Public Meeting on Draft Spent Nuclear Fuel from Germany Environmental Assessment

Potential Acceptance and Disposition of Spent Nuclear Fuel Containing U.S.-Origin Highly Enriched Uranium from the Federal Republic of Germany

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Presentation Outline

- **Update on the National Environmental Policy Act (NEPA) process and a summary of information in the Draft Spent Nuclear Fuel from Germany Environmental Assessment (EA)**

- **Status of EM's efforts on the feasibility study regarding the potential acceptance and disposition of graphite-based spent nuclear fuel (SNF) from Germany at the Savannah River Site (SRS)**

- **Potential paths forward**

NEPA Process for the Spent Nuclear Fuel from Germany EA

NEPA

The National Environmental Policy Act establishes a process for decisionmakers to use in considering the potential environmental impacts (both positive and negative) of major actions before making decisions.

NEPA requires a Federal agency to consider the potential environmental, human health, and socioeconomic effects of a proposed action and a range of reasonable alternatives for implementing the action, including the option of taking no action at all.

The No Action Alternative provides a baseline against which to compare other alternatives.

- **DOE is seeking the opportunity to collect public comments regarding the Draft Spent Nuclear Fuel from Germany EA**
- **Comment period extends to March 11, 2016; Publication of NOA marked the beginning of the comment period.**
- **A Notice of Availability (NOA) of the Final EA along with the NEPA determination will be made in the *Federal Register* once completed**

NEPA Steps

Steps in the EA Process

Notice of Intent to Prepare EA

Scoping Meeting

Notice of Availability of the Draft EA

Public Meeting

Final EA issued
Results in either:
- Finding of No Significant Impact
- EIS Preparation

- **Published Notice of Intent to prepare the Spent Nuclear Fuel from Germany EA (DOE/EA-1977) on June 4, 2014 *Federal Register,* beginning the NEPA process**

- **Scoping meeting was held June 24, 2014**

- **Published Notice of Availability (NOA) in the *Federal Register* regarding the Draft Spent Nuclear Fuel from Germany EA in January 25, 2016 along with details about this public meeting and how to submit comments on the Draft EA**

- **Newspaper advertisements, site updates and environmental bulletins (notifying Stakeholders and interested parties) were also used to communicate the availability of the Draft EA and the public meeting**

Background

- The Department's effort is to ensure US-Origin materials are stored, processed, and dispositioned to reduce, and potentially eliminate, the amount of US-origin highly enriched uranium (HEU) at civilian facilities worldwide. This will eliminate the potential for the material to be used for an improvised nuclear device, a radiological dispersal device, or other radiological exposure device.

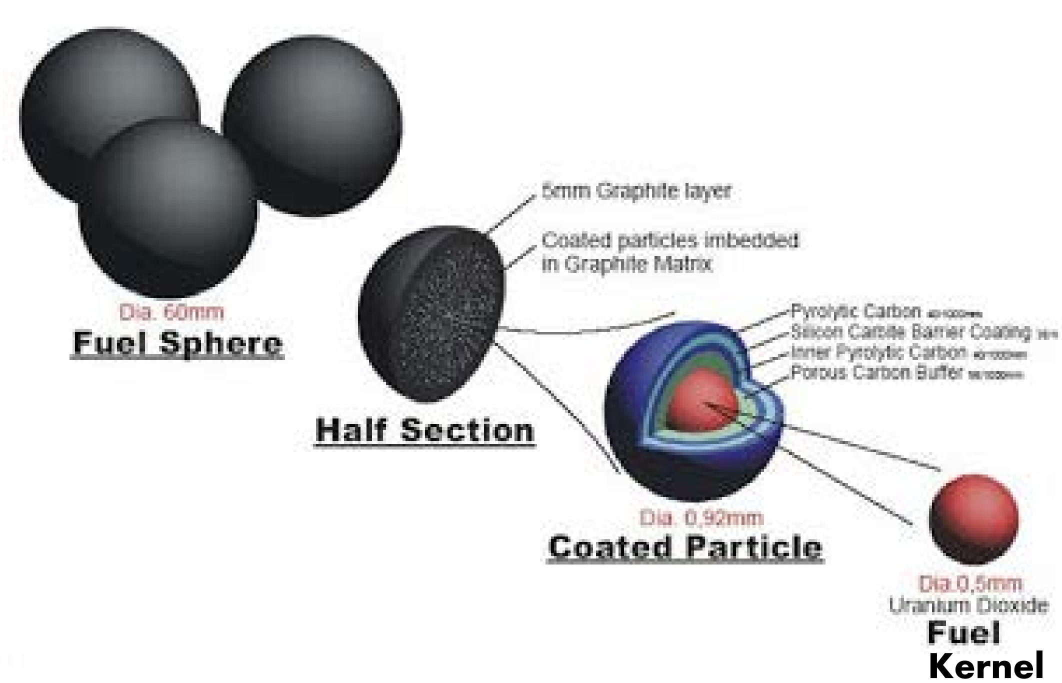
- Graphite-Cladded SNF from Germany under consideration , used in research reactors, is approximately 1 million graphite spheres stored in Jülich and Ahaus, Germany originally containing ~900 kg of highly enriched uranium (HEU) (prior to irradiation) from the U.S.

- At the request of German government, DOE's Environmental Management is conducting a feasibility evaluation for the proposed action that would receive, store, process, and disposition the material at the Savannah River Site.

- Savannah River National Laboratory (SRNL) researched the ability to chemically digest the graphite matrix encapsulating the HEU fuel kernels to allow processing of the fuel.

- The Draft Spent Nuclear Fuel from Germany EA was prepared to evaluate the impacts from the proposed action.

Composition of German HEU Fuel



- **Approx. 1 million, 60mm graphite spheres**
- **Characteristics of a sphere:**
  - ~ 200 g of A3-3 graphite
  - 1g of uranium, ~93% enriched
  - 10g of thorium
- **Currently stored in 455 CASTOR casks:**
  - AVR (Jülich)
  - THTR-300 (Ahaus)

CASTOR Cask

- **Casks are certified in Germany by the German equivalent to the US Nuclear Regulatory Commission (NRC)**
- **Casks are being reviewed for acceptance as DOE/US Department of Transportation (DOT) - certified Type B casks**

CASTOR Cask cut away

Source of Material

- **US-Origin HEU material was provided for purposes of peaceful uses and development of nuclear energy**
  - Explored the use of coated fuel particles embedded in graphite spheres, used in pebble-bed reactors, cooled by helium (high temperature gas-cooled reactor, HTGR)
- **Used in two research reactors in Germany**
  - AVR Reactor (*1967-1988*) was the first high temperature reactor in Germany to test the technology of graphite spheres
  - THTR-300 (*1983-1989*) was a demonstration research reactor to prove the AVR concept design to produce electricity

AVR Experimental Reactor, 15MW(e), Jülich

THTR-300, Demonstration Reactor, 300 MW(e), Hamm-Uentrop

graphite SNF spheres

Technology Development Efforts to Date

- Needed a method to separate the fuel kernels from the graphite matrix without generation of graphite fines
- ~$10 million in funding for research and development (R&D) was provided by Forschungszentrum Jülich (FZJ)
- Savannah River National Laboratory (SRNL) R&D focused on chemical digestion of the graphite, results led to a vapor phase digestion of the graphite
- Vapor phase digestion:
  - Allows better control of the digestion process
  - Is more adaptable to remote handling operations; and
  - Reduces the amount of waste generated
- An Independent review team conducted a Technology Readiness Assessment to evaluate the technology maturation efforts to date. SRNL and the independent review team agreed on the current technology readiness level of this technology
- Next steps in the research and development are to demonstrate the technology on a pilot scale size and optimization of the process

Laboratory Equipment Used for Research

SRNL R&D Results

Results after 6 hours on graphite only pebbles

Recovered fuel kernels from unirradiated graphite pebbles

Scope of the Spent Nuclear Fuel from Germany EA

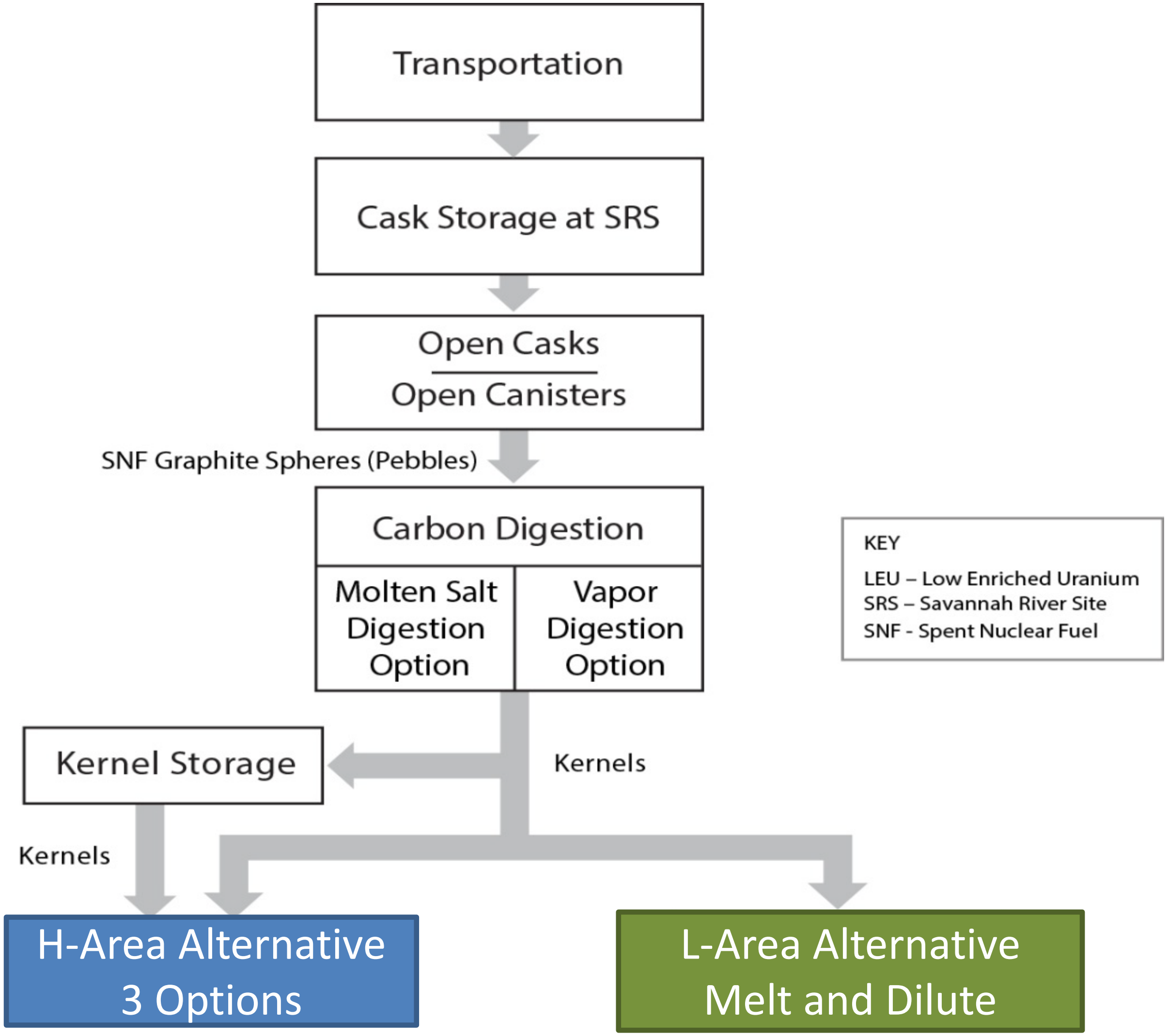
- **Draft Spent Nuclear Fuel from Germany EA considers:**
  - Transportation
  - Receipt and storage of the SNF
  - Carbon digestion (SRNL technology)
  - Processing the fuel kernels
  - Material disposition
  - Waste management

CASTOR Cask being loaded into the transportation frame

Alternatives Evaluated

- **No Action Alternative (NEPA baseline)**
- **H-Area Alternative**
- **L-Area Alternative**

Both action alternatives require the use of the Carbon Digestion Technology (under development by SRNL)



H-Area Options Evaluated

H-Area Alternative

Requires construction of a uranium solidification building in H-Area

Vitrification Option

- Fuel kernels dissolved
- Fission products/ uranium/ thorium sent to SRS High Level Waste System

Low Enriched Uranium (LEU) Option

- Fuel kernels dissolved
- Uranium separated and down blended to LEU
- LEU solidified and dispositioned as low level waste
- Fission products/ thorium sent to SRS High-Level Waste (HLW) System

Low Enriched Uranium/Thorium Option

- Fuel kernels dissolved
- Uranium and thorium separated and down blended to LEU/thorium
- LEU/thorium solidified and dispositioned as low level waste
- Fission products sent to SRS HLW System

L-Area Alternative Evaluated

**L-Area Alternative
Melt and Dilute**

- Kernels down blended to a low-enriched uranium mixture (kernels would not be dissolved as in the H-Area Alternatives)
- Low-enriched uranium mixture melted and cast to uranium-aluminum alloy ingots
- Ingots stored in concrete overpacks on a storage pad in L-Area

Requires construction and building modifications in L-Area: sand filter, fan room, stack, and truck bay

Areas Analyzed

- Impacts on air quality
- Impacts on general population and workers
- Impacts that could occur as a result of postulated accidents and intentional destructive acts (terrorist actions and sabotage)
- Socioeconomic effects
- Potential disproportionately high and adverse effects on low-income and minority populations (environmental justice)
- Impacts from transportation of radioactive materials, including transport across the ocean
- Impacts on waste management activities
- Short- and long-term land use impacts, including potential impacts of disposal
- Cumulative impacts
- Other resource areas also analyzed for SRS

Comparison of Impacts from the Alternatives

	H-Area Alternative			L-Area Alternative
	Vitrification	*LEU*	*LEU-Thorium*	*Melt and Dilute*
Air Quality	**Minor changes in criteria air pollutants may require modification of the Clean Air Act permit.** Small quantities of hazardous air pollutants would be emitted. Minimal increase in radiological emissions.			
Radiological Operations	**Risk to the public from normal operations would be small.** No latent cancer fatalities (LCFs) would be expected in the offsite population under any alternative/option. The annual risk of an LCF [a] for the maximally exposed individual would be:			
Public	1 in 20 Million	1 in 17 Million		1 in 50 Million
	Worker doses would be maintained below the DOE dose limit 5 rem per year. No LCFs would be expected in the worker population under any alternative/option. The annual risk of a single LCF[a] occurring in the worker population would be:			
Workers	1 in 50			1 in 200
	The annual likelihood of a major operational accident is extremely unlikely (1 chance in 10,000 to 1 chance in 1 million). The annual likelihood of a beyond-design-basis accident, such as an earthquake followed by a fire or spill that results in a release from the building, is beyond extremely unlikely (less than 1 chance in 1 million).			
Accidents	No increase in the LCF risk from accidents at H-Canyon relative to currently approved operations.			LCF risk from accidents would be similar to or less than those at H-Canyon.
Socioeconomics	**Under any alternative/option there would be a small beneficial impact from preserving existing jobs.**			
	No new jobs	Up to 20 new jobs related to operation of a new uranium solidification facility		No new jobs
Environmental Justice	**No disproportionately high and adverse impacts on minority or low-income populations.** Minimal general population impacts from radiological and nonradiological emission exposures and from socioeconomic factors.			

[a] Compared with the H-area alternative, under the L-Area Alternative, half as much material would be processed annually, and operations would last twice as long.

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Comparison of Impacts from the Alternatives

Transportation	H-Area Alternative: *Vitrification*	H-Area Alternative: *LEU*	H-Area Alternative: *LEU-Thorium*	L-Area Alternative: *Melt and Dilute*
Spent Nuclear Fuel Transport From Germany to Savannah River Site	• About 30 shipments over an approximately 3.5-year period to transport the 455 CASTOR casks of spent nuclear fuel from Germany. A typical shipment would be 16 casks. • Under incident-free ship transport there would be no impacts on the public. • The probability of an accident at sea resulting in leakage from a CASTOR cask would be between 1 in 910,000 (in the deep sea) to 1 in 67 million (in coastal waters); risk of impact on the public would be extremely low (less than 1 in 1 million). • The risk of a single LCF in the public from a port accident would be about 1 in 10 million. • Rail transport from the port to SRS under incident-free conditions would result in no LCFs (0.0003 LCFs) in the public. • Risks of a fatality from a rail transport accident are 1 in 2 trillion for radiological impacts and 1 in 10,000 for nonradiological (physical) impacts.			
Grouted LEU or LEU-Thorium Waste Transport from SRS for offsite disposal *Transportation Impacts*	No shipments of LEU or LEU-Thorium waste would occur.	Both rail and truck transport were evaluated for shipments to commercial facilities or the DOE Nevada National Security Site (NNSS). The largest impacts were for truck transport to NNSS.		No shipments of LEU or LEU-Thorium waste would occur.
Incident Free	Not Applicable	300 shipments No LCFs (0.002)	510 shipments No LCFs (0.003)	Not Applicable
Accidents: *Risk of an LCF* *Risk of traffic fatality*		1 chance in 200,000 1 chance in 20	1 chance in 200,000 1 chance in 10	

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Comparison of Impacts from the Alternatives

Waste Type	Waste Disposition	H-Area Alternative: Vitrification	H-Area Alternative: LEU	H-Area Alternative: LEU-Thorium	L-Area Alternative: Melt and Dilute
High-activity waste	Onsite storage	101 DWPF canisters	32 DWPF canisters	15 DWPF Canisters	82 Multi-canister overpacks
Saltstone	Onsite disposal	190,000 (cubic feet)	220,000 (cubic feet)	220,000 (cubic feet)	130,000 (cubic feet)
Grouted LEU or LEU Thorium Waste	Onsite or offsite disposal	No grouted waste form generated	3,600 *As generated (cubic feet)* 67,000 *As disposed (cubic feet)*	10,100 *As generated (cubic feet)* 72,500 or more *As disposed (cubic feet)*	No grouted waste form generated

Summary

- The disposition of this material supports the Department's objectives to reduce and eliminate the amount of US-Origin HEU at civilian facilities worldwide
- The Final EA and a Finding of No Significant Impact will **NOT** constitute a decision to accept the German material by the Department
- More technology maturation is necessary before the Department can make a decision
- This work would be done at SRS and completely funded by Germany
- Public involvement is an important component in DOE's decision making process as such the Department will hold another public meeting to discuss the decision if the technology is proven successful
- As stated before, until the technology has been proven successful the Department will not receive the proposed material at SRS

How to Provide Your Comments

Court Reporter

If you provide oral comments tonight, a court reporter will record your comments

Comment Form

Comment forms are available in the registration area. If you would like to provide written comments on the scope of the Draft Spent Nuclear Fuel from Germany EA, please use the comment form and drop it off at the registration table when you leave. Alternatively, you may mail, e-mail, or fax your comments to the Department of Energy at the addresses below.

E-Mail

You may submit your comments electronically to GermanSpentNuclearFuelEA@leidos.com

Facsimile

The toll-free fax number to submit your comments is 1-800-865-0277

U. S. Mail

Written comments on the Draft Spent Nuclear Fuel from Germany EA should be submitted to the Department of Energy at the following address:

Tracy Williams, NEPA Compliance Officer
Draft Spent Nuclear Fuel from Germany EA
U. S. Department of Energy
P.O. Box A
Aiken, South Carolina 29802