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BIOPHYSICS SECTION  
RADIOLOGICAL SCIENCES DEPARTMENT  
RADIOACTIVE CONTAMINATION IN THE  
HANFORD ENVIRONS

FOR THE PERIOD  
JANUARY, FEBRUARY, MARCH

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RADIOACTIVE CONTAMINATION IN THE HANFORD ENVIRONS

FOR THE PERIOD

JANUARY, FEBRUARY, MARCH

1953

**SPECIAL RE-REVIEW**

**FINAL DETERMINATION**

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BY W. Jordan DATE 2/13/81

By

H. J. Paas

May 22, 1953

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ABSTRACT

SECTION I - RADIOACTIVE CONTAMINATION IN EFFLUENT GASES:

$I^{131}$  emission averaged 1.9 curies per day from the separation facilities; maximum daily emission from the Redox stack was 17 curies per day. Ruthenium emission from the Redox stack averaged  $<0.01$  curie per day and did not exceed 0.05 curie per day at any time. Total tritium oxide emission from 4 reactor stacks averaged 0.5 curie per day including a maximum emission of 1.3 curie per day at the 100-F area. Occasional positive  $C^{14}$  and  $S^{35}$  measurements at the reactor stacks reached maximum values of  $2.2 \times 10^{-2}$  curie per day and  $6.1 \times 10^{-4}$  curie per day, respectively. The activity density of  $A^{41}$  in reactor effluent gas ranged from  $<4 \times 10^{-6}$  to  $1 \times 10^{-4}$   $\mu\text{c/cc}$  of stack effluent.

SECTION II - RADIOACTIVE CONTAMINATION ON VEGETATION:

The amount of  $I^{131}$  deposited on vegetation remained on the same order of magnitude as that previously observed. Maximum deposition was noted at the 200 West area gatehouse where the average of  $4.2 \times 10^{-5}$   $\mu\text{c/g}$  included a maximum measurement of  $1.9 \times 10^{-4}$   $\mu\text{c/g}$ . Negligible deposition was detected at the plant perimeter and in nearby residential areas during the latter part of the quarter. Off-site samples showed positive deposition in the Colfax-Pullman area and in the Lind-Connell area; average values were on the order of  $5 \times 10^{-6}$   $\mu\text{c/g}$  with maximum measurements of  $2 \times 10^{-5}$   $\mu\text{c/g}$ . The activity density of non-volatile beta particle emitters averaged between  $1 \times 10^{-5}$  and  $1.8 \times 10^{-4}$   $\mu\text{c/g}$  at all locations with a predominance of lower values occurring during the latter part of the quarter. The positive deposition of alpha particle emitters at perimeter locations was significant when comparing these data to similar measurements obtained during the previous six months.

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### SECTION III - RADIOACTIVE CONTAMINATION IN THE ATMOSPHERE:

Ionization chamber readings showed average dosage rates of 1.3 mrep per day near the separation areas and 0.5 mrep per day at residential communities adjacent to the project. Average activity density of filterable beta particle emitters ranged from  $2 \times 10^{-13}$   $\mu\text{c/cc}$  to  $1.1 \times 10^{-12}$   $\mu\text{c/cc}$  near the separation areas; this activity averaged  $< 2 \times 10^{-13}$   $\mu\text{c/cc}$  in residential areas. Significant decreases in the number of radioactive particles in the atmosphere resulted after the higher measurements which were noted during the previous quarter; average values ranged from  $1 \times 10^{-2}$  to  $7 \times 10^{-2}$  particle/ $\text{m}^3$  in the separation areas and were  $< 5 \times 10^{-3}$  particle/ $\text{m}^3$  at nearly all residential areas. Air samples collected in the Redox effluent at locations within a mile of the stack showed several values in excess of one particle/ $\text{m}^3$ .  $\text{I}^{131}$  in the atmosphere remained at the low concentrations noted during the latter part of 1952; maximum measurement over a one week period during January was  $1.1 \times 10^{-11}$   $\mu\text{c/cc}$ .  $\text{I}^{131}$  averaged  $< 1 \times 10^{-13}$   $\mu\text{c/cc}$  at all locations beyond the immediate environs of the separation areas. The activity density of alpha particle emitters in the atmosphere was  $< 4 \times 10^{-5}$   $\mu\text{c/cc}$  in the majority of samples analyzed; the maximum measurement was detected at the 100-H area.

### SECTION IV - RADIOACTIVE CONTAMINATION IN HANFORD WASTES:

The activity density of gross beta particle emitters in reactor effluent water increased to average values ranging from  $2.6 \times 10^{-3}$  to  $4.4 \times 10^{-3}$   $\mu\text{c/cc}$  at the six reactors. Maximum activity density of reactor effluent water was  $5.9 \times 10^{-3}$   $\mu\text{c/cc}$  at the 100-D area. Trace alpha activity detected in the effluent at two of the reactors included one exceptionally high measurement of  $2.6 \times 10^{-6}$   $\mu\text{c/cc}$ ; plutonium and polonium were detected in isolated samples.  $\text{I}^{131}$  discharged to the river at the 100-F area averaged 0.42 mc/day. Except for a significant decrease in beta activity measured in the Redox swamp, the amounts of contamination in 200 area wastes remained on the order of magnitude previously observed.

Uranium was detected at the Laundry Ditch and T-swamp. Trace quantities of plutonium were detected in nearly all 300 area waste line samples with the bulk of the measurements showing values on the order of  $1 \times 10^{-8}$   $\mu\text{c/cc}$ .

#### SECTION V - RADIOACTIVE CONTAMINATION IN THE COLUMBIA RIVER:

The maximum activity density of beta particle emitters in the Columbia River was measured immediately below 100-F area where the average was  $1.1 \times 10^{-5}$   $\mu\text{c/cc}$  and the maximum individual measurement was  $1.7 \times 10^{-5}$   $\mu\text{c/cc}$ . Samples collected at McNary Dam averaged  $8 \times 10^{-7}$   $\mu\text{c/cc}$ . One gallon samples collected from the downstream Columbia between the Maryhill Ferry and Portland, Oregon, showed trace beta particle emission ranging from  $1 \times 10^{-8}$  to  $2.2 \times 10^{-7}$   $\mu\text{c/cc}$ . Significant alpha particle emission in the Columbia River was confined to locations directly below the 300 area where the monthly averages ranged from  $8.3 \times 10^{-8}$  to  $1.1 \times 10^{-7}$   $\mu\text{c/cc}$ . The activity density of alpha particle emitters in mud collected from the shore of the river averaged  $< 1 \times 10^{-6}$   $\mu\text{c/g}$  at all locations except those directly below the 300 area where values ranged from  $1.5 \times 10^{-6}$  to  $5.3 \times 10^{-6}$   $\mu\text{c/g}$ . The average activity density of beta particle emitters in raw water samples ranged from  $3 \times 10^{-7}$  to  $1.2 \times 10^{-6}$   $\mu\text{c/cc}$  at all areas except 100-B and 100-C where the averages were  $< 5 \times 10^{-8}$   $\mu\text{c/cc}$ . Maximum activity density in raw water was  $2.6 \times 10^{-6}$   $\mu\text{c/cc}$  at the 100-H area.

#### SECTION VI - RADIOACTIVE CONTAMINATION IN RAIN:

The activity density of beta particle emitters in rainfall averaged  $< 1 \times 10^{-6}$   $\mu\text{c/cc}$  at 23 out of 27 locations at which rain samples were collected. Individual samples collected inside the separation areas showed values ranging from  $< 1$  to  $7 \times 10^{-6}$   $\mu\text{c/cc}$ . Radioautographs of these same samples showed no evidence of particulate contamination.

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

The average activity density of alpha particle emitters ranged from  $5 \times 10^{-9}$  to  $8 \times 10^{-9}$   $\mu\text{c/cc}$  at five Richland wells and averaged  $1.1 \times 10^{-8}$  and  $1.5 \times 10^{-8}$   $\mu\text{c/cc}$  at two Benton City drinking supplies. The maximum measurement was  $3.6 \times 10^{-8}$   $\mu\text{c/cc}$  at Richland Well #4. Uranium analysis indicated trace quantities of this contaminant in each of these wells. Drinking water supplies which used the Columbia River as a source of supply showed trace beta particle emission; average values ranged up to  $3.4 \times 10^{-7}$   $\mu\text{c/cc}$  in sanitary water at the manufacturing areas and averaged  $1.3 \times 10^{-6}$   $\mu\text{c/cc}$  at Pasco. Samples of backwash material obtained from the filter beds of the sand and coal filters at the Pasco filter plant showed the activity density of gross beta particle emitters to average on the order of  $10^{-6}$   $\mu\text{c/cc}$  in the liquid portion and  $10^{-2}$   $\mu\text{c/g}$  in the solid portion. Samples obtained from the surface of the two types of filters showed average values on the order of  $10^{-4}$   $\mu\text{c/g}$ . A comparison of the activity measured in the inlet and outlet water at the plants showed that the process had a decontamination factor of nearly 3. Test well #4 at the 300 area showed maximum alpha particle emission for the 300 area test wells averaging  $1.2 \times 10^{-7}$   $\mu\text{c/cc}$  with a maximum measurement of  $1.9 \times 10^{-7}$   $\mu\text{c/cc}$ ; uranium in this well averaged  $9.9 \times 10^{-2}$   $\mu\text{g/cc}$ .

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## INTRODUCTION

This document summarizes the results obtained by the Regional Survey forces of the Control Unit, Biophysics Section, Radiological Sciences Department from monitoring the Hanford environs for radioactive contamination during January, February, and March, 1953. The amounts of contamination discharged to the atmosphere, river, and earth's surface were measured at the source of emission and the extent and magnitude of contamination in the environs were determined from the results of the radiochemical analysis of liquid, solid, and gaseous samples from representative environmental locations. These data were supplemented with recorded and direct readings obtained from fixed and portable instrumentation.

The frequency of sampling at the various locations varied from daily to monthly, depending upon the sampling location, the probability of contamination, and the trend of the results of previous measurements. Except for changes as indicated in the discussion, the monitoring methods used during the quarter were identical to those described in previous publications of this series (HW-24203, HW-25866, HW-27510, and HW-27641). The analytical procedures used by the control laboratory for the radiochemical analyses followed those outlined in HW-20136. The counting rates obtained from these analyses were corrected by the factors described in HW-22682, HW-23769, and HW-27584. Decay corrections were applied to measurements for specific isotopes and to those selected gross beta particle measurements which contained an abundance of short half-life particle emitters; all sample results were corrected back to the activity density in the sample at the time the sample was collected.

Project maps which show the location of the monitoring stations and sampling locations referred to in the discussion have been published

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in HW-25866 and HW-21214. Project boundaries indicated on these maps and referred to in the subsequent discussion are those defined by the Atomic Energy Commission in drawing SK-7-414.

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SECTION IRADIOACTIVE CONTAMINATION IN EFFLUENT GASESSEPARATION AREAS

Separations process effluent gases were sampled directly from the stacks, and from the sand filters.

Average  $I^{131}$  emission from the separation facilities was 1.9 curies per day; 90 per cent of this  $I^{131}$  was emitted from the Redox stack. The maximum  $I^{131}$  emission was 17 curies per day during January.

Ruthenium emission from the Redox and Semiworks stacks averaged less than  $1 \times 10^{-2}$  curie per day; the maximum emission of less than  $5 \times 10^{-2}$  curie per day was measured during January.

200 EAST AREA - SEMIWORKS STACK

Initial processing of irradiated uranium took place at the Semiworks facility during February. Monitoring of gas from the fifty-foot level of the stack for  $I^{131}$  was started a few days prior to this first dissolving operation although no detectable amounts of  $I^{131}$  were measured in the Semiworks effluent gases until March. At that time, analysis of the stack gas scrubber samples for ruthenium and  $I^{131}$  and analysis of filters in series with the scrubbers for ruthenium was initiated.

The results obtained from monitoring for  $I^{131}$  and ruthenium at the Semiworks stack are presented in Table I below.

TABLE I  
SUMMARY OF RESULTS FROM STACK MONITORING  
SEMIWORKS STACK  
JANUARY, FEBRUARY, MARCH  
1953

<u>Month</u>	<u>Curie <math>I^{131}</math> Emitted Daily</u>		<u>Curie Ruthenium Emitted Daily</u>	
	<u>Maximum</u>	<u>Average</u>	<u>Maximum</u>	<u>Average</u>
February	$<3.3 \times 10^{-5}$	$<2.3 \times 10^{-5}$	-	-
March	$4.2 \times 10^{-4}$	$6.4 \times 10^{-5}$	$4.3 \times 10^{-4}$	$<1.3 \times 10^{-4}$
Quarter	$4.2 \times 10^{-4}$	$<5.9 \times 10^{-5}$	-	-

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The results in Table I show that negligible amounts of  $I^{131}$  and ruthenium were emitted to the atmosphere from this facility during the quarter. The sand filter sampling equipment will be held in standby status until such time as the emission rates of  $I^{131}$  and ruthenium from the stack approach more significant quantities.

200 WEST AREA - T-PLANT STACK

Table II summarizes the results obtained from monitoring for  $I^{131}$  at the fifty-foot level of the T-Plant stack.

TABLE II  
SUMMARY OF RESULTS FROM  $I^{131}$  MONITORING  
T-PLANT STACK  
JANUARY, FEBRUARY, MARCH

Month	1953			
	Curies of $I^{131}$ Dissolved Per Day		Curies of $I^{131}$ Emitted Per Day	
	Maximum	Average	Maximum	Average
January	430	49	0.96	0.16
February	270	31	11	0.46
March	190	35	0.10	0.04
Quarter	430	38	11	0.21
Last Quarter	2530	170	2.2	0.29

An increase of 17 days in the average cooling time during the present quarter partially accounted for the decrease in the average amount of  $I^{131}$  released from dissolving operations at T-Plant during the present quarter. On January 24, 11 curies of  $I^{131}$  were emitted to the atmosphere over a 24 hour period when the 4-5L-T silver reactor preheater was not operating properly. Readjustment of this preheater reduced the  $I^{131}$  emission rate to values of 0.1 curie per day or less throughout the remainder of the quarter. Omitting the one high measurement, the average  $I^{131}$

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emission for this quarter was 0.09 curie per day, a significant decrease from the previous quarter.

200 WEST AREA - S-PLANT

The results obtained from monitoring for  $I^{131}$  at the Redox stack and sand filter during the present quarter are presented in Table III.

TABLE III  
SUMMARY OF RESULTS FROM  $I^{131}$  MONITORING  
S-PLANT  
JANUARY, FEBRUARY, MARCH  
1953

Month	Cooling Time (Days)		$I^{131}$ Curies of Dissolved Per Day		$I^{131}$ Curies of Emitted Per Day		$I^{131}$ Emitted Via Sand Filter Daily Units of $10^{-4}$ Curie	
	Max.	Avg.	Max.	Avg.	Max.	Avg.	Max.	Avg.
January	112	94	2400	210	17	3.4	1.5	<0.4
February	103	93	220	45	2.8	0.77	7.0	<2.0
March	123	101	130	46	3.2	0.81	*	*
Quarter .	123	96	2400	100	17	1.7	7.0	<1.0
Last Qtr.	110	84	720	160	5.2	1.1	7.1	1.5

\* Monitoring for  $I^{131}$  at the sand filter outlet was discontinued after February 24, 1953.

A further increase of 19 days in the average cooling period of the irradiated metal processed at the Redox facility during the present quarter was noted. This increase in the cooling period contributed to a decrease in the average amount of  $I^{131}$  present in the processed metal from 160 curies per day during the previous quarter to 100 curies per day during the present quarter.

Average  $I^{131}$  emission from the Redox stack was 1.7 curies per day this quarter compared to 1.1 curies per day during the last quarter.

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The average for this quarter was weighted by the high measurements obtained when the A-cell silver reactor failed on January 11. Before replacement of this reactor was effected, 60 curies of  $I^{131}$  were emitted to the atmosphere over a seven day period. Maximum emission occurred on January 13, 1953, when 17 curies of  $I^{131}$  were emitted over a twenty-four hour period. Replacement of this faulty reactor effectively reduced the  $I^{131}$  emission to a rate similar to previous values.

Monitoring for  $I^{131}$  at the downstream side of the Redox sand filter was discontinued during February when the continued low emission from this source did not warrant operation of this additional equipment.

Table IV summarizes the results obtained from monitoring for ruthenium at the Redox stack.

TABLE IV  
SUMMARY OF RESULTS FROM RUTHENIUM MONITORING  
S-PLANT STACK  
JANUARY, FEBRUARY, MARCH  
1953

Month	Filter Collection*		Scrubber Collection		Total	
	Max.	Avg.	Max.	Avg.	Max.	Avg.
January			<4.7	<1.3	<4.7	<1.3
February			<1.8	<1.1	<1.8	<1.1
March*	0.8	0.4	1.4	<0.4	1.9	<0.8
Quarter			<4.7	<1.1	<4.7	<1.1
Last Quarter			58	4.0	58	4.0

\* A filter was installed in the sampling system during March.

The average results in Table IV indicate that the trend noticed last quarter toward decreased ruthenium emission was continued during this

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quarter. Absence of individual high daily emission is partly responsible for the continued low average ruthenium emission from the 291-S stack. The filter eliminated from the sampling equipment during the last quarter was replaced during March because of suspected inefficiency of the scrubber for collecting particles containing ruthenium. As shown in the preceding table, there was no significant change in the total measured ruthenium emission after the filter was replaced.

Table V is a summary of the filter measurements obtained from the upstream side of the Redox sand filter.

TABLE V  
SUMMARY OF FILTER MEASUREMENTS  
UPSTREAM OF REDOX SAND FILTER  
JANUARY, FEBRUARY, MARCH  
1953

Month	C.P. Meter Readings units of $10^{-3}$ mrep/hr/ft <sup>3</sup> of gas		Radioactive Particles			
	Max.	Avg.	Particles Per Ft <sup>3</sup> of Gas		Particles Per Day* units of $10^7$	
			Max.	Avg.	Max.	Avg.
January	97	13	1.32	0.40	7.2	2.2
February	138	46	0.50	0.26	2.7	1.4
March	56	22	0.60	0.23	3.3	1.2
Quarter	138	28	1.32	0.31	7.2	1.7
Last Qtr.	270	11	0.64	0.26	3.5	1.4

\* Gas flow rate through the sand filter was estimated to be 38,000 cfm.

A significant increase over the last quarter in the average activity collected on these filters with a smaller increase in the number of particles collected was noted. The filters were monitored with a C.P. meter at the time of removal and any which contained over 50 mrep/hr were considered too contaminated to allow accurate radioautographing. For

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this reason, the average particle concentrations reported in Table V are below the true values. The highest concentrations of particles in the gas entering the sand filter usually occurred when moving of contaminated equipment or decontamination work was in progress in the 202-S building.

Spot checks of the number of particles collected on the filter operated at the downstream side of the Redox sand filter revealed that, since initiating these measurements in October, 1952, the average particle concentration in the gas leaving the sand filter was  $8.8 \times 10^{-5}$  particle/ft<sup>3</sup>; the maximum concentration was  $1.3 \times 10^{-3}$  particle/ft<sup>3</sup> measured during the last week of February, 1953. These values correspond to  $4.8 \times 10^3$  and  $7.1 \times 10^4$  particles/day, respectively.

Comparing the results in Table V with those obtained from the downstream side of the sand filter revealed that the efficiency of this sand filter for removing particulate contamination from the ventilation air is still greater than 99.9 per cent.

#### 200 WEST AREA - U-PLANT STACK

Results obtained during the present quarter from monitoring for filterable activity at the ten foot level of the 291-U stack are reported in Table VI.

TABLE VI  
SUMMARY OF FILTER MEASUREMENTS  
U-PLANT STACK  
JANUARY, FEBRUARY, MARCH

Month	Gross Alpha Particle Emitters		Gross Beta Particle Emitters		Radioactive Particles	
	Units of 10 <sup>-8</sup> curie/day		Units of 10 <sup>-6</sup> curie/day		Units of 10 <sup>3</sup> particles/day	
	Max.	Avg.	Max.	Avg.	Max.	Avg.
January	4.1	1.3	39	5.8	<6.2	<0.7
February	3.4	1.2	9.0	3.4	11	3.3
March	3.1	1.0	5.5	1.8	41	17
Quarter	4.1	1.2	39	3.7	41	5.9
Last Qtr.	34	3.3	150	8.7	55	6.7

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The decrease in average daily emission of gross alpha particle emitters from the 291-U stack is a continuation of a trend noted during the previous quarter; the average emission during the three month period of July, August, and September of 1952 was  $1.2 \times 10^{-7}$  curie per day.

The average amount of gross beta particle emitters discharged to the atmosphere daily from this facility during the quarter is not significantly different from that measured during December, 1952, when an average of  $3.6 \times 10^{-6}$  curie per day was discharged. The average for the previous quarter was weighted by the high emission measured during November, 1952, when the TBP process was placed in operation.

The concentration of radioactive particles in the effluent from 291-U stack did not change significantly during the present quarter. The filters operated at the ten foot level of this stack usually contained 0 to 3 particles at the time of removal, and a variation of one or two particles per filter caused an unusually large variation in the calculated particle emission from the stack.

The results of the particle measurements at 291-U stack compare favorably with the results discussed previously from the downstream side of the Redox sand filter where an average of  $4.8 \times 10^3$  particles per day was discharged to the stack via the sand filter. All of the gas passing to the 291-U stack has been filtered through a sand filter.

#### REACTOR AREAS

Samples of the reactor areas stack gases were collected from the ventilation ducts near the stack breeching. These samples were analyzed for  $S^{35}$ ,  $C^{14}$ , tritium oxide, radioactive particles, and filterable gross alpha and gross beta particle emitters; the results of these measurements at the various reactors are summarized in Tables VII through X.

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TABLE VII  
SUMMARY OF STACK MONITORING RESULTS

105-F STACK

JANUARY, FEBRUARY, MARCH

1953

Curies Emitted Per Day

Month	Tritium Oxide	$C^{14}$		$S^{35}$		Filterable Particle Emitters		Radioactive Particles Units of $10^5$ /day
		Units of $10^{-3}$		Units of $10^{-4}$		Gross Alpha Units of $10^{-7}$	Gross Beta Units of $10^{-5}$	
January	1.3	<4.5		<4.5		22	3.1	10
Max.	0.3	<4.5		<4.5		7.5	1.6	4.0
Avg.								
February	1.0	<4.5		<4.5		7.5	6.6	6.6
Max.	0.3	<4.5		<4.5		4.8	5.4	3.1
Avg.								
March	0.2	<4.5		6.1		14	36	32
Max.	0.1	<4.5		<4.5		8.5	14	7.2
Avg.								
Quarter	1.3	<4.5		6.1		22	36	32
Max.	0.2	<4.5		<4.5		6.9	7.1	5.1
Avg.								
Last Qtr.	0.4	<6		<8		97	110	18
Max.	0.1	<6		<8		11	34	4.8
Avg.								

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TABLE VIII  
SUMMARY OF STACK MONITORING RESULTS  
105-D STACK  
JANUARY, FEBRUARY, MARCH  
1953

Month	Curies Emitted Per Day					Radioactive Particles Units of $10^5$ /day
	Tritium Oxide	$C^{14}$ Units of $10^{-3}$	$S^{35}$ Units of $10^{-4}$	Filterable Particle Emitters Gross Alpha Units of $10^{-7}$	Gross Beta Units of $10^{-5}$	
January						
Max.	0.3	<4.5	<4.5	10	18	<6.0
Avg.	0.1	<4.5	<4.5	5.0	7.5	<0.3
February						
Max.	0.2	<4.5	<4.5	2.8	7.5	2.4
Avg.	0.1	<4.5	<4.5	1.9	2.2	0.8
March						
Max.	0.3	<4.5	<4.5	16	11	5.1
Avg.	0.1	<4.5	<4.5	8.5	4.7	1.3
Quarter						
Max.	0.3	<4.5	<4.5	16	18	5.1
Avg.	0.1	<4.5	<4.5	5.2	4.8	0.8
Last Qtr.						
Max.	0.6	<6	<8	8.0	20	22
Avg.	0.1	<6	<8	1.0	7.0	5.3

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TABLE IX  
SUMMARY OF STACK MONITORING RESULTS

105-DR STACK

JANUARY, FEBRUARY, MARCH

1953

Curies Emitted Per Day

Month	Tritium Oxide	C <sup>14</sup> Units of 10 <sup>-3</sup>	S <sup>35</sup> Units of 10 <sup>-4</sup>	Filterable Particle Emitters		Radioactive Particles Units of 10 <sup>5</sup> /day
				Gross Alpha Units of 10 <sup>-7</sup>	Gross Beta Units of 10 <sup>-5</sup>	
January						
Max.	0.2	8.9	<4.5	1.8	0.6	<6.0
Avg.	0.06	<4.5	<4.5	1.4	0.5	<0.4
February						
Max.	0.2	<4.5	<4.5	1.3	6.1	<0.8
Avg.	0.08	<4.5	<4.5	1.0	1.6	<0.2
March						
Max.	1.1	12	<4.5	120	1.4	3.4
Avg.	0.2	<4.5	<4.5	32	0.6	1.1
Quarter						
Max.	1.1	12	<4.5	120	6.1	3.4
Avg.	0.1	<4.5	<4.5	12	0.9	0.5
Last Qtr.						
Max.	0.1	<6	<8	11	1.3	<0.8
Avg.	0.05	<6	<8	3.7	0.4	<0.1

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TABLE X  
SUMMARY OF STACK MONITORING RESULTS

105-H STACK

JANUARY, FEBRUARY, MARCH

1953

Month	Curies Emitted Per Day					Radioactive Particles Units of $10^5$ /day
	Tritium Oxide	$C^{14}$ Units of $10^{-3}$	$S^{35}$ Units of $10^{-4}$	Filterable Particle Emitters Gross Alpha Units of $10^{-7}$	Gross Beta Units of $10^{-5}$	
January						
Max.	0.2	22	<4.5	30	3.7	6.5
Avg.	0.08	5.3	<4.5	14	3.1	0.5
February						
Max.	0.6	<4.5	<4.5	5.5	7.5	11
Avg.	0.1	<4.5	<4.5	3.9	3.4	3.7
March						
Max.	0.3	<4.5	<4.5	25	5.8	0.8
Avg.	0.06	<4.5	<4.5	12	3.3	0.3
Quarter						
Max.	0.6	22	<4.5	30	7.5	11
Avg.	0.09	<4.5	<4.5	9.6	3.3	1.5
Last Qtr.						
Max.	0.3	<6	<8	77	36	4.1
Avg.	0.05	<6	<8	11	9.4	1.5

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$S^{35}$  emission averaged less than  $4.5 \times 10^{-4}$  curie per day throughout the quarter; one positive measurement at 105-F revealed that  $6.1 \times 10^{-4}$  curie per day was discharged to the atmosphere from this stack on February 25, 1953. Improvements in sampling technique were responsible for lowering the detection limit for  $S^{35}$  from  $8 \times 10^{-4}$  curie per day during the quarter, and there is no indication that this one positive measurement represents a significant change over previous data.

Occasional positive  $C^{14}$  measurements were obtained during the quarter at the 105-H and 105-DR area stacks. The maximum daily  $C^{14}$  emission was measured at 100-H area on December 23, 1952, when  $2.2 \times 10^{-2}$  curie per day was discharged to the atmosphere from the 105-H stack. The detection limit of these measurements was also lowered during the quarter from  $6 \times 10^{-3}$  to  $4.5 \times 10^{-3}$  curie per day. The positive  $C^{14}$  measurements obtained at 105-H and 105-DR stacks were above the previous detection limits and represented a significant increase in the maximum values obtained from these areas.

There were small general increases in the activity density of tritium oxide in the effluent gases from the reactor area stacks during the present quarter; the total emission from all stacks monitored averaged 0.5 curie per day during the present quarter compared to 0.3 curie per day during the previous quarter. The maximum measurement was obtained at the 105-F reactor area stack on January 25, 1953, when 1.3 curies of tritium oxide per day were emitted from this stack. The daily emission of tritium oxide from a single reactor area stack has exceeded this value on two occasions since 1951. The first occasion was on January 7, 1952, when 1.5 curies per day were emitted from the 105-D stack; and the other was on May 22, 1952, when 2.2 curies per day were emitted from the 105-H stack. Gross alpha and beta particle emission decreased significantly at the 105-F and 105-H reactor stacks. Increased average

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daily emission at the 105-DR stack was weighted by a single high measurement which was not repeated during subsequent sampling periods.

With the exception of one high measurement obtained during March at 105-DR, there was no significant change in the concentration of radioactive particles in the effluent gases discharged to the atmosphere from the 105-DR, 105-F and 105-H area stacks during the present quarter. There was a significant decrease in the average daily emission of radioactive particles from the 105-D area stack from  $5.3 \times 10^5$  particles per day during the previous quarter to  $8.4 \times 10^4$  particles per day during the present quarter.

Initial measurements at the 105-C area stack for radioactive particles and gross alpha and gross beta particle emitters were obtained during March, 1953. The average results of these spot measurements were  $3 \times 10^6$  particles per day,  $6 \times 10^{-5}$  curie per day of gross beta particle emitters, and less than  $2 \times 10^{-7}$  curie per day of gross alpha particle emitters. Routine sampling at 105-C for these contaminants, tritium oxide,  $C^{14}$ , and  $S^{35}$  will be initiated during April pending approval of an extended Special Work Permit and a standard sampling procedure.

Measurements of the activity density from argon ( $A^{41}$ ) in the reactor areas stack effluent, taken last quarter at the 105-H, 105-DR, and 105-D area stacks, were continued this quarter when additional measurements were made at 105-D, 105-B, and 105-C area stacks. The results obtained to date at all of the reactor areas using the equipment and methods described in the previous quarterly report in this series (HW-27641) are presented in Table XI.

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TABLE XI  
SUMMARY OF MEASUREMENTS FOR A<sup>41</sup>  
REACTOR AREAS STACKS  
OCTOBER, 1952, THROUGH MARCH, 1953

Area Sampled	Dates of Sampling	Activity Density of A <sup>41</sup> Units of 10 <sup>-5</sup> $\mu$ c/cc	
		Maximum	Average
100-H Area	10/28/52 - 11/14/52	6.6	4.8
100-DR Area	12/11/52 - 12/15/52	10.0	8.0
100-D Area	12/18/52 - 12/24/52	3.9	2.3
100-F Area	1/ 5/53 - 2/ 9/53	2.7	1.7
100-B Area	2/ 9/53 - 2/25/53	3.9	2.0
100-C Area	3/16/53 - 3/18/53	<0.4	<0.4

The activity density of A<sup>41</sup> in effluent gases was considerably lower at the 105-C area stack than at the other reactor area stacks; significance of this difference cannot be tested because of the small number (three) of samples of the 105-C stack gases collected.

The presence of a short half-life component in the 105-C stack gases was detected in all three samples; the half-life appeared to be on the order of one minute. Spot measurements of the A<sup>41</sup> activity density in reactor areas effluent gases will be maintained in the future.

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SECTION II

RADIOACTIVE CONTAMINATION ON VEGETATION

The deposition of radioactive contamination on vegetation in the Hanford environs was determined by the results obtained from analyzing over 2,200 samples of predominant vegetation. Over 1,600 samples were collected from the immediate environs and the balance were collected from remote locations in eastern and southern Washington and northern Oregon. All samples were analyzed for the activity density of  $I^{131}$ ; all samples from remote locations and approximately one-half of the samples from the immediate environs were analyzed for the activity density of non-volatile beta particle emitters. The activity density of alpha particle emitters on vegetation was determined by analyzing weekly samples collected from 9 locations on and adjacent to the project.

Table I summarizes the results obtained from the measurements for the activity density of  $I^{131}$  and of non-volatile beta particle emitters; average results obtained during the previous quarter are included for comparison.

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TABLE I  
RADIOACTIVE CONTAMINATION ON VEGETATION  
JANUARY, FEBRUARY, MARCH

Location	1953				Non-Volatile Emitters		
	<sup>131</sup> I Units of 10 <sup>-6</sup> $\mu$ c/g				Units of 10 <sup>-6</sup> $\mu$ c/g		
	No. Samples	Max.	Avg.	Last Qtr. Avg.	Max.	Avg.	Last Qtr. Avg.
North of 200 Areas	213	22	4	5	170	48	53
Near the 200 Areas	155	58	7	7	120	53	70
Route 3	13	62	25	13			40
200 West Gate	101	190	42	20	220	77	83
200 East Tower #16	100	72	9	8	140	50	77
Batch Plant	45	76	16	13	100	57	67
Meteorology Tower	12	64	21	11			55
South of 200 Areas	319	34	4	5	84	33	64
Richland	156	27	<3	4	100	32	49
Pasco Environs	66	12	<3	3	71	28	50
Kennewick Environs	104	19	3	5	71	29	42
Benton City - Kiona	39	17	<3	<3	90	34	47
Richland "Y"	11	10	<3	<3			32
Hanford	19	9	<3	3			25
200 East Area	48	20	6	6	140	51	50
200 West Area	66	120	26	21	2500	180	110
Redox Area	88	130	26	15			33
Wahluke Slope	55	8	<3	<3	90	39	28
Goose Egg Hill	20	73	15	7	130	31	56
Rattlesnake Mountain	10	94	18	8	51	38	116
PSN-300-310-330	39	100	15	12	91	80	60
<u>Off-Area Sampling</u>							
Pasco to Ringold	50	10	<3	<3	180	47	31
Prosser to Patterson - McNary	228	32	<3	<3	150	31	42
Eastern Washington	109	22	3	4	110	40	47
So. Washington and No. Oregon	206	7	<3	<3	110	33	31

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The average activity density of  $I^{131}$  on vegetation at locations shown in Table I was not significantly different than that observed during the previous quarter. The maximum deposition of  $1.9 \times 10^{-4} \mu\text{c/g}$  near the 200 West area gate house represented an increase over the maximum deposition of  $1.3 \times 10^{-4} \mu\text{c/g}$  measured during the last three months of 1952. A large number of the maximum measurements summarized in Table I were made during the month of January when emission of  $I^{131}$  at the Redox facility increased from values on the order of a curie per day to a maximum emission of 17 curies per day. The effect of the high  $I^{131}$  emission on the deposition during the quarter may be appraised by reviewing the measurements on a month to month basis; these data are presented in Table II.

**TABLE II**  
**ACTIVITY DENSITY FROM  $I^{131}$  ON VEGETATION**  
**JANUARY, FEBRUARY, MARCH**  
**1953**

Location	Units of $10^{-6} \mu\text{c/gram}$					
	January		February		March	
	Max.	Avg.	Max.	Avg.	Max.	Avg.
North of 200 Areas	22	7	10	<3	18	<3
Near 200 Areas	58	12	49	7	7	<3
Route 3	62	49	27	16	5	4
200 West Gate	190	75	120	30	14	4
200 East Tower #16	72	15	30	7	6	<3
Batch Plant	50	22	76	23	12	4
Meteorology Tower	64	48	42	13	5	<3
South of 200 Areas	34	10	10	<3	14	<3
Richland	27	6	10	<3	5	<3
Pasco Environs	12	6	6	<3	5	<3
Kennewick Environs	19	7	7	<3	7	<3
Benton City - Kiona	17	6	8	<3	<3	<3
Richland "Y"	10	7	5	<3	<3	<3
Hanford	9	3	<3	<3	6	<3
200 East Area	14	9	20	5	10	5
200 West Area	120	49	120	25	19	4

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TABLE II (contd.)  
ACTIVITY DENSITY FROM  $I^{131}$  ON VEGETATION  
JANUARY, FEBRUARY, MARCH

Location	1953					
	Units of $10^{-6} \mu\text{c}/\text{gram}$					
	January		February		March	
	Max.	Avg.	Max.	Avg.	Max.	Avg.
Redox Const. Area	110	41	130	27	20	5
Wahluke Slope	<3	<3	-	-	8	<3
Goose Egg Hill	73	15	-	-	-	-
Rattlesnake Mtn.	94	18	-	-	-	-
PSN 300-310-320	100	28	16	9	7	3
<u>Off-Area Sampling</u>						
Pasco to Ringold	10	4	-	-	9	<3
Prosser to	11	3	32	<3	7	<3
Patterson-McNary			8	<3	22	4
Eastern Washington			7	<3	6	<3
So. Washington and No. Oregon	7	<3				

Estimated isoactivity maps showing the deposition pattern of  $I^{131}$  on vegetation as based on the data summarized in Table II are presented in Figures 1, 2, and 3. As indicated in Figure 1,  $I^{131}$  deposition in excess of  $1 \times 10^{-4} \mu\text{c}/\text{g}$  was confined to a small region inside the 200 West area. Deposition ranging from  $2.5 \times 10^{-5} \mu\text{c}/\text{g}$  to  $1 \times 10^{-4} \mu\text{c}/\text{g}$  was confined to a region that did not exceed a distance of 5 miles from the source of the high  $I^{131}$  emission. During February (Figure 2) the deposition pattern reflected the repair of the faulty silver reactor at the Redox facility and except for several isolated locations at which the activity density was on the order of  $1$  to  $2 \times 10^{-5} \mu\text{c}/\text{g}$ , detectable contamination was confined to the immediate region around the separation areas. Further decreases observed during March (Figure 3) resulted from continued efficient operation of the reactors which removed the  $I^{131}$  from the effluent; the average

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activity density of  $I^{131}$  on vegetation observed during the latter part of the quarter was comparable to the low amounts measured during October, 1952. A composite map showing the deposition of  $I^{131}$  based on all samples collected from the immediate environs during the three month period is presented in Figure 4.

Table III summarizes the results obtained from analyzing vegetation samples collected at remote locations.

TABLE III  
RADIOACTIVE CONTAMINATION ON VEGETATION  
OFF AREA LOCATIONS  
JANUARY, FEBRUARY, MARCH

Location	1953			Non-Volatile	
	Units of $10^{-6} \mu\text{c/g}$			Emitters	
	$I^{131}$				
	No. Samples	Max.	Avg.	Max.	Avg.
Moxee	12	4	<3	30	22
Union Gap	6	7	<3	59	33
Wapato	12	5	<3	36	24
Toppenish	12	5	<3	54	28
Toppenish to Goldendale	25	6	<3	48	30
Goldendale	12	5	<3	47	33
Goldendale to Wishram	9	5	<3		
Lyle	6	<3	<3	35	28
Bingen	6	<3	<3	59	35
Camas	12	4	<3	72	44
Vancouver	12	5	<3	76	44
Portland	12	5	<3	37	23
Troutdale	6	3	<3	110	46
Bonneville	6	<3	<3	53	30
Hood River	6	7	<3	73	37
The Dalles	12	5	<3	81	32
Moody	6	7	<3	47	36
Rufus	6	6	<3	66	35
Blalock	6	3	<3	61	32
Arlington	6	7	<3	46	44

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TABLE III (contd.)  
RADIOACTIVE CONTAMINATION ON VEGETATION  
OFF AREA LOCATIONS  
JANUARY, FEBRUARY, MARCH  
1953

Location	Units of $10^{-6} \mu\text{c/g}$ $\text{I}^{131}$			Non-Volatile Emitters	
	No. Samples	Max.	Avg.	Max.	Avg.
Heppner Junction	6	5	<3	61	40
Boardman	6	6	<3	46	35
Umatilla	4	4	<3	60	35
Walla Walla	4	<3	<3	25	20
Touchet	4	6	<3	28	28
Lowden	4	9	4	25	19
Walla Walla	8	4	<3	27	21
Dixie	4	<3	<3	87	62
Waitsburg	8	10	<3	58	31
Dayton	8	19	6	86	49
Pullman	8	19	5	51	37
Colfax	4	15	4	24	24
Steptoe	4	22	6	19	19
Rosalia	4	3	<3	19	19
Spokane	8	10	<3	58	45
Cheney	8	4	<3	110	56
Sprague	8	4	<3	77	43
Ritzville	8	13	<3	79	58
Lind	8	19	5	110	48
Connell	8	16	5	43	34

The activity density of  $\text{I}^{131}$  averaged less than  $3 \times 10^{-6} \mu\text{c/g}$  at all remote locations except in a region east of the plant which included the Colfax-Pullman area and the Lind-Connell area. It is significant to note that the positive deposition in these two areas occurred during the month of March when negligible deposition was measured on the immediate environs. Off-site samples did not exceed  $8 \times 10^{-6} \mu\text{c/g}$  at any location during January and February when the higher deposition and emission was measured locally.

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The results obtained from the analysis for the activity density of non-volatile beta particle emitters may also be referred to in Tables I and III. General decreases in this activity observed at nearly all locations during this quarter reflected a reduction in the number of airborne radioactive particles from that observed in the Pacific Northwest during the last two months of 1952. Nearly all the maximum measurements indicated in Tables I and III were observed during the early part of January when residual particulate contamination apparently remained on the vegetation.

Table IV summarizes the results obtained from the analysis of vegetation samples for the activity density of alpha particle emitters.

TABLE IV  
ACTIVITY DENSITY  
FROM GROSS ALPHA PARTICLE EMITTERS ON VEGETATION  
JANUARY, FEBRUARY, MARCH  
1953

	Units of $10^{-8} \mu\text{c}/\text{gram}$				
<u>Location</u>	<u>January</u>	<u>February</u>	<u>March</u>	<u>Quarterly Average</u>	<u>Maximum Result</u>
<u>Near 200 Areas</u>					
200 West Gatehouse	49	120	74	81	160
Batch Plant	39	44	31	38	85
Rt. 4S Mile 4	17	42	18	26	58
Meteorology Tower	52	170	140	120	240
Rt. 4S Mile 6	40	12	15	18	40
<u>300 Area</u>	150	400	1700	590	1700
<u>Outlying</u>					
Richland	6	56	12	25	56
Pasco	<5	14	5	8	15
Benton City	6	10	<5	7	11

A comparison of the values summarized in Table IV with the results of similar measurements obtained during the previous quarter

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show a general increase in the activity density of alpha particle emitters on vegetation during this quarter. These increases were on the order of a factor of 2 to 5 at manufacturing area locations and at the outlying communities near the project perimeter. The positive deposition of alpha particle emitters on vegetation at outlying locations was significant as the average deposition at Richland, Pasco, and Benton City was  $< 5 \times 10^{-8}$   $\mu\text{C/g}$  during each of the last six months of 1952. The value of  $1.7 \times 10^{-5}$   $\mu\text{C/g}$  observed at one of the manufacturing areas represented one of the highest measurements obtained since this type of analysis was inaugurated.

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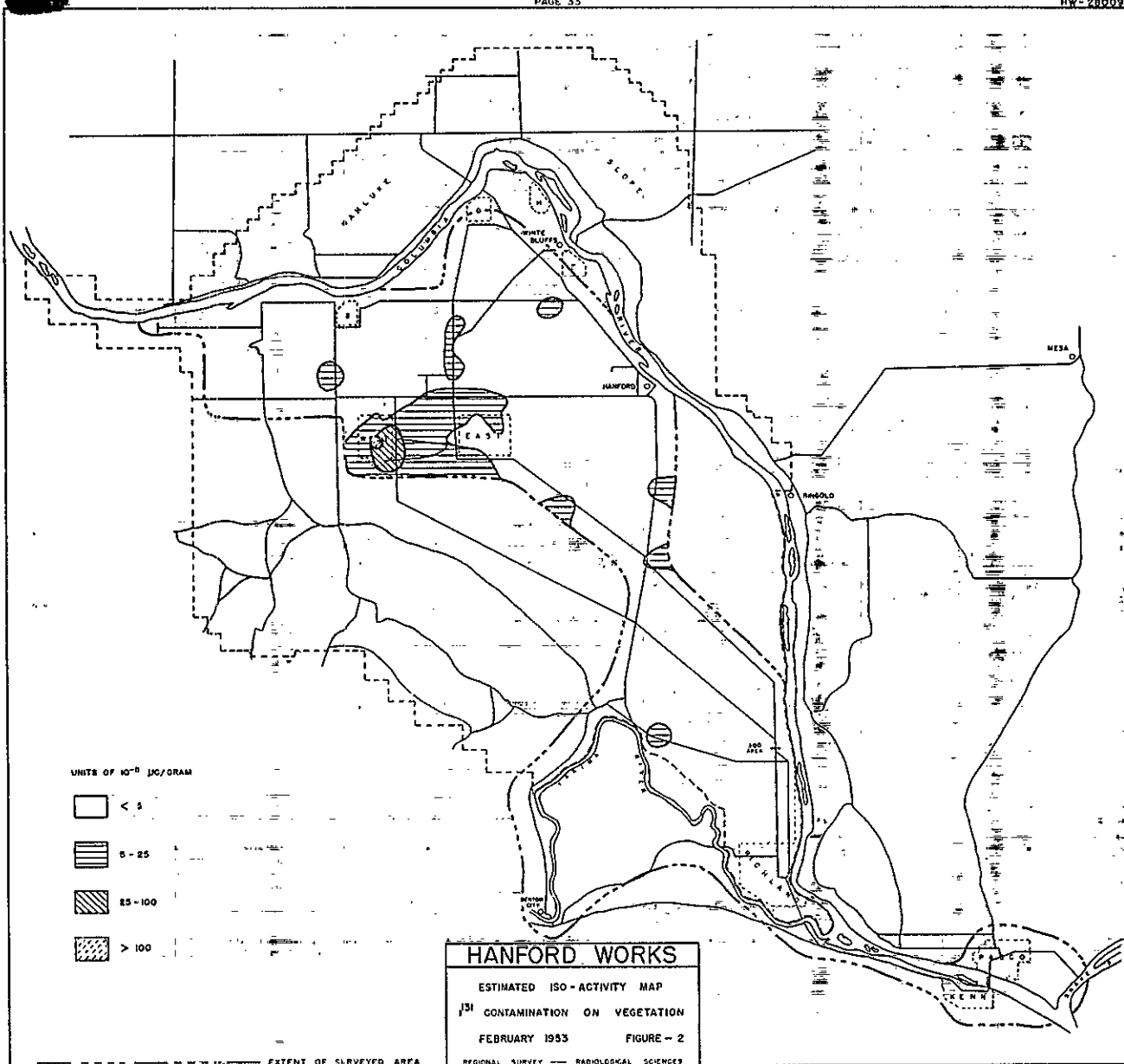




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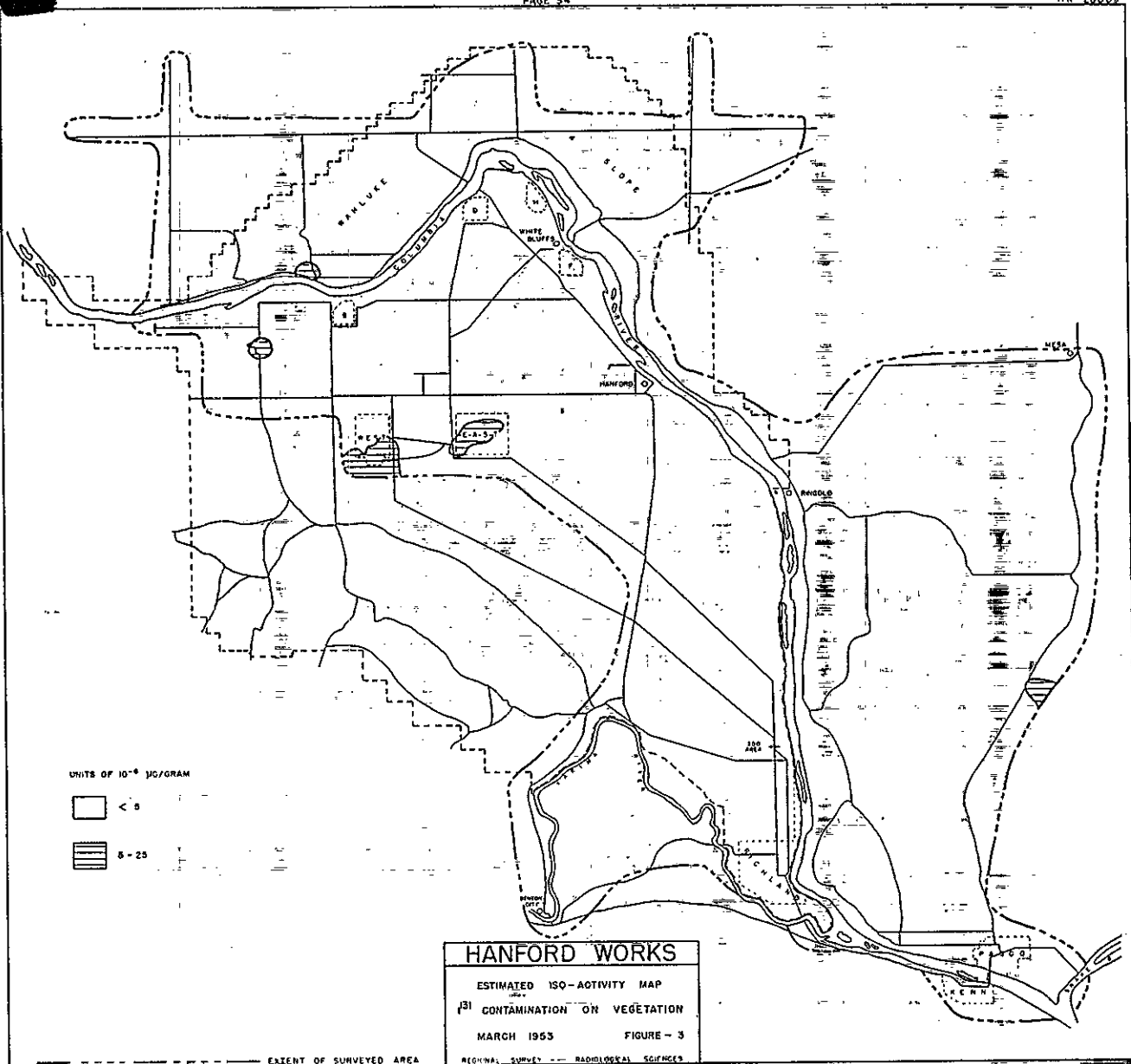
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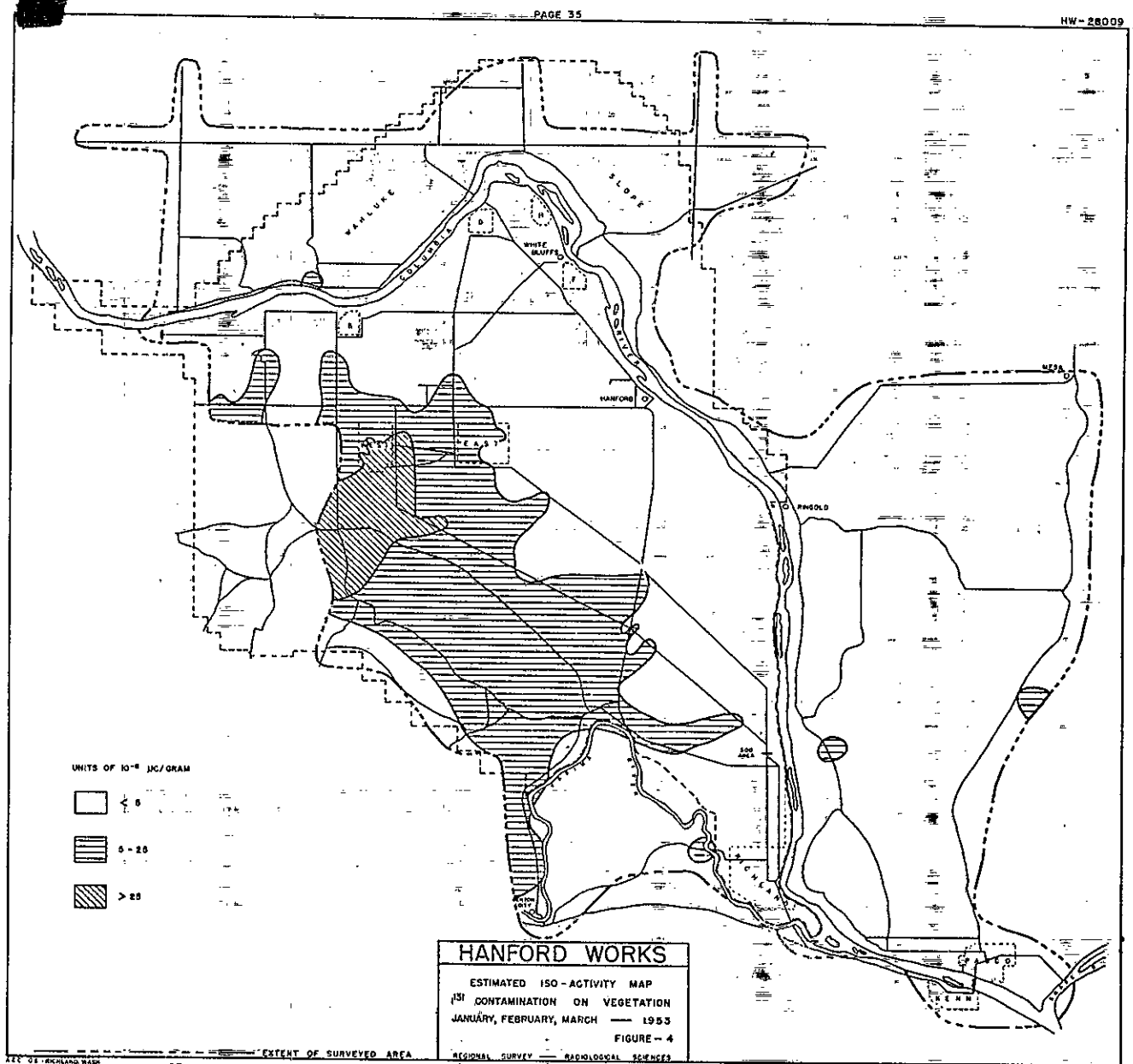
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SECTION III  
RADIOACTIVE CONTAMINATION IN THE ATMOSPHERE

Dosage rates from airborne contaminants were evaluated from recorded data obtained from the operation of Victoreen Integrators at locations in the manufacturing areas and in the residential communities adjacent to the site. These data were tabulated for each 8 hour interval during the quarter; Table I summarizes the results of these measurements as computed from the accumulated readings.

TABLE I  
AVERAGE DOSAGE RATES AS MEASURED BY VICTOREEN INTEGRATORS  
JANUARY, FEBRUARY, MARCH

Location	No. of Integrators	Units of mrep per 24 hours 1953			Quarterly Average
		January	February	March	
100-B Area	3	0.36	0.50	0.56	0.47
100-D Area	3	0.16	0.24	0.26	0.22
100-F Area	3	0.28	0.24	0.24	0.25
100-H Area	3	0.34	0.47	0.43	0.41
200 West Area	2	0.13	0.13	0.21	0.15
200 East Area	3	2.45	0.32	0.33	1.03
Riverland	1	0.52	0.64	0.51	0.56
300 Area	1	0.00	0.05	0.0	0.02
Richland	1	0.43	0.46	1.04	0.64
Pasco	1	0.31	0.43	0.32	0.35
Benton City	1	2.39	0.82	1.82	1.68
North Richland North	1	0.00	0.25	0.11	0.12
North Richland South		0.00	0.70	*	0.35
Hanford	1	0.07	0.11	0.26	0.15
Kennewick	1	3.20	0.78	0.28	1.42
Redox	1	2.06	0.57	8.14	3.59
200-E Semiworks	1	0.00	1.64	1.00	0.88

\* Discontinued

Decreases on the order of 0.2 to 0.5 mrep/day occurred at the reactor areas, 200 West area, Pasco, and Richland. Dosage rates at the

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300 area, 200 East area and near North Richland remained essentially the same as during the previous quarter; small increases on the order of 0.1 to 0.3 mrep/day were observed at the remaining stations. An average of 8.1 mrep/day observed at Redox was believed to be weighted by the inclusion of readings which may have been caused by chamber leakage; careful examination of the data did not show positive proof of this leakage but film packs which are sensitive to 5 mrep/day showed no indication of a dosage on this order of magnitude.

Table II summarizes the results obtained from exposing C-type detachable ionization chambers in the air monitoring stations; the indicated dosage was determined from the minimum reading obtained by exposing 2 chambers at each location.

TABLE II  
RADIATION LEVEL OBSERVED  
WITH "C" TYPE DETACHABLE IONIZATION CHAMBERS  
JANUARY, FEBRUARY, MARCH  
1953

<u>Units of mrep per 24 hours</u>				
<u>Location</u>	<u>January</u>	<u>February</u>	<u>March</u>	<u>Quarterly Average</u>
Within 100-B Area	0.4	0.4	0.5	0.4
Within 100-D Area	0.4	0.5	0.4	0.4
Within 100-F Area	0.4	0.4	0.3	0.4
Within 200 West Area	1.0	0.5	0.4	0.3
Within 200 East Area	0.2	0.8	0.4	0.5

A review of the detachable chamber data showed that present dosage rates were not significantly different than those measured during the last quarter in 1952.

Monitoring at outside locations between the operating areas and in the various military and construction camps was accomplished by exposing

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detachable M and S type ionization chambers and charging and reading them with battery operated equipment. Again, two chambers were used at each location and the average dosage rate as shown in Table III represents the minimum discharge of the paired chambers.

TABLE III  
RADIATION LEVEL OBSERVED WITH  
"M" AND "S" TYPE DETACHABLE IONIZATION CHAMBERS  
JANUARY, FEBRUARY, MARCH  
1953

<u>Location</u>	<u>Units of mrep per 24 hours</u>				<u>Group Average</u>
	<u>Jan.</u>	<u>Feb.</u>	<u>March</u>	<u>Quarterly Average</u>	
<u>100 Areas and Environs</u>					
Route 1, Mile 8	0.44	0.50	0.47	0.47	
Route 2N, Mile 10	0.56	0.51	0.41	0.49	
Route 2N, Mile 5	0.48	0.07	0.28	0.28	
At White Bluffs	0.37	0.44	0.39	0.40	
Route 11-A, Mile 1	1.52	1.82	1.55	1.63	
Hanford 614 Bldg.	0.43	0.37	0.77	0.52	0.56
Intersection Rt. 1 and Rt. 4N	0.50	0.40	0.36	0.42	
At Hanford 101 Bldg.	0.46	0.44	0.42	0.44	
100-H Area	0.50	0.48	0.51	0.50	
P-11 Area	0.33	0.46	0.38	0.39	
100-B NE Construction	0.66	0.71	Disc.	0.69	
100-B SE Construction	0.52	Disc.	Disc.	0.52	
<u>Within 5 miles of 200 East Area</u>					
Route 4S, Mile 6			1.08	1.08	
Batch Plant	0.54	0.46	0.78	0.59	
Route 11-A, Mile 6	0.59	1.02	1.39	1.00	
Route 3, Mile 1	2.28	1.03	1.89	1.73	
Meteorology 200'	Disc.	Disc.	Disc.	Disc.	
Route 4S, Mile 2.5	1.93	0.86	0.34	1.04	
Redox Area	1.05	0.77	2.01	1.28	1.31
Route 4S, Mile 4.5	0.75	0.57	0.53	0.62	
Semiworks #1	2.33	-	0.40	1.37	
Semiworks #2	2.69	-	1.07	1.88	
Semiworks 200 E	0.00	1.64	0.48	0.71	

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TABLE III (contd.)  
RADIATION LEVEL OBSERVED WITH  
"M" AND "S" TYPE DETACHABLE IONIZATION CHAMBERS  
JANUARY, FEBRUARY, MARCH  
1953

Units of mrep per 24 hours

<u>Location</u>	<u>Jan.</u>	<u>Feb.</u>	<u>March</u>	<u>Quarterly Average</u>	<u>Group Average</u>
Military Camp PSN 300	2.01	1.63	1.10	1.58	
PSN 310	0.56	0.98	0.96	0.83	
PSN 320	0.78	1.89	0.73	1.13	
PSN 330	-	-	0.81	0.81	
Redox Outside	4.51	5.30	2.15	3.99	
<u>Within 10 Miles of 200 East</u>					
Route 4S, Mile 10	2.09	-	1.53	1.81	
Route 10, Mile 1	0.93	1.82	0.87	1.21	
Route 10, Mile 3	1.12	1.82	1.57	1.50	1.30
Route 2S, Mile 4	0.74	0.67	0.59	0.67	
<u>Near 300 Areas</u>					
Route 4S, Mile 16	1.17	0.56	0.46	0.73	
Route 4S, Mile 22	0.63	-	0.61	0.62	
North Richland North	0.50	0.62	0.56	0.56	0.60
North Richland South	0.62	0.54	Disc.	0.58	
300 Area	0.49	0.62	0.47	0.53	
<u>Outlying</u>					
Richland	0.65	1.15	0.74	0.85	
Benton City	0.29	0.43	0.35	0.36	
Pasco	0.37	0.27	0.41	0.35	0.47
Kennewick	0.43	0.43	0.33	0.32	

Except for an increase of 0.4 mrep/day in the region within 10 miles of the 200 East area, the dosage rates summarized in Table III were not significantly different from those measured during the previous quarter. The increase of 0.4 mrep/day was largely weighted by readings obtained at stations located at Route 10, Mile 3 and Route 4S, Mile 10. Statistical analysis showed large deviation in the week to week values and

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therefore the increases at these individual stations were not significant when compared to the previous quarter.

Air filters which were exposed at monitoring stations for one week periods were used to determine the activity density from filterable gross beta particle emitters in the atmosphere. Several days were allowed between the time of sample removal and the time of counting for decay of the daughter products of natural particle emitters. The results obtained from these measurements are summarized in Table IV.

TABLE IV  
AVERAGE FILTERABLE BETA PARTICLE EMITTERS IN AIR  
JANUARY, FEBRUARY, MARCH  
1953

<u>Location</u>	<u>Activity Density - Units of <math>10^{-14}</math> <math>\mu\text{C/cc}</math></u>				
	<u>January</u>	<u>February</u>	<u>March</u>	<u>Quarterly Average</u>	<u>Weekly Maximum</u>
<u>200 Areas and Vicinity</u>					
200 E Semiworks	20	25	14	19	37
200 W Tower #4	78	43	36	52	110
200 W Redox Area	150	91	82	110	400
Gable Mountain	32	24	30	29	70
200 E Tower #15	51	34	29	39	79
PSN 320	50	38	9	33	120
<u>100 Areas and Vicinity</u>					
100-D	56	40	63	53	100
100-H	35	49	68	50	120
Hanford 101 Bldg.	20	18	8	15	42
Hanford 614 Bldg.	13	6	7	9	25
White Bluffs	15	16	15	15	35
300 Area 614-Bldg.	19	11	16	16	42
<u>Outlying</u>					
North Richland	10	4	8	8	20
Pasco	8	7	11	8	24
Benton City	18	4	7	10	32
Riverland	26	14	17	19	56

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The average activity density of filterable beta particle emitters remained on the same order of magnitude near the reactors. Small decreases near the separation areas and at the outlying stations were not significant except at Gable Mountain and at Pasco where statistical comparison indicated the differences to be of questionable significance.

Additional evaluations of the activity density of beta particle emitters were obtained from the analysis of filters which were removed from the dual monitors. Table V summarizes the results of these measurements.

TABLE V  
AVERAGE FILTERABLE BETA PARTICLE EMITTERS IN AIR  
DUAL UNIT MONITORS  
JANUARY, FEBRUARY, MARCH  
1953

<u>Location</u>	<u>Activity Density - Units of <math>10^{-14}</math> <math>\mu</math>c/cc</u>				
	<u>January</u>	<u>February</u>	<u>March</u>	<u>Quarterly Average</u>	<u>Weekly Maximum</u>
200 West East Center #1	71	48	39	56	120
200 West East Center #2	110	74	44	83	270
200 East Southeast #1	44	33	25	35	69
200 East Southeast #2	58	25	25	38	61
Richland #1	8	6	7	7	12
Richland #2	15	9	25	16	64

A review of the data summarized in Table V showed that although the average activity density decreased at the separation areas during the quarter, the average values for the three month period was comparable to that measured during the last quarter. Average values during the month of March were approaching the lower order of magnitude noted during the month of October prior to the influx of particulate contamination from sources other than Hanford.

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The number of radioactive particles in the atmosphere was determined from the results obtained from radioautographing air filters which had been exposed for seven day periods. CWS #6 filter paper was used and air flows were either 2.5 or 10 cfm. The filters were exposed to type K X-ray film for 168 hours and the number of particles was determined by counting the number of dark spots on the developed film. The results of these findings in the separation areas and at remote locations are tabulated in Tables VI and VII.

TABLE VI  
SUMMARY OF PARTICLE DEPOSITION NEAR THE SEPARATION AREAS

<u>JANUARY, FEBRUARY, MARCH</u>						
<u>1953</u>						
<u>Units of <math>10^{-3}</math> particle/meter<sup>3</sup></u>						
<u>Location</u>	<u>Total Volume of Air Sampled m<sup>3</sup></u>	<u>Jan.</u>	<u>Feb.</u>	<u>March</u>	<u>Present Quarter Averages</u>	<u>Previous Quarter Averages</u>
<u>200 East and Vicinity</u>						
2704 Outside	9283	6.3	30	8.7	15	39
BY-SE	8969	12	22	5.1	12	71
BY-NE	9240	6.3	14	7.9	9.2	29
"B" Gate	9278	8.1	18	6.2	11	27
2701 Outside	8564	19	14	8.1	14	64
2704 Inside	9282	16	17	6.7	13	33
221-B	9283	28	12	8.4	15	16
2701 Inside	6427	12	18	11	15	30
<u>200 West and Vicinity</u>						
2701 Outside	9283	17	17	24	20	56
2722	8636	22	12	42	25	58
"T" Gate	8598	22	15	33	24	69
222-T Outside	8870	19	23	79	42	69
231	8568	22	7.3	85	38	360
Redox	7838	84	13	21	35	380
W Guard Tower	8916	13	35	15	21	260

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TABLE VI (contd.)

Units of  $10^{-3}$  particle/meter<sup>3</sup>

Location	Total Volume of Air Sampled m <sup>3</sup>				Present Quarter Averages	Previous Quarter Averages
		Jan.	Feb.	March		
2701 Inside	9282	13	19	26	20	36
272	9018	13	7.7	11	11	32
222-T Hall	6456	16	13	42	28	30
222-T Lab.	9282	15	15	10	13	59
222-U Lab.	9283	15	6.0	7.3	9.2	190
291-S Inside	10965	72	-	-	72	590
"U" Plant Gate	8152	24	7.7	29	20	290
<u>Meteorology Tower</u>						
3'	31416	3.9	5.3	4.3	4.4	9.4
50'	48552	2.6	3.1	2.5	2.7	1.1
100'	40824	3.5	1.9	3.6	3.1	1.5
150'	33700	3.7	2.9	6.1	4.2	4.0
200'	32959	2.6	2.2	8.0	4.0	4.1
250'	32959	8.5	2.1	3.3	5.2	3.4
300'	28848	6.0	3.4	5.3	5.2	1.7
350'	30545	9.0	1.9	4.2	5.7	3.7
400'	20562	12	3.7	4.9	7.5	3.1

TABLE VII

SUMMARY OF PARTICLE DEPOSITIONOUTSIDE THE SEPARATION AREASJANUARY, FEBRUARY, MARCH

1953

Units of  $10^{-3}$  particle/meter<sup>3</sup>

<u>Location</u>	<u>Total Volume of Air Sampled m<sup>3</sup></u>	<u>Jan.</u>	<u>Feb.</u>	<u>March</u>	<u>Present Quarter Averages</u>	<u>Previous Quarter Averages</u>
<u>Area Locations</u>						
100-B Area	35343	2.0	1.7	0.9	1.5	10
100-D Area	36720	1.4	1.3	4.5	2.5	16

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TABLE VII (contd.)

Units of  $10^{-3}$  particle/meter<sup>3</sup>

Location	Total Volume of Air Sampled m <sup>3</sup>				Present Quarter Averages	Previous Quarter Averages
		Jan.	Feb.	March		
White Bluffs	33354	1.6	1.0	3.9	2.5	4.9
100-F Area	34119	1.4	1.8	4.5	2.8	17
300 Area	37111	10	7.9	20	13	36
Hanford 101	34255	2.3	1.8	1.8	2.0	6.9
<u>Off Area Locations</u>						
Benton City	37060	2.5	1.5	2.0	2.0	12
Pasco	34221	1.7	1.2	2.0	1.7	9.4
Richland	37128	4.0	1.9	1.7	2.5	21
Boise	9278	4.2	5.9	3.6	4.5	44
Klamath Falls, Ore.	9282	2.1	2.5	4.3	3.1	25
Great Falls, Mont.	7553	55	1.7	3.5	20	57
Walla Walla	6139	3.8	5.6	8.2	5.4	19
Meacham, Ore.	8560	4.9	3.2	2.1	3.4	18
Lewiston, Idaho	11876	5.1	2.5	3.6	3.7	54
Spokane, Wash.	35785	4.4	0.8	2.0	2.3	9.0
Kennewick	31416	1.1	1.5	1.7	1.5	8.4
Yakima	58667	0.8	0.1	1.8	1.0	0.2

Significant decreases in the number of radioactive particles in the atmosphere were noted at all locations. The decrease in number of particles to values one-half to one-fifth of values observed during the previous quarter was largely caused by exceptionally high concentrations during the last quarter of 1952 when particulate contamination from sources other than Hanford entered the environs. Particle concentrations during this quarter were on the order of magnitude expected for normal Hanford operation. (The values tabulated for the month of March do not include any samples collected after the first nuclear explosion at Nevada on March 17).

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Estimations of the number of radioactive particles in the Redox effluent gases were obtained by operating the portable, large volume air sampler in the effluent during periods of low atmospheric dilution ratios. Samples were collected at a rate of 120 cfm for periods ranging from 15 minutes to 1 hour. The filters were processed in a manner comparable to that used in the routine particle program. The results obtained from 36 air filters show that the average number of particles in the effluent gases normally ranged from 0.1 to 1 particle per  $m^3$ . Several of the filters showed particle concentrations in excess of 1 particle/ $m^3$ ; maximum concentrations obtained on February 20 and March 8 were 12 particle/ $m^3$  and 4 particles/ $m^3$ .

The portable air sampler was operated continuously on March 12 for a 9 hour period and the filter was analyzed for beta emitters with the following results: total beta  $7 \times 10^{-3} \mu c/\text{filter}$ , zirconium  $3.8 \times 10^{-4} \mu c/\text{filter}$ , ruthenium  $2.5 \times 10^{-3} \mu c/\text{filter}$  and rare earth and yttrium  $3 \times 10^{-3} \mu c/\text{filter}$ .

$I^{131}$  concentrations in the atmosphere were measured by analyzing caustic scrubber solutions through which an air flow of 2 cfm was passed for daily or weekly periods. The results obtained from these measurements are summarized in Table VIII.

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TABLE VIII  
AVERAGE ACTIVITY DENSITY OF I<sup>131</sup> DETECTED BY AIR SCRUBBERS  
JANUARY, FEBRUARY, MARCH  
1953

<u>Location</u>	Units of $10^{-12}$ $\mu\text{c/cc}$				
	<u>January</u>	<u>February</u>	<u>March</u>	<u>Quarterly Average</u>	<u>Weekly Maximum</u>
<u>200 Areas and Vicinity</u>					
200 East Southeast	0.7	<0.1	<0.1	0.3	2.5
200 East Tower #16	1.1	0.3	0.4	0.6	11.4
200 West Gatehouse	0.7	0.2	0.1	0.3	1.8
Gable Mountain	0.1	<0.1	<0.1	<0.1	0.2
Redox Area	0.3	0.1	0.2	0.2	0.6
200 West Tower #4	0.2	<0.1	<0.1	<0.1	0.3
200 East Semiworks	0.3	0.2	<0.1	0.1	0.3
<u>Outlying Locations</u>					
100-H Area	0.1	<0.1	<0.1	<0.1	0.3
300 Area	<0.1	<0.1	<0.1	<0.1	<0.1
Richland	<0.1	<0.1	<0.1	<0.1	<0.1
North Richland	<0.1	<0.1	<0.1	<0.1	<0.1
Benton City	<0.1	<0.1	<0.1	<0.1	0.1
Pasco	<0.1	<0.1	<0.1	<0.1	<0.1

The activity density from I<sup>131</sup> in the atmosphere remained at the low concentrations noted in the environs during the latter part of 1952. A review of the data on a month to month basis shows detectable quantities in the immediate environs of the separation areas during the month of January and negligible quantities measured during February and March. The positive measurements during January coincided with high I<sup>131</sup> emission from the Redox plant where failure of a silver reactor on January 11 caused 60 curies of I<sup>131</sup> to be admitted to the atmosphere over a one week period. The maximum values indicated in Table VIII were nearly all measured during the week in which the high emission occurred.

Thirty-six I<sup>131</sup> samples were obtained during periods when dissolving was in progress and when the atmospheric dilution ratio of the

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stack effluent was less than 500:1. Although trace quantities of  $I^{131}$  were indicated in several samples, no individual measurements showed a concentration in excess of  $5 \times 10^{-9} \mu\text{c/cc}$ .

The air filters which were used to determine the activity density of beta particle emitters (Table IV) were also used to determine the activity density from alpha particle emitters in the atmosphere. Table IX summarizes the results obtained from these measurements.

TABLE IX  
AIR FILTER MONITORING RESULTS  
JANUARY, FEBRUARY, MARCH

Location	Number Samples	1953 Alpha Particle Emitters - Activity Density $\times 10^{-15} \mu\text{c/cc}$	
		Weekly Maximum	Quarterly Average
200 West Tower #4	12	74	23
200 East, Semiworks	9	8	<4
Gable Mountain	13	14	7
Pasco	12	26	8
300 Area	13	60	20
100-D Area	13	34	14
Benton City	13	<4	<4
Hanford 614 Bldg.	13	8	<4
White Bluffs	12	7	<4
North Richland North	13	9	<4
200 West Redox Area	13	28	10
100-H Area	13	100	21
Hanford 101 Bldg.	12	5	<4
Riverland	13	7	<4
200 East Tower #15	13	12	5
Meteorology Tower, Ground level**			
PSN 320	13	10	<4
DUAL UNITS*			
200 WEC #1	12	20	9
200 WEC #2	12	28	12
200 ESE #1	13	11	7
200 ESE #2	13	17	<4
Richland #1	13	22	6
Richland #2	13	20	5

\* These units are operated alternately at a given location, each unit representing operation during 50 per cent of the month.

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The average activity density of alpha particle emitters in the atmosphere was in the same order of magnitude as that measured during the previous quarter at all locations except 200 West #4, Pasco, 300 Area, 100-D, Richland, and PSN 320. Comparison of data obtained at stations where the differences were noted showed that the decreases observed at 100-D area and at Richland were significant. Decreases noted at Pasco and PSN 320 largely resulted from one exceptionally high measurement at each of these locations during the previous quarter.

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## SECTION IV

RADIOACTIVE CONTAMINATION IN HANFORD WASTES

The activity density of alpha and beta particle emitters in Hanford wastes was determined from the results obtained from the radiochemical analysis of liquid and solid samples collected directly from the open waste sources. Sampling frequencies, which were based on the probability of contamination and on the potential hazard, varied from daily to weekly at all locations. Radiation levels at the various waste zones were determined from portable instrument surveys over open terrain around the perimeter of the waste ponds. Summaries of the results of these findings are given for each of the manufacturing areas.

100 AREA WASTES

The results obtained from analysis of 500 ml samples of effluent water which were collected at the outlet weir of the reactor retention basins are summarized in Table I. The data includes only results from those samples which were analyzed within 16 hours after sampling.

TABLE I  
RADIOACTIVE CONTAMINATION IN REACTOR EFFLUENT WATER  
DURING PERIODS OF NORMAL OPERATION  
JANUARY, FEBRUARY, MARCH

1953									
Activity Density from Gross Beta Particle Emitters									
Units of $10^{-3} \mu\text{c/cc}$									
<u>Location</u>	<u>Total Samples</u>	<u>January</u>		<u>February</u>		<u>March</u>		<u>Quarter</u>	
		<u>Max.</u>	<u>Avg.</u>	<u>Max.</u>	<u>Avg.</u>	<u>Max.</u>	<u>Avg.</u>	<u>Max.</u>	<u>Avg.</u>
100-B Area	52	5.0	3.9	5.5	4.5	5.5	4.5	5.5	4.4
100-C Area	106	3.6	2.8	3.1	2.4	5.4	2.5	5.4	2.6
100-D Area	66	5.9	4.5	4.5	3.6	4.2	3.1	5.9	3.8
100-DR Area	83	4.5	3.9	4.6	3.5	4.0	3.4	4.6	3.7
100-H Area	102	3.8	3.0	4.1	3.6	5.1	3.4	5.1	3.4
100-F Area	78	4.0	3.1	4.6	3.9	5.2	3.9	5.2	3.7

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Increases in the activity density of gross beta particle emitters were noted at each of the reactor areas during this period. Statistical comparison of current average values with the results of similar measurements obtained during the previous quarter showed these increases to be significant at the 100-B, 100-DR, and 100-H areas. Small increases in the power level at each of these reactors also occurred during the present period. The number of days in which the reactors were operated during this period was nearly identical to the number of days observed during the previous quarter.

The activity density of alpha particle emitters in reactor effluent water averaged  $<5 \times 10^{-9}$   $\mu\text{c/cc}$  at all areas except 100-B and 100-F; average values at the latter locations were  $7.3 \times 10^{-8}$   $\mu\text{c/cc}$  and  $1.1 \times 10^{-8}$   $\mu\text{c/cc}$ , respectively. The unusually high average at the 100-B area was weighted considerably by one high measurement in a sample collected on March 20 which showed  $2.6 \times 10^{-6}$   $\mu\text{c/cc}$ . Deletion of this high measurement from the data would cause the average over the three month period to drop to  $<5 \times 10^{-9}$   $\mu\text{c/cc}$ ; the next highest measurement was  $8 \times 10^{-9}$   $\mu\text{c/cc}$ . Radiochemical analysis of a representative number of reactor effluent water samples for the activity density of uranium showed this activity to be  $<2 \times 10^{-9}$   $\mu\text{c/cc}$  in all samples analyzed.

Thirty-one samples of reactor effluent were analyzed for plutonium. Positive indication of this contaminant were found in three samples; two samples collected at 100-C reactor showed values of  $2.3 \times 10^{-8}$  and  $7.8 \times 10^{-9}$   $\mu\text{c/cc}$  and one samples collected at the 100-D area showed  $5.6 \times 10^{-9}$   $\mu\text{c/cc}$ .

Thirty-four one gallon samples from the reactor basins were analyzed for polonium. Trace indications of this activity were detected at all areas except at 100-H area some time during the quarter. Positive values ranged from  $7 \times 10^{-10}$   $\mu\text{c/cc}$  to  $3.2 \times 10^{-9}$   $\mu\text{c/cc}$  with the latter value occurring at the 100-B area on March 10.

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Four samples of sludge which were obtained from the 107-DR basin on February 25 showed the activity density from beta particle emitters to range from 0.08 to 2.0  $\mu\text{c/g}$ ; alpha particle emission was detected in one sample containing  $3.6 \times 10^{-5} \mu\text{c/g}$ .

Analysis of daily composite samples collected from the sump in the waste discharge line at the Biology farm at the 100-F area showed the activity density from  $\text{I}^{131}$  in the farm liquid wastes averaged  $6.2 \times 10^{-6} \mu\text{c/cc}$  during the quarter; the maximum measurement was  $3.4 \times 10^{-5} \mu\text{c/cc}$ . The average amount of  $\text{I}^{131}$  in this waste increased about 50 per cent when these data were compared to the previous quarter. Calculations based on the metered volume of water used in the flushing operation in the Biology Farm and on the average activity density found in the waste line sample showed that an average of 0.42 mc of  $\text{I}^{131}$  was discharged to the river daily; average daily discharge during individual months was 0.32, 0.41, and 0.53 mc per day for January, February, and March, respectively.

The burning grounds in the 100-D, 100-F and 100-H area were surveyed on two occasions during the quarter. VGM and TGM readings showed the radiation level to be in the range of natural background (100 to 200 c/m) in all cases.

A portable instrument survey of a drainage ditch which goes to the river through an area west of the 105-F exclusion zone showed readings as high as 5,000 c/m on a VGM. Radiochemical analysis of samples of water and mud from this ditch for the activity density of beta particle emitters showed values of  $9.8 \times 10^{-8} \mu\text{c/cc}$  and  $8.6 \times 10^{-4} \mu\text{c/g}$ , respectively. Concentration of alpha particle emitters was  $\leq 5 \times 10^{-9} \mu\text{c/cc}$  in the water and was  $1.2 \times 10^{-6} \mu\text{c/g}$  in the mud.

#### 200 AREA WASTES

Table II summarizes the results obtained from the radiochemical analysis of samples collected from separation area waste sources.

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TABLE II  
RADIOACTIVE CONTAMINATION IN THE 200 AREA WASTES  
JANUARY, FEBRUARY, MARCH  
1953

LIQUID SAMPLES

<u>Location</u>	<u>Number Samples</u>	<u>Uranium + Plutonium</u>		<u>Beta Particle Emitters</u>	
		<u>Units of <math>10^{-9} \mu\text{c/cc}</math></u>		<u>Units of <math>10^{-7} \mu\text{c/cc}</math></u>	
		<u>Maximum</u>	<u>Average</u>	<u>Maximum</u>	<u>Average</u>
T-Swamp	32	3.7	<0.5	24	7.8
U-Swamp	21	110	7.8	6.0	2.7
Laundry Ditch	20	86	7.7	61	9.1
231 Ditch	24	3.2	0.9	17	4.4
200 E "B" Ditch	39	0.7	<0.5	15	2.0
200 E "B" Swamp	26	1.3	<0.5	18	4.2
234-35 Ditch	12	4.5	0.9	8.1	3.6
200 E Retention Pond	52	0.7	<0.5	17	2.9
200 W Retention Pond	37	1.4	<0.5	30	12
234 Retention Pond	7			60	17
Redox Swamp	11	4.8	1.3	790	340
Redox Retention Basin	6	1.2	0.6	140	100

SOLID SAMPLES

		<u>Units of <math>10^{-6} \mu\text{c/g}</math></u>		<u>Units of <math>10^{-5} \mu\text{c/g}</math></u>	
T-Swamp	23	480	66	240	58
Laundry Ditch	12	210	70	340	98
200 E "B" Ditch	39	21	2.0	650	52
200 E "B" Swamp	25	10	2.5	300	74
234-35 Ditch	12	79,000	12,000	19	8.9
Redox Swamp	11	660	120	170,000	60,000

The average activity density from beta particle emitters in separation area wastes remained on the order of magnitude expected at nearly all locations. Although a significant decrease was observed in beta particle emission in the liquid samples from the Redox swamp, the activity density of these emitters in mud collected around the pond perimeter

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remained at values higher than expected. The high activity in this mud was apparently residual contamination from the leak in the cooling water system which was noted during the latter part of 1952.

Samples of waste water collected during January from the 231 ditch, Laundry Ditch, and T-Swamp showed positive indications of uranium. In general, these values were on the order of  $10^{-9}$   $\mu\text{c}/\text{cc}$ ; one sample from the Laundry Ditch showed  $7.8 \times 10^{-7}$   $\mu\text{c}/\text{cc}$  and a sample from the 231 ditch showed  $6.5 \times 10^{-8}$   $\mu\text{c}/\text{cc}$ . The only location which showed significant amounts of uranium in mud was the Laundry Ditch where the average of  $1.7 \times 10^{-4}$   $\mu\text{c}/\text{g}$  included a maximum measurement of  $3.5 \times 10^{-4}$   $\mu\text{c}/\text{g}$ .

Portable instrument surveys using VGM's showed average readings ranging from 100 c/m to 3,000 c/m at the edges of the T-Ditch, T-Swamp, B-Ditch, B-Swamp, and Laundry Ditch. Maximum instrument readings were 3,500 c/m at the T-Ditch and at the Laundry Ditch; the latter values were found over mud at the edge of the water.

A ground contamination survey in the region bounded by the 241-U retention basin, 241-S tank farm and the 207-S retention basin was performed on March 27 by surveying an area of 1 square meter at intervals of 100 feet. Although the majority of VGM and TGM readings were in the range of 100 to 500 c/m above background, fifteen locations showed readings in excess of 1,000 c/m. The maximum reading was 80,000 c/m. Particulate deposition was indicated at nearly all locations at which the higher readings were found.

A similar survey in a 700' x 1200' area due east of the 202-S stack during the latter part of March indicated the presence of radioactive particles at nearly every survey location. TGM readings in this region on the order of 1,000 to 20,000 c/m predominated with 2 of the locations showing readings of 80,000 c/m.

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300 AREA WASTES

The results obtained from analyzing liquid and solid samples from 300 area waste sources for the activity density of beta and alpha particle emitters are presented in Table III.

TABLE III  
RADIOACTIVE CONTAMINATION IN 300 AREA WASTES  
JANUARY, FEBRUARY, MARCH  
1953

Location	Number Samples	Beta Particle Emitters		Alpha Particle Emitters		Uranium	
		Units of $10^{-7} \mu\text{c/cc}$		Units of $10^{-8} \mu\text{c/cc}$		Units of $10^{-6} \mu\text{c/cc}$	
		Max.	Avg.	Max.	Avg.	Max.	Avg.
Old Pond							
Inlet Liquid	12	99	16	460	220	7.8	2.7
New Pond							
Inlet Liquid	12	140	16	460	190	2.2	1.2
300 Area Waste Line	60	880	37	13,000	500	42	2.4
		Units of $10^{-3} \mu\text{c/g}$		Units of $10^{-6} \mu\text{c/g}$		Units of $10^{-6} \mu\text{c/g}$	
Old Pond							
Inlet Solid	12	<1	<1	170	52	500	100
New Pond							
Inlet Solid	12	2.0	<1	2200	280	1100	260

Wide variation in the individual sample results were largely associated with the time at which the sample was taken and with the liquid level of the pond at the time it was collected. These variations were consistent with observations noted in the past and in general, the average and maximum values indicated in Table III were on the order of magnitude expected at the indicated locations. Trace quantities of plutonium were detected in nearly every 300 area waste line sample analyzed. The bulk of the measurements showed values on the order of  $1 \times 10^{-8} \mu\text{c/cc}$ ; the average amount of plutonium found in the waste line during the quarter was  $1.9 \times 10^{-8} \mu\text{c/cc}$ .

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SECTION VRADIOACTIVE CONTAMINATION IN THE COLUMBIA RIVER

The activity density of gross beta and alpha particle emitters in the Columbia River was evaluated from the results obtained from the radiochemical analysis of river samples which were obtained weekly from 19 locations between the reactors and Patterson. These data were supplemented with daily measurements at a control station near the Hanford Ferry and with monthly measurements at remote locations along the downstream Columbia River. Weekly samples from a location above the reactor areas and from the Yakima and Snake Rivers were used to evaluate the activity density of naturally occurring beta particle emitters in these waters.

Table I summarizes the results obtained from the radiochemical analysis for the activity density of gross beta particle emitters in river water at locations in the immediate environs.

TABLE I  
AVERAGE CONTAMINATION FROM GROSS BETA PARTICLE EMITTERS  
IN THE COLUMBIA RIVER  
JANUARY, FEBRUARY, MARCH

Activity Density - Units of  $10^{-8} \mu\text{C/cc}$

<u>Location</u>	<u>Jan.</u> <u>Avg.</u>	<u>Feb.</u> <u>Avg.</u>	<u>March</u> <u>Avg.</u>	<u>Qtr.</u> <u>Avg.</u>	<u>Last</u> <u>Qtr.</u> <u>Avg.</u>	<u>Maximum</u> <u>Measurement</u> <u>This Quarter</u>
Wills Ranch	<5	<5	<5	<5	<5	<5
100-B 181 Bldg.	8	<5	<5	<5	<18	8
Allard Station	610	270	64	320	440	1300
100-C 181 Bldg.	16	5	<5	10		31
100-D 181 Bldg.	640	440	540	530	300	790
100-H 181 Bldg.	1100	860	820	900	470	1400
Below 100-H	660	530	470	550	1000	960
100-F 181 Bldg.	1300	860	760	950	750	1500
Below 100-F	1300	1000	1200	1100	1100	1700



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TABLE I (contd.)

Activity Density - Units of  $10^{-8} \mu\text{C/cc}$ 

Location	Jan. Avg.	Feb. Avg.	March Avg.	Qtr. Avg.	Last Qtr. Avg.	Maximum Measurement This Quarter
Hanford So. Bank	840	1100	900	900	900	1600
Hanford Middle	750	810	770	780	770	1800
Hanford N. Bank	590	460	320	480	440	750
300 Area	300	440	380	370	370	690
Richland	420	460	470	440	460	650
Yakima River Mouth	< 5	< 5	< 5	< 5	< 5	8
Highland Pump Station	310	350	310	320	280	420
Pasco-Kennewick Bridge						
Kennewick Side	300	300	170	260	140	370
Pasco Side	400	330	300	340	260	510
Sacajawea Park	63	170	210	160	150	310
Snake River Mouth	< 5	< 5	38	13	5	110
McNary Dam	86	81	71	80	73	180
Patterson	95	58	58	70	67	120

A review of the data summarized in Table I indicates that the average activity density of beta particle emitters in Columbia River water at locations below the reactors remained essentially the same as that observed during the previous quarter. Differences noted at locations near the reactors were associated with the levels at which the reactors were operating and with shut-down periods at the individual reactors. A comparison of the river measurements on a month to month basis showed no definite trend during the three month period. Increased activity density of beta particle emitters noted in reactor effluent admitted to the river tended to be offset by increased dilution of this effluent by the higher flow of the Columbia River. The average flow rate of the river during the three month period was 547,000 gallons per second as compared with an average flow of 424,000 gallons per second during the previous quarter. Mean flow rates during January, February, and March were 393,000, 588,000 and 669,000 gallons per second, respectively. Maximum flow

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measured on March 13 was 713,000 gallons per second and minimum flow of 315,000 gallons per second was measured on January 12. Figure 5 details these measurements.

The activity density of gross beta particle emitters in the downstream Columbia River was determined by analyzing one gallon samples which were collected at ten locations between the Maryhill Ferry and Portland, Oregon. Trace activity ranging from  $1 \times 10^{-8} \mu\text{c/cc}$  to  $2.2 \times 10^{-7} \mu\text{c/cc}$  was detected in this region. Individual values for several locations were as follows: Portland,  $3.6 \times 10^{-8} \mu\text{c/cc}$ ; The Dalles,  $1.2 \times 10^{-7} \mu\text{c/cc}$ ; Maryhill Ferry,  $1.7 \times 10^{-7} \mu\text{c/cc}$  and Arlington  $2.2 \times 10^{-7} \mu\text{c/cc}$ .

Nearly all samples obtained from the Columbia River were analyzed for the activity density of alpha particle emitters. The only location which consistently showed detectable emission was below the 300 area where the average activity density during the three individual months was  $1.1 \times 10^{-7}$ ,  $7 \times 10^{-9}$ , and  $8.3 \times 10^{-8} \mu\text{c/cc}$ . The maximum measurement noted on January 2 was  $3.8 \times 10^{-7} \mu\text{c/cc}$ .

A survey of an island adjacent to the 100-D area using portable instruments showed VGM and CP readings ranging from 500 c/m to 5,000 c/m around the island perimeter and readings of 35 mrep/hr (including 10 to 15 mr/hr) at locations adjacent to the point where the 107-D effluent pipe discharges water. Samples of mud from the island showed the activity density of beta particle emitters to be on the order of  $0.2 \mu\text{c/g}$ ; no alpha particle emission was detected in these samples. A water sample obtained on the island showed the concentration of beta particle emitters to be  $5.8 \times 10^{-4} \mu\text{c/cc}$ .

Deposition of radioactive material by waters of the Columbia River was estimated by analyzing mud collected along the shore of the river. Duplicate samples were obtained at each sampling location; one sample was taken at the edge of the water and the other sample from an underwater

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location 5' from shore. Table II summarizes the results obtained from the analysis of these samples for the activity density of beta particle emitters.

TABLE II  
RADIOACTIVE CONTAMINATION  
IN COLUMBIA RIVER MUD SAMPLES  
JANUARY, FEBRUARY, MARCH  
1953

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

<u>Location</u>	<u>Jan.</u> <u>Avg.</u>	<u>Feb.</u> <u>Avg.</u>	<u>March</u> <u>Avg.</u>	<u>Qtr.</u> <u>Avg.</u>	<u>Last</u> <u>Qtr.</u> <u>Avg.</u>	<u>Maximum</u> <u>This</u> <u>Quarter</u>
Wills Ranch						
Shore	3.6	3.1	3.8	3.5	2.7	4.9
5' Out	3.4	3.2	2.2	3.0	3.4	5.2
Allard Station						
Shore	23	5.0	4.4	11	8.9	51
5' Out	32	4.8	3.6	13	9.2	63
100-H Area						
Shore	7.5	3.3	4.7	5.1	10	12
5' Out	11	4.8	4.9	6.6	31	19
Below 100-F						
Shore	14	7.4	8.6	9.7	10	21
5' Out	16	6.9	8.2	9.8	19	23
Hanford Ferry						
Shore	21	8.7	6.8	13	12	48
5' Out	17	7.4	7.2	11	12	30
300 Area						
Shore	28	4.7	5.1	13	10	72
5' Out	22	4.8	6.3	11	8.3	56
Byers Landing						
5' Out	3.4		2.9	3.1	5.9	3.4
Richland Dock						
Shore	8.4	4.4	5.6	6.4	7.6	13
5' Out	12	7.4	20	14	11	49
Kennewick Highlands						
Pump Station						
Shore	6.2	4.6	2.8	4.4	7.3	9.1
5' Out	7.6	3.5	6.0	5.5	11	14

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TABLE II (contd.)

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

Location	Jan. Avg.	Feb. Avg.	March Avg.	Qtr. Avg.	Last Qtr. Avg.	Maximum This Quarter
PK Bridge (Pasco)						
Shore	4.2	2.3	3.8	3.4	5.5	5.1
5' Out	2.6	2.5	4.7	3.1	7.0	6.8
PK Bridge (Kennewick)						
Shore	5.9	2.4	3.1	3.6	6.8	9.0
5' Out	7.7	3.6	4.9	5.2	7.3	9.8
Sacajawea Park						
5' Out	22	5.2	8.0	11	16	34
McNary Dam						
5' Out	5.1	3.6	4.2	4.3	4.4	9.1
Patterson						
5' Out	3.6	2.3	4.4	3.6	3.6	5.9
Snake River Mouth						
5' Out	2.8	2.2	4.0	3.0	3.3	4.9

With the exception of one or two isolated locations at which the average results were influenced by one exceptionally high measurement, the average activity density of beta particle emitters in mud samples was not significantly different from that measured during the latter part of 1952.

The activity density of alpha particle emitters in mud samples collected at locations indicated in Table II averaged  $<1 \times 10^{-6} \mu\text{c}/\text{g}$  at all locations except those immediately below the 300 area. Average values over the three month period immediately below the 300 area ranged from  $1.5 \times 10^{-6} \mu\text{c}/\text{g}$  to  $5.3 \times 10^{-6} \mu\text{c}/\text{g}$ . Positive indications of alpha particle emission were detected at this location during each of the three months in the quarter.

Weekly samples were collected from the raw water river export line at each of the reactor and separation areas. Table III summarizes the results obtained from analyzing these samples for the activity density of gross beta particle emitters.

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TABLE III  
RADIOACTIVE CONTAMINATION IN RAW WATER  
RIVER EXPORT LINE  
JANUARY, FEBRUARY, MARCH  
1953

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

<u>Location</u>	<u>Jan. Avg.</u>	<u>Feb. Avg.</u>	<u>March Avg.</u>	<u>Qtr. Avg.</u>	<u>Last Qtr. Avg.</u>	<u>Maximum This Quarter</u>
183 Bldg., 100-B Area	<5	<5	<5	≤5	<5	<5
183 Bldg., 100-C Area	<5	<5	<5	≤5		<5
183 Bldg., 100-D Area	87	66	38	61	45	110
183 Bldg., 100-DR Area	96	57		76	54	110
183 Bldg., 100-H Area	140	150	66	120	99	260
183 Bldg., 100-F Area	130	91	23	78	100	190
283 Bldg., 200-E Area	46	36	26	36	<17	58
283 Bldg., 200-W Area	49	54	20	39	35	67

A review of the preceding data together with a comparison with results of similar measurements during the previous quarter generally shows a decreasing trend occurring during this period and indicates negligible difference between the quarterly averages. These observations were in agreement with those noted for the Columbia River water (Table I) and were expected as the raw water at the operating areas originates from the Columbia River. The samples which were analyzed represent this water prior to chlorination and final filtration for consumption.

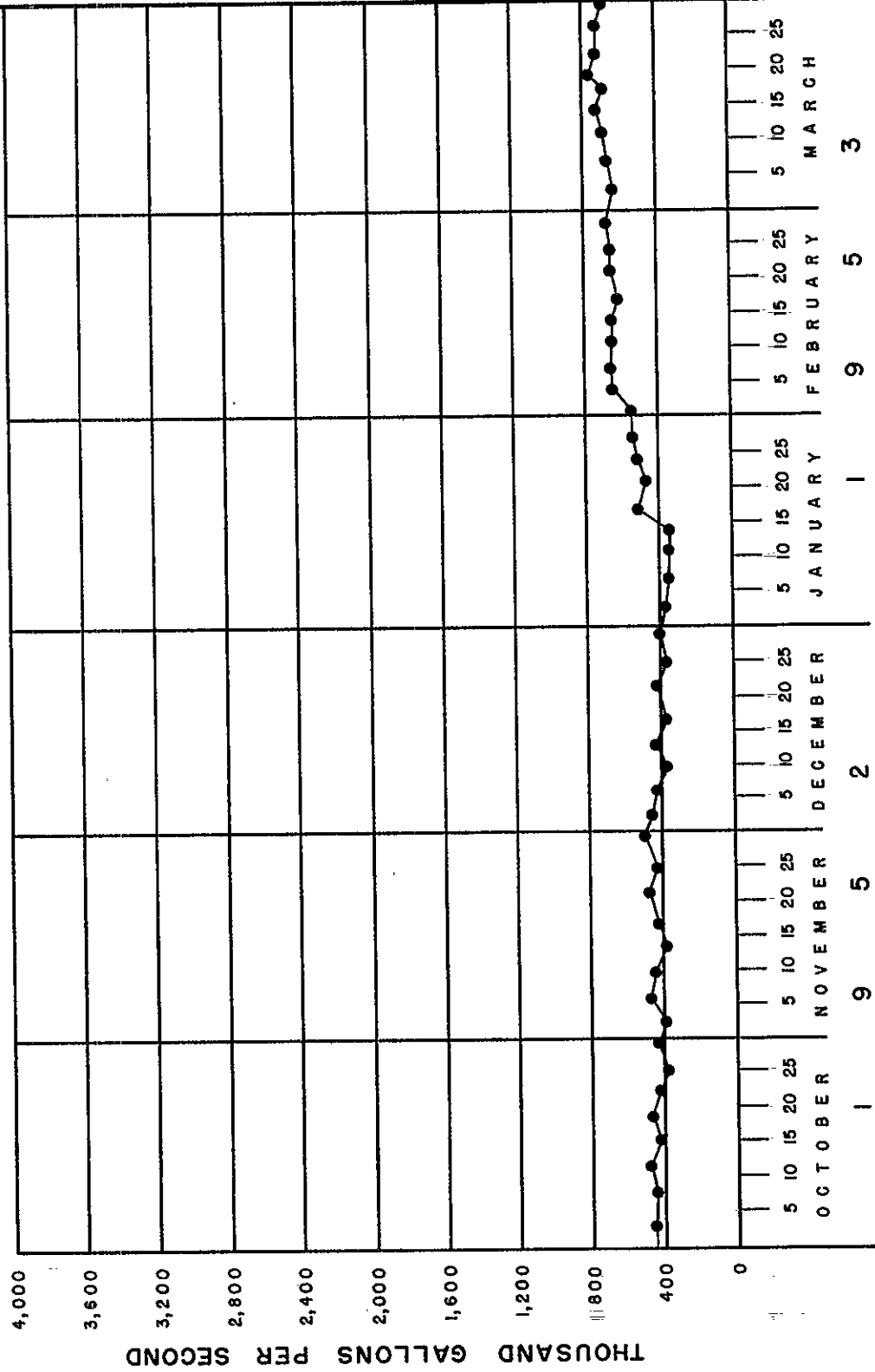
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COLUMBIA RIVER FLOW  
JANUARY - FEBRUARY - MARCH

FIGURE - 5

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SECTION VI

RADIOACTIVE CONTAMINATION IN RAIN

The activity density of gross beta particle emitters in precipitation in the Hanford environs was determined from the results of the analysis of 260 samples collected on and adjacent to the project. Abnormal amounts of precipitation during the month of January caused the bulk of these samples to be collected during that period. Total precipitation during January was 2.16 inches; the average rainfall during the month of January as measured over a thirty-five year period is 0.85 inches. Table I summarizes the rainfall data as measured at the Meteorology Station near the separation areas; measurements for the past two years are included for comparison.

TABLE I  
PRECIPITATION MEASURED AT HANFORD  
JANUARY, FEBRUARY, MARCH

<u>Year</u>	<u>Units - Inches</u>			<u>Quarterly Total</u>
	<u>January</u>	<u>February</u>	<u>March</u>	
1951	0.84	0.51	0.46	1.81
1952	0.65	0.50	0.06	1.21
1953	2.16	0.25	0.17	2.58

Table II summarizes the results obtained from analyzing rain samples for the activity density of gross beta particle emitters.

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TABLE II  
ACTIVITY DENSITY OF GROSS BETA PARTICLE EMITTERS IN RAIN  
JANUARY, FEBRUARY, MARCH  
1953

<u>Location</u>	<u>Number Samples</u>	<u>Units of <math>10^{-6}</math> <math>\mu\text{c/cc}</math></u>	
		<u>Maximum</u>	<u>Average</u>
<u>In 200 East Area</u>	<u>35</u>	<u>2</u>	<u>&lt;1</u>
250' E of stack	9	2	<1
2000' E of stack	9	2	<1
750' SE of stack	8	2	<1
3500' SE of stack	9	1	<1
<u>In 200 West Area</u>	<u>51</u>	<u>7</u>	<u>1</u>
1000' E of stack	12	3	<1
7000' E of stack	11	7	2
8000' SE of stack	12	4	1
4900' SE of stack	10	2	1
Redox Area	6	2	1
<u>100 Area Environs</u>	<u>70</u>	<u>3</u>	<u>&lt;1</u>
100-B SE	9	3	<1
100-D SW	10	1	<1
100-F SW	10	<1	<1
Hanford 614	10	3	<1
Hanford 101	10	<1	<1
White Bluffs	10	<1	<1
100-H SE	11	3	<1
<u>Perimeter Locations</u>	<u>38</u>	<u>2</u>	<u>&lt;1</u>
Richland	9	<1	<1
Pasco H and R	8	<1	<1
Benton City	8	2	<1
Riverland	7	<1	<1
North Richland	6	<1	<1
<u>Intermediate Locations</u>	<u>66</u>	<u>3</u>	<u>&lt;1</u>
Route 4S, Mile 6	9	<1	<1
300 Area 614	9	<1	<1
200 North 614	10	1	<1
Gable Mountain	8	<1	<1
Batch Plant	9	3	<1
622 Building	21	<1	<1

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A comparison of the average measurements indicated in Table II with the results of similar measurements obtained during the previous quarter shows that the values during the latter part of 1952 were from 5 to 20 times greater than those currently measured. The decrease noted during this period was largely the result of exceptionally high measurements during the months of November and December, 1952, when increased airborne particulate contamination over the environs caused the activity density of beta particle emitters to be exceptionally high. The current values compared favorably to those measured during the third quarter of 1952 and to those measured during October, 1952. Maximum and average values were lower than those measured during the same three month period in 1952.

Several of the evaporated rain samples which were originally collected inside the 200 West area were radioautographed to determine if any radioactive particles were present. Visual examination of the film after an exposure period of 168 hours showed no evidence of particulate contamination.

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SECTION VIIRADIOACTIVE CONTAMINATION  
IN DRINKING WATER SUPPLIES AND TEST WELLS

Radioactive contamination in drinking water supplies and test wells was measured by analyzing over 1,100 samples for the activity density of gross beta and gross alpha particle emitters. The volume analyzed in nearly 800 of these samples was 500 ml and in the remainder was 11.7 liters. The smaller volume samples were analyzed for alpha and beta particle emitters and the larger volume samples were used primarily to determine alpha particle emission when increased sensitivity was desired; the latter samples were also used for specific uranium and plutonium measurements. Sampling frequencies at the various supplies varied from daily to monthly with the bulk of the drinking water sources being sampled on a weekly basis.

The results obtained from analyzing drinking water samples from locations which showed the average activity density of alpha particle emitters to exceed the individual sample detection limit of  $5 \times 10^{-9}$   $\mu\text{C}/\text{cc}$  during the quarter are summarized in Table I.

TABLE I  
CONTAMINATION FROM ALPHA PARTICLE EMITTERS  
IN DRINKING WATER  
JANUARY, FEBRUARY, MARCH  
1953  
500 ml samples

Location	Number Samples	Alpha Particle Emitters Units of 10 <sup>-9</sup> $\mu$ c/cc		Number Samples	Uranium Units of 10 <sup>-3</sup> $\mu$ g/cc	
		Max.	Avg.		Max.	Avg.
Richland Well #4	57	36	7	35	18	5
Richland Well #12	12	11	7	6	6	5
Richland Well #14	13	7	5	7	4	3
Richland Well #15	13	11	8	7	7	5
Richland Well #18	13	9	5	6	5	3
Benton City Store	14	15	11	6	6	5
Benton City Water Co. Well	12	21	15	7	18	10
Sacajawea Park	10	9	7	5	7	6
Patterson	12	11	6	6	6	5
Pasco Improvement Farm	2	7	5	0	-	-

The average activity density of alpha particle emitters in Richland wells and Benton City drinking supplies was nearly identical to that observed during the previous quarter. As in the past, trace quantities of uranium were found in each of the wells which showed detectable alpha particle emission. Uranium values at these locations were comparable to those observed during the latter part of 1952.

Many other drinking water supplies showed trace alpha particle emission at some time during the quarter. The magnitude of the activity barely exceeded the detection limit for an individual sample and except for isolated cases, the positive values were not confirmed by subsequent samples. A complete summary showing the results obtained from all drinking water supplies sampled during the quarter is presented in Table II.

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TABLE II  
SUMMARY OF ALPHA AND BETA PARTICLE EMITTERS MEASURED IN  
WATER SUPPLIES  
500 ml samples  
JANUARY, FEBRUARY, MARCH  
1953

Location	Samples	Alpha Particle Emitters Units of $10^{-9} \mu\text{c/cc}$		Beta Particle Emitters Units of $10^{-8} \mu\text{c/cc}$	
		Max.	Avg.	Max.	Avg.
Richland Well #4	57	36	7	5	1
Richland Well #5	13	13	5	4	<1
Richland Well #12	12	11	7	<1	<1
Richland Well #13	12	8	4	2	<1
Richland Well #14	13	7	5	2	<1
Richland Well #15	13	11	8	3	<1
Richland Well #18	13	9	5	2	<1
Tract House J#685	10	6	2	3	<1
3000 Area Well "A"	10	7	3	15	3
3000 Area Well "B"	2	<2	<2	2	1
3000 Area Well "C"	9	7	3	61	7
3000 Area Well "D"	2	3	<2	8	4
3000 Area Well "E"	11	8	3	13	2
Durand Well #5	11	9	3	4	<1
Columbia Field Well "A"	11	9	2	5	1
Columbia Field Well "B"	10	11	2	21	2
Columbia Field Well "C"	4	7	4	10	4
Hanford Well #1	8	4	3	4	1
Hanford Well #4	10	5	2	8	<1
Headgate Well	12	3	<2	3	<1
1100 Area Well #8	13	4	2	4	<1
Midway	12	10	<2	3	<1
Riverland	13	11	2	9	1
Lower Knob	13	2	<2	6	<1
Wills Ranch	12	11	3	2	<1
Pistol Range	13	12	4	15	2
White Bluffs Fire Hall	14	12	4	55	29
White Bluffs Telephone Exch.	11	4	2	38	25
Benton City Store	14	15	11	6	1
Benton City Water Co.	12	2	<2	5	1
Kiona	13	7	3	2	<1

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TABLE II (contd.)

Location	Samples	Alpha Particle Emitters Units of $10^{-9} \mu\text{c/cc}$		Beta Particle Emitters Units of $10^{-8} \mu\text{c/cc}$	
		Max.	Avg.	Max.	Avg.
Enterprise Well	12	5	2	36	3
Kennewick Standard Station	11	4	<2	44	16
Hanford Well #7 (Sanitary)	13	6	<2	2	<1
100-B (Sanitary)	11	3	<2	2	<1
100-C (Sanitary)	11	3	<2	4	<1
100-D (Sanitary)	11	<2	<2	81	23
100-DR (Sanitary)	11	3	<2	32	16
100-H (Sanitary)	11	4	<2	69	28
100-F (Sanitary)	11	5	<2	98	34
100-K Well #1	13	4	<2	9	1
200 East (Sanitary)	14	3	<2	90	16
200 West (Sanitary)	11	2	<2	53	34
300 Area	11	5	<2	1	<1
251 Bldg.	11	6	2	6	3
Byers Landing	1	<2	<2	4	4
Redox Administration Bldg.	13	<2	<2	39	9
Sacajawea Park	10	9	7	3	<1
McNary Dam	11	3	<2	3	<1
Patterson	12	11	6	1	<1
Plymouth	11	5	<2	2	<1
Prosser	12	7	<2	3	1
Pasco Improvement Farm Well	2	7	5	1	<1
Pasco Sanitary	13			430	130

The alpha particle measurements summarized in Table II were comparable to past data and in many cases the trace quantities detected were of questionable significance when compared to the detection limit of the measurement. Wells which showed trace emission were resampled using a larger volume sample (11.7 liters) to increase the sensitivity of the individual measurement from  $5 \times 10^{-9} \mu\text{c/cc}$  to  $2 \times 10^{-10} \mu\text{c/cc}$ . Table III summarizes the results obtained from analyzing the large volume samples.

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TABLE III  
SUMMARY OF ALPHA PARTICLE EMITTERS  
MEASURED IN DRINKING WATER  
11.7 liter samples  
JANUARY, FEBRUARY, MARCH

Location	1953		Maximum	Average
	Units of $10^{-10}$ $\mu\text{c/cc}$	Number Samples		
Richland Well #4	5		54	31
Richland Well #5	8		31	13
Richland Well #12	7		87	35
Richland Well #13	6		32	23
Richland Well #14	7		37	17
Richland Well #15	6		63	37
Richland Well #18	6		45	30
Tract House #J685	7		19	8
Columbia Field Well "A"	6		18	9
Columbia Field Well "B"	6		15	9
Columbia Field Well "C"	4		36	16
1100 Area Well #8	7		30	11
3000 Area Well "A"	4		16	8
3000 Area Well "C"	4		13	10
3000 Area Well "E"	3		7	6
3000 Area Durand #5	7		17	9
Benton City Store	7		78	36
Benton City Water Co.	6		100	53
Kiona	7		39	12
Enterprise Well	7		32	9
Headgate Well	5		25	13
Kennewick Standard Station	4		13	8
Riverland	5		20	8
Midway	6		6	4
Lower Knob	5		3	<2
Wills Ranch	6		11	6
Hanford Well #1	5		19	10
Hanford Well #4	6		16	10
White Bluffs Fire House	5		28	13
Pistol Range	5		19	7
B. Y. Well	8		29	11
McGee Well	6		11	4
Ford Well	6		8	3
Meeker Well	6		8	3
Hanford #7 Sanitary	4		13	9
251 Building	6		10	5
3000 Pond Inlet (Raw)	1		10	10

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The average and maximum values shown in Table III were on the order of magnitude expected from previous data and were not indicative of any significant trend or change occurring during the quarter.

The activity density of gross beta particle emitters in drinking water supplies was determined from the analysis of all 500 ml samples collected from locations shown in Table II. A summary of the results of these measurements may be referred to in Table II. Consistent with previous observations, all drinking water supplies using the Columbia River as a source of supply showed significant beta particle emission. In general, these locations were confined to the manufacturing areas on the project and the residential communities of Kennewick and Pasco. The average activity density of beta particle emitters at these locations was comparable to that observed during the previous quarter. Similarity in these data was expected as the average activity density of beta particle emitters measured in Columbia River water during this period was not significantly different from that measured during late 1952 (Section V).

In addition to those from locations shown in Tables II and III, a number of drinking water samples was obtained from remote communities in Oregon and Washington. Radiochemical analysis of these samples for the activity density of alpha and beta particle emitters showed values below the detection limits of  $5 \times 10^{-9}$  and  $5 \times 10^{-8}$   $\mu\text{c/cc}$ , respectively. Spot samples which were analyzed for uranium showed no indication of this contaminant.

Table IV summarizes the results obtained from analyzing various types of samples which were collected at the Pasco filter plant.

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TABLE IV  
RADIOACTIVE CONTAMINATION  
MEASURED AT PASCO FILTER PLANT  
JANUARY, FEBRUARY, MARCH  
1953

<u>Type Sample</u>	<u>Number Samples</u>	<u>Activity Density Gross Beta Particle Emitters</u>	
		<u>Maximum</u>	<u>Average</u>
Water Entering Plant From River	10	$5.1 \times 10^{-6} \mu\text{c/cc}$	$3.4 \times 10^{-6} \mu\text{c/cc}$
Sand (Surface of sand filter)	5	$2.5 \times 10^{-4} \mu\text{c/g}$	$1.9 \times 10^{-4} \mu\text{c/g}$
First Backwash Material (liquid)	12	$1.8 \times 10^{-6} \mu\text{c/cc}$	$1.1 \times 10^{-6} \mu\text{c/cc}$
First Backwash Material (solid)	12	$7.5 \times 10^{-2} \mu\text{c/g}$	$3.6 \times 10^{-2} \mu\text{c/g}$
Coal (Surface of coal filter)	6	$4.2 \times 10^{-4} \mu\text{c/g}$	$2.8 \times 10^{-4} \mu\text{c/g}$
First Backwash Material (liquid)	2	$2.0 \times 10^{-6} \mu\text{c/cc}$	$1.5 \times 10^{-6} \mu\text{c/cc}$
First Backwash Material (solid)	2	$9.5 \times 10^{-2} \mu\text{c/g}$	$6.4 \times 10^{-2} \mu\text{c/g}$
Water Leaving Plant	13	$4.3 \times 10^{-6} \mu\text{c/cc}$	$1.3 \times 10^{-6} \mu\text{c/cc}$

The activity density of beta particle emitters in samples of filtering media and waters at the Pasco Filter plant was not significantly different from that measured during the previous quarter. Analysis of one sample of foam from the surface of the sand filter showed the activity density of beta particle emitters to be  $6.3 \times 10^{-5} \mu\text{c/g}$  and several samples of similar material from the surface of the coal filter showed an average of  $1.4 \times 10^{-2} \mu\text{c/g}$  including a maximum of  $2.0 \times 10^{-2} \mu\text{c/g}$ . One sample of water obtained from the meter at the filter plant showed a value of  $4.2 \times 10^{-6} \mu\text{c/cc}$ .

A series of sanitary water samples and sand filter trap samples from the Pasco Filter plant was collected at one hour intervals on February 25 to determine if the activity density of beta particle emitters increased at the filter plant as a result of the admission of some reactor basin sludge to the river at the 100-D area during that day (Section IV). Analysis of the data showed no significant variation in the activity density measurements and the individual measurements were nearly identical to

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values observed during January and February. Radiochemical analysis of these samples for the activity density of alpha particle emitters showed values below the detection limit in all cases.

In addition to the samples obtained from drinking water supplies, nearly 200 water samples were obtained from test and experimental wells on the reservation. Table V summarizes the results obtained at locations where the average activity density from alpha or beta particle emitters exceeded the detection limits of the measurements.

TABLE V  
SUMMARY OF ALPHA AND BETA PARTICLE EMITTERS  
MEASURED IN TEST WELLS  
500 ml samples  
JANUARY, FEBRUARY, MARCH  
1953

Location	Number Samples	Alpha Particle Emitters		Beta Particle Emitters	
		Units of $10^{-9}$ $\mu\text{c/cc}$		Units of $10^{-9}$ $\mu\text{c/cc}$	
		Maximum	Average	Maximum	Average
300 Area Well #1	12	8	5	6	1
300 Area Well #3	25	53	29	23	4
300 Area Well #4	12	190	120	9	2
300 Area North Well	4	1700	1100	12	7
B-Y Well	13	12	4	30	3
McGee Well	13	2	2	52	5
Meeker Well	13	4	2	9	1

Average alpha particle emission in samples collected from the 300 area wells during this quarter was comparable to that measured during the last quarter of 1952. Uranium was identified as the contaminant in each of the 300 area wells; average values for uranium at Wells #1, #3, and #4 were  $3 \times 10^{-3}$   $\mu\text{g/cc}$ ,  $2.6 \times 10^{-2}$   $\mu\text{g/cc}$ , and  $9.9 \times 10^{-2}$   $\mu\text{g/cc}$ ,

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respectively. Uranium in the 300 North area well averaged  $1.8 \mu\text{g/cc}$  including a maximum measurement of  $2.2 \mu\text{g/cc}$ .



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