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ABC RESEARCH AND DEVELOPMENT REPORT

Technology - Hanford

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RADIOACTIVE CONTAMINATION IN THE ENVIRONS OF THE HANFORD WORKS FOR THE PERIOD OCTOBER, NOVEMBER, DECEMBER, 1948

By

W. Singlevich and H. J. Paas
June 22, 1949

DEVELOPMENT DIVISION
HEALTH INSTRUMENT DIVISIONS
GENERAL ELETRIC COMPANY
HANFORD WORKS

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RADIOACTIVE CONTAMINATION IN THE ENVIRONS OF THE HANFORD WORKS FOR THE QUARTER OCTOBER, NOVEMBER, DECEMBER 1948.

INTRODUCTION:

The radioactive contamination detected in various media at the Hanford Works and vicinity for the quarter October, November and December, 1948 is summarized in this report; individual monthly summations of these measurements are included in the H. I. Environs Monthly reports issued to the Hanford Files.

ABSTRACT:

Section I - Meteorological Data:

No outstanding changes from meteorological conditions previously observed were noted during this quarter. The wind prevailed from the northwest in the separations area with more varied wind directions in the vicinity of the 100 Areas. Complete summaries of the wind directions, wind velocities and atmospheric dilution factors as measured during hours of irradiated uranium dissolution are included.

Section II- Airborne Contamination and Air Radiation Levels:

Complete data summarizing the radioactive contamination detected in the atmosphere using detachable ionization chambers, integrons, and air filter devices is included. No significant trends or changes were noted in comparing the current activity levels with that of the previous period; small changes noted are discussed. Radioautographs of filters indicate less "stack discharge" active particles in the atmosphere in the vicinity of Hanford, particularly during December. Tables summarizing the measurements for active particles are included.

Section III- Alpha and Beta Contamination In the Columbia River:

The flow trend of the Columbia River during this period is discussed; the average flow rate was 518,000 gallons per second. The average beta-gamma emitters measured in Columbia River samples varied from less than 50 μμc/liter above the 100-B Area to 1329 μμc/liter near the south bank of the river near Hanford; the average at Pasco was 260 μμc/liter. These results are higher by factors of 2 to 3 at most locations in the river as compared with the results of the previous quarter. Over ninety per cent of this activity is from 14.8 hour sodium (Na^{24}). No alpha activity was detected in the river samples. A cross section survey of the river between the 300 Area and Richland indicated that the radioactive contamination in the river was relatively well dispersed. Radioactivity in mud samples taken from the banks of the Columbia are tabulated with some discussion of results; no significant trends were noted. A complete summary of the 300 Area waste pond dike break is included. Calculations based on rough estimations indicated that about 12 to 61 pounds of uranium were discharged into the Columbia River on October 25, 1948 over a period of 1 1/2 hours. A study of about 500 river samples taken from near Richland as far down the river as Portland, Oregon indicated that no uranium exceeding that which could be detected as natural background was measured in any of the samples. Indications of levels above background were detected in the river

[redacted]

just below the 300 Area. Summaries of some of the correlation studies of some of the above data are included in Figures 9, 10, and 11.

Section IV- Beta Contamination in Rain and Snow:

No outstanding changes or trends were noted in the radioactivity detected in rain samples during this period. An isoactivity map of the estimated distribution of the separation stack effluent during one snowfall is included.

Section V- Alpha and Beta Contamination In Drinking Water:

The results of the assay of one thousand and eleven samples of drinking water for radioactive contamination are discussed and tabulated. The results during this period remained essentially the same as found in the last period.

Section VI- Beta Contamination on Vegetation:

Small decreases in the overall deposition of radioactive wastes from the separations area stack on vegetation was observed during this period as compared with the previous three months. An isoactivity chart summarizing the estimated distribution of stack effluent wastes on vegetation in the environs of the Hanford Works is included. All results for assay of radioactive contamination in vegetation at representative sampling locations are tabulated. New methods of analyses for I^{131} in vegetation are summarized (sensitivity limit, 2 $\mu\mu c$ I^{131}/kg vegetation). Analyses for non-volatile emitters (fission product isotopes) indicate a probable background level of 10 $\mu\mu c$/kg due to natural occurring K^{40} in vegetation in this area.

Section VII- Alpha and Beta Contamination in Hanford Wastes:

The levels of radioactive contamination measured in the 100, 200, and 300 Area waste systems are reviewed; no outstanding changes or trends were noted in comparing the results of this period with those of previous surveys.

[redacted]

SECTION I

METEOROLOGICAL DATA

The meteorological conditions for the period October, November, and December, 1948, observed at the Meteorology Station (622 Building) during the time of metal dissolution are summarized graphically on Figures 1 through 4. The original meteorological measurements were made by the Meteorology Group of the Health Instrument Division. Figure 1 presents the three month average wind direction data for the dissolving hours as observed using an eight point compass. As in the past, the northwest quadrant prevailed at the 200-West meteorology tower station, with the wind coming from the northwest and west directions over fifty per cent of the time. This predominant wind direction is reflected in the iso-activity pattern of the land and air contamination. (See Figure 20). Figure 2 summarizes the average monthly wind directions at the Meteorology Tower. The monthly average wind directions during October and December were in good agreement with the three month average; however, during November, a noticeable increase in the wind prevailing from the southwest direction was observed; the wind from the northwest quadrant decreased. These month-to-month wind direction trends are reflected on the vegetation contamination patterns as shown by the monthly iso-activity maps and, occasionally, on the pattern of measured activity on samples from the Wahluke Slope, where trace quantities of eight day iodine were detected when the southwest wind prevailed. In general, the higher wind velocities accompanied the wind from the southwest.

Figure 3 summarizes the wind direction data as recorded about twenty feet above the ground at the 100 Areas and fifty foot above the ground at the 200 West Area. A comparison of the data within months indicated that the wind in the 100 Areas tended to prevail from a more southerly direction than it did at the 200 West Meteorology Station with the overall prevailing direction predominating from the west. The wind

[redacted]

from the northwest occurred considerably less than the significant prevailing directions in the 100 Areas. The amount of wind from the east recorded in the 100 Areas is about twice that recorded at the Meteorology Station. This wind condition could account for the radioactive contamination on vegetation occasionally found in the general vicinity of Riverland and Midway. Figure 4 is a graphic summation of the atmospheric dilution factors as observed during the hours of metal dissolution in the separations area. It is noteworthy to emphasise that the aloft condition prevailed in excess of 75% of the time during October and November, and decreased to an average of 45% of the time during December. The low dilution ratios during the dissolving of uranium increased from about 4% in November to 8% in December. This change observed in December was apparently due to the increased amount of dissolving during the daylight hours as these hours are usually the periods in which low dilutions usually occur.

Table I presents the mean wind velocities as recorded at each of the meteorological stations. This mean represents the average of all directions on a monthly basis.

TABLE I
WIND VELOCITY MEANS AS OBSERVED
DURING
OCTOBER - NOVEMBER - DECEMBER
1948
DURING HOURS OF METAL DISSOLUTION
(Miles per Hour)

Period	200-West	100-B	100-D	100-F
October	- -*	4.9	3.8	4.1
November	- -*	5.4	6.1	4.5
December	10.7	6.7	3.4	4.8
Period Average	- -	5.6	4.4	4.5

*The wind velocities at the Meteorology Tower were not recorded during the month of October and November.

There were three occasions during the latter part of November when the wind velocity exceeded 30 miles per hour at the 622 building (Meteorology Station). The

[redacted]

high velocities were measured on one occasion between 4:00 PM and 12:00 M and on the other between 12:00 M and 9:00 AM. Several other above average velocities were observed during this period; however, they did not occur during the period of metal dissolution. For details of the meteorological conditions based on an overall twenty four hour basis rather than during the dissolving time as reviewed in this section, please refer to the Health Instrument Divisions Monthly Meteorological Reports as summarized by D. M. Jenne, of the Health Instrument Divisions Meteorology Group (1) (2) (3).

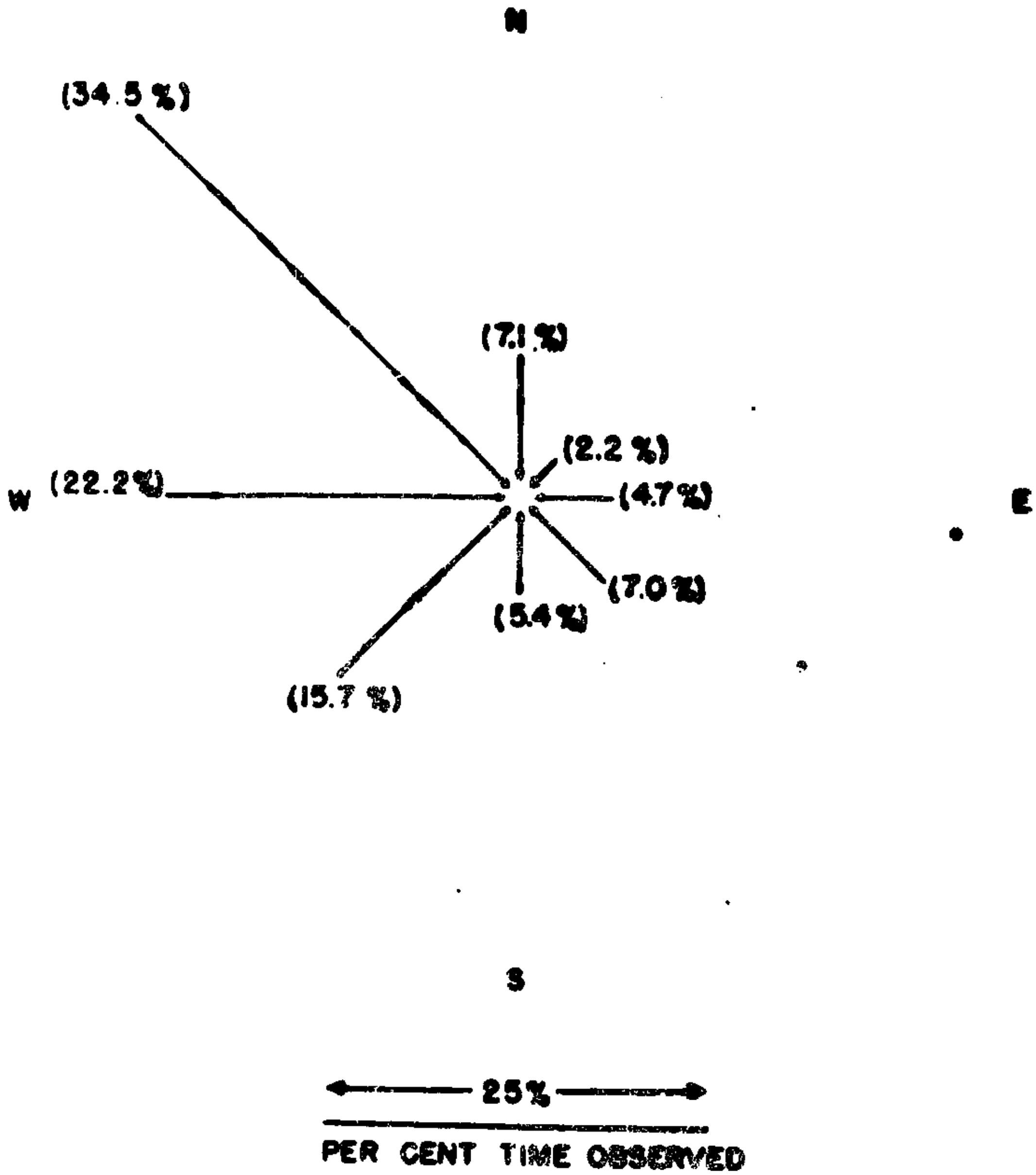
SECTION I

(See Figures 1, 2, 3, and 4)

[redacted]

SUMMARY WIND DIRECTIONS -- 200-W
DISSOLVING HOURS ONLY
OCTOBER — NOVEMBER — DECEMBER
1948

FIGURE 1



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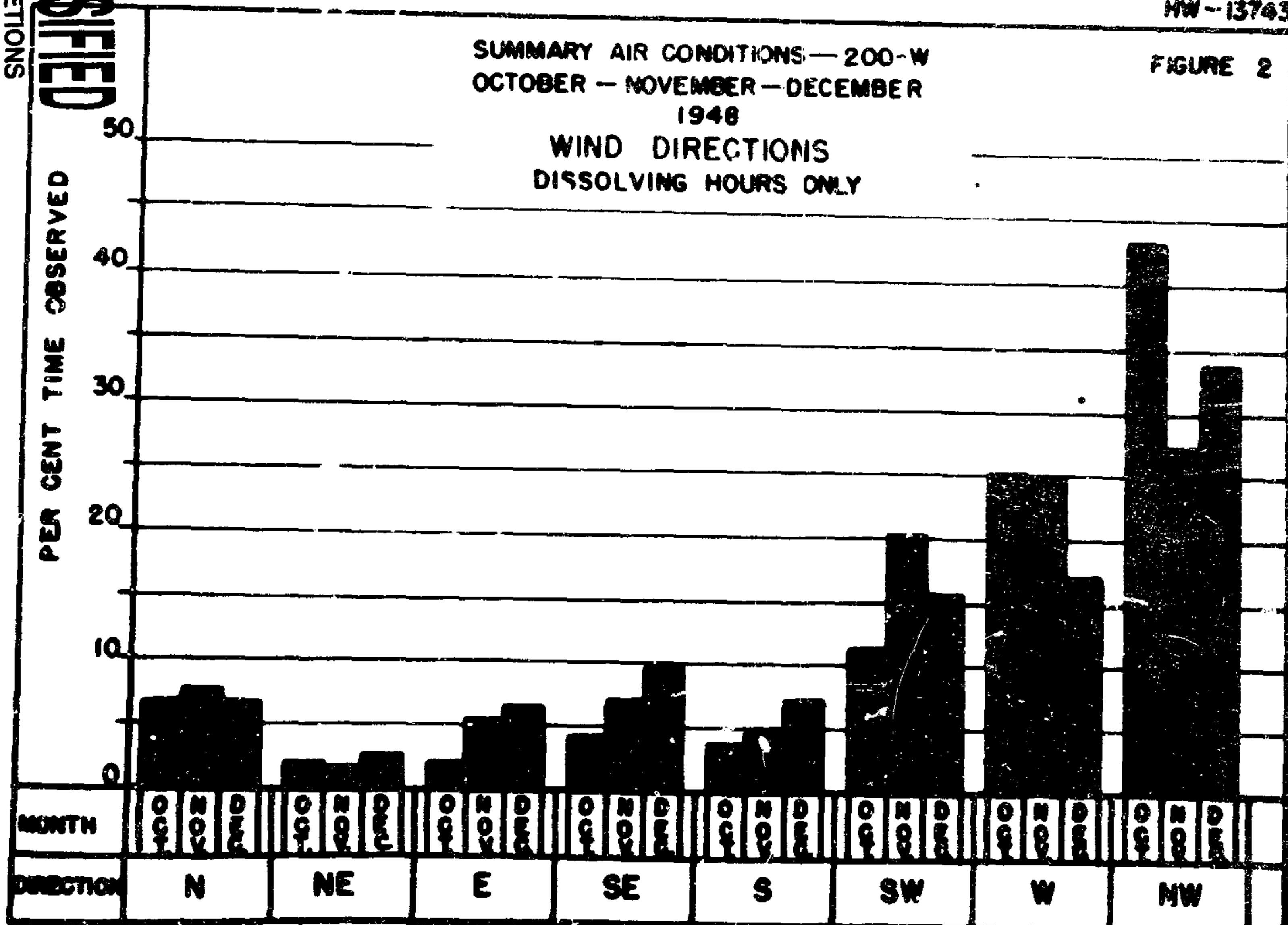

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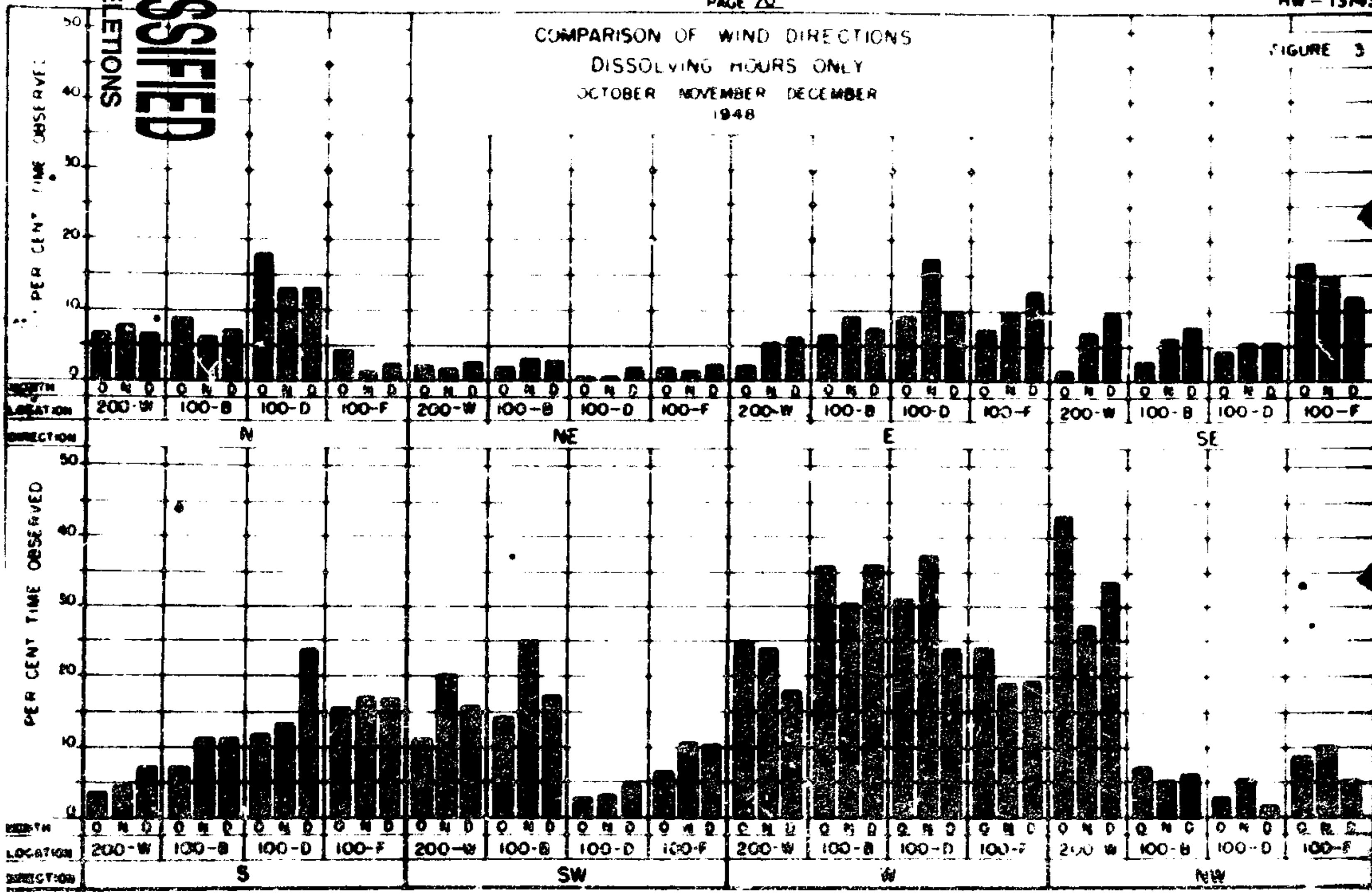
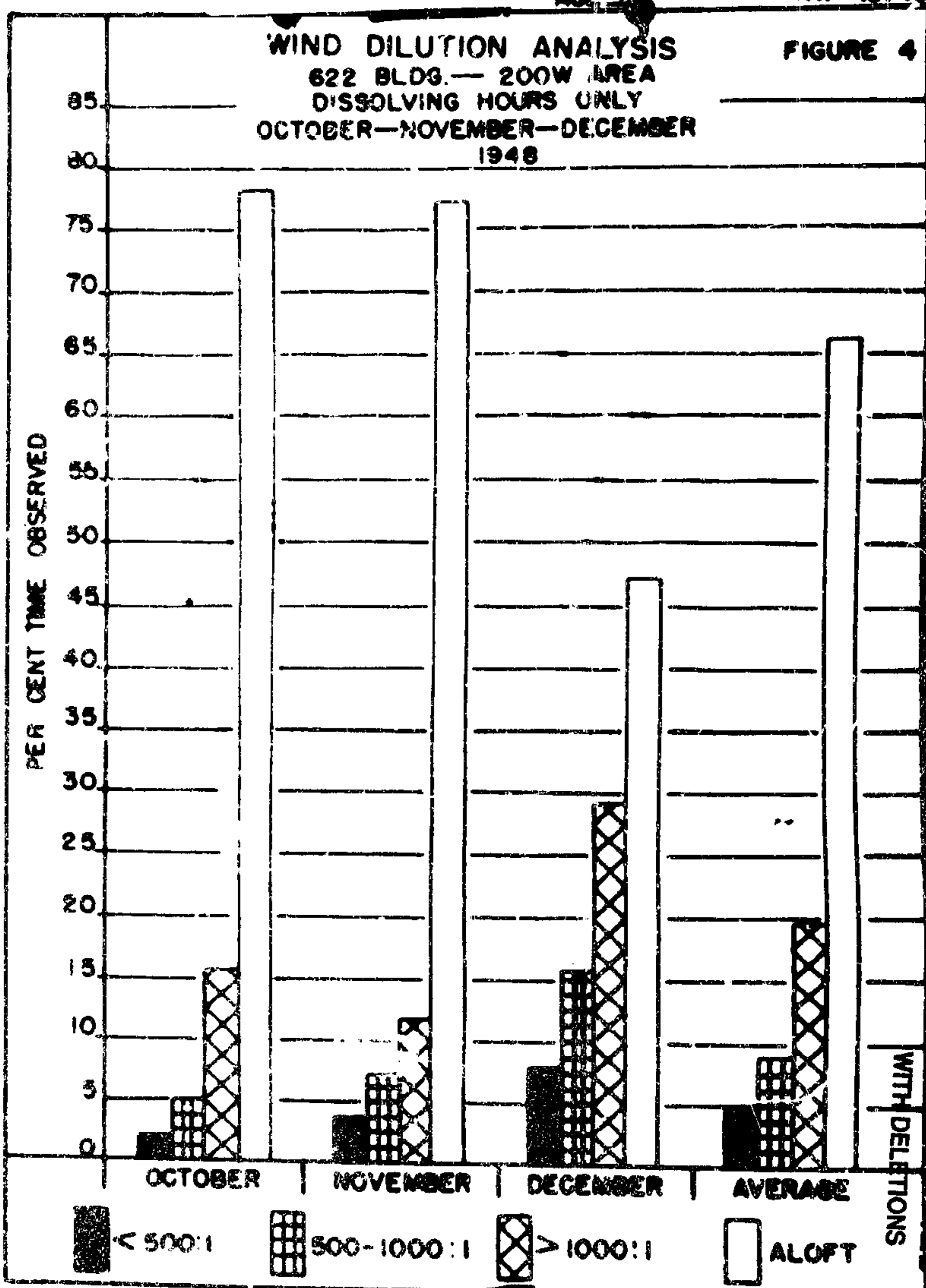


FIGURE 3

COMPARISON OF WIND DIRECTIONS
DISSOLVING HOURS ONLY
OCTOBER NOVEMBER DECEMBER
1948

PER CENT TIME OBSERVED



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SECTION II

AIRBORNE CONTAMINATION AND AIR RADIATION LEVELS

The radiation levels in air were measured by means of thin walled detachable ionization chambers (Hanford types "M", "S", and "C") supported four feet off of the ground. The airborne contamination was measured by counting small asbestos filter papers about one and one-half inches in diameter through which about two cubic feet per minute of air was pulled using a motoairo pump; the total air sampling period for each filter unit is seven days. A summary of the radiation levels measured at the various locations on and adjacent to the Hanford Works Area proper is presented in Table II. A study of the results obtained using the "C" type chamber indicated that the average for the overall three month period did not differ from the previous three month average. As in the past, the measured radiation levels in the 100 Areas were within the background range of the detachable chambers used (0.3 to 0.5 mrep per 24 hours). Slightly higher than the background level was measured at the monitor stations within the separation areas and near the 300 Area.

A review of the current "M" and "S" Chamber readings indicated no significant changes or trends when compared with the results of previous surveys within the last six months. There was no significant trend observed at any individual location or within any isolated zone. A new station located within the 234-235 area showed the highest recorded dosage rates; the average dosage rate at this location was 0.9 mrep/24 hours. All locations outside of a ten mile radius of the 200 Areas indicated average dosage rates within the range of the background of the instruments used.

It is interesting to note the consistency of the radiation levels in the outlying communities of Richland, Benton City, and Riverland. The chamber at each of these locations indicated a three month average of 0.5 mrep/24 hours; the individual

[redacted]

weekly observations were, in general, consistently about 0.5 mrep/24 hours.

A review of the operating conditions and the amount of uranium dissolved considering the weight, irradiation, and cooling time of the uranium before dissolving indicated that there should not have been any significant changes in the air radiation levels usually observed; the continuity of the current detachable chamber readings tend to confirm this observation.

The average beta activity detected in the air as determined by measuring the activity deposited on a C.W.S. #5 filter paper is summarized in Table III. A graphic portrayal of the same data is presented in Figure 5. The results of a statistical comparison between the averages of the individual locations, and between the current three month average of each location with the average of the previous three months is included in the lower portion of Figure 5.

The current average beta activity detected on the filters using thin mica-window counters indicated no significant changes from the average beta activity detected on filters at the same locations in the previous quarter. This generalization is again in line with expectations based on the normal operating conditions in the separations areas.

Outside of the monitoring locations within the separation areas, the only monitoring station where the average airborne beta activity was greater than 1.0 x 10^{-9} µc/liter was at the Hanford Station where the three month average was 1.3 x 10^{-9} µc/liter. The slightly higher beta activity detected on filters from the Hanford area was probably due to the prevalance of the higher velocity winds from the southwest quadrant during this period. A similar "higher beta activity deposition" was observed on the vegetation in this zone during the same period.

Radioautographic studies of the filter papers used in the airborne activity monitoring program continued to indicate the presence of stack discharge active particles. These measurements were made by exposing the filters to type K X-Ray film for a period of 168 hours. After developing the film, the darkened spots on the film were visually counted; each dark spot was assumed to be representative of a stack discharge active particle. These data are not to be confused with the data obtained using motoaires outdoors with the filters exposed directly to the atmosphere or with the current "particle frame" study. The filters discussed here refer to the filters located under a protective cupola type roof as installed in the 614 building which house the integrons and micromax recorders of the air monitoring program. The particles detected on these filters will represent only those particles drawn through the vents of the cupola with the two cubic feet per minute flow through the 1½ inch filter paper.

The data obtained using the above procedure is certainly not more than a qualitative indication of the trend in estimating the number of particles captured on a filter paper. The table below indicates the total number of particles estimated to be on the filters. Each month represents the study of four filters from each location; the numbers indicated in the table are a summation of the total estimated particles on the filters from each of the listed locations.

Based on the data presented below, there is an obvious trend in the fewer particles detected during December as compared with November and October; this trend is particularly noticeable for the filter samples taken within or near the separation areas. It is worthwhile to mention that the particles listed for the 300 Area are probably small particles of uranium rather than fission product "stack discharge active particles"; analyses have shown that most of the activity on the 300 Area filters was mostly uranium.

[redacted]

NUMBER OF STACK DISCHARGE ACTIVE PARTICLES DETECTED ON FILTERS

RADIOAUTOGRAPH METHOD - 168 HOUR EXPOSURE

OCTOBER - NOVEMBER - DECEMBER

1948

Location	Dates Covered		
	October	November	December
Pasco	5	0	0
Benton City	3	0	1
Richland	3	0	0
300 Area	13	2	4
200 East Area (18)	246	58	9
200 East Area (E)	325	42	16
200 West Area (4)	90	1	19
200 West Area (Center)	310	6	4
Gable Mountain	49	0	5
White Bluffs	16	0	0
Hanford	40	5	1
Hanford 101	13	1	1
100-D Area	16	0	3
105 DR Area	18	1	1

SECTION II

(See Figure 5 and Tables II and III)

[redacted]

TABLE II
RADIATION LEVEL OBSERVED
WITH
DETACHABLE IONIZATION CHAMBERS
(mrep per 24 hours)

"C" CHAMBER READINGS

LOCATION	OCTOBER	NOVEMBER	DECEMBER	QUARTERLY AVERAGE
Within 100-B	0.3	0.3	0.3	0.3
Within 100-D	0.4	0.4	0.4	0.4
Within 100-F	0.4	0.4	0.4	0.4
Within 200-W	0.3	0.4	0.7	0.5
Within 200-E	0.5	0.6	0.7	0.6
Within 300 Area	0.5	0.5	0.6	0.5

"M" AND "S" CHAMBER READINGS

LOCATION	OCTOBER	NOVEMBER	DECEMBER	QUARTERLY AVERAGE	GROUP AVERAGE
100 Areas and Environs					
Route 1, Mile 8	0.5	0.8	0.5	0.6	
Route 2N, Mile 10	0.5	0.6	***	0.6	
Route 2N, Mile 5	0.8	0.8	***	* *	0.59
At 105 DR	0.8	0.7	0.8	0.8	
At White Bluffs	0.5	0.6	0.7	0.6	
Route 11A, Mile 1	0.6	0.6	0.5	0.6	
At Hanford 614	0.5	0.5	0.5	0.5	
At Route 4N, &Route 1	0.5	0.6	0.4	0.5	
At Hanford 101	0.6	0.7	0.7	0.7	
Within 5 Miles 200-East Area					
Route 4S, Mile 6	0.7	0.9	0.7	0.8	
Route 11A, Mile 6	0.5	0.7	0.7	0.7	
Route 3, Mile 1	***	0.5	0.6	0.5	0.70
In 234-235 Area	0.9	0.8	0.9	0.9	
Meteorology 200 '	0.9	0.6	0.6	0.7	
Within 10 Miles 200-East Area					
Route 4S, Mile 10	0.8	0.7	0.9	0.8	
Route 10, Mile 1	0.7	0.8	0.4	0.7	
Route 10, Mile 3	* *	* *	* *	* *	0.74
Route 2S, Mile 4	0.9	0.7	0.9	0.8	
Near 300 Area					
Route 4S, Mile 16	0.5	0.5	***	0.5	
Route 4S, Mile 22	0.5	0.5	0.6	0.5	0.49
Outlying Zone					
Richland	0.5	0.5	0.5	0.5	
Benton City	0.5	0.5	0.5	0.5	
&Riverland	0.5	0.5	0.5	0.5	0.50

***Chambers were leaking and the results obtained were voided.
**Chambers removed from this location. The dosage rates tabulated include the back-ground of the chambers used which vary from about 0.3 to 0.5 mrep per 24 hours.

TABLE III

SUMMARY OF RESULTS OF AIR FILTER SAMPLING PROGRAM

AEROSOL BETA ACTIVITY

October - November - December

1948

LOCATION	AVERAGE μc/PER LITER
Pasco	1.1×10^{-10}
100-D Area	1.5×10^{-10}
300 Area	3.4×10^{-10}
200-East- Tower 18	3.1×10^{-9}
200-West-Gatehouse	1.0×10^{-9}
Benton City	1.0×10^{-10}
Hanford	1.3×10^{-9}
White Bluffs	1.4×10^{-10}
105-DR Construction Zone	1.9×10^{-10}
Gable Mountain	5.4×10^{-10}
Richland	1.6×10^{-10}
200-West, Tower 4	6.7×10^{-10}
200-East, Southeast	3.2×10^{-9}
Hanford 101 Building	2.9×10^{-10}

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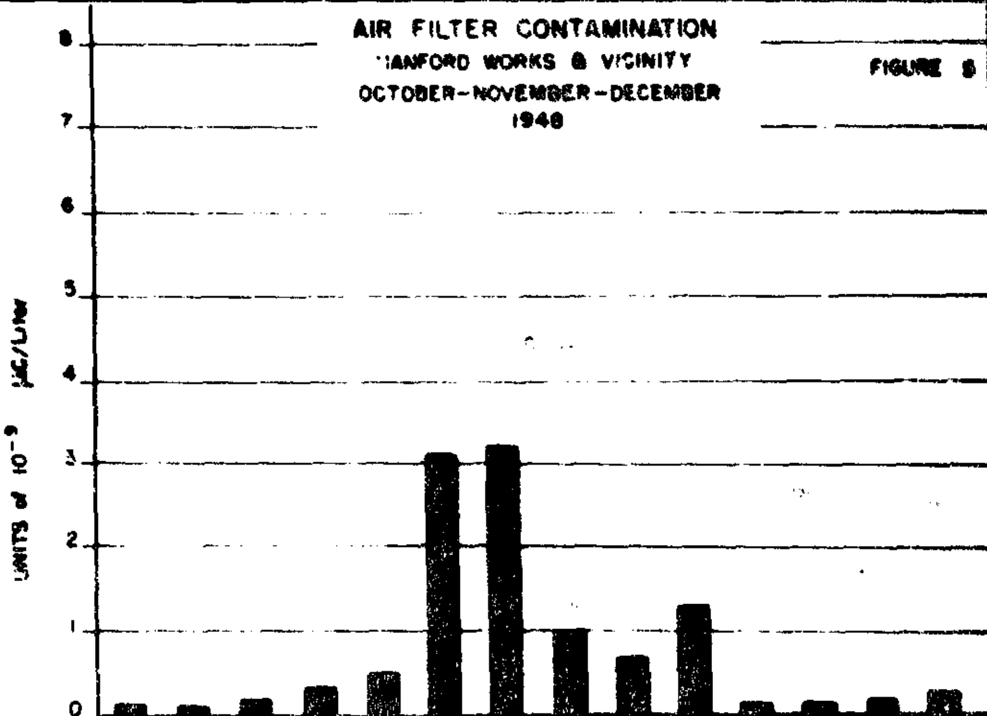
AIR FILTER CONTAMINATION
HANFORD WORKS & VICINITY
OCTOBER–NOVEMBER–DECEMBER
1948

FIGURE 8



	PASCO	BENTON CITY	RICHLAND	300 AREA	GABLE MT	200 E Tower 18	200 E SE	200 W Gate	200 W Tower 4	HANFORD	WHITE BLUFFS	100–D	100–DR	HANFORD 101
PASCO	↔		Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ				Δ
BENTON CITY		Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ			Δ	Δ
RICHLAND	Δ	Δ	↔			Δ	Δ	★		Δ	Δ	Δ	Δ	
300 AREA	Δ	Δ		Δ		Δ	Δ	Δ	Δ	Δ	★	Δ		
GABLE MT	Δ	Δ			↔	Δ	Δ	Δ		Δ	Δ	Δ	★	
200 E Tower 18	Δ	Δ	Δ	Δ	Δ	↔		Δ	Δ		Δ	Δ	Δ	Δ
200 E SE	Δ	Δ	Δ	Δ	Δ		Δ	Δ			Δ	Δ	Δ	Δ
200 W Gate	Δ	Δ	★	Δ	Δ	Δ	Δ	↔		Δ	Δ	Δ	Δ	Δ
200 W Tower 4	Δ	Δ		Δ		Δ	Δ		↔	Δ	Δ	Δ	Δ	Δ
HANFORD	Δ	Δ	Δ	Δ	Δ			Δ	Δ	Δ	Δ	Δ	Δ	Δ
WHITE BLUFFS			Δ	★	Δ		Δ	Δ	Δ	Δ	↔			
100 – D			Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ		↔		Δ
100 – DR		Δ	Δ		★	Δ	Δ	Δ	Δ	Δ			↔	
HANFORD 101	Δ	Δ				Δ	Δ	Δ	Δ	Δ		Δ		↔

Δ CURRENT VARIANCE INVALIDATES TEST

★ CURRENT DIFFERENCE APPROACHES SIGNIFICANCE

↔ NO SIGNIFICANT DIFFERENCE SINCE PREVIOUS QUARTER

☐ NO SIGNIFICANT DIFFERENCE BETWEEN CURRENT AVERAGES

SECTION III

ALPHA AND BETA CONTAMINATION IN THE COLUMBIA RIVER

The amount of radioactive contamination detected in river water samples from the Columbia River at sampling locations downstream from the 100 Areas increased during this period; this increase in activity was an expected one because of the reduced dilutions brought about by the decreasing flow rate of the Columbia River. This decrease in river flow is a normal trend for the Columbia at this time of the year.

The average flow rate of the Columbia River, as measured by the Power Division at Richland during October, November, December, 1948, was approximately 413,000 gallons per second. The maximum measured flow during this quarter was 518,000 gallons per second as observed in early September. The minimum flow of 328,000 gallons per second was measured during the latter part of December. Figure 6 summarizes the trend of the measured flow rate of the Columbia during this period. It is interesting to note that during this same period last year, unlike the trend noted this year, the river flow increased slightly during late October and then receded throughout November. Figure 7 summarizes the average beta activity measured in samples of river water taken at the listed locations. The normal frequency of river sampling is once each week at all locations; the normal individual sample volume is 500 ml. The results are corrected for the decay occurring between time of sampling and time of counting on the basis of the 14.8 hour half-life of Na^{24}. The maximum decay period between any sampling and counting is twelve hours. Table IV summarizes the average values obtained during the quarter.

TABLE IV

AVERAGE BETA-GAMMA CONTAMINATION IN COLUMBIA AND YAKIMA RIVERS

October November December

1948

Location	Micro-microcuries per liter* (μμc/liter)
Pasco	240
Richland	336
300 Area	273
Hanford North Bank	516
Hanford Middle	825
Hanford South Bank	1329
100-F	519
100-D	317
100-B	< 50
Above 100-B	< 50
Yakima Mouth	< 50
Yakima Horn	< 50

* The normal reporting level for the beta-gamma activity in 500 ml. river samples is currently established at 50 μμc/liter $(5 \times 10^{-5}$ μc/liter.

Background measurements taken one mile above the 100-B Area gave values ranging between one and ten μμc/liter. These values agree with previous determinations in samples from this location. Twelve samples from the 181-B building where the water is taken into the 100-B Area indicated an average value of 35 μμc/liter with a maximum of 400 μμc/liter. These results are about three times as high as those obtained during the previous quarter; it is believed that this condition is due to a "backwater" effect caused by the low river level.

The entering river water at the 100-D Area averaged 320 uuc/liter; this activity is from the 100-B Area wastes. This amounts to a threefold increase over the previous quarter with the higher individual results occuring at the times of minimum river flow. A similar increase in beta activity was observed at 100-F Area where the average beta activity was 519 uuc/liter.

At Hanford Ferry the maximum activity was detected in samples taken from the south bank of the river; the average activity was 1330 uuc/liter. Samples from the middle of the river averaged 820 uuc/liter; from the north bank, 520 uuc/liter. These values are two to three times higher than noted during the last quarter and two to four times higher than during the same period in 1947.

The average activity detected in samples from the river near the 300 Area and Richland was 270 uc/liter and 340 uuc/liter, respectively. The higher results at Richland are due to the more desirable practice of taking a river sample in the current of the river rather than in the more stagnant water along the shore as is done near the 300 Area. The samples from the Pasco-Kennewick bridge averaged 260 uuc/liter with individual results as high as 860 uuc/liter. This is the highest average for any quarter in 1948, although it is almost identical with the values measured for the same quarter in 1947.

Ether extractions for plutonium and uranium were made on all routine Columbia River samples and indicated an average less than the detectable 6 dis/min/liter at all locations. Occasional single results greater than 6 dis/min/liter were detected at random locations. This could be due to addition of contamination in the crowded laboratory or to possible natural activity fluctuating about a mean slightly lower than the present detection limit.

Several samples were obtained from nearby rivers and streams which showed natural alpha and beta activity comparable with the background measurements of the Columbia River above the 100-B Area. Samples from the Palouse, Snake, Touchet, Yellowhawk and Umatilla rivers indicated a natural beta activity ranging from 1 to 20 uuc/liter. The Columbia averaged about 4 uuc/liter above 100-B Area. The alpha activity measurements indicated a level less than 6 dis/min/liter in samples from all the above streams.

Figure 8 portrays the results of a cross-section survey of the Columbia River between Richland and the 300 Area. Nine samples were taken at four cross-section locations, each cross section consisting of three samples from various depths of the river near each shore and three samples from the middle of the river. The measured beta-gamma activity in the samples averaged about 400 uuc/liter in the section of the river surveyed. There was no significant difference found in comparing the activity measured in the samples from the four cross-section locations. Only small differences were observed between the beta-gamma activity measured in samples taken at various depths, although later consideration and tests indicated significant dilutions of the bottom samples as they were withdrawn. Statistical analysis of these data indicated a probable uniform dispersion of the beta-gamma activity in the samples from this region of the Columbia River. Similar studies will be continued upstream during the low water period in an effort to determine at what region in the river the beta-gamma activity admitted from the 100 Areas is uniformly mixed.

The above mentioned samples were also analyzed for alpha activity. Four of the samples indicated questionable alpha activity in excess of 6 dis/min/liter. Three of these samples were adjacent to Richland where 25, 10 and 7 dis/min/liter were measured. Fluorophotometer analyses of these samples indicated that the uranium content was less than 2 ug/liter in all cases. The two highest samples from the west bank at Richland showed $<$ 2 dis/min/liter from plutonium as determined by a TTA analysis; hence there is some question as to the validity of the positive alpha activity indicated in the original samples.

Thirty-five samples were obtained from the Yakima River during the quarter. As average of <50 uuc/liter was obtained at the mouth; the average at the Yakima Horn was also <50 uuc/liter. The measurements for alpha activity in these samples indicated <6 dis/min/liter.

In addition to the routine river water samples taken during this period, one hundred and seventy-four mud samples were obtained from the river banks at eight selected locations along the Columbia River. Half of the samples were taken along the shore near the edge of the river, whereas the balance of the samples were taken on the shore five feet from the waters edge. It was expected that the sample five feet from the edge would give some information on the activity deposited on the river bottom as the river water recedes. This would be primarily a qualitative estimate since the exposure and decay period is a function of the slope of bank and the rate at which the river flow is decreasing. The results of this program are summarized in Table V which includes the number of samples taken as well as the maximum and average beta-gamma activity detected by a direct count of one gram of the dried material. No correction was made for self-absorption or for the known beta activity from K^{40} present in the potassium salts of the mud.

TABLE V

COLUMBIA RIVER MUD SAMPLES

Total Beta-Gamma Activity in muc/kg (milli-microcuries/kilogram)

October- November- December
1948

Location	No. Samples	At River Shore		5 Ft. From River Shore	
		Maximum	Average	Maximum	Average
Near Wills Ranch	28	18	9	38	12
Allard Pumping Sta.	20	19	11	38	11
At 100-H Area	22	20.1	12	25	13
Below 100-F Area	22	108.0	23	25	16
Richland Dock	22	25.1	13	21	12
At 300 Area	23	44.1	16	33	19
Pasco-Kenn. Bridge	25	13.1	12	43	18
Hanford Ferry	12	27.1	12	13	10

In general, no trend at any location was observed; no significant difference was noted in comparing the activity detected in the shore samples with the off shore samples. The "Near Wills Ranch" location approximately six miles upstream above the 100-B Area may be considered as the background source for radioactivity measured in Columbia River mud samples.

An analysis of the tabulated results shown in Table V indicated that the activity in the mud samples from downstream locations varied within a range that could be attributed to the fluctuation around the mean background activity level. As the average activity detected in samples from downstream locations are within a factor of two when compared with Wills Ranch, it appears that only natural radioactivity is detected in those river shore mud samples.

All samples were analyzed for alpha activity from plutonium and uranium by the ether extraction method; some of the samples were spot checked for uranium content using a fluorophotometer. The average results for the analyses indicated a level of activity less than 6 dis/min/gram at all locations with no indication of uranium. Occasional flyer results showed a range of activity from 7 dis/min/gram to 20 dis/min/gram; these high samples were not confirmed by analyses of resamples from the

[redacted]

locations considered.

During the period October, December, 1948, the 300 Area waste pond was partially discharged into the Columbia River on October 25, 1948, when the northwest dike of the pond accidentally gave way. A preliminary report discussing the effects of the 300 Area dike break on the uranium contamination introduced into the Columbia River was given in the "H. I. Environs Report for October." (HW-11534, issued November 3, 1948.)

The purpose of the following detailed summary is to review in more detail the circumstances of the dike break and to present the complete survey data obtained in the effort to trace the uranium discharged into the river.

The 300 Area waste pond has long been a source of trouble as a radioactive contamination hazard. In the earlier days of Hanford operation, unknown quantities of uranium were discharged into the pond; even today, under more strict control, it is estimated that probably two-three pounds of uranium are discharged daily into the 300 Area pond from the 303 Area; this neglects any uranium that could be sent to the waste pond from the 3706 or 321 buildings. (Currently, uranium from the 321 Building is to be dumped into a "crib" about five miles north of the 300 Area.) All these wastes, the exact quantities of which are not quantitatively known, have been discharged over the past years into the pond. The pond itself covers an area of about 490,000 square feet and is about five feet deep. The walls of this waste pond are constructed of crushed rock and earth; the bottom is of earth, through which the waste solution continuously percolates through the ground and eventually penetrates into the water table. This latter condition has been the source of the uranium found in the 300 Area Sanitary Water System; this waste problem was discussed in HW-11333.(9)

The normal liquid height level of the waste solution in the 300 Area Pond during this period was about three feet. It was then observed shortly afterwards that

[redacted]

the level of the water in the pond had increased by about three to four feet. As far as could be determined, there was no significant increase in the normal volume of waste solution discharge into the pond. It was generally believed that the compounds of aluminum discharged into the pond just prior to the time of the dike break formed flocculent precipitates carrying the small solid matter to the bottom of the pond and effectively sealing off the normal percolation and draining effect of the pond, which previously kept the level of water in the pond relatively constant. About this time it was also observed that there were definite small leaks through the east bank of the pond; small seepage through the wall of the north bank was also noticeable.

With the increased pressure on the banks of the pond caused by the higher level of water, a weak point was eventually found in the north-west corner of the pond where the dike then gave way about 2:30 P.M. October 25, 1948. The bulk of the contents of the 300 Area Pond were lost, traveling about 1000 to 1500 feet over the ground adjacent to the pond proper before it emptied into the Columbia River.

It was estimated that there was about a four foot drop in the level of the water in the pond wastes before all liquid flow to river was stopped about 4:00 P.M. Information obtained from an official aerial photograph taken of the 300 Area on January 30, 1948, indicated the pond area to be about 490,000 square feet. From this information, it was then estimated that approximately 14½ million gallons of waste solution were discharged into the Columbia River between 2:30 P. M. and 4:00 P.M., October 25, 1948.

The Power Division reported that the flow of the Columbia River on October 20th was about 486,000 gallons per second. If we assume that the fourteen and one-half gallons of 300 waste water was uniformly discharged into the river over the one and one-half hour period, than the dilution factor of river water to the discharged waste solution would be about 180 to 1.

Considerable difficulty was encountered in the attempt to estimate the probable total quantity of uranium that found its way into the river. As reported previously, the approximate level of uranium contamination in the north-west corner of the pond where the dike broke was between 100 and 500 µg U/liter solution. At the inlet side, near the northwest corner, the average uranium concentration found during July, August, and September was about 20 mgs. U/liter waste solution. Some measurements taken from the north-east corner of the pond indicated a level of about 100 µg U/liter solution. Mud samples from the northwest corner were as high as 3.3 mg U/gram mud and as high as 43 mgs. U gram mud from the inlet side. A study of the individual waste analyses indicated a wide variation of activity levels depending on when the samples were taken with respect to the time the bulk of the active waste was discharged into the pond; hence, the average uranium content value reported will include the low and high values of the total samples taken as spot checks and will not necessarily give the true average uranium content in the pond at the time it gave way. Just how much active mud escaped with the waste solution when the dike broke is certainly not known; in addition, it was not possible at the time of the incident to estimate how much of the uranium in the waste solution was retained by the ground over which the wastes traveled before finding its way into the river. At best, any calculation estimating the total quantity of uranium discharged into the Columbia River would only be a guess. However, if it is assumed that any active uranium in the mud was retained by the ground and that only waste solution containing 100-500 µg uranium per liter solution found its way to the river, for the estimated 14½ million gallons of waste solution lost, a figure approaching 5500 grams to a maximum of 27500 grams of uranium (about 12-61 pounds of uranium) would have entered the river over a period of 1½ hours. Resolving these calculated estimations in terms of uranium per unit volume of river water, assuming thorough mixing of the waste solution with river water, the resultant uranium in the river should have been about 0.6 ug U/liter to 2.8 ug U/liter. These estimations indicate a level of uranium lower than that amount of uranium found occurring naturally in many deep water wells and is higher than the 2-10 ug U/liter detected in drinking well water samples of the Richland Area. Hence, a preliminary survey of the probable effect of the dike break on the contamination introduced into the river did not indicate an alarming condition at that time.

Nevertheless, special effort was exerted to obtain samples at various points in the Columbia River from the 300 Area to Portland, Oregon, for uranium measurements as a special precaution in lieu of the lack of concrete and factual information as to how much uranium entered the river and how the uranium distributed itself after entering the river.

The summary of the analysis of approximately 500 special samples taken to trace the uranium lost from the pond is presented graphically. The complete original analytical data for each sample is on file in the Health Instrument Divisions Site Survey Group. In general, the data indicated that probably at a point about a mile below Richland, no true significant quantity of uranium was found in any of the river samples taken, i.e. no individual sample indicated uranium exceeding a level of about 15 ug uranium/liter solution which is in the order of magnitude of the average uranium measured in Benton City well water samples. Of the few samples analyzed for plutonium on the assumption that plutonium might have been present in the waste water, results indicated alpha activity from that source below the detectable quantity of [illegible] dis/min/liter.

Figure 9, graphically summarizes the results for uranium analyses in river water after the dike break listing the approximate location and time the river water sample was taken. The survey included that portion of the Columbia River lying between the 300 Area and Portland, Oregon. Referring to Figure 9, samples taken from the river right at the 300 Area pond shortly after the dike break indicated a maximum alpha

[redacted]

activity from uranium of 2281 dis/min/liter taken 30 yards downstream from the pond near the river shore. Please note that a routine sample taken from approximately the same location about 1½ hours before the dike broke indicated alpha activity of only 9 dis/min/liter. Samples taken from the river 100 and 200 yards downstream 2 hours after the maximum active sample was taken indicated activity of 333 and 124 dis/min/liter. By this time, through the cooperation of the Atomic Energy Commission, boats were launched on the river between Pasco and the 300 Area. An automobile was dispatched to take samples of the river further downstream. The results of these surveys are summarized on Figure 9. The solid dots represent samples where the analysis indicated less than 6 dis/min/liter; the open circles indicate samples were the analyses indicated alpha activity from uranium exceeding the detectable limit, i.e., 6 dis/min/liter; the actual value determined by the analyses is listed adjacent to the open circle. Although, no such survey was ever made before to study the background radioactivity of the river, it seems that some of the samples were slightly higher than the expected background of the river; this might have been due to small errors in the already crowded laboratory where attempts were made to process rapidly the unprecedented large number of samples. It is certain, from the time studies of the river flow and the time of the dike break, that the dike break could not have influenced the slightly higher background levels of alpha activity detected in some of the river water samples.

To correlate more closely the sampling of the river with the time of the dike break and the probable time that the uranium discharged into the river at the 300 Area would reach a given spot in the river, a river flow and sample activity correlation map was prepared. The river flow was given as 4[illegible],000 gallons per second on the day of the dike break. The mean flow of the river during this period was about 3-3½ m.p.h. with the speed approaching a maximum of 5 m.p.h. rarely at certain spots in the river. The minimum flow was about 3 m.p.h. The much discussed and commonly

[redacted]

accepted river flow of 13 m.p.h. for the Columbia is only true when the river approaches the flood stage. The best overall average river flow figure given by the Power Division was about 3 1/3 m.p.h. This was the flow taken for the correlation map. The distance along the river was measured in river miles using a large map and a planimeter. Since the dike broke at 1430 (2:30 PM) and the flow from the pond ceased entering the river about 1600, 1500 was chosen as the zero starting time for waste solution entry into the river giving a leeway of ½ to 1 hour, respectively, from the actual starting time of the dike break to gauge the approximate time that it would be expected that the uranium in the waste solution would reach a given location in the river at a given time. Figure 10 summarizes the results of this correlation in which the sample location, time of sampling, and analytical result for the uranium analysis is shown. Each sample location listed also represents the time that it was estimated that any uranium would be present in the river if it was discharged from the 300 Area Pond at 2:30 PM, October 25, 1943. The only real significant sample of this group shown on the graph is the one previously mentioned taken 30 yards downstream from the pond; the value was 2280 dis/min/liter of alpha activity from uranium. The other results indicated less than 6 dis/min/liter with a few exceptions where trace quantities of uranium were detected. It is doubtful if this was "Hanford uranium" as the bulk of other samples taken at times when it was certain that Hanford uranium could not have reached those points at the time the river samples were taken indicated comparable background levels of alpha activity. It might again be pointed out that these levels of activity from uranium are lower than that normally found in the drinking water wells of Benton City, the uranium occurring as a natural radioactive background.

In addition to the sampling procedures already discussed, through the courtesy of the Engineering Corps. at McNary Dam, samples were taken from 5 locations across the Columbia every hour. These samples were analyzed for uranium. The results of

[redacted]

the sampling are graphically summarized in Figure 11. The maximum sample activity was 69 dis/min/liter; this sample was not duplicated for lack of sample material, but samples taken from almost duplicate locations about the same time indicated normal background levels. One other high questionable value of 49 dis/min/liter was obtained. This particular sample did not coincide with the expected time of arrival of the Hanford uranium as can be seen by referring to Figure 10. The uranium from the Hanford 300 Area Pond would not have reached McNary Dam until the following day in this particular instance. Hence, here again, the possibility of contamination in the laboratory existed. Outside of these two positive values that appear to be in error, the general results of the remaining samples indicate the probable alpha background measurements of the river at McNary.

By way of summarizing the overall survey of the dike break at 300 Area on October 25, 1948, the following information appears to be available.

(a) Approximately 14½ million gallons of 300 Area waste pond solution were discharged into the Columbia River between 2:30 PM and 4:00 PM October 25, 1948 as a result of an accidental dike break.

(b) No good figures were available to estimate the total amount of uranium discharged into the Columbia River but superficial calculations indicated that probably 12 to 60 pounds of uranium might have been lost.

(c) If the 12-60 pounds of uranium discharged into the river is assumed, considering the flow of the river, volume of wastes, assuming uniform distribution etc., then the average activity in the river would have been 0.6 to 2.8 µg/U/liter above the normal background.

(d) Based on the results of the analysis of 500 river samples taken strategically, the following statements can be made by way of summarizing the highlights of the survey:

1) The maximum single result was 2280 dis/min/liter of alpha activity

[redacted]

detected in a sample 30 yards downstream from the 300 Area dike.

2) Trace quantities of uanium probably from the pond were detected in river samples to about one mile above Richland.
3) River samples taken below Richland and as far downstream as Portland, Oregon, indicated a normal background for alpha activity and were, on an overall average basis, lower than the alpha activity from natural uranium as measured in drinking water deep wells in the vicinity of the Hanford Works. These samples included sanitary water samples from the Kennewick and Pasco areas which use the Columbia River as a source of drinking water.
4) Spot checks for plutonium in river and pond samples indicated <.6 dis/min/liter from that source.

SECTION III

(Figures 6,7,8,9,10 and 11)

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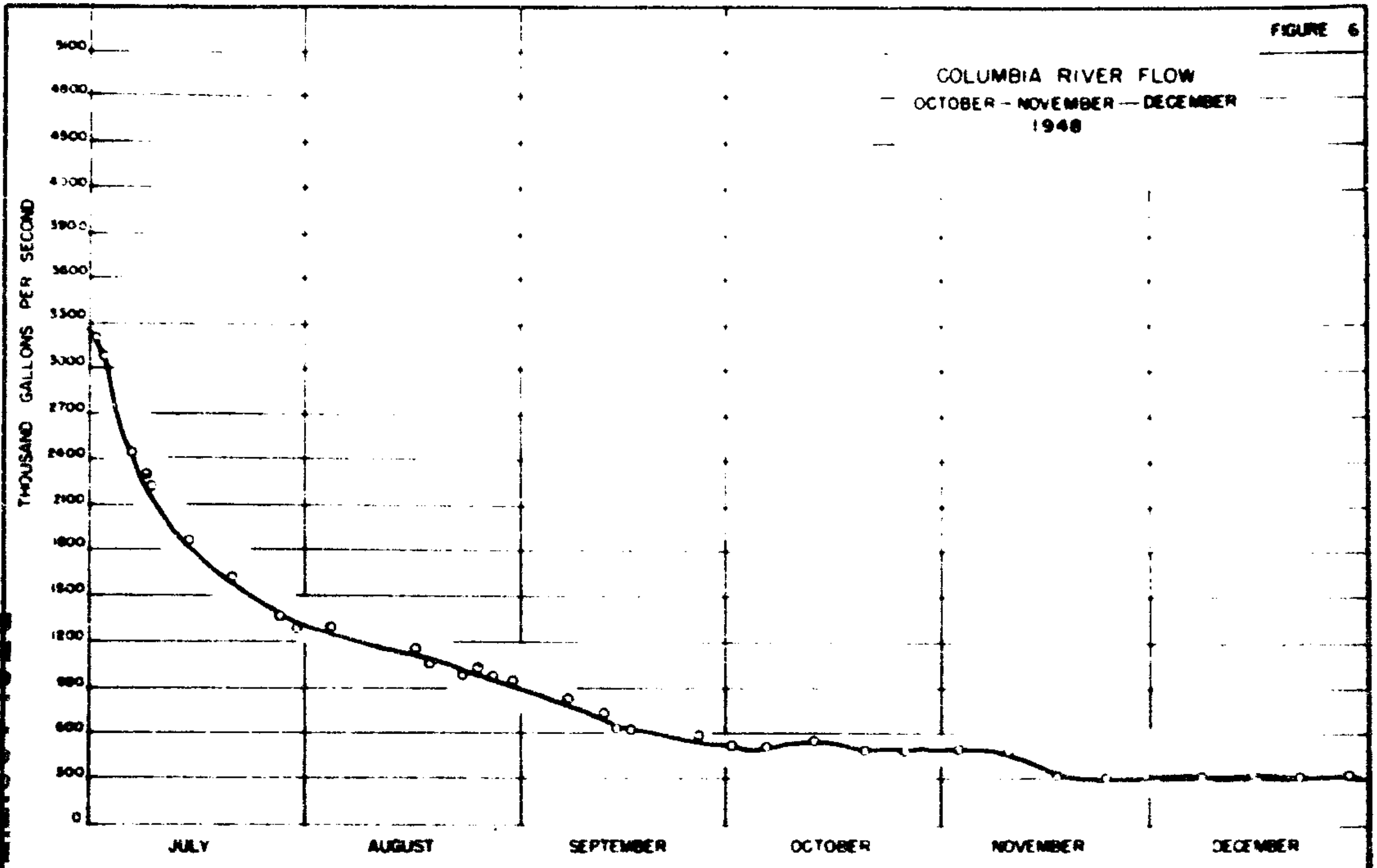
FIGURE 6



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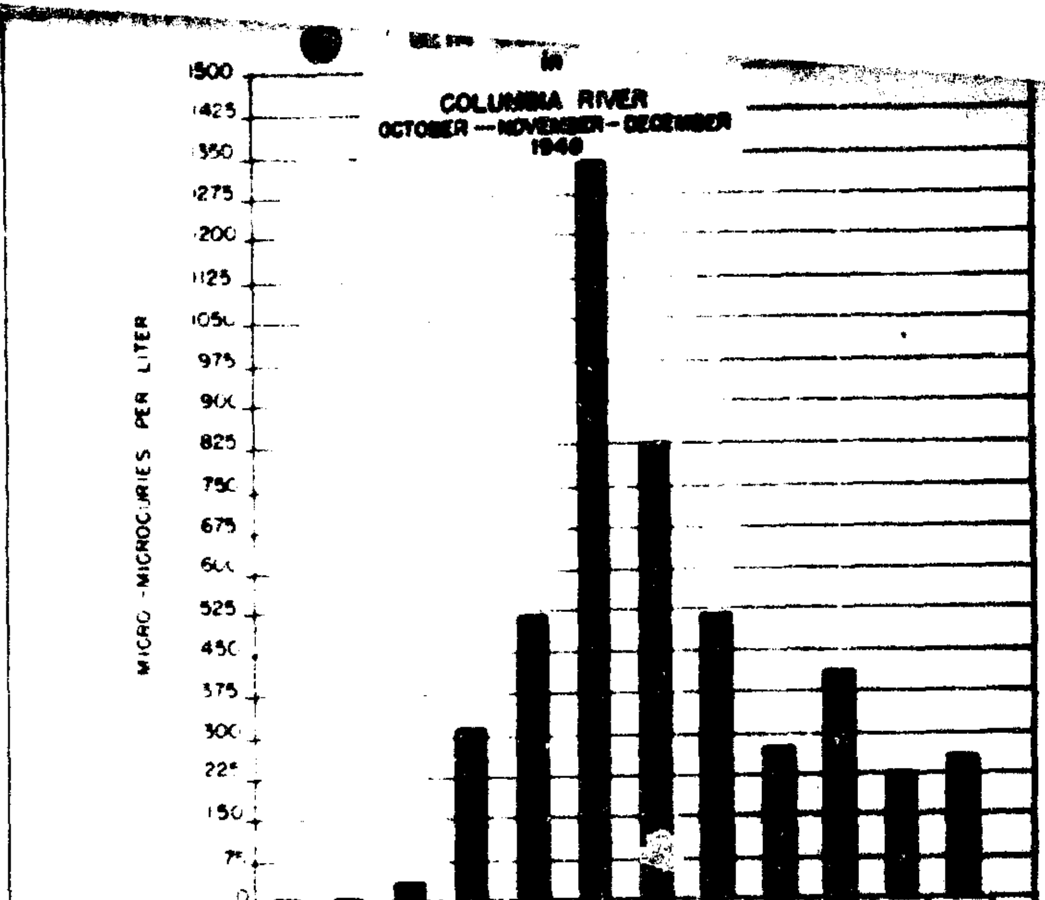

	ABOVE 100-B NO 1	ABOVE 100-B NO 2	181-B	181-D	181-F	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ABOVE 100 B No 1	⟷	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
ABOVE 100-B No 2	Δ	⟷	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
181 — B	Δ	Δ	Δ	★★	★★	Δ	Δ	Δ	★★	★★	★★	★★
181 — D	Δ	Δ	★★	↑	★	Δ	Δ	Δ				
181 — F	Δ	Δ	★★	★	↑	★★			★		★	★
HANFORD SO BANK	Δ	Δ	Δ	Δ	★★	↑	★	★★	Δ	Δ	Δ	Δ
HANFORD MIDDLE	Δ	Δ	Δ	Δ		★	↑		Δ	Δ	Δ	Δ
HANFORD NO BANK	Δ	Δ	Δ	Δ		★★		Δ	Δ	Δ	Δ	Δ
300 AREA	Δ	Δ	★★		★	Δ	Δ	Δ	⟷			
RICHLAND MIDDLE NO 1	Δ	Δ	★★			Δ	Δ	Δ		↑	★	
RICHLAND MIDDLE NO 2	Δ	Δ	★★		★	Δ	Δ	Δ		★	⟷	
PASCO-KENN BRIDGE	Δ	Δ	★★		★	Δ	Δ	Δ				Δ

- [ ] NO SIGNIFICANT DIFFERENCE BETWEEN CURRENT AVERAGES
- ↑ QUESTIONABLE INCREASE SINCE PREVIOUS QUARTER
- Δ CURRENT VARIANCE INVALIDATES TEST
- ★ CURRENT DIFFERENCE APPROACHES SIGNIFICANCE
- ★★ CURRENT DIFFERENCE HIGHLY SIGNIFICANT
- ⟷ NO SIGNIFICANT CHANGE SINCE PREVIOUS QUARTER

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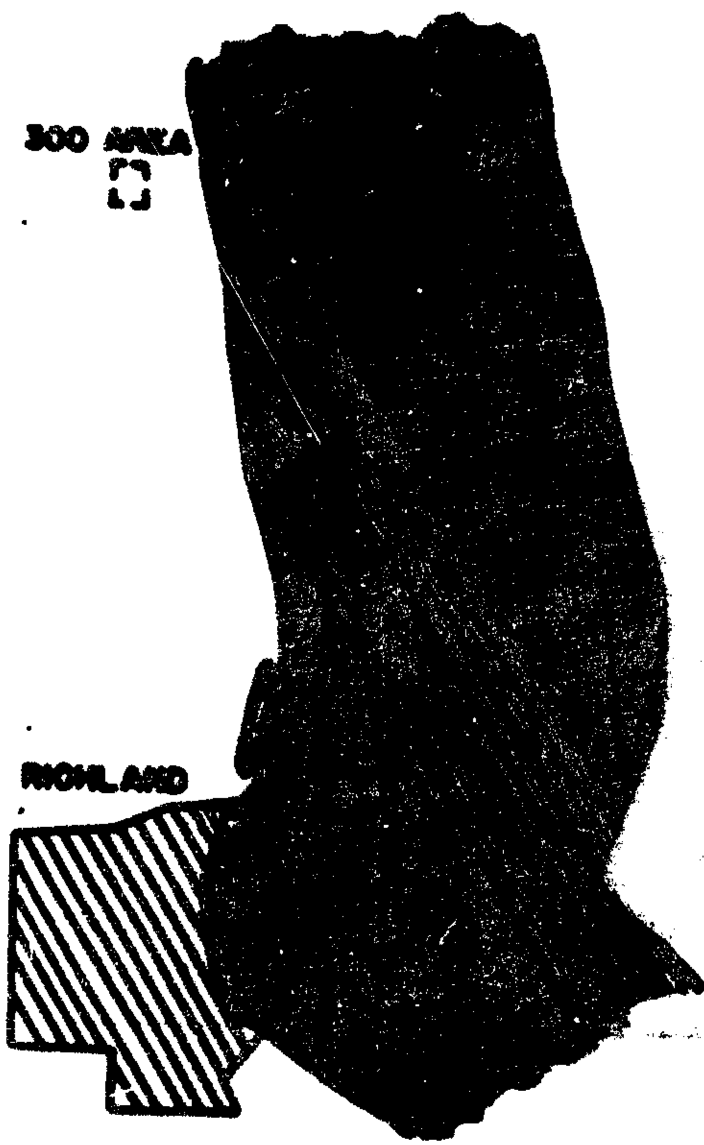
PAGE 35

ESTIMATED DISTRIBUTION BETA-GAMMA ACTIVITY IN COLUMBIA RIVER
DECEMBER 10, 1946



KEY

[redacted]

FLOW: 365,000 GALLONS PER SECOND

[redacted]

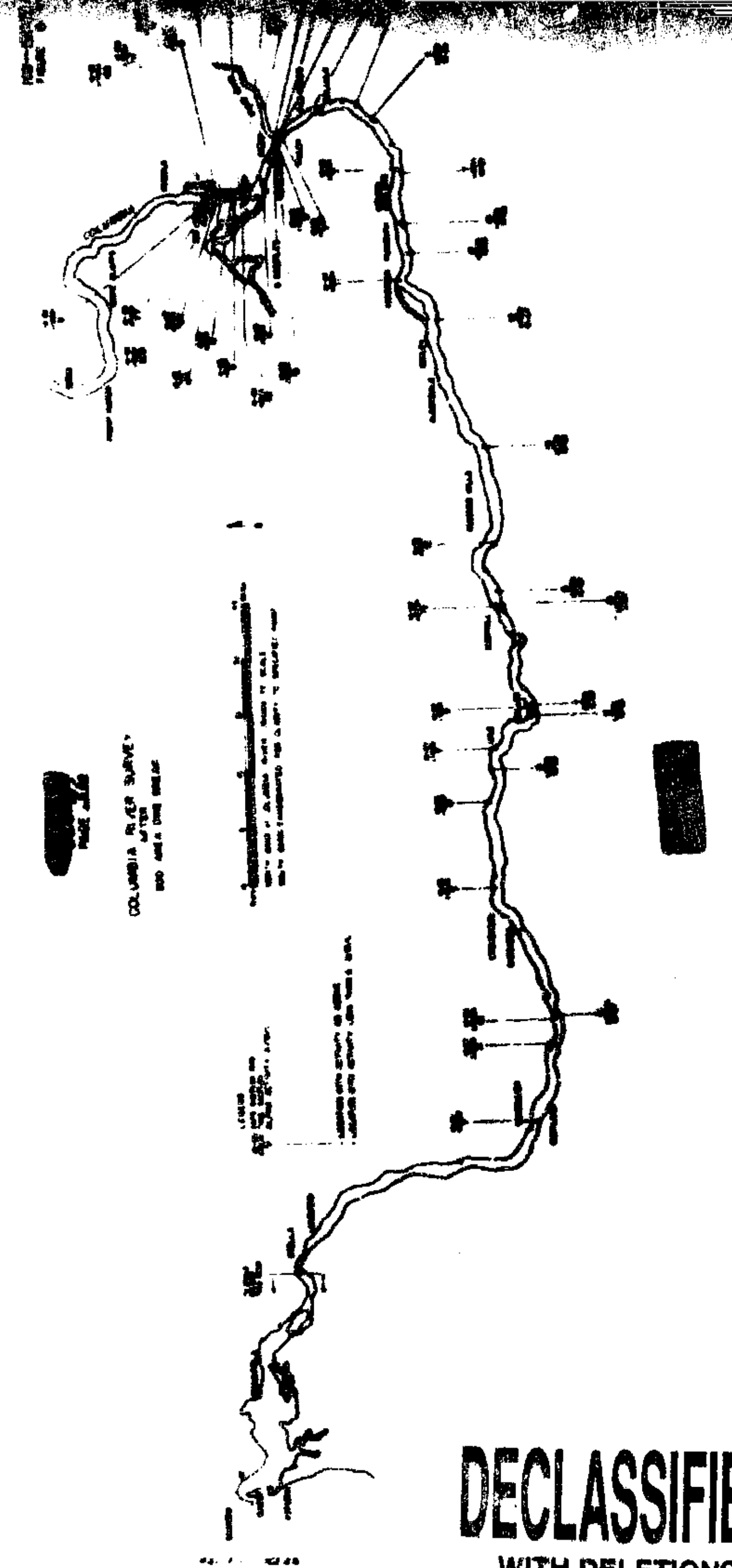


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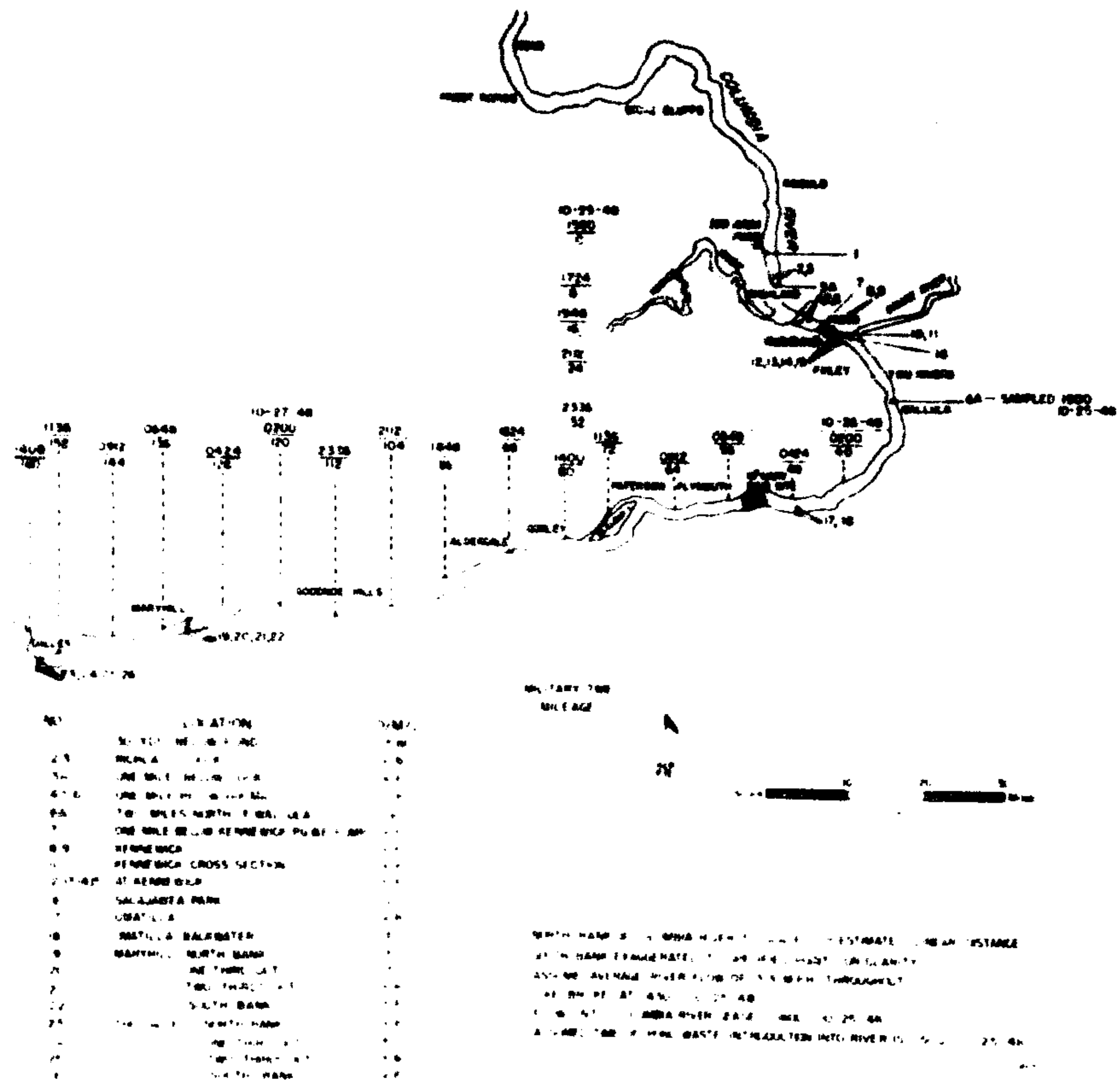
FIGURE 10

RIVER FLOW AND ALPHA ACTIVITY CORRELATION



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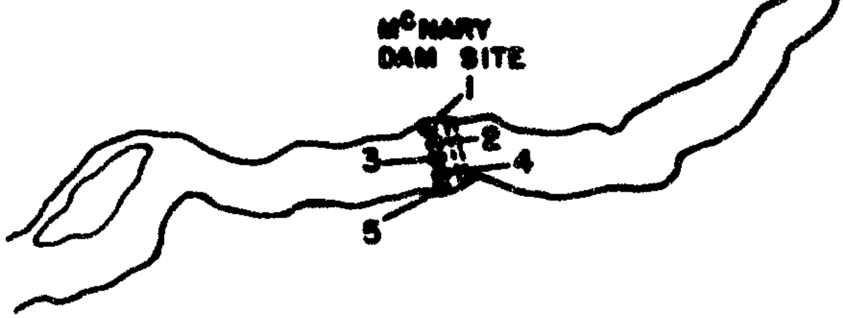
HOURLY MONITORING RESULTS AT McNARY DAM SITE



DATE	TIME	NO. 1	NO. 2	NO. 3	NO. 4	NO. 5
10-25-48	2100	<6	<6	<6	12	46
10-25	2200	<6	<6	6	<6	7
10-25	2300	<6	<6	10	6	<6
10-25	2400	6	<6	<6	<6	<6
10-26-48	0100	<6	<6	<6	14	<6
10-26	0200	<6	<6	<6	<6	<6
10-26	0300	6	<6	6	<6	[illegible]
10-26	0400	<6	<6	<6	<6	[illegible]
10-26	0500	7	<6	6	<6	[illegible]
10-26	0600	<6	7	<6	<6	[illegible]
10-26	0700	<6	<6	6	<6	[illegible]
10-26	0800	<6	<6	<6	10	[illegible]
10-26	0900	<6	<6	<6	<6	[illegible]
10-26	1000	10	6	<6	6	<6
10-26	1100	<6	6	<6	<6	<6
10-26	1200	<6	<6	<6	<6	[illegible]
10-26	1300	6	6	16	<6	7
10-26	1400	<6	<6	<6	<6	<6
10-26	1500	<6	7	<6	<6	<6
10-26	1600	<6	<6	<6	6	<6
10-26	1700	<6	<6	<6	6	<6
10-26	1800	<6	<6	<6	<6	<6

ALL UNITS ALPHA ACTIVITY REPORTED IN D/M/L

TO CONVERT D/M TO μg U DIVIDE BY 1.5

[redacted]

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[redacted]

SECTION IV

BETA CONTAMINATION IN RAIN AND [illegible]

Two hundred and seventeen rain samples were collected from [illegible] and adjacent to the Hanford Site during this period. The precipitation as [illegible] by the Meteorology Group was 0.45 inches in October, 0.95 inches in [illegible] 1.11 inches in December for a total of 2.51 inches. The values for [illegible] December included 1.7 and 8.1 inches of snow respectively.

The volume of the rain samples analyzed varied from several ml. to [illegible] pending on the amount of rainfall at a given location.

The average beta-gamma activity measured in any rain sample did not [illegible] muc/liter at any location. The highest activity was detected in [illegible] in the 200 East Area where the average of thirty-two rain samples [illegible] locations was 6.4 muc/liter. Maximum results were in the [illegible] the 200 East Area while the maximum value found inside the [illegible] liter. In general, the activity measured in rain is lower by a factor [illegible] West Area when compared with rain activity in the East [illegible] Area is located downwind from the 200 West Area, the higher [illegible] be a result of the deposition of the combined stack effluents [illegible] areas. The average beta-gamma activity measured in samples [illegible] about the same as that measured at the intermediate locations [illegible] areas and the project perimeter; the average in the [illegible] the average in the intermediate zone was 0.6 muc/liter. Average values of [illegible] muc/liter were measured in samples collected between the [illegible] meteorology tower.

Twenty-nine rain samples from four off-area locations, indicated the [illegible] average results: Pasco, 0.3 muc/liter; Benton City, 0.04 muc/liter, [illegible] muc/liter; and Benson's Ranch, 0.05 muc/liter.

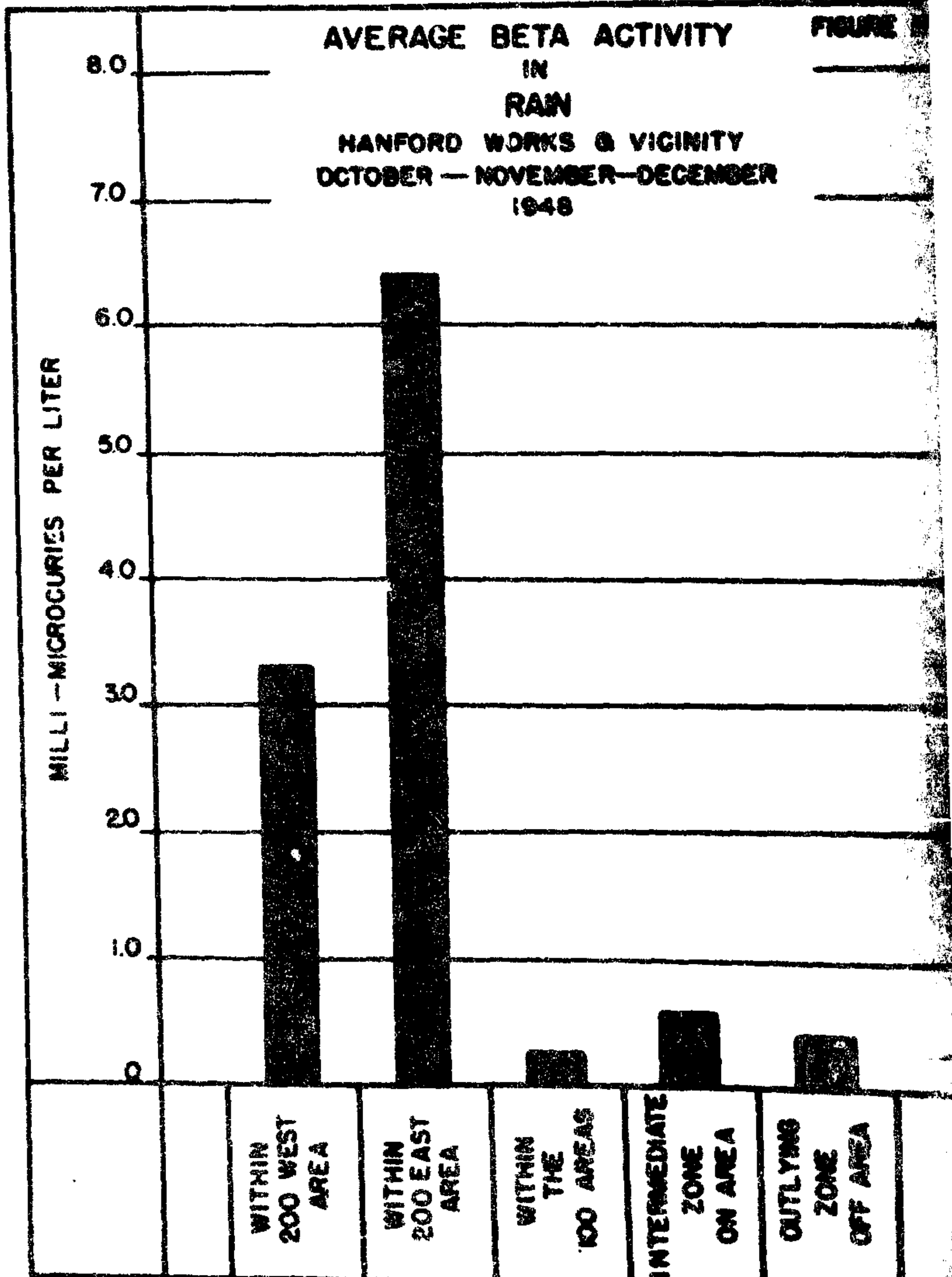
HS-File

Figure 12 is a graphic presentation of the average ured in rain samples collected from the various zones discussed in this the report. A total of fifty-four samples of freshly fallen snow were December 9th from different locations within the immediate vicinity of the tions areas. Snow fell during the nine hours immediately preceding the lection. On the basis of the average power level of the 100 Area piles and known cooling times, about three curies of I^{131} were present in the metal during this period. The wind prevailed from the northwest at velocities between 10 and 15 MPH and the dilution rate fluctuated between 700:1 and during the snow fall period. Beta activity as high as 300 u uc/liter was in samples inside the 200 East Area for this survey; the maximum activity inside the 200 West Areas was 150 u uc/liter. It is interesting to note maximum results in the West area were obtained in the vicinity of the same location where the maximum activity is detected on vegetation samples area. Outside of the operating areas, all results with the exception of within the limits of the background of the instruments used. One sample milepost 4, Route 4S, indicated activity of 120 u uc/liter. Figure 13 is activity map showing the estimated distribution of the beta activity in the snow samples collected within the separation areas.

SECTION IX

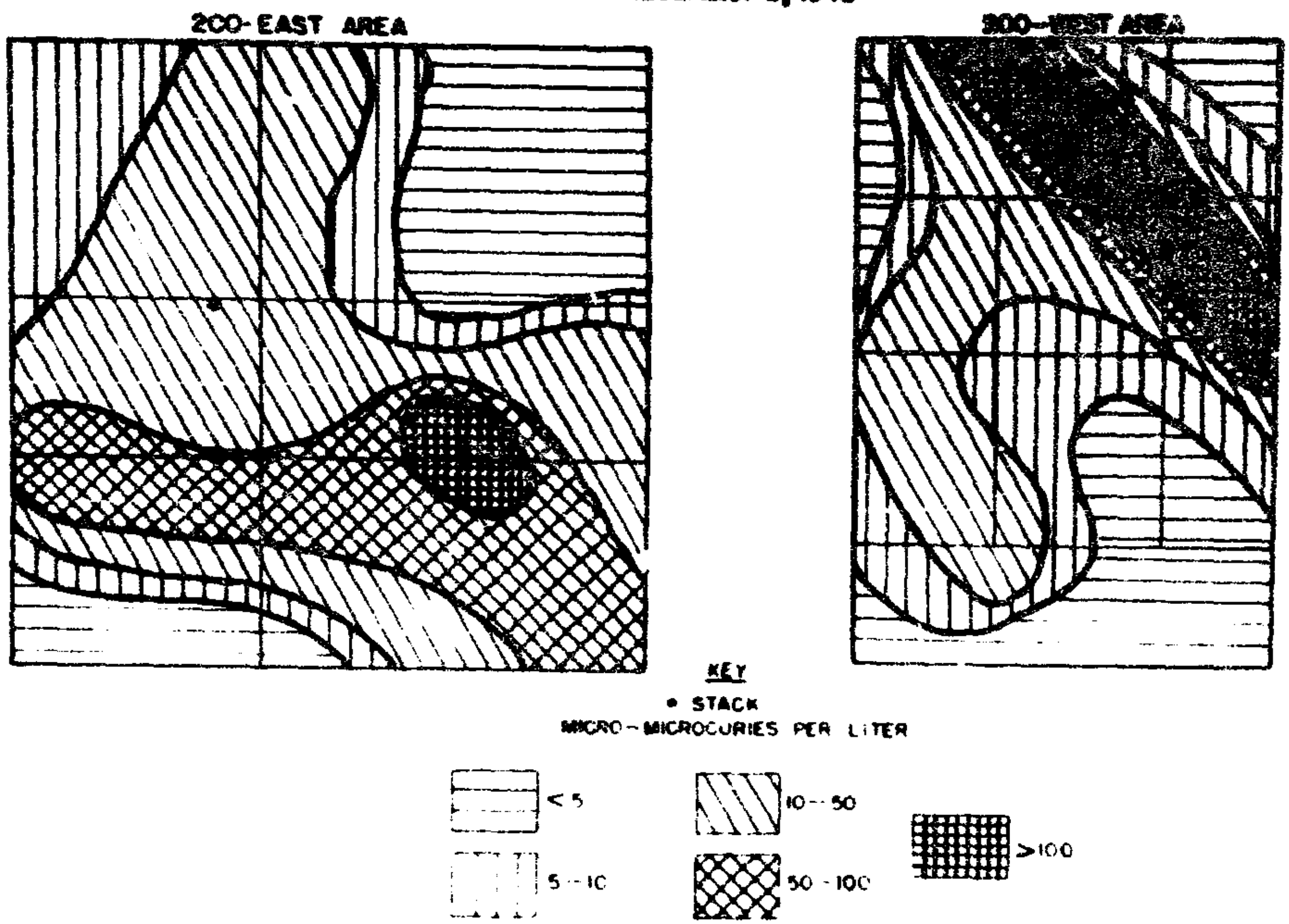
(See Figures 12 and 13)

[redacted]


AVERAGE BETA ACTIVITY
IN
RAIN
HANFORD WORKS & VICINITY
OCTOBER — NOVEMBER—DECEMBER
1948
MILLI—MICROCURIES PER LITER
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0
WITHIN 200 WEST AREA
WITHIN 200 EAST AREA
WITHIN THE 100 AREAS
INTERMEDIATE ZONE ON AREA
OUTLYING ZONE OFF AREA

[redacted]

ISO—ACTIVITY MAP
BETA ACTIVITY IN SNOW
DECEMBER 9, 1949



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SECTION V

ALPHA AND BETA CONTAMINATION IN DRINKING WATER AND TEST WELLS

One thousand and eleven drinking water samples and ninety-nine test well [illegible] les were obtained and analysed during the period October - December, 1948. The number of large water samples (12 liter volumes) was increased during this [illegible] approximately one-fifth of all the samples currently taken were 12 liter volume [illegible] ples.

The number of samples obtained from each of the locations varies from five samples per week to one sample per month depending upon the location of the water source, the probability of a water source becoming contaminated, and on the [illegible] activity determined by previous measurements for radioactive contamination.

The alpha activity measurements for plutonium and uranium were made [illegible] the ether-extraction counting method (4); fluorophotometer analyses [illegible] for specific uranium measurements. Beta-gamma activity was determined by a [illegible] count, using thin mica-window counters, of the residue of an evaporated sample [illegible] A tabulation of the assay for radioactive contamination in test wells [illegible] period is summarized in Table VI.

TABLE VI

AVERAGE ALPHA AND BETA ACTIVITY MEASURED IN TEST WELLS

500 ml. Samples

Location	Number Samples	Alpha dis/min/liter		Beta [illegible]	
		Average	Maximum	Average	[illegible]
300 Area # 1**	52	47	132	5	
300 Area # 2**	52	52	100	5	
300 Area # 3**	51	43	427	4	
300 Area # 4**	47	79	123	7	
B-Y Well	11	5	10	3	
Spring 13	11	3	9	9	
White Bluffs Q-1439B	6	6	24	3	
White Bluffs Q-1440	6	12	19	4	[illegible]

** The four 300 Area Wells were formerly included in the drinking water [illegible]

[redacted]

In the early part of December, these wells were discontinued as a supply [illegible] 300 Area drinking water system on the basis of the positive uranium [illegible] found in these sources. As a result, the 300 Area wells are regarded as "[illegible] although they were part of the drinking water supply during the first two [illegible] covered of this quarter. The 300 Area now receives its drinking water from [illegible] Area well supply. The alpha activity measured in the test well samples was [illegible]mined, by fluorophotometer tests, to be from uranium. The following summary [illegible] months of October and December illustrate the magnitude of the decrease of [illegible]ium content in the 300 Area wells measured by fluorophotometer analysis; this [illegible] is an anticipated one as previous measurements indicated a corresponding de[illegible]rease in well activity with decreasing flow of the Columbia River.

Location	Number Samples	October Average ug/U/liter	Number Samples	[illegible]
300 Area #1	18	30	7	[illegible]
300 Area #2	18	48	7	[illegible]
300 Area #3	18	21	6	[illegible]
300 Area #4	13	65	6	[illegible]

Figure 14 summarizes the alpha activity measured in the drinking [illegible] 300 Area. The change in the trend of radioactive contamination [illegible] supply system can be correlated to the day (December 8, 1948) the [illegible] supply was changed from the contaminated 300 Area Wells to the [illegible] Area well system which is currently the source of drinking water for the [illegible] The results of the radiochemical analysis of the 500 ml. and 12 liter [illegible] samples are summarized in Tables VII and VIII.

Average alpha activity exceeding two (2) dis/min/liter and beta activity [illegible] than ten (10) u uc/liter tabulated; the total number of samples taken from each [illegible]ation from which the average was computed is included. A review of the drinking water data indicated that small amounts of alpha activity were detected in samples from the Richland Wells. The alpha activity in these wells was confirmed to be [illegible]

[redacted]

uranium by specific fluorophotometer measurements. It is believed that this sample [illegible] is natural occurring uranium in deep well water sources. The average alpha count [illegible] detected in Richland Wells #2 and 15 was 10 and 15 dis/min/liter; fluorophotometer analysis indicated 6 and 7 ug U/liter in samples from each of the locations, respect- ively. Similiar trace quantities of uranium were detected in other drinking water sources as indicated in Tables VII and VIII. The Benton City Water supply has con- tinually shown more alpha activity than any surrounding wells. A new well in this region (Benton City Water Company Well) was sampled for the first time in late September. As expected, the alpha activity in this well was of the same order of magni- nitude as measured in other Benton City Well water supply samples. In general, an average alpha activity of about 25 dis/min/liter was detected in well water samples from the Benton City region. Samples from the White Bluffs well again indicated that small quantities of uranium are present in the water table of this area. The average alpha activity measured in forty-six 500 ml. samples was 13 dis/min/liter analyzed by the ether-extraction method. Nineteen samples were analyzed by the fluor- orophotometer method for uranium content; the average value was 9 ug U/liter.

The overall average beta-gamma emitters detected in drinking water samples [illegible] less than the normal reporting level of 50 u uc/liter. Occasional samples taken from the drinking supply in Pasco and Kennewick indicated trace quantities of beta gamma activity. Analyses showed that over ninety per cent of this activity was the short lived isotope of sodium (Na^{24}-14.8 hour half-life). This activity is Pasco and Kennewick drinking water as supplied by the Columbia is prevalent during low river flow which is experienced during the winter months; the overall level of Na^{24} in the water is, even at its maximum concentration, more below the permissible concentration for 14.8 hour sodium in drinking water. About ten per cent of the drinking water samples taken were also analyzed for alpha activity from plutonium using the T.T.A extraction method; all results indicated less than 6 dis/min/liter from that source.

SECTION V

(See Figure 14, Tables VI, VII and VIII)

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TABLE VII

SUMMARY OF ALPHA AND BETA-GAMMA ACTIVITY MEASURED IN WATER [illegible]

500 ml. Samples

October - November - December
[illegible]

Location	No. Samples	Beta-Gamma Activity		Alpha Activity [illegible]	
		μ μc/liter		[illegible]	
		Maximum	Average	[illegible]	[illegible]
Columbia Camp	10	<10	<5	[illegible]	[illegible]
Head Gate	10	10	<5	7	[illegible]
Hanford	6	44	9	10	6
3000 Area A	10	10	5	10	5
3000 Area B	9	16	5	[illegible]	[illegible]
3000 Area D	10	16	5	[illegible]	[illegible]
3000 Area D	9	<10	5	[illegible]	[illegible]
3000 Area E	6	10	[illegible]	[illegible]	[illegible]
3000 Durand 5	8	11	[illegible]	[illegible]	[illegible]
Richland Well #2	16	[illegible]	[illegible]	[illegible]	[illegible]
Richland Well #4	13	[illegible]	[illegible]	[illegible]	[illegible]
Richland Well #5	8	11	5	[illegible]	[illegible]
Richland Well #13	47	21	[illegible]	[illegible]	[illegible]
Richland Well #12	10	16	5	[illegible]	[illegible]
Richland Well #14	10	<10	5	[illegible]	[illegible]
Richland Well #15	18	14	6	[illegible]	[illegible]
Richland Well #16	11	18	7	15	7
Richland Well #18	8	13	7	[illegible]	[illegible]
Tract House K-748	10	15	6	11	4
Tract House J-605	10	<10	5	13	8
Benton City	12	15	5	31	[illegible]

[redacted]

TABLE VII (CONTINUED)

Location	No. Samples	Beta-Gamma Activity u uc/liter		Alpha Activity dis/min/liter	
		Maximum	Average	Maximum	Average
Cobbs Corner	12	< 10	< 5	8	5
Kennewick 614	13	45	20	10	3
Riverland	11	< 10	< 5	9	3
Midway	11	14	< 5	11	3
Lower Knob	12	60	5	9	2
Wills Ranch	11	< 10	< 5	12	5
Pasco	12	116	45	7	3
Sogersons Ranch	7	< 10	< 5	25	5
Pistol Range	10	11	< 5	10	6
White Bluffs	46	11	< 5	21	13

[redacted]

TABLE VIII

SUMMARY OF ALPHA AND BETA-GAMMA ACTIVITY MEASURED IN WATER SUPPLIES

12 Liter Samples

October - November - December

Location	No. Samples	Beta-Gamma Activity u uc/liter		Alpha Activity [illegible]	
		Maximum	Average	Maximum	Average
Richland Well #13	6	< 10	< 5	10	5
# 2	6	< 10	< 5	14	7
# 4	3	< 10	< 5	10	8
# 5	2	< 10	< 5	6	6
#12	3	< 10	< 5	4	4
#14	3	< 10	< 5	10	7
#15	5	< 10	< 5	14	7
#16	5	< 10	< 5	7	4
#18	4	< 10	< 5	8	5
Tract House K-748	4	< 10	< 5	4	3
J-685	4	< 10	< 5	4	2
Columbia Camp	7	< 10	< 5	4	2
Headgate	6	< 10	< 5	4	3
Hanford Well	3	< 10	< 5	5	3
3000 Area Well A	5	< 10	< 5	11	5
Well B	5	< 10	< 5	5	4
Well C	6	< 10	< 5	5	4
Well D	6	< 10	< 5	5	4
Well E	3	< 10	< 5	4	4
3000 Durand #5	3	< 10	< 5	4	3
Benton City Chevron Sta.	6	< 10	< 5	25	19
Cobbs Corner	5	< 10	< 5	4	5

[redacted]

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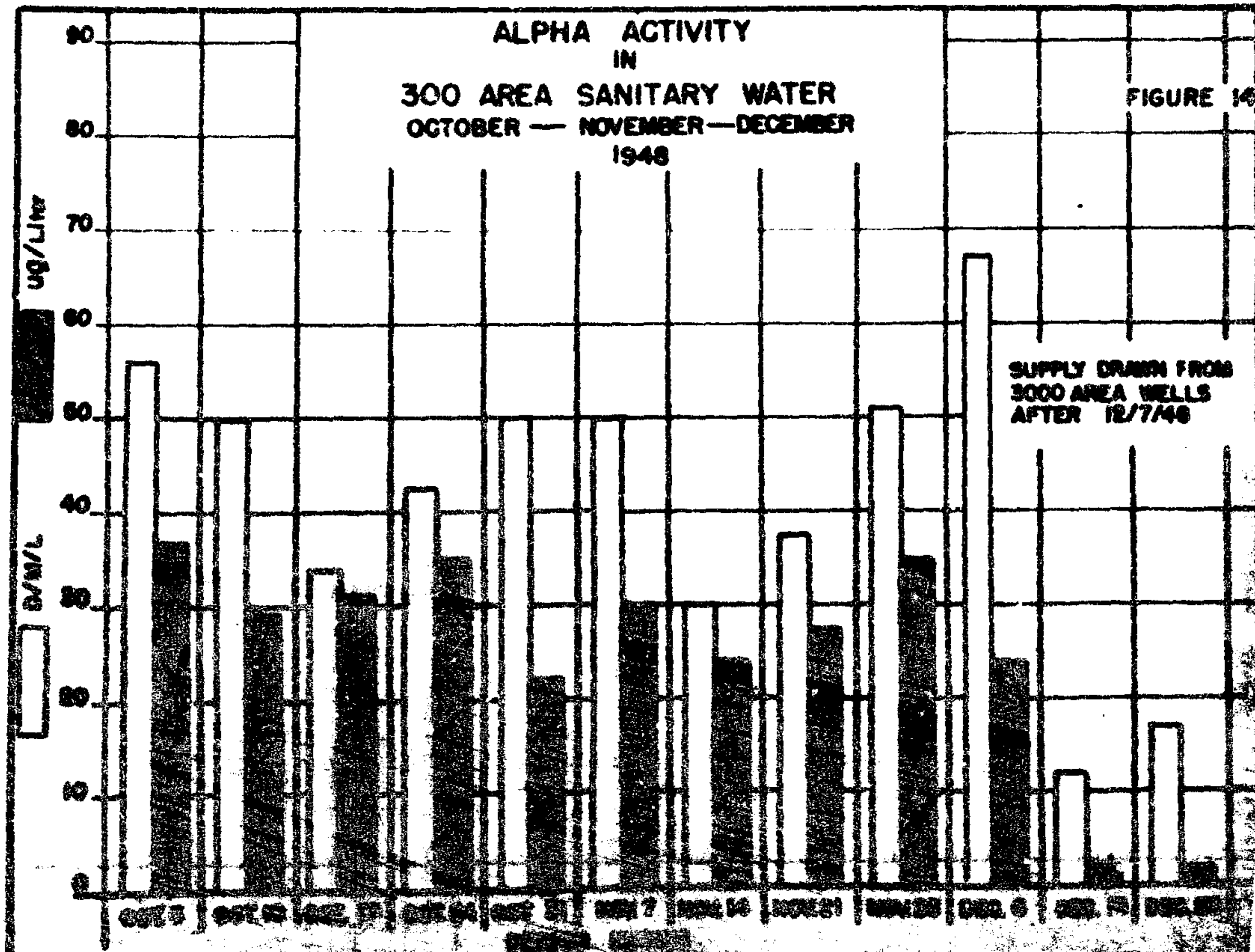
TABLE VIII (CONTINUED)

Location	No. Samples	Beta-Gamma Activity [illegible]		Alpha Activity [illegible]	
		Maximum	Average	[illegible]	[illegible]
Benton City H_2O Co.	1	< 10	< 5	[illegible]	[illegible]
Kennewick 614	10	< 10	< 5	< 2	< 2
Kennewick Std. Sta.	10	41	7	17	6
Riverland	4	< 10	< 5	2	< 2
Midway	4	< 10	< 5	2	< 2
Lower Knob	4	< 10	< 5	3	< 2
Wills Ranch	3	< 10	< 5	< 2	< 2
Pasco H&R Depot	10	81	18	6	2
Segersons Ranch	2	< 10	< 5	< 2	< 2
Pistol Range	6	< 10	< 5	7	[illegible]
White Bluffs	5	< 10	< 5	14	14
Sanitary 100-H	1	< 10	< 5	< 2	< 2

[redacted]



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SECTION VI

BETA-GAMMA CONTAMINATION OF VEGETATION

The quantity of eight day radio-iodine formed during [illegible] solution of the irradiated uranium in the separation areas, as calculated, is [illegible] marized below:

Month	200 East Area Curies I^{131}	200 West Area Curies I^{131}
October	223	[illegible]
November	213	[illegible]
December	139	[illegible]
Total	575	714

A total of 1289 curies of I^{131} formed during dissolving for the three months did not differ greatly from the 1366 curies of I^{131} formed during the previous [illegible] ter, of this total, 714 curies of I^{131} were formed in the 200 West Area [illegible] units and 575 curies in the 200 East Area dissolver units.

It is interesting to note that 53 per cent of the time during this [illegible] one or two of the separation areas were [illegible] range of cooling time for the irradiated uranium [illegible] cooling periods occurring during the month of December.

Figure 15 graphically portrays the calculated quantity of I^{131} formed in the dissolver, based on the irradiation of the metal, the total weight, and cooling [illegible]

The results for the radioactive contamination measured in vegetation [illegible] during October and November were based on a direct count of a one gram vegetation sample using a thin mica-window counter with corrections made for eight day [illegible] geometry, and self-absorption losses. The limit of sensitivity for this [illegible] measurement was about 0.04 uc/kg based on a one gram sample. Residual long half-[illegible] isotopes in the vegetation was neglected and the assumption was made that all the activity on the vegetation was from eight day iodine (I^{131}). To correct for [illegible]

[redacted]

error in the assumption, methods were developed to measure the activity from only and that from the longer half-lived fission product elements present in etation including a measurement for the beta activity from the isotope of (K^{40}) present in the potassium salts in the vegetation. This particular was applied to all vegetation samples analyzed effective December 1, 1948. Environs Report for December 1948 (5) reviews the analytical procedures for the I^{131} measurement and for the non-volatile longer half-lived elements; the sensitivity for the I^{131} analysis based on a five gram vegetation sample is 2 I^{131}/kg (0.002 uc I^{131}/kg). The limit of sensitivity for the non-volatile is about 5 muc/kg (0.005 uc/kg) although a "reporting level" of 10 muc/kg is it was found by spot checks that the beta activity from K^{40} in the vegetation ages about 10 m uc/kg; this latter figure is based on only twenty K^{40} and is considered as a tentative value until more measurements are made to establish the background level of the radioactivity from K^{40} in the this locality.

Comparing the data for direct measurements on vegetation with that of the previous three month period, small decrease in active contamination measured on the vegetation is noted. The overall estimated distribution of radioactive wastes deposited on vegetation in the environs of Hanford is attached (Figure 20). A wind rose summarizing the average ions only during the periods when radioactive wastes were emitted from tion areas stacks is also included on Figure 20. The pattern of the the wastes agrees reasonably well with the overall average wind directions. 22 shows the overall average beta activity detected on vegetation from the locations. The most outstanding decrease in beta activity was observed in the idential communities of Pasco, Kennewick, and Richland. Sixty-five samples locations in Richland averaged 0.027 uc/kg whereas the previous quarter

[redacted]

0.030 uc/kg. Similarly, the average beta activity based on forty-seven [illegible] Kennewick decreased from 0.056 uc/kg to 0.022 uc/kg in this period. A [illegible] decrease was observed in Pasco where forty-eight samples averaged 0.0[illegible] uc/kg [illegible] pared with the average of 0.026 uc/kg for the previous period. One [illegible] sample from Pasco, indicating 0.164 uc/kg tended to minimize the decrease in overall average activity at that location. This sample was greater by a [illegible] two than any other sample from the Tri-City Area.

Minor decreases in beta activity deposition in the Benton City region were significant, the average beta activity detected on vegetation in and adjacent [illegible] ton City was about 0.020 uc/kg. Beta activity of 0.026 uc/kg was found in the [illegible] inity of Columbia Camp and the road between the Camp and Benton City.

Inside the perimeter fence, the beta activity on vegetation varied [illegible] kg to 0.15 uc/kg at locations such as the 100 Areas, Hanford, [illegible] intermediate locations. Approaching the separation areas the beta [illegible] tion was somewhat greater. An overall three month average of 0.4 and 0.[illegible] beta activity was detected on samples along Route 3 and just outside the [illegible] Gate. Individual results as great as 2.8 uc/kg were measured [illegible] side the 200 West gate. Within the separation areas, the average beta [illegible] lower than that found between the areas. Fifty-five vegetation samples [illegible] West Area averaged 0.085 uc/kg. (0.42 maximum) while forty-six samples from [illegible] Area averaged 0.21 uc/kg (1.2 maximum). The higher activity found on the [illegible] in the East Area is again attributed to its geographical location, which [illegible] downwind pattern of the prevailing wind and represents an accumulation of the [illegible] active wastes emitted from both stacks. Table 9 is a summary of the [illegible] statistical comparison of the current average beta activity detected in vegetation samples with that of the previous quarter for some selected locations; the total number of samples considered in the analyses is also included in the summary.

[redacted]

During the month of December, most of the vegetation was analyzed [illegible] for I^{131} and the non-volatile emitters. Table 10 summarizes the results [illegible] during December, 1948. In general, the I^{131} activity averaged 0.00[illegible] uc/kg in the residential areas, this average increasing approximately four-fold near the [illegible]ration areas where an average I^{131} activity of 0.07 uc/kg was measured. The lo[illegible] half-life component ranged from about 0.006 uc/kg to 0.05 uc/kg, the higher [illegible] again occurring near the separation areas. The latter results included the beta [illegible]ivity from the natural occurring K^{40} in the potassium salts in the vegetation.

TABLE 10
RADIOACTIVE CONTAMINATION IN VEGETATION
DECEMBER 1948

LOCATION	I^{131} as uc I^{131}/kg MAXIMUM	AVERAGE	Non-Volatile Emitters [illegible] MAXIMUM	AVERAGE
Inside 200 East	0.019	0.007	0.242	[illegible]
Inside 200 West	0.226*	0.004	0.409	[illegible]
Adjacent to 200 Areas	1.400	0.072	0.379	[illegible]
North of 200 Areas	0.032	0.005	0.049	[illegible]
South of 200 Areas	0.005	0.002	0.062	[illegible]
Richland	0.009	< 0.002	0.037	[illegible]
Pasco	0.002	< 0.002	0.019	< 0.[illegible]
Kennewick	0.002	< 0.002	0.027	[illegible]
Benton City	0.002	< 0.002	< 0.010	< 0.[illegible]
Wahluke Slope	0.007	0.012	0.033	[illegible]
Hanford	0.012	0.002	0.021	[illegible]

In addition to the monitoring for radioactive contamination already [illegible] surveys of the Pasco to Ringold area were also made during the quarter. [illegible] samples taken, an average beta-gamma contamination level of .035 uc/kg was [illegible] by the direct count method. This is not significantly different from the level [illegible]

[redacted]

activity measured in the Tri-City area during this period. Eleven [illegible] were analyzed for the non-volatile emitters; none were significantly [illegible] the reporting level of .010 µc/ kg.

A special survey of vegetation in the Horse Thief Valley section [illegible] October, 1948. A total of 123 vegetation samples were collected, the [illegible] gamma activity detected was .030 µc/kg, as determined by the direct [illegible] Comparing this average with the October results from the Tri-City [illegible] significant difference in the contamination level between both [illegible] from this location were analyzed for I^{131} and for the non-volatile [illegible] For I^{131}, no results were above the reporting level of .002 uc/kg; the [illegible] beta activity results fluctuated slightly above and below the reporting [illegible] .010 µc/kg.

Three surveys of the Plymouth-Kennewick-[illegible] area [illegible] ivity deposition during this period. Fifty-six samples were [illegible] beta-gamma contamination measured was 0.032 µc/kg as [illegible] method. During December, twelve samples were analyzed for [illegible] activity; the results indicated contamination levels below [illegible] for both sources of activity.

Twenty-five samples were collected in the area between [illegible] The surveys indicated an average beta-gamma level of .0[illegible] direct count method. No significant trend was noted during [illegible]

Two surveys of the Wahluke Slope Area were completed [illegible] six samples taken on November 20, averaged 0.0267 µc/kg (direct [illegible] six of these samples were analyzed for the non-volatile [illegible] average activity was 0.005 µc/kg. The average beta activity [illegible] direct count method during this period was significantly lower than [illegible] measured on a similar survey in September when the average was 0.[illegible] µc/kg.

average beta activity on the vegetation in December based on seventy-one [illegible] 0.026 μc/kg.

Two surveys of the Benton Gap region indicated an average beta [illegible] 0.041 μc/kg. No difference was observed in the activity measured at [illegible] vations. The maximum individual result was 0.08 μc/kg. Figure [illegible], [illegible] deposition of beta activity on the vegetation at the various elevations on [illegible]

In addition to the samples taken on and adjacent to the Hanford project, vegetation samples were collected from an area bounded by Ellensburg, The [illegible] Pendleton and Spokane. The beta activity, as measured by the direct count [illegible] averaged about 0.025 uc/kg, this figure is based on about 200 samples collected [illegible] ing October, 1948. Those samples collected in the Walla Walla-Pendleton Area [illegible] aged 0.030 uc/kg and were significantly higher than samples collected in the [illegible] nish-Dalles Area which averaged only 0.020 uc/kg.

It is believed that this small difference, although significant, is due [illegible] varying amounts of K^{40} in the vegetation rather than to deposited [illegible] from the Hanford Project as spot checks for the most significant isotope in [illegible] gases, 8 day iodine (I^{131}), in these vegetation samples indicated less [illegible] uc I^{131}/kg. vegetation. It still remains to be proven, however, that [illegible] in K^{40} content in the vegetation of this area can be expected.

[redacted]

TABLE 9

STATISTICAL COMPARISON OF AVERAGE BETA ACTIVITY DENSITIES*

ON VEGETATION

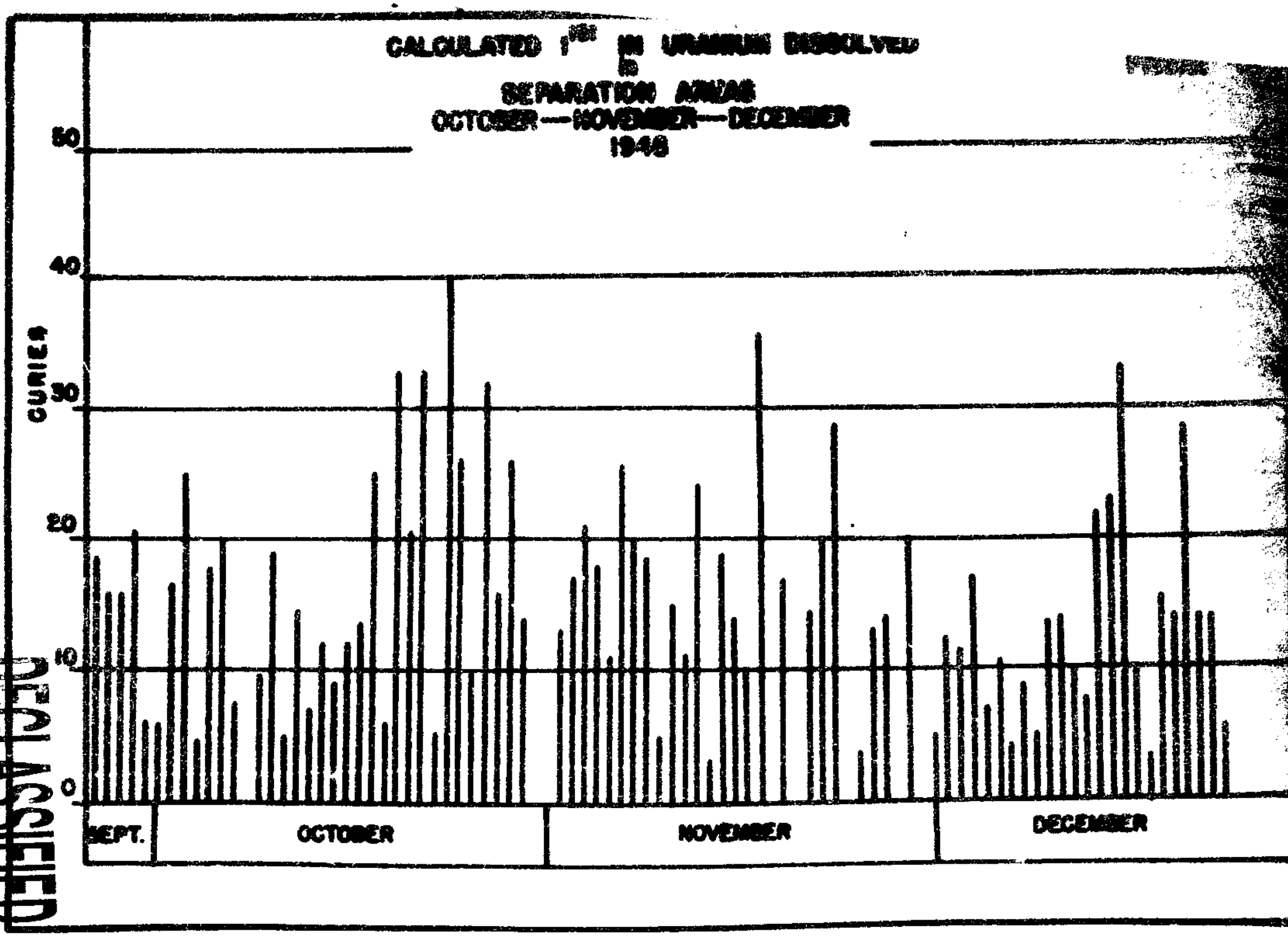
1948

Values in Microcuries per Kilogram								
LOCATION	JULY - SEPTEMBER			OCTOBER - DECEMBER			"t"	CONCLUSIONS
	No. Samples	Maximum	Average	No. Samples	Maximum	Average	"t" Test	
Richland	62	0.111	0.030	63	0.087	0.017	2.60	Highly Significant Decrease this quarter.
Kennewick	52	0.090	0.036	47	0.067	0.022	2.62	Highly Significant Decrease this quarter.
Pasco	51	0.086	0.028	48	0.164	0.019	1.38	High individual sample nullifies otherwise significant decrease
Columbia Camp & Vicinity	104	0.094	0.033	100	0.104	0.026	1.71	Decrease not significant.
Benton City & Vicinity	40	0.138	0.032	37	0.102	0.020	1.69	Decrease not significant.
Hanford & Vicinity	26	0.203	0.052	25	0.120	0.040	<1.00	No significant trend.
Benton City to Richland	39	0.160	0.039	36	0.104	0.025	2.15	Decrease of questionable significance.
Gable Mt. & Vicinity	50	0.144	0.049	50	0.099	0.040	1.58	No significant change
Midway-Riverland & Vicinity	61	0.084	0.028	68	0.093	0.031	< 1.00	No significant change

*These values were based on the direct measurement for beta activity on vegetation correcting for decay for 8 day iodine, geometry of the mica-window counters, and self-absorption.

SECTION VI

(See Figures 15, 16, 17, 18, 19, 20, and 22 - Tables 9 and 10)


CALCULATED I^{131} IN URANIUM DISSOLVED
IN
SEPARATION AREAS
OCTOBER—NOVEMBER—DECEMBER
1948
CURIES
50
40
30
20
10
0
SEPT.
OCTOBER
NOVEMBER
DECEMBER

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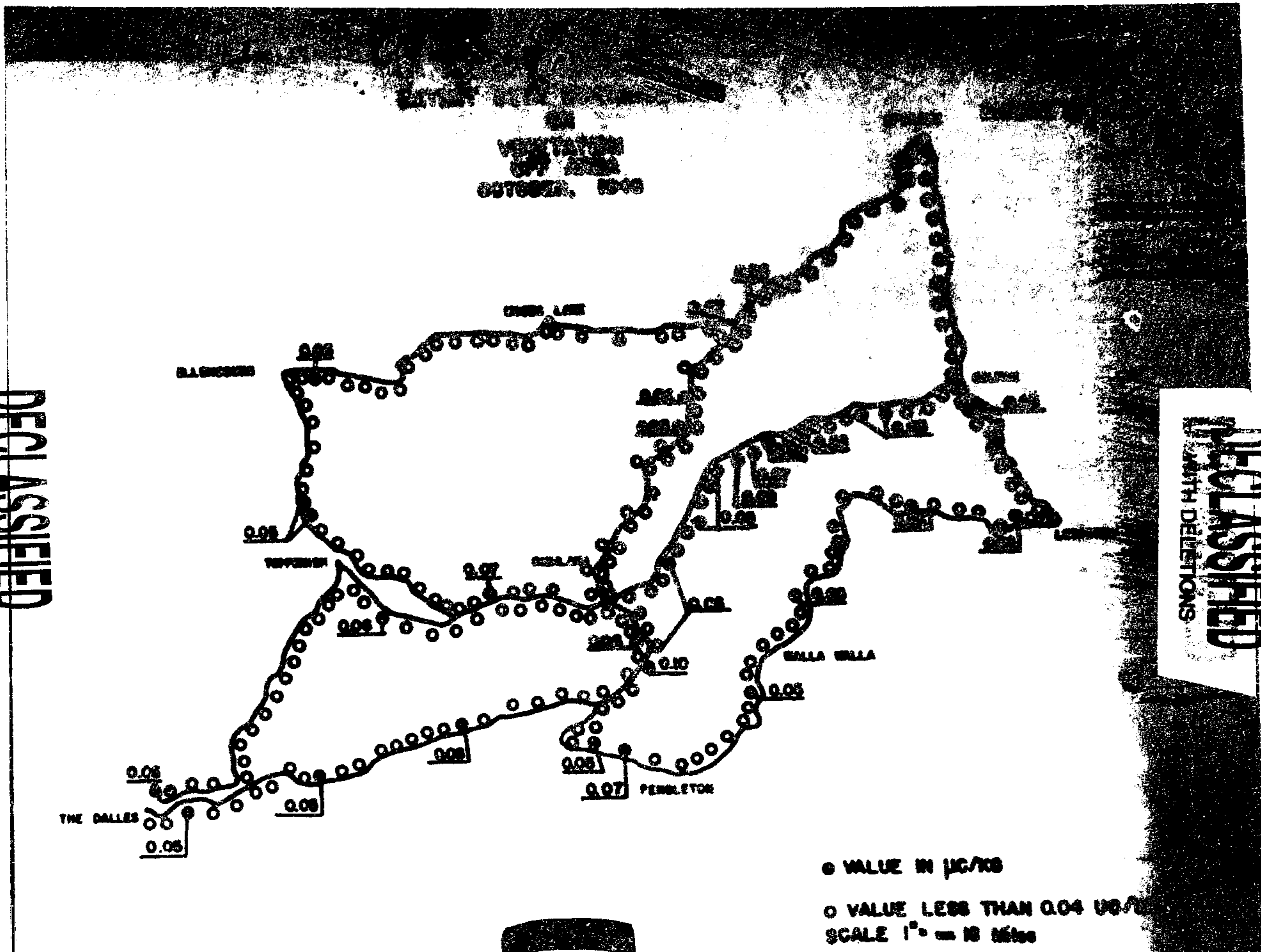

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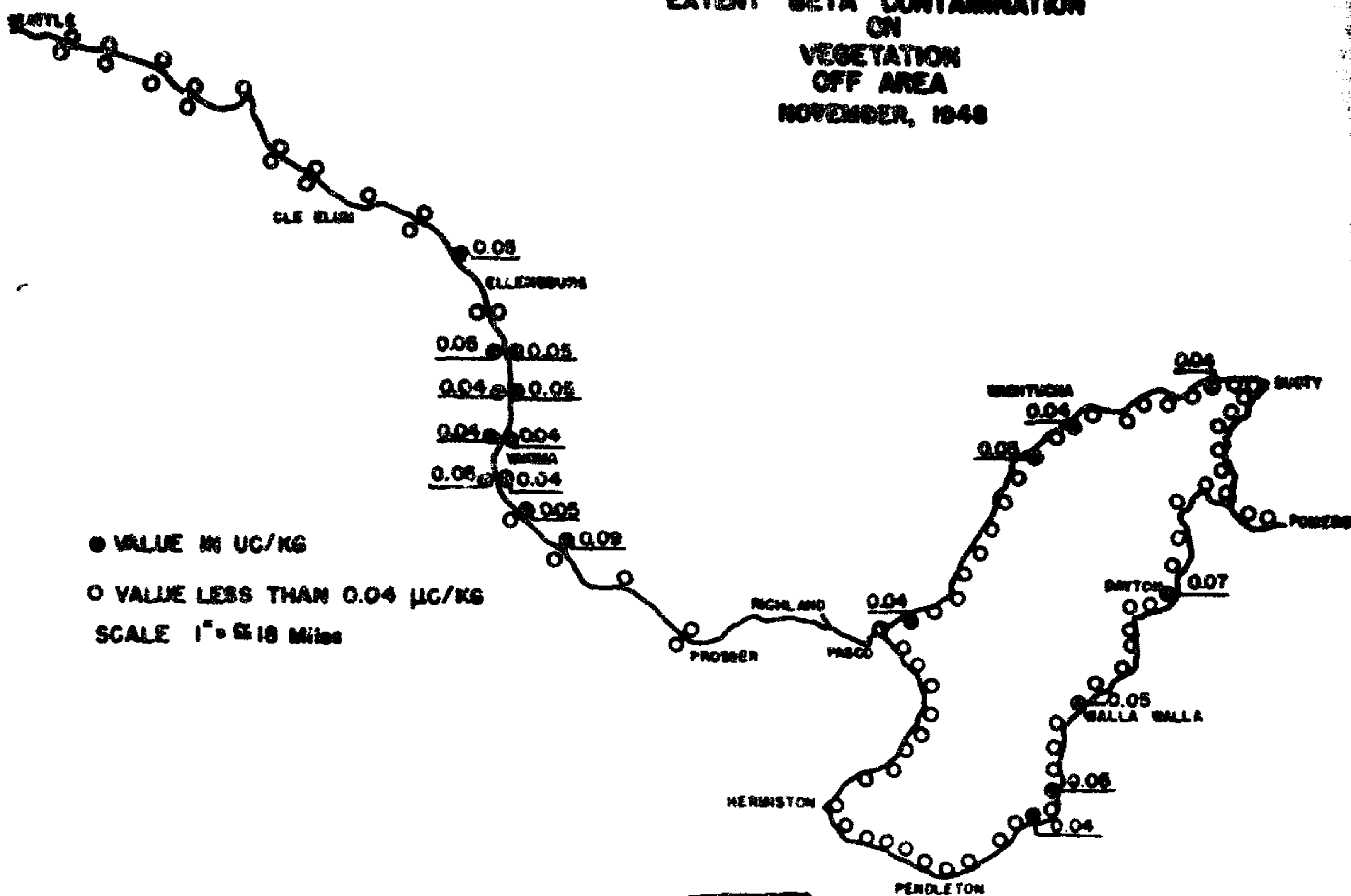
FIGURE [redacted]

EXTENT BETA CONTAMINATION ON VEGETATION OFF AREA NOVEMBER, 1948



● VALUE IN UC/KG

○ VALUE LESS THAN 0.04 μC/KG

SCALE 1" = 18 Miles

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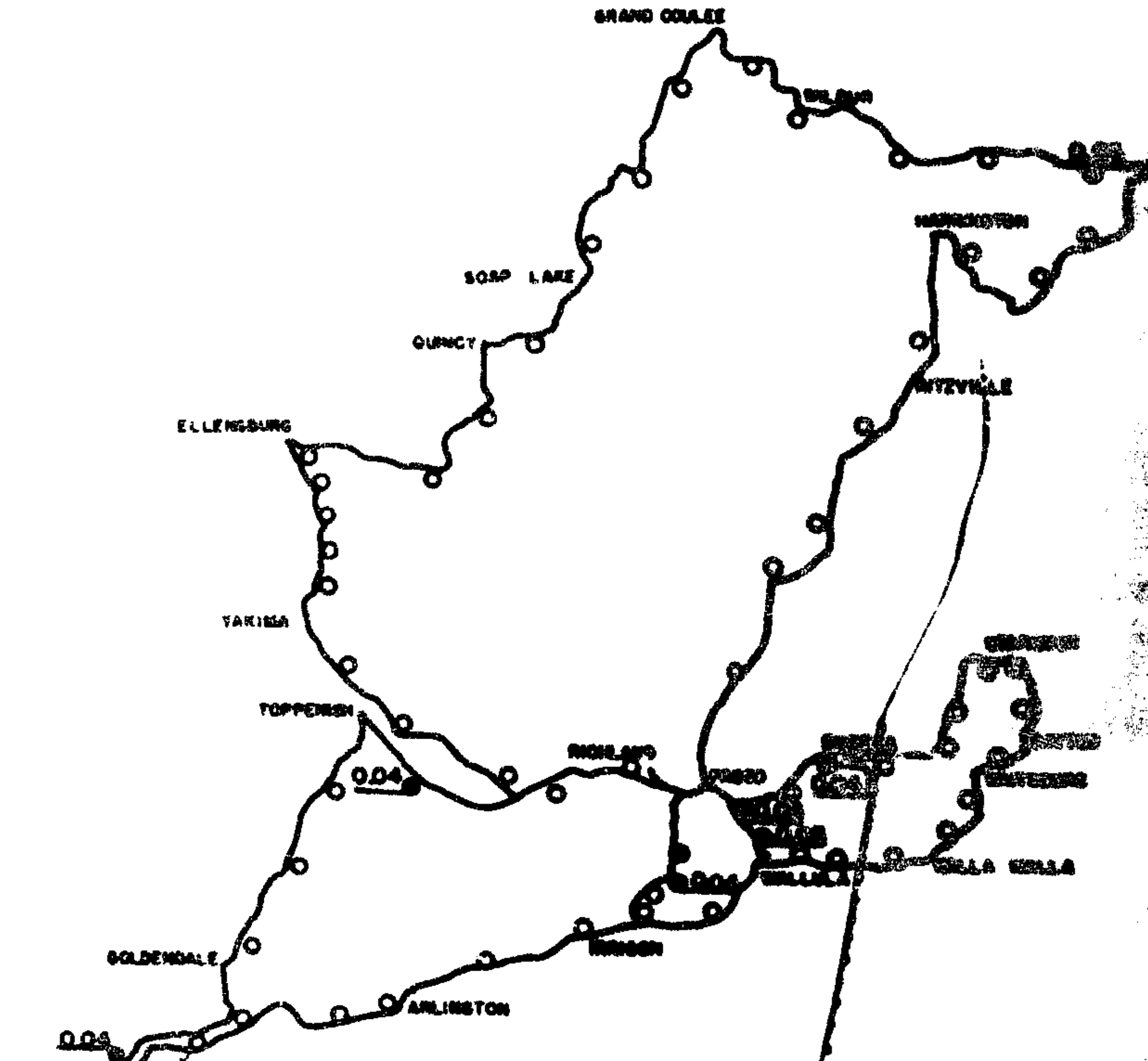
EXTENT BETA CONTAMINATION
ON
VEGETATION
OFF AREA
DECEMBER, 1948

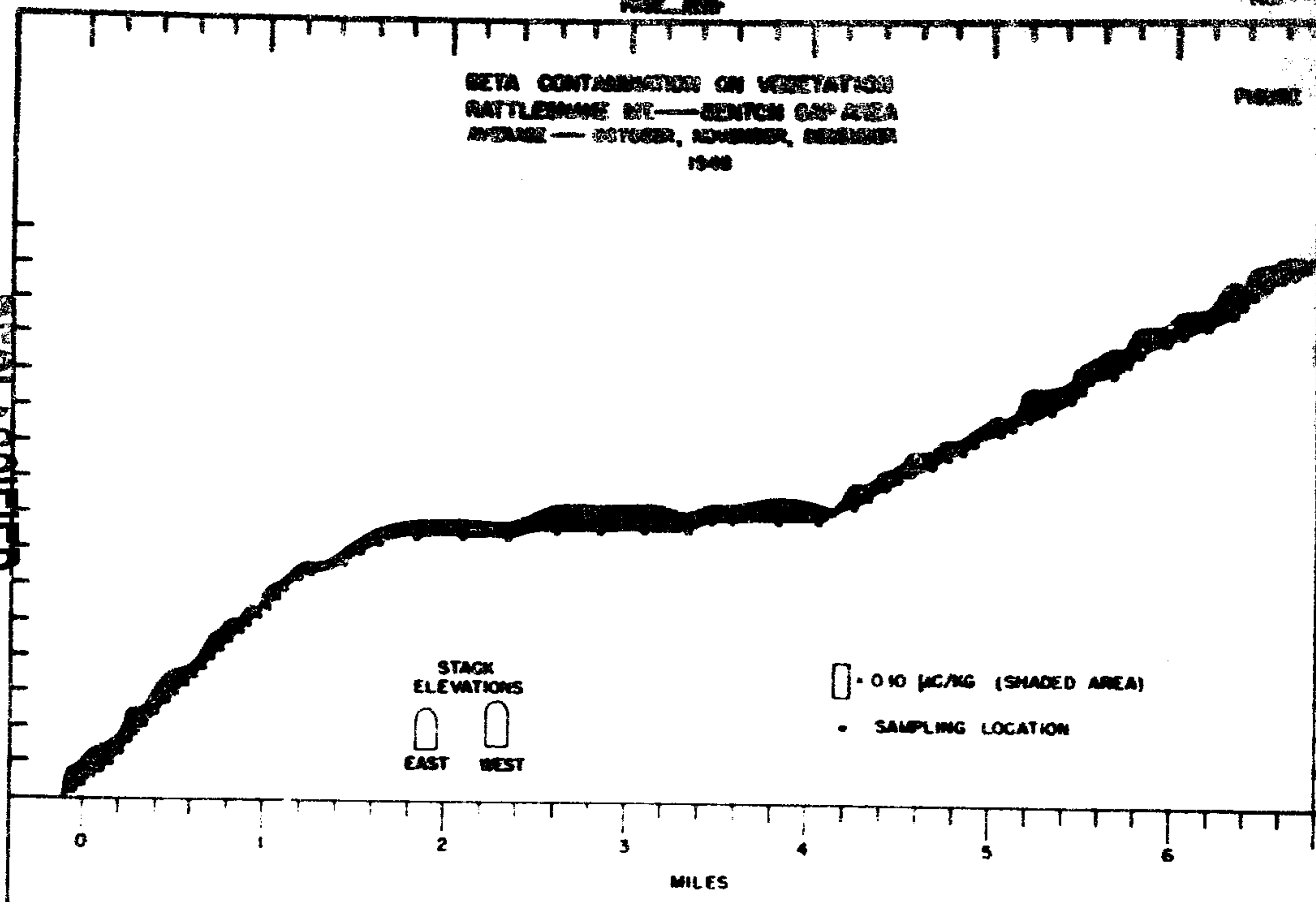


● VALUE IN µc/kg

○ VALUE LESS THAN 0.04 µc/kg

SCALE 1" = 28.18 Miles

[redacted]



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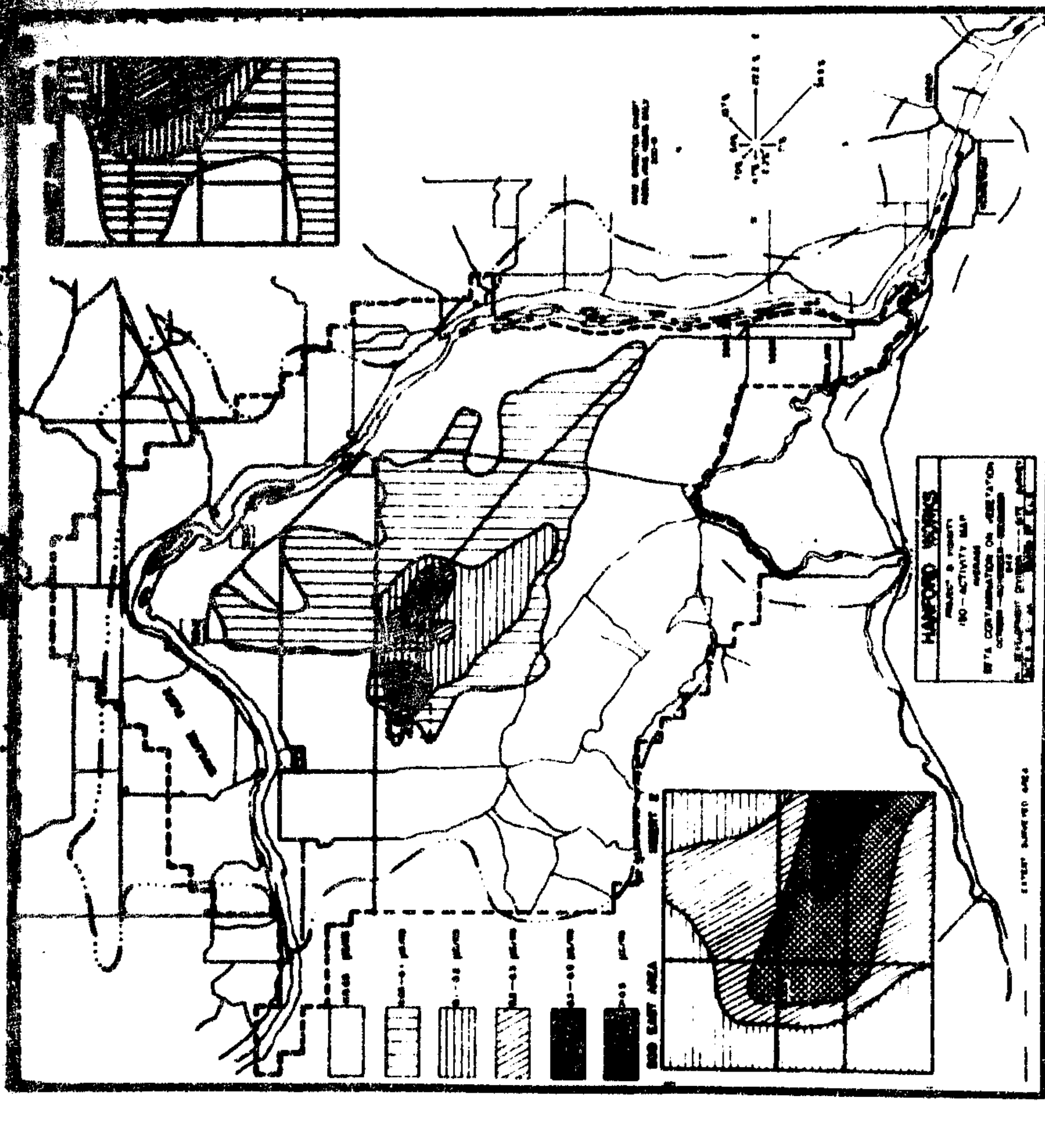

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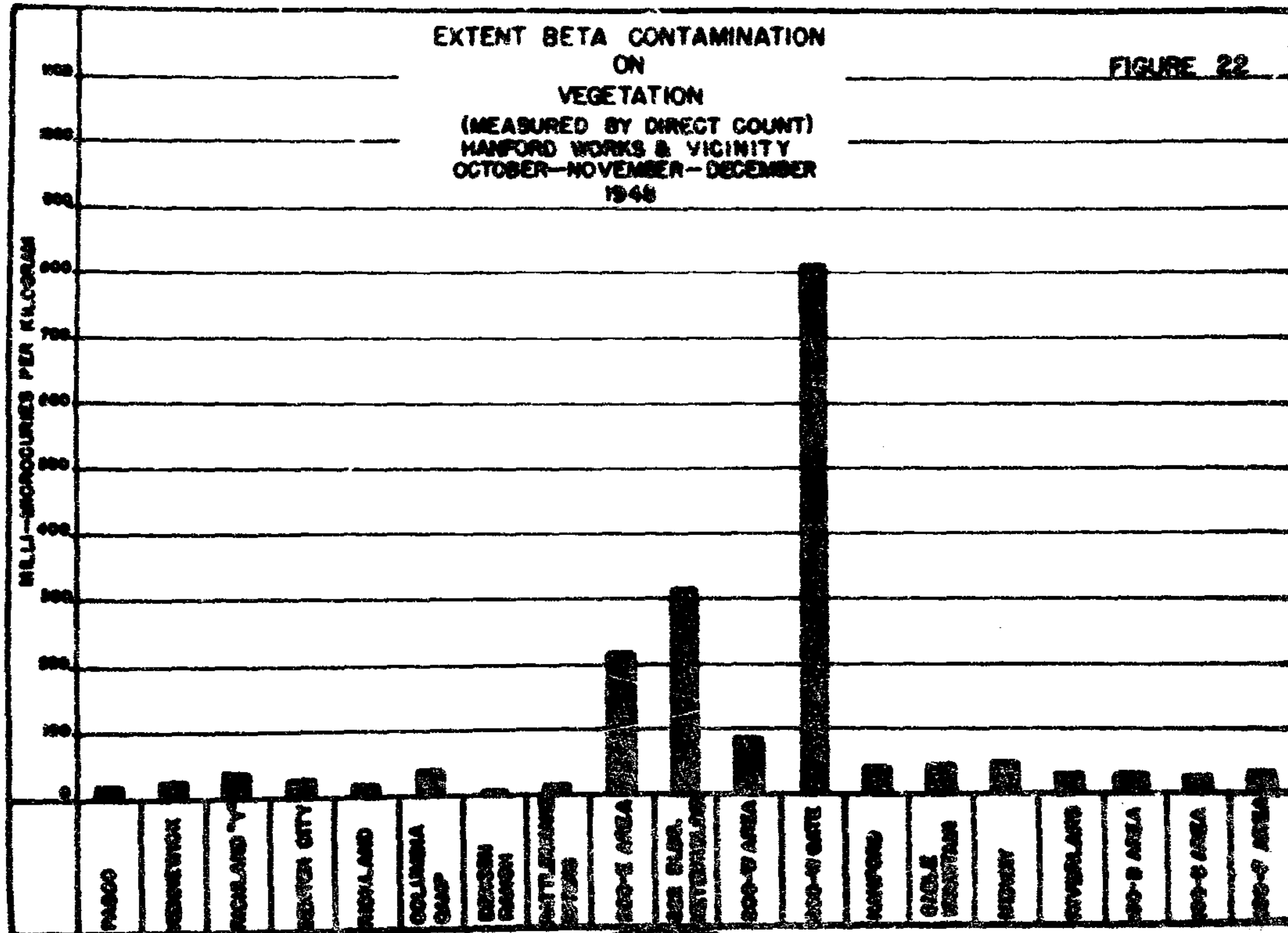

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SECTION VII

ALPHA AND BETA CONTAMINATION IN HANFORD WASTE

100 AREAS:

About one hundred samples were taken from the 107 waste effluent waters; the beta-gamma activity in these samples varied from about 200 to 300 m μc/liter; the average activity detected in the 107 samples was 230, 260, and 220 m μc/liter at the 100B, 100D, and 100F Areas, respectively. The average activity values in the 107 waste waters at 100B and 100F remained about the same during this period as compared with the previous three months; a slight increase was noted in the 107-D wastes during this period.

Samples taken from the 1904 spillways indicated that the beta activity is slightly higher at this point than found in the 107 basins; this difference may be superficial in that the averages were compiled on the basis of two-three samples per week which is not a truly representative picture of the overall average radioactive contamination level at that point. Statistical comparisons indicate that the activity levels measured in the 107 basins are comparable to the levels measured in samples taken from the spillways. Figure 21 summarizes the results of the radioactive contamination monitoring at the 107 basins and the 1904 spillways.

The overall average alpha activity from plutonium and uranium in these waste samples as determined by the ether-extraction method indicated the values to be less than 25 dis/min/liter.

Analyses of the waste samples for alpha activity from plutonium (T.T.A. extraction method) indicated the average alpha activity to be less than 6 dis/min/liter in samples from all areas. Eleven samples were analyzed specifically for polonium; the results showed no detectable alpha activity from polonium (< 6 dis/min/liter). Twelve samples of the effluent were analyzed for that activity due to S^{35}. In general, this beta activity averaged about 10 m μc/liter. An average of 8.9, 11.3, and

[redacted]

10.4 mμc/liter from S^{35} was detected in samples from the 107-D, 107-F, and 107-B Areas, respectively. The maximum beta activity from S^{35} detected in any individual sample was 34 mμc/liter taken from the 107-F Area basin.

Five samples of the 100-B dryer room condensate were analyzed for beta activity. The average beta activity from S^{35} in this condensate was 181 μc/liter. The individual maximum result was 302 μc/liter. Two samples of the water soluble oil (commercial Calol) were obtained from 100-B. The beta activity measured in these samples was 5.6 and 8.3 mμc/liter, respectively.

200 AREAS:

Retention Basins:

Seventeen samples taken from the retention basins in the separations indicated that the radioactive contamination level in 200 East Area was about the same as that in the 200 West Area. The beta activity measured in the 271-B basin samples averaged 0.170 mμc/liter whereas that measured in the 271-T samples averaged 0.130 mμc/liter. The maximum beta activity result in an individual sample was 0.47 mpa/liter taken from the 271-B basin. This result was nearly twice as high as the maximum detected in 271-T (0.290 mμc/liter).

All retention basin samples were analyzed for alpha activity; the average alpha activity was less than 30 dis/min/liter in each area. The maximum alpha activity detected in an individual sample was about 60 dis/min/liter.

T Swamp and Vicinity:

Forty samples from this area indicated that the average beta activity ranged from 0.07 mμc/liter to 0.10 mμc/liter at various sampling locations around the swamp perimeter and inlet. The maximum beta activity detected in this waste area was 0.670 mμc/liter. These same samples were analyzed for alpha activity; the results varied from 30 dis/min/liter to 1000 dis/min/liter.

U Swamp and Vicinity:

The beta activity measured in samples from the U Swamp was less than .3 [redacted]

[redacted]

μμc/liter with an occasional maximum in the neighborhood of 0.1 μμc/liter. Alpha activity detected in the same samples varied from 30 dis/min/liter to 1100 dis/min/liter, the average being around 100 dis/min/liter. This activity detected in the T Swamp apparently originates from the laundry waste water. The swamp has two sources of waste water, the laundry and the 231 building. The latter indicated minimum activities, most samples indicating a level of alpha-beta activity less than the ... detectable amounts.

Beta and alpha activity measurements in the laundry effluent varied considerably; this variation is directly dependent on the contamination level of the clothing in process and on the time a sample was taken. In the most unusual cases in this period, beta activity in excess of 12 μc/liter were detected in a sample from the laundry ditch inlet. Samples from about 600 feet below the inlet side indicated activity in excess of 7 μc/liter. Alpha activity of about 1000 dis/min/liter was detected in a few samples from each location.

Solid Sampling:

In addition to the liquid sampling, samples of mud were taken from those waste areas in which possible accumulation of activity in the mud could take place as the waste liquids seep into the earth. The beta activity measured in the T swamp mud was about half that found in the liquid waste, average about 0.05 μc/kg throughout the quarter. Maximum results were in the range of 0.1 μc/kg to 0.15 μc/kg, which again is considerably less than that detected in the liquid. The results of the alpha measurements indicated a definite accumulation in that the mud values exceeded the measurements in the surrounding liquid media.

The average alpha activity in the T Swamp mud was about 200 dis/min/gram with occasional maximums of 600 dis/min/gram.

Weekly samples of laundry lint obtained on the ground just outside the laundry building in the 200 West Area showed an average beta activity level of 0.4 μc/kg and an average alpha activity level of 750 dis/min/gram. Individual maximum values measured in these samples indicated a maximum beta activity of about 2.0 µc/kg and maximum alpha activity of about 2500 dis/min/gram. Table 11 summarizes the results of the sampling program in the various waste zones within the confines of the separation areas.

ALPHA AND BETA ACTIVITY IN 200 AREA WASTES

OCTOBER - NOVEMBER - DECEMBER

1948

Location of Sample	BETA ACTIVITY AS µc/liter		ALPHA ACTIVITY AS dis/min/liter		SOURCE OF WASTE
	AVERAGE	MAXIMUM	AVERAGE	MAXIMUM	
271-B Retention Basin	0.17	0.47	30	60	Process cooling water
271-T Retention Basin	0.13	0.29	30	50	Process cooling water
Laundry Ditch Inlet	0.60	12.4	85	430	Wash and rinse water
Laundry Ditch at 600'	0.07	7.4	150	830	Wash and rinse water
231 Pipe Outlet	0.05	0.24	30	35	Process cooling water
231 Waste Ditch	0.05	0.13	35	220	Process cooling water
T Swamp Inlet	0.10	0.67	30	70	271 T Retention basin
T Swamp So. Side	0.08	0.30	130	1000	271 T Retention basin
T Swamp W. Side	0.07	0.17	33	140	271 T Retention basin
U Swamp Inlet	0.05	0.05	55	320	Laundry Waste & 231 [illegible]
U Swamp West Side	0.05	0.60	170	1100	Laundry Waste & 231 [illegible]

200 North Area:

Weekly portable instrument surveys of the three waste ditches in this area showed the normal radiation level to be around 3.0 to 4.0 mrep/hr. Maximum readings obtained were 5.0 mrep/hr at the "P" Ditch.

Test Wells: Surveys of the test wells, using portable instrumentation indicated no significant changes in the underground radiation levels adjacent to the waste lines from surveys of previous months.

Surface Waste Lines: The surface surveys of the waste lines between the 271 buildings and the tank farms were discontinued during this period. This survey is currently performed by the S Division.

300 Area Wastes:

The old 300 Area retention basin has been repaired and in addition to the old basin a new retention basin was built adjacent to the old pond; the data tabulated in the table below summarizes the alpha and beta-gamma activity detected in samples from the retention basins during this quarter:

300 AREA PONDS

OCTOBER - NOVEMBER - DECEMBER

1948

Location & Type Sample	Total Beta Activity muc/kg*		Total Alpha Activity dis/min/kg*	
	Maximum	Average	Maximum	Average
Old Pond Inlet (Water)	3.3	0.6	13000	3300
Old NW Corner (Water)	0.3	0.2	4400	2300
New Pond Inlet (Water)	0.6	0.3	6100	2100
Old Pond Inlet (Mud)	5.9	0.08	7×10^5	2×10^5
Old Nw Corner (Mud)	0.1	0.04	2×10^5	6×10^4

*It is assumed that one (1) liter of liquid waste weighs one (1) kilogram.

All samples collected during December were analyzed for uranium by the fluorophotometer method; the results indicated that the alpha activity was from uranium. The fluorophotometer results indicated values as high as 1×10^4 µg U/liter of waste water and 2.4×10^5 µg U/kg waste mud.

Sixty-five 300 Area waste line samples from the principal waste line in the 300 Area were collected during this quarter. The contamination level varied widely from day to day and ranged to maximums of 2.5 muc/liter for the total beta activity.

Maximum values of 6500 dis/min/liter of alpha activity were measured by the ether-extraction process and a value as high as 10,000 μg U/liter waste solution was measured in one waste sample using the fluorophotometer method. The average alpha activity from plutonium as determined by the T.T.A. extraction process indicated less than 6 dis/min/liter; the maximum value for plutonium was 8 dis/min/liter.

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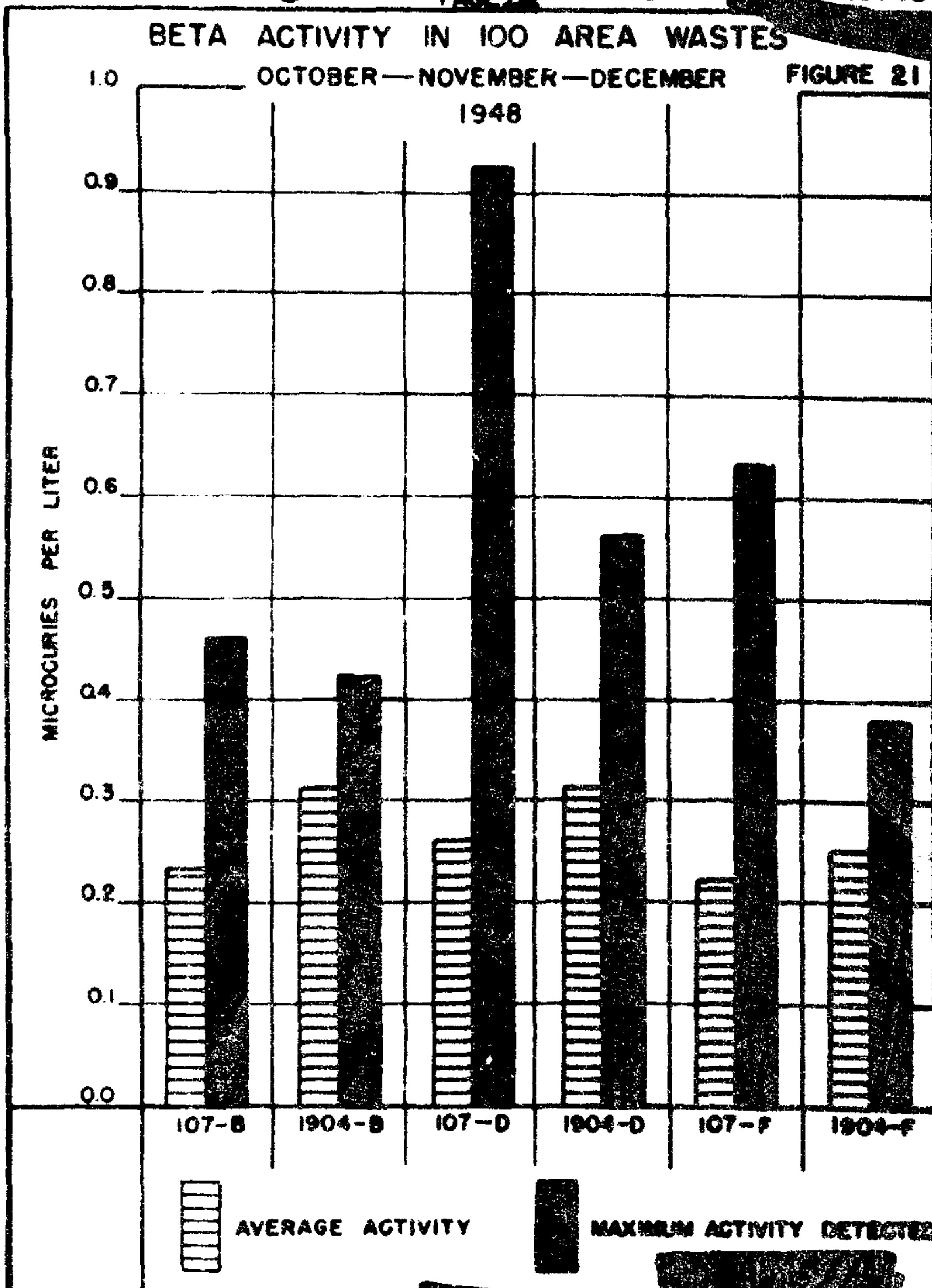
BETA ACTIVITY IN 100 AREA WASTES
OCTOBER—NOVEMBER—DECEMBER
1948
FIGURE 21
MICROCURIES PER LITER
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
107-B
1904-B
107-D
1904-D
107-F
1904-F
AVERAGE ACTIVITY
MAXIMUM ACTIVITY DETECTED

[redacted]