PRESENTATION TO
THE NUCLEAR WASTE TECHNICAL REVIEW BOARD

SUBJECT: HIGH-LEVEL WASTE GLASS PRODUCERS OVERVIEW

PRESENTER: ROBERT W. BROWN

PRESENTER'S TITLE AND ORGANIZATION: DEPUTY PROJECT MANAGER VITRIFICATION PROJECT OFFICE U.S. DEPARTMENT OF ENERGY RICHLAND, WASHINGTON

PRESENTER'S TELEPHONE NUMBER: (509) 376-7391

AUGUST 28-29, 1990
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BACKGROUND


- IN ACCORDANCE WITH PUBLIC LAW 97-90, THE PRESIDENT SUBMITTED THE DEFENSE WASTE MANAGEMENT PLAN (DWMP) TO CONGRESS IN JUNE 1983. THIS PLAN DESCRIBED THREE MAJOR HIGH-LEVEL WASTE PROCESS FACILITIES TO BE BUILT IN SEQUENCE AT THREE DOE SITES:

  - DEFENSE WASTE PROCESSING FACILITY (DWPF) SAVANNAH RIVER SITE
  - HANFORD WASTE VITRIFICATION PLANT (HWVP) HANFORD SITE
  - IDAHO FACILITY IDAHO SITE
# WASTE PRODUCERS HLW OVERVIEW

## ORIGIN OF HLW

<table>
<thead>
<tr>
<th>SITE</th>
<th>SOURCE/ORIGIN</th>
<th>CURRENT CONDITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAVANNAH RIVER</td>
<td>DEFENSE PRODUCTION OF SPECIAL NUCLEAR MATERIALS (SNM) - REPROCESSED FUEL</td>
<td>NEUTRALIZED; LIQUID AND SLUDGE STORED IN CARBON STEEL TANKS</td>
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<tr>
<td>WEST VALLEY</td>
<td>COMMERCIAL REPROCESSED FUEL; AEC/DOE EXPERIMENTAL FUEL</td>
<td>NEUTRALIZED; SLUDGE AND SUPERNATANT</td>
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<td>DEFENSE PRODUCTION OF SNM REPROCESSED FUEL</td>
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VITRIFICATION PROGRAM/PROJECT OBJECTIVES

- PROGRAM OBJECTIVES:
  TO DEVELOP, DEMONSTRATE AND IMPLEMENT TECHNOLOGY FOR THE LONG-TERM MANAGEMENT OF HIGH-LEVEL NUCLEAR WASTE

- PROJECT OBJECTIVES:
  TO DESIGN, CONSTRUCT AND OPERATE FACILITIES TO IMMOBILIZE HIGH-LEVEL NUCLEAR WASTE FOR STORAGE, TRANSPORTATION TO AND SUBSEQUENT DISPOSAL IN A FEDERAL GEOLOGIC REPOSITORY
VITRIFICATION PROGRAM/PROJECT
QUALITY ASSURANCE GOALS

- ACHIEVE A HIGH LEVEL OF QUALITY IN ALL HLW ACTIVITIES

- OPERATE IN A WAY THAT COMPLIES WITH FEDERAL REGULATIONS AND REQUIREMENTS

- PROTECT THE ENVIRONMENT AND THE HEALTH AND SAFETY OF DOE EMPLOYEES, DOE CONTRACTORS AND THE GENERAL PUBLIC

- OPERATE IN A WAY THAT INSTILLS CONFIDENCE IN OUR ABILITY TO OPERATE SAFELY AND RELIABLY
LIQUID FED CERAMIC MELTER (LFCM) SELECTION CHRONOLOGY

- DWPF SELECTS LFCM TECHNOLOGY - 1980
- WVNS ASSESSES USE OF AVM (ATELIERS de VITRIFICATION de MARCOULE) vs. LFCM FOR VITRIFYING WVDP WASTES - 1982
- DOE PANEL ENDORSES LFCM TECHNOLOGY FOR WEST VALLEY DEMONSTRATION PROJECT (WVDP) - 1983
FACTORS SUPPORTING LFCM TECHNOLOGY SELECTION

- HIGHER CAPACITY
- LONGER UNIT LIFE
- DEMONSTRATED COMPATABILITY WITH SLURRY FEEDS (NEUTRALIZED FEED RATHER THAN ACID FEEDS)
- GREATER INDUSTRY ACCEPTANCE
- POTENTIAL PROCESSING AND MAINTENANCE SIMPLIFICATION
- DEMONSTRATED WASTE FORM QUALITY RELATIVE TO U.S. REGULATORY REQUIREMENTS
BOROSILICATE GLASS - THE "PREFERRED" HIGH-LEVEL RADIOACTIVE WASTE FORM

'55

Early AEC studies on clay-waste mixtures yielded glass-like waste forms (1300 °C process temperatures)

'60's

U.S., British, French research focused on borosilicate glass for process ability (1150 °C)

'70

WSEP - DOE Radioactive Pilot Plant R&D:
- Phosphate glass
- Borosilicate glass

'82

West Valley selection of glass

'84

Hench Panel confirms DWPF selection of borosilicate glass

'87

HWVP EIS selects glass

'90

EPA rulemaking lists glass as "preferred" waste form
HLW GLASS PRODUCERS STRATEGY

- RECEIVE A PRODUCT ACCEPTANCE SPECIFICATION FROM RW
- ESTABLISH A PLAN FOR MEETING THE SPECIFICATION
- QUALIFY THE PRODUCT AND THE PRODUCTION PROCESS
- PRODUCE AND CERTIFY EACH PRODUCT UNIT
HLW GLASS PRODUCERS IMPLEMENTATION PROCESS

WASTE ACCEPTANCE SPECIFICATION (WAS)

OUTLINES ADMINISTRATIVE AND TECHNICAL REQUIREMENTS THAT EACH CANISTERED WASTE FORM MUST MEET

WASTE FORM COMPLIANCE PLAN (WCP)

DESCRIBES THE PROCESSES, SYSTEMS, AND TECHNIQUES THAT ENSURE THAT WAS REQUIREMENTS ARE MET

WASTE FORM QUALIFICATION REPORT (WQR)

COMPILES THE INFORMATION AND DATA FROM WCP IMPLEMENTATION THAT DEMONSTRATE COMPLIANCE WITH WAS

PRODUCTION RECORDS (PRs)

DOCUMENTS PRODUCTION OF EACH CANISTERED WASTE FORM

WILL ACCOMPANY EACH UNIT WHEN TURNED OVER TO THE REPOSITORY
WASTE ACCEPTANCE PROCESS HISTORY

- SAVANNAH RIVER ESTABLISHED INTERSITE COORDINATION GROUP - 1970s

- WASTE ACCEPTANCE COMMITTEE (WAC) SUPERCEDED INTERSITE COORDINATION GROUP IN OCTOBER 1984

- INTERIM, DRAFT, GENERIC WASTE ACCEPTANCE REQUIREMENTS ISSUED JANUARY 1985. DRAFT, GENERIC WASTE ACCEPTANCE REQUIREMENTS REVISED JANUARY 1989

- WASTE ACCEPTANCE PROCESS DEFINED BY DOE JULY 1985
WASTE ACCEPTANCE PROCESS HISTORY (CONTINUED)

- FIRST DRAFT WASTE ACCEPTANCE PRELIMINARY SPECIFICATIONS (WAPS) FOR THE DWPF RELEASED IN DECEMBER 1986 (DRAFT FOR CONCURRENCE, REV. 1 - APRIL 1988)

- WAPS FOR WVDP ISSUED - FEBRUARY 1987

- DWPF WASTE FORM QUALIFICATION REPORT (WQR) TECHNICAL REVIEW GROUP KICK-OFF MEETING - MAY 1989
VITRIFICATION PROCESS FLOW DIAGRAM

High-Level Waste → Glass Formers and Additives

→ Feed Preparation

→ Offgas Treatment

→ Melter/Turntable

→ Canister Decontamination

→ Canister Storage

→ Canister Closure
## SUMMARY OF HLW CANISTER QUANTITIES AND PHYSICAL CHARACTERISTICS

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<tr>
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<th>West Valley Demonstration Project</th>
<th>Savannah River Plant</th>
<th>Hanford</th>
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<tbody>
<tr>
<td><strong>Projected Number of Canisters (2020)</strong></td>
<td>300</td>
<td>5750</td>
<td>1960</td>
</tr>
<tr>
<td><strong>Outside Diameter (cm)</strong></td>
<td>61</td>
<td>61</td>
<td>61</td>
</tr>
<tr>
<td><strong>Overall Height (cm)</strong></td>
<td>300</td>
<td>300</td>
<td>300</td>
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<tr>
<td><strong>Material</strong></td>
<td>Stainless Steel</td>
<td>Stainless Steel</td>
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<tr>
<td><strong>Wall Thickness (cm)</strong></td>
<td>0.34</td>
<td>1.0</td>
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<tr>
<td><strong>Weight (kg)</strong></td>
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<tr>
<td>Canister (empty)</td>
<td>252</td>
<td>450</td>
<td>450</td>
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<tr>
<td>Glass</td>
<td>1895</td>
<td>1700</td>
<td>1650</td>
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<tr>
<td><strong>Total</strong></td>
<td>2147</td>
<td>2150</td>
<td>2100</td>
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<tr>
<td><strong>Maximum KCi per Canister</strong></td>
<td>96.6</td>
<td>230</td>
<td>400</td>
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<tr>
<td><strong>Maximum Watts per Canister</strong></td>
<td>289</td>
<td>670</td>
<td>1158</td>
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## PROJECT/PROGRAM SCHEDULES

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CONCLUSIONS

- PROVEN PROCESS
- EPA PREFERRED WASTE FORM
- AGGRESSIVE, LOGICAL SCHEDULES
- COMPREHENSIVE REQUIREMENTS OF WAPS
- NUCLEAR GRADE QUALITY ASSURANCE
- MANAGEMENT INTERFACES WELL DEFINED
- FORMAL, PERMANENT RECORDS ESTABLISHED