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FINAL REPORT: PRODUCTION TEST IP-719
THE EFFECT OF WATER PLANT VARIABLES
ON EFFLUENT ACTIVITY

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THE EFFECT OF WATER PLANT VARIABLES
ON EFFLUENT ACTIVITY

INTRODUCTION

One source of the parent materials which are converted into the radioisotopes in reactor effluent is the impurity content of Columbia River water. It has been demonstrated that as the efficiency of removal of the radioisotope parent materials increases, the amount of radioisotopes in the reactor effluent decreases. An example of this is the activity reduction which results from the use of high alum feed. In order to determine whether effluent activity would be influenced by the length of filter run, a half-plant test was initiated at DR Reactor on September 28, 1964, under the authorization of Production Test IP-719¹. This report presents the results of the test.

SUMMARY

The water treatment plant at DR Reactor was operated for a three-month period with half the filters on a seven-hour filter cycle and the other half on a 5.25-hour filter cycle. The shorter filter cycle did not significantly reduce either the filtered water turbidity or the P³² and As⁷⁶ concentration in the reactor effluent. It can be concluded that in the range investigated effluent activity is not influenced by the length of filter cycle as long as breakthrough is avoided.

1. R. G. Geier. Production Test IP-719, The Effect of Water Plant Variables on Effluent Activity, HW-83829. September 1, 1964.

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RL-REA-687
Page 3

DISCUSSION

A. Filter Operation

During the test which began September 28, 1964 and continued until December 30, 1964, the filters on the control side of DR Reactor were operated in the normal manner. That is, the operating time between filter backwashes was the maximum which would produce reactor quality water. Throughout the test period the length of filter runs on the test side was seven hours. On the test side the length of filter run was arbitrarily fixed to be 25 per cent less than on the control side. Thus, the test side filter run time was 5.25 hours. Other filter variables such as backwash time and backwash flow rate were kept the same on the two sides.

B. River Conditions

A tabulation of daily river pH and turbidity measurements during the test is given in Table I. Monthly averages were:

	<u>River pH</u>	<u>River Turbidity, ppm</u>
October, 1964	8.39	6.5
November, 1964	8.09	5.1
December, 1964	8.26	5.0

C. Water Plant Chemical Treatment

The nominal 18 ppm alum feed rate was maintained throughout the test. The water plant operated to produce pH 7.0 water, and this was used in the reactor without additional adjustment from September 28 to October 20. During the remainder of test, the pH of the coolant was reduced to 6.6 by sulfuric acid addition to the filter effluent flume.

Daily measurements of alum feed rate and coolant pH are given in Table I. A sodium dichromate feed rate of 1.0 ppm was used.

D. Filtered Water Turbidity

Average daily filtered water turbidity measurements from each side of the reactor are given in Table I for October and November. The monthly averages were:

	<u>Filtered Water Turbidity</u>	
	<u>Test</u>	<u>Control</u>
October	0.0058	0.0065
November	0.0051	0.0053

It appears that the shortened filter run had no significant effect on filtered water turbidity.

E. Effluent Radioactivity

During the test, the reactor effluent from each side was sampled each week day during operation and analyzed for phosphorus-32 and arsenic-76. Detailed results are given in Table I, and the monthly averages were:

	<u>Phosphorus-32</u> pc/ml		<u>Arsenic-76</u> pc/ml	
	<u>Test</u>	<u>Control</u>	<u>Test</u>	<u>Control</u>
October	4.6	4.6	64	61
November	7.5	8.3	77	66
December	10.5	10.4	104	102

The results indicate an upward trend. This was common to all of the small reactors during the period. Since there was essentially no difference in the results from the two sides, it can be concluded that in the range investigated, filter run time did not influence effluent radioactivity.

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RL-REA-687
Page 5

TABLE I
OPERATING DATA OBTAINED DURING
WATER PLANT VARIABLES TEST

	Raw Water pH	Raw Water Turbidity, ppm	Alum Feed, ppm	Coolant pH	Filtered Water Turbidity		Phosphorus-32 pc/ml		Arsenic-76 pc/ml	
					Test	Control	Test	Control	Test	Control
9-28	8.26	5	17.8	6.94	.004		3.5	5.8	56	30
29	8.41	6	17.0	6.92	.005		1.8	1.9	52	51
30	8.36	9	18.1	6.93	.006		2.8	2.4	50	56
10-1	8.38	7	17.5	6.96	.0047	.0056	2.4	2.5	55	63
2	8.43	"	17.6	6.93	.0055	.0057	3.9	1.4	82	67
3	8.46	"	19.1	6.92	---	---	---	---	---	---
4	8.52	6	18.1	6.94	.0045	.0046	---	---	---	---
5	8.53	7	18.3	6.95	.0047	.0049	---	---	---	---
6	8.54	"	17.5	6.95	.0063	.0073	---	---	65	56
7	8.42	"	19.3	6.95	.0060	.0065	---	---	---	---
8	8.56	"	14.0	6.94	.0064	.0060	---	---	---	---
9	8.46	"	20.0	6.93	.0065	.0079	5.5	5.0	47	40
10	8.42	"	15.9	6.93	.0067	.0068	---	---	---	---
11	8.40	6	17.1	6.92	---	---	---	---	---	---
12	8.40	7	17.4	6.96	.0064	.0078	---	---	---	---
13	8.38	"	18.2	6.95	.0080	.0080	2.1	2.3	---	---
14	8.30	5	17.5	6.94	.0073	.0085	5.6	4.4	51	70
15	8.33	6	17.5	6.92	.0063	.0074	3.1	2.4	59	58
16	8.35	7	18.6	6.94	.0065	.0075	3.7	3.4	69	63
17	8.39	"	20.4	6.94	.0056	.0060	---	---	---	---
18	8.39	"	20.2	6.94	.0054	.0065	---	---	---	---
19	8.36	"	20.4	6.93	.0051	.0065	3.6	6.0	56	66
22	8.35	"	13.8	6.69	.0054	.0070	---	---	---	---
23	8.33	"	17.6	6.64	.0052	.0068	6.1	6.5	68	60
24	8.37	5	19.5	6.63	.0057	.0066	---	---	---	---
25	8.39	"	19.4	"	.0062	.0064	---	---	---	---
26	8.26	"	19.8	6.62	.0066	.0067	5.6	6.1	91	85
28	8.32	7	21.1	6.63	.0050	.0060	---	---	---	---
29	8.19	6	20.4	6.65	.0060	.0058	5.9	6.0	26	23
30	8.25	"	19.8	"	.0048	.0049	7.2	9.1	93	83
31	8.21	"	19.9	"	.0053	.0056	---	---	---	---

TABLE I (Cont'd)

	Raw Water pH	Raw Water Turbidity, ppm	Alum Feed, ppm	Coolant pH	Filtered Water Turbidity		Phosphorus-32 pc/ml		Arsenic-76 pc/ml	
					Test	Control	Test	Control	Test	Control
11-1	8.22	7	19.9	6.63	.0050	.0060	---	---	---	---
2	8.23	6	18.5	6.64	.0050	.0050	3.9	8.4	89	95
3	8.13	"	17.6	6.62	.0050	.0060	4.2	8.5	52	45
4	8.13	5	17.2	6.54	.0055	.0056	6.5	9.2	35	39
5	8.16	"	17.1	6.63	.0055	.0053	8.1	8.7	103	98
6	8.15	"	17.5	6.66	.0053	.0055	5.1	7.7	57	54
7	7.94	"	17.1	6.60	.0039	.0047	---	---	---	---
8	8.08	"	17.2	"	.0039	.0045	---	---	---	---
9	8.01	"	17.1	6.64	.0042	.0049	7.7	9.7	70	69
10	8.01	"	17.3	6.60	.0040	.0044	8.1	8.6	58	68
11	8.07	"	17.2	6.61	.0040	.0045	9.2	6.4	62	61
12	8.06	"	"	"	.0040	.0039	6.5	6.8	82	60
13	8.08	"	17.3	"	.0055	.0057	7.1	8.4	72	73
14	8.13	"	17.7	6.64	.0040	.0040	---	---	---	---
15	8.10	"	17.7	6.62	.0052	.0055	---	---	---	---
16	8.05	"	17.8	6.65	.0045	.0044	---	---	---	---
17	8.08	"	17.6	6.66	.0053	.0043	9.6	7.5	75	55
18	8.06	"	18.5	6.65	.0055	.0048	8.7	6.7	94	59
19	8.04	"	17.8	"	.0057	.0045	8.2	7.8	81	67
20	8.07	"	17.5	6.60	---	---	---	---	---	---
21	8.25	-	18.6	6.68	.0045	.0045	---	---	---	---
22	8.23	-	17.7	6.65	.0049	.0049	---	---	---	---
23	8.07	-	18.2	6.62	.0053	.0057	---	---	---	---
24	8.06	5	17.0	6.59	.0072	.0074	---	---	---	---
25	8.03	4	20.1	6.60	.0047	.0063	10.3	10.3	---	---
26	8.07	4	20.7	6.61	.0056	.0066	---	---	---	---
27	8.05	5	20.7	6.67	.0058	.0066	---	---	---	---
28	8.07	"	20.1	6.62	.0060	.0059	---	---	---	---
29	8.04	"	20.6	6.60	.0070	.0056	---	---	---	---
30	8.06	"	20.5	6.62	.0071	.0056	9.3	9.6	142	77
12-1	8.08	"	20.8	6.59	.008	.008	---	---	---	---
2	8.11	"	20.8	6.62	.006	.006	9.9	10.0	55	62
3	8.16	"	20.7	"	"	"	12.8	11.7	156	120
4	8.12	5	20.8	"	"	"	---	---	---	---

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