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DEVELOPMENT TEST AUTHORIZATION IP-154-AL
SULFURIC ACID STUDY

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DEVELOPMENT TEST AUTHORIZATION IP-154-AL
SULFURIC ACID STUDY

INTRODUCTION

This test is a part of a program seeking ways to reduce the amount of radioactivity in reactor effluent water. Arsenic-76 is a major contributor to the gastrointestinal radiation dose received by downstream users of river water. Phosphorus-32 is the principal radioisotope in the flesh of whitefish caught in the vicinity of the Hanford reservation. Recent activation analyses of the commercial grade sulfuric acid used in process water treatment have indicated that this acid may be an important source of the parent elements that are transformed to arsenic-76 and phosphorus-32 in the reactors.

OBJECTIVE

The purpose of this test is to determine if the impurities in commercial grade sulfuric acid have a significant effect on the release rates of arsenic-76 and phosphorus-32 to the river in reactor effluent water.

BASIS AND JUSTIFICATION

The radioactivity released to the river in IPD wastes, principally reactor effluent cooling water, has steadily increased since original start-up. The downstream effects of this waste disposal are approaching the Hanford off-plant working limit during certain seasons of the year. Methods must be found to reduce these effects before they limit production. Two effects are most limiting, the activity in downstream drinking water supplies and the activity in the flesh of food fish. Arsenic-76 contributes about 40% of the hazard in drinking water and phosphorus-32 most of the hazard in whitefish. Therefore, a program to reduce only two of the many radioisotopes in reactor effluent water can reduce the probability of the need to set a production limit because of river contamination.

Recent activation analyses of the commercial sulfuric acid used in process water treatment indicates that this may be a source of an appreciable fraction of the parent elements necessary for the production of arsenic-76 and phosphorus-32. Although chemically pure sulfuric acid will be used in this test, it is not the purpose of this test to prove that this high quality acid should be used as a process chemical. Any further study to determine acceptable changes in water treatment chemicals would be the responsibility of others.

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COST

Chemical Effluents Technology, HLO, will bear all expense of the acid, of the modification of 183-F piping required and all expense for collecting and analyzing samples. The 100-F Power Operation will absorb any minor cost incurred through the additional operator attention the test may require.

SCHEDULE

Area: 100-F

Starting Date: About May 15, 1958

Termination Date: When 20,000 pounds of acid are used up, or when 100-F reactor is shut down for more than two hours.

PROCEDURE

Use "chemically pure" H_2SO_4 in treating water that is to cool one half of the reactor tubes while using commercial acid for the water cooling the other half, and then compare the concentrations of As^{76} and P^{32} in water samples taken from the near and far reactor effluent risers. The "CP" acid will be fed for at least four days to the water cooling the far (or west) side reactor tubes.

About 20,000 pounds of chemically pure acid will be purchased from one of our normal suppliers of commercial grade acid. This company will not be required to guarantee the purity of the acid on delivery, since they will load the high quality acid into fifty-five (55) gallon drums that have previously been used for handling commercial grade acid. However, they will make an effort to drain and rinse the drums to assure minimum quantities of impurities. The purity of the acid will again be threatened when it is transferred from drums to a tank truck. The truck and handling equipment will be drained and rinsed to assure minimum quantities of contamination. The same procedure will be followed at the 183-F building by water treatment personnel prior to making the first transfer of acid from the truck. The feed system will be so modified that this acid will be added only to the far (or west) side. The normal acid feed will be so modified that commercial grade acid is added only to the near (or east) side.

It is felt that within four days the difference in arsenic-76 and phosphorus-32 concentrations between the two sides will be apparent.

During the test period, both the grades of acid being added will be sampled daily. Process influent and effluent water samples will also be taken each day for five days. One week after the test is completed another set of water samples will be taken. The concentration of As^{76} and P^{32} in all effluent samples will be determined. Upon completion of the effluent analyses, a selection of the acid additive samples and of the coolant influent samples will be made. Activation analyses will be performed on these selected samples and the concentration of arsenic and phosphorus determined.

Addition of the "CP acid" will start during the week following a normal reactor outage and when the power level is at least 80% of the anticipated level. In so far as possible the treatment of both sides of the water plant should be the same except for the quality of acid used. The maintenance of similar conditions on both sides should extend for at least one week after the addition of the "CP acid" is completed. The amount of "CP acid" supplied should last for four days. When the "CP acid" supply is used up, the addition of commercial acid can be resumed.

If the reactor is shut down for more than two hours before the supply of acid is exhausted, the addition of the "CP acid" will be discontinued. Rescheduling of the test will depend upon 1) agreement of all parties concerned, 2) results obtained from the portion completed, and 3) the amount of unused acid remaining.

PROCESS STANDARDS

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This development test requires no deviation from Process Standards.

RESPONSIBILITY

No sudden adverse operating problems are anticipated, but this test may be terminated at the discretion of the 100-F Power Manager.

The 100-F Power Operation is to be responsible for the installation of temporary piping, the necessary valving changes and the cleanup of the tanks and lines. The 100-F Power Operation is also to be responsible for the addition of the "CP acid" into the process water and for the normal operation of the water treatment facilities.

Chemical Effluents Technology, HLO, is to be responsible for the procurement of the "CP acid." This same group will also be responsible for sample collection and analyses, and data evaluation.

Radiological Engineering Operation will be responsible for coordination of effort and process recommendations.

HAZARDS

Since some of the piping will be temporary, attention is called to potential safety hazards involved in installation, operation and removal of lines used for concentrated sulfuric acid.

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Radiological Engineering
Process & Reactor Development Operation

W. R. Conley

Water Plant Engineering
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