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EARTH SCIENCES' WASTE DISPOSAL MONITORING

ACTIVITIES SUMMARY, APRIL, 1956

By

EARTH SCIENCES PERSONNEL

Earth Sciences Unit
RADIOLOGICAL SCIENCES DEPARTMENT

HANFORD ATOMIC PRODUCTS OPERATION
RICHLAND, WASHINGTON

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EARTH SCIENCES' WASTE DISPOSAL MONITORING

ACTIVITIES SUMMARY, APRIL, 1956

INTRODUCTION

One hundred and eighty-nine water samples were taken from monitoring wells by Earth Sciences personnel during the month, and forty-seven additional samples were taken by Regional Monitoring personnel. The samples were analyzed by the Radioanalysis Laboratory using standard radiochemical procedures. Of these, thirty-three were analyzed to determine the concentration of certain isotopes of greatest concern while the remainder were analyzed for the gross concentration of beta-gamma emitters. Non-radioactive salt analyses were performed on one hundred and sixty-four samples in the Earth Sciences laboratory.

SUMMARY

Extensive movement of trace amounts of radioactive material in a southeast direction from waste disposal sites in 200-E Area was indicated by well sampling data. Evidence of radioactive material and stable ions characteristic of high-salt wastes was found as distant as 13 miles from the source. There is an indication that the flow of this material toward the southeast is being diverted or cut off by the rapidly growing ground water mound being developed from disposal of Purex cooling water. The estimated areas of detectable radioactive contamination are described in two maps at the end of this report.

MONITORING RESULTS AND EVALUATION

TABLE I

*321 CRIB SITE ACTIVITY DENSITIES
FOR MONTH OF APRIL

Well Number	Beta-Gamma Emitters Units of μc/cc	Alpha-Emitters Units of μc/cc
321-2	3×10^{-9}	2.1×10^{-9}
321-4	1.0×10^{-8}	2.5×10^{-9}
321-5	1.0×10^{-8}	6.1×10^{-9}
321-6	7×10^{-9}	[illegible]
321-7	1.0×10^{-8}	6×10^{-11}
321-8	5×10^{-9}	1.1×10^{-8}
321-9	5×10^{-9}	5×10^{-11}

*This site sampled monthly by Regional Monitoring

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There were no significant changes in the concentration of radioactive material in the 321 crib wells. Wells number 6 and 8 still contain alpha emitters in concentrations about three times background, probably reflecting the continued high river levels and resulting reverse gradient in the region.

TABLE II

*361-B REVERSE WELL AND 5-6 CRIB SITE ACTIVITY DENSITIES FOR THE MONTH OF APRIL

Well Number	Beta-Gamma Emitters Units of $\mu c/cc$	Alpha-Emitters Units of $\mu c/cc$
361-B-1	6×10^{-9}	2.7×10^{-9}
361-B-2	4×10^{-9}	4×10^{-10}
361-B-3	8×10^{-9}	1.8×10^{-9}
361-B-4	2.0×10^{-8}	7×10^{-10}
361-B-5	2.0×10^{-8}	2×10^{-10}
361-B-6	1.3×10^{-8}	1.5×10^{-9}
361-B-7	3.5×10^{-8}	5×10^{-10}
361-B-9	1.6×10^{-8}	1.5×10^{-9}
361-B-11	6×10^{-9}	5×10^{-10}

*This site sampled monthly by Regional Monitoring

The beta-gamma activity found in samples from seven of the 361-B area wells during March was no longer apparent in samples collected in April. This type of fluctuation in monitoring wells cannot be explained with assurance, but may represent a further shift in the direction of movement of the ground water as the mound beneath the Purex swamp continues to grow. These wells are located 3 - 5000 feet south and southeast of the BY crib site.

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TABLE III

241-B 2nd CYCLE CRIB SITE ACTIVITY DENSITIES AND NON-RADIOACTIVE SALT CONCENTRATIONS FOR MONTH OF APRIL

Well Number	Beta-Gamma Emitters Units of μc/cc					Alpha Emitters μc/cc	Non-Radioactive Salts	
	1st week	2nd week	3rd week	4th week	5th week		NA ppm	NO_3 ppm
224-B-4			$7.5x10^{-7}$		$2.8x10^{-7}$	$6.3x10^{-9}$	20	1,530
241-B-5		$2.6x10^{-3}$	$1.2x10^{-3}$	$7.2x10^{-3}$			>1,000	9,920
241-B-11		$5.0x10^{-2}$	$4.8x10^{-2}$	$5.2x10^{-2}$			>1,000	10,360
241-B-15		$1.1x10^{-2}$	$8.5x10^{-3}$	$1.5x10^{-2}$			32	2,786
241-B-16		$5.3x10^{-3}$	$6.0x10^{-4}$	$1.4x10^{-2}$			>1,000	8,460
241-B-17		$9.2x10^{-3}$	$5.5x10^{-3}$	$1.6x10^{-2}$			850	5,360
241-B-18			$5.5x10^{-6}$		$5.4x10^{-6}$	0	64	422
241-B-19			$3.2x10^{-4}$		$3.8x10^{-4}$	$1x10^{-10}$	160	6,360
241-BY-2							27	57
241-BY-8			$2.6x10^{-7}$		$1.7x10^{-7}$	$1x10^{-10}$	28	1.3
241-BY-9		0.10	0.10	$7.4x10^{-3}$			>1,000	7,330
241-BY-10		$5.6x10^{-3}$					180	1,200
241-BY-11		0.23	0.17	0.22			>1,000	21,200
241-BY-12		1.00	1.00	1.10			>1,000	112,000
241-BY-13		$4.5x10^{-2}$					640	6,710
241-BY-14			$3.9x10^{-7}$		$2.4x10^{-8}$	$1.1x10^{-9}$	31	25
241-BY-15		$1.2x10^{-3}$	$3.4x10^{-6}$		$1.2x10^{-6}$	$6x10^{-10}$	46	31
241-BY-16		$1.1x10^{-5}$	$5.5x10^{-7}$		$1.2x10^{-7}$	$8x10^{-10}$	23	5.5

Samples from well 224-B-4, 900 feet southeast of the nearest BY crib, showed a decrease in radioactive and non-radioactive contamination to 5 - 10% of the previous month's average. The beta-gamma emitter concentration in samples from the 241-B-5 well, 750 feet southeast of the BY-9 crib increased five-fold during the month. Samples collected from well 241-B-15, 550 feet east of the BY-2 crib contained only 17% of the sodium ion concentration present the previous month, but the beta-gamma emitter concentration remained at approximately the

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same level. Both radioactive and non-radioactive waste contamination decreased in the 241-BY-8 well to 0.5 - 1.0% of that present in March. The well is 800 feet southwest of the nearest BY crib. Samples from the 241-BY-14 well, 1800 feet southwest of the BY cribs revealed a beta-gamma emitter concentration decrease to about 5% of the previous month's average, while the nitrate ion concentration increased eight-fold. The sodium ion concentration in the 241-BY-13 well increased eight-fold over the February average. This well is adjacent to the west edge of the unused BY-8 crib. Samples from the 241-BY-14 well, 1800 feet southwest of the BY cribs, revealed a reduced concentration of beta-gamma emitters to about 5% of the previous month's average. During the same period the nitrate ion concentration increased nine-fold.

The above data are believed to substantiate the apparent shift in the direction of ground water movement in the area from the southeast to the south or southwest. The contamination formerly found in the BY-8 and BY-14 wells was evidently from the BX trenches. This material is being swept away but should soon be replaced by higher-level BY crib wastes. The sharply increased nitrate ion concentration in the BY-14 well indicates the approach of this material. The shift is ascribed to the influence of large-scale cooling water disposal from the Purex plant. The rate of movement is probably much lower than formerly and may be nearly halted.

TABLE IV

361-T REVERSE WELL SITE ACTIVITY DENSITIES AND NON-RADIOACTIVE SALT CONCENTRATIONS FOR MONTH OF APRIL

Well Number	Beta-Gamma Emitters Units of µc/cc					Alpha Emitters µc/cc	Non-Radioactive Salts	
	1st week	2nd week	3rd week	4th week	5th week		NA ppm	NO_3 ppm
241-T-361		$5.8x10^{-7}$	$5x10^{-8}$	$3.1x10^{-7}$		0.0	52	49
361-T-12		$1.7x10^{-7}$	$1.2x10^{-7}$	$1.6x10^{-7}$		0.0	22	0.0
361-T-14		$2.7x10^{-7}$	$3.2x10^{-7}$	$5.4x10^{-7}$		0.0	19	10.5
361-T-15		$6.5x10^{-7}$	$5.8x10^{-7}$	$4.4x10^{-7}$		0.0	15	75
361-T-16		$3.7x10^{-7}$	$2.9x10^{-7}$	$3.9x10^{-7}$		$3.8x10^{-9}$	60	1,110
361-T-17		$1.9x10^{-7}$	$1.9x10^{-7}$	$2.4x10^{-7}$		$1.4x10^{-9}$	120	690
361-T-18		$4.6x10^{-7}$	$2.4x10^{-7}$	$1.6x10^{-7}$		$2.4x10^{-9}$	82	1,100
361-T-19		$1.3x10^{-7}$	$1.5x10^{-7}$	$1.2x10^{-6}$		$4.0x10^{-9}$	90	41
361-T-22		$2.4x10^{-7}$	$2.2x10^{-7}$	$1.3x10^{-7}$		$1.6x10^{-9}$	17	410
361-T-23		$8.1x10^{-7}$	$2.3x10^{-7}$	$1.0x10^{-7}$		0.0	23	162
361-T-24							10	38

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After a period of little or no variation in the concentration of radioisotopes in the 361-T monitoring wells a strong decrease occurred in six of the eleven wells in this group. Wells 361-T-12, 361-T-15, 361-T-16, 361-T-17, 361-T-18, and 361-T-22 exhibited beta-gamma emitter concentration levels of 2 - 20% of the average for the previous month. These data are correlative with results listed in Table V for wells in an adjacent area.

TABLE V

241-T CRIB SITE ACTIVITY DENSITIES AND NON-RADIOACTIVE SALT CONCENTRATIONS FOR MONTH OF APRIL

Well Number	Beta-Gamma Emitters Units of µc/cc					Alpha Emitters µc/cc	Non-Radioactive Salts	
	1st week	2nd week	3rd week	4th week	5th week		NA ppm	NO_3 ppm
224-T-4		2.3×10^{-7}	3.1×10^{-7}	2.8×10^{-7}		0.0	15	<1
224-T-10							>1,000	16,500
241-T-15		5.0×10^{-6}	7.7×10^{-6}	8.8×10^{-6}		3.5×10^{-8}	900	4,400
241-T-16		6.1×10^{-5}	1.4×10^{-5}	4.9×10^{-5}		8.3×10^{-9}	560	2,200
241-T-17		3.5×10^{-5}	4.4×10^{-5}	4.7×10^{-5}		1.5×10^{-8}	550	3,600
241-T-18		3.0×10^{-7}	3.4×10^{-7}	4.3×10^{-6}		5×10^{-10}	19	14.2
241-T-19		6.3×10^{-7}	4.7×10^{-7}	7.2×10^{-7}		1.1×10^{-9}	25	496
241-T-20		0.0	0.0	5×10^{-8}		1×10^{-10}	12	112
241-T-21		4×10^{-8}	6×10^{-8}	1.0×10^{-7}		0.0	9	<1
231-2		1.6×10^{-7}	7×10^{-8}	8×10^{-8}		0.0	11	<1
241-TY-2		4.2×10^{-4}	2.0×10^{-4}	2.6×10^{-4}		1.1×10^{-8}	780	4,720
241-TY-5		1.4×10^{-6}	2.3×10^{-6}	1.3×10^{-6}		5.4×10^{-9}	--	1,640

Wells 224-T-4, 241-T-20, 241-T-21, and 231-2 exhibited beta-gamma emitter concentration levels of 2 - 50% of the average for March. Well 241-TY-2 had a beta-gamma emitter concentration 19-fold higher than the March average. This well is 950 feet south of the T-Plant second cycle crib. No consistent trend is evident from the changes observed in these wells or the changes found in the 361-T wells.

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TABLE VI

216-S CRIB SITES ACTIVITY DENSITIES AND NON-RADIOACTIVE SALT CONCENTRATIONS FOR MONTH OF APRIL.

Well Number	Beta-Gamma Emitters Units of $\mu c/cc$					Alpha Emitters $\mu c/cc$	Non-Radioactive Salts	
	1st week	2nd week	3rd week	4th week	5th week		NA ppm	NO_3 ppm
241-S-6				4.2×10^{-7}			20	12
241-S-12							23	66
241-S-14							72	31
241-S-15			1.0×10^{-7}	1.4×10^{-7}		2.1×10^{-9}	22	25
241-S-16			6.0×10^{-7}				28	11
241-S-17							25	4.6
241-SX-5			4.7×10^{-7}	1.3×10^{-7}		2.2×10^{-9}	23	12
241-SX-12			2.4×10^{-4}	1.0×10^{-5}		9.0×10^{-9}	23	17
Redox Crib #2		5.2×10^{-7}	0.0	2.3×10^{-7}		2×10^{-10}	24	<1
Redox Crib #3		9.8×10^{-8}	1.3×10^{-7}	7.6×10^{-8}		1.1×10^{-9}	31	<1
216-S-7#1		1.7×10^{-3}	1.5×10^{-3}	1.3×10^{-3}		1.7×10^{-8}	24	2

Samples from the 241-S-15 well and the 241-SX-5 well showed a decrease in beta-gamma emitter concentration to 8 - 15% of the average found during the previous month. These wells are believed to be located on the edge of a plume of contaminated ground water moving southeast from the 216-SX-1 crib. The same movement is believed to be responsible for a 2500-fold increase in beta-gamma emitter concentration in well 241-SX-12. The "Redox Crib #2 and #3" wells are monitoring wells adjacent to the Redox caverns. The beta-gamma emitter concentrations in these wells decreased to 3 - 8% of the average for March.

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TABLE VII

PUREX CRIBS ACTIVITY DENSITIES AND NON-RADIOACTIVE SALT CONCENTRATIONS FOR MONTH OF APRIL

Well Number	Beta-Gamma Emitters Units of μc/cc 1st week	2nd week	3rd week	4th week	5th week	Alpha Emitters μc/cc	Non-Radioactive Salts NA ppm	NO_3 ppm
241-A-1		1.2×10^{-7}		5×10^{-8}		9×10^{-10}	28	12.1
216-A-1Ø6	1.5×10^{-7}	2.0×10^{-7}		4×10^{-8}		1.1×10^{-8}	31	12.6
216-A-5Ø12		1.5×10^{-7}		6×10^{-8}		1.6×10^{-9}	31	25.5
216-A-6Ø17			2.1×10^{-6}	6.1×10^{-7}			42	11.3
2 - 3			1.0×10^{-7}	5×10^{-8}		2.4×10^{-9}	20	4
8 - 32	3.2×10^{-7}		1.7×10^{-7}	6×10^{-8}		1.5×10^{-9}	15	7.8
8 - 17	1.8×10^{-7}		1.1×10^{-7}	7×10^{-8}		5×10^{-10}	19	1.0
19 - 43	1.7×10^{-7}		8.1×10^{-7}	9×10^{-8}		0.0	19	< 1
20 - 20	4×10^{-8}		1.0×10^{-7}	0.0		0.0	270	360
24 - 33	2.3×10^{-7}		1.8×10^{-7}	1.2×10^{-7}		8×10^{-10}	23	1.2
31 - 30	1.0×10^{-7}		1.6×10^{-7}	1.3×10^{-7}		1.2×10^{-9}	28	9.8
34 - 39	4.8×10^{-7}		1.8×10^{-7}	1.1×10^{-7}		9×10^{-10}	31	12.1
38 - 43			3.1×10^{-7}	2.1×10^{-7}		0.0	21	< 1
S8 - 19			1.2×10^{-7}	4×10^{-8}		2×10^{-10}	25	< 1
S12 - 3			2.2×10^{-7}	9×10^{-8}		9×10^{-10}	23	< 1
34 - 39		1.3×10^{-6}	9.8×10^{-7}	4.6×10^{-7}		0.0	20	< 1
45 - 69		3.2×10^{-7}	1.7×10^{-7}	9×10^{-8}		7×10^{-10}	15	24.9
28 - 41							30	9.2

Wells 241-A-1, 241-A-1Ø6, and 241-A-5Ø12 show decreases in beta-gamma emitter concentration to 1 - 3% of the average for the previous month. The material sampled in these wells is believed to originate at the HY cribs. The decreases evident this month are believed to represent a diversion of the southeastward movement of this material, probably into a more southerly direction, as a result of the reconstruction of the B-swamp mound by Purex operation. The wells

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southeast of 200-E Area that have also contained traces of scavenged waste from the BY cribs are apparently being cut off from the flow from this crib. These wells have recently undergone a very sharp decrease in nitrate ion concentration. The rising Purex Mound is probably responsible for this effect.

TABLE VIII

CRITICAL MONITORING WELLS - FISSION PRODUCT ANALYSES FOR MONTH OF APRIL

Well Number	CESIUM ACTIVITY DENSITY Units of 10^{-7} $\mu c/cc$				STRONTIUM ACTIVITY DENSITY Units of 10^{-7} $\mu c/cc$			
	1st week	2nd week	3rd week	4th week	1st week	2nd week	3rd week	4th week
241-BY-9		52		< 7.4		< 2.0	< 2.0	< 2.0
241-BY-11		72		< 7.4		< 2.0	< 2.0	< 2.0
241-BY-12		1000		< 7.4		< 2.0	< 2.0	< 2.0
241-S-12		< 7.4	< 7.4	< 7.4		< 2.0	< 2.0	< 2.0
241-S-14		< 7.4	< 7.4	< 7.4		< 2.0	< 2.0	< 2.0
241-B-5		< 7.4	< 7.4	< 7.4		< 2.0	< 2.0	< 2.0
241-B-11		< 7.4	< 7.4	< 7.4		< 2.0	< 2.0	< 2.0
241-B-15		< 7.4	< 7.4	< 7.4		< 2.0	< 2.0	< 2.0
241-B-16		< 7.4	< 7.4	< 7.4		< 2.0	< 2.0	< 2.0
241-B-17		< 7.4	< 7.4	< 7.4		< 2.0	< 2.0	< 2.0
224-T-10		< 7.4	< 7.4	< 7.4				< 2.0

The 241-BY-12 well underwent an 8-fold increase in Cs^{137} early in the month followed by a sharp decrease. This well is adjacent to the west edge of the 216-BY-4 crib. The 241-B-11 well had but 8% of the Cs^{137} concentration found in the well during the previous month. This well is about 700 feet southeast of the nearest BY crib. These changes may also reflect a shift in the direction of ground water movement in the 200-E Area as a result of the growth of the Purex Mound.

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TABLE IX

241-BC CRIB SITE ACTIVITY DENSITIES AND NON-RADIOACTIVE SALT CONCENTRATIONS FOR MONTH OF APRIL

Well Number	Beta-Gamma Emitters Units of $\mu c/cc$					Alpha Emitters 10^{-9} $\mu c/cc$	Non-Radioactive Salts	
	1st week	2nd week	3rd week	4th week	5th week		NA ppm	NO_3 ppm
241-BC-1	$1.0x10^{-7}$		$2.6x10^{-7}$	$1.2x10^{-7}$			23	< 1
241-BC-2	$9.5x10^{-7}$		$8.5x10^{-7}$	$5x10^{-8}$			20	< 1
241-BC-3	$2.0x10^{-7}$		$3.4x10^{-7}$	$1.9x10^{-7}$			18	< 1
241-BC-4	$5.0x10^{-7}$		$1.1x10^{-6}$	$3.7x10^{-7}$			25	< 1
241-BC-5	$1.7x10^{-7}$		$4.7x10^{-7}$	$6x10^{-8}$			19	< 1
241-BC-6	$5.4x10^{-7}$		$7.3x10^{-7}$	$3.6x10^{-7}$			18	< 1

There was no significant change in the concentration of contaminants in the BC crib monitoring wells.

WELL DRILLING

U.S.G.S. drilling crews completed 195 feet of wells remaining from those budgeted in FY 1955 and 1118 feet of wells budgeted in FY 1956. A total of 1611 feet of the 5000 feet budgeted in FY 1956 has now been completed.

The lump-sum well drilling contractor, The Strasser Drilling Co., completed 720 feet of drilling this month for a total of 1702 feet drilled to date. The contractor is about 20% behind schedule on his 5000-foot drilling contract.

TABLE X

Well Number	Drilled This Month (feet)	Date Started	Date Finished	Total Depth (feet)
U.S.G.S				
14 - 27	195	3/1/56	4/11/56	350
20 - 41	175	4/16/56	--	175
361-T-24	265	3/20/56	4/13/56	307
361-T-25	148	4/17/56	--	148
241-S-16	69	3/15/56	4/4/56	310
241-S-17	286	4/6/56	4/18/56	286
241-S-18	175	4/23/56	--	175
Lump-Sum Contractor				
241-SX-12	125	3/21/56	3/27/56	125
216-A-8#1	289	3/29/56	4/17/56	289
216-A-8#2	204	4/10/56	--	204
216-A-8#3	103	4/18/56	--	103

LABORATORY WORK

Hydrological research was performed to accumulate basic information for expressing mathematically the behavior of water in a ground water mound. To derive an equation relating the height (h) of the water table to the distance along a flow path for one dimensional flow it is necessary to introduce an assumed condition of continuity of the dependent variable and apply to the Darcy equation for ground water movement. If the continuity of the dependent variable, microscopic velocity, is assumed, i.e.:

$$\frac{\partial V}{\partial X} = 0,$$

the equation is derived in the form

$$h_1 = h_2 - \frac{(h_2 - h_3)(X_1 - X_2)}{X_3 - X_2} \qquad (1)$$

where h_1, h_2, and h_3 represent ground water elevations at points X_1, X_2, and X_3. If the continuity of the dependent variable quantity flow rate (Q) is assumed, i.e.:

$$\frac{\partial Q}{\partial X} = 0,$$

the equation is derived in the form

$$h_1^2 = h_2^2 - \frac{(h_2^2 - h_3^2)(X_1 - X_2)}{X_3 - X_2}. \qquad (2)$$

Thus, it was possible to test the validity of the two assumptions by measuring the relative heights of points on a water mound in a sand-box model. Data collected from such model studies have been found to fit equation (2) much better than equation (1), indicating that the assumption of an equation of continuity of the quantity flow rate is more valid than that for the macroscopic velocity. This information will be useful in further derivations of hydrologic formulas.

A large amount of data regarding the fluctuation of ground water levels in wells was examined to determine transmissibilities. The technique involves comparing the water level records to reported river level changes and applying a standard formula to the cyclic changes to calculate transmissibilities. Much of the data is from old records, but a special effort is being made to collect water level fluctuation data during the 1956 high river stage. Most of the wells in which the fluctuations are significant are located within two miles of the river. Thus, the operating areas for which transmissibility information can be so obtained are the reactor areas and the 300 Area. The calculated transmissibilities are, of necessity, very general in character, representing the average characteristic of a rather large region. The calculations show a transmissibility of about 1.4×10^6 gal/day/ft near Riverland, increasing to about 4.3×10^6 gal/day/ft midway between Riverland and 100-B, and decreasing sharply to about 6.9×10^5 gal/day/ft at 100-B. The transmissibility appears to increase again in the area between 100-D and 100-H to about 1.0×10^4 gal/day/ft, decreasing again at 100-F to about 6.0×10^5 gal/day/ft. All of these transmissibilities are expressed on unit gradient. It is emphasized that they are broad averages and should be applied with caution to specific points within the region. As was discovered earlier, the aquifer supplying water to the region just north of Gable Mountain was found to have a relatively high transmissibility of about 5.1×10^6 gal/day/ft on unit gradient.

The desorption of radioisotopes from soil by various organic solvents was measured. A sample of 200-E soil was equilibrated with a solution containing radio-strontium, radio-cesium, and plutonium. The mixture was then centrifuged and the supernatant decanted from the soil. The soil was then washed twice with water, being separated from the solution each time by centrifuging. The drained soil was then dried overnight and the decanted solution and both wash waters were combined and analysed for the radioisotopes being studied. Essentially 100% of the Cs and Pu and about 95% of the Sr was taken up on the soil. Aliquots of the dried soil were then treated with each of four organic solvents: Soltrol, Shell Spray Base, Hexone, and 20% TBP in Shell Spray Base. The treatment consisted of shaking, centrifuging, and decanting. No significant amount of any of the isotopes was removed from the soil by any of the solvents tested.

Additional infiltration rate experiments were conducted on soil samples obtained from the Redox cavern spoils pile. The tests differed from previous experiments in that raw water containing significant amounts of suspended solids was used in place of filtered tap water. The infiltration rate of the raw water into the soil column decreased significantly with time but increasing the calcium ion concentration in the water produced no improvement in the infiltration rate.

Samples from seven tanks of waste were evaluated to measure the volume that could be passed through a soil column before breakthrough of long-lived isotopes occurred. Samples from waste tanks 28-108-BY, 29-110-BY, 30-106-BY, and 31-107-BY showed no breakthrough of radio-strontium or radio-cesium in three column volumes. A sample of tank-scavenged waste from 5-11C-10C-105C showed rapid breakthrough of radio-strontium, probably because of aluminum ion interference. A sample of tank scavenged waste from 6-112C-105C was found to be essentially aluminum free and did not produce strontium breakthrough in three column volumes; however, cesium breakthrough occurred within two column volumes. A composited sample of scavenged first-cycle waste from the 5-101-TY tank showed no significant breakthrough of strontium after five column volumes, but cesium breakthrough occurred after one column volume. The very low initial concentration of Cs^{137} resulted in a concentration in the effluent of no more than 0.1 of the Handbook 52 MPC value after four column volumes. The presence of Co^{60} in several of the process wastes introduced a new factor that must be considered in supplying data to permit evaluation for ground disposal. The difficulty in obtaining analyses has delayed final evaluation of this factor on some of the wastes.

An attempt is underway to evaluate the distribution coefficient (K_d) for critical radioisotopes by an equilibrium technique and to relate this value to existing ion exchange equations for estimating the disposal volume. The determination of the K_d values for cesium and strontium in 10 samples of 26-105-BY scavenged waste resulted in standard deviations of 72% and 29% respectively for two-gram samples of whole soil weighed on a torsion balance. If the soil was separated into two fractions (0.25 - 2.0 mm and <0.25 mm) and a proportionate amount of each fraction weighted separately on an analytical balance to make a total of two grams, the standard deviations were reduced to 9.5% and 4.0% for cesium and strontium, respectively. The large error obtained for K_d using the whole soil (<2 mm.) sample probably can be attributed to the difficulty of obtaining a uniform particle size distribution in each sample.

Tests were performed to evaluate the effect of small amounts of bentonite clay added to drilling mud on the mechanical analyses of drilled samples from the well. The clay was used in drilling the first forty feet of 241-SX-12 well to stablize the hole during drilling. Mechanical analyses of four samples from the 241-SX-12 well were compared with ten samples from wells drilled in the same area in previous years. A summary of the data is given in Table XI.

[redacted]

TABLE XI

PERCENTAGE OF 2μ CLAY IN WELL SAMPLES

Well	Depth in Feet			
	10	20	30	40
241-SX-12	8.7	6.7	3.7	0
241-SX-2	5.1	3.4	4.3	2.9
241-S-4	5.7	-	5.5	-
241-S-5	-	7.0	-	4.0
241-S-6	5.1	-	5.6	-
4 Well Ave.	5.3	5.2	5.1	3.5

The data do not indicate a significant difference in clay content due to the addition of bentonite in the drilling slurry.

[redacted]

[redacted] **DECLASSIFIED**

GROUND WATER CONTAMINATION FROM 200 EAST AREA CRIB SITES

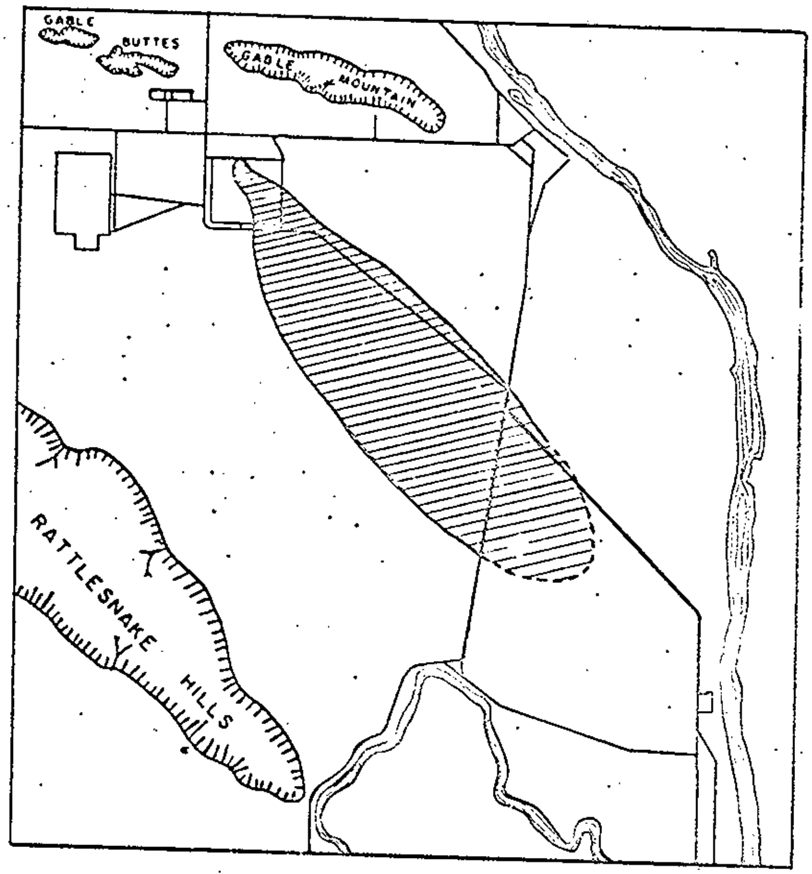

Figure 1

APPROXIMATE AREA OF KNOWN GROUND WATER CONTAMINATION AS OF APRIL 30, 1956.

[redacted]

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GROUND WATER COMTAMINATION FROM 200 WEST AREA CRIB SITES

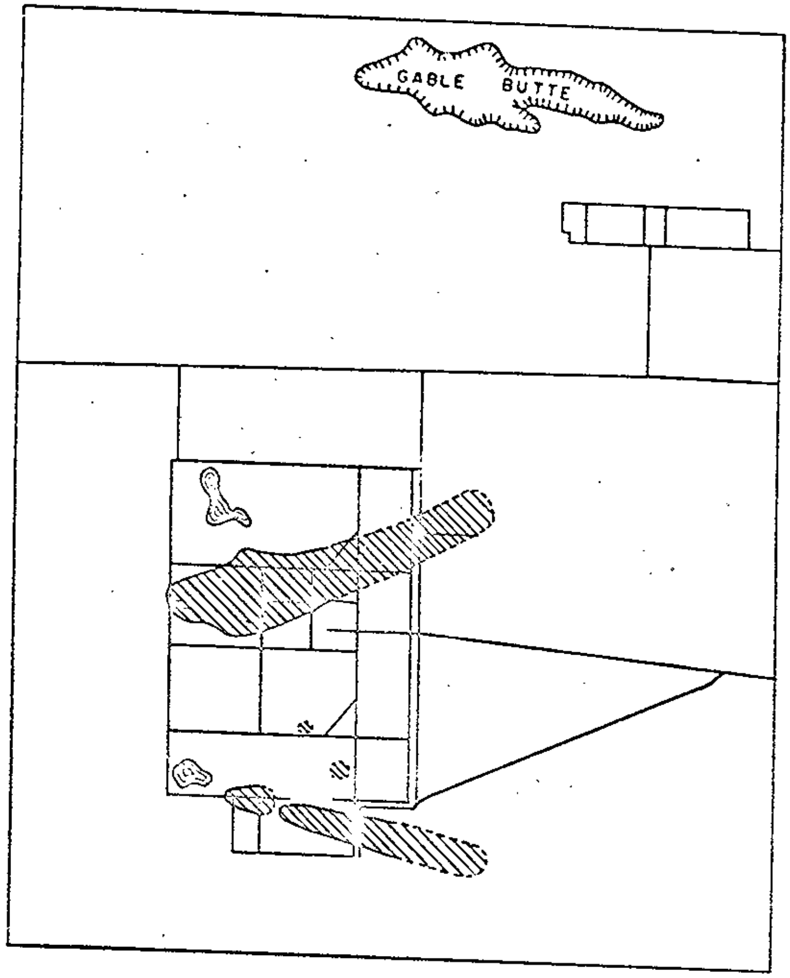

Figure 2

APPROXIMATE AREA OF KNOWN GROUND WATER CONTAMINATION AS OF APRIL 30, 1956