CONF-960212--83-Extd. Sum

WSRC-MS-95-0422

Waste Vitrification Projects Throughout the U.S. Initiated by SRS (U)

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A document prepared for WASTE MANAGEMENTY 1996 at Tucson, from 02/25/96 - 02/29/96.

DOE Contract No. DE-AC09-89SR18035

DISCLAIMER

0422

WSRC-MS-95-~~XXX~~

Keywords: Mixed waste, hazardous waste, waste minimization

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Extended sunmmary of a paper proposed for presentation and publication in the Proceedings of the Waste Management International Conference, Tucson, AZ, February 25-29, 1996

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Proposed for Session 4.5, "Savannah River Site - Progress in Waste Management and Environmental Restoration."

WASTE VITRIFICATION PROJECTS THROUGHOUT THE U. S. INITATIATED BY SRS

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EXTENDED ABSTRACT

Technologies are being developed by the US Department of Energy's (DOE) Nuclear Facility sites to convert high-level, low-level, and mixed wastes to a solid stabilized waste form for permanent disposal. Vitrification is one of the most important and environmentally safest technologies being developed.The Environmental Protection Agency (EPA) has declared vitrification the Best Demonstrated Available Technology (BDAT) for high-level radioactive waste [1] and produced a Handbook of Vitrification Technologies for Treatment of Hazardous and Radioactive Waste [2]. The Defense Waste Processing Facility (DWPF) being tested at SRS will soon start vitrifying the high-level waste at SRS. The DOE Office of Technology Development (OTD) has taken the position that mixed waste needs to be stabilized to the highest level reasonably possible to ensure that the resulting waste forms will meet both current and future regulatory specifications. Vitrification produces durable waste forms at volume reductions up to 97% [3]. Large reductions in volume minimize long-term storage costs making vitrification cost effective on a life cycle basis [4].

The US DOE Savannah River Site (SRS), which is operated by Westinghouse Savannah River Company (WSRC), is currently investigating vitrification for disposal of various low-level and mixed wastes [3,5] Development of "cradle-to-grave" Joule heated vitrification processes have been initiated at SRS for a wide variety of wastes which include but are not limited to the following:

- spent filter aids from waste water treatment
- waste sludges
- combinations of spent filter aids from waste water treatment and waste sludges
- combinations of supernate and waste sludges
- incinerator ash, incinerator off-gas blowdown
- combinations of incinerator ash and off-gas blowdown,
- cement formulations in need of remediation into glass
- ion exchange zeolites
- inorganic filter media,
- asbestos or glass fiber filters
- radioactive materials including TRU wastes

"Cradle-to-grave" vitrification processes are being developed for commercialization and for demonstration in a "Transportable Vitrification System" (TVS). For each vitrification process the following protocol is followed:

- Analyze wastes
- Develop surrogate if necessary
- Surrogate "proof-of-principle" laboratory scale studies
- Actual waste "proof-of-principle" laboratory scale studies
- Surrogate pilot-scale demonstration
- Actual waste pilot-scale demonstration
- Actual waste field-scale demonstration or commercialization

This is the same protocol that was used to develop the "cradle-to-grave" vitrification process for the High-Level Liquid Waste (HLW) at SRS. Figure 1 shows the status of various vitrification projects initiated by SRS.

Vitrification of various low-level and mixed wastes has been demonstrated in laboratory studies at SRS for the following wastes:

- Actual SRS M-Area nickel plating line (RCRA F006) waste water sludges and spent filter aids. Stabilization of the heavy metals in the glass was achieved by use of reactive additives* such as diatomaceous earth, perlite (perflo), rice husk ash, and/or precipitated silica, e.g. the Reactive Additive Stabilization Process (RASP) developed at SRS.[6]

- Simulated SRS Consolidated Incinerator Facitilty (CIF) wastes (ash and blowdown alone and mixtures of the two). Stabilization of the heavy metals in the glass was achieved using RASP.

- Actual and simulated Oak Ridge Reservation (ORR) West End Treatment Facility (WETF) waste water sludges. Stabilization of the heavy metals in the glass was achieved using RASP and conventional glass forming additives. Simulated wastes were vitrified at SRS and the actual wastes were vitrified in a joint SRS/ORR vitrification program at ORR.

- Actual and simulated ORR Pond Waste (B&C Ponds) sludge. Stabilization of the heavy metals in the glass was achieved using RASP and conventional glass forming additives. Simulated wastes were vitrified at SRS and the actual wastes were vitrified in a joint SRS/ORR vitrification program at ORR.

- Simulated Rocky Flats (RF) waste water sludge. Stabilization of the heavy metals in the glass was achieved using RASP and conventional glass forming additives.

- Simulated Los Alamos National Laboratory (LANL) incinerator ash. Stabilization of the heavy metals in the glass was achieved using RASP and conventional glass forming additives.

- Simulated Fernald mill tailings (silo waste from OU-4). Stabilization of the heavy metals in the glass was achieved using RASP and conventional glass forming additives.

- Non-radioactive asbestos pipe coverings dissolved off pipe using hot concentrated NaOH in a patent developed at SRS. The asbestos and NaOH are fed directly to a melter for vitrification.

- Non-radioacitve resins of interest to the Electric Power Research Institute under a joint SRS/EPRI Cooperative Research And Developement Agreement (CRADA)

- Small samples of actual and simulated Am/Cm residues have been vitrified for safe shipment to ORR for ORR to recover these valuable isotopes.

- Small samples of actual and simulated Pu wastes have been vitrified for safe storage or disposal as part of development of a large scale process for disposition of excess Pu.

Pilot scale vitrification of the following wastes has been achieved.

- Actual and simulated SRS M-Area wastes. The actual waste pilot scale demonstration was carried out at the Catholic University of America and the simulated pilot scale demonstration was carried out at Clemson University

- Actual ORR WETF and K25 Pond Sludge wastes are to be vitrified in an SRS pilot scale melter at RUST Federal under a joint CRADA

Actual waste processing includes the following wastes. The DWPF will be starting soon. The first commercial full scale and first field scale demonstrations of actual mixed waste in the DOE complex will occur in early 1996 based on the "cradle-to-grave" processes developed by SRS.

- Vitrification of high-level wastes
- Vitrification of ORR sludges (K25 Pond Waste and WETF Sludge) will be initiated in March, 1996 in the SRS Transportable Vitrification System (TVS)
- Vitrification of M-Area Sludge will be initiated in May, 1996 at SRS in a stationary Vendor Treatment Facility (VTF)

Summaries of the waste characteristics, laboratory treatability studies (crucible and pilot scale), and glass formulations will be discussed. This detail will include pertinent information about

- waste loading
- melt temperature
- varying alkali additives
- varying reactive silica additives (perlite, sand, and precipitated silica)
- melt line refractory corrosion
- general refractory corrosion
- predictability of process/product models used to target glass formulations

ACKNOWLEDGMENT

This paper was prepared in connection with work done under Contract No. DE-AC09-89SR18035 with the U.S. Department of Energy. A portion of this work was funded by DOE Office of Technology Development Mixed Waste Focus Area (MWFA).

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7. U.S. Patent # (patent received July, 1995).

VITRIFICATION DEVELOPMENT MATRIX

	SRS NEW	SRS M-AREA	ORR WETF	ORR K25	RF SLUDGE	LANL ASH	FERNALD OU-4	SRS CIF	ASBESTOS	EPRI RESINS	SRS Am/Cm	SRS Pu
Analyze Waste	■	■	■	■	■	■	■	■	■	■	■	■
Surrogate "Proof of Principle"	■	NA	■	■	■	■	■	■	■	■	■	■
Actual Waste "Proof of Principle"	■	■	8/94	9/95							3/95	5/95
Surrogate Pilot Scale Testing	■	■	■	NA								
Actual Waste Pilot Scale Testing	■	9/94	10/95	10/95								
Commercialization	NA	7/95	NA	NA								
Prod. Integrated Testing	4/94	3/96	10/95	10/95								
Waste Processing	12/95	5/96	3/96	5/96								

■ COMPLETED

□ IN PROGRESS AND DATE INITIATED

Figure 1. Vitrification Iniative Development Matrix.