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[redacted] HANFORD TECHNICAL RECORD

HW-25866

BIOPHYSICS SECTION

RADIOLOGICAL SCIENCES DEPARTMENT

RADIOACTIVE CONTAMINATION IN THE ENVIRONS OF THE HANFORD WORKS

FOR THE PERIOD

JANUARY, FEBRUARY, MARCH

1

October 15, 195

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Health and Safety

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RADIOACTIVE CONTAMINATION IN THE ENVIRONS OF THE HANFORD WORKS FOR THE PERIOD JANUARY, FEBRUARY, MARCH, 1952

October 15, 1952

HANFORD TECHNICAL RECORD

by

H. J. Paas

HANFORD WORKS
RICHLAND, WASHINGTON

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ABSTRACT

SECTION I - RADIOACTIVE CONTAMINATION IN EFFLUENT GASES:

I-131 emission measured at the separation facility stacks averaged 2.2 curies per day throughout the period. Maximum daily emission was on the order of 9 curies. Daily monitoring for ruthenium discharged from the Redox stack was started in March and showed an average of 0.06 curie leaving this facility daily. Average uranium emission ranged from 0.5 mg per day to 16 mg per day at the T-Plant and Redox Plant. In an isolated case during January, 300 mg U were measured leaving the B facility over a 24-hour period. Plutonium emission averaged less than 1 mg per day at each separation facility. Trace quantities of tritium oxide averaging less than 9×10^{-8} μc/cc were detected leaving the reactor stacks in the 100-D, 100-H and 100-F Areas. Spot measurements for S-35 and C-14 discharged from the reactor stacks showed negligible quantities in nearly all instances. Measurements to determine particulate contamination leaving the 100 Area stacks showed values below the detection limit in nearly all samples; the maximum measurement was 0.3 particle/m^3 leaving the 105-F stack.

SECTION II - RADIOACTIVE CONTAMINATION ON VEGETATION:

Increases in the activity density from I-131 on vegetation were not significant at perimeter and residential locations, but were highly significant in the region of higher deposition near the 200 West Area. Maximum measurements were noted in an elongated area that included nearly all of the 200 West Area and extended eastward to a point inside the 200 East Area; the average activity density exceeded 1×10^{-4} μc/gm in this region. The increase in activity density was weighted by measurements obtained during February when the activity density averaged over 2.5×10^{-4} μc/gm near the 200 West Area gatehouse. Trace quantities of I-131 on the order of 10^{-6} μc/gm were detected in the residential areas of Pasco, Kennewick and Benton City and at isolated locations near Sunnyside and Moxee City. Decreases in the activity density from non-volatile emitters on vegetation were largely due to the higher measurements observed during the previous quarter when the Nevada Bomb Tests were carried out. Samples collected during the early part of the quarter showed evidence of residual particulate contamination from the Nevada Tests. Excluding samples collected from inside the separation areas, the maximum activity density from non-volatile emitters detected on the project was 1.1×10^{-4} μc/gm. With the exception of samples collected near the 300 Area, the average activity density from gross alpha emitters on vegetation ranged from 1.0 to 6.8×10^{-7} μc/gm throughout the environs. Near the 300 Area, an average of 2.4×10^{-6} μc/gm included a maximum measurement of 4.3×10^{-6} μc/gm.

SECTION III - RADIOACTIVE CONTAMINATION IN THE ATMOSPHERE:

Radiation dosage rates evaluated from ionization chamber readings remained on the order of background in the residential areas and ranged from 0.8 to 1.2 mrep/day near the manufacturing areas. The activity density from gross beta emitters in the atmosphere was on the order of 1 to 2 x 10^{-12} μc/cc near the separation facilities and less than 5 x 10^{-13} μc/cc at outlying locations; the maximum measurement was 1.1 x 10^{-11} μc/cc observed over a one week period near the Redox Area. A significant reduction in the number of radioactive particles in the atmosphere originating from off-site sources caused particle deposition in the immediate environs to approach the order of magnitude that was measured prior to the Nevada Tests. In general, particulate contamination in the immediate environs was approximately 10 times greater than that noted at remote locations during the latter part of the quarter. Trace quantities of alpha emitters were detected at all monitoring locations during some interval in the quarter; positive averages for the three month period were noted at 18 of the 31 monitoring stations with a maximum value of 1.1 x 10^{-13} μc/cc found near the 200 West Area. The activity density from I-131 was comparable to that measured during the previous quarter with average values in the range of 1 to 5 x 10^{-12} μc/cc near the operating facilities and in the range of 1 to 5 x 10^{-13} μc/cc at perimeter locations. Portable scrubber samples obtained while the off-gases were observed looping toward ground level showed a maximum measurement of 1.2 x 10^{-9} μc/cc.

SECTION IV - RADIOACTIVE CONTAMINATION IN HANFORD WASTES:

The increasing trend in the activity density from gross beta emitters measured at the outlet of the 107 basins at the Reactor Areas did not continue during this period. The mean activity at the 5 basins ranged from 1.1 to 1.9 x 10^{-3} μc/cc; the maximum measurement was 2.7 x 10^{-3} μc/cc at the 107-B basin. Trace alpha activity, on the order of 10^{-8} μc/cc, was detected in only 3 of the 400 samples analyzed. Spot checks for uranium and plutonium showed negligible activity in all cases. I-131 in Biology farm waste averaged 6.4 x 10^{-6} μc/cc including a maximum measurement of 3.9 x 10^{-5} μc/cc. A near 3-fold increase in this activity was noted during February and March. Except for general increases ranging from a factor of 2 to 4 in the activity density from uranium in the 300 Area Pond, the gross contamination measured at waste sources in the 200 and 300 Areas was comparable to that noted during the latter part of 1951.

SECTION V - RADIOACTIVE CONTAMINATION IN THE COLUMBIA RIVER:

As expected during periods in which the flow rate of the Columbia River remains constant, the average activity density from gross beta emitters was nearly identical to that observed during the previous quarter. Maximum activity detected below the 100-H Area averaged 6.1 x 10^{-6} μc/cc including a maximum of 1.9 x 10^{-5} μc/cc. The mean activity was less than 2.2 x 10^{-6} μc/cc at all locations below Richland. Results obtained from the analysis of mud samples for the activity density from gross alpha and beta emitters were not significantly different than those noted during the previous quarter and were not indicative of any significant month to month fluctuation. The average activity density from gross beta emitters in raw water ranged from less than 5×10^{-8} μc/cc to 9.1×10^{-7} μc/cc with maximum values prevailing at the 100-F Area. No alpha emission was detected in raw water samples. Analysis of river samples obtained from several other rivers in the Pacific Northwest showed the background activity in these sources to be comparable to that in the Columbia River above 100-B Area.

SECTION VI - RADIOACTIVE CONTAMINATION IN RAIN:

Radiochemical analysis of over 200 rain samples collected from various locations in the environs showed the maximum activity density from gross beta emitters to be on the order of 1×10^{-4} μc/cc at locations in the 200 West Area. Trace activity was detected at perimeter locations with isolated samples showing values in the range of 1 to 2×10^{-5} μc/cc and average values in the range of 1 to 8×10^{-6} μc/cc.

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

Drinking water samples obtained from the water table below the Benton City - Richland region showed trace alpha emission which was confirmed to be uranium. Average values were on the order of 1.5×10^{-2} μg U/cc at Benton City and 6×10^{-3} μg U/cc at Richland. Drinking water supplies which use the Columbia River as their source represented the only locations at which the activity density from beta particle emitters exceeded 5×10^{-8} μc/cc. Average values for the activity density from beta emitters in sanitary water at the operating areas were on the order of 2.5×10^{-7} μc/cc. Radiochemical analysis of samples collected at the Pasco Filter Plant for the activity from gross beta emitters showed small but related decreases in all types of samples analyzed. Maximum activity was noted in backwash material from the filter beds in which the liquid and solid portions showed an average of 7.1×10^{-7} μc/cc and 1.1×10^{-2} μc/gm, respectively. A decontamination factor of 7 at the filter plant was calculated by comparing the inlet and outlet activity. Beta activity in drinking water samples collected from various communities along the Columbia River between Pasco, Washington and Portland, Oregon was less than 5×10^{-8} μc/cc. Results obtained from the analysis of test well samples were not significantly different from expected values.

SECTION I

RADIOACTIVE CONTAMINATION IN EFFLUENT GASES

Samples of effluent gas were collected at the stacks in the Separation and Reactor Areas throughout the quarter. Monitoring methods were comparable to those described in previous reports (HW-22313 and HW-23133). Analytical techniques followed the standard procedures used at the Control Laboratory (HW-20136).

200 WEST AREA - T-PLANT STACK:

Table I summarizes the results obtained from monitoring for I-131 at this facility during the quarter.

TABLE I

SUMMARY OF RESULTS FROM STACK MONITORING

200 WEST AREA STACK (T PLANT)

JANUARY, FEBRUARY, MARCH

1 9 5 2

Month	Curies of I-131 Dissolved per 24 Hrs.		Curies I-131 Emitted Daily		Curies Emitted Through Sand Filter Daily	
	Maximum	Average	Maximum	Average	Maximum	Average
January	3530	1110	7.6	1.9	2.4	0.9
February	1960	750	8.5	1.1	2.6	0.4
March	2670	1390	7.0	2.0	2.4	0.8
Quarter	3530	1130	8.5	1.8	2.6	0.7
Previous Quarter	2800	1230	30.0	3.0	28.0	3.0*

* These values were weighted by measurements obtained during the first week of October when the sand filter emission averaged 14 curies.

The average value was comparable to the average daily emission measured during November and December of 1951. In general, approximately one-half of the total I-131 emitted entered the stack through the sand filter. The latter ratio also was comparable to that noted during November and December in 1951.

Spot air filter samples obtained during January and February showed that from 0.4 to 0.8 mg of plutonium and from 0.4 to 300 mg of uranium discharged from the T-Plant stack over 24-hour periods. Except for one high uranium measurement, these values were comparable to measurements obtained during the previous quarter when the total amount of plutonium and uranium discharged did not exceed 25 mg/day.

200 WEST AREA - REDOX STACK:

The monitoring equipment installed at the Redox Area during the previous quarter was placed in service during the month of January when the first material was processed at this facility. Table II summarizes the results obtained from monitoring for I-131 at this location during the quarter.

TABLE II

SUMMARY OF RESULTS FROM STACK MONITORING

REDOX STACK

JANUARY, FEBRUARY, MARCH

1 9 5 2

Month	Curies of I-131 Dissolved per 24 Hrs.		Curies I-131 Emitted Daily	
	Maximum	Average	Maximum	Average
January	110	0.2	0.12	0.01
February	990	125	0.22	0.05
March	700	135	2.0	0.4
Quarter	990	105	2.0	0.2

Statistical comparison of these measurements with similar measurements at other facilities was not attempted as the above values represented the dissolving of irradiated uranium which had been cooled for extended periods of time, and the frequency of individual dissolvings was random throughout the period. Preliminary estimations based on the above data indicate that the I-131 emission from this source will be comparable to that measured at the other separation facilities.

The amount of ruthenium discharged to the atmosphere was measured by drawing stack gas through a filter and caustic scrubber connected in series. Spot samples obtained during January and February indicated that approximately 1.5×10^{-3} curie of ruthenium was discharged daily. Daily monitoring for this contaminant was started during the early part of March; the latter results indicate that the daily emission ranged from 0.09 to 0.24 curie /day with an over-all average of 0.06 curie/day during March. The ruthenium collected on the filters indicated that an average of 7×10^{-4} curie of ruthenium per day left this facility as particulate matter.

Air filter samples collected between February 13 and March 6 showed that an average of 0.2 mg of plutonium and 16 mg of uranium were emitted from the Redox Stack daily.

200 EAST AREA - B-PLANT:

Table III summarizes the monitoring results obtained from the measurement for I-131 discharged from this facility.

TABLE III

SUMMARY OF RESULTS FROM STACK MONITORING
200 EAST AREA STACK
JANUARY, FEBRUARY, MARCH
1 9 5 2

Month	Curies of I-131 Dissolved per 24 Hrs.		Curies I-131 Emitted Daily		Curies Emitted Through Sand Filter Daily*	
	Maximum	Average	Maximum	Average	Maximum	Average
January	2610	910	1.6	0.2	-	-
February	3960	1040	1.2	0.3	-	-
March	2350	750	0.3	0.08	0.05	0.02
Quarter	3960	910	1.6	0.2	-	-
Previous Quarter	3880	1340	10.6	2.0	6.8	1.2

* Monitoring at the sand filter was discontinued due to low emission measured at stack. Spot checks during March confirmed former observations.

The average emission of 0.2 curie of I-131 per day represented a ten-fold decrease in the amount of I-131 discharged from this facility during the quarter. This decrease was largely a result of exceptionally high measurements during October and November of 1951 prior to the addition of mercury salts to the dissolving operation.

Average values throughout the quarter were comparable to those measured during the month of December, 1951.

Air filter samples obtained during the periods January 8 through January 15 and February 12 through March 6 showed that the amount of plutonium emitted from the B-Plant stack was 28 and 2.4 µg/24 hours, respectively. Average uranium emission during the same periods was 300 and 1.3 mg/24 hours, respectively. With the exception of the one high uranium measurement, these values were comparable to those measured during previous quarters.

REACTOR AREAS:

The activity density from tritium oxide discharged to the atmosphere from the reactor stacks was measured by sampling at the base of the 105 stacks in the 100-D, 100-H, and 100-F Areas. Daily samples were obtained from each of these sources as well as from various environmental locations Monday through Friday, throughout the quarter. Sampling methods and analytical techniques have been outlined in previous publications of this series (HW-23133 and HW-20136).

Table IV summarizes the average results obtained over the three-month period at all locations where daily monitoring was carried out.

Coincident with the shut-down of the P-10 operation in the 100-B Area during the latter part of March 1952, the related environmental sampling program conducted by the Regional Survey Group was terminated. An over-all appraisal of the results obtained from monitoring for tritium oxide in the atmosphere during the duration of this operation is currently being prepared and will be presented in a separate publication.

TABLE IV

ACTIVITY DENSITY FROM TRITIUM OXIDE IN ATMOSPHERE

JANUARY, FEBRUARY, MARCH

1 9 5 2

Location	Units of 10^{-9} µc/cc		
	January	February	March
Pistol Range	< 4	8	< 4
White Bluffs	< 4	< 4	< 4
100-D SE	5	< 4	< 4
Riverland	< 4	< 4	< 4
100-C Cons't Area #1	< 4	< 4	5
100-C Cons't Area #2	< 4	< 4	< 4
100-C Cons't Area #4	< 4	< 4	< 4
100-B Area SW Corner	< 4	< 4	< 4
100-B Area SE Corner	< 4	< 4	< 4
100-B Area NE Corner	< 4	< 4	< 4
100-B Area 151-B	< 4	< 4	< 4
100-B Area 183 Building	< 4	< 4	< 4
100-B Area 1701 Building	< 4	< 4	< 4
100-B Area 107 Inlet	< 4	< 4	< 4
100-B Area 181-B Roof	< 4	< 4	< 4
Richland	< 4	< 4	< 4
100-D Area 105 Stack	81	46	27
100-H Area 105 Stack	8	6	5
100-F Area 105 Stack	30	30	11

Air filter samples were obtained from the 100-F, 100-H, and 100-D Area stacks over the period March 15 through March 21 for the specific purpose of measuring the amount of uranium and plutonium emitted from these facilities. Analysis of these samples showed that from 7 to 11 µg of plutonium were emitted over a 24-hour period from each area. No significant difference was noted when comparing the results from the individual areas. Uranium emission from the reactor stacks ranged from 1.8×10^5 to 5.8×10^5 µg/day from each area. The higher measurements were noted at the 100-D Area.

Several of the air filter samples obtained from the reactor stacks were exposed to Type K X-ray film to determine the number of radioactive particles discharged to the atmosphere. These measurements indicated that the number of particles discharged was below the detection limit of the measurement in the majority of cases. The maximum measurement showed 0.3 particle/m^3 leaving the 100-F Area stack. (The detection limit for small air samples of this type is on the order of 0.05 particle/m^3.)

Sixty-one samples collected from the 105-D, 105-F, and 105-H stacks were analyzed for C-14 with results summarized in Table V.

TABLE V

SUMMARY OF C-14 AND S-35 MEASUREMENTS-REACTOR STACKS

JANUARY, FEBRUARY, MARCH

1952

units of 10^{-10} µc/cc

Area	C-14 Maximum	C-14 Average	S-35 Maximum	S-35 Average
105-D	51	9.8	1.1	<1
105-F	15	4.5	<1	<1
105-H	250	23.0	4.4	<1

Fifty-two samples collected from the reactor stacks were analyzed for S-35 with results summarized in Table V above. Only four individual samples showed this activity to be above the detection limit of analysis.

SECTION II

RADIOACTIVE CONTAMINATION ON VEGETATION

The magnitude and extent of radioactive I-131 deposited on the environs of the Hanford Works was determined by analyzing over 2,500 vegetation samples during the three-month period. Nearly 2,000 of these samples were obtained from locations within the project perimeter and in the adjoining communities of the Tri-City area; the remainder of the samples was collected from remote locations in the states of Washington, Oregon, and Idaho. Maps showing the locations from which these samples were obtained may be referred to in Figures 1 and 2.

Vegetation samples were analyzed according to standard procedures and techniques used in the control laboratory (HW-20136). The counting rates were corrected for counting efficiencies, decay, and sample weight by factors normally applied in this calculation (HW-22682).

In addition to the measurement for I-131, approximately one-half of the collected samples was also analyzed for the activity density from non-volatile beta emitters. This measurement included the activity which results from naturally occurring isotopes such as potassium (K-40) and uranium. Samples from eight representative locations in the immediate environs were also analyzed to determine the activity density from gross alpha emitters.

Table I summarizes the results obtained from the measurements for the activity density from beta particle emitters during the quarter; mean values obtained at these same locations during the previous quarter are included for comparison.

TABLE I

RADIOACTIVE CONTAMINATION ON VEGETATION

JANUARY, FEBRUARY, MARCH

1952

Location	No. Samples	I-131 units of 10^{-6} µc/gram Maximum	Average	Previous Average	Non-Volatile units of 10^{-6} µc/gram Maximum	Average	Previous Average
North of 200 Areas	213	110	15	10	110	32	47
Near the 200 Areas	184	220	38	22	110	32	58
Route 3	13	6200	630	105	50	35	67
200 West Gate	126	12000	1200	128	390	56	68
200 East Tower #16	125	290	92	70	88	32	56
Batch Plant	52	1500	170	50	76	37	58
Meteorology Tower	13	210	91	71	60	34	54
South of 200 Areas	329	310	28	8	76	28	42
Richland	188	580	27	6	85	21	40
Pasco Environs	78	75	13	4	57	17	36
Kennewick Environs	120	250	23	5	79	21	32
Benton City - Kiona	38	72	16	4	61	26	41
Richland "Y"	13	55	18	6	26	17	48
Hanford	26	58	9	8	85	37	44
200 East Area	48	310	76	48	810	54	57
200 West Area	63	2500	190	31	300	35	94
Redox Area	95	1600	270	39	53	36	72
Wahluke Slope	109	73	22	6	44	24	45
Goose Egg Hill	38	150	39	15	65	35	51
Rattlesnake Mountain	37	69	21	10	94	41	57
PSN-300-310-320	39	230	57	12	51	32	43
Off-Area Sampling							
Pasco to Ringold	75	82	7	4	68	25	44
Prosser to Patterson - McNary	250	97	7	4	84	25	38
Eastern Washington	190	7	< 3	-	170	26	-
So. Wash. and No. Ore.	120	69	< 3	-	83	18	-
Yakima Barricade to Ellensburg	82	51	3	-	89	18	-

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A comparison of the above data with similar measurements obtained during the previous quarter shows that the activity density from I-131 increased throughout the environs during this period. These increases were not significant at perimeter locations and in residential areas but were highly significant in the region of higher contamination near the 200 West Area gate-house and along Route 3 which borders the 200 West Area on the east side. The magnitude of the latter increases was on the order of a factor of 6 to 10 whereas the increases at the project perimeter were on the order of a factor of from 2 to 4. The estimated average deposition pattern is presented in Figure 3. A review of the iso-activity map (Figure 3) shows that the mean activity exceeded 1×10^{-4} μc/gm in an elongated area which included nearly all of the 200 West Area and extended eastward to a point inside the 200 East Area. This area of higher deposition was approximately two miles wide. During the previous quarter, the area in which the deposition exceeded 1×10^{-4} μc/gm was confined to a small region (less than one square mile) near the 200 West Area gate-house. It is also worthy of mention that trace quantities of I-131 were detected throughout the quarter in the residential areas of Pasco, Kennewick, and Benton City and at nearly all sampling locations on the Wahluke Slope.

A review of the deposition data indicates that the higher deposition noted during this quarter was weighted by the results obtained during the month of February when the activity density from I-131 showed general increases on the order of a factor of 2 to 5 throughout the environs. Table II summarizes the average measurements on a month to month basis for this period.

The over-all significance of the February results may also be appraised by reviewing the estimated iso-activity maps for each of the three months during the quarter; Figures 4, 5, and 6 present these data. Two significant observations noted when comparing the month to month deposition include the exceptionally high deposition (average activity density exceeding

2.5 x 10^{-4} μc/gm) noted near the 200 West Area during February, and the very spotty deposition noted throughout the environs during the month of March. The change in deposition pattern occurring during the three month period may be largely associated with varying meteorological conditions since the over-all emission of I-131 from the separation area stacks did not change significantly during the month of February.

TABLE II
ACTIVITY DENSITY FROM I-131 ON VEGETATION
JANUARY, FEBRUARY, MARCH
1952

	units of 10^{-6} μc/gram					
	January		February		March	
Location	Max.	Aver.	Max.	Aver.	Max.	Aver.
North of 200 Area	83	17	110	22	44	6
Near the 200 Areas	170	50	220	51	89	19
Route 3	870	210	6200	1700	400	120
200 West Gate	2700	1100	12000	2000	1200	380
200 East Tower #16	290	130	260	100	120	38
Batch Plant	1500	200	84	59	130	55
Meteorology Tower	136	100	210	92	180	82
South of 200 Areas	270	28	310	50	110	10
Richland	44	14	580	71	27	5
Pasco Environs	36	10	75	26	15	4
Kennewick Environs	51	14	250	54	19	5
Benton City	47	14	72	30	20	6
Richland "Y"	23	16	55	32	23	6
Hanford	58	14	15	8	9	5
200 East Area	300	130	190	79	100	25
200 West Area	570	96	2500	290	1200	180
Redox Const. Area	1300	330	700	230	1600	210
Wahluke Slope	5	< 3	73	39	18	7
Goose Egg Hill	150	49	--	--	83	29
Rattlesnake Mountain	69	32	--	--	28	15
PSN-300-310-320	120	54	230	97	55	22
Prosser to Patterson - McNary	30	8	97	15	18	3
Pasco to Ringold	82	12	13	5	23	5
Eastern Wash.	5	< 3	7	< 3	5	< 3
So. Wash. and No. Oregon	--	--	69	5	12	< 3
Yakima Barricade to Ellensburg	14	< 3	--	--	51	3

Samples obtained from remote locations (Figure 2) showed that the average activity density from I-131 in eastern and southern Washington and northern Oregon was essentially below the detection limit of the measurement (less than 3×10^{-6} µc/cc) throughout the quarter. Quantities of I-131 which were believed significant for remote locations during this period were detected in isolated samples which were collected at Sunnyside, Washington, and near Moxee City, Washington. The values obtained from the latter samples showed the activity density from I-131 to be on the order of 5 to 7×10^{-5} µc/gm. Except for these two measurements, the I-131 deposition pattern at remote locations was not significantly different from that observed during the previous quarter.

Although the mean activity density from non-volatile emitters on vegetation showed general decreases at all locations during the quarter, the current average activity density from this source was still above that expected if the sources of deposition were confined to normal Hanford Operations. The higher results observed during the previous quarter were directly associated with the Nevada Bomb Tests (HW-24203) and many of the measurements obtained during the early part of this period were also influenced by residual particulate matter from these tests. The contributions from the Nevada Tests may be appraised by comparing the measurements obtained from remote locations in Oregon and Washington with the results found at locations in the immediate environs; average values at the remote locations ranged from 2 to 3×10^{-5} µc/gm as compared with average values of 2 to 5×10^{-5} µc/gm found in the residential areas bordering the project, on the Wahluke Slope, on Rattlesnake Mountain, and at intermediate locations between the operating areas on the plant. One sample collected in eastern Washington showed the activity density from non-volatile emitters to be 1.7×10^{-4} µc/gm; excluding samples collected from within the separations areas, the maximum activity detected in samples collected from the Hanford Works was 1.1×10^{-4} µc/gm.

The program inaugurated during the month of December, 1951, for the purpose of determining the specific activity density from gross alpha emitters on vegetation, was enlarged during this quarter to include sampling locations in the residential communities of Richland, Pasco, and Benton City. Bi-monthly samples obtained throughout the period from nine representative locations showed trace quantities of alpha emitters. Table III summarizes the average values obtained from these measurements.

TABLE III

ACTIVITY DENSITY FROM GROSS ALPHA EMITTERS ON VEGETATION

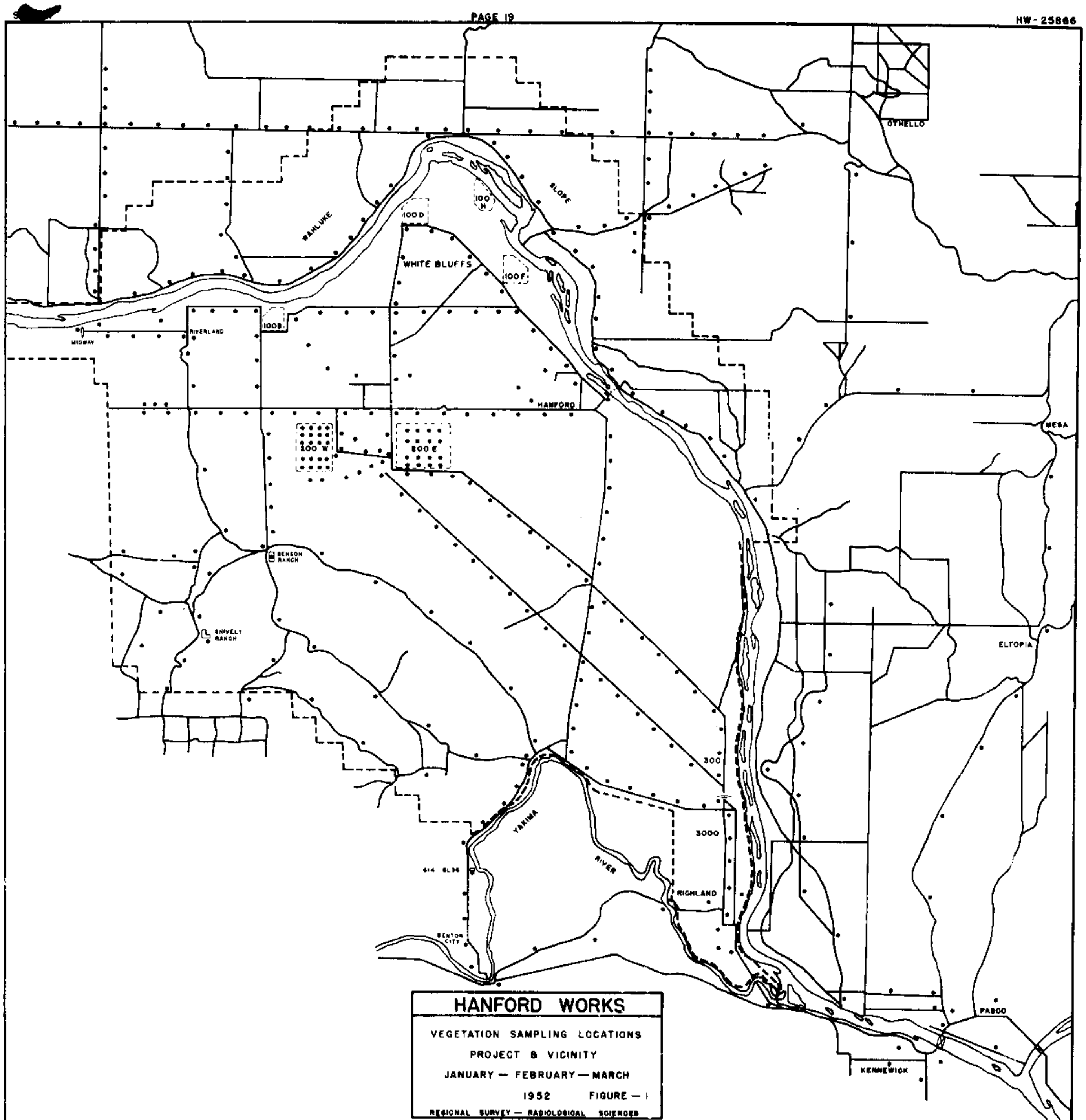
JANUARY, FEBRUARY, MARCH

1 9 5 2

	units of 10^{-8} μc/gram				
Location	January	February	March	Quarterly Average	Maximum Result
Near 200 Areas					
200 West Gatehouse	100	56	62	68	100
Batch Plant	16	8	25	14	25
Rt. 4S, Mile 4	12	16	19	16	24
Meteorology Tower	57	44	30	40	57
Rt. 4S, Mile 6	< 5	6	18	8	18
300 Area	-	310	46	240	430
Outlying					
Richland	10	16	14	13	16
Pasco	8	9	18	11	18
Benton City	11	12	< 5	10	14

A comparison of the data in Table III with the few initial measurements obtained during December, 1951, shows favorable comparison for locations near the 200 Areas. The relatively high deposition noted near the 300 Area was apparently not related to emission from the separation or reactor area stacks, but was more probably associated with the 300 Area sources.

HW-25866



HANFORD WORKS

VEGETATION SAMPLING LOCATIONS
PROJECT & VICINITY
JANUARY — FEBRUARY — MARCH
1952 FIGURE — 1

REGIONAL SURVEY — RADIOLOGICAL SCIENCES

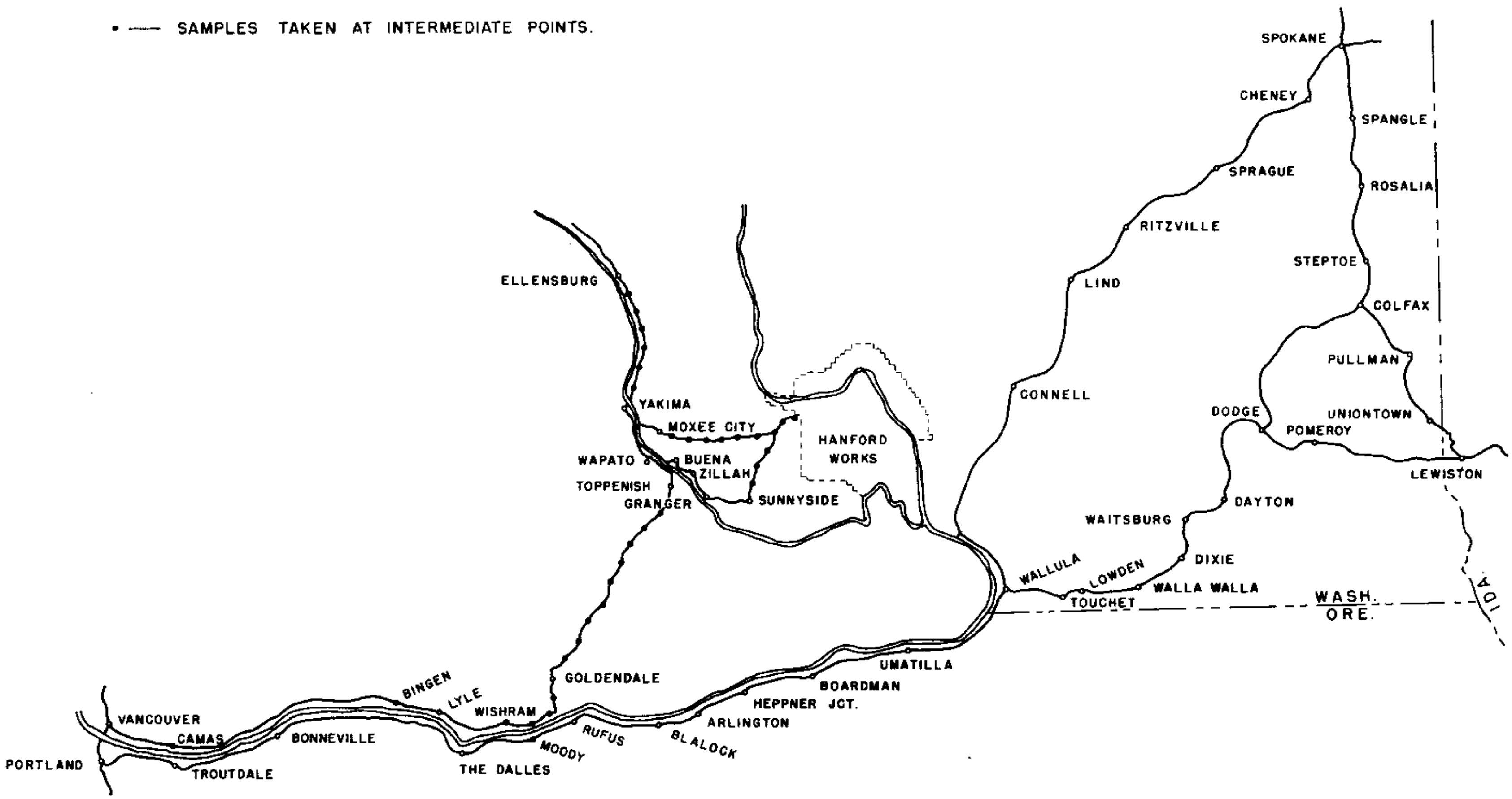
OFF AREA VEGETATION SAMPLING LOCATIONS

1 9 5 2

FIGURE — 2

∘ —— TOWNS FROM WHERE SEVERAL SAMPLES WERE TAKEN.

• —— SAMPLES TAKEN AT INTERMEDIATE POINTS.



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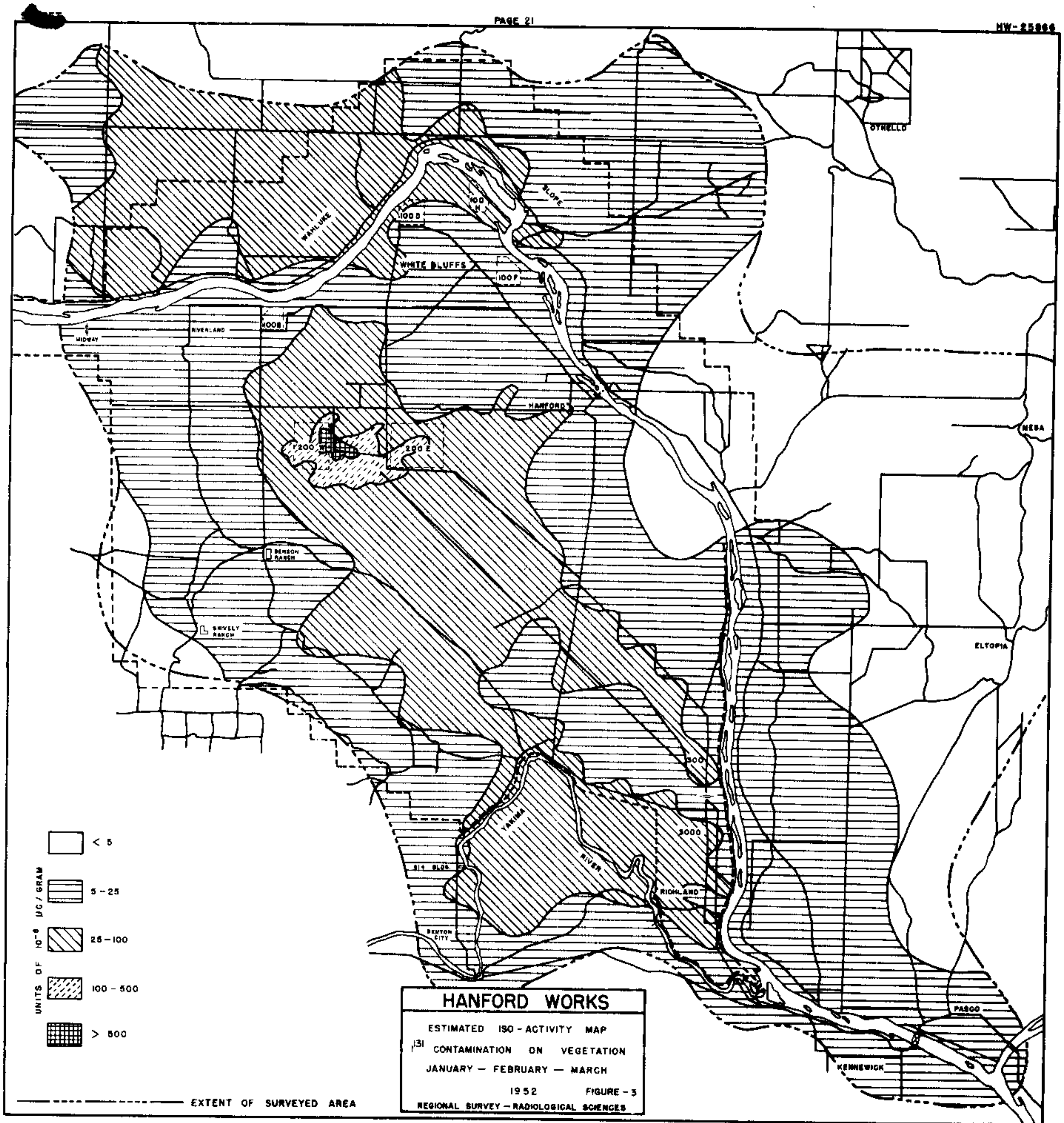
HW-25866



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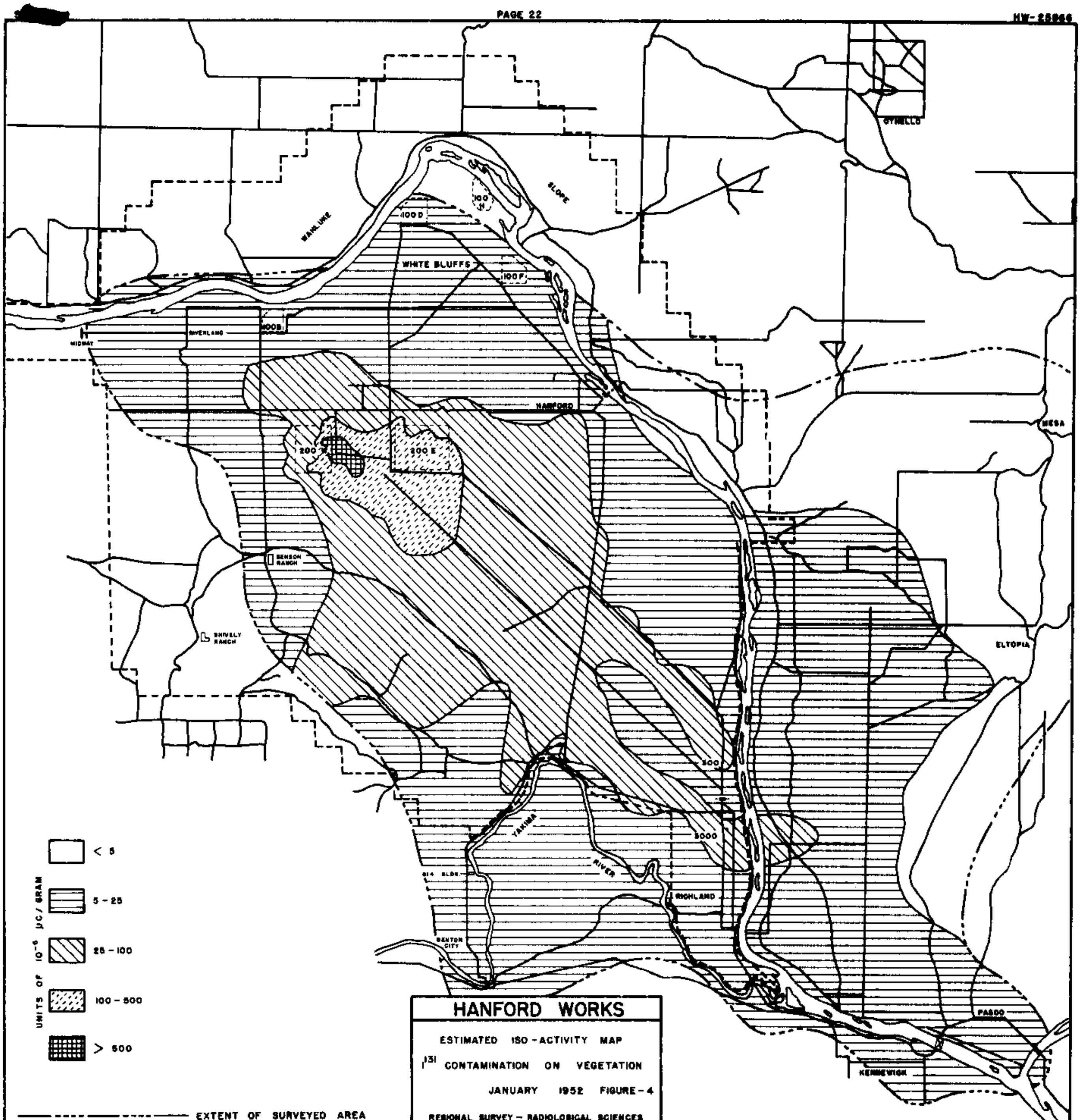
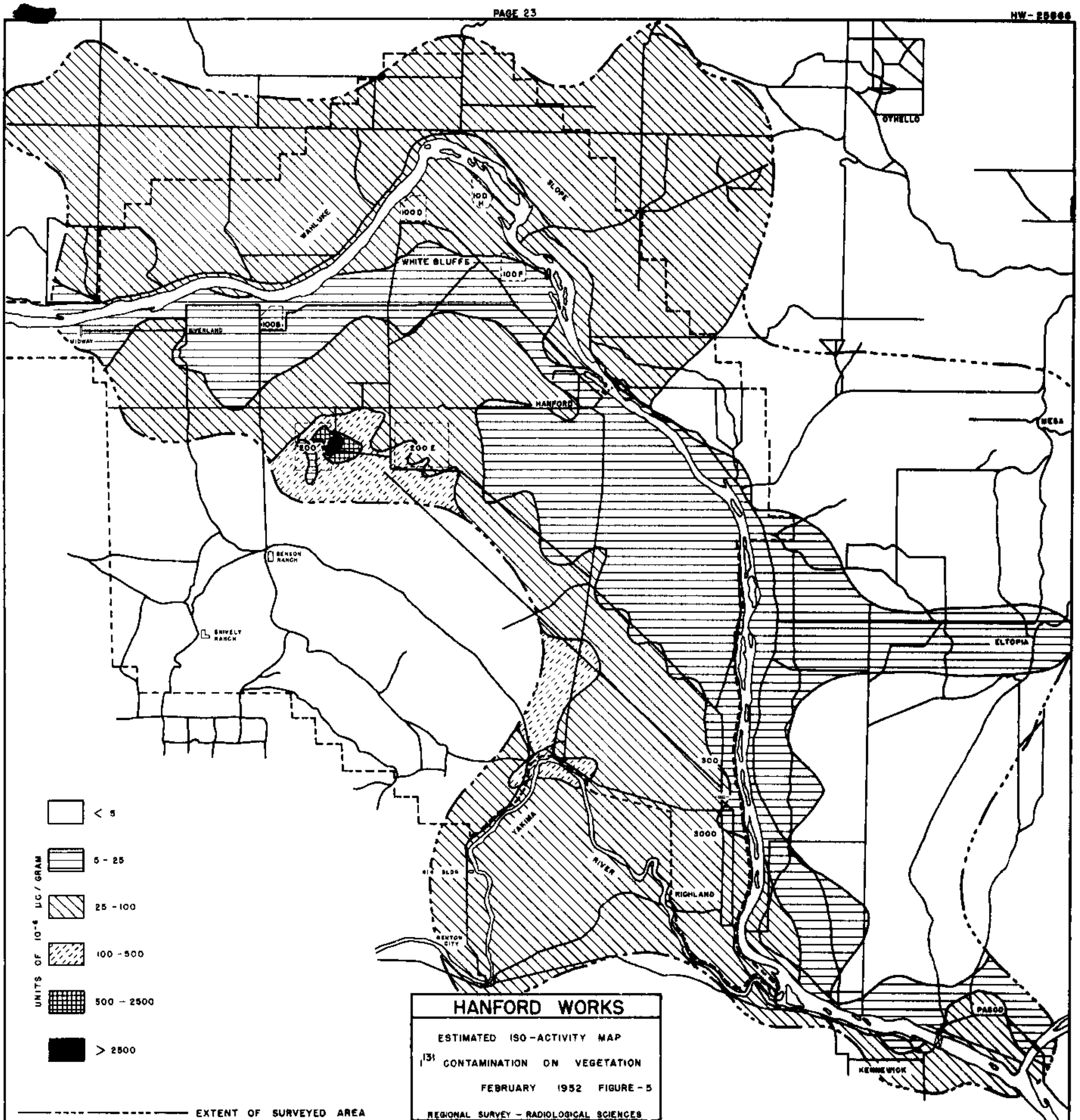
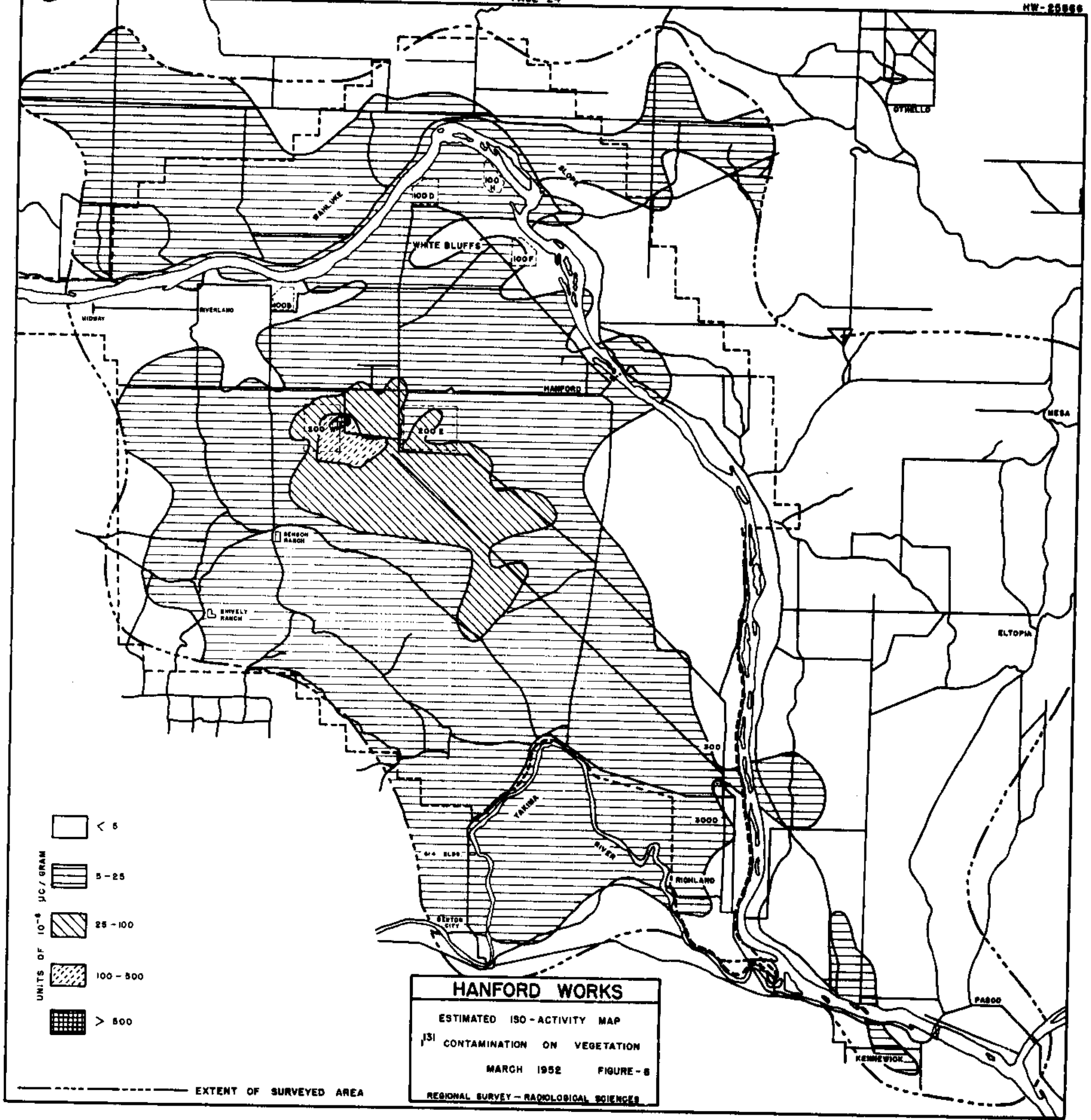


HANFORD WORKS
ESTIMATED ISO-ACTIVITY MAP
I131 CONTAMINATION ON VEGETATION
JANUARY 1952 FIGURE-4
REGIONAL SURVEY - RADIOLOGICAL SCIENCES
UNITS OF 10^-6 µC/GRAM
< 5
5 - 25
25 - 100
100 - 500
> 500
EXTENT OF SURVEYED AREA
WAHLUKE
SLOPE
100 D
100 H
100 F
WHITE BLUFFS
100 B
RIVERLAND
MIDWAY
HANFORD
200 W
200 E
BENSON RANCH
SNIVELY RANCH
MESA
ELTOPIA
300
3000
YAKIMA
RIVER
RICHLAND
BENTON CITY
614 BLDG
PASCO
KENNEWICK

HW-25866


OTHELLO
WAHLUKE
SLOPE
100 D
100 H
WHITE BLUFFS
100 F
100 B
OVERLAND
MIDWAY
HANFORD
MESA
200 W
200 E
BENSON RANCH
SNIVELY RANCH
ELTOPIA
300
3000
YAKIMA
RIVER
RICHLAND
BENTON CITY
PASCO
KENNEWICK
< 5
5 - 25
25 - 100
100 - 500
500 - 2500
> 2500
UNITS OF 10⁻⁶ μc / GRAM
EXTENT OF SURVEYED AREA
HANFORD WORKS
ESTIMATED ISO-ACTIVITY MAP
I131 CONTAMINATION ON VEGETATION
FEBRUARY 1952 FIGURE - 5
REGIONAL SURVEY - RADIOLOGICAL SCIENCES

HW-25866



HANFORD WORKS
ESTIMATED ISO-ACTIVITY MAP
I^{131} CONTAMINATION ON VEGETATION
MARCH 1952 FIGURE-6
REGIONAL SURVEY — RADIOLOGICAL SCIENCES

SECTION III
RADIOACTIVE CONTAMINATION IN THE ATMOSPHERE

The activity density of beta emitters in the atmosphere, together with the subsequent dosage rates from air-borne contaminants, was determined by evaluating data collected from various types of fixed and portable instrumentation, and by operating air filters and air scrubbers. Most of the monitoring equipment was maintained at locations on the Hanford project and in the nearby residential communities, with several additional stations operated at remote locations in the states of Washington, Oregon, Idaho, and Montana; the additional stations served the purpose of obtaining data for the evaluation of natural background and for the recognition and measurement of any activity originating from sources other than Hanford. The locations at which equipment was operated in the immediate environs may be referred to on the map presented in Figure 7. Results obtained from this monitoring program are discussed separately for each type of measurement in the following paragraphs.

Radiation dosage rates were determined by evaluating readings obtained from Victoreen integrons which were operated around the perimeter of the Hanford operating areas and in the residential communities bordering the plant. Table I summarizes these data. The indicated dosage rates represent the accumulated average of 8-hour exposure periods during the quarter.

The average dosage rates tabulated in the following table were comparable to similar measurements obtained during the last several months of 1951 and showed no trends within the reported period. As in the past, the majority of individual readings obtained at perimeter locations was on the order of natural background (0.3 to 0.5 mrep/24 hours). The average dosage rate of 6 mrep/24 hours measured at the Redox Area was significantly higher than the averages noted at any other station and was partially accounted for by the inclusion of several questionable readings during the month of March which may have been attributed to a faulty instrument.

TABLE I

AVERAGE DOSAGE RATES AS MEASURED BY VICTOREEN INTEGRONS

JANUARY, FEBRUARY, MARCH

1 9 5 2

Location	No. of units	January	February	March	Quarterly Average
100-B Area	3	0.7	0.9	0.8	0.8
100-D Area	3	0.1	0.4	0.6	0.4
100-F Area	3	0.2	0.6	0.6	0.5
100-H Area	3	0.3	0.3	0.3	0.3
200 West Area	2	0.6	0.7	0.5	0.6
200 East Area	4	0.2	0.2	0.4	0.3
Redox Area	1	6.0	5.5	5.0	6.0
Riverland	1	0.7	0.1	0.2	0.3
300 Area	1	0.3	0.8	0.9	0.7
Richland	1	1.1	1.3	1.1	1.2
Pasco	1	0.6	-	1.4	1.0
Benton City	1	0.7	0.8	0.6	0.7
North Richland North	1	0.8	0.6	0.9	0.8
North Richland South	1	0.8	1.0	0.7	0.8
Hanford	1	0.3	0.6	0.3	0.4
Kennewick	1	0.2	1.9	0.6	0.9

Radiation levels were also obtained from "C" type detachable ionization chambers at air monitoring stations in the operating areas. Two chambers were used at each location and the minimum reading was used to determine the dosage rate. Table II summarizes the results from this measurement.

The small increase observed in the corresponding readings during the previous quarter did not continue during the present period. Monthly and quarterly averages were comparable to those noted during the third quarter of 1951 and, in general, were in agreement with the order of magnitude expected for this type of measurement.

TABLE II

"C" TYPE DETACHABLE IONIZATION CHAMBERS

JANUARY, FEBRUARY, MARCH

1 9 5 2

Location	units of mrep per 24 hours			
	January	February	March	Quarterly Average
Within 100-B Area	0.4	0.4	0.4	0.4
Within 100-D Area	0.5	0.6	0.5	0.5
Within 100-F Area	0.4	0.4	0.4	0.4
Within 200 West Area	0.4	0.5	0.4	0.5
Within 200 East Area	0.6	0.7	0.6	0.6

Air radiation levels at locations between the operating areas and in the various military and construction camps located on the project were determined by evaluating readings obtained from detachable "M" and "S" type ionization chambers. Again, two chambers were used at each station with the minimum reading used for evaluating the dosage. Table III summarizes average measurements obtained from this type of monitoring.

Dosage rates measured at locations near the 300 Area, in the environs of the 100 Areas, and in the outlying communities bordering the project were not significantly different from those measured during the previous quarter. A decrease of 0.25 mrep/24 hours was noted in the average dosage rate obtained at 14 monitoring stations located within a five mile radius of the 200 East Area. This average decrease was not significant; however, the decreases noted from stations located at the Semi-Works at Army Camp PSN 300, and along Route 4S, Mile 6, represented significant changes when compared with data obtained during the previous period.

TABLE III

RADIATION LEVEL OBSERVED WITH "M" AND "S" TYPE DETACHABLE IONIZATION CHAMBERS JANUARY, FEBRUARY, MARCH 1952

Location	January	February	March	Quarterly Average	Group Average
	units of mrep per 24 hours				
100 Areas and Environs					
Route 1, Mile 8	0.57	0.58	0.52	0.56	
Route 2N, Mile 10	0.56	0.59	0.45	0.53	
Route 2N, Mile 5	0.49	0.48	0.39	0.45	
White Bluffs	0.50	0.44	0.46	0.47	
Route 11-A, Mile 1	0.29	2.46	0.50	1.08	
Hanford 614 Building	0.49	0.47	0.48	0.48	0.54
Intersection Rt. 1 and Rt. 4N	0.50	0.49	0.43	0.47	
Hanford 101 Building	0.56	0.44	0.38	0.46	
100-H Area	0.58	0.53	0.46	0.52	
P-11 Area	0.55	0.49	0.45	0.50	
100-B NE Construction	0.35	0.69	0.45	0.50	
100-B SE Construction	0.42	0.52	0.44	0.46	
Within 5 Miles of 200 East Area					
Route 4S, Mile 6	1.19	0.73	1.61	1.18	
Batch Plant	0.61	0.49	0.49	0.53	
Route 11-A, Mile 6	1.44	0.59	0.64	0.89	
Route 3, Mile 1	0.98	1.67	0.80	1.15	
Meteorology 200'	1.30	0.48	0.47	0.75	
Route 4S, Mile 2.5	0.93	0.44	0.71	0.69	
Redox Area	1.56	1.79	0.65	1.33	1.01
Route 4S, Mile 4.5	0.39	1.62	1.33	1.11	
Semi-Works #1	0.79	1.41	0.72	0.97	
Semi-Works #2	0.67	0.66	1.00	0.78	
200 East PSN 300	0.83	1.41	1.44	1.23	
PSN 310	1.37	0.80	1.25	1.14	
PSN 320	1.41	0.49	1.81	1.24	
PSN 330	0.54	1.03	1.73	1.10	
Within 10 Miles of 200 East Area					
Route 4S, Mile 10	1.15	0.67	0.60	0.81	
Route 10, Mile 1	0.70	0.99	0.64	0.78	
Route 10, Mile 3	2.17	0.71	1.74	1.54	1.25
Route 2S, Mile 4	1.49	1.40	2.74	1.88	

TABLE III (Contd.)

Location	January	February	March	Quarterly Average	Group Average
	units of mrep per 24 hours				
Near 300 Area					
Route 4S, Mile 16	1.32	1.52	0.77	1.20	
Route 4S, Mile 22	1.70	1.32	0.88	1.30	
North Richland North	0.52	0.44	0.53	0.50	0.85
North Richland South	0.40	0.46	0.50	0.45	
300 Area	0.86	1.15	0.45	0.82	
Outlying					
Richland	0.79	1.24	0.52	0.85	
Benton City	0.44	0.52	0.48	0.48	
Pasco	0.36	0.55	0.39	0.43	0.57
Kennewick	0.32	0.66	0.60	0.53	

The activity density from filterable beta emitters in the atmosphere was determined by analyzing the activity collected on small air filters obtained from various locations throughout the environs. CWS #6 paper was used as the filtering medium through which an air flow on the order of 2.5 cfm was motivated by a one-quarter horse-power motoair pump. These filters were exposed for one week periods after which they were held for several days prior to analysis to allow for decay of the daughter products of radon and thoron. Results obtained from this type of monitoring are presented in Table IV.

TABLE IV
AVERAGE FILTERABLE BETA EMITTERS IN AIR
JANUARY, FEBRUARY, MARCH
1 9 5 2

Location	Activity Density - units of 10^{-14} μc/cc				
	January	February	March	Quarterly Average	Maximum Weekly
200 Areas and Vicinity					
200 East Southeast	100	-	-	~100	340
200 East Tower #16	100	-	-	~100	160
200 East Semi-Works	96	112	280	160	510
200 West Tower #14	63	97	130	93	290
200 West Gatehouse	150	560	-	~230	560
200 West Redox Area	86	130	430	210	1100
Gable Mountain	13	27	72	36	230
200 East Tower #15	87	80	170	110	320
100 Areas and Vicinity					
100-D	59	62	32	49	88
100-H	35	30	48	37	64
Hanford 101 Building	40	22	13	26	59
Hanford 614 Building	27	32	13	23	57
White Bluffs	57	43	25	43	77
300 Area 614 Building	17	13	28	19	62
Outlying					
Richland	45	46	-	~45	200
North Richland	23	18	13	18	39
Pasco	18	10	7	12	30
Kennewick	14	13	4	11	30
Benton City	20	44	58	39	190
Riverland	29	13	48	30	110

A comparison of the above data with the results obtained from similar measurements during the previous quarter show that the over-all activity density from filterable beta emitters decreased at nearly all locations during this period. This general decrease to about 1/2 or 1/5 of previous values represented a significant trend when the data for grouped locations were

 [redacted]

compared. Causes for this decrease were not associated with emission from the Hanford stacks but were largely attributed to the higher results during the previous quarter which resulted from the influx of particulate contamination from the Nevada bomb tests. One exception to the mentioned decrease was observed at the Redox Area where, during one week in March, the average activity density from beta emitters was 1.1×10^{-11} µc/cc. The particulate contamination in this case was emitted from the Redox facility and its presence was confirmed by ground surveys in the region.

The small air filters which were removed from dual air monitors were also analyzed for filterable beta emitters. These data supplement those tabulated in Table IV and are presented in Table V.

TABLE V

AVERAGE FILTERABLE BETA ACTIVITY IN AIR

DUAL UNIT AIR MONITORS

JANUARY, FEBRUARY, MARCH

1952

Location	Activity Density - units of 10^{-14} µc/cc				
	January	February	March	Quarterly Average	Maximum Weekly
200 West East Center #1	120	150	130	130	250
200 West East Center #2	230	160	120	180	430
200 East Southeast #1	80	45	58	62	120
200 East Southeast #2	41	64	130	74	250
200 East East Center #1	79	47	-	~74	120
200 East East Center #2	17	6	-	~13	36
Richland #1	13	14	35	20	120
Richland #2	18	23	72	40	240
Meteorology Tower					
Ground Level	130	100	64	94	190
200' Level	-	210	190	~200	700
400' Level	-	53	160	~120	550

The general decrease noted when reviewing the data in Table IV was confirmed when comparing the results obtained from analyzing the filters from dual monitors. In one extreme case, at the 200 East Area, the activity decreased to one-tenth of the value measured during the previous quarter.

The number of radioactive particles in the atmosphere was measured by radioautographing air filters collected from various stations throughout the environs and from remote stations in the Pacific Northwest. These air filters were operated for one week periods with air flows through the filters of 2.5 or 10 cfm. Type K X-ray film was used for the radioautograph and the exposure was 168 hours. Filters from off-area locations were filmed the week following removal and filters from environmental locations were filmed during the week in which they were removed. Tables VI and VII summarize the results of these measurements.

The number of radioactive particles in the atmosphere decreased significantly during this period. Concentrations were generally approaching the order of magnitude that was measured during July, August, and September in 1951 prior to the Nevada tests. Residual particulate contamination from the Nevada tests caused the results during January to be somewhat higher than those noticed during February and March. Toward the end of the quarter, particulate contamination in the immediate environs became approximately 10 times greater than that noted at remote locations in Idaho, Montana, and Oregon.

The small air filters used for determining the activity density from filterable beta emitters (Table IV) were also used to measure the activity density from gross alpha emitters in the atmosphere. Analytical techniques and calculation corrections applied to these data were those normally used in the Control Unit (HW-20136 and HW-23769). A summary of the results from these measurements is presented in Table VIII.

TABLE VI

SUMMARY OF PARTICLE DEPOSITION

JANUARY, FEBRUARY, MARCH

1 9 5 2

Location	Total Volume of air sampled m^3	Units of 10^{-3} particle/meter^3: January	February	March	Present Quarter Averages 1952	Previous Quarter Averages 1952
Area Locations						
100-B Area	37349	19.	19.	19.	19.	300.
100-D Area	33422	31.	5.6	28.	20.	160.
White Bluffs	30565	2.2	130.	190.	130.	130.
100-F Area	39950	28.	4.3	20.	17.	180.
300 Area	39219	55.	15.	45.	38.	420.
Hanford 101	35785	32.	4.4	3.8	12.	450.
Off Area Locations						
Benton City, Wash.	33680	20.	4.1	14.	12.	140.
Pasco, Wash.	37016	27.	11.	14.	15.	190.
Richland, Wash.	40171	27.	6.3	>180.	76.	400.
Boise, Idaho	31961	50.	7.1	0.9	17.	430.
Klamath Falls, Ore.	9882	17.	2.6	<0.3	6.5	570.
Great Falls, Mont.	10652	34.	3.1	<0.3	12.	620.
Walla Walla, Wash.	9994	40.	6.4	1.5	14.	310.
Meacham, Ore.	5270	69.	7.2	<9.8	27.	370.
Lewiston, Idaho	10083	55.	5.3	0.6	18.	640.
Spokane, Wash.	39916	30.	3.4	1.4	9.9	420.
Kennewick, Wash.	23817	33.	3.5	67.	32.	250.
Yakima, Wash.	37842	26.	3.8	27.	17.	150.

TABLE VII

SUMMARY OF PARTICLE DEPOSITION

JANUARY, FEBRUARY, MARCH

1 9 5 2

Location	Total Volume of air sampled m^3	January	February	March	Present Quarter Averages 1952	Previous Quarter Averages 1952
		Units of 10^{-3} particle/meter^3				
200 East and Vicinity						
2704 Outside	9990	63.	20.	120.	67.	210.
H. I. Garden	10001	80.	20.	81.	59.	210.
BY-SE	9878	620.	130.	>690.	470.	870.
BY-NE	9998	500.	81.	130.	220.	340.
"B" Gate	10001	67.	29.	150.	83.	240.
222-B Outside	9988	160.	36.	130.	100.	330.
2701 Outside	9997	71.	20.	110.	66.	650.
2704 Inside	10002	56.	28.	140.	78.	230.
221-B	9998	110.	580.	330.	360.	250.
222-B Hall	10002	130.	60.	250.	150.	250.
222-B Lab.	9254	1020.	>1480.	1040.	1200.	1360.
2701 Inside	10001	76.	24.	140.	80.	270.
200 West and Vicinity						
2701 Outside	9966	95.	87.	110.	96.	250.
2722	9975	190.	71.	170.	140.	280.
"T" Gate	9983	200.	56.	160.	130.	330.
222-T Outside	10001	200.	78.	130.	130.	280.
231	9889	180.	76.	300.	180.	280.
Redox	9952	51.	17.	>580.	230.	190.
West Guard Tower	9974	55.	33.	230.	110.	210.
2701 Inside	9970	72.	58.	78.	69.	250.
272	8444	84.	50.	110.	79.	230.

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TABLE VII (Contd.)

Location	Total Volume of air sampled m3	January	February	March	Present Quarter Averages 1952	Previous Quarter Averages 1952
222-T Hall	9984	300.	160.	180.	210.	280.
222-T Lab.	10011	660.	>790.	650.	700.	1150.
222-U Lab.*	6393	-	18.	94.	57.	-
Meteorology Tower						
3'	40018	30.	14.	31.	25.	190.
50'	40494	50.	4.3	26.	18.	160.
100'	32159	37.	6.4	42.	23.	180.
150'	28106	25.	9.2	>320.	120.	210.
200'	25964	32.	11.	>370.	140.	220.
250'	25964	49.	9.4	>340.	130.	200.
300'	24058	64.	14.	>360.	140.	190.
350'	22078	36.	10.	>460.	150.	170.
400'	15047	59.	12.	>530.	220.	300.

*Equipment installed on January 5, 1952.

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TABLE VIII
GROSS ALPHA EMITTERS IN AIR
JANUARY, FEBRUARY, MARCH
1952

Location	Activity Density - units of 10^{-15} μc/cc		
	Number Samples	Maximum	Average
Single Units			
200 East Southeast	6	8	<4
200 West, Tower #4	13	35	9
200 East, Semi-Works	13	15	6
200 East, Tower #16	5	11	6
Gable Mountain	13	13	<4
Richland	13	5	<4
Kennewick	12	31	4
Pasco	13	17	<4
300 Area	13	34	13
100-D Area	11	16	6
200 West Gate	5	19	10
Benton City	12	6	<4
Hanford 614 Building	11	9	<4
White Bluffs	13	8	5
North Richland North	13	9	<4
200 West Redox Area	13	61	13
100-H Area	13	72	10
Hanford 101 Building	13	5	<4
Riverland	13	5	<4
200 East Tower #15	13	13	6
Meteorology Tower, Ground Level	11	14	8
Meteorology Tower, 200' Level	6	7	<4
Meteorology Tower, 400' Level	7	9	<4
Dual Monitoring Units:			
200 West East Center #1	13	105	28
200 West East Center #2	13	43	20
200 East Southeast #1	13	39	7
200 East Southeast #2	13	28	7
Richland #1	13	6	<4
Richland #2	11	7	<4
200 East East Center #1	6	7	5
200 East East Center #2	6	7	4

As in the past, trace quantities of alpha emitters were detected at all locations during some period in the quarter. In a large number of instances, the activity density from this source was not significantly different from the detection limit for this type of measurement (4×10^{-15} μc/cc). Thirteen out of 31 locations show averages below the detection limit over the three month period. Maximum values tended to prevail at locations which were near the manufacturing facilities with the maximum measurement of 1.1×10^{-13} μc/cc at the 200 West Area gate-house representing a decrease to one-half the value of maximum measurements from the previous quarter.

The activity density from I-131 in the atmosphere was determined by analyzing scrubber samples through which an air flow of approximately 2.0 cfm was passed for daily and weekly periods. These samples were analyzed according to standard procedures used in the control laboratory and the subsequent counting rates were corrected for geometry, yield efficiency, and volume by factors normally applies to this type of calculation (HW-20136 and HW-22682). The results of these measurements for the three month period are presented in Table IX.

With the exception of significantly lower results obtained at the station located in Tower 16 at the 200 East Area, the values quoted were comparable to those measured during the last three months in 1951. A significant decrease in the activity density of I-131 in the atmosphere was noted during the previous quarter, and the current data tend to confirm the lower concentrations of I-131 throughout the environs. Current measurements are in accord with monitoring results obtained from equipment operated in the Separations Area stacks (Section I) and indicate that the silver reactors in the off-gas lines continue to operate at high efficiencies.

Several instances occurred during the quarter in which the effluent from the separation process stack was observed looping toward ground level. Portable scrubber samples were obtained in the majority of these cases and except for two samples, the activity density from I-131 in the samples was less than 1 x 10^{-12} µc/cc. The two positive results showed values of 5.9 x 10^{-12} µc/cc and 1.2 x 10^{-9} µc/cc. These samples were obtained between 2,000 and 4,000 feet southeast of the Redox stack on February 12.

TABLE IX

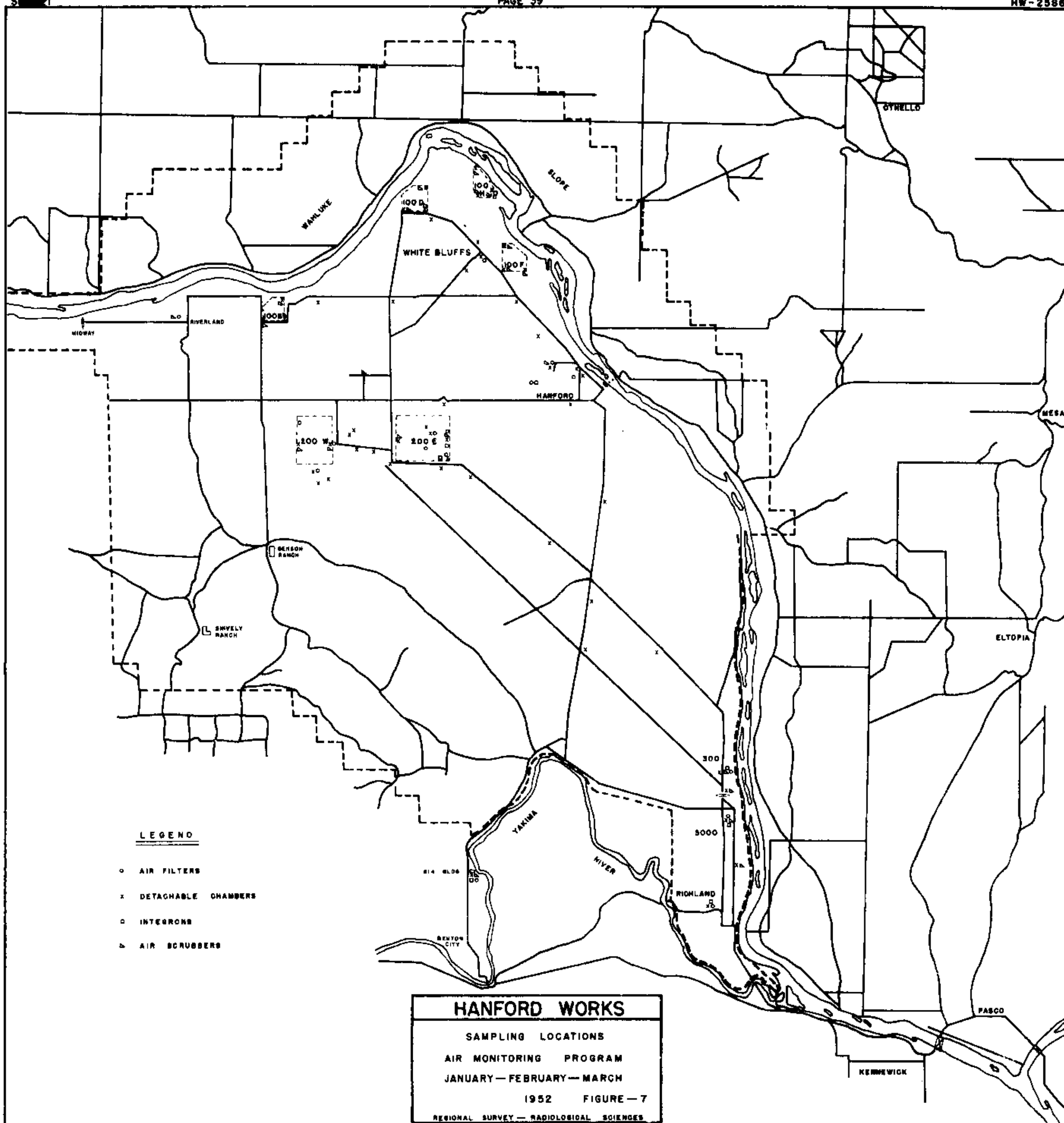
AVERAGE ACTIVITY DENSITY OF I-131 DETECTED IN SCRUBBERS

JANUARY, FEBRUARY, MARCH

1952

Location	January	February	March	Quarterly Average	Maximum Weekly
	units of 10^{-12} µc/cc				
200 Areas and Vicinity					
200 East Southeast	1.1	1.7	0.6	1.1	2.1
200 East Tower #16	3.4	2.6	2.6	2.9	16.
200 West Gatehouse	3.1	7.1	5.9	5.4	14.
Gable Mountain	<0.1	0.4	0.2	0.2	0.6
Redox Area	0.8	1.0	0.6	0.8	2.0
200 West Tower #4	2.0	1.1	0.1	1.1	3.0
Outlying Locations					
100-H Area	0.2	0.1	<0.1	0.1	0.3
300 Area	0.1	0.3	0.1	0.2	0.7
Richland	0.2	1.0	0.2	0.5	2.0
North Richland	0.2	0.5	0.2	0.3	1.0
Benton City	0.3	0.5	<0.1	0.3	1.1
Pasco	0.2	0.2	0.2	0.2	0.4
Kennewick	0.1	0.8	<0.1	0.3	1.8

HW-25866


OTHELLO
WAHLUKE
SLOPE
100 D
100 H
WHITE BLUFFS
100 F
100 B
RIVERLAND
MIDWAY
HANFORD
MESA
200 W
200 E
BENSON RANCH
SHIVELY RANCH
ELTOPIA
300
3000
YAKIMA
RIVER
RICHLAND
614 BLDG
BENTON CITY
PASCO
KENNEWICK
LEGEND
AIR FILTERS
DETACHABLE CHAMBERS
INTEGRONS
AIR SCRUBBERS
HANFORD WORKS
SAMPLING LOCATIONS
AIR MONITORING PROGRAM
JANUARY — FEBRUARY — MARCH
1952 FIGURE — 7
REGIONAL SURVEY — RADIOLOGICAL SCIENCES

SECTION IV

RADIOACTIVE CONTAMINATION IN HANFORD WASTES

Nearly 1,000 samples were obtained from the various waste locations in the manufacturing areas for the purpose of evaluating the activity density from gross alpha and gross beta emitters in these sources. Analytical procedures and calculation corrections applied to these results were those previously reported (HW-20136, HW-22682, and HW-23769). Instrument surveys were used to supplement data obtained from the analysis of direct samples.

100 AREA WASTES:

Results obtained from the analysis of 500 ml. samples collected at the outlet of the 107-basins in the five reactor areas are presented in Table I.

TABLE I

RADIOACTIVE CONTAMINATION LEAVING THE 107 BASINS DURING PERIODS OF NORMAL PILE OPERATION JANUARY, FEBRUARY, MARCH 1952

Location	No. Samples	Alpha Emitters units of 10^{-9} μc/cc	Beta Emitters units of 10^{-3} μc/cc	
			Max.	Aver.
100-B Area	81	<5	2.7	1.9
100-D Area	91	<5	2.4	1.7
100-DR Area	80	<5	2.5	1.6
100-H Area	89	<5	2.1	1.6
100-F Area	63	<5	1.9	1.1

The small increases noted in the activity density from gross beta emitters in the effluent water during the previous quarter were not reflected at all areas during this period. At the 107-DR and 107-F basins, slight decreases were noted. A statistical comparison of average results on a month to month, and on a quarter to quarter basis showed no significant change occurring during the present period.

Individual samples collected at the 107-D, 107-H, and 107-DR basins showed the activity density from alpha emitters to be 1.1×10^{-7}, 1.9×10^{-8}, and 2.6×10^{-8} μc/cc, respectively. These three measurements represented the only positive indication of activity from alpha sources at the basins during this period.

Specific analysis of a large number of the 107 effluent samples for the activity density from uranium and plutonium showed negligible activity in all cases.

Surveys of the burning grounds in the reactor areas with portable instruments (VGM's and CP meters) showed no indication of contamination.

The activity density from I-131 in waste material discharged to the river from the Biology Farm at the 100-F Area averaged 6.4×10^{-6} μc/cc during the quarter. The maximum measurement was 3.9×10^{-5} μc/cc. An increase which approached significance was observed in this activity during February and March; fifty-eight samples collected during these two months showed average activity density of 8.2×10^{-6} μc/cc as compared with an average of 3.0×10^{-6} μc/cc during January.

<u>200 AREA WASTES:</u>

Table II summarizes the results obtained from the analysis of liquid and solid samples collected from 200 Area waste sources.

TABLE II

RADIOACTIVE CONTAMINATION IN THE 200 AREA WASTE SYSTEMS

JANUARY, FEBRUARY, MARCH

1 9 5 2

LIQUID SAMPLES

Location	No. Samples	Alpha Emitters units of 10^{-9} μc/cc Max.	Alpha Emitters units of 10^{-9} μc/cc Aver.	Beta Emitters units of 10^{-7} μc/cc Max.	Beta Emitters units of 10^{-7} μc/cc Aver.
T Swamp	34	11	< 5	21	4.9
U Swamp	19	42	15	4.2	1.2
Laundry Ditch	24	570	81	17	3.4
231 Ditch	24	210	32	4.3	2.2
200-E "B" Ditch	39	8.8	< 5	55	21
200-E "B" Swamp	25	7.9	< 5	61	12
234-35 Ditch	12	51	21	5.4	1.9
200-E Retention Pond	52	5.9	< 5	170	27
200-W Retention Pond	51	160	5.5	21	7.0
234 Retention Pond	8	450	180	-	-
Redox Swamp	12	29	7.6	5.7	3.2

SOLID SAMPLES

Location	No. Samples	Alpha units of 10^{-6} μc/gm Max.	Alpha units of 10^{-6} μc/gm Aver.	Beta units of 10^{-5} μc/gm Max.	Beta units of 10^{-5} μc/gm Aver.
T Swamp	19	260	53	110	24
Laundry Ditch	13	73	38	120	33
200-E "B" Ditch	36	12	3.4	1900	350
200-E "B" Swamp	22	8.8	3.0	450	250
234-35 Ditch	13	1100	270	5.4	3.2
Redox Swamp	13	1.5	1.2	17	5.8

Although considerable variation was observed when comparing results of individual measurements, the average maximum results as summarized in Table II were not indicative of any significant trend or change during the three month period.

Spot samples from each of the waste sources indicated in Table II were also analyzed for the activity density from uranium and plutonium. The average activity density from uranium in samples from the laundry ditch was 6×10^{-8} µc/cc with maximum measurements on the order of 3.9×10^{-7} µc/cc. Twelve mud samples obtained at the edge of the ditch showed an average of 3×10^{-5} µc/gm including a maximum measurement of 1.5×10^{-4} µc/gm. Uranium detected in water samples obtained at the T Swamp gave activity densities on the order of 1 to 3×10^{-8} µc/cc.

Portable instrument surveys using VGM's along the waste ditches in the 200 West Area showed maximum readings at the T Swamp ditch where the average counting rate was about 400 c/m above background during the quarter. Similar surveys around the perimeter of the T Swamp showed an average value of 350 c/m above background. In the 200 East Area, exceptionally high readings were found along the "B" Waste Ditch where counting rates in excess of 10,000 c/m were found over the water at the ditch inlet; readings over the mud at this same location approached 14,000 c/m in isolated cases. Normally, maximum readings at this location are on the order of 1,000 to 4,000 c/m above background. Background ranges from 100 to 300 c/m.

Instrument surveys at the 200 North Area open waste ditches were discontinued during this quarter coincident with the shutdown of operations at this location. Spot checks will be made of the contaminated waste ditches in this region after the shutdown of the area and subsequent clean-up is completed.

300 AREA WASTES:

The results obtained from the analysis of liquid and solid samples collected at waste sources in the 300 Area are summarized in Table III.

TABLE III

RADIOACTIVE CONTAMINATION IN 300 AREA WASTES
JANUARY, FEBRUARY, MARCH
1 9 5 2

Location	Number Samples	Beta Emitters units of 10^{-7} μc/cc Max.	Beta Emitters Aver.	Alpha Emitters units of 10^{-8} μc/cc Max.	Alpha Emitters Aver.	Uranium μc/cc Max.	Uranium Aver.
Old Pond Inlet	12	25	7.1	480	150	17	3.9
New Pond Inlet	13	19	6.1	400	130	6.0	2.7
300 Area Waste Line	63	68	8.5	1200	130	16	1.7
		units of 10^{-3} μc/gm		units of 10^{-6} μc/gm		μg/gram	
Old Pond Inlet	13	4.8	<1	720	130	1900	330
New Pond Inlet	12	3.4	1.2	800	480	1800	610

General increases ranging from a factor of two to four were noted in the activity density from uranium in the ponds at the 300 Area. Considerable variation in the week to week measurements was also noted but was not significant when compared to the results of several similar measurements over the past several years. The activity density from gross beta emitters in 300 Area wastes was comparable to that noted during the previous quarter.

Radiochemical analysis of the samples obtained directly from the waste line leading to the new pond for the activity from plutonium showed an average activity density of 1.1×10^{-8} μc/cc; the maximum measurement was 1.1×10^{-7} μc/cc. These values represent an increase by a factor of two when compared to the results obtained during the last quarter of 1951.

SECTION V
RADIOACTIVE CONTAMINATION IN THE COLUMBIA RIVER

Over 500 samples of Columbia River water were collected from representative locations and analyzed for the activity density from gross beta and alpha emitters. Analytical procedures and the calculations applied to the counting rates were those normally used by the Control Unit (HW-20136, HW-22682, and HW-23769). Samples were collected from each of these locations (Figure 8) on a weekly basis and at one location in the region of higher contamination near the Hanford Ferry, samples were obtained on a daily basis. These data were supplemented with samples obtained from locations above the Hanford operating areas, from the Yakima River, and from the Snake River mouth; the samples from the last two sources were used to determine the magnitude of natural background in the Columbia River and its tributaries.

Table I summarizes the results obtained from the radiochemical analysis for the activity density from gross beta emitters in Columbia River water.

As expected during periods in which the flow rate of the Columbia River remains rather constant, the activity density from gross beta emitters showed neglibible fluctuation over the three month period. A further comparison of the data summarized in Table I with similar measurements obtained during the previous quarter shows that current values were essentially the same as those previously observed. Two individual samples which were collected below the 100-H Area adjacent to the Allard pumping station were significantly higher than maximum measurements obtained at these locations during previous periods of low river flow; the latter results, which show the activity density to be 1.8×10^{-5} and 1.9×10^{-5} $\mu c/cc$, were among the highest measurements obtained at river locations during fall and winter months. These higher measurements were not associated with operating conditions or with dilution ratio and may have been caused by the

[redacted]

TABLE I

AVERAGE ACTIVITY DENSITY OF GROSS BETA EMITTERS

IN THE COLUMBIA RIVER

JANUARY, FEBRUARY, MARCH

1 9 5 2

units of 10^{-8} μc/cc

Location	January Average	February Average	March Average	Quarter Average	Last Quarter Average	Maximum Measurement This Quarter
Wills Ranch	<5	<5	<5	<5	<5	<5
100-B 181 Bldg.	<5	<5	<5	<5	<5	9
Allard Pumping Station	180	720	1100	660	110	1800
100-D 181 Bldg.	180	160	330	220	170	510
100-H 181 Bldg.	210	250	260	240	250	390
Below 100-H	260	410	830	480	610	1900
100-F 181 Bldg.	350	560	570	500	540	750
Below 100-F	560	550	520	540	520	700
Hanford South Bank	540	590	590	570	550	1100
Hanford Middle	610	520	550	550	490	1100
Hanford North Bank	210	220	290	250	280	360
300 Area	250	230	310	270	280	360
Richland	190	180	230	200	250	320
Highland Pumping Station	220	220	190	211	190	320
Pasco-Kennewick Bridge						
Kennewick Side	170	170	150	160	160	290
Pasco Side	180	170	210	190	180	250
Sacajawea Park	140	48	100	89	110	170
Snake River Mouth	<5	<5	<5	<5	<5	6
McNary Dam	40	53	48	50	52	76
Patterson	33	35	48	39	38	98
Yakima River Mouth	<5	<5	<5	<5	<5	<5

[redacted]

collection of particulate contamination in the sample. A number of the samples collected from the outlet of the 107 retention basins in the reactor areas have shown particulate contamination when the filters from filtration of 500 ml. samples were radioautographed.

Figure 9 shows the trend of the flow rate of the Columbia River over the period October 1951 through March 1952. The mean flow rate, January through March, was 590,000 gallons per second compared with an average of 596,000 gallons per second during the previous quarter. The maximum measured flow rate was 690,000 gallons per second on March 27 and the minimum flow rate was 480,000 gallons per second measured on February 11. These values were not significantly different from those which were measured during October, November, and December of 1951; the similarity in these data as well as little variation in reactor effluent activity density largely accounts for the negligible change in activity measured in the river during the present period.

The samples collected at locations summarized in Table I were also analyzed for the activity density from gross alpha emitters. Although several samples showed trace quantities of this activity, on the order of 5×10^{-9} µc/cc to 1.5×10^{-8} µc/cc, the average activity from this source was less than 5×10^{-8} µc/cc at all individual locations. Resamples obtained from locations which indicated trace activity did not confirm the activity which was indicated in the original sample. Several samples from each of the sampling locations were spot checked for the activity density from uranium. In all cases, the activity density from this source was below the detection limit of the measurement.

Four large volume samples were obtained at Bonneville Dam during the three month period. Analysis of these samples for the activity density from gross beta and gross alpha emitters showed this activity to be below the detection limits of the measurement in each case.

Two mud samples were collected each week from fifteen locations along the Columbia River. One sample was obtained from a location below the surface of the water approximately five feet from the shoreline and the other sample was taken directly at the edge of the water. These samples were analyzed for the activity density from alpha and beta emitters. Table II summarizes the results obtained from the beta measurements.

The measurements summarized in Table II were not significantly different from those noted during the previous quarter and monthly trends were not significant during this quarter. A further comparison of the activity measured in the on-shore samples with the activity measured in the off-shore samples showed no significant difference in the two sets of data. Maximum measurements on the order of 4 to 6 x 10^{-4} μc/gram noted at the Allard pumping station and at the Hanford Ferry were somewhat higher than normally expected for this type of measurement but were not significant when compared with the over-all data collected from these locations during the last six months.

Analysis of a large number of the samples collected from the locations summarized in Table II for the activity density from gross alpha emitters showed negligible activity from this source. Spot checks of several samples from each of the locations in Table II indicated negligible activity from uranium.

One hundred twenty-eight water samples were collected from the raw water-river export line at the 183 and 283 Buildings in the Hanford manufacturing areas. The results obtained from the analysis of these samples for the activity density from beta emitters is presented in Table III.

TABLE II

RADIOACTIVE CONTAMINATION IN COLUMBIA RIVER MUD SAMPLES

JANUARY, FEBRUARY, MARCH

1 9 5 2

Location	January Average	February Average	March Average	Quarter Average	Last Quarter Average	Maximum This Quarter
	Beta Emitters - units of 10^{-5} μc/gram					
Wills Ranch, shore	3.5	3.0	2.5	2.9	3.4	4.2
Wills Ranch, 5' out	4.1	3.5	2.5	3.4	3.7	5.8
Allard Pumping Sta., shore	2.4	1.3	3.1	2.3	5.5	5.4
Allard Pumping Sta., 5' out	3.4	8.4	19.	10.	3.7	48.
100-H Area, shore	4.3	5.3	3.8	4.5	6.7	9.1
100-H Area, 5' out	5.0	9.9	6.4	6.8	7.2	14.
Below 100-F Area, shore	4.6	4.4	3.7	4.2	11.5	8.2
Below 100-F Area, 5' out	6.7	6.3	3.4	5.2	9.4	14.
Richland Dock, shore	5.6	10.	6.4	7.2	7.0	19.
Richland Dock, 5' out	8.0	8.3	16.	11.	7.4	26.
300 Area, shore	5.1	1.7	5.5	4.7	3.0	11.
300 Area, 5' out	5.2	3.9	3.9	4.3	4.2	9.3
Pasco Bridge (Pasco shore)	3.4	4.4	5.7	4.7	3.6	13.
Pasco Bridge (Pasco 5' out)	3.7	1.7	2.5	2.5	4.2	4.8
Pasco Bridge (Kenn. shore)	3.7	3.5	2.9	3.4	3.8	5.1
Pasco Bridge (Kenn. 5' out)	2.0	3.2	2.6	2.7	5.6	4.0
Hanford Ferry, shore	14.	10.	3.2	8.4	8.0	45.
Hanford Ferry, 5' out	10.	19.	4.3	11.	6.0	66.
Highland Pumping Sta., shore	4.7	3.2	3.0	3.5	5.4	4.9
Highland Pumping Sta., 5' out	5.1	4.5	2.4	3.9	6.4	6.7
Byers Landing	3.7	1.9	2.7	2.8	5.0	3.7
Sacajawea Park, 5' out	-	4.8	6.2	5.7	11.	13.
McNary Dam, 5' out	2.7	5.3	3.0	3.2	3.6	5.4
Patterson, 5' out	3.4	3.8	3.6	3.6	2.9	5.7
Snake River Mouth, 5' out	2.8	3.3	3.2	3.1	3.9	4.8

TABLE III

RADIOACTIVE CONTAMINATION IN RAW WATER

RIVER EXPORT LINE

JANUARY, FEBRUARY, MARCH

Location	Beta Emitters - units of 10^{-8} μc/cc					
	January Average	February Average	March Average	Quarter Average	Last Quarter Average	Maximum This Quarter
183 Building, 100-B Area	<5	<5	<5	<5	<5	8.6
183 Building, 100-D Area	38	41	64	46	30	96
183 Building, 100-DR Area	17	84	51	48	26	180
183 Building, 100-H Area	44	58	59	52	64	110
183 Building, 100-F Area	84	110	78	91	95	130
283 Building, 200 East Area	44	43	30	39	34	72
283 Building, 200 West Area	43	74	36	51	33	97

Statistical comparison of the data summarized above with those obtained during the previous quarter shows no significant trend or change in the magnitude of the results. Similarity in these data was expected since the source of the raw water at the manufacturing areas, the Columbia River, itself showed no significant change in the activity density from gross beta emitters during this period. As in the past, the measurements at the most downstream area (100-F) were somewhat higher than those collected from the upstream reactor areas which are located in regions of lesser contamination along the Columbia River.

All raw water samples were analyzed for the activity density from alpha emitters by the ether extraction method. In all cases, the activity density from this source was less than 5×10^{-9} μc/cc. Spot checks of several samples for uranium showed no significant amounts of activity from this contaminant.

Weekly samples were also obtained from each of the raw water retention ponds in the separations areas. The activity density from gross beta emitters averaged 4.3 x 10^{-7} μc/cc and 5.7 x 10^{-7} μc/cc at the 200 East and 200 West Areas, respectively. Maximum measurements noted at each of the two basins were on the order of 8.0 x 10^{-7} μc/cc. Analysis of these same samples for the activity density from gross alpha emitters showed this activity density to be less than 5 x 10^{-9} μc/cc in all samples analyzed.

In addition to the river and raw water samples which were collected from various locations in the environs of the Hanford Works, analysis of samples collected from remote locations were used for the purpose of evaluating the activity density due to natural emitters in river waters of the Pacific Northwest. Samples collected from the Yakima River near Prosser and Yakima, the Naches River at Yakima, the Snake River at Lewiston, Idaho, and the Walla Walla and Touchet Rivers showed that the activity densities from natural alpha and beta particle emitters in those waters were below the detection limits of the measurement.

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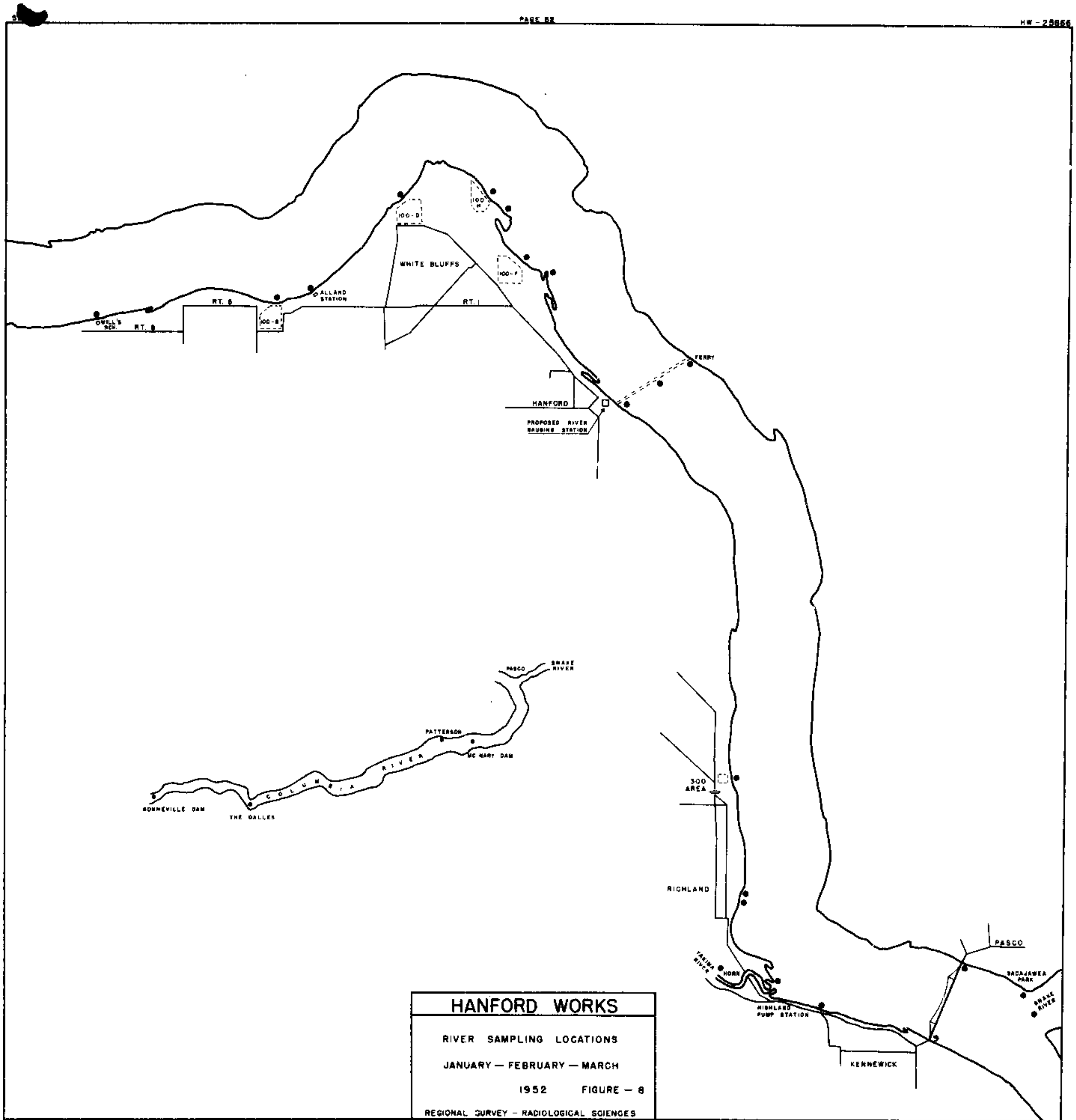

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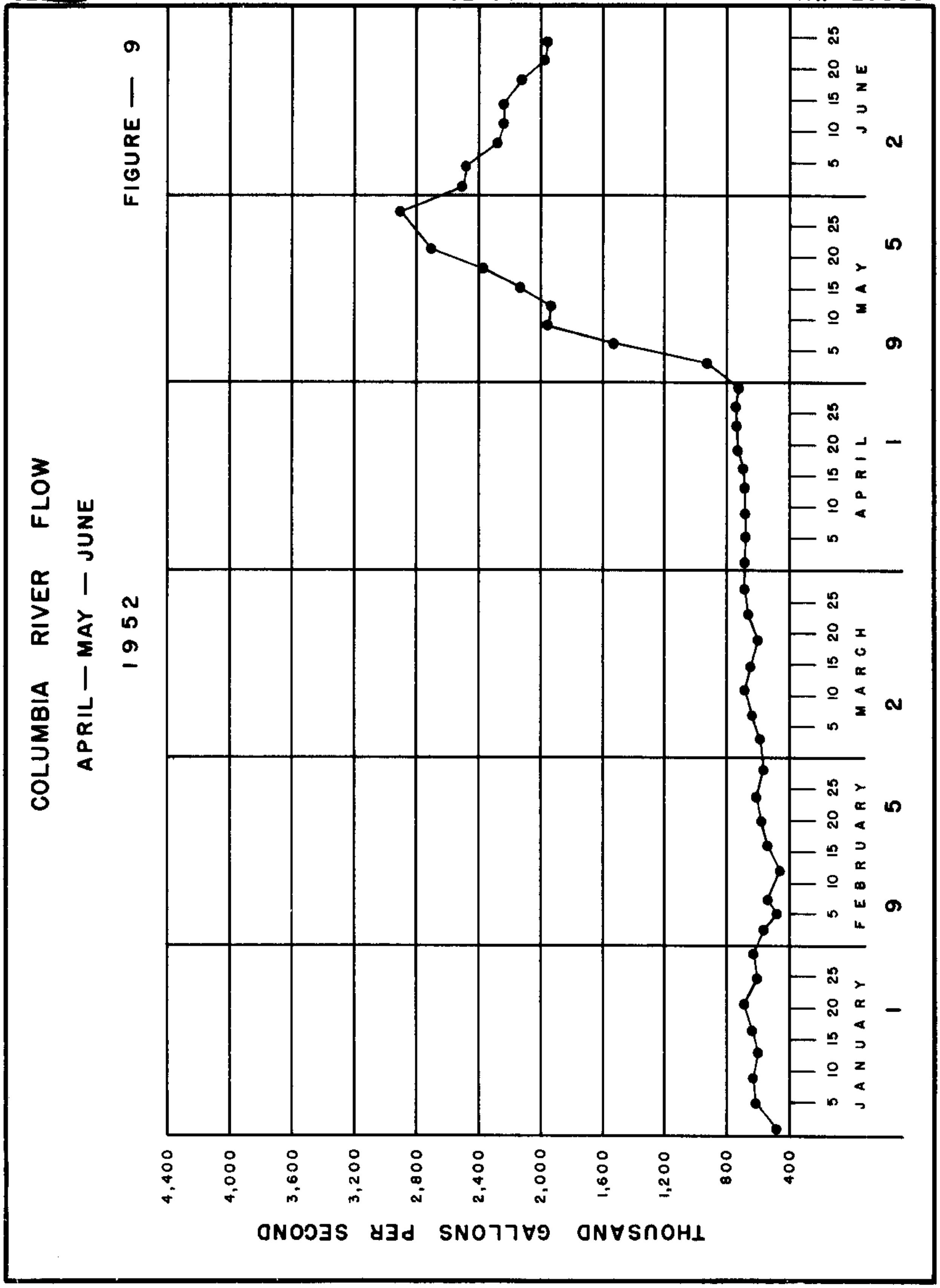
COLUMBIA RIVER FLOW
APRIL — MAY — JUNE
1952
FIGURE — 9
THOUSAND GALLONS PER SECOND
4,400
4,000
3,600
3,200
2,800
2,400
2,000
1,600
1,200
800
400
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
5 10 15 20 25
1
9
5
2
1
9
5
2

SECTION VI

RADIOACTIVE CONTAMINATION IN RAIN

The concentration of beta emitters in rain was determined quantitatively by analyzing over 200 rain samples which were collected at locations on and adjacent to the Hanford Works Area. A map showing the locations at which rain collectors were maintained may be referred to in Figure 10. Analytical procedures used for the radiochemical analyses and the calculation correction factors applied to the counting rates were those normally used for water samples (HW-20136, HW-23769, and HW-22682).

Table I summarizes the rainfall data for the period January, February and March, 1952, as measured at the Meteorology station adjacent to the 200 West Area. Similar data for 1950 and 1951 are included for comparison.

TABLE I

PRECIPITATION MEASURED AT HANFORD WORKS

JANUARY, FEBRUARY, MARCH

1 9 5 2

units-inches

Year	January	February	March	Quarterly Total
1950	1.80	1.06	0.87	3.73
1951	0.84	0.51	0.46	1.81
1952	0.65	0.50	0.06	1.21

A comparison of the rainfall data with that measured during the previous quarter showed a significant reduction in total precipitation.

Table II summarizes the results obtained from the measurement of the activity density of gross beta emitters in rainfall collected during this period.

[redacted]

TABLE II

ACTIVITY DENSITY FROM GROSS BETA EMITTERS IN RAIN

JANUARY, FEBRUARY, MARCH

1 9 5 2

Location	Number Samples	units of 10^{-6} µc/cc Maximum	Average
In 200 East Area	33	26	4
250' E of stack	8	9	3
2000' E of stack	7	5	2
750' SE of stack	8	26	8
3500' SE of stack	10	14	4
In 200 West Area	41	121	15
1000' E of stack	8	11	5
7000' E of stack	7	6	4
8000' SE of stack	9	121	32
4900' SE of stack	8	100	27
Redox Stack	9	34	7
100 Area Environs	61	38	2
100-B SE	6	1	<1.0
100-D SW	8	1	<1.0
100-F SW	8	9	2
Hanford 614	10	7	1
Hanford 101	10	3	1
White Bluffs	10	26	3
100-H SE	9	38	8
Perimeter Locations	40	22	2
Richland	9	2	1
Pasco H and R	9	7	1
Benton City	7	3	1
Riverland	7	2	1
North Richland	8	22	6
Intermediate Location	64	16	2
Route 4S, Mile 6	9	16	3
300 Area 614	8	11	2
200 North 614	11	7	2
Gable Mountain	10	3	1
Batch Plant	9	12	4
622 Building	17	5	1

[redacted]

A review of the data presented indicates that the average activity density from beta emitters in rainfall collected during this period was not significantly different from that noted during the last quarter in 1951, or from that of the same three month period in 1951. Several of the individual samples which showed the activity density to be on the order of 1×10^{-4} µc/cc were considerably higher than the maximum measurements found during the previous quarter, but the frequency of occurrence of the higher measurement was not sufficient to influence a significant trend in the mean concentration. In general, it is expected that the activity density from gross beta emitters would be less than 5×10^{-6} µc/cc at perimeter locations and in residential communities, and less than 5×10^{-5} µc/cc in the region within a 2 to 3 mile radius of the separations facilities.

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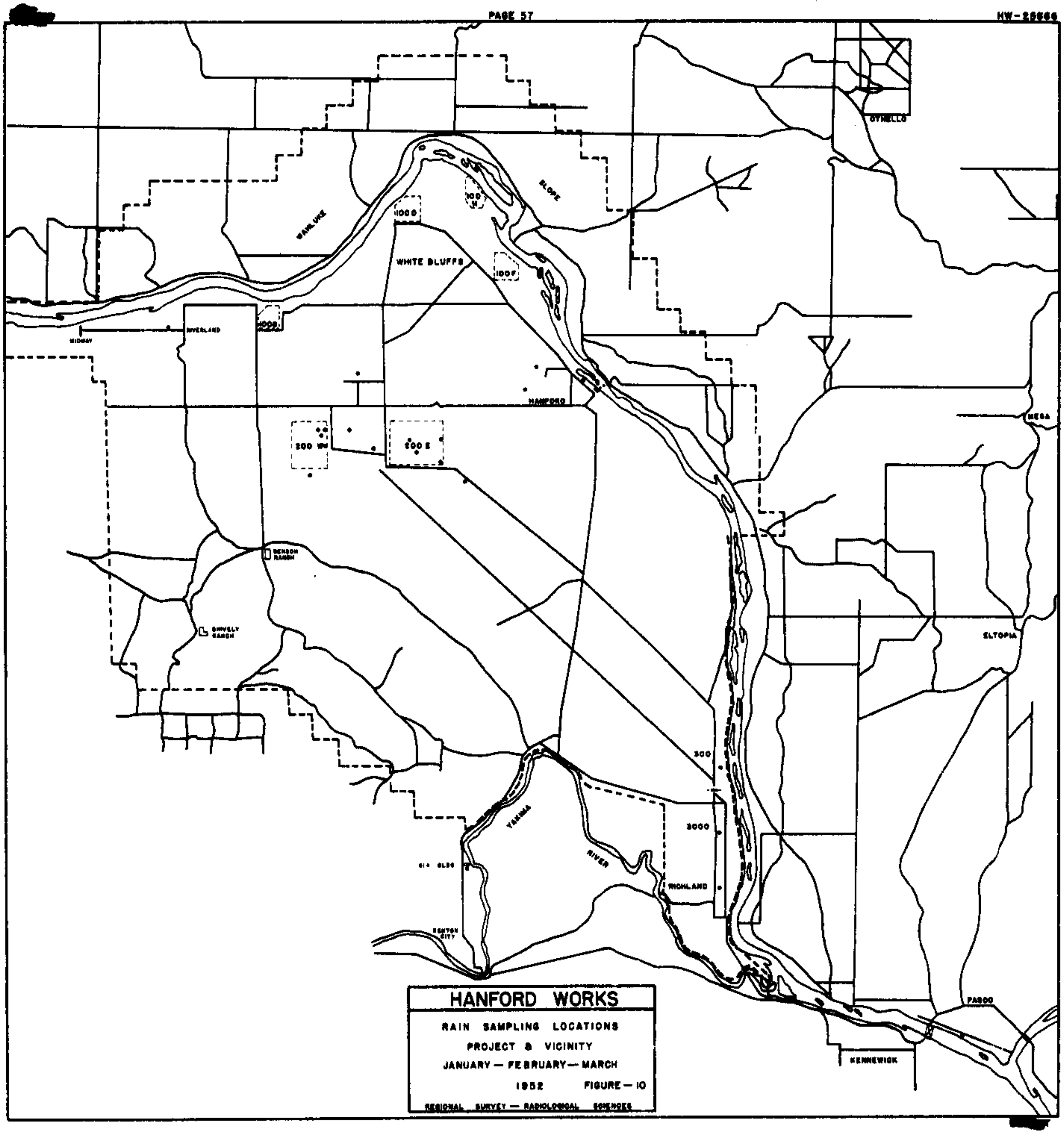
OTHELLO
WAHLUKE
SLOPE
100 D
100 H
100 F
100 B
WHITE BLUFFS
MIDWAY
RIVERLAND
HANFORD
MESA
200 W
200 E
BENSON RANCH
SHIVELY RANCH
ELTOPIA
300
3000
YAKIMA
RIVER
RICHLAND
BENTON CITY
PASCO
KENNEWICK
HANFORD WORKS
RAIN SAMPLING LOCATIONS
PROJECT & VICINITY
JANUARY — FEBRUARY — MARCH
1952 FIGURE — 10
REGIONAL SURVEY — RADIOLOGICAL SCIENCES

SECTION VII
RADIOACTIVE CONTAMINATION IN DRINKING WATER SUPPLIES AND TEST WELLS

The activity density of gross beta and gross alpha emitters in drinking water supplies and test wells was evaluated by analyzing nearly 1,200 samples collected from various sources (Figure 11) on and adjacent to the Hanford Works area. Analytical procedures and the calculation correction factors applied to the counting rates were identical with those summarized in previous publications of the Control Unit (HW-20136, HW-22682, and HW-23769). The frequency of sampling at various drinking water supplies varied from daily to monthly, depending on the location of the well, the probability of contamination, and the current trend of the activity density measurements. Over 900 of the samples were 500 ml. samples which were analyzed primarily for the activity from gross beta emitters. The alpha measurements obtained from analyzing 500 ml. samples were supplemented by analyzing 12 liter samples for the activity density from gross alpha emitters, plutonium and uranium.

Table I summarizes the results obtained at locations where the activity density from alpha emitters averaged above the individual sample detection limit of 5×10^{-9} µc/cc during the three month period.

Consistent with past data, the locations at which the activity density from alpha emitters exceeded 5×10^{-9} µc/cc were essentially confined to the Richland, North Richland, and Benton City regions. The magnitude of current results was nearly identical with that observed in the past. In nearly every instance, the well samples which indicated detectable alpha emission also showed trace quantities of uranium.

In addition to those locations summarized in Table I, individual samples collected from nearly all remaining wells in the region showed trace alpha particle emission at some time during the quarter. Usually this activity was on the order of 10^{-9} µc/cc and in the great majority of cases, the positive measurements were not confirmed by resample. A complete tabulation which includes the results from all wells sampled during the period is presented in Table II.

TABLE I

ACTIVITY DENSITY OF ALPHA EMITTERS IN DRINKING WATER JANUARY, FEBRUARY, MARCH 1952

500 ml. samples

		Uranium and Plutonium units of 10^{-9} µc/cc			Uranium units of 10^{-3} µg/cc	
Location	Number Samples	Max.	Aver.	Number Samples	Max.	Aver.
Richland Well #14	61	14	7	62	12	8
Richland Well #5	13	88	13	12	10	3
Richland Well #12	13	10	5	12	12	8
Richland Well #13	12	110	13	12	7	6
Richland Well #14	13	11	6	12	11	8
Richland Well #15	12	35	9	11	13	9
Richland Well #18	13	10	5	12	9	7
3000 Area Well "A"	11	9	5	11	7	3
3000 Area Well "B"	8	54	12	8	4	3
3000 Area Well "C"	13	22	5	13	16	3
1100 Area Well #8	12	42	8	9	3	2
Lower Knob	13	130	12	-	-	-
Benton City Store	13	17	12	13	18	14
Benton City Water Co. Well	13	22	12	13	24	16
200 East Sanitary	13	78	7	15	<2	<2
Sacajawea Park	11	9	5	11	9	6

TABLE II

SUMMARY OF ALPHA AND BETA EMITTERS MEASURED IN WATER SUPPLIES

JANUARY, FEBRUARY, MARCH

1 9 5 2

500 ml. samples

Location	Number Samples	Alpha Emitters units of 10^{-9} µc/cc		Beta Emitters units of 10^{-8} µc/cc	
		Max.	Aver.	Max.	Aver.
Richland Well #2	12	9	5	<1	<1
Richland Well #4	61	14	7	8	<1
Richland Well #5	13	88	13	<1	<1
Richland Well #12	13	10	5	1	<1
Richland Well #13	12	110	13	1	<1
Richland Well #14	13	11	6	1	<1
Richland Well #15	12	35	9	2	<1
Richland Well #18	13	10	5	16	2
Tract House J-685	13	8	2	4	<1
3000 Area Well "A"	11	9	5	<1	<1
3000 Area Well "B"	8	54	12	2	<1
3000 Area Well "C"	13	22	5	<1	<1
3000 Area Well "D"	1	3	3	<1	<1
3000 Area Well "E"	12	15	4	<1	<1
3000 Area Durand #5	13	7	2	<1	<1
Columbia Field Well "A"	11	13	3	11	1
Columbia Field Well "B"	12	10	4	11	2
Columbia Field Well "C"	13	11	4	4	1
Hanford Well #1	13	10	4	<1	<1
Hanford Well #4	13	8	3	3	<1
Hanford Well #7	13	9	<2	1	<1
Headgate Well	12	3	<2	<1	<1
1100 Area Well #8	12	42	8	5	<1
Midway Well	13	4	<2	5	<1
Riverland Well	13	2	<2	2	<1
Lower Knob	13	130	12	<1	<1
Wills Ranch Well	10	2	<2	2	<1
P-11 Well	9	5	<2	2	<1
Pistol Range	13	5	3	2	<1
White Bluffs Fire Hall	12	9	4	25	10
White Bluffs Tele. Exch.	10	8	4	18	7

TABLE II (Contd.)

Location	Number Sampled	Alpha Emitters units of 10^{-9} μc/cc		Beta Emitters units of 10^{-8} μc/cc	
		Max.	Aver.	Max.	Aver.
Pasco Improvement Farm	2	6	4	5	3
Benton City Store	13	17	12	<1	<1
Benton City Water Co. Well	13	22	12	1	<1
Cobb's Corner	13	19	4	2	<1
Enterprise	13	2	<2	2	<1
Kennewick Standard Sta.	11	45	5	28	15
100-B Sanitary	12	5	<2	2	<1
100-D Sanitary	12	28	3	44	24
100-DR Sanitary	14	9	3	82	22
100-H Sanitary	12	4	<2	60	29
100-F Sanitary	10	6	<2	60	32
200 East Area Sanitary	13	78	72	24	9
200 West Area Sanitary	12	5	<2	44	23
300 Area Sanitary	15	6	3	1	<1
251 Building	11	25	4	10	2
Byers Landing	2	3	3	<1	<1
Redox Administration Bldg.	13	3	<2	24	9
Sacajawea Park	11	9	5	3	<1
McNary Dam	13	2	<2	11	4
Patterson	12	13	4	<1	<1
Plymouth	13	6	<2	2	<1
Pasco Sanitary	12	-	-	47	27

Those wells which showed trace alpha emission in individual samples were resampled on a 12 liter sample basis. The larger volume increased the sensitivity of the measurement to 2×10^{-10} μc/cc and provided an excellent means for establishing the validity of the trace emission which was indicated by analyzing the smaller 500 ml. sample. Table III summarizes the results obtained from the analysis of the larger volume samples.

A comparison of the results summarized in Table III with the results of similar measurements obtained from identical locations during the previous quarter showed no significant difference. A limited review of the

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fluctuations noted within the quarter was not indicative of any significant trend or change during the present period.

TABLE III

SUMMARY OF ALPHA EMITTERS MEASURED IN DRINKING WATER

12 liter samples

JANUARY, FEBRUARY, MARCH

units of 10^{-10} μc/cc

1 9 5 2

Location	Number Samples	Maximum	Average
Richland Well #2	6	65	28
Richland Well #4	3	70	48
Richland Well #5	5	30	24
Richland Well #12	5	50	43
Richland Well #13	6	53	23
Richland Well #14	6	76	41
Richland Well #15	6	64	18
Richland Well #18	6	60	38
Tract House J-685	5	16	11
Columbia Field Well "A"	4	17	14
Columbia Field Well "B"	5	13	9
Columbia Field Well "C"	6	22	15
1100 Area Well #8	4	35	19
3000 Area Well "A"	5	24	17
3000 Area Well "B"	4	26	14
3000 Area Well "C"	7	31	22
3000 Area Well "E"	7	19	10
3000 Area Durand #5	7	22	15
Benton City Store	7	120	89
Benton City Water Co. Well	7	120	62
Cobb's Corner	6	31	17
Enterprise Well	7	31	10
Kennewick Std. Station	7	11	7
Riverland	6	13	6
Midway	7	9	6
Wills Ranch	7	12	6
Hanford Well #1	7	20	13
Hanford Well #4	6	15	9
P-11 Well	2	21	18
White Bluffs Fire House	6	31	25
200 North Well #5	5	15	8
Pistol Range	7	31	21
Hanford Well #7 (San.)	5	12	10
251 Building (San.)	6	12	3
3000 Area Pond Inlet	1	9	9

The results obtained from analyzing 500 ml. samples from water supplies for the activity from gross beta emitters are summarized in Table II. Consistent with past observations, the only drinking water supplies which showed the activity density from beta particle emitters to exceed 5×10^{-8} μc/cc were those which took water directly from the Columbia River. These locations included Pasco and Kennewick city water and the sanitary water consumed in the various Hanford Works operating areas. The latter source represents water which is pumped directly from the river at the reactor areas and transported to all manufacturing areas via the raw water-river export line. (The results obtained from analyzing the raw water samples may be referred to in Section V.) As expected during periods in which both the flow rate of the Columbia River and the quantity of beta particle emitters admitted to it from the reactor areas show no significant variation, the activity density from beta emitters noted at downstream locations was not significantly different from that measured during the last quarter in 1951.

Radiochemical analysis of samples collected at the Pasco Filter Plant for the activity from gross beta emitters showed small but related decreases in all types of samples collected. Average values showed that the activity density from beta emitters in water entering the plant from the Columbia River decreased to nearly one-half the previous value; beta particle emitters in backwash material from the sand filter showed decreases to one-third and one-fourth of previous values for solid and liquid portions, respectively. Small decreases were also observed in surface samples obtained from the top of the anthracite coal and sand filters. As in the past, maximum measurements were noted in the solid fraction of backwash material from the sand filter. A summary of the results obtained from the analysis of samples collected at the filter plant is presented in Table IV.

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TABLE IV

PASCO FILTER PLANT MEASUREMENTS

JANUARY, FEBRUARY, MARCH

1 9 5 2

Type Sample	Number Samples	Activity Density Gross Beta Particle Emitters	
		Maximum	Average
Water Entering Plant From River	9	2.5×10^{-6} μc/cc	1.9×10^{-6} μc/cc
Sand (surface of sand filter)	12	2.6×10^{-5} μc/gm	1.1×10^{-5} μc/gm
First Backwash Material (liquid)	11	1.3×10^{-6} μc/cc	7.1×10^{-7} μc/cc
First Backwash Material (solid)	12	2.3×10^{-2} μc/gm	1.1×10^{-2} μc/gm
Coal (surface of coal filter)	13	1.7×10^{-4} μc/gm	8.0×10^{-5} μc/gm
Water Leaving Plant	12	4.7×10^{-7} μc/cc	2.7×10^{-7} μc/cc

During February, the filter bed below the Columbia River at Clover Island (Kennewick drinking water intake) was exposed for repair. Core samples of the accumulated material over the filter bed were obtained and analyzed for the activity from gross alpha and beta emitters. Analysis of these samples showed that the activity from alpha and beta emitters in this accumulated material was below the detection limit of the measurement ($<10^{-6}$ μc/gram).

One liter samples of drinking water were collected from various communities along the Columbia River between Pasco, Washington, and Portland, Oregon, during March. Analysis of these samples for the activity density from gross beta emitters showed this activity to be less than 5×10^{-8} μc/cc at all locations. Communities at which samples were collected included Vancouver, Washougal, Camas, and Bingen in Washington, and Portland, Troutdale, The Dalles, Boardman, Arlington, and Umatilla in the state of Oregon.

Several samples were also collected from drinking water supplies at various communities northwest of the Hanford Project. Locations sampled included Sunnyside, Granger, Zillah, Ellensburg, Yakima, and Moxee City. These analyses were directed toward determining if the natural uranium which is indicated in the water table around Benton City extended farther up the Yakima Valley. Analysis for gross alpha emitters along with several spot checks by the LaF_3 method for plutonium showed negligible activity from these sources in all cases. The activity density from gross beta emitters in these samples was $< 5 \times 10^{-8}$ μc/cc.

Over 200 samples were obtained from test wells located on or immediately adjacent to the Hanford Works area. The majority of these wells was sampled on a repetitive basis throughout the period. In nearly all cases, 500 ml. samples were used to determine the activity density from gross beta and gross alpha emitters; in those cases where trace activity was indicated, the data were supplemented by analyzing 12 liter samples. Tables V and VI summarize the results obtained from the analysis of the 500 ml. and 12 liter samples, respectively.

A comparison of these data to measurments obtained during the previous quarter showed no significant change or trend. Positive measurements were largely confined to the wells in the 300 Area; the remaining locations which show positive averages were weighted considerably by the results of one individual sample which, in the majority of cases, was not confirmed by subsequent sampling.

Sampling continued on a monthly basis at the 48 test wells which were drilled by the Geology Group of the Biophysics Section. Analysis of these samples for the activity density from gross beta and gross alpha emitters showed these densities to be less than 5×10^{-8} μc/cc and less than 2×10^{-9} μc/cc, respectively.

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TABLE V

SUMMARY OF ALPHA AND BETA EMITTERS MEASURED IN TEST WELLS JANUARY, FEBRUARY, MARCH 1 9 5 2

500 ml. samples

Location	Number Samples	Alpha Emitters units of 10^{-9} μc/cc Max.	Alpha Emitters units of 10^{-9} μc/cc Aver.	Beta Emitters units of 10^{-8} μc/cc Max.	Beta Emitters units of 10^{-8} μc/cc Aver.
300 Area Well #1	12	53	11	4	1
300 Area Well #2	1	78	78	1	1
300 Area Well #3	25	38	19	4	<1
300 Area Well #4	12	260	190	5	3
300 Area North Well	9	5900	4200	30	14
B-Y Well	12	6	3	2	<1
200 North Well #5	9	7	2	2	<1
Snively Ranch Well	1	2	2	<1	<1
Rattlesnake Springs	1	<2	< 2	1	1
Ford Ranch Well	11	9	< 2	1	<1
Meeker Ranch Well	13	6	< 2	2	<1

TABLE VI

ACTIVITY DENSITY FROM ALPHA PARTICLE EMITTERS IN TEST WELLS JANUARY, FEBRUARY, MARCH 1 9 5 2

11.4 liter samples

Location	Number Samples	units of 10^{-10} μc/cc Max.	units of 10^{-10} μc/cc Aver.
B-Y Well	5	34	25
Snively Ranch	1	8	8
Rattlesnake	1	8	8
McGee Well	6	6	3
Meeker Well	6	5	2

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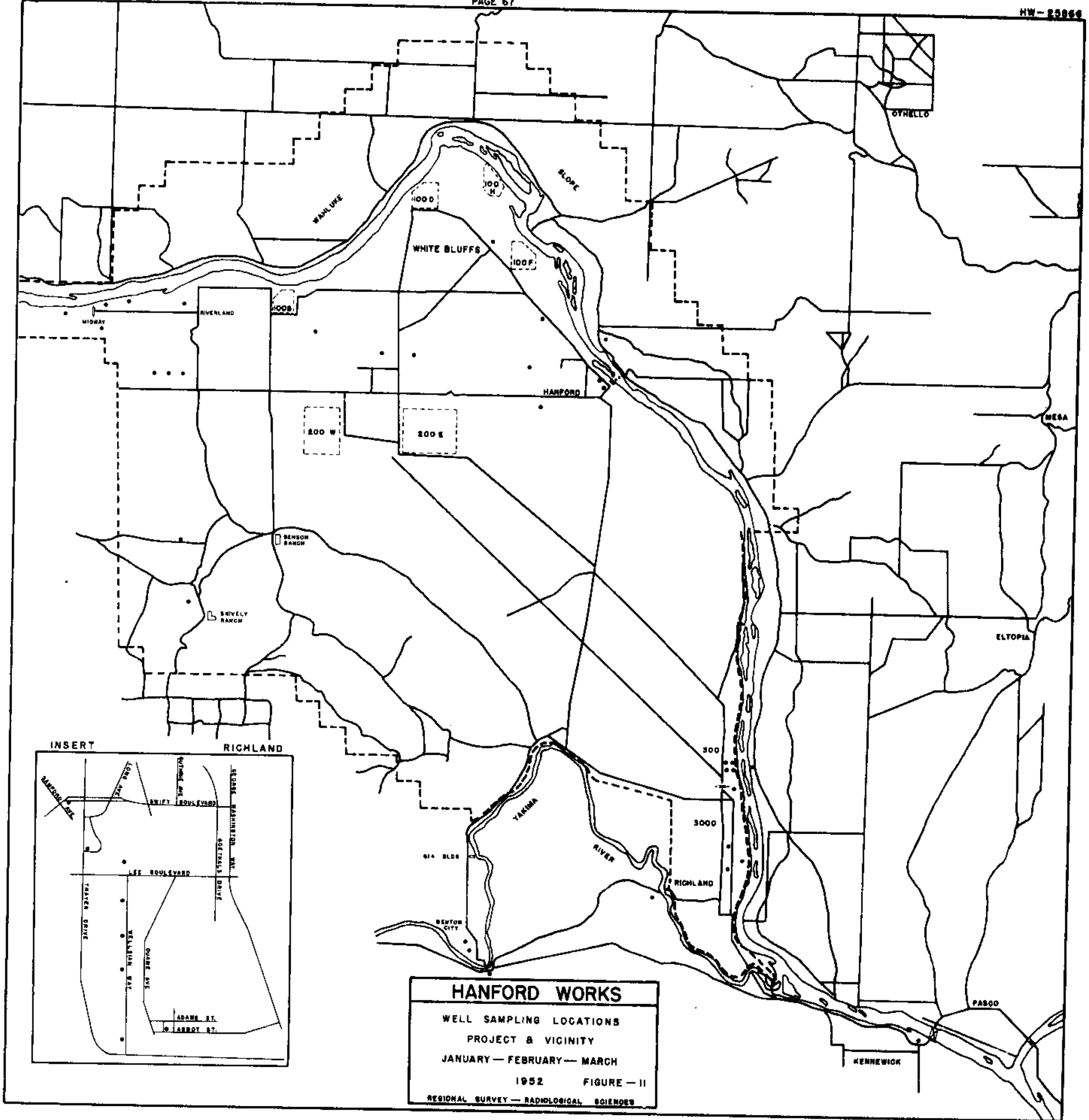
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WAHLUKE
SLOPE
100 D
100 H
100 F
100 B
WHITE BLUFFS
MIDWAY
RIVERLAND
HANFORD
200 W
200 E
MESA
BENSON RANCH
SNIVELY RANCH
ELTOPIA
300
3000
YAKIMA
RIVER
RICHLAND
BENTON CITY
PASCO
KENNEWICK
INSERT
RICHLAND
SWIFT BOULEVARD
LEE BOULEVARD
THAYER DRIVE
WELLSIAN WAY
GOETHALS DRIVE
GEORGE WASHINGTON WAY
DUANE AVE
ADAMS ST.
ABBOT ST.
HANFORD WORKS
WELL SAMPLING LOCATIONS
PROJECT & VICINITY
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FIGURE — 11
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