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DUN--7211

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REACTOR EFFLUENT WATER ANALYTICAL DATA

JANUARY - JUNE 1970

A. P. Larrick

August 17, 1970

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REACTOR EFFLUENT WATER ANALYTICAL DATA

JANUARY - JUNE 1970

This report contains all of the analytical results from cooling water effluent samples from KE and KW Reactors for the first six months of 1970. The results are reported in pCi/ml ($p = 10^{-12}$) corrected to the time of sampling. Sampling at the KW Reactor was discontinued on February 1, 1970 due to shutdown of the reactor. There were not any radionuclides released from KE Reactor during February, 1970 due to an extended shutdown.

P-32, As-76, Cr-51, Np-239, Zn-65, Sc-46, Mn-56, and I-131 concentrations are reported. The effluent samples are obtained from the top of each riser of the reactors. Grab samples are taken daily, Monday through Friday, at about 8 A.M. from a continuously flowing sample line and analyzed for P-32, As-76, Cr-51, Sc-46, and Np-239.

An automatic compositor accumulates a one-week sample (Tuesday - Tuesday, 8 A.M.) at intervals of five to fifteen minutes which is analyzed for Zn-65 and I-131. The samples are calculated to the middle of the sample period.

The sample concentrations have been averaged for each month to represent the average concentration of each reactor's effluent water. The standard deviation, $\sigma = \sqrt{\frac{n\sum X^2 - (\sum X)^2}{n^2}}$, has been added as an indication of the spread of

the data distribution. From the average concentrations and the reactor's total water flow for the month, the quantity of each radionuclide discharged during the month has been calculated and is reported in curies/day released.

The concentration of each isotope at the Ringold boundary site has been calculated using appropriate dilution and decay factors. For all cases the concentrations at Ringold are well below the 10CFR20 limits for concentrations in uncontrolled areas.

A. P. Larrick

A. P. Larrick, Senior Engineer
Reactor Materials Subsection

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DAILY EFFLUENT RISER ANALYSES - JANUARY 1970
(Units of pCi/ml Corrected to Sampling Time)

Date	Arsenic-76		Phosphorous-32	
	KE	KW	KE	KW
1	H	H	H	H
2	56	*	4.3	*
5	38	*	2.9	*
6	49	*	4.5	*
7	50	*	3.5	*
8	41	*	*/*	*
9	43	*	3.2	*
12	52	96	1.5	6.1
13	39/50	78	1.6/3.4	5.6
14	48/46	83	1.3/1.1	4.2
15	*/*	80	*/*	3.8
16	*/*	86	*/*	3.0
19	35	38	2.5	2.2
20	25	32	2.2	5.5
21	38	37	2.3	3.1
22	54	108	1.6	2.4
23	56	56	1.9	1.6
26	30/27	35	3.1/0.9	1.6
27	28/31	39	2.9/1.2	2.4
28	32/37	43	1.9/0.9	2.5
29	29/27	31	2.1/1.1	2.2
30	25/22	28	2.7/1.2	2.1
Average	38.76	58.00	2.23	3.22
Standard Deviation, σ	10.50	26.45	1.01	1.43

Date	Chromium-51		Neptunium-239	
	KE	KW	KE	KW
1	H	H	H	H
2	78	*	64	*
5	85	*	56	*
6	84	*	66	*
7	63	*	73	*
8	*/*	*	*/*	*
9	99	*	54	*
12	87	86	48	54
13	80/105	94	42/49	56
14	78/99	93	41/50	58
15	*/*	92	*/*	56
16	*/*	93	*/*	62
19	75	90	34	61
20	75	83	39	59
21	72	91	40	54
22	71	87	39	55
23	81	66	53	36
26	65/83	89	37/44	58
27	69/85	94	35/41	62
28	61/80	83	36/35	58
29	69/76	93	34/39	58
30	82/64	92	39/35	56
Average	70.2	78.00	40.1	49.6
Standard Deviation, σ	26.44	29.22	17.1	18.9

* - reactor shutdown
H - holiday

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DAILY EFFLUENT RISER ANALYSES - JANUARY 1970
(Units of pCi/ml Corrected to Sampling Time)

<u>Date</u>	<u>Scandium-46</u>	
	<u>KE</u>	<u>KW</u>
1	H	H
2	8.4	*
5	6.6	*
6	7.7	*
7	6.4	*
8	*/*	*
9	7.7	*
12	7.6	9.9
13	6.4/8.4	12
14	6.1/7.3	8.4
15	*/*	6.3
16	*/*	7.1
19	7.4	8.6
20	7.5	14.0
21	7.4	6.7
22	6.8	7.5
23	5.8	5.8
26	7.2/8.6	*
27	6.8/9.6	6.6
28	5.8/6.5	7.6
29	7.6/7.9	8.3
30	11/8.4	7.1
Average	7.05	8.41
Standard Deviation, σ	3.1	2.1

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KE REACTOR DAILY EFFLUENT RISER ANALYSES - MARCH 1970
(Units of pCi/ml Corrected to Sampling Time)

<u>Date</u>	<u>³²P</u>	<u>⁷⁶As</u>	<u>²³⁹Np</u>	<u>⁵¹Cr</u>	<u>⁴⁶Sc</u>
23	*/*	*/*	*/*	*/*	*/*
24	3.8/4.0	34/46	25/30	39/54	5.1/5.5
25	4.3/4.7	42/54	29/34	43/56	5.1/8.0
26	*/*	*/*	*/*	*/*	*/*
27	*/*	*/*	*/*	*/*	*/*
30	4.5/4.9	50/56	33/42	54/81	8.7/8.9
31	4.2/5.8	52/71	34/45	54/78	9.4/11
Average	4.5	50.6	34.0	57.4	7.7
Standard Deviation, σ	0.6	10.2	6.2	13.9	2.1

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DAILY EFFLUENT RISER ANALYSES - APRIL 1970
(Units of pCi/ml Corrected to Sampling Time)

<u>Date</u>	<u>³²P</u>	<u>⁷⁶As</u>	<u>⁵¹Cr</u>	<u>²³⁹Np</u>	<u>⁴⁶Sc</u>	<u>⁵⁶Mn</u>
1	4.9/5.7	63/75	60/77	39/49	11/13	
2	4.1/5.0	60/73	44/85	34/59	4.0/23	
3	3.5/3.9	55/88	58/73	41/54	4.4/5.2	
6	*/*	*/*	*/*	*/*	*/*	
7	*/*	*/*	*/*	*/*	*/*	
8	*/*	*/*	*/*	*/*	*/*	
9	*/*	*/*	*/*	*/*	*/*	
10	*/*	*/*	*/*	*/*	*/*	
13	4.1	53	55	46	6.0	
14	2.2	49	66	49	4.4	
15	6.2	62	64	53	8.5	9300
16	7.0	69	73	52	6.2	
17	6.5	69	62	51	5.1	
20	7.2	69	67	50	5.0	
21	7.3	67	67	50	6.3	
22	7.4	65	70	52	10	
23	7.0	73	67	49	6.0	
24	9.6	**/69	*/79	*/56	*/1.3	2989
27	9.7	67.6	72	60	5.7	
28	7.0	65.7	67	57	5.9	
29	7.1	64	77	60	5.4	
30	5.2	79	76	62	6.0	
Average	6.03	66.77	67.9	51.1	7.12	
Standard Deviation, σ	1.9	8.7	9.2	7.1	8.8	

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DAILY EFFLUENT RISER ANALYSES - MAY 1970
(Units of pCi/ml Corrected to Sampling Time)

<u>Date</u>	<u>⁷⁶As</u>	<u>³²P</u>	<u>²³⁹Np</u>	<u>⁵¹Cr</u>	<u>⁴⁶Sc</u>
1	69	5.2	61	74	5.9
4	42	2.9	70	81	7.3
5	66	3.6	58	63	6.3
6	63	1.4	70	84	8.1
7	31	3.4	56	70	9.5
8	59	1.8	76	83	8.7
11	*	*	*	*	*
12	*	*	*	*	*
13	*	*	*	*	*
14	*	*	*	*	*
15	*	*	*	*	*
18	*	*	*	*	*
19	*	*	*	*	*
20	43	4.0	48	57	9.6
21	62	4.0	78	101	*
22	65	2.6	47	52	3.8
25	55	1.4	82	75	7.0
26	83	1.6	78	75	10.0
27	44	1.1	76	76	6.7
28	85	1.2	76	66	6.9
29	*	1.5	79	78	6.8
Average	59	2.55	68.2	73.9	7.43
Standard Deviation, σ	15.3	1.3	11.5	11.8	1.7

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DAILY EFFLUENT RISER ANALYSES - JUNE 1970
(Units of pCi/ml Corrected to Sampling Time)

<u>Date</u>	<u>⁷⁶As</u>	<u>³²P</u>	<u>²³⁹Np</u>	<u>⁵¹Cr</u>	<u>⁴⁶Sc</u>	<u>⁵⁶Mn</u>
1	46	1.5	86	82	8.5	
2	26/32	1.4/1.7	**288/165 *** 86/104	**83/79 ***79/115	**12/2.4 ***5.5/*	
3	*/*	*/*	*	*	*	
4	*/*	*/*	*	*	*	
5	18/41	0.82/3.5	62/71	56/82	6.5/6.2	
8	33/*	1.2	92	86	5.6	
9	36	1.0	89	88	6.6	6970
10	47	1.0	92	91	7.6	5290
11	46	1.3	91	94	6.9	6280
12	59	1.5	97	94	7.6	8740
15	52	1.7	123	115	8.5	5840
16	46	1.2	102	102	6.0	6190
17	42	1.8	107	108	8.7	5770
18	23	2.2	102	108	7.6	8570
19	32	1.1	91	101	6.4	8590
22	28	1.6	112	111	5.5	4120
23	17	*	327	117	5.4	3790
24	*	*	*	*	*	*
25	*	*	*	*	*	*
26	*	*	*	*	*	*
29	*	*	*	*	*	*
30	*	*	*	*	*	*
Average	36.7	1.53	110.4	94.3	6.86	6377
Standard Deviation, σ	11.7	0.6	77	15.6	1.9	1632

*No sample

**0455 o'clock

***0610 o'clock

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COMPOSITE ANALYSES

<u>Seven-Day Period Beginning</u>	<u>Iodine-131 Analyses January-June 1970</u>		<u>Zinc-65 Analyses January-June 1970</u>	
	<u>KE</u>	<u>KW</u>	<u>KE</u>	<u>KW</u>
1-07	*/0.48	0.43	5.7	8.0
1-14	*/0.15	0.39	24.2	10.8
1-21	*/0.093	0.34	*/7.8	
1-28	*/0.41	*/*	*/12.9	
3-25	0.180/0.232		8.7/8.7	
4-01	*/*		*/*	
4-08	0.351/*		12.3/*	
4-15	0.211/0.425		13.2/9.5	
4-22	.210		7.2	
4-29	0.434		12.8	
5-06	0.191		9.7	
5-13	0.314		5.2	
5-20	0.496		18.6	
5-27	*		*	
6-03	.232		14.5	
6-10	.457		4.42	
6-17	.364		16.3	

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QUANTITIES OF RADIONUCLIDES RELEASED WITH THE REACTOR
COOLING WATER EFFLUENT

		<u>Daily Average</u> (Curies/day)		<u>Month's Total</u> (Curies)	<u>Monthly Average</u> <u>Concentrations</u> (pCi/ml)		<u>10CFR20 Guide</u> <u>Concentration</u> <u>to Uncontrolled</u> <u>Areas</u> (pCi/ml)
		<u>KE</u>	<u>KW</u>		<u>At</u> <u>Reactor</u> <u>Riser*</u>	<u>At</u> <u>Ringold</u> <u>Boundary**</u>	
⁷⁶ As	Jan.	37.8	49.4	2703	39.9	.161	20
	Feb.	0	--	0	0	0	
	Mar.	12.3	--	381	7.6	.037	
	Apr.	60.3	--	1809	55.2	.211	
	May	46.1	--	1429	42.3	.115	
	June	27.5	--	825	25.2	.049	
³² P	Jan.	2.17	2.74	152	2.25	.011	20
	Feb.	0	--	0	0	0	
	Mar.	1.07	--	33	1.00	.0051	
	Apr.	5.45	--	163	5.00	.024	
	May	1.99	--	62	1.83	.0061	
	June	1.14	--	34	1.05	.0025	
⁵¹ Cr	Jan.	76.7	77.0	4765	61.6	.315	2000
	Feb.	0	--	0	0	0	
	Mar.	13.9	--	431	12.8	.066	
	Apr.	61.3	--	1840	56.2	.271	
	May	57.7	--	1789	53.0	.180	
	June	70.5	--	2115	64.7	.156	
²³⁹ Np	Jan.	45.0	52.0	3007	37.2	.172	100
	Feb.	0	--	0	0	0	
	Mar.	8.3	--	257	7.6	.035	
	Apr.	46.2	--	1386	42.3	.183	
	May	53.3	--	1652	48.8	.149	
	June	86.6	--	2598	76.0	.167	
⁴⁶ Sc	Jan.	6.9	7.2	437	6.4	.032	40
	Feb.	0	--	0	0	0	
	Mar.	1.9	--	59	1.7	.088	
	Apr.	6.4	--	192	5.9	.028	
	May	5.8	--	179	5.3	.018	
	June	5.1	--	153	4.7	.011	

QUANTITIES OF RADIONUCLIDES RELEASED WITH THE REACTOR
COOLING WATER EFFLUENT

		<u>Daily Average</u> (Curies/day)		<u>Month's Total</u> (Curies)	<u>Monthly Average</u> <u>Concentrations</u> (pCi/ml)		<u>10CFR20 Guide</u> <u>Concentration</u> <u>to Uncontrolled</u> <u>Areas</u> (pCi/ml)
		<u>KE</u>	<u>KW</u>		<u>At</u> <u>Reactor</u> <u>Riser*</u>	<u>At</u> <u>Ringold</u> <u>Boundary**</u>	
¹³¹ I	Jan.	0.28	0.39	21	0.28	0.0014	0.3
	Feb.	0	--	0	0	0	
	Mar.	0.21	--	7	.05	.00025	
	Apr.	.29	--	9	.27	.00126	
	May	0.26	--	8	.24	.00078	
	June	0.26	--	8	0.24	.00057	
⁶⁵ Zn	Jan.	12.7	9.4	685	9.4	.048	100
	Feb.	0	--	0	0	0	
	Mar.	8.7	--	270	1.9	.0098	
	Apr.	9.9	--	297	9.7	.047	
	May	8.8	--	273	8.1	.027	
	June	8.8	--	264	8.1	.019	
⁵⁶ Mn	June	4770	--	143,100	4,370	1.21	100

*Average daily concentration multiplied by monthly Time-Operated-Efficiency

**Columbia River flow rates in cu. ft./sec: January (87,000); February (77,000); March (86,000); April (92,000); May (131,000); and June (183,100).
Concentration at Ringold includes dilution factor and decay allowing for hold-up time of 45 minutes in retention basins and river travel time.

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