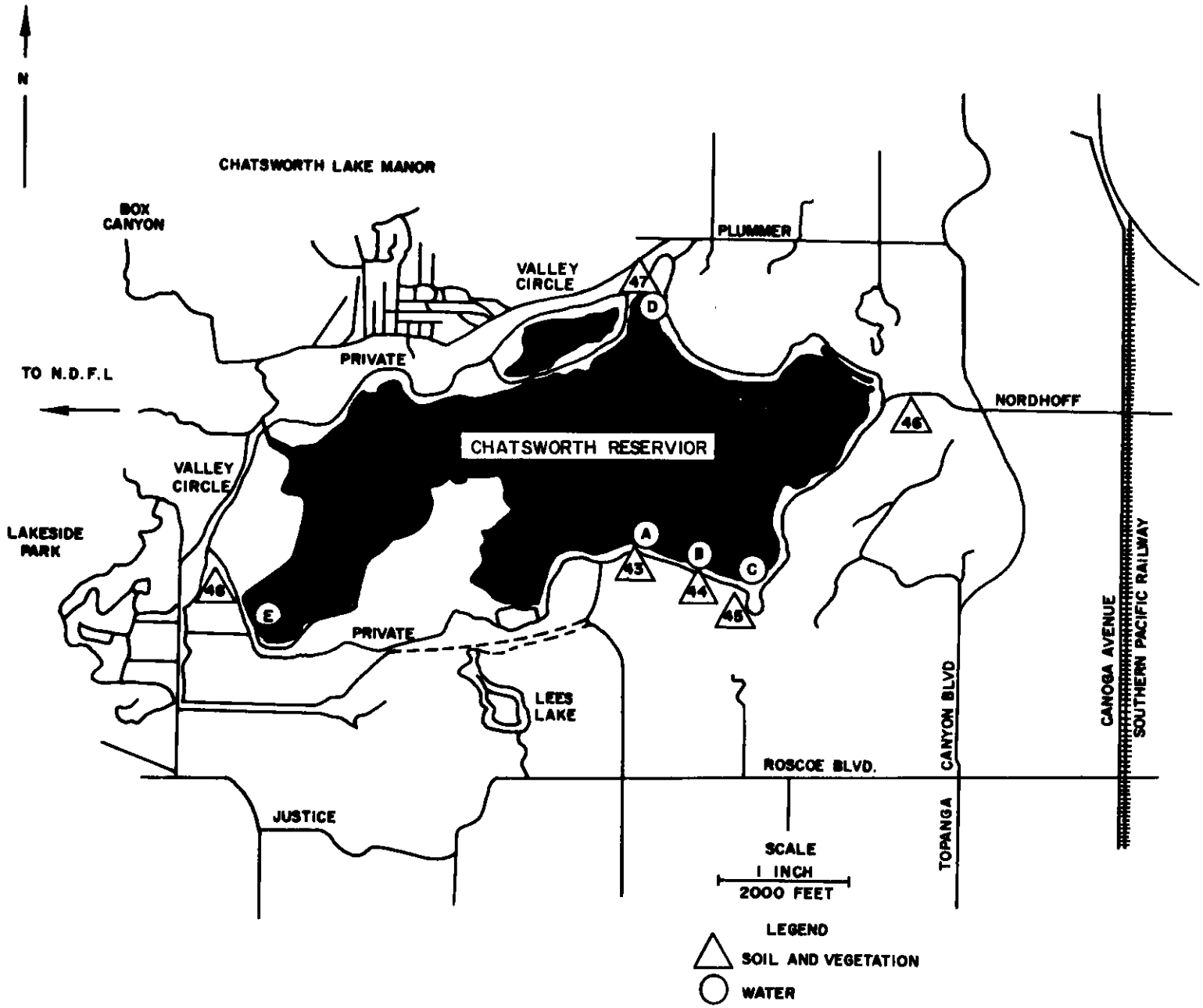


Figure 7. Map of Chatsworth Reservoir Sampling Stations

TABLE XI

SAMPLE STATION LOCATIONS

STATION	LOCATION
SV-1	SRE Reactor
SV-2	SRE Perimeter Drainage Ditch
SV-3	Building 064 Parking Lot
SV-4	West of Building 020
SV-5	Building 363
SV-6	Rocketdyne Retention Reservoir, PFL
SV-7	Rocketdyne PFL
SV-8	Rocketdyne PFL
SV-9	Rocketdyne PFL
SV-10	Santa Susana Site Access Road
SV-11	Santa Susana Site Access Road
SV-12	KEWB Reactor
SV-13	Sodium Cleaning Pad
SV-14	Canyon below Building 022
SV-15	Reseda Blvd. and Ventura Blvd.
SV-16	Topanga Canyon Blvd. and Ventura Blvd.
SV-17	Topanga Canyon Blvd. and Vanowen St.
SV-18	Topanga Canyon Blvd. and Saticoy St.
SV-19	Santa Susana Site Entrance
SV-20	Topanga Canyon Blvd. and Devonshire St.
SV-21	Reseda Blvd. and Devonshire St.
SV-22	Reseda Blvd. and Nordhoff St.
SV-23	Reseda Blvd. and Sherman Way
SV-24	Headquarters
SV-25	DeScto Ave. and Plummer St.
SV-26	Nordhoff St. and Mason Ave.
SV-27	DeSoto Ave. and Parthenia St.
SV-28	Canoga Ave. and Nordhoff St.
SV-29	Santa Susana Knolls
SV-30	Los Angeles Ave. at Bridge
SV-31	Los Angeles Ave. and Sycamore Road
SV-32	Tapo Canyon
SV-33	Los Angeles Ave. and Sinaloa Road

STATION CON'T	LOCATION CON'T
SV-34	Meier Canyon
SV-35	Brandeis Camp Entrance
SV-36	Moorpark Road and Camarillo Road
SV-37	Moorpark Road at Oil Pumping Station
SV-38	Moorpark Road and Ventura Blvd.
SV-39	Ventura Blvd. at Potrero Road
SV-40	Ventura Blvd. at Cornell Corners (Agoura)
SV-41	Ventura Blvd. at Calabasas
SV-42	Non-Radioactive Materials Disposal Area, Nuclear Development Field Laboratory
SV-43	Chatsworth Reservoir Dam - West Side
SV-44	Chatsworth Reservoir Dam - Mid Point
SV-45	Chatsworth Reservoir Dam - East Side
SV-46	Chatsworth Reservoir Perimeter Road - Northeast Side
SV-47	Chatsworth Reservoir Perimeter Road - North Side
SV-48	Chatsworth Reservoir Perimeter Road - West Side
SV-49	Adjacent to Rocketdyne Boundary
SV-50	Burro Flats Access Road
SV-51	Storage Area Adjacent to Calibration Facility
W 2	SRE Perimeter Drainage Ditch
W 6	Rocketdyne Retention Reservoir, PFL
W 7	Well Water from Engineering Test Building
W 11	Well Water from Building 363
W R.O.	Run Off Collection Sump, ETB and SRE Area
W C.T.	Edison Cooling Tower
W R.D.	SRE Retention Dam
W A	Chatsworth Reservoir
W B	Chatsworth Reservoir
W C	Chatsworth Reservoir
W D	Chatsworth Reservoir
W E	Chatsworth Reservoir

SV-Soil and Vegetation

W-Water

B. SAMPLING AND PREPARATION METHODS

SOIL

Surface soil types available for sampling range from decomposed granite to clay and loam. Samples are collected from the top ½ 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 8 hours. After cooling, the soil is sieved to obtain a 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 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 plant leaves. These plant types maintain a more active rate of growth during the dry season, a characteristic uncommon to most plant types indigenous to the local area. Vegetation leaves stripped from the plant are placed in individual ice cream cartons and transferred to the laboratory for radioanalysis. Plant root systems are not routinely sampled.

Vegetation samples are first washed with tap water to remove foreign matter, followed by a thorough distilled water rinse. The vegetation is placed in porcelain crucibles and ashed in a muffle furnace at 500°C for approximately 8 hours, producing a fine, completely oxidized 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 Chatsworth Reservoir. The water is drawn into 1-liter polyethylene bottles and transferred to the laboratory.

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

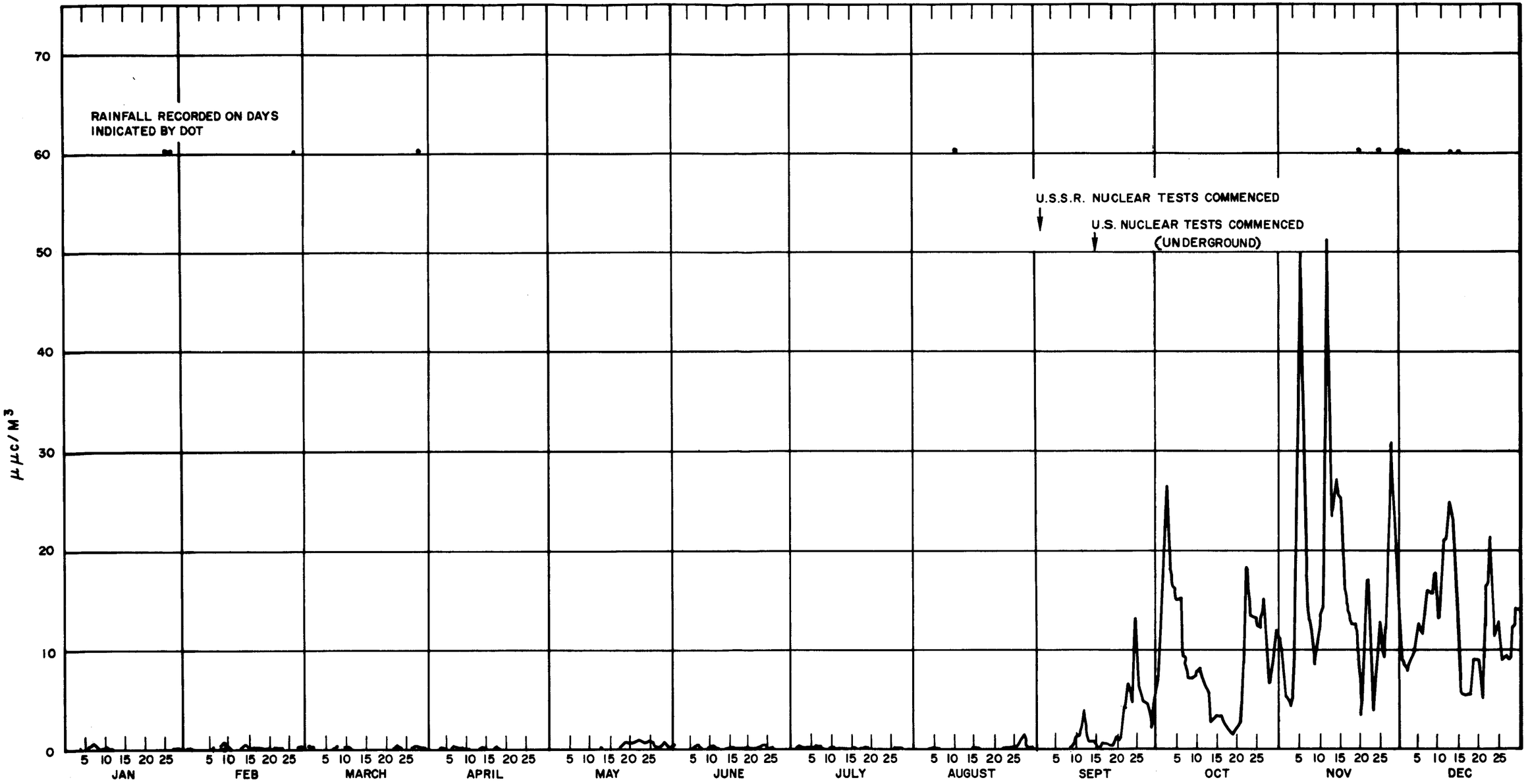
AIR

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 a filter tape which is automatically changed at the end of each sampling period. The filter is removed from the sampler, the activity allowed to decay for at least 72 hours, and counted. The volume of a typical daily environmental air sample is approximately 21 cubic meters. The minimum detection limit, which varies somewhat between samplers due to differences in airflow, is on the order of 0.02 uuc/m^3.

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

A graph of long-lived airborne radioactivity concentrations detected at the Headquarters facility during 1961 and 1962 is shown in Figure 8. Airborne radioactivity concentrations subsequent to the nuclear weapons test series in Nevada during the fall of 1958 had decreased to relatively insignificant values until the resumption of atmospheric testing of nuclear weapons by the USSR in the fall of 1961. The graph shows a rapid increase in airborne radioactivity from mid-September to November, 1961. Subsequent average concentrations during 1962 decreased considerably by the end of June and remained low until mid-October.

Transient radioactivity peaks during 1962 occurred in February, April, October, November, and December, the December peak being sustained over a period of several days. Also indicated on the graph are days on which rainfall was recorded at the Headquarters facility weather station. This illustrates the effect of precipitation on airborne radioactivity values. In general, during periods of precipitation the airborne radioactivity decreased somewhat due to the combined effects of particulate removal by rainfall and wind conditions generally associated with precipitation in the local area.



LONG LIVED AIRBORNE PARTICULATE RADIOACTIVITY

ATOMICS INTERNATIONAL HEADQUARTERS- 1961

Figure 8. Long-Lived Airborne Particulate Radioactivity Atomics International Headquarters – 1961

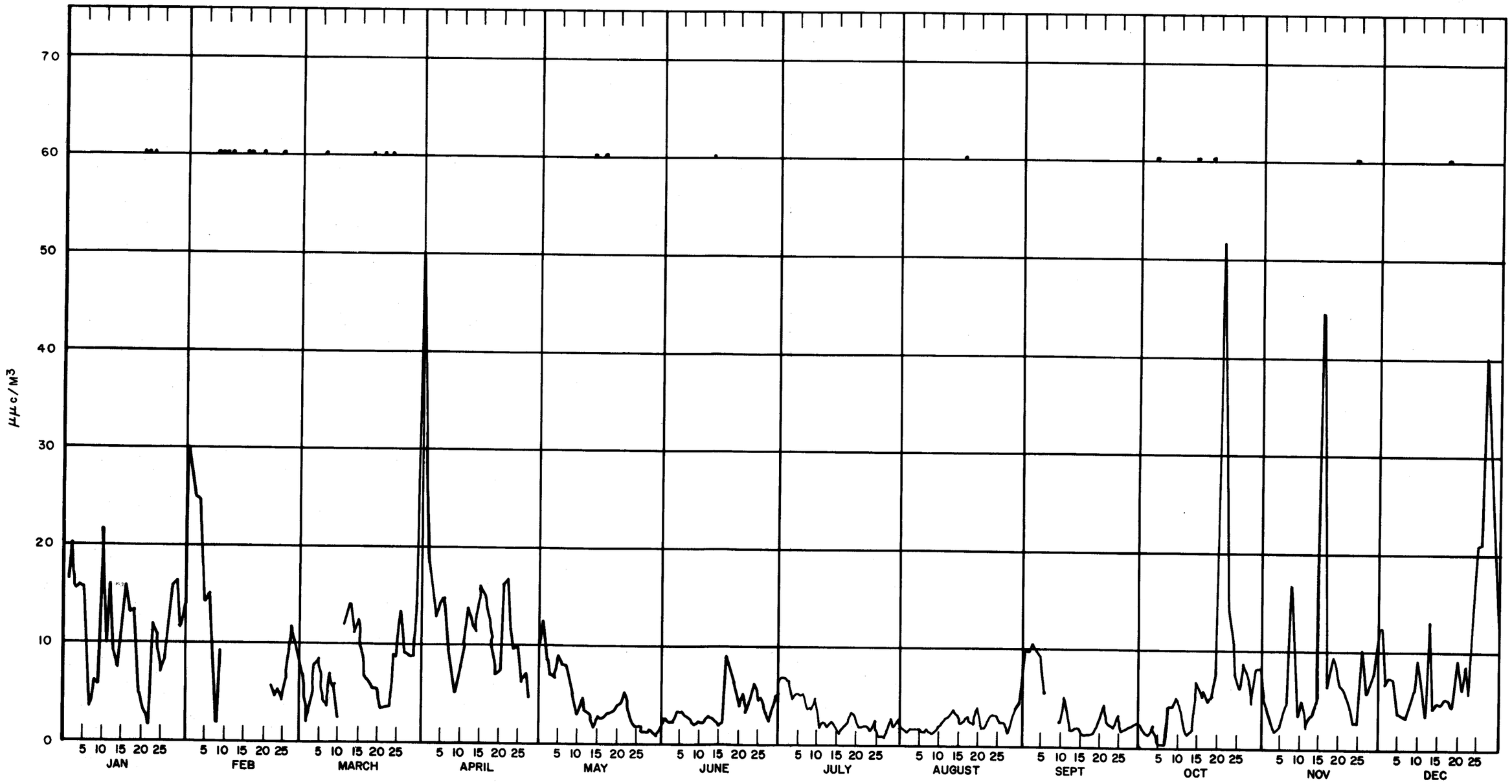


Figure 8. Long-Lived Airborne Particulate Radioactivity Atomics International Headquarters – 1962

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 counter-detector configuration provides nearly a 2π geometry. The detector has a thin Mylar window and is continually purged with a 90% argon, 10% methane counting gas. A preset count mode of operation is used for all sample types; however, an overriding preset 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 XII were determined using typical values for preset count, preset time, system efficiencies, background count rates (approximately 0.03 cpm α and 12 cpm β-γ), and sample size.

TABLE XII
MINIMUM DETECTION LIMITS

Sample	Activity	Minimum Detection Limits*
Soil	α	0.24 ± 0.048 (uuc/gram)
	β-γ	6.9 ± 1.1 (uuc/gram)
Vegetation	α	0.086 ± 0.089 (uuc/gram ash)
	β-γ	13.8 ± 2.1 (uuc/gram ash)
Water	α	0.052 ± 0.054 (uuc/liter)
	β-γ	2.5 ± 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 specific activity of approximately 830 dpm per gram of KCl and a beta energy of 1.33 mev. Its advantages 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 proven insignificant.

In practice, KCl is sieved and divided into aliquots, increasing each in 100 milligram increments from 100 to 1200 milligrams. These aliquots are transferred to 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 and multiplied by the net sample counting rate to obtain 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.

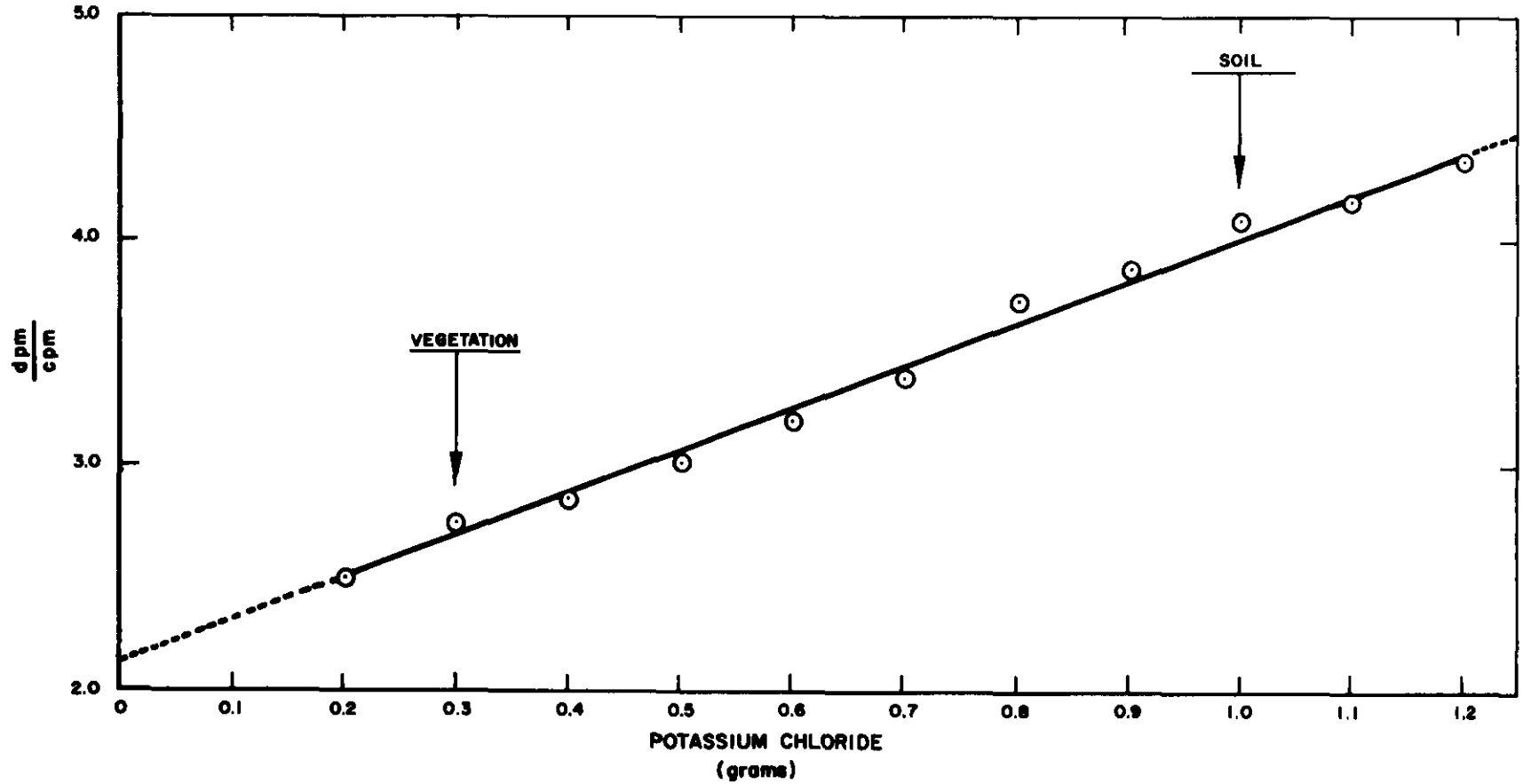


Figure 9. Self-Absorption Correction Graph