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PNL 10-18-89*

September 8, 1960

DEVELOPMENT TEST IP-957-A  
USE OF HIGH ALUM FEED FOR WATER TREATMENT

OBJECTIVE

The objective of this development test is to determine the amount of reduction of the concentration of phosphorus-32 in reactor effluent water which can be achieved by using excess aluminum sulfate flocculating agent for water treatment.

BASIS AND JUSTIFICATION

Whitefish caught in the Columbia River in the vicinity of the Hanford reactors contribute appreciable internal exposure to humans who eat the fish, due to phosphorus-32 in the flesh. Because of its feeding habits the whitefish accumulates an appreciable quantity of  $P^{32}$  from reactor effluent in the Columbia River. The  $P^{32}$  concentration in whitefish is greatest in the late summer and early fall months because the concentration of  $P^{32}$  in river water is high during this period of relatively low flow and the fish feed at the maximum rate during the period of the year when the river temperature is highest. If the concentration of  $P^{32}$  in effluent can be reduced during this critical period of the year, August to November, the amount of  $P^{32}$  which man assimilates by eating whitefish can be reduced accordingly.

Phosphorus-32 in effluent water is derived from the irradiation of  $S^{32}$  and  $P^{31}$  in process water. The fraction derived from each of the parent isotopes is not known. Recent laboratory work leads to the assumption that  $P^{31}$  accounts for the majority.

In small scale laboratory tests of the effectiveness of alum flocs in removing impurities from river water, it was observed that as much as 98 percent of ionic arsenic and phosphorus was removed with alum at pH values from 6.0 to 7.2 at an alum concentration of 20 ppm.

TEST DETAILSA. General

Area: 100-B

Duration: Up to six months.

Start: As soon as possible after the approval of this test.

Equipment: Modification of equipment to permit addition of excess alum will not be required.

- Costs:
1. Chemicals. Additional cost of excess alum should be charged to 5R26.70.
  2. Sampling. Operator time consumed in obtaining samples should be charged to 5R26.70.
  3. No production loss is authorized or anticipated.

Excess alum will be used in the treatment of the water for the near (north) side of 105-B reactor. In addition the rate of feed of aluminum sulfate will be as near 20 ppm as efficient operation of the water treatment plant will permit. The water for the far (south) side will be treated as usual. The test will begin about three or four days after reactor start up in order to avoid the perturbing influence of start up on effluent activity measurements.

B. Radioactivity

It is expected that the rate of release of  $P^{32}$  will drop off on the test side of the reactor beginning immediately with the change of coagulant but a stable lower level will not be established until more than a month later. In addition the high coagulant feed rates will, no doubt, reduce the output of other radionuclides. Frequent measurement of the  $P^{32}$  activity in the water will be made at the beginning of the test. In addition comparative samples will be taken weekly from each half of the reactor for more complete analyses. Discharge area dose rates will be measured as often as possible to determine the magnitude of any changes that may occur. It is expected that these effects will be small and changes gradual.

The following samples will be obtained from the riser sample lines in the near and far sample rooms:

Sample Numbers	Volume	Sample Frequency	Duration
# 1 Near - #25 Near	500 cc	Daily	5 weeks
# 1 Far - #25 Far			
#26 Near - #33 Near	500 cc	Daily	4 weeks
#26 Far - #33 Far			

Samples will be taken by 105-B Processing Operation and will be picked up by Regional Monitoring, HLO, and delivered to Radiological Chemistry. No samples will be taken during reactor outage. The sampling schedule should be resumed where it was interrupted beginning about 4 hours after start up.

In addition, routine weekly two gallon samples will be obtained as usual except that duplicate samples will be obtained from the near and far riser sample lines. These samples will be obtained by Regional Monitoring with the cooperation of 105-B Processing and delivered to Purex Analytical Laboratories. These samples will be obtained on Monday but only if the reactor has been operating 48 hours or more.

#### C. Water Plant Operation

In order to determine the maximum feed rate, alum feed will be increased to 10 ppm. The pH will be reduced to 7.0 by the addition of sulfuric acid while the rate of feed is increased stepwise, 2 ppm per shift or less, to the point where head loss becomes intolerable or other considerations such as filter breakthrough or the optical quality of the water become limiting. The objective being to produce high quality water at an adequate rate while adding alum at a rate as near 20 ppm as possible. The turbidity in the filter effluent should be 0.008 ppm or lower and other measures of water quality should be equally high. It is expected that it may take a week or more to establish the procedure that will be subsequently followed throughout the test.

The water treatment facilities should be sectionalized as much as possible without risk of inadvertent reactor outage. Water from the north (test) side should be used for filter backwash and during outages. It is intended that water from the south (control) side will not be used on the test side of the reactor. However, it is recognized that in the interest of efficient and safe operation some compromises will be required.

#### D. Process Standards

No exceptions to process standards are authorized by this test.

#### E. Hazards

No new hazards will be introduced by this test.

### RESPONSIBILITIES

#### Research and Engineering Section

##### Process and Reactor Development Sub-Section

Radiological Engineering will be responsible for coordination of effort, for scheduling of effluent water samples, arranging for analyses and evaluation of results, preparation of report on test results, and for termination of the test.

Process Technology Sub-Section will be responsible for technical advice and assistance on water plant operation.

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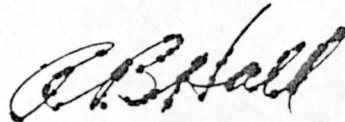
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Manufacturing Section

B Reactor Sub-Section

B Power will be responsible for addition of alum, for sectionalizing of the water plant, and for safety, and continuity of water plant operation. The Manager, B Power, may terminate this test in the unlikely event that intolerable process difficulties require it.

B Processing will be responsible for operational safety and continuity of the reactor, and for obtaining effluent water samples. This test may also be terminated by the Manager, B Processing, if unforeseen process difficulties require it.



Radiological Engineering Unit  
Process & Reactor Development Sub-Section  
Research & Engineering Section  
IRRADIATION PROCESSING DEPARTMENT

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