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FRUIT AND VEGETABLE RADIOACTIVITY SURVEY FOLLOW-ON, NEVADA TEST SITE ENVIRONS

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Monitoring Operations Division
Environmental Monitoring and Support Laboratory
U.S. ENVIRONMENTAL PROTECTION AGENCY
Las Vegas, Nevada 89114

September 1978

This work performed under a Memorandum of
Understanding No. EY-76-A-08-0539
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ABSTRACT

During the 1974 growing season, the Environmental Monitoring and Support Laboratory-Las Vegas, of the U.S. Environmental Protection Agency, collected samples of fruits and vegetables grown in the area surrounding the Nevada Test Site. The objective was to estimate the potential radiological dose to off-site residents from consumption of locally grown foodstuffs. It became necessary to collect additional samples for analysis of iron-55 and plutonium-238 and -239. This report compiles the results of the earlier study with these new results. No evidence was found of contamination of foods by these radioisotopes resulting from close-in fallout of radioactivity from nuclear testing at the Nevada Test Site.

ACKNOWLEDGEMENT

For 2 years of this project, residents around the Nevada Test Site have provided this Laboratory with large quantities of their home-grown produce. The unfailing support from these people and their interest in the off-site radiological safety program have made it possible to conduct a survey which could not have otherwise been carried out. Their assistance in this project is gratefully acknowledged.

INTRODUCTION

The Environmental Monitoring and Support Laboratory-Las Vegas, of the U.S. Environmental Protection Agency (EPA), initiated a project in the spring of 1974 to assess the potential internal exposure to residents in the vicinity of the Nevada Test Site (NTS) to radioactivity from eating locally grown fruits and vegetables. A variety of food types was collected during the 1974 growing season along with samples of irrigation water and soil from gardens and orchards.

A report covering the results of analyses for tritium, strontium-89 and -90, and gamma-emitting radionuclides in samples collected during 1974 has been published[1].

The original intent had been to analyze all samples for gamma-emitting radionuclides and to perform radiochemical analysis on selected samples for tritium, iron-55, strontium-89 and -90, and plutonium-238 and -239. Because of unexpected laboratory difficulties, it was necessary to delay analysis for iron-55 and to collect additional samples of fruits and vegetables for plutonium analysis. Additional background samples were purchased at a Las Vegas supermarket in 1975 and samples were collected from home gardens around the NTS during the 1976 growing season.

This report presents the results of analysis for iron-55 on samples of soil collected in 1974 and on fruits and vegetables collected in 1974 and 1976. Plutonium-238 and -239 results are reported for fruit and vegetable samples collected in 1975 and 1976.

SAMPLE COLLECTION

Crops from selected gardens and orchards in the off-site area were hand-picked by EPA representatives. In general, all samples were logged and tagged in the field at the time of collection. Although actual sample sizes varied

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[1]Andrews, Vernon E., and Jack C. Vandervort. Fruit and Vegetable Radioactivity Survey, Nevada Test Site Environs. EMSL-LV-0539-013. U.S. Environmental Protection Agency. Las Vegas, Nevada. April 1978.

slightly, based upon the availability at some locations, an attempt was made to obtain 4 kilograms of each crop sampled. Root crops were collected by removing the portion above ground with clippers or knife and removing the root and its surrounding soil with a coring tool. In 1974 the soil was removed from the roots and the two were logged separately. The soil so collected constituted the garden soil samples from those gardens where root crops were obtained. No soil was collected in 1976. When it was not possible to collect a sufficient sample of root or leaf crop of one type, composites of two or more similar crops were collected.

Samples were collected in 1974 from 26 home gardens and orchards representing 19 areas. In 1976, samples were collected from 10 gardens and orchards, including a home garden not sampled in 1974 and a sample from an area not previously included (Moapa). Sampling locations and types of samples collected at each location in the NTS off-site area during 1974 and 1976 are listed in Table 1. Azimuths and distances are measured from the NTS Control Point (CP) which is located near the geographic center of the areas used in past years for atmospheric tests. The locations are plotted in Figure 1 and keyed to Table 1 by sampling location number.

During 1975 background vegetable and fruit samples, representing potential contamination from worldwide fallout, were purchased from a Las Vegas supermarket for plutonium-238 and -239 analysis. The sample types and origins for background samples collected during 1974 and 1975 are listed in Table 2. Figure 2 shows the approximate origins of the background samples as shown on the packing crates.

For ease of comparison to data reported in the first survey report[2], the location numbers used and figures employed are the same with the new locations added.

SAMPLE ANALYSIS

Because the purpose of the project was to assess the potential for ingestion of radionuclides in locally grown produce, the food samples were prepared for analysis as they would have been in a home kitchen. In general, samples were washed, peeled when appropriate, and allowed to dry.

All samples were initially analyzed for gamma-emitting nuclides by gamma spectrometry using a 10.2- by 10.2-cm thallium-activated sodium iodide crystal

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[2] Ibid., page 1.

and 400-channel pulse height analyzer. The food samples were then freeze-dried to remove moisture and were ashed in a high-temperature oven to prepare them for radiochemical analysis.

ANALYTICAL RESULTS

All soil sample analytical results are listed in Appendix 1, including those previously reported[3]. All analytical results for fruit and vegetable samples, including those reported earlier are given in Appendix 2. These two appendices update the data in Appendix 1 and Appendix 3, respectively, from the first report.

During 1974, gamma spectrometry results were computed using a matrix technique that did not permit determination of a counting error term. By 1976, a least-squares technique had been instituted which does produce the counting error term. Therefore, some results for beryllium-7, zirconium-95, and cesium-137, which are determined from gamma spectrometry, have error terms associated with them and some do not.

The analytical technique developed to measure the iron-55 content of fruit and vegetable samples resulted in a lower limit of detection of approximately 0.5 to 0.9 picocuries per gram of ash. The actual value depends upon the chemical yield of each sample. The minimum detectable concentrations on a wet weight basis ranged from 2 to 18 picocuries per kilogram (pCi/kg) depending on the ash content of each sample. No iron-55 was detected in any of the soil or food samples. The two positive results from locations 1 and 2 (Alamo) in the earlier report for iron-55 in soil were not valid and resulted from the analytical procedure used at that time.

Of the 14 food types which were collected from around the NTS and analyzed for plutonium, 3 showed the presence of plutonium-238 or -239. In at least two cases — the radish sample from Adaven and the beet greens from Springdale — the 2-sigma counting error term is so nearly equal to the reported value that they are considered to be statistically insignificant. The only sample which can probably be considered to be positive is the concentration of 0.16 ± 0.1 pCi/kg

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[3] Ibid., page 1.

of plutonium-238 in the beet root sample from Hiko. One of the four 1975 background samples analyzed for plutonium-238 and -239 was positive, with a measured concentration of 0.23 ± 0.077 pCi/kg of plutonium-238 in peaches from Thermal, California. It is most likely, in both cases, that the plutonium-238 resulted from surface contamination not easily removed by washing.

A sample of wheat collected from the Moapa Indian Reservation was analyzed by gamma spectrometry and by radiochemical analysis for strontium-89 and -90. No gamma-emitting radionuclides were found and the strontium concentrations were less than 300 pCi/kg of strontium-89 and less than 33 pCi/kg of strontium-90. The high values for minimum detectable concentrations resulted from the high (11%) ash content of the wheat.

The only gamma-emitting radionuclide found on any of the samples collected in 1976, other than potassium-40, was beryllium-7, a naturally occurring nuclide produced by cosmic ray interactions in the stratosphere. It is commonly found as surface contamination on leafy crops. In the 1976 samples, concentrations of 200 to 600 pCi/kg of beryllium-7 were found on four samples from around the NTS.

DISCUSSION

In this portion of the Fruit and Vegetable Survey only three positive plutonium-238 and -239 results were obtained, of which at least two are statistically insignificant. However, if it is assumed that all three represent the amount of plutonium radioactivity present, comparison to the measured concentrations in soil from the respective gardens shows that the concentrations in soil are lower than those measured in the food samples. The forms of plutonium found in the environment are relatively insoluble and plant uptake from soil is normally quite low. It would seem, then, that the plutonium levels measured in the vegetable samples resulted from surface contamination by small particulates which were not removed by washing. The maximum concentration observed in food samples from near the NTS was lower than the maximum background sample concentration.

The dose resulting from ingestion of plutonium may be calculated as:

$D = 6.73 \times 10^{-4}$ millirem per picocurie plutonium-238,

$D = 7.60 \times 10^{-4}$ millirem per picocurie plutonium-239;

where D is the absorbed dose equivalent during the first year after ingestion[4].

If it is assumed that a person eats 200 grams per week for a full year of a vegetable containing 0.2 pCi/kg of plutonium-238, the absorbed dose to bone would be 1.5×10^{-3} millirem. If the vegetable contains 0.2 pCi/kg of plutonium-239, the dose to bone, under the same conditions, would be 1.7×10^{-3} millirem. The dose received would be equal to 0.001% of the radiation protection standard for average dose to a suitable sample of the population[5].

CONCLUSIONS

As shown in the first report, the estimated dose to a person eating locally grown foods as a result of nuclear testing would be due primarily to strontium-90 and would result in a dose to bone of less than 0.1% of the radiation protection standard (170 millirem) for the first year. The hypothetical dose is not changed by the result of this follow-on study, which estimates an additional dose equivalent of 0.001% of the radiation protection standard after 1 year of a hypothetical consumption rate of locally grown foods contaminated with the maximum observed concentration of plutonium-238 or plutonium-239.

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[4]U.S. Nuclear Regulatory Commission. Regulatory Guide 1.109, Calculation of annual doses to man from routine releases of reactor effluents for the purpose of evaluating compliance with 10CFR50, Appendix I. pp 1.109-24. Washington, DC. March 1976.

[5]U.S. Energy Research and Development Administration. "Standards for radiation protection." ERDA Manual Chapter 0524. p 3. April 1975.

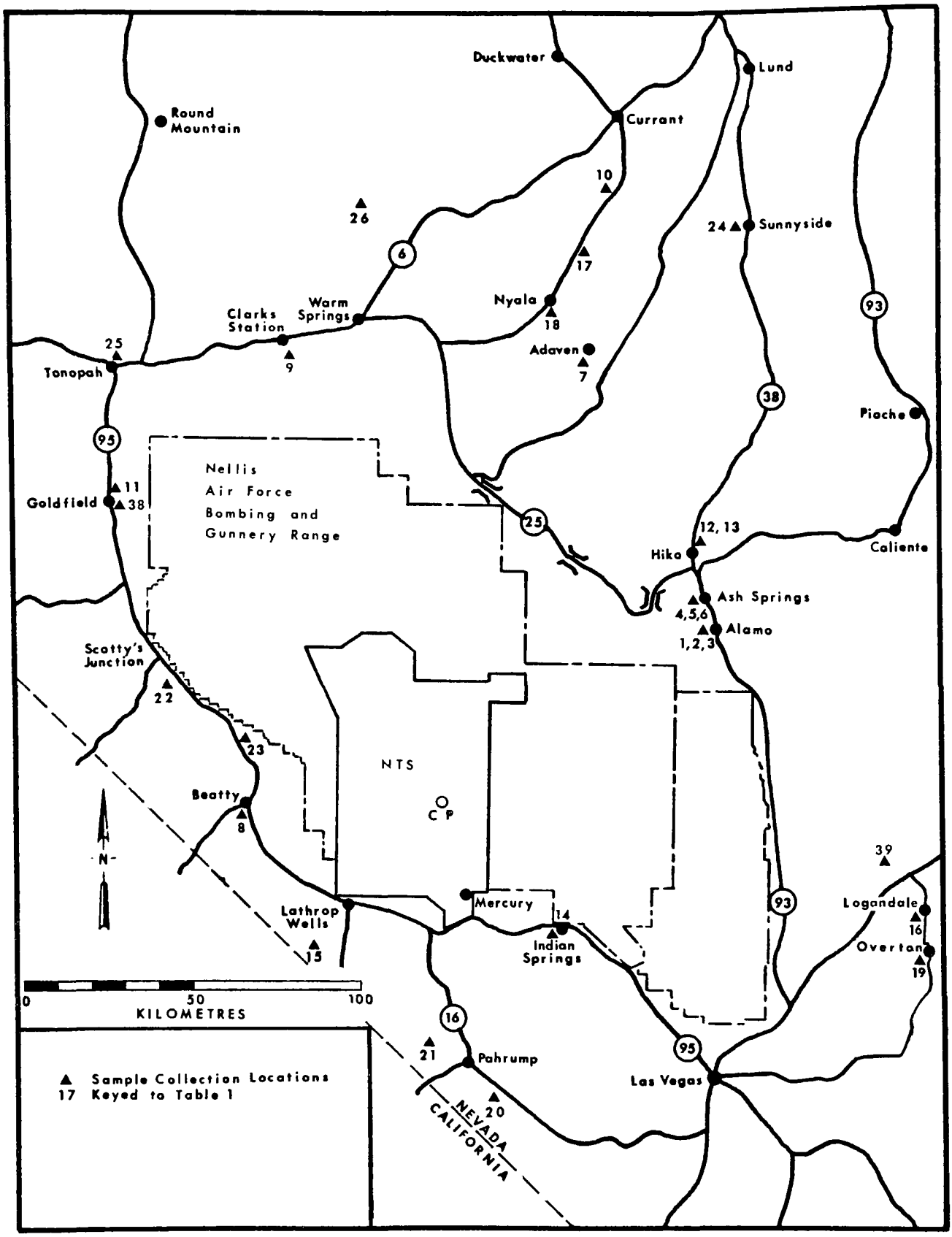

Figure 1. Sample Collection Locations

TABLE 1. SAMPLE COLLECTION SUMMARY

STA. NO.	LOCATION (Nevada)	AZIMUTH, DISTANCE (Deg, Km)[a]	SAMPLE							
				SOIL		PLANT				
			WATER	Garden	Orchard	Leaf	Root	Seed	Fruit	Alfalfa
1	Alamo	058°, 92	X	X	X		X	X		
2	Alamo	058°, 92	X	X		X				
3	Alamo	058°, 92	X		X				X	
4	Ash Springs	052°, 95	X	D		X				
5	Ash Springs	052°, 95	X	X			X			
6	Ash Springs	052°, 95	X		X				X	
7	Adaven	018°, 138	X	X	X	X	X	X	X	X
8	Beatty	267°, 61	X	D	X	X	X	X	X	
9	Clark Station	340°, 138	X	X			X			
10	Currant	015°, 182	X	D	X	X	X	X	X	
11	Goldfield	307°, 137	X	X		X	X	X		
12	Hiko	045°, 105	X	X		X	X	X		
13	Hiko	045°, 105	X	X	D		X		X	
14	Indian Springs	138°, 61	X	X	X	X	X	X	X	
15	Lathrop Wells	223°, 53	X	X	X	X	X		X	
16	Logandale	106°, 145	X		X				X	
17	Nyala	016°, 177	X	X	X	X	X	X	X	X
18	Nyala	012°, 148	X	D	X	X	X	X	X	X
19	Overton	109°, 156	X	X		X			X	
20	Pahrump	170°, 88	X	D	X	X	X	X	X	
21	Pahrump	175°, 72	X	X	X		X	X	X	X
22	Scotty's Jct.	288°, 72	X	D		X	X			
23	Springdale	280°, 60	X	D	X	X	X	X	X	X
24	Sunnyside	027°, 175	X	X		X	X	X		X
25	Tonopah	318°, 164	X	D		X	X	X		
26	Warm Springs	350°, 175	X	D	X		X		X	
38	Goldfield	307°, 137				X	X			
39	Moapa	103°, 127						X		

[a] Azimuth and distance from the Nevada Test Site Control Point (CP).

D = Duplicate sample collected.

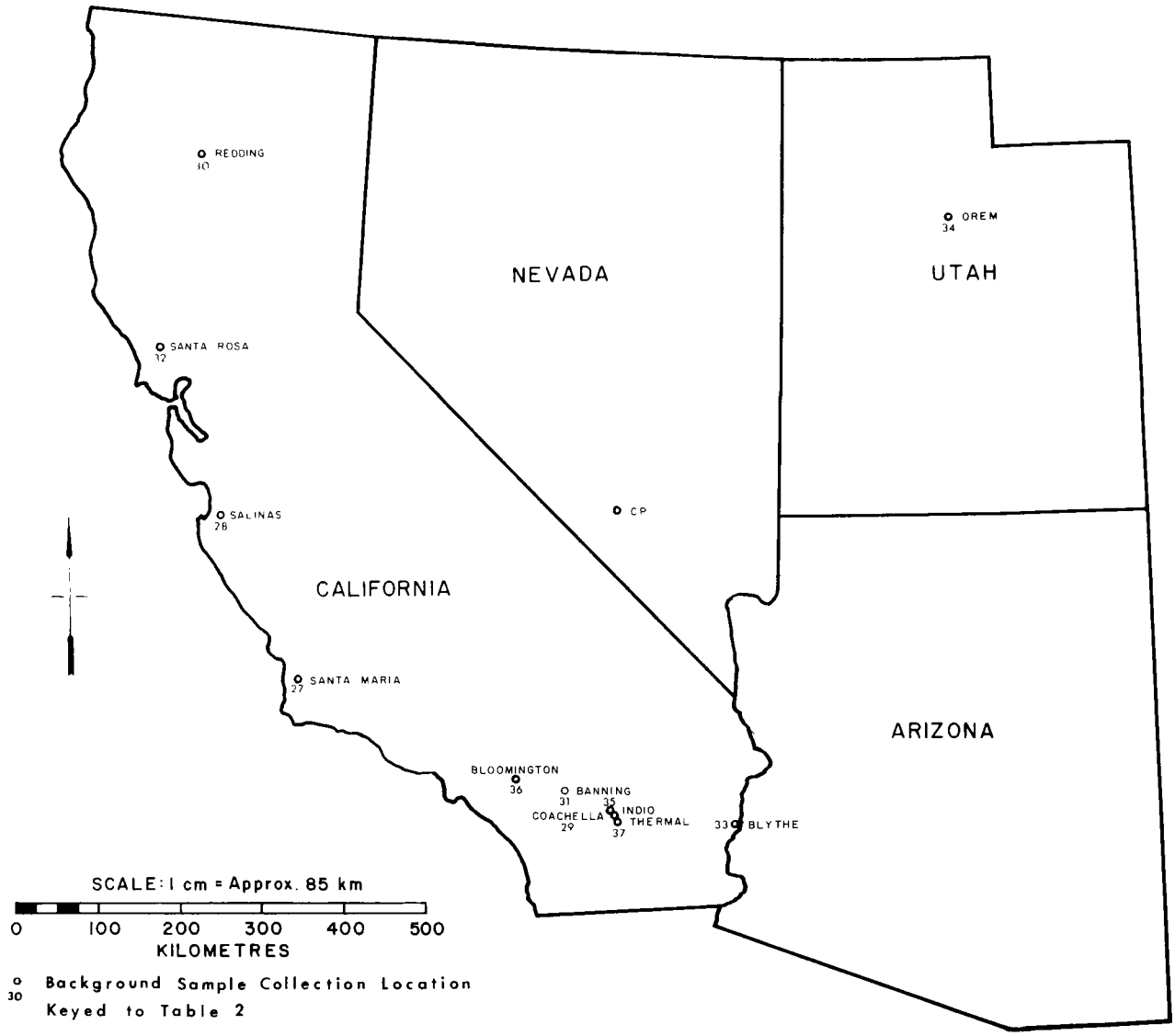

Figure 2. Background Sample Origins

TABLE 2. BACKGROUND SAMPLE SURVEY

STATION NUMBER	ORIGIN	DATE	ITEM
27	Santa Maria, California	07/08/74	Carrots
27	Santa Maria, California	07/08/74	Cabbage
28	Salinas, California	07/08/74	Turnips
28	Salinas, California	07/08/74	Lettuce
28	Salinas, California	07/08/74	Turnip Greens
29	Coachella, California	07/08/74	Sweet Corn
30	Redding, California	07/08/74	Peaches
31	Banning, California	07/08/74	Apricots
32	Santa Rosa, California	07/08/74	Plums
32	Santa Rosa, California	10/16/74	Plums
33	Blythe, California	10/16/74	Lettuce
34	Orem, Utah	10/16/74	Cabbage
35	Indio, California	05/21/75	Carrots
36	Bloomington, California	05/21/75	Turnips
36	Bloomington, California	05/21/75	Turnip Greens
37	Thermal, California	05/21/75	Peaches

APPENDIX 1. SOIL SAMPLE ANALYTICAL RESULTS

STATION NUMBER	COLLECTION DATE (1974)	SOURCE	RADIONUCLIDE CONCENTRATION (pCi/g)[a]						K (mg/g)
			^{55}Fe	^{89}Sr	^{90}Sr	^{137}Cs	^{238}Pu	^{239}Pu	
1	06/05	O	NA	<3	2.6 ± 1.4	0.31	<0.004	0.055 ± 0.013	22
1	06/05	G	<4	<2	<2	0.29	<0.007	0.019 ± 0.006	26
2	06/05	G	NA	<2	<2	0.19	<0.005	0.022 ± 0.007	25
3	08/26	O	<8	<2	<2	0.45	<0.03	<0.03	28
4	09/24	G	<6	<3	<2	0.19	<0.04	<0.03	44
4	09/24	G[b]	<5	<3	<3	0.37	<0.04	<0.04	34
5	06/06	G	<6	<2	<2	0.50	<0.004	0.030 ± 0.009	22
6	06/06	O	<5	<2	<2	0.32	<0.007	0.066 ± 0.012	22
7	07/23	G	<7	<2	<2	1.2	<0.04	0.070 ± 0.032	28
7	08/24	G	<7	<2	<2	0.69	0.031 ± 0.025	<0.03	51
8	07/11	G	<8	<2	<1	ND	<0.03	0.044 ± 0.023	30
8	07/23	O	<6	<2	<1	0.41	<0.05	<0.03	31
8	08/15	G	<7	<2	<1	ND	<0.03	0.029 ± 0.020	37
9	08/12	G	<7	<2	<2	1.9	<0.03	<0.03	55
10	07/18	G	<12	<2	<1	0.80	<0.04	0.044 ± 0.035	9.4
10	08/14	O	<4	<2	<1	1.0	<0.05	0.042 ± 0.038	16
10	08/27	G	<10	<2	<1	0.91	0.038 ± 0.031	0.17 ± 0.052	20
11	07/19	G	<7	<2	<2	0.48	<0.03	0.054 ± 0.027	24
12	08/05	G	<5	<2	<2	0.78	<0.03	0.022 ± 0.021	22
13	06/05	G	NA	<2	<2	0.60	<0.004	0.029 ± 0.008	27
13	06/05	O	<5	<2	<2	0.54	0.0054 ± 0.0049	0.022 ± 0.011	22
13	08/13	O	<9	<2	<1	0.32	<0.03	<0.03	27
14	06/13	O	<4	<2	<2	0.29	<0.05	0.065 ± 0.041	8.4
14	07/08	G	<5	<3	<1	ND	<0.04	<0.04	13
15	06/07	O	NA	<2	<2	0.33	<0.006	0.014 ± 0.008	32
15	07/17	G	<8	<2	<2	0.41	<0.04	<0.04	32
16	07/15	O	<5	<2	<1	0.31	<0.03	<0.03	23

APPENDIX 1. (CONTINUED)

STATION NUMBER	COLLECTION DATE (1974)	SOURCE	RADIONUCLIDE CONCENTRATION (pCi/g)[a]						K (mg/g)
			^{55}Fe	^{89}Sr	^{90}Sr	^{137}Cs	^{238}Pu	^{239}Pu	
17	07/18	G	<6	<2	<1	1.1	<0.04	<0.04	24
17	08/21	O	<13	<2	<2	1.0	<0.03	0.068 ± 0.041	25
18	06/12	O	<4	<3	<1	0.96	<0.04	0.13 ± 0.046	27
18	07/23	G	<7	<2	<2	0.39	<0.03	0.031 ± 0.026	17
18	08/28	G	<10	<1	<0.8	0.52	<0.03	0.033 ± 0.022	26
19	07/15	G	<5	<2	<1	0.11	<0.04	<0.03	16
20	06/06	O	<6	<2	<2	0.37	<0.005	0.026 ± 0.005	17
20	07/12	G	<6	<2	<1	0.29	<0.04	<0.03	18
20	08/15	G	<6	<2	<2	0.68	<0.04	<0.04	23
21	06/26	G	<5	<2	<1	ND	<0.05	0.045 ± 0.028	24
21	06/26	O	<6	<3	<1	ND	<0.04	<0.02	22
22	08/12	G	<8	<2	<0.9	0.31	<0.03	<0.03	47
22	09/16	G	<11	1.4 ± 1.1	<0.9	ND	<0.05	<0.04	46
23	06/28	O	<7	<2	<1	0.16	<0.03	0.014 ± 0.037	30
23	08/15	G	<4	<2	<1	ND	<0.03	<0.03	43
23	08/15	G	<7	<2	<2	0.43	<0.03	0.046 ± 0.032	49
24	08/28	G	<14	<3	2.6 ± 1.4	0.26	<0.03	<0.02	9.6
25	07/18	G	<5	<2	<1	1.3	0.0035 ± 0.0030	0.034 ± 0.008	32
25	09/17	G	<4	<2	<1	0.93	<0.04	<0.04	52
26	06/19	O	<4	<2	<0.9	0.56	0.046 ± 0.043	0.069 ± 0.032	16
26	08/27	G	<5	<2	<2	0.36	<0.04	0.064 ± 0.037	16
26	09/17	G	<6	<2	<1	0.33	<0.04	<0.03	17

[a] Detectable concentrations given ± 2-sigma counting error for air-dried soil

[b] Duplicate Sample

O=Orchard; G=Garden

NA=No Analysis; ND=Not Detected

APPENDIX 2. FRUIT AND VEGETABLE SAMPLE ANALYTICAL RESULTS

STATION NUMBER	SAMPLE TYPE	COLLECTION DATE	RADIONUCLIDE CONCENTRATION (pCi/kg WET WEIGHT)[a]							
			^{3}H	^{7}Be	^{55}Fe	^{89}Sr	^{90}Sr	^{95}Zr	^{238}Pu	^{239}Pu
1	Mixed roots, beet and carrot	08/05/74	NA	ND	NA	NA	NA	ND	NA	NA
1	Corn	08/05/74	NA	ND	NA	NA	NA	ND	NA	NA
2	Cabbage	08/05/74	NA	ND	NA	NA	NA	ND	NA	NA
3	Peaches	08/21/74	NA	ND	NA	NA	NA	ND	NA	NA
4	Cabbage	09/24/74	NA	ND	NA	NA	NA	ND	NA	NA
5	Mixed roots, beet and turnip	08/13/74	NA	ND	NA	<9	6.8 (5.5)	ND	NA	NA
6	Apples	08/13/74	NA	ND	NA	NA	NA	ND	NA	NA
7	Turnip greens	07/23/74	NA	400	<13	NA	NA	44	NA	NA
7	Mixed roots, turnip and rutabaga	07/23/74	NA	ND	NA	NA	NA	ND	NA	NA
7	Corn	08/28/74	NA	ND	NA	<9	<5	ND	NA	NA
7	Alfalfa	08/28/74	NA	570	NA	<40	<22	ND	NA	NA
7	Apples	08/28/74	NA	ND	NA	NA	NA	ND	NA	NA
7	Radish	08/03/76	NA	ND	NA	NA	NA	ND	<0.1	0.12 (0.11)

APPENDIX 2. (CONTINUED)

STATION NUMBER	SAMPLE TYPE	COLLECTION DATE	RADIONUCLIDE CONCENTRATION (pCi/kg WET WEIGHT)[a]							
			^{3}H	^{7}Be	^{55}Fe	^{89}Sr	^{90}Sr	^{95}Zr	^{238}Pu	^{239}Pu
7	Lettuce	08/03/76	NA	520 (240)	NA	NA	NA	ND	NA	NA
7	Beet	08/04/76	NA	ND	NA	NA	NA	ND	<0.2	<0.2
7	Mixed leaf, beet and chard	08/04/76	NA	600 (78)	NA	NA	NA	ND	NA	NA
8	Turnip roots	07/11/74	<300	ND	NA	NA	NA	ND	<0.03	<0.04
8	Turnip greens	07/11/74	380 (280)	ND	<18	NA	NA	ND	NA	NA
8	Peaches	07/23/74	NA	ND	NA	NA	NA	ND	NA	NA
8	Corn	07/23/74	NA	ND	NA	NA	NA	ND	NA	NA
9	Carrots	08/12/74	<300	ND	NA	<8	<4	ND	NA	NA
10	Turnip roots	07/18/74	NA	ND	NA	NA	NA	ND	<0.04	<0.06
10	Turnip greens	07/18/74	NA	ND	<7	<20	<13	ND	NA	NA
10	Plums	08/14/74	NA	ND	NA	NA	NA	ND	NA	NA
10	Corn	08/21/74	NA	ND	NA	NA	NA	ND	NA	NA
10	Corn	08/27/74	NA	ND	NA	<9	<5	ND	NA	NA

APPENDIX 2. (CONTINUED)

STATION NUMBER	SAMPLE TYPE	COLLECTION DATE	RADIONUCLIDE CONCENTRATION (pCi/kg WET WEIGHT)[a]							
			^{3}H	^{7}Be	^{55}Fe	^{89}Sr	^{90}Sr	^{95}Zr	^{238}Pu	^{239}Pu
10	Beet roots	08/03/76	NA	ND	NA	NA	NA	ND	<0.4	<0.2
10	Beet greens	08/03/76	200 (72)	ND	NA	NA	NA	ND	NA	NA
11	Lettuce	07/17/74	NA	ND	NA	NA	NA	ND	NA	NA
11	Cabbage	07/19/74	NA	ND	NA	NA	NA	ND	NA	NA
11	Corn	09/16/74	NA	ND	NA	NA	NA	ND	NA	NA
11	Potatoes	09/16/74	NA	ND	NA	NA	NA	ND	NA	NA
12	Corn	08/05/74	<300	ND	NA	NA	NA	ND	NA	NA
12	Chard	08/05/74	<300	100	<13	<31	32 (20)	25	NA	NA
12	Onions	08/05/74	<300	ND	NA	<8	14 (5.2)	ND	NA	NA
13	Apples	09/09/74	NA	ND	NA	NA	NA	ND	NA	NA
13	Beet roots	08/04/76	NA	ND	NA	NA	NA	ND	0.16 (0.10)	<0.04
13	Chard	08/04/76	NA	310 (130)	NA	NA	NA	ND	NA	NA
14	Onions	07/08/74	<300	ND	NA	NA	NA	ND	NA	NA

APPENDIX 2. (CONTINUED)

STATION NUMBER	SAMPLE TYPE	COLLECTION DATE	RADIONUCLIDE CONCENTRATION (pCi/kg WET WEIGHT)[a]							
			^{3}H	^{7}Be	^{55}Fe	^{89}Sr	^{90}Sr	^{95}Zr	^{238}Pu	^{239}Pu
14	Lettuce	07/08/74	490 (280)	ND	NA	NA	NA	ND	NA	NA
14	Corn	07/08/74	360 (320)	ND	NA	NA	NA	ND	NA	NA
14	Peaches	08/15/74	NA	ND	NA	NA	NA	ND	NA	NA
14	Lettuce	07/20/76	NA	320 (110)	NA	NA	NA	ND	NA	NA
14	Onions	07/20/76	NA	ND	NA	NA	NA	ND	NA	NA
15	Cabbage	07/17/74	NA	ND	<5	NA	NA	ND	NA	NA
15	Turnip roots	07/17/74	NA	ND	NA	NA	NA	ND	NA	NA
15	Peaches	06/07/74	<300	ND	NA	NA	NA	ND	NA	NA
16	Plums	07/15/74	<300	ND	NA	NA	NA	ND	NA	NA
17	Mixed leaf, turnip and lettuce	07/18/74	NA	ND	<5	14 (11)	<8	ND	NA	NA
17	Turnip roots	07/18/74	NA	ND	NA	NA	NA	ND	NA	NA
17	Plums	08/21/74	NA	ND	NA	NA	NA	ND	NA	NA
17	Corn	08/21/74	NA	ND	NA	<12	<7	ND	NA	NA

APPENDIX 2. (CONTINUED)

STATION NUMBER	SAMPLE TYPE	COLLECTION DATE	RADIONUCLIDE CONCENTRATION (pCi/kg WET WEIGHT)[a]							
			^{3}H	^{7}Be	^{55}Fe	^{89}Sr	^{90}Sr	^{95}Zr	^{238}Pu	^{239}Pu
17	Alfalfa	08/27/74	NA	910	NA	NA	NA	63	NA	NA
18	Apricots	07/11/74	<300	ND	NA	NA	NA	ND	NA	NA
18	Mixed roots, carrot and onion	07/23/74	<300	ND	NA	NA	NA	ND	NA	NA
18	Mixed leaf, cabbage and lettuce	07/23/74	<300	ND	<4	<9	<6	ND	NA	NA
18	Corn	08/28/74	NA	ND	NA	NA	NA	ND	NA	NA
18	Alfalfa hay	08/28/74	NA	720	NA	<95	75 (54)	ND	NA	NA
18	Celtus	08/03/76	NA	ND	<14	NA	NA	ND	<0.2	<0.1
18	Apples	08/03/76	NA	ND	<3	NA	NA	ND	NA	NA
18	Radish	08/03/76	NA	ND	NA	NA	NA	ND	<0.07	<0.09
18	Apples	10/07/76	NA	ND	NA	NA	NA	ND	NA	NA
19	Beet roots	07/15/74	<300	ND	NA	NA	NA	ND	NA	NA
19	Lettuce	07/15/74	640 (280)	ND	NA	NA	NA	ND	NA	NA
20	Lettuce	06/06/74	NA	ND	NA	NA	NA	ND	NA	NA

APPENDIX 2. (CONTINUED)

STATION NUMBER	SAMPLE TYPE	COLLECTION DATE	RADIONUCLIDE CONCENTRATION (pCi/kg WET WEIGHT)[a]							
			^{3}H	^{7}Be	^{55}Fe	^{89}Sr	^{90}Sr	^{95}Zr	^{238}Pu	^{239}Pu
20	Apricots	07/04/74	650 (290)	ND	NA	NA	NA	ND	NA	NA
20	Turnip roots	07/12/74	330 (270)	ND	NA	NA	NA	ND	NA	NA
20	Corn	07/15/74	480 (400)	ND	NA	<11	9.2 (7.4)	ND	NA	NA
21	Radish	06/26/74	<300	ND	NA	NA	NA	ND	NA	NA
21	Plums	06/26/74	<300	ND	NA	NA	NA	ND	NA	NA
21	Corn	07/24/74	NA	ND	NA	NA	NA	ND	NA	NA
21	Alfalfa	09/12/74	NA	ND	NA	NA	NA	ND	NA	NA
22	Lettuce	07/15/74	NA	ND	NA	NA	NA	ND	NA	NA
22	Mixed roots, carrot and turnip	08/12/74	NA	ND	NA	NA	NA	ND	NA	NA
23	Chard	06/28/74	NA	ND	<2	NA	NA	ND	NA	NA
23	Turnip roots	08/15/74	<300	ND	NA	NA	NA	ND	<0.04	<0.07
23	Alfalfa	08/15/74	<300	ND	NA	NA	NA	110	NA	NA
23	Pears	09/11/74	<300	ND	NA	NA	NA	ND	NA	NA

APPENDIX 2. (CONTINUED)

STATION NUMBER	SAMPLE TYPE	COLLECTION DATE	RADIONUCLIDE CONCENTRATION (pCi/kg WET WEIGHT)[a]							
			^{3}H	^{7}Be	^{55}Fe	^{89}Sr	^{90}Sr	^{95}Zr	^{238}Pu	^{239}Pu
23	Corn	09/11/74	500 (290)	ND	NA	NA	NA	ND	NA	NA
23	Beet roots	07/15/76	NA	ND	NA	NA	NA	ND	NA	NA
23	Beet greens	07/15/76	NA	ND	<16	NA	NA	ND	<0.3	0.21 (0.20)
23	Pears	10/07/76	NA	ND	NA	NA	NA	ND	NA	NA
24	Cabbage	09/28/74	NA	ND	NA	NA	NA	ND	NA	NA
24	Corn	08/28/74	NA	ND	NA	<12	<7	ND	NA	NA
24	Alfalfa	08/28/74	NA	ND	NA	NA	NA	ND	NA	NA
24	Carrots	08/28/74	NA	ND	NA	NA	NA	ND	NA	NA
25	Cabbage	07/12/74	NA	ND	NA	NA	NA	ND	NA	NA
25	Lettuce	07/19/74	NA	ND	<8	<16	12 (11)	ND	NA	NA
25	Carrots	08/14/74	NA	ND	NA	NA	NA	ND	NA	NA
25	Corn	08/14/74	NA	ND	NA	<5	<3	ND	NA	NA
25	Beet roots	08/03/76	NA	ND	NA	NA	NA	ND	<0.04	<0.06

APPENDIX 2. (CONTINUED)

STATION NUMBER	SAMPLE TYPE	COLLECTION DATE	RADIONUCLIDE CONCENTRATION (pCi/kg WET WEIGHT)[a]							
			^{3}H	^{7}Be	^{55}Fe	^{89}Sr	^{90}Sr	^{95}Zr	^{238}Pu	^{239}Pu
25	Beet greens	08/03/76	NA	ND	<16	NA	NA	ND	<0.2	<0.2
26	Pears	08/27/74	NA	ND	NA	NA	NA	ND	NA	NA
26	Potatoes	08/27/74	NA	ND	NA	NA	NA	ND	NA	NA
27 Bkg	Carrots	07/08/74	820 (300)	ND	<4	<5	<3	ND	NA	NA
27 Bkg	Cabbage	07/08/74	450 (270)	ND	<3	<5	<3	ND	NA	NA
28 Bkg	Turnip roots	07/08/74	650 (280)	ND	<3	<6	<4	ND	NA	NA
28 Bkg	Turnip roots	07/11/74	760 (250)	ND	<5	<10	<7	ND	NA	NA
28 Bkg	Turnip greens	07/11/74	1300 (290)	ND	<8	<17	<9	ND	NA	NA
28 Bkg	Lettuce	07/08/74	750 (280)	ND	<2	<3	<2	ND	NA	NA
29 Bkg	Corn	07/08/74	640 (310)	ND	<5	<8	<5	ND	NA	NA
30 Bkg	Peaches	07/08/74	670 (280)	ND	<3	<5	<5	ND	NA	NA
31 Bkg	Apricots	07/08/74	640 (280)	ND	NA	<6	<5	ND	NA	NA
32 Bkg	Plums	07/08/74	560 (280)	ND	<2	<3	<2	ND	NA	NA

APPENDIX 2. (CONTINUED)

STATION NUMBER	SAMPLE TYPE	COLLECTION DATE	RADIONUCLIDE CONCENTRATION (pCi/kg WET WEIGHT)[a]							
			^{3}H	^{7}Be	^{55}Fe	^{89}Sr	^{90}Sr	^{95}Zr	^{238}Pu	^{239}Pu
32 Bkg	Plums	10/16/74	NA	<7	NA	NA	NA	ND	<0.7	<0.5
33 Bkg	Lettuce	10/16/74	NA	<2	NA	NA	NA	ND	NA	NA
34 Bkg	Cabbage	10/16/74	NA	<3	NA	NA	NA	ND	<0.3	<0.2
35 Bkg	Carrots	05/21/75	NA	ND	NA	NA	NA	ND	<0.2	<0.2
36 Bkg	Turnip roots	05/21/75	NA	ND	NA	NA	NA	ND	<0.2	<0.1
36 Bkg	Turnip greens	05/21/75	NA	ND	NA	NA	NA	ND	<0.7	<0.9
37	Peaches	05/21/75	NA	ND	NA	NA	NA	ND	0.23 (0.077)	<0.07
38	Beet roots	08/02/76	NA	ND	NA	NA	NA	ND	<0.1	<0.05
38	Lettuce	08/02/76	NA	ND	<10	NA	NA	ND	<0.1	<0.09
39	Wheat	08/06/76	NA	ND		<300	<33	ND	NA	NA

[a] Values shown in parentheses are the 2-sigma counting error

NA=No Analysis; ND=Not Detected

Bkg=Background sample

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