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Edited by W.A. Haney

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CHEMICAL EFFLUENTS TECHNOLOGY WASTE DISPOSAL INVESTIGATIONS

October, November, December, 1960

Prepared by Members of the

Chemical Effluents Technology Operation

Edited by: W. A. Haney

March 7, 1961

Chemical Research & Development Operation
Hanford Laboratories Operation

Hanford Atomic Products Operation
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CHEMICAL EFFLUENTS TECHNOLOGY WASTE DISPOSAL INVESTIGATIONS
October, November, December, 1960

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 report is primarily concerned with plant assistance research in the field of waste disposal during the quarter October, November, December, 1960.

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

I. Interpretation of Ground-Water Monitoring Data (W. A. Haney)

Special Monitoring Well Samples

During this report period large volume samples from four selected wells were obtained and given special analytical processing to further detail the radioisotopes which are included in routine "gross beta" determinations. Samples were analyzed for the predominant long-lived isotopes of interest in separations wastes. Results of these analyses are in good agreement with recent routine sample analytical results (appendix).

The positive Sr and rare earth results noted in the sample from the 299E-25-3 well monitoring the Purex 216-A-6 steam condensate crib are in agreement with sporadic low Sr^{90} results noted in routine samples during the past several months. Coincidental with the appearance of Sr in this well was the appearance of decayed animal matter in the samples. Filtered residue, including a small amount of hair, was sent to Biology Operations

for possible identification of the animal. Rodents in the vicinity are known to ingest small amounts of radioactive material from low activity disposal operations, and have on previous occasions been found in project wells. It is probable that the decaying animal is the source of activity in the 299E-25-3 well since breakthrough of Sr^{90} in the cribbed waste would be quite premature based on soil column tests. Also, preliminary results from a well dilution-test employing $CaCl_2$ showed little or no dilution during the week following addition of the salt to the well. Future analytical results of samples from this well will be followed closely. The 216-A-6 crib is scheduled for abandonment due to inadequate infiltration capacity in January, 1961.

The positive Co^{60} results noted in samples from the 299E-24-8 well confirmed previous analyses. The source of this isotope is scavenged waste discharged to the 216-BY cribs in 1955. The positive total alpha analysis noted in a sample from the 299W-22-20 well last quarter (HW-67753-RD) was investigated further. Analysis of several resamples showed the total alpha to be below the detection limit of 6.4×10^{-8} μc/ml.

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, during the period October-December, 1960. Only minor local changes were evident during this reporting period; and the areal extent of the various contamination-level zones is essentially the same as shown in last quarter's report, HW-67[illegible]-RD.

TABLE I

Radioisotopic Analyses of Special Monitoring Well Samples
(concentrations in units of μc/cc

Isotope	Well 699-S31-1	299W-15-1(1)*	299E-24-8(2)*	299E-25-3(3)*
Total alpha	$<2.6 \times 10^{-8}$	$<5.0 \times 10^{-8}$	$<2.6 \times 10^{-8}$	$<5.2 \times 10^{-8}$
Gross Beta	$<2.4 \times 10^{-7}$	3.2×10^{-6}	7.8×10^{-6}	1.4×10^{-5}
Ru^{106}	$<3.5 \times 10^{-7}$	$2.9 \times 10^{-6} \pm 5.2 \times 10^{-7}$	$7.0 \times 10^{-6} \pm 7.4 \times 10^{-7}$	$1.4 \times 10^{-5} \pm 1.1 \times 10^{-6}$
R.E.+Y	$<1.3 \times 10^{-8}$	$<1.2 \times 10^{-8}$	$<1.8 \times 10^{-8}$	8.2×10^{-7}
Cs^{137}	$<6.7 \times 10^{-9}$	$<5.1 \times 10^{-9}$	$<9.0 \times 10^{-9}$	$<1.6 \times 10^{-8}$
Pm^{147}	$<2.3 \times 10^{-8}$	$<2.1 \times 10^{-8}$	$<3.4 \times 10^{-8}$	$<2.4 \times 10^{-7}$
Te^{127}	$<1.4 \times 10^{-8}$	$<2.0 \times 10^{-8}$	$<1.7 \times 10^{-8}$	$<1.1 \times 10^{-8}$
Ce^{144}	$<7.1 \times 10^{-9}$	$<6.6 \times 10^{-9}$	$<1.4 \times 10^{-8}$	4.9×10^{-7}
Total Sr	$<1.4 \times 10^{-8}$	$<8.4 \times 10^{-9}$	$<9.6 \times 10^{-9}$	7.8×10^{-8}
Sb^{125}	$<3.6 \times 10^{-7}$	$<2.7 \times 10^{-7}$	$<4.1 \times 10^{-7}$	$<3.2 \times 10^{-7}$
Zr^{95}-Nb^{95}	$<1.6 \times 10^{-7}$	$<3.3 \times 10^{-7}$	$<2.2 \times 10^{-7}$	$<3.9 \times 10^{-7}$
Co^{60}	$<1.6 \times 10^{-7}$	$<5.5 \times 10^{-7}$	8.3×10^{-7}	$<2.2 \times 10^{-7}$

* These numbers refer to the approximate well locations as indicated by encircled numbers on Figure 1.

(1) 216-BY and 241-B Cribs

The slow movement of contaminated ground water from the 216-BY scavenged waste crib site (Site A, Figure 1) continued with slight but real increases in beta-emitter concentrations noted in wells located to the north and south of this facility. At the same time, seven wells immediately adjacent to the cribs showed slight decreases in concentrations of radioisotopes.

The maximum average gross beta-emitter concentration at Site A this quarter was detected in well 299E-33-9, 1.5×10^{-3} μc/cc. The maximum Co^{60} concentration detected this quarter was 6.5×10^{-5} μc/cc in well 299E-33-17.

(2) 216-A Cribs and Contaminated Ground Water Southeast of 200 East Area

Radioactive contaminants in the ground water under Purex waste disposal facilities and contaminants which have moved from this area to the southeast are shown as Sites B and D respectively on Figure 1.

All of the wells monitoring the 216-A-8 and A-24 tank farm condensate cribs continue to show decreases in radioisotope concentrations to about 50% of the previous quarter's average. The three wells defining ground-water contamination at Site D showed a drop of 10-15% in gross beta concentrations. No long lived radioisotopes were detected in samples from wells monitoring Purex cribs during this report period, other than the sporadic appearance of Sr^{90} in well 299E-25-3 which was previously discussed.

(3) 216-BC Cribs and Trenches

As during the previous quarter, only four of the twenty wells monitoring the 216-BC scavenged waste cribs and trenches (Site C, Figure 1) contained concentrations of radioisotopes greater than the

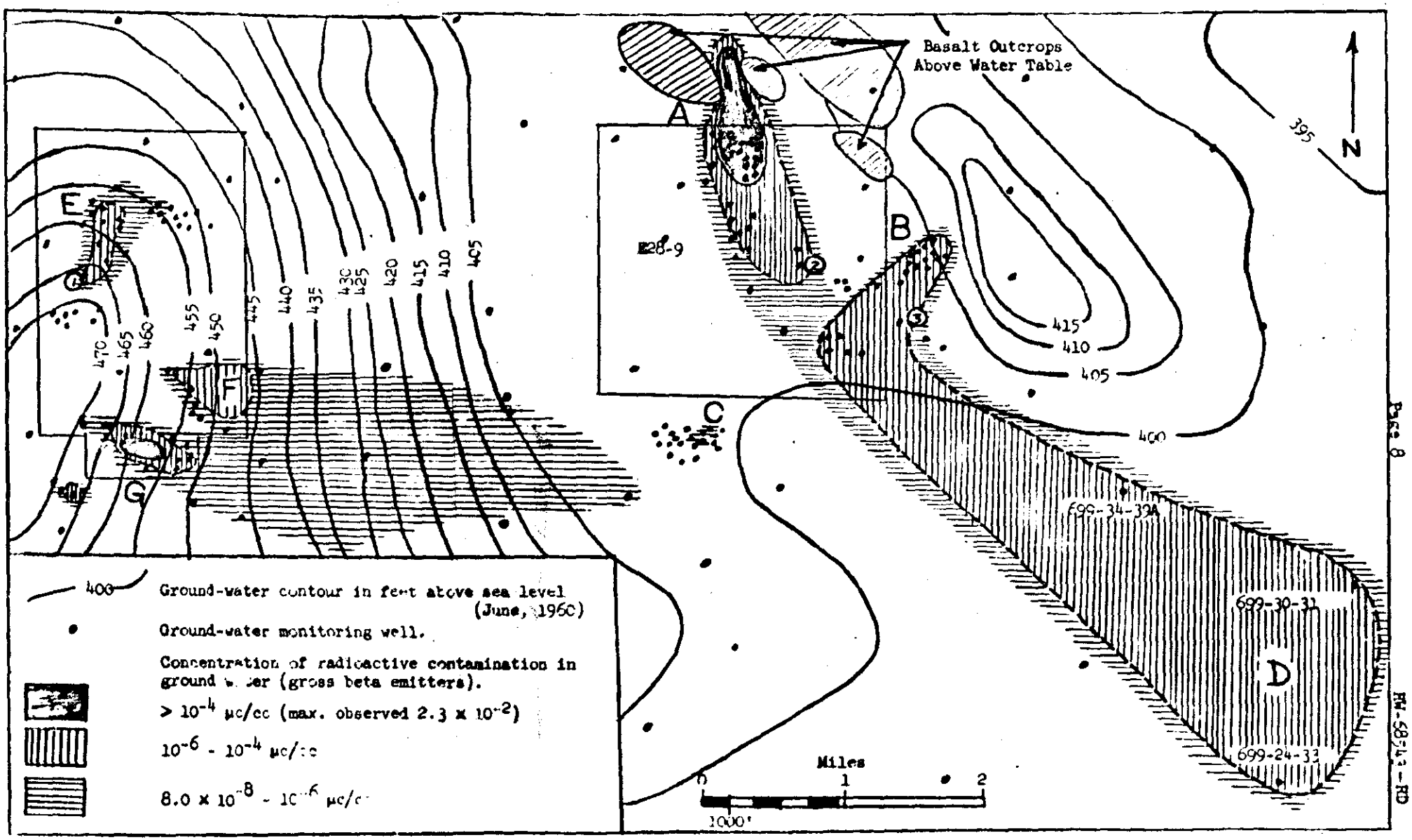

FIGURE 1 - Map of Separations Area Showing Probable Extent of Ground-Water Contamination, December, 1960

routine detection limit (8×10^{-8} μcβ/cc) this quarter. The maximum average concentration was 1.6×10^{-7} μcβ/cc in well 299E-13-6. No long-lived isotopes have ever been detected in ground-water samples from wells at Site C.

Gross beta determinations on samples from well 699-34-51, located about one-half mile southeast of the 216-BC facility, were below the routine detection limit (8×10^{-8} μc/cc) for the first time in two years. This is in accord with the gradual reduction of the already low concentrations of ground-water contaminants at Site C.

200 West Area

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

Maximum gross beta-emitter concentrations for the three sites in 200 West Area for this reporting period, together with maximum concentration averages for the previous quarter are presented in the following table.

TABLE II

Maximum Average Concentrations of Gross Beta Activity
In 200 West Area Wells

Site	Well Number	October - December, 1960	July - September, 1960
E	299W-19-1	4.3×10^{-6} μc/cc	6.8×10^{-6} μc/cc
F	299W-19-2	2.9×10^{-6} μc/cc	1.8×10^{-6} μc/cc
G	299W-22-14	2.3×10^{-2} μc/cc	2.6×10^{-2} μc/cc

Only one well in 200 West Area contains concentrations of long-lived fission products greater than routine detection limits. Well 299W-22-2

continues to show the presence of Sr^{90}; the maximum concentration this quarter was 2.1×10^{-7} $\mu c Sr^{90}/cc$ which is about 20% of the previous quarter's maximum concentration.

II. Plant Waste Disposal Practice

Chemical Processing Department

(1) Waste Tank Leak Detection (W. A. Haney, R. W. Nelson)

Three of the scheduled five shallow wells have been drilled around the southeast quadrant of the 241-106-TY underground waste tank to investigate the disposition of the waste suspected to have leaked from this vessel. The wells are spaced about 10 feet from the tank and 16 feet apart. All three wells penetrated contaminated soil containing radioisotopes of Ru and Cs. All three wells showed maximum concentrations of radionuclides at the 60-65 foot level which is about 15 feet below the tank bottom level. Radioisotope concentrations in the soil were much lower than anticipated based on analyses of the tank contents. This probably indicates that the wells are an appreciable distance from the leak point.

An applied unsaturated flow phenomena study is in progress to calculate the progressive development of the waste pattern beneath a leaking tank. Before these calculations could be completed it was necessary to obtain soil samples and measurements of the required soil parameters. In this case determination of capillary conductivity and pressure as a function of moisture content were needed. Such determinations for 10 typical tank-farm soil samples were recently received from the Irrigation Laboratory, University of California.

Another requirement, definition of the stratigraphic geology under the tank farms, has been completed, HW-66729. Also needed are solution methods for the non-linear partial differential equation describing the flow system. The basic equation is difficult to solve but a finite difference method is expected to be capable of accomplishing solution with the aid of the computer.

It is anticipated that the current work will develop satisfactory flow pattern information for application to leak detection facility design (to supplement tank liquid-level measurements) by the end of the next quarter.

(2) Treatment of Condensate Wastes (J. M. Skarpelos)

Following modifications to the Micro-Pilot Plant equipment, the first extended experiment was performed to evaluate clinoptilolite for decontaminating Purex Tank Farm Condensate. In this experiment the waste was pretreated by passage through activated carbon. Cesium-137 was removed effectively by the clinoptilolite to a concentration less than its maximum permissible concentration in water (2×10^{-4} μc/cc) from about 7200 column volumes of waste. Both the carbon and clinoptilolite were inefficient in removing strontium and the Sr^{90} in the effluent exceeded its MPC_w (1×10^{-5} μc/cc) during most of the run.

Tests using simulated wastes showed that the presence of soluble TBP and hydrocarbons had little or no effect on the cesium decontamination ability of clinoptilolite.

Irradiation Processing Department

(1) NPR Decontamination Wastes (W. N. Koop)

Additional methods were investigated for scavenging radionuclides from a propreitary phosphoric acid cleaning solution waste that will result from decontaminating carbon steel portions of the NPR primary loop. Effective scavenging of radioisotopes and precipitation of an insoluble phosphate sludge was previously demonstrated (HW-67753-RD) by adding $CaCl_2$ and NaOH to the waste. However, this method has some unattractive aspects in that it requires large quantities of treatment chemicals and generates an undesirable large volume of sludge.

One alternate method studied involves the precipitation of either ferric hydroxide, manganese dioxide, or both. Experimental results showed that the addition of potassium permanganate and ferrous sulfate provides better scavenging than either reagent alone. The minimum concentration of iron in the final waste volume is 500 ppm for effective scavenging (>95% removal of the test radionuclides). Also, when both $FeSO_4$ and $KMnO_4$ were employed as reactants at the most effective pH of 11.5 ($NaOH/H_3PO_4$ mole ratio of 3:1) the settled sludge volume was between 3-10% of the final waste volume.

Tests were also conducted to determine the radioisotope removal efficiency resulting from precipitation of an aluminum phosphate or a calcium aluminum phosphate compound. Interest in the use of aluminum in the scavenging reagent was stimulated by the possibility of reducing caustic requirements. When calcium ($CaCl_2$) was added with the aluminum a compact sludge was formed and radioisotope

removal results were more reproducible than when aluminum alone was added. The minimum concentration of aluminum in the final waste volume was 1000 ppm for effective scavenging. At this aluminum concentration, 500 ppm calcium was required to produce a compact sludge. The optimum $NaOH/H_3PO_4$ mole ratio was 2:1 (pH 8.0); however, the sludge volume was 10-25% of the total waste volume. Although the aluminum-calcium method requires less caustic addition than does the iron-permanganate scheme, it generates about 3 times the volume of sludge given by the latter method.

Neither method provides effective removal of isotopes of antimony or cesium, but greater than 90% of the isotopes of cobalt, ruthenium, silver, zinc, zirconium, strontium, iron and cerium were removed by both methods. Economic considerations-chemical costs versus sludge storage costs-appear to be the major deciding factor in determining which of the two methods would be preferred.

Phosphate in the resulting supernatant solution may constitute a problem, due to the potential for increased P^{32} production, if the liquid waste is discharged to the river above downstream reactors. Soil column experiments are planned to evaluate phosphate and radioisotope removal in expectation that disposal of the waste to a covered pit near the NPH site may be permissible.

(2) Fission Product Release Experiments (R. K. Hilliard, D. L. Reid, L. F. Coleman)

The study of fission product release from irradiated uranium this quarter was directed toward continuing the determination of the

effect of irradiation level on uranium oxidation and fission product release rates. Results to date are summarized in Table III. Experimental conditions were identical for these tests: 11.5 gram specimens, 30 days cooling time, heated to 1700 C and held at this temperature for 24 minutes. Uranium oxidation was 69 ± 4% for all specimens. The percentage of fission product released was determined by analyses of both the specimen residue and the trapped fission products in the off-gas train.

TABLE III

Effect of Irradiation On Fission Product Release

	Percent Released For Various Exposures		
Fission Product	10^{16} nvt	10^{17} nvt	10^{20} nvt
Iodine	70	80	90
Tellurium	60	60	50
Xenon	80	95	100
Cesium	30	50	55
Strontium	0.2	0.5	2
Ruthenium	0.5	0.5	0.5
Barium	0.2	0.4	2
Zirconium	0.05	0.05	0.05

Particle release was greatly accelerated in tests using uranium exposed to 1.5×10^{20} nvt. Many uranium oxide particles up to 20 microns in size penetrated the liquid caustic scrubbers and deposited on a millipore filter membrane, a phenomenon not observed at lower irradiation levels.

In experiments using unirradiated uranium and an air atmosphere, the particles were collected on millipore filters or by electrostatic precipitation and observed by optical and electron microscopy. Over the range of temperatures studied, 450-1300 C, particles ranging from less than 0.01 to 50 microns in diameter were observed. The most marked change in the numbers of particles generated occurred at a furnace temperature of 1200 C. At this temperature and above, the number of particles generated increased by orders of magnitude over that produced below 1000 C. The particulate material collected in this case consisted of agglomerates of extremely small particles primarily in the size range 0.005-0.02 micron, Increasing the air velocity increased the number of particles emitted with little observable effect on the size of particles generated. It has not yet been determined whether this increase was due to increased entrainment of particles or to increased particle generation. X-ray analyses of the particles collected showed the uranium oxide present to be U_3O_8 over the range of temperature studied.

(3) Pilot Scale Study of Reactor Effluent Decontamination Using Aluminum Beds (H. G. Rieck)

Operation of the pilot scale aluminum shavings bed at 100-D Area continued this quarter to collect information on decontamination factors, pressure drops, and radiation levels at increased flow rates. The bed was operated at a linear flow rate of 6 ft/minute, which is about 50% higher than the velocity maintained last quarter. Decontamination factors for As^{76} and P^{32}, the isotopes of primary interest, were about 60% and 50% respectively, slightly lower

than noted at the lower flow rate. Pressure drop continued to increase until at the end of December it was about 0.3 inch per linear foot of bed. The continuing increase in pressure drop and its possible effect on an anticipated long bed-life are of particular interest. Radiation at the tank wall increased to 1500 mr/hr then leveled off at this dose rate.

The bed is not affected by retaining stagnant water during a reactor shutdown. An experiment indicated that decontamination was just as effective following a stagnation period as before.

Experimental columns filled with aluminum shavings were operated to measure the influence of proposed improved reactor coolant treatment processes on aluminum bed decontamination. Coolant treatment tests were terminated before equilibrium was fully established in the columns, requiring extrapolation of collected data to equilibrium conditions and reliance on comparison with control column results. Complete information from these tests was not available for analysis at year end.

III. Well Drilling Summary (D. J. Brown, V. L. McGhan)

Company	Completed Wells	Feet Drilled	Date Completed	Total Feet	To Water	To Basalt
Hatch Drilling Co.	699-37-82-B	[illegible]	10-13-60	627	Yes	Yes
Hatch Drilling Co.	699-67-98	60	10-6-60	185	Yes	Yes
Hatch Drilling Co.	699-37-82-A	213	10-10-60	440	[illegible]	No
Hatch Drilling Co.	699-57-83	355	12-6-60	355	Yes	Yes
Hatch Drilling Co.	699-27-8	577	11-4-60	577	Yes	Yes
Hatch Drilling Co.	299-E27-4	290	11-1-60	290	Yes	No
Hatch Drilling Co.	299-E25-11	340	11-18-60	340	Yes	No
Hatch Drilling Co.	699-20-39	632	12-12-60	632	Yes	Yes
Hatch Drilling Co.	299-E25-12	340	11-29-60	340	Yes	No
Hatch Drilling Co.	299-E25-13	340	12-8-60	340	Yes	No
Hatch Drilling Co.	299-W15-100	70	12-21-60	70	No	No
Hatch Drilling Co.	299-W15-97	70	12-26-60	70	No	No
Hatch Drilling Co.	299-W15-98	60			No	No
Hatch Drilling Co.	299-W15-99	70	12-16-60	70	No	No
Hatch Drilling Co.	299-E16-1	245			Yes	Yes

The Hatch Drilling Company has essentially completed work on current Hanford drilling contracts. With less than 1000 feet of drilling remaining, the work should be completed by the end of January, 1961.

IV. Appendix

TABLE I-A

Average Concentrations of Gross Beta-Emitters, October–December, 1960
(Detection Limits is 8 x 10-8 μc/cc at 95% C.L.)

Well	Concentration (μc/cc)	Well	Concentration (μc/cc)
200 East Area (prefixed by 299)		E13-1	6.0 x 10^{-8}
E28-1	1.3 x 10^{-6}	E13-2	8.0 x 10^{-8}
E28-2	8.2 x 10^{-6}	E13-3	6.0 x 10^{-8}
E28-3	4.0 x 10^{-8}	E13-4	1.4 x 10^{-7}
E28-4	1.7 x 10^{-6}	E13-5	6.0 x 10^{-8}
E28-5	7.7 x 10^{-6}	E13-6	1.6 x 10^{-7}
E28-6	3.9 x 10^{-7}	E25-2	1.0 x 10^{-5}
E27-1	7.3 x 10^{-6}	E24-1	1.1 x 10^{-5}
E23-1	3.1 x 10^{-7}	E25-3	2.5 x 10^{-5}
E28-7	2.4 x 10^{-7}	E25-4	5.0 x 10^{-6}
E26-1	9.0 x 10^{-8}	E24-4	6.0 x 10^{-8}
E33-16	3.2 x 10^{-4}	E24-5	6.0 x 10^{-8}
E33-15	7.3 x 10^{-4}	E17-1	1.4 x 10^{-6}
E33-12	7.6 x 10^{-4}	E24-2	1.4 x 10^{-5}
E33-17	6.2 x 10^{-4}	E25-1	6.6 x 10^{-6}
E33-13	6.1 x 10^{-5}	E33-19	1.9 x 10^{-4}
E33-14	2.1 x 10^{-4}	E33-20	2.0 x 10^{-4}
E33-11	7.7 x 10^{-5}	E13-7	8.0 x 10^{-8}
E33-9	1.[illegible] x 10^{-3}	E13-8	4.0 x 10^{-8}
E33-8	9.0 x 10^{-6}	E13-9	5.0 x 10^{-8}
E33-1	5.9 x 10^{-5}	E13-10	4.0 x 10^{-8}
E33-2	5.9 x 10^{-5}	E13-11	4.0 x 10^{-8}
E33-3	3.1 x 10^{-4}	E13-12	3.0 x 10^{-8}
E33-4	2.1 x 10^{-4}	E13-13	5.0 x 10^{-8}
E33-7	7.0 x 10^{-6}	E13-14	5.0 x 10^{-8}
E33-10	2.0 x 10^{-8}	E24-7	1.5 x 10^{-7}
E33-6	1.0 x 10^{-5}	E25-5	1.0 x 10^{-6}
E33-5	6.0 x 10^{-6}	E25-6	5.9 x 10^{-6}
E33-18	1.1 x 10^{-4}	E25-9	4.6 x 10^{-6}
E24-3	7.0 x 10^{-8}	E19-1	4.0 x 10^{-8}
E13-16	4.0 x 10^{-8}	E26-5	2.0 x 10^{-6}
E25-7	3.0 x 10^{-5}	E13-20	7.0 x 10^{-8}
E[illegible]-8	7.8 x 10^{-5}	E26-4	5.8 x 10^{-6}
E13-15	3.0 x 10^{-8}	E25-10	6.2 x 10^{-6}
E[illegible]-17	2.0 x 10^{-8}	E26-2	2.2 x 10^{-6}
E[illegible]-18	4.0 x 10^{-8}	E26-3	9.3 x 10^{-6}
E13-19	5.0 x 10^{-8}	E27-3	5.0 x 10^{-8}
E33-21	3.0 x 10^{-8}	E17-2	1.1 x 10^{-5}
E24-8	2.1 x 10^{-5}	E17-3	1.[illegible] x 10^{-5}
E28-8	3.0 x 10^{-6}	E25-11	2.7 x 10^{-7}
E28-9	6.[illegible] x 10^{-6}	E25-12	5.0 x 10^{-8}
E32-1	4.[illegible] x 10^{-8}		

(Table I-A Cont.)

Well	Concentration (μc/cc)	Well	Concentration (μc/cc)
200 West Area (prefixed by 299)			
W11-1	[illegible] x 10^{-7}	W22-10	2.2 x 10^{-5}
W11-2	[illegible] x 10^{-8}	W22-11	6.0 x 10^{-6}
W11-3	4.0 x 10^{-8}	W22-15	-
W11-4	[illegible] x 10^{-8}	W22-16	8.2 x 10^{-6}
W11-5	4.0 x 10^{-8}	W23-2	7.0 x 10^{-6}
W11-6	4.0 x 10^{-8}	W23-3	2.8 x 10^{-7}
W11-7	[illegible] x 10^{-7}	W22-12	2.3 x 10^{-6}
W11-8	[illegible] x 10^{-8}	W22-13	2.9 x 10^{-7}
W11-9	[illegible] x 10^{-8}	W22-14	2.3 x 10^{-6}
W11-10	[illegible] x 10^{-8}	W26-3	1.1 x 10^{-6}
W12-1	2.0 x 10^{-8}	W22-17	3.1 x 10^{-6}
W10-3	2.7 x 10^{-6}	W22-1	2.8 x 10^{-7}
W10-4	2.9 x 10^{-6}	W22-2	1.4 x 10^{-6}
W11-11	7.0 x 10^{-7}	W15-5	4.0 x 10^{-8}
W11-12	1.2 x 10^{-6}	W19-1	3.0 x 10^{-8}
W14-1	1.8 x 10^{-7}	W22-19	2.0 x 10^{-5}
W10-5	3.0 x 10^{-8}	W23-4	9.0 x 10^{-7}
W15-2	2.0 x 10^{-8}	W22-20	2.1 x 10^{-5}
W10-1	4.0 x 10^{-8}	W 6-1	3.0 x 10^{-8}
W10-2	-	W19-2	2.9 x 10^{-6}
W15-3	2.6 x 10^{-6}	W19-3	3.8 x 10^{-7}
W14-2	1.6 x 10^{-7}	W21-1	6.5 x 10^{-7}
W15-4	2.9 x 10^{-6}	W22-21	4.3 x 10^{-7}
W15-1	4.3 x 10^{-6}	W18-2	-
W23-1	1.3 x 10^{-7}	W18-5	2.0 x 10^{-8}
W22-4	1.0 x 10^{-7}	W15-6	3.0 x 10^{-8}
W22-18	3.3 x 10^{-4}	W18-1	6.0 x 10^{-8}
W22-5	1.2 x 10^{-4}	W18-3	6.0 x 10^{-8}
W22-6	-	W18-4	-
W22-7	1.5 x 10^{-6}	W19-4	4.0 x 10^{-8}
W22-8	3.5 x 10^{-7}	W22-22	1.0 x 10^{-7}
W22-9	3.4 x 10^{-6}	W22-23	1.3 x 10^{-7}
		W22-24	2.0 x 10^{-6}
300 Area Wells*			
399-3-2	7.0 x 10^{-8}	399-1-3	3.7 x 10^{-7}
399-3-3	-	399-1-4	1.2 x 10^{-7}
399-3-1	2.0 x 10^{-7}	399-8-2	1.0 x 10^{-8}
399-3-4	2.9 x 10^{-7}	399-6-1	7.0 x 10^{-8}
399-1-1	2.3 x 10^{-7}	399-4-1	1.2 x 10^{-7}
399-1-2	2.1 x 10^{-7}	399-5-1	5.0 x 10^{-8}
399-8-1	7.0 x 10^{-8}	399-8-3	5.0 x 10^{-8}

* Activity in these wells is in agreement with uranium analyses.

(Table I-A Cont.)

Well	Concentration (μc/cc)
600 Area Wells (prefixed by 699)	
S27-E14	5.0 x 10^{-8}
34-51	5.0 x 10^{-8}
25-55	6.0 x 10^{-8}
24-33	1.1 x 10^{-6}
19-45	5.0 x 10^{-8}
20-20	4.0 x 10^{-8}
35- 9	5.0 x 10^{-8}
8-32	2.0 x 10^{-8}
40-24	2.0 x 10^{-8}
40-33	5.0 x 10^{-8}
54-42	5.0 x 10^{-8}
47-60	3.0 x 10^{-8}
60-60	3.0 x 10^{-8}
63-90	-
59-80B	2.8 x 10^{-7}
43-89	4.0 x 10^{-8}
34-88	2.0 x 10^{-8}
25-80	-
35-70	2.0 x 10^{-8}
55-70	4.0 x 10^{-8}
49-79	2.0 x 10^{-8}
39-79	6.0 x 10^{-8}
35-78	4.0 x 10^{-8}
32-77	2.0 x 10^{-8}
36-61A	2.1 x 10^{-7}
34-39A	8.6 x 10^{-6}
45-69	4.0 x 10^{-8}
45-42	3.0 x 10^{-8}
50-30	1.0 x 10^{-8}
25-70	2.0 x 10^{-8}
55-89	-
71-52	-
70-68	-
41-62	5.0 x 10^{-8}
50-42	1.0 x 10^{-8}
14-27	4.0 x 10^{-8}
72-88	-
65-72	-
54-57	3.0 x 10^{-8}
51-50	4.9 x 10^{-6}
49-48	-

Well	Concentration (μc/cc)
S 8-19	4.0 x 10^{-8}
17- 5	-
2- 3	3.0 x 10^{-8}
S12- 3	4.0 x 10^{-8}
S31- 2	8.0 x 10^{-8}
8-17	4.0 x 10^{-8}
S 7-34	-
10-54	-
12-64	-
50-53	2.5 x 10^{-8}
61-66	4.0 x 10^{-8}
51-18	-
65-50	4.0 x 10^{-8}
47-35	3.0 x 10^{-8}
45-20	-
38-43	6.0 x 10^{-8}
28-41	6.0 x 10^{-8}
55-50C	3.0 x 10^{-8}
49-57	2.0 x 10^{-8}
42-42	4.0 x 10^{-8}
48-71	1.0 x 10^{-8}
51-63	2.0 x 10^{-8}
71-30	-
32-72	9.0 x 10^{-8}
32-75	3.0 x 10^{-7}
38-75	4.1 x 10^{-7}
35-66	5.0 x 10^{-8}
31-69	4.0 x 10^{-8}
31-73	4.0 x 10^{-8}
50-84	3.0 x 10^{-8}
11-45	-
65-25	4.0 x 10^{-8}
77-50	-
62-43	4.0 x 10^{-8}
S 6-E4F	6.0 x 10^{-8}
S 6-E4G	4.0 x 10^{-8}
S 6-E4H	3.0 x 10^{-8}
78-62	-
77-54	-
1-18	3.0 x 10^{-8}
83-47	-
74-44	-

(Table I-A Cont.)

Well	Concentration (μc/cc)	Well	Concentration (μc/cc)
42-12	-	55-76	2.0×10^{-8}
26-15	2.0×10^{-8}	55-95	3.0×10^{-8}
9E- 2	3.0×10^{-8}	S15-20	4.0×10^{-8}
31-53B	4.0×10^{-8}	38-65	2.0×10^{-8}
28-52	5.0×10^{-8}	44-64	3.0×10^{-8}
19-88	1.0×10^{-8}	36-61B	4.0×10^{-8}
33-56	2.1×10^{-7}	32-62	3.0×10^{-8}
24-46	3.0×10^{-8}	S11-E12	1.0×10^{-7}
2-33	-	S 3-E12	2.0×10^{-8}
14-40	2.0×10^{-8}	37-82A	6.0×10^{-8}
19-58	1.0×10^{-8}	37-82B	5.0×10^{-8}
20-82	2.0×10^{-8}	66-58	3.0×10^{-8}
17-47	3.0×10^{-8}	26- 8	-
17-70	-	57-83	6.0×10^{-8}
65-59	3.0×10^{-8}	22-38	1.0×10^{-8}