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REACTION OF HIGH SALT AQUEOUS PLUS ORGANIC WASTE WITH SOIL

INTERIM REPORT

K. C. Knoll

Process Research and Development
Chemical Effluents Technology
CHEMISTRY DEPARTMENT

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INTRODUCTION

At the request of the Chemical Processing Department personnel a study was made to determine if it would be feasible to put a high salt, acidic aqueous waste mixed with organic compounds into the Z-1A tile field. The factors to be considered are the extent of adsorption of plutonium and americium by the soil and the effect on the infiltration of the waste into the soil by the organic compounds present.

CONCLUSIONS

Soil has considerable capacity for this high salt, acidic waste containing organic compounds and can imbibe it almost as readily as water. These data, obtained from column measurements in the laboratory, would be less favorable than those obtained in the field as the moisture cannot spread horizontally in a column. Uptake of plutonium by the soil was very minor and of americium negligible.

DISCUSSION

Methods

A synthetic waste was prepared by mixing a high salt, acidic, aqueous phase, similar to Waste Treatment Facility CWV waste with an organic phase. The

aqueous portion had the following composition:

<u>Constituent</u>	<u>M</u>
HNO ₃	0.30
AlF(NO ₃) ₂	0.26
Al(NO ₃) ₃	0.44
Mg(NO ₃) ₂	0.18
Ca(NO ₃) ₂	0.18
Fe(NO ₃) ₃	0.05
NaNO ₃	2.38
Total NO ₃ ⁻	5.4

This was diluted with $\frac{1}{15}$ its own volume of water to represent water added to the waste stream. To this aqueous part the following organic mixtures, expressed in parts per thousand, were added:

25 parts of	Lard oil	25%
	CCl ₄	75%
1.2 parts of	Dibutyl Butylphosphonate	30%
	CCl ₄	70%
3.1 parts of	Tributyl Phosphonate	20%
	CCl ₄	80%

The organic part was not entirely miscible with the aqueous part. Even after thorough mixing there was some separation on standing.

Soil from the Z-1A tile field spoils pile was sieved to less than 2mm and used for test columns. For studying waste flow the columns were fed with cold synthetic waste; for studying nuclide uptake the synthetic waste was spiked with actual CWW waste. To determine the ability of the soil to continue to accept a flow of waste, a 12-foot-long soil column was fed with waste and the change of flow rate with time was observed. All columns were fed by gravity flow at constant head.

Results

Flows of wastes and water through similar soil columns were compared. Figure 1 shows the flow rate change with time, for water; Figure 2, that of waste. In the latter figure the arrows show the time when flow was interrupted and then restarted after draining. The presence of organic compounds in the soil did not change the flow rate as shown by the continuation of the curves after stopping and restarting the columns. Comparison of Figures 1 and 2 shows that the flow rates for both water and waste stabilized at rates not significantly different. The very rapid initial flow rate for the waste was probably caused by the reaction of the acid waste with the soil which may have opened channels.

Two columns were run with synthetic waste spiked with actual waste. Effluent samples were assayed for both Am^{241} and Pu^{239} and breakthrough curves drawn for both. The 50 percent breakthrough was found to occur (Figure 3) at between 1.5 and 4.0 column volumes for Pu^{239} . If the Am^{241} curve is extrapolated the 50 percent breakthrough point falls below 3.01 column volumes. It is evident from these data that the soil can be expected to take up very minor amounts of plutonium and essentially no americium.

The 12-foot, 1-inch I.D. soil column continued to take waste until the experiment was terminated, after 103 days of operation. The flow rate dropped with the passage of time; for the first 7 days flow averaged 0.56 ml/hr/cm^2 ($3.32 \text{ gal/ft}^2/\text{day}$); from the 30th to the 37th day - 0.12 ml/hr/cm^2 ($0.69 \text{ gal/ft}^2/\text{day}$); for the last 20 days the average flow was 0.002 ml/hr/cm^2 .

(0.012 gal/ft²/day). Under field conditions this decrease in flow rate would probably be less.

Acknowledgment

The author wishes to acknowledge the work of Mr. R. L. Schmidt in the laboratory.

Column Description

	<u>1</u>	<u>2</u>
Diameter	2.2 cm	2.2 cm
Length	12.69 cm	12.92 cm
Soil weight	87.0 g	87.0 g
Head	11.42 cm water	11.44 cm water

Figure 1

Flow of water into soil.

Column Description

	<u>1</u>	<u>2</u>
Diameter	2.2 cm	2.2 cm
Length	14.92 cm	14.63 cm
Soil weight	87.0 g	87.0 g
Head	28.8 cm water	29.0 cm water

Figure 2
Flow of waste into soil.

Column Volumes
Column Description

	<u>1</u>	<u>2</u>
Diameter	1.9 cm	1.9 cm
Length	10.0 cm	10.0 cm
Soil weight	47.4 g	47.4 g
Head	10.9 cm water	10.8 cm water

Figure 3.

Americium and Plutonium breakthrough curves.