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Oak Ridge National Laboratory

Health Physics Division

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Subject: Monitoring of White Oak Dam Discharge Water During  
Flood of January 30 - 31, 1950

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Submitted By: W. D. Cottrell

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Monitoring of White Oak Dam Discharge Water  
During Flood of January 30 - 31, 1950

During the period January 29 through February 2, 1950, 5.65 inches of rainfall was recorded at Oak Ridge National Laboratory. The greatest volume 3.98 inches, fell on the 30th and 31st of January.

Due to this flash rainstorm, White Oak Creek and White Oak Lake were flooded within a few hours. These conditions necessitated the sampling and monitoring of the discharge water from White Oak Dam on an "around the clock schedule".

While the water pouring over the coffer piling was at a high level, 1000 ml size samples were collected at approximately one hour intervals. When the water receded to a level near the top of the coffer piling, samples were collected less frequently.

In the laboratory, two 10 ml volumes from each of the original samples were brought to dryness in small aluminum dishes under a heat lamp. After cooling to room temperature the samples were given a long count in a beta chamber at approximately 10% geometry.

In monitoring for gamma radioactivity, large samples of approximately eight gallons each were collected over a 28 hour period. The samples were emptied into a previously decontaminated 14" in diameter by 14" in height stainless steel container. The monitoring equipment consisted of a Scaler, scale of 64, G.M. Tube enclosed in a brass cylinder, and a Wizard Recorder. Each sample was counted for five minutes. Background count was taken on tap water previous to the monitoring of each sample from White Oak Dam.

Using the conversion factor  $4.1 \times 10^{-4}$  x net counts per minute, the gamma radiation was calculated in terms of mr/hr.

As an additional check on the radioactivity discharged from White Oak Dam during this period, a composite sample consisting of 100 ml from each of the 1000 ml samples, was sent to the Chemistry Division for a radiochemical analyses.

Following are the results obtained from the monitoring and the radiochemical analyses of the discharged water from White Oak Dam during the previously mentioned flood period.

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Beta Monitoring Data

Date	Time	Water Level* inches	ft.	c/m/ml @ 10% Geom.	Curies Discharged	Probable Conc. in Clinch River
1-30-50	11:30 A.M.	- 3.7	- 0.31	3.0		
1-30-50	3:00 P.M.	+ 13.5	1.13	1.2		
1-30-50	5:30 P.M.	+ 21.5	1.79	1.7		
1-30-50	6:30 P.M.	+ 24.6	2.05	0.7		
1-30-50	7:45 P.M.	+ 24.0	2.00	0.6		
1-30-50	8:55 P.M.	+ 20.9	1.74	0.7		
1-30-50	10:00 P.M.	+ 17.2	1.43	0.9		
1-30-50	11:00 P.M.	+ 14.7	1.23	0.8		
1-30-50	12:00 M	+ 12.3	1.03	0.6		
1-30-50				$\frac{0.6}{10.2} = 0.14 \text{ curies}/10^6 \text{ gall}$	8.63	$2.99 \times 10^{-7} \text{ } \mu\text{c/cc}$
1-31-50	1:00 A.M.	+ 9.8		0.6		
1-31-50	2:00 A.M.	+ 8.6		0.7		
1-31-50	3:00 A.M.	+ 7.4		0.9		
1-31-50	4:00 A.M.	+ 6.2		0.7		
1-31-50	5:00 A.M.	+ 4.9		0.9		
1-31-50	6:00 A.M.	+ 4.3		0.6		
1-31-50	7:00 A.M.	+ 3.7		0.7		
1-31-50	8:00 A.M.	+ 2.5		1.0		
1-31-50	11:30 A.M.	0.0		1.0		
1-31-50	5:40 P.M.	- 0.6		1.3		
1-31-50	10:00 P.M.	+ 8.6		0.6		
1-31-50					2.17	$0.87 \times 10^{-7} \text{ } \mu\text{c/cc}$

\*Positive sign denotes water level above top of coffer piling, whereas a negative sign indicates a level below top of piling.

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Beta Monitoring Data

<u>Date</u>	<u>Time</u>	<u>Water Level* inches</u>	<u>c/m/ml @ 10% Geom.</u>	<u>Curies Discharged</u>	<u>Probable Conc. in Clinch River</u>
2-1-50	2:00 A.M.	+ 7.4	1.0		
2-1-50	6:00 A.M.	+ 3.7	0.6		
2-1-50	9:00 A.M.	+ 1.2	1.0		
2-1-50	11:30 A.M.	- 0.6	0.6		
2-1-50	6:45 P.M.	+ 3.1	0.6		
2-1-50	11:00 P.M.	+ 5.5	0.7		
2-1-50				1.17	0.49 x 10 <sup>-7</sup> µc/cc
2-2-50	3:00 A.M.	+ 4.9	1.0		
2-2-50	7:00 A.M.	+ 3.1	0.6		
2-2-50	11:00 A.M.	0.0	0.6		
2-2-50	5:30 P.M.	- 1.2	0.6		
2-2-50	11:00 P.M.	- 3.7	1.0		
2-2-50				1.85	0.62 x 10 <sup>-7</sup> µc/cc
2-3-50	3:00 A.M.	- 7.4	0.6		
2-3-50	7:00 A.M.	- 11.1	0.6		
2-3-50	11:00 A.M.	- 13.5	1.0		
2-3-50				1.18	0.31 x 10 <sup>-7</sup> µc/cc
Total for 5 Day Period 1-30 - 2-3-50				15.00	
Probable Average Concentration in Clinch River for Week Ending 2-5-50					0.88 x 10 <sup>-7</sup> µc/cc

\*Positive sign denotes water level above top of coffer piling, whereas a negative sign indicates a level below top of piling.

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Gamma Submersion Data

<u>Date</u>	<u>Time</u>	<u>n/c/min.</u>	<u>mr/hr</u>	<u>Curies Discharged</u>
1-30-50	11:30 A.M.	5	.002	
1-30-50	5:30 P.M.	5	.002	
1-30-50	6:30 P.M.	4	.002	
1-30-50	7:45 P.M.	4	.002	
1-30-50	10:45 P.M.	28	.011	7.08
1-31-50	1:45 A.M.	25	.010	
1-31-50	4:45 A.M.	29	.012	
1-31-50	8:00 A.M.	11	.005	
1-31-50	11:30 A.M.	26	.011	
1-31-50	3:00 P.M.	16	.007	2.94
2-1-50	11:30 A.M.	14	.006	1.44
2-2-50	11:00 A.M.	14	.006	1.37
2-3-50	11:00 A.M.	8	.003	0.44

Total gamma curies discharged 1-30 - 2-3-50

13.27

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Radiochemical Analyses of White Oak Dam Discharge Water

<u>Fraction</u>	<u>cts/m/ml @ 10% Geom.</u>	<u>% of Total Activity</u>
Gross B	8	61.54
Ru - B	1	7.69
Zr - B	2	15.38
Cb - B	4	30.77
Tre - B	1	7.69
Cs - B	4	30.77
Sr - B	1	7.69
Pu - $\delta$	15*	
		100.00**

\*Pu  $\delta$  counted and reported at  $\sim 50\%$  geometry, based on this count the Pu concentration in Clinch River was approximately  $(1.8 \times 10^{-6} \text{ } \mu\text{g/cc})$

\*\*Percentages of the different constituents were calculated using as a total activity figure the sum of the counts for the separate fractions.

Even though the total volume of water and the number of curies discharged from White Oak Dam during a flash flood may be increased many fold, the concentration in Clinch River does not increase in the same proportion due to the dilution afforded by a much larger flow in the river.

During this period, only on one day did the probable average concentration in Clinch River exceed the maximum permissible concentration for surface streams, and then only by a factor of  $\sim 3$ . The probable average concentration in the river for the week during which the flood occurred was less than the maximum permissible concentration.

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