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AEC RESEARCH AND DEVELOPMENT REPORT

HW-10242 DEL

Technology - Hanford

RADIOACTIVE CONTAMINATION IN THE ENVIRONS OF THE HANFORD WORKS AND VICINITY FOR THE PERIOD JANUARY - FEBRUARY - MARCH - 1946

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June 10, 1946

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Hanford Works

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RADIOACTIVE CONTAMINATION IN THE ENVIRONS OF THE HANFORD WORKS AND VICINITY FOR THE PERIOD JANUARY, FEBRUARY, MARCH, 1948.

INTRODUCTION:

This report summarizes the contamination measured in the various media in the Hanford Works and vicinity areas for the quarterly period, January, February, and March, 1948.

The report is divided into the following topical sections:

SECTIONS:

Section I	Meteorological - Dissolving Data
Section II	Beta Contamination in the Air and Radiation Levels in the Air
Section III	Alpha and Beta Contamination in the Columbia River
Section IV	Beta Contamination in the Rain and Snow
Section V	Alpha and Beta Contamination in Drinking Water
Section VII	Alpha and Beta Contamination in Hanford Vegetation

All results are evaluated in some detail in each respective section of this report. Statistical analysis is used whenever possible to determine significant trends, averages, or, differences in average values between the various locations sampled in the levels of contamination measured.

Summary tables listing the various locations tested and the significant differences are prepared wherever possible. These tables are most conveniently utilized by referring to the corresponding graphs showing the actual quantities of activity measured at the specific locations. Average values calculated are also tabulated to assist the reader in evaluating the relative degree of difference noted between the locations compared.

The methods of collecting and analyzing the various samples for active contamination are similar to those reported in HW-9[illegible] (1) unless otherwise specified in the particular section of the report under consideration.

The sampling and instrument locations from which all the data presented in this report were gathered remain essentially the same as reported in HW-9[illegible]C (2) except as revised and corrected on Maps 1 and 2 [illegible] report.

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SECTION I

METEOROLOGICAL - DISSOLVING DATA

(Meteorology Data Courtesy of the Meteorology Section of the H.I. Station)

A summary of the meteorological conditions as observed and measured at the 100 areas and 200-West Area is graphically presented on Figures 1 through 9. Previous to this report, the overall monthly average conditions as observed at the Meteorology Station, 200 West Area, were presented for comparison to the trend of the spread of radioactive contamination in the various areas at the Hanford Works and vicinity. In order to correlate, in greater detail, the effects of the atmosphere on the contamination patterns, an analysis of the meteorological conditions during "dissolving hours only" (during the time of the expulsion of 8 day radio-iodine from the stacks), is presented on Figures 4, 5, 6, 7, 8, and 9. The meteorological conditions existing during the actual time of dissolving should be regarded as more closely related to the distribution of radioactive contamination in the vadose zone than the overall monthly average atmospheric conditions. The overall monthly averages computed on a 24-hour basis are presented for comparison on Figures 1, 2, and 3.

A more detailed study of the meteorological conditions as observed at the Hanford Works Area indicated that the wind directions at each of the 100 Areas differ considerably in certain periods from recorded directions observed at the Meteorology Tower in 200 West Area. A series of twelve wind roses is presented on Figure 8 for comparison of the variations in wind direction as observed at the four different locations. While the prevailing wind direction prevailed 42% of the time from the north-west at the 200 West Area Station, whereas in the 100 Areas this direction prevailed only 10% of the time. The month of February presented an unusual condition when the prevailing direction was north-west at the 200 West Area, south at 100-F Area, and west at 100-B and 100-D Areas.

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Figure 4 is a "wind rose chart" summarizing the wind [redacted] quarter as observed on an eight-point compass at the [redacted]. as Figure 5 is a breakdown of the same data into monthly [redacted] ure 4 and Figure 6 represent the meteorological conditions [redacted] ving hours only. These graphs can be compared to Figure 3 [redacted] only summarize the same data on a 24-hour observation basis.

Figure 9 shows a some not more detailed study of the wind [redacted] at the 200-foot area. The existing directions during the [redacted] graphs are given on a sixteen-point compass "wind rose" for [redacted] and, also summarized in one wind rose showing the average for the [redacted] ters. The prevailing quadrant is the NW with the prevailing [redacted] January and March and being N in February.

The most outstanding difference found when comparing the existing meteorological conditions to the existing conditions at actual time of [redacted] is observed in the dilution data. The wind dilution characteristics [redacted] lated for actual time of dissolving (Figure 8) differ [redacted] tion conditions as calculated on a 24-hour basis (Figure 3). [redacted] ous difference in comparing the dilution data is the [redacted] condition about 78% of the time that dissolving was in [redacted] amount of time that the aloft condition existed when computed for [redacted] day averaged only 4%. Accordingly, dilutions less than [redacted] 3.7% of the total dissolving hours. This figure is lower by a factor [redacted] when compared to the 24-hour condition. As low dilutions produce [redacted] desirable stack gas liberation conditions, a study was made to [redacted] exact wind conditions during the observed low dilution periods. [redacted] a graphic summary of the study. For wind dilutions less than [redacted] average velocity was lower by a factor of three when compared to [redacted]

all average velocity; however, the wind directions for all dilutions [illegible] 1000 : 1 were in good agreement with the normal prevailing conditions.

It is of interest to note that in 88% of the cases that dilutions [illegible] 1000 : 1 occurred, the time of day was between 1000 and 1400. In [illegible] this time of day would be very close to the period of peak [illegible] due to the infrequent occurrence of this condition in the past [illegible] effect should not have caused a significant increase in the [illegible] levels.

Figure 10 is a summary of the [illegible] present in the uranium dissolved in the 300 Shot and 300 West [illegible] period.

SECTION IX
AIRBORNE CONTAMINATION AND AIR [illegible]

The airborne contamination and radiation levels in the air [illegible] were measured by detachable ionization chambers and air filtration [illegible] Map 1 shows the location of the "F", "S", and "C" type [illegible] the air filter locations.

A summary of the radiation levels measured [illegible] the detachable chambers is given in Table I. [illegible] type chamber results shows that the individual averages [illegible] ent in trend when compared to the average of the [illegible] tion is located and also inconsistent when correlated [illegible] som to the average radiation levels found in the previous [illegible] five locations increased from 0.2 Mrep per 24 hours to [illegible] The level at each of these stations is currently about [illegible] Each of these latter stations fall within a sector between [illegible] using the meteorology tower as a being point. The radiation [illegible]

at these specific locations indicated a definite pattern of airborne radioactivity in a south-east direction. This pattern is in very good agreement with the iso-activity map (Map 5), and the wind rose (Figure 1). Since a decrease in the dispersed contamination is normally expected as the distance from the source increases, it is of interest to mention the fact that the airborne level of activity is relatively uniform throughout this pattern and is of approximately the same magnitude at a distance of thirteen airline miles to the southeast as it is at three miles.

The average radioactivity levels measured by the "B" chambers have decreased slightly throughout this quarter; currently, (March 31), the average radiation levels are the lowest recorded in the past six months. As the "B" type chambers are located in outlying area buildings, the [illegible] activity measurements are not as great as those found in the [illegible] and "S" type chambers, [illegible] usually located very close to [illegible].

Table II shows the average beta activity detected on the [illegible] air filters. There are, at present, thirteen air [illegible] and nearby vicinity. A comparison with the activity [illegible] quarter shows that there were no significant increases [illegible] current period, in fact, a downward trend prevailed [illegible] previous, higher levels were observed. Airborne [illegible] Area, Tower 18, decreased by a factor of two; and, at [illegible] decreased by a factor of three. A very significant decrease was [illegible] 100-D where the previous average concentration of 2.2×10^{-9} [illegible] creased to 3.7×10^{-10} mc per liter.

Table III summarizes the results of a statistical analysis of the [illegible] airborne concentration levels measured by the air filter [illegible] the five mile radius around the stacks, the airborne [illegible]

relatively uniform. There is no significant difference between the average activity detected on filters from Richland, Pasco, 300 Area, 100-B Area, Hanford, Benton City, and White Bluffs. This uniformity changes at Cable Mountain where the average concentration is significantly higher than Pasco but is not significantly greater than the activity in the Richland Area.

In the separation areas, the average activity at 200-East, Tower 18, and 200-West Gatehouse is significantly higher than at 200-West, Tower 4. As the 200-West, Tower 4, station is located in the 241 TX area, it is evident that the active construction program there is being carried on in a location where the level is considerably lower than the immediate surroundings. It is of interest to note that both Tower 18 in 200-East Area and the Gatehouse in 200-West Area, in areas where the highest average beta concentration was measured, are both located to the south-east of the respective stacks.

Figure 11 is a bar graph showing the comparison of the airborne concentrations as monitored by air filter units.

SECTION III

ALPHA AND BETA CONTAMINATION IN COLUMBIA RIVER

The flow rate of the Columbia River during the first quarter of [illegible] showed very little fluctuation. The average rate as measured by [illegible] Department at Richland was 439,000 gallons per second; the peak flow [illegible] period was 478,000 gallons per second. The river flow in this area [illegible] last year averaged about 380,000 gallons per second. Figure 12 shows the trend of the river flow for this period as compared to the previous [illegible] period. A decrease in the flow rate is noted when compared to last period, however, this decrease in flow is somewhat insignificant when compared to the fluctuations in other quarterly periods. The beta results of the weekly river samples taken at the twelve locations are presented by a bar graph and

on Figure 13. A map showing these sampling locations may be referred to in the quarterly report for October - December, 1947, (HW-9496).(2) As expected, the lowest activity level is observed in samples collected from the river above 100-B Area. A slight increase in the beta contamination can be noticed in samples taken from the 181-B and 181-D locations; however, the increase is not statistically significant and the average order of magnitude is less than 10^{-6} μc per liter, the limit of sensitivity for this particular type of analysis. The average river contamination increases very significantly at 181-F Area. This increase is a consistent one and is attributed to the 100-D effluent water which raised the average contamination at 181-F Area about 1.3×10^{-6} μc per liter. Samples taken from the Columbia River at Hanford on the south bank, show another highly significant increase of about 7.8×10^{-6} μc per liter over 100-F Area. As usual, the highest concentration was again found at the south bank of the river; however, a cross section river survey shows that the level does not exist uniformly across the river. A highly significant decrease is observed between the average at the south bank and the average in the middle, and consistent with this difference, the average at the north bank is significantly lower than the average in the middle of the river. These cross section samples are taken within a fifteen minute period. Continuing downstream from Hanford, the average level of beta contamination decreases significantly to Richland; the average activity in samples collected there was 1.4×10^{-4} μc per liter. The most distant downstream sampling location at Pasco shows that the average beta contamination was 8.8×10^{-5} μc per liter; this is approximately ten times higher than the level detected at the 100-B Area; even though this high factor exists, it should be pointed out that the activity level measured at Pasco is very low, approaching the limit of sensitivity

of the analysis which is about 8×10^{-6} μc per liter. Table IV summarizes the average beta activity detected in samples at various points along the river and includes the results of a statistical comparison between the individual averages.

A comparison of this quarter's data to the previous quarter offers very few differences. The average at Hanford south bank has increased slightly, but not significantly. During the last period, the average beta concentration at Pasco and Richland were of the same magnitude whereas in this quarter, the expected decrease between Richland and Pasco is very evident. In general, one would normally expect to find very little change between the river concentrations in the two quarters, the minute river flow fluctuations insure a relatively constant river to contamination dilution factor. All river samples were analyzed for alpha activity and all results showed less than 8 dis/min/liter.

SECTION IV

BETA CONTAMINATION IN THE RAIN AND SNOW

Over 160 rain samples were collected from twenty-one locations on the site and nearby vicinity in this quarter. A location map showing the approximate location of each of the collection points may be referred to in the previous quarterly report, HW-9486.(2) The samples varied in volume from several ml. to 500 ml.

An analysis of the rain data shows that with the exception of one sample collected in Riverland, the average amount of activity collected in rain samples decreased as the distance between the collection point and the contamination area stacks increased. For this reason the results are grouped into five zones which include each of the 200 Areas, the 100 Areas, the intermediate locations which include all samples collected between the

areas and the project perimeter, and finally, the outlying locations which include all collection points beyond the perimeter fences.

Figure 14 is a graphic presentation of the average beta activity measured in rain samples collected in the above zones. As in the past, samples collected in the 200-West Area showed the maximum average beta activity (2.4×10^{-6} μc per liter); however, this is a decrease by a factor of seven when compared to the last period average of 3.4×10^{-6} μc per liter. The results of the samples collected at the other locations do not differ significantly from the [redacted] measured in the previous quarter.

A statistical analysis of the results for the average beta activity determined in rain samples for this period is presented in Table V. The average beta activities for each zone is also included in Table V.

The rain sample collected at Riverland on February 26, 1948 indicated 1.25×10^{-2} μc per liter of beta activity in a volume of 60 ml. This sample was filtered and the entire activity was confined to the filter. The half life of this sample is greater than the expected 8 day for [redacted]. The problem is under consideration with the problem of residual longer [redacted] material found in some air filters and vegetation samples.

One complete snow survey was possible in this period. A total [redacted] of 5.2 inches was recorded between the period starting at 1600 on January 31, 1948, and ending at 1530 on February 1, 1948. At this time, the wind prevailed from the northwest at an average velocity of 13 miles per hour. Wind direction averaged 1,000 : 1 over the entire period. These wind conditions are about the same as the prevailing conditions on the site. Since the rainfall lasted about twenty-four hours, it is felt that this survey was representative of an average condition. Thirty-four samples were collected the following morning and analyzed for beta activity. The average activity measured in these samples was [redacted] μc per liter; the maximum activity was 3.6×10^{-6} μc per liter, [redacted] Route 48, File 82.

SECTION V

ALPHA AND BETA CONTAMINATION IN DRINKING WATER

A summary of the average alpha and beta activity detected in samples of drinking water taken during this period is presented in Table VI. The frequency of sampling is also tabulated in the same table.

All drinking water samples and test well samples contained, on an average basis, less than 5 X 10^{-6} uc per liter of beta activity and less than 5 dis/min/liter of alpha activity during this period. The 300 Area water is an exception to the above statement; the average alpha activity detected in samples from the 300 Area ranged from 2.5 dis/min/liter to 8.8 dis/min/liter. One sample from the 300 Area Sanitary system was as high as 13 dis/min/liter. The alpha contamination in the 300 Area water is known fluorophotometric analysis confirm the contaminant as uranium. Figures 15 and 16 show the [illegible] sample analysis of the 300 Area Sanitary and Well #1 water [illegible] flow of the Columbia River. The trend is not as significant [illegible] served since the river flow did not fluctuate significantly [illegible] of observation. It is expected that the magnitude of [illegible] wells at 300 Area increases in an approximate proportion [illegible] Columbia River flow rate.

Although below significant reporting level, 23 is of interest [illegible] the highest average activity detected in any of the [illegible] was 1.4 X 10^{-5} uc per liter of beta activity and 1.1 [illegible].

A tabulated summary of the results of a statistical [illegible] radio-active contamination measured in the drinking water [illegible] Tables VII and VII-A. Although the magnitude of the [illegible] these samples is below the reporting level, it was felt [illegible] tion might be added to the survey results by this statistical [illegible] as showing that the average alpha activity in samples [illegible] Area and Benton City is significantly higher than [illegible] Richland Durand Well #3.

[redacted]

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SECTION VI

BETA CONTAMINATION ON VEGETATION

The quantity of 8 day radioiodine [illegible] in the metal [illegible] in the 200-East and West Areas for the period, January, February, and March, [illegible] calculated on the basis of the weight of the uranium dissolved in [illegible] below:

200 EAST AREA		200 WEST AREA	
Month	Curies Iodine	Month	Curies Iodine
January	310	January	[illegible]
February	164	February	114
March	479	March	[illegible]

NOTE: For the last period, October - December, 1947, [illegible] curies of radioiodine were involved.

Map 1 shows the approximate location of the vegetation samples taken at [illegible] frequency not less than once every four weeks.

The average beta activity detected on vegetation samples [illegible] and nearby vicinity, is summarized graphically on Figure [illegible] activity chart showing the deposition of beta contamination on [illegible] for the period, January thru March, 1948. The pattern on this [illegible] correlates favorably with the prevailing wind direction [illegible] with the air monitoring results (Tables I and II).

A statistical analysis of one hundred and [illegible] from fourteen locations in the Richland, Kennewick, [illegible] indicated that there was no significant difference in the [illegible] existing between any two sampling locations in the residential [illegible] rage over the entire area during the quarter was [illegible] well below the tolerance value of 0.20 uc per kg. [illegible] the maximum concentrations on the vegetation were found [illegible]

each of the communities; however, these values were not significantly [illegible] the minimum in the same area.

The average of the Benton City - Columbia Camp Area does not [illegible] antly from the average found in the Richland Area. An average of [illegible] at Cobbs Corner is considerably below the average of the [illegible] however, this average is not significantly below the average of [illegible] Area.

With the exception of McGee Ranch, there is no significant [illegible] the vegetation contamination levels found in the Riverland-[illegible] Richland. In February, a sample from McGee's Ranch Area [illegible] this individual sample is significantly higher than the average [illegible] ples collected in nearby areas.

An analysis of 107 vegetation samples taken within the [illegible] showed that the average in the 200 West Area (0.82 μc per kg) is [illegible] higher than that of samples collected in the 200-East Area [illegible] Further investigation showed that the samples collected [illegible] Area yielded an average contamination level of 1.48 μc [illegible] significantly higher than that measured within the [illegible] three month average beta contamination on vegetation [illegible] at Route 3, Mile Post 8, located just between the [illegible] highest individual vegetation sample in the quarter was [illegible] location on March 9th; the beta activity measured was [illegible]

No significant difference was found between [illegible] found in the 200 East Area and the average level found [illegible] of the 200-East Area, approaching the base of [illegible] country survey in which 25 vegetation samples were [illegible] this area showed an average level of 0.33 μc per kg [illegible] ted was 2.62 μc per kg. Five of these samples were [illegible]

separation area stacks.

Results from a survey of 166 samples taken on the Wahluke Plateau, the latter part of March, showed the average level of beta contamination to be [redacted] per kg. This average does not differ significantly from the average [redacted] measured at Richland and the Tri City area.

Three vegetation surveys of the Benton Gap in the Rattlesnake [redacted] plated in this period. A highly significant decrease in the average [redacted] tamination was found toward the end of the quarter. During [redacted] uary 1948, the average was 0.09 μc per kg. and 0.10 μc per kg. [redacted] significant trends were found. However, the average activity [redacted] 0.06 uc per kg., is a highly significant decrease from either of the [redacted] Simple correlations were made between the results of each survey [redacted] determine if the trend was a uniform decrease throughout the [redacted] coefficients showed no significance, thus indicating that the [redacted] form in respect to the amount of previous contamination found at [redacted] The maximum beta activity was found at the 1500 to [redacted] cation that this builds up from a minimum activity at [redacted] creases to a level at the summit which is comparable to [redacted] ures 18, 19, and 20, illustrate the amount of this [redacted] elevations. It appears that a high degree of [redacted] of the gap and the average amount of beta activity. [redacted] not available at the present time, but, the slope at the [redacted] (1500 - 2000 feet) is about 150 feet per mile whereas the [redacted] elevations is greater than 700 feet per mile.

All current vegetation data are calculated using [redacted] activity on the vegetation is eight day radioiodine. However, [redacted] indicated the presence of longer half-life fission products [redacted] in the vegetation collected within the 200 West Area. To date [redacted] sketchy surveys, the indication is that the activity from [redacted] in vegetation collected on the Wahluke Plateau, Richland, [redacted]

near the vicinity of the 100 Areas is less than 0.02 μc per kg. the limit of [redacted] sitivity of this type analysis. Further work is in progress on this problem.

SECTION VII

ALPHA AND BETA CONTAMINATION IN RAINFALL WATERS

Weekly samples taken from the 100 Area effluent waters, the source of [redacted] ver contamination previously mentioned in Section III, were analyzed for alpha-beta activity; the results are summarized in the table below:

SAMPLE LOCATION	ALPHA CONTAMINATION	BETA CONTAMINATION
1904-B	2.3 dis/min/liter	5.5×10^{-6} μc per liter
107-D	2.8 dis/min/liter	0.17 μc per liter
107-F	7.2 dis/min/liter	0.19 μc per liter

Statistical analysis of the above data indicated that the [redacted] ti[redacted] at 1904-B is significantly lower than that at D and F. This is [redacted] to the operating schedules of the respective areas. Further [redacted] the average alpha activity at 107-F is not significantly higher [redacted] at 107-D even though the difference is by a factor of three. [redacted] contamination remained essentially the same, with no [redacted] pared to preceding data.

The maximum average contamination measured at the [redacted] a portable G.M. counter for this period is summarized below:

JANUARY - FEBRUARY - MARCH - 1948

Location	No. of Surveys	Maximum Contamination
"B" Ditch	10	~12,000 counts per minute
"F" Ditch	7	~12,000 counts per minute
"H" Ditch	8	~12,000 counts per minute

[redacted]

Eleven surveys of the fourteen test holes around the waste lines in the [illegible] West Area as measured by a G.M. probe indicated no unusually high readings. However, surveys around the "B" and "E" hole measured from 2 to 6 times above the usual background of fifty counts per minute.

Eight surveys were made of the waste lines in the 200-West and 200-East Area during this period. No significant readings above the background of fifty counts per minute were found.

A brief summary of the 241-T Swamp Area contamination is tabulated below.

WATER SAMPLES	BETA ACTIVITY		ALPHA ACTIVITY	
Location	uc per liter (Maximum)	uc per liter (Average)	d/m/liter (Maximum)	d/m/liter (Average)
T Swamp - Inlet	5.2×10^{-5}	2.9×10^{-5}	180	80
T Swamp - W. Side	1.8×10^{-4}	6.6×10^{-5}	600	72
T Swamp - So.Side	2.1×10^{-4}	6.4×10^{-5}	540	80

A statistical analysis of the beta activity on the above tabulation shows that there is no significant difference between the inlet side of the swamp and the west and south side.

The average beta activity measured this period is essentially of the same order of magnitude measured in the last quarter. The alpha activity in the swamp has increased by a factor of 4 - 10 when compared to the average levels measured last quarter.

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MUD SAMPLES	BETA ACTIVITY		ALPHA ACTIVITY	
Location	uc per kg (Maximum)	uc per kg (Average)	d/m/gm (Maximum)	d/m/gm (Average)
T Swamp - West Side	0.66	0.17	76	30
T Swamp - South Side	0.26	0.11	130	68

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The alpha activity in the mud remained essentially the same as [illegible] quarter, however, there has been a noted increase in the average beta [illegible] measured this quarter.

A brief summary of the level of contamination measured in samples [illegible] the "U" swamp is tabulated below:

JANUARY - FEBRUARY - MARCH - 194[illegible]

WASTE LIQUOR	BETA ACTIVITY		ALPHA ACTIVITY	
Location	μc per liter		dis/min/liter	
	(Maximum)	(Average)	(Maximum)	(Average)
Laundry Ditch Inlet	1.0 X 10^{-4}	2.7 X 10^{-6}	80	[illegible]
231 Ditch Inlet	8.0 X 10^{-6}	1.5 X 10^{-6}	170	[illegible]
U Swamp Inlet	1.1 X 10^{-4}	3.0 X 10^{-6}	80	[illegible]

A brief summary of the beta contamination detected in samples collected from the 300 Area Retention Basin for this period is tabulated below:

JANUARY - FEBRUARY - MARCH - 194[illegible]

WASTE LIQUORS	BETA ACTIVITY		ALPHA ACTIVITY	
Location	μc per liter		dis/min/liter	
	(Maximum)	(Average)	(Maximum)	(Average)
Pond Inlet	5.1 X 10^{-3}	1.2 X 10^{-6}	[illegible]	[illegible]
N.W. Corner	6.9 X 10^{-4}	1.6 X 10^{-6}	[illegible]	[illegible]

The radioactive contamination measured in the 300 Area Pond [illegible] quarter is relatively the same as observed in the last quarter.

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M. J. [illegible]
W. C. [illegible]
HEALTH INSTRUMENT DIVISIONS

WS/ec

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[redacted] [redacted] [redacted]

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TABLE I

RADIATION LEVEL OBSERVED

WITH

DETACHABLE IONIZATION CHAMBERS

(Mrep per 24 Hours)

Chamber Readings

"C" CHAMBER READINGS

LOCATION	JAN.	FEB.	MARCH	[redacted]
100-B	0.3	0.3	0.3	0.3
100-D	0.4	0.4	0.4	0.4
100-F	0.4	0.4	0.4	0.4
200-E	0.6	0.4	0.4	0.4
200-W	0.4	0.3	0.4	0.4
300 Area	0.4	0.3	0.3	0.3

"N" & "S" CHAMBER READINGS	JAN.	FEB.	MARCH	[redacted]
100 Area & Environs				
Route 1, Mile 8	0.4	0.5	0.5	0.5
Route 2N, Mile 10	0.3	0.3	0.3	0.3
Route 2N, Mile 5	0.5	0.4	0.4	0.4
Route 11A, Mile 1	0.5	0.9	0.5	0.6
Route 1 & 4N	0.3	0.3	0.3	0.4
Within 5 Miles 200 East				
Route 4S, Mile 6	0.7	0.8	1.1	1.0
Route 11A, Mile 6	0.7	0.4	0.5	0.6
Route 3, Mile 1	0.7	1.2	0.9	0.8
Meteorology Tower 200'	0.7	0.7	0.5	0.6
Within 10 Miles 200 East				
Route 4S, Mile 10	0.7	0.7	0.7	0.7
Route 10, Mile 1	0.5	1.2	1.2	1.2
Route 10, Mile 3	1.0	0.9	1.1	1.1
Route 2S, Mile 4	0.8	1.2	0.8	0.9
Near 300 Area				
Route 4S, Mile 16	0.9	1.4	0.7	1.0
Route 4S, Mile 22	1.3	1.1	0.7	1.0
Special Zones*				
Hanford	0.5	0.7	0.5	0.6
700 Area	0.5	0.9	0.6	0.7
Benton City	0.7	0.5	0.5	0.6
200-W TX Area	0.6	0.6	0.7	0.6
105 Dr Area	-	0.6	0.7	0.7
White Bluffs	-	0.6	0.6	0.6
Hanford 101 Building	1.4	0.7	0.6	0.9

*These locations have been added to the original locations since the last report was issued.

NOTE: All of the above values include the background measurements of the instruments which vary from about 0.3 to 0.5 mrep per 24 hours.

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[redacted]

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TABLE II

SUMMARY OF RESULTS OF AIR FILTER SAMPLING PROGRAM

Beta Activity - 8 Day Lives

January - February - March

1946

LOCATION	AVERAGE [illegible] per cubic meter
Pasco	[illegible]
100-D Area	5.7 X 10[illegible]
300 Area	[illegible]
200-East - Tower 18	[illegible]
200-West - Gatehouse	[illegible]
Benton City	[illegible]
Hanford	[illegible]
White Bluffs	[illegible]
1C5 DR Construction	[illegible]
Gable Mountain	[illegible]
Richland	[illegible]
200-West - Tower 4	[illegible]
200-East - Southeast	[illegible]

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TABLE III

RESULTS OF STATISTICAL ANALYSIS OF AVERAGE BETA ACTIVITY

AS FOUND ON AIR FILTERS

January - February - March

1948

LOCATIONS COMPARED	NUMBER SAMPLES	AVERAGE ACTIVITY uc per Liter	"t" TEST	CONCLUSION
Richland Pasco	13 13	3.8×10^{-10} 2.6×10^{-10}	1.0	No Significant difference
Richland 100-D Area	13 13	3.8×10^{-10} 3.7×10^{-10}	1.0	No Significant difference
Richland 300 Area	13 13	3.8×10^{-10} 3.3×10^{-10}	1.0	No Significant difference
Benton City Richland	13 13	3.4×10^{-10} 3.8×10^{-10}	1.0	No Significant difference
Hanford Richland	12 13	3.1×10^{-10} 3.8×10^{-10}	1.0	No Significant difference
White Bluffs Richland	9 13	3.1×10^{-10} 3.8×10^{-10}	1.0	No Significant difference
1.5 DR Const. Richland	9 13	4.0×10^{-10} 3.8×10^{-10}	1.0	No Significant difference
Gable Mountain Richland	13 13	6.4×10^{-10} 3.8×10^{-10}	1.8	No Significant difference
Gable Mountain Pasco	13 13	6.4×10^{-10} 2.6×10^{-10}	3.0	Gable Mtn. [illegible] greatly higher [illegible]
200-West Twr. 4 200-East - SE	11 13	7.0×10^{-10} 1.1×10^{-9}	1.0	No Significant difference
200-West Twr. 4 200-East Twr. 18	11 13	7.0×10^{-10} 2.2×10^{-9}	4.5	200-West [illegible] significantly [illegible] than 200-East
200-East Twr. 18 200-East SE	13 13	2.2×10^{-9} 1.1×10^{-9}	2.7	Difference [illegible] exists
200-West Gatehouse 200-West - Twr 4	9 11	1.6×10^{-9} 7.0×10^{-10}	4.5	200-West [illegible] significantly higher than 200-West Twr. #4.

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TABLE IV

RESULTS OF STATISTICAL ANALYSIS OF AVERAGE BETA ACTIVITY AS MEASURED IN SAMPLES FROM THE COLUMBIA RIVER

January - February - March

1948

LOCATIONS COMPARED	NUMBER SAMPLES	AVERAGE ACTIVITY μc per Liter	"t" TEST VALUE	CONCLUSIONS
Above 100-B 100-B Area	6 6	9.6 X 10⁻⁷ 6.3 X 10⁻⁶	1.87	No Significant difference
100-B Area 100-D Area	6 12	6.3 X 10⁻⁶ 6.6 X 10⁻⁶	.07	Averages compare exceptionally well
Above 100-B 100-D Area	6 12	9.6 X 10⁻⁷ 6.6 X 10⁻⁶	1.78	No Significant difference
100-D Area 100-F Area	12 11	6.6 X 10⁻⁶ 1.9 X 10⁻⁴	4.13	100-F Significantly higher than 100-B
Hanford So. Bank Hanford Middle Ri.	13 13	9.4 X 10⁻⁴ 3.2 X 10⁻⁴	3.81	Hanford South bank [illegible]
Hanford Middle Ri. Hanford No. Bank	13 13	3.2 X 10⁻⁴ 1.5 X 10⁻⁴	3.67	Water of [illegible] significantly higher than north bank
Richland Hanford No. Bank	12 13	1.4 X 10⁻⁴ 1.5 X 10⁻⁴	.49	No Significant difference
Richland Pasco Bridge	12 10	1.4 X 10⁻⁴ 6.5 X 10⁻⁵	3.81	[illegible]
Yakima Mouth #1 Yakima Mount #2	12 12	2.1 X 10⁻⁶ 4.9 X 10⁻⁶	1.68	[illegible]

[redacted] [redacted] [redacted]

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TABLE VI

SUMMARY OF AVERAGE ALPHA AND BETA ACTIVITY MEASURED IN THE SANITARY WATER

JANUARY - FEBRUARY - MARCH - 1948

Location	Number Samples	Average Beta Activity μc per liter	Average Alpha dis/min/liter
Pasco	11	6.8 X 10^{-8}	[illegible]
Kennewick 614	11	7.1 X 10^{-8}	[illegible]
Kennewick Std. Sta.	11	6.0 X 10^{-8}	[illegible]
Benton City	14	3.0 X 10^{-8}	[illegible]
Cobbs Corner	12	6.0 X 10^{-8}	[illegible]
Headgate	13	3.4 X 10^{-8}	[illegible]
Riverland	11	3.6 X 10^{-8}	[illegible]
Midway	11	3.0 X 10^{-8}	[illegible]
Pistol Range	11	3.9 X 10^{-8}	[illegible]
Columbia Camp	13	4.2 X 10^{-8}	[illegible]
Lower Knob	11	4.7 X 10^{-8}	[illegible]
Wills Ranch	9	4.3 X 10^{-8}	[illegible]
Richland #2	3	8.3 X 10^{-8}	[illegible]
Richland #4	9	4.5 X 10^{-8}	[illegible]
Richland #6	10	4.0 X 10^{-8}	[illegible]
Richland #12	9	5.2 X 10^{-8}	[illegible]
Richland #13	98	4.8 X 10^{-8}	[illegible]
Richland #14	9	2.8 X 10^{-8}	[illegible]
Richland #15	4	8.9 X 10^{-8}	[illegible]
Richland #16	13	2.7 X 10^{-8}	[illegible]
Richland #16	13	5.7 X 10^{-8}	[illegible]
White Bluffs	93	4.7 X 10^{-8}	[illegible]
300 Area #1	91	4.0 X 10^{-8}	[illegible]
300 Area #2	84	5.1 X 10^{-8}	[illegible]
300 Area Sanitary	90	5.1 X 10^{-8}	[illegible]
3000 Area D #1	11	2.9 X 10^{-8}	[illegible]
3000 Area Ramney D	13	5.8 X 10^{-8}	[illegible]
Tract House K-746	13	5.2 X 10^{-8}	[illegible]
Hanford Well	10	7.0 X 10^{-8}	[illegible]
100-B Sanitary	12	2.9 X 10^{-8}	[illegible]
100-D Sanitary	12	6.2 X 10^{-8}	[illegible]
100-F Sanitary	12	9.6 X 10^{-8}	[illegible]
200-W Sanitary	12	4.6 X 10^{-8}	[illegible]
200-E Sanitary	12	1.9 X 10^{-8}	[illegible]
BY Well	3	9.1 X 10^{-8}	[illegible]
Spring 13	8	1.4 X 10^{-7}	[illegible]
Ranch 13	2	1.2 X 10^{-7}	[illegible]
Snively Ranch	2	3.9 X 10^{-8}	[illegible]
Rattlesnake Spring	2	6.0 X 10^{-7}	[illegible]
200-N #6	2	5.7 X 10^{-8}	[illegible]
McGee Well	2	7.2 X 10^{-8}	[illegible]
Ford Well	2	6.8 X 10^{-8}	[illegible]
Meeker Well	2	3.4 X 10^{-8}	[illegible]

[redacted]

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[redacted]

[redacted]

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TABLE V

RESULTS OF STATISTICAL ANALYSIS OF AVERAGE BETA ACTIVITY MEASURED IN RAIN SAMPLES

January - February - March

- 1948 -

LOCATIONS COMPARED	NUMBER SAMPLES	AVERAGE ACTIVITY $\mu\mu c$ per Liter	"t" TEST	[redacted]
200 West Area	24	5.4×10^{-3}	2.10	[redacted]
200 East Area	26	2.0×10^{-3}		[redacted]
200 West Area	24	5.4×10^{-3}	4.12	[redacted]
Intermediate Zone	54	9.3×10^{-4}		[redacted]
200 East Area	26	2.0×10^{-3}	2.08	[redacted]
Intermediate Zone	54	9.3×10^{-4}		[redacted]
100 Areas	17	1.6×10^{-4}	2.08	[redacted]
Intermediate Zone	54	9.3×10^{-4}		[redacted]
Outlying Zone	32	2.1×10^{-4}	2.08	[redacted]
Intermediate Zone	54	9.3×10^{-4}		[redacted]

[redacted]

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TABLE VII

RESULTS OF STATISTICAL ANALYSIS OF RADIOACTIVE CONTAMINATION

MEASURES IN THE SANITARY WATER

January - February - March 1948

BETA ACTIVITY

LOCATIONS COMPARED	NUMBER OF SAMPLES	AVERAGE ACTIVITY μc per liter	[illegible]
Benton City	14	3.0×10^{-6}	1.61
Pasco	11	5.8×10^{-6}	
Pasco	11	6.8×10^{-6}	1.69
Richland #13	98	4.8×10^{-6}	
Kennewick 614	11	7.1×10^{-6}	0.87
Kennewick Std. Sta.	11	6.0×10^{-6}	
Benton City	14	3.0×10^{-6}	2.48
Cobbs Corner	12	6.0×10^{-6}	
Richland #13	98	4.8×10^{-6}	2.00
Hanford	10	7.0×10^{-6}	
300 Well #1	21	4.0×10^{-6}	1.45
300 Well #2	84	5.1×10^{-6}	
300 Well #1	21	4.0×10^{-6}	1.96
Richland #13	98	4.8×10^{-6}	
300 Well #2	84	5.1×10^{-6}	0.4
Richland #13	98	4.8×10^{-6}	
Richland #13	98	4.8×10^{-6}	[illegible]
Richland #16	13	2.7×10^{-6}	
3000 #6	86	5.8×10^{-6}	1.18
3000 Durand #1	11	2.9×10^{-6}	
3000 #6	86	5.8×10^{-6}	1.00
3000 Ramey D	13	3.8×10^{-6}	
100-F Sanitary	12	9.6×10^{-6}	2.22
100-B Sanitary	12	2.9×10^{-6}	
100-F Sanitary	12	9.3×10^{-6}	.65
100-D Sanitary	12	6.2×10^{-6}	
200-E Sanitary	12	1.9×10^{-6}	.82
200-W Sanitary	12	4.8×10^{-6}	
100-F Raw Water	12	1.0×10^{-5}	3.78
100-D Raw Water	12	7.0×10^{-7}	

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TABLE VII-A

RESULTS OF STATISTICAL ANALYSIS OF RADIOACTIVE CONTAMINATION

MEASURED IN THE SANITARY WATER

January - February - March 1946

ALPHA ACTIVITY

LOCATIONS COMPARED	NUMBER OF SAMPLES	AVERAGE ACTIVITY dis/min/liter	[illegible]	
300 Area #1	111	2.3	2.08	
300 Area #2	103	2.9		
Richland #13	114	0.4	1.07	
Richland #18	13	0.8		
Richland #13	114	0.4	0.56	
3000 Area #6	104	0.8		
Tract House K-748	13	0.8	0.40	
Richland #13	114	0.4		
300 Area #1	111	2.3	[illegible]	
Richland #13	114	0.4		
White Bluffs	111	1.1	[illegible]	
Richland #13	114	0.4		
Benton City	15	0.7	[illegible]	
Richland #13	114	0.4		
Spring #13	7	1.1	[illegible]	
Richland #13	114	0.4		

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AVERAGE WIND DIRECTIONS
JANUARY — FEBRUARY — MARCH
1948

FIGURE

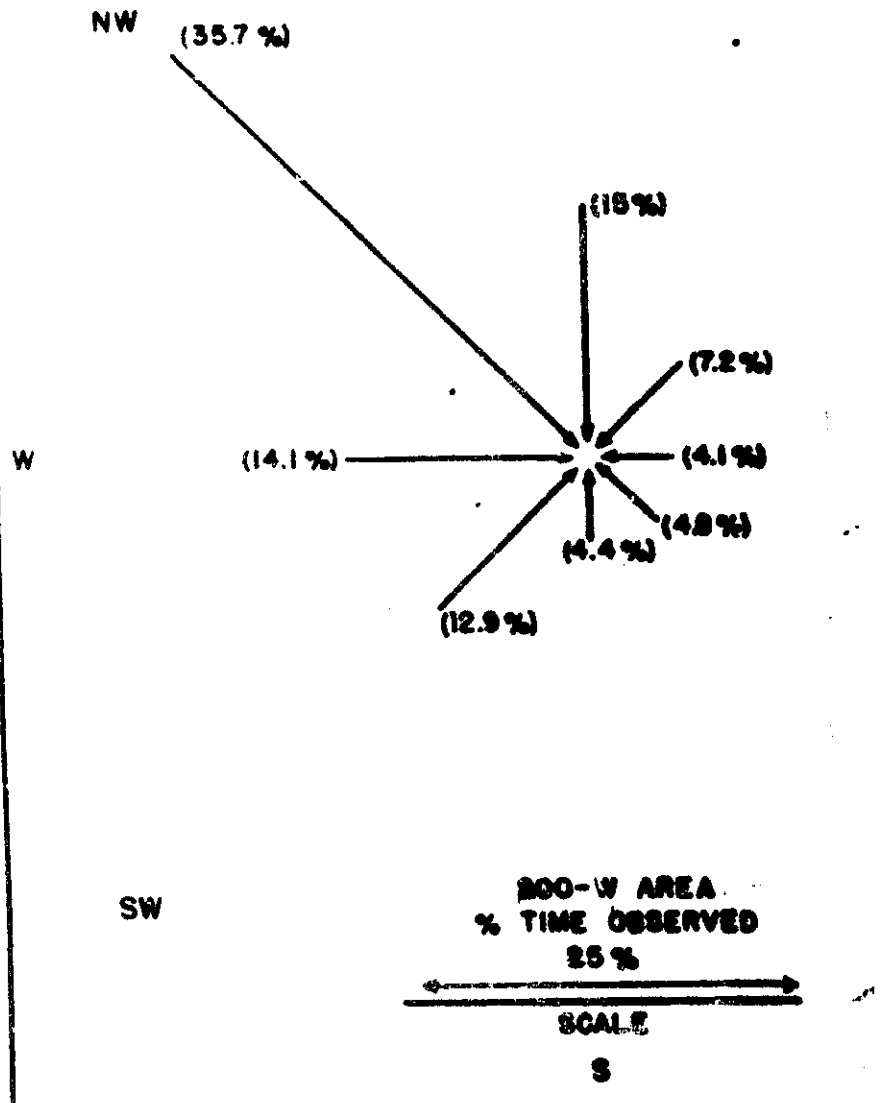

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FIGURE 2

SUMMARY AIR CONDITIONS
200-W AREA

MONTHLY WIND DIRECTION
JANUARY—FEBRUARY — MARCH
1948

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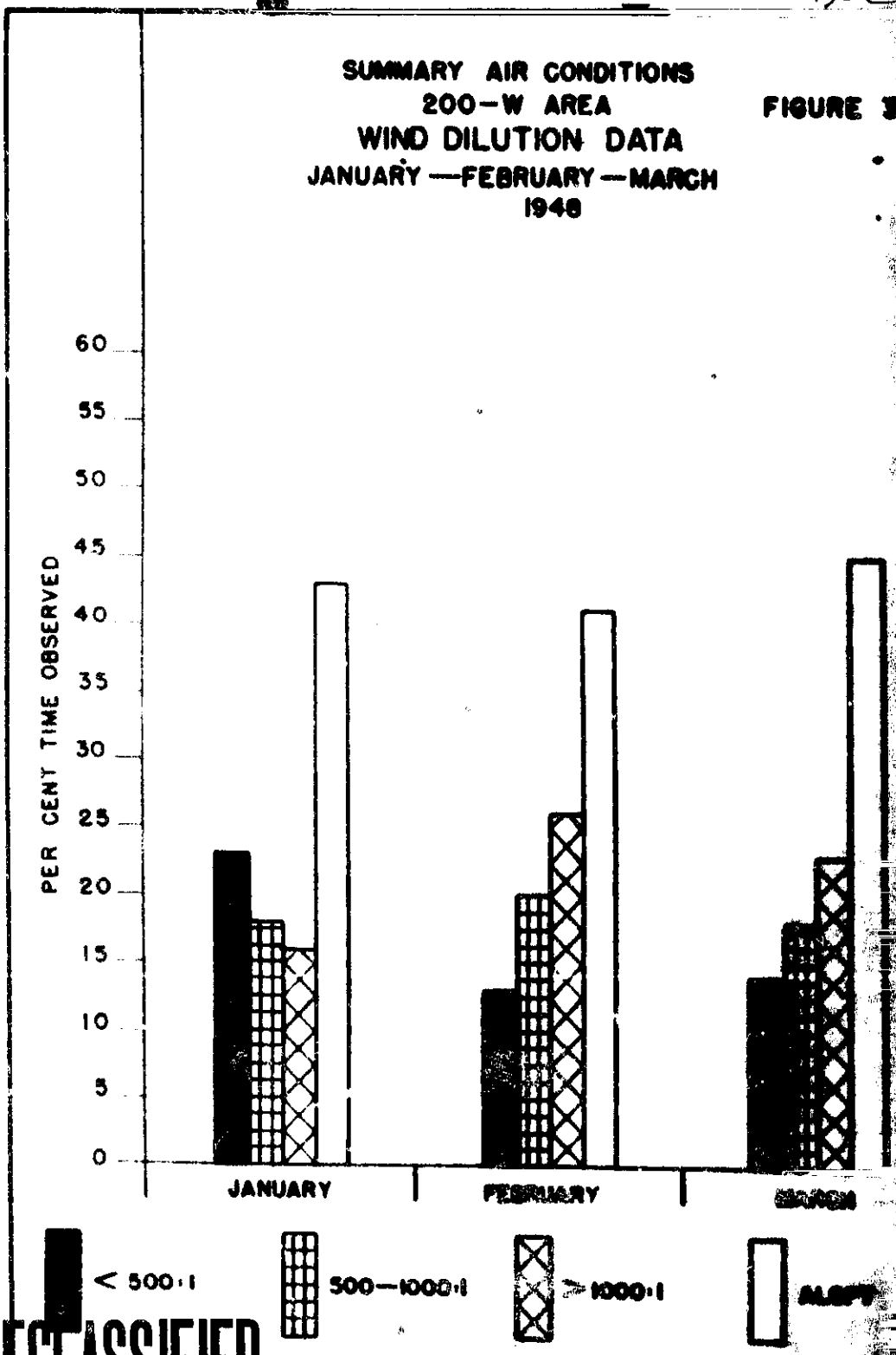
SUMMARY AIR CONDITIONS
200-W AREA
WIND DILUTION DATA
JANUARY —FEBRUARY —MARCH
1948

FIGURE 3



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SUMMARY WIND DIRECTIONS—200-W
DISSOLVING HOURS ONLY
JAN'JARY—FEBRUARY—MARCH
1948

FIGURE 4

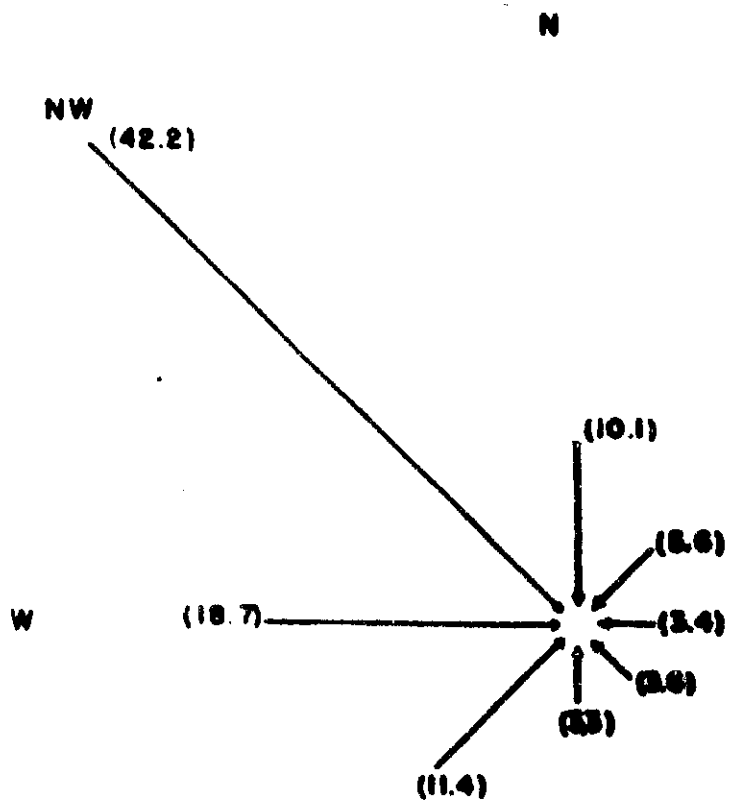

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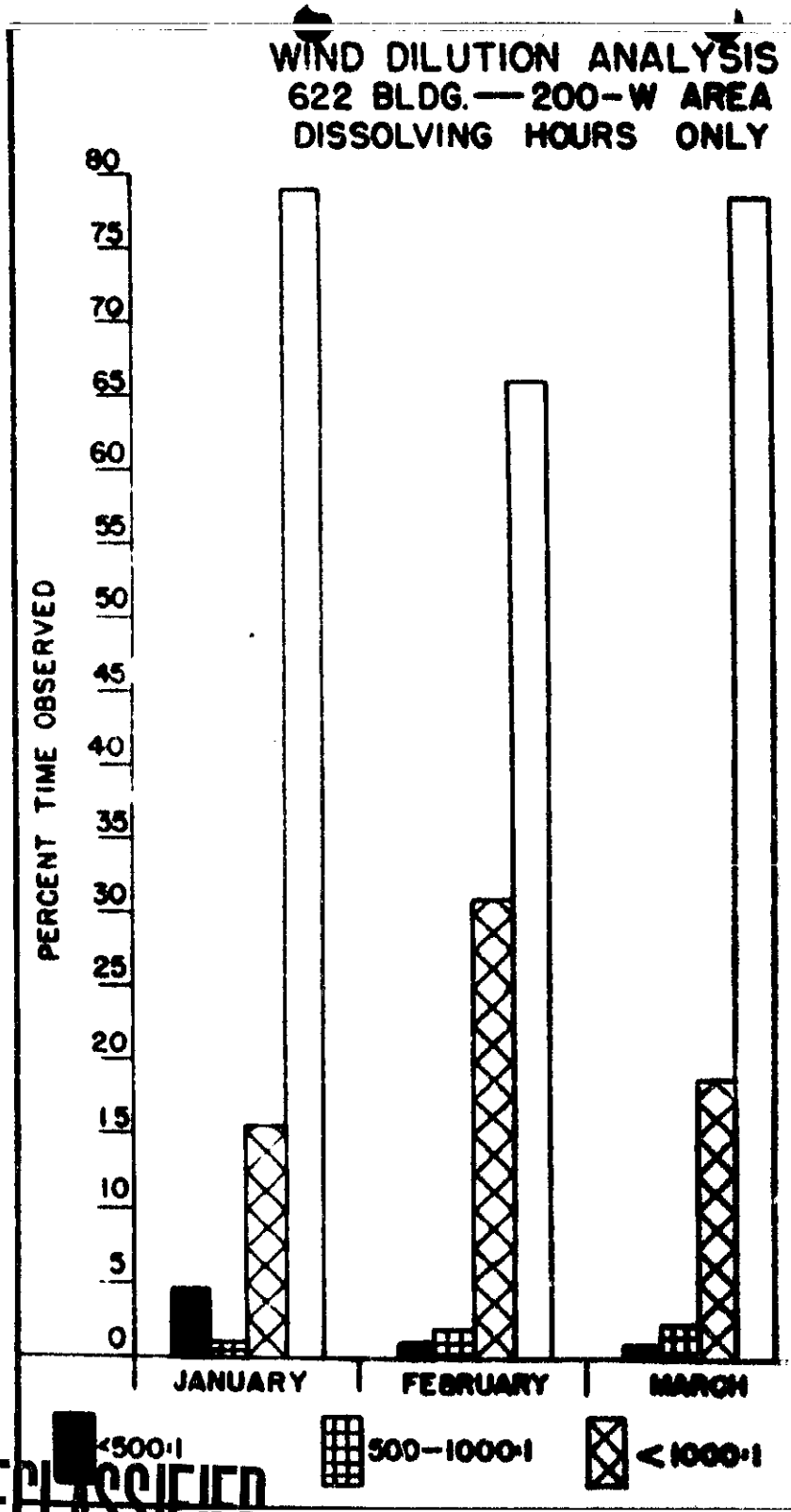
FIGURE 5

SUMMARY AIR CONDITIONS — 200-W
JANUARY — FEBRUARY — MARCH
1948

WIND DIRECTIONS
DISSOLVING HOURS ONLY

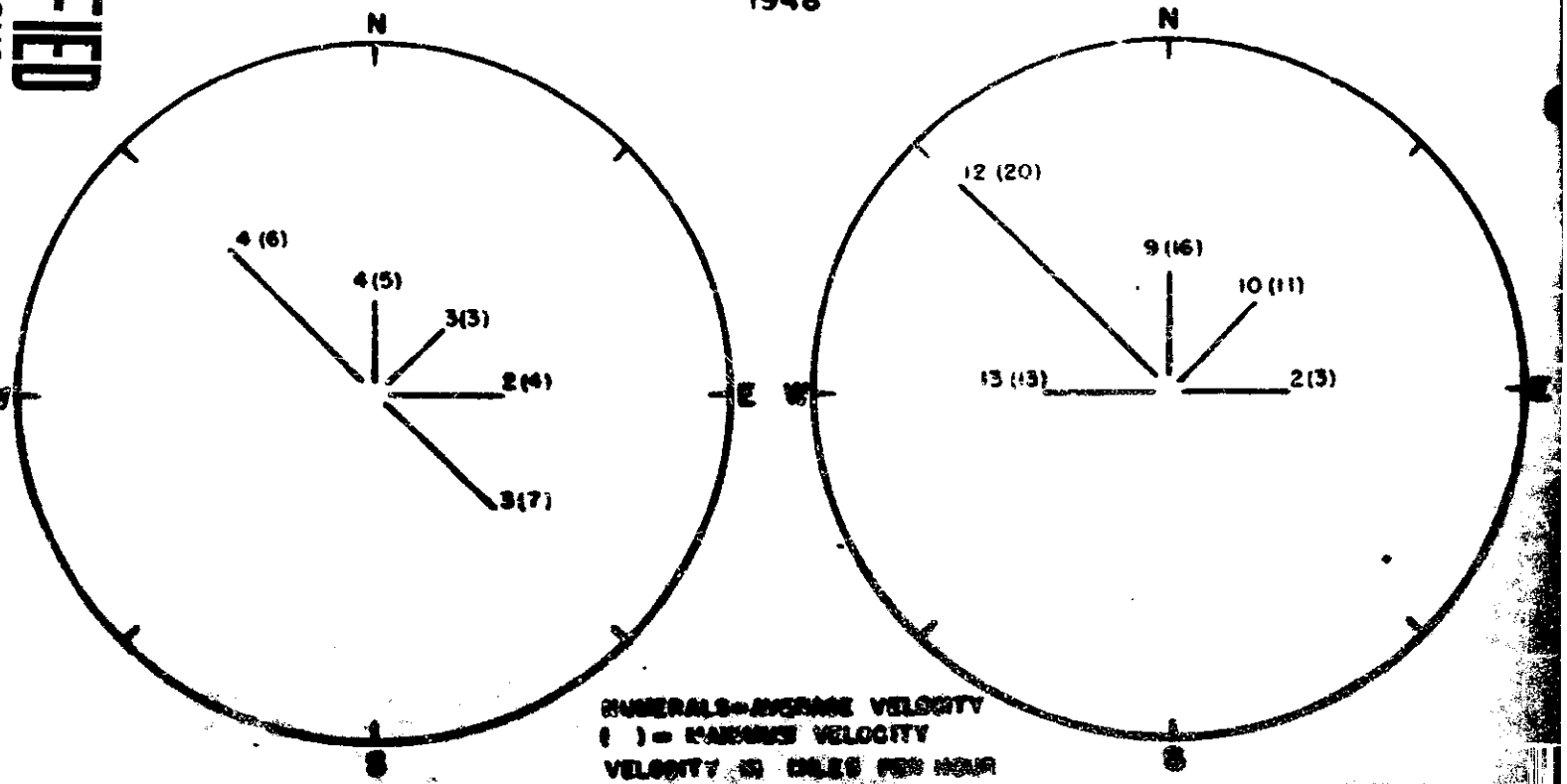
FIGURE 6



WIND CONDITIONS DURING LOW DILUTION PERIODS

FIGURE 7

DISSOLVING HOURS ONLY
200-W AREA
JANUARY—FEBRUARY—MARCH
1948



NUMERALS = AVERAGE VELOCITY
( ) = MAXIMUM VELOCITY
VELOCITY IN MILES PER HOUR

[redacted]

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FIGURE 8

COMPARISON OF WIND DIRECTIONS
AS OBSERVED DURING ACTUAL DISSOLVING HOURS

HW 1
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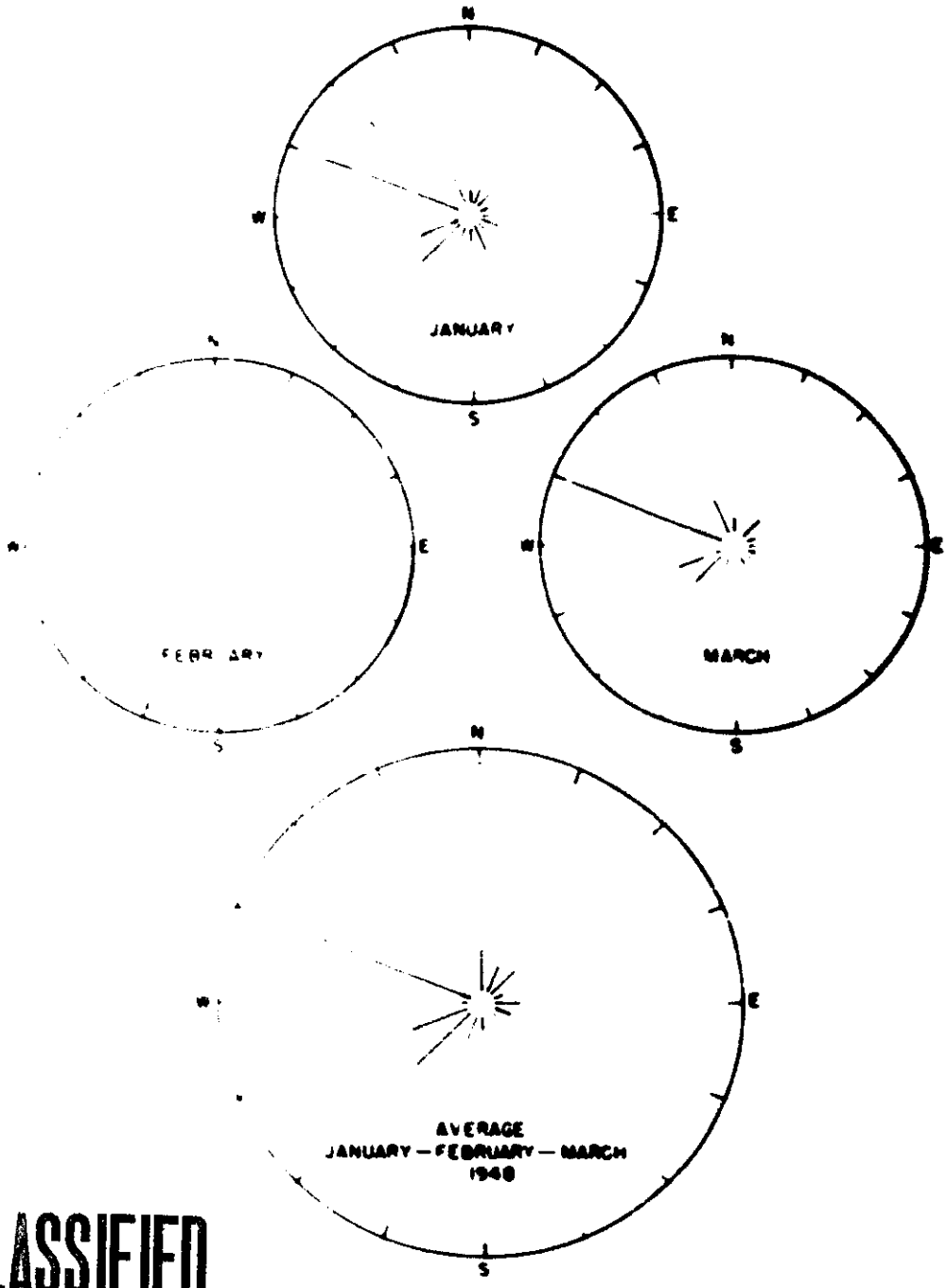
RECORDED WIND DIRECTIONS
200-W
DISSOLVING HOURS ONLY
JANUARY—FEBRUARY—MARCH
1948

FIGURE 9



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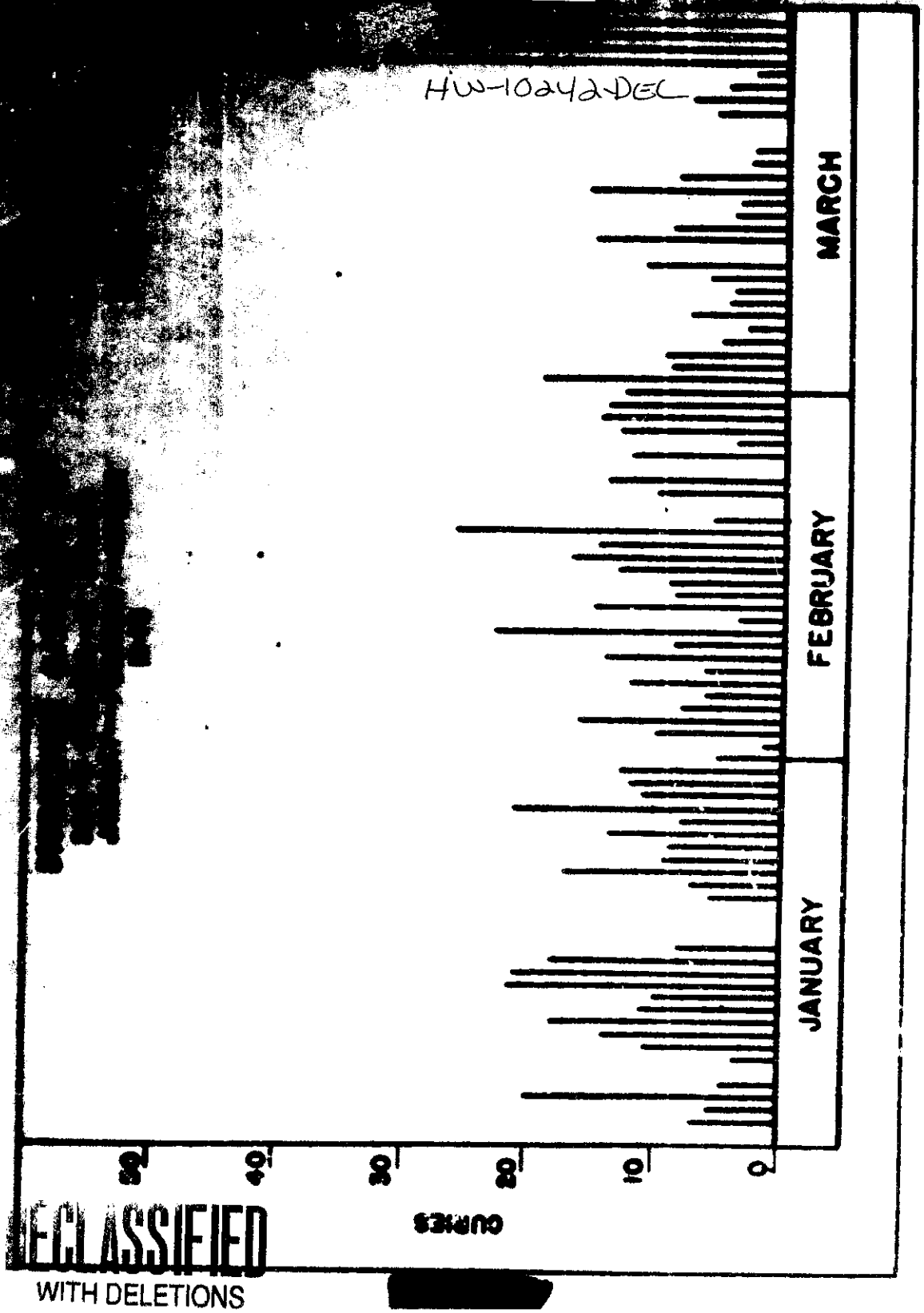

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AIR FILTER CONTAMINATION
HANFORD WORKS & VICINITY
JANUARY-FEBRUARY-MARCH
1948

FIGURE

BETA ACTIVITY

COLUMBIA RIVER FLOW
JANUARY — FEBRUARY — MARCH
1948

FIGURE

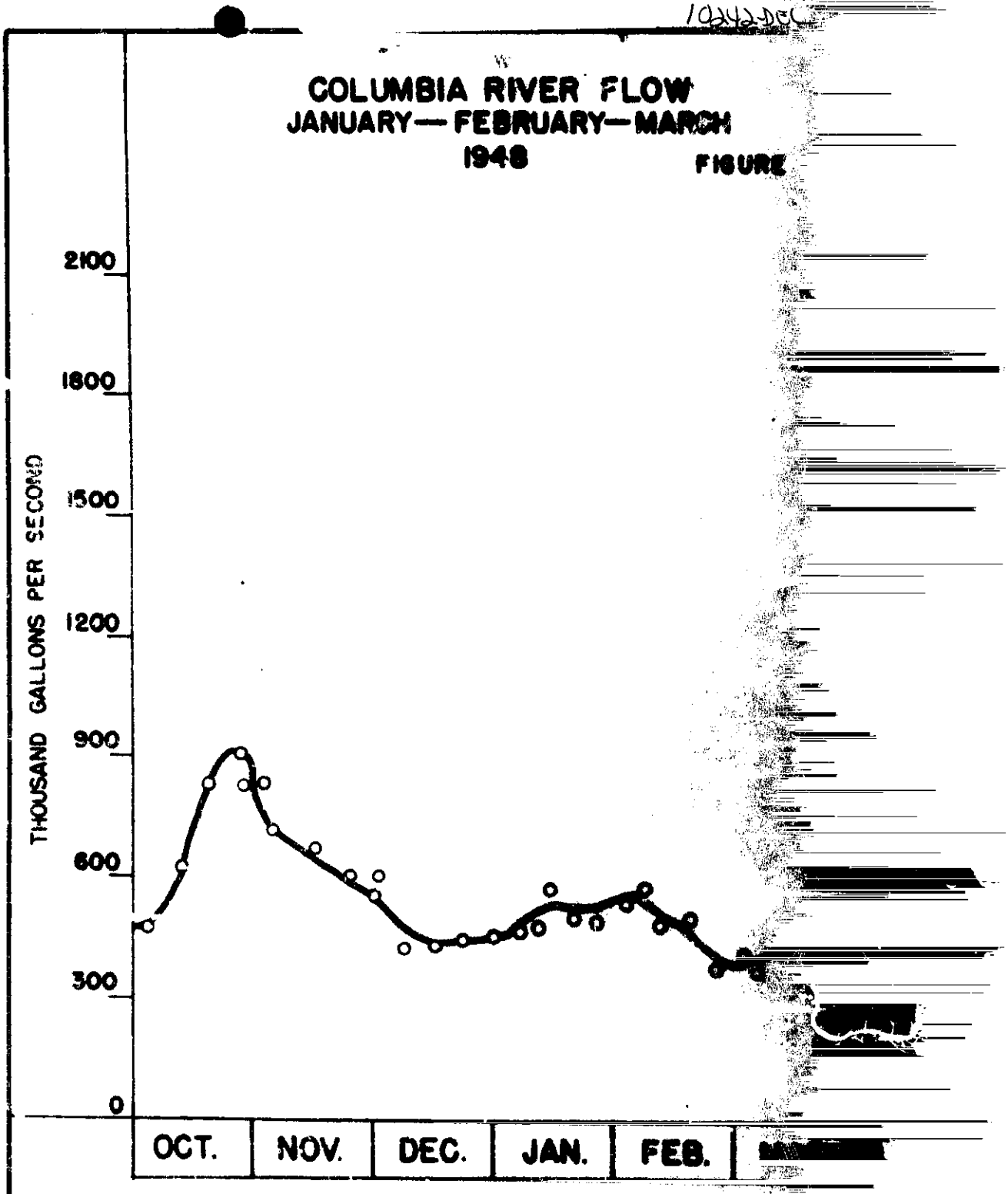

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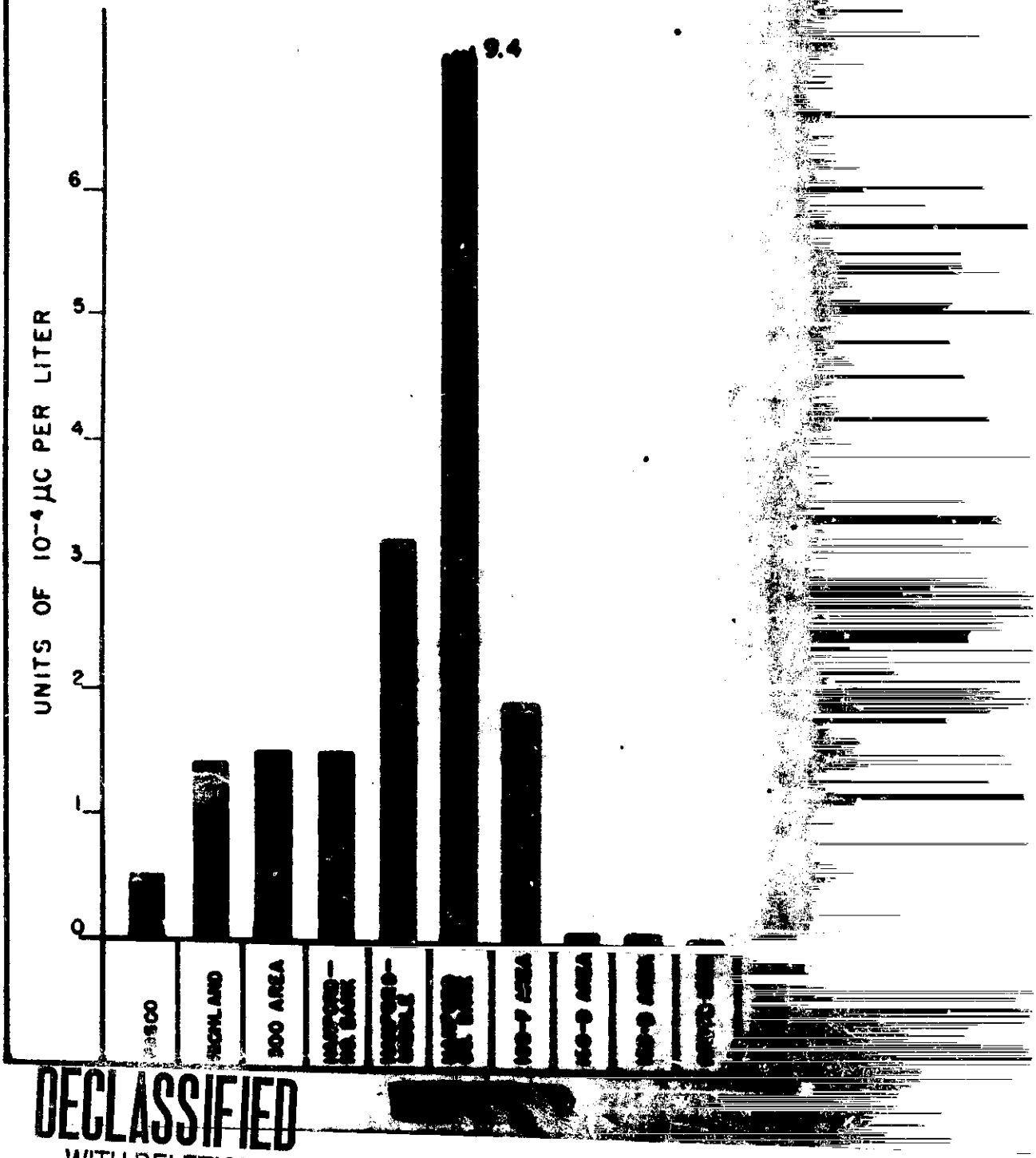
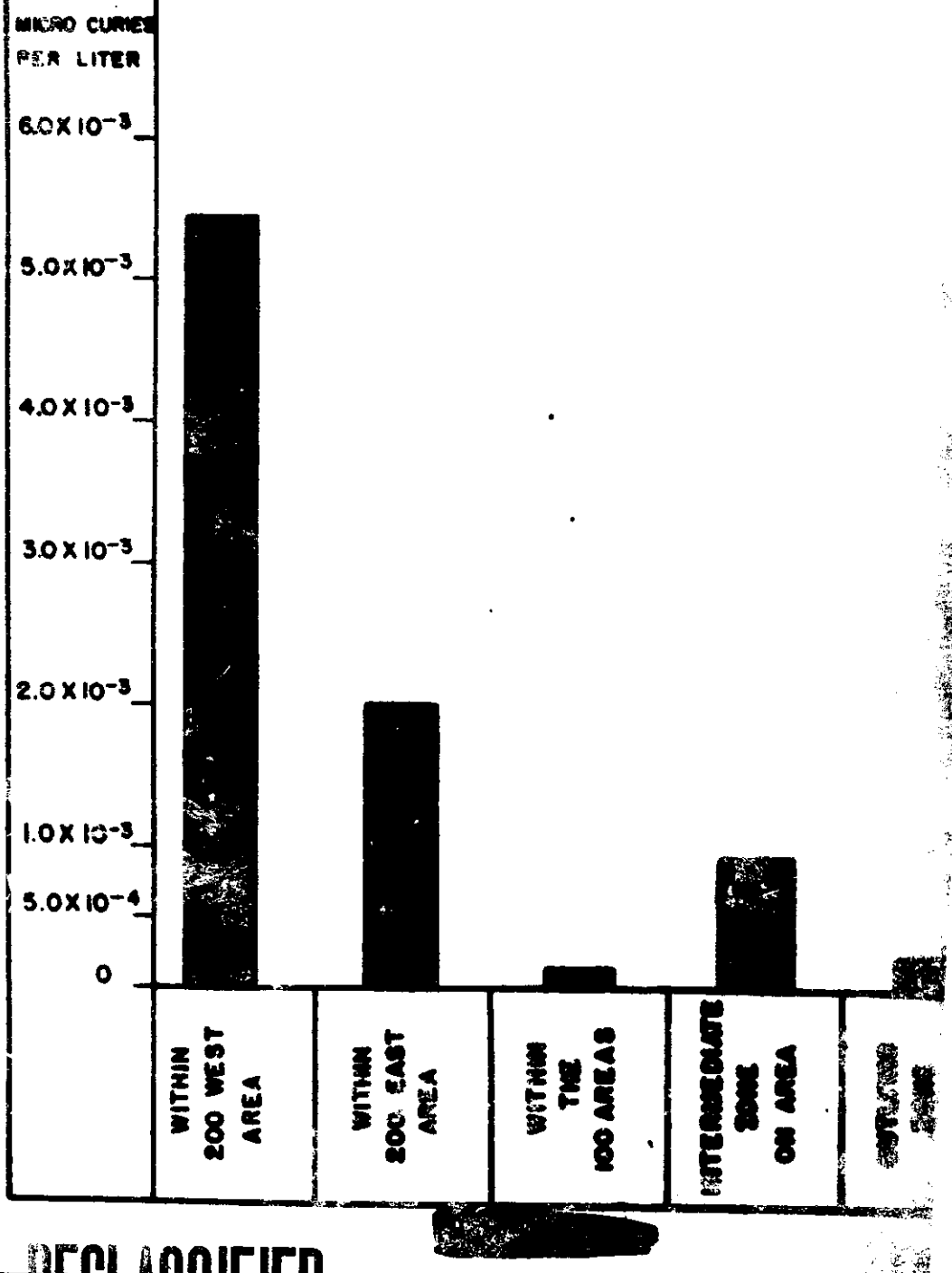
FIGURE 18

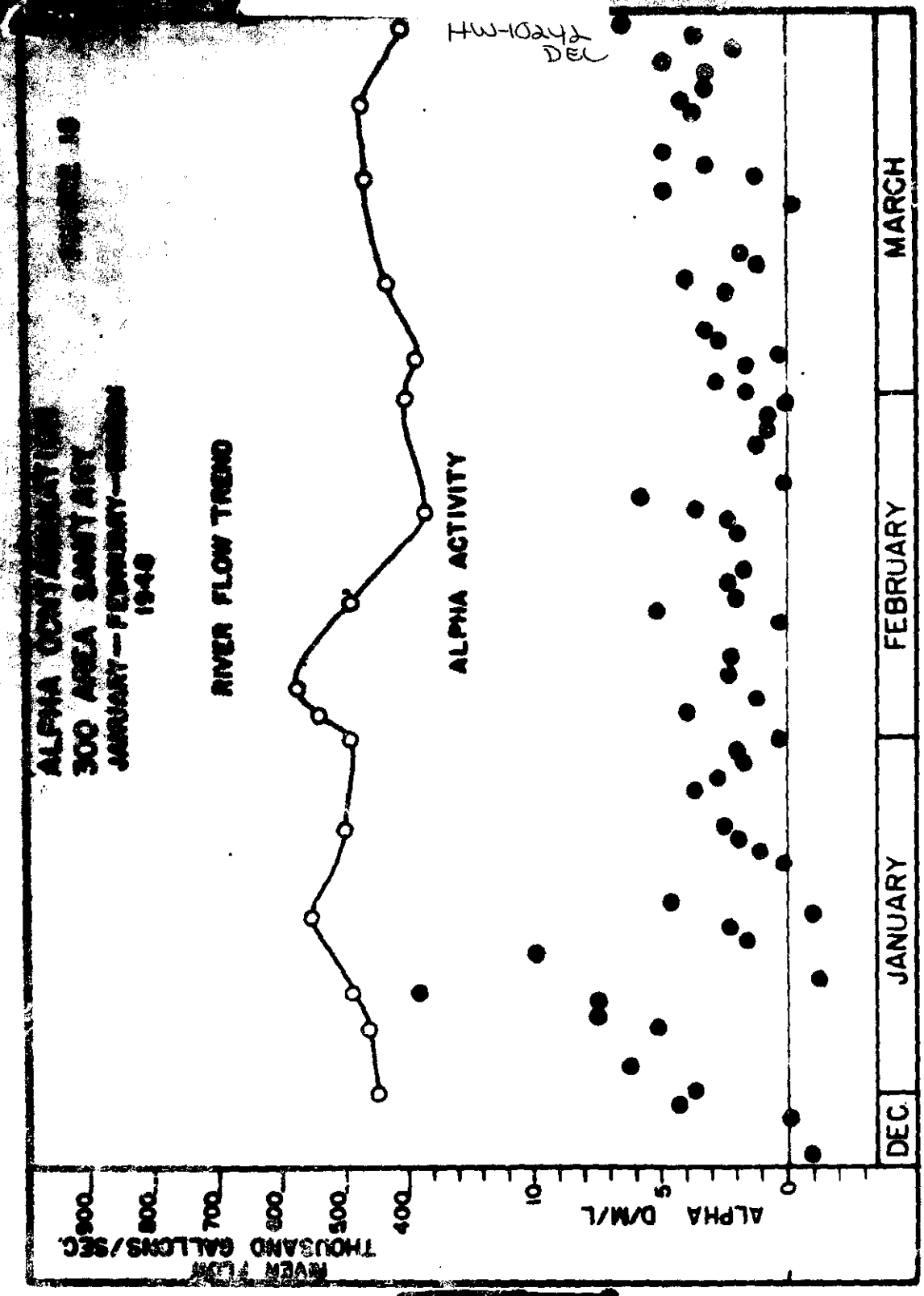
BETA CONTAMINATION IN COLUMBIA RIVER
JANUARY—FEBRUARY- MARCH 1948

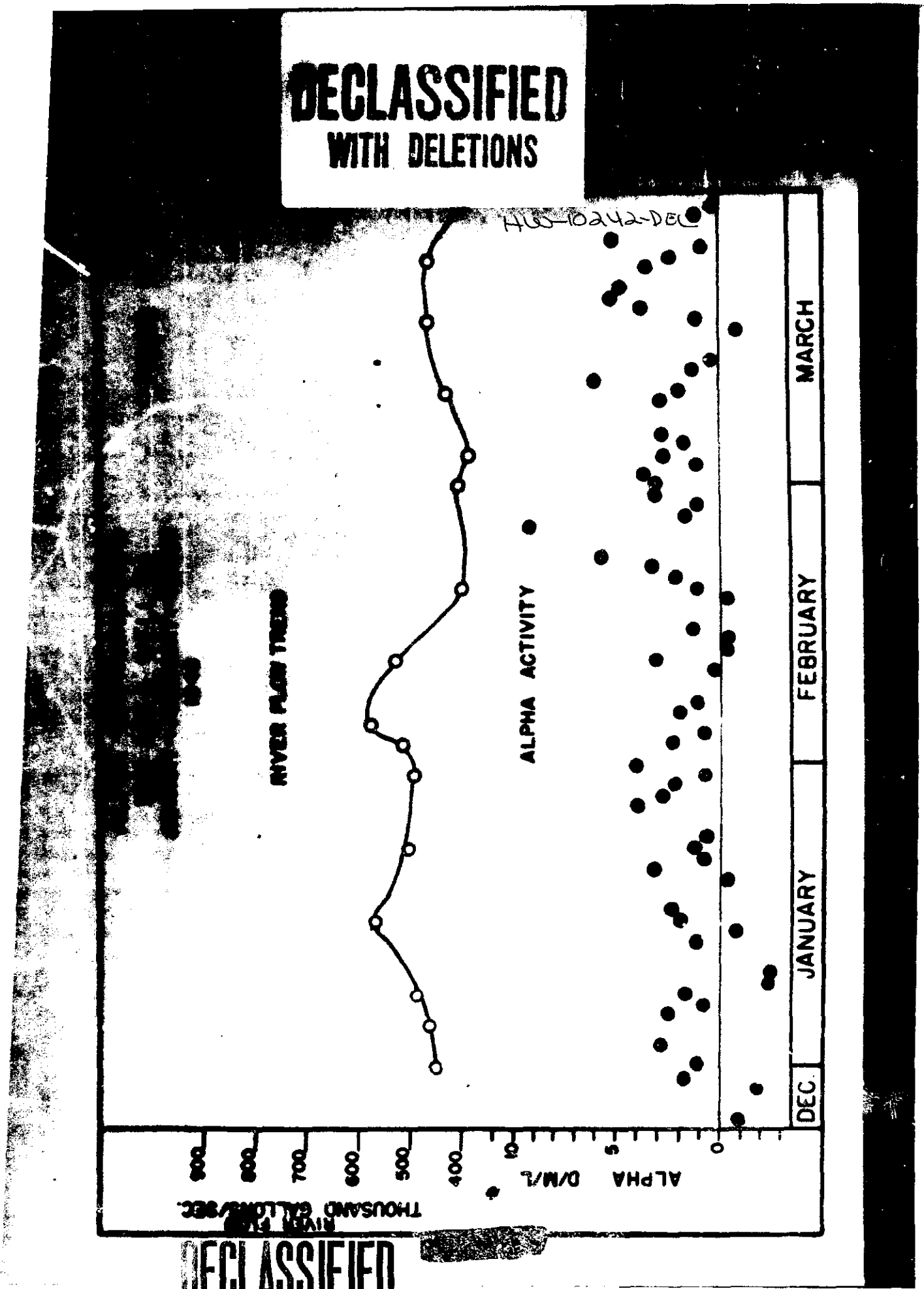


AV :RAGE BETA ACTIVITY
IN
RAIN
HANFORD WORKS & VICINITY
JANUARY—FEBRUARY—MARCH
1948

FIGURE 14







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WITH DELETIONS

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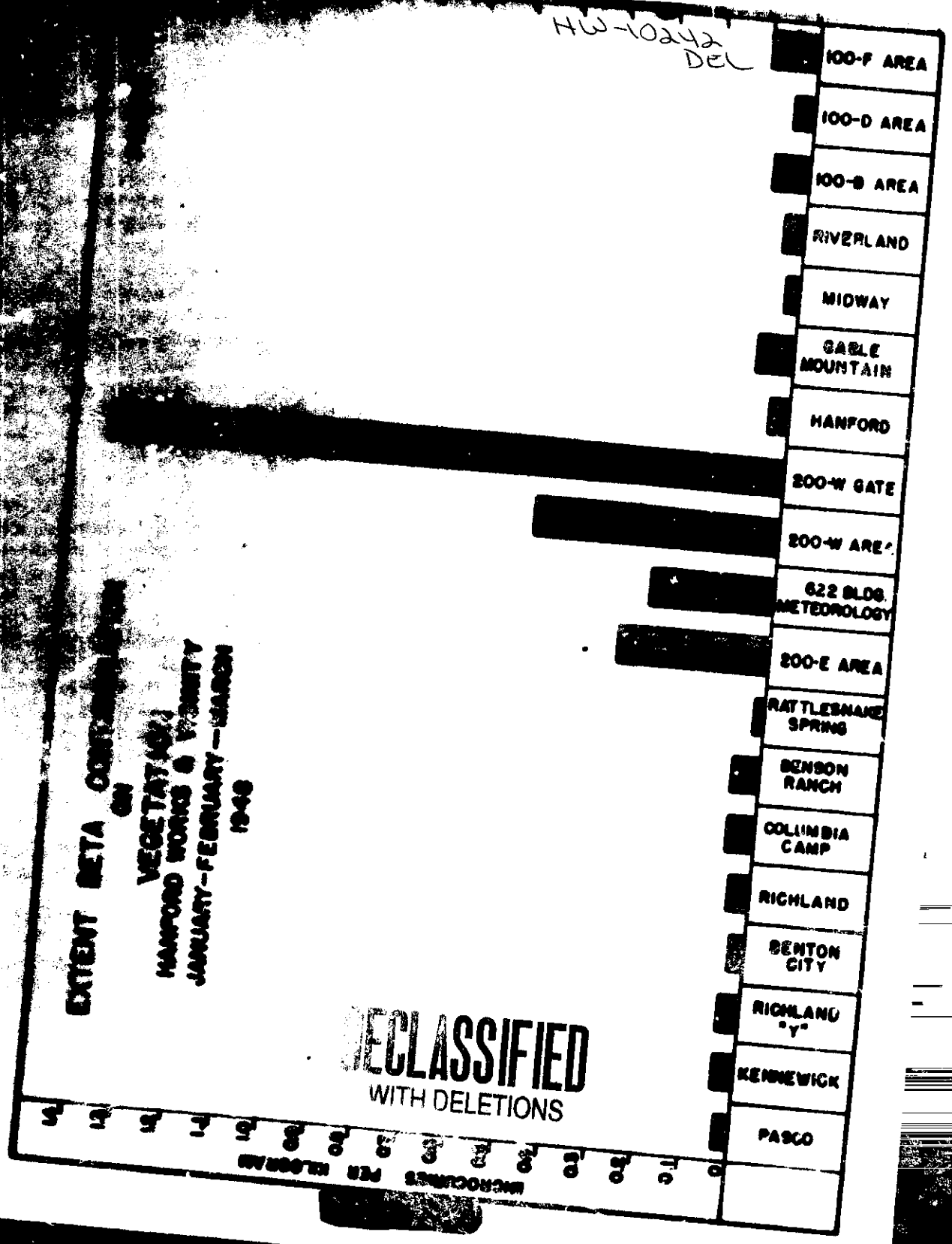

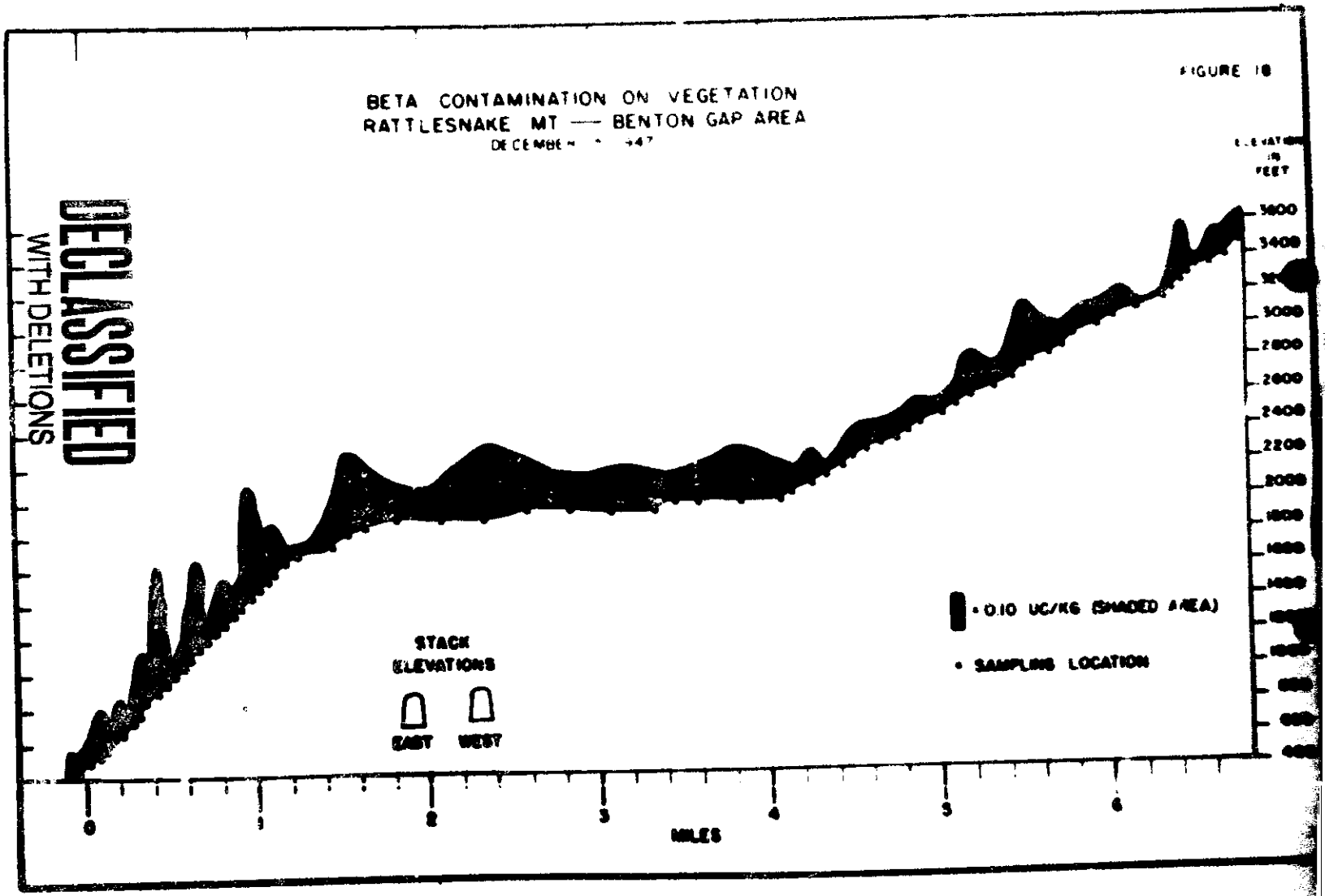

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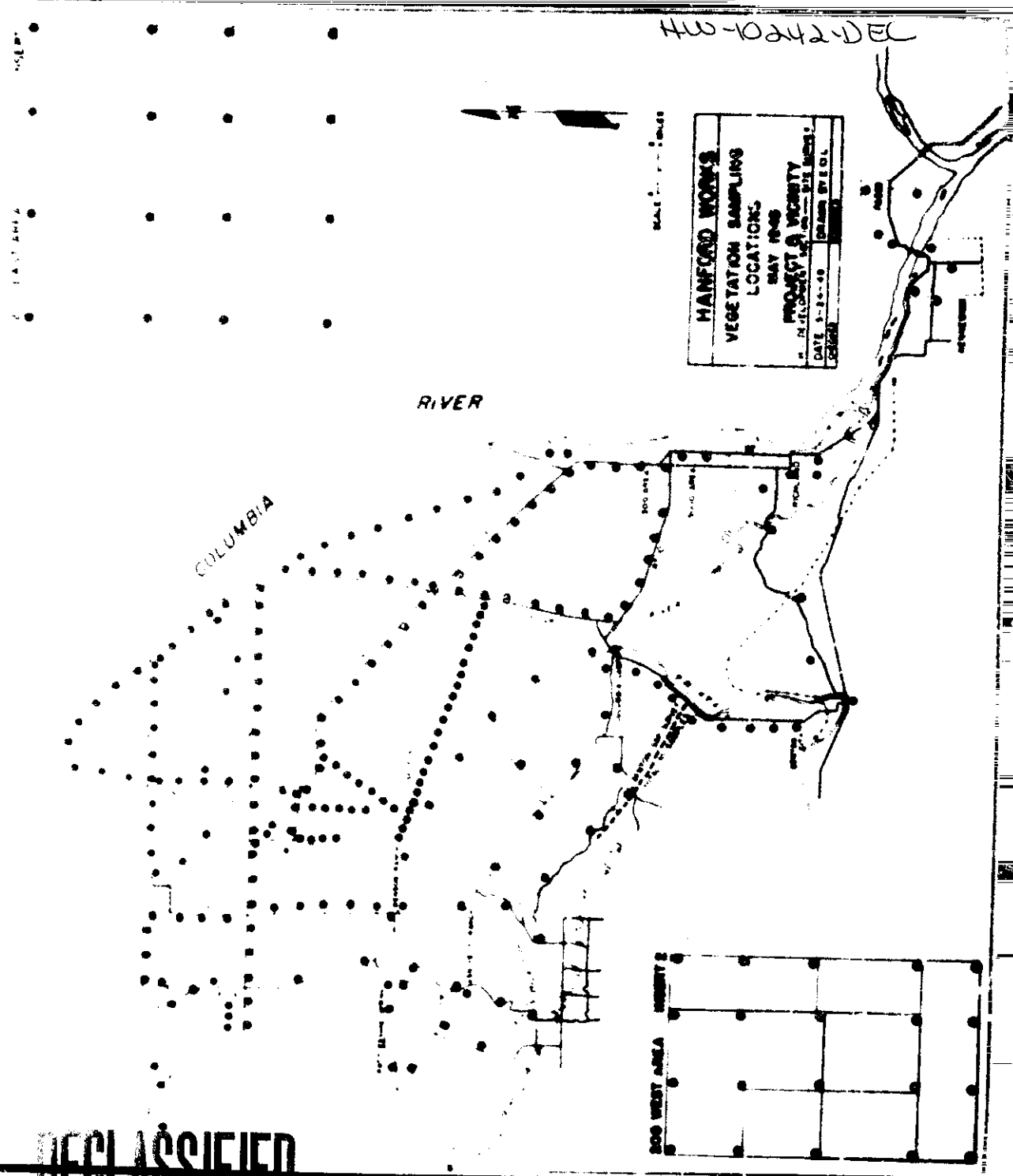

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