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VITRIFICATION OF INCINERATOR ASH-I DISSOLUTION RATE (U)

by

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An internal report being submitted for release
to answer a request from EG&G Idaho

DISCLAIMER

This paper was prepared in connection with work done under Contract No. DE-AC09-76SR0001 (now DE-AC09-88SR18035) with the U.S. Department of Energy.

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MEMORANDUM

TO: M. J. PLODINEC

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INTRODUCTION AND SUMMARY

At the request of Waste Disposal Technology Division, Chemical Technology Division is investigating vitrification of alpha waste incinerator (AWI) ash. In laboratory tests, a glass containing up to 50 wt % ash can be made using Frit 131 at 1150°C. Based on these tests, a melter the size of the CTD minimelter should be able to vitrify AWI ash as it is produced.

DISCUSSION

Intimate mixtures of alpha waste incinerator ash (Table 1) and Frit 131 (Table 2) in several different proportions were melted in alumina crucibles at 1150°C. The approximate time required for the ash to dissolve was noted.

The appearance of a button of the molten product cast into a graphite mold is seen in Figure 1. Up to 50 wt percent ash readily dissolved in the glass. The specimens containing no ash were colorless. The color changed from light yellow-green at 20 and 30 wt percent ash to darker brown at 40 and 50 wt percent ash.

The dissolution rate of the ash in Frit 131 at 1150°C was determined to be approximately 7 g/hr/in^2 of surface area. In the specimens containing 20 wt percent ash 20 grams of ash dissolved in approximately 2 hours. In the specimen containing 50 wt percent ash 50 grams of ash dissolved in approximately 4 hours. The area of the crucible was approximately 1.5 in^2.

APPLICATION OF INCINERATOR ASH GLASS PRODUCTION

Eventually, a glass melter may be coupled with the experimental alpha waste incinerator at TNX. A melter with a surface area of 24 in^2 (similar to the CTD minimelter) is available for this application. Based on the results of these tests, at the present operating rate of the incinerator (0.6 lb ash produced/hr) such a melter would be able to vitrify the ash as produced.

This is believed to be a conservative conclusion because the dissolution rate should be greater in an actual glass melter:

- Convection cells should be more significant in an actual melter.
- A bubbler is being installed in the melter.

PROGRAM

Corrosion tests with Monofrax K-3 and Inconel 690 will be carried out with glass containing incinerator ash as time permits. These tests may also be useful in determining melter corrosion rates during production of a Cs-only waste-glass.

WNR:lmn

TABLE 1

Elemental Composition of ICTF Ash[a,b]

	Element	Weight Percent (Average)
*	Ca	48
*	Ti	38
*	Mg	6.5
*	Al	3.4
*	Cl	3.0
*	Na	0.36
*	K	0.13
*	Sr	0.055
**	Si	0.027
*	Zn	0.016
*	Mn	0.012
**	P	0.0063
*	Sb	0.0048
**	Ba	0.0045
*	V	0.0034
**	Fe	0.0022
*	W	0.0018
*	Cr	0.0017
*	As	0.0017
*	La	0.00074
**	Pb	0.00042
*	Au	0.000069
*	Dy	0.000017

a. Excluding carbon, oxygen, and nitrogen.
b. Runs 24, 27, 30-31, 34.
* Neutron activation analysis (NNA).
** Inductively coupled plasma-emission spectroscopy (ICP).

TABLE 2

Composition of Frit 131

Compound	Wt %
SiO_2	57.9
Na_2O	17.7
B_2O_3	14.7
Li_2O	5.7
MgO	2.0
TiO_2	1.0
La_2O_3	0.5
ZrO_2	0.5