#25/

CHEMICAL EFFLUENTS TECHNOLOGY WASTE DISPOSAL INVESTIGATIONS

JANUARY - JUNE 1962

by

Donald J. Brown

Chemical Effluents Technology
CHEMICAL RESEARCH AND DEVELOPMENT

HANFORD LABORATORIES OPERATION

September 10, 1962

HANFORD ATOMIC PRODUCTS OPERATION

General Electric Company
Richland, Washington

Operated for the Atomic Energy Commission by the General Electric Company under Contract No. AT(45-1)-1350.

DISTRIBUTION

1. F. E. Adley
2. G. J. Alkire
3. D. E. Anderson
4. R. G. Barnes
5. J. R. Bovingdon
6. D. J. Brown
7. J. H. Brown
8. R. E. Brown
9. V. R. Chapman - R. E. Roberts
10. J. P. Corley
11. E. Doud
12. R. F. Foster
13. R. G. Geier
14. W. A. Haney
15. G. L. Hanson
16. M. K. Harmon
17. O. F. Hill
18. J. L. Nelson
19. E. R. Irish
20. P. C. Jerman
21. B. F. Judson
22. R. L. Junkins
23. C. E. Linderoth
24. W. H. Reas
25. L. C. Schwendiman
26. R. H. Silletto
27. R. J. Sloat
28. A. J. Stevens
29. R. E. Tomlinson
30. M. T. Walling
31. 300 Files
32. File Copy
33-45. Extra

HANFORD ATOMIC PRODUCTS OPERATION
RICHLAND, WASHINGTON

NOTICE!

This report was prepared for use within General Electric Company in the course of work under Atomic Energy Commission Contract AT-(45-1)-1350, and any views or opinions expressed in the report are those of the authors only. This report is subject to revision upon collection of additional data.

Thi ... ited States,
nor the Co
A. ... uracy, com-
pleteness, ... nformation,
apparatus ... ; or
B. ... the use of
any inforn
As ... mployee or
contractor ... s or distrib-
utes, or pi ... Commission.

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

54-3000-366 (9-59) AEC-GE RICHLAND, WASH.

TABLE OF CONTENTS

CHEMICAL EFFLUENTS TECHNOLOGY WASTE DISPOSAL INVESTIGATIONS

JANUARY - JUNE, 1962

I. INTRODUCTION

The Chemical Effluents Technology Operation performs research to investigate the chemical and physical aspects of environmental contamination resulting from the disposal of plant effluents or from potential process incidents. This is a semi-annual report, published to give the latest information on the status of contamination in the ground water.

Previously, this report included a map to show the extent to which gross beta emitter concentrations were distributed in the ground water. The change in contamination pattern was observed and evaluated by comparing the most recent map with those of the previous report periods. With the recent discovery that tritium is a product of uranium fission a special analytical program was started to determine the concentrations and relative distribution of this radioisotope in the ground water. In addition to the regular gross beta map this report now contains a map of the tritium contamination in the ground water.

Two additional maps are included in this report. One map shows the extent of nitrate ion movement in the ground water, delineating that zone where the concentration exceeds the new (April, 1962) U. S. Public Health Service drinking water standard of 45 ppm (1). The other map is an isothermal map of the ground water in the region where radioactive contamination has been detected. Using a series of these temperature maps, each constructed for a different depth interval, it may be possible to follow the movement of some of the waste liquids in three-dimensions as they spread out in the ground water beneath a crib site.

Where possible the contamination in the ground water is identified with a particular source area or crib. In some cases, however, the contaminants have spread out so far from their source area that such definition is impossible.

Ground water monitoring results utilized in this report were obtained from samples collected routinely by the Environmental Studies and Evaluation Operation and analyzed by the Radiological Chemical Analysis Operation.

Well structures at Hanford are identified according to their location on the plant. The first group of numbers (199, 299, 699) identifies the general area (100, 200,600) in which the well is located. In the 100 and 200 Areas the second group of numbers (B3, E24, W22) identifies the particular area and the sheet map encompassing that portion of the area in which the well is located. The third group of numbers identifies a particular well, generally in the chronological order in which they were drilled. In the 600 Area the second and third group of numbers express in thousands of feet the nearest plant coordinates, the north coordinate being the second group of numbers and the west coordinate being the third group. Wells located south and east of the origin of the plant coordinate system are identified by the letters "S" and "E" in front of the coordinates.

II. INTERPRETATION OF GROUND WATER MONITORING DATA (D. J. Brown)

Special Monitoring Well Samples

During this report period large volume samples from seven selected wells were obtained and given special analytical processing to further detail the radionuclides which are included in routine gross beta determinations. The results of these analyses appear in Table I. Four of the wells listed in this table showed no detectable concentrations of those radionuclides for which individual analyses were made. In well 199-F5-1, located within the 100-F Area, the gross beta emitter concentration was 1.2×10^{-5} μc/cc. This activity could not be attributed to any of the isotopes for which a routine analysis was made. A special S^{35} analysis was made on the basis of the energy peak of the beta activity and the result agreed with that obtained for the gross beta, 6.0×10^{-6} to 1.3×10^{-5} μc/cc. All of the gross beta activity in well 199-B4-1 was assumed to be Cr^{51}. Generally in all wells on the project, other than the 100 Area wells, Ru^{106}-Rh^{106} is assumed to be the major isotope present in well water samples.

Well 299-E13-13, located south of the 200-East Area, was found to contain detectable concentrations of Sr^{90}. Three separate analyses were made of this sample and all three confirmed the presence of this isotope in the sample. Normally when Sr^{90} is found to be present in the ground water, the gross beta activity is extremely high, 10^{-2} to 10^{-1} μc/cc. In this sample, however, the gross beta activity was very low, 10^{-7} μc/cc. The water from this well will be sampled again and analyzed to confirm the presence or absence of this isotope. If Sr^{90} is detected in the ground water at this site a study will be made to determine how it migrates downward through the soil column to the water table before the normal breakthrough of Ru^{106}.

200-East Area

Figure 1 is a map of the 200 Areas showing the extent of detectable ground water contamination as indicated by analyses of routine samples collected during the period January - June, 1962.

TABLE I

RADIOISOTOPIC ANALYSES OF SPECIAL MONITORING WELL SAMPLES

[Concentrations in μc/cc x 10^{-8}]

Isotope	699-62-43A	699-54-57	699-20-E12	699-40-1	199-F5-1	199-B4-1	299-E13-13	MPCw*
Total α	< 1.5	< 1.5	< 2.2	< 2.2	< 3.5	< 2.8	< 3.0	--
Total β	< 120	< 1.7	< 150	< 150	1200	30,000	17 ± 3.0	--
Total Sr	< 0.4	< 0.5	< 0.5	< 0.5	< 0.4	< 1.2	11	100 (Sr^{90})
Ce^{144}-Pr^{144}	< 1.2	< 2.0	< 1.9	< 0.7	< 0.9	< 0.9	< 0.8	10,000
Ru^{106}	< 11	< 6.4	< 6.7	< 11	< 9.6	< 12	< 6.7	10,000
Cs^{137}	< 0.6	< 0.6	< 0.6	< 0.7	< 0.8	< 1.0	< 1.2	20,000
Pm^{147}	< 5.0	< 3.3	< 2.8	< 2.8	< 4.7	< 3.4	< 4.5	200,000
Co^{60}	< 1.1	< 1.0	< 0.8	< 1.2	< 0.9	< 0.8	< 0.9	50,000
Tritium	< 1000	< 1000	< 1000	< 1000	< 1000	< 1000	< 1000	3,000,000
Cr^{51}	< 23	< 23	< 23	< 23	< 23	24,000	< 23	2,000,000
Zn^{65}	< 1.3	< 1.3	< 1.3	< 3.2	< 1.3	< 2.6	< 1.3	100,000

*Recommended maximum permissible concentration in drinking water for continuing occupational exposure. U. S. Department of Commerce N.B.S. Handbook 69.

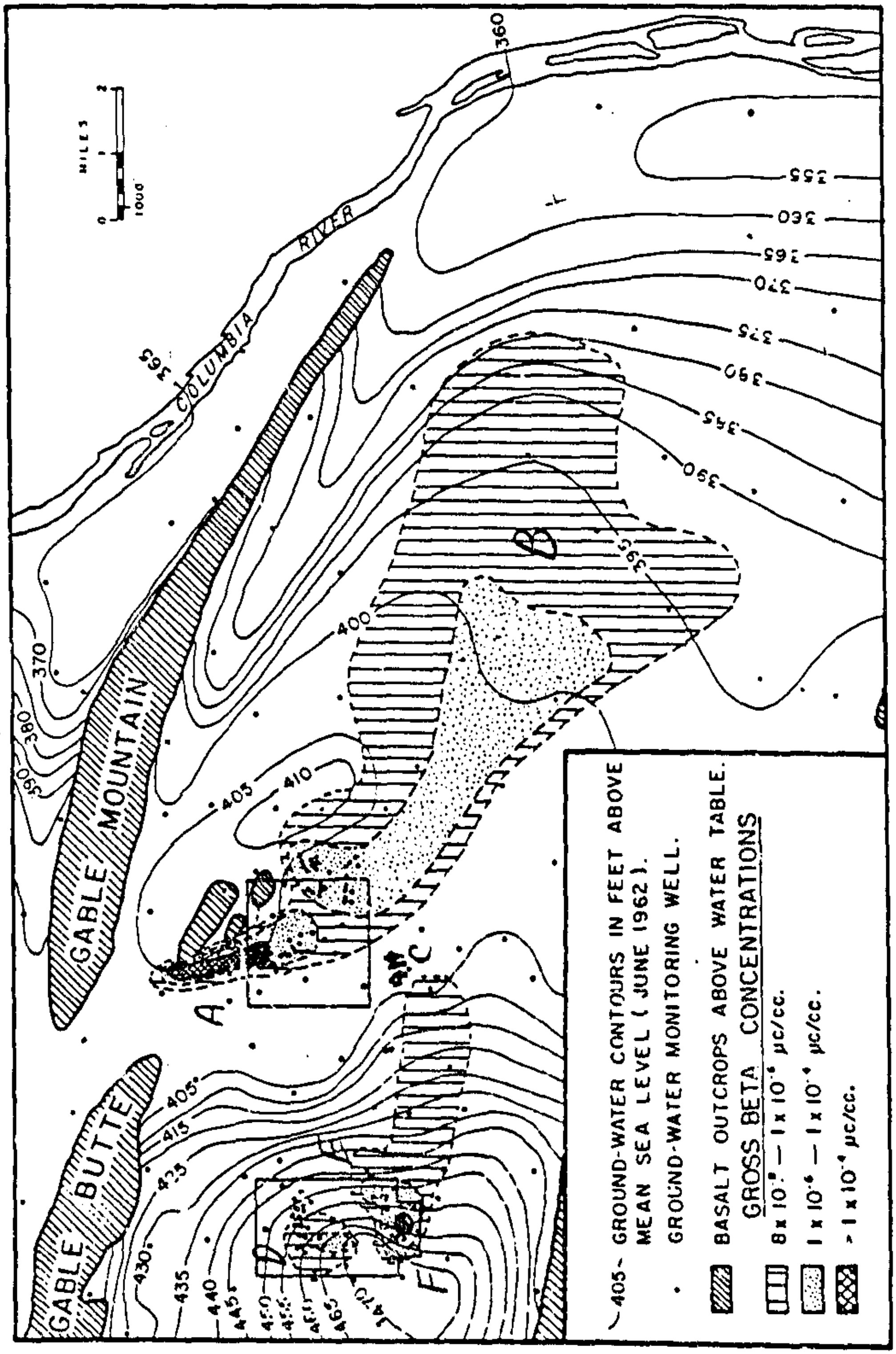

FIGURE 1.

Probable Extent Of Ground Water Gross Beta Contamination

January - June 1962

Only minor changes were noted in the contaminated ground water pattern which results from the discharge of radioactive liquid wastes into cribs located in and about the 200-East Area. At Site B, Figure 1, the plume of contaminated ground water, which was noted in the last report as starting to fan out along the leading edge, is now more noticeable and appears to be forking in two directions; one part moving to the east and the other to the south. These preferential directions of ground water movement in this region agree with geological and hydrological studies which show a division of the permeable glaciofluviatile sediments to the east and south.

Contamination was detected in only one well at the 216-BC crib area, Site C, Figure 1. This well, 299-E13-13, is located adjacent to the 216-BC-15 specific retention trench and about 1000 feet south of the nearest 216-BC crib. During the previous report period this well showed a significant increase in gross beta emitters, from below the detection limit to 10^{-6} μc/cc which prompted a special isotopic analysis of the ground water in this well; the results of that analysis are reported in Table I. Further studies will be made to determine if the Sr^{90} reported to be present in the well is from the disposal facilities in this area.

No significant changes were noted in the contaminated ground water zones at Site A, Figure 1, during the current report period. The maximum average gross beta emitter concentration at Site A was detected in well 299-E33-15, 5.9×10^{-4} μc/cc. The maximum Co^{60} concentration, 2.3×10^{-5} μc/cc was detected in well 699-50-53, located three quarters of a mile north of the 216-BY cribs. These abandoned cribs are believed to be the source of the radioactivity present in the ground water in this monitoring well.

200-West Area

Three major areas of ground water contamination in 200-West Area are shown on Figure 1 as Sites D, E, and F. Only minor changes were noted in the areal extent of contaminated ground water under 200-West Area.

Maximum gross beta emitter concentrations for the three sites in 200-West Area for this report period, together with concentration averages for the previous six months, are presented below:

TABLE II

AVERAGE CONCENTRATIONS OF GROSS BETA ACTIVITY IN 200-WEST AREA WELLS

Site	Well Number	January - June, 1962	July - December, 1961
D	299-W15-4	6.0×10^{-6} μc/cc	5.0×10^{-6} μc/cc
E	299-W19-2	5.7×10^{-7} " "	1.6×10^{-6} " "
F	299-W22-12	6.8×10^{-3} " "	1.4×10^{-2} " "

Only one well in 200-West Area contains concentrations of long-lived fission products greater than routine detection limits. Well 299-W22-2 continues to show the presence of Sr^{90}. The source of the Sr^{90} in this well is the 216-S-1 and 2 cribs which were abandoned in 1956. The maximum concentration detected during this report period was 3.4×10^{-7} μc Sr^{90}/cc.

III. FISSION PRODUCT TRITIUM IN THE GROUND WATER

The tritium ground water contamination map, Figure 2, shows contamination patterns resulting from the disposal of wastes to ground in the 200 Areas. In general, the contamination patterns outlined on this map are in good agreement with those

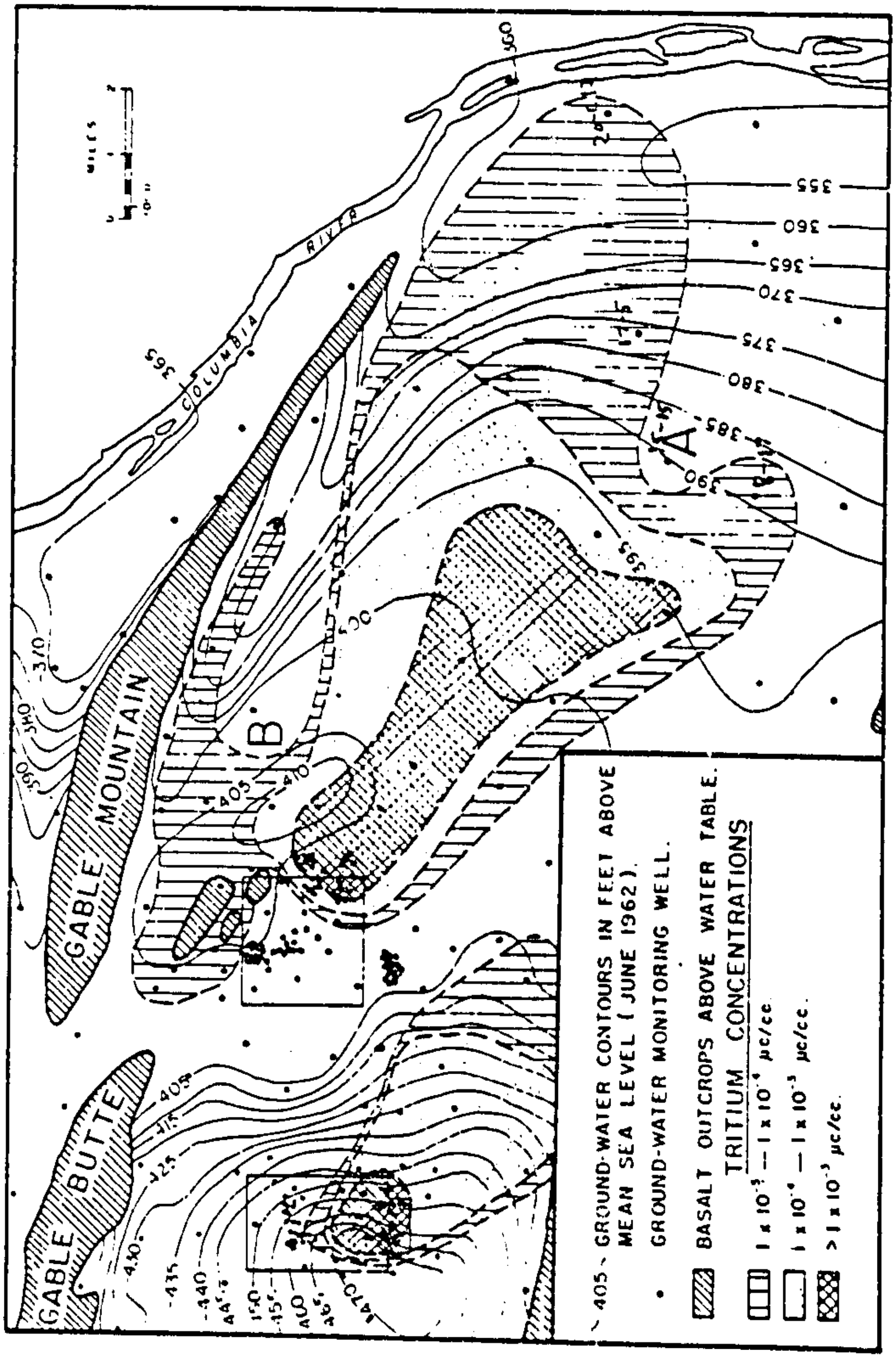

FIGURE 2.

Probable Extent Of Ground Water Tritium Contamination

January-June 1962

noted on the gross beta emitter (essentially all Ru^{106}-Rh^{106}) map for the same period, Figure 1. The major difference was noted in the northern part of 200-East Area. The source of radiocontaminants at that site is the 216-BY scavenged waste cribsite. Evidently, the concentration of tritium in scavenged wastes was sufficiently low to preclude detection at the current detection limit of 1×10^{-5} μc H^3/cc. The presence of tritium in the ground water south of Gable Mountain is attributable to the B-swamp which receives condenser cooling water and acid fractionator condensate from the Purex plant. This waste stream contains tritium in concentrations up to 10^{-3} μc/cc. Since a major portion of the water going into this swamp is from this source stream, the tritium concentration in the swamp is also at or near 10^{-3} μc H^3/cc.

The tritium contamination pattern southeast of the 200 East Area is quite similar to that shown for the gross beta emitters, Figure 1. The forking of the contamination to the south and east about midway to the river, Site A, is also noticeable on the tritium map. Samples of water taken at riverbank locations adjacent to the most eastward contaminated ground water plume did not contain tritium above the detection limit of 1×10^{-5} μc/cc. Efforts are now being made to lower the detection limit to 1×10^{-8} μc/cc. This would extend our knowledge of the ground water flow pattern beneath the Hanford Works by permitting the tracing of tritium from the source area.

IV. CONTAMINATION OF THE GROUND WATER BY NITRATE IONS

A new standard was established by the U. S. Public Health Service in April, 1962 for nitrate ions in drinking water (1); the recommended maximum concentration is now set at 45 ppm. Figure 3 is a map of the Separations Areas showing the extent to which the ground water is contaminated by nitrate ions in excess of the 45 ppm limit. This map also shows several zones of lesser concentration. The background concentration of nitrate ion in the ground water is between 2 and 4 ppm. Concentrations slightly above this background concentration have been detected eastward to the Columbia River.

The nitrate ion concentration in some of the wastes discharged into the ground within the Separations Areas ranged between 200,000 and 300,000 ppm. The highest concentrations reported to be present in the ground water beneath one of these sites was between 20,000 to 30,000 ppm. These high concentrations have since decreased to less than 2,000 ppm.

Within the 200-East Area there are two major disposal sites where the nitrate concentration is reported to be above the recommended limit. The 216-BY crib sites in the northern part of the area and the Purex crib sites south and east of the Purex plant. The highest concentration reported in the ground water beneath the 200-East Area is to the north in well 699-50-53 with 1,500 ppm.

In the 200-West Area there are three major disposal sites where the nitrate concentration exceeded the recommended limit. These are the crib sites at T-plant, U-plant, and Redox plant. Beneath T-plant and U-plant the ground water is carrying the contamination to the east. At the Redox plant some of the ground water is moving the nitrate to the east and some to the west. The westward movement is explained by the fact that the particular crib is located on the axis of the 200-West ground water mound.

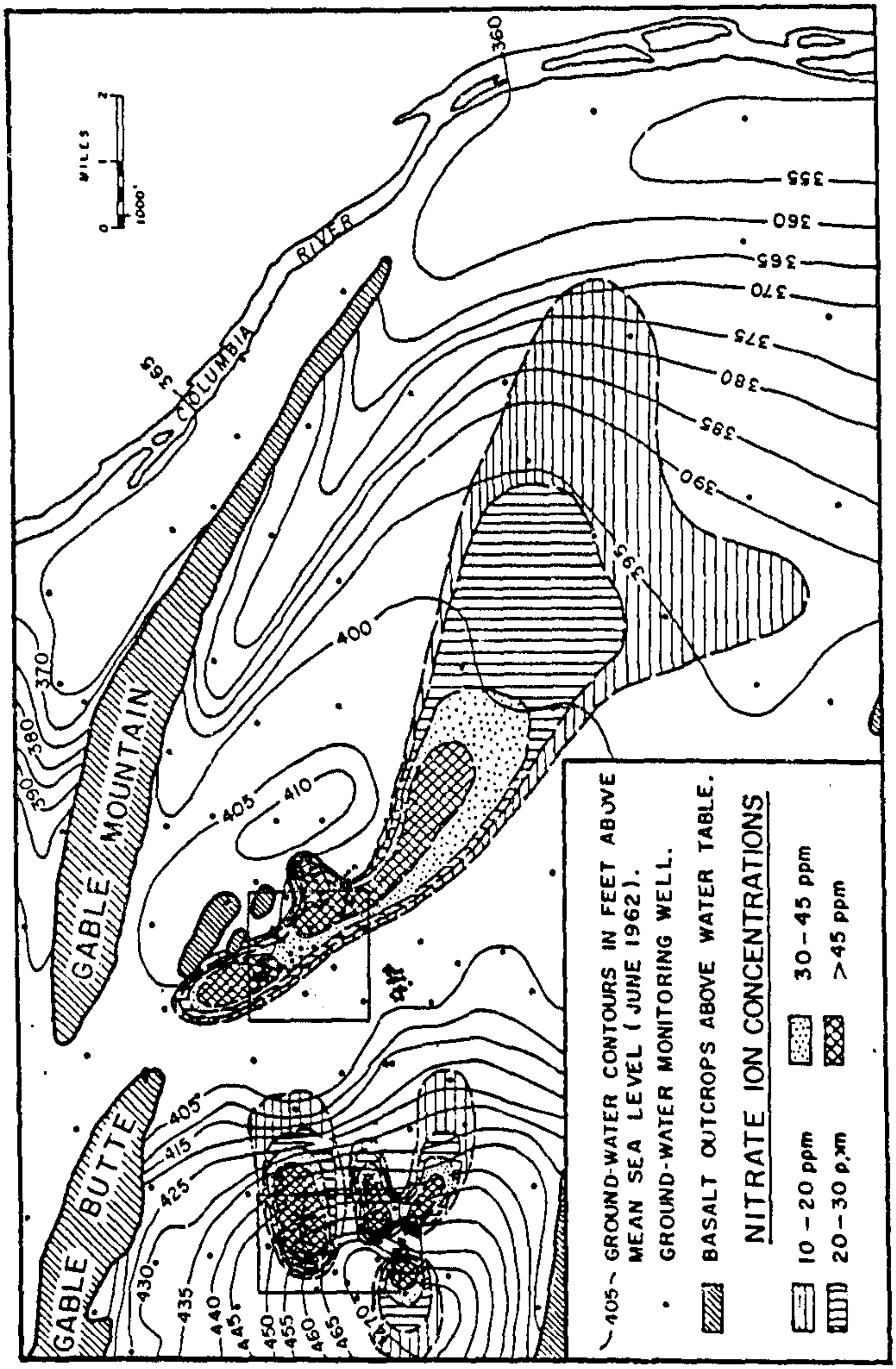

FIGURE 3.
Probable Extent Of Ground Water Nitrate Ion Contamination

January - June 1962

V. GROUND WATER TEMPERATURE SURVEY

A newly developed temperature probe is being used to obtain temperature profiles of the ground water in monitoring wells located on the Hanford Project. An isothermal map of the water table beneath the Separations Areas was made from data obtained during January - June, 1962. The temperature data were adjusted on the basis of the regional geothermal gradient to correspond to readings which might be expected at an elevation of 350 feet above mean sea level. In subsequent reports temperature maps at other depth intervals may be included to show the three-dimensional aspect of the movement of ground water in this region. (See Figure 4).

The region where the ground water appears to be the hottest thermally is just east of the Purex plant. The temperature of the ground water in this locality is between 70 and 80 degrees Centigrade. The Gable Mountain swamp, south of the western end of Gable Mountain, also receives some warm water which accounts for the isothermal pattern in this area. The warm ground water north of Gable Mountain has its source in the 100 Areas.

VI. WELL DRILLING SUMMARY (R. E. Brown)

Wells are drilled at the Hanford Works for multipurpose uses. All provide geological data and many are means of procuring hydrological information in support of waste disposal operations and investigations. During this report period eighty-eight 75-foot wells were drilled for the Chemical Processing Department in the 241-A and 241-SX tank farms to monitor the high-level waste storage tanks for leakage. These wells were drilled under Project CAC-928, Contract AT(45-1)-1666 by the Haden Drilling Company of Pasco, Washington. One deep well, 299-E24-9, was also drilled on this same

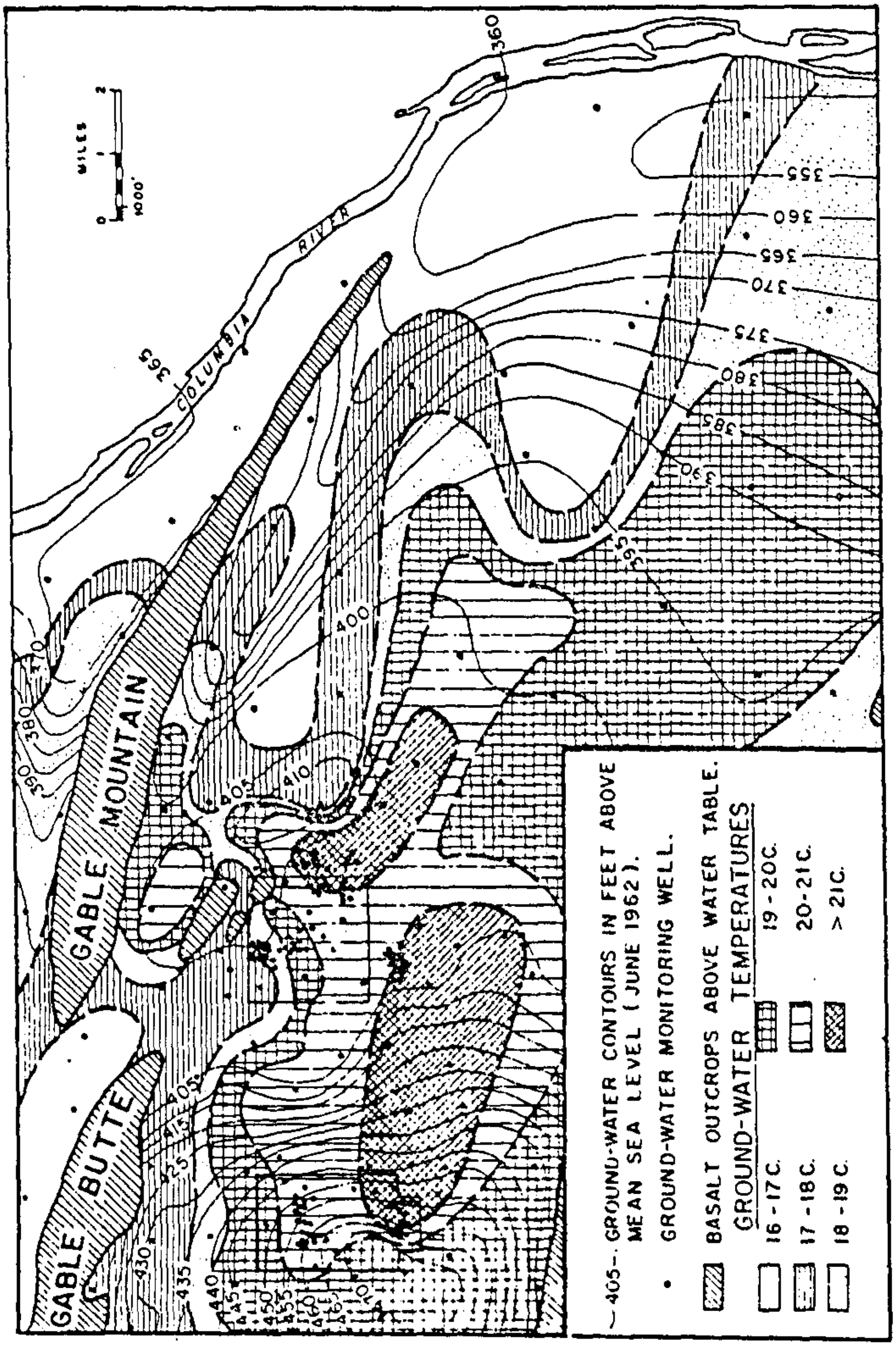

FIGURE 4.
Isothermal Map Of The Ground Water

January - June 1962

contract as a monitoring well for a new crib south of the Purex plant.

The last remaining well, 699-36-93, on the Chemical Effluents Technology FY 1961 Well Drilling Program was completed during this report period. This work was done by the A. M. Jannsen Drilling Company of Aloha, Oregon, under Project CAH-921, Contract AT(45-1)-1639.

An emergency water supply well for the Chemical Processing Department was drilled by the Smith and Sons Drilling Company of Pasco, Washington, under Project CGC-897, Contract AT(45-1)-1671. This well, 299-E28-11, is located west of the 221-B plant in the 200-East Area.

Well	Feet Drilled	Date Completed	Total Depth	To Water?	To Basalt?
299-E24- 9	370	4-28-62	370	Yes	No
299-E25-59	75	2- 1-62	75	No	"
-60	75	2- 5-62	75	"	"
-61	75	2- 6-62	75	"	"
-62	75	2- 9-62	75	"	"
-63	75	2-13-62	75	"	"
-64	75	4- 5-62	75	"	"
-65	75	4- 6-62	75	"	"
-66	75	4- 9-62	75	"	"
-67	75	4- 9-62	75	"	"
-68	75	4-10-62	75	"	"
-69	75	4-10-62	75	"	"
-70	75	4-13-62	75	"	"
-71	75	4-12-62	75	"	"
-72	75	4-12-62	75	"	"
-73	75	4-16-62	75	"	"
-74	75	4-16-62	75	"	"
-75	75	4-17-62	75	"	"
-76	75	4-24-62	75	"	"
-77	75	4-18-62	75	"	"
-78	75	4-20-62	75	"	"
-79	75	4-21-62	75	"	"
-80	75	4-24-62	75	"	"
-81	75	4-26-62	75	"	"
-82	75	4-26-62	75	"	"
-83	75	4-27-62	75	"	"

WELL DRILLING SUMMARY (contd.)

Well	Feet Drilled	Date Completed	Total Depth	To Water?	To Basalt?
299-E25-84	75	4-30-62	75	No	No
-85	75	4-30-62	75	"	"
-86	75	5- 1-62	75	"	"
-87	75	5- 1-62	75	"	"
-88	75	5- 2-62	75	"	"
-89	75	5- 2-62	75	"	"
-90	75	5- 3-62	75	"	"
-91	75	5- 3-62	75	"	"
-92	75	5- 4-62	75	"	"
-93	75	5- 4-62	75	"	"
-94	75	5- 7-62	75	"	"
-95	75	5- 7-62	75	"	"
-96	75	5- 8-62	75	"	"
-97	75	5- 8-62	75	"	"
299-E28-11	347	6- 4-62	347	Yes	"
299-W23-73	75	2-16-62	75	No	No
-74	75	2-19-62	75	"	"
-75	75	2-20-62	75	"	"
-76	75	2-20-62	75	"	"
-77	75	2-21-62	75	"	"
-78	75	2-22-62	75	"	"
-79	75	2-23-62	75	"	"
-80	75	2-23-62	75	"	"
-81	75	2-26-62	75	"	"
-82	75	2-26-62	75	"	"
-83	75	2-27-62	75	"	"
-84	75	2-27-62	75	"	"
-85	75	3- 1-62	75	"	"
-86	75	3- 1-62	75	"	"
-87	75	3- 2-62	75	"	"
-88	75	3- 5-62	75	"	"
-89	75	3- 6-62	75	"	"
-90	75	3- 6-62	75	"	"
-91	75	3- 9-62	75	"	"
-92	75	3- 8-62	75	"	"
-93	75	3- 8-62	75	"	"
-94	75	3- 9-62	75	"	"
-95	75	3-12-62	75	"	"
-96	75	3-14-62	75	"	"
-97	75	3-15-62	75	"	"
-98	75	3-14-62	75	"	"

WELL DRILLING SUMMARY (contd.)

Well	Feet Drilled	Date Completed	Total Depth	To Water?	To Basalt?
299-W23-99	75	3-12-62	75	No	No
-100	75	3-16-62	75	"	"
-101	75	3-15-62	75	"	"
-102	75	3-16-62	75	"	"
-103	75	3-19-62	75	"	"
-104	75	3-19-62	75	"	"
-105	75	3-21-62	75	"	"
-106	75	3-20-62	75	"	"
-107	75	3-22-62	75	"	"
-108	75	3-22-62	75	"	"
-109	75	3-23-62	75	"	"
-110	75	3-23-62	75	"	"
-111	75	3-26-62	75	"	"
-112	75	3-26-62	75	"	"
-113	75	3-27-62	75	"	"
-114	75	4- 4-62	75	"	"
-115	75	3-27-62	75	"	"
-116	75	3-29-62	75	"	"
-117	75	3-29-62	75	"	"
-118	75	4- 2-62	75	"	"
-119	75	3-30-62	75	"	"
-120	75	4- 3-62	75	"	"
-121	75	4- 3-62	75	"	"
699-36-93	138	1-10-62	700	Yes	Yes

VII. REFERENCES

1. U. S. Public Health Service, Drinking Water Standards. Federal Register, Rules and Regulations, Title 42, Chapter 1, Part 72, Subpart J. U. S. Printing Office, Washington, D. C. March 6, 1962.

VIII. APPENDIX

TABLE III

AVERAGE CONCENTRATIONS OF GROSS BETA EMITTERS, JANUARY - JUNE, 1962

[Detection Limit is 8×10^{-8} μc/cc at 95% C.L.]

Well 200-East Area (prefixed by 299)	Concentration (Units of 10^{-8} μc/cc)	Well	Concentration (Units of 10^{-8} μc/cc)
E28-1	Not sampled	E13-6	< 8
E28-2	50	E25-2	400
E28-3	< 8	E24-1	690
E28-4	230	E25-3	650
E28-5	320	E25-4	100
E28-6	< 8	E24-4	760
E27-1	1400	E24-5	4,100
E23-1	< 8	E17-1	2,900
E28-7	9	E24-2	770
E26-1	< 8	E25-1	350
E33-16	14,000	E33-19	4,100
E33-15	59,000	E33-20	4,400
E33-12	18,000	E13-7	< 8
E33-17	19,000	E13-8	< 8
E33-13	1,000	E13-9	< 8
E33-14	3,800	E13-10	< 8
E33-11	5,800	E13-11	< 8
E33-9	6,600	E13-12	< 8
E33-8	5,500	E13-13	13
E33-1	510	E13-14	< 8
E33-2	1,500	E24-7	< 8
E33-3	5,500	E25-5	190
E33-4	6,200	E25-6	330
E33-7	100	E25-9	140
E33-10	< 8	E24-3	8
E33-6	350	E13-16	< 8
E33-5	200	E25-7	4,600
E33-18	3,200	E25-8	2,700
E13-1	< 8	E13-15	< 8
E13-2	< 8	E13-17	< 8
E13-3	< 8	E13-18	< 8
E13-4	< 8	E13-19	< 8
E13-5	< 8	E33-21	< 8

VIII. APPENDIX (contd.)

TABLE III (contd.)

Well	Concentration (Units of 10^{-8} $\mu c/cc$)	Well	Concentration (Units of 10^{-8} $\mu c/cc$)
200-East Area (prefixed by 299)			
E24-8	1,300	E27-4	38
E28-8	< 8	E17-2	920
E28-9	< 8	E17-3	1,400
E32-1	< 8	E26-6	< 8
E19-1	< 8	E25-11	2,800
E26-5	1,000	E25-12	2,300
E13-20	< 8	E16-2	160
E26-4	1,800	E16-1	< 8
E26-2	43	E28-10	39
E26-3	2,600	E23-2	< 8
E25-10	3,300	E34-1	< 8
200-West Area (prefixed by 299)			
W11-1	9	W15-4	600
W11-2	not sampled	W15-1	15
W11-3	< 8	W23-1	not sampled
W11-4	< 8	W22-4	" "
W11-5	< 8	W22-18	" "
W11-6	< 8	W22-5	" "
W11-7	< 8	W22-6	" "
W11-8	< 8	W22-7	" "
W11-9	< 8	W22-8	" "
W11-10	< 8	W22-9	" "
W12-1	< 8	W22-10	530
W10-3	130	W22-11	< 8
W10-4	190	W22-15	7,400
W11-11	82	W22-16	26
W11-12	130	W23-2	< 8
W14-1	16	W23-3	17
W10-5	< 8	W22-12	680,000
W15-2	< 8	W22-13	200,000
W10-1	< 8	W22-14	630,000
W10-2	not sampled	W26-3	130
W15-3	130	W22-17	160
W14-2	28	W22-1	28
W22-2	200	W18-2	10
W15-5	< 8	W18-5	< 8
W19-1	< 8	W15-6	< 8
W22-19	4,700	W18-1	< 8

VIII. APPENDIX (contd.)

TABLE III (contd.)

Well	Concentration (Units of 10^{-8} μc/cc)	Well	Concentration (Units of 10^{-8} μc/cc)
200-East Area (prefixed by 299)			
W23-4	47	W18-3	not sampled
W22-20	240	W18-4	< 8
W6 -1	< 8	W19-4	< 8
W19-2	57	W22-22	< 8
W19-3	30	W22-23	10
W21-1	10	W22-24	< 8
W22-21	23	W11-13	18
		W14-3	41
300 Area Wells (prefixed by 399)			
3-2	not sampled	1-4	12
3-3	" " "	8-2	< 8
3-1	17	6-1	< 8
2-1	18	4-1	18
1-1	17	5-1	< 8
1-2	19	8-3	< 8
8-1	< 8	4-7	13
1-3	28		
600 Area Wells (prefixed by 699)			
S27-E14	8	8-17	< 8
34-51	< 8	S7-34	< 8
25-55	< 8	10-54	< 8
24-33	130	12-64	< 8
19-43	< 8	40-24	< 8
20-20	14	40-33	< 8
35-9	< 8	54-42	< 8
8-32	< 8	47-60	< 8
S8-19	< 8	60-60	< 8
17-5	< 8	63-90	not sampled
2-3	< 8	59-80B	8
S12-3	< 8	43-89	not sampled
S31-1	< 8	34-88	< 8

VIII. APENDIX (contd.)

TABLE III (contd.)

Well 600 Area (prefixed by 699)	Concentration (Units of 10^{-8} μc/cc)	Well	Concentration (Units of 10^{-8} μc/cc)
25-80	< 8	48-71	< 8
35-70	< 8	51-63	< 8
55-70	< 8	71-30	< 8
49-79	< 8	32-72	< 8
39-79	< 8	32-70	20
35-78	< 8	38-70	15
32-77	< 8	35-66	< 8
36-61A	< 8	31-65	< 8
34-39A	390	51-75	< 8
45-69	< 8	50-84	< 8
45-42	< 8	63-25	< 8
50-30	< 8	77-36	< 8
25-70	< 8	62-43	< 8
55-89	< 8	S6-E4B	< 8
71-52	< 8	S6-E4D	< 8
70-68	< 8	S6-E4E	< 8
40-62	< 8	S6-E4F	< 8
50-42	< 8	S6-E4G	< 8
68-38	< 8	S6-E4H	< 8
57-29	< 8	S6-E4J	< 8
15-26	10	78-62	< 8
72-88	not sampled	77-54	< 8
65-72	" " " "	1-18	< 8
54-57	< 8	83-47	< 8
62-32	< 8	74-44	< 8
31-30	320	42-12	< 8
49-48	< 8	26-15	16
50-53	< 8	9-E2	< 8
61-66	< 8	31-53B	< 8
51-18	< 8	28-52	< 8
65-50	< 8	19-88	< 8
47-35	< 8	33-56	< 8
45-20	< 8	HAN 9	< 8
38-43	< 8	24-46	< 8
28-40	< 8	2-33	< 8
55-50C	< 8	14-40	< 8
49-57	< 8	19-58	< 8
42-42	< 8	20-82	< 8

VIII. APPENDIX (contd.)

TABLE III (contd.)

Well 600 Area (Prefixed by 699)	Concentration (Units of 10^{-8} μc/cc)	Well	Concentration (Units of 10^{-8} μc/cc)
17-47	< 8	57-83	< 8
17-70	not sampled	20-39	< 8
65-59	< 8	69-45	< 8
55-76	< 8	67-51	< 8
55-95	< 8	49-55	< 8
S14-20	< 8	53-55	< 8
38-65	< 8	47-46	< 8
66-23	< 8	72-92	< 8
44-64	< 8	40-1	< 8
36-61B	< 8	20-E12	< 8
32-62	< 8	72-73	< 8
15-15	< 8	36-60	not sampled
S11-E12	< 8	89-35	< 8
S3-E12	< 8	S18-E2	< 8
37-82A	< 8	43-104	not sampled
37-82B	16	54-37	" " " " "
67-98	< 8	36-93	< 8
27-8	< 8		

3000 Area Wells (prefixed by 3099)	
47-18	
45-18	< 8
45-16	< 20
49-16	not sampled

VIII. APPENDIX (contd.)

TABLE IV

AVERAGE TRITIUM CONCENTRATION IN WELL WATER SAMPLES, JANUARY - JUNE, 1962

(Detection limit is 1.0 x 10^{-5} μc/cc at 90% C. L.)

Well	Concentration (Units of 10^{-5} μc/cc)	Well	Concentration (Units of 10^{-5} μc/cc)
200 West Area (prefixed by 299)			
W6-1	< 1	W19-2	150
W10-1	< 1	W22-14	18,000
W11-7	< 1	W22-19	1,400
W11-11	41	W22-20	20
W15-2	< 1	W23-4	100,000
W15-4	120		
200-East Area (prefixed by 299)			
E23-2	20	E26-4	200
E24-1	1,100	E28-6	50
E24-4	< 1	E28-8	< 1
E25-3	400	E28-10	2
E25-4	< 1	E32-1	< 1
E25-6	50	E33-4	< 1
E25-12	16		
600 Area (prefixed by 699)			
17-5	< 1	34-51	< 1
18-48	< 1	34-88	< 1
18-43	< 1	35-9	38
20-20	20	36-61B	< 1
20-E12	7	37-42	180
24-33	50	37-82	< 1
25-55	1	38-70	60
25-70	38	39-79	< 1
25-80	< 1	40-1	< 1
26-15	30	40-24	2
27-8	7	40-33	22
30-31	200	42-12	< 1

VIII. APPENDIX (contd.)

TABLE IV (contd.)

Well 600 Area (prefixed by 699)	Concentration (Units of 10^{-5} μc/cc)	Well	Concentration (Units of 10^{-5} μc/cc)
31-65	< 1	42-42	100
32-70	< 1	45-20	< 1
34-39A	280	45-42	25
45-69	< 1	S12-3	< 1
S3-E12	< 1	50-85	< 1
1-18	< 1	51-63	< 1
2-3	< 1	51-75	1
8-17	2	53-55	1
8-32	< 1	54-42	4
9-E8	< 1	54-75	1
15-15	< 1	55-50	< 1
15-26	220	55-76	< 1
47-35	< 1	55-89	< 1
47-46	3	57-83	< 1
48-71	< 1	59-80B	< 1
49-55	7	60-60	< 1
49-57	< 1	61-66	< 1
49-79	< 1	62-43	< 1
50-28	1	63-90	< 1
50-30	1	65-50	< 1
50-42	2	65-72	< 1
50-53	4	71-84	< 1