



**Civilian Radioactive Waste  
Management System**

Management & Operating Contractor

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# DOE-EM Owned SNF Disposal Criticality

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Criticality Department**



# Overview

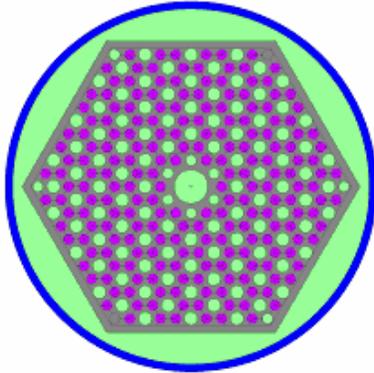
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- **DOE SNF Grouping, Basket Designs and Potential Modifications**
- **Ongoing Work**
- **Remaining effort to support 03/08 LA submittal**
- **Draft EPA/NRC Rule**

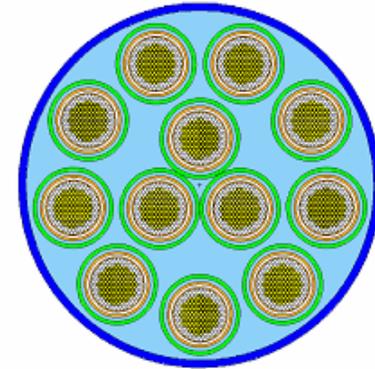
# DOE SNF Grouping Summary

<b>DOE Fuel Groups</b>	<b>Representative Fuel Type</b>	<b>Neutron Absorber</b>
Uranium Metal	N-Reactor	None
Uranium-Zirconium/Uranium-Molybdeum	Enrico Fermi	Fe/Gd Shot
Uranium Oxide (High Enriched Uranium)	Shippingport Pressurized Water Reactor	None
Uranium Oxide (Low Enriched Uranium)	Three Mile Island (debris)	None
Uranium-Aluminum	Advanced Test Reactor	None
Uranium/Thorium/Plutonium Carbide	Fort St. Vrain	None
Mixed Oxide	Fast Flux Test Facility	Ni-Gd Alloy
Uranium/Thorium Oxide	Shippingport Light Water Breeder Reactor	Al/Gd Shot
Uranium-Zirconium-Hydride	Training Research Isotopes General Atomics	Ni-Gd Alloy

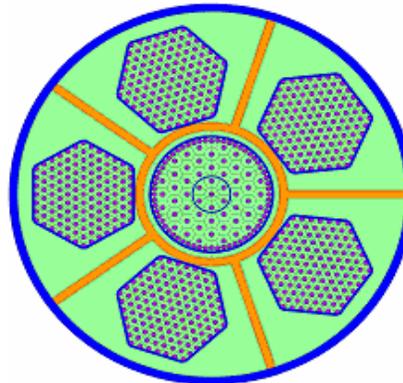
# Layout of DOE SNF Baskets



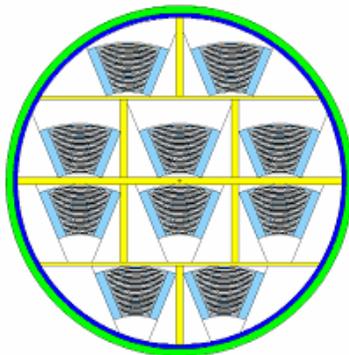
Radial View of Fort St. Vrain Canister



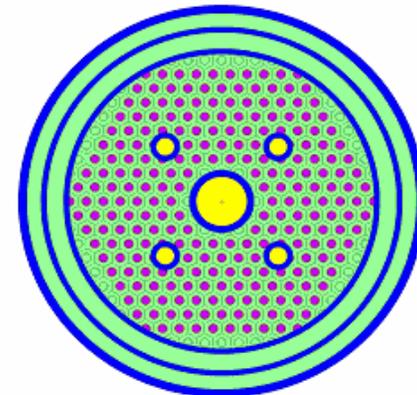
Radial View of Enrico Fermi Canister



Radial View of FFTF Canister

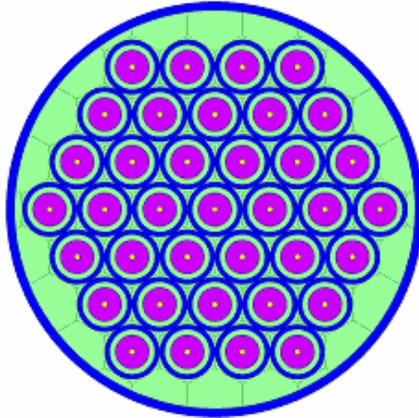


Radial View of ATR Canister

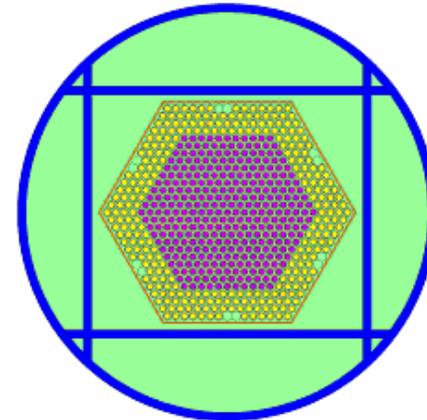


Radial View of TMI-2 Type K Canister

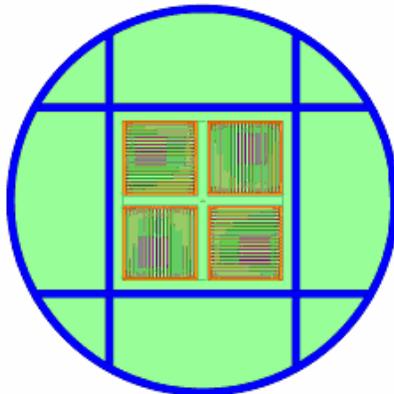
# Layout of DOE SNF Baskets (cont.)



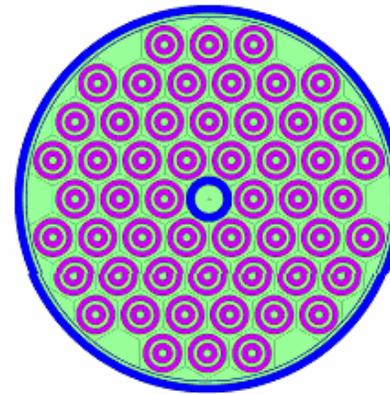
Radial View of TRIGA Canister



Radial View of Shippingport LWBR  
Canister



Radial View of Shippingport PWR Canister



Radial View of N Reactor Mark IV Canister

## ■ TRIGA (UZrH<sub>x</sub>)

- Changing the neutron absorber incorporation from 12 tubes with 8 wt% Gd to all tubes with 2 wt% Gd
- Reducing the number of rods from 37 per layer, 3 layers per canister, to 33 rods per layer

## ■ FFTF (MOX)

- Potential changes in basket structure to possibly include 5 locations rather than 6.
- Potential addition of shot for moderator exclusion/neutron absorption
- Need to analyze DFAs with pulled out rods

## ■ Fermi (U-Mo/U-Zr)

- Changing the Stainless Steel Tubes Surrounding the 01 canisters to Ni-Gd

## ■ Criticality Potential of WPs affected by Igneous Intrusion

- FFTF, Fermi, TRIGA, ATR, Fort St. Vrain, TMI, Shippingport LWBR, Shippingport PWR, N-Reactor
- Study considers damage WPs, drift conditions, and degradation of DOE SNF and WP materials

## ■ Geochemistry Report: Material Degradation and Release Model

- FFTF, N-Reactor, TMI
- Model examines nominal, seismic, and igneous scenarios

## ■ Geochemistry Report: External Accumulation Model

- FFTF, N-Reactor, TMI
- Model predicts accumulation of fissile and non-fissile materials in the invert, fractures, and lithophysae in the rock beneath a degrading WP



# Remaining Effort to Support 03/08 LA Submittal

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- Evaluate in-package degradation and release and external accumulation of remaining DOE SNF types with the latest updates to the geochemistry models
- Update the Phase I and II Summary Report with the latest criticality evaluations including design changes, additional fuel types and Ni-Gd performance
- Update the FEPs screening analysis based on the latest inputs

- **According to draft 10 CFR 63, if a FEP has been screened out for the first 10,000 years, it does not need to be included for dose calculations beyond 10,000 years.**
- **In the draft Rule, criticality is used as an example of such FEPs. Note, however, that this is a draft Rule and comments against this particular point have been made by the State.**
- **Whether the reasoning for this screening stands or gets changed remains to be seen.**

- BSC (Bechtel SAIC Company) 2001. *Evaluation of Codisposal Viability for Th/U Carbide (Fort Saint Vrain HTGR) DOE-Owned Fuel*. TDR-EDC-NU-000007 REV 00. Las Vegas, Nevada: Bechtel SAIC Company. ACC: [MOL.20011017.0092.](#)
- CRWMS M&O 1999. *Evaluation of Codisposal Viability for MOX (FFTF) DOE-Owned Fuel*. BBA000000-01717-5705-00023 REV 00. Las Vegas, Nevada: CRWMS M&O. ACC: [MOL.19991014.0235.](#)
- CRWMS M&O 2000. *Evaluation of Codisposal Viability for HEU Oxide (Shippingport PWR) DOE-Owned Fuel*. TDR-EDC-NU-000003 REV 00. Las Vegas, Nevada: CRWMS M&O. ACC: [MOL.20000227.0240.](#)
- CRWMS M&O 2000. *Evaluation of Codisposal Viability for Th/U Oxide (Shippingport LWBR) DOE-Owned Fuel*. TDR-EDC-NU-000005 REV 00. Las Vegas, Nevada: CRWMS M&O. ACC: [MOL.20001023.0055.](#)

- CRWMS M&O 2000. *Evaluation of Codisposal Viability for U-Zr/U-Mo Alloy (Enrico Fermi) DOE-Owned Fuel.* TDR-EDC-NU-000002 REV 00. Las Vegas, Nevada: CRWMS M&O. ACC: [MOL.20000815.0317.](#)
- CRWMS M&O 2000. *Evaluation of Codisposal Viability for UZrH (TRIGA) DOE-Owned Fuel.* TDR-EDC-NU-000001 REV 00. Las Vegas, Nevada: CRWMS M&O. ACC: [MOL.20000207.0689.](#)
- CRWMS M&O 2001. *Evaluation of Codisposal Viability for U-Metal (N Reactor) DOE-Owned Fuel.* TDR-EDC-NU-000004 REV 00. Las Vegas, Nevada: CRWMS M&O. ACC: [MOL.20010314.0004.](#)