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(M-3679, 19th Ed.)

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RADIOACTIVE CONTAMINATION IN THE HANFORD ENVIRONS
FOR THE PERIOD
JANUARY, FEBRUARY, MARCH
1957

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By

M. W. McConiga and J. K. Soldat

Regional Monitoring
Radiation Protection Operation

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June 17, 1957

HANFORD ATOMIC PRODUCTS OPERATION
RICHLAND, WASHINGTON

Work performed under Contract No. W-31-109-Eng-52 between
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Health and Safety
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ABSTRACT

SECTION I: RADIOACTIVE CONTAMINATION IN EFFLUENT GASES

Total average I^{131} emission from A-plant and S-plant stacks this quarter was 1.4 curies per day compared to 1.5 curies per day during the previous quarter. Approximately 70 per cent of the I^{131} was emitted from S-plant stack this quarter. Ruthenium emission from the S-plant stack remained at previously noted low rates of less than 0.01 curie per day.

Average tritium oxide, C^{14}, and S^{35} measurements were generally comparable to previous measurements. Maximum emission rate of tritium oxide was 1.1 curies per day at 100-B Area in January. No significant changes were noted in the gross alpha activity density of reactor stack gases this quarter, and the concentrations of radioactive particles at 100-B reactor stack have shown a decreasing trend for the past six months. Average values of gross beta activity density for this and the previous quarter were 9.2×10^{-6} and 9.3×10^{-5} curie per day, respectively.

SECTION II: RADIOACTIVE CONTAMINATION ON VEGETATION

The average deposition of I^{131} on off-project vegetation was $< 3 \times 10^{-6}$ $\mu c/gm$ during the quarter. Average I^{131} activity density on project vegetation ranged from $< 3 \times 10^{-6}$ $\mu g/gm$ to 2×10^{-5} $\mu c/gm$, with a maximum deposition of 2.8×10^{-4} $\mu c/gm$.

The I^{131} was released from the Chemical Processing Areas with no significant contribution from bomb fallout this quarter. The I^{131} deposition patterns for January, February, and March are illustrated in the Appendix.

SECTION III: RADIOACTIVE CONTAMINATION IN THE ATMOSPHERE

Average dose rates measured by Victoreen Integrons increased to 5.8 mrad per day this quarter from the average of 1.6 noted last quarter. The average value in the Tri-City Area was 0.7 mrad per day this quarter compared to 2.2 mrad per day for the previous quarter. No significant changes were noted in the dosage rates monitored by detachable ionization chambers. The decreasing trend in radioactive particle concentrations noted in November and December, 1956, continued through the present quarter demonstrating a continued reduction in bomb fallout.

SECTION IV: RADIOACTIVE CONTAMINATION IN HANFORD WASTES

Gross beta activity in reactor cooling water discharged to the Columbia River averaged 15,000 curies per day this quarter compared to 12,500 curies per day last quarter. (Both values uncorrected for reactor down-time.) A summary of activity in liquid wastes discharged to open swamps and ditches is tabulated, and results of ground surveys at 100-D Area following a contamination incident on February 22 are illustrated in the Appendix. Ground surveys in the Tri-City Area detected only one particle in 100,000 square feet surveyed.

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

Comparison of turbidities and beta emitter activity densities in Columbia River water indicate a relationship may exist between these measurements.

General increases in the beta particle emitter activity densities of Columbia River water and mud were noted this quarter. Raw water samples reflected this increase along with increases in reactor effluent water activity and Columbia River water turbidity. The river flow volumes were nearly the same as last quarter.

SECTION VI: RADIOACTIVE CONTAMINATION IN TEST WELLS

Wells drilled around the A-8 crib site and down the ground water gradient from that unit continued to increase in beta emitter activity density, definitely marking the A-8 crib as the source of contamination. No evidence of these wastes have been detected other than in local wells.

The only wastes now detectable beyond their immediate disposal sites are those which have been traced 10,000 feet eastward from the Redox or WR cribs at levels up to 10^{-6} $\mu c/ml$.

SECTION VII: RADIOACTIVE CONTAMINATION IN DRINKING WATER

The Columbia River flow during the first quarter was only slightly higher than that of the fourth quarter of 1956. Pasco Filter Plant samples showed increased beta emitter activity densities all through the treatment process, particularly in the backwash samples. Water leaving the plant increased to 2.6×10^{-6} over last quarter's 1.8×10^{-6} $\mu c/ml$.

Higher beta emitter activity densities, with an essentially constant river flow, may be related to river water turbidity as suggested in Section V.

MPC fractions, based on the occupational limit, present in Pasco, Kennewick, and 100-F Area raw and sanitary waters are presented.

INTRODUCTION

The document summarizes the results obtained from monitoring the Hanford environs for radioactive contamination during the period January, February, and March, 1957. Samples were collected by Regional Monitoring forces according to procedures previously outlined in documents of this series.[1, 2] These samples were analyzed by Radiological Chemical Analysis forces according to procedures and techniques described in a previously published laboratory manual.[3]

Counting rates obtained from these analyses were corrected for geometry, backscatter, air-window absorption, source size, self-absorption, chemical yield, and collection efficiency by Radiological Chemical Analysis forces using factors described in previous reports.[4, 5, 6] 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. These sections discuss the amounts of active material discharged from plant facilities and their effect on the contamination of vegetation, air, soil, and water.

SECTION I

RADIOACTIVE CONTAMINATION IN EFFLUENT GASES

Radioactive contaminants in the separations and reactor area effluent gases released to the Hanford environs were sampled at the stacks and the stack breechings. Daily filter and scrubber samples from the separations area were analyzed for I^{131}, $Ru^{103-106}$, and filterable total beta activity. Semi-weekly filter samples and monthly tritium oxide and C^{14}-S^{35} samples were taken from the reactor area stacks. The results obtained are discussed below and summarized in Tables I through V in Appendix A.

SEPARATIONS AREAS

No significant changes in the emission rates of I^{131} or filterable gross beta particle emitters were noted from the A-plant stack this quarter when the results were compared with those of the previous quarter (Table I).[9]

A gradual decrease inthe maximum daily emission rate of I^{131} from the S-plant stack was noted this quarter. Maximum value last quarter was 23 curies per day on December 21, 1956; the maximum during the January reporting period was 9.6 curies per day on December 27, 1956 (Table II). Emission rates of ruthenium from the S-plant stack remained below the detection limit of about 0.01 curie per day again this quarter (Table II).

Concentrations of filterable radioactive materials discharged from the U-plant stack this quarter decreased to values one-tenth of those noted last quarter (Table III). Reduced operations at this facility were partially responsible for the decreased emission rates.

REACTOR AREAS

Total average tritium oxide emission from the eight reactor area stacks was 1.8 curies per day this quarter compared to 1.5 curies per day for the previous quarter. Maximum daily emission of 1.1 curies per day

 [redacted]

occurred at 100-B reactor stack on January 10, 1957; last quarter's maximum value was 1.0 curie per day at 100-D.

Re-evaluation of the detection limit of the C^{14}-S^{35} sampling and analysis procedures led to new values. The new detection limits are 6.4×10^{-3} curie per day for C^{14} and 6.4×10^{-4} curie per day for S^{35}, compared to previous values of 4.5×10^{-3} and 4.5×10^{-4}, respectively.

No significant change in the average C^{14} emission rate was noted this quarter (Table IV). Several scattered positive measurements were obtained from all reactor areas, except 100-KW and 100-KE. Maximum measurement was again found at 100-D Area where a value of 1.5×10^{-2} curie per day was obtained in February; last quarter's maximum was 1.1×10^{-2} curie per day.

Slight increases in the daily average S^{35} emission were noted at 100-C and 100-DR Areas this quarter (Table IV), where values below the detection limit were obtained last quarter. S^{35} emission rates at 100-F Area decreased from the high values noted during the past two quarters.[8, 9] This quarter's average value was 8.8×10^{-4} curie per day compared to 3.5×10^{-3} curie per day last quarter.

No significant changes have been noted in the activity density of alpha particle emitters discharged from the reactor area stacks during the past twelve months (Table V).[7, 8, 9]

The activity density of gross beta particle emitters and the concentration of radioactive particles in the 100-B reactor stack gases both decreased for the second consecutive quarter (Table V). Extended shut-downs of this area contributed to these decreases. One other significant change noted was an increase by a factor of 3 in the average values for these two types of measurements noted at 100-F this quarter. Activity density of gross beta emitters was 3.0×10^{-3} curie per day and radioactive particle emission was 3.0×10^{6} particles per day this quarter, compared to values of 0.95×10^{-3} curie per day and 1.1×10^{6} particles per day for the previous quarter.

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300 AREA - 327 BUILDING

Weekly filter and scrubber samples collected from the plenum of the 327 Building stack were analyzed for gross beta particle emitters. Monthly average values for January, February, and March were 3.0×10^{-4}, 6.0×10^{-4}, and $< 5.0 \times 10^{-5}$ curie of beta particle emitters per day. Quarterly average and maximum values were 4.4×10^{-4} and 1.5×10^{-3} curie per day.

 [redacted]

SECTION II

RADIOACTIVE CONTAMINATION ON VEGETATION

Determination of the radioactive contamination of vegetation in the environs was made by radiochemical analysis of over 2500 samples. More than 2100 of these samples were from the immediate environs and the remainder from off-area locations in eastern and southern Washington and northern Oregon. All samples were analyzed for I^{131}; 1400 were analyzed for non-volatile beta particle emitters. Forty samples from selected locations were analyzed for alpha particle emitters. The results of these measurements are discussed below and are summarized in Tables VI through IX in Appendix A.

Average deposition of I^{131} on off-project vegetation remained at or below the reporting limit of $< 3 \times 10^{-6}$ $\mu c/gm$ again this quarter (Tables VI and VII). Results of measurements of I^{131} on project vegetation summarized in Table VI indicate that the quarterly average increased to 9×10^{-6} $\mu c/gm$ this quarter compared to an average of $< 3 \times 10^{-6}$ $\mu c/gm$ obtained last quarter.[9] The majority of this increase was due to the use of a multiplying factor of 3 applied to all positive I^{131} vegetation results. Recent work on the use of gamma ray spectroscopy techniques for vegetation analysis undertaken by Analytical Chemistry indicated that the present wet chemistry techniques now used by the Radiological Chemical Analysis Laboratory may yield results which are low by a factor of approximately this magnitude. More research is being done to resolve the differences in the results of the two methods. The deposition patterns for January, February, and March are illustrated in Figures I, II, and III in Appendix B.

The concentrations of non-volatile beta emitters on vegetation remained at low levels throughout the quarter. The majority of the non-volatile emitters are deposited from bomb fallout and there was only minor deposition from this source throughout the quarter (Tables VI and VIII).

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The average concentration of alpha particle emitters on vegetation near the Chemical Processing Areas increased two-fold this quarter following a similar increase last quarter (Table VII). Average activity density in this region was 5.9×10^{-7} $\mu c/gm$ compared to the average of 2.8×10^{-7} $\mu c/gm$ obtained last quarter. The maximum value of 2.5×10^{-6} $\mu c/gm$ was detected at the 200 West Gate where last quarter's maximum of 1.2×10^{-6} $\mu c/gm$ was obtained. Increases were also noted in alpha particle emitter activity density of off-project vegetation. Several scattered positive values were obtained this quarter; the maximum measurement of 2.7×10^{-7} $\mu c/gm$ was obtained on a sample collected from Pasco.

[redacted]

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SECTION III

RADIOACTIVE CONTAMINATION IN THE ATMOSPHERE

The magnitude and extent of airborne contamination in the Hanford environs were determined from analyses of filter and scrubber samples and from data recorded in the operation of Victoreen Integrons, H. M. Chambers, and Detachable Ionization Chambers. The results obtained by each of these monitoring methods are summarized in Tables X through XIII in Appendix A.

No unusual changes were noted this quarter in the average dosage rates measured by detachable ionization chambers. Two changes of possible significance occurred in average dosage rates measured by Victoreen Integrons this quarter (Table X). Quarterly average dosage measurement at Benton City increased to 5.8 mrad/day this quarter compared to a value of 1.6 mrad/day last quarter.[9] The unusually high monthly average of 12.8 mrad/day, responsible for this increase, was attributed to instrument difficulties. The average dosage measured in the Tri-City Area decreased to a value approximately one-half of that noted last quarter; present quarter average was 0.7 mrad/day. No significant changes were noted in the dosages measured by other integrons, H. M. chambers, or ionization chambers.

Activity density of alpha particle emitters in the atmosphere this quarter remained below the detection limit of 6×10^{-15} μc/ml at all locations sampled. Both the activity density of beta particle emitters and the concentrations of radioactive particles in the atmosphere decreased this quarter reflecting reduced fallout of bomb debris. In extreme cases, average particle concentrations were one-tenth of those found last quarter (Table XI).

The results obtained from radiochemical analysis of caustic scrubber samples for iodine are summarized in Table XII; quarterly average iodine concentrations were similar to those measured previously. Scattered positive values were detected at all locations monitored, with the highest values of 1.9×10^{-12} μc/ml being found at 200 West - Redox 614 Building.

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SECTION IV

RADIOACTIVE CONTAMINATION IN HANFORD WASTES

The magnitude and extent of radioactive contamination in Hanford wastes were determined from the results of over 2700 measurements. Solid and liquid samples obtained from open waste areas were analyzed radiochemically for gross alpha and beta particle emitters. Specific isotopic analyses were also performed for certain other contaminants. These measurements were supplemented with data obtained from portable instrument surveys at various locations on the plant.

100 AREA WASTE

Radioactive contamination discharged to the Columbia River from the reactor areas was determined by analyzing samples collected daily from the outlets of the effluent water retention basins and correcting the results for decay. A summary of the activity of beta particle emitters discharged to the river per unit of time, not corrected for periods of reactor outage (when no samples were taken) is given in Table XIII in Appendix A.

The average total beta activity in cooling water discharged to the river from all reactors increased from 12, 500 curies per day last quarter to 15, 000 curies per day during the current quarter. This increase reflects increasing power levels noted in several reactors, and is also possibly related to increased river turbidity (See Section V).

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. An average of 83 μc/day was discharged to the river during the quarter, compared to last quarter's average of 45 μc/day.[9]

[redacted]

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200 AREA WASTES

Liquid and solid samples collected from waste sources in the separations areas are summarized in Tables XIV and XV in Ap endix A. The changes in alpha and beta particle emitter activity density noted when this quarter's results were compared with those of last quarter are within the range of fluctuations normally found in these waste streams. Decreases noted in activity density in liquid samples from the T-plant ditch and swamp are a continuation of long-term trends resulting from shut down of T-plant facility.

One set of samples of waste water and mud from the newly established Redox swamp at 200 West Area were collected in March. Gross alpha and beta particle emitter activity densities of the waste water were 1.6×10^{-8} and 4.5×10^{-7} μc/ml, respectively. Corresponding values for the mud samples were 1.2×10^{-4} μc of alpha emitter per gm and 1.3×10^{-2} μc of beta emitters per gm of mud. High mud values probably resulted from activity flushed from a previously contaminated pipe line being used to discharge waste to this swamp.

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 200 to > 100,000 c/m at 200 West Area locations, with maximum readings found at the U-swamp inlet. All 200 East locations showed counting rates of 200 to 800 c/m above background.

Readings obtained over the waters at the edge of the swamps and ditches ranged from 200 to 60,000 c/m at 200 West Area with background readings obtained in 200 East.

300 AREA WASTE

Radioactive contamination in waste water entering the 300 Area north pond was measured in samples collected by Regional Monitoring and Fuels Preparation Department personnel (Table XVI). Individual samples from this source varied widely in activity density, as has been found in the past. Average uranium discharged to the pond this quarter was nearly identical to last quarter's average.

ENVIRONS - GROUND CONTAMINATION

Ground surveys of about fifty selected locations in the Tri-City Area detected only one particle in the 100,000 square feet surveyed. Spot re-checks confirmed the decrease from the average of 1 particle per 14,000 square feet found last quarter. Spot surveys of areas adjacent to project roadways revealed no major changes over values illustrated in the previous quarterly report in this series.

Surveys of 400 square foot plots around Redox showed an average of 2 radioactive particles per plot with a maximum of 12 particles per plot. Similar surveys around the Purex exclusion area revealed an average of 1 particle per plot and a maximum of 4 particles per plot. Approximately 60 per cent of all separations areas plots surveyed contained no particles.

A ground contamination incident occurred at 100-D Area on February 22, 1957, in which radioactive particulates were scattered over a large part of the area. Gamma spectroscopy measurements of particles from the ground and of material from the 107-D basin, showed that the source of the ground contamination was very probably the 107-D basin, which had been pumped down previously. No significant amounts of contamination were detected in surveys outside of 100-D, except at the old Ferry Landing near 100-D Area. The results of the survey within 100-D Area are illustrated in Figure 4 in Appendix B.

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SECTION V

RADIOACTIVE CONTAMINATION IN THE COLUMBIA RIVER AND RELATED WATERS

Approximately 500 samples of water were collected from the Columbia, Yakima, and Snake Rivers to determine the concentration of their radioactive contaminants. Alpha particle emitters averaged below the reporting limit of 5×10^{-9} $\mu c/ml$ for all river locations sampled this quarter.

General increases in the beta particle emitter activity density of the Columbia River water (Table XVII) were noted this quarter.

The monthly one-liter samples collected from the Columbia River between McNary Dam and Portland revealed gross beta activity densities ranging from 2×10^{-7} to 8×10^{-7} $\mu c/ml$, similar to that of last quarter.[9] The maximum value, 8×10^{-7} $\mu c/ml$, occurred at Arlington in January.

Thirteen water samples collected from the south bank of the Columbia River at the Hanford Ferry Landing were analyzed for the activity density of I^{131}. Average and maximum results for this quarter were 1×10^{-7} and 1.6×10^{-7} $\mu c/ml$, respectively, compared to 7.8×10^{-8} and 1.8×10^{-7} $\mu c/ml$, rexpectively, in the previous quarter.

More than 250 river mud samples 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 reporting limit of 3×10^{-6} $\mu c/gm$.

The activity density of beta particle emitters in Columbia River mud increased this quarter at most locations along with river water activity. River mud samples collected within the project ranged from 2.1×10^{-5} $\mu c/gm$ to a maximum of 3.6×10^{-4} $\mu c/gm$ obtained at 100-H Area. Off-project mud samples collected from the Columbia, Snake, and Yakima Rivers ranged from 2×10^{-5} $\mu c/gm$ to 6×10^{-5} $\mu c/gm$.

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More than 150 samples of raw water were collected from the 183 and 283 Buildings in the reactor and separations areas for gross alpha and beta analysis (Table XVIII). The activity density from gross alpha emitters was below the detection limit for all samples.

The raw water samples represent water prior to purification for drinking; the increased activity density of beta particle emitters in raw water this quarter reflects the increase in Columbia River water activity. The maximum activity density of 4.2×10^{-5} $\mu c/ml$ was found at 183-H Building on December 27, 1956, during a period of below-average river flow.

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 [redacted]

SECTION VI

RADIOACTIVE CONTAMINATION IN TEST WELLS

INTRODUCTION

The average and maximum values for beta emitter activity densities and uranium are presented for 98 test wells. Nitrate ion concentrations were rather incomplete for these wells and were deleted from the report for the sake of brevity. The 216 BC crib and trench monitoring wells formerly listed in Table IV of Section VI were deleted, all wells being below detection limits; however, this group will be reinstated in the report if positive results appear.

The 321 Crib monitoring wells formerly listed in Table VIII of Section VI were deleted to shorten the report. The 321 Crib (uranium wastes) has been out of service for several years and uranium in the wells is evidently fixed at the site.

Wells in the reactor areas formerly listed in Table IX were left out of this report. With the exception of the well monitoring the 100-F Animal Farm, these wells mainly monitor line and basin leaks of effluent which is disposed to the Columbia River and which will probably be delayed in the sediments, at least as long as they would be held in the retention basins.

The detection limit now used for total beta analyses is 2×10^{-7} $\mu c/ml$, rather than 1×10^{-7} $\mu c/ml$.

200 EAST AREA AND VICINITY

The locations of wells listed in Tables XIX through XXI in Appendix A are shown in Figure 4 of the third quarterly report for 1956.[9]

Table XIX includes wells originally drilled to monitor the 241-B-361 reverse well wastes, now decayed to a low-level. These wells occasionally detect wastes moving away from other units, such as the B-plant 2nd cycle and BY crib sites to the north, as is shown by the increase in beta emitters in well 299-E28-5, nearest to these cribs.

[redacted]

Table XX lists wells which monitor the above-mentioned cribs. The only changes of significance in this group are increases in beta emitters in wells 299-E33-18 and 299-E33-19 which lie close to the 242-B waste evaporator crib, also high in uranium wastes. At present, none of these wastes can be traced beyond the 200 East Area boundaries and are evidently approximately in hydraulic balance between the 200 East and 200 West ground water mounds.

Table XXI lists wells which monitor the Purex disposal units and others which bound the 200 Areas and are most likely to detect the movement of wastes away from the sites of disposal.

Wells drilled around the A-8 crib and those directly down the ground water gradient from that unit continued to increase in beta emitter activity density, marking the A-8 crib as the source of contamination. At present, these wastes appear to remain in the immediate area, blocked to the east by the ground water mound built by Purex cooling water disposal, and approximately in balance between the 200 West and 200 East ground water mounds.

Beta emitter activity in 699-35-70 and 699-36-61 is evidently from the Redox disposal units or the 216 WR cribs in 200 West Area and, at present, are the only wastes detectable beyond the limits of an area of disposal.

200 WEST AREA AND VICINITY

The locations of the wells listed in Tables XXII through XXIV in Appendix A are shown in Figure 5 of the third quarterly report for 1956.

Wells in Table XXII monitor the T-plant 2nd cycle crib and tank farm area. There were no evidently significant changes in the activity levels of these wells.

Wells in Table XXIII were originally drilled to monitor the now-decayed 241-T-361 reverse well wastes and have detected the movement of crib wastes from the T-plant 2nd cycle sites, but show essentially no change in activity levels from the previous report.

Wells listed in Table XXIV monitor the Redox cribs and tank farm sites. Probably the only change of significance is an increase in the beta emitter activity density of well 299-W22-4, 400 feet down the ground water gradient, from 6×10^{-6} $\mu c/ml$ to 3×10^{-5} $\mu c/ml$. This shows eastward movement of 216-S-1 and 2 crib wastes, which may be those appearing in wells 699-35-70 and 699-36-61, beyond the area boundary to the east.

[redacted]

SECTION VII

RADIOACTIVE CONTAMINATION IN DRINKING WATER

The results of 566 samples of drinking water analyzed for gross alpha and beta particle emitters are presented in Table XXV in Appendix A. Drinking water derived from the Columbia River was nearly identical in beta emitter activity densities to that of last quarter, with the exception of the White Bluff's Fire Hall and 200 East and 200 West Area samples which increased 7 to 15 times to levels of 10^{-6} $\mu c/ml$. Composites of Kennewick drinking water were slightly lower and Pasco's slightly higher that last quarter.[9]

The Columbia River flow averaged 5.2×10^5 gps, as compared with 5.0×10^5 gps in the fourth quarter of 1956.

Isotopic analyses of raw and sanitary water from Pasco, Kennewick, and 100-F Area were made in March and approximate MPCs calculated from the available data. In per cent of the occupational limit, the values are as follows: Kennewick raw water - 0.44 per cent, sanitary water - 0.20 per cent; Pasco raw water - 0.38 per cent, sanitary water 0.11 per cent; 100-F Area raw water - 1.9 per cent, and sanitary water - 0.5 per cent.

The results of 84 samples analyzed for alpha emitters and uranium are compared in Table XXVI. These samples show no significant changes in total alpha or uranium activity when compared with past measurements.

The results of samples collected from successive stages of the water treatment process of the Pasco Filter Plant are shown in Table XXVII.

The water entering the plant was higher in beta emitters last quarter, in line with the data in Section V (River Water) as were the filter and back-wash material. The water leaving the plant averaged 2.6×10^{-6} $\mu c/ml$, as compared to last quarter's average of 1.8×10^{-6} $\mu c/ml$.

[redacted]

APPENDIX A

Tables I through XXVII

TABLE I

IODINE-131 AND FILTERABLE BETA PARTICLE EMITTERS DISCHARGED FROM THE A-PLANT STACK JANUARY, FEBRUARY, MARCH 1957

Units of Curies Per Day

	I-131		Filterable Total Beta	
Month	Maximum	Average	Maximum	Average
January	1.3	0.18	0.013	0.004
February	2.7	0.36	0.10	0.027
March	3.0	0.82	0.69	0.025
Quarter	3.0	0.44	0.69	0.018
Last Quarter	4.4	0.68	0.29	0.039

TABLE II

IODINE-131 AND RUTHENIUM DISCHARGED FROM THE S-PLANT STACK JANUARY, FEBRUARY, MARCH 1957

Units of Curies Per Day

	I-131		Ruthenium	
Month	Maximum	Average	Maximum	Average
January	9.6	0.92	<0.01	<0.01
February	6.7	1.5	<0.01	<0.01
March	2.9	0.47	<0.03	<0.01
Quarter	9.6	0.99	<0.03	<0.01
Last Quarter	23	0.86	<0.01	<0.01

[redacted]

TABLE III

RADIOACTIVE PARTICULATE MATERIALS DISCHARGED FROM THE U-PLANT STACK JANUARY, FEBRUARY, MARCH 1957

Month	Alpha Particle Emitters Units of 10^{-8} curie/day		Beta Particle Emitters Units of 10^{-5} curie/day		Radioactive Particle Concentrations Units of 10^{4} Particles/day	
	Max.	Avg.	Max.	Avg.	Max.	Avg.
January	0.6	0.3	0.07	0.04	2.1	0.58
February	0.6	0.3	0.07	0.04	3.5	0.98
March	0.8	0.4	0.14	0.04	0.69	0.35
Quarter	0.8	0.3	0.14	0.04	3.5	0.63
Last Quarter	31	3.7	3.1	0.57	40	2.5

TABLE IV

QUARTERLY SUMMARY OF TRITIUM OXIDE, CARBON-14, SULFUR-35 DISCHARGED FROM REACTOR STACKS JANUARY, FEBRUARY, MARCH 1957

Stack	Tritium Oxide Units of curie/day		Carbon-14 Units of 10^{-3} curie/day		Sulfur-35 Units of 10^{-4} curie/day	
	Maximum	Average	Maxumum	Average	Maximum	Average
100-B	1.1	0.44	7.0	<6.4	<6.4	<6.4
100-C	0.89	0.35	9.4	<6.4	27	9.6
100-KW	0.25	0.14	<6.4	<6.4	6.7	<6.4
100-KE	0.10	<0.10	<6.4	<6.4	<6.4	<6.4
100-D	0.31	0.22	15	<6.4	17	11
100-DR	0.91	0.34	7.7	<6.4	31	10
100-H	<0.10	<0.10	12	<6.4	<6.4	<6.4
100-F	0.19	0.15	11	8.7	23	8.8

[redacted]

TABLE V

QUARTERLY SUMMARY OF RADIOACTIVE PARTICULATE MATERIAL DISCHARGED FROM THE REACTOR STACKS JANUARY, FEBRUARY, MARCH 1957

Stack	Alpha Particle Emitters (Units of 10^{-7} curie/day)		Beta Particle Emitters (Units of 10^{-5} curie/day)		Radioactive Particle Concentrations (Units of 10^{5} Particles/day)	
	Maximum	Average	Maximum	Average	Maximum	Average
100-B	0.62	0.21	5.5	0.92	7.1	0.86
100-C	2.2	0.35	150	16	62	13
100-KW	0.70	0.22	29	8.8	10	0.67
100-KE	1.4	0.33	12	5.2	0.86	0.06
100-D	0.74	0.16	1100	150	16	1.5
100-DR	1.3	0.33	48	5.0	710	25
100-H	2.2	0.54	14	7.8	43	2.5
100-F	1.0	0.36	730	300	97	*30

* The autoradiographs of most of the filters from 100-F reactor area stack were too dense to interpret this month.

[redacted]

TABLE VI

RADIOACTIVE CONTAMINATION ON VEGETATION
JANUARY, FEBRUARY, MARCH
1957
Units of 10^{-6} $\mu c/gm$

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.
Project							
200-West Area	77	110	15	4	460	110	110
200-West - Redox	26	150	20	4	470	110	140
200-West - Gate	65	41	8	3	190	79	110
Route 3	13	14	6	< 3	---	---	---
Meteorology Tower	13	28	7	< 3	110	68	100
Batch Plant	13	14	5	3	180	74	94
200-East Area	52	95	11	3	340	110	98
200-East - Purex	96	62	10	8	570	83	91
Near 200 Areas	309	150	6	< 3	550	84	98
North of 200 Areas	244	23	< 3	< 3	760	76	89
South of 200 Areas	389	62	5	< 3	290	74	75
PSN-50-51-61	36	160	15	< 3	87	60	73
Goose Egg Hill	117	28	12	< 3	200	60	79
Wahluke Slope	153	160	3	< 3	410	69	110
Off Project							
Pasco to Ringold	125	22	< 3	< 3	230	69	72
Richland	127	14	< 3	< 3	93	50	52
Benton City - Kiona	26	14	3	< 3	190	60	69
Richland "Y"	13	12	4	< 3	---	---	---
Kennewick Environs	176	22	< 3	< 3	260	63	53
Pasco Environs	128	13	< 3	< 3	1240	92	51
Prosser to Paterson - McNary	65	7	< 3	< 3	460	66	59
Eastern Washington	137	7	< 3	< 3	1250	98	70
So. Washington and No. Oregon	129	11	< 3	< 3	270	65	54

[redacted]

TABLE VII

RADIOACTIVE CONTAMINATION FROM IODINE ON VEGETATION
JANUARY, FEBRUARY, MARCH
1957

Units of 10^{-6} $\mu c/gm$

Location	January		February		March	
	Max.	Avg.	Max.	Avg.	Max.	Avg.
Project						
200-West Area	110	31	21	7	31	7
200-West - Redox	71	24	18	9	150	28
200-West - Gate	41	16	7	3	16	5
Route 3	14	9	5	< 3	12	6
Meteorology Tower	22	11	5	< 3	28	8
Batch Plant	14	9	4	< 3	10	3
200-East Area	25	8	12	6	95	20
200-East - Purex	26	7	34	6	62	19
Near 200 Areas	28	5	25	3	150	10
North of 200 Areas	15	3	8	< 3	23	< 3
South of 200 Areas	62	5	8	< 3	43	7
PSN 50-51-61	160	32	31	9	18	< 3
Goose Egg Hill	280	24	21	6	35	8
Wahluke Slope	7	< 3	160	5	12	< 3
Off Project						
Pasco to Ringold	10	< 3	5	< 3	22	< 3
Richland	5	< 3	7	< 3	14	3
Benton City - Kiona	14	4	4	< 3	13	< 3
Richland "Y"	< 3	< 3	5	3	12	6
Kennewick Environs	5	< 3	6	< 3	22	< 3
Pasco Environs	4	< 3	4	< 3	13	< 3
Prosser to Paterson - McNary	7	< 3	4	< 3	< 3	< 3
Eastern Washington	7	< 3	< 3	< 3	< 3	< 3
So. Washington and No. Oregon	< 3	< 3	< 3	< 3	11	< 3

[redacted]

TABLE VIII

RADIOACTIVE CONTAMINATION FROM NON-VOLATILE BETA PARTICLE EMITTERS ON VEGETATION

JANUARY, FEBRUARY, MARCH

1957

Units of 10^{-6} $\mu c/gm$

Location	January		February		March	
	Max.	Avg.	Max.	Avg.	Max.	Avg.
Project						
200-West Area	460	120	440	130	390	95
200-West - Redox	80	65	160	120	470	160
200-West - Gate	100	77	190	83	170	78
Meteorology Tower	94	57	110	73	110	73
Batch Plant	180	90	93	64	110	67
200-East Area	260	95	340	130	260	89
200-East - Purex	540	110	120	61	570	81
Near 200 Areas	140	64	180	77	550	110
North of 200 Areas	760	63	190	75	270	89
South of 200 Areas	290	68	270	65	280	90
PSN 50-51-61	76	53	87	69	81	58
Goose Egg Hill	140	64	200	60	150	56
Wahluke Slope	410	73	120	65	120	69
Off Project						
Pasco to Ringold	230	69	170	83	95	54
Richland	77	57	74	44	93	49
Benton City - Kiona	51	46	65	44	190	90
Kennewick Environs	190	66	99	54	260	70
Pasco Environs	310	66	170	60	1240	150
Prosser to Paterson - McNary	460	80	190	57	160	59
Eastern Washington	500	98	370	96	1250	100
So. Washington and No. Oregon	330	75	210	53	270	67

[redacted]

TABLE IX

RADIOACTIVE CONTAMINATION FROM ALPHA PARTICLE EMITTERS ON VEGETATION JANUARY, FEBRUARY, MARCH 1957

Units of 10^{-7} $\mu c/gm$

Location	January Average	February Average	March Average	Quarter Maximum	Quarter Average
Near 200 Areas					
200-West Gate	19	11	20	25	16
Meteorology Tower	5	4.8	3.1	6.8	4.3
Batch Plant	1.6	6.8	5.2	10	4.1
Rt. 4S, Mi. 4	2.1	2.9	3.4	4.1	2.8
Rt. 4S, Mi. 6	3.3	1.5	2.7	3.7	2.5
Outlying					
Pasco	2.7	1.4	<1.0	2.7	1.5
Benton City	<1.0	<1.0	<1.0	1.0	<1.0

[redacted]

TABLE X

AVERAGE DOSE RATES MEASURED BY IONIZATION CHAMBERS
JANUARY, FEBRUARY, MARCH
1957

Units of mrad Per Day*

Location	Integrons and HM Chambers Quarterly Average	Integrons and HM Chambers Average Last Quarter	Detachable Chambers Quarterly Average	Detachable Chambers Average Last Quarter
100 Areas and Vicinity	5.1	5.2	1.3	1.0
200 Areas and Vicinity	3.4	4.1	1.4	1.2
300 - 3000 Areas and Vicinity	2.1	3.2	2.0	1.1
Benton City	5.8	1.6	---	---
Tri-City Area	0.7	2.2	---	---

* Includes normal background meansurements.

[redacted]

TABLE XI

RADIOACTIVE PARTICULATE MATERIALS FILTERED FROM AIR

JANUARY, FEBRUARY, MARCH

1957

Location	Beta Particle Emitters Units of 10^{-14} $\mu c/ml$		Concentration of Radioactive Particles Units of 10^{-3} Particles/m^3	
	Quarterly Average	Average Last Quarter	Quarterly Average	Average Last Quarter
100 Areas and Vicinity	28	54	9	100
200 Areas and Vicinity	33	45	16	110
300 - 3000 Areas and Vicinity	28	50	18	90
Benton City	23	24	8	73
Tri-Cities	14	42	13	140
Seattle, Wn.	--	--	17	80
Spokane, Wn.	--	--	23	190
Walla Walla, Wn.	--	--	33	210
Yakima, Wn.	--	--	20	110
Boise, Idaho	--	--	34	260
Lewiston, Idaho	--	--	12	180
Great Falls, Mont.	--	--	43	110
Meacham, Ore.	--	--	8	97
Klamath Falls, Ore.	--	--	41	220

[redacted]

TABLE XII

CONCENTRATIONS OF IODINE DETECTED BY AIR SCRUBBERS
JANUARY, FEBRUARY, MARCH
1957

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

Location	January	February	March	Qtrly. Avg.	Wkly. Max.	Avg. Last Qtr.
100 Areas and Vicinity	<0.1	<0.1	<0.1	<0.1	0.4	<0.1
200 Areas and Vicinity	0.3	0.2	0.3	0.25	1.9	<0.2
300 Area and Vicinity	<0.1	<0.1	<0.1	<0.1	0.2	<0.1
Benton City	<0.1	0.1	<0.1	<0.1	0.2	<0.1
Tri-Cities	<0.1	<0.1	<0.1	<0.1	0.2	<0.1

TABLE XIII

BETA PARTICLE EMITTERS DISCHARGED TO RIVER
IN REACTOR EFFLUENT WATER
JANUARY, FEBRUARY, MARCH
1957

Units of 10^{3} $\mu c/sec$

Location	No. Samples	January		February		March		Quarterly	
		Max.	Avg.	Max.	Avg.	Max.	Avg.	Max.	Avg.
100-B	54	31	16	21	14	19	12	31	14
100-C	57	51	37	33	27	51	32	51	32
100-KW	51	53	38	49	33	77	52	77	41
100-KE	56	39	25	65	37	63	40	65	34
100-D	35	17	12	19	11	--	--	19	8
100-DR	43	9	4	7	2	32	19	32	8
100-H	61	21	15	29	21	44	25	44	20
100-F	59	16	12	24	14	32	23	32	17

[redacted]

TABLE XIV

RADIOACTIVE CONTAMINATION IN 200 AREA WASTE SYSTEMS

JANUARY, FEBRUARY, MARCH

1957

Liquid Samples

Location	Alpha Particle Emitters Units of 10^{-8} $\mu c/ml$ Maximum	Alpha Average	Alpha Average Last Quarter	Beta Particle Emitters Units of 10^{-7} $\mu c/ml$ Maximum	Beta Average	Beta Average Last Quarter
T-Ditch	<0.5	<0.5	<0.5	27	9.0	80
T-Swamp	<0.5	<0.5	<0.5	110	1.9	140
Laundry Ditch	11	0.9	1.0	<5.0	<5.0	8.3
U-Ditch Inlet	37	4.7	2.6	25	<5.0	490
231 Ditch	12	2.9	200	<5.0	<5.0	4.7
234-5 Ditch	2.6	<0.5	6.5	<5.0	<5.0	4.3
U-Swamp	150	34	9.2	380	74	510
B-Ditch	<0.5	<0.5	<0.5	<5.0	<5.0	5.8
B-Swamp	<0.5	<0.5	<0.5	<5.0	<5.0	5.6
Purex	11	0.8	1.2	<5.0	<5.0	9.1
222-S Swamp	38	14	21	30	6.8	7.1

Solid Samples

Location	Alpha Units of 10^{-6} $\mu c/gm$ Maximum	Alpha Average	Alpha Average Last Quarter	Beta Units of 10^{-5} $\mu c/gm$ Maximum	Beta Average	Beta Average Last Quarter
T-Ditch	18	9.6	13	5200	2700	5200
Laundry Ditch	8.2	5.8	4.6	170	25	23
234-5 Ditch	1200	380	690	4.1	2.8	4.2
B-Swamp	1.2	0.6	1.2	11	3.7	6.5
Purex	16,000	830	790	30	5.3	5.6
222-S Swamp	520	160	220	290	100	260

[redacted]

TABLE XV

RADIOACTIVE CONTAMINATION IN 200 AREA WASTE SYSTEMS
JANUARY, FEBRUARY, MARCH
1957

Liquid Samples

Location	Uranium Units of 10^{-9} $\mu c/ml$ Maximum	Average	Average Last Quarter
U-Swamp	1600	310	49
Laundry Ditch	120	6.8	13
U-Ditch	280	34	22
222-S Swamp	330	97	150

Solid Samples

Location	Units of 10^{-6} $\mu c/gm$ Maximum	Average	Average Last Quarter
Laundry Ditch	110	20	1.1
222-S Swamp	200	78	110

TABLE XVI

RADIOACTIVE CONTAMINATION IN 300 AREA POND INLET
JANUARY, FEBRUARY, MARCH
1957

Units of 10^{-8} $\mu c/ml$

Liquid Samples	Maximum	Average	Average Last Quarter
Beta Particle Emitters	1800	120	310
Alpha Particle Emitters	270	50	94
Uranium	480	78	83
Plutonium	2.3	0.32	1.4

[redacted]

TABLE XVII

CONCENTRATIONS OF BETA PARTICLE EMITTERS IN RIVER WATER
JANUARY, FEBRUARY, MARCH
1957

Units of 10^{-8} $\mu c/ml$

Location	January Average	February Average	March Average	Quarter Average	Average Last Quarter
Columbia River					
Wills Ranch	< 5	< 5	< 5	< 5	< 5
181-B	< 5	< 5	< 5	< 5	< 5
181-C	< 5	5	< 5	< 5	< 5
181-KW	670	460	490	540	250
181-KE	850	180	960	660	320
181-D	2270	1260	3350	2290	1000
181-H	2590	2270	2170	2350	1570
Below 100-H	2260	2630	1810	2230	2310
181-F	3690	3370	3510	3530	2180
Below 100-F	3630	2790	3230	3130	2190
Hanford	3830	4690	3550	4020	2860
300 Area	1660	1610	1760	1680	1040
Byer's Landing	1290	1010	920	1070	700
Richland	1070	1090	1070	1080	800
Kennewick Highlands Pumping Station	780	900	670	780	520
Pasco Bridge (Kennewick side)	640	680	700	640	510
Pasco Bridge (Pasco side)	710	720	600	710	480
Pasco Filter Plant Pumping Station	1080	960	930	990	620
Sacajawea Park	520	330	560	470	300
Below McNary Dam	86	96	80	87	59
Paterson	92	96	110	100	59
Snake River					
Mouth	< 5	< 5	5	< 5	< 5
Yakima River					
Prosser	< 5	< 5	< 5	< 5	< 5
Shore	< 5	12	< 5	6	< 5
Mouth	< 5	< 5	< 5	< 5	5

[redacted]

TABLE XVIII

CONCENTRATIONS OF BETA PARTICLE EMITTERS IN RAW WATER

RIVER EXPORT LINE

JANUARY, FEBRUARY, MARCH

1957

Units of 10^{-8} $\mu c/ml$

Location	January Average	February Average	March Average	Quarter Average	Average Last Quarter
183-B	8	7	5	7	6
183-C	<5	9	11	8	<5
183-KW	480	360	650	500	260
183-KE	780	370	530	560	300
183-D	2230	870	2250	1780	1080
183-DR	2210	1500	1800	1840	1010
183-H	2840	2100	2640	2530	1540
183-F	2710	2200	2860	2600	1510
283-East	14	25	15	18	410
283-West	15	14	11	13	350

[redacted]

TABLE XIX

361-B REVERSE WELL AND 5-6 CRIB SITES, WELL ACTIVITY DENSITIES JANUARY, FEBRUARY, MARCH 1957

Well	Beta Emitters Units of 10^{-8} $\mu c/ml$ Maximum	Beta Emitters Units of 10^{-8} $\mu c/ml$ Average	Uranium Units of 10^{-9} $\mu c/ml$ Maximum	Uranium Units of 10^{-9} $\mu c/ml$ Average
299-E23-1	< 20	< 20	6.2	5.1
299-E26-1	< 20	< 20	< 2.0	< 2.0
299-E27-1	< 20	< 20	2.6	< 2.0
299-E28-1	36	21	5.5	2.6
299-E28-2	< 20	< 20	---	---
299-E28-3	88	24	2.7	< 2.0
299-E28-4	36	< 20	< 2.0	< 2.0
299-E28-5	240	170	< 2.0	< 2.0
299-E28-6	60	32	---	---
299-E28-7	49	21	38	26

[redacted]

TABLE XX

B-PLANT 2ND CYCLE AND BY CRIB SITES, WELL ACTIVITY DENSITIES JANUARY, FEBRUARY, MARCH 1957

Location	Beta Emitters Units of $\mu c/ml$ Maximum	Beta Emitters Units of $\mu c/ml$ Average	Uranium Units of 10^{-9} $\mu c/ml$ Maximum	Uranium Units of 10^{-9} $\mu c/ml$ Average
299-E33-1	3.8×10^{-2}	2.9×10^{-2}	33	< 2.0
299-E33-2	8.5×10^{-3}	7.0×10^{-3}	21	< 2.0
299-E33-3	9.0×10^{-2}	5.4×10^{-2}	3.6	3.3
299-E33-4	1.5×10^{-2}	1.2×10^{-2}	3.4	2.4
299-E33-5	2.0×10^{-2}	1.7×10^{-2}	4.9	4.3
299-E33-6	2.2×10^{-6}	1.9×10^{-6}	< 2.0	< 2.0
299-E33-7	4.4×10^{-2}	3.3×10^{-2}	3.8	2.9
299-E33-8	6.0×10^{-7}	5.3×10^{-7}	< 2.0	< 2.0
299-E33-10	3.9×10^{-6}	1.6×10^{-6}	< 2.0	< 2.0
299-E33-11	2.6×10^{-3}	1.7×10^{-3}	< 2.0	< 2.0
299-E33-12	4.0×10^{-2}	3.2×10^{-2}	5.6	2.7
299-E33-13	2.5×10^{-2}	2.2×10^{-2}	2.3	2.2
299-E33-14	2.5×10^{-4}	2.1×10^{-4}	2.2	< 2.0
299-E33-15	1.7×10^{-2}	1.4×10^{-2}	5.0	4.0
299-E33-16	1.5×10^{-2}	1.0×10^{-2}	5.3	3.9
299-E33-17	1.8×10^{-2}	1.6×10^{-2}	< 2.0	< 2.0
299-E33-18	4.3×10^{-5}	3.1×10^{-5}	13.2	13.1
299-E33-19	1.1×10^{-4}	3.9×10^{-5}	60	50
299-E33-20	1.7×10^{-4}	1.3×10^{-4}	6.6	5.3

[redacted]

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TABLE XXI

PUREX AND ADJACENT WELL ACTIVITY DENSITIES

JANUARY, FEBRUARY, MARCH

1957

Location	Beta Emitters Units of $\mu c/ml$ Maximum	Beta Emitters Units of $\mu c/ml$ Average	Uranium Units of 10^{-9} $\mu c/ml$ Maximum	Uranium Units of 10^{-9} $\mu c/ml$ Average
299-E17-1	$<2.0 \times 10^{-7}$	$<2.0 \times 10^{-7}$	3.2	<2.0
299-E24-1	$<2.0 \times 10^{-7}$	$<2.0 \times 10^{-7}$	2.9	2.4
299-E24-3	2.3×10^{-6}	8.9×10^{-7}	<2.0	<2.0
299-E24-5	$<2.0 \times 10^{-7}$	$<2.0 \times 10^{-7}$	<2.0	<2.0
299-E24-7	$<2.0 \times 10^{-7}$	$<2.0 \times 10^{-7}$	<2.0	<2.0
299-E25-1	3.8×10^{-6}	1.8×10^{-6}	<2.0	<2.0
299-E25-2	3.2×10^{-5}	1.9×10^{-5}	2.4	<2.0
299-E25-3	$<2.0 \times 10^{-7}$	$<2.0 \times 10^{-7}$	<2.0	<2.0
299-E25-4	1.8×10^{-5}	9.6×10^{-6}	<2.0	<2.0
299-E25-5	1.7×10^{-3}	1.2×10^{-3}	<2.0	<2.0
299-E25-6	4.9×10^{-4}	2.3×10^{-4}	<2.0	<2.0
299-E25-7	2.2×10^{-3}	1.2×10^{-3}	2.4	<2.0
299-E25-8	4.9×10^{-7}	4.9×10^{-7}	<2.0	<2.0
299-E25-9	1.4×10^{-6}	4.7×10^{-7}	<2.0	<2.0
699-19-43	$<2.0 \times 10^{-7}$	$<2.0 \times 10^{-7}$	<2.0	<2.0
699-25-56	$<2.0 \times 10^{-7}$	$<2.0 \times 10^{-7}$	<2.0	<2.0
699-31-30	$<2.0 \times 10^{-7}$	$<2.0 \times 10^{-7}$	<2.0	<2.0
699-34-39	2.1×10^{-7}	$<2.0 \times 10^{-7}$	<2.0	<2.0
699-34-51	2.9×10^{-7}	$<2.0 \times 10^{-7}$	<2.0	<2.0
699-35-70	2.1×10^{-5}	1.7×10^{-6}	2.2	<2.0
699-36-61	8.2×10^{-7}	5.9×10^{-7}	<2.0	<2.0
699-42-42	$<2.0 \times 10^{-7}$	$<2.0 \times 10^{-7}$	<2.0	<2.0
699-45-69	2.4×10^{-7}	$<2.0 \times 10^{-7}$	2.3	<2.0
699-47-60	$<2.0 \times 10^{-7}$	$<2.0 \times 10^{-7}$	2.1	<2.0
699-54-57	$<2.0 \times 10^{-7}$	$<2.0 \times 10^{-7}$	<2.0	<2.0

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TABLE XXII

T-PLANT CRIB SITES, WELL ACTIVITY DENSITIES
JANUARY, FEBRUARY, MARCH
1957

Location	Beta Emitters Units of $\mu c/ml$		Uranium Units of 10^{-9} $\mu c/ml$	
	Maximum	Average	Maximum	Average
299-W10-1	2.7×10^{-7}	$< 2.0 \times 10^{-7}$	3.1	< 2.0
299-W10-2	1.2×10^{-4}	9.0×10^{-5}	26	21
299-W10-3	1.5×10^{-5}	6.4×10^{-6}	26	18
299-W10-4	2.2×10^{-5}	2.0×10^{-5}	4.6	3.0
299-W10-5	3.5×10^{-7}	$< 2.0 \times 10^{-7}$	2.0	< 2.0
299-W11-11	4.9×10^{-5}	3.9×10^{-5}	17	16
299-W11-12	1.4×10^{-6}	8.8×10^{-7}	< 2.0	< 2.0
299-W14-1	9.6×10^{-6}	7.9×10^{-6}	12.3	8.5
299-W14-2	1.5×10^{-5}	1.1×10^{-5}	14.6	12
299-W15-1	8.2×10^{-7}	3.5×10^{-7}	< 2.0	< 2.0
299-W15-2	$< 2.0 \times 10^{-7}$	$< 2.0 \times 10^{-7}$	< 2.0	< 2.0
299-W15-3	2.5×10^{-5}	1.4×10^{-5}	14.3	13.8
299-W15-4	4.3×10^{-4}	3.7×10^{-4}	< 2.0	< 2.0

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TABLE XXIII

361-T REVERSE WELL SITE, WELL ACTIVITY DENSITIES
JANUARY, FEBRUARY, MARCH
1957

	Beta Emitters Units of 10^{-8} $\mu c/ml$		Uranium Units of 10^{-9} $\mu c/ml$	
Location	Maximum	Average	Maximum	Average
299-W10-10	220	36	< 2.0	< 2.0
299-W11-1	< 20	< 20	2.5	2.2
299-W11-2	81	< 20	2.0	< 2.0
299-W11-3	29	< 20	< 2.0	< 2.0
299-W11-4	110	50	3.7	< 2.0
299-W11-5	54	40	2.9	2.4
299-W11-6	53	24	< 2.0	< 2.0
299-W11-7	63	< 20	< 2.0	< 2.0
299-W11-8	22	< 20	< 2.0	< 2.0
299-W11-9	100	25	< 2.0	< 2.0
299-W11-51	49	< 20	< 2.0	< 2.0
299-W12-1	60	< 20	< 2.0	< 2.0

[redacted]

TABLE XXIV

REDOX CRIB SITES, WELL ACTIVITY DENSITIES
JANUARY, FEBRUARY, MARCH
1957

Location	Beta Emitters Units of $\mu c/ml$ Maximum	Average	Uranium Units of 10^{-9} $\mu c/ml$ Maximum	Average
299-W22-4	1.0×10^{-4}	3.3×10^{-5}	< 2.0	< 2.0
299-W22-5	1.3×10^{-2}	1.0×10^{-2}	4.0	3.0
299-W22-6	1.3×10^{-6}	$< 2.0 \times 10^{-7}$	6.6	5.8
299-W22-7	3.9×10^{-7}	2.7×10^{-7}	< 2.0	< 2.0
299-W22-8	2.2×10^{-7}	$< 2.0 \times 10^{-7}$	< 2.0	< 2.0
299-W22-9	2.5×10^{-7}	$< 2.0 \times 10^{-7}$	< 2.0	< 2.0
299-W22-10	7.1×10^{-4}	6.1×10^{-4}	< 2.0	< 2.0
299-W22-11	$< 2.0 \times 10^{-7}$	$< 2.0 \times 10^{-7}$	3.0	2.4
299-W22-12	4.4×10^{-3}	3.3×10^{-3}	7.0	6.3
299-W22-13	8.3×10^{-3}	6.4×10^{-3}	< 2.0	< 2.0
299-W22-14	8.3×10^{-3}	6.5×10^{-3}	6.1	5.3
299-W22-15	1.2×10^{-2}	8.3×10^{-3}	7.7	6.5
299-W22-16	3.6×10^{-5}	3.1×10^{-5}	4.5	4.0
299-W22-17	3.8×10^{-4}	3.8×10^{-4}	3.9	3.7
299-W22-64	4.2×10^{-3}	4.2×10^{-3}	2.0	2.0
299-W23-1	2.5×10^{-6}	3.0×10^{-7}	2.1	2.1
299-W23-2	1.9×10^{-6}	7.6×10^{-7}	3.0	2.4
299-W23-3	7.7×10^{-7}	6.6×10^{-7}	3.8	3.2
299-W26-2	9.4×10^{-6}	3.7×10^{-6}	< 2.0	< 2.0
299-W26-3	1.3×10^{-6}	3.8×10^{-7}	< 2.0	< 2.0

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TABLE XXV

CONCENTRATIONS OF ALPHA AND BETA PARTICLE EMITTERS IN WATER SUPPLIES JANUARY, FEBRUARY, MARCH 1957

Location	No. Samples	Alpha Particle Emitters Units of 10^{-9} $\mu c/ml$		Beta Particle Emitters Units of 10^{-8} $\mu c/ml$	
		Max.	Avg.	Max.	Avg.
Mattawa Chev. Station	10	< 5	< 5	< 5	< 5
Midway and Vicinity	31	< 5	< 5	6	< 5
100-B Area	13	< 5	< 5	16	11
100-C Area	13	< 5	< 5	22	10
100-K Area	13	< 5	< 5	450	180
100-D Area	13	< 5	< 5	1400	680
100-DR Area	13	< 5	< 5	1600	610
100-H Area	13	< 5	< 5	1100	450
100-F Area	14	< 5	< 5	1700	690
White Bluff's Fire Hall	13	< 5	< 5	170	32
PSN 21	13	10	8	< 5	< 5
B-Y Well	11	< 5	< 5	< 5	< 5
251 Building	13	< 5	< 5	170	22
200-East Area	39	< 5	< 5	28	10
200-West Area	52	< 5	< 5	24	9
300 Area, 3000 Area (San)	25	< 5	< 5	8	< 5
Byer's Landing Pump Station	11	< 5	< 5	< 5	< 5
Larson Farm	13	6	< 5	6	< 5
Richland	33	6	< 5	8	< 5
Prosser	13	< 5	< 5	12	< 5
Benton City	26	14	7	6	< 5
Headgate Well	13	< 5	< 5	11	< 5
Enterprise	14	9	< 5	< 5	< 5
Kennewick	62	< 5	< 5	760	210
Pasco	32	< 5	< 5	520	86
Sacajawea	12	10	7	7	< 5
McNary	26	< 5	< 5	5	< 5
Paterson Store	13	8	6	< 5	< 5

TABLE XXVI

CONCENTRATIONS OF ALPHA PARTICLE EMITTERS IN DRINKING WATER JANUARY, FEBRUARY, MARCH 1957

Location	No. Samples	Alpha Particle Emitters Units of 10^{-9} $\mu c/ml$ Max.	Avg.	No. Samples	Uranium Units of 10^{-9} $\mu c/ml$ Max.	Avg.
Columbia Field (San)	11	<5	<5	13	6	2
B-Y Well	11	<5	<5	11	4	2
PSN 21	13	10	8	13	9	8
Lee Blvd. (San)	12	6	<5	12	6	4
Benton City Store	12	14	11	12	12	9
Benton City Water Company	1	9	9	1	6	6
Sacajawea	12	10	7	12	9	7
Paterson Store	13	8	6	13	9	6

TABLE XXVII

CONCENTRATIONS OF BETA PARTICLE EMITTERS AT THE PASCO FILTER PLANT JANUARY, FEBRUARY, MARCH 1957

Type Sample	No. Samples	Maximum	Average
Water Entering Plant from River	37	2.9×10^{-5} $\mu c/ml$	9.9×10^{-6} $\mu c/ml$
Filter Bed Material	13	5.7×10^{-4} $\mu c/gm$	2.3×10^{-4} $\mu c/gm$
Backwash Activity (Soluble)	13	9.9×10^{-5} $\mu c/ml$	1.1×10^{-5} $\mu c/ml$
Backwash Activity (Insoluble)	11	3.5×10^{-1} $\mu c/gm$	1.2×10^{-1} $\mu c/gm$
Foam from Filter Beds	0	---	---
Water Leaving Plant	19	5.2×10^{-6} $\mu c/ml$	2.6×10^{-6} $\mu c/ml$

[redacted]

APPENDIX B

Figures 1 through 4

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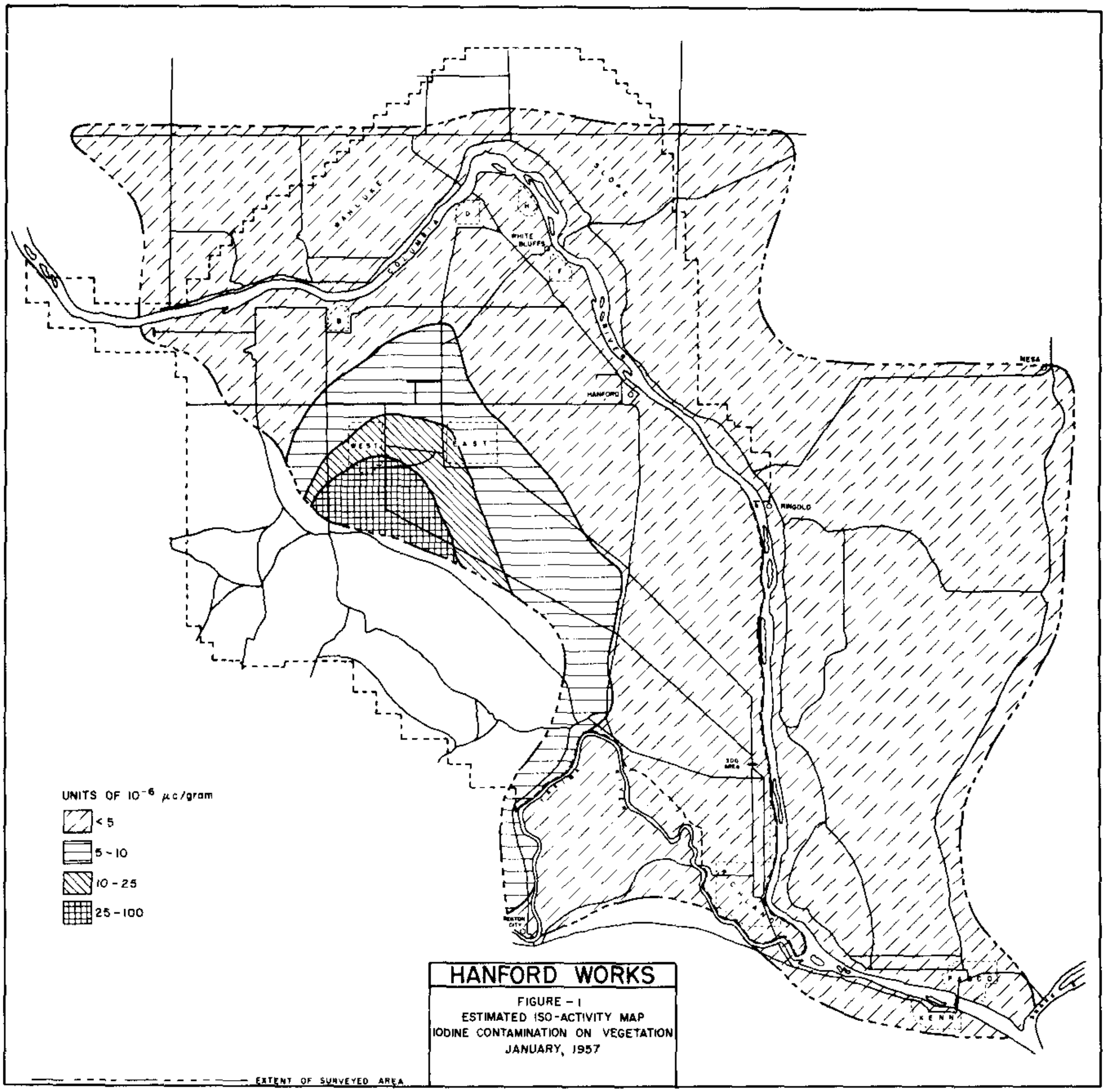
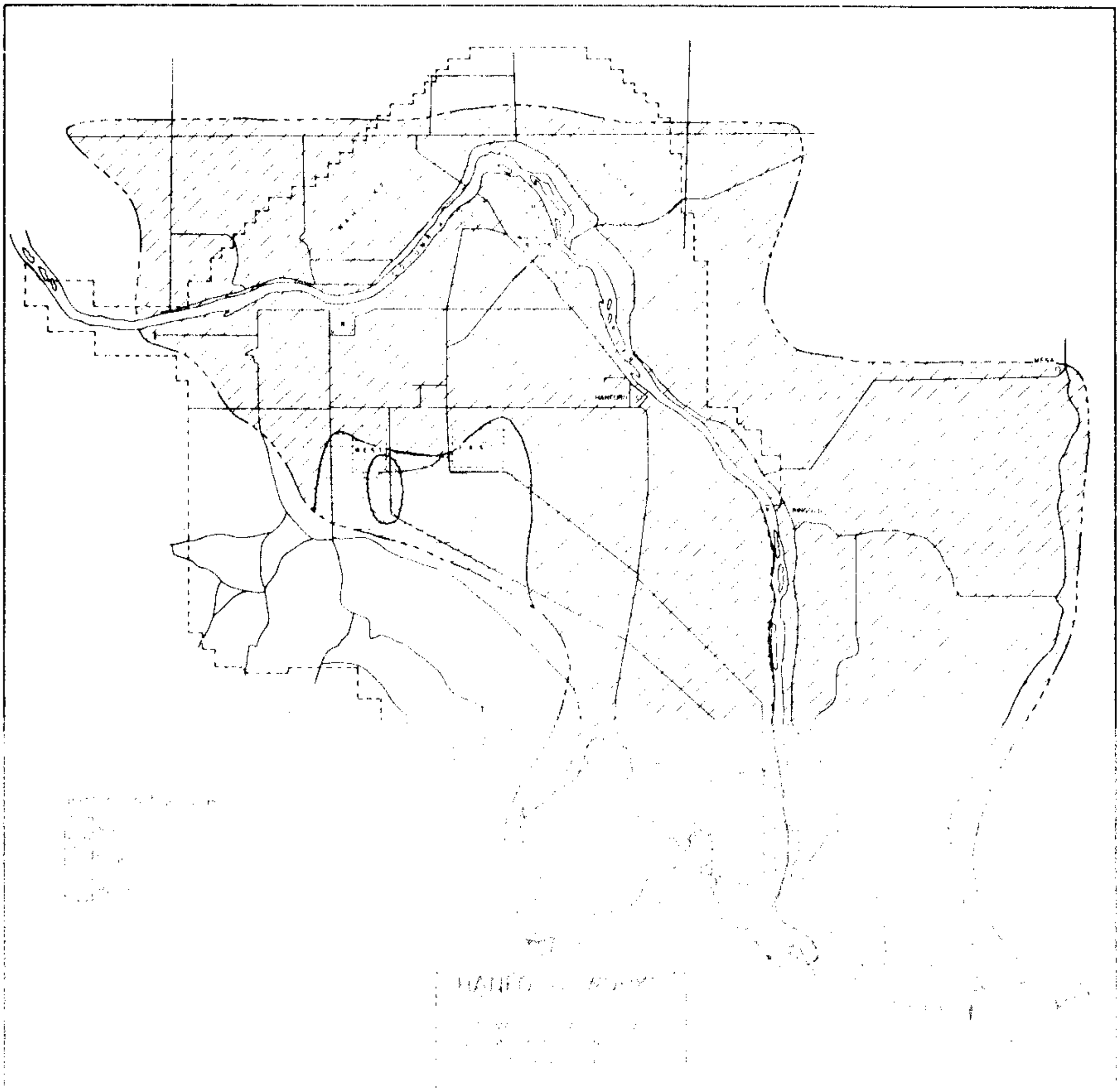

UNITS OF 10^-6 μc/gram
< 5
5 - 10
10 - 25
25 - 100
HANFORD WORKS
FIGURE - I
ESTIMATED ISO-ACTIVITY MAP
IODINE CONTAMINATION ON VEGETATION
JANUARY, 1957
EXTENT OF SURVEYED AREA
WHITE BLUFFS
HANFORD
RINGOLD
MESA
WEST
EAST
BENTON CITY

[redacted]



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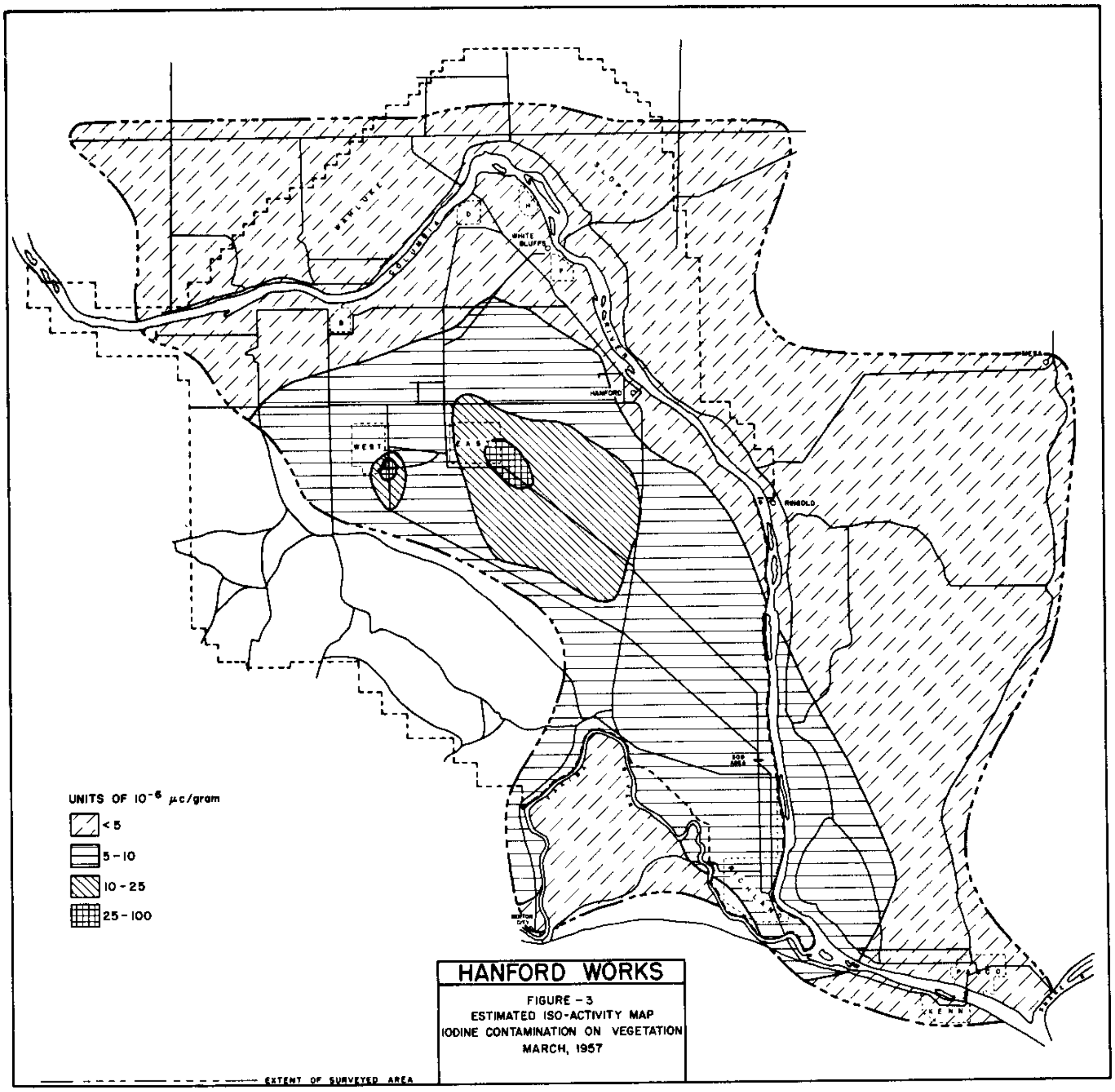

HANFORD WORKS

FIGURE - 3
ESTIMATED ISO-ACTIVITY MAP
IODINE CONTAMINATION ON VEGETATION
MARCH, 1957

[redacted]

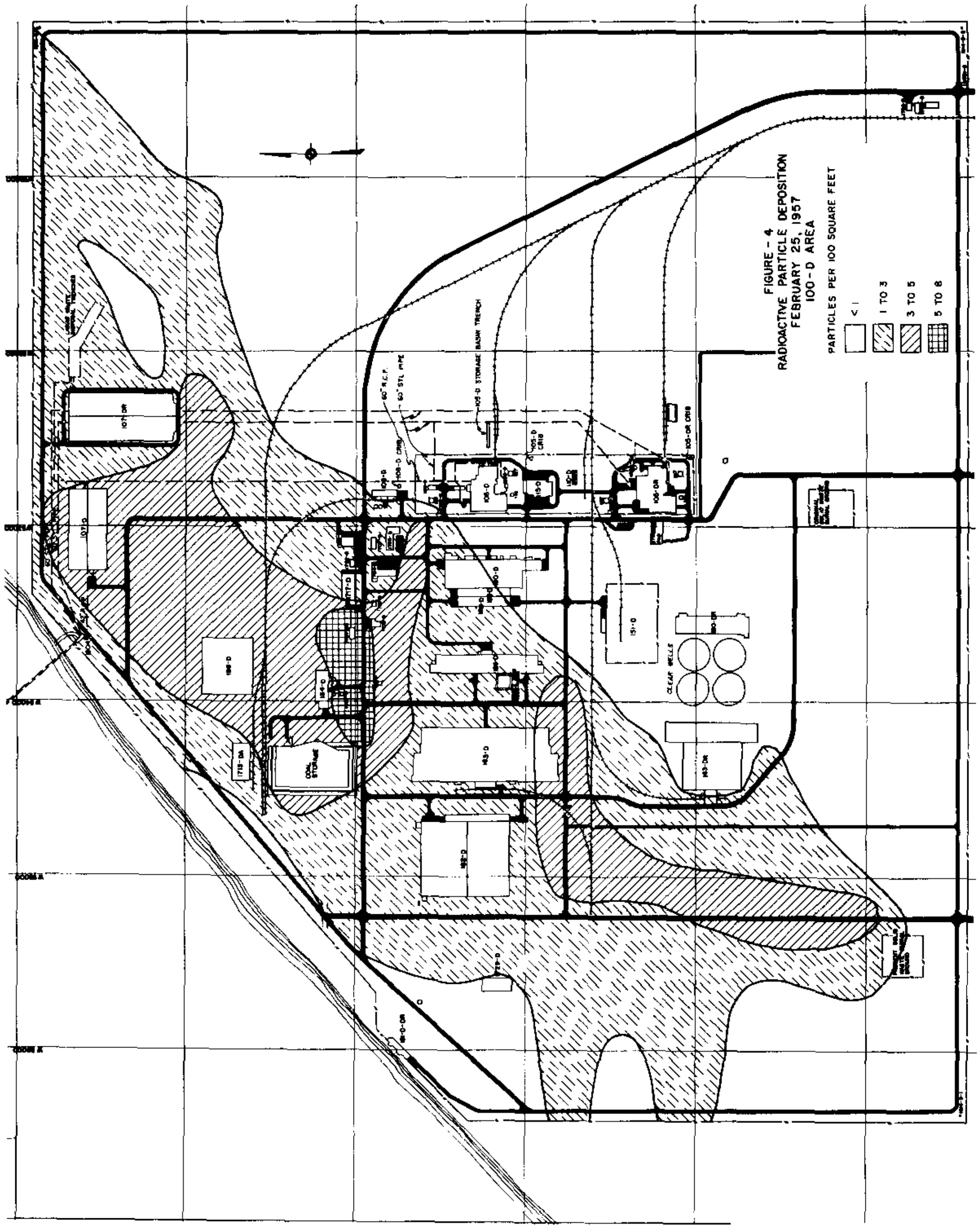
FIGURE - 4
RADIOACTIVE PARTICLE DEPOSITION
FEBRUARY 25, 1957
100-D AREA
PARTICLES PER 100 SQUARE FEET
< 1
1 TO 3
3 TO 5
5 TO 8
CLEAR WELLS
COAL STORAGE
105-D
105-DR
151-D
183-D
182-D
183-DR
107-DR
107-D
105-D STORAGE BASIN TRENCH

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