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ENVIRONMENTAL RADIOACTIVITY AT THE NEVADA TEST SITE JULY 1964 THROUGH JUNE 1965

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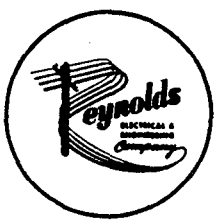

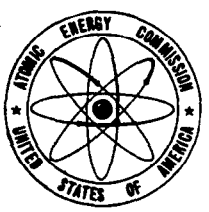

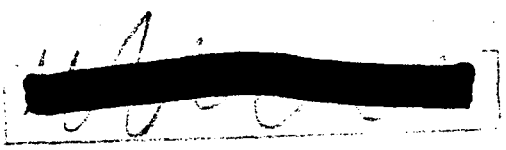

RADIOLOGICAL SCIENCES DEPARTMENT
SITE FACILITIES DIVISION
REYNOLDS ELECTRICAL & ENGINEERING CO., INC.

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and
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Table of Contents

TABLES

FIGURES

ABSTRACT

Under contract with the U. S. Atomic Energy Commission, the Environmental Surveillance Branch of the Reynolds Electrical & Engineering Co., Inc., Radiological Sciences Department conducts routine environmental surveys within the boundaries of the Nevada Test Site. The results of radiological analyses (gross alpha and beta) of air, water, soil, and vegetation samples collected from July 1964 through June 1965 are reported.

The most significant increase in air sample radioactivity (approximately 10 times the average value of $6.6 \times 10^{-7} \mu Ci/m^3$) was observed at all sampling stations during the last week in October 1964. This occurrence was ascribed to fallout from the atmospheric detonation of a nuclear device on the Chinese mainland, 14 October 1964.

During the 12-month period reported, no prolonged hazardous conditions were detected, nor did there appear to be any significant general increase in environmental contamination levels.

Chapter 1

INTRODUCTION

The Reynolds Electrical and Engineering Co., Inc., Radiological Sciences Department routinely surveys, samples, and documents radiological conditions in the environment at the Nevada Test Site (NTS).

Once each week, members of the Environmental Surveillance Branch survey radiation levels in working and living areas with portable instruments. Surface swipes are taken and samples of air and potable water are collected for laboratory analysis. In addition, once each month, samples of industrial and natural surface water, soil, and vegetation are collected from the above areas and also from other locations such as reservoirs, springs, and waste ponds. Environmental samples are analyzed routinely for gross alpha and beta radioactivity to detect any significant increase and to document normal levels of radioactivity in the environment at the NTS.

This report presents the data derived from this sampling program for the period July 1964 through June 1965.

Chapter 2

METHODS

2.1 SAMPLE COLLECTION

Samples were collected routinely at the locations shown in Figure 2.1. A detailed description of sampling frequency and the sampling station locations is given in Appendix A.

2.1.1 Air

During most of the report period, airborne radioactive particles were collected on 8-inch by 10-inch glass fibre filters (Gelman Type E) with an airflow provided by centrifugal-vane air pumps. Volume sampling rates were maintained at approximately 4 cubic feet per minute (cfm). The actual rate was estimated by averaging measurements made at the beginning and the end of each sampling period with a calibrated rotometer.

During the final months of the report period, a gradual changeover to a new type of air sampler with a 4-inch diameter paper filter (Whatman #41) was initiated. Air flow was provided by positive displacement air pumps and was measured by in-line total volume gas meters. The sampling rates of these samplers were maintained at approximately 3 cfm.

The volume of air sampled during the regular 7-day sampling interval was approximately 1×10^3 cubic meters (m^3).

Immediately after removal from the sampler, each filter was placed in a glassine envelope

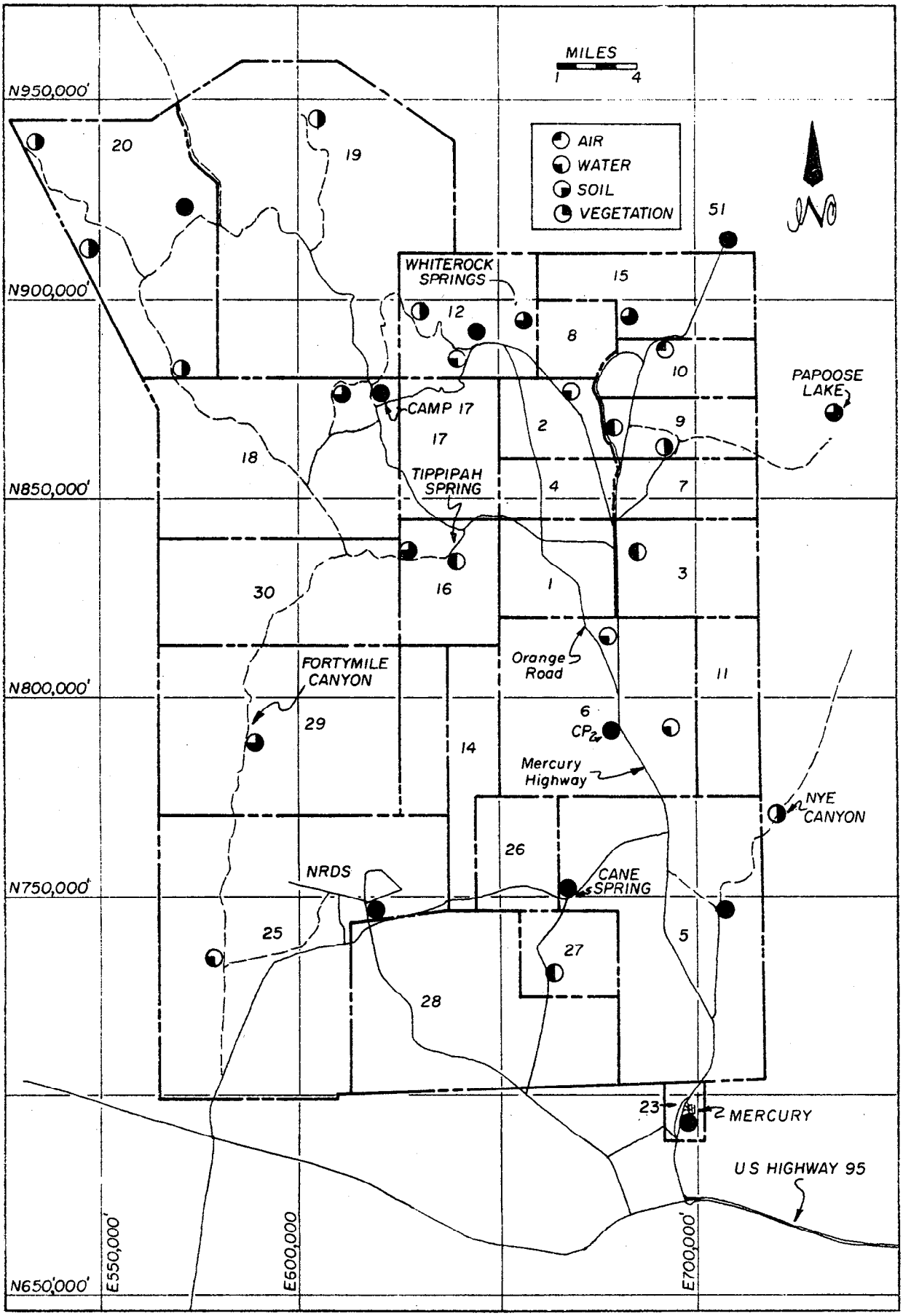

Figure 2.1 NTS Environmental Surveillance Sampling Locations

for transportation to the laboratory.

2.1.2 Water

One-liter water samples were collected in polyethylene bottles. Potable water was collected from taps at the point of consumption after allowing the water to flow for several minutes. Industrial and natural surface waters were sampled at the surface by means of a dipper or by submerging the sample bottle below the surface. All sample bottles were decontaminated before reuse.

2.1.3 Soil and Vegetation

Soil and vegetation samples were collected concurrently. Vegetation samples were collected from the top portions of the dominant perennial shrubs found at each station. Soil samples were taken from a 64-square inch area of clear ground to a depth of 1/4 inch. Both sample types were taken to the laboratory in sealed, one-quart "ice cream" cartons.

2.1.4 Surface Contamination

Though surface swipes are merely an aid to monitoring, and the results of swipe counts are not included in this report, the collection method is described here. An area of approximately one square foot was wiped with one side of a 2-inch Whatman 41 filter paper. The swipe was monitored immediately with portable instruments (Eberline Model PAC-3G and Model E500B) for alpha and beta/gamma radioactivity. Three separate spots within one location (office, shop, etc.) were checked. The swipes were then forwarded to the laboratory for more accurate determination of gross alpha and

beta contamination.

In addition, a low range gamma instrument (Precision Model 111 Scintillator) was used to determine approximate "background" radiation levels and to aid in locating possible contamination. The instrument was modified to allow calibration of the low range (0-0.025 mR/hr).

2.2 SAMPLE PREPARATION

2.2.1 Air Samples

Air sample filters were held for at least five days before being analyzed to permit the decay of radon and thoron daughters to insignificant levels.

2.2.2 Water Samples

One-liter water samples were evaporated to 15 ml, transferred to 2-inch stainless steel planchets, and evaporated to dryness under infra-red lamps. A wetting agent was added during final evaporation to provide an even distribution of the sample on the planchet.

2.2.3 Soil Samples

Soil samples were passed through a 60-mesh screen (0.25 mm aperture), weighed, and then dried for 24 hours. After drying, the samples were reweighed. A 5-gram subsample was removed from each sample and leached for a 2-hour period in 8N HNO_3. Following leaching, the residue was washed in deionized water. The wash water was added to the leachate, and this solution was evaporated to dryness on a 2-inch stainless steel planchet.

2.2.4 Vegetation Samples

Vegetation samples were weighed and then dried for approximately 24 hours at 105° C. The total dry weight was obtained. The leaves were shaken off and separated from stem fragments by passing them through a 3-mesh (6.73 mm) screen, and the dry "leaf weight" was recorded. The leaf portion of each sample was ashed at 500° C, and a one gram subsample of the ash was leached and evaporated in the same manner as described for soil samples.

2.3 COUNTING PROCEDURES

All routine environmental samples were analyzed for gross alpha and beta radioactivity by gas proportional counting. Air samples were analyzed with a Nuclear Chicago ULTRA-SCALER system having a 9-inch by 10-inch detection chamber to accommodate the 8-inch by 10-inch filters. All other samples were analyzed with a Beckman WIDEBETA system equipped with an automatic sample changer. The efficiencies (ratio of observed counts to known disintegrations) and average background count rates of these two systems, and the counting time intervals used were as follows:

		Ultrascaler	Widebeta
Efficiency, percent	α	22	26
	β	51	50
Background, counts/min.	α	1.5	0.04
	β	560	1.6
Count intervals, min.			
Background	α,β	100	100
Sample	α	20	10
	β	40	5

The radioactivity of a sample (x) was computed as follows:

$$x = \frac{R_s - R_b}{ABC}$$

where

R_s = gross count rate of sample, c/m

R_b = background count rate, c/m

A = efficiency, c/d, decimal

B = 2.22 d/m-pCi, or 2.22×10^6 d/m-μCi

C = subsample amount, m^3, 1, or g

The percent counting error at the 2-sigma confidence level ($\%\ E_{2\sigma}$) for each value of $\underline{x}$ was computed as follows:

$$\%E_{2\sigma} = \frac{100z}{R_s - R_b}\left[\frac{R_s}{t_s} + \frac{R_b}{t_b}\right]^{1/2}$$

where

z = 2, the number of standard deviations for the confidence interval (95.4%)

t_s = sample count interval, minutes

t_b = background count interval, minutes

The value of $\underline{x}$ was arbitrarily considered statistically significant, that is, greater than the background, if the net count rate of the sample was greater than two times the net count rate for which the 2-sigma error was 100 percent. Non-significant values, equal to or less than this "detection limit", were recorded as zeros for subsequent statistical calculations.

The detection limit was computed as follows:

$$D.L. = \frac{2z}{ABC}\left[\frac{d + R_b}{t_s} + \frac{R_b}{t_b}\right]^{1/2}$$

where

d = net count rate for which the 2-sigma error is 100% = $E_{2\sigma}$, c/m

The approximate detection limits for the different sample types, assuming uniform sample dimensions and analysis parameters, are as follows:

		Detection Limits	
Sample Type	Units	Gross Alpha	Gross Beta
Air	$\mu Ci/m^3$	2.9×10^{-9}	1.6×10^{-8}
Water	pCi/1	1.5×10^{0}	2.8×10^{0}
Soil	pCi/g, dry	3.0×10^{-1}	5.7×10^{-1}
Vegetation	pCi/g, ash	1.5×10^{0}	2.8×10^{0}

Chapter 3

RESULTS AND DISCUSSION

3.1 STATISTICAL SUMMARY OF RESULTS

The frequency distributions of results for the different sample types are shown in Figures 3.1 through 3.3. In each case, the distribution is skewed to the right which indicates that the populations sampled do not fit the normal, or Gaussian, model. These populations more closely approximate a log-normal distribution model. The variances and, consequently, the estimated confidence interval for the means of these sample populations were reduced by a factor of approximately two through the use of the logarithmic transformation.

This transformation is made by treating the logarithms of observed values as normally distributed random variables. The true mean of a population of such variables is estimated, then, by

$$\bar{X} = \log^{-1}\left(\frac{\Sigma \log x_i}{N} + \frac{s^2}{2}\right)$$

and the confidence limits for this mean are calculated from

$$\log^{-1}(\log \bar{X} \pm ts/N^{1/2})$$

where

x_i = observed value

N = number of observations

s^2 = variance of log values

t = "Student's" t-value for the confidence level (95.0%)

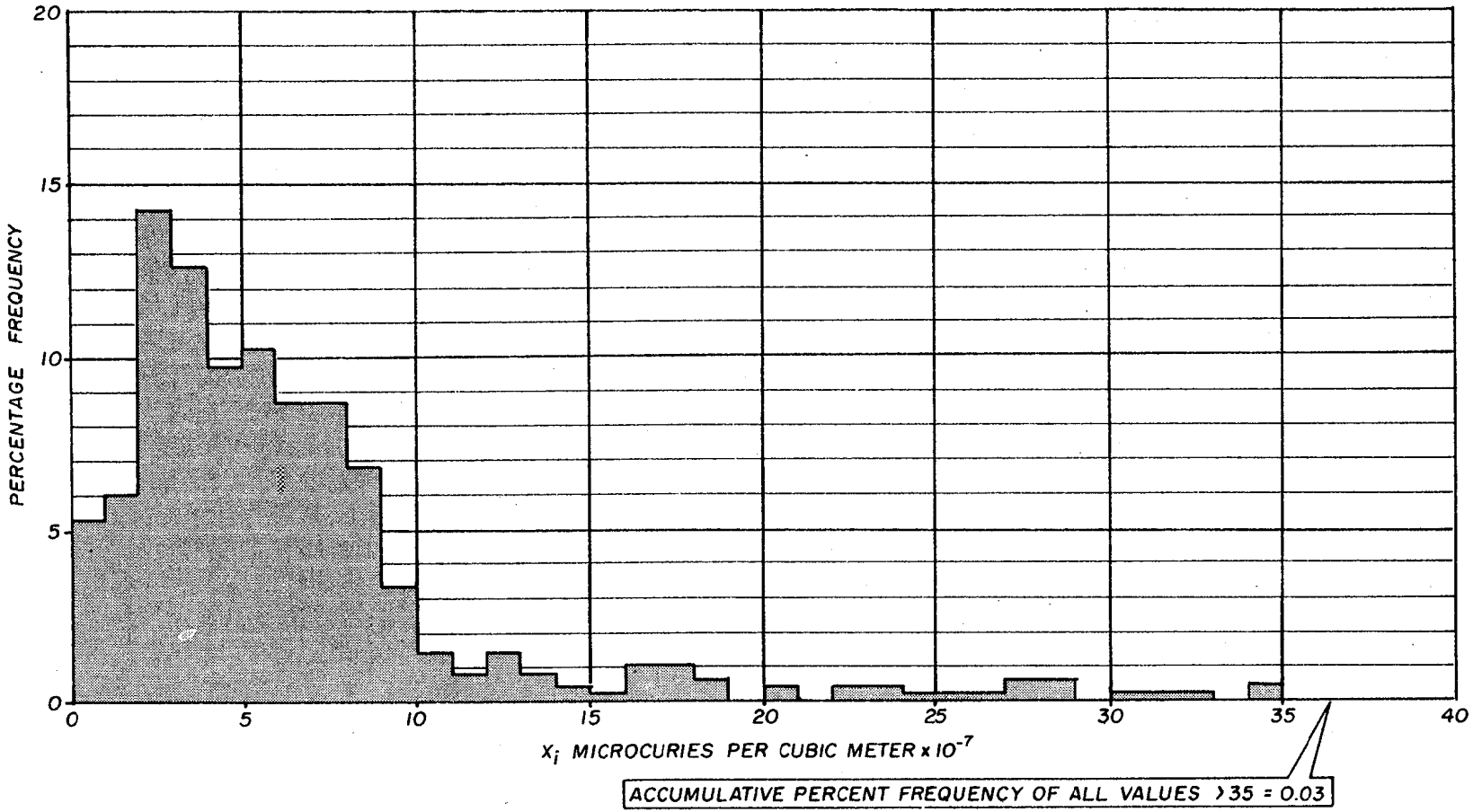

Figure 3.1 Frequency Distribution of Gross Beta Radioactivity in NTS Environmental Air Samples from July 1964 through June 1965

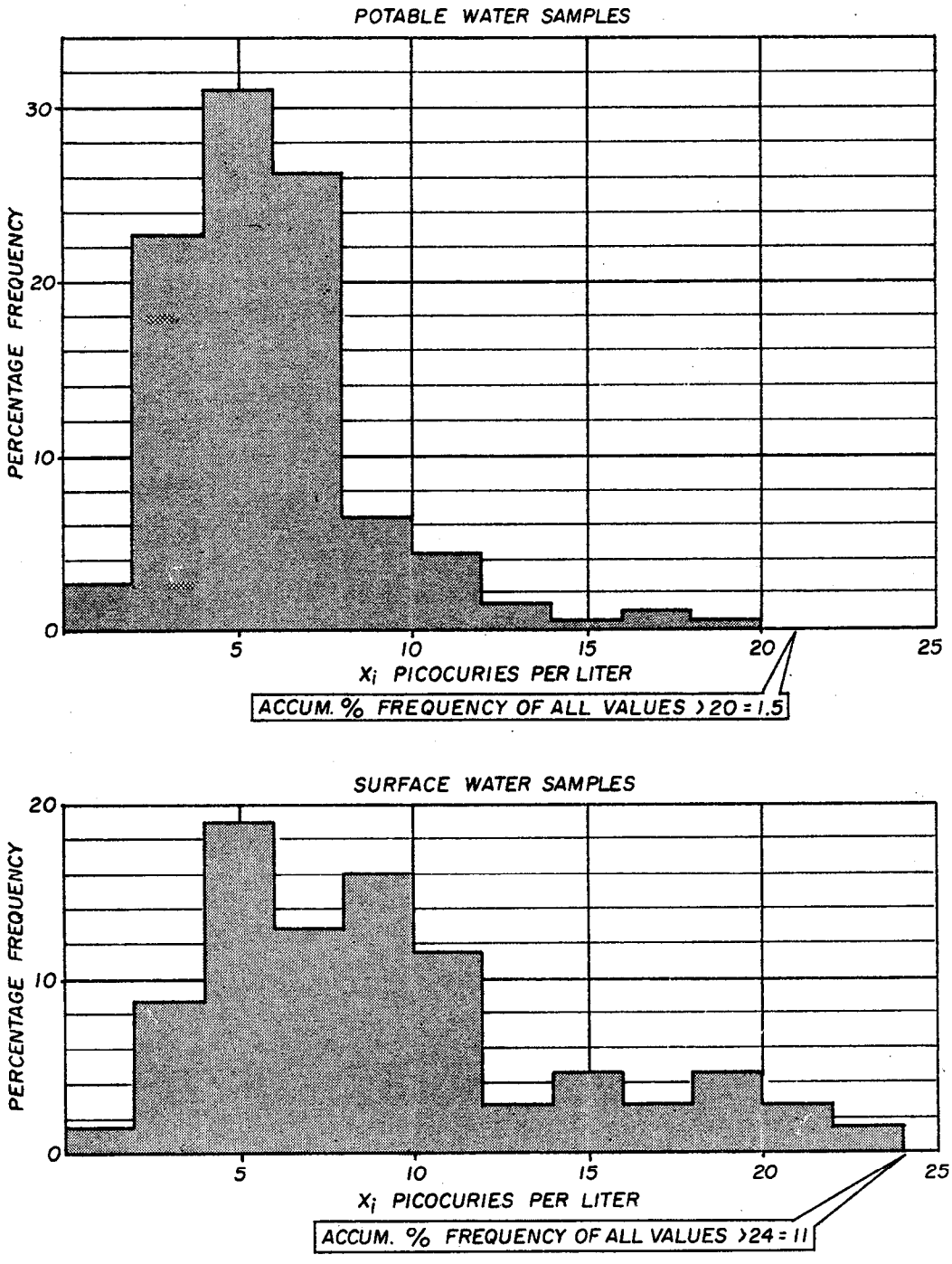

Figure 3.2 Frequency Distributions of Gross Beta Radioactivity in NTS Environmental Water Samples from February 1965 through June 1965

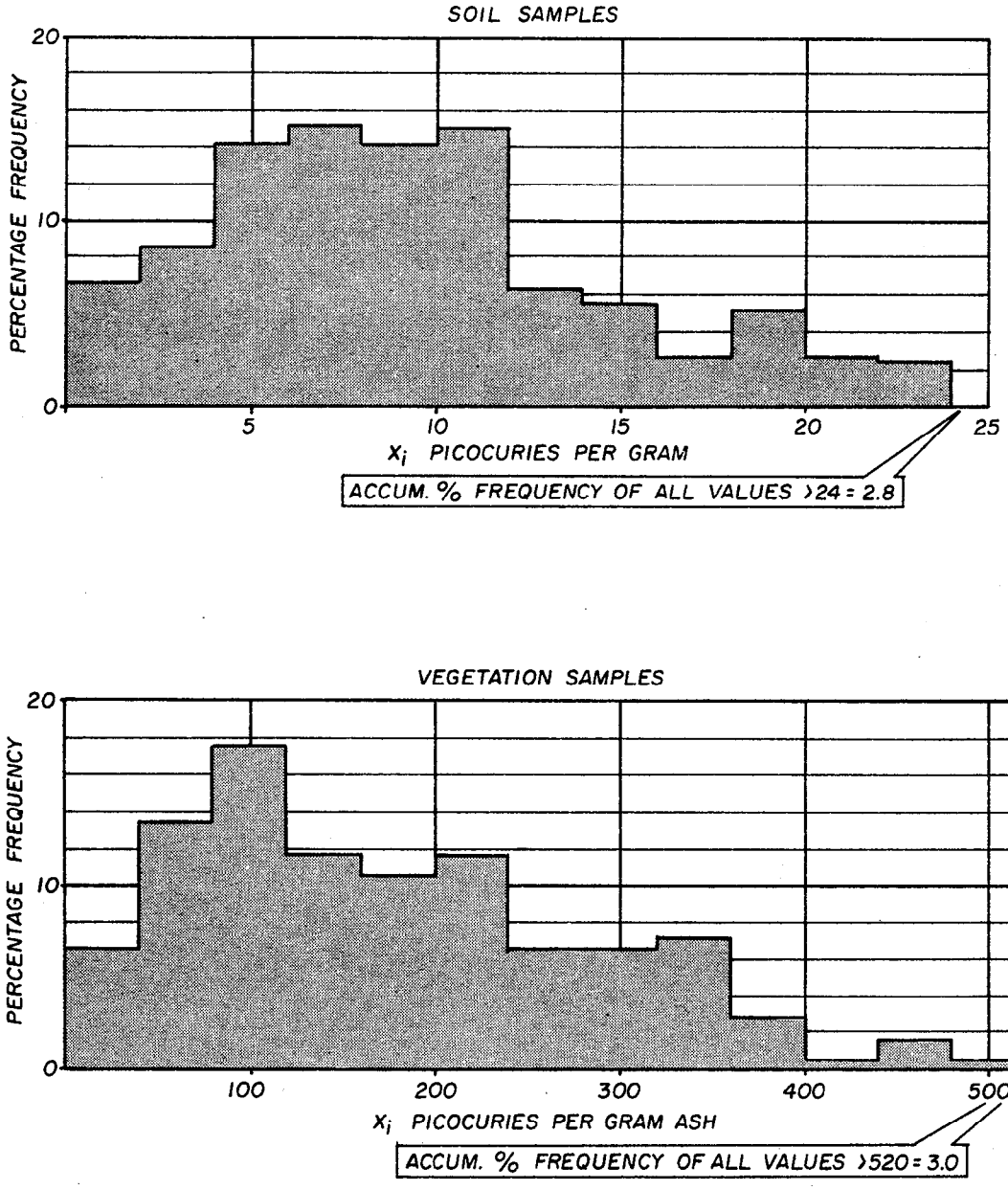

Figure 3.3 Frequency Distributions of Gross Beta Radioactivity in NTS Environmental Soil and Vegetation Samples from July 1964 through June 1965

The parameters estimated, as shown above, for the population of gross beta radioactivity in each sample type are shown in Table 3.1. In addition, the frequencies of occurrence of detectable beta radioactivity, the maxima for all sample types, and the modes for air and water are listed. The mode, a useful statistic for evaluating skewed distributions, indicates the value, or interval of values, which was observed most frequently.

Except in the case of soil samples, gross alpha radioactivity was detected infrequently, and then only at unrelated locations and times. For this reason, and because of the high degree of uncertainty associated with alpha results uncorrected for mass absorption, a statistical summary of this data would not be meaningful. Therefore, only the frequency of occurrence and the maxima of detectable alpha values are reported for each sample type in Table 3.2.

Table 3.1

SUMMARY OF GROSS BETA RADIOACTIVITY
OBSERVED IN NTS ENVIRONMENTAL AIR, WATER, SOIL, AND
VEGETATION SAMPLES
JULY 1964 THROUGH JUNE 1965

Sample Population Parameter	Air (Filter) $\mu Ci/m^3$	Water Potable pCi/l	Water Surface[a] pCi/l	Soil (Dry) pCi/g	Vegetation (Ash) pCi/g
n/N[b]	509/509	180/185	63/66	150/150	150/150
Mean	6.6×10^{-7}	5.6	10	8.8	1.7×10^{2}
Upper 95% C.L.	7.2×10^{-7}	6.2	13	10	1.9×10^{2}
Lower	6.0×10^{-7}	5.2	8.3	7.8	1.5×10^{2}
Mode	$2\text{-}3 \times 10^{-7}$	4-6	4-6	4-12	$0.8 - 1.2 \times 10^{2}$
Maximum	9.1×10^{-7}	47	90	73	9.9×10^{2}

Table 3.2

SUMMARY OF GROSS ALPHA RADIOACTIVITY
OBSERVED IN NTS ENVIRONMENTAL AIR, WATER, SOIL, AND
VEGETATION SAMPLES
JULY 1964 THROUGH JUNE 1965

Sample Population Parameter	Air (Filter) $\mu Ci/m^3$	Water Potable pCi/l	Water Surface[a] pCi/l	Soil (Dry) pCi/g	Vegetation (Ash) pCi/g
n/N[b]	258/509	22/185	4/66	36/150	17/150
Maximum	1.0×10^{-6}	1.5	3.5	0.89	9.9

(a) Except contaminated waste ponds

(b) Frequency of occurrence of detectable radioactivity = no. of samples with detectable radioactivity/total no. of samples analyzed.

3.2 AIR

The means and ranges of gross beta radioactivity in weekly collections of air samples from 11 to 14 sample stations are tabulated in Appendix B.1 and plotted in Figure 3.4.

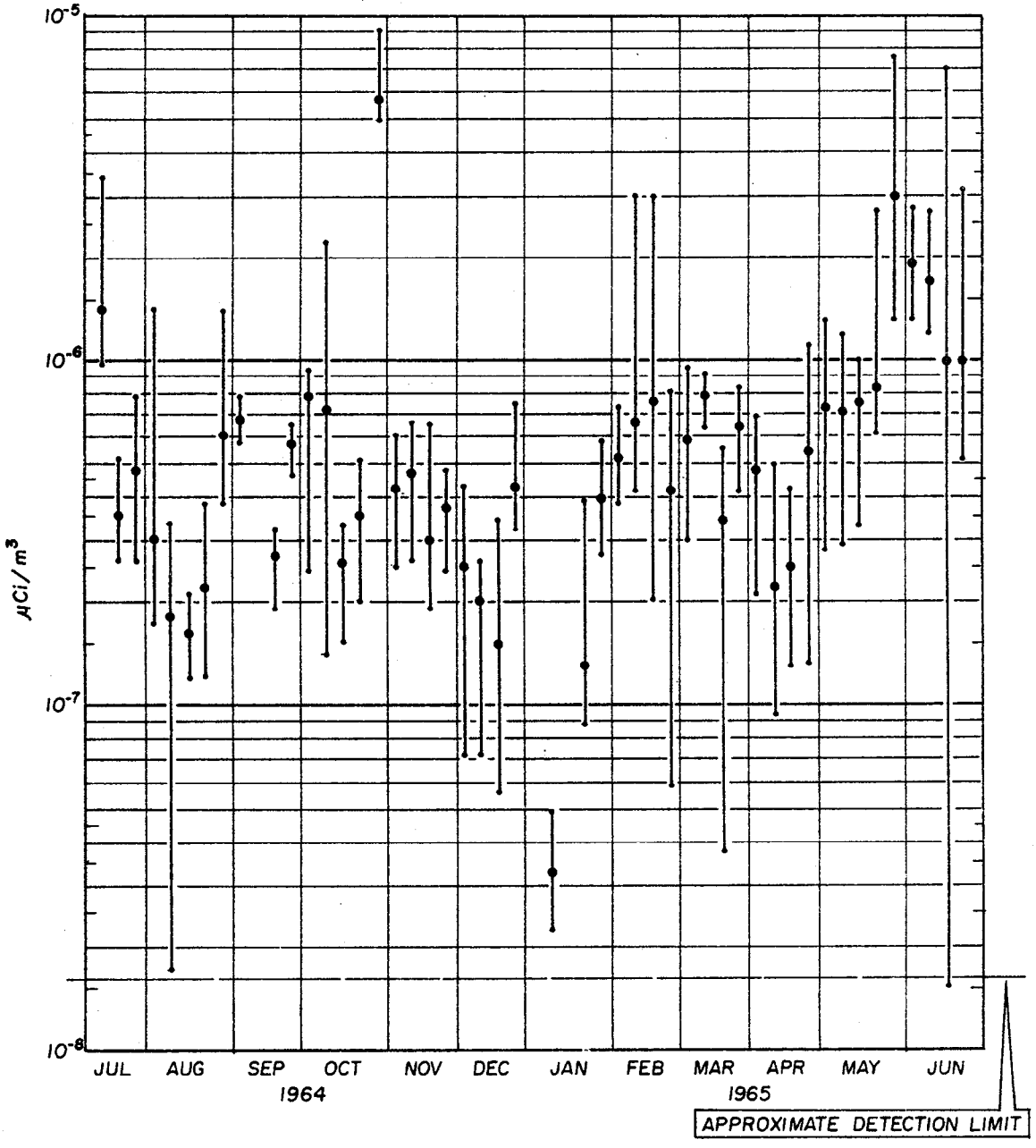

Figure 3.4 Weekly Means and Ranges of Gross Beta Radioactivity in all NTS Environmental Air Samples from July 1964 through June 1965

These data extend those reported for the previous period, January 1964 through June 1964.* For that period, the "normal" level of beta radioactivity in air samples was given the value of 10^{-6} $\mu Ci/m^3$.

Several of the sample periods shown in Figure 3.4 exhibit a very wide range of values (greater than a factor of 10). In all cases, this was the result of a single high or low value and affected the mean relatively little.

All air samples collected during the last week in October 1964 were significantly more radioactive than those collected during other sampling periods. There were no releases of radioactive effluents on-site during this sampling period. Gamma spectrum and decay analyses of these samples showed that this additional radioactivity was due to the presence of fresh fission products whose age indicated that their origin was the atmospheric detonation of a nuclear device on the Chinese mainland, 14 October 1964. There was a slight but noticeable increase in gross alpha activity for these samples. The beta-to-alpha ratio was approximately 100:1. That this was widespread fallout was indicated also by the relatively narrow range of values.

In general, prolonged decreases in airborne radioactivity corresponded closely with periods of reduced testing operations. The obvious increase in airborne contaminants, extending from the last week in May through the middle of June, coincided with a period of intensive testing at the NTS and the NRDS.

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*Glora, M. A. and B. L. Brown "Environmental Surveillance, January-June 1964: A Semiannual Report". NVO-162-16. Reynolds Electrical and Engineering Co., Inc., Radiological Sciences Department. August 1964.

However, it should be noted that the levels of airborne radioactivity reported here fall generally within the range of values for other locations during the same period as published in Radiological Health Data.* Furthermore, the major temporal fluctuations in airborne radioactivity at the NTS, that is, a minimum in January and a maximum in May (excepting the Chinese fallout episode), closely resemble the pattern of seasonal variation of widespread fallout generally related to meteorological periods.

3.3 WATER

The detection limit for analyses of water samples collected prior to February 1965 was in excess of the MPC values because the sample size was small (50ml). In February, sampling and preparation procedures described above were instituted which reduced the detection limits by a few orders of magnitude. The results of analyses prior to this date indicate only that MPC values were not seriously exceeded, and do not constitute a body of quantitative data. Therefore, only those results (excepting contaminated waste ponds) obtained after February 1965 are reported here.

3.3.1 Potable Water

The means and ranges of gross beta radioactivity in weekly collections of potable water from all locations sampled are tabulated in Appendix B.2 and shown in Figure 3.5. Mean values ranged between 3.7 and 10 pCi/l. The maximum values were below the maximum permissible concentration of unidentified radionuclides (MPCU) in water for individuals in controlled areas (300 pCi/l = 3×10^{-7} μCi/cc) as given in the footnotes to Annex 1 of the

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*Published monthly by the U.S. Department of Health, Education and Welfare, Public Health Service, Division of Radiological Health.

Appendix, Chapter 0524, AEC Manual.

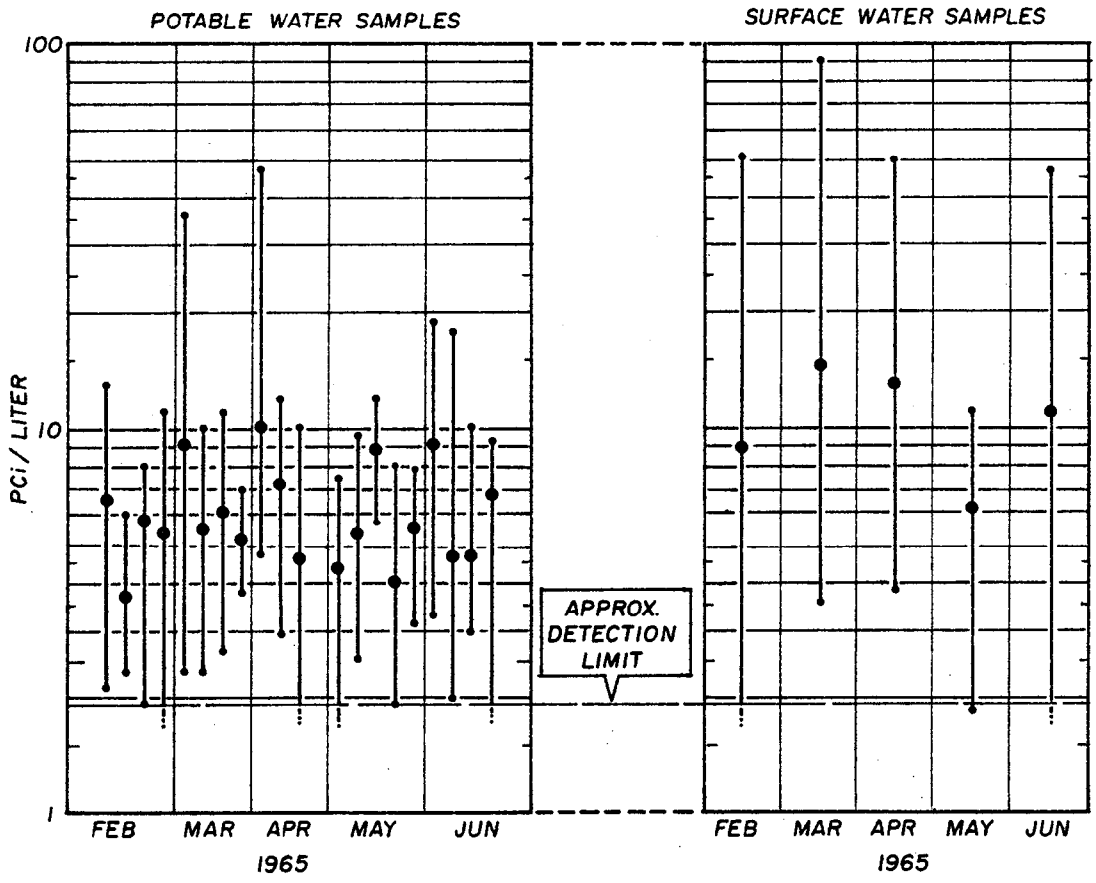

Figure 3.5 Weekly Means and Ranges of Gross Beta Radioactivity in all NTS Environmental Potable Water Samples from February through June 1965

Figure 3.6 Monthly Means and Ranges of Gross Beta Radioactivity in all NTS Environmental Surface Water Samples from February through June 1965

3.3.2 Surface Water

The means and ranges of gross beta radioactivity in monthly collections of surface water from all locations sampled, excepting contaminated waste ponds, are listed in Appendix B.3 and plotted in Figure 3.6. Mean values ranged from 6.2 to 14 pCi/l, and the maximum value observed was 90 pCi/l.

It should be noted that the frequency distribution for surface water values is different from that for potable water (Figure 3.2) such that, while the modes are the same, surface water has a secondary mode and more high values than potable water.

Included in the population of surface water values are results of samples from four sources not fitting the term "surface water" precisely. These are the samples taken directly from Well J-12 and Well 3 and those from the two swimming pools. With the exception of the Mercury swimming pool, these sources are not exposed directly to atmospheric fallout. As a further complication, the swimming pools are filtered continually. Future reports will present separate summaries for such distinct sources.

3.3.3 Contaminated Waste Ponds

Permanent bodies of contaminated water are located at the Control Point (CP) decontamination area and at the Haines Lakes in Area 12. The waste pond at the CP area was constructed to contain liquid radioactive waste from the decontamination operations performed in the area. The Haines Lakes were established as reservoirs for industrial water when a water source was exposed during construction of tunnel U12e (E tunnel). The water source became contaminated during a test in E tunnel in 1961 and has continued to discharge contaminated seepage water. Like the CP waste pond, these reservoirs are controlled radiation zones.

The higher levels of activity detected in these waters permit the reporting of contamination levels for the period from July 1964 through June 1965. The arithmetic means and the ranges are as follows:

Location	No. of Samples	Alpha (pCi/l) Mean	Alpha (pCi/l) Range	Beta (pCi/l) Mean	Beta (pCi/l) Range
CP Waste Pond	7	None detected		1200	360-2500
Haines Lakes					
Upper	9	1.9	1.2 - 2.5	4900	1700-8100
Lower	9	1.9	1.5 - 2.2	4500	1100-8000

3.4 SOIL AND VEGETATION

The frequency distributions of soil and vegetation sample populations, like that for surface water, appear to be somewhat multimodal. This would indicate the presence of two or more subpopulations (for each sample type), each with its own set of parameters. Such subpopulations may be related to either temporal or spatial variations. Analysis of the variance of these data should reveal the relative significance of time and space factors and isolate the component subpopulations. The results of such analysis will be included in a subsequent report.

It has been noted that soil type, pH and chemical make-up have a profound effect on the uptake of elements by vegetation.* Studies underway at present indicate that certain isotopes are effectively concentrated by the indigenous vegetation. If this proves to be the case, the entire soil-vegetation sampling program should be reevaluated with a view towards individual isotopic analyses rather than gross alpha and beta analysis.

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*Cannon, H. L. "The Distribution of Prennial Shrubs on Basin Sediments of the Nevada Test Site and Vicinity; A Preliminary Report." United States Department of the Interior, Geological Survey; Technical Letter, Special Projects - 13; August 5, 1964.

Chapter 4

CONCLUSION

Evaluation of environmental surveillance data collected at the NTS and NRDS from July 1964 through June 1965 indicate that the environmental exposure of test site personnel to radioactive contamination outside of controlled areas was within recommended limits. While it was possible to detect, in some cases, increased environmental burdens of radionuclides, these were generally of a low level. The greatest single increase noted, a ten-fold increase in the gross beta activity of air samples during the last week in October 1964, was caused by fallout from the atmospheric detonation of a nuclear device on the Chinese mainland 14 October 1964.

Appendix A

ENVIRONMENTAL SURVEILLANCE SAMPLING STATION LOCATIONS

Area	Station Location	Sample Type[a]	Frequency[b]
2	Well 2 reservoir	SW	Mo
3	Cafeteria	A, PW	Wk
	Well 3A reservoir	SW	Mo
5	Well 5B	A	Wk
	Well 5B reservoir	SW, S, V	Mo
	Gate 250	A	Wk
	Cane Spring	SW, S, V	Mo
	Well 5B reservoir	SW, S, V	Mo
	Nye Canyon barricade	S, V	Mo
6	Cafeteria	PW	Wk
	Dispensary	A	Wk
	CP-2 contaminated waste pond	SW	Mo
	Camp 6 compound	S, V	Mo
	Well C reservoir	SW	Mo
	Well 3b reservoir	SW	Mo
9	Dispensary	A, PW	Wk
	Ice house	PW	Mo
	Stake 9B-36	S, V	Mo
10	Gate 700	A	Wk
12	Wash north of motor pool	S	Mo
	Upper Haines Lake	SW	Mo
	Lower Haines Lake	SW	Mo
	Gold Meadows barricade	S, V	Mo
	Cafeteria	A, PW	Wk
	White Rock Spring	SW, S, V	Mo
15	USPHS farm reservoir	SW, S, V	Mo
16	Cattle pond	SW, S, V	Mo
	Dispensary	A	Wk
	Tippipah Spring	SW	Mo
18	Camp 17 cafeteria	A	Wk
	Camp 17 dispensary	PW	Wk
	Camp 17 reservoir	SW, S, V	Mo
	Well 8	SW, S, V	Mo

Area	Station Location	Sample Type[a]	Frequency[b]
19	Stake 19C-32	S, V	Mo
20	Dispensary	A, PW, S, V	Wk
	Stake 20L-3	S, V	Mo
	Stake 20J-51	S, V	Mo
	Stake 20A-108	S, V	Mo
23	Bldg. 214	A	Wk
	Cafeteria	PW	Wk
	Swimming pool	SW, S, V	Mo
25	LASL H-8 facility	A	Wk
	Cafeteria	PW	Wk
	CP water tower	SW, S, V	Mo
	Well J-12	SW	Mo
	Fortymile Canyon (stake 833)	SW, S, V	Mo
27	Dispensary	A	Wk
	Cafeteria	PW	Wk
51	Dispensary	A	Wk
	Cafeteria	PW	Wk
	Swimming pool	SW	Mo
	Well 3	SW	Mo
	Papoose Lake (North end)	SW, S, V	Mo
	Groom Lake runoff pond	SW, S, V	Mo

(a)A=air, SW=surface water, PW=potable water, S=soil, V=vegetation
(b)Wk=weekly, Mo=monthly

Appendix B

SAMPLING PERIOD MEANS AND RANGES OF GROSS BETA RADIOACTIVITY IN ENVIRONMENTAL AIR AND WATER SAMPLES FROM NTS JULY 1964 THROUGH JUNE 1965

B.1 Air Samples (Values in terms of $\mu Ci/m^3$)

Date (Week ending)	Mean		Range Maximum	Range Minimum
7/11/64	1.4×10^{-6}		3.4×10^{-6}	9.8×10^{-7}
7/18/64	3.6×10^{-7}		5.1×10^{-7}	2.6×10^{-7}
7/25/64	4.8×10^{-7}		7.8×10^{-7}	2.6×10^{-7}
8/1/64	3.0×10^{-7}		1.4×10^{-6}	1.7×10^{-7}
8/8/64	1.8×10^{-7}		3.3×10^{-7}	1.7×10^{-8}
8/15/64	1.6×10^{-7}		2.1×10^{-7}	1.2×10^{-7}
8/22/64	2.2×10^{-7}		3.8×10^{-7}	1.2×10^{-7}
8/29/64	6.1×10^{-7}		1.4×10^{-6}	3.8×10^{-7}
9/5/64	6.8×10^{-7}		7.8×10^{-7}	5.7×10^{-7}
9/12/64	(a)		(a)	(a)
9/19/64	2.7×10^{-7}		3.2×10^{-7}	1.9×10^{-7}
9/26/64	5.8×10^{-7}		6.5×10^{-7}	4.6×10^{-7}
10/3/64	7.8×10^{-7}		9.4×10^{-7}	2.4×10^{-7}
10/10/64	7.2×10^{-7}		2.2×10^{-6}	1.4×10^{-7}
10/17/64	2.6×10^{-7}		3.3×10^{-7}	1.5×10^{-7}
10/24/64	3.5×10^{-7}		5.1×10^{-7}	2.0×10^{-7}
10/31/64	5.7×10^{-6}	(max.)	9.1×10^{-6}	4.9×10^{-6}
11/7/64	4.2×10^{-7}		6.0×10^{-7}	2.5×10^{-7}
11/14/64	4.7×10^{-7}		6.5×10^{-7}	2.6×10^{-7}
11/21/64	3.0×10^{-7}		6.5×10^{-7}	1.9×10^{-7}
11/28/64	3.7×10^{-7}		4.8×10^{-7}	2.4×10^{-7}
12/5/64	2.5×10^{-7}		4.3×10^{-7}	7.1×10^{-8}
12/12/64	2.0×10^{-7}		2.6×10^{-7}	7.1×10^{-8}
12/19/64	1.5×10^{-7}		3.4×10^{-7}	5.6×10^{-8}
12/26/64	4.3×10^{-7}		7.5×10^{-7}	3.2×10^{-7}
1/2/65	(a)		(a)	(a)
1/9/65	3.3×10^{-8}		4.9×10^{-8}	2.2×10^{-8}
1/16/65	(a)		(a)	(a)
1/23/65	1.3×10^{-7}		3.9×10^{-7}	8.7×10^{-8}
1/30/65	3.9×10^{-7}		5.8×10^{-7}	2.7×10^{-7}
2/6/65	5.2×10^{-7}		7.3×10^{-7}	3.8×10^{-7}
2/13/65	6.6×10^{-7}		3.0×10^{-6}	4.1×10^{-7}
2/20/65	7.6×10^{-7}		3.0×10^{-6}	2.0×10^{-7}

Date (Week ending)	Mean	Range	
		Maximum	Minimum
2/27/65	4.2×10^{-7}	8.2×10^{-7}	5.8×10^{-8}
3/6/65	5.8×10^{-7}	9.6×10^{-7}	3.0×10^{-7}
3/13/65	7.9×10^{-7}	9.1×10^{-7}	6.3×10^{-8}
3/20/65	3.4×10^{-7}	5.6×10^{-7}	3.7×10^{-7}
3/27/65	6.5×10^{-7}	8.3×10^{-7}	4.2×10^{-7}
4/3/65	4.9×10^{-7}	6.9×10^{-7}	2.1×10^{-8}
4/10/65	2.2×10^{-7}	5.0×10^{-7}	9.4×10^{-7}
4/17/65	2.5×10^{-7}	4.3×10^{-6}	1.3×10^{-7}
4/24/65	5.4×10^{-7}	1.1×10^{-6}	1.3×10^{-7}
5/1/65	7.3×10^{-7}	1.3×10^{-6}	2.8×10^{-7}
5/8/65	7.1×10^{-7}	1.2×10^{-6}	2.9×10^{-7}
5/15/65	7.6×10^{-7}	1.0×10^{-6}	3.3×10^{-7}
5/22/65	8.3×10^{-6}	2.7×10^{-6}	6.1×10^{-6}
5/29/65	3.0×10^{-6}	7.6×10^{-6}	1.3×10^{-6}
6/5/65	1.9×10^{-6}	2.8×10^{-6}	1.3×10^{-6}
6/12/65	1.7×10^{-6}	2.7×10^{-6}	1.2×10^{-8}
6/19/65	1.0×10^{-6}	6.9×10^{-6}	1.5×10^{-7}
6/26/65	1.0×10^{-6}	3.1×10^{-6}	5.1×10^{-7}

(a)No samples taken

B. 2 Potable Water Samples (Values in terms of pCi/l)

Date (Week ending)	Mean	Range Maximum	Range Minimum
2/6/65	6.4	13	2.1
2/13/65	3.7	6.0	2.3
2/20/65	5.7	8.0	1.9
2/27/65	5.4	11	D. L. (b)
3/6/65	9.0	36	2.3
3/13/65	5.3	10	2.3
3/20/65	6.0	11	2.6
3/27/65	5.2	7.2	3.7
4/3/65	10	47	4.7
4/10/65	7.2	12	2.9
4/17/65	4.5	10	D. L. (b)
4/24/65	(a)	(a)	(a)
5/1/65	4.2	7.4	D. L. (b)
5/8/65	5.3	9.5	2.5
5/15/65	8.6	12	5.6
5/22/65	3.9	7.9	1.9
5/29/65	5.4	7.8	3.1
6/5/65	8.8	19	3.3
6/12/65	4.7	18	2.0
6/19/65	4.7	10	3.0
6/26/65	6.6	9.2	D. L. (b)

(a)No samples taken
(b)Detection Limit

B. 3 Surface Water Samples (Values in Terms of pCi/l)

Date (Month)	Mean	Range Maximum	Range Minimum
2/65	8.7	52	D. L. (a)
3/65	14	90	3.5
4/65	13	50	3.8
5/65	6.2	11	1.8
6/65	11	47	D. L. (a)

(a)Detection Limit