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# RADIOACTIVE CONTAMINATION IN THE HANFORD ENVIRONS

FOR THE PERIOD

APRIL, MAY, JUNE 1955

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HANFORD TECHNICAL RECORD

GENERAL ELECTRIC

HANFORD ATOMIC PRODUCTS OPERATION

RICHLAND, WASHINGTON

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Health and Safety
(M-3679, 16th Ed.)

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# RADIOACTIVE CONTAMINATION IN THE HANFORD ENVIRONS FOR THE PERIOD APRIL, MAY, JUNE 1955

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By Authority of CG-PR-1
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By CE Barlow 8-11-78
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By

Members of

Regional Radiation Measurements Unit

August 9, 1955

HANFORD ATOMIC PRODUCTS OPERATION
RICHLAND, WASHINGTON

Operated for the Atomic Energy Commission by the
General Electric Company under Contract #W-31-109-Eng-52

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## ABSTRACT


### SECTION I: RADIOACTIVE CONTAMINATION IN EFFLUENT GAS

Beta particle emitters discharged from Semi-Works stack averaged less than $3.4 \times 10^{-3}$ c/day; this represented a 500 fold increase from the previous quarter during which the facility was not operative. The total average daily $I^{131}$ emission from S and T Plants was 2.3 curies with maxima from T-Plant of 14 curies on April 7 and from S-Plant of 18 curies on March 26. Ruthenium average daily emission was less than 0.01 curie, the detection limit for the system. Total average daily emission of tritium oxide from all reactors was 1.1 curies. Two detectable emissions of $C^{14}$ were noted including a maximum of $6 \times 10^{-3}$ c/day from 105-B Area stack on March 29. $S^{35}$ average daily emission was lower by 25 to 50 per cent for all areas except 105-C and 105 B where emissions were of the same order of magnitude as those for the first quarter. Daily average emission of beta and alpha particle emitters as particulates continued within normal limits.

### SECTION II: RADIOACTIVE CONTAMINATION ON VEGETATION

Average concentrations of radio-iodine in the environs decreased markedly from the previous quarter with the greatest decline being observed in June. Additional radio-iodine detected in May was determined to originate from off-site nuclear detonations. Radioactive decay and precipitation accounted for the overall decrease.

Activity density measurements on non-volatile beta particle emitters were quite consistent with values from the previous quarter. Comparative decreases north of the separation areas and increases south of the areas were not unusual and were due to normal plant operation and shifting meteorological conditions.

During April, off-site contamination from non-volatile beta particle emitters was found to be quite widespread and as high as $7.2 \times 10^{-4}$ μc/gm of vegetation in eastern Washington. Isotopic analysis indicated the source of the activity to be a nuclear detonation.

Analyses for alpha particle emitters on vegetation indicated either low or negative results for the quarter.


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## SECTION III: RADIOACTIVE CONTAMINATION IN THE ATMOSPHERE

Dose rates measured by Victoreen Integrons increased to average values ranging from 0.4 to 4.8 mrad/day in and near the production areas. No significant changes were measured by detachable ionization chambers in the average dose rates present at stations outside the manufacturing areas and in residential areas. Small, though significant, increases were measured in the activity density of beta particle emitters filtered from air; concentrations averaged between $3.4 \times 10^{-13}$ μc/ml and $1.0 \times 10^{-12}$ μc/ml at all sampling locations including those on-site and in surrounding residential areas. General increases in radioactive particle concentrations in air were noted at locations both near the separation areas and at remote stations; the average concentrations did not exceed 0.20 ptle/$m^3$ at any location. Airborne $I^{131}$ concentrations decreased to normal during the period from values previously reported, averaging less than $1.7 \times 10^{-12}$ μc/ml near the separation areas and less than $0.1 \times 10^{-13}$ μc/ml in residental areas. The activity density of alpha particle emitters in the atmosphere was normal during the quarter.

## SECTION IV: RADIOACTIVE CONTAMINATION IN HANFORD WASTES

The average activity of beta particle emitters discharged to the Columbia River from reactor retention basins increased significantly in all reactor areas, except 100-H, with the maximum increase occurring in the 100-B Area where the discharge averaged 23,000 μc/sec for the quarter. Trace quantities of alpha particle emitters, plutonium, and polonium were found in isolated samples from the effluent basins in various areas. $I^{131}$ discharged to the river from the Animal Farm averaged 38 μc/day. Ground surveys of control plots around Redox continued. Particle frequency maps covering the plant and adjoining areas may be referred to in the text. Ground surveys in the Tri-City area showed average frequencies of particles detectable by portable instruments to be one particle per 3,000 to 4,000 square feet. A map from a special survey of 100-H Area and a particle frequency map recording the unusual contamination found there may be referred to in the text.

## SECTION V: RADIOACTIVE CONTAMINATION IN THE COLUMBIA RIVER AND RELATED WATERS

An increase in the average flow rate of the Columbia River from $6.0 \times 10^5$ gps last quarter to $1.0 \times 10^6$ gps during the present quarter resulted in general decreases in the activity density of beta particle emitters in river water, mud, and in raw water derived from the Columbia. Beta particle emitter activity density in the Columbia River ranged from less than $5 \times 10^{-8}$ μc/ml above the HAPO project to

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$1.5 \times 10^{-5}$ μc/ml at the south bank near Hanford. Maximum measurements below McNary Dam were $4.0 \times 10^{-7}$ μc/ml at Paterson and $9.0 \times 10^{-8}$ μc/ml at Arlington both in April.

All measurements for alpha particle emitters in the river samples collected this quarter revealed activity densities below the detection limits of $5 \times 10^{-9}$ μc/ml for water and $3 \times 10^{-6}$ μc/gm for mud.

## SECTION VI: RADIOACTIVE CONTAMINATION IN RAIN

The total precipitation of 1.27 inches for the period was approximately 90 per cent of the 35-year Hanford average of 1.41 inches. The activity density of beta particle emitters increased significantly during May when measurements were influenced by nuclear detonation debris. Samples collected from relatively remote locations showed values ranging from <1 to $97 \times 10^{-6}$ μc/ml, whereas samples collected in the immediate vicinity of the separation areas ranged from 3 to $72 \times 10^{-6}$ μc/ml.

## SECTION VII: RADIOACTIVE CONTAMINATION IN DRINKING WATER AND TEST WELLS

Detectable concentrations of alpha particle emitters were measured in drinking water from nine sources this quarter; uranium analyses performed on eight of these wells yielded positive averages in all but one instance. Concentration of alpha particle emitters ranged from <5 to $62 \times 10^{-9}$ μc/ml in all wells tested. Water sources derived from the Columbia River showed general decreases in beta particle emitter concentrations this quarter, reflecting increased dilution of reactor effluent water caused by higher river flow rates. Activity density of beta particle emitters in all drinking water sampled ranged from <0.5 to $15 \times 10^{-8}$ μc/ml; average values for the Pasco and Kennewick water supplies were 0.6 and $2.4 \times 10^{-8}$ μc/ml, respectively.

The increasing trend in activity density of alpha particle emitters in test wells 303-2 and 303-6 noted during the previous quarter was reversed this quarter at two of the locations. Samples of test wells 303-4, 303-7, and 303-11 yielded average values significantly higher than those noted during the past quarter at these locations. The 11.7 liter water samples previously collected for alpha particle emitter activity density were discontinued this quarter because sufficient sensitivity can be obtained from the 500 ml samples.

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## INTRODUCTION

This document summarizes the results obtained from monitoring the HAPO environs for radioactive contamination during the period April, May, and June 1955. Samples were collected by Regional Monitoring forces according to procedures previously outlined in documents of this series.(1, 2, 3) These samples were analyzed by the Radio-Analysis Laboratory of the Regional Radiation Measurements Unit according to procedures and techniques described in a previously published laboratory manual.(4) Counting rates obtained from these analyses were corrected for geometry, backscatter, air-window absorption, source size, self-absorption, chemical yield, and collection efficiency by Radiation Measurements Evaluation forces using factors described in previous reports.(5, 6, 7, 8) Additional corrections for decay were applied to those samples in which significant amounts of short half-life beta particle emitters were found. The findings obtained from analyzing the direct samples were supplemented with readings obtained from portable and fixed instrumentation.

The results obtained from the described efforts are presented in Sections I through VII which are written by various members of the organizations responsible for them. These sections discuss the amounts of active material discharged from plant facilities and their effect on the contamination of vegetation, air, soil, and water.

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## SECTION I

## RADIOACTIVE CONTAMINATION IN EFFLUENT GASES

by

C. W. Thomas

Radioactive contaminants in the effluent gases released to the Hanford environs through separation and reactor plant stacks were measured by collection of gas samples at these locations. Radiochemical and chemical analyses were performed on scrubber and filter samples collected daily in the separation area stacks and weekly at the reactor stacks. Summaries of the results from measurements in each manufacturing area are presented herein.

### SEPARATION AREAS

#### 200 EAST AREA - SEMI-WORKS

Measurements made on the particulate material filtered from samples of effluent gas collected at the fifty foot level of the Semi-Works stack are presented in Table I.

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TABLE I

BETA PARTICLE EMITTERS DISCHARGED
FROM THE SEMI-WORKS STACK
APRIL, MAY, JUNE
1955

Units of Curie Per Day

| Month | Maximum | Average |
|---|---|---|
| April | $2.7 \times 10^{-3}$ | $6.9 \times 10^{-4}$ |
| May | $1.2 \times 10^{-2}$ | $<2.7 \times 10^{-3}$ |
| June | $1.9 \times 10^{-2}$ | $3.8 \times 10^{-3}$ |
| Quarter | $1.9 \times 10^{-2}$ | $<3.4 \times 10^{-3}$ |
| Last Quarter | $1.9 \times 10^{-5}$ | $<7.6 \times 10^{-6}$ |

Semi-Works facility commenced operation during the reporting quarter, consequently a 500-1000 fold increase in beta particle emission was noted in the stack effluent gas.

200 WEST AREA T-PLANT

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

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TABLE II

IODINE-131 DISCHARGED FROM THE T-PLANT STACK

APRIL, MAY, JUNE

1955

Units of Curies Per Day

| Month | Maximum | Average |
|---|---|---|
| April | 14. | 1.4 |
| May | 7.5 | 1.5 |
| June | 3.6 | 1.1 |
| Quarter | 14. | 1.3 |
| Last Quarter | 92. | <5.4 |

Daily average emission of $I^{131}$ from T-Plant stack decreased to 25 per cent of that found during the previous quarter. An average of 73 curies of $I^{131}$ per day was available in the processed metal compared to 120 curies during the previous quarter.

Table III is a summary of the results obtained in monitoring the T-Plant stack effluent for beta and alpha particle emitters filtered from samples of the effluent gas.

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TABLE III

RADIOACTIVE PARTICULATE MATERIALS IN
T-PLANT STACK EFFLUENT
APRIL, MAY, JUNE
1955

Units of $10^{-4}$ Curie Per Day

| Month | Ru | Sr | RE and Y | Nb | Zr | Pu |
|---|---|---|---|---|---|---|
| April | 9.2 | 1.6 | 8.4 | 4.4 | 2.3 | .6 |
| May | 54 | 56 | 58 | 38 | 5.8 | 1.7 |
| June | 46 | 23 | 92 | 34 | 7.3 | 1.9 |
| Quarter | 36 | 27 | 53 | 25 | 5.0 | 1.4 |
| Last Quarter | 93 | 40 | 141 | 58 | 15 | 1.5 |

The fission product spectrum was similar to that of the previous quarter; however, the average emission rate was 1/2 to 1/3 of that found during the previous period. The average ratio of the activity of $Ru^{103}$ to that of $Ru^{106}$ was 3.0 and varied from 4.1 to 1.6 compared to the previous quarter average ratio of 4.0 which varied from 8.3 to less than 1.

Table IV gives a summary of the ammonium nitrate discharged in the effluent gas from both separation plants during the quarter.

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TABLE IV

AMMONIUM NITRATE DISCHARGED FROM THE T-PLANT AND S-PLANT STACKS

APRIL, MAY, JUNE

1955

Units of Grams Per Day

| Month | T-Plant | S-Plant |
|---|---|---|
| April | $3.3 \times 10^3$ | $4.3 \times 10^4$ |
| May | $2.5 \times 10^1$ | $2.8 \times 10^3$ |
| June | $3.1 \times 10^3$ | $2.9 \times 10^3$ |
| Quarter | $2.1 \times 10^3$ | $1.6 \times 10^4$ |
| Last Quarter | $6.7 \times 10^3$ | $3.6 \times 10^4$ |

200 WEST AREA - S-PLANT

A summary of the results obtained from monitoring for $I^{131}$ at the S-Plant stack is presented in Table V.

TABLE V

IODINE-131 DISCHARGED FROM THE S-PLANT STACK

APRIL, MAY, JUNE

1955

Units of Curies Per Day

| Month | Maximum | Average |
|---|---|---|
| April | 18. | 2.4 |
| May | 0.66 | 0.17 |
| June | 1.6 | 0.30 |
| Quarter | 18. | 0.96 |
| Last Quarter | 17. | <2.4 |

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Forty-two per cent of the average daily $I^{131}$ emission to the atmosphere was contributed by S-Plant facility. The maximum daily emission of 18 curies occurred on March 26. The daily average $I^{131}$ emission was 42 per cent of the value for the first quarter and instrumental in this decrease was the average cooling period for the processed metal which was 125 days compared to 88 days for the previous quarter.

Table VI summarizes the results obtained from monitoring the S-Plant effluent gases for ruthenium activity.

TABLE VI

RADIOACTIVE RUTHENIUM DISCHARGED FROM THE S-PLANT STACK
APRIL, MAY, JUNE
1955

Units of Curie Per Day

| Month | Maximum | Average |
|---|---|---|
| April | <0.03 | <0.01 |
| May | <0.02 | <0.01 |
| June | <0.02 | <0.01 |
| Quarter | <0.03 | <0.01 |
| Last Quarter | <0.2 | <0.05 |

The figures reported in Table VI are based on measurements made at a point 20 feet above the base of the stack and do not include any contributions from radioactive material sloughing off from the upper stack lines into the effluent.

The average daily ruthenium emission of less than 0.01 curie was noted during the quarter and is the detection limit for the system used.

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The results obtained by monitoring the S-Plant stack effluent gases for fission products other than ruthenium and iodine are tabulated in Table VII.

TABLE VII

RADIOACTIVE PARTICULATE MATERIALS IN S-PLANT STACK EFFLUENT APRIL, MAY, JUNE 1955

Units of $10^{-4}$ Curie Per Day

| Month | Sr | Re and Y | Nb | Zr | Pu |
|---|---|---|---|---|---|
| April | <.6 | 3.0 | <5.6 | <3.8 | <0.2 |
| May | <.7 | 4.6 | <7.5 | 1.0 | <0.2 |
| June | 5.0 | <20 | <11 | <2.0 | <0.5 |
| Quarter | <2.1 | <9.2 | <8.0 | <2.3 | <.03 |
| Last Quarter | <1.0 | 3.4 | <7.8 | <2.7 | .05 |

The fission product spectrum and the daily average emission discharged from S-Plant stack was comparable to that of the previous quarter.

200 WEST AREA - U-PLANT

Table VIII is a summary of the results obtained from filtering gas samples from the U-Plant stack.

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TABLE VIII

RADIOACTIVE PARTICULATE MATERIALS IN
IN U-PLANT STACK EFFLUENT
APRIL, MAY, JUNE
1955

| Month | Alpha Particle Emitters, Units of $10^{-8}$ Curie/day | | Beta Particle Emitters, Units of $10^{-5}$ Curie/day | |
|---|---|---|---|---|
| | Maximum | Average | Maximum | Average |
| April | 1.2 | 0.69 | 4.7 | 1.1 |
| May | 1.4 | 0.59 | 15. | 3.9 |
| June | 1.7 | 0.42 | 14. | 3.0 |
| Quarter | 1.7 | 0.56 | 15. | 2.7 |
| Last Quarter | 3.6 | 0.61 | 14. | 3.0 |

Daily average emission of gross beta and alpha particle emitters fluctuated within normal limits during the quarter.

## REACTOR AREAS

Tables IX through XIII summarize the measurements for tritium oxide, $C^{14}$, $S^{35}$, and solid beta and alpha particle emitters, respectively, in reactor stack effluent gases. The total average daily emission of tritium oxide from all reactors was 1.1 curies. Two detectable emissions of $C^{14}$ were noted including a maximum of $6 \times 10^{-3}$ curie per day. A decrease of 1/2 to 1/4 of that from the previous quarter's average daily emission of $S^{35}$ was noted for all areas except 105-C and 105-B where emissions were comparable to those of the previous quarter. The daily average of particulates emitted from reactor stacks was similar to that of the previous quarter.

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TABLE IX

TRITIUM OXIDE DISCHARGED FROM REACTOR STACKS

APRIL, MAY, JUNE

1955

Units of Curie Per Day

| Stack | April | | May | | June | | Quarterly | |
|---|---|---|---|---|---|---|---|---|
| | Max. | Avg. | Max. | Avg. | Max. | Avg. | Max. | Avg. |
| 100-B | 0.42 | 0.26 | 0.15 | 0.10 | 0.25 | 0.18 | 0.42 | 0.17 |
| 100-C | 0.25 | 0.18 | 0.46 | 0.12 | 0.32 | 0.08 | 0.46 | 0.11 |
| 100-D | 0.38 | 0.21 | 1.03 | 0.53 | 1.23 | 0.71 | 1.23 | 0.50 |
| 100-DR | 0.33 | 0.16 | 0.58 | 0.29 | 0.06 | 0.04 | 0.58 | 0.15 |
| 100-H | 0.19 | 0.12 | 0.31 | 0.12 | 0.13 | 0.06 | 0.31 | 0.10 |
| 100-F | 0.16 | 0.13 | 0.30 | 0.11 | 0.13 | 0.06 | 0.30 | 0.10 |

TABLE X

CARBON-14 DISCHARGED FROM REACTOR STACKS

APRIL, MAY, JUNE

1955

Units of $10^{-3}$ Curie Per Day

| Stack | April | | May | | June | | Quarterly | |
|---|---|---|---|---|---|---|---|---|
| | Max. | Avg. | Max. | Avg. | Max. | Avg. | Max. | Avg. |
| 100-B | 6.3 | <4.5 | <4.5 | <4.5 | <4.5 | <4.5 | 6.3 | <4.5 |
| 100-C | <4.5 | <4.5 | <4.5 | <4.5 | <4.5 | <4.5 | <4.5 | <4.5 |
| 100-D | <4.5 | <4.5 | 4.5 | <4.5 | <4.5 | <4.5 | 4.5 | <4.5 |
| 100-DR | <4.5 | <4.5 | <4.5 | <4.5 | <4.5 | <4.5 | <4.5 | <4.5 |
| 100-H | <4.5 | <4.5 | <4.5 | <4.5 | <4.5 | <4.5 | <4.5 | <4.5 |
| 100-F | <4.5 | <4.5 | <4.5 | <4.5 | <4.5 | <4.5 | <4.5 | <4.5 |

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TABLE XI

SULFUR-35 DISCHARGED FROM REACTOR STACKS

APRIL, MAY, JUNE

1955

Units of $10^{-4}$ Curie Per Day

| Stack | April | | May | | June | | Quarterly | |
|---|---|---|---|---|---|---|---|---|
| | Max. | Avg. | Max. | Avg. | Max. | Avg. | Max. | Avg. |
| 100-B | 13. | 6.6 | 14. | 7.1 | 6.2 | 6.2 | 14. | 6.8 |
| 100-C | 9.1 | 5.7 | 8.1 | <4.5 | 14. | 5.5 | 14. | <4.5 |
| 100-D | 28. | 14. | 5.6 | <4.5 | 5.3 | <4.5 | 28. | 6.0 |
| 100-DR | 39. | 23. | <4.5 | <4.5 | 6.6 | 5.0 | 39. | 9.1 |
| 100-H | 30. | 13. | 21. | 5.5 | <4.5 | <4.5 | 30. | 6.7 |
| 100-F | 69. | 23. | 51. | 18. | 5.5 | <4.5 | 69. | 17. |

TABLE XII

ALPHA PARTICLE EMITTERS DISCHARGED AS PARTICULATES

FROM REACTOR STACKS

APRIL, MAY, JUNE

1955

Units of $10^{-7}$ Curie Per Day

| Stack | April | | May | | June | | Quarterly | |
|---|---|---|---|---|---|---|---|---|
| | Max. | Avg. | Max. | Avg. | Max. | Avg. | Max. | Avg. |
| 100-B | 1.0 | 0.43 | 0.92 | 0.52 | 1.4 | 1.1 | 1.4 | 0.58 |
| 100-C | 1.0 | 1.0 | 3.0 | 0.87 | 2.8 | 0.09 | 3.0 | 0.60 |
| 100-D | 0.36 | 0.28 | 1.4 | 0.59 | 2.2 | 1.4 | 2.2 | 0.74 |
| 100-DR | 0.96 | 0.62 | 2.9 | 1.2 | 3.6 | 2.0 | 3.6 | 1.3 |
| 100-H | 0.99 | 0.71 | 2.9 | 1.4 | 1.3 | 0.24 | 2.9 | 0.82 |
| 100-F | 1.9 | 1.1 | 2.3 | 0.85 | 3.7 | 2.9 | 3.7 | 1.3 |
| 100-KW | - | - | - | - | 0.05 | 0.05 | 0.05 | 0.05 |

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TABLE XIII

BETA PARTICLE EMITTERS DISCHARGED AS PARTICULATES
FROM REACTOR STACKS
APRIL, MAY, JUNE
1955
Units of $10^{-5}$ Curie Per Day

| Stack | April | | May | | June | | Quarterly | |
|---|---|---|---|---|---|---|---|---|
| | Max. | Avg. | Max. | Avg. | Max. | Avg. | Max. | Avg. |
| 100-B | 310. | 130. | 600. | 340. | 660. | 490. | 660. | 290. |
| 100-C | 4.4 | 4.4 | 3.3 | 0.16 | 4.2 | 1.7 | 4.4 | 1.1 |
| 100-D | 260. | 190. | 200. | 170. | 200. | 160. | 260. | 170. |
| 100-DR | 7.9 | 3.8 | 1.6 | 0.89 | 2.7 | 1.6 | 7.9 | 2.0 |
| 100-H | 29. | 13. | 180. | 40. | 5.4 | 2.6 | 180. | 20. |
| 100-F | 330. | 200. | 340. | 140. | 190. | 130. | 340. | 160. |
| 100-KW | - | - | - | - | 0.43 | 0.43 | 0.43 | 0.43 |

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## SECTION II

## RADIOACTIVE CONTAMINATION ON VEGETATION

by

V. K. Schlatter

The radiochemical analysis of 2700 vegetation samples from the environs was completed for measurement of radioactive contamination on vegetation. Over 2000 samples were collected from the immediate vicinity, while the remainder were obtained from eastern and southern Washington and northern Oregon. The analysis of all samples for $I^{131}$ was supplemented by determination of non-volatile beta particle emitters on 1400 of the samples. Analysis for alpha particle emitters was made on approximately fifty samples collected from suspected sites.

Averages for the present and previous quarter are compared in Table I. Table II summarizes the off-area contamination for the present quarter. Tables III and IV show by months the average contamination measured at each location.

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TABLE I

RADIOACTIVE CONTAMINATION ON VEGETATION

APRIL, MAY, JUNE

1955

Units of $10^{-6}$ μc/gm

| Location | No. Samples | Iodine-131 Max. | Iodine-131 Avg. | Iodine-131 Avg. Last Qtr. | Non-Volatile Beta Emitters Max. | Non-Volatile Beta Emitters Avg. | Non-Volatile Beta Emitters Avg. Last Qtr. |
|---|---|---|---|---|---|---|---|
| North of 200 Areas | 227 | 280 | 5 | 8 | 1000 | 95 | 110 |
| Near the 200 Areas | 272 | 230 | 7 | 19 | 1300 | 85 | 120 |
| Route 3 | 13 | 280 | 41 | 75 | 170 | 140 | 130 |
| 200 West Gate | 66 | 320 | 37 | 130 | 620 | 80 | 130 |
| Batch Plant | 23 | 92 | 14 | 71 | 230 | 93 | 130 |
| Meteorology Tower | 13 | 66 | 16 | 82 | 290 | 82 | 140 |
| South of 200 Areas | 361 | 120 | 6 | 6 | 850 | 78 | 71 |
| Richland | 147 | 34 | <3 | 5 | 140 | 49 | 58 |
| Pasco Environs | 132 | 150 | 4 | <3 | 370 | 55 | 46 |
| Kennewick Environs | 171 | 9 | <3 | 4 | 110 | 40 | 51 |
| Benton City - Kiona | 30 | 63 | 4 | 4 | 130 | 69 | 60 |
| Richland "Y" | 12 | 5 | <3 | 6 | -- | -- | -- |
| Hanford | 5 | 36 | 11 | 21 | -- | -- | -- |
| 200 East Area | 62 | 71 | 7 | 16 | 4100 | 150 | 110 |
| 200 West Area Redox Area | 67 | 130 | 16 | 120 | 1500 | 180 | 530 |
| Wahluke Slope | 148 | 120 | 6 | 6 | 610 | 110 | 240 |
| Goose Egg Hill | 84 | 53 | 11 | 18 | 930 | 110 | 76 |
| Rattlesnake Mountain | 101 | 48 | 4 | 18 | 610 | 110 | 62 |
| PSN-50-51-61 | 38 | 42 | 6 | 45 | 240 | 67 | 84 |
| Redox Construction | 46 | 180 | 18 | 95 | 320 | 95 | 270 |
| Off Area Sampling | | | | | | | |
| Pasco to Ringold | 97 | 23 | <3 | 5 | 183 | 52 | 65 |
| Prosser to Paterson - McNary | 118 | 26 | <3 | <3 | 170 | 49 | 57 |
| Eastern Washington | 180 | 6 | <3 | <3 | 720 | 69 | 71 |
| So. Washington and No. Oregon | 199 | 4 | <3 | <3 | 340 | 51 | 72 |

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TABLE II

CONCENTRATION OF IODINE-131 ON VEGETATION

APRIL, MAY, JUNE

1955

Units of $10^{-6}$ μc/gm

| Location | April | | May | | June | |
|---|---|---|---|---|---|---|
| | Max. | Avg. | Max. | Avg. | Max. | Avg. |
| North of 200 Areas | 59 | 3 | 280 | 11 | 8 | <3 |
| Near the 200 Areas | 50 | 7 | 230 | 12 | 10 | <3 |
| Route 3 | 280 | 100 | 76 | 20 | 8 | 4 |
| 200 West Gate | 110 | 42 | 320 | 44 | 94 | 26 |
| Batch Plant | 38 | 17 | 92 | 17 | <3 | <3 |
| Meteorology Tower | 53 | 28 | 66 | 18 | 6 | <3 |
| South of 200 Areas | 30 | 5 | 120 | 10 | 41 | <3 |
| Richland | 34 | 4 | 12 | <3 | 4 | <3 |
| Pasco Environs | 93 | 8 | 150 | 5 | <3 | <3 |
| Kennewick Environs | 9 | <3 | 21 | <3 | 4 | <3 |
| Benton City - Kiona | 9 | 3 | 63 | 8 | <3 | <3 |
| Richland "Y" | 6 | 3 | 4 | <3 | <3 | <3 |
| Hanford | 36 | 13 | <3 | <3 | * | * |
| 200 East Area | 24 | 14 | 71 | 7 | 4 | <3 |
| 200 West Area Redox Area | 49 | 21 | 130 | 23 | 10 | 4 |
| Wahluke Slope | 9 | <3 | 120 | 16 | 10 | <3 |
| Goose Egg Hill | 44 | 6 | 53 | 26 | 12 | <3 |
| Rattlesnake Mountain | 6 | 3 | 48 | 8 | 18 | <3 |
| PSN-50-51-61 | 21 | 7 | 42 | 10 | 4 | <3 |
| Redox Construction | 43 | 17 | 180 | 25 | 22 | 8 |
| Off Area Sampling | | | | | | |
| Pasco to Ringold | 14 | <3 | 23 | 3 | 8 | <3 |
| Prosser to Paterson - McNary | 8 | <3 | 26 | 3 | <3 | <3 |
| Eastern Washington | 6 | <3 | <3 | <3 | 3 | <3 |
| So. Washington and No. Oregon | 4 | <3 | 4 | <3 | <3 | <3 |

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TABLE III

CONCENTRATIONS OF NON-VOLATILE BETA PARTICLE EMITTERS ON VEGETATION

APRIL, MAY, JUNE

1955

Units of $10^{-6}$ μc/gm

| Location | April | | May | | June | |
|---|---|---|---|---|---|---|
| | Max. | Avg. | Max. | Avg. | Max. | Avg. |
| North of 200 Areas | 1000* | 200 | 1000 | 98 | 230 | 53 |
| Near the 200 Areas | 1300** | 110 | 680 | 87 | 440 | 64 |
| Route 3 | 170 | 140 | *** | *** | *** | *** |
| 200 West Gate | 230 | 100 | 620 | 76 | 140 | 60 |
| Batch Plant | 230 | 100 | 200 | 74 | 220 | 100 |
| Meteorology Tower | 200 | 110 | 290 | 87 | 58 | 46 |
| South of 200 Areas | 130 | 69 | 850 | 110 | 150 | 56 |
| Richland | 140 | 55 | 81 | 43 | 54 | 35 |
| Pasco Environs | 370 | 74 | 130 | 40 | 74 | 40 |
| Kennewick Environs | 110 | 49 | 70 | 33 | 80 | 33 |
| Benton City - Kiona | 130 | 69 | 120 | 73 | 94 | 66 |
| 200 East Area | 4100 | 390 | 380 | 74 | 110 | 45 |
| 200 West Area Redox Area | 1500 | 330 | 1500 | 190 | 230 | 97 |
| Wahluke Slope | 150 | 92 | 610 | 160 | 210 | 72 |
| Goose Egg Hill | 110 | 72 | 930 | 160 | 210 | 84 |
| Rattlesnake Mountain | 160 | 99 | 610 | 160 | 200 | 68 |
| PSN-50-51-61 | 130 | 74 | 240 | 73 | 62 | 40 |
| Redox Construction | 320 | 110 | 250 | 92 | 49 | 35 |
| Off Area Sampling | | | | | | |
| Pasco to Ringold | 140 | 78 | 180 | 46 | 110 | 48 |
| Prosser to Paterson - McNary | 170 | 64 | 100 | 42 | 120 | 35 |
| Eastern Washington | 720 | 280 | 190 | 41 | 72 | 26 |
| So. Washington and No. Oregon | 340 | 67 | 290 | 56 | 340 | 51 |

* If this maximum is omitted, the new maximum becomes 280.0 and the average becomes 130.0.

** If this maximum is omitted, the new maximum becomes 160.0 and the average becomes 81.0.

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TABLE IV

RADIOACTIVE CONTAMINATION ON VEGETATION OFF-AREA LOCATIONS

APRIL, MAY, JUNE

1955

Units of $10^{-6}$ μc/gm

| Location | Iodine-131 No. Samples | Iodine-131 Max. | Iodine-131 Avg. | Non-Volatile Beta Emitters No. Samples | Non-Volatile Beta Emitters Max. | Non-Volatile Beta Emitters Avg. |
|---|---|---|---|---|---|---|
| Wallula | 4 | <3 | <3 | 2 | 96 | 70 |
| Touchet | 4 | <3 | <3 | 2 | 30 | 25 |
| Lowden | 4 | <3 | <3 | 2 | 36 | 29 |
| Walla Walla | 8 | <3 | <3 | 4 | 21 | 18 |
| Dixie | 4 | <3 | <3 | 2 | 34 | 30 |
| Waitsburg | 9 | <3 | <3 | 4 | 32 | 21 |
| 5 Mi. East of Waitsburg | 1 | <3 | <3 | 0 | | |
| Dayton | 9 | <3 | <3 | 4 | 28 | 25 |
| Pomeroy | 8 | <3 | <3 | 4 | 32 | 22 |
| Lewiston | 8 | <3 | <3 | 3 | 69 | 33 |
| Uniontown | 4 | <3 | <3 | 2 | 87 | 50 |
| Pullman | 8 | <3 | <3 | 4 | 80 | 45 |
| Colfax | 5 | 3 | <3 | 2 | 26 | 21 |
| Steptoe | 5 | 3 | <3 | 2 | 20 | 17 |
| Rosalia | 5 | <3 | <3 | 2 | 52 | 32 |
| Spangle | 5 | <3 | <3 | 2 | 36 | 28 |
| Spokane | 10 | <3 | <3 | 4 | 29 | 23 |
| Sprague | 8 | <3 | <3 | 4 | 88 | 41 |
| Sprague to Ritzville | 4 | <3 | <3 | 1 | 400 | 400 |
| Ritzville | 9 | 5 | <3 | 4 | 180 | 58 |
| Lind | 8 | <3 | <3 | 4 | 33 | 21 |
| Reardon | 5 | 6 | <3 | 2 | 190 | 100 |
| Davenport | 5 | <3 | <3 | 2 | 38 | 35 |
| Harrington | 5 | <3 | <3 | 2 | 18 | 14 |
| Harrington to Sprague | 2 | <3 | <3 | 0 | | |
| Connell | 8 | <3 | <3 | 4 | 47 | 34 |
| Delaney | 1 | <3 | <3 | 0 | | |
| Dodge | 1 | <3 | <3 | 1 | 70 | 70 |
| Central Ferry | 1 | <3 | <3 | 0 | | |
| 5 Mi. No. Central Ferry | 1 | <3 | <3 | 0 | | |
| Dusty | 1 | 3 | 3 | 0 | | |
| Thornton | 1 | <3 | <3 | 0 | | |
| Plaza | 1 | 3 | 3 | 1 | 280 | 280 |



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TABLE IV (contd.)

| Location | Iodine-131 No. Samples | Iodine-131 Max. | Iodine-131 Avg. | Non-Volatile Beta Emitters No. Samples | Non-Volatile Beta Emitters Max. | Non-Volatile Beta Emitters Avg. |
|---|---|---|---|---|---|---|
| Deepcreek | 1 | <3 | <3 | 1 | 400 | 400 |
| Telford | 1 | 3 | 3 | 0 | | |
| Creston | 1 | 5 | 5 | 1 | 720 | 720 |
| Wilbur | 1 | 4 | 4 | 0 | | |
| Almira | 1 | 3 | 3 | 0 | | |
| 10 Mi. West of Almira | 1 | <3 | <3 | 0 | | |
| Coulee City | 1 | 5 | 5 | 1 | 510 | 510 |
| 12 Mi. from Coulee City | 1 | <3 | <3 | 0 | | |
| Soap Lake | 1 | 3 | 3 | 0 | | |
| Stratford | 1 | <3 | <3 | 0 | | |
| Stratford to Odessa | 6 | 4 | <3 | 2 | 130 | 97 |
| Odessa | 1 | <3 | <3 | 0 | | |
| Lamona | 1 | <3 | <3 | 0 | | |
| Moxee | 12 | <3 | <3 | 6 | 44 | 24 |
| Union Gap | 6 | <3 | <3 | 3 | 50 | 32 |
| Wapato | 12 | <3 | <3 | 6 | 62 | 29 |
| Toppenish | 12 | <3 | <3 | 6 | 65 | 30 |
| Toppenish to Goldendale | 23 | 4 | <3 | 11 | 84 | 43 |
| Goldendale | 12 | <3 | <3 | 6 | 170 | 65 |
| Goldendale to Wishram | 9 | 4 | <3 | 6 | 110 | 64 |
| Lyle | 6 | <3 | <3 | 3 | 33 | 19 |
| Bingen | 6 | <3 | <3 | 3 | 86 | 53 |
| Camas | 12 | <3 | <3 | 6 | 80 | 45 |
| Vancouver | 12 | <3 | <3 | 6 | 340 | 130 |
| Portland | 11 | <3 | <3 | 6 | 93 | 49 |
| Troutdale | 6 | <3 | <3 | 3 | 83 | 47 |
| Bonneville | 6 | <3 | <3 | 3 | 100 | 70 |
| Hood River | 6 | <3 | <3 | 3 | 290 | 110 |
| Dalles | 12 | <3 | <3 | 6 | 69 | 32 |
| Moody | 6 | <3 | <3 | 3 | 41 | 38 |
| Rufus | 6 | <3 | <3 | 3 | 56 | 46 |
| Blalock | 6 | <3 | <3 | 3 | 75 | 61 |
| Arlington | 6 | <3 | <3 | 3 | 58 | 39 |
| Heppner Junction | 6 | <3 | <3 | 3 | 71 | 53 |
| Boardman | 6 | <3 | <3 | 3 | 60 | 43 |

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At a majority of the locations sampled, the activity density of $I^{131}$ on vegetation dropped to from 1/2 to 1/9 of the average measurements from last quarter. The trend is illustrated by Table III where a definite decline was observed in the final month of the quarter. Radioactive decay and an increase in precipitation accounted for the decrease in concentration of the contamination. A significant amount of $I^{131}$ was measured above the Hanford tolerance limit in April. The residual deposition pattern from the previous quarter is illustrated in Figure 1.

A measureable quantity of radio-iodine was detected during May in the immediate vicinity and north of HAPO. The presence of $I^{133}$ and $I^{135}$ revealed that much of the deposition originated from off-area sources. Figures 2 and 3 illustrate the contamination pattern for May and June, respectively.

A decline from the previous quarter in the average concentration of the non-volatile beta particle emitters was observed at and north of the 200 West Area, while a slight increase was apparent at locations south and east of the area. The changes were not exceptional and followed to some degree the fluctuations observed in the second quarter of 1954.

During April, a significant increase was noted in the activity density of non-volatile beta particle emitters at several off-site locations. In eastern Washington, an average activity density of greater than $2.5 \times 10^{-4}$ $\mu c/gm$ was found to spread over an area exceeding 1000 square miles. The source of the contamination was determined by isotopic analyses to be fallout from nuclear detonations.

Average concentrations of alpha particle emitters on vegetation did not differ significantly from those of the previous quarter and are summarized in Table V.

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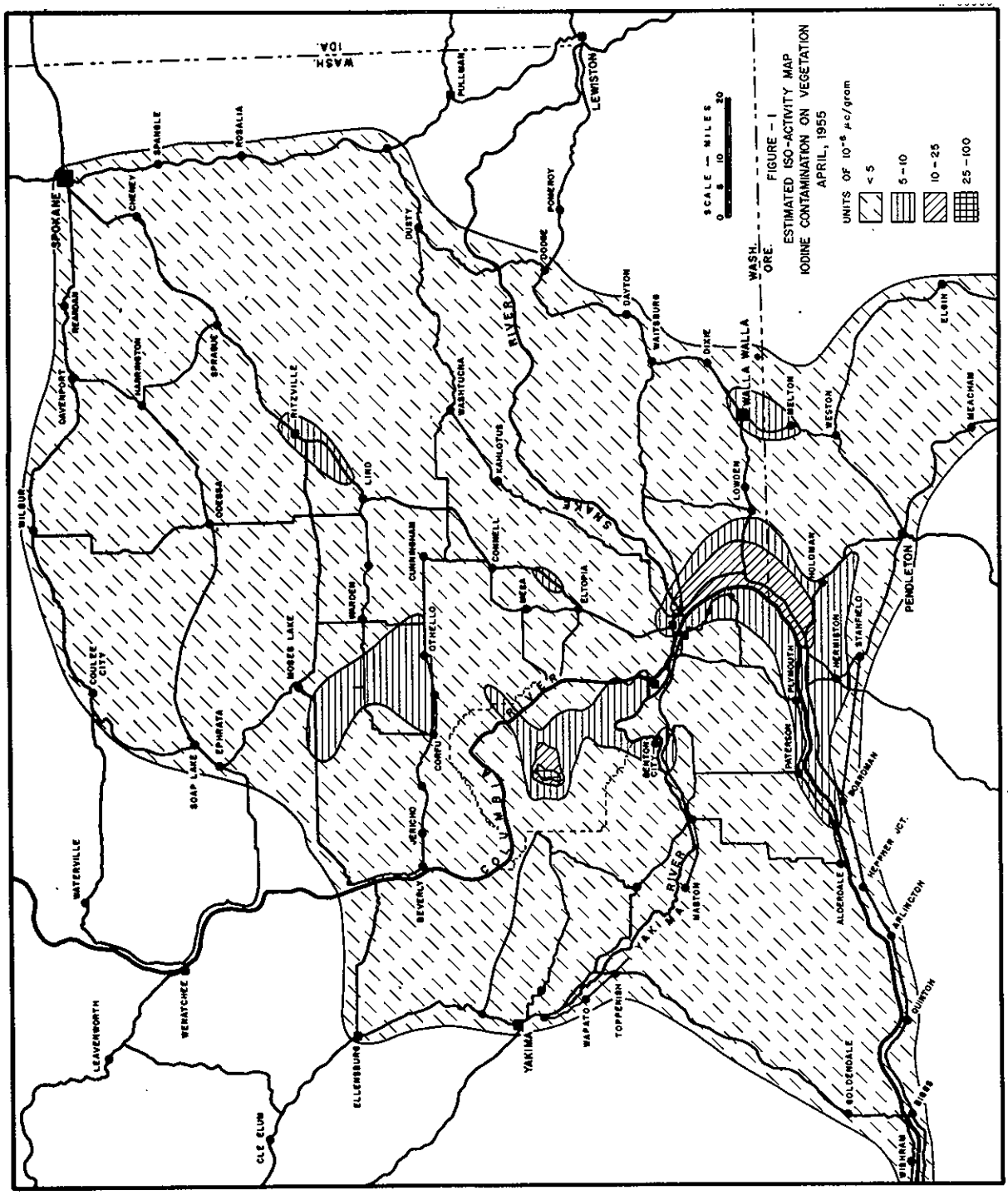


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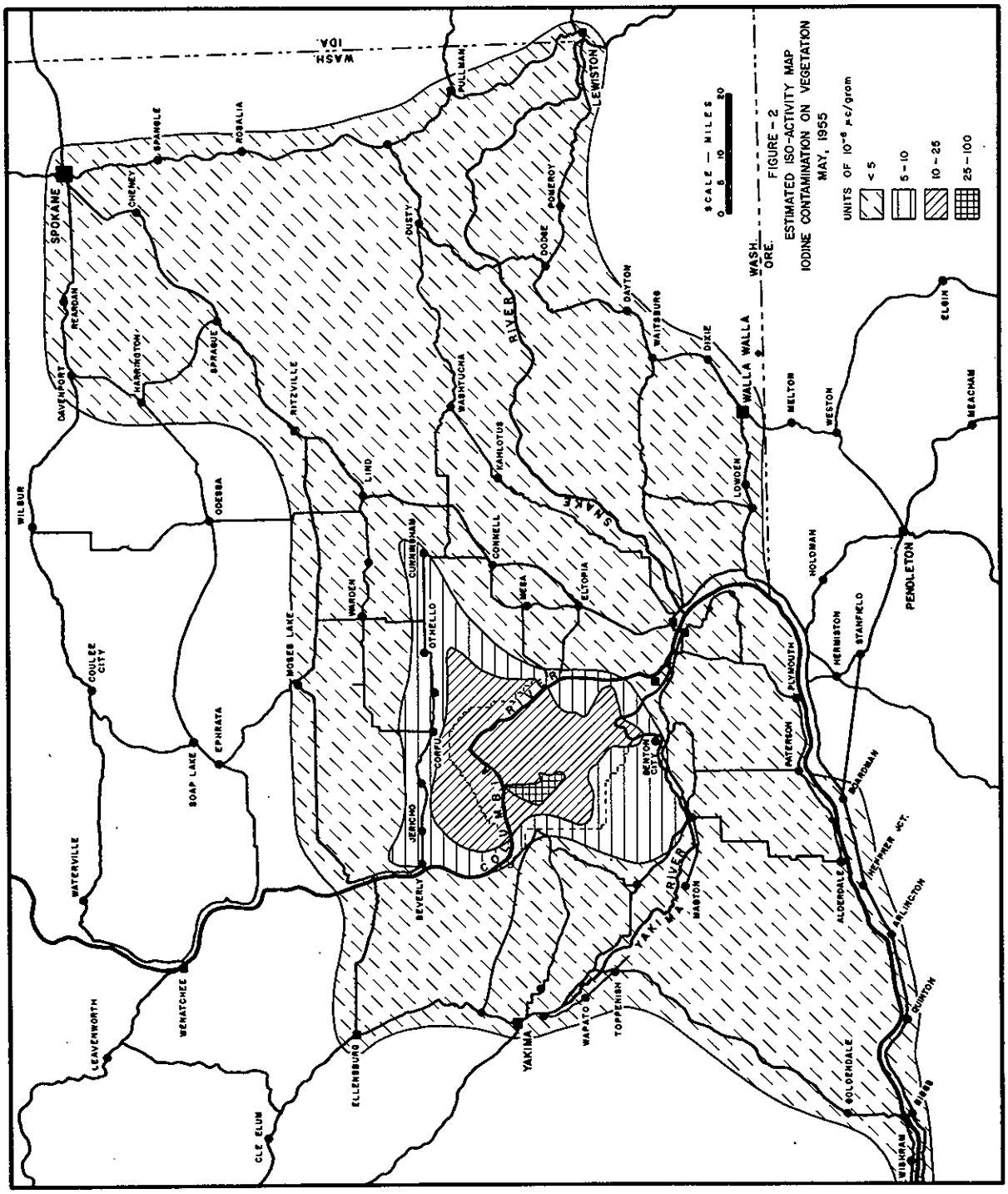


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AEC-GE RICHLAND, WASH.

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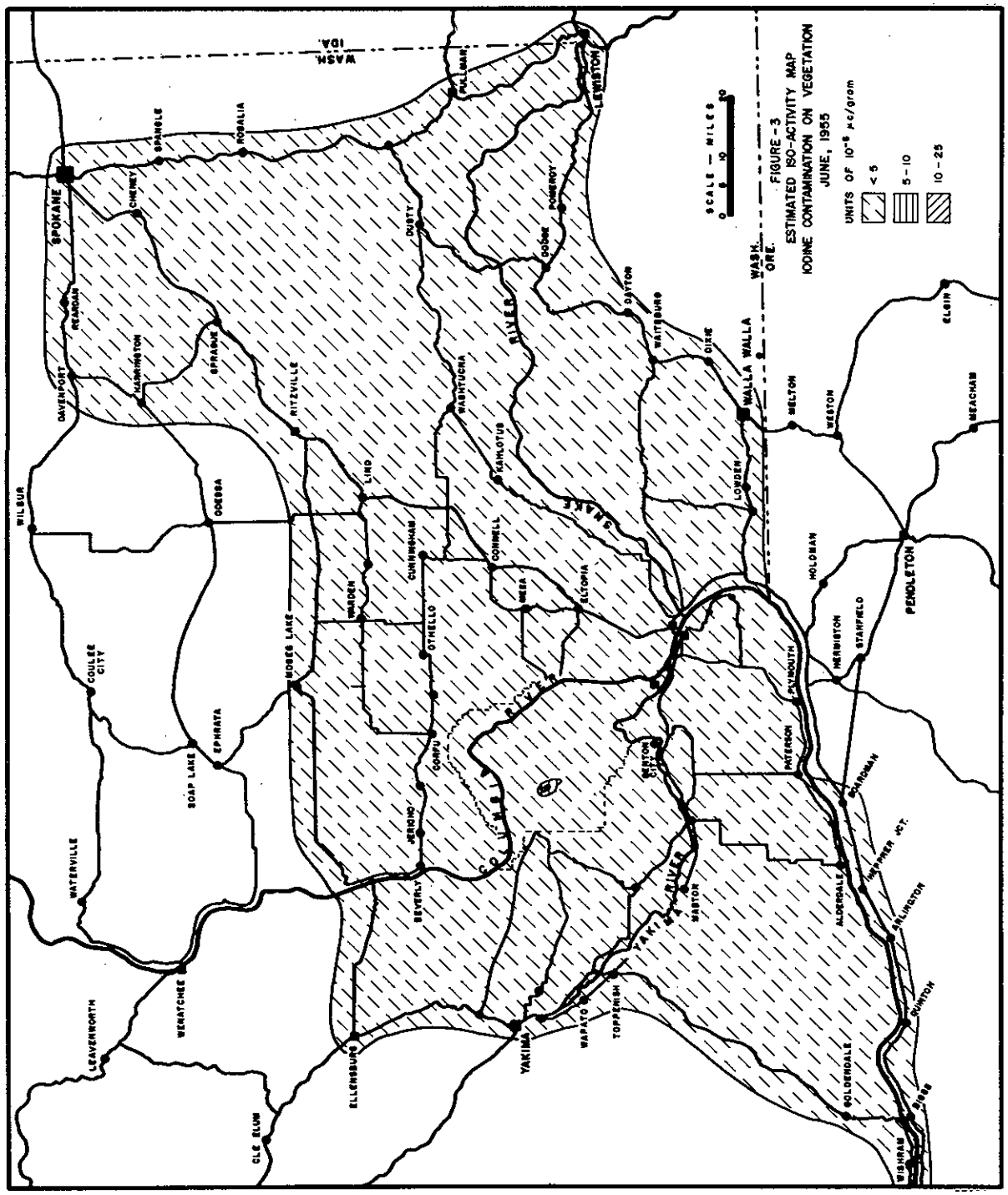


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TABLE V

CONCENTRATIONS OF ALPHA PARTICLE EMITTERS ON VEGETATION

APRIL, MAY, JUNE

1955

Units of $10^{-8}$ μc/gm

| Location | April | May | June | Quarterly Average | Quarterly Maximum |
|---|---|---|---|---|---|
| Near 200 Areas | | | | | |
| 200 West Gatehouse | 40 | 13 | 29 | 29 | 68 |
| Batch Plant | 15 | 10 | 34 | 20 | 56 |
| Route 4S, Mile 4 | <10 | 16 | <10 | 11 | 24 |
| Meteorology Tower | 53 | <10 | 34 | 32 | 59 |
| Route 4S, Mile 6 | <10 | <10 | <10 | <10 | 13 |
| 300 Area | <10 | <10 | 12 | <10 | 12 |
| Outlying | | | | | |
| Richland | <10 | <10 | <10 | <10 | <10 |
| Pasco | <10 | <10 | <10 | <10 | 11 |
| Benton | <10 | <10 | <10 | <10 | <10 |

## SECTION III

## RADIOACTIVE CONTAMINATION IN THE ATMOSPHERE

by

G. E. Pilcher

The magnitude and extent of airborne contamination in the HAPO environs were determined from analyses of filter and scrubber samples and from data recorded in the operation of Victoreen Integrons and detachable ionization chambers. The results obtained by measurements made by each of the monitoring methods during the quarter are summarized in the accompanying tables.

Victoreen Integrons were operated continuously at stations located at the perimeter of the manufacturing areas and in residential communities neighboring the plant. Accumulated dosage readings were tabulated by eight hour intervals and calculated in units of measured dosage per 24 hours. A summary of the average dosage rates for the three month period is given in Table I.

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TABLE I

AVERAGE DOSE RATES MEASURED BY VICTOREEN INTEGRONS

APRIL, MAY, JUNE

1955

Units of mrad per 24 hours

| Location | No. of Units | April | May | June | Quarterly Average |
|---|---|---|---|---|---|
| Riverland | 1 | <0.1 | <0.1 | 0.3 | <0.2 |
| 100-B Area | 3 | 0.8 | 0.4 | 1.3 | 0.8 |
| 100-D Area | 3 | 0.7 | 1.6 | 4.6 | 2.3 |
| 100-F Area | 3 | 0.8 | 1.0 | 3.2 | 1.7 |
| 100-H Area | 3 | 0.2 | 0.3 | 0.6 | 0.4 |
| 100-K Area * | 3 | - | 3.1 | 2.9 | 3.0 |
| White Bluffs * | 1 | - | - | <0.1 | <0.1 |
| Hanford | 1 | 0.1 | 0.2 | 1.3 | 0.5 |
| 200 West Area | 2 | 1.5 | 2.8 | 1.2 | 1.8 |
| Redox | 1 | 2.5 | 6.0 | 5.9 | 4.8 |
| 200 East Area | 3 | 0.4 | 2.9 | 2.1 | 1.8 |
| 200 East Semi-Works | 1 | 0.8 | 2.2 | 1.9 | 1.6 |
| 300 Area | 1 | 0.7 | 0.3 | 1.4 | 0.8 |
| 1100 Area | 1 | <0.1 | 0.8 | 0.7 | 0.5 |
| 700 Area | 1 | 0.4 | 0.5 | 0.3 | 0.4 |
| Kennewick | 1 | <0.1 | <0.1 | 0.4 | <0.2 |
| Pasco | 1 | 0.4 | 0.4 | 0.8 | 0.5 |
| Benton City | 1 | 0.4 | 0.1 | 0.3 | 0.3 |

* New Location

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General increases in average dose rates over those reported during the previous quarter were measured at locations in the vicinity of the 100 Areas and in the residential areas surrounding the plant. In most cases, the increases occurred during the month of June. The reason for these increases are obscure; similar dose rate measurements by other radiation detection instruments did not reflect this change.

The dosage rates present at stations located around the perimeter of the plant manufacturing areas were measured using detachable C-type ionization chambers. Duplicate instruments were used at each location with the minimum value of discharge included as the reported value. A summary of these dosage rate measurements is given in Table II.

TABLE II

AVERAGE DOSE RATES MEASURED WITH
"C" TYPE DETACHABLE IONIZATION CHAMBERS
APRIL, MAY, JUNE
1955
Units of mrad per 24 hours

| Location | April | May | June | Quarterly Average |
|---|---|---|---|---|
| 100-B Area | 1.3 | 0.8 | 0.7 | 0.9 |
| 100-D Area | 0.9 | 0.8 | 0.8 | 0.8 |
| 100-H Area | 0.5 | 0.5 | 0.5 | 0.5 |
| 100-F Area | 1.3 | 0.4 | 0.3 | 0.7 |
| 100-K Area * | - | 0.6 | 0.7 | 0.6 |
| 200 West Area | 0.5 | 0.9 | 0.8 | 0.7 |
| 200 East Area | 0.6 | 0.3 | 0.5 | 0.5 |
| 200 East, Semi-Works | 0.8 | 1.0 | 0.6 | 0.8 |

* New Location

A comparison of the above data with previous results showed that there were no significant changes in the values for the current period from similar measurements made during the past year.

The dosage rates present at intermediate locations on the project and in residential areas around the plant perimeter were measured using detachable M- and S-type ionization chambers. Readings were obtained from these instruments at frequencies ranging from daily to weekly, and dosage rates were again reported from the chamber which showed the minimum discharge at each location. A summary of these measurements is given in Table III.

TABLE III

AVERAGE DOSE RATES MEASURED WITH
"M" AND "S" TYPE DETACHABLE IONIZATION CHAMBERS
APRIL, MAY, JUNE
1955

Units of mrad per 24 hours

| Location | April | May | June | Quarterly Average | Group Average |
|---|---|---|---|---|---|
| 100 Areas and Environs | | | | | |
| Route 1, Mile 8 | 0.65 | 0.67 | 0.47 | 0.60 | |
| Route 2N, Mile 10 | 0.46 | 0.59 | 0.41 | 0.49 | |
| Route 2N, Mile 5 | 0.55 | 0.58 | 0.45 | 0.53 | |
| White Bluffs | 0.62 | 0.91 | 0.62 | 0.72 | |
| Route 11-A, Mile 1 | 0.95 | 1.05 | 0.57 | 0.86 | |
| Hanford 614 Building | 0.47 | 0.50 | 0.48 | 0.48 | 0.65 |
| Intersection Rt. 1 and Rt. 4N | 0.57 | 0.53 | 0.47 | 0.52 | |
| Military Camp, PSN 3 | 0.62 | 0.66 | 0.70 | 0.66 | |
| Military Camp, PSN 21 | 1.25 | 1.28 | 0.45 | 0.99 | |

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TABLE III (contd.)

Units of mrad per 24 hours

| Location | April | May | June | Quarterly Average | Group Average |
|---|---|---|---|---|---|
| Within 5 miles of 200 East Area | | | | | |
| Route 4S, Mile 6 | 0.78 | 0.91 | 0.89 | 0.86 | |
| Batch Plant | >8.55 | 3.86 | 1.70 | >4.70 | |
| Route 11-A, Mile 6 | 1.14 | 0.83 | 1.22 | 1.06 | |
| Route 3, Mile 1 | 0.70 | 1.16 | 0.46 | 0.77 | |
| Route 4S, Mile 2.5 | >5.55 | 0.93 | 0.63 | 2.37 | |
| Redox Area | 1.05 | 1.13 | 1.06 | 1.08 | 1.70 |
| Route 4S, Mile 4.5 | 0.69 | 1.48 | 0.95 | 1.04 | |
| Military Camp, PSN 61 | 0.81 | 1.96 | 1.30 | 1.36 | |
| Military Camp, PSN 51 | 0.65 | 1.09 | 0.79 | 0.84 | |
| Military Camp, PSN 50 | 1.00 | 1.28 | 0.58 | 0.95 | |
| Military Camp, PSN 42 | 0.51 | 0.86 | 0.63 | 0.67 | |
| Within 10 miles of 200 East | | | | | |
| Route 4S, Mile 10 | 0.54 | 1.91 | 0.92 | 1.12 | |
| Route 10, Mile 1 | 1.66 | 0.88 | 1.04 | 1.19 | 1.19 |
| Route 10, Mile 3 | 2.97 | 1.89 | 1.62 | 2.16 | |
| Route 2S, Mile 4 | 1.13 | 1.20 | 0.52 | 0.95 | |
| Military Camp, PSN 70 | 1.50 | 1.34 | 1.52 | 1.44 | |
| 300 Area and Environs | | | | | |
| Route 4S, Mile 16 | 1.47 | 1.24 | 0.84 | 1.18 | |
| Route 4S, Mile 22 | 0.82 | 1.05 | 1.15 | 1.01 | |
| Military Camp, PSN 60 | 2.00 | 3.07 | 0.57 | 1.88 | 1.14 |
| 300 Area | 1.09 | 0.54 | 0.87 | 0.83 | |
| 1100 Area | 1.06 | 0.71 | 0.56 | 0.78 | |
| Outlying | | | | | |
| Richland, 700 Area | 1.71 | 0.92 | 0.92 | 1.18 | |
| Benton City | 0.59 | 0.55 | 0.50 | 0.55 | |
| Pasco | 0.39 | 0.32 | 0.24 | 0.32 | 0.64 |
| Kennewick | 0.61 | 0.45 | 0.49 | 0.52 | |

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No significant differences in average dose rates were measured at the given grouped locations compared to the values found during the previous reporting period.

The activity density of beta particle emitters in the atmosphere was measured using filters through which air was passed at flow rates of 2 to 2.5 cfm for daily or weekly periods. These samples were analyzed and counted several days after their removal from the sampling location to allow for the decay of the daughter products of the natural airborne particle emitters. A summary of the results obtained from these measurements during the period is given in Table IV.

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TABLE IV

CONCENTRATIONS OF BETA PARTICLE EMITTERS FILTERED FROM AIR

SINGLE UNIT MONITORS

APRIL, MAY, JUNE

1955

Units of $10^{-14}$ μc/ml

| Location | April | May | June | Quarterly Average | Weekly Maximum |
|---|---|---|---|---|---|
| 100 Areas and Vicinity | | | | | |
| 100-D Area | 46. | 35. | 24. | 34. | 58. |
| 100-H Area | 50. | 47. | 45. | 47. | 85. |
| Hanford 614 Building | 44. | 41. | 42. | 43. | 81. |
| White Bluffs | 54. | 43. | 44. | 47. | 83. |
| 100-K Area #1 * | - | 38. | 50. | 45. | 70. |
| 100-K Area #2 * | - | 63. | 71. | 68. | 110. |
| 100-K Area #3 * | - | - | 72. | 72. | 130. |
| 200 Areas and Vicinity | | | | | |
| 200-E Semi-Works | 44. | 72. | 82. | 67. | 150. |
| 200-West-West Center | 47. | 46. | 66. | 53. | 120. |
| 200 West, Redox Area | 66. | 49. | 84. | 65. | 160. |
| Gable Mountain | 41. | 42. | 43. | 42. | 67. |
| Military Camp, PSN 50 | 17. | 62. | 81. | 66. | 130. |
| 200 West-East Center | 72. | 120. | 110. | 100. | 160. |
| 300 Area; 614 Building | 37. | 36. | 42. | 38. | 74. |
| Outlying Areas | | | | | |
| 1100 Area | 48. | 97. | 82. | 75. | 150. |
| Pasco | 40. | 45. | 55. | 47. | 77. |
| Benton City | 28. | 25. | 53. | 35. | 82. |
| Riverland | 53. | 110. | 56. | 78. | 300. |

* New locations

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General increases in the concentrations of beta particle emitters filtered from air occurred during the quarter in all outlying areas. Values measured near the operations areas were essentially normal, with only slight indications of this increase. These changes in the background concentrations found may be attributed to probable contamination occurring from off-site.

Additional evaluations of the concentrations of beta particle emitters in the atmosphere were made by analyzing the small air filters removed from dual air monitors operated at two locations. The results of these measurements are given in Table V.

TABLE V

CONCENTRATIONS OF BETA PARTICLE EMITTERS FILTERED FROM AIR

DUAL UNIT MONITORS

APRIL, MAY, JUNE

1955

Units of $10^{-14}$ µc/ml

| Location | April | May | June | Quarterly Average | Weekly Maximum |
|---|---|---|---|---|---|
| 200-ESE #1 | 37. | 36. | 58. | 43. | 120. |
| 200-ESE #2 | 14. | 12. | 12. | 13. | 44. |
| Richland #1 | 27. | 36. | 64. | 42. | 89. |
| Richland #2 | 41. | 44. | 120. | 66. | 310. |

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The quarterly averages shown in Table V reflect the same increases noted in the results shown in Table IV, with the concentrations measured in Richland showing the principal change from the previous period.

The number of radioactive particles in the atmosphere was determined by autoradiographing air filters through which sample air flow rates of from 2.5 to 10 cfm were passed for periods ranging from daily to weekly. Monitoring stations were maintained throughout the immediate plant environs and at several remote locations in Washington, Oregon, Idaho, and Montana in order to evaluate particles originating both from HAPO and from outside sources. All filters were autoradiographed for seven days using type K X-ray film. A summary of the results of measurements near the separation areas is given in Table VI; similar results of measurements made outside the separations areas and at remote locations are given in Table VII.

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TABLE VI

SUMMARY OF PARTICLE CONCENTRATIONS NEAR THE SEPARATION AREAS

APRIL, MAY, JUNE

1955

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

| Location | Total Volume of Air Sampled; Cubic Meters | April | May | June | Present Quarter Averages | Previous Quarter Averages |
|---|---|---|---|---|---|---|
| 200-E Vicinity | | | | | | |
| 2704 Outside | 9176 | 56 | 33 | 35 | 41 | 9 |
| BY - SE | 8657 | 37 | 19 | 43 | 33 | 23 |
| "B" Gate | 9180 | 69 | 38 | 48 | 51 | 16 |
| 2704 Inside | 9176 | 32 | 39 | 39 | 37 | 14 |
| 2-EWC-614 Bldg. | 8581 | 20 | 21 | 17 | 19 | 11 |
| 200-W Vicinity | | | | | | |
| 2701 Outside | 9163 | 110 | 36 | 100 | 78 | 50 |
| 2722 | 9176 | 57 | 29 | 47 | 43 | 17 |
| "T" Gate | 8564 | 36 | 30 | 35 | 33 | 29 |
| 222-T Outside | 8934 | 260 | 180 | 88 | 180 | 140 |
| 231 | 9176 | 53 | 31 | 30 | 37 | 30 |
| Redox | 9159 | 69 | 27 | 54 | 48 | 71 |
| 2701 Inside | 9027 | 54 | 46 | 97 | 64 | 22 |
| 272 | 9074 | 36 | 34 | 77 | 48 | 16 |
| 2-WWC-614 Bldg. | 9172 | 34 | 27 | 45 | 35 | 11 |
| "U" - Gate | 9176 | 58 | 27 | 47 | 43 | 14 |
| 222-U Lab. Inside | 9172 | 20 | 9 | 33 | 20 | 19 |
| Meteorology Tower | | | | | | |
| 3' | 36720 | 27 | 15 | 16 | 19 | 8 |
| 50' | 36720 | 18 | 19 | 18 | 18 | 8 |
| 100' | 29160 | 32 | 19 | 21 | 23 | 7 |
| 150' | 25488 | 34 | 17 | 26 | 25 | 7 |
| 200' | 23544 | 34 | 23 | 33 | 30 | 8 |
| 250' | 23544 | 32 | 19 | 23 | 24 | 8 |
| 300' | 21816 | 37 | 19 | 27 | 27 | 9 |
| 350' | 21816 | 43 | 18 | 38 | 32 | 11 |
| 400' | 14688 | 50 | 19 | 31 | 32 | 12 |

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TABLE VII

SUMMARY OF PARTICLE CONCENTRATIONS OUTSIDE THE SEPARATION AREAS

APRIL, MAY, JUNE

1955

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

| Location | Total Volume of Air Sampled; Cubic Meters | April | May | June | Present Quarter Averages | Previous Quarter Averages |
|---|---|---|---|---|---|---|
| Area Locations | | | | | | |
| 100-B Area | 7854 | 4 | 11 | 9 | 9 | 9 |
| 100-D Area | 9231 | 23 | 12 | 4 | 13 | 11 |
| White Bluffs | 8955 | 9 | 12 | 9 | 10 | 11 |
| 100-F Area | 9278 | 11 | 8 | 13 | 11 | 14 |
| 300 Area | 9240 | 3 | 2 | 2 | 2 | 16 |
| 100-K #3 * | 4909 | - | 14 | 10 | 12 | |
| Off Area Locations | | | | | | |
| Benton City, Wn. | 9274 | 11 | 11 | 3 | 8 | 11 |
| Pasco, Wn. | 8759 | 16 | 13 | 9 | 13 | 5 |
| Richland, Wn. | 8466 | 34 | 22 | 36 | 31 | 23 |
| Boise, Idaho | 9291 | 110 | 89 | 430 | 200 | 31 |
| Klamath Falls, Ore. | 9278 | 87 | 48 | 42 | 58 | 26 |
| Great Falls, Mont. | 9278 | 83 | 63 | 32 | 60 | 29 |
| Walla Walla, Wn. | 9265 | 99 | 51 | 52 | 66 | 19 |
| Meacham, Ore. | 9265 | 47 | 39 | 20 | 36 | 19 |
| Lewiston, Idaho | 9282 | 95 | 99 | 64 | 87 | 23 |
| Spokane, Wn. | 9176 | 99 | 94 | 93 | 95 | 23 |
| Kennewick, Wn. | 8424 | 31 | 20 | 63 | 36 | 12 |
| Yakima, Wn. | 8266 | 38 | 10 | 8 | 17 | 16 |
| Seattle, Wn. | 9265 | 25 | 36 | 3 | 23 | 20 |

* New Location

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General increases in particle concentrations during the current period were noted for nearly all sampling locations, both near the separation areas and at remote stations. Again in this instance, the increases were not severe and indicate that the measurements were weighted by probable particulate contamination from sources other than Hanford.

The activity density of $I^{131}$ in the atmosphere was determined from the radiochemical analysis of caustic scrubber solutions through which air was passed at rates of 2 to 2.5 cfm for periods ranging from one to seven days. The results obtained from these measurements are summarized in Table VIII.

TABLE VIII

CONCENTRATIONS OF IODINE$^{131}$ DETECTED BY AIR SCRUBBERS

APRIL, MAY, JUNE

1955

Units of $10^{-12}$ µc/ml

| Location | April | May | June | Quarterly Average | Weekly Maximum |
|---|---|---|---|---|---|
| 200 Areas and Vicinity | | | | | |
| 200-ESE | 0.1 | 0.1 | <0.1 | 0.1 | 0.2 |
| Gable Mountain | <0.1 | <0.1 | <0.1 | <0.1 | 0.2 |
| 200 West East Center | 1.1 | 1.6 | 2.2 | 1.6 | 4.2 |
| 200 West West Center | 0.1 | <0.1 | 0.1 | 0.1 | 0.2 |
| 200 East Semi-Works | 0.1 | <0.1 | 0.6 | 0.3 | 2.2 |
| Redox Area | 2.8 | <0.1 | 0.1 | 1.1 | 11. |
| White Bluffs * | - | - | 0.1 | 0.1 | 0.2 |
| Outlying Areas | | | | | |
| 100-H Area | <0.1 | <0.1 | <0.1 | <0.1 | 0.2 |
| 300 Area | 0.4 | 0.1 | <0.1 | 0.2 | 1.5 |
| 1100 Area | 0.3 | <0.1 | <0.1 | 0.1 | 1.0 |
| 700 Area | 0.3 | <0.1 | <0.1 | 0.1 | 1.0 |
| Pasco | <0.1 | <0.1 | <0.1 | <0.1 | 0.2 |
| Benton City | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| 100-K Center K-3 * | - | - | <0.1 | <0.1 | <0.1 |

* New Location

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Significant decreases in $I^{131}$ activity densities in air were noted during the quarter at stations in the vicinity of the separation areas. This condition represents a return to values normally measured in these locations following the increases noted in the previous reporting period. The concentrations measured in the surrounding residential areas remained generally below detection limits.

The concentration of alpha particle emitters in the atmosphere was determined by counting the same filters used for the beta particle emitter measurements which were summarized in Tables IV and V above. A summary of the alpha measurements is given in Table IX.

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TABLE IX

CONCENTRATIONS OF ALPHA PARTICLE EMITTERS FILTERED FROM AIR

APRIL, MAY, JUNE

1955

Units of $10^{-15}$ µc/ml

| Location | Number Samples | Weekly Maximum | Quarterly Average |
|---|---|---|---|
| 200 West West Center | 13 | <4 | <4 |
| 200 East Semi-Works | 13 | <4 | <4 |
| Gable Mountain | 11 | <4 | <4 |
| Pasco | 13 | 15 | <4 |
| 300 Area | 13 | 30 | 5 |
| 100-D Area | 12 | 7 | <4 |
| Benton City | 13 | <4 | <4 |
| Hanford | 12 | 6 | <4 |
| White Bluffs | 13 | 26 | 4 |
| 1100 Area | 12 | 12 | <4 |
| 200 West - Redox Area | 13 | <4 | <4 |
| 100-H Area | 13 | <4 | <4 |
| Riverland | 12 | <4 | <4 |
| Military Camp PSN 50 | 9 | 11 | <4 |
| 200 West East Center | 13 | 11 | 4 |
| Dual Unit Monitors | | | |
| 200 ESE #1 | 13 | 5 | <4 |
| 200 ESE #2 | 13 | 4 | <4 |
| Richland #1 | 13 | 9 | <4 |
| Richland #2 | 13 | 7 | <4 |
| 100-K #1 * | 8 | 6 | <4 |
| 100-K #2 * | 8 | 9 | 4 |
| 100-K #3 * | 5 | 8 | 5 |

* New Locations

The average concentrations of alpha particle emitters compared favorably at all locations with those previously reported, and are indicative of normal operations at HAPO.

## SECTION IV

## RADIOACTIVE CONTAMINATION IN HANFORD WASTES

by

B. V. Andersen

The magnitude and extent of radioactive contamination in Hanford wastes were determined from the results of over 1600 measurements. Liquid and solid samples were obtained directly from open waste areas at frequencies varying from daily to monthly; these samples were analyzed radiochemically for the activity densities from gross alpha and beta particle emitters. Specific isotopic analyses were performed when measurements indicated unusual contamination and were carried out repetitiously on samples from locations which have a high probability of containing unusual quantities of certain contaminants. These measurements were supplemented with data obtained from portable instrument surveys around the perimeter of the waste storage areas and over open terrain at various locations on the plant.

The results of these measurements are summarized for each of the manufacturing areas.

### 100 AREA WASTE

Table I summarizes the results obtained from analysis of 500 ml samples of effluent water which were collected at the outlet weir of the reactor basins. Analysis of all samples was completed within twelve hours after collection and the measured counting rates of beta particle emitters were corrected for decay and expressed as activity of materials discharged to the Columbia River per unit of time.

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TABLE I

BETA PARTICLE EMITTERS DISCHARGED TO RIVER
IN REACTOR EFFLUENT WATER
APRIL, MAY, JUNE
1955
Units of $10^3$ μc/second

| Location | No. Samples | April Max. | April Avg. | May Max. | May Avg. | June Max. | June Avg. | Quarterly Max. | Quarterly Avg. |
|---|---|---|---|---|---|---|---|---|---|
| 100-B Area | 100 | 25 | 22 | 35 | 30 | 22 | 19 | 35 | 23 |
| 100-C Area | 86 | 41 | 30 | 44 | 37 | 38 | 28 | 44 | 32 |
| 100-D Area | 76 | 25 | 20 | 23 | 17 | 23 | 18 | 25 | 18 |
| 100-DR Area | 90 | 16 | 14 | 26 | 19 | 29 | 21 | 29 | 18 |
| 100-H Area | 104 | 25 | 17 | 38 | 21 | 14 | 11 | 38 | 16 |
| 100-F Area | 68 | 25 | 22 | 38 | 30 | 35 | 22 | 38 | 25 |
| 100-KW Area | 64 | 7.7 | 6.5 | 9.9 | 8.6 | 9.6 | 7.0 | 9.9 | 7.2 |
| 100-KE Area | 68 | 12 | 11 | 15 | 12 | 10 | 7.7 | 15 | 9.4 |

A significant increase was found in the activity of beta particle emitters discharged to the river in all reactor areas except 100-H when compared with values from the previous quarter. The greatest increase occurred in the 100-B Area where the discharge averaged 23,000 μc/sec during the quarter compared with 17,000 μc/sec to the river during the first quarter of 1955. The general increases can be related to expected seasonal variations in the coolant water quality, a phenomenon which has been common to the spring "run-off" season for the past several years. It was also noted that although the power levels at the K reactors have been approaching that of the other areas, the rate of discharge to the river is significantly lower. The exact cause of this phenomenon has not been found and may be ascribed to water treatment, age of the reactor or some other cause not yet determined.

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The average activity of alpha particle emitters in reactor effluent water entering the river was less than $1 \times 10^{-2}$ μc/sec at all areas. Individual samples showed trace alpha particle emitter discharge at various times during the quarter with values indicating contaminants in the range of $1 \times 10^{-2}$ to $7.2 \times 10^{-2}$ μc/sec.

One positive uranium measurement was found in the 100-KE Reactor effluent from among 156 samples from all of the reactor areas analyzed specifically for uranium.

From 41 samples of reactor effluent analyzed specifically for plutonium, one sample from 100-H Area was above the detection limit of $3 \times 10^{-9}$ μc/ml. This sample was obtained from 100-H on May 21, 1955 and the activity discharge rate to the river was 0.016 μc/sec of plutonium.

Trace amounts of polonium were detected in 10 out of 41 samples of effluent water from all reactors. The activity discharge rate varied from $2 \times 10^{-3}$ to $7 \times 10^{-3}$ μc/sec which is not significantly different from values measured during the last quarter.

The activity density of $I^{131}$ in waste discharged to the Columbia River from the Biology Farm at 100-F Area was measured by analyzing composite samples collected from the sump in the waste discharge line. On the average, 38 μc/day were discharged to the river during the quarter, a value comparing favorably with the discharge rate of the previous period.

## 200 AREA WASTES

Liquid and solid samples were collected directly from the waste sources in the separation areas and analyzed for gross alpha and beta particle emitters. Specific analyses for the activity density of uranium and plutonium were performed on a number of samples at suspected locations and on all samples which showed high alpha particle emission. A summary of results is given in Table II.

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TABLE II

RADIOACTIVE CONTAMINATION IN 200 AREA WASTE SYSTEMS

APRIL, MAY, JUNE

1955

LIQUID SAMPLES

| Location | No. Samples | Alpha Particle Emitters Units of $10^{-8}$ µc/ml Maximum | Alpha Particle Emitters Units of $10^{-8}$ µc/ml Average | Beta Particle Emitters Units of $10^{-7}$ µc/ml Maximum | Beta Particle Emitters Units of $10^{-7}$ µc/ml Average |
|---|---|---|---|---|---|
| T-Ditch | 13 | <0.5 | <0.5 | 100. | 58. |
| T-Swamp | 39 | 1.6 | <0.5 | 160. | 60. |
| U-Swamp | 29 | 160. | 20. | 7200. | 690. |
| Laundry Ditch | 25 | 21. | 3.9 | 18. | 5.9 |
| 231 Ditch | 26 | 18. | 2.9 | 21. | 3.9 |
| 200-E "B" Ditch | 13 | <0.5 | <0.5 | 40. | 11. |
| 200-E "B" Swamp | 5 | 0.6 | <0.5 | 5.4 | 3.9 |
| 234-35 Ditch | 13 | 74. | 6.7 | 13. | 2.7 |
| "U" Ditch Inlet | 12 | 40. | 4.0 | 1100. | 110. |

SOLID SAMPLES

| | | Units of $10^{-6}$ µc/gm | | Units of $10^{-5}$ µc/gm | |
|---|---|---|---|---|---|
| T-Ditch | 12 | 24. | 5.3 | *12,000. | *2200. |
| T-Swamp | 26 | 9.6 | 2.4 | 820. | 180. |
| Laundry Ditch | 15 | 83. | 33. | 47. | 21. |
| 200-E "B" Ditch | 8 | 83. | 16. | 150. | 67. |
| 200-E "B" Swamp | 5 | 2.8 | 1.4 | 15. | 8.1 |
| 234-35 Ditch | 12 | 6300. | 660. | 18. | 5.4 |

* If this maximum is omitted the new maximum becomes 4800. and the new average becomes 1300.

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The various increases and decreases noted when comparing the measurements summarized in Table II with the data collected during the preceding period were caused by the normally wide variation of concentrations in the waste systems.

The activity density of the U-Swamp waste water was significantly higher than during the last quarter. Isotopic analysis of water and mud samples from U-Swamp revealed 10 to 15 per cent Ru, 20 to 40 per cent Cs, 1 to 4 per cent Sr and 45 to 60 per cent Rare Earths. The results from specific analyses of 200 Area waste for uranium are reported in Table III.

TABLE III

RADIOACTIVE CONTAMINATION IN 200 AREA WASTE SYSTEMS

APRIL, MAY, JUNE

1955

LIQUID SAMPLES

| Location | No. Samples | Uranium Units of $10^{-9}$ µc/ml Maximum | Uranium Units of $10^{-9}$ µc/ml Average |
|---|---|---|---|
| "U" Swamp Inlet | 13 | 1900. | 180. |
| "U" Swamp West Side | 13 | 950. | 190. |
| Laundry Ditch Inlet | 13 | 85. | 10. |
| Laundry Ditch 600 Ft. from Inlet | 13 | 20. | 11. |
| "U" Ditch Inlet | 12 | 320. | 32. |

SOLID SAMPLES

| | | Units of $10^{-6}$ µc/gm | |
|---|---|---|---|
| "B" Ditch Inlet | 3 | 280.0 | 94.0 |
| "B" Ditch 1st Underpass | 3 | 1.7 | 1.2 |
| "B" Swamp North Side | 2 | 3.3 | 2.1 |
| 234-5 Ditch Pipe Outlet | 11 | 5.0 | 1.8 |
| Laundry Ditch Inlet | 13 | 150.0 | 56.0 |

The values listed in Table III for uranium in liquid and solid waste appear to be significantly higher than the results obtained during the last quarter.

Portable instrument surveys using GM type meters were performed at the perimeter of all open waste zones in the separations areas. Counting rates obtained over mud showed values ranging from 300 to 60,000 c/m at 200 West Area locations while all 200-East locations showed counting rates of less than 1,000 c/m above background. Readings obtained over the waters at the edge of the swamps and ditches ranged from 200 to 30,000 c/m at 200 West Area with background readings obtained in 200 East.

## 300 AREA WASTE

The proportional sampler for collection of radioactive waste samples from the north pond inlet has completely rusted out requiring collection of all samples by means of dip sampling. Table IV summarizes the results obtained from the radiochemical analyses for alpha particle emitters, beta particle emitters, uranium, and plutonium.

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TABLE IV

RADIOACTIVE CONTAMINATION IN 300 AREA POND INLET

APRIL, MAY, JUNE

1955

| Liquid Samples | No. Samples | Activity Density Units of $10^{-8}$ µc/ml Maximum | Average |
|---|---|---|---|
| Beta Particle Emitters | 58 | 1000. | 91. |
| Alpha Particle Emitters | 62 | 420. | 85. |
| Uranium | 62 | 490. | 60. |
| Plutonium | 58 | 1.6 | 0.5 |

| Solid Samples * | No. Samples | Activity Density Units of $10^{-3}$ µc/gm Maximum | Average |
|---|---|---|---|
| Beta Particle Emitters | 6 | 6.0 | 3.1 |
| Alpha Particle Emitters | 6 | 2.9 | 2.0 |
| Uranium | 5 | 8.5 | 3.4 |

* Last sample collected on April 29, 1955.

Individual samples from the 300 Area pond inlet varied widely in activity density as was expected, but did decrease significantly in alpha particle emitters including uranium and plutonium. This decrease may have been caused by the change in sampling method.

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ENVIRONS - GROUND CONTAMINATION

Ground surveys of control plots around Redox were continued throughout the quarter at a reduced frequency. This was made possible by discontinuation of the survey of the two outer rings of existing plots which have contained only a few particles without any significant changes in number of particles for some time. The median values for the index defining the relative frequency of particles measured in the control plots as their number varies over time is shown in Figure 4. Previously, this index did not represent the same plots for different survey periods; at present, with the reduced number of weekly plot reading, the same plots were surveyed during each period.

A comparison of Figure 4 with similar indices for the last quarter indicates a significant reduction in the index from 1.2 to 0.85. The probable causes for this decline include radioactive decay and the effects of rain, wind, and other meteorological phenomena. Integration of the area on isofrequency charts showed that on the average during the first two weeks of May, 1955, there have been $3.4 \times 10^6$ particles detectable by portable instruments on the ground within one mile of the Redox stack. Using the average dose rate per particle measured in the surveys, or approximately 20 mrad/hr, the total activity represented by this area would be 0.7 curie. These values are significantly lower than the $5 \times 10^6$ particles representing 2-4 curies on the ground found as of December 17, 1954.

Ground surveys were completed each month along the side of main roads on and adjacent to the project with 2,000 square feet surveyed at one-mile intervals. The patterns of particle frequencies found during these surveys in April, May, and June are shown as Figures 5, 6, and 7.

FIGURE – 4
CONCENTRATIONS OF PARTICLES ON 200-W CONTROL PLOTS




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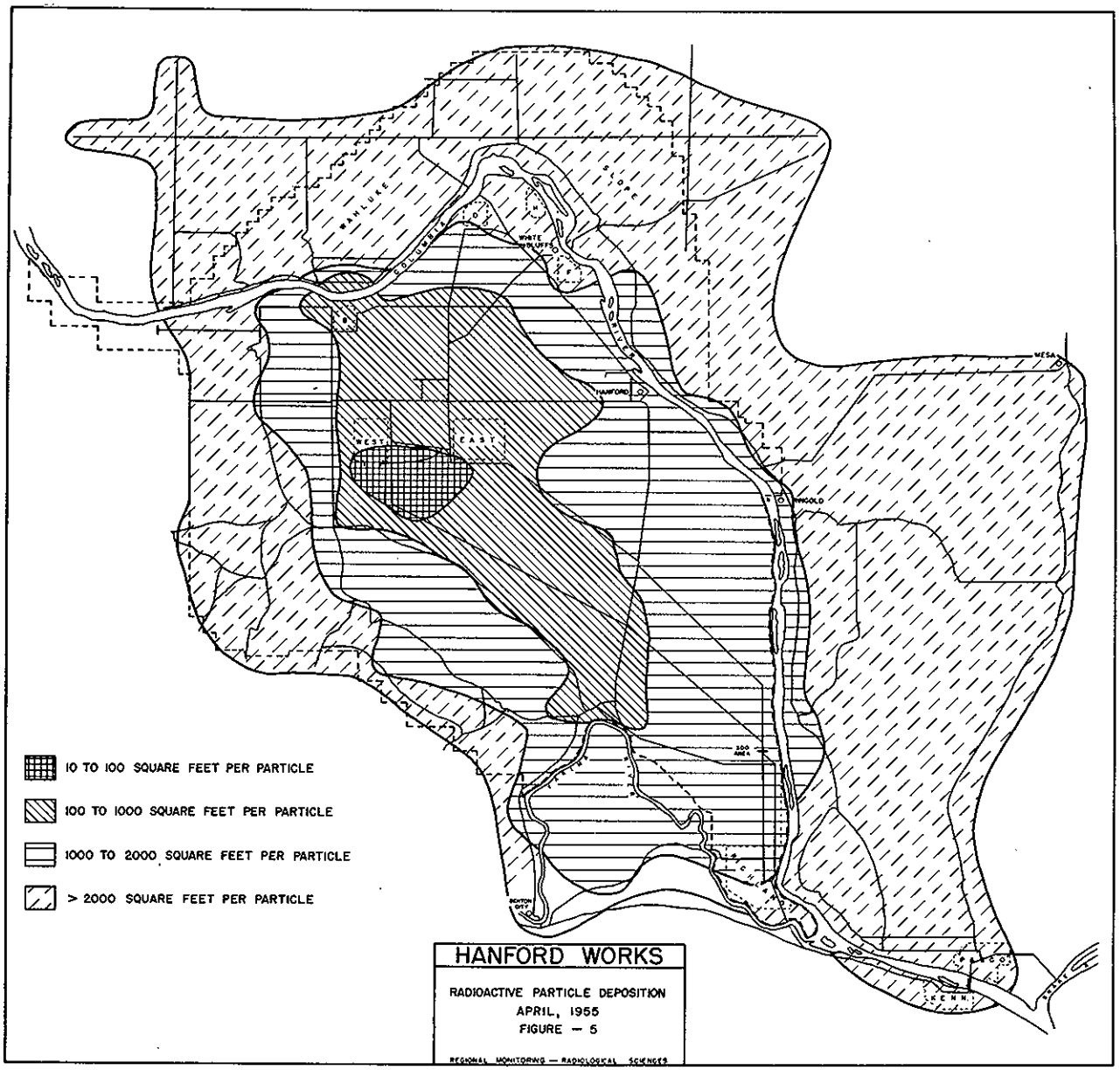
10 TO 100 SQUARE FEET PER PARTICLE
100 TO 1000 SQUARE FEET PER PARTICLE
1000 TO 2000 SQUARE FEET PER PARTICLE
> 2000 SQUARE FEET PER PARTICLE
WANLUKE
COLUMBIA
WHITE BLUFFS
HANFORD
WEST
EAST
MESA
WOOLD
BENTON CITY
KENN.
HANFORD WORKS
RADIOACTIVE PARTICLE DEPOSITION
APRIL, 1955
FIGURE — 5
REGIONAL MONITORING — RADIOLOGICAL SCIENCES

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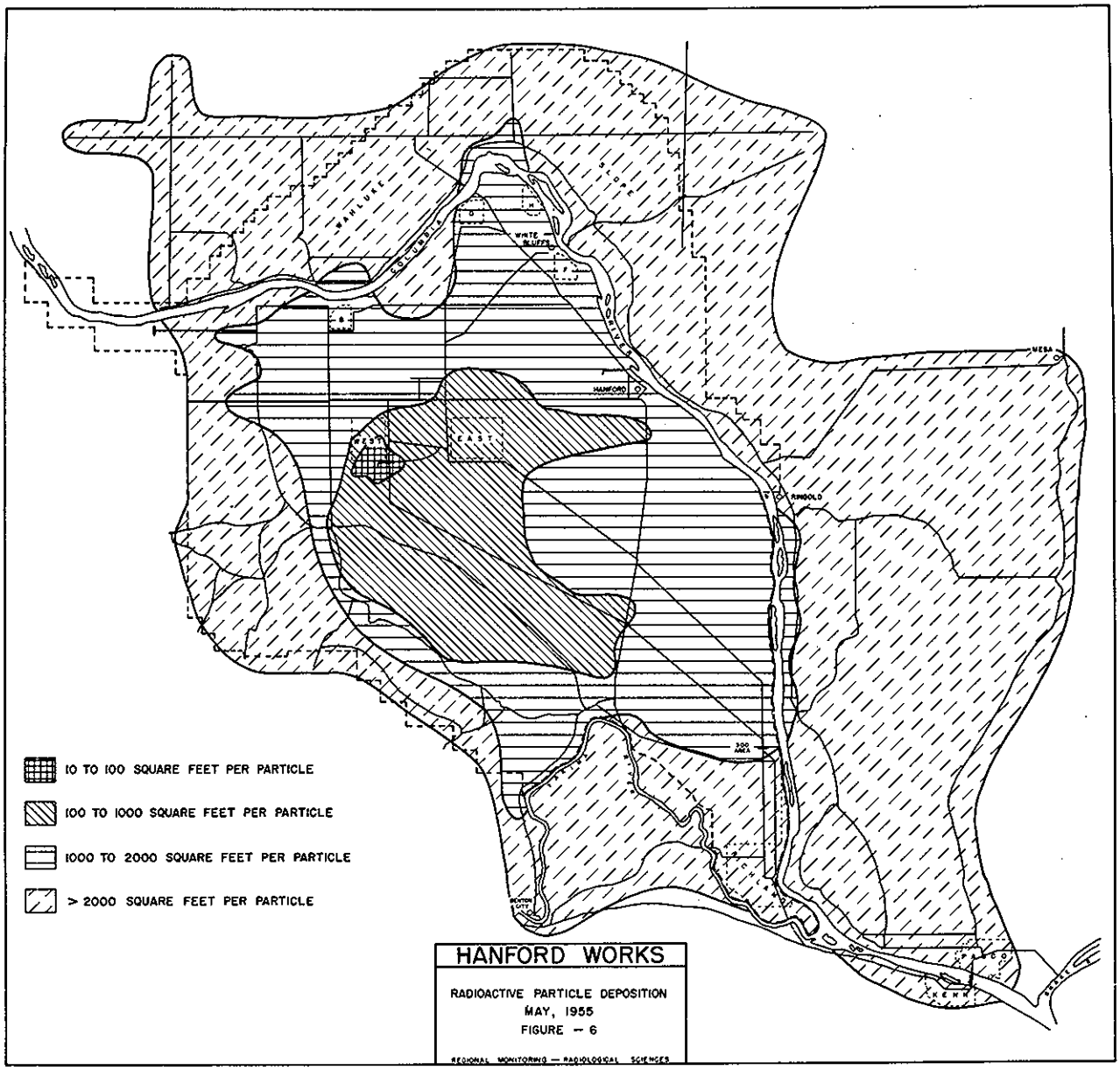


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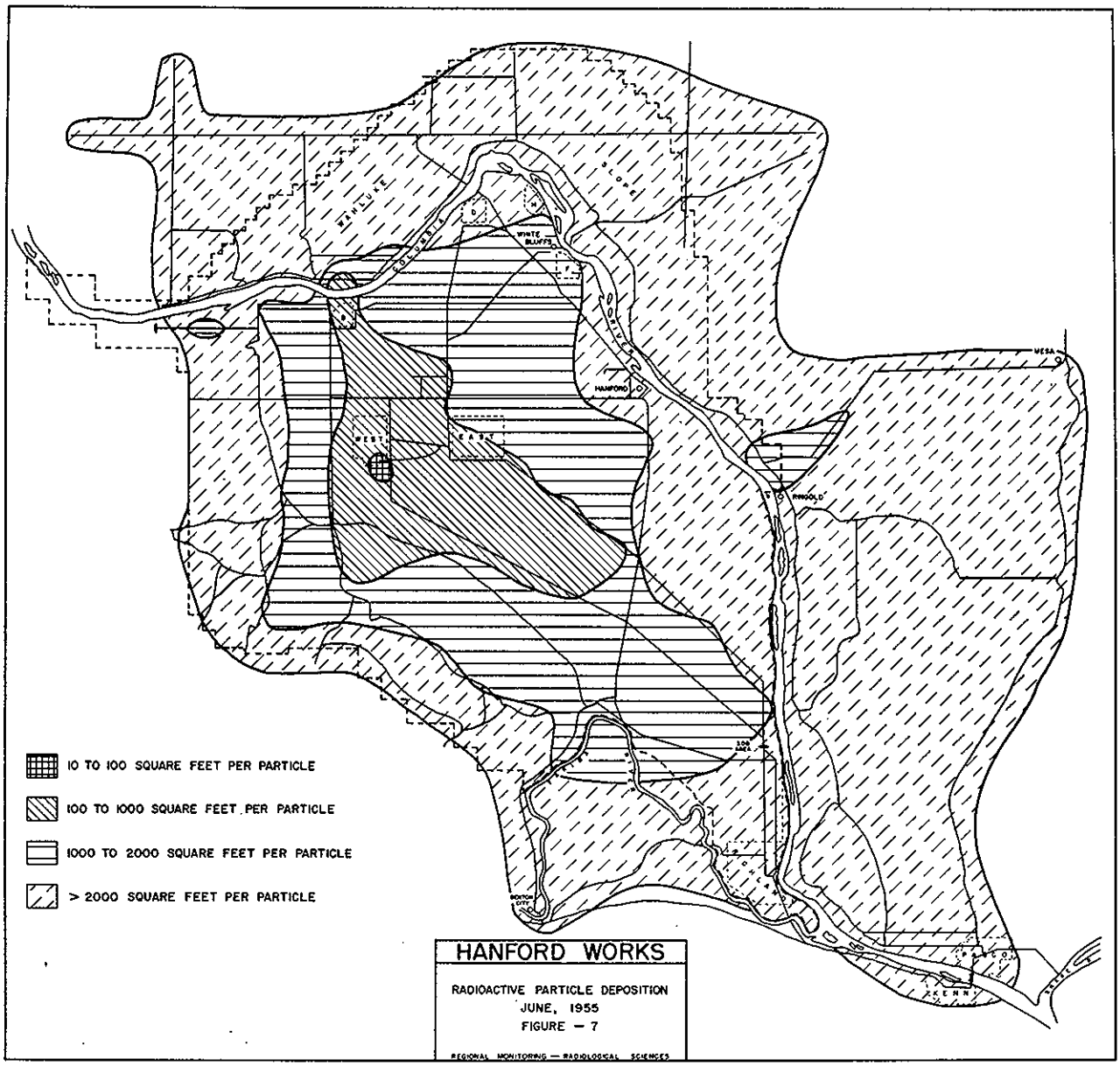


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Ground surveys of selected locations in the Tri-City area showed average frequencies of particles detectable by portable instruments of one particle per 3,000 to 4,000 square feet. The particle frequency was not significantly different from that reported for the first quarter of 1955.

A ground survey of 26,000 square feet inside 100-H Area on May 12, 1955, showed 13 particles of which 5 were found in a 2,000 square foot area near the 1614-2-N Building. A ground survey on May 26, 1955, confirmed a pattern of contamination extending from 105-H to the northwest corner of that area as shown in Figure 8.

Particle frequencies varied from 16 particles per 100 square feet between 105-H and 184-H Buildings to about 2 to 5 particles per 100 square feet near the area corner. Survey of 10,000 square feet on the Wahluke Slope in line with the measured pattern showed six particles. Maximum dose rate of any one particle was 150 mrad/hr. The particles were composed of mixed fission products. The total activity present in the surveyed area was estimated to be 0.06 curie, mostly in the form of small particles reading 5,000 c/m or less. The path of contamination indicated the source to be the 105-H stack and comparison of emissions from this stack revealed that the emission probably occurred during the week of May 3 to May 10, 1955, when 0.01 curie was emitted which agrees favorably with the estimated activity on the ground.

A similar ground survey inside 100-F indicated one particle per 2,000 square feet with the majority of the particles located in the northeast sector of the 100-F Area. The active material in these particles was found to be ruthenium probably associating them with the contamination originating last year at Redox.

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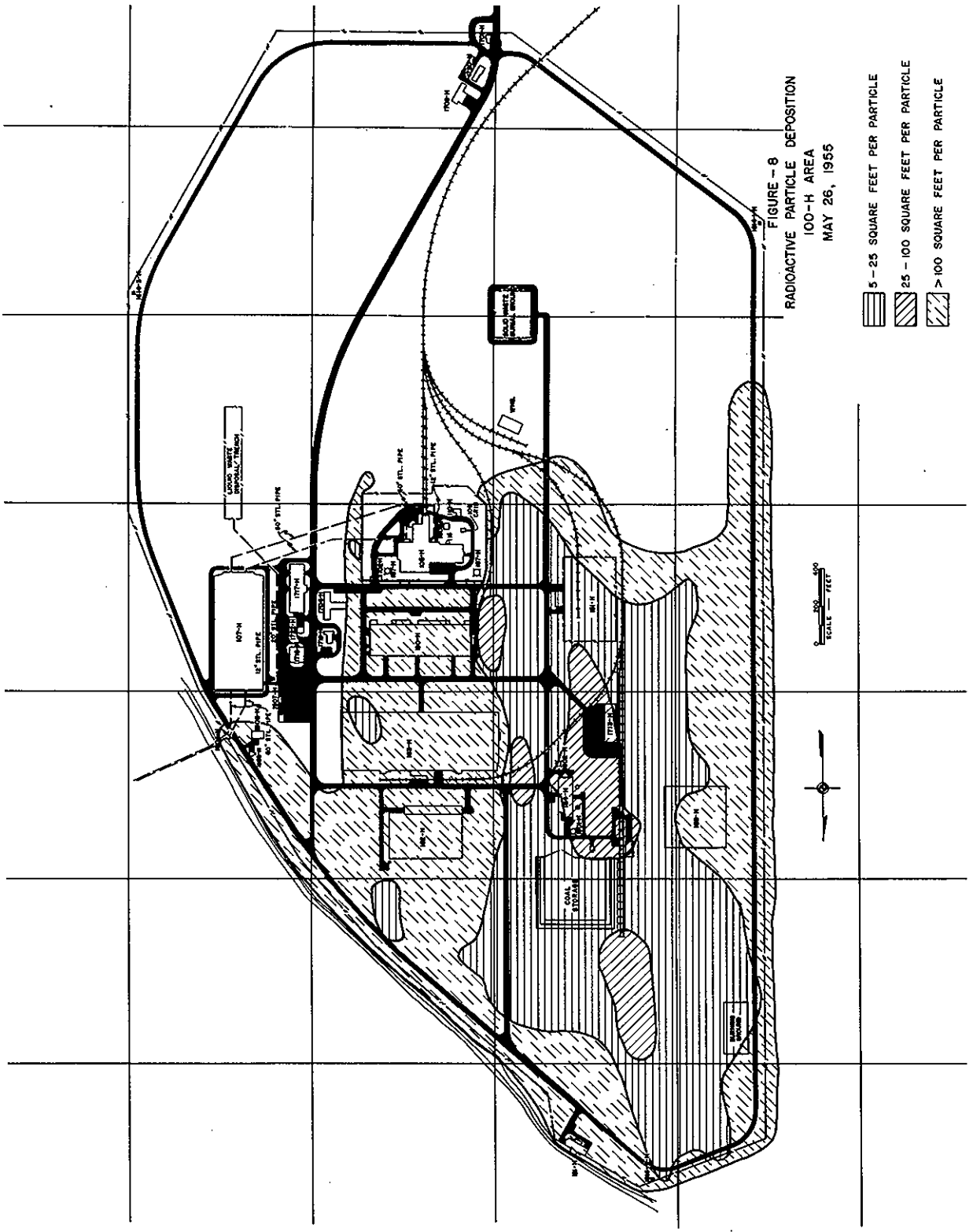


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## SECTION V

## RADIOACTIVE CONTAMINATION IN THE COLUMBIA RIVER AND RELATED WATERS

by

J. K. Soldat

Samples of water were collected from the Columbia, Yakima, and Snake Rivers to determine the contamination resulting from the discharge of reactor cooling water to the Columbia River. Daily and weekly 500 ml samples were collected at HAPO and downstream to McNary Dam; monthly one gallon samples were collected from the Columbia River between McNary Dam and Portland. All samples were analyzed for gross beta and alpha particle emitters.

The activity density of alpha particle emitters in the river water sampled was below the detection limit of $5 \times 10^{-9}$ μc/ml throughout the quarter; activity density of beta particle emitters is summarized in Table I.

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TABLE I

CONCENTRATION OF BETA PARTICLE EMITTERS IN RIVER WATER

APRIL, MAY, JUNE

1955

Units of $10^{-8}$ μc/ml

| Location | April Avg. | May Avg. | June Avg. | Qtr. Avg. | Last Qtr. Avg. | Max. This Qtr. |
|---|---|---|---|---|---|---|
| Columbia River | | | | | | |
| Wills Ranch | <5 | <5 | <5 | <5 | <5 | <5 |
| 181-B Area | <5 | <5 | <5 | <5 | <5 | 9 |
| 181-C Area | <5 | <5 | <5 | <5 | 6 | 8 |
| Allard Station | 8 | 24 | 3 | 13 | 10 | 78 |
| 181-KW Area | 360 | 270 | 67 | 210 | - | 570 |
| 181-KE Area | - | - | 150 | 150 | - | 500 |
| 181-D Area | 720 | 800 | 340 | 600 | 580 | 1600 |
| 181-H Area | 1000 | 1000 | 330 | 760 | 780 | 1600 |
| Below 100-H Area | 970 | 1600 | 590 | 1100 | 1600 | 2000 |
| 181-F Area | 1600 | 1500 | 990 | 1400 | 1400 | 2000 |
| Below 100-F Area | 960 | 1800 | 670 | 1200 | 1600 | 2400 |
| Hanford South Bank | 1600 | 2000 | 930 | 1500 | 2000 | 3400 |
| Hanford Middle | 1500 | 1700 | 790 | 1300 | 1500 | 2800 |
| Hanford North Bank | 740 | 750 | 430 | 640 | 860 | 1600 |
| 300 Area | 630 | 760 | 450 | 630 | 730 | 890 |
| Byers Landing | 250 | 580 | 260 | 380 | 170 | 610 |
| Richland | 520 | 400 | 250 | 390 | 520 | 710 |
| Kennewick Highlands Pumping Station | 300 | 220 | 240 | 250 | 380 | 410 |
| Pasco Bridge (Kenn. Side) | 230 | 200 | 150 | 190 | 270 | 400 |
| Pasco Bridge (Pasco Side) | 290 | 280 | 200 | 260 | 350 | 440 |
| Pasco Pumping Plant | 320 | 340 | 230 | 300 | 420 | 510 |
| Sacajawea Park | 210 | 180 | 160 | 180 | 210 | 260 |
| McNary Dam Pool | 66 | 40 | 44 | 50 | 73 | 66 |
| Below McNary Dam | 39 | 34 | 35 | 36 | 42 | 54 |
| Paterson | 40 | 41 | 35 | 38 | 50 | 61 |
| Snake River | | | | | | |
| At Mouth | <5 | <5 | <5 | <5 | 24 | 7 |
| Yakima River | | | | | | |
| At Mouth | <5 | <5 | <5 | <5 | <5 | 10 |
| At Horn | <5 | 16 | <5 | 7 | <5 | 70 |
| At Prosser | <5 | <5 | <5 | <5 | <5 | 8 |
| 3000 Area Pond Inlet | <5 | <5 | <5 | <5 | <5 | <5 |

General decreases were noted in the activity density of beta particle emitters in the Columbia River water this quarter when the results in Table I were compared with similar values for the previous quarter. These were seasonal changes which coincided with the increased river flow during the present period; average river flow during the quarter was $1.05 \times 10^6$ gps compared to $6.0 \times 10^5$ gps during the previous quarter. The river flow rates for this and the previous quarter are shown in Figure 9.

The monthly one gallon samples collected from the Columbia River between Arlington and Portland, Oregon, revealed gross beta activity densities ranging from $3 \times 10^{-8}$ to $3 \times 10^{-7}$ μc/ml. The maximum measurements for April, May, and June were $3 \times 10^{-7}$, $1 \times 10^{-7}$, and $2 \times 10^{-7}$ μc/ml, respectively. The first two maxima occurred at Arlington, Oregon, and the latter one occurred at The Dalles.

The activity density of $I^{131}$ measured in water samples collected from the south bank of the Columbia River at Hanford averaged $9 \times 10^{-8}$ μc/ml this quarter compared to $1.2 \times 10^{-7}$ μc/ml during the previous quarter; the maximum measurement was $3.0 \times 10^{-7}$ μc/ml compared to $3.8 \times 10^{-7}$ μc/ml during last quarter. The decreases resulted partly from the increased river flow and partly from the revised method of calculation initiated this quarter, as described in the previous document of this series.(9)

During April, a river velocity float study revealed the minimum time of travel of the Columbia River water from 100-B to Hanford as 6.2 hours at a river flow rate of $6.4 \times 10^5$ gps. Similar studies during May and June revealed travel times of the water from 100-B to Pasco of 22.0 hours at $6.6 \times 10^5$ gps and 11.2 hours at $2.7 \times 10^6$ gps, respectively.

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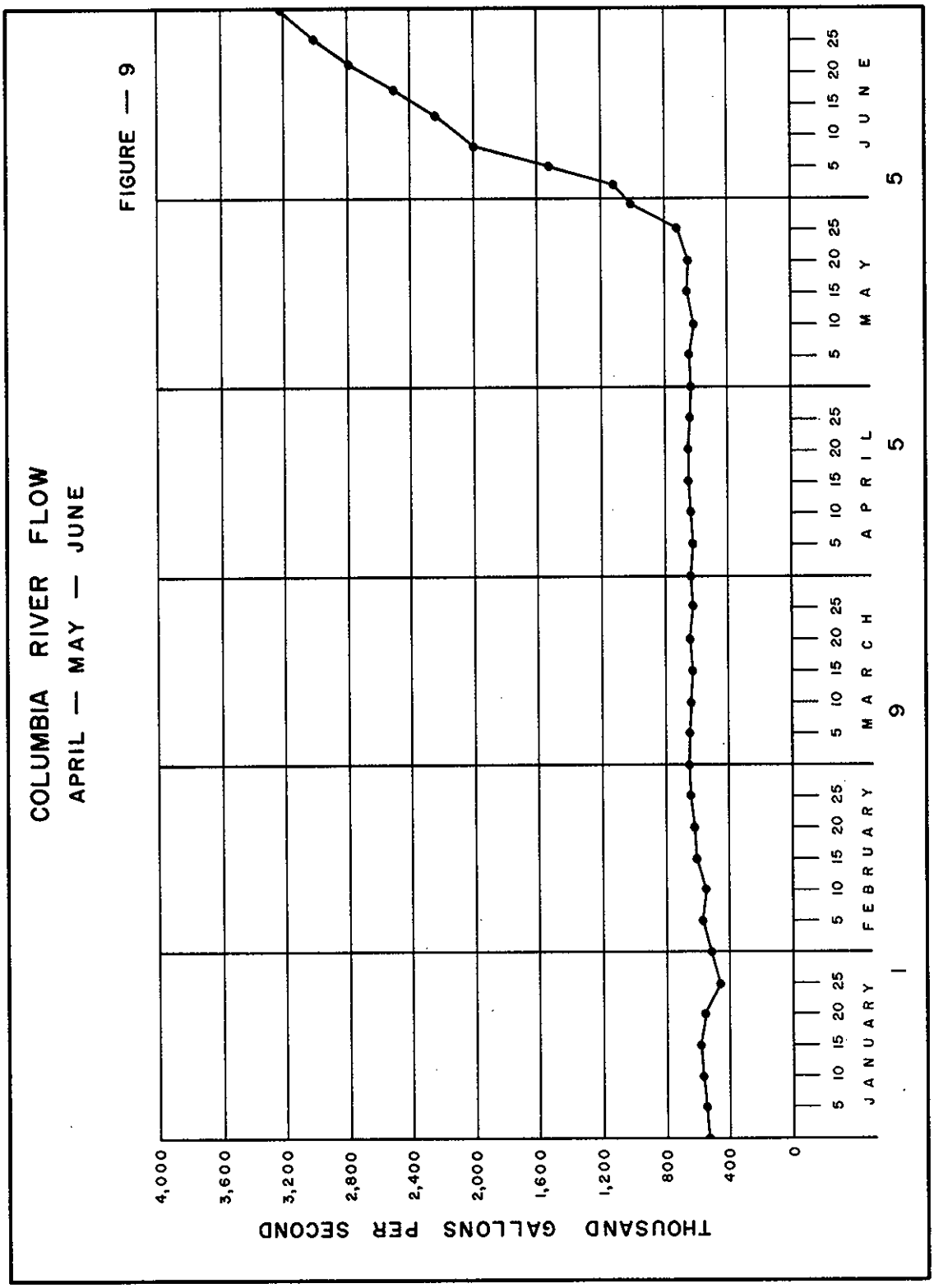


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Samples of river mud were collected from the Columbia River and nearby tributaries for measurement of gross alpha and beta particle emitters. All alpha particle emitter concentrations were below the detection limit of $3 \times 10^{-6}$ μc/gm. Table II summarizes the results of the gross beta activity measurements.

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TABLE II

CONCENTRATION OF BETA PARTICLE EMITTERS IN RIVER MUD SAMPLES

APRIL, MAY, JUNE

1955

Units of $10^{-5}$ μc/gm

| Location | April Avg. | May Avg. | June Avg. | Qtr. Avg. | Last Qtr. Avg. | Max. This Qtr. |
|---|---|---|---|---|---|---|
| Columbia River | | | | | | |
| Wills Ranch | | | | | | |
| Shore | 3.0 | 3.2 | 2.6 | 2.9 | 2.6 | 4.0 |
| 5' Out | 2.9 | 3.8 | 3.8 | 3.5 | 2.9 | 5.9 |
| Allard Station | | | | | | |
| Shore | 38. | 3.5 | 3.3 | 14. | 2.8 | 130. |
| 5' Out | 7.0 | 2.8 | 3.6 | 4.4 | 2.6 | 22. |
| 100-H Area | | | | | | |
| Shore | 8.7 | 23. | 9.3 | 13. | 9.0 | 41. |
| 5' Out | 8.0 | 14. | 6.5 | 9.3 | 6.2 | 26. |
| 100-F Area | | | | | | |
| Shore | 8.7 | 18. | 8.7 | 11. | 7.3 | 31. |
| 5' Out | 49. | 31. | 13. | 30. | 8.7 | 100. |
| Hanford Ferry | | | | | | |
| South Shore | 5.6 | 4.6 | 4.6 | 4.9 | 7.8 | 11. |
| 5' Out | 14. | 8.0 | 6.9 | 9.5 | 8.1 | 38. |
| 300 Area | | | | | | |
| Shore | 6.8 | 5.1 | 2.8 | 5.0 | 6.4 | 18. |
| 5' Out | 5.1 | 4.4 | 3.3 | 4.4 | 6.7 | 8.6 |
| Byer's Landing | | | | | | |
| Shore | 5.0 | 3.9 | 2.7 | 3.3 | 6.2 | 5.0 |
| Richland | | | | | | |
| Shore | 5.6 | 7.7 | 2.8 | 5.4 | 5.0 | 11. |
| 5' Out | 10. | 5.5 | 4.4 | 7.0 | 7.8 | 26. |
| Kennewick Highlands Pumping Station | | | | | | |
| Shore | 2.7 | 3.0 | 2.6 | 2.7 | 3.4 | 3.9 |
| 5' Out | 3.1 | 3.3 | 2.6 | 3.0 | 3.6 | 5.8 |
| Pasco-Kennewick Bridge (Kenn. Side) | | | | | | |
| Shore | 2.4 | 4.4 | 3.1 | 3.0 | 4.0 | 4.8 |
| 5' Out | 2.3 | 5.0 | 3.7 | 3.3 | 3.4 | 6.3 |
| Sacajawea Park | | | | | | |
| 5' Out | 2.5 | 3.5 | 4.1 | 3.6 | 4.2 | 6.3 |
| McNary Dam Pool | 5.2 | 15. | 6.2 | 8.8 | 12. | 21. |
| Below McNary Dam | | | | | | |
| 5' Out | 2.6 | 2.8 | 1.7 | 2.4 | 2.9 | 4.7 |
| Paterson | | | | | | |
| 5' Out | 3.4 | 3.1 | 2.3 | 2.9 | 3.2 | 4.3 |

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TABLE II (contd.)

Units of $10^{-5}$ μc/gm

| Location | April Avg. | May Avg. | June Avg. | Qtr. Avg. | Last Qtr. Avg. | Max. This Qtr. |
|---|---|---|---|---|---|---|
| Snake River | | | | | | |
| Near Mouth 5' Out | 2.8 | 2.8 | 2.4 | 2.7 | 2.4 | 3.2 |
| Yakima River | | | | | | |
| Horn Shore | 2.3 | 2.4 | 2.5 | 2.4 | 2.0 | 3.4 |
| 5' Out | 1.9 | 2.1 | 1.6 | 1.8 | 2.0 | 2.8 |
| Prosser | | | | | | |
| 5' Out | 0.8 | 2.3 | 2.4 | 1.8 | 2.0 | 3.8 |

The values in Table II reveal unusually high values at two locations when compared with previous data. The April monthly average at Allard Station ($3.8 \times 10^{-4}$ μc/gm) was higher by a factor of ten than the expected results ($3 \times 10^{-5}$ μc/gm). The April and May averages for the sampling location below 100-F were higher than expected by factors of 3 to 5. There were no significant changes in water flow rates during the period from October 1954, through May 1955, and the increases were not paralleled by increased activity density of river water at the two locations.

Table III is a summary of the results of analysis of 500 ml samples of raw water for beta particle emitter activity density. These samples were collected from the 183 and 283 Buildings in the reactor and separation areas and represent water prior to purification for drinking purposes.

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TABLE III

CONCENTRATIONS OF BETA PARTICLE EMITTERS IN RAW WATER

RIVER EXPORT LINE

APRIL, MAY, JUNE

1955

Units of $10^{-8}$ µc/ml

| Location | April Avg. | May Avg. | June Avg. | Qtr. Avg. | Last Qtr. Avg. | Max. This Qtr. |
|---|---|---|---|---|---|---|
| 183 Bldg., 100-B Area | <7 | 7 | <5 | <5 | <5 | 20 |
| 183 Bldg., 100-C Area | <5 | <5 | <5 | <5 | <5 | <5 |
| 183 Bldg., 100-D Area | 140 | 170 | 81 | 120 | 150 | 230 |
| 183 Bldg., 100-DR Area | 120 | 180 | 110 | 130 | 150 | 230 |
| 183 Bldg., 100-F Area | 230 | 240 | 120 | 190 | 210 | 310 |
| 183 Bldg., 100-H Area | 220 | 250 | 120 | 190 | 210 | 340 |
| 183 Bldg., 100-KW Area | 71 | 59 | 30 | 52 | 71 | 92 |
| 183 Bldg., 100-KE Area | - | 68 | 34 | 44 | - | 100 |
| 283 Bldg., 200 East | 47 | 57 | 21 | 43 | 64 | 96 |
| 283 Bldg., 200 West | 77 | 83 | 45 | 67 | 120 | 130 |

The decreases noted in the average values for this quarter when compared with the previous quarter averages (Table III) resulted from decreases in the activity density of river water which is the source of the same water. The raw water samples were also analyzed for alpha particle emitter activity density and all measurements were below the detection limit of $5 \times 10^{-9}$ µc/ml.

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## SECTION VI

## RADIOACTIVE CONTAMINATION IN RAIN

by

D. L. Reid

A total of 113 rain samples was collected from 24 locations in the Hanford environs and analyzed for the gross beta particle emitter activity density. The total precipitation of 1.27 inches for the quarter was approximately 90 per cent of the 35 year average of 1.41 inches. Table I summarizes the total precipitation measured at the Meteorology Tower adjacent to the separation areas; measurements for the three previous years are included for comparison.

### TABLE I

### PRECIPITATION MEASURED AT METEOROLOGY STATION

### APRIL, MAY, JUNE

### 1955

Units - Inches

| Year | April | May | June | Quarterly Total |
|---|---|---|---|---|
| 1952 | 0.13 | 0.58 | 1.07 | 1.78 |
| 1953 | 0.77 | 0.28 | 0.55 | 1.60 |
| 1954 | 0.07 | 0.41 | 0.10 | 0.58 |
| 1955 | 0.40 | 0.59 | 0.28 | 1.27 |

The values obtained for the activity density of gross beta particle emitters in the rain samples are presented in Table II.

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TABLE II

CONCENTRATIONS OF BETA PARTICLE EMITTERS IN RAIN

APRIL, MAY, JUNE

1955

Units of $10^{-6}$ μc/ml

| Location and Gauge No. | Number Samples | Maximum | Weighted Average |
|---|---|---|---|
| In 200 East Area | 16 | 13 | 4 |
| 250' E of stack | 6 | 13 | 3 |
| 2000' E of stack | 4 | 3 | 2 |
| 3500' SE of stack | 6 | 12 | 6 |
| In 200 West Area | 16 | 72 | 12 |
| 1000' E of stack | 3 | 17 | 2 |
| 7000' E of stack | 4 | 39 | 9 |
| 8000' SE of stack | 3 | 22 | 12 |
| 4900' SE of stack | 4 | 26 | 12 |
| Redox Area | 2 | 72 | 31 |
| 100 Area Environs | 28 | 24 | 6 |
| 100-B SE | 6 | 5 | 3 |
| 100-D SW | 5 | 24 | 7 |
| 100-F SW | 4 | 6 | 3 |
| Hanford 614 | 4 | 8 | 16 |
| White Bluffs | 4 | 12 | 5 |
| 100-H Area SE | 5 | 9 | 4 |
| Perimeter Locations | 19 | 97 | 9 |
| 700 Area 614 | 4 | 9 | 3 |
| Pasco H and R | 6 | 7 | <1 |
| Benton City | 5 | 97 | 28 |
| Riverland | 4 | 9 | 5 |
| Intermediate Locations | 34 | 33 | 3 |
| Route 4S, Mile 6 | 5 | 33 | 6 |
| 300 Area 614 | 1 | <1 | <1 |
| 200 North Area 614 | 5 | 10 | 7 |
| Gable Mountin | 4 | 3 | 2 |
| Batch Plant | 5 | 17 | 3 |
| 622 Building | 14 | 7 | 2 |

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Comparison of the data summarized in Table II with the previous quarterly values shows that the activity density increased markedly at all sampling stations except those in close proximity to the separation areas which showed only slight, but significant increases. The increase in average activity density resulted from large increases associated with measurements obtained in May. These increases are ascribed to radioactive debris from nuclear detonations entering the environs (Section III) since the HAPO emission decreased significantly (Section I) from the previous quarterly averages.

The measurements obtained during this quarter were significantly lower than those obtained during the same period of 1954 when the activity density was also influenced by fallout from nuclear detonations. (10)

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## SECTION VII

## RADIOACTIVE CONTAMINATION IN DRINKING WATER AND TEST WELLS

by

J. K. Soldat

Approximately one thousand 500 ml samples collected from drinking water supplies and test wells were analyzed this quarter to determine the radioactive contamination in these waters; 800 of these samples represented drinking water supplies and the remainder were obtained from the HAPO water table as test well samples. The 11.7 liter samples previously collected for alpha particle emitter activity density were discontinued this quarter because the 500 ml samples provide sufficient sensitivity with respect to the maximum permissible concentrations listed in Reference (11). A summary of the results of the analysis of drinking water samples for alpha and beta particle emitters is presented in Table I.

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TABLE I

CONCENTRATION OF ALPHA AND BETA PARTICLE EMITTERS IN WATER SUPPLIES APRIL, MAY, JUNE 1955

| Location | No. Samples | Alpha Particle Emitters Units of $10^{-9}$ µc/ml Maximum | Alpha Particle Emitters Units of $10^{-9}$ µc/ml Average | Beta Particle Emitters Units of $10^{-8}$ µc/ml Maximum | Beta Particle Emitters Units of $10^{-8}$ µc/ml Average |
|---|---|---|---|---|---|
| Midway and Vicinity | 45 | 7 | <5 | 14 | <5 |
| 100-B (San) | 10 | <5 | <5 | 9 | <5 |
| 100-C (San) | 12 | <5 | <5 | 6 | <5 |
| 100-K (San) | 11 | <5 | <5 | 92 | 40 |
| 100-D (San) | 13 | <5 | <5 | 90 | 44 |
| 100-DR (San) | 13 | <5 | <5 | 82 | 40 |
| 100-H (San) | 12 | <5 | <5 | 110 | 55 |
| 100-F (San) | 12 | <5 | <5 | 150 | 77 |
| White Bluffs Fire Hall | 13 | <5 | <5 | 30 | 14 |
| Pistol Range | 13 | 8 | <5 | 10 | <5 |
| 251 Building | 13 | <5 | <5 | 20 | 8 |
| 200 East (San) | 40 | <5 | <5 | 49 | 10 |
| 200 West (San) | 52 | <5 | <5 | 54 | 26 |
| 300 Area Wells | 12 | <5 | <5 | 9 | <5 |
| North Richland Wells | 144 | 10 | <5 | 9 | <5 |
| Byers Landing | 8 | 62 | 9 | 8 | <5 |
| Larsen Farm | 8 | 6 | <5 | <5 | <5 |
| Richland Wells | 150 | 15 | 5 | 9 | <5 |
| Kennewick | 35 | <5 | <5 | 69 | 24 |
| Pasco | 26 | 10 | <5 | 23 | 6 |
| McNary Dam | 12 | <5 | <5 | <5 | <5 |
| Plymouth | 12 | <5 | <5 | <5 | <5 |
| Paterson | 13 | 12 | <5 | <5 | <5 |
| Enterprise | 13 | <5 | <5 | 13 | <5 |
| Headgate | 13 | <5 | <5 | <5 | <5 |
| Benton City | 37 | 20 | 10 | <5 | <5 |
| Prosser | 13 | <5 | <5 | <5 | <5 |

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As in the past, positive measurements of beta particle emitter activity density were obtained from nearly all of the drinking water supplies sampled this quarter, with monthly averages ranging from <5 to 77. x $10^{-8}$ μc/ml. Drinking water which originated from the Columbia River showed higher activity densities than that which originated from wells.

Seasonal increases in the Columbia River flow rates this quarter were reflected in decreased river water activity density and consequently in the activity density of both alpha and beta particle emitters in drinking water supplies derived from the river.

Locations listed in Table I which had average values for alpha particle emitter activity density equal to or above the detection limit of 5 x $10^{-9}$ μc/ml were analyzed for uranium content. These locations were confined to well water supplies and in nearly all cases the uranium activity density accounted for the majority of the activity present. The results of the uranium analyzes at these locations is summarized in Table II.

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TABLE II

CONCENTRATIONS OF ALPHA PARTICLE EMITTERS
IN DRINKING WATER
APRIL, MAY, JUNE
1955

| Location | Alpha Particle Emitters, Units of $10^{-9}$ µc/ml | | | Uranium, Units of $10^{-9}$ µc/ml | | |
|---|---|---|---|---|---|---|
| | No. Samples | Max. | Avg. | No. Samples | Max. | Avg. |
| 3000 Area Well "L" | 1 | 9 | 9 | 1 | <2 | <2 |
| Richland Well #4 | 62 | 15 | 6 | 62 | 8 | 5 |
| Richland Well #12 | 12 | 9 | 6 | 12 | 10 | 7 |
| Richland Well #14 | 12 | 10 | 5 | 12 | 8 | 5 |
| Richland Well #15 | 11 | 11 | 7 | 11 | 8 | 7 |
| Benton City Store | 13 | 20 | 13 | 13 | 11 | 9 |
| Benton City Water Company | 11 | 18 | 15 | 11 | 14 | 10 |
| Sacajawea Park Well | 13 | 10 | 7 | 13 | 7 | 6 |
| Byers Landing | 8 | 6.2 | 9 | - | - | - |

The results in Table II were not significantly different from those obtained during the previous quarter when most of the same locations had a positive average activity density for alpha particle emitters.

Supplemental samples collected from various stages in the water treatment process at the Pasco Filter Plant were analyzed for beta particle emitter activity density to determine the decontamination efficiency of the treatment process.

Table III summarizes the results of these analyses.

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TABLE III

CONCENTRATIONS OF BETA PARTICLE EMITTERS
AT THE PASCO FILTER PLANT
APRIL, MAY, JUNE
1955

| Type Sample | No. Samples | Maximum | Average |
|---|---|---|---|
| Water Entering Plant from River | 39 | $5.1 \times 10^{-6}$ μc/ml | $3.0 \times 10^{-6}$ μc/ml |
| Sand (surface of sand filter) | 12 | $4.5 \times 10^{-4}$ μc/gm | $1.4 \times 10^{-4}$ μc/gm |
| First Backwash Material (liquid) | 12 | $8.4 \times 10^{-7}$ μc/ml | $4.2 \times 10^{-7}$ μc/ml |
| First Backwash Material (solid) | 12 | 0.11 μc/gm | $2.0 \times 10^{-2}$ μc/gm |
| Coal (surface of coal filter) | 13 | $3.1 \times 10^{-4}$ μc/gm | $1.5 \times 10^{-4}$ μc/gm |
| First Backwash Material (liquid) | 14 | $1.4 \times 10^{-6}$ μc/ml | $5.1 \times 10^{-7}$ μc/ml |
| First Backwash Material (solid) | 14 | $3.6 \times 10^{-2}$ μc/gm | $1.2 \times 10^{-2}$ μc/gm |
| Water Leaving Plant | 13 | $7.0 \times 10^{-7}$ μc/ml | $4.0 \times 10^{-7}$ μc/ml |

The average values listed in Table III are slightly lower than similar values obtained during the previous quarter because of the general decrease in the river water activity density. The decontamination factor was not significantly different this quarter from that determined during the previous quarter. The average factor was approximately 8 compared to a factor of 10 obtained for the second quarter of 1954.

Alpha particle emitters were detected in the solid material from the filter backwash water, but not in the liquids nor in the water leaving the plant. Activity density of alpha particle emitters in the coal and sand backwash solids averaged $1.9 \times 10^{-6}$ and $5.2 \times 10^{-6}$ μc/gm, respectively, including maximum measurements of $5.7 \times 10^{-6}$ and $1.8 \times 10^{-5}$ μc/gm, respectively. These values were in the range of those obtained in previous quarters.

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The results of the analysis of test well samples for alpha and beta particle emitters are summarized in Table IV for locations where either type of measurement yielded a positive average.

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TABLE IV

CONCENTRATIONS OF ALPHA AND BETA PARTICLE EMITTERS IN TEST WELLS APRIL, MAY, JUNE 1955

| Location | No. Samples | Alpha Particle Emitters Units of $10^{-9}$ µc/ml Maximum | Alpha Particle Emitters Units of $10^{-9}$ µc/ml Average | Beta Particle Emitters Units of $10^{-8}$ µc/ml Maximum | Beta Particle Emitters Units of $10^{-8}$ µc/ml Average |
|---|---|---|---|---|---|
| 107-B-1 | 1 | <5 | <5 | 42 | 42 |
| 107-B-2 | 1 | <5 | <5 | 490 | 490 |
| 108-B-1 | 1 | <5 | <5 | 16 | 16 |
| 108-B-2 | 1 | <5 | <5 | 34 | 34 |
| 107-D-1 | 1 | <5 | <5 | 550 | 550 |
| 107-F-3 | 1 | <5 | <5 | 96 | 96 |
| 108-F-1 | 1 | <5 | <5 | 24 | 24 |
| 107-H-1 | 1 | <5 | <5 | 11 | 11 |
| 361-B-1 | 1 | 7 | 7 | <5 | <5 |
| 361-B-4 | 1 | <5 | <5 | 6 | 6 |
| 361-B-5 | 1 | <5 | <5 | 8 | 8 |
| 361-B-7 | 1 | <5 | <5 | 15 | 15 |
| 300 Area Well #1 | 8 | 15 | 11 | <5 | <5 |
| 300 Area Well #3 | 8 | 72 | 50 | 11 | <5 |
| 300 Area Well #4 | 7 | 150 | 77 | <5 | <5 |
| 303-1 | 13 | 740 | 400 | 10 | <5 |
| 303-2 | 13 | 1000 | 36 | 12 | <5 |
| 303-3 | 5 | 800 | 34 | 10 | 5 |
| 303-4 | 13 | 990 | 640 | 11 | <5 |
| 303-5 | 5 | 200 | 95 | 21 | <5 |
| 303-6 | 13 | 1100 | 570 | 11 | <5 |
| 303-7 | 3 | 920 | 700 | 17 | 8 |
| 303-9 | 3 | 32 | 28 | <5 | <5 |
| 303-10 | 2 | 190 | 180 | <5 | <5 |
| 303-11 | 3 | 190 | 150 | <5 | <5 |
| 303-12 | 3 | 190 | 140 | 8 | <5 |
| 3000-7 | 3 | 14 | 12 | 18 | 8 |
| 8-6.7 - 34.2 | 1 | 5 | 5 | <5 | <5 |
| 34-88.5 | 2 | <5 | <5 | 51 | 27 |
| 25 - 80 | 2 | 8 | 5 | 8 | <5 |
| 39 - 79 | 1 | 8 | 8 | <5 | <5 |
| 32 - 77 | 1 | <5 | <5 | 8 | 8 |
| 70 - 68 | 1 | <5 | <5 | 6 | 6 |
| 70.8 - 80.6 | 1 | 10 | 10 | <5 | <5 |
| 64.6 - 72.3 | 1 | 5 | 5 | <5 | <5 |

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The significant increases noted in the previous quarter for the average alpha particle emitter activity density at test wells 303-2, and 303-6 continued into the early part of the present quarter when the maximum measurements of approximately $1 \times 10^{-6}$ μc/ml were obtained. The measurements made in the latter part of this quarter at these locations indicated a reversal of the trend at these two wells. An increasing trend in the average alpha particle emitter activity density was noted at wells 303-4, 303-7, and 303-11 this quarter; the increase at well 303-4 was a continuation of the one noted during the previous quarter. The previous quarter averages were $3.8 \times 10^{-7}$ μc/ml, $1.1 \times 10^{-7}$ μc/ml, and $1.5 \times 10^{-8}$ μc/ml, for the 303-4, 303-7, and 303-11 wells, respectively.

Test wells sampled by Regional Monitoring for the first time this quarter were the 107, 108, and the 361-B series of wells. The first two series are located near the 107 basins and 108 Building in the 100 Areas while the latter series are wells in the vicinity of the 361-B Tank Farm. These wells are located where positive beta particle emitter activity density would normally be expected in the ground water.

Samples from 300 Area Wells #1, #3, and #4 were also analyzed for uranium; average results were $7 \times 10^{-9}$ μc/ml, $4.9 \times 10^{-8}$ μc/ml, and $7.4 \times 10^{-8}$ μc/ml respectively. The maximum measurement of $1.9 \times 10^{-7}$ μc/ml was obtained at Well #4.

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## LITERATURE CITED


1. Members of Regional Radiation Measurements Unit — Radioactive Contamination in the Hanford Environs for the Period October, November, December 1954. April 29, 1955. HW-36505.

2. Paas, H. J. — Radioactive Contamination in the Hanford Environs for the Period April, May, June 1953. October 2, 1953. HW-29514.

3. Paas, H. J. — Radioactive Contamination in the Hanford Environs for the Period January, February, March 1953. May 22, 1953. HW-28009.

4. Healy, J. W., R. C. Thorburn and Z. E. Carey — HI Control Laboratory Routine Chemical Procedures. July 15, 1951. HW-20136.

5. Wolff, J. H. — Calculation Constants Used by Regional Survey. November 20, 1951. HW-22682.

6. Wolff, J. H. — Calculation Constants Used by Regional Survey, Part II. Alpha Sample Counting Rate Conversion Factors, March 17, 1952. HW-23769.

7. Norton, H. T. and G. E. Pilcher — The Calculation of Beta Particle Emitter Concentration in Hanford Reactor Effluent Water, August 15, 1953. HW-27584.

8. Schwendiman, L. C. — Standard Practices Counting Manual, January 4, 1954. HW-30492.

9. Members of Regional Radiation Measurements Unit — Radioactive Contamination in the Hanford Environs for the Period January, February, March 1955. May 15, 1955. HW-36506.

10. Paas, H. J., et al — Radioactive Contamination in the Hanford Environs for the Period April, May, June 1954. November 24, 1954. HW-33896.

11. — Maximum Permissible Amounts of Radioisotopes in the Human Body and Maximum Permissible Concentrations in Air and Water. National Bureau of Standards Handbook 52, March 20, 1953.


[redacted]
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