DPST-84-557

TECHNICAL DIVISION
SAVANNAH RIVER LABORATORY

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SRL Record Copy (4)

July 18, 1984

TO: E. L. ALBENESIUS, 773-A

FROM: K. E. MERSMAN, 773-A (2) KEM

EP-TOXICITY TESTING OF MERCURY REMOVAL RESIN GROUT

SUMMARY

The use of ES-465 cation exchange resin to remove mercury from evaporator overheads in H area will result in a concentrated, mercury contaminated slurry waste. Samples of resin loaded to capacity with mercury from simulated process solutions after solidification with cement readily passed the EPA Hazardous Waste Identification Test.

INTRODUCTION

Substantial amounts (up to 300 ppb) of mercury are contained in the overheads from the 242-H, and 242-16H evaporators. These evaporator overheads are currently sent to the H-Area seepage basins. In an effort to update and improve the waste disposal practices, the use of an ion exchange resin to remove mercury is being investigated. The Waste Process Technology Division at SRL has tested Duolite ES-465 cation exchange resin to determine its effectiveness in removing mercury. The results of these tests are very encouraging, therefore a pilot scale mercury removal column will be installed and tested at the 242-16H evaporator.[1] If this

test is successful, the mercury removal column could become an addition to the H-Area Effluent Treatment Facility or a process addition to the H-Area tank farm evaporators.

The use of the ion exchange resin to remove mercury from these process streams will result in a concentrated, mercury-contaminated slurry waste. The waste can be solidified using cement to produce a structurally stable waste form for disposal. To determine the method of final disposal, the grout must be classified as "hazardous" or "solid waste."

Solids wastes such as the mercury removal resin grout, which are potential chemical hazards to the environment, can fit into one of two categories, each with different disposal requirements. These two categories of waste are "solid waste" and "hazardous waste" as defined by the Resource Conservation and Recovery Act (RCRA) of 1976. In South Carolina, the disposal requirements for each of these categories are established by the Environmental Protection Agency (EPA) and the South Carolina Department of Health and Environmental Control (DHEC). Specifically, Subtitles C and D of RCRA cover the management of the two types of waste. Subtitle D prohibits open dumping and requires environmentally safe handling of "solid waste." Subtitle C requires a special landfill with stringent requirements for disposal of "hazardous waste."[2] For the case of the mercury removal resin grout, mercury is the only component which makes the grout a potential "hazardous waste."

To determine which category a waste will fit into, the EPA requires a classification test. The test, EP-toxicity, consists of a physical integrity test followed by an extraction.[3] For the case of the mercury removal resin grout, the mercury concentration in the extract cannot exceed 0.2 mg/L if the waste is to be classified as "solid waste." Otherwise, the waste is classified as "hazardous."

Simulated process solutions were used to load the mercury removal resin. The resin was solidified with the addition of cement and water using a formulation based on grout formulations typically used to solidify power reactor ion exchange resins.[4] Envirodyne Engineers of St. Louis, Missouri, an EPA sanctioned laboratory, performed the EP-toxicity test for the two samples. One sample was a blank which was made with unloaded resin. For the formulation tested, the EP-toxicity test results showed that the mercury removal resin grout does not fit into the "hazardous waste" category.

Test Description

The sample to be tested must be 3.15 cm in diameter and at least 7.1 cm tall. The grout samples were poured into a mold of

the proper sample dimensions. The samples were then allowed to cure for 28 days.

Before leaching, the samples are subjected to a structural integrity test. The sample is placed in a specially designed compaction tester and a 0.33 kg weight is dropped on the sample 15 times. The entire sample (either intact or in pieces) is then transferred to an extraction vessel for leaching.

The sample is leached with 16g of leachant per gram of solid sample. The leachant is distilled water with the pH adjusted to 5.0 $\pm$ 0.2 by the addition of 0.5N acetic acid. The pH is monitored and maintained at 5.0 by further addition of 0.5N acetic acid. During the course of the 24 hour extraction, no more than 4 ml of acid per gram of solid may be added. The leachant is stirred throughout the test. The test sample is suspended in the center of the extraction vessel with a stainless steel wire. At the end of the 24 hour extraction, the extract is analyzed for the various contaminants of the EP-toxicity test.

Sample Preparation

Duolite ES-465 cation exchange resin was loaded to capacity with mercury by contact with a simulated process solution. The resin was then air-dried. The resin was then mixed with water and Portland Type I cement in a laboratory mixer. The resin contained 1.57×10^{-2}g Hg/g. A blank sample was also made using the resin in the sodium form. Table 1 lists the sample codes and a description of the samples. Table 2 details the formulation used to solidify the resin.

Test Results

The structural integrity portion of the EP-toxicity test had no effect on the mercury removal resin grout. No breaking or cracking was evident.

The test results for the mercury removal resin grout are listed in the table in the attached letter from Envirodyne. Values listed with a less than sign (<) were at the detection limit and have a uncertainty of $\pm$ 75%. The uncertainty of the other values are within $\pm$ 10%. All the values for the various contaminants of the EP-toxicity tests were found to be at least 25 times less than the maximum level set by the EPA. By virtue of these results, the mercury removal resin grout is shown to be a non-hazardous waste. There, the grout may be disposed of as "solid waste" as defined by Subtitle D of RCRA.

REFERENCES

1. D. A. Weber, TA 2-1068, "Pilot Scale Mercury Removal Column." April 6, 1984.

2. H. W. Bledsoe, Letter to I. W. Marine, "The Difference Between Solid Waste and Hazardous Waste as Defined by EPA and the Implication to Saltcrete Disposal." October 8, 1980.

3. Federal Register, Rules and Regulations, Volume 45, No. 98. May 19, 1980, p. 33127.

4. P. Colombo and R. M. Neilson, "Properties of Radioactive Waste Containers," First Topical Report, BNL-NUREG 50957. August 1979.

TABLE 1: EP-TOXICITY SAMPLES OF MERCURY REMOVAL RESIN GROUT

Sample	Description
HG1	Blank Sample
HG2	Simulated Process Sample

TABLE 2: FORMULATION OF MERCURY REMOVAL RESIN GROUT

Component	Wt %
Water	36
Resin	27
Portland Type I Cement	37

KEM:ske
Disc 7

ENVIRODYNE
ENGINEERS

12161 Lackland Road,
St. Louis, Missouri 63146
(314) 434-6960

May 29, 1984
2028-09000

Mr. Ken Mersman
703H Room 126
E. I. du Pont de Nemours
and Company, Inc.
Savannah River Plant
Aiken, South Carolina 29801

Dear Mr. Mersman:

Enclosed are the results from Hg1 and Hg2 solid samples for EP Toxicity Testing. As noted, neither of the samples surpasses the maximum allowable levels for classification as a hazardous waste.

If we may be of further help, please do not hesitate to call.

Sincerely,

Paul B. Humburg

Paul B. Humburg
Manager, Inorganic
Laboratory

PBH/rbk
Enclosure

ENVIRODYNE
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2028-09000

EP TOXICITY TESTING
(mg/l)

	Hg 1	Hg 2	Maximum Concentration for Contaminants
Hg	<0.0002	0.0002	0.2
As	<0.003	<0.003	5.0
Ba	<0.1	<0.1	100.0
Cd	0.03	0.04	1.0
Cr	0.07	0.05	5.0
Pb	<0.05	<0.05	5.0
Se	<0.003	<0.003	1.0
Ag	0.020	0.004	5.0
Endrin	<0.00004	<0.00004	0.02
Lindane	<0.001	<0.001	0.4
Methoxychlor	<0.020	<0.020	10.0
Toxaphene	<0.001	<0.001	0.5
2,4-D	<0.02	<0.02	10.0
Silvex	<0.002	<0.002	1.0

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