

ENVIRONMENTAL MONITORING  
SEMIANNUAL REPORT  
JULY 1, 1963 TO DECEMBER 31, 1963  
AND  
ANNUAL REPORT  
1963

**ATOMIC INTERNATIONAL**  
A DIVISION OF NORTH AMERICAN ATOMICS, INC.

ENVIRONMENTAL MONITORING  
SEMIANNUAL REPORT  
JULY 1, 1963 TO DECEMBER 31, 1963  
AND  
ANNUAL REPORT  
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by

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## 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. Radioactivity in the environment generally decreased during the last six months of 1963, although soil beta-gamma and Chatsworth Reservoir water alpha radioactivity increased since the first half of the year. The environmental radioactivity reported herein is attributed to nuclear weapons tests and to naturally occurring fluctuations, not to Atomics International operations.



Figure 1. Atomics International World Headquarters

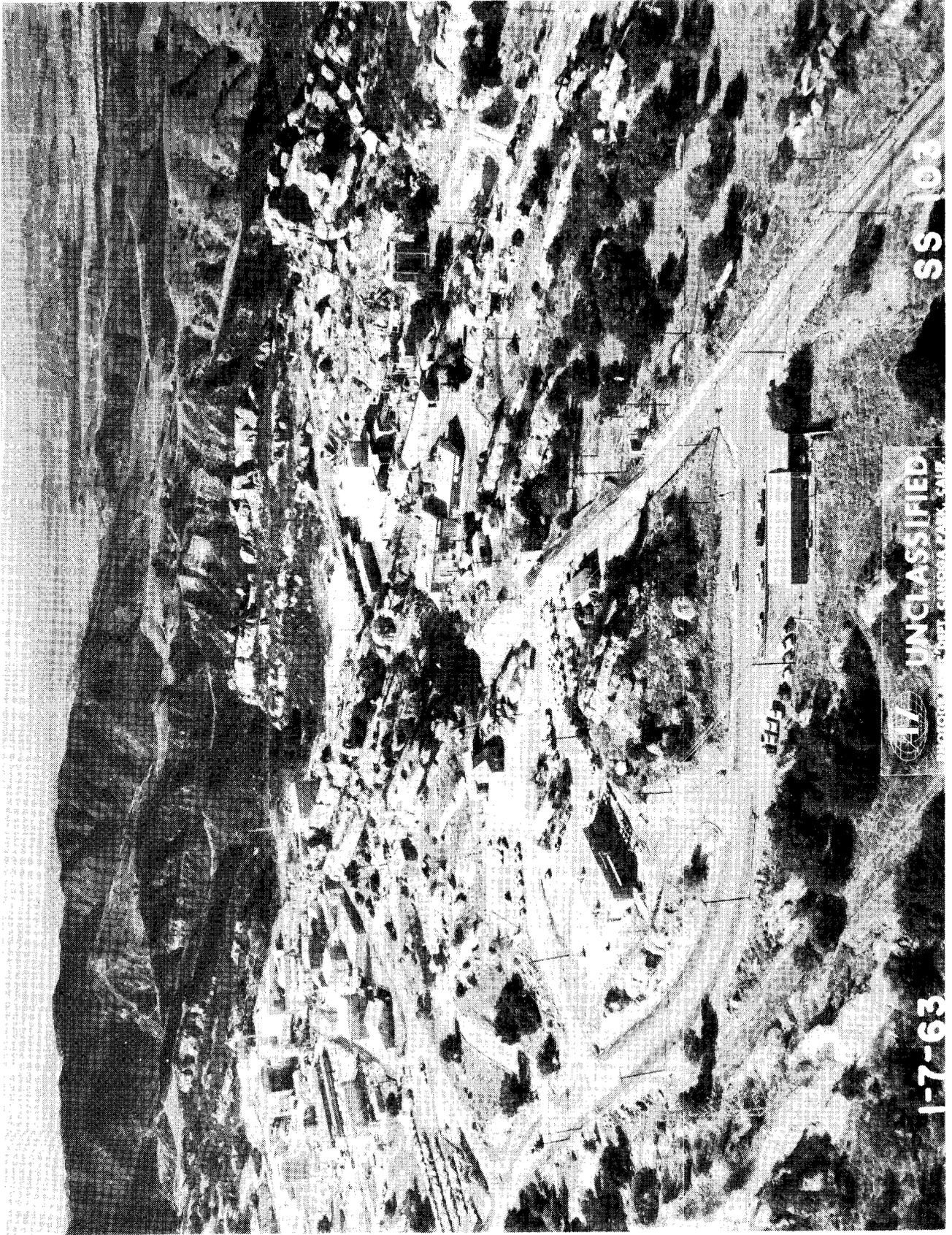


Figure 2. Atomic International Nuclear Development Field Laboratory



## 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 testing facilities for the support of advanced nuclear studies, is located in the Simi Hills of Ventura County 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 hazard control at Atomics International requires 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 the company's radiological safety procedures and of engineering safeguards incorporated into facility design.

The environs of Atomics International Headquarters and the Nuclear Development Field Laboratory (NDFL) are surveyed monthly to determine the concentration of radioactivity in typical surface soil, vegetation, and water samples. Also, continuous environmental air monitoring at the sites provides information concerning airborne particulate radioactivity. This report summarizes environmental monitoring results for the last six months of 1963 and compares the 1963 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 - 1963

The average radioactivity concentration in 612 soil and vegetation samples is presented in Tables I and II.

TABLE I  
SOIL RADIOACTIVITY DATA - 1963  
I.a. SEMIANNUAL AVERAGES

Area	Activity	First Half - 1963		Last Half - 1963	
		No. Samples	Average uuc/gram	No. Samples	Average uuc/gram
On Site	$\alpha$	78	0.42 to 0.45	78	0.41 to 0.42
	$\beta$ - $\gamma$	78	44	78	45
Off Site	$\alpha$	227	0.39 to 0.43	228	0.37 to 0.41
	$\beta$ - $\gamma$	227	41	228	44

I.b. MONTHLY AVERAGES  
uuc/gram

Area	Activity	J	F	M	A	M	J	J	A	S	O	N	D
		On Site	$\alpha$	0.51 to 0.57	0.46	0.43 to 0.47	0.42 to 0.44	0.32 to 0.38	0.37 to 0.41	0.37 to 0.39	0.36 to 0.38	0.58	0.34 to 0.35
	$\beta$ - $\gamma$	40	35	42	41	51	56	48	47	45	48	41	41
Off Site	$\alpha$	0.39 to 0.42	0.40 to 0.42	0.44 to 0.46	0.39 to 0.43	0.37 to 0.41	0.37 to 0.41	0.27 to 0.36	0.36 to 0.40	0.41 to 0.44	0.39 to 0.43	0.42 to 0.46	0.38 to 0.40
	$\beta$ - $\gamma$	36	31	42	41	48	49	56	51	42	41	40	35

TABLE II  
VEGETATION RADIOACTIVITY DATA - 1963  
II.a. SEMIANNUAL AVERAGES

Area	Activity	First Half - 1963		Last Half - 1963	
		No. Samples	Average uuc/gram/ash	No. Samples	Average uuc/gram/ash
On Site	$\alpha$	78	0.51 to 0.52	78	0.35 to 0.37
	$\beta$ - $\gamma$	78	558	78	373
Off Site	$\alpha$	228	0.44 to 0.45	228	0.28 to 0.29
	$\beta$ - $\gamma$	228	489	228	287

II.b. MONTHLY AVERAGES  
uuc/gram/ash

Area	Activity	J	F	M	A	M	J	J	A	S	O	N	D
		On Site	$\alpha$	0.56	0.92	0.42 to 0.43	0.54 to 0.55	0.43	0.20 to 0.23	0.56 to 0.57	0.28 to 0.30	0.35 to 0.37	0.33 to 0.34
	$\beta$ - $\gamma$	387	419	539	583	804	614	614	456	343	327	283	214
Off Site	$\alpha$	0.52	0.67 to 0.68	0.54	0.45	0.27 to 0.28	0.22 to 0.24	0.22 to 0.24	0.35	0.22 to 0.24	0.28	0.33 to 0.36	0.26 to 0.27
	$\beta$ - $\gamma$	431	439	458	616	624	364	396	284	253	274	263	250

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 analyzed. Well water is sampled monthly from the supply system at two locations. The average well water radioactivity is presented in Table III.

TABLE III  
WELL WATER RADIOACTIVITY DATA - 1963  
III.a. - SEMIANNUAL AVERAGES

Location	Activity	First Half-1963		Last Half-1963	
		No. Samples	Average uuc/liter	No. Samples	Average uuc/liter
NDFL	$\alpha$	12	0.22 to 0.23	12	0.12 to 0.13
	$\beta$ - $\gamma$	12	10	12	4.2 to 4.4

III.b. - MONTHLY AVERAGES  
uuc/liter

Activity	J	F	M	A	M	J	J	A	S	O	N	D
$\alpha$	0.16	0.25	0.18 to 0.20	0.13	0.49	0.12 to 0.14	0.14	0.20	0.05 to 0.07	0.21	0.05 to 0.07	0.10
$\beta$ - $\gamma$	16	6.5	7.2	17	5.3	5.2	7.5	4.6	3.7	2.1 to 2.4	3.5	4.0

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 are averaged into data presented in Tables I, II, VI, and VII. Normally, four water samples are obtained from the lake surface; however, the reservoir was drained in October, 1963 for maintenance thereby preventing further surface water sampling during the year. A fifth sample is obtained from the reservoir supply inlet located on the north side of the lake. The average radioactivity concentration in surface and supply water samples is presented in Table IV.

**TABLE IV**  
**CHATSWORTH RESERVOIR WATER RADIOACTIVITY DATA - 1963**  
**IV.a. - SEMIANNUAL AVERAGES**

Sample	Activity	First Half - 1963		Last Half - 1963	
		No. Samples	Average uuc/liter	No. Samples	Average uuc/liter
Lake	$\alpha$	24	0.75	13	1.0
Surface	$\beta$ - $\gamma$	24	19	13	16
Supply	$\alpha$	6	0.46	6	0.69
Inlet	$\beta$ - $\gamma$	6	10 to 11	6	7.8

**IV.b. - MONTHLY AVERAGES**  
**uuc/liter**

	Activity	J	F	M	A	M	J	J	A	S	O	N	D
Lake	$\alpha$	0.72	0.59	0.79	0.85	0.80	0.73	0.93	1.2	0.82	1.5	*	*
Surface	$\beta$ - $\gamma$	22	17	16	20	20	19	15	14	18	20	*	*
Supply	$\alpha$	0.19	0.06	1.1	0 to 0.05	0.91	0.50	1.3	1.2	0.16	0.50	0.88	0.09
Inlet	$\beta$ - $\gamma$	21	0 to 2.5	12	3.9	13	11	12	12	3.6	4.6	9.9	4.2

\* No samples due to dry reservoir

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 - 1963**  
**SEMIANNUAL AVERAGES**

Site	Activity	First Half - 1963		Last Half - 1963	
		No. Samples	Average uuc/M <sup>3</sup>	No. Samples	Average uuc/M <sup>3</sup>
Headquarters	$\beta$ - $\gamma$	179	9.6	181	3.7
NDFL	$\beta$ - $\gamma$	141	6.9	151	2.7

Table I shows a decrease, during the last six months of 1963, in "on-site" soil alpha radioactivity and a probable decrease in "off-site" alpha radioactivity. Soil beta-gamma radioactivity increased in both "on-site" and "off-site" samples; however, since this is a general increase throughout the area, it is not attributed to Atomic International operations.

Table II shows a considerable decrease in vegetation radioactivity during the last six months. Monthly data shows maximum concentrations occurring during late spring and early summer, coincident with periods of rainfall.

Table III shows that NDFL well water radioactivity decreased during the last six months of the year. Table IV shows that alpha radioactivity in Chatsworth Reservoir lake surface and supply water increased and that beta-gamma radioactivity decreased during the same period. Reservoir water originates as run-off from the Sierra Mountains at a considerable distance from the local area, and, since both NDFL well water and reservoir water radioactivities are similar, the radioactivity in well water is not attributed to Atomic International operations.

Table V shows decreases in averaged airborne radioactivity at both the Headquarters and NDFL sites during the last six months. This decrease is attributed to a reduction in fallout from nuclear weapons testing.

#### B. COMPARISON OF ENVIRONMENTAL RADIOACTIVITY DATA FOR 1963 WITH PREVIOUS YEARS

This section summarizes the environmental monitoring results for the calendar year 1963. Also, the annual averages for the years 1957 through 1962 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 1963  
VI.a. - ALPHA RADIOACTIVITY

Year	On Site		Off Site	
	No. Samples	Average uuc/gram	No. Samples	Average uuc/gram
1963	156	0.41 to 0.43	455	0.38 to 0.42
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

Year	On Site		Off Site	
	No. Samples	Average uuc/gram	No. Samples	Average uuc/gram
1963	156	45	455	42
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 1963  
VII.a. - ALPHA RADIOACTIVITY

Year	On Site		Off Site	
	No. Samples	Average uuc/gram/ash	No. Samples	Average uuc/gram/ash
1963	156	0.43 to 0.44	456	0.36 to 0.37
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
1963	156	465	456	388
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 1963

Year	Alpha		Beta-Gamma	
	No. Samples	Average uuc/liter	No. Samples	Average uuc/liter
1963	24	0.17 to 0.18	24	6.9 to 7.0
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 THROUGH 1963

Year	Lake Surface			Supply Inlet		
	No. Samples	Average uuc/liter		No. Samples	Average uuc/liter	
		$\alpha$	$\beta-\gamma$		$\alpha$	$\beta-\gamma$
1963	37	0.84	18	12	0.57 to 0.58	9.0 to 9.2
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 presented in Tables I, II, III, IV, VI, VII, VIII, and IX 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 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  $\beta$ - $\gamma$  RADIOACTIVITY DATA - 1957 THROUGH 1963

Year	Headquarters		NDFL	
	No. Samples	Average uuc/M <sup>3</sup>	No. Samples	Average uuc/M <sup>3</sup>
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

Decreased beta-gamma radioactivity in all sample types during 1963 is apparent from Tables VI, VII, VIII, IX, and X. Alpha radioactivity shows a probable increase in "off-site" soil and a definite increase in Chatsworth Reservoir water. Slightly decreased alpha radioactivity is noted in the other sample types, both "on-site" and "off-site". Radioactivity concentrations of similar magnitude in samples taken in 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 1963, the radioactivity detected during 1963 is not attributed to Atomic International operations; rather, it is felt to have been 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 in all sample types reflects this contamination to the environment, and is most readily apparent in vegetation, water, and air.

Rainfall was recorded at the Headquarters weather station during every month of 1963 except July and ranged from trace amounts to 3.4 inches in February. A total of 12.7 inches was recorded at Headquarters and 9.4 inches was recorded at the NDFL. Rainwater radioactivity at Headquarters averaged 1100.  $\mu\text{c/liter}$  beta-gamma. Soil contamination from fallout and rainout 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  $\frac{1}{2}$  inch, is small.

Atomics International does not release radioactivity into the environment in concentrations in excess of 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's 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. 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 adequately survey 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 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 (NDFL), Simi Valley, Russell 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 is approximately ten miles, and the total survey area comprises about 150 square miles. Sample station locations are indicated on Figures 4, 5, 6, 7, and in Table XI.

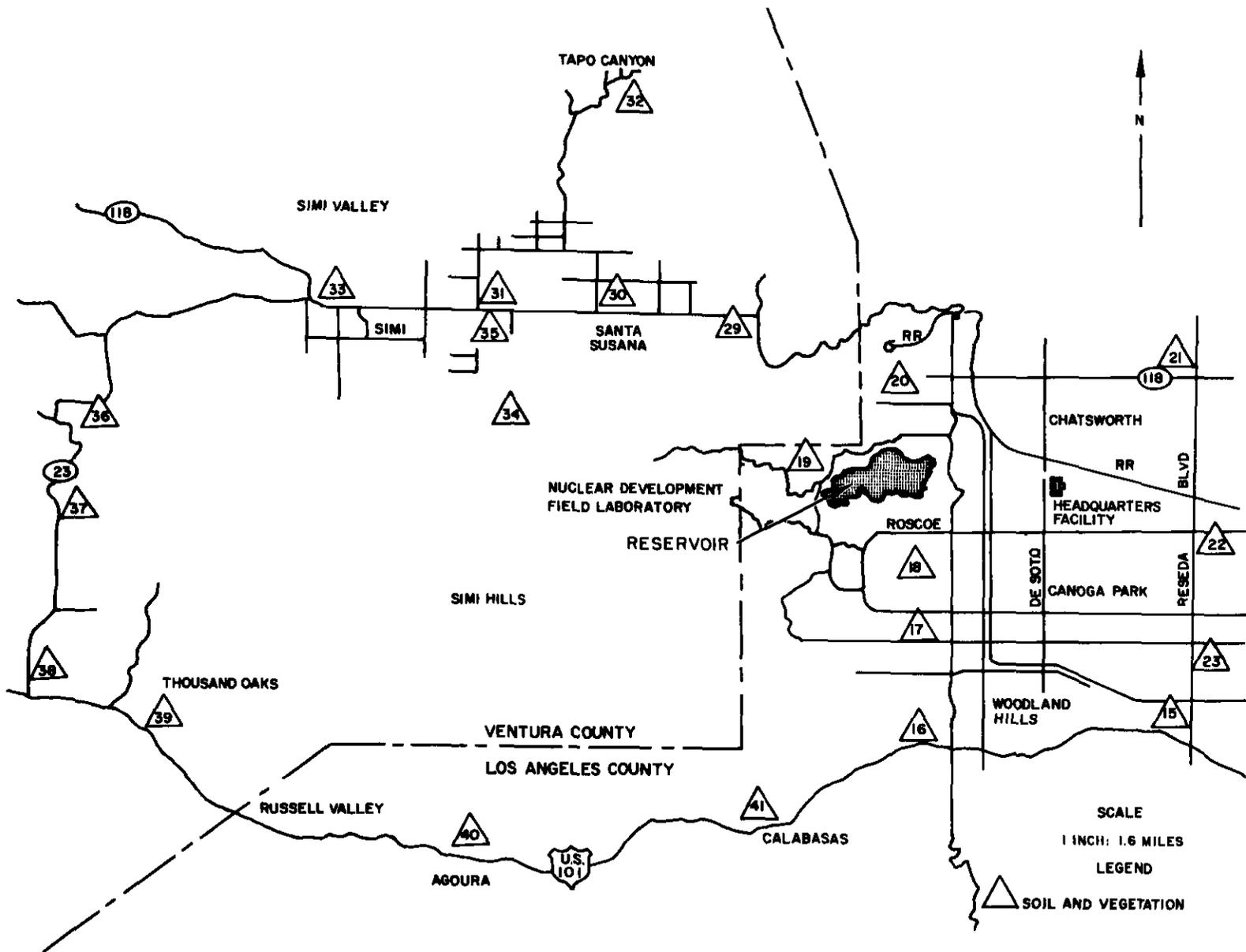


Figure 4. Map of Reseda, Canoga Park, Simi Valley, and Russell Valley Sampling Stations

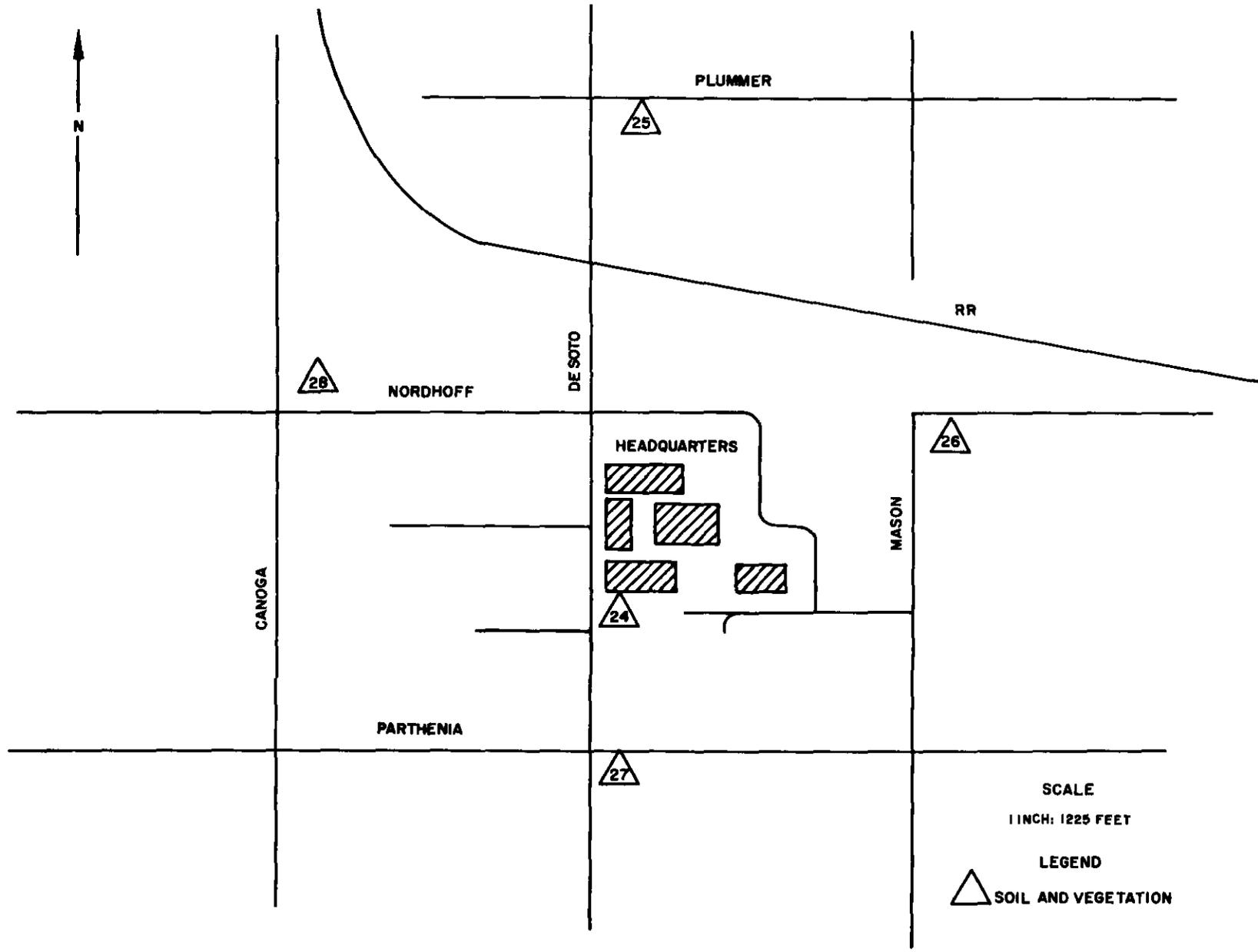


Figure 5. Map of Headquarters Vicinity Sampling Stations

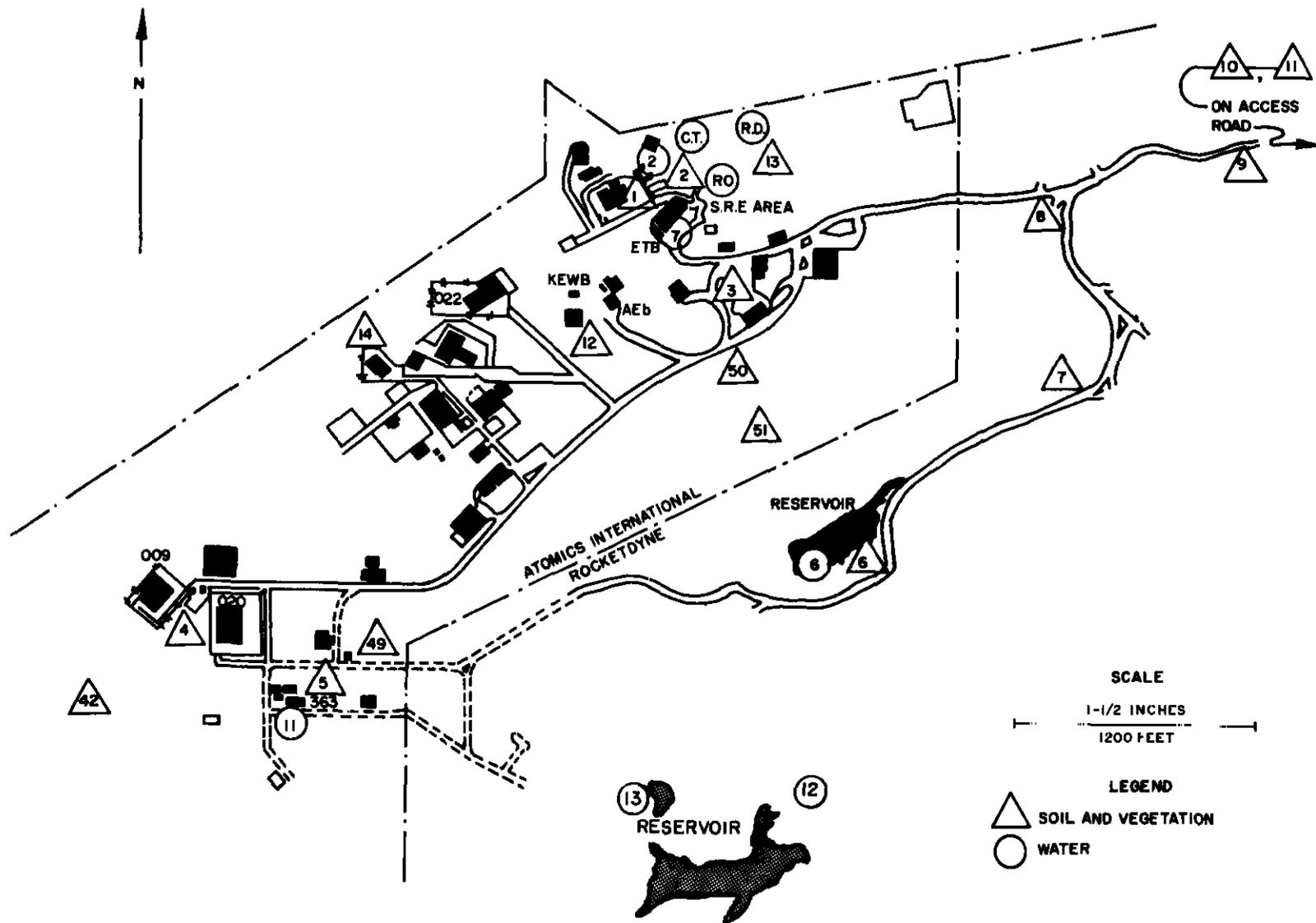


Figure 6. Map of NDFL Sampling Stations

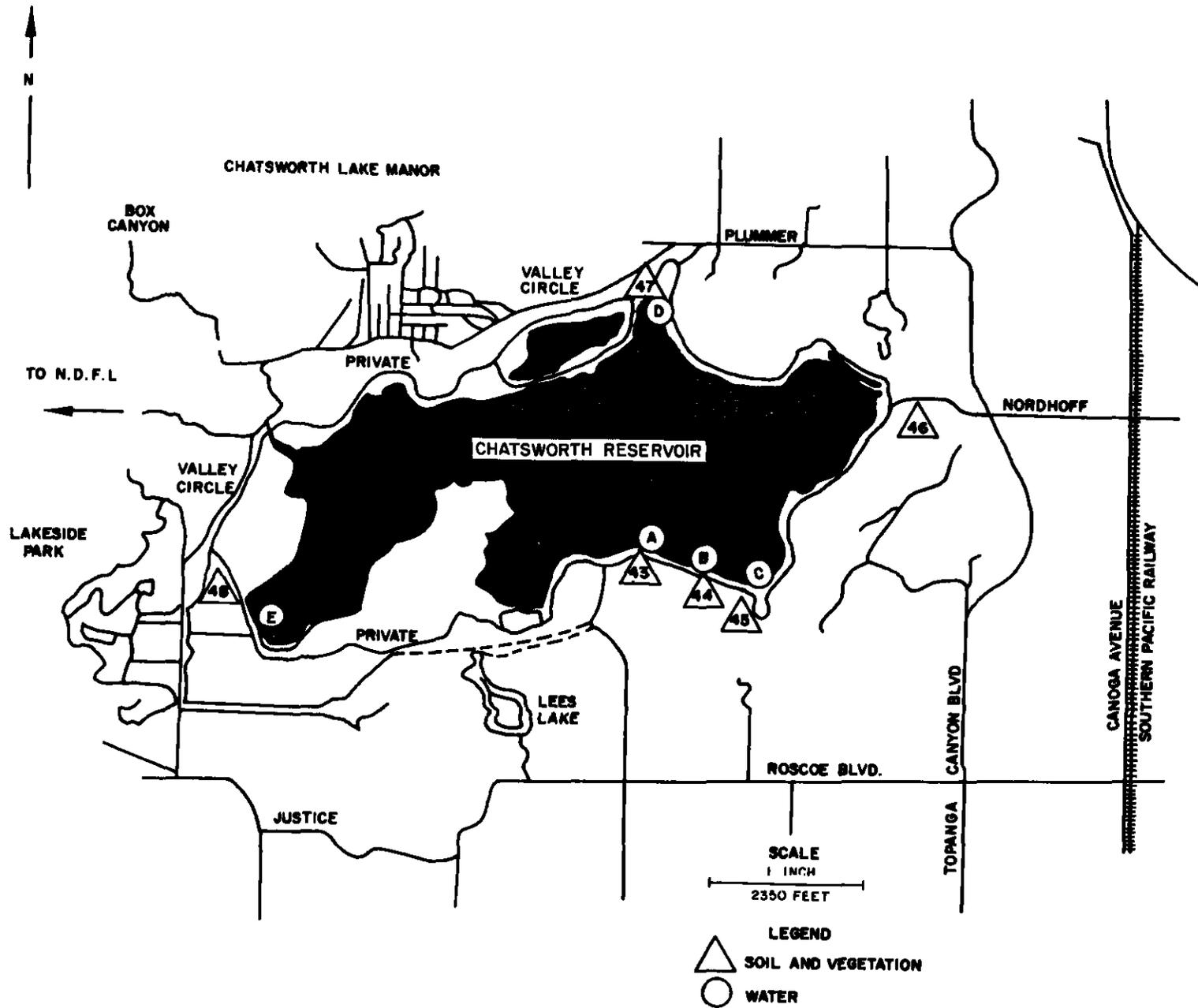


Figure 7. Map of Chatsworth Reservoir Sampling Stations

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	DeSoto 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
SV-34	Meier Canyon
SV-35	Brandeis Camp Entrance

## STATION CON'T

## LOCATION CON'T

SV-36	Moorpark Road and Camarillo Road
SV-37	Moorpark Road at Arcturus St.
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 (G Street)
SV-51	Area Adjacent to Calibration Facility, Bldg. 029
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 12	Rocketdyne Retention Reservoir, PFL
W 13	Rocketdyne Retention Reservoir, PFL
W R.C.	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 taken 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 radicanalysis.

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 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 plant 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 placed in ice cream cartons for transfer to the laboratory for radicanalysis. Plant root systems are not routinely sampled.

Vegetation samples are first washed with tap water to remove foreign matter, and then thoroughly rinsed in 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 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 water is also obtained from the 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 with distilled water to produce a uniform sample distribution, re-dried under infra-red lamps, and counted.

#### AIR

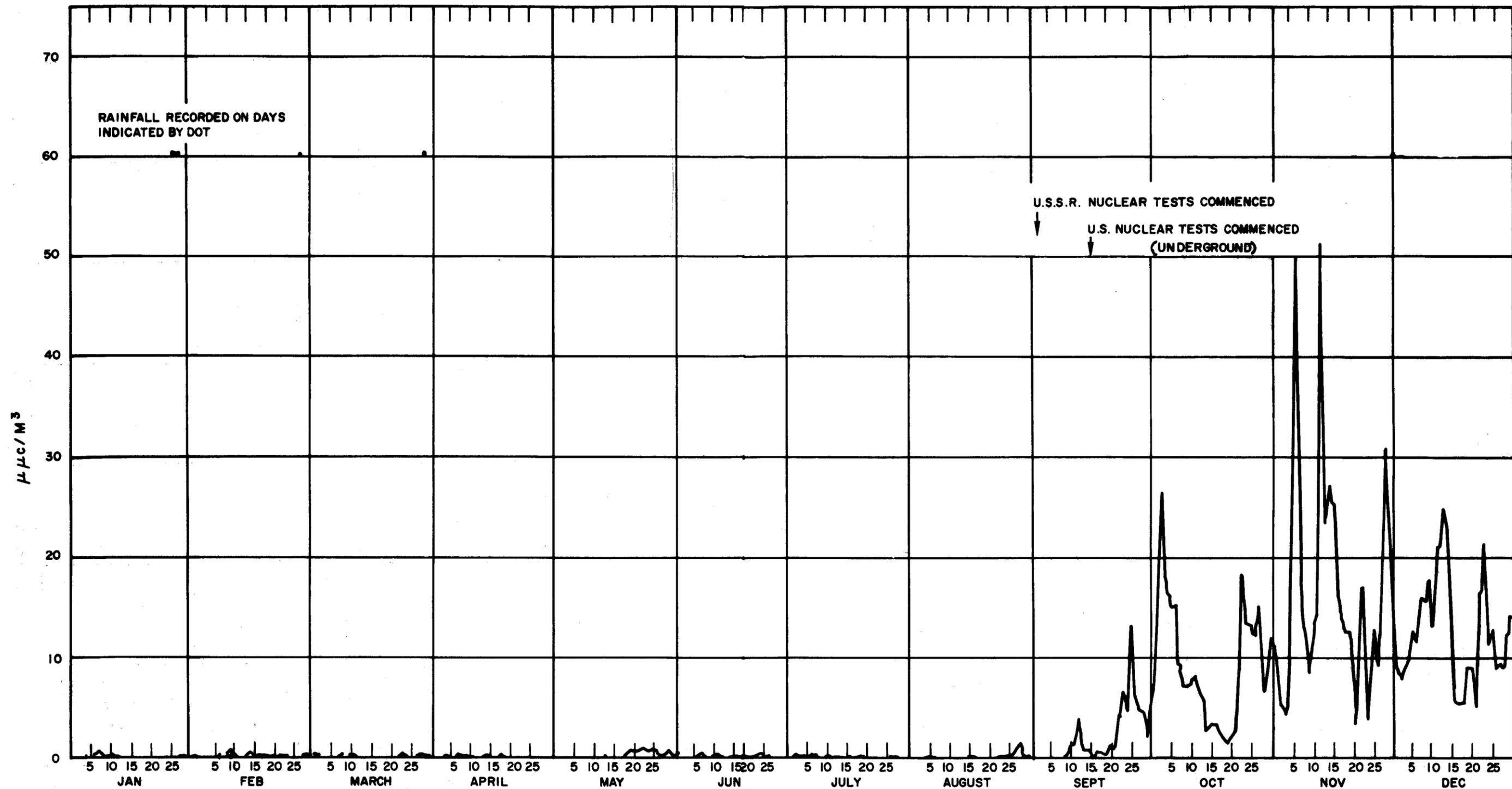
Environmental air sampling is conducted continuously at the Headquarters and NDFL sites with automatic air samplers operating on 24-hour sampling cycles. Airborne particulate radioactivity is collected on a filter tape which is automatically changed at the end of each sampling period. The filter is removed from the sampler and counted after the radioactivity is allowed to decay for at least 72 hours. 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<sup>3</sup>.

When abnormally high airborne activities are observed, the radioactivity decay is 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 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 long-lived airborne radioactivity concentrations detected at the Headquarters facility during 1961, 1962, and the 1963 reporting period is presented in Figure 8. Airborne radioactivity concentrations present subsequent to the nuclear weapons test series in 1958 had decreased to relatively insignificant levels 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. Airborne radioactivity concentrations during 1962 decreased considerably by the end of June and remained low until mid-October

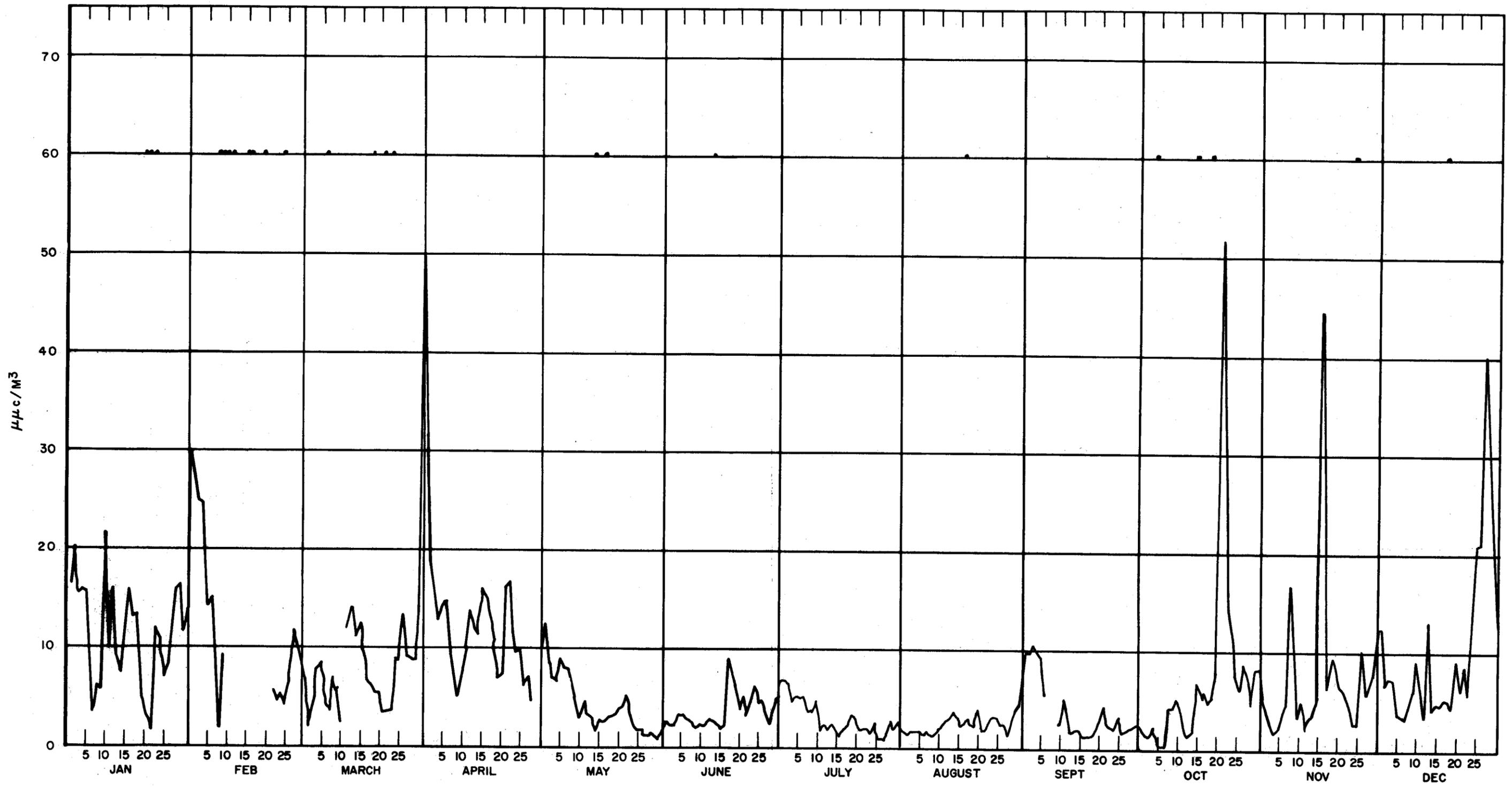
when transient peaks occurred and continued through July, 1963. Currently, airborne radioactivity concentrations are remaining low with little daily variations.

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 levels. In general, during periods of precipitation the airborne radioactivity decreased somewhat due to the combined effects of particulate removal from the air by rainfall and wind conditions associated with precipitation in the local area.



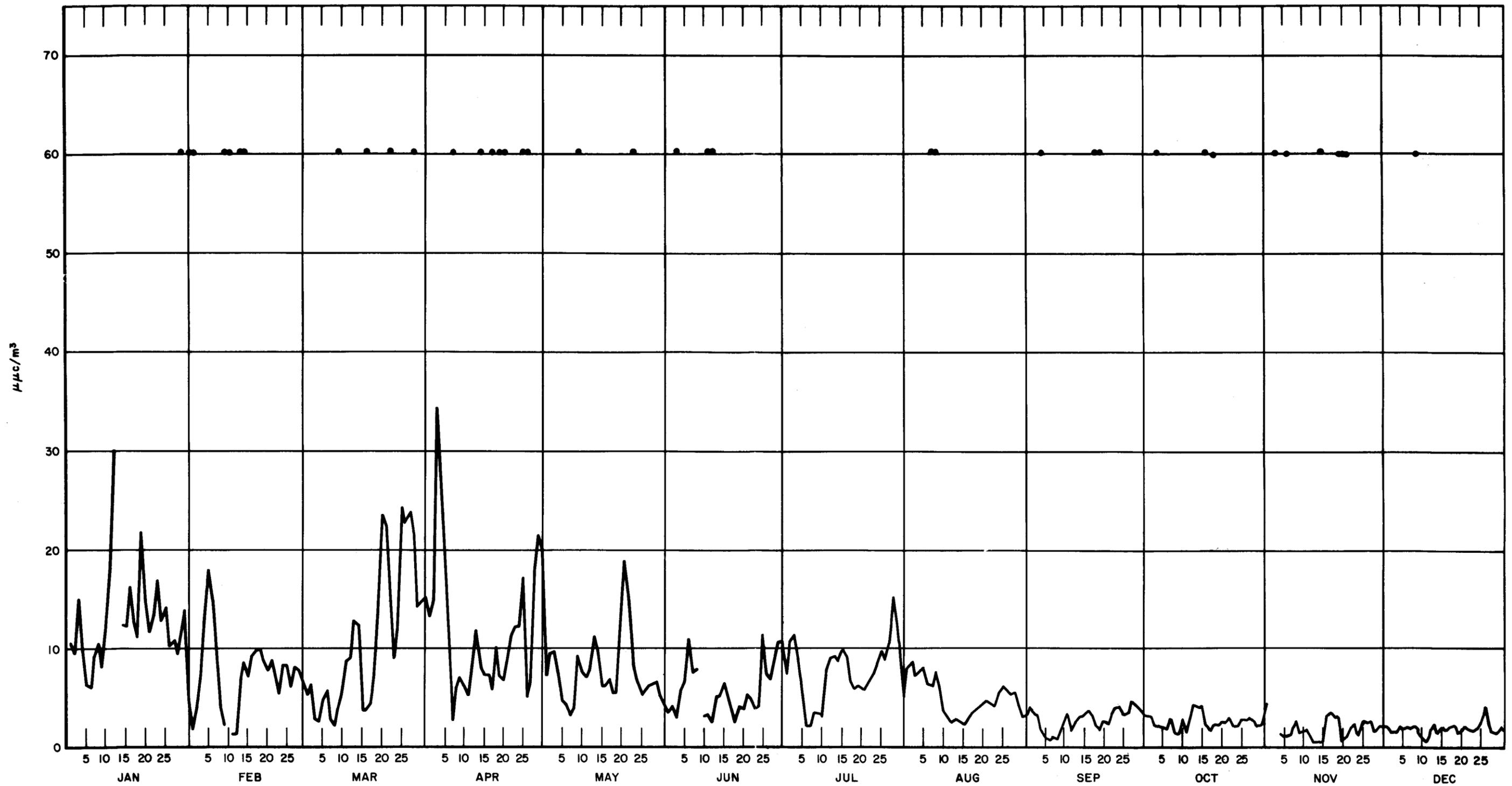
LONG LIVED AIRBORNE PARTICULATE RADIOACTIVITY  
 ATOMICS INTERNATIONAL HEADQUARTERS-1961

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



LONG LIVED AIRBORNE PARTICULATE RADIOACTIVITY  
 ATOMICS INTERNATIONAL HEADQUARTERS-1962

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



LONG-LIVED AIRBORNE PARTICULATE RADIOACTIVITY  
 ATOMICS INTERNATIONAL HEADQUARTERS - 1963

Figure 8. Long-Lived Airborne  
 Particulate Radioactivity  
 Atomics International  
 Headquarters - 1963

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 2  $\pi$  geometry. The detector has a thin window and is continually purged with a 90% argon, 10% methane counting gas. A preset count mode of operation is used for all samples; 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  $\alpha$  and 12 cpm  $\beta$ - $\gamma$ ), and sample size.

TABLE XII  
MINIMUM DETECTION LIMITS

Sample	Activity	Minimum Detection Limits *
Soil	$\alpha$	0.24 + 0.048 (uuc/gram)
	$\beta$ - $\gamma$	6.9 + 1.1 (uuc/gram)
Vegetation	$\alpha$	0.086 + 0.089 (uuc/gram ash)
	$\beta$ - $\gamma$	13.8 + 2.1 (uuc/gram ash)
Water	$\alpha$	0.052 + 0.054 (uuc/liter)
	$\beta$ - $\gamma$	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 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 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.

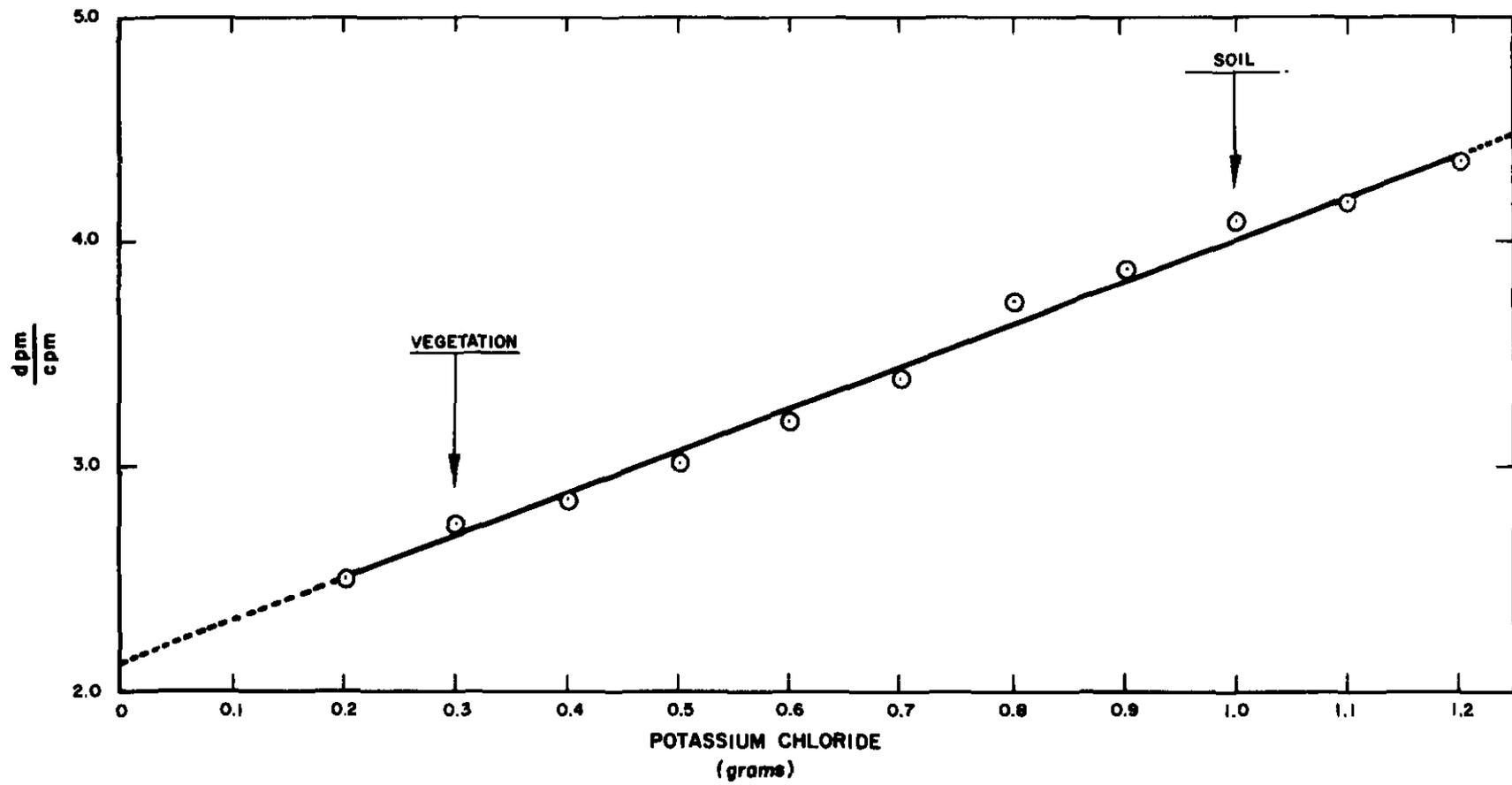


Figure 9. Self-Absorption Correction Graph