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RADIOACTIVE CONTAMINATION IN THE ENVIRONS
OF THE HANFORD WORKS FOR THE PERIOD
APRIL, MAY, JUNE, 1952

by

H. J. Paas

December 15, 1952

HANFORD WORKS
RICHLAND, WASHINGTON

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ABSTRACT

SECTION I - RADIOACTIVE CONTAMINATION IN EFFLUENT GASES:

An average of four curies of I^{131} per day was discharged to the atmosphere from separations facilities. Maximum emission was measured at the Redox stack where 21 curies of I^{131} were emitted over a particular 24 hour period. Ruthenium emitted from the Redox plant averaged less than 0.1 curie per day, including a maximum measurement of 1.7 curies per day. Plutonium emission averaged less than 1 mg per day. Radiochemical analyses of particles emitted from the Redox plant showed that 90 to 98% of the total activity was due to Ru^{106} and Ru^{103} ; I^{131} in particulate contamination ranged from 1 to 5%. Daily monitoring for tritium oxide at three of the reactor stacks showed average emission on the order of 0.10 curie per day at each reactor; the maximum measurement was 0.96 curie per day at the 100-F Area.

SECTION II - RADIOACTIVE CONTAMINATION ON VEGETATION:

The amount of I^{131} deposited on vegetation decreased at nearly all locations in the immediate environs. Maximum deposition was measured in a small region on the order of 1 to 2 square miles near the southwest corner of the 200 West Area where the average activity density from I^{131} exceeded 1×10^{-4} $\mu\text{c/gm}$. The maximum individual sample from this area contained 2.2×10^{-4} $\mu\text{c/gm}$. I^{131} on vegetation collected at the project perimeter and in the nearby residential communities decreased to values $< 3 \times 10^{-6}$ $\mu\text{c/cc}$ toward the end of the quarter. Off-site monitoring showed trace quantities of I^{131} at only six out of fifty-eight communities in which surveys were completed. The activity density from non-volatile beta particle emitters averaged from 2 to 6×10^{-5} $\mu\text{c/gm}$. Significant increases noted in this activity during May and June were caused by the influx of particulate contamination from the Nevada tests. Maximum values on the order of 1 to 3×10^{-4} $\mu\text{c/gm}$ were measured in samples collected at local and remote locations. Estimated iso-activity maps showing the deposition pattern from airborne contaminants are included in the text.

SECTION III - RADIOACTIVE CONTAMINATION IN THE ATMOSPHERE:

Ionization chamber readings showed average radiation dosage rates of 1.2 mrep/day at locations within a 10 mile radius of the separation facilities. Similar measurements obtained in the residential areas ranged from 0.2 to 0.9 mrep/day. The activity density from filterable beta particle emitters in the atmosphere averaged from 8.4×10^{-13} to 3.2×10^{-12} $\mu\text{c/cc}$ at locations in the separation areas and averaged from

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2.5 to 5.9×10^{-13} $\mu\text{c/cc}$ at outlying locations. Significant increases in the number of radioactive particles in the atmosphere coincident with the Nevada tests reflected higher activity densities from filterable beta particle emitters during May and June. Prior to May 2, average particle concentrations were on the order of 1 to 5×10^{-2} particles/ m^3 in the immediate environs and 3 to 5×10^{-4} particles/ m^3 at remote locations. During the latter part of May and early June, these values increased to on the order of 2 particles/ m^3 at isolated locations. In extreme cases, values in the range of 5 to 10 particles/ m^3 were detected at remote locations in Idaho and Montana over 24 hour periods. General decreases in the activity density from I^{131} in the atmosphere were observed at most locations; maximum concentrations observed near the Redox plant showed an average of 6×10^{-12} $\mu\text{c/cc}$ including a maximum weekly measurement of 1.8×10^{-11} $\mu\text{c/cc}$. The activity density from alpha particle emitters averaged 1 to 3×10^{-14} $\mu\text{c/cc}$ in the separation areas and less than 4×10^{-15} $\mu\text{c/cc}$ at perimeter and outlying locations.

SECTION IV - RADIOACTIVE CONTAMINATION IN HANFORD WASTES:

The average activity density from gross beta particle emitters in reactor effluent water admitted to the Columbia River ranged from 1.7 to 2.3×10^{-13} $\mu\text{c/cc}$ at the five reactor areas. The maximum measurement was 3.1×10^{-3} $\mu\text{c/cc}$ at the 107-B basin. The activity density from gross alpha particle emitters averaged less than 5×10^{-9} $\mu\text{c/cc}$ at all areas. Composite samples obtained from the waste sump at the Biology Farm showed the average activity density from I^{131} to be 2.6×10^{-6} $\mu\text{c/cc}$. With the exception of measurements obtained from samples collected at the 234-5 ditch, the activity density from radioactive contaminants in liquid and solid samples obtained from 200 Area waste sources showed little deviation from previous measurements. Mud samples from the 234-5 ditch showed average alpha particle emission of 2.5×10^{-3} $\mu\text{c/gm}$ including a maximum measurement of 1.5×10^{-2} $\mu\text{c/gm}$. Plutonium was detected in several samples obtained from this source.

SECTION V - RADIOACTIVE CONTAMINATION IN THE COLUMBIA RIVER.

Significant decreases in the average activity density from gross beta particle emitters in Columbia River water were caused by the increased dilution of reactor effluent by the greater flow of the river. Measured flow rates increased from 604,000 gallons per second on April 1 to 3,173,000 gallons per second on May 29. The maximum activity was detected below the 100-F Area where the average activity density was 4.9×10^{-6} $\mu\text{c/cc}$. A sample collected from this location during early April which showed 2.1×10^{-5} $\mu\text{c/cc}$ represented one of the most contaminated samples of river water obtained in the routine

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program over the past several years. Alpha particle emission averaged less than 5×10^{-9} $\mu\text{c/cc}$ at all river locations. Expected decreases in the activity density from beta emitters in raw water, which resulted from the higher flow rate of the Columbia River, were observed at all operating areas. Maximum measurements obtained at the 100-F Area averaged 8.4×10^{-7} $\mu\text{c/cc}$ including a maximum value of 9.1×10^{-7} $\mu\text{c/cc}$.

SECTION VI - RADIOACTIVE CONTAMINATION IN RAIN:

The results obtained from analyzing rain samples collected from 27 scattered locations showed no trend or change in the mean activity from beta particle emitters. Maximum activity was detected near the Redox Area where 3 samples averaged 1.8×10^{-5} $\mu\text{c/cc}$. Isolated results were weighted on the high side due to the deposition of radioactive particles in the rain collectors.

SECTION VII - RADIOACTIVE CONTAMINATION IN DRINKING WATER SUPPLIES AND TEST WELLS:

Seven Richland wells and two Benton City wells showed the mean activity density from alpha particle emitters to equal or exceed the sensitivity limit of the measurement throughout the quarter. The average activity density in Richland supplies was on the order of 5 to 6×10^{-9} $\mu\text{c/cc}$ and at Benton City 1.2×10^{-8} and 1.7×10^{-8} $\mu\text{c/cc}$. Uranium was identified as the contaminant in each case; mean values for Richland supplies ranged from 3 to 7×10^{-3} $\mu\text{g/cc}$ and at Benton City were on the order of 1.5×10^{-2} $\mu\text{g/cc}$. These results were consistent with previous measurements. Trace activity from beta particle emitters were noted in the sanitary water in the 100-F and 100-H Areas, and in Kennewick and Pasco where the source of drinking water is the Columbia River. Maximum measurements found at Pasco averaged 2.5×10^{-7} $\mu\text{c/cc}$ including a maximum value of 6×10^{-7} $\mu\text{c/cc}$. Initial samples of backwash material collected from the anthracite coal filter at the Pasco Filter Plant showed the activity density from gross beta emitters to be on the same order of magnitude as that measured in backwash material from the sand filter. Radiochemical analyses of samples of drinking water supplies obtained from remote locations in the Yakima Valley showed no detectable emission. General increases noted in the activity density from gross alpha particle emitters in the 300 Area wells were consistent with observations made during this same three month period in previous years.

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INTRODUCTION

This document summarizes the results of measurements performed by the Regional Survey group to determine the magnitude and extent of radioactive contamination in the Hanford environs during April, May and June, 1952. Monitoring methods and techniques used during this period were similar to those outlined in previous quarterly reports of this series (HW-23133, HW-24203, and HW-25866). Analytical procedures used by the Control Laboratory for the radio-chemical analysis of liquid, gaseous, and solid samples are outlined in HW-20136. The counting rates obtained from these analyses were corrected for geometry, backscatter, self-absorption, air-window absorption, collection efficiency, source size, chemical yield, and weight/volume by factors summarized in documents HW-22682 and HW-23769. Decay corrections were applied to measurements for specific isotopes and to selected gross beta measurements which included short half-life emitters.

The location of monitoring stations referred to in the discussion may be identified from a series of maps presented in HW-25866. Separate location maps were included for each of the general types of environmental monitoring.

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SECTION I

RADIOACTIVE CONTAMINATION IN EFFLUENT GASES

Samples of the effluent gases from the separations areas were collected from the fifty-foot level of the stacks and from the sand filters; new monitoring facilities were installed and those of one location were discontinued during this quarter.

An average of four curies of I^{131} per day was discharged to the atmosphere this quarter from the separations facilities; ruthenium emitted from the Redox Stack averaged less than 0.1 curie per day, with the maximum measurement of 1.7 curies per day occurring during June. The amount of plutonium discharged to the atmosphere averaged less than 1 mg per day; uranium emission ranged from 6 to 440 mg per day, the latter measurement being obtained at the Redox Stack during April.

Results obtained from measurements at each of the separations facilities are discussed below.

200 EAST AREA

The sampling program at B-Plant was discontinued after April 14, 1952 because of curtailment of operations at this facility. The dissolving schedule of B-Plant was relatively light; 12 dissolving operations were undertaken during this quarter compared to 88 last quarter.

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TABLE I
SUMMARY OF RESULTS FROM STACK MONITORING
200 EAST AREA STACK

<u>Month</u>	<u>Curies of I¹³¹</u> <u>Dissolved per</u> <u>24 hrs.</u>		<u>Curies I¹³¹</u> <u>Emitted Daily</u>		<u>Curies Emitted</u> <u>Through Sand</u> <u>Filter Daily</u>	
	<u>Maximum</u>	<u>Average</u>	<u>Maximum</u>	<u>Average</u>	<u>Maximum</u>	<u>Average</u>
April	2140	190	0.26	0.03	0.08	0.02
Last Quarter	3960	910	1.6	0.2	0.05	0.02

One air filter sample obtained during the first part of April indicated that slightly less than 0.1 mg of plutonium and 66 mg of uranium were discharged to the atmosphere daily from the B-Plant stack. These values were comparable to those obtained during previous quarters.

200 WEST AREA - T-PLANT STACK

Table II summarizes the results obtained from I¹³¹ monitoring at the T-Plant facility during the quarter.

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TABLE II
SUMMARY OF RESULTS FROM STACK MONITORING
200 WEST AREA STACK
APRIL, MAY, JUNE
1952

Month	Curies of I ¹³¹ Dissolved per 24 hrs.		Curies I ¹³¹ Emitted Daily		Curies Emitted Through Sand Filter Daily	
	Maximum	Average	Maximum	Average	Maximum	Average
April	3040	1020	9.2	2.8	9.4	2.6
May	2580	570	8.0	1.2	0.9	0.3
June	290	50	4.3	0.7	0.5	0.1
Quarter	3040	580	9.2	1.7	9.4	1.3
Last Quarter	3530	1130	8.5	1.8	2.6	0.7

The average daily I¹³¹ emission was nearly identical to that measured during the previous quarter. The difference between the individual monthly averages was associated with the dissolving schedules; a relatively heavy schedule was undertaken in April and a very light schedule in June.

Spot filter samples at T-Plant showed an average of 0.4 mg of plutonium and 5.9 mg of uranium emitted to the atmosphere daily from this facility. These values were in accord with the results from similar measurements obtained during previous quarters.

200 WEST AREA - REDOX STACK

Monitoring at the Redox Stack for I¹³¹ and ruthenium emission was continued during the quarter. Table III summarizes the results obtained from the I¹³¹ monitoring at the stack and sand filter; Table IV summarizes the results obtained from the ruthenium monitoring at the stack.

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TABLE III
SUMMARY OF RESULTS FROM I¹³¹ MONITORING
REDOX STACK AND SAND FILTER*
APRIL, MAY, JUNE
1952

<u>Month</u>	<u>Curies of I¹³¹</u> <u>Dissolved per</u> <u>24 hrs.</u>		<u>Curies I¹³¹</u> <u>Emitted Daily</u>		<u>Curies Emitted</u> <u>Through Sand</u> <u>Filter Daily</u>	
	<u>Maximum</u>	<u>Average</u>	<u>Maximum</u>	<u>Average</u>	<u>Maximum</u>	<u>Average</u>
April	1290	530	14	1.9	-	-
May	1610	640	21	4.3	0.027	0.0035
June	1600	380	3.5	1.1	-	-
Quarter	1610	520	21	2.5	-	-
Last Quarter	990	105	2.0	0.2	-	-

* The sand filter sampling equipment was not operated continuously during this quarter.

TABLE IV
SUMMARY OF RESULTS FROM RUTHENIUM MONITORING
REDOX STACK
APRIL, MAY, JUNE
1952

<u>Month</u>	<u>Curies Of Ruthenium Emitted Per Day</u>					
	<u>Filter Collection</u>		<u>Scrubber Collection</u>		<u>Total</u>	
	<u>Maximum</u>	<u>Average</u>	<u>Maximum</u>	<u>Average</u>	<u>Maximum</u>	<u>Average</u>
April	0.008	0.0008	0.95	0.013	0.95	0.014
May	>0.070*	0.0069	0.15	0.011	>0.07	0.018
June	1.7	0.22	0.21	0.016	1.7	0.24
Quarter	>1.7	0.077	0.95	0.012	>1.7*	0.086

* Two filters contained too much ruthenium to allow accurate analysis. These filters were removed May 23 and 24, 1952.

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Monitoring facilities at Redox differ from those at the other separations area stacks by the inclusion of a CWS Type 6 filter preceding the scrubber system. This filter removes the particulate matter in the gas stream although the absorption of certain chemical forms of ruthenium on the filter does not allow true evaluation of the particle emission by this means.

Short periods of unusually high I^{131} , Ru^{103} , Ru^{106} and radioactive particle emission from the Redox facility were noted during the quarter and a preliminary investigation to determine their cause was conducted. The particulate matter emitted from the stack and containing the occluded activity, ranged from microscopic translucent hygroscopic crystals adhering to the soil sand, to visible chalky particles varying in shape and size with a few having a diameter of approximately $1/2''$. These larger visible particles were easily fractured and apparently were a conglomerate of the microscopic crystals with the beta particle activity varying in direct relationship with size. Chemical analysis of the inactive material showed the composition to be mainly ammonium nitrate with a small amount of occluded dust particles. The major radioactive isotopes present were Ru^{106} , Ru^{103} and I^{131} . The total radioactive Ru present varied from 90 to 98% of the total beta particle activity with I^{131} ranging from 1 to 5 per cent.

Samples were collected in the 202-S sample galleries downstream of the glass wool filters in the oxidizer, vessel vent, and condenser vent systems, and downstream of the reactors A-3 and B-3 to determine the contribution of each system to the total material exhausted through the stack. An attempt was made to correlate the results of these samples with those of the stack and sand filter samples. Quantitative evaluation of the amount of activity which was being contributed to the stack gases by these systems was not possible because of the erratic and unknown flow rates through each system. However, some conclusions could be drawn

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from the sample results. Radioautographs of filters and analysis of filters and scrubbers from the Redox and filters sampling positions revealed that the efficiency of this unit was at least 99 per cent, and that very little activity was being emitted to the stack via this source. Results of laboratory analyses of filters and scrubbers from the downstream side of the silver reactors indicated that these units were not the major sources of the I^{131} or of the particulate activity being emitted from the stack.

Samples taken downstream of the glass wool filter in the oxidizer vent system indicated that, during periods when the ruthenium scrubber was not in operation and oxidation was in progress, significant amounts of I^{131} and ruthenium may be passed to the stack. The activity density from ruthenium of gases passing through the glass wool filters in the vessel vent and condenser systems was found to be relatively high compared to that at the stack, but the ratio of the volumes of gas passed through these filters to the total volume passed up the stack was not known.

A pilot model of a constant gas monitor, installed by the Environmental Hazards and General Studies Unit, was operated during June to give further information concerning the cycle of operation during which high evolution occurred. Results of such monitoring indicated satisfactory operation of the silver reactors.

Further investigation of the vent systems was curtailed in favor of the more comprehensive investigation initiated by Separations Technology personnel with the cooperation of Radiation Monitoring Unit personnel and this group.

Filter samples from the Redox Stack indicated an average of 0.03 mg of plutonium and 440 mg of uranium per day emitted to the atmosphere. There is no explanation for the unusually high uranium measurement which was obtained in April.

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Plans for making sanitary water available at the Redox Stack sample shack were formulated during the quarter and an excavation permit was issued. Water is necessary at this location for safety reasons, for mixing scrubber solutions, and for operating an air conditioner to prevent over-heating of the motoairs.

200 WEST - TBP PLANT

Equipment for monitoring the effluent gases from the 291-U stack was designed and installed at the 292-U Building this quarter. The facilities installed allow monitoring by a filter and scrubber system in series.

100 AREAS

Measurements for C^{14} , S^{35} , tritium oxide and radioactive particles at the reactor area stacks are summarized in Table V below. The units were changed from the activity per volume of gas used last quarter to the present basis of activity emitted per day by estimating the flow through each stack to be 1.5×10^5 cubic feet per minute. (1)

TABLE V
SUMMARY OF STACK MONITORING RESULTS
REACTOR AREAS
APRIL, MAY, JUNE

<u>Activity</u> <u>Type</u>	<u>100-D</u>		<u>100-F</u>		<u>100-H</u>	
	<u>Maximum</u>	<u>Average</u>	<u>Maximum</u>	<u>Average</u>	<u>Maximum</u>	<u>Average</u>
C-14						
c/day	$<6.0 \times 10^{-3}$	$<6.0 \times 10^{-3}$	1.6×10^{-2}	$<6.0 \times 10^{-3}$	7.6×10^{-3}	$<6.0 \times 10^{-3}$
S-35						
c/day	$<7.5 \times 10^{-4}$	$<7.5 \times 10^{-4}$	$<7.5 \times 10^{-4}$	$<7.5 \times 10^{-4}$	$<7.5 \times 10^{-4}$	$<7.5 \times 10^{-4}$
Tritium Oxide						
c/day	0.44	0.10	0.96	0.14	2.2	0.10
Radioactive						
Particles						
ptles/day	8.5×10^5	5.8×10^4	3.4×10^6	1.8×10^6	6.6×10^6	1.6×10^6

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SECTION II

RADIOACTIVE CONTAMINATION ON VEGETATION

The amounts of I^{131} and non-volatile beta particle emitters deposited on vegetation in the environs of the Hanford Works were measured by analyzing over 2900 vegetation samples. Over 2,000 of these samples were obtained from locations on the Hanford Project and in the adjoining communities of the Tri-City area; over 800 samples were collected from locations in southern and eastern Washington and northern Oregon. Table I summarizes the results obtained from these measurements; average values obtained from similar measurements during the previous quarter are included for comparison.

The amount of I^{131} deposited on vegetation at nearly all locations in the immediate environs decreased during this quarter. Near the 200 East Area, this decrease was partially associated with the reduction in operation of the B facility during the latter part of April; the general decrease was also influenced by desirable meteorological conditions which tended to dilute the separation stack effluent to trace quantities at the project perimeter.

The significance of the decrease in I^{131} deposition during this quarter may be further appraised by reviewing the data summarized in Table II which shows these results on a month to month basis throughout the quarter.

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TABLE I
RADIOACTIVE CONTAMINATION ON VEGETATION
APRIL, MAY, JUNE
1952

Location	No. Samples	units of 10^{-6} $\mu\text{c}/\text{gram}$		Non-Volatile units of 10^{-6} $\mu\text{c}/\text{gram}$	
		Maximum	Average	Maximum	Average
North of 200 Areas	212	19	4	390	70
Near the 200 Areas	177	52	10	710	97
Route 3	13	220	31	330	100
200 West Gate	126	220	48	310	100
200 East Tower #16	127	80	12	720	70
Batch Plant	45	110	26	590	70
Meteorology Tower	13	39	4	230	80
South of 200 Areas	351	34	5	550	100
Richland and Kadlec Hosp.	168	18	<3	660	70
Pasco, Sacajawea Pk. and Jct. U. S. Hwy. 410	75	41	<3	490	90
Kennewick and Kenn. Highlands	118	200	4	560	65
Benton City and Cobb's Corner	38	13	<3	160	50
Richland "Y"	13	8	<3	140	50
Hanford	26	18	6	310	100
200 East Area	48	24	11	800	70
200 West Area	65	190	41	300	50
Redox Const. Area	90	220	31	620	110
Wahluke Slope	153	19	5	480	120
Goose Egg Hill	57	97	14	1000	230
Rattlesnake Mountain	93	18	5	1000	50
PSN 300-310-320	39	47	15	250	53
Off-Area Sampling					
Pasco to Ringold	74	22	6	500	200
Prosser to Patterson-McNary	245	12	<3	1060	55
Eastern Washington	212	22	<3	210	41
So. Washington and No Oregon	220	14	<3	580	38
Yakima Barricade to Ellensburg	85	10	<3	1020	78
Priest Rapids	3	22	7	123	94

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TABLE II
ACTIVITY DENSITY FROM I¹³¹ ON VEGETATION
APRIL, MAY, JUNE
1952

Location	units of 10 ⁻⁶ μ c/gram					
	April		May		June	
	Maximum	Average	Maximum	Average	Maximum	Average
North of 200 Areas	18	3	19	5	13	5
Near the 200 Areas	52	9	33	12	32	8
Route 3	220	90	60	32	34	22
200 West Gate	220	97	170	37	37	14
200 East Tower	34	10	80	14	37	11
Batch Plant	56	31	110	33	38	15
Meteorology Tower	39	24	29	18	17	10
South of 200 Areas	38	5	34	7	28	5
Richland	7	<3	18	<3	15	<3
Pasco Environs	41	4	21	<3	9	<3
Kennewick Environs	202	7	16	<3	14	<3
Benton City	7	<3	13	<3	10	<3
Richland "Y"	3	<3	6	<3	8	<3
Hanford	14	5	14	7	18	5
200 East Area	15	7	22	12	24	13
200 West Area	170	52	190	42	110	27
Redox Const. Area	160	56	220	43	96	27
Wahluke Slope	17	4	19	8	9	<3
Goose Egg Hill	96	18	41	16	23	7
Rattlesnake Mountain	18	6	14	5	12	5
PSN-300-310-320	41	14	43	17	47	13
Off Area Sampling						
Pasco to Ringold	14	4	22	10	15	3
Prosser to Patterson-McNary	5	<3	12	<3	11	<3
Eastern Washington	22	<3	7	<3	16	<3
So. Washington and No. Oregon	4	<3	14	<3	6	<3
Yakima Barricade to Ellensburg	6	<3	10	4	4	<3
Priest Rapids	--	--	11	7	--	--

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Maps showing estimated lines of iso-activity based on the results obtained from individual locations for the months of April, May, and June are presented in Figure 1, 2, and 3. A review of these presentations shows that the area in which the activity density from I^{131} exceeded $1 \times 10^{-4} \mu\text{c/gm}$ was confined to a small region on the order of 1 to 2 square miles located in the southwest corner of the 200 West Area. The location of the higher deposition correlates favorably with the stack emission data (Section I) indicating that the source of most of the I^{131} measured during this period was the Redox Area. During April and June, large areas within the project showed the activity density from I^{131} to be below the detection limit of $3 \times 10^{-6} \mu\text{c/gm}$. This quarter represents the first period in which I^{131} concentration was below the detection limit over large areas of the Hanford Project since the increased production schedules were effected in 1950 and 1951. The deposition of I^{131} during the month of May (Figure 2) covered a much larger area than that found during April and June (Figures 1 and 3) and was directly associated with the increased emission of I^{131} at the Redox facility. An average of 4.3 curies of I^{131} per day were emitted from the Redox Area during May as compared with average emission of 1.9 and 1.1 curies per day during April and June, respectively.

A comparison of these data with similar measurements obtained during the same period in 1951 shows a highly significant decrease in I^{131} deposition. Maximum measurements during 1951 were on the order of $2 \text{ to } 6 \times 10^{-2} \mu\text{c/gm}$ at many locations whereas current maximum measurements were on the order of $2.2 \times 10^{-4} \mu\text{c/gm}$. The higher measurements in 1951 resulted from the failure of the silver reactors in the off-gas lines of the dissolvers.

A composite of the measurements illustrated in Figures 1 through 3 is presented in Figure 4 which shows the estimated I^{131} deposition based on all samples collected during the three month period.

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TABLE III
RADIOACTIVE CONTAMINATION ON VEGETATION
OFF AREA LOCATIONS
APRIL, MAY, JUNE
1952

<u>Location</u>	<u>units of 10^{-6} $\mu\text{C/gm}$</u>			<u>Non-Volatile Emitters</u>	
	<u>No. Samples</u>	<u>Maximum</u>	<u>Average</u>	<u>Maximum</u>	<u>Average</u>
Yakima Barricade to Ellensburg	21	10	<3	1020	150
Yakima	10	5	<3	314	72
Yakima to Ellensburg	12	3	<3	28	12
Ellensburg	8	<3	<3	23	16
Buena	8	3	<3	21	14
Zillah	8	4	<3	33	<10
Granger	3	<3	<3	13	12
Sunnyside	8	4	<3	18	<10
Sunnyside to Herse Thief Point	6	6	<3	19	16
Moxee	13	8	<3	490	100
Union Gap	6	<3	<3	57	20
Wapato	12	<3	<3	82	32
Toppenish	12	<3	<3	37	24
Toppenish to Goldendale	27	4	<3	130	27
Goldendale	12	10	<3	80	23
Goldendale to Wishram	9	6	<3	113	41
Lyle	6	<3	<3	22	10
Bingen	6	4	<3	23	17
Camas	12	3	<3	24	14
Vancouver	12	5	<3	64	20
Portland	12	<3	<3	21	12
Troutdale	6	<3	<3	17	<10
Bonneville	6	3	<3	36	18
The Dalles	12	<3	<3	105	24
Moody	6	<3	<3	192	66
Rufus	6	4	<3	103	41
Blalock	6	6	<3	173	61
Arlington	4	<3	<3	42	24
Heppner Jct.	6	<3	<3	132	56
Boardman	6	<3	<3	73	34
Umatilla	6	3	<3	101	38
Cold Springs	2	14	13	584	514
Pendleton	4	8	5	425	294
Meacham	2	4	4	178	136
Stanfield Jct.	1	10	10	--	--
Wallula	12	6	<3	177	79
Touchet	6	6	<3	139	51
Louden	6	3	<3	64	27
Walla Walla	12	7	<3	64	31
Dixie	6	<3	<3	66	40
Waitsburg	12	4	<3	160	65
Dayton	12	3	<3	214	70

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TABLE III (contd.)

Location	units of 10^{-6} ^{131}I $\mu\text{c/gm}$			Non-Volatile Emitters	
	No. Samples	Maximum	Average	Maximum	Average
Dodge	4	<3	<3	24	20
Pomeroy	12	4	<3	104	32
Lewiston	12	4	<3	109	43
Uniontown	6	<3	<3	183	36
Pullman	12	<3	<3	66	35
Colfax	10	<3	<3	143	61
Steptoe	6	3	<3	107	39
Rosalia	6	<3	<3	38	21
Spangle	6	3	<3	98	45
Spokane	12	3	<3	38	22
Cheney	12	16	<3	65	24
Sprague	12	3	<3	49	29
Ritzville	12	3	<3	40	20
Lind	12	4	<3	105	36
Connell	12	22	5	121	42

In general, the mean activity density averaged less than 3×10^{-6} $\mu\text{c/gm}$ in remote areas. Trace deposition was detected at only 6 of the 58 communities in which surveys were completed. The maximum deposition at an off-area location was found at Connell, Washington, where a sample showed 2.2×10^{-5} $\mu\text{c/gm}$.

The activity density from non-volatile beta particle emitters (results summarized in Tables I and III) at locations in the environs showed average values on the order of 2 to 6×10^{-5} $\mu\text{c/gm}$. This order of magnitude was slightly higher than that expected for normal Hanford operation and was apparently caused by particulate contamination deposited during the months of May and June from the third set of Nevada tests. Maximum measurements during the last two months of the quarter on the order of 1 to 3×10^{-4} $\mu\text{c/gm}$ were common, and in extreme cases, individual samples showed 5.8×10^{-4} $\mu\text{c/gm}$ and 1.0×10^{-3} $\mu\text{c/gm}$. Many of the higher values were found at remote locations. Figure 5 shows the random distribution of this deposition during the quarter.

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The results obtained from the analysis of vegetation samples collected on a bi-monthly basis from 9 scattered locations for the activity density of gross alpha particle emitters are presented in Table IV.

TABLE IV
ACTIVITY DENSITY FROM ALPHA EMITTERS ON VEGETATION
APRIL, MAY, JUNE

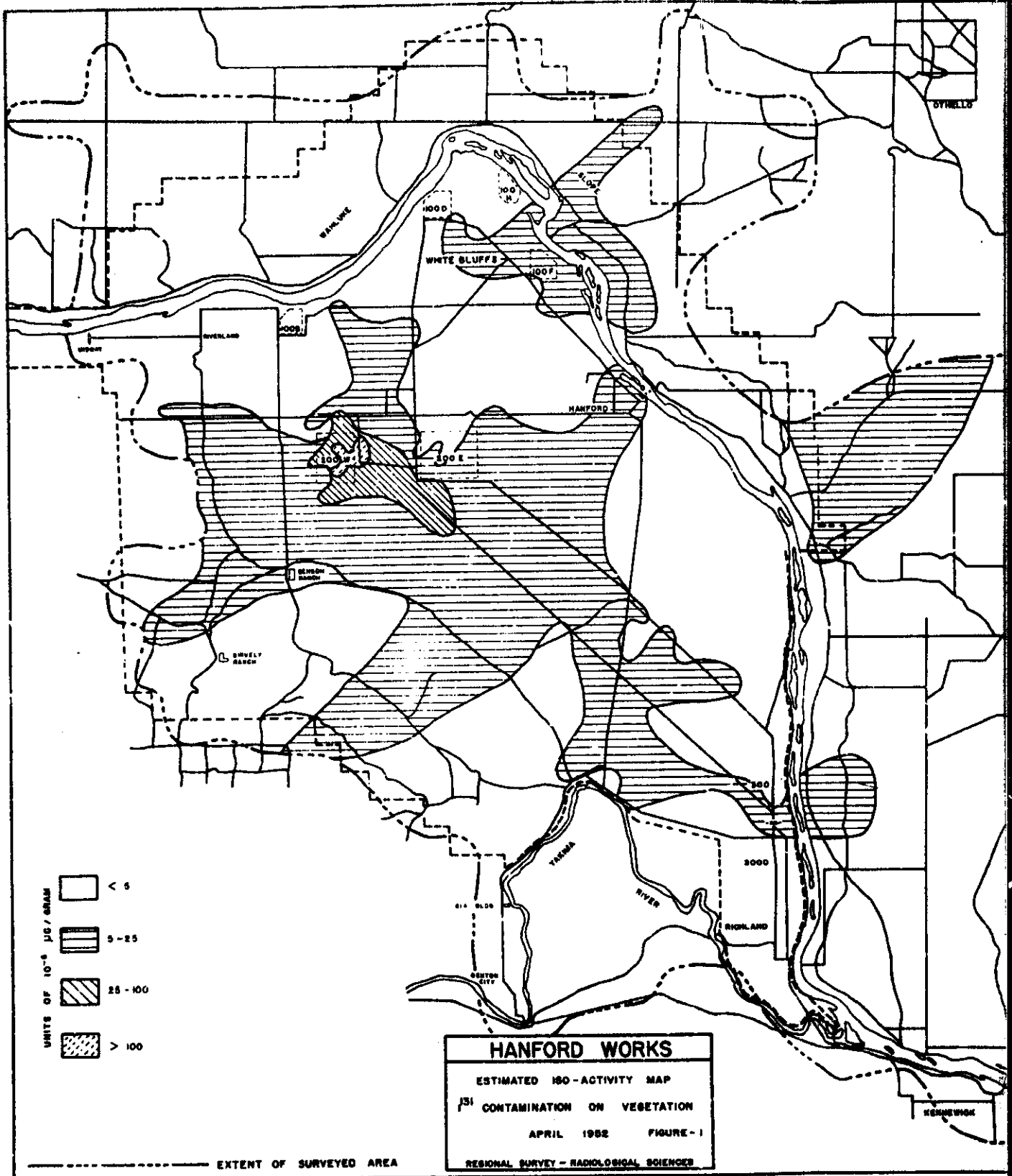
	1952				
	units of 10^{-8} $\mu\text{c/gm}$				
<u>Location</u>	<u>April</u>	<u>May</u>	<u>June</u>	<u>Quarterly Average</u>	<u>Maximum Result</u>
<u>Near 200 Areas</u>					
200 West Gatehouse	11	13	<5	9	18
Batch Plant	13	23	7	15	57
Route 4S, Mile 4	<5	6	7	5	13
Meteorology Tower	20	13	5	13	34
Route 4S, Mile 6	<5	6	<5	<5	13
300 Area	200	25	63	67	200
<u>Outlying</u>					
Richland	<5	<5	<5	<5	5
Pasco	<5	5	18	11	81
Benton City	<5	<5	<5	<5	6

The activity density from gross alpha emitters on vegetation decreased to 1/3 to 1/8 of values during the previous quarter at all locations during this period. Maximum measurements were observed near the 300 Area and this observation was consistent with trends observed in data collected since December of 1951.

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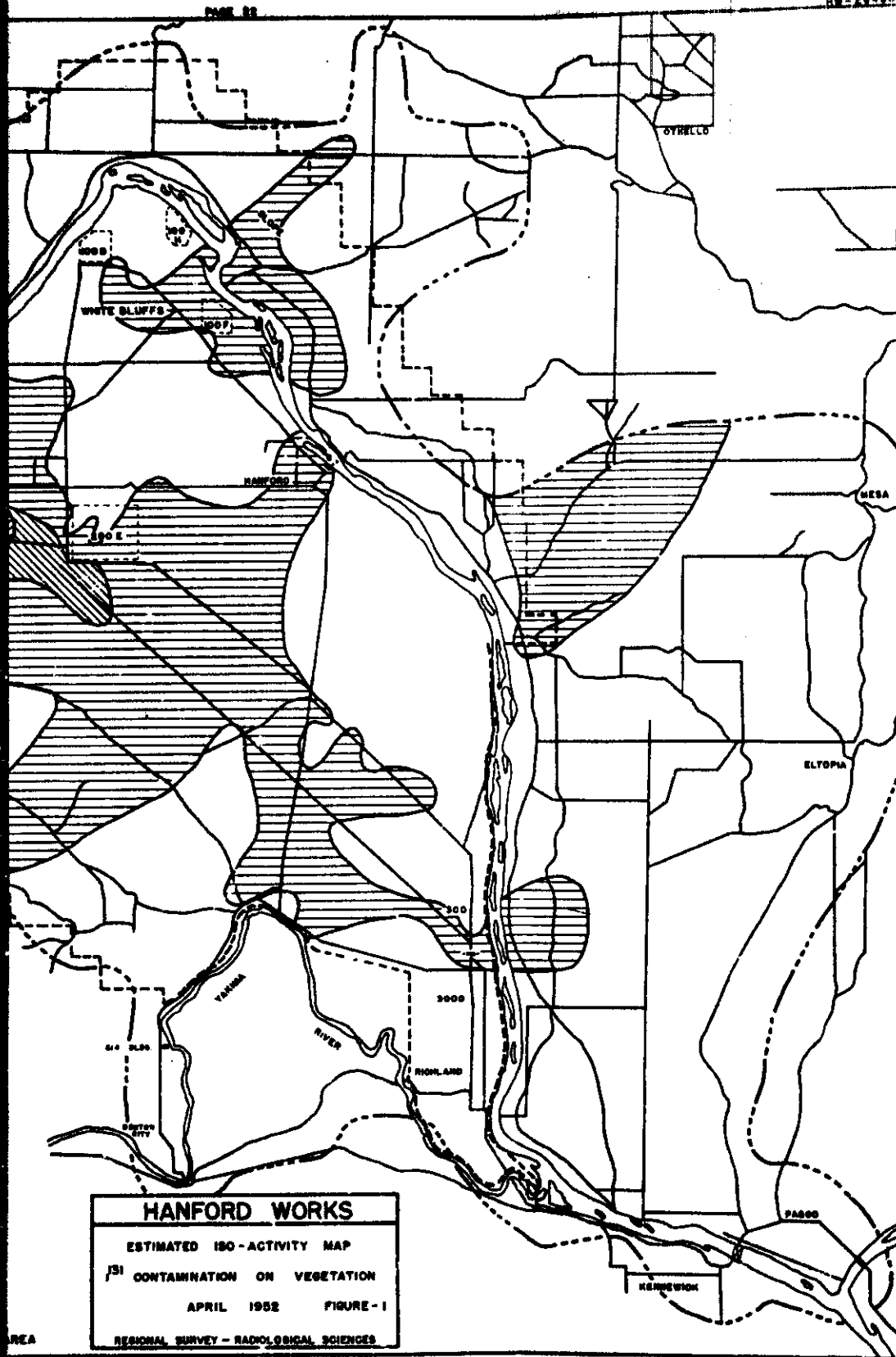


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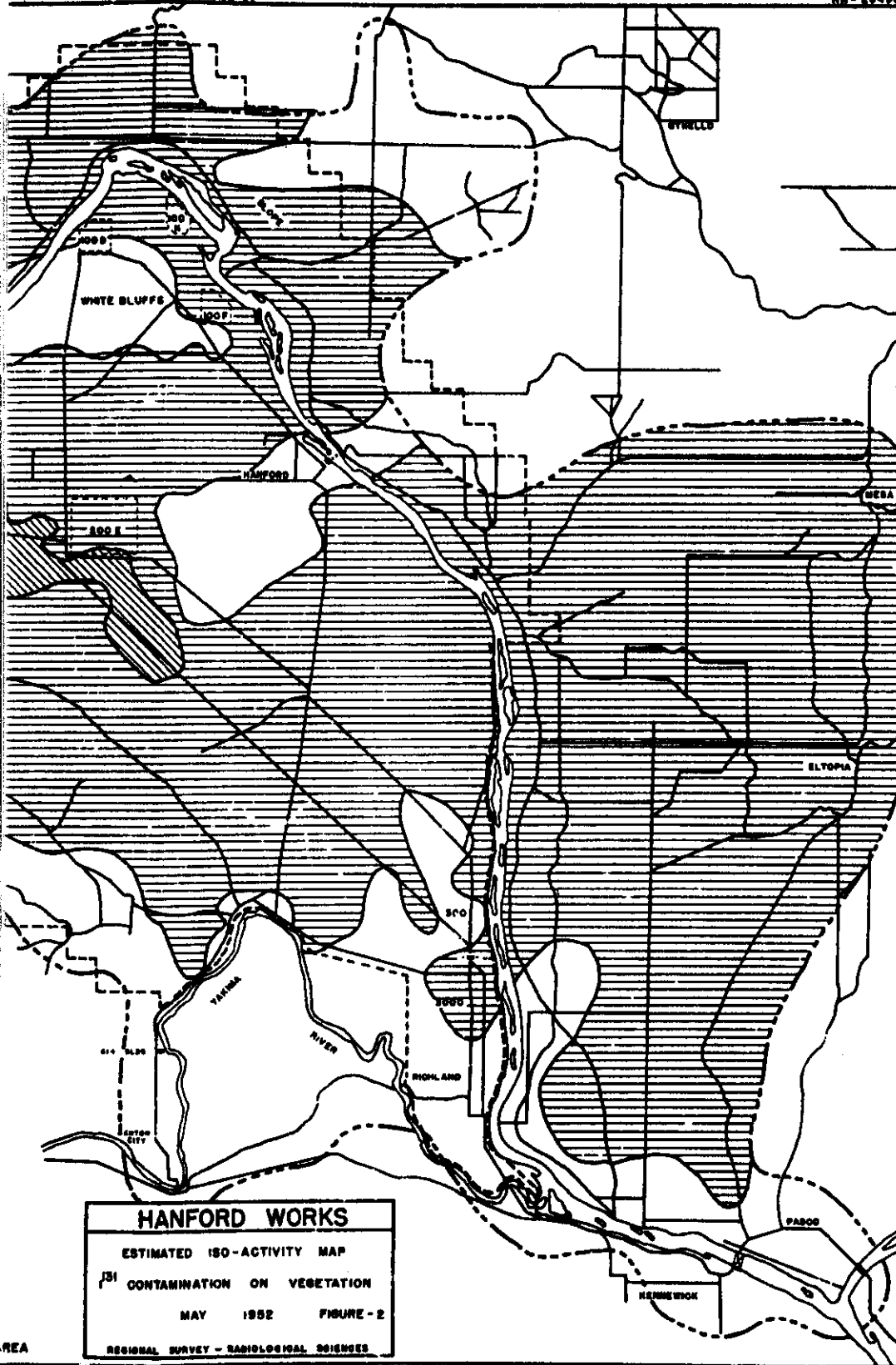
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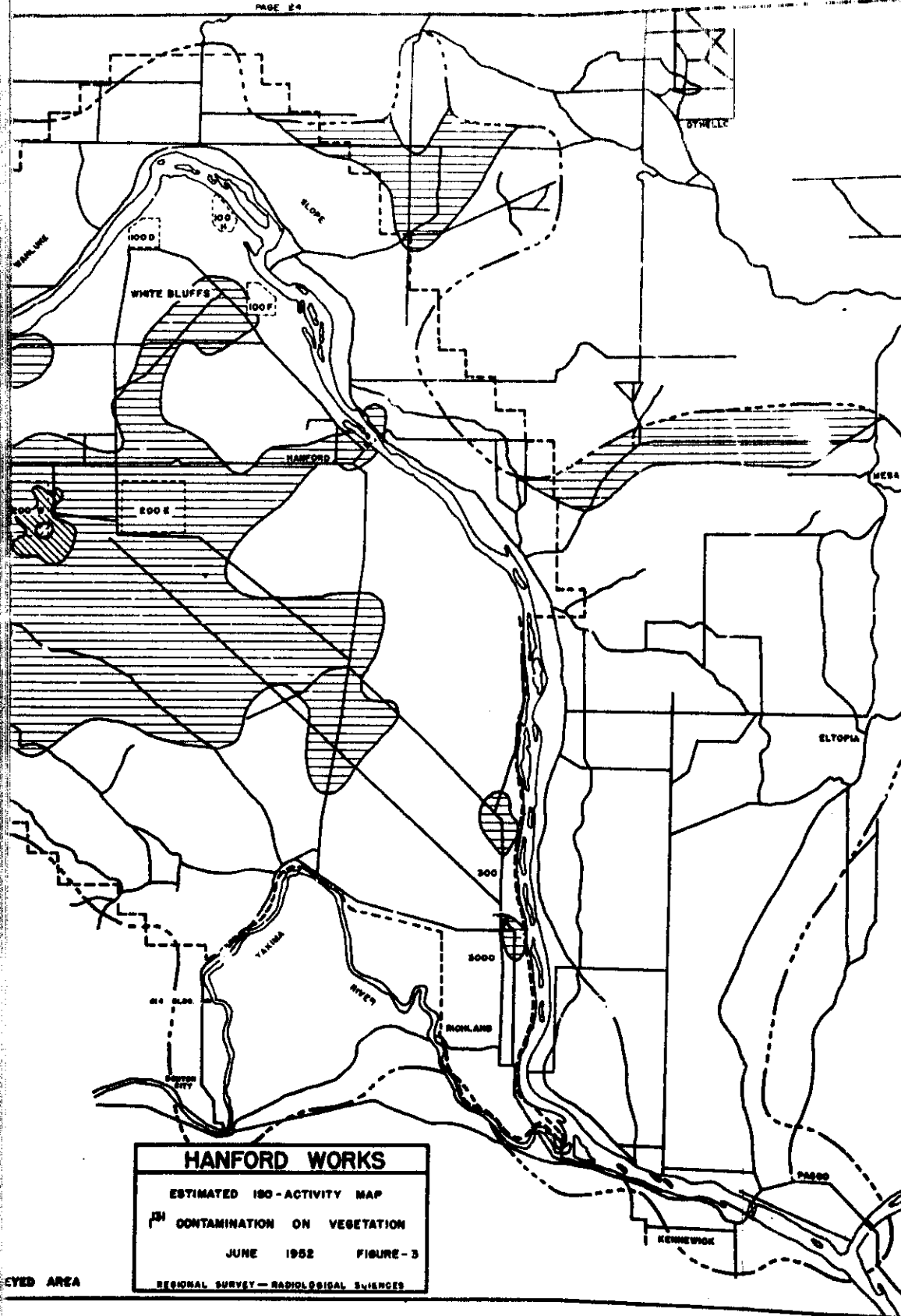
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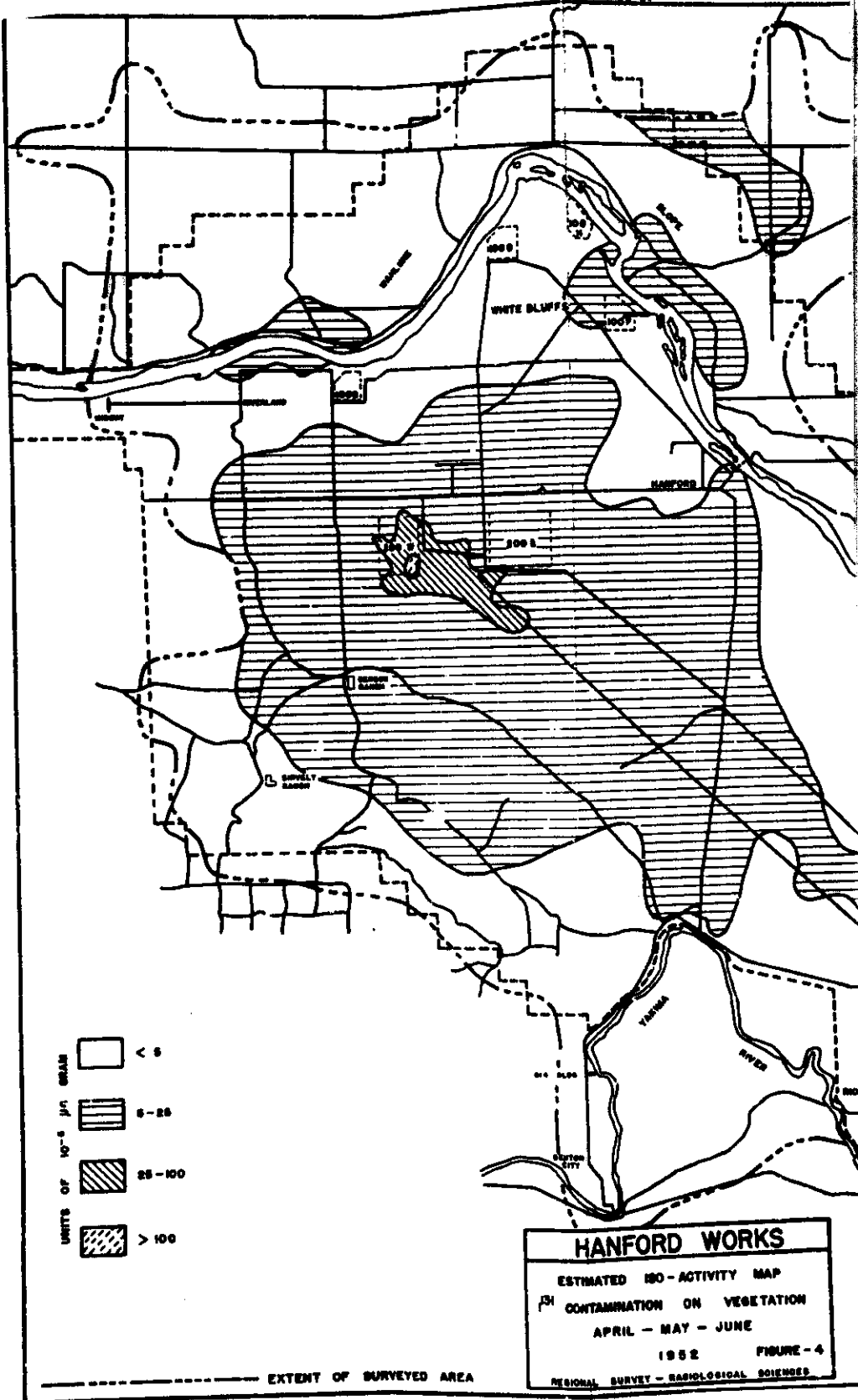


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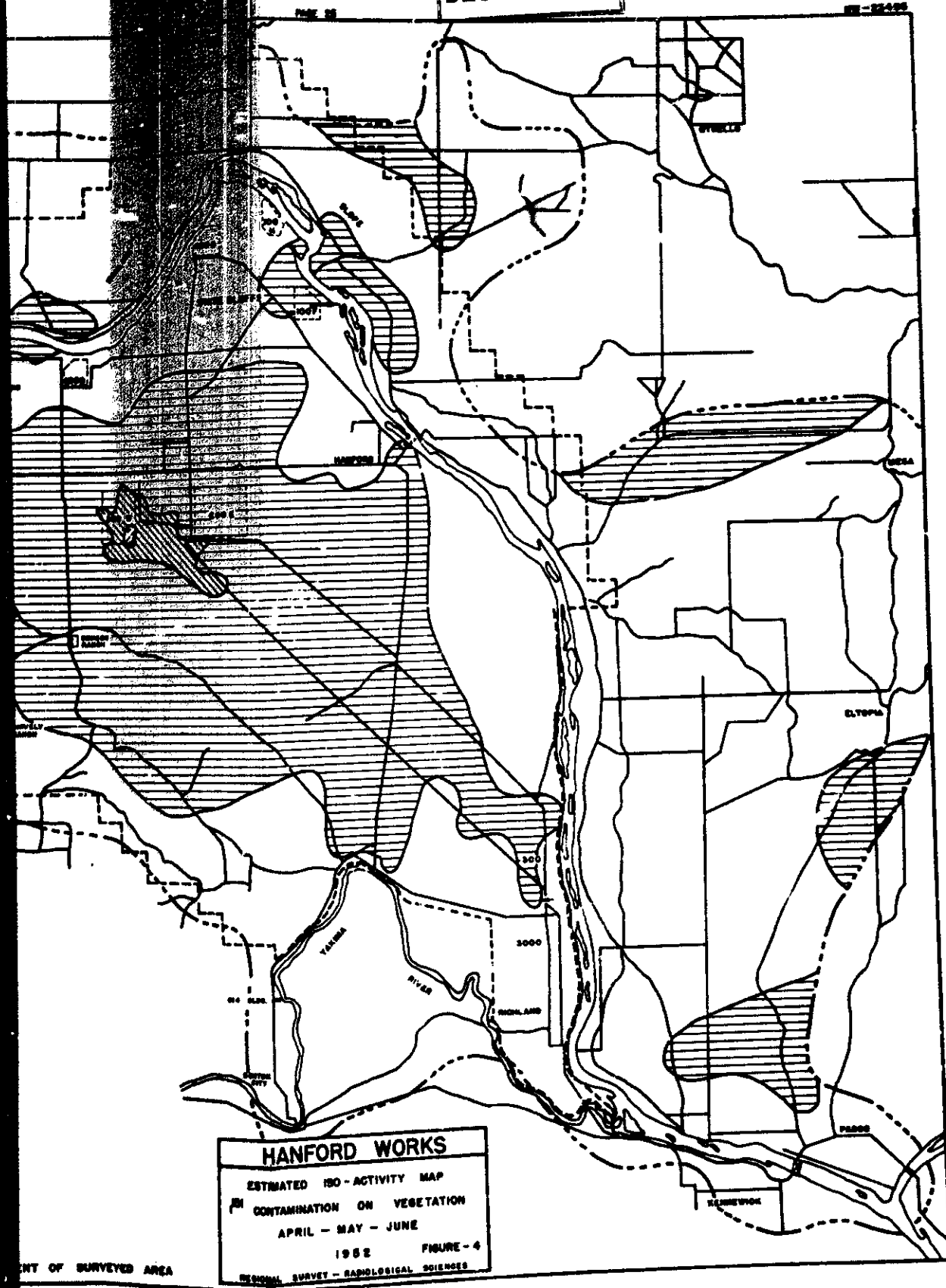
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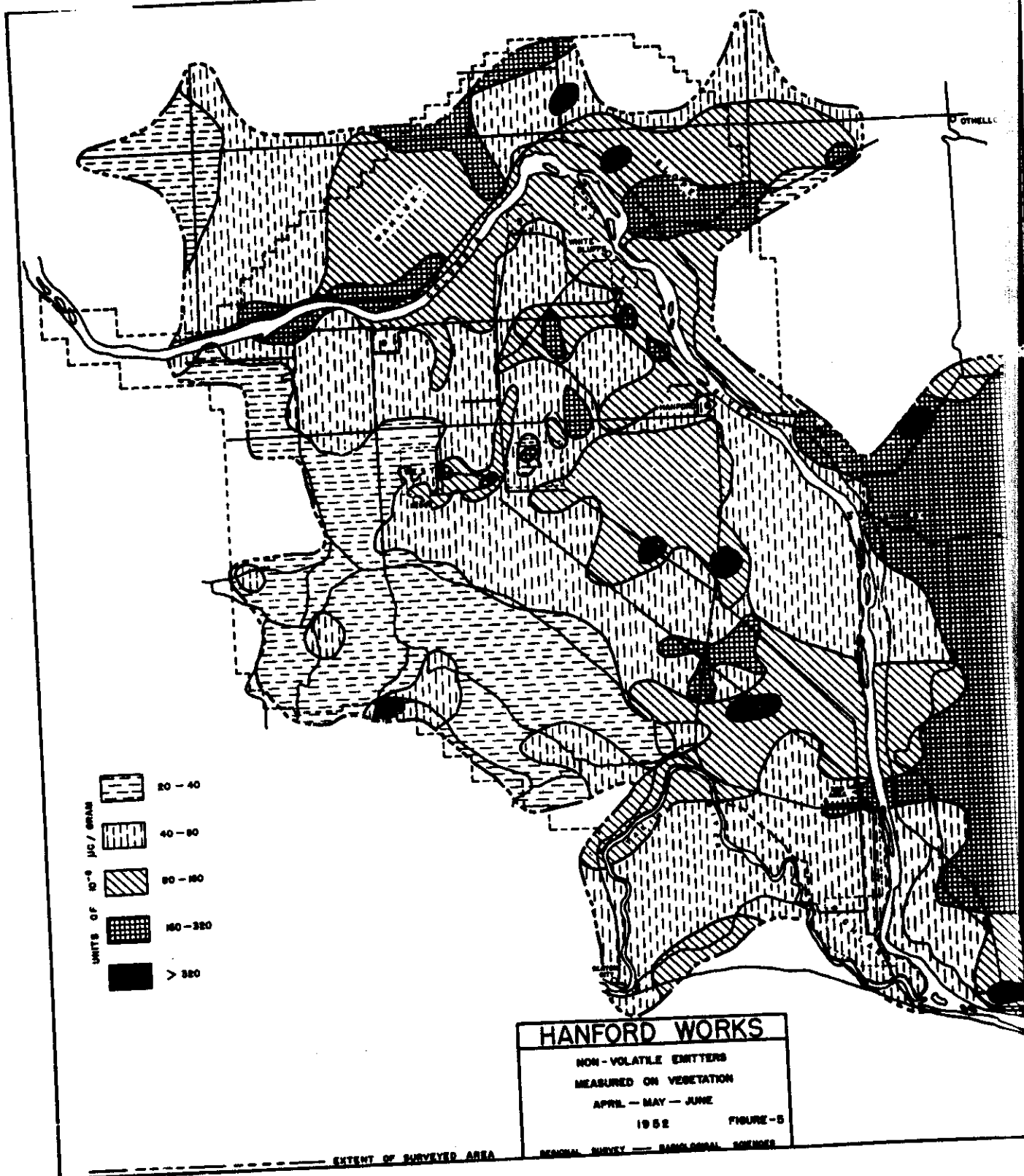
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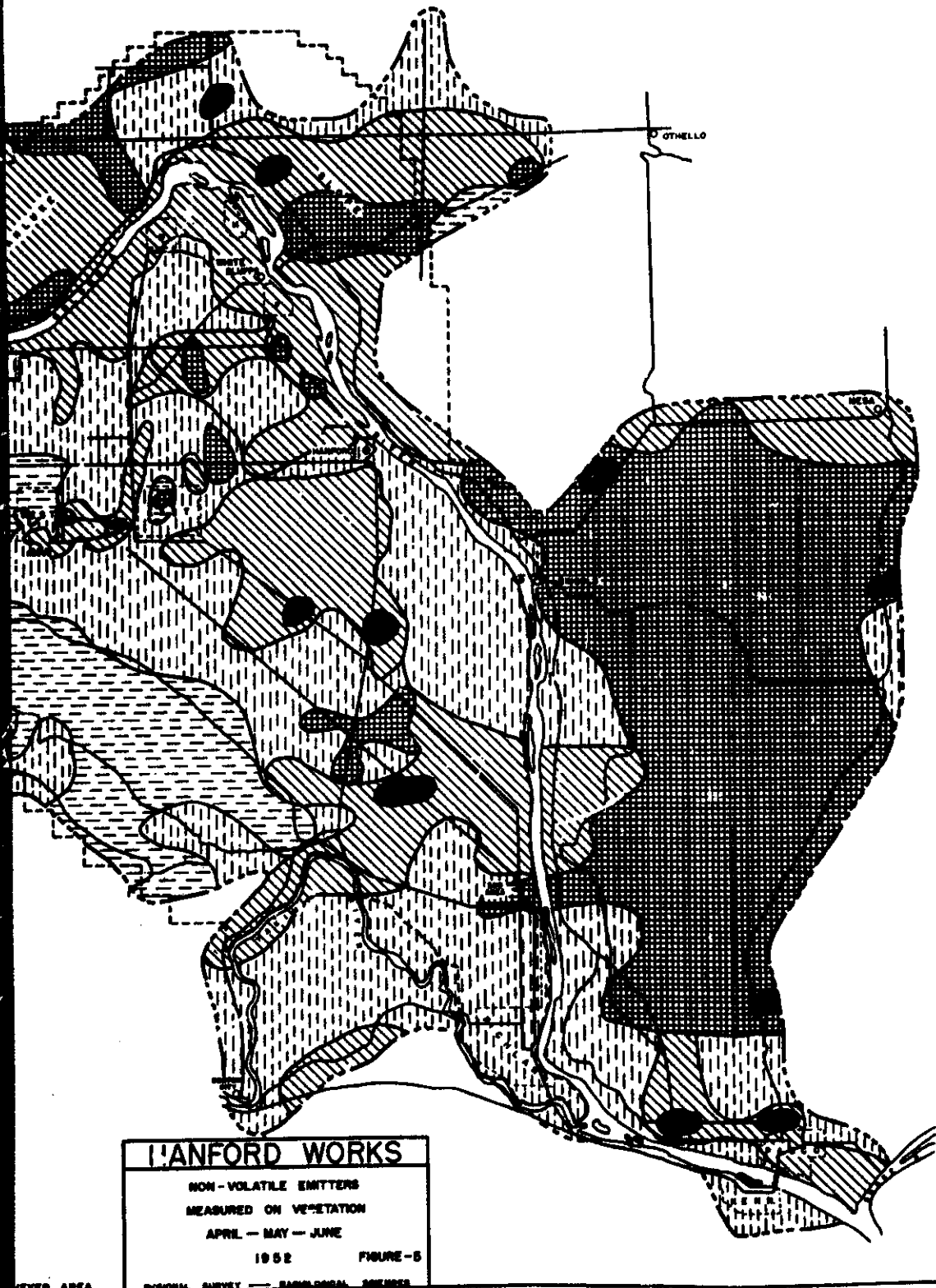


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SECTION IIIRADIOACTIVE CONTAMINATION IN THE ATMOSPHERE

Recorded data obtained from the operation of Victoreen integrators maintained at fixed locations throughout the environs were used to evaluate radiation dosage rates. Individual readings were obtained for each 8 hour interval throughout the period and the average dosage rate as presented in the following table represents the mean dosage rate tabulated from these accumulated readings.

TABLE I
AVERAGE DOSAGE RATES AS MEASURED BY VICTOREEN INTEGRONS
APRIL, MAY, JUNE
1952

<u>Location</u>	<u>units of mrep per 24 hours</u>				<u>Quarterly Average</u>
	<u>No. of Units</u>	<u>April</u>	<u>May</u>	<u>June</u>	
100-B Area	3	0.9	0.7	1.8	1.1
100-D Area	3	0.7	1.1	1.3	1.0
100-F Area	3	0.3	1.0	1.0	0.8
100-H Area	3	0.3	0.4	0.2	0.3
200 West Area	2	3.8	*	*	~ 3.8
200 East Area	4	1.2	0.4	0.3	0.6
Riverland	1	0.6	1.3	0.8	0.9
300 Area	1	1.1	0.9	1.0	1.0
Richland	1	1.3	1.2	1.7	1.4
Pasco	1	0.8	1.2	1.4	1.1
Benton City	1	0.9	1.8	1.9	1.5
North Richland North	1	0.9	0.8	0.9	0.9
North Richland South	1	1.5	1.3	0.9	1.2
Hanford	1	0.7	0.9	0.9	0.8
Kennewick	1	1.4	1.9	5.0	2.8
Redox	1	*	*	2.8	~ 2.8

* Recorded data obtained during these periods were not evaluated due to discrepancies caused by excessive leakage in the chamber.

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A comparison of the preceding data to those obtained during the previous quarter indicates a general increase in mean dosage rate throughout the environs. At many of the stations this increase tends to be weighted toward the middle and end of the quarter when the influx of particulate contamination from the Nevada tests appeared to influence the readings. Average dosage rates were approximately twice as high as those normally expected for Hanford operation. Dosage rates at perimeter locations such as Kennewick, Pasco, and Benton City were generally higher than those noted at locations near the Hanford facilities.

Detachable "C" type ionization chambers were placed inside the monitoring stations and the readings from these instruments were used to supplement the integron data. Two chambers were used at each installation and the reading which indicated the minimum discharge rate was used to determine the dosage. The results of these findings for individual and grouped locations are presented in Table II.

TABLE II
"C" TYPE DETACHABLE IONIZATION CHAMBERS
APRIL, MAY, JUNE

	<u>1952</u>				
	<u>Units of mrep per 24 hours</u>				
<u>Location</u>	<u>April</u>	<u>May</u>	<u>June</u>	<u>Quarterly Average</u>	
Within 100-B Area	0.4	0.3	0.3	0.3	
Within 100-D Area	0.5	0.5	0.5	0.5	
Within 100-F Area	0.4	0.4	0.3	0.4	
Within 200 West Area	0.4	0.9	0.4	0.4	
Within 200 East Area	0.5	0.6	0.5	0.5	

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Statistical comparison of the results summarized in Table II with the results obtained during the past several quarters showed no significant change or trend occurring during this period. The "C" type chambers apparently did not reflect the increase drawn by the integron monitoring because the chambers were located inside wooden buildings and the integron chambers were exposed to the outer atmosphere.

Detachable "M" and "S" type ionization chambers were used at intermediate locations for determining air radiation levels. Again, paired samples were used at each location and the mean discharge was evaluated in a manner comparable to that used for the "C" type ionization chambers. Table III summarizes the results of these measurements for individual and grouped locations.

TABLE III
RADIATION LEVEL OBSERVED WITH
"M" AND "S" TYPE DETACHABLE IONIZATION CHAMBERS
APRIL, MAY, JUNE
1952
Units of mrep per 24 hours

<u>Location</u>	<u>April</u>	<u>May</u>	<u>June</u>	<u>Quarterly Average</u>	<u>Group Average</u>
<u>100 Areas and Environs</u>					
Route I	0.54	0.49	0.39	0.47	
Route 2N, Mile 10	0.53	0.44	0.43	0.47	
Route 2N, Mile 5	0.41	0.47	0.41	0.43	
White Bluffs	0.42	0.46	0.43	0.44	
Route 11-A, Mile 1	0.70	3.28	1.15	1.71	
Hanford 614 Building	0.58	0.34	0.41	0.44	0.56
Intersection Rt. 1 and Rt. 4N	0.52	0.46	0.39	0.46	
Hanford 101 Building	0.43	0.48	0.41	0.44	
100-H Area	0.49	0.48	0.49	0.48	
P-11 Area	0.53	0.48	0.42	0.48	
100-B NE Construction	0.44	0.54	0.46	0.48	
100-B SE Construction	0.42	0.48	0.48	0.46	

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TABLE III (contd.)

<u>Location</u>	<u>April</u>	<u>May</u>	<u>June</u>	<u>Quarterly Average</u>	<u>Group Average</u>
Within 5 Miles of 200					
<u>East Area</u>					
Route 4S, Mile 6	4.10	1.82	0.98	2.30	
Batch Plant	0.48	0.59	0.54	0.54	
Route 11-A, Mile 6	0.78	0.94	0.43	0.72	
Route 3, Mile 1	1.18	1.64	1.45	1.42	
Meteorology 200'	0.39	0.46	0.42	0.42	
Route 4S, Mile 2.5	1.47	1.42	0.61	1.17	
Redox Area	1.92	1.15	1.49	1.52	1.20
Route 4S, Mile 4.5	1.28	0.61	0.57	0.82	
Semi-Works #1	1.29	0.81	0.85	0.98	
Semi-Works #2	0.84	0.85	1.67	1.12	
200 East PSN 300	0.94	1.05	1.91	1.30	
PSN 310	1.45	0.73	0.75	0.98	
PSN 320	0.80	2.51	0.68	1.33	
PSN 330	1.34	1.25	0.91	1.17	
Redox Outside *	1.60	1.12	1.27	1.33	
Within 10 Miles of 200					
<u>East Area</u>					
Route 4S, Mile 10	1.24	1.30	1.52	1.35	
Route 10, Mile 1	1.82	0.92	0.51	1.08	
Route 10, Mile 3	1.22	0.51	0.77	0.83	1.22
Route 2S, Mile 4	0.89	0.61	3.46	1.65	
Near 300 Area					
Route 4S, Mile 16	1.03	0.62	0.57	0.74	
Route 4S, Mile 22	0.80	1.10	0.64	0.85	
North Richland North	0.59	0.36	0.55	0.50	0.62
North Richland South	0.57	0.93	0.50	0.67	
300 Area	0.31	0.29	0.42	0.34	
<u>Outlying</u>					
Richland	1.13	0.84	0.62	0.86	
Benton City	0.55	0.36	0.55	0.49	
Pasco	0.31	0.28	0.25	0.28	
Kennewick	0.24	0.23	0.29	0.24	0.47

* Installation made April 17, 1952.

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The mean dosage rates for the grouped locations indicated in Table III were not significantly different from those previously measured or from expected values. Significant trends observed at several isolated locations such as Route 4S, Mile 6 and Route 4S, Mile 10 were minimized as many of the monitoring stations located between stations which indicated a trend, showed little or no deviation from previous measurements. As in the past, dosage rates measured at outlying locations were on the order of natural background for this region.

Continuous air samples, drawn through CWS #6 filter paper at a flow rate of 2.5 cfm were used to evaluate the activity density from filterable beta emitters in the atmosphere. Normally, these filters were exposed for a seven day period at a location; the filters were retained for several days prior to analysis to allow for the decay of the daughter products of natural emitters. Table IV summarizes the results obtained from this measurement.

Statistical analysis of the preceding data indicates that the decreasing trend in the mean activity density from filterable beta particle emitters observed during the previous quarter continued during the month of April and early May. During the middle of May, highly significant increases in this activity were noted at nearly all locations and continued to prevail throughout the balance of the quarter. Nearly all of the latter increases were directly associated with particulate contamination which presumably originated from the Nevada tests, and were not caused by emission from Hanford sources. A comparison of the quarterly average to that of the previous quarter shows the mean activity to be within a factor of 2 at all locations and not statistically different from that previously observed. Maximum measurements over a one week period showing 1.1×10^{-11} $\mu\text{c/cc}$ at the 202-S facility were identical to maximum values observed at this location during the previous quarter.

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TABLE IV
AVERAGE FILTERABLE BETA EMITTERS IN AIR
APRIL, MAY, JUNE

1952

<u>Location</u>	Activity Density - Units of 10^{-14} $\mu\text{c/cc}$				
	<u>April</u>	<u>May</u>	<u>June</u>	<u>Quarterly Average</u>	<u>Maximum Weekly</u>
<u>200 Areas and Vicinity</u>					
200 East Semi-Works	54	96	103	84	200
200 West Tower #4	67	170	130	120	290
200 West Redox Area	160	200	600	320	1080
Gable Mountain	14	60	130	69	230
200 East Tower #15	59	130	130	110	250
<u>100 Areas and Vicinity</u>					
100-D	19	79	86	61	160
100-H	45	72	110	74	160
Hanford 101 Building	8	38	52	33	79
Hanford 614 Building	10	97	80	62	170
White Bluffs	17	27	79	41	210
300 Area 614 Building	35	59	52	49	93
<u>Outlying</u>					
Richland	14	53	76	48	130
North Richland	6	29	39	25	65
Pasco	10	40	58	36	83
Kennewick	<4	15	58	24	85
Benton City	8	22	61	30	98
Riverland	10	71	96	59	160

Additional evaluations of the activity density from filterable emitters in the atmosphere were obtained from counting the activity on the filters removed from dual air monitors operated at several selected locations. The results obtained from these measurements are presented in Table V.

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TABLE V
AVERAGE FILTERABLE BETA EMITTERS IN AIR
DUAL UNIT AIR MONITORS
APRIL, MAY, JUNE

Location	1952				
	Activity Density - Units of 10^{-14} $\mu\text{c/cc}$				
	April	May	June	Quarterly Average	Maximum Weekly
200 West East Center #1	149	368	364	300	855
200 West East Center #2	60	64	39	55	240
200 East Southeast #1	37	74	110	74	186
200 East Southeast #2	36	86	95	73	168
Richland #1	20	65	78	55	123
Richland #2	8	42	73	41	127
<u>Meteorology Tower</u>					
Ground Level	68	97	95	89	199
200' Level	181	49	43	98	805
400' Level	13	30	39	28	55

As noted in the data collected from operating the single air monitors (Table IV), the average density from filterable beta particle emitters detected on filters removed from dual units generally showed lower values during the month of April and higher values during May and June. Again, the former trend was a continuation of a decrease observed during the previous quarter and the latter observation was apparently caused by particulate contamination from the Nevada tests. Statistical comparison of the average values of this and the previous quarter showed no significant difference.

Over 1,000 air filters were radioautographed during the three month period to determine the number of radioactive particles in the atmosphere. Approximately 20 percent of these filters were obtained from off-site locations in Washington, Idaho, Oregon, and Montana. Type K X-ray film

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was used for the radioautograph and the exposure periods to the film were on the order of 168 hours. The sensitivity of the measurement was on the order of 3 d/m based on C^{14} and Sr^{90} standards. The results of these measurements at on-area and off-area locations are summarized in Tables VI and VII, respectively.

Significant increases in the number of radioactive particles in the atmosphere were observed at nearly all locations during May and June. Data collected prior to May 2 showed average particle concentrations on the order of 1×10^{-2} to 5×10^{-2} particle/ m^3 in the immediate environs and values on the order of 3 to 5×10^{-4} particle/ m^3 at remote locations. Particulate contamination which presumably originated from the Nevada tests was detected on filters removed during the week of May 2 at all monitoring locations; the number of particles in the atmosphere at most locations rose to a value on the order of 0.1 to 0.5 particle/ m^3 during the one week period. Particle concentrations decreased in the following three weeks; filters removed during the week of May 30 showed concentrations on the order of 0.1 to 1.6 particles per cubic meter throughout the Pacific Northwest. These higher concentrations apparently caused by additional nuclear explosions at Nevada continued throughout the month of June and reached maximum values during the weeks ending June 6 and June 13 when the average number of particles in the atmosphere at isolated locations exceeded 2 particles/ m^3 over a 7-day period.

Many of the monitoring locations were operated on a daily basis toward the latter part of the quarter. Radioautographs of filters which were exposed for one day periods showed maximum values at Boise, Idaho, and Great Falls, Montana, where average values on the order of 5 to 10 particles/ m^3 prevailed over a one day period. These latter values represented some of the highest concentrations of radioactive particles measured since the inception of the particle monitoring program several years ago. Special surveys in the more contaminated regions resulting

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TABLE VI
SUMMARY OF PARTICLE DEPOSITION
APRIL, MAY, JUNE
1952

Units of 10^{-3} particle/meter³

Location	Total Volume of air Sampled m ³	April	May	June	Present Quarter Averages 1952	Previous Quarter Averages 1952
<u>200 East and Vicinity</u>						
2704 Outside	8752	25	110	170	110	67
H. I. Garden	9258	36	120	130	98	59
BY-SE	9228	31	83	74	63	470
BY-NE	7456	29	91	91	70	220
"B" Gate	9261	21	130	130	95	83
222-B Outside	8386	60	160	110	100	100
2701 Outside	8981	27	140	210	130	66
2704 Inside	9245	31	83	100	76	78
221-B	9265	16	31	36	28	360
222-B Hall	8552	110	84	57	80	150
222-B Lab.	6815	540	36	57	250	1200
2701 Inside	9263	17	120	110	85	80
<u>200 West and Vicinity</u>						
2701 Outside	9023	66	220	330	210	96
2722	8871	98	150	120	120	140
"T" Gate	8862	110	160	98	120	130
222-T Outside	9104	160	220	110	160	130
231	9181	80	120	190	130	180
South Guard Tower	9187	120	140	680	340	230
West Guard Tower	7958	40	110	210	110	110
2701 Inside	7630	39	69	200	120	69
272	8913	28	120	120	88	79
222-T Hall	9271	110	130	140	130	210
222-T Lab.	9270	730	1020	870	870	700
222-U Lab.	8685	9.5	63	95	57	57
291-S Inside	1837	-	-	610	610	-
<u>Meteorology Tower</u>						
3'	37145	13	43	33	30	25
50'	37670	8.9	32	31	25	18
100'	27602	8.8	45	27	26	23
150'	26053	15	33	40	30	120
200'	24088	9.6	41	28	26	140
250'	24088	8.2	42	24	25	130
300'	22324	11	52	37	33	140
350'	22324	7.0	40	38	28	150
400'	15027	7.6	48	50	36	220

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TABLE VII
SUMMARY OF PARTICLE DEPOSITION
APRIL, MAY, JUNE

1952						
Units of 10^{-3} particle/meter ³						
Location	Total Volume of air Sampled	April	May	June	Present Quarter Averages 1952	Previous Quarter Averages 1952
	m ³					
<u>Area Locations</u>						
100-B Area	34464	4.6	41	66	37	19
100-D Area	36414	7.8	39	31	26	20
White Bluffs	23834	16.	83	54	42	130
100-F Area	36074	3.6	93	89	63	17
300 Area	37111	30.	90	62	61	38
Hanford 101 Bldg.	36754	3.3	64	55	42	12
<u>Off Area Locations</u>						
Benton City, Wash.	32895	3.3	28	46	30	12
Pasco, Wash.	37043	0.4	43	55	35	15
Richland	38301	0.9	94	79	60	76
Boise, Idaho	29797	0.3	160	640	290	17
Klamath Falls, Ore.	9064	0.8	260	280	190	6.5
Great Falls, Mont.	9296	0.3	240	1470	640	12
Walla Walla, Wash.	8560	<0.3	91	78	54	14
Meacham, Ore.	5100	*	77	110	98	27
Lewiston, Idaho	8782	<0.4	180	540	270	18
Spokane, Wash.	37128	0.3	55	150	73	9.9
Kennewick, Wash.	18241	0.4	37	34	21	32
Yakima, Wash.	30243	0.2	7.5	45	23	17

* No filters received within this period. Motor burned out. Weather hindered replacements.

from the Nevada test were performed by the Regional Survey Group. The results obtained from such a survey in the area between Richland, Washington, and the Idaho Falls site have been summarized in an associated report (HW-24727).

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I^{131} concentrations in the atmosphere were determined from the analysis of caustic scrubber solutions through which an air flow of 2 cfm was passed for intervals varying from 1 to 7 days. Table VIII summarizes the results obtained from these measurements.

TABLE VIII
AVERAGE ACTIVITY DENSITY OF I^{131} DETECTED IN SCRUBBERS
APRIL, MAY, JUNE

1952

Units of 10^{-12} $\mu\text{c/cc}$

<u>Location</u>	<u>April</u>	<u>May</u>	<u>June</u>	<u>Quarterly Average</u>	<u>Maximum Weekly</u>
<u>200 Area and Vicinity</u>					
200 East Southeast	1.0	1.1	0.7	0.9	2.4
200 East Tower #16	2.3	2.1	1.6	2.0	10.5
200 West Gatehouse	4.8	1.2	0.7	2.2	5.7
Gable Mountain	0.2	0.2	0.1	0.2	0.4
Redox Area	4.8	10.1	3.5	6.0	18.4
200 West Tower #4	0.4	0.6	0.1	0.4	1.3
<u>Outlying Locations</u>					
100-H Area	0.9	0.5	0.8	0.7	0.3
300 Area	0.3	0.2	0.1	0.2	0.6
Richland	0.1	0.2	0.2	0.2	0.5
North Richland	0.3	0.2	<0.1	0.2	0.7
Benton City	0.1	<0.1	<0.1	<0.1	0.1
Pasco	0.2	<0.1	<0.1	<0.1	0.5
Kennewick	0.1	<0.1	0.1	0.1	0.1

Except for isolated cases, the average activity density from I^{131} in the atmosphere decreased during this period. This decrease was not significant when compared to measurements obtained during the first quarter of 1952, but was in very good agreement with a similar decrease noted in the activity density from I^{131} deposited on vegetation during this period (Section II). Two monitoring locations in the separation areas showed small increases which were within a factor of two of previous values; these increases were largely weighted by the results obtained from one or two high samples during the period and were not indicative of any trend.

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The air filter samples which were used to determine the activity density from filterable beta particle emitters were also used to determine the activity density from gross alpha particle emitters in the atmosphere. Table IX summarizes the results of these measurements.

TABLE IX
GROSS ALPHA EMITTERS IN AIR
APRIL, MAY, JUNE
1952

<u>Location</u>	<u>Activity Density - Units of 10^{-15} $\mu\text{c/cc}$</u>		
	<u>Number</u> <u>Samples</u>	<u>Maximum</u>	<u>Average</u>
200 West Tower #4	13	34	20
200 East Semi-Works	13	24	9
Gable Mountain	13	15	6
Richland	26	23	8
Kennewick	12	26	11
Pasco	13	33	12
300 Area	13	75	25
100-D Area	13	51	10
Benton City	13	7	<4
Hanford 614 Bldg.	13	6	<4
White Bluffs	13	19	4
North Richland North	13	5	<4
200 West Redox Area	13	19	4
100-H Area	13	83	23
Hanford 101 Bldg.	13	7	<4
Riverland	13	8	<4
200 East Tower #15	12	40	14
Meteorology Tower, Ground level	13	41	16
Meteorology Tower, 200' level	13	14	<4
Meteorology Tower, 400' level	13	8	<4
PSN 320	11	29	8
<u>Dual Monitoring Units:</u>			
200 West East Center #1	13	172	59
200 West East Center #2	13	40	10
200 East Southeast #1	13	8	<4
200 East Southeast #2	13	3	<4
Richland #1	13	23	7
Richland #2	13	21	9

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Although maximum measurements were not significantly different from values observed during January, February, and March, the average activity density from gross alpha particle emitters in air showed increases which approached significance at many of the monitoring locations. The latter increases were on the order of a factor of 4 to 5 in extreme cases, and were not definitely correlated with any specific phase of the Hanford operation, although the increase was attributed to Hanford sources.

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SECTION IVRADIOACTIVE CONTAMINATION IN HANFORD WASTES

The activity density from alpha and beta particle emitters at the various Hanford waste locations during April, May, and June, 1952, was determined by analyzing nearly 1,100 liquid and solid samples. These analyses were supplemented with data collected from instrument surveys performed around the perimeter of the open waste areas and over terrain which may have been contaminated from the transportation of waste materials. The results obtained from these measurements are summarized for the reactor, separations, and metal fabrication areas in the following paragraphs.

100 AREA WASTES

Table I summarizes the results obtained from the analysis of daily samples collected at the outlet of the 107 basins in the reactor areas.

TABLE I
RADIOACTIVE CONTAMINATION IN REACTOR EFFLUENT WATER
DURING PERIODS OF NORMAL PILE OPERATION

APRIL, MAY, JUNE

1952

<u>Location</u>	<u>Number</u> <u>Samples</u>	<u>Alpha Emitters</u> <u>Units of 10^{-9} μc/cc</u>		<u>Beta Emitters</u> <u>Units of 10^{-3} μc/cc</u>	
		<u>Maximum</u>	<u>Average</u>	<u>Maximum</u>	<u>Average</u>
100-B Area	108	<5	<5	3.1	2.3
100-D Area	111	<5	<5	2.5	2.0
100-DR Area	97	<5	<5	2.4	2.2
100-H Area	106	<5	<5	2.9	1.8
100-F Area	116	<5	<5	2.6	1.7

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The average activity density from beta emitters in the reactor effluent water showed increases at each area during this period. These increases were not significant at the 100-B, 100-D, and 100-H Area, but were significant at the 100-DR and 100-F Areas. The maximum measurements detected during this period were not significantly different from maximum measurements observed during the first quarter of 1952. A partial cause for the increase noted in these measurements was a small increase in the operating power level of the reactors during this period.

As indicated in Table I, the activity density from gross alpha emitters in effluent water was less than 5×10^{-9} $\mu\text{c/cc}$ in all samples analyzed. A large number of these same samples were also analyzed for uranium and plutonium; in all cases, the results of the measurements were below the detection limit of the analysis.

Fifty-eight composite samples were obtained from the waste discharged from the Biology Section Farm at the 100-F Area. The average activity density from I^{131} in these samples was 2.0×10^{-6} $\mu\text{c/cc}$ including a maximum measurement of 1.5×10^{-5} $\mu\text{c/cc}$. Each of these values were considerably below those measured during the previous quarter.

Monthly instrument surveys using C. P. meters and VGM's were completed at the burning grounds in each of the reactor areas. Very little contamination was found as most of the VGM readings showed values well within 1,000 c/m of background in the region at the time of survey.

200 AREA WASTES

The results obtained from the analysis of liquid and solid samples collected from 200 Areas waste sources are summarized in Table II.

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TABLE II
RADIOACTIVE CONTAMINATION
IN THE 200 AREA WASTE SYSTEMS
APRIL, MAY, JUNE
1952

LIQUID SAMPLES

Location	Number Samples	Alpha Emitters Units of 10^{-8} $\mu\text{c}/\text{cc}$		Beta Emitters Units of 10^{-7} $\mu\text{c}/\text{cc}$	
		Maximum	Average	Maximum	Average
T Swamp	34	6.8	0.5	8.6	2.3
U Swamp	26	4.8	1.2	2.5	<1
Laundry Ditch	23	93	11	9.6	2.8
231 Ditch	24	120	6.4	2.4	<1
200-E "B" Ditch	33	5.3	<0.5	100	9.7
200-E "B" Swamp	26	0.8	<0.5	42	8.2
234-35 Ditch	14	25	4.1	<1	<1
200-E Retention Pond	50	2.4	<0.5	27	4.2
200-W Retention Pond	40	1.3	<0.5	6.3	2.1
234 Retention Pond	10	190	45	-	-
Redox Swamp	9	1.5	0.5	<1	<1

SOLID SAMPLES

		Units of 10^{-6} $\mu\text{c}/\text{gm}$		Units of 10^{-5} $\mu\text{c}/\text{gm}$	
		Maximum	Average	Maximum	Average
T Swamp	21	280	26	280	38
Laundry Ditch	12	110	59	170	40
200-E "B" Ditch	35	47	9.0	2100	400
200-E "B" Swamp	26	4.6	2.4	630	170
234-35 Ditch	12	15000	2500	5.6	3.5
Redox Swamp	9	36	9.5	5.3	3.6

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With the exception of measurements obtained from samples collected at the 234-5 ditch, the results summarized in Table II were not indicative of any trend or departure from values found during the previous quarter. Mud samples obtained from 234-5 ditch showed a ten-fold increase in the average activity density from gross alpha emitters. Several spot samples which were collected from various locations along the ditch were analyzed for plutonium. In extreme cases, values of 0.01 and 0.02 $\mu\text{c/gm}$ were obtained. Several samples showed values in the range of 1.5 to 4.0 $\times 10^{-3}$ $\mu\text{c/gm}$. These plutonium measurements were considerably higher than those previously detected at this source. Detailed surveys along the ditch during the month of May when the higher levels of contamination were detected indicated trace quantities of plutonium throughout the entire length of the waste ditch. Liquid samples obtained at the same time showed negligible quantities of plutonium. All plutonium estimations were determined by the LaF_3 method.

Portable instrument surveys were completed on a weekly basis around the perimeter of the open waste ponds and waste ditches in the separation areas. VGM readings showed average counting rates in the range of 100 to 500 c/m at the T Swamp, T Ditch, and laundry ditch in the 200 West Area. Maximum measurements showed 2,000 c/m over mud at the T ditch. Background in this region ranges from 100 to 200 c/m.

Similar surveys completed at waste facilities in the 200 East Area showed maximum VGM readings of 20,000 to 30,000 c/m over mud adjacent to the B ditch. Maximum readings over the water in this ditch were 5,000 to 7,000 c/m. Surveys around the B swamp perimeter showed readings on the order of 1,000 c/m over the mud and 500 c/m over the water. The results from instrument surveys at the waste facilities were not significantly different than those found in the past.

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300 AREA WASTES

Table III summarizes the results obtained from the analysis of liquid and solid samples collected from waste sources in the 300 Area.

TABLE III
RADIOACTIVE CONTAMINATION IN 300 AREA WASTES
APRIL, MAY, JUNE
1952

<u>Location</u>	<u>Number</u> <u>Samples</u>	<u>Beta Emitters</u> <u>Units of 10^{-7} $\mu\text{c/cc}$</u>		<u>Alpha Emitters</u> <u>Units of 10^{-8} $\mu\text{c/cc}$</u>		<u>Uranium</u> <u>$\mu\text{g U/cc}$</u>	
		<u>Max.</u>	<u>Avg.</u>	<u>Max.</u>	<u>Avg.</u>	<u>Max.</u>	<u>Avg.</u>
Old Pond							
Inlet Liquid	11	10	5.0	470	180	9.4	2.6
New Pond							
Inlet Liquid	12	41	7.2	400	140	5.6	1.8
300 Area							
Waste Line	62	470	22	6500	450	12	2.6
		<u>Units of 10^{-3} $\mu\text{c/gm}$</u>		<u>Units of 10^{-6} $\mu\text{c/gm}$</u>		<u>$\mu\text{g U/gm}$</u>	
Old Pond							
Inlet Solid	12	<1	<1	230	61	540	140
New Pond							
Inlet Solid	12	1.2	<1	480	200	2100	670

The activity density from gross beta particle emitters found in 300 Area waste sources was not significantly different from that detected during the previous quarter. Uranium detected in liquid waste was nearly identical to that found during early 1952. Average gross alpha particle emission increased three-fold in liquid wastes but was largely accounted for by one sample in which the activity density from alpha particle emitters was found to be 6.5×10^{-5} $\mu\text{c/cc}$. Plutonium measurements in the 300 Area waste line samples showed an average of 1.7×10^{-8} $\mu\text{c/cc}$ including a maximum of 2.9×10^{-7} $\mu\text{c/cc}$. The latter value represented a three-fold increase over the maximum measurement during the previous quarter.

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SECTION VRADIOACTIVE CONTAMINATION IN THE COLUMBIA RIVER

Radioactive contamination in the Columbia River was determined by analyzing weekly samples collected from 16 locations between the northwest perimeter of the project and the cities of Pasco and Kennewick. These data were supplemented with results from the analysis of samples from remote downstream locations at McNary Dam, Patterson, and Bonneville Dam. The activity density from natural emitters was determined from samples collected from the Columbia River upstream from the reactor areas, and from the non-contaminated Yakima and Snake Rivers which are tributaries of the Columbia. The results obtained from the analysis for the activity density of gross beta particle emitters in these samples are summarized in Table I.

Decreases in the average activity density from gross beta particle emitters were observed at nearly all sampling locations during this quarter. Average values were about one-half of those measured during January, February, and March of 1952. This over-all decrease was caused by the increased dilution of reactor effluent by the greater flow of the Columbia River. The average flow rate of the Columbia River was 1,800,000 gallons/second during this period. The increase in average flow rate was weighted by high flow rates during the last part of the quarter; average flow rates for April, May, and June were 869,000, 2,068,000, and 2,682,000 gallons per second, respectively. The maximum measured flow rate was 3,173,000 gallons/second on May 29 and the minimum flow rate was 604,000 gallons/second on April 1. These values represent highly significant increases over the measured flow rates of the previous quarter. Figure 6 shows the trend of the flow rate of the Columbia River over the period January, 1952, through June, 1952.

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TABLE I
AVERAGE ACTIVITY DENSITY OF GROSS BETA EMITTERS
IN THE COLUMBIA RIVER
APRIL, MAY, JUNE
1952

Location	Units of 10^{-8} $\mu\text{c/cc}$				Last Quarter Average	Maximum Measure- ment This Quarter
	April Average	May Average	June Average	Quarter Average		
Wills Ranch	<5	<5	<5	<5	<5	<5
100-B 181 Bldg.	<5	24	<5	14	<5	95
Allard Pumping Station	330	180	15	96	660	670
100-D 181 Bldg.	77	89	26	66	220	170
100-H 181 Bldg.	170	210	150	170	240	300
Below 100-H	430	410	160	330	480	630
100-F 181 Bldg.	550	250	130	300	500	600
Below 100-F	1100	380	230	490	540	2100
Hanford South Bank	700	460	230	470	570	1100
Hanford Middle	400	330	230	320	550	580
Hanford North Bank	220	130	61	135	250	300
300 Area	280	200	130	200	270	330
Richland	240	200	100	180	200	330
Yakima River Mouth	<5	<5	<5	<5	<5	6
Highland Pumping Station	170	110	63	110	210	220
Pasco-Kennewick Bridge						
Kennewick Side	130	72	38	79	160	170
Pasco Side	170	84	51	99	190	200
Sacajawea Park	43	46	38	43	89	68
Snake River Mouth	<5	<5	12	6	<5	17
McNary Dam	50	51	24	38	46	70
Patterson	24	22	16	20	39	30
Bonneville	<5	8	<5	<5	<5	8

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A sample of river water collected below the 100-F Area which had an activity density of 2.1×10^{-5} $\mu\text{c/cc}$ was the most contaminated sample obtained during the quarter and represented one of the highest concentrations obtained in the routine sampling program over the past several years. This sample was obtained during early April when the lower river flow rates prevailed.

All river samples collected from the locations indicated in Table I were analyzed for the activity density from gross alpha particle emitters. The mean activity density from these sources was less than 5×10^{-9} $\mu\text{c/cc}$ at all locations. Several individual samples indicated trace quantities of alpha particle emitters which were not confirmed by resample or by the results from samples collected from other downstream locations. The latter values were on the order of 1×10^{-8} $\mu\text{c/cc}$. Approximately one sample from each location was analyzed each month for the activity from uranium; the activity from this contaminant was below the detection limit of the measurement in all cases.

In addition to the river samples collected from the immediate environs, a number of samples were collected from various rivers and streams in southern and eastern Washington and in northern Oregon. Analysis of these samples for the activity density from alpha and beta particle emitters which may occur naturally in these areas showed values below the detection limit of the measurement in all events. The sensitivity limit of these measurements were 5×10^{-8} $\mu\text{c/cc}$ for beta particle emitters and 5×10^{-9} $\mu\text{c/cc}$ for alpha particle emitters.

The activity density from beta particle emitters in Columbia River mud was determined by analyzing samples collected from representative locations between the reactor areas and Bonneville Dam. Table II summarizes the results from these analyses.

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TABLE II
RADIOACTIVE CONTAMINATION
IN COLUMBIA RIVER MUD SAMPLES
APRIL, MAY, JUNE
1952

Beta Emitters - Units of 10^{-5} $\mu\text{c}/\text{gram}$

Location	April Avg.	May Avg.	June Avg.	Quarter Avg.	Last Quarter Avg.	Max. This Quarter
Wills Ranch						
Shore	3.1	3.4	5.0	3.8	2.9	8.4
5' out	3.8	3.2	2.9	3.3	3.4	5.1
Allard Station						
Shore	8.4	2.7	3.2	4.4	2.3	16
5' out	10	2.0	3.0	4.7	10	21
100-H Area						
Shore	4.8	3.4	4.1	4.2	4.5	8.9
5' out	6.4	3.7	4.2	4.8	6.8	12
Below 100-F						
Shore	8.5	3.3	6.3	6.1	4.2	16
5' out	69	5.0	4.7	24	5.2	240
Hanford Ferry						
Shore	4.8	3.0	4.8	4.1	8.5	6.2
5' out	3.6	3.0	6.1	4.2	11	13
300 Area						
Shore	6.0	4.6	4.9	5.2	4.7	14
5' out	8.8	3.9	4.6	3.2	4.3	26
Byers Landing						
Shore	-	-	-	-	-	-
5' out	3.2	3.6	3.8	3.5	2.8	3.8
Richland Dock						
Shore	4.5	6.2	7.2	6.0	7.2	16
5' out	5.5	3.8	4.0	4.4	11	6.1
Kennewick Highlands Pump Plant						
Shore	5.3	3.9	6.2	5.0	3.5	15
5' out	3.1	3.6	3.8	3.5	3.9	5.5
PK Bridge (Pasco)						
Shore	2.9	3.0	3.2	3.0	4.7	4.8
5' out	5.1	3.4	3.0	3.8	2.5	7.6

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TABLE II (contd.)

Location	April Avg.	May Avg.	June Avg.	Quarter Avg.	This Quarter Avg.	Max. This Quarter
PK Bridge (Kennewick)						
Shore	3.6	2.8	2.2	2.9	3.4	6.3
5' out	3.7	1.9	2.2	2.5	5.2	2.7
Sacajawea Park						
5' out	6.2	3.8	4.6	4.7	5.7	8.6
McNary Dam						
5' out	3.2	3.6	3.1	3.3	3.2	4.1
Patterson						
5' out	2.4	4.0	3.6	3.4	3.6	6.1
Snake River Mouth						
5' out	4.1	3.2	4.7	3.9	3.1	8.8

Statistical comparison of the values summarized above with the results obtained from similar measurements during the first quarter of 1952 showed no significant difference. Although some variation was noted in the activity measured in the on-shore and off-shore samples, an analysis of these differences for several of the locations showed these discrepancies to be well within the order of magnitude expected.

Many of the mud samples were also analyzed for the activity density from gross alpha particle emitters and from uranium. In all cases, the results of these measurements showed no detectable activity from these contaminants. Samples obtained from the base of Bonneville Dam where accumulated activity may be expected to be found also showed no detectable alpha particle emission.

During May of 1952, some portions of the Columbia River were covered with a foam-like scum which was comparable to that observed during the same period in 1950 (HW-19454). Analysis of several samples of this material for the activity density from gross beta emitters showed values in the range of 2 to 3×10^{-5} $\mu\text{c/gm}$. These values were significantly lower than those observed in 1950 when similar samples showed values in the range of 2 to 7×10^{-3} $\mu\text{c/gm}$.

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Weekly samples were obtained from various raw water supplies in the Hanford operating areas which use the Columbia River as a source of raw water. These samples were analyzed for the activity density from gross beta and alpha particle emitters; the results obtained from the beta measurements are summarized in Table III.

TABLE III
RADIOACTIVE CONTAMINATION IN RAW WATER -
RIVER EXPORT LINE
APRIL, MAY, JUNE
1952

Beta Emitters - Units of 10^{-8} $\mu\text{c/cc}$

<u>Location</u>	<u>April</u> <u>Avg.</u>	<u>May</u> <u>Avg.</u>	<u>June</u> <u>Avg.</u>	<u>Quarter</u> <u>Avg.</u>	<u>Last</u> <u>Quarter</u> <u>Avg.</u>	<u>Maximum</u> <u>This</u> <u>Quarter</u>
183 Building, 100-B Area	<5	<5	<5	<5	<5	5
183 Building, 100-D Area	12	12	<5	9	45	28
183 Building, 100-DR Area	5	15	<5	9	48	31
183 Building, 100-H Area	33	25	21	26	52	45
183 Building, 100-F Area	65	38	20	41	91	84
283 Building, 200-E Area	<5	<5	<5	<5	39	7
283 Building, 200-W Area	11	5	<5	5	51	24

Expected decreases in the activity density from beta emitters in raw water were observed at all operating areas. These decreases resulted from the higher flow rate of the Columbia River which increased the dilution of contaminated reactor effluent by factors ranging from 2 to 6 throughout the three month period. The maximum measurements indicated in Table III were obtained during the month of April when the flow rate of the Columbia River was the lowest measured during the three month period.

The average activity density from alpha particle emitters in raw water was less than 5×10^{-9} $\mu\text{c/cc}$ at all operating areas.

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Analysis of weekly samples collected from the raw water retention basins in the separations areas for the activity density of beta particle emitters showed average values to be less than 5×10^{-8} $\mu\text{c/cc}$ at the 200 East and 200 West facilities. Trace activity was detected in these basins during the month of April when the average activity was 7×10^{-8} $\mu\text{c/cc}$ including a maximum measurement of 1.6×10^{-7} $\mu\text{c/cc}$.

Two samples of algae were collected from the surface of the Columbia River at Bonneville Dam. The average activity density from gross beta particle emitters in these samples was 2.7×10^{-5} $\mu\text{c/gm}$. No alpha particle emission was detected in the algae samples.

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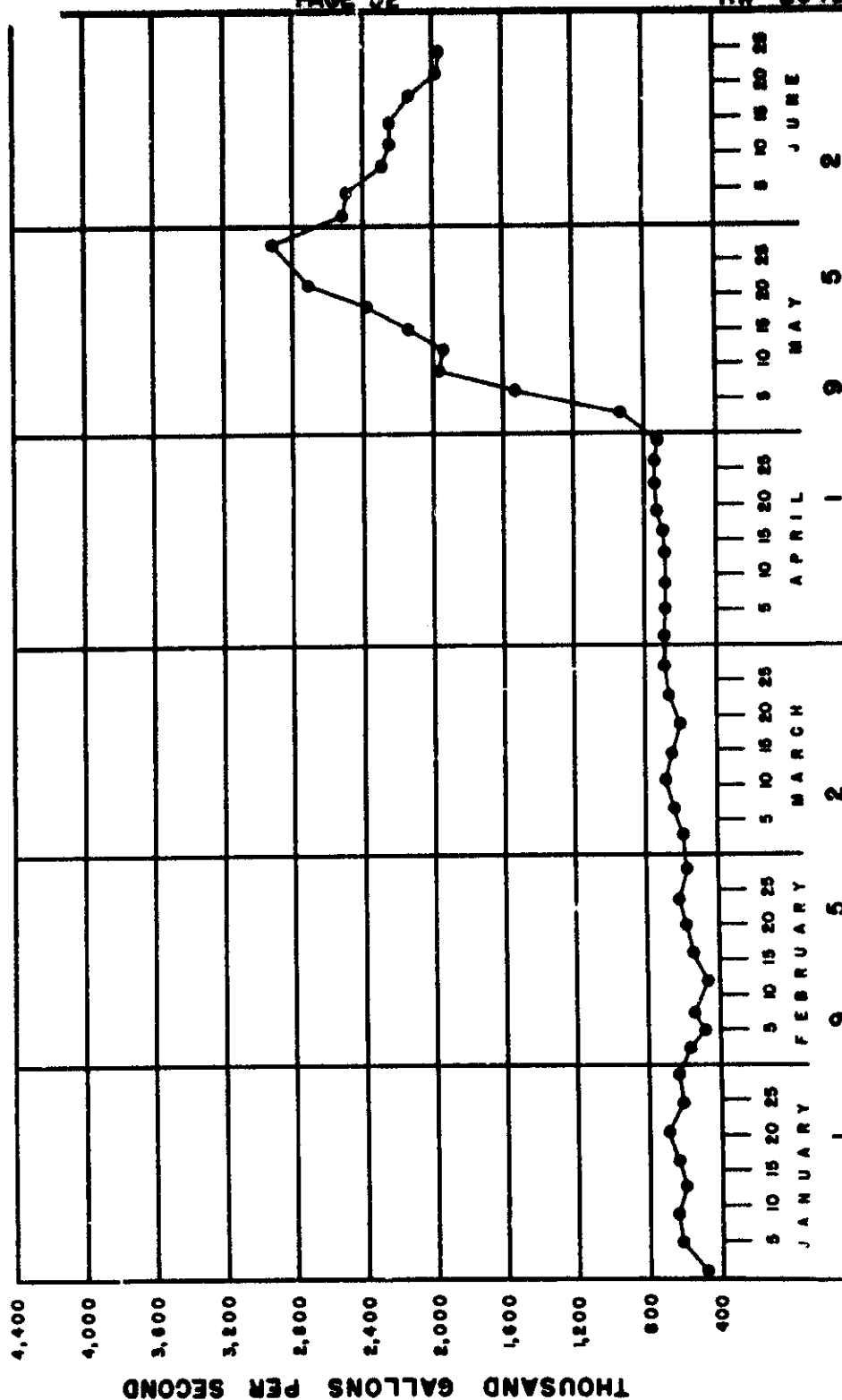
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COLUMBIA RIVER FLOW

APRIL - MAY - JUNE

1952

FIGURE - 6



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SECTION VI
RADIOACTIVE CONTAMINATION IN RAIN

One hundred and eight samples were collected from 27 scattered locations in the environs during the period April, May, and June, 1952. The bulk of these samples was collected during the last two months of the quarter when heavier rain-fall occurred. A summary of rain-fall data as measured at the Meteorology station adjacent to the 200 West Area for the period April, May, and June, 1949, through 1952, is presented in Table I.

TABLE I
PRECIPITATION MEASURED AT HANFORD WORKS
APRIL, MAY, JUNE

Year	<u>Units - Inches</u>			<u>Quarterly</u>
	<u>April</u>	<u>May</u>	<u>June</u>	<u>Total</u>
1949	0.02	0.16	0.01	0.19
1950	0.47	0.27	2.92	3.66
1951	0.53	0.43	1.38	2.34
1952	0.13	0.58	1.07	1.78

A summary of the results obtained from the analysis of rain samples for gross beta emitters is presented in Table II.

A comparison of these data with the results of similar measurements obtained during the previous quarter show no change or trend in the mean activity from beta particle emitters at the majority of locations. General decreases predominated at the 200 West Area but were significant at only two of the five locations. Activity densities, measured at 4900 feet and 8000 feet southeast of the T-Plant stack, were approximately 1/10 of those previously measured.

One rain sample collected at Route 4S, Mile 6 showed the activity density to be 3.8×10^{-4} $\mu\text{c/cc}$ and caused the average activity density in six samples collected from this location to rise to a value of

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TABLE II
ACTIVITY DENSITY FROM GROSS BETA EMITTERS IN RAIN
APRIL, MAY, JUNE
1952

<u>Location</u>	<u>No. Samples</u>	<u>Activity Density x 10⁶ μc/cc</u>	
		<u>Maximum</u>	<u>Average</u>
<u>In 200 East Area</u>	<u>15</u>	<u>16</u>	<u>4</u>
250' E of stack	4	8	4
2000' E of stack	4	8	4
750' SE of stack	4	16	6
3500' SE of stack	3	3	2
<u>In 200 West Area</u>	<u>19</u>	<u>26</u>	<u>4</u>
1000' E of stack	4	8	4
7000' E of stack	4	12	6
8000' SE of stack	4	4	3
4900' SE of stack	4	5	4
Redox Area	3	26	18
<u>100 Area Environs</u>	<u>25</u>	<u>11</u>	<u>4</u>
100-B SE	3	8	5
100-D SW	3	9	4
100-F SW	4	6	3
Hanford 614	4	10	4
Hanford 101	4	5	3
White Bluffs	3	7	5
100-H SE	4	11	3
<u>Perimeter Locations</u>	<u>19</u>	<u>6</u>	<u>2</u>
Richland	4	6	3
Pasco H and R	5	1	<1
Benton City	3	2	1
Riverland	3	3	1
North Richland	4	4	2
<u>Intermediate Locations</u>	<u>30</u>	<u>380</u>	<u>18</u>
Route 4S, Mile 6	6	380	68
300 Area 614	1	2	2
200 North 614	4	7	3
Gable Mountain	4	8	5
Batch Plant	4	7	3
622 Building	11	69	8

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6.8×10^{-5} $\mu\text{c/cc}$. Investigation into the source of this exceptionally high activity density showed that a radioactive particle was collected in the rain sample. Deletion of this one sample from those collected at this location would result in an average of 4×10^{-6} $\mu\text{c/cc}$ which would be well within the order of magnitude expected at this location.

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SECTION VII

RADIOACTIVE CONTAMINATION IN DRINKING WATER SUPPLIES AND TEST WELLS

More than 1100 water samples, collected from drinking water supplies and test wells, were analyzed during the period April, May and June, 1952. Approximately 900 of these were 500 ml. samples and were analyzed for the activity density from gross alpha and beta particle emitters. The remainder of them were 11.7 liter samples and were used to determine the activity density from gross alpha particle emitters and for specific analyses for uranium and plutonium. Sampling frequencies at the various supplies varied from daily to monthly with the bulk of the drinking water supplies being sampled on a weekly basis.

The results obtained from analyzing drinking water samples from locations which showed the mean activity density from alpha particle emitters to equal or exceed the sensitivity limit for individual samples of 5×10^{-9} $\mu\text{c/cc}$ during the quarter, are summarized in Table I.

Trace quantities of alpha particle emitters detected in the water supplies of Richland and Benton City were on the order of magnitude of similar measurements obtained during the past year. Uranium was detected at all well locations at which the gross alpha emission exceeded the detection limit. Maximum values for each of the measurements were somewhat below those detected during the previous quarter but were not indicative of a significant trend in concentration.

Trace quantities of alpha particle emitters were detected in many of the individual samples which were obtained from locations other than those shown in Table I. In the majority of instances, the activity density barely exceeded the detection limit of the analyses (5×10^{-9} $\mu\text{c/cc}$), and

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TABLE I
ACTIVITY DENSITY IN DRINKING WATER
APRIL, MAY, JUNE
1952
500 ml. samples

Location	Number Samples	Alpha Emitters units of 10 ⁻⁹		Number Samples	Uranium units of 10 ⁻³	
		μc/cc			μg/cc	
		Max.	Average		Max.	Average
Richland Well #2	13	10	5	15	13	7
Richland Well #4	64	10	5	62	13	6
Richland Well #5	13	25	5	13	9	3
Richland Well #12	13	12	6	12	14	7
Richland Well #13	13	15	6	13	13	6
Richland Well #14	12	9	5	13	11	5
Richland Well #15	12	10	6	13	12	7
Durand Well #5	13	38	5	13	4	2
Benton City Store	12	20	12	12	20	13
Benton City Water Co. Well	13	23	17	13	21	16
Byers Landing	2	10	6	-	-	-
Sacajawea Park	13	10	6	13	10	7

except for a few isolated cases, the positive values were not confirmed by subsequent sample. Tables II and III summarize the results obtained from all wells sampled during the quarter; the former tabulation represents the results obtained from 500 ml. samples and the latter tabulation, the results from the larger volume samples.

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TABLE II
SUMMARY OF ALPHA AND BETA EMITTERS MEASURED IN
WATER SUPPLIES
500 ml. samples
APRIL, MAY, JUNE
1952

Location	Number Samples	Alpha Emitters		Beta Emitters	
		units of 10^{-9}		units of 10^{-8}	
		$\mu\text{c/cc}$	$\mu\text{c/cc}$	$\mu\text{c/cc}$	$\mu\text{c/cc}$
		Max.	Average	Max.	Average
Richland Well #2	13	10	5	3	1
Richland Well #4	64	10	5	4	<1
Richland Well #5	13	25	5	1	<1
Richland Well #12	13	12	5	4	<1
Richland Well #13	13	15	6	4	1
Richland Well #14	12	9	5	2	<1
Richland Well #15	12	10	6	6	1
Richland Well #18	13	7	4	4	<1
Tract House J-685	13	3	2	1	<1
3000 Area Well "A"	11	5	2	<1	<1
3000 Area Well "B"	13	8	2	1	<1
3000 Area Well "C"	11	4	2	2	<1
3000 Area Well "D"	13	8	2	<1	<1
3000 Area Well "E"	13	4	2	1	<1
3000 Area Durand #5	13	38	5	1	<1
Columbia Field Well "A"	13	5	<2	2	<1
Columbia Field Well "B"	13	5	2	9	2
Columbia Field Well "C"	11	9	2	9	2
Hanford Well #1	13	10	2	2	<1
Hanford Well #4	13	6	3	8	1
Hanford Well #7 (San.)	13	6	<2	2	<1
Headgate Well	13	3	<2	1	<1
1100 Area Well #8	12	6	2	1	<1
Midway	14	5	<2	<1	<1
Riverland	14	3	<2	1	<1
Lower Knob	12	2	<2	2	<1
Wills Ranch	12	2	<2	3	<1
Pistol Range	13	6	3	2	<1
White Bluffs Fire Hall	13	6	3	3	1
White Bluffs Tele. Exch.	9	7	3	2	1
Pasco Improvement Farm Well	3	5	4	3	2

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TABLE II (contd.)

Location	Number Samples	Alpha Emitters		Beta Emitters	
		units of 10^{-9}		units of 10^{-8}	
		$\mu\text{c/cc}$		$\mu\text{c/cc}$	
		Max.	Average	Max.	Average
Benton City Store	12	20	12	2	<1
Benton City Water Co. Well	13	23	17	5	1
Cobb's Corner	13	5	2	2	<1
Enterprise Well	13	7	<2	2	<1
Kennewick Standard Station	13	5	<2	12	7
100-B Sanitary	13	4	<2	4	<1
100-D Sanitary	12	4	<2	10	3
100-DR Sanitary	13	2	<2	5	2
100-H Sanitary	13	3	<2	17	7
100-F Sanitary	13	6	<2	35	13
200 East Sanitary	13	2	<2	4	1
200 West Sanitary	13	3	<2	8	2
300 Area Sanitary	12	5	2	<1	<1
251 Building	17	14	2	4	<1
Byers Landing	2	<2	<2	3	1
Redox Administration Bldg.	13	5	<2	2	<1
Sacajawea Park	13	10	6	6	1
McNary Dam	13	5	<2	3	1
Patterson	13	7	2	2	<1
Plymouth	12	4	<2	<1	<1
Prosser	12	<2	<2	10	2
Pasco Sanitary	13	-	-	60	25

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TABLE III

SUMMARY OF ALPHA EMITTERS MEASURED IN DRINKING WATER

11.7 liter samples
APRIL, MAY, JUNE
units of 10⁻¹⁰ μ c/cc
1952

<u>Location</u>	<u>Number Samples</u>	<u>Maximum</u>	<u>Average</u>
Richland Well #2	5	50	34
Richland Well #4	5	47	22
Richland Well #5	6	20	12
Richland Well #12	5	54	26
Richland Well #13	5	53	19
Richland Well #14	5	47	24
Richland Well #15	5	70	29
Richland Well #18	5	50	18
Tract House J-685	6	11	4
Columbia Field Well "A"	6	15	11
Columbia Field Well "B"	7	11	6
Columbia Field Well "C"	6	11	6
1100 Area Well #8	6	18	11
3000 Area Well "A"	4	20	8
3000 Area Well "B"	5	14	9
3000 Area Well "C"	4	17	8
3000 Area Well "D"	5	8	6
3000 Area Well "E"	5	10	6
3000 Area Durand #5	5	30	12
Benton City Store	6	110	87
Benton City Water Co. Well	6	140	110
Cobb's Corner	6	18	11
Enterprise Well	6	8	4
Kennewick Std. Station	6	10	8
Riverland	6	9	6
Midway	5	9	7
Lower Knob	6	4	2
Wills Ranch	6	10	4
Hanford Well #1	5	26	13
Hanford Well #4	5	18	12
White Bluffs Fire House	6	37	19
Pistol Range	4	14	9
Hanford #7 Sanitary	5	19	8
251 Building Sanitary	5	13	6
Clover Island	1	2	2
3000 Area Pond Inlet	4	9	6
Bonneville Dam	3	11	6

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The higher concentrations of gross beta particle emitters were noted in the sanitary water in 100-F and 100-H Areas, and in Kennewick and Pasco where the source of such water is the Columbia River. The maximum measurements, obtained at Pasco, were not significantly different from those measured during the previous quarter.

A further comparison of the beta measurements summarized in Table II with the results of similar measurements obtained during the previous quarter showed that the mean activity density from beta particle emitters decreased in separation and reactor area sanitary water from values on the order of 2 to $3 \times 10^{-7} \mu\text{c/cc}$ to a mean value of less than $5 \times 10^{-8} \mu\text{c/cc}$ during this period. This decrease was largely associated with the increased flow rate of the Columbia River which increased the dilution of the reactor effluent admitted from the 107 basins.

Table IV summarizes the results obtained from analysis of samples of various solid and liquid media collected at the Pasco Filter Plant.

TABLE IV
PASCO FILTER PLANT MEASUREMENTS
APRIL, MAY, JUNE
1952

Type Sample	No. Samples	Activity Density Gross Beta Particle Emitters	
		Maximum	Average
Water Entering Plant From River	13	$2.0 \times 10^{-6} \mu\text{c/cc}$	$9.9 \times 10^{-7} \mu\text{c/cc}$
Sand (surface of sand filter)	13	$1.2 \times 10^{-4} \mu\text{c/gm}$	$4.2 \times 10^{-5} \mu\text{c/gm}$
First Backwash Material (liquid)	13	$1.8 \times 10^{-6} \mu\text{c/cc}$	$6.2 \times 10^{-7} \mu\text{c/cc}$
First Backwash Material (solid)	13	$1.5 \times 10^{-2} \mu\text{c/gm}$	$6.6 \times 10^{-3} \mu\text{c/gm}$
Coal (surface of coal filter)	13	$1.9 \times 10^{-4} \mu\text{c/gm}$	$4.0 \times 10^{-5} \mu\text{c/gm}$
First Backwash Material (liquid)	5	$2.8 \times 10^{-6} \mu\text{c/cc}$	$9.6 \times 10^{-7} \mu\text{c/cc}$
First Backwash Material (solid)	5	$5.3 \times 10^{-3} \mu\text{c/gm}$	$2.5 \times 10^{-3} \mu\text{c/gm}$
Water Leaving Plant	13	$6.0 \times 10^{-7} \mu\text{c/cc}$	$2.5 \times 10^{-7} \mu\text{c/cc}$

A small decrease in the activity density from beta particle emitters in the river water entering the plant was accompanied by a small decrease in the mean activity density of the water leaving the plant during this quarter. These decreases were not significant and were again caused by the high flow rate of the Columbia River increasing the dilution of reactor effluents. Samples of backwash material were collected from the anthracite coal filter for the first time during this quarter; mean values for beta emitters of $9.6 \times 10^{-7} \mu\text{c/cc}$ in the liquid portion and $2.5 \times 10^{-3} \mu\text{c/gm}$ in the solid portion were not significantly different from values obtained from analyzing backwash material from the sand filter. The coal filter samples were obtained during the latter part of the quarter when the mean activity in the water entering the plant was at a minimum for the period. Similar samples will be obtained on a weekly basis in the future.

In addition to the drinking water supplies in the immediate environs, which were sampled on a repetitive basis, a number of spot samples were obtained from drinking water supplies at communities near Ellensburg and Yakima and in the Yakima Valley. Analysis for the activity densities from beta and alpha particle emitters, which may occur naturally in these supplies, showed these activity densities to be less than $5 \times 10^{-8} \mu\text{c/cc}$ and $5 \times 10^{-9} \mu\text{c/cc}$, respectively. Analysis for uranium showed no trace of this contaminant in any sample analyzed.

Table V summarizes the results obtained from analyzing water samples obtained from test wells which showed detectable alpha or beta particle emission during this period.

General increases noted in the activity density from gross alpha particle emitters in the 300 Area wells were consistent with observations made during this same three month period in previous years. Apparently, the alpha activity in these wells increases with increased flow of the Columbia River. As in the past, significant quantities of uranium were found in each of the 300 Area wells; average uranium concentrations in Wells #1, #3, and #4 were 3.2×10^{-2} , 7.2×10^{-2} , and $0.2 \mu\text{g/U/cc}$, respectively. The maximum uranium measurement of $0.28 \mu\text{g/U/cc}$ was found at Well #4.

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TABLE V
SUMMARY OF ALPHA AND BETA EMITTERS MEASURED IN TEST WELLS
500 ml. samples
APRIL, MAY, JUNE
1952

Location	Number Samples	Alpha Emitters		Beta Emitters	
		units of 10^{-9}		units of 10^{-8}	
		$\mu\text{c/cc}$		$\mu\text{c/cc}$	
		Max.	Average	Max.	Average
300 Area Well #1	10	110	26	6	2
300 Area Well #3	22	160	78	3	1
300 Area Well #4	10	280	190	2	1
300 Area North Well	7	4700	3200	25	4
B-Y Well	13	10	4	3	<1
200 North Area Wells	10	6	2	1	<1
McGee Well	13	5	<2	2	<1
Ford Well	13	2	<2	3	<1
Meeker Well	13	4	<2	1	<1

Several 11.7 liter water samples were obtained from test wells at which the activity density from alpha particle emitters was on the order of the detection limit of the measurement ($2 \times 10^{-9} \mu\text{c/cc}$) based on the smaller volume samples. The only wells which indicated trace activity were the 200 North Area Well and the B-Y Well which showed average values of $9 \times 10^{-10} \mu\text{c/cc}$ and $1.9 \times 10^{-9} \mu\text{c/cc}$, respectively. The latter measurements were not believed significant when compared to data collected over the past 12 month period.

At least one water sample was obtained from each of the 48 test wells drilled by the Geology group. The activity densities from alpha and beta particle emitters were less than 5×10^{-9} and $5 \times 10^{-8} \mu\text{c/cc}$, respectively, in each sample analyzed. These findings were consistent with previous observations.

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