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DEVELOPMENT DIVISION
HEALTH INSTRUMENT DIVISIONS

RADIOACTIVE CONTAMINATION IN THE ENVIRONS OF THE HANFORD WORKS

FOR THE PERIOD
OCTOBER, NOVEMBER, DECEMBER, 1949

HANFORD TECHNICAL RECORD

[redacted]

DECLASSIFIED
WITH DELETIONS

HW-17003 DEL

Technology - Hanford

[redacted]

RADIOACTIVE CONTAMINATION IN THE ENVIRONS OF THE HANFORD WORKS FOR THE PERIOD OCTOBER, NOVEMBER, DECEMBER, 1949

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PSullivan 4-29-99

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Development Division
Health Instrument Divisions

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By Authority of
J.E. Barber, Rockwell 8/11/78
By M.S. ... 8/2/78

March 2, 1950

HANFORD WORKS
RICHLAND, WASHINGTON

Operated for the Atomic Energy Commission
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RADIOACTIVE CONTAMINATION IN THE ENVIRONS OF THE HANFORD WORKS FOR THE PERIOD OCTOBER-NOVEMBER-DECEMBER,1949

INTRODUCTION:

This report summarizes the measurements made for radioactive contamination in the environs of the Hanford Works. The principal sources of the radioactivity originating as a result of operations at Hanford which affect the environment in this area are the two waste stacks in the separations area and the cooling water from the four pile areas. Measurements are also made on samples taken from the Hanford waste systems which are primarily confined within the project proper. Although monthly summaries of these data are reported in Health Instrument Divisions Environs reports, a somewhat more detailed discussion of these data is covered in the quarterly report. In this manner, a better evaluation of possible trends can be detected as a result of the increased number of measurements made available by combining the data for a three month period.

ABSTRACT

SECTION I - METEOROLOGICAL DATA:

During the quarter, the wind directions within the separations area prevailed from the northwest with variable wind directions in the vicinity of the 100 Areas. Metal dissolution was in progress eighty-eight per cent of the time when the calculated atmosphere dilution ratios were greater than 1000 to 1. Complete charts and graphs summarizing the wind directions and velocity during this period are included with a reference to their effect on the pattern of the distribution of I-131 on vegetation in this area.

SECTION II - RADIOACTIVE CONTAMINATION ON VEGETATION:

Dissolving during this period was normal using 83 to 101 days cooling time for the irradiated uranium with the exception of the experimental dissolving when 16 day cooled uranium was dissolved within a twenty-four period on December 2 and 3, 1949. Prior to the experimental dissolving (green run), the levels of deposited I-131 and non-volatile emitters on vegetation did not differ significantly from the activity levels measured during the previous quarter. Iso-activity maps in which the magnitude and extent of the deposited I-131 on vegetation are included in this document. Just after the green-run, when large quantities of I-131 were discharged into the atmosphere due to the dissolving of the green metal, increases in deposited I-131 concentrations on vegetation over the past month approached factors of 100 to 600 in the residential areas of Richland, Kennewick, and Benton City; increases by factors as high as 1000 were experienced just outside the separations area. The maximum concentration of I-131 on vegetation just after the green run was about 28 μc/kg as compared with a maximum of 55 mμc/kg measured before the green run. The overall pattern of deposited I-131 after the green run extended in an elongated shape about 40 miles wide and 200 miles long lying northeast and southwest of the 200 West Area stack. The I-131 deposition on the vegetation in the Wahluke Slope area was in the range of 0.1 to 0.5 μc/kg with a small isolated areas approached 1.0 μc I-131/kg vegetation. Surveys of the Benton Gap of Rattlesnake Mountain indicated highest I-131 deposition on the plateau portion of the Gap where activity of 1.7 μc/kg was measured in a sample taken at the 1900 foot level. A detailed compilation of the data obtained prior to and after the green run are summerized in the form of tables and graphs.

SECTION III - AIRBORNE CONTAMINATION AND AIR RADIATION LEVELS

Atmospheric radiation levels as determined by fixed and detachable ionization chamber did not differ significantly from those levels usually encountered in this area. Aerosol beta activity and I-131 concentrations in the atmosphere remained essentially the same as noted in previous months except for the momentary increases noted during the green run period of December 2 and 3, 1949 when abnormally high concentrations of radioactive stack effluent were discharged into the atmosphere. Measurements for active particles in the atmosphere indicated a decrease from the somewhat higher numbers detected during September; current estimations indicate a return to normal conditions. Slight increases in the number of active particles inside some of the operations buildings in the separations areas were noted during this period and the causes were attributed to local conditions.

SECTION IV - RADIOACTIVE CONTAMINATION IN HANFORD WASTES

Monitoring for radioactive contamination in the 100, 200, and 300 Area waste systems did not differ significantly from normal levels previously observed; small deviations and fluctuations such as small increases in the level of activity of the laundry wastes are discussed. It was estimated, based on a one week study of laundry waste, that 6.8×10^8 dis/min of alpha activity primarily from uranium was discharged into the laundry ditch and U Swamp in a one week period.

SECTION V - RADIOACTIVE CONTAMINATION IN THE COLUMBIA AND YAKIMA RIVERS

As anticipated, with the decreased flow of the Columbia River during this period, corresponding increases in the activity of the river were observed. Beta emitters approaching 2425 μμc/liter were measured in river samples taken near Hanford; 300-500 μμc/liter were measured in samples taken from near Kennewick and Pasco. This activity is primarily from 14.8 hour sodium (Na-24). Measurements for radioactive contamination in other water supplies using the Columbia as the source of supply are discussed; none of these surveys indicated significant deviations from normal or anticipated conditions.

SECTION VI - BETA ACTIVITY IN RAIN AND SNOW

Radioactive contamination in rain and snow followed the normal patterns expected with the exception of the green run period when activity in rain samples were as high as 271 μμc/liter.

SECTION VII - RADIOACTIVE CONTAMINATION IN DRINKING WATER AND TEST WELL

Levels of alpha activity measured in drinking water did not deviate from the levels measured in past surveys. Uranium, presumably occurring in natural quantities continued to be found in some Richland drinking water supplies; an average value of 21 ug U/liter water was measured in a Benton City Well; this well is representative of the highest level of uranium in the drinking water of this general area. Complete data of all water analyses are presented in the form of tables and graphs.

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SECTION I

METEOROLOGICAL DATA

The summary of the meteorological conditions presented for the period October, November, and December, 1949, includes only that data which were recorded and observed during the actual hours of metal dissolution. The measurements were made by the Meteorology Group of the Health Instrument Divisions for the daily 24 hours periods; the data which were representative of the periods during which radioactive gases were emitted to the atmosphere were extracted by the Site Survey Group.

Figures 1 through 4 summarize the observed and recorded wind conditions graphically. Figure 1 presents the three month average wind direction data as recorded at the 200 foot level at the Meteorology Tower near the 200 West Area. The meteorological data at the 200 foot level are used as this height is most comparable with the height of the stack emitting the radioactive gases. The prevailing wind was from the northwest quadrant; the northwest component contributed 23 per cent of the wind and the west component contributed 24 per cent of the wind. A minimum of wind was recorded from the easterly components; all southerly directions accounted for approximately 25 per cent of the wind. Again, the south and southwest directions accounted for the higher velocity winds; the maximum wind velocity measured during the quarter was 55 miles per hour on November 27, 1949. The wind direction data presented in Figure 1 may be favorably compared with the iso-activity pattern of deposited radioactive contamination on vegetation (see Figure 6).

Figure 2 summarizes the average monthly wind direction as observed at the Meteorology Tower. The October and November direction data corresponded favorably with the quarterly average at this location; however, an increasing amount of wind was noticed from the southwest direction during the month of December. It is significant that the east and northeast components again showed a minimum of wind. The month to month fluctuations in predominating wind directions directly influenced the trend of deposited radioactive contamination on vegetation. The occasional trace quantities of I-131 activity detected on the vegetation on the Wahluke Slope was attributed to the southerly

wind components and their corresponding higher velocities.

Figure 3 summarizes the wind direction as recorded at the 200 West Area and the 100 Areas. This graph portrays the differences in prevailing wind directions which occur at the 100 Areas and at the 200 West Meteorology Tower. The data portrayed for the 100 Area locations represent observations made at elevations less than 50 feet above ground; the 200 West data represent observations made at 200 feet above ground level. This elevation difference could possibly account for some of the direction differences noted; however, it has been found that at the Meteorology Tower where observations are made at levels from 50 feet above ground to 400 feet above ground, differences in wind velocity may be encountered, but rarely in direction.

In the vicinity of the 100 Areas the wind prevailed from the northwest about 5 to 10 per cent of the time and about 25 to 35 per cent of the time in the 200 West Area. Also worthy of mention is the fact that in the 100 Areas, the amount of wind observed from the northwest was nearly identical to that amount observed from the east whereas the east direction accounted for the minimum amount of wind in the 200 West Area. Meteorological records were not available from the 100-D Area for the months of October and November; however, the data for December differed significantly from that of the 100-B and 100-F Areas in that it showed the prevailing direction to be south 32 per cent of the time. The northwest, southwest, and northwest directions only accounted for 2 per cent of the wind at 100-D, whereas these directions tended to prevail at the other monitoring locations.

Figure 4 is a graphic summation of the atmospheric dilution factors as determined during the hours of metal dissolution in the separation areas. The desirable 1000 to 1 dilution ratio prevailed 88 per cent of the time when dissolving was in progress. The undesirable dilution ratio of less than 500 to 1 occurred 5 per cent of the time during the quarter. Most of the low dilution periods existed during November when the dilution ratio of 500 to 1 was encountered 12 per cent of the time. During October and December the 500:1 dilution ratio existed only 1 and 2 per cent of the time,

respectively.

The complete absence of rain during the early part of this quarter was broken when 1.47 inches of rain fell during November. The total precipitation during November exceeded that during October and December by a factor of almost fifteen. A complete tabulation of the rainfall data and the beta activity measured in rain samples, is presented in Section VI of this report.

The first measured snowfall occurred on December 15, however a trace amount of snow was detected on October 23. The total snowfall during the quarter was 0.65 inches.

SECTION I

(Please refer to Figures 1,2,3, and 4)

SUMMARY WIND DIRECTIONS
AT
METEOROLOGY TOWER — 200-W AREA
DISSOLVING HOURS ONLY
OCTOBER - NOVEMBER - DECEMBER
1949

FIGURE 1

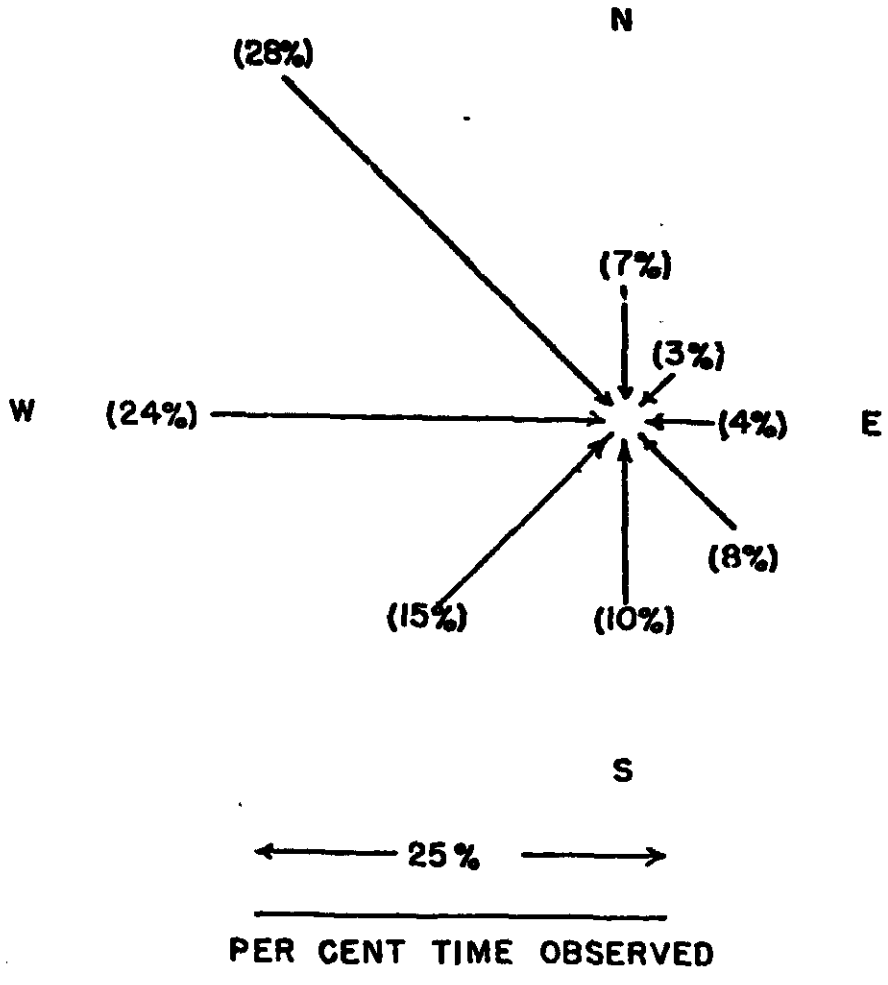


FIGURE 2

SUMMARY AIR CONDITIONS —— 200 W

OCTOBER – NOVEMBER – DECEMBER

1949

WIND DIRECTIONS

DISSOLVING HOURS ONLY

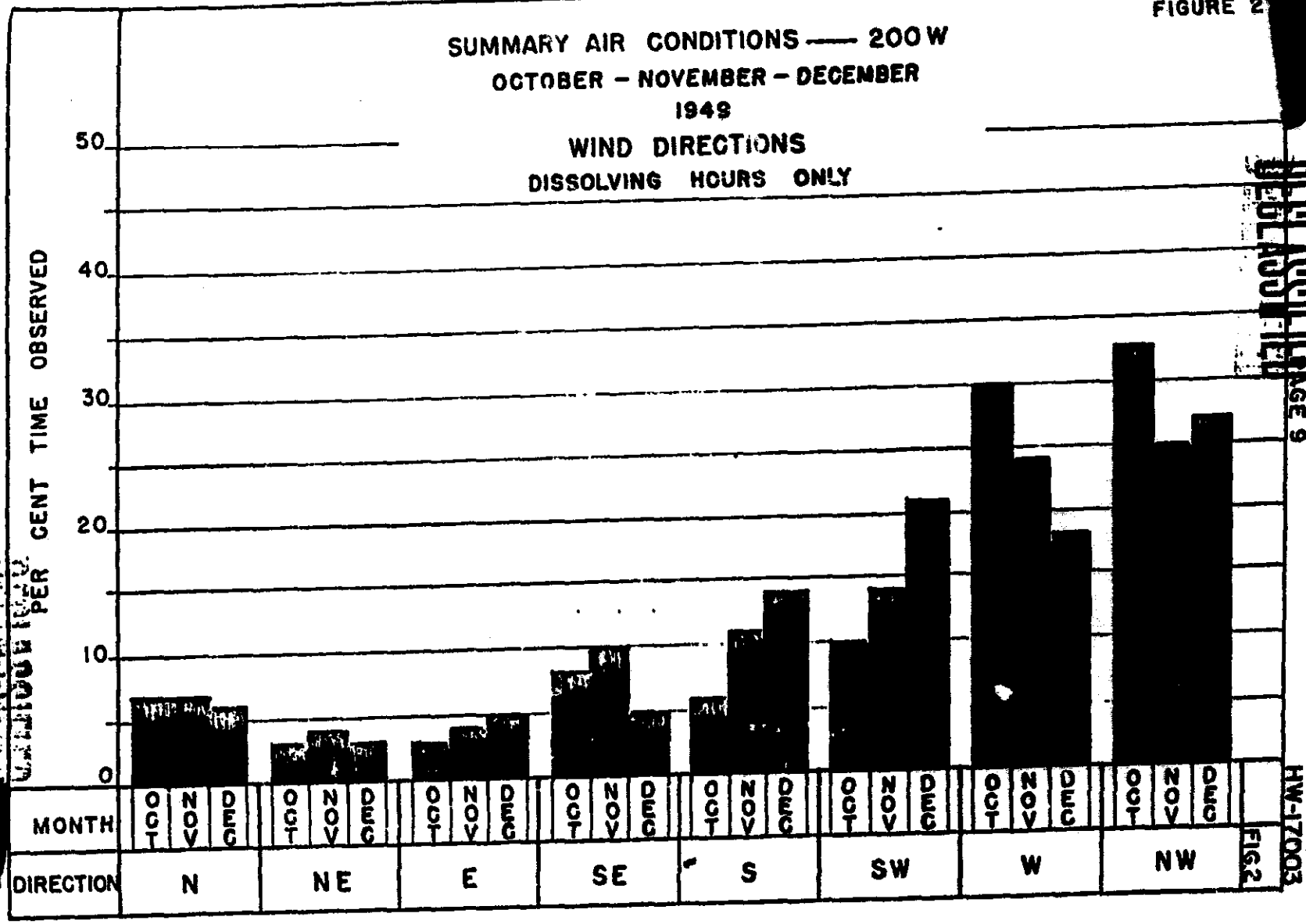


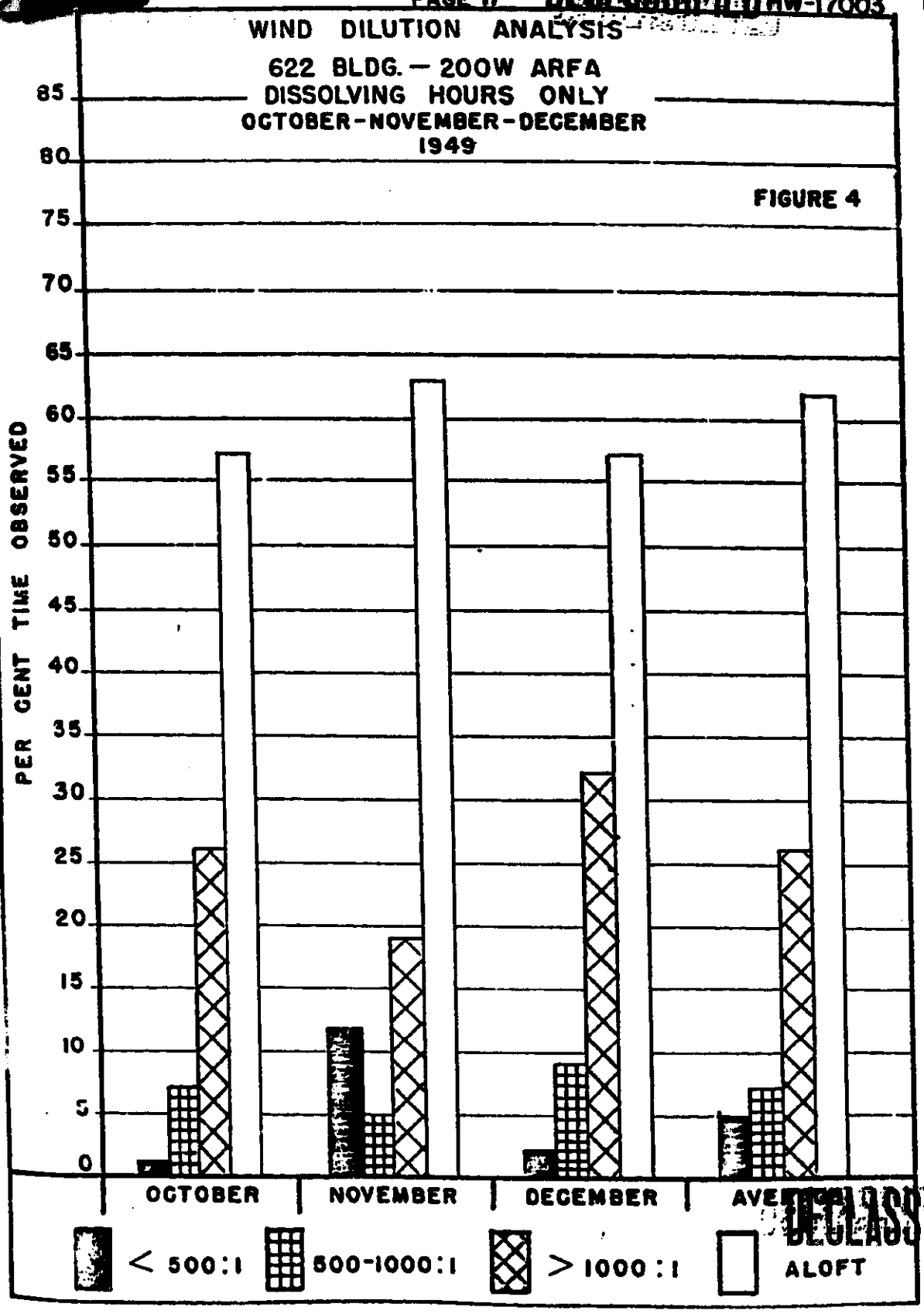
FIG 3

FIGURE 3

COMPARISON OF WIND DIRECTIONS
DISSOLVING HOURS ONLY
OCTOBER-NOVEMBER-DECEMBER
1949

PER CENT TIME OBSERVED

MONTH O N D O N D O N D O N D O N D O N D O N D O N D
LOCATION 200-W 100-S 100-D 100-F 200-W 100-S 100-D 100-F 200-W 100-S 100-D 100-F 200-W 100-S 100-D 100-F
DIRECTION N NE E SE S SW W NW



SECTION II
RADIOACTIVE CONTAMINATION ON VEGETATION

The following tabulation summarizes the amount of 3 day radio-iodine (I-131) calculated to have been released during dissolution of irradiated uranium during October-November-December, 1949. The calculations are based on the weights and cooling time of each batch of irradiated uranium which is dissolved, but does not represent the actual amounts of radioactive gases which were liberated into the atmosphere. The calculation does not include corrections for the retention of the radioactive gases in the dissolver and does not correct for the efficiency of the sand filters and scrubbers.

TABLE I

CALCULATED CURIES OF I-131 FORMED DURING DISSOLVING
OCTOBER NOVEMBER DECEMBER
1949

Month	200 East Area Curies I-131	200 West Area Curies I-131	Total Curies I-131
October	221.5	181.5	403.0
November	227.0	187.0	414.0
December	252.5	5247.5*	5500.0*

* These figures include the radioactive gases formed during the experimental dissolution of one ton of irradiated uranium cooled only 16 days. This experimental green run was performed on December 2, 1949. A detailed discussion of the complete data of this experiment is included in a report issued under separate cover.

Figure 5 presents the calculated amount of I-131 released in the dissolver units during uranium dissolution for each day during the period. With the exception of the green run, the cooling times for uranium dissolved during this period ranged from 83 to 101 days.

Due to the large amount of activity released at the time of the green run, it was necessary to present the results of the sampling program for this quarter in two distinct parts in order to eliminate any distorting which would result from combining the data before and after the green run. For the main part this section will be primarily directed to covering that period before the green run. The highlights of some of the data gathered following the green run are presented for puposes of comparison.

A total of approximately twenty-five hundred vegetation samples were collected during this period, about half of these were obtained after the green run. The majority of the samples collected after the green run were only analyzed for the beta activity from the eight day radio-iodine (I-131), while those collected previous to the green run were analyzed for both I-131 activity and for the beta activity from the longer half lived non-volatile fission product elements. The methods of analyses for I-131 and non-volatile emitters may be referred to in a previous report.(1)

Table II summarizes the measured I-131 activity in vegetation samples which were collected from representative locations on and adjacent to the Hanford Works. The I-131 activity detected after the green run is tabulated separately from that which was measured during October and November. The average I-131 activity measured on vegetation during October and November did not differ significantly from the overall average during the previous quarter, although isolated areas such as Gable Mountain and Benton City indicated small increases which could have been due to a small increase in the dissolving for the period. Previous to the green run, the maximum individual and average I-131 activity (55 mμc/kg and 21 mμc/kg, respectively) were once again found on vegetation collected in the immediate vicinity of the 200 West Gatehouse. The I-131 activity found along Route 3 which passes the 200 West Gatehouse confirms this higher deposition which occurred in this vicinity during October and November; individual samples taken along Route 3 showed I-131 activity approaching 50 mμc/kg and averaging 12 mμc/kg. An iso-activity map for the period previous to December 3, which shows the localized deposition of I-131 in this region is presented in Figure 6 .

A review of Figure 6 shows that with the exception of the region that is within about a five mile radius of the separation areas, the overall I-131 average on vegetation was less than 2 mμc/kg during October and November. Nearly one hundred and fifty samples were obtained from the residential communities of Richland, Pasco, Kennewick, Richland Y, and Benton City, during October and November; the average I-131

(1) HW-14243, Radioactive Contamination In The Environs Of The Hanford Works For The Period January-February-March, 1949, by W. Singlevich and H.J. Paas, December 23, 1949.

activity was less than 2 mμc/kg in each area and the maximum I-131 activity of 11 mμc/kg was detected in Richland.

Several off-area surveys were completed during October and November. Based on samples collected at five and ten mile intervals in the region bounded by Lewiston, Spokane, Ellensburg, and Maryhill, the overall average I-131 activity off the site was less than 2 mμc/kg. Figure 7 shows the extent of this survey, the frequency of sampling and includes the I-131 activity measured on the vegetation samples from each sampling location. A special survey of the Yakima-Ellensburg region which was completed late in September showed general I-131 activity deposition comparable with that found in the later survey.(2)

A significant increase in the I-131 activity on vegetation occurred immediately after the dissolving of the green run on December 3. Table II summarizes the results of the vegetation sampling program for the period previous to, and the period immediately after the green run.

TABLE II
I-131 ACTIVITY MEASURED ON VEGETATION
OCTOBER-NOVEMBER-DECEMBER
1949
units - mμc/kg

LOCATION	BEFORE GREEN RUN			AFTER GREEN RUN		
	Number Samples	Maximum	Average	Number Samples	Maximum	Average
Inside 200 East Area	45	15	8	-	-	-
Inside 200 West Area	40	44	7	-	-	-
North of 200 Area	140	7	<2	40	1244	395
Near the 200 Areas	112	42	4	35	4856	1621
Route 3	15	50	12	6	27648	12246
200 West Gate	9	55	21	1	11340	11340
Meteorology Tower	8	18	6	1	2471	2471
South of 200 Areas	198	13	<2	52	1044	265
Richland	46	11	<2	10	426	104
Pasco	34	5	<2	8	164	83
Kennewick	32	7	<2	8	1073	245
Benton City	27	7	<2	3	862	617
Richland "y"	8	4	<2	2	345	205
Hanford	17	3	<2	4	534	246

The I-131 results tabulated above, for the period after the green run are also presented in Figures 8 and 9 which show the estimated distribution of deposited I-131 on vegetation on the project and the environs, respectively.

(2) HW-14953, H.I. Environs Report For October 1949, by W. Singlevich, November 3, 1949.

The extent of the I-131 sampling (Figure 9) was influenced by the trend of the initial I-131 measurements, and in general, all main thoroughfares in an area bounded by Klamath Falls, Ellensburg, Kettle Falls, and Baker, were sampled.

The maximum I-131 activity measured after the green run was found inside the 200 West Area where a sample collected near the perimeter fence directly east of the stack showed 28.0 μc/kg. I-131 activity exceeding 10 μc/kg was common inside the separation areas and along nearby Route 3. The deposited I-131 activity on vegetation outside of the 200 West perimeter fence and within a radius of four miles of the stack, was between 5 and 10 μc/kg. The pattern of the deposited I-131 on vegetation tended to elongate in a northeast and southwest direction from the stack, the greater deposition predominating to the south in the vicinity of the abrupt rise of the Horse Heaven Hills where the average I-131 on vegetation was between 1 and 2 μc/kg. The maximum I-131 activity measured in this region was 4.3 μc/kg in a sample collected above Kiona. About ten miles north of the 200 West stack an abrupt decrease in the I-131 activity was noted. The deposition on the Wahluke Slope was in the range of 0.1 to 0.5 μc/kg with the exception of two small isolated areas in which the I-131 activity was between 0.5 and 1.0 μc/kg. These are the identical areas which consistently show the highest I-131 activity on the slope.

Seventy samples were obtained from the Benton Gap of Rattlesnake Mountain over a six mile strip which included elevations from about 400 feet to 3600 feet above sea level. The deposition was highest on the plateau at an elevation of about 1900 feet where the I-131 averaged 1.7 μc/kg as compared with an average of 0.5 and 0.3 μc/kg at the base and summit, respectively. Figure 10 shows the deposition pattern in the "gap" and includes the elevation and distance scales. The higher deposition on the plateau compares favorably with a similar higher deposition that was noted a year ago, when the maximum activity was found at the 1900 foot level.(3) The highest activity measured on the "gap" during this period was 3.2 μc/kg in a sample collected at an elevation of 1900 feet.

(3) HW-13743 Radioactive Contamination In The Environs of HW October, November, December, 1948. To File by W. Singlevich and H.J. Paas, June 22, 1949.

In an area approximately 40 miles wide and 200 miles long, lying northeast and southwest of the 200 West Area, the I-131 activity on vegetation ranged between 0.1 and 0.5 μc/kg. This area included the communities of Goldendale, Arlington, Plymouth, Walla Walla, Odessa, and Moses Lake. The vegetation surveys after the green run were extended to Mount Hood, Klamath Falls, and Baker, south of the stack, and Kettle Falls to the north. Activity from I-131 at these extreme locations fluctuated around the background level of the I-131 analyses falling between 10-20 mμc/kg.

During October and November, the same samples which were measured for I-131 activity were also analyzed for the activity from the non-volatile emitters.

TABLE III
NON-VOLATILE EMITTERS MEASURED ON VEGETATION
OCTOBER-NOVEMBER-DECEMBER
1949
units mμc/kg

LOCATION	Number Samples	BEFORE GREEN RUN Maximum	Average
North of 200 Areas	146	30	12
Near the 200 Areas	115	42	15
Route 3	16	64	21
200 West Gate	8	65	26
Meteorology Tower	8	26	18
South of 200 Areas	197	25	12
Richland	45	26	10
Pasco	35	24	10
Kennewick	33	40	<10
Benton City	27	30	11
Richland "Y"	8	20	<10
Hanford	17	23	10
Rattlesnake MP Post	65	23	12
Goose Egg Hill	49	57	16
Plymouth to Kennewick to Hover	12	30	14
Pasco to Ringold	18	27	16
Pasco to Eltopia	5	14	<10

A summary of the non-volatile emitters measured on vegetation samples during October and November, 1949, is presented in Table III. Figure 11 shows the estimated deposition pattern of this activity on the vegetation during the period. The highest average for the non-volatile emitters was measured directly outside the perimeter fence at the 200 West Area Gatehouse where the average for the two-months was 26 mμc/kg; two samples were as high as 65 and 64 mμc/kg in this region. It is interesting to note that the maximum non-volatile activity was measured in samples from the same

locations where the maximum I-131 activity was measured.

Vegetation samples collected within the residential areas of Richland, Pasco, Kennewick, Benton City, and the Richland "Y", showed an average non-volatile activity of about 10 muc/kg. The reporting level for this analysis is set at 10 muc/kg which is currently considered to be the background level of non-volatile beta activity in vegetation in this region due to the naturally occurring isotope of potassium (K-40) present in the potassium salts of the vegetation.

SECTION II

(Please refer to Figures 5,6,7,8,9,10, and 11.)

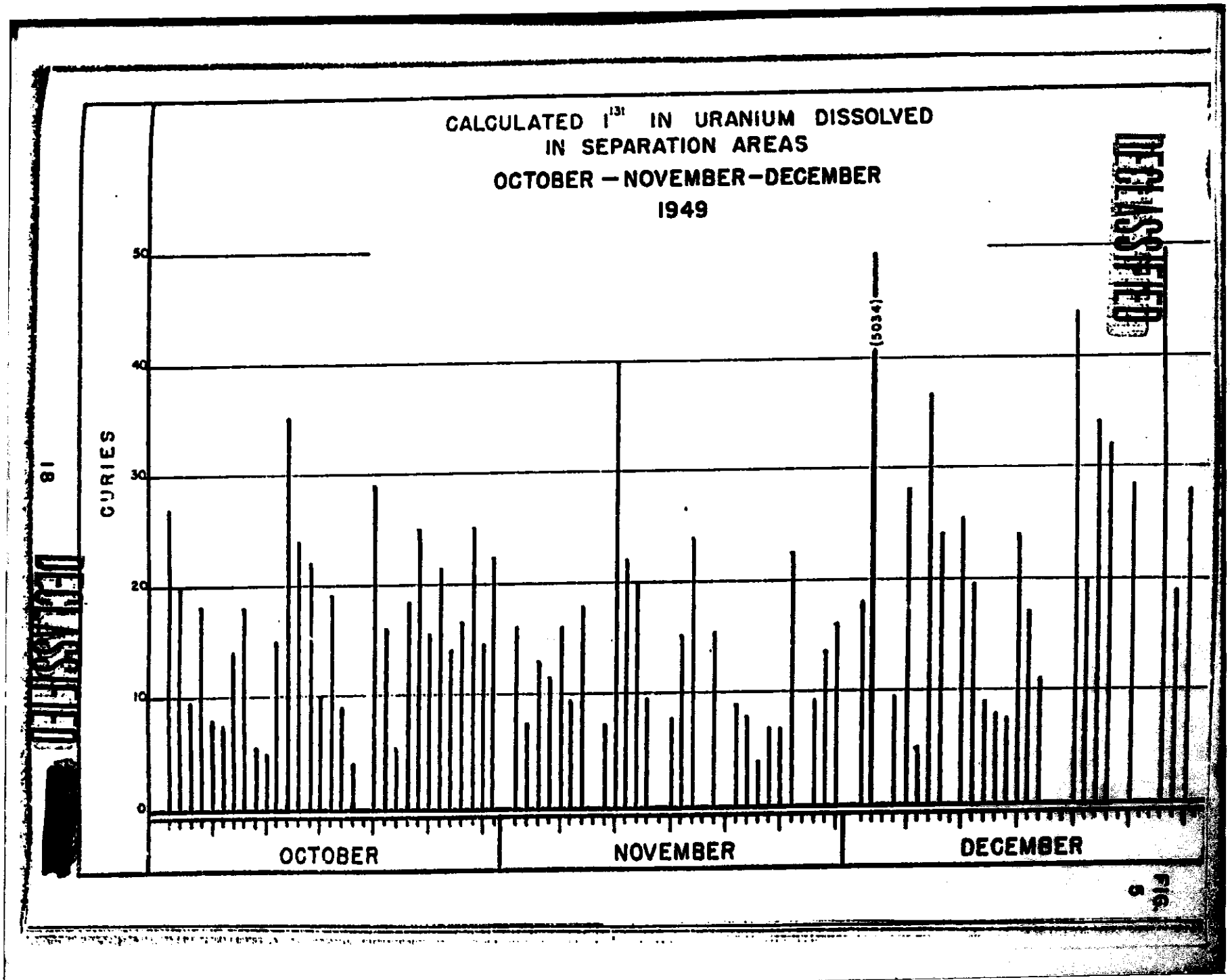
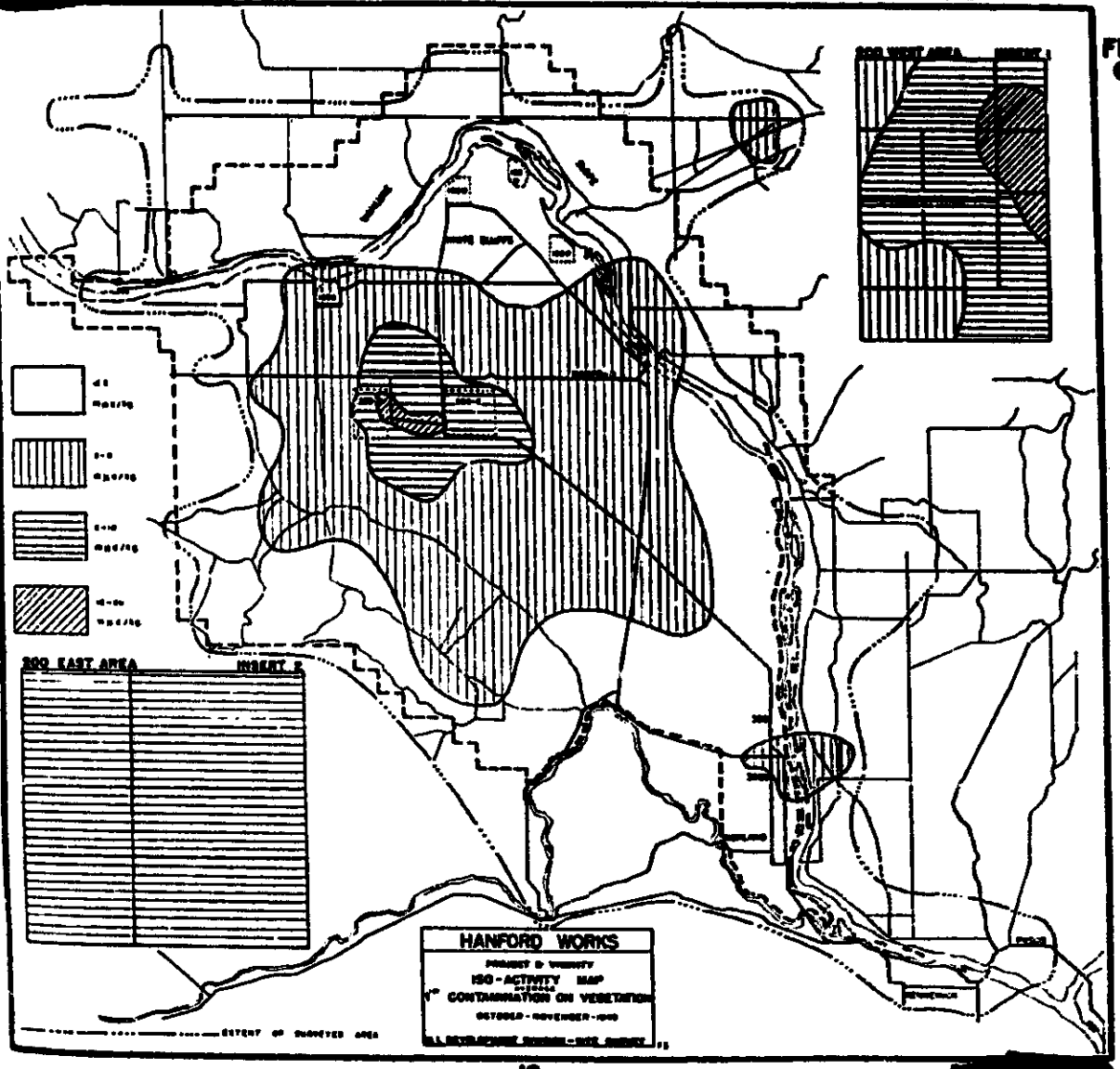

CALCULATED I[131] IN URANIUM DISSOLVED
IN SEPARATION AREAS
OCTOBER – NOVEMBER – DECEMBER
1949
CURIES
50
40
30
20
10
0
(5034)
OCTOBER
NOVEMBER
DECEMBER
DECLASSIFIED
DECLASSIFIED
81

FIG. 9

FIG. 6



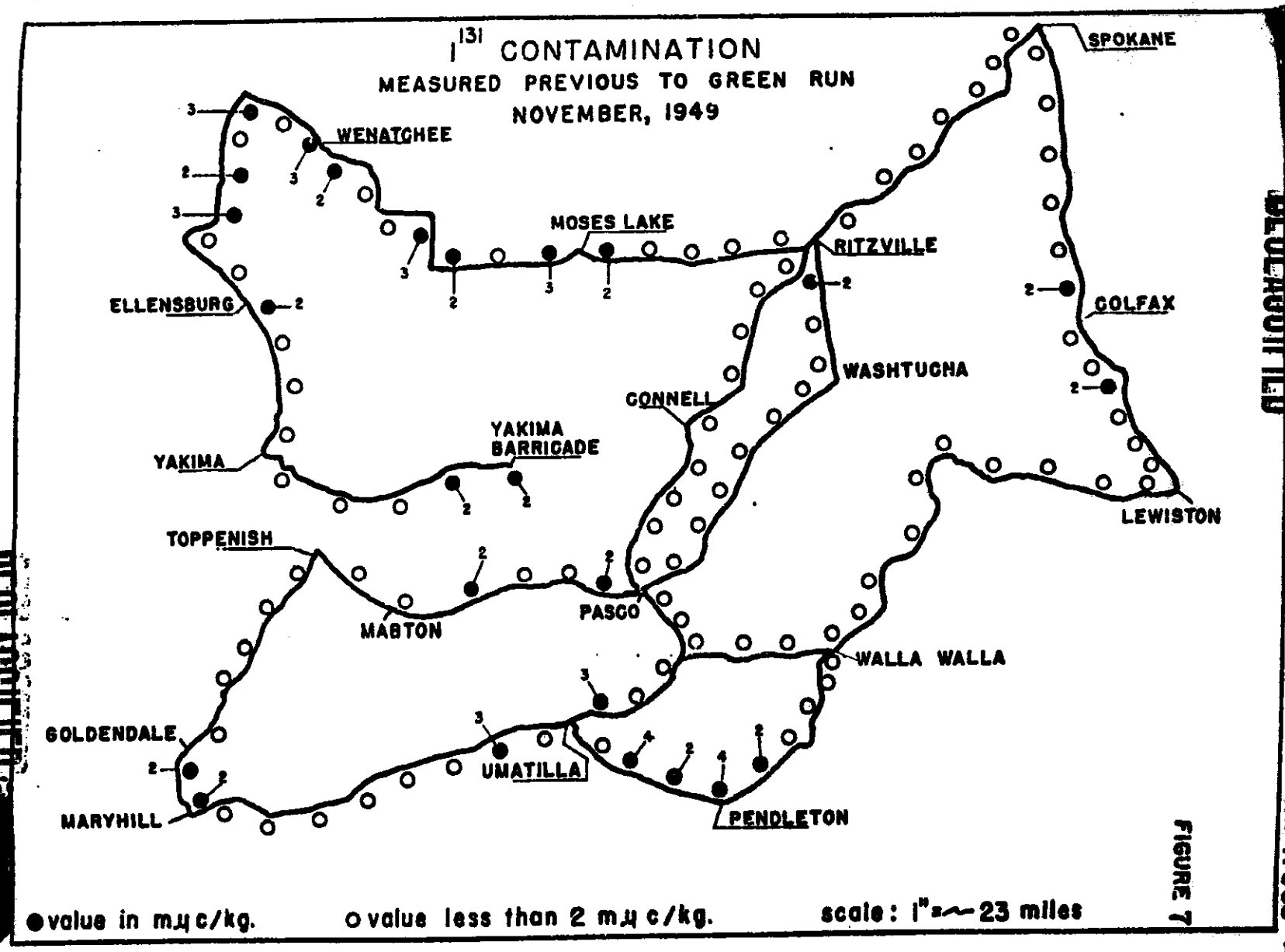


FIGURE 7

FIG. 8

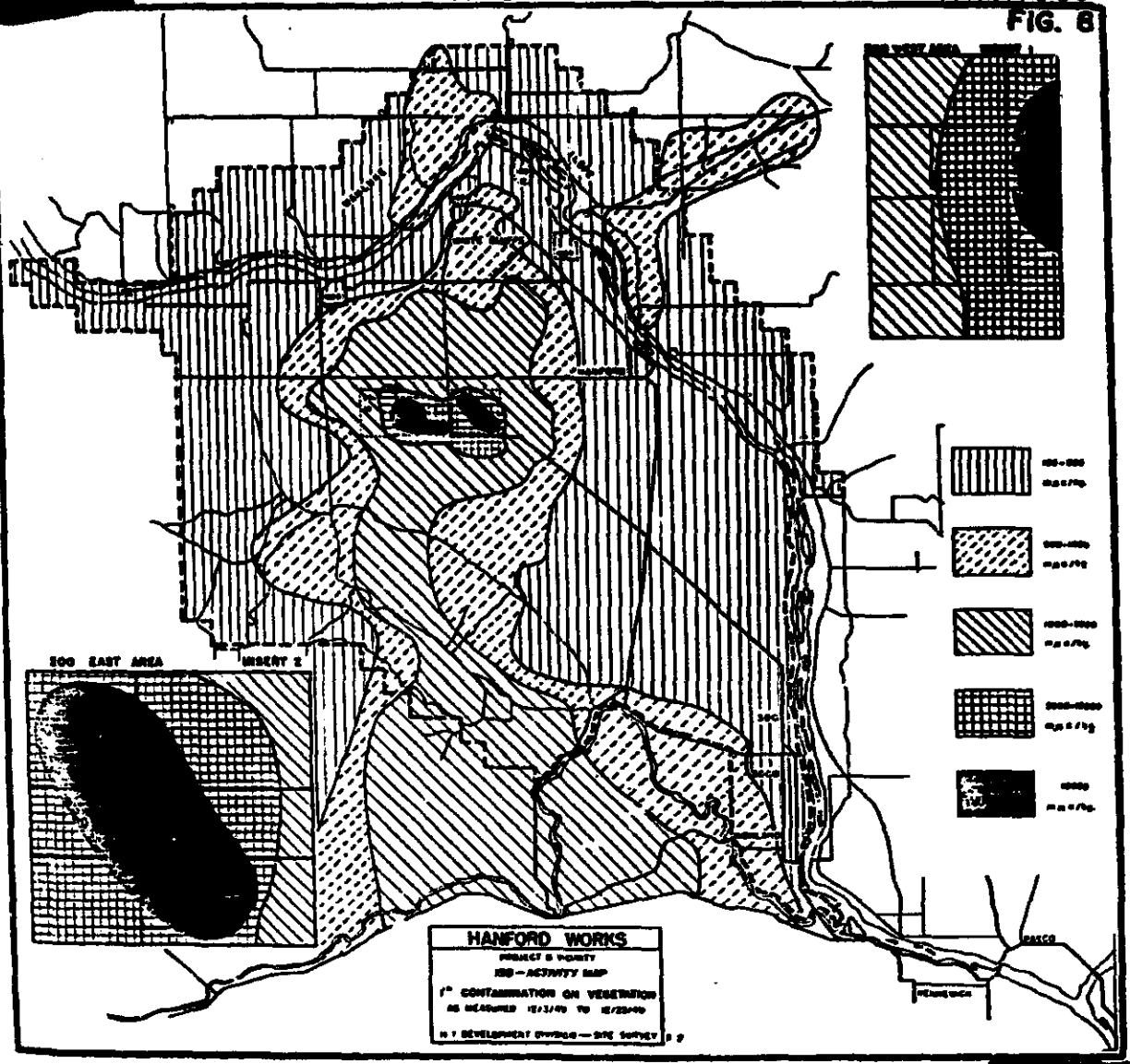
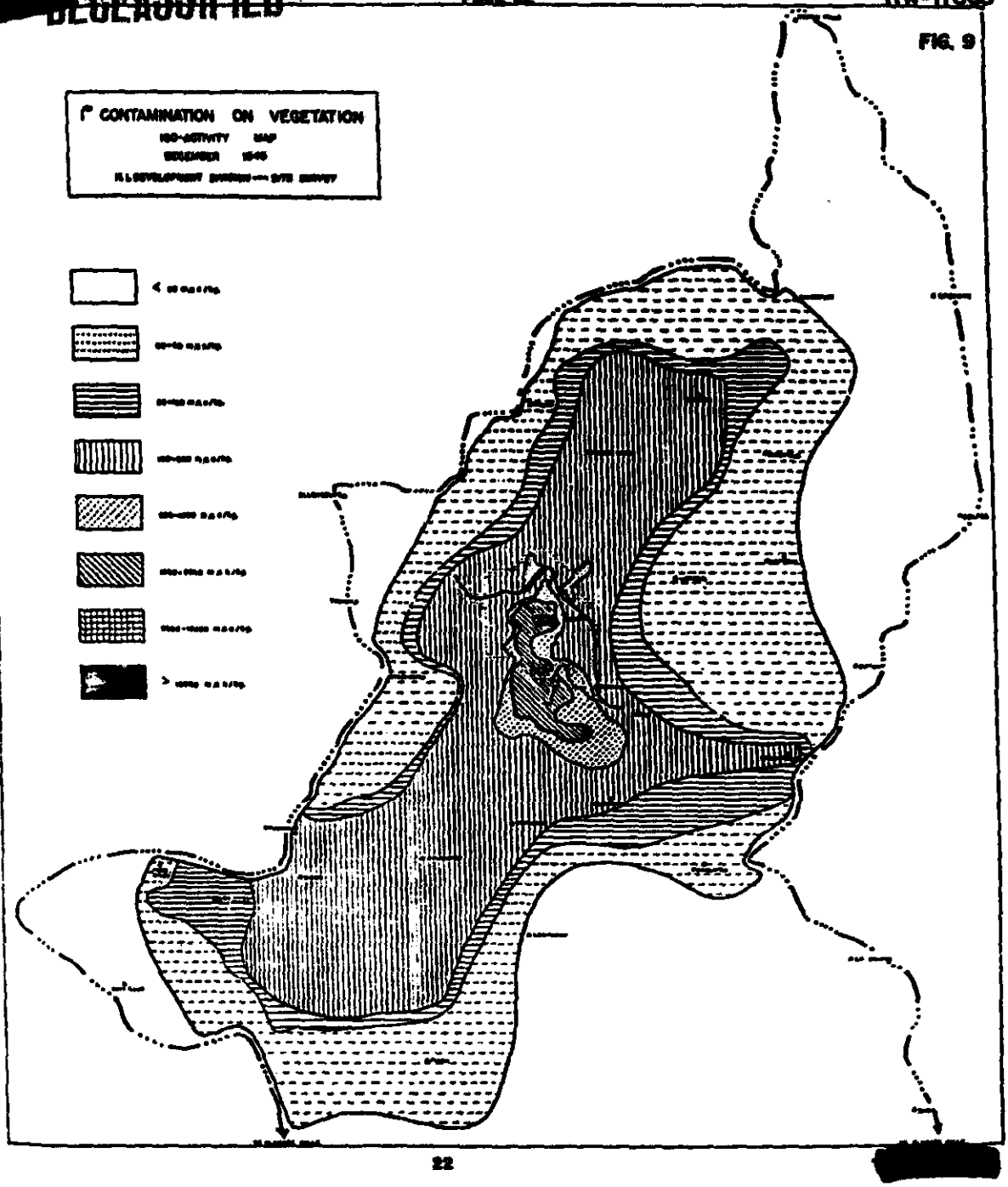


FIG. 9



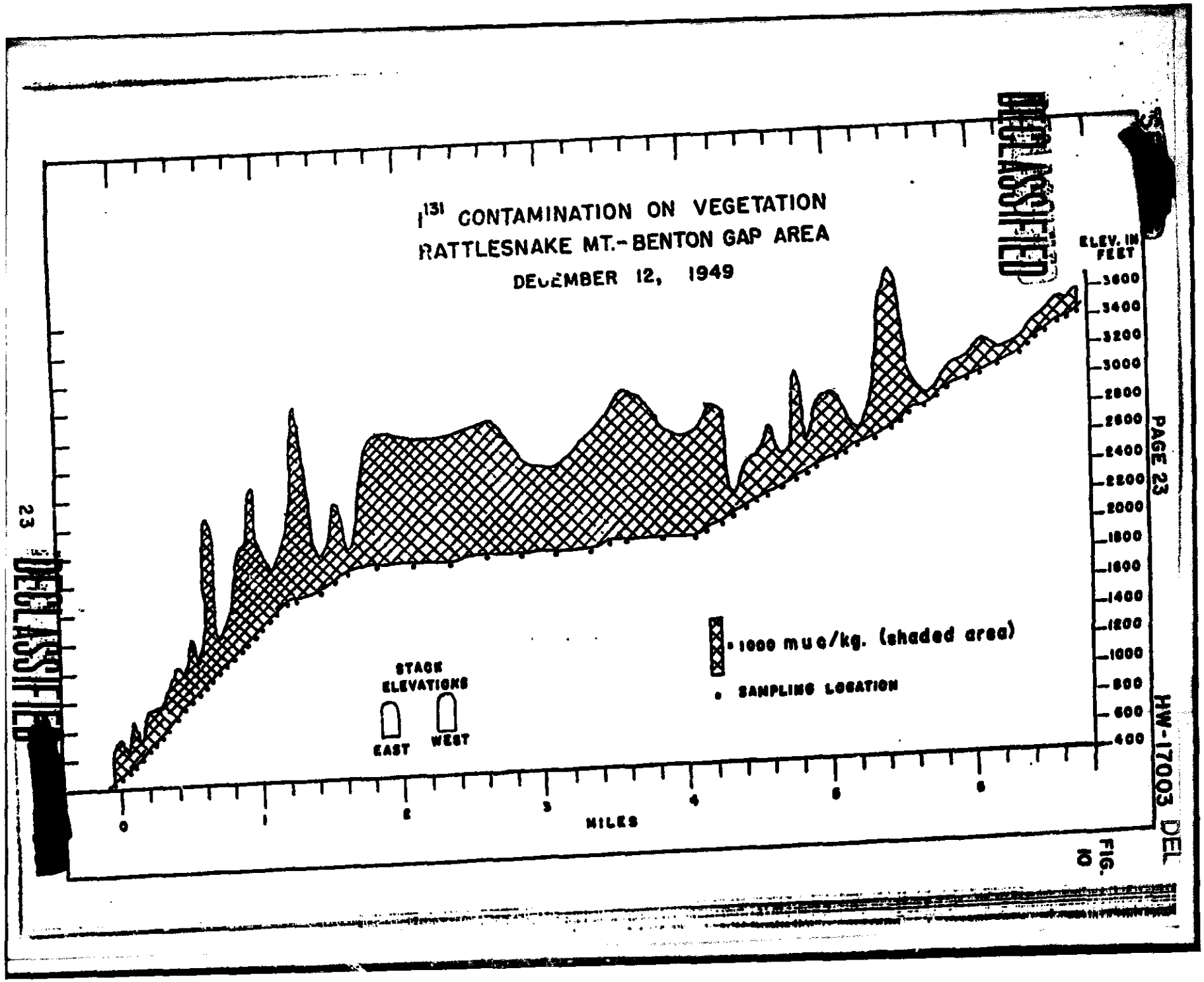

I131 CONTAMINATION ON VEGETATION
RATTLESNAKE MT.-BENTON GAP AREA
DECEMBER 12, 1949
ELEV. IN FEET
3600
3400
3200
3000
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
= 1000 mu c/kg. (shaded area)
SAMPLING LOCATION
STACK ELEVATIONS
EAST
WEST
0
1
2
3
4
5
6
MILES
DECLASSIFIED
DECLASSIFIED
PAGE 23
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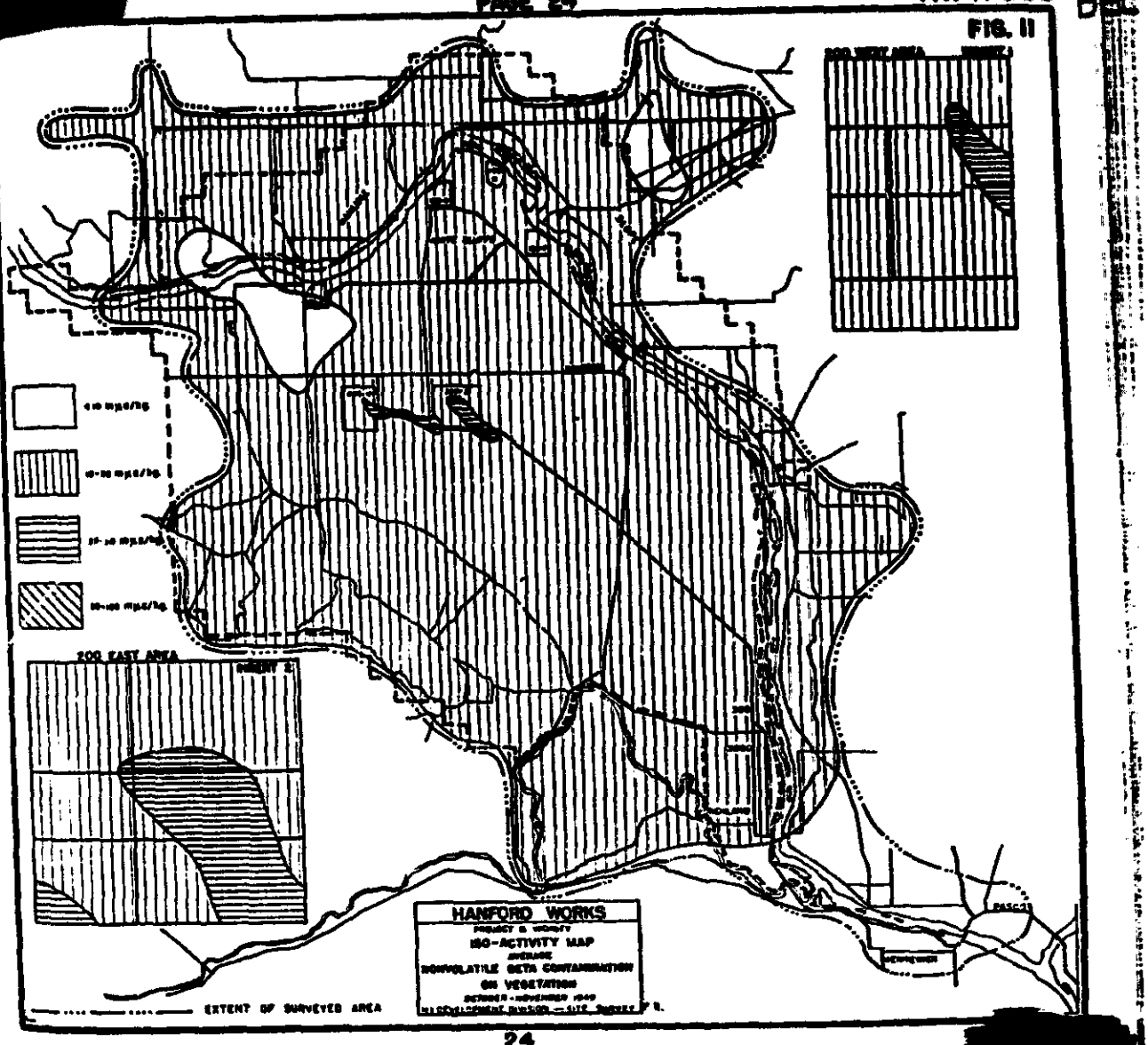
FIG. 10
23

FIG. II



SECTION III
AIRBORNE CONTAMINATION AND AIR RADIATION LEVELS

The airborne contamination and air radiation levels at the Hanford Works were measured by several methods; the method of monitoring was dependent upon the location of the equipment, the source and type of activity measured, and the trend of the current data as compared with previous airborne activity measurements. The more common methods used for this measurement were fixed ionization chambers, detachable ionization chambers, counting rate meters, air filters, and air scrubbers. The results and trends observed and recorded from each phase of this program are discussed separately.

The air radiation levels as measured by the fixed Victoreen Integrons which were located along the perimeter fence of all operating areas and in the vicinity of the populated residential areas adjacent to the Hanford Works showed very little trend during the period October-November-December, 1949. A review of this data for the three month period (Table I) shows that dosage rates were consistent from month to month, and in general were comparable with the background measurements of small detachable ionization chambers; these backgrounds vary between 0.3 and 0.5 mrep/24 hours.

Although the average dosage rates measured at Pasco and Riverland appear to be greater than the background of the integrons used, some doubt is assigned to these values as these two locations are considerably removed from the service areas, and upon checking at weekly intervals several suspected cases of leakage were noted. The higher averages for these locations are weighted by the high values obtained when the instruments were not functioning properly. If these doubtful high values were omitted from the average, dosage rates comparable with the normal expected range would be obtained.

TABLE I

AVERAGE DOSAGE RATES AS MEASURED BY VICTOREEN INTEGRONS

OCTOBER-NOVEMBER-DECEMBER 1949

units of mrep per 24 hrs.

LOCATION	Number of units	AVERAGE DOSAGE AS mrep/24 Hours		
		October	November	December
100-B Area	3	0.5	0.5	0.5
100-D Area	3	0.2	0.1	0.2
100-F Area	3	~ 5	0.3	0.5
100-H Area	3			0.3
200 West Area	2	0.4	0.1	0.2
200 East Area	3	0.4	0.2	0.1
Riverland	1	2.0	1.6	1.0
300 Area	1	1.1	1.5	0.4
700 Area	1	0.3	0.4	0.1
Pasco	1	0.7	1.2	0.3
Benton City	1	0.4	0.2	0.1
3000 Area (N)	1	0.4	0.8	1.1
3000 Area (S)	1	0.1	0.3	0.1
Hanford	1	0.7	0.5	0.4

Radiation levels in air were also measured by means of detachable ionization chambers (Hanford Types "M", "S", and "C"). These ionization chambers were supported five feet off the ground and located at random on and adjacent to the site. The frequency of reading the detachable chambers were based on the trend of previous results and on the capacity of the chamber at a given location. Normally this frequency was three observations per week.

A review of the current "detachable chamber" dosage rates indicated no significant changes or trends observed during the quarter. The higher dosage rates were observed at locations near to, and directly downwind from the separation area stacks. In general, the existing dosage rate within a radius of five miles of the separation areas was about 1.0 mrep/24 hours; this figure included the natural background which varies between 0.3 and 0.5 mrep per 24 hours. Average dosage rates of 1.0 mrep/24 hours were observed at a few locations nearly ten miles from the separation areas, each of these locations was directly downwind from the prevailing wind direction (see Figure 1, Section I).

The atmospheric radiation level barely exceeded the average background in the vicinity of the 100 Areas, although the average dosage rate computed from eight locations where paired readings were taken of 0.56 mrep/24 hours was probably not

TABLE II

RADIATION LEVEL OBSERVED WITH DETACHABLE IONIZATION CHAMBERS OCTOBER NOVEMBER DECEMBER 1949 (mrep per 24 hours)**

"C" CHAMBER READINGS LOCATION	OCTOBER	NOVEMBER	DECEMBER	QUARTERLY AVERAGE
Within 100-B	0.5	0.5	0.5	0.5
Within 100-D	0.2	0.1	0.2	0.2
Within 100-F	0.6	0.3	0.5	0.5
Within 200-W	0.4	0.1	0.2	0.2
Within 200-E	0.4	0.2	0.1	0.2
Within 300 Area	1.1	1.5	0.4	1.0

"L" AND "S" CHAMBER READINGS LOCATION	OCTOBER	NOVEMBER	DECEMBER	QUARTERLY AVERAGE	GROUP AVERAGE
100 Area and Environs					
Route 1, Mile 8	0.6	*	0.5	0.6	
Route 2N, Mile 10	0.5	*	0.7	0.6	
Route 2N, Mile 5	0.4	0.6	0.6	0.6	0.55
At White Bluffs	0.6	0.6	0.6	0.6	
Route 11A, Mile 1	0.8	0.8	*	0.8	
At Hanford 614	0.4	0.4	0.4	0.4	
At Hanford 101	0.5	0.6	*	0.6	
At 100-H Area ***		0.5	0.5	0.5	
Within 5 Miles 200 East Area					
Route 4S, Mile 6	0.9	1.5	1.6	1.3	
Route 11A, Mile 6	0.9	1.1	1.3	1.1	1.19
Route 3, Mile 1	1.4	*	*	1.4	
Meteorology 200'	0.9	*	*	0.9	
Within 10 Miles 200-East Area					
Route 4S, Mile 10	0.7	1.7	0.6	1.0	
Route 1C, Mile 1	0.6	1.5	0.7	0.9	
Route 1D, Mile 3	0.6	0.4	0.7	0.6	1.01
Route 2S, Mile 4	0.8	1.8	*	1.3	
Near 300 Area					
Route 4S, Mile 16	0.6	0.6	0.9	0.7	
Route 4S, Mile 22	0.7	1.4	0.9	1.0	0.85
Outlying Zone					
Richland	0.4	0.5	0.4	0.4	
Benton City	0.4	0.4	0.7	0.5	0.47
Riverland	*	*	*	*	

* Chambers found to be leaking and data voided.

** The dosage rates tabulated include the background of the chambers used which vary from about 0.3 to 0.5 mrep per 24 hours.

*** New location established during the quarter.

significantly higher than former values. Three new stations were established inside the 100-H Area during this quarter. The dosage rate of 0.5 mrep/24 hours measured there was identical to the background dosage rate found immediately previous to the startup of operation in this area.

The dosage rates at locations which are removed from the site proper such as Richland, Benton City, and Riverland, reflect very good consistency; the average dosage rates during the quarter were between 0.45 and 0.50 mrep/24 hours. This average was within the error and fluctuation of the background measurement. Table II summarizes the radiation levels measured on and adjacent to the Hanford Works.

The average filterable beta activity in air was determined by measuring the activity deposited on a CWS #6 filter paper while passing about two cubic feet of air per minute through the filter for a period of one week. This activity showed a significant increase during the period October-November-December, 1949; this increase in average was a result of the higher beta activity detected after December 3. One ton of green uranium (dissolved after sixteen days cooling period) was dissolved on December 3, when an estimated 5050 curies of I-131 and 4750 curies of Xe-133 were formed in the dissolver at this time. Estimations of the amount of this activity actually liberated to the atmosphere and a more detailed appraisal of its deposition pattern and concentration may be referred to in a special report on this operation.

A summary of the average filterable beta activity detected in air as determined by measuring the activity on the filter paper useing thin mica window counters during the period October-November-December, 1949, is presented in Table III:

TABLE III

AVERAGE FILTERABLE BETA ACTIVITY IN AIR

OCTOBER-NOVEMBER-DECEMBER

1949

units μc/liter

LOCATION	OCTOBER AVERAGE	NOVEMBER AVERAGE	DECEMBER AVERAGE *
200-East, SE Corner	1.5×10^{-9}	9.2×10^{-10}	3.1×10^{-9}
200-West Tower #4	2.0×10^{-10}	3.8×10^{-10}	1.2×10^{-9}
Gable Mountain	3.5×10^{-10}	6.4×10^{-10}	9.7×10^{-10}
Richland	$<1.0 \times 10^{-10}$	5.0×10^{-11}	1.8×10^{-10}
Pasco	6.6×10^{-11}	1.5×10^{-11}	3.0×10^{-11}
300 Area	2.2×10^{-10}	1.8×10^{-10}	1.1×10^{-10}
200 East, Tower #16	1.1×10^{-9}	3.5×10^{-10}	6.4×10^{-10}
Benton City	1.4×10^{-10}	1.5×10^{-10}	2.8×10^{-10}
Hanford 614 Building	1.4×10^{-10}	1.9×10^{-10}	6.6×10^{-10}
White Bluffs	1.0×10^{-10}	2.1×10^{-10}	4.6×10^{-10}
3000 Area North	1.5×10^{-10}	1.4×10^{-10}	3.0×10^{-10}
200 West Tower #15	1.3×10^{-10}	3.7×10^{-10}	2.2×10^{-10}
200 West Gate	2.1×10^{-10}	3.4×10^{-10}	1.9×10^{-9}

* Includes only that data obtained after December 3, which includes the "green run" period.

A review of the data in the above table indicates that the increase in filterable beta activity approached a factor of ten at the 200 West Tower #4 and the 200 West Gate during the month of December. Smaller increases were observed at locations which were north and northeast of the separation areas including such locations as Hanford, White Bluffs, and 3000 Area. The radioactive effluent discharged to the atmosphere on December 3 did not show a significant increase in the amount of filterable beta activity detected in the residential communities of Pasco, Benton City, and Richland. The averages at these locations were in the order of 10^{-10} μc/liter of air throughout the quarter and the small fluctuation noted on a month to month basis were well within the expected error of measurement.

In conjunction with the air filter monitors, caustic scrubbers were also run in series with the air filters. These caustic scrubbers selectively extract the 8-day iodine (I-131) from the air stream sample. A review of the I-131 detected at the various locations during the quarter indicated a significant increase in the average activity during the month of December. The increase in the atmospheric I-131 concentration was in good agreement with a similar trend observed in the filterable

beta activity measurements as shown in Table III. The highest activity in the I-131 scrubbers was observed at the 200-West Area Gate location where the average activity was 1.2×10^{-8} μc/liter during December as compared with the October-November average of about 1.0×10^{-9} μc/liter. This increase by about a factor of ten was nearly identical to the magnitude of increase noted when comparing the average of the filterable beta activity detected during December with that average found during October-November. It is interesting to note that I-131 activity was detected at Benton City and Richland by scrubber samples, whereas the filterable beta activity measurements did not reflect an increase at these locations in December. Table IV presents the results of the scrubber monitoring program for those locations which operated throughout the quarter.

TABLE IV
AVERAGE I-131 DETECTED IN SCRUBBERS
OCTOBER-NOVEMBER-DECEMBER
1949

units μc/liter

LOCATION	OCTOBER AVERAGE	NOVEMBER AVERAGE	DECEMBER AVERAGE
200 West Area Gate	9.0×10^{-10}	1.6×10^{-9}	1.2×10^{-8}
Benton City	5.0×10^{-10}	4.4×10^{-11}	4.1×10^{-10}
200 East-SE	6.1×10^{-10}	4.2×10^{-10}	4.6×10^{-9}
300 Area	1.0×10^{-10}	5.2×10^{-11}	9.0×10^{-10}
Richland	2.5×10^{-10}	1.5×10^{-11}	3.0×10^{-10}
100-H Area *	- - - -	3.0×10^{-11}	9.7×10^{-10}

* This unit placed in service November 1, 1949.

A resume of the entire air filter and caustic scrubber data for the quarterly period shows that the activity that was airborne did not show any trend or departure from previous results during October-November and also shows that all increases observed during the quarter were confined to the month of December and are directly attributed to the activity liberated to the atmosphere on the night of December 3, 1949.

In addition to the routinely operated scrubbers, many units were installed to specifically monitor the I-131 that was discharged to the atmosphere during the "green run". These scrubbers were operated independent of air filters thus the air volume scrubbed included the beta activity that normally would be filtered before being

scrubbed; however, it was assumed that the activity detected in these special scrubbers was essentially all I-131. A detailed description of the equipment, its location, and the results of the special monitoring were presented in a report confined to this operation. Some highlights of these measurements are included in this report. The highest I-131 activity measured in caustic scrubbers was found in the 200 East Area at the 2701 and 2704 Buildings where the average I-131 activity over a period of eight hours was 2.4×10^{-6} and 3.0×10^{-6} μc/liter of air, respectively. Fourteen special scrubber collections were made within the separation areas and the average I-131 activity in the air was between 1.0×10^{-7} and 1.0×10^{-6} μc/liter of air at nearly all locations; the respective collection periods included various intervals between December 2, at 2000 and December 8, at 1400.

Thirteen of these special scrubber samples were collected from locations within the vicinity of the 100 Areas. The maximum activity was found at 100-D Area and 100-H Area where the I-131 activity averaged 6.6×10^{-8} and 6.4×10^{-8} μc/liter, respectively, for the period between December 2, at 2000 and December 3, at 1130. The average magnitude of the I-131 activity detected after December 3, in the vicinity of the 100 Areas was in the order of $\times 10^{-9}$ μc/liter of air.

Caustic scrubbers were operated during the "green run" at Riverland, Benton City, Richland, Boise, Spokane, and Klamath Falls, and with the exception of one collection from Benton City the average I-131 detected in these samples was less than 6.0×10^{-9} μc/liter. The one sample from Benton City which was collected between December 3, 0840, and December 7, at 1310, showed I-131 activity of 3.4×10^{-8} μc/liter. The scrubbers that were located at Boise, Spokane, and Klamath Falls, were operated through December 7, and on the basis of continual sampling, the average I-131 activity was less than 3.0×10^{-10} μc/liter at each location.

The one and one-half inch diameter filter papers that were used in measuring the filterable beta activity (Table III) were radioautographed by exposing the small filter papers to K type X-Ray film for 168 hours. The number of particles was visually estimated by counting the number of individual darkened spots on the developed film.

The number of particles detected on the filters from the same locations listed in Table III ranged from zero to five particles per filter, per week, throughout the quarter. The average number of particles detected throughout the entire quarter was the normal level usually found in the random collection previous to September 6, 1949 and the small fluctuation observed in the number of active particles estimated for each location was well within the range of the usual number of particles randomly collected.

The number of active particles detected at all locations during this quarter represent a significant decrease from the abnormally high levels detected during the week ending periods of September 13 and 20, 1949, when it was established that the increase of that time was due to a foreign source rather than to specific Hanford operations.(1)

In addition to the 614 Building air filters, special filters installed at numerous locations on and off the Hanford Works were also radioautographed in an effort to specifically estimate the number of active particles detected on filter papers. These installations consisted of filtering either 2 or 10 cubic feet of air per minute through a CWS #6 type filter paper which has an effective collection area of about 25 square inches. Each unit operated for a period of one week; the filter was then removed and exposed to Type K, X-Ray film for a period of 168 hours.

Table V includes a summary of the calculated active particles per cubic meter of air sampled at the listed locations.

(1) HW-14953, H. I. Environs Report For Month of October 1949, by W. Singlevich, November 3, 1949.

TABLE V

SUMMARY OF PARTICLE DEPOSITION

OCTOBER- NOVEMBER- DECEMBER

1949

units of 10^{-3} particles/meter^3

LOCATION	OCTOBER AVERAGE	NOVEMBER AVERAGE	DECEMBER AVERAGE	QUARTER * AVERAGE
200 East & Vicinity				
2704 (Outside)	1.0	0.4	0.8	0.7
H. I. Garden	1.6	0.9	1.2	1.2
[illegible]-SE	0.9	0.4	0.8	0.7
[illegible]-NE	0.4	1.4	1.0	0.9
B-Gate	1.1	2.9	6.4	3.5
222-B (Outside)	1.4	2.5	5.4	3.1
2701 (Outside)	0.2	0.4	0.9	0.5
2704 (Inside)	0.4	0.7	1.6	0.9
221-B (Outside Gallery)	10.6	3.2	6.8	5.9
222-B Hall	2.8	7.7	5.3	5.3
222-B Laboratory	64.2	65.9	31.2	53.7
2701 (Inside)	<0.4	0.7	0.1	0.3
200 West & Vicinity				
2701 (Outside)	0.5	0.5	5.8	2.3
2722	1.0	1.6	10.2	4.3
T-Gate	0.7	2.4	0.1	1.1
222-T (Outside)	5.3	2.5	5.2	4.3
231	1.3	3.3	0.4	1.7
So. Guard Tower	0.4	0.7	0.7	0.6
U-Gate	0.3	0.5	0.8	0.5
W. Guard Tower	0.2	0.8	0.5	0.5
2701 (Inside)	0.4	0.4	5.0	1.9
272 (Inside)	0.4	1.1	8.4	3.3
222-T (Inside)	26.8	53.2	58.5	46.1
Meteorology Tower **				
3' Level	0.6	0.7		0.7
50' Level	0.5	0.7		0.6
100' Level	0.9	0.7		0.8
150' Level	1.9	1.0		1.5
200' Level	0.8	1.6		1.2
250' Level	0.7	1.6		1.2
300' Level	0.9	1.1		1.0
350' Level	0.1	1.5		1.3
400' Level	0.4	<0.1		0.3

* The quarterly average was computed on the basis of the total volume of air sampled during the quarter and the total number of particles collected.

** The filters from this location were not obtainable because of inclement weather.

The particle deposition rates in the vicinity of the 200 Areas for the months of October-November-December, 1949, compare favorably with similar data obtained previous to September 6. A comparison of the current deposition rates with the number of particles detected between September 6 and September 23 shows a definite decrease occurring during this quarter; however, this type of comparison would be biased as the number of particles found during early September were attributed to an outside source and their momentary occurrence at Hanford barely covered a two week period.

The particle deposition data show that only a few particles were detected outside of the 271-T and 271-B exclusion areas; no location outside of this region showed an average deposition greater than 4.3×10^{-3} particles/cubic meter of air during the quarter. Within the exclusion areas, the greatest deposition was found inside the laboratory buildings where the quarterly averages were 54×10^{-3} and 46×10^{-3} particles/cubic meter at the 222-B and 222-T Laboratories, respectively. The number of particles found at each of these locations was about eight times greater than the number of particles found at any other location. It is worthy of mention to note that the next highest particle concentration was also found at an inside location; the unit operating immediately outside the gallery in the 221-B Building showed an average of 6.9×10^{-3} particles/cubic meter.

Active particle monitoring at 50' intervals at the Meteorology Tower showed a questionable difference in the concentrations at the various levels. In all cases the number of particles detected was very small. The maximum deposition was found at the 150' level where an average of 1.5×10^{-3} particles/cubic meter was found throughout the quarter. Very little data were obtained during the month of December due to the inclement weather.

Several particle monitoring units were in operation at various locations around the Hanford Works perimeter, in the nearby residential communities, and at far off-area locations in the states of Washington, Montana, Oregon, and Idaho. A location map is presented in Figure 12 which shows the distance and locations of the off area

stations as compared with the geographical location of the Hanford Works. This map may be used along with Figures 1 and 2, which show the wind direction prevailing at the st.. locations.

A summary of the particle deposition rates at the perimeter and off area loca..s is presented in Table VI.

TABLE VI
SUMMARY OF PARTICLE DEPOSITION
ON AREA AND OFF AREA LOCATIONS
OCTOBER NOVEMBER DECEMBER
1949
units of 10^{-3} particle/meter^3

Location	October Average	November Average	December Average	Quarterly Average
Hanford Area Locations				
100-B Area	0.3	0.2	<0.1	<0.2
100-D Area	6.5	<0.1	<0.1	<2.2
White Bluffs	0.5	0.1	<0.1	<0.2
100-F Area	<0.1	<0.1	- -	<0.1
Off Area Locations				
Benton City, Washington	3.5	<0.2	0.3	<1.3
Pasco, Washington	<0.2	<0.2	- -*	<0.2
Richland, Washington	<0.1	<0.1	0.5	<0.2
Boise, Idaho	<0.3	0.5	<0.1	<0.3
Klamath Falls, Oregon	0.2	0.2	<0.1	<0.2
Stampede Pass, Washington	0.3	0.3	<0.1	<0.2
Great Falls, Montana	0.5	<1.0	- -*	<0.2
Walla Walla, Washington	<0.3	<0.3	<0.1	<0.2
Meacham, Washington	<0.3	<0.3	<0.1	<0.2
Lewiston, Idaho	<0.3	<0.3	<0.1	<0.2
Spokane, Washington	<0.3	<0.4	0.5	<0.4

* The motors were out of service at these locations.

The number of particles detected at all the off area locations was negligible during November and December. The deposition rates during these two months was in good agreement with those observed during the summer and early fall. The particle deposition rates for the month of October seemed to indicate a small residual collection which apparently remained from the higher atmospheric active particle concentration observed during the middle of September.

SECTION III
(Please refer to Figure 12)

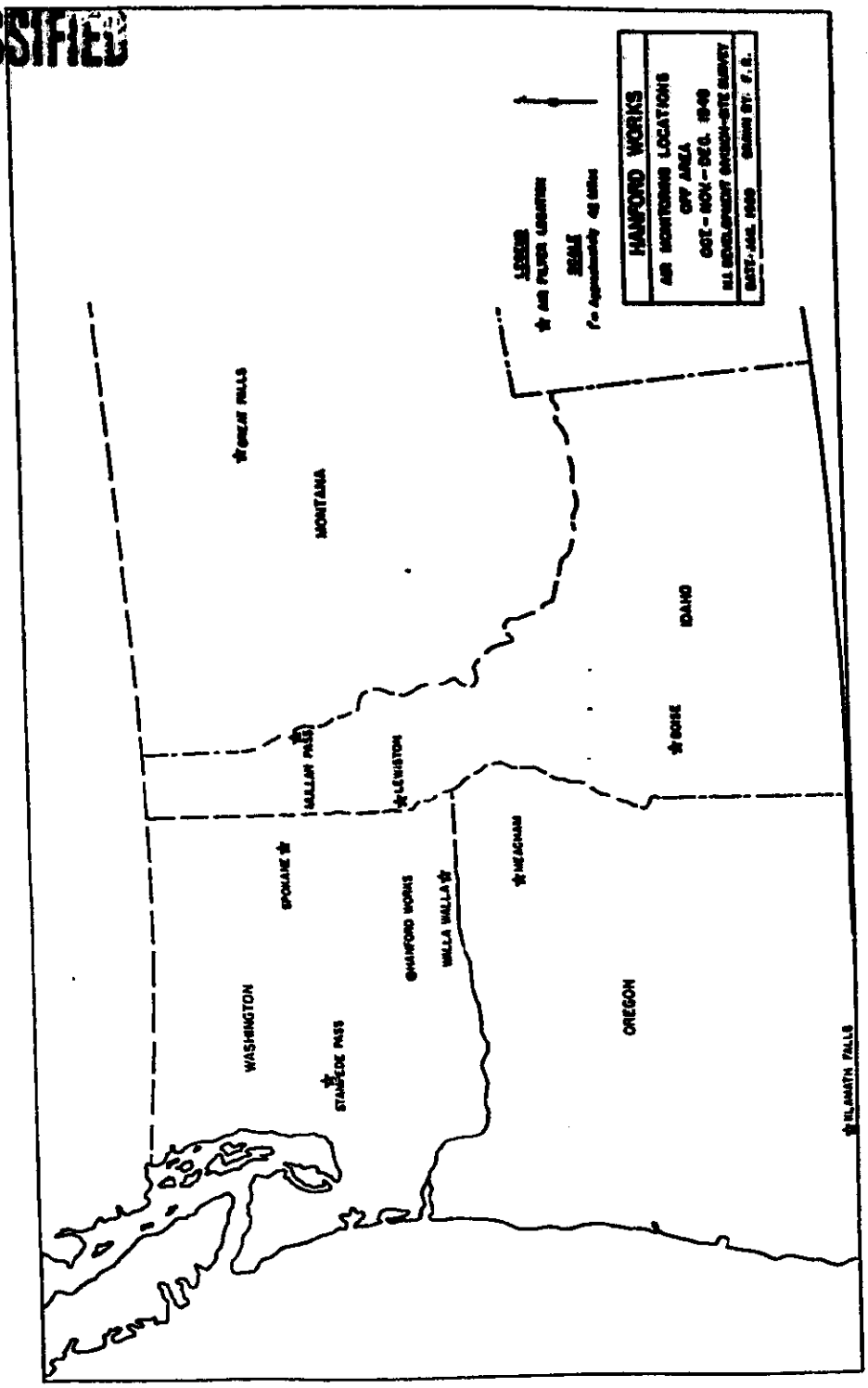


FIG. 12

SECTION IV

RADIOACTIVE CONTAMINATION IN HANFORD WASTES

100 AREAS:

The radioactive effluent water from the 107 basins in the 100 Areas was sampled about three times per week throughout the period October-December 1949. The volume of these samples was 500 ml.. The results discussed in this report include only those samples which were radio-assayed less than twelve hours after the sample was taken from the basin to minimize the exorbitant correction factors applied for decay of 14.8 hour sodium (Na-24).

The average beta activity detected in these samples varied from about 350 to 450 muc/liter; the average beta activity detected in the 107 samples during the quarter was 448, 375, 422, and 268 muc/liter at the 100-B, 100-D, 100-F, and 100-H Areas, respectively. The average activity level at 100-H was slightly lower than the other 100 Areas as this area did not start until October 20, 1949; this area operated at a power level below 150 MW during the remainder of October. The average activity values in the 107 waste waters in the 100 Areas showed a slight increase during the quarter, this increase being well within the range of fluctuation expected in the effluent water activity. The operating conditions of the 100-B, 100-D, and 100-F Areas were normal; the power level at 100-B and 100-F was 275 MW at each area and at 100-D was 305 MW.

The maximum activity detected in 107 waste effluent was 850 muc/liter at the 100-B Area during November. This was higher than the expected maximum of between 400 and 500 muc/liter, but also was in agreement with a similar measurement made in this Area during April 1949. It was suspected that these two samples could have contained some solid or organic material which had accumulated basin activity before being discharged in the effluent water.

Based on the radio-chemical analyses of the effluent and on the known flow rates, it was estimated that an average of 267 curies of beta emitters were discharged into the Columbia River each 24 hour day during the quarter. This is a weighted average

which takes into account the waste from 100-H Area after October 20. Approximately 50 to 75 curies of this activity was from the longer half-lived elements which would include Fe-59, P-32, Cr-51, Ca-45, etc. and the remaining activity would be primarily from 14.8 hour sodium (Na-24). It was assumed that the activity from the short half-lived (2.6 hours) Mn-56 had decayed. Figure 13 summarizes the results of the radioactive contamination monitoring of the 107 basins. Spot samples were obtained from the 1904 spillways; the activity in these samples was comparable with that in the 107 basin effluent samples.

The average alpha activity from plutonium and uranium in the 107 waste samples averaged less than 10 dis/min/liter in all the 100 Areas.

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. There were no samples analyzed specifically for polonium or sulphur (S-35) during this period.

Six samples were obtained from the "C" Ditch in the 100-F Area. The beta activity in the water averaged 50 μμc/liter with the more concentrated activity detected at inlet. The maximum beta activity in the mud was also found at the inlet, where the beta activity was 195 μμc/kg. No alpha activity greater than 6 dis/min/gram was detected in these samples.

200 AREAS:
RETENTION BASINS

Twenty-five samples were taken from the 200 East Area Retention Basin; the average beta activity in these samples was 750 μμc/liter. Considerable variation in these results was indicated in both the day to day fluctuations and the difference found by taking simultaneous samples from each of the four basin corners. The maximum measured beta activity in the 200 East Retention Basin was 9600 μμc/liter; results between 100 μμc/liter and 400 μμc/liter were not uncommon. This beta activity appears to be significantly high when it is compared with the 200 West Area Retention Basin activity. Sixteen samples taken from the 200 West basin showed the average

beta activity in this waste to be 100 μμc/liter; the maximum result was 280 μμc/liter. Very little difference was noted in the day to day results and no difference was observed in the distribution of the activity in the 200 West basin.

Table I summarizes the results of radio-chemical analyses of samples taken from the 200 Area Waste Systems:

TABLE I
RADIOACTIVE CONTAMINATION IN 200 AREA WASTES
OCTOBER NOVEMBER DECEMBER
1949

Location	Type Sample	Alpha dis/min/kg Maximum	Alpha dis/min/kg Average	Beta μc/kg Maximum	Beta μc/kg Average
T Swamp	Water	35	13	1.1	<0.1
T Swamp	Mud	7.3×10^5	2.0×10^5	190	55
U Swamp	Water	236	50	0.2	<0.1
Laundry Ditch (Inlet)	Water	6510	792	0.5	0.2
Laundry Ditch 600'	Water	1500	200	0.3	0.1
Laundry Ditch	Mud	1.1×10^5	6.3×10^4	110	75
231 Ditch	Water	24	16	<0.1	<0.1
200-E "B" Ditch	Mud	3.8×10^4	7.0×10^3	3000	830
234-235 Ditch	Water	73	25	<0.1	<0.1
234-235 Ditch	Mud	5.2×10^4	2.0×10^4	18	11
200-E "B" Ditch	Water	41	<6	1.1	0.3
Laundry Lint	Solid	1.0×10^6	2.2×10^5	325	90

The above results indicate several instances of increased activity, most notably the alpha activity detected in the laundry ditch and the "U" Swamp. The apparent source of this activity is the waste from the processed contaminated clothes in the West Area Laundry. This fact was further established by the alpha activity detected in the waste line which was collected on the ground in the vicinity of the 200 West Laundry. Continuous sampling of the laundry effluent showed that 434 μc of beta activity and 6.8×10^8 dis/min of alpha activity were discharged into the laundry ditch during the one week period of study. This estimation was based on the collection of one ounce samples from each batch of laundry waste, combining these samples and analyzing aliquots of the combined sample and then correcting for the volume of water by flow meter readings.

Portable instrument surveys (V.G.M.) indicated radiation levels of 500-600 counts

per minute above background in the vicinity of the "T" Ditch and swamp and near the laundry ditch. Several V.G.M. readings between 1200 and 2000 counts per minute were found on mud along the shore of the 200 East "B" Ditch.

Land surveys inside the 200 Areas were completed each month. With the exception of the survey immediately after the "green run" the general radiation level on the ground did not exceed background. A pile of burned ashes, apparently from the mass burning of weeds along the 200 East "B" Ditch showed the highest portable instrument reading in the 200 Areas, this reading was 16,000 counts per minute (V.G.M.). Decay and aluminum absorption studies of samples of these ashes are in process.

Portable instrument surveys along the waste ditches in the 200 North Area, showed that the average radiation levels were about 2500, 20,000, and 50,000 counts per minute above the instrument background at the N, P, and R Ditches, respectively.

300 AREA WASTE:

A summary of the radio-active contamination detected in samples taken from the 300 Area waste ponds during October-November-December, 1949 was:

TABLE II
ALPHA AND BETA ACTIVITY IN 300 AREA WASTE
OCTOBER NOVEMBER DECEMBER
1949

Location	Alpha Activity - dis/min/liter		Beta Activity - mc/liter	
	Maximum	Average	Maximum	Average
Old Pond Inlet (liquid)	7000	2000	0.2	0.1
New Pond Inlet (liquid)	7400	2700	45.5*	0.5
	dis/min/kg		uc/kg	
	Maximum	Average	Maximum	Average
Old Pond Inlet (mud)	1.2×10^7	3.7×10^6	1.4	0.5

* Result not included in average as this was not considered as a representative sample. Fluorophotometer analysis of the above samples indicated that the alpha activity was primarily from uranium.

Forty-three liquid waste samples were taken directly from the waste line that flowed into the above ponds. The average alpha activity in the samples taken was 750 dis/min/liter with maximum activity approaching 2500 dis/min/liter in several samples.

Fluorophotometer analyses of the above samples showed that the average uranium activity was around 300 ug U/liter. Ten of the waste line samples were analyzed for plutonium by the TTA process. In only one instance was positive plutonium activity detected, this sample showed plutonium activity of 300 dis/min/liter.

The average beta activity in the samples taken directly from the waste line was 0.26 mμc/liter with the maximum result as high as 2.1 mμc/liter.

SECTION IV
(Please refer to Figure 13)

BETA ACTIVITY MEASUREMENTS IN 107 WASTE EFFLUENT

1949-OCTOBER-NOVEMBER-DECEMBER-1949

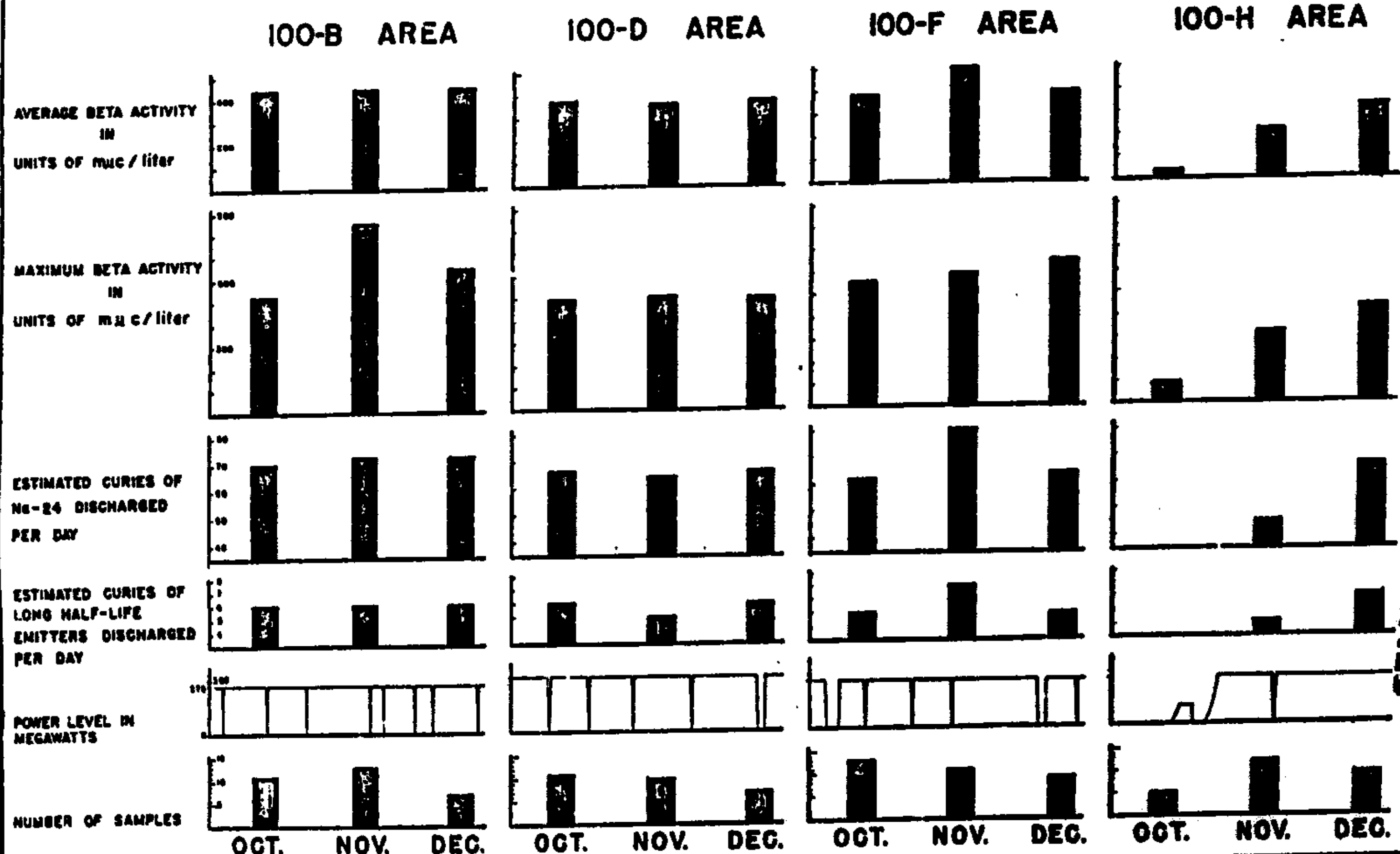


FIG 13

 [redacted]

SECTION V

RADIOACTIVE CONTAMINATION IN THE COLUMBIA AND YAKIMA RIVERS

The beta activity detected in samples obtained from the Columbia River at locations downstream from the 100 Areas showed a significant increase in activity during this quarter. This increase is in good agreement with that observed during the same period in other years, and is directly attributed to the decreasing flow rate of the Columbia River. The source of the radioactive contamination found in the Columbia River is the pile effluent which is discharged into the river after a short hold up in the 107 basins.

The average flow rate of the Columbia River, as measured by the Power Division at Richland, during October-November-December 1949, was approximately 455,000 gallons per second. The maximum measured flow during the quarter was 630,000 gallons per second as measured early in December. The minimum flow during this period was 360,000 gallons per second noted early in November. These flow rates do not differ significantly from those recorded in 1948; the average for the same period in 1948 was 413,000 gallons per second. Figure 14 summarizes the trend of the measured flow rate of the Columbia during the quarter; the data for the previous three months are included for a better evaluation of the decreasing trend mentioned above.

The normal frequency of river sampling is once a week at the key locations. The volume of these samples is 500 ml. The results discussed and tabulated in this report include only those samples which were radio-assayed less than twelve hours after the sample was taken from the river to minimize the exorbitant correction factors applied for decay of 14.8 hour sodium (Na^{24}). Table 1 summarizes the results of the radio-chemical analysis for the alpha and beta emitters in the river samples:

TABLE I

RADIOACTIVE CONTAMINATION IN THE COLUMBIA RIVER

OCTOBER NOVEMBER DECEMBER

1949

LOCATION	Number Samples	ALPHA - dis/min/liter MAXIMUM*	ALPHA - dis/min/liter AVERAGE	BETA - μμc/liter** MAXIMUM	BETA - μμc/liter** AVERAGE
Wills Ranch	10	<6	<6	<50	<10
Above 100-B Area	4	<6	<6	<50	<10
181-B Area	11	8	<6	225	40
181-D Area	9	<6	<6	885	693
181-H Area	10	10	<6	1595	808
181-F Area	11	<6	<6	2210	950
Foster Ranch (Below 100F)	10	7	<6	915	480
Hanford South Bank	7	<6	<6	3475	2425
Hanford Middle	8	<6	<6	3775	2225
Hanford North Bank	9	8	<6	3315	1075
300 Area	8	7	<6	890	480
Richland	13	7	<6	1500	900
Pasco Bridge (Kennewick Side)	7	<6	<6	690	345
Pasco Bridge (Pasco Side)	7	<6	<6	940	480

* Results not confirmed by subsequent samples.

** The reporting level for individual samples is currently established at 50 μμc/liter; for an average including 4 or more samples reporting level of 10 μμc/liter is used.

The background beta activity in the Columbia River can be appraised from the samples taken at Wills Ranch and above 100-B; each of these locations are above the Hanford operating piles. The average activity in these samples was about 3 μμc/liter; no individual sample exceeded 10 μμc/liter. Tracer beta activity detected at 181-B was attributed to a probable "backwater" effect caused by the low flow rate of the Columbia during this quarter. This sample location is upstream from the 107 discharge line, and averaged 40 μμc/liter.

The addition of the 107-B waste reflects an average beta activity of 690 μμc/liter at the 100-D sampling location. Beta activity in the river continues to increase as the sampling progresses downstream, the contributing 100 Area wastes causing average beta activity of 800 and 950 μμc/liter in the river water at 181-F and 181-H, respectively. Each of these averages was considerably higher than the averages at the same locations, during the same period in 1948. This increase approaches a factor of nearly two at 181-F, and at the Hanford South Bank. The start up of 100-H Area, and its continual operation at a power level of 275 MW since early November, is one of the contributing factors which may influence this increase.

The dispersion of the activity across the width of the river again shows a uniformity in the amount of activity carried between the southbank and the middle at Hanford. The activity on the surface near the north bank was about one-half that detected in samples taken from the middle and near the south bank. This dispersion pattern seems to change each year, the only factor which can be knowingly associated with this change is the high water stage occurring around May and June, which may shift the main channel of the river and affect the dispersion of the admitted 100 Area radioactive wastes. Figure 15 portrays the cross river dispersion pattern of the beta activity measured by taking cross-section river samples at Hanford; data for 1947 and 1948 are included for comparison. This graph also shows the increase in river activity as compared with the operation of two pile areas in 1947, three pile areas in 1948, and four pile areas in 1949.

The beta activity measured in river samples at downstream locations did not reflect the magnitude of difference noted near Hanford. This fact may be accounted for in part by the decreased river flow rate which is more pronounced at downstream locations and reduces the speed of the river allowing for additional decay of the Na-24; the added dilution effect of the Yakima River, should also be included as a contributing factor. The average beta activity in river samples taken near Pasco, was about 400 μμc/liter in 1949 as compared with an average of 260 μμc/liter during the same period in 1948.(1)

Samples taken on each side of the river at Pasco indicated that the activity on the south side of the river was again somewhat lower than that measured on the north side; averages during the quarter were 345 and 480 μμc/liter on the south and north sides, respectively. This difference may be due to the Yakima River, which enters the Columbia River on the south bank and thus probably shifts the activity in downstream Columbia water to the north bank.(1)

Ether-extraction for uranium and for plutonium were made on all river samples and

(1) HW-13743 (Secret Document) Radioactive Contamination In The Environs Of The Hanford Works For The Period October, November, December, 1948. To file from W. Singlevich and H. J. Paas.

showed the averages to be less than the detectable amounts of 6 dis/min/liter at all locations. Table I includes the maximum results of the alpha measurements; a few samples which indicated slightly greater than 6 dis/min/liter were not confirmed by the subsequent weekly samples.

Weekly river samples were obtained from the Yakima River at the mouth and at the Horn. Samples taken near the shore, and in the middle of the river at the mouth, and near the shore at the Horn, showed alpha and beta activity below the detection limits of the analyses. The measurements for the background activity were comparable with those made in the Columbia River water above the 100-B Area.

Several samples were obtained from nearby rivers and streams; each of these samples showed background alpha activity comparable with the background measurements in the upper Columbia and Yakima Rivers. River samples analyzed for background radioactivity were the Malhuer, Deschutes, Williamson, and Grande Ronde Rivers. All these rivers are located south and southwest of the Hanford Works and have their headwaters in the mountainous regions in Oregon.

Supplementing the direct sampling of the Columbia River water, one hundred and fifty-six mud samples were obtained from nine shore locations. Samples were obtained from locations on shore, as well as five feet out from the shoreline. In a period of receding river flow, it would be expected that the on-shore samples should be slightly higher if the activity in the river deposited along the banks as the water receded. This trend was not observed during this quarter as the river flow remained relatively constant throughout quarter.

Table II summarizes the beta activity measured in samples taken from representative locations.

TABLE II

COLUMBIA RIVER MUD SAMPLES
OCTOBER NOVEMBER DECEMBER
1949

Location	Number Samples	Beta Activity in milli-microcuries per kilogram Onshore Samples Maximum	Onshore Samples Average	Five Feet From Shore Maximum	Five Feet From Shore Average
Near Wills Ranch	9	22	14	20	12
Allard Pump Station	9	22	12	14	11
At 100-H Area	6	35	18	17	13
Below 100-F Area	9	38	22	39	25
Richland Dock	10	42	13	73	22
At 300 Area	9	156	50	171	34
Pasco Bridge (Pasco Side)	9	39	15	22	15
Pasco Bridge (Kennewick Side)	9	27	15	33	16
Hanford Ferry	8	32	17	44	20

These mud samples were also analyzed for alpha activity from plutonium and /or uranium by the ether-extraction method, and specifically for uranium by the fluorophotometer method. This activity was less than 2 dis/min/gram in all cases except for one sample from the 300 Area which contained 25 dis/min/gram. This sample along with the occurrence of higher than normal beta activity along the 300 Area shoreline prompted a special survey of the mud in this vicinity. Samples were obtained at varying distances from the shoreline, along approximately 200 yards of shoreline. The results of the analyses of these samples showed that a wide variation in both the beta and alpha activity existed in this region. The beta activity ranged from 5 mμc/kg to 80 mμc/kg with a predominance of results around the lower figure. The alpha activity in the same samples varied from less than 2 dis/min/gram to 2300 dis/min/gram; the uranium varied from less than 1 ug U/gram to 12 ug U/gram. This wide variation shows that it was difficult to evaluate a true average contamination picture at this location. Weather conditions permitting, additional and more thorough surveys will be made in an effort to resolve this problem.

The alpha and beta activity measured at the other locations along the river was in very good agreement with the past data.

Raw river water in the Columbia River export line which is subsequently used for drinking purposes in the areas was sampled at the 183 buildings in the 100 Areas and

at the 233 buildings in the 200 Areas. The samples were analyzed for alpha activity from plutonium and/or uranium and for the beta emitters. Analyses for the alpha emitters indicated less than 6 dis/min/liter in all samples; the beta-gamma activity measured is tabulated in Table III .

TABLE III
BETA ACTIVITY IN RAW WATER RIVER EXPORT LINE
OCTOBER NOVEMBER DECEMBER
1949

Location	Number Samples	μμc/liter Maximum	μμc/liter Average
183 Building 100-B Area	11	25	<10
183 Building 100-D Area	11	305	165
183 Building 100-F Area	11	1170	355
183 Building 100-H Area	11	517	290
283 Building 200-E Area	19	121	45
283 Building 200-W Area	19	146	45

The beta activity detected in the raw water was slightly higher during this quarter, this increase was a direct effect of the increased radioactive contamination in the Columbia River water which is the source of the activity detected. The beta activity detected in the raw water is the same activity which subsequently is found in the sanitary water supply of the area drinking water. The difference in activity noted when comparing the 100 Area data with the 200 Area data can be attributed to the decay of the Na-24, the decay period being dependent on the length of time taken to transport this water to the 200 Areas. Decay studies indicated that approximately 95 per cent of the activity in the water was Na-24. Whether any activity in this water is contributed by deposition of stack effluent on the retention basin water in the separation areas is not yet known with any degree of confidence.

The increased beta activity found in the raw water during this quarter prompted the direct sampling of the raw water retention ponds in the 200 Areas. This program was started in December. The initial results from five of these samples showed the average beta activity to be 300 μμc/liter in the 200 East Area. The activity detected in the 200 West basin was less than 50 μμc/liter. These results indicated the magnitude of activity that might be expected in the basin; the wide variation found

in the above data could have been influenced by the duration of the retention period at the time the water sample was taken.

The raw water and retention pond samples tabulated above were also analyzed for alpha activity by the ether-extraction method. The alpha activity detected was less than 6 dis/min/liter in all samples.

Figure 16 is a graphic presentation of the beta activity detected in the raw water supplies and includes the quarterly average and maximum, as measured at each area. This graph may be compared with Figure 20 in Section V which shows the results of similar beta activity measurements in the sanitary supplies of the respective areas.

SECTION V

(Please refer to Figures 14,15, and 16)

COLUMBIA RIVER FLOW

OCTOBER-NOVEMBER-DECEMBER

1949

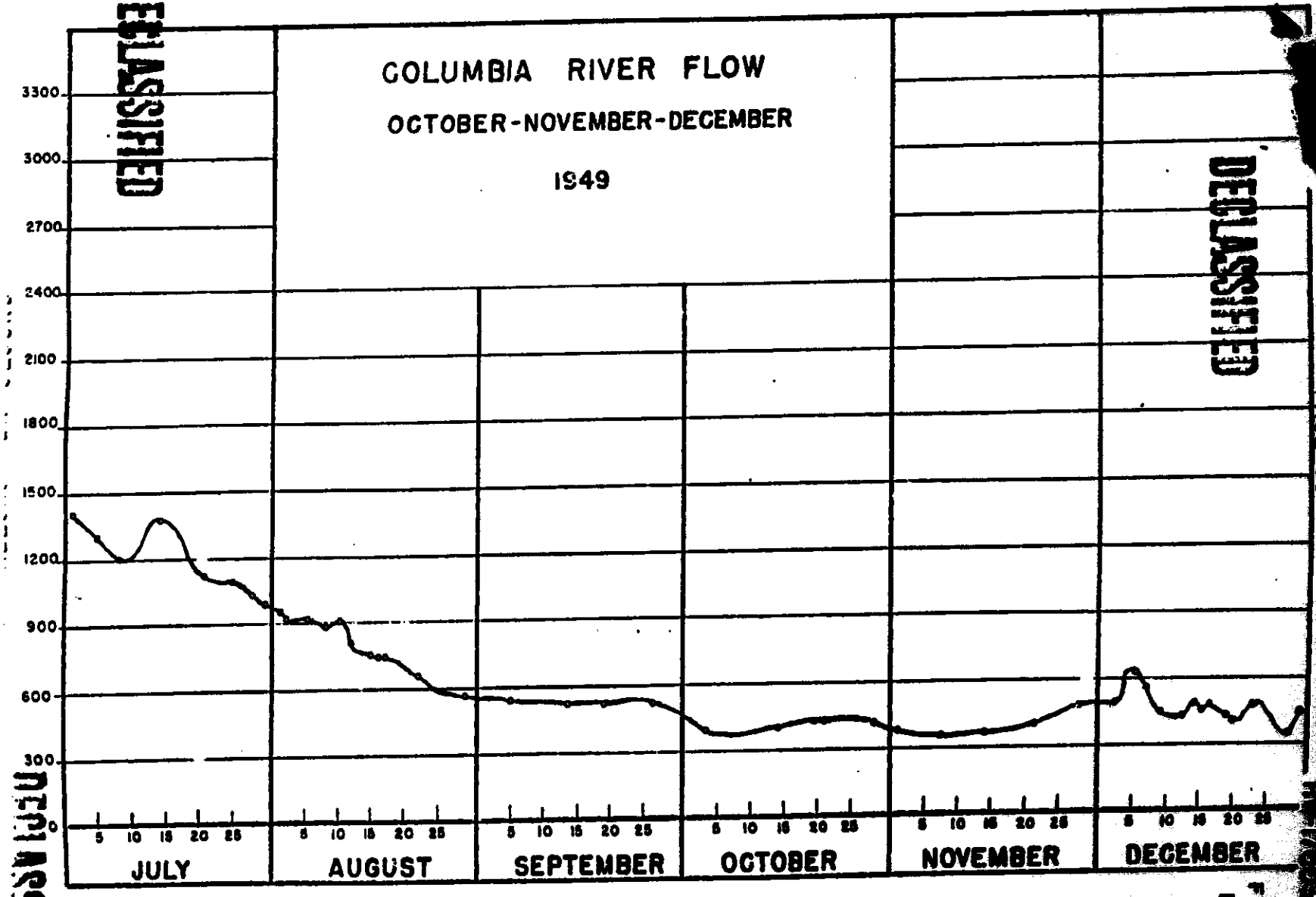
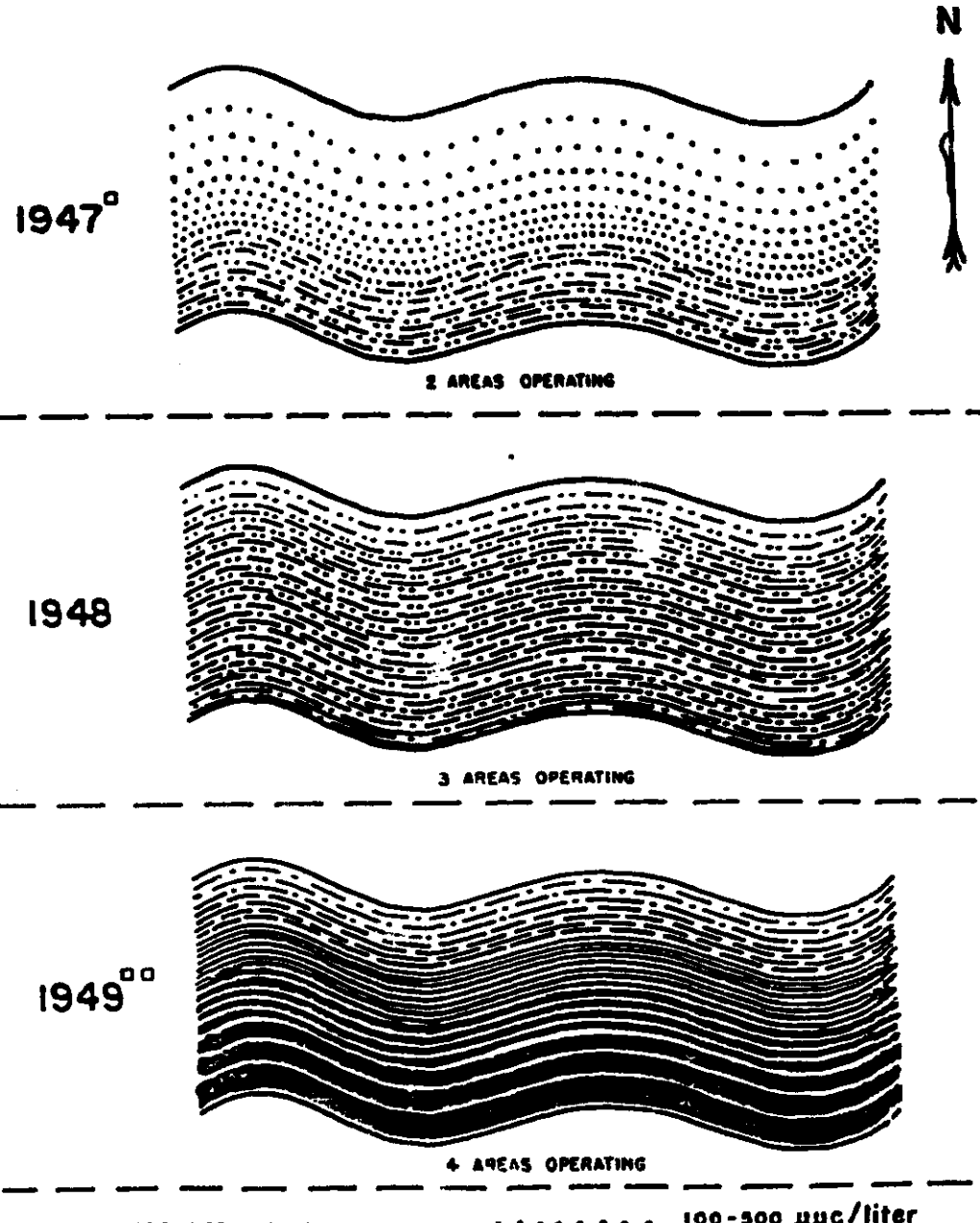


FIG. 14

FIG. 15

ESTIMATED DISPERSION OF AVERAGE BETA ACTIVITY IN THE COLUMBIA RIVER AT THE HANFORD FERRY

OCTOBER-NOVEMBER-DECEMBER



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BETA ACTIVITY MEASURED IN RAW WATER

HANFORD WORKS OPERATING AREAS
OCTOBER-NOVEMBER-DECEMBER
1949

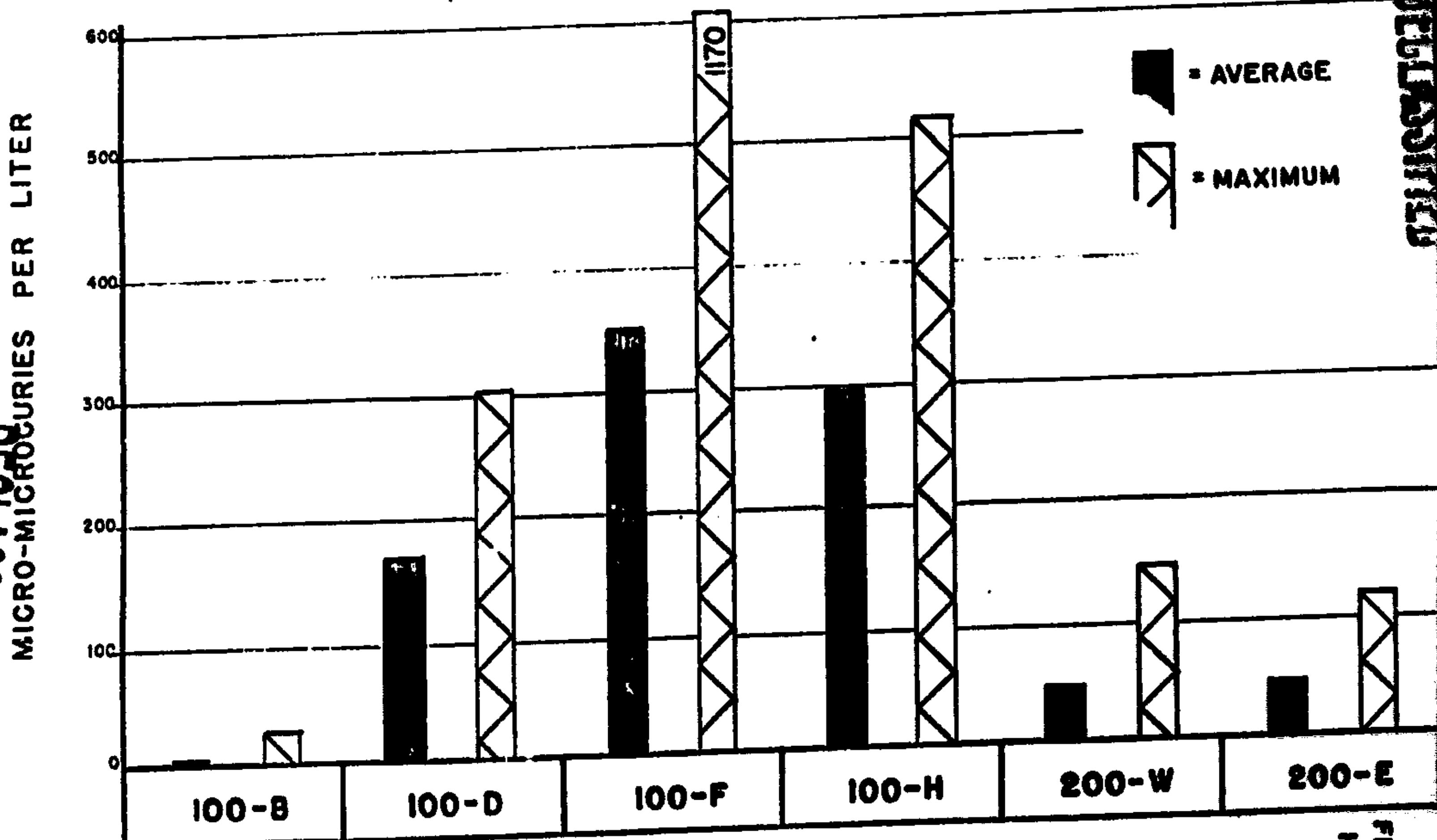


FIG. 16

[redacted]

BETA ACTIVITY IN RAIN AND SNOW

One hundred and forty-four rain samples were collected from thirty-four locations on and adjacent to the site. The number of samples from each location varied from three to seven samples, depending on the amount of precipitation measured at the wide-spread sampling locations.

Table 1 summarizes the rainfall data for the quarter; the figures presented represent the total precipitation and include measured rainfall as well as the measured melted snow. The 1948 data is included for comparison.

TABLE I
PRECIPITATION MEASURED AT HANFORD WORKS
OCTOBER NOVEMBER DECEMBER

units of 0.01 inches

PERIOD	OCTOBER	NOVEMBER	DECEMBER	TOTAL
1948	0.45	0.95	1.11	2.51
1949	0.10	1.47	0.16	1.73

The all time 35 year average rainfall for this quarter was 2.3 inches; the current quarter was extremely dry when compared with this average. The far majority of rain samples were collected during November as this month accounted for 85 per cent of the total rainfall.

A review of the beta activity measured in rainfall samples showed that the results which were obtained immediately after the "green run" on December 3, were considerably higher than any results obtained during October and November. The highest activity was detected in a sample taken within the 200 East Area which contained 271 mμc/liter. This activity was considerably higher than that found at the other three locations in the 200 East Area where maximum results were 88, 33, and 47 mμc/liter, respectively. In general, the bulk of the beta activity collected in rain after the "green run" was found inside the 200 West Area. Beta activity averaged 41 mμc/liter in the 200 West Areas as compared with a quarterly average of 25 mμc/liter in the 200 East Area. The maximum beta activity detected in rain in the 200 West Area was 167 mμc/liter, three other locations inside the 200 West Area showed

maximum activity of 161, 159, and 63 muc/liter. The maximum activities mentioned above are 15 to 25 times higher than the maximums that were measured previous to the "green run".

The maximum beta activity measured in rain collected on the project outside of the separation areas was 112 muc/liter. This sample was collected at the Meteorology Tower and compares favorably with a maximum result of 105 muc/liter detected in a sample collected at the Batch Plant. The maximum beta activity measured in rain in the intermediate zone before the "green run" was 10 muc/liter in a sample collected at the Meteorology Tower.

Twenty-eight samples were collected in the vicinity of the 100 Areas. Very little difference was observed in the beta activity measured before and after the "green run". The quarterly average beta activity in rain in this region was 0.4 muc/liter, with maximum results of 1.7 and 2.7 muc/liter before and after the "green run", respectively.

Nineteen samples were obtained from locations outside the perimeter barricade. The highest average beta activity in rain was found at Pasco where seven samples averaged 10.5 muc/liter. This average was influenced by one sample collected immediately after the "green run" which contained 69 muc/liter. Other maximum results from outside locations after the "green run" were Riverland 18 muc/liter; Benton City 11.7 muc/liter; and Richland 2.0 muc/liter.

Figure 17 is a graphic portrayal of the results obtained from the rain sampling program during the quarter. This graph includes the quarterly average beta activity detected in samples from each of the five zones established, and shows the maximum activity detected previous to and after the "green run".

Three of the samples collected immediately after the "green run" within five miles of the 200 West Area showed initial counting rates of 15, 146, and 291 counts per minute. Decay studies showed the half life to be essentially eight days indicating that the beta emitter in these rain samples was 8 day iodine (I-131).

Several rain samples were radio-autographed during the quarter. No active particles were detected on these samples, however, the radioautographs indicated an evenly distributed activity, which was believed to be I-131 on the basis of the decay studies above.

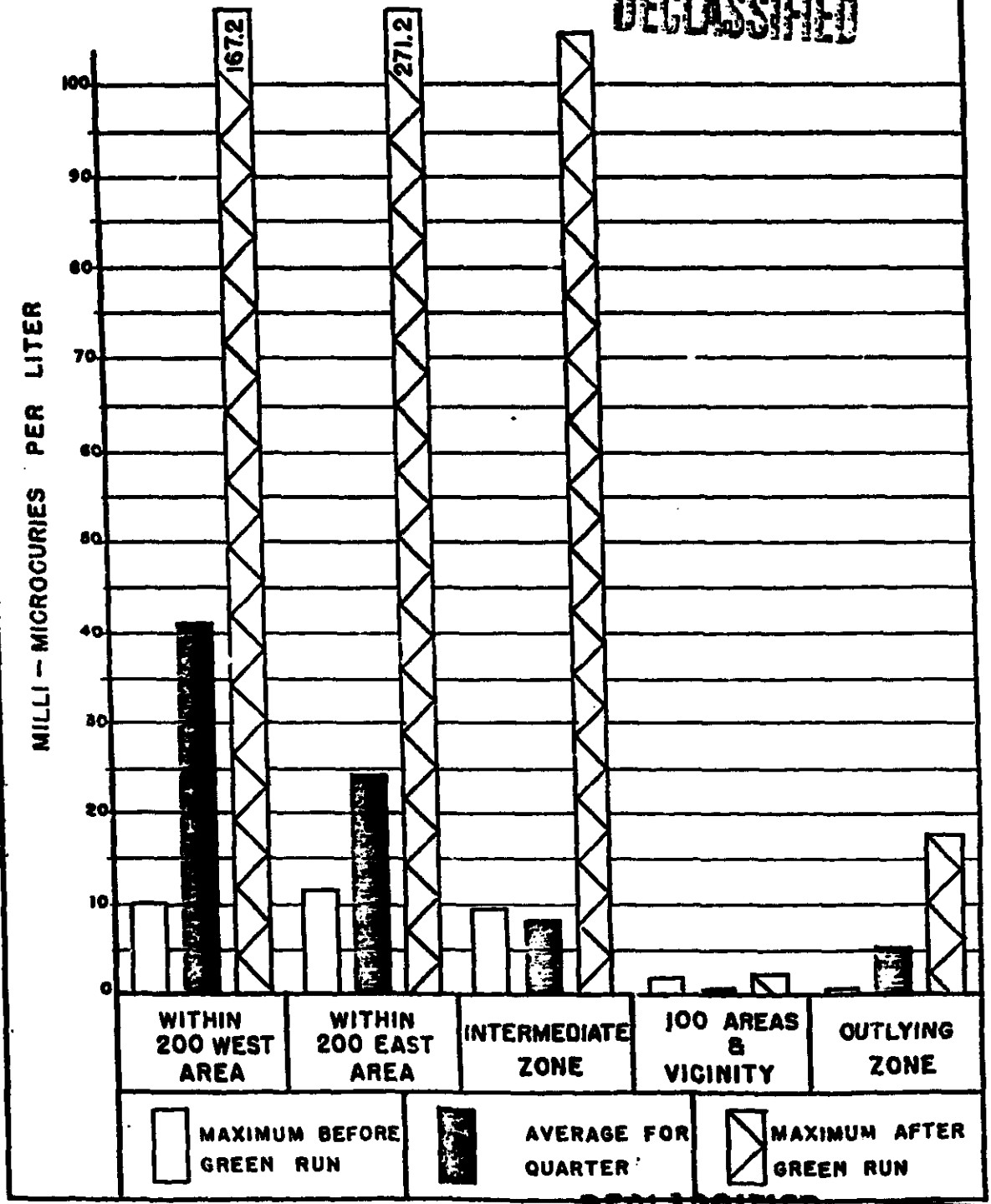
SECTION VI

(Please refer to Figure 17)

DEL

BETA ACTIVITY IN RAIN AND SNOW
HANFORD WORKS AND VICINITY
OCTOBER-NOVEMBER-DECEMBER
1949

FIGURE 17



SECTION VII
RADIOACTIVE CONTAMINATION IN DRINKING WATER AND TEST WELLS

Six hundred and forty-three drinking water samples were analyzed during the period October-December, 1949. One hundred and thirty-three of these samples were 12 liter samples and the remainder were 500 ml. samples.

The 500 ml. samples were analyzed for beta and alpha activity; the 12 liter samples were analyzed primarily for the alpha emitters. Representative drinking water samples were analyzed specifically for uranium by the fluorophotometer method. Those samples in which additional alpha activity was indicated, were analyzed for plutonium by the TTA extraction process.

The frequency of sampling the various locations varied from daily to monthly; this frequency depending on the location, the probability of contamination, and the trend of the current activity detected. The overall sampling frequency decreased during the month of December, as the efforts of the field program were temporarily devoted to special studies.

A trace quantity of alpha activity continued to be detected in the well systems of Richland and Benton City, these measurements confirm similar observations in the past. The alpha activity found in these systems was confirmed to be from uranium, which is believed to occur naturally in these areas. Maximum average uranium activity of 21 ug/liter was found in the Benton City Water Company well; this location also showed the maximum individual result of 45 ug U/liter. Uranium activity in the underground Richland system is about one-fourth of the activity in Benton City. The maximum average at a Richland location was 8 ug U/liter with a maximum of 18 ug U/liter. Figures 18 and 19 portray the results of the alpha activity measured in samples taken from the Richland and Benton City areas, respectively.

Table I is a summary of the alpha activity measured in drinking water at locations which continually show positive alpha activity.

TABLE I

ALPHA ACTIVITY IN DRINKING WATER*

OCTOBER-NOVEMBER-DECEMBER

1949

Location *	Alpha Activity as dis/min/liter 500 cc Samples Maximum	500 cc Samples Average	12 Liter Samples Maximum	12 Liter Samples Average	Uranium as ug U/liter Maximum	Uranium as ug U/liter Average
Richland Well #2	16	9	12	5	18	8
Richland Well #4	15	9	6	6	8	6
Richland Well #5	11	7	5	3	7	3
Richland Well #14	19	12	9	7	8	6
Richland Well #15	13	9	10	9	10	6
Richland Well #18	11	7	9	4	8	5
Benton City Store	33	12	20	7	13	3
Benton City Water Co.	40	29	20	9	45	21
Cobb's Corner	25	7	4	3	8	2

*The number of samples from each location above varied between 5 and 10.

In addition to the locations summarized above, positive alpha activity was occasionally detected in individual samples from several other locations, but in no case do the subsequent samples confirm these activity measurements. Tables II and III, summarize the results of the alpha and beta activity measurements in drinking water samples from all locations; this table includes the trace activities mentioned above.

Beta activity measured in the 500 ml. samples showed that with the exception of those locations near the river, the overall average was less than 10 μμc/liter. The locations which were near the Columbia River, or whose raw water was taken directly from the Columbia River indicated trace amounts of beta activity in the water. Examples of the latter case include Pasco, Kennewick, and those sanitary water supplies in the areas at Hanford Works. Maximum activity of 215, 160, and 145 μμc/liter was detected at Kennewick, Kennewick Highlands, and Pasco, respectively. The average beta activity was 145, 85, and 85 μμc/liter at these locations, respectively. The average beta activity in the area sanitary supplies was about 20 μμc/liter with occasional results approaching 100 μμc/liter. These results are somewhat lower than the Pasco and Kennewick supplies discussed above, this apparently is due to the additional retention period and the duration of the transport period of the area raw water. In comparing the activity of the area raw water with the area sanitary water, it was found that the beta activity in the raw water was about six times as high as that measured in the area sanitary water. The transport time of raw water from the 100

TABLE II

SUMMARY OF ALPHA ACTIVITY MEASURED IN DRINKING WATER

12 Liter Samples

units of dis/min/liter

OCTOBER-NOVEMBER-DECEMBER

1949

LOCATION	Number Samples	MAXIMUM	AVERAGE
Foster's Ranch	3	3	2
Columbia Camp	2	4	2
Headgate	2	3	2
Hanford Well #1	4	5	2
Hanford Well #4	4	5	3
Sanitary H_2O Hanford #7	5	10	4
3000 Area Well A	3	2	2
3000 Area Well B	4	4	2
3000 Area Well C	4	3	2
3000 Area Well D	2	2	2
3000 Area Well E	2	<2	<2
3000 Durand #5	5	4	<2
Richland #13	8	8	3
Richland #2	6	12	5
Richland #4	2	6	6
Richland #5	2	5	3
Richland #14	3	9	7
Richland #15	4	10	9
Richland #16	1	<2	<2
Richland #18	6	9	4
Tract House K-748	1	4	4

(Cont'd.)

TABLE II

SUMMARY OF ALPHA ACTIVITY MEASURED IN DRINKING WATER
12 Liter Samples
units of dis/min/liter
OCTOBER-NOVEMBER-DECEMBER
1949

LOCATION	Number Samples	MAXIMUM	AVERAGE
Tract House J-685	6	7	< 2
Benton City Store	6	20	7
Benton City Water Company Well	6	20	9
Cobb's Corner	5	4	3
Kennewick Highlands	5	2	< 2
Kennewick Standard Station	5	4	2
Enterprise	6	3	< 2
Riverland	5	3	< 2
Midway	5	4	< 2
Wills Ranch	5	6	< 2
Pasco	5	< 2	< 2
Segerson's Ranch	5	3	< 2
Pistol Range	5	4	3
300 Area Sanitary	3	4	< 2
White Bluffs Ice House	5	5	2

TABLE III

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

500 ml. Samples

OCTOBER NOVEMBER DECEMBER

1949

LOCATION	Number Samples	Alpha Activity dis/min/liter Maximum	Alpha Activity dis/min/liter Average	Beta Activity u uc/liter Maximum	Beta Activity u uc/liter Average
Foster's Ranch Well	9	14	<2	<10	<10
Columbia Camp	10	19	5	<10	<10
Headgate	10	6	2	<10	<10
Hanford Well #1	6	10	5	15	<10
Sanitary H_2O Hanford #7	30	8	3	18	<10
Raw H_2O Hanford #7	13	8	3	135	15
3000 Area Well A	5	6	4	24	<10
3000 Area Well B	6	11	5	11	<10
3000 Area Well C	6	7	3	<10	<10
3000 Area Well D	4	6	4	<10	<10
Richland Well #13	45	16	6	18	<10
Richland Well #2	7	16	9	16	<10
Richland Well #4	7	15	9	77	15
Richland Well #5	4	11	7	29	12
Richland Well #14	8	19	12	58	<10
Richland Well #15	5	13	9	<10	<10
Richland Well #18	8	11	7	39	<10
Tract House J-685	10	8	3	16	<10
Benton City Store	10	33	12	32	<10
Benton City H_2O Co. Well	9	40	29	15	<10
Cobb's Corner	10	25	7	16	<10
Enterprise	10	<2	<2	14	<10
Kennewick Highlands	9	15	4	160	85
Kennewick Standard Station	9	5	2	217	144
Pasco	9	6	2	146	85
Pistol Range	10	7	5	16	<10
300 Area Sanitary	40	43	6	76	<10
White Bluffs	9	3	<2	177	56
Sanitary H_2O 100-D	10	5	2	30	16
100-F	10	3	2	85	56
100-H	27	7	2	113	34
100-B	10	5	2	16	<10
200-E	16	6	4	44	16
200-W	18	6	<2	52	11

Area to the 200 Areas was estimated to be about 10 to 11 hours by the Power Division. This transport time is sufficient to account for the decay of the 14.8 hour sodium (Na-24) in the raw river export lines such that the activity in the 200 Area sanitary water should be about one half that of the 100 Area sanitary water. This fact is well substantiated by evidence obtained in measuring actual radioactive contamination in the various water sources. For example, the average activity detected in samples from the 100 Area sanitary water was 16, 56, and 34 μμc/liter at 100-D, 100-F, and 100-H Areas, respectively. The activity in samples from the 200 Areas averaged 16 and 10 μμc/liter in 200 East and 200 West Areas, respectively.

Figure 20 reviews the results of the beta activity measured in the area sanitary water supplies during the quarter. These may be compared with a similar review of the beta activity measured in the raw water supplies which appear in Section V of this report.

One hundred and ninety samples were obtained from the test wells on and adjacent to the site. One hundred and sixty-two of these samples were 500 ml. and 28 were 12 liter samples. The only wells which showed any detectable activity were those located in the 300 Area. Some of these 300 Area wells are occasionally used as a source of supply for 300 Area Sanitary water. The pumping into the sanitary system was confined to Well #2, as it was found that of the four 300 Area wells that Well #2 contained the least amount of uranium contamination. The total volume taken from this well during the quarter was 998,300 gallons. Of this volume none was pumped in October; 286,100 gallons in November; and, 712,000 gallons in December. Forty-nine, 500 ml. samples from Well #2, showed an average alpha activity of 75 dis/min/liter; the maximum activity was 1800 dis/min/liter. Uranium was detected in all samples from this well; the average was 30 ug U/liter and the maximum 197 ug U/liter. Considerable day to day variation in each of the activity measurements was observed and it is apparent that confirming results are difficult to obtain. Table IV summarizes the results obtained from the measurement of the alpha activity in the 300 Area Well system.

TABLE IV
ALPHA ACTIVITY IN 300 AREA WELLS
OCTOBER-NOVEMBER-DECEMBER
1949

LOCATION	Alpha Activity dis/min/liter 500 cc Samples Maximum	Average	12 Liter Samples* Maximum	Average	Uranium Activity ug U/liter Maximum	Average
Well #1	2300	315	55	55	70	55
Well #2	1770	75	8	5	200	30
Well #3	335	20	16	11	50	15
Well #4	730	110	--	--	94	50

* Result represent only two samples from each location.

Figure 21 , portrays the results of the day to day alpha activity measured in 300 Area Well #2, and also indicates those dates on which water was admitted to the sanitary system.

SECTION VII
(Please refer to Figures 18,19,20, and 21)

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HJP/db

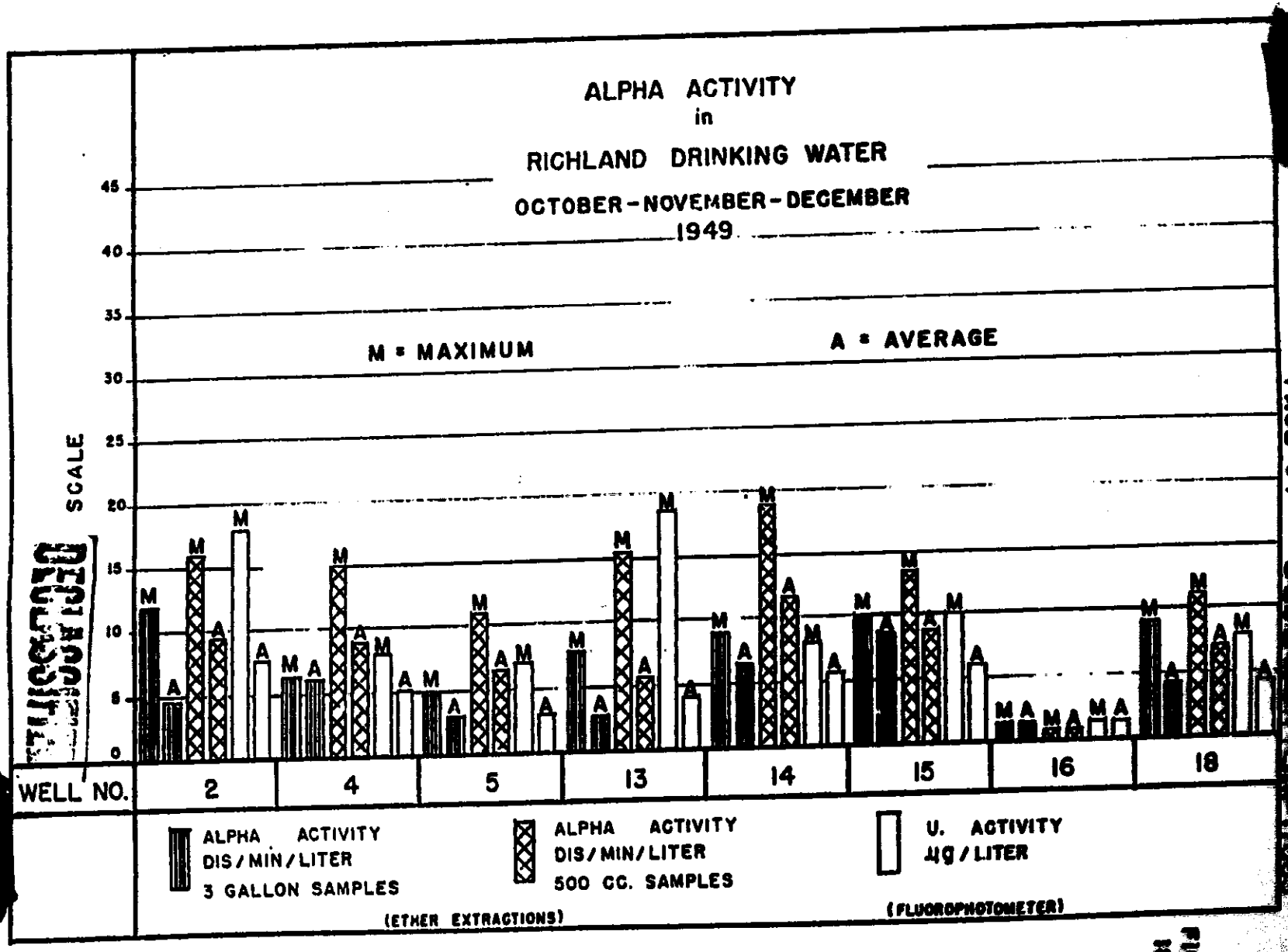


Fig 15

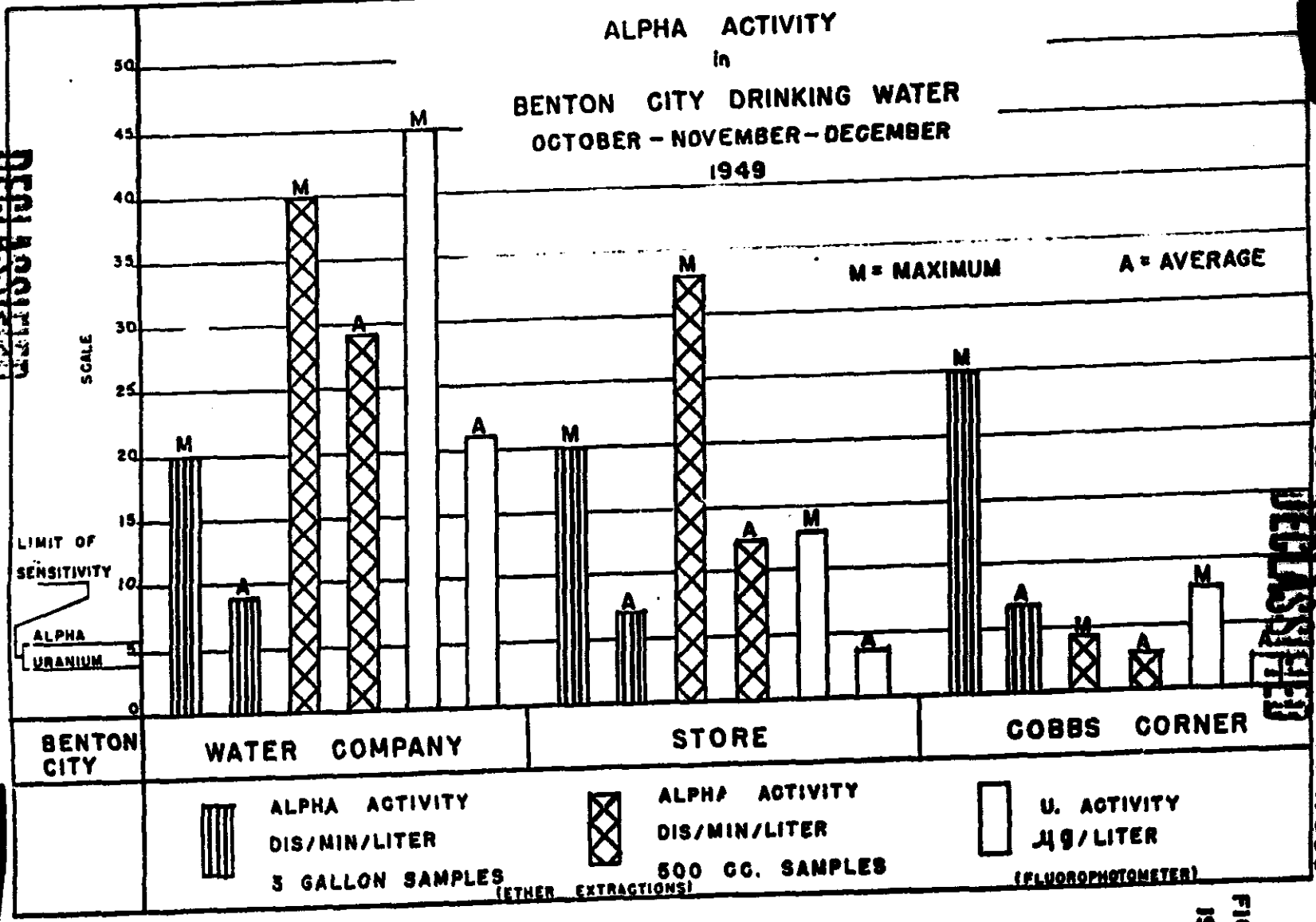


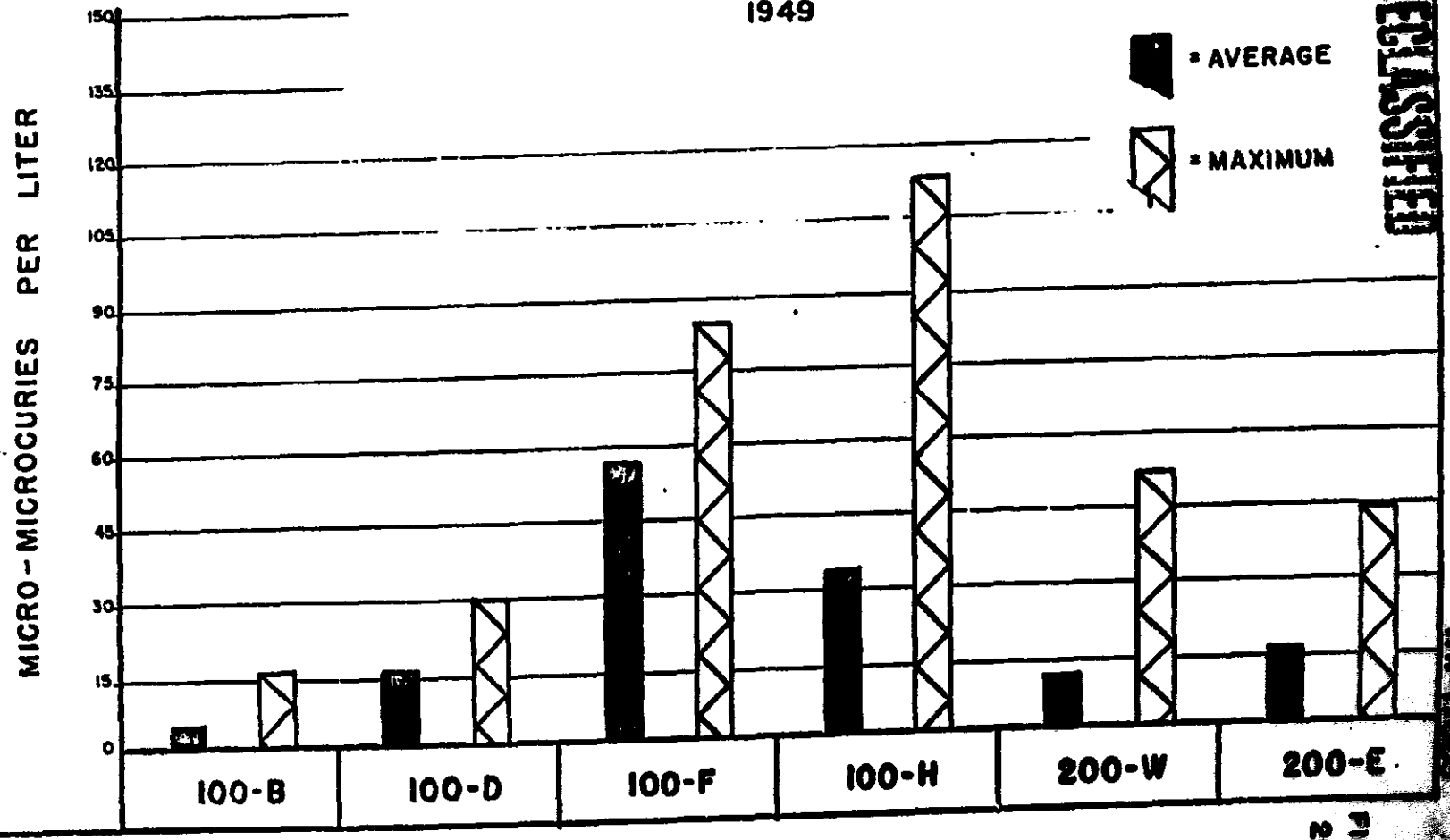
FIG. 19

BETA ACTIVITY MEASURED IN SANITARY WATER

HANFORD WORKS OPERATING AREAS

OCTOBER-NOVEMBER-DECEMBER

1949



ALPHA ACTIVITY MEASURED IN WELL NO. 2
300 AREA
OCTOBER – NOVEMBER – DECEMBER
1949

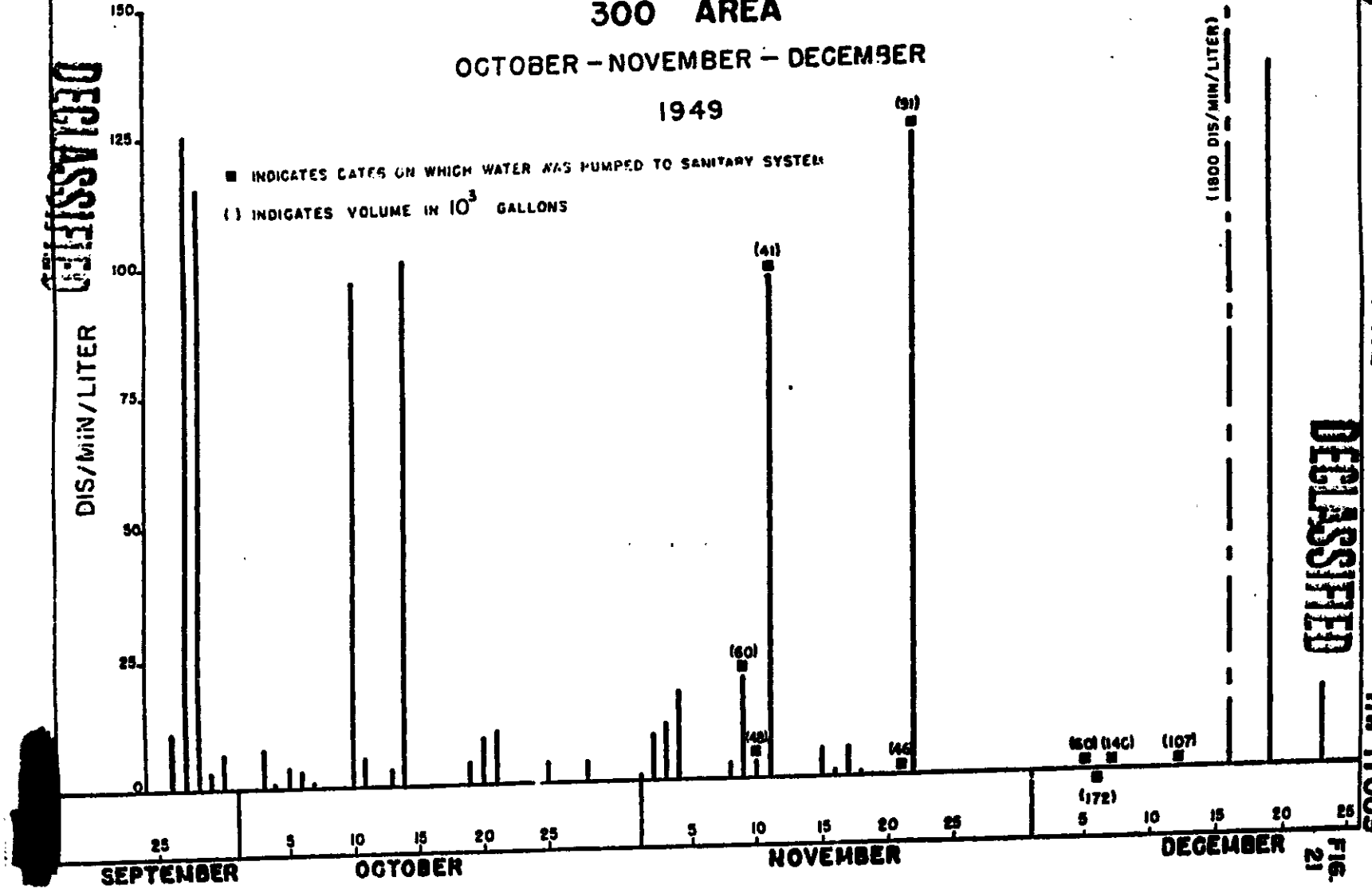


FIG. 21