

South Carolina Governor's Nuclear Advisory Council



GERMAN GRAPHITE PEBBLE BED SPENT NUCLEAR FUEL

October 12, 2017 | Gary DeLeon (EIC), Guenter Mank (JEN)

Background

Current Status

Benefits from Success

Next Steps

Summary

Recommendation

JEN was formed on September 1, 2015, to manage the decommissioning of nuclear facilities at the Forschungszentrum Jülich (Juelich Research Center), which was founded in 1956.

Decommissioning projects include:

- FRJ-1 Research Reactor (MERLIN)
- FRJ-2 Research Reactor (DIDO)
- AVR High Temperature Research Reactor

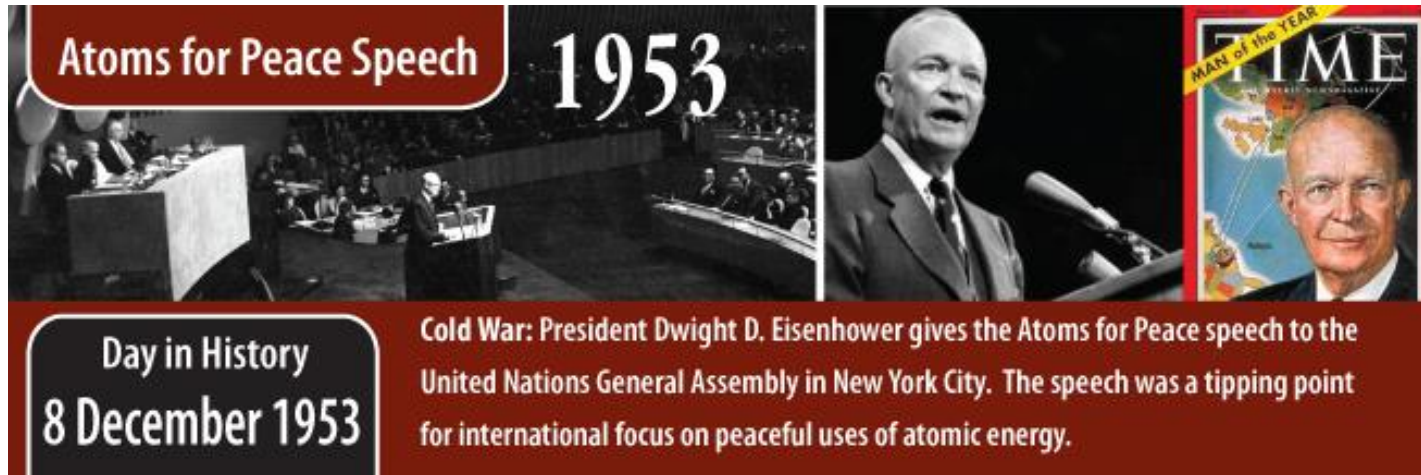




Photo: Samuel Edlow (far left) and USAEC officials receive a shipment

For 60 years, Edlow International Company has managed the transportation of radioactive materials (Class 7) world-wide:

- transport by road, rail, air and ocean;
- provide regulatory assistance to clients; and
- consulting services regarding nuclear fuel cycle.



- The U.S. and Germany have a long-standing and ongoing cooperation to repatriate U.S.-origin highly enriched uranium (HEU) as part of the U.S. Atoms for Peace program.
- Within the non-proliferation policy 29 transports for the repatriation of spent nuclear fuel (SNF) from the Juelich research reactors FRJ-1 and 2 to the U.S. took place from 1977 to 2008, when the last reactor was closed down in Juelich.
- The High Temperature Reactor (HTR) graphite fuel, which contains U.S.-origin HEU, is still stored in Germany and is awaiting return to the U.S. under the non-proliferation policy.

“In every case where the US provides to another country fissionable material for research or power reactors, whether by gift, lease, or sale, the US should seek to reserve the right to regain such fissionable materials after usage in such country’s reactor, in order to reprocess such material and obtain all the by-products therefrom for peaceful purposes, and in order to obviate the necessity of creating reprocessing facilities in such other country.”
(National Security Council, 1954)

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The U.S., together with the other nations, committed themselves to:

“Repatriate all civilian HEU to their countries of origin
or otherwise permanently dispose or down blend remaining stocks of civilian HEU,
where economically and technically feasible, and where there is a viable non-HEU alternative.”

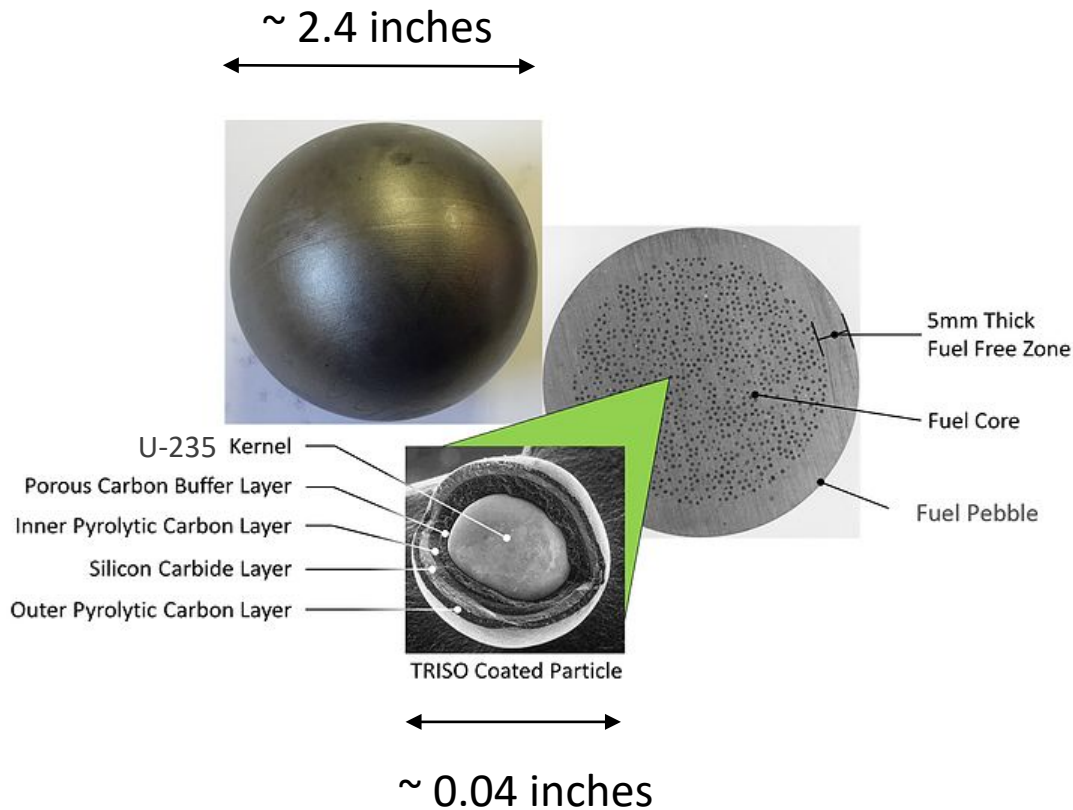


AVR Reactor



Graphite fuel, containing ~ 900 kg of U.S. – origin HEU (up to 93% enrichment), has been used in two reactors as part of Germany’s research and development program for high temperature pebble-bed reactor technology.

- Arbeitsgemeinschaft Versuchsreaktor (AVR-reactor), Jülich (1966-1988)
~ 290,000 pebbles (including ~ 55,000 LEU pebbles)
- Thorium Hoch-Temperatur Reaktor (THTR-300 reactor), Hamm (1983-1989)
~ 690,000 pebbles



Graphite pebble bed fresh fuel

- 60 mm diameter (~ size of tennis ball)
- Each pebble contains 200 g graphite and 1 g U-235
- By extracting the fuel kernels the material to be processed is reduced by a factor of ~200

The Graphite Pebbles are stored and transported in CASTOR® THTR/AVR Type B casks:

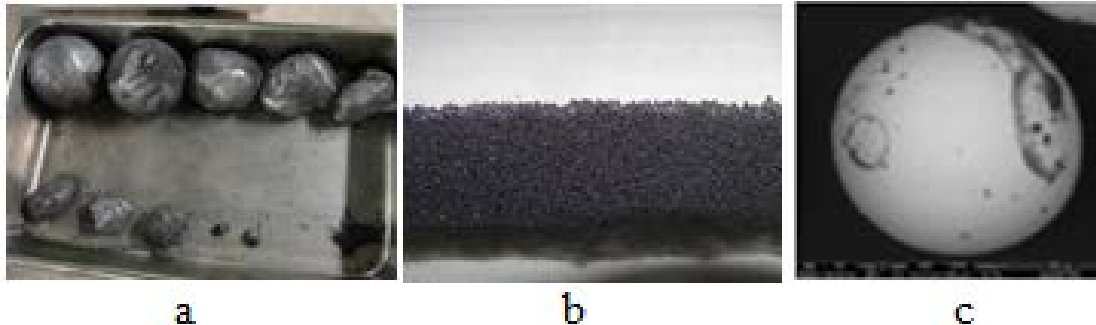
- Cask Dimensions
 - 4.53 ft. diameter
 - 9.13 ft. height
- Cask weight: ~ 32 metric tons
- Competent Authority Certification issued by U.S. DOT / U.S. NRC in February 2017



*Cutaway model of CASTOR® THTR/AVR cask
in Juelich (152 casks)*

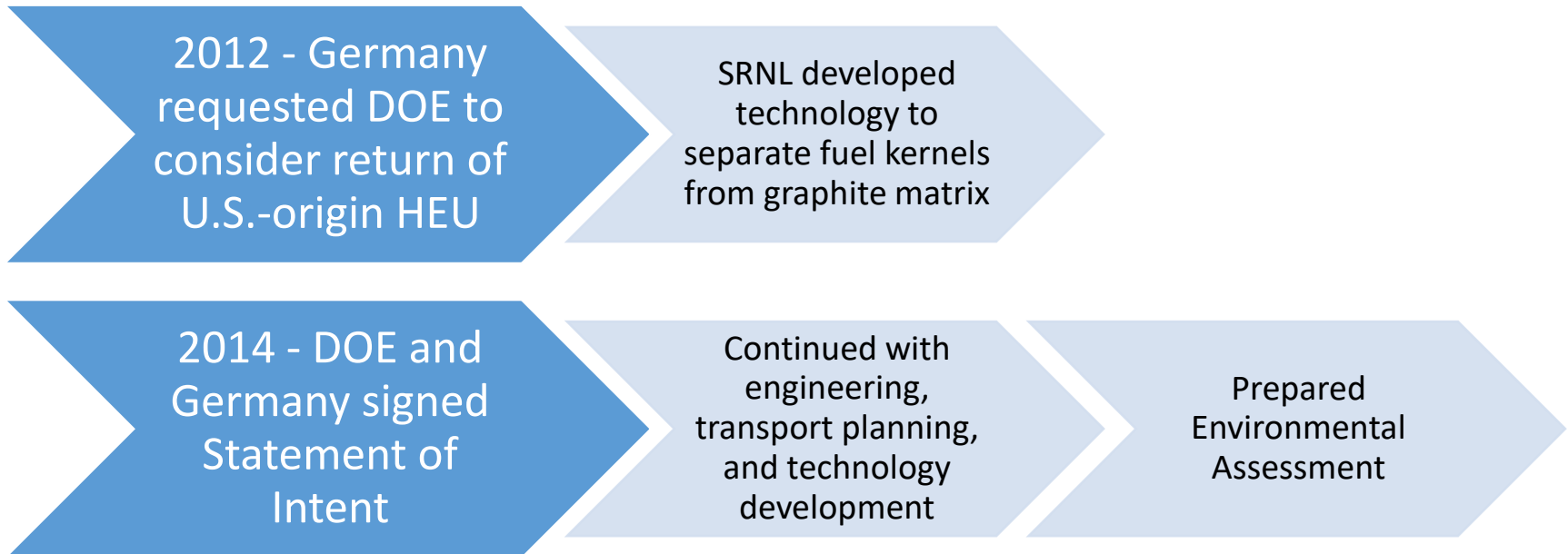
Current Status:

- Aim: Extract HEU-kernels fuel from the pebbles
Eliminate HEU by down blending to LEU
- Savannah River National Laboratory (SRNL) developed the technology to extract the HEU kernels:



a - partially digested graphite pebbles, b - recovered kernels, and c - microscopic picture of a recovered kernel.

- With the new vapor process the LLW is significantly decreased
- The HEU will be down blended in the H-canyon at SRS



Aim is to have the technology for disposition demonstrated before the graphite fuel from Germany is received at SRS

Current Status (continued)

- The developed Engineering and Transportation Planning concept for receipt and disposition is considered in the EA.
- Environmental Assessment (EA) prepared to analyze potential environmental impacts.



EA Public Meeting - North Augusta, South Carolina

Benefits from Success

- Supports U.S. HEU minimization objective and is consistent with U.S. nonproliferation policy.

*~ 900 kg of HEU fresh fuel
would be returned to the U.S. for safe disposition*

- Provides disposition pathway for graphite fuels and help pave the way for high temperature graphite-moderated reactors being developed in the U.S. and other countries.
- Additional mission to H-Canyon and Savannah River Site (SRS).
- Economic benefits to local community.



Picture courtesy of International Nuclear Services (UK)



H - Canyon

Next Steps

- U.S. DOE issue Final EA and Finding of No Significant Impact (FONSI) - if determined.
 - *Completion of EA does not constitute a decision to accept the graphite fuel from Germany*
- Complete technology development.
- Complete contract between U.S. DOE and Germany to repatriate graphite fuel.
- Continue with stakeholder involvement.

Summary

- Significant progress made showing that it is feasible to disposition German graphite fuel.
- Draft EA indicates environmental impacts are negligible.
- Additional work needed to help inform decision to repatriate the German graphite fuel.
- Provides additional mission to H-Canyon and SRS.
- Economic benefits to local community.
- Supports U.S. HEU minimization objective and consistent with U.S. nonproliferation policy.

Recommendation

South Carolina Governor's Nuclear Advisory Council provide a letter to SC Governor:

- *support feasibility study and technology development at SRS to disposition German graphite fuel; and*
- *support repatriation of German graphite fuel to the U.S. within the non-proliferation policy.*

Thank you!



Danke!