

**Nuclear Waste Technical Review Board  
Engineered Barrier System Panel Meeting**

**Disposal of Hanford Site  
Cesium and Strontium Capsules**

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**Richland, Washington  
June 15, 1994**

# Introduction

- **Cesium and strontium capsules represent approximately 42 percent of the total radioactivity for Hanford nuclear wastes**
- **As part of the Hanford Site cleanup, the manner of disposal for the cesium and strontium capsules must be resolved**

# Background

- **Hanford Defense Waste - Environmental Impact Statement (DOE-1987)**
  - **Called for cesium (Cs) and strontium (Sr) capsules, once overpacked, as being candidates for repository disposal**
- **Hanford Defense Waste - Record of Decision (DOE-1988)**
  - **"Prior to shipment to a geologic repository, these wastes will be packaged in accordance with repository waste acceptance specifications."**

## **Background (cont)**

- **Disposal of cesium and strontium capsules is included in the scope of recently negotiated Tri-Party Agreement milestones**
- **Hanford has recently initiated an evaluation of making an alternative waste form material; namely, process the cesium and strontium into a glass waste form, which would then be packaged and shipped to the repository**

## **Background (cont)**

- **Disposal of cesium and strontium capsules is included in the scope of recently negotiated Tri-Party Agreement milestones**
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# Waste Form Material

- **Cesium (Cs)**
  - **Cesium chloride (CsCl)**
  - **Certain alkali metals (Na, K, and Rb) along with Si, Al, and Fe are the primary impurities**
  - **CsCl loaded into capsule as a melt cast**
  - **Primary radioisotope is Cs-137, with Cs-135 as a minor impurity; about one-third of Cs is radioactive**
  - **Cs-137 decays to Ba-137**

# Cesium

- **Capsules**
  - 1338 capsules
- **Waste Form Mass**
  - Approximately 2.7 kg per capsule
  - 3612 kg of CsCl
  - 2852 kg of Cs
  - 761 kg of Cl
- **Curies/Watts**
  - 90 M Ci (1/1/1995)\* 165 watts/capsule
  - 63 M Ci (1/1/2010) 116 watts/capsule

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\* Cs-135 at approximately 1000Ci

# Waste Form Material

- **Strontium (Sr)**
  - **Strontium fluoride ( $\text{SrF}_2$ )**
  - **Other metal fluorides are the primary impurities (major ones: fluorides for barium; calcium; sodium)**
  - **$\text{SrF}_2$  loaded into capsule as a compacted powder**
  - **Primary radioisotope is Sr-90**
  - **Sr-90 decays to Y-90, which decays to Zr-90**



# Strontium

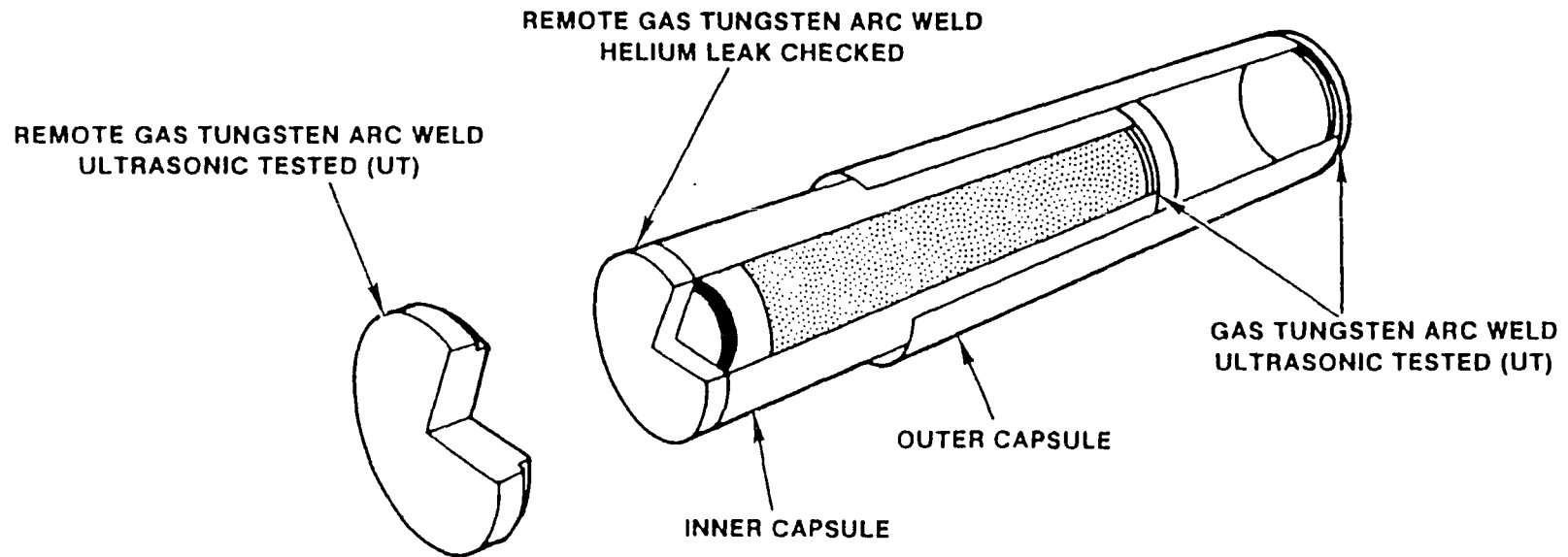
- **Capsules**
  - 610 capsules
- **Waste Form Mass**
  - Approximately 2.7 kg per capsule
  - 1647 kg of SrF<sub>2</sub>
  - 1149 kg of Sr
  - 498 kg of F
- **Curies/Watts**
  - 51 MCi (1/1/1995) 273 watts/capsule
  - 36 MCi (1/1/2010) 193 watts/capsule

# **Metallic Capsule Barriers**

- **Two sealed metallic barriers contain each waste form**
  - **Cs capsules**
    - **Inner barrier--stainless steel/316L**
    - **Outer barrier--stainless steel/316L**
  - **Sr capsules**
    - **Inner barrier--Hastelloy/C-276**
    - **Outer barrier--stainless steel/316L**

# DISPOSAL OF HONFORD CESIUM AND STRONTIUM CAPSULES

	FORM	LOADING	PERCENT OF THEORETICAL DENSITY BASED ON TOTAL VOID SPACE OF CAPSULE	TEMPERATURE			
				AIR		WATER	
				CENTER LINE	SURFACE	CENTER LINE	SURFACE
STRONTIUM FLUORIDE	COMPACTED POWDER	150 kCi (MAX)	68	860°C	430°C	660°C	71°C
CESIUM CHLORIDE	MELT-CAST	70 kCi	65	450°C	200°C	327°C	58°C



	CAPSULE									
	INNER					OUTER				
	MATERIAL	WALL THICKNESS	OUTSIDE DIAMETER	TOTAL LENGTH	TOTAL CAP THICKNESS	MATERIAL	WALL THICKNESS	OUTSIDE DIAMETER	TOTAL LENGTH	TOTAL CAP THICKNESS
STRONTIUM FLUORIDE	HASTELLOY C-276 (UT)	0.305 (UT)	5.72	48.39	1.02	STAINLESS STEEL 316-L (UT)	0.277 (UT)	6.67	51.05	1.02
CESIUM CHLORIDE	STAINLESS STEEL 316-L (UT)	0.241 (UT)	5.72	50.10	1.02	STAINLESS STEEL 316-L (UT)	0.277 (UT)	6.67	52.77	1.02

NOTE: ALL DIMENSIONS ARE IN cm

## **Major Questions to be Answered**

- **Can the proposed geologic repository actually accommodate disposal of the Hanford cesium and strontium capsules in some packaged form?**
  - **Are cesium and strontium waste form materials acceptable?**
  - **If the two waste forms are acceptable, then are the respective metallic capsule types acceptable as part of the shipment from Hanford to the repository?**
  - **If either of the two (waste form + capsule) types must be overpacked to be acceptable, what overpacking concepts are acceptable and what would their acceptance specifications be?**

## **Major Questions to be Answered (cont)**

- **If either or both of the waste forms are not acceptable for repository disposal, what vitrified waste form/packaging concepts would be acceptable, and what would the acceptance specifications be?**

## **Status of EM/RW Program Interface**

- **EM has not yet requested an official OCRWM position on the acceptability of any cesium and strontium capsule disposal option**
- **Unofficially, OCRWM has provided indications on several occasions that encapsulated CsCl/SrF<sub>2</sub> waste forms may not be acceptable**
- **Need to continue dialogue between EM/RL and RW/YMSCO to establish technical basis for disposal of encapsulated Cs and Sr materials**