FINDING OF NO SIGNIFICANT IMPACT FOR THE FINAL ENVIRONMENTAL ASSESSMENT FOR THE ACCEPTANCE AND DISPOSITION OF SPENT NUCLEAR FUEL CONTAINING U.S.-ORIGIN HIGHLY ENRICHED URANIUM FROM THE FEDERAL REPUBLIC OF GERMANY

Issued By: United States Department of Energy

Action: Finding of No Significant Impact (FONSI)

Summary: The Department of Energy (DOE) has completed the *Final Environmental Assessment for the Acceptance and Disposition of Spent Nuclear Fuel Containing U.S.-Origin Highly Enriched Uranium from the Federal Republic of Germany* (DOE/EA-1977) (*Spent Nuclear Fuel from Germany EA*). DOE prepared this *Spent Nuclear Fuel from Germany EA* to evaluate potential environmental impacts of the receipt, storage, processing and disposition of certain spent nuclear fuel (SNF) from a research and development program of the Federal Republic of Germany (Germany). DOE is considering the feasibility of accepting this SNF containing U.S.-origin highly enriched uranium[1] (HEU) at DOE's Savannah River Site (SRS) for processing and disposition.

Under the proposed action, the German government would work with DOE to transport SNF packaged in CASTOR[2] casks by chartered ship from Germany to Joint Base Charleston-Weapons Station, near Charleston, South Carolina. The CASTOR casks would be transferred to railcars at Joint Base Charleston-Weapons Station, transported to SRS, unloaded, and placed in approved secure storage. When processing facilities are ready, DOE would move the CASTOR casks to the processing facility, and the SNF would be removed from the CASTOR casks and processed. After processing, the resulting waste forms, including the uranium, would be disposed or stored until appropriate disposal facilities are available.

Repatriating the SNF containing U.S.-origin HEU from Germany supports the U.S. policy objective to reduce, and eventually to eliminate, HEU from civil commerce and is consistent with U.S. nonproliferation policy.

DOE announced the availability of the *Draft Spent Nuclear Fuel from Germany EA* (*Draft EA*) in the *Federal Register* on January 25, 2016 (81 FR 4023). DOE provided email notification of the availability of the *Draft EA*, advertised availability in local newspapers, and posted the *Draft*

[1] Highly enriched uranium has a concentration of 20 percent or greater of the isotope uranium-235. Low-enriched uranium has a uranium-235 concentration of less than 20 percent. Natural uranium contains approximately 0.7 percent uranium-235.

[2] CASTOR is the name given to a dry-storage cask for storage and transport of radioactive material. CASTOR casks are Type B packages certified for the transport of materials with high levels of radioactivity, including SNF. Type B packages must withstand, without loss of contents, normal transport conditions such as heat, cold, vibration, changes in pressure, being dropped, compressed, sprayed with water, or struck by objects, as well as more serious accident conditions. These requirements are demonstrated during the licensing process for each Type B package through rigorous testing in accordance with 10 CFR 71, Packaging and Transportation of Radioactive Material.

EA on DOE websites. During this period, DOE informed the states of South Carolina, Georgia, and Nevada of the availability of the EA, and solicited comments from the states and the public on the *Draft EA*. DOE also held a public meeting on the *Draft EA* on February 4, 2016 in North Augusta, South Carolina. In response to stakeholders' requests, the public comment period was extended to March 25, 2016. DOE considered all comments received in developing the final *Spent Nuclear Fuel from Germany EA*.

Based on the analysis in the *Spent Nuclear Fuel from Germany EA*, DOE has determined that the proposed action is not a major Federal action significantly affecting the quality of the environment within the context of the National Environmental Policy Act (NEPA), and thus does not require the preparation of an environmental impact statement. This Finding of No Significant Impact (FONSI) does not constitute a decision to select any alternative, and it is not a decision to proceed with the project.

CONTACT INFORMATION AND DOCUMENT AVAILABILITY:

This FONSI and the *Spent Nuclear Fuel from Germany EA* are available on the DOE NEPA website at http://energy.gov/node/918941 and also at the SRS website at: http://www.srs.gov/general/pubs/envbul/nepa1.htm.

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SUPPLEMENTAL INFORMATION:

Background

DOE has prepared the *Spent Nuclear Fuel from Germany EA* in accordance with Council on Environmental Quality (CEQ) and DOE NEPA implementing regulations at 40 CFR Parts 1500 through 1508 and 10 CFR Part 1021, respectively. In the EA, DOE analyzes the potential environmental impacts of receipt, storage, processing, and disposition of SNF from Germany containing, prior to irradiation, approximately 900 kilograms of U.S.-origin HEU. The SNF is composed of kernels containing thorium and U.S.-origin HEU embedded in small graphite spheres. About 94 percent of the graphite spheres contain HEU kernels. The remaining spheres contain low-enriched uranium (LEU) kernels that cannot reasonably be separated from the HEU spheres.

The U.S. provided the HEU to Germany under the Atoms for Peace program between 1965 and 1988. The spent fuel was irradiated at the Arbeitsgemeinschaft Versuchsreaktor (AVR) reactor, which operated from 1967 to 1988, and the Thorium High Temperature Reactor-300 (THTR), which operated from 1983 to 1989. Germany operated these reactors as part of a research and development program for the pebble bed, high-temperature, gas-cooled reactor technology.

In a February 2012 letter, a State Secretary of the Federal Ministry of Education and Research of the Federal Republic of Germany requested DOE's Under Secretary for Nuclear Security to consider the option of accepting the SNF, and collaboration on the request was initiated in May 2012. In April 2014, DOE, the Federal Ministry of Education and Research of the Federal Republic of Germany, and the Ministry for Innovation, Science and Research of the State of North Rhine-Westphalia on behalf of the North Rhine-Westphalian State Government, Germany, signed a Statement of Intent to cooperate in conducting the preparatory work necessary to support DOE's consideration of the request that it accept the SNF from Germany and to use SRS facilities for processing and disposition. The preparatory work includes conducting studies, technical and engineering work, and preparation of the EA. The EA analysis and the technology maturation work will allow DOE to reach an informed decision on the proposed receipt, acceptance, processing and disposition of the SNF from Germany. The Statement of Intent specifies that Forschungszentrum Jülich, an interdisciplinary research center funded primarily by the German government, will bear the cost of the preparatory phase – feasibility studies and NEPA analysis – and if there is a decision to proceed with the project, would also bear the costs associated with acceptance, processing, and disposition of the SNF. In September 2015, the responsibility for the AVR facility and resulting SNF was transferred to Jülicher-Entsorgungsgesellschaft Für Nuklearanlagen mbH (JEN). Although the analyses in the EA are based on the total quantity of SNF from both AVR and THTR, the German government has not indicated whether the THTR SNF would be proposed for return to the United States. However, if a decision is made to proceed with the project, and the THTR SNF were included, the additional costs would be negotiated with the understanding that costs associated with acceptance, processing, and disposition of the spent AVR and THTR fuel would be the responsibility of the appropriate German entity.

Proposed Action

The proposed action is to transport SNF packaged in CASTOR casks by ship from Germany to Joint Base Charleston-Weapons Station, near Charleston, South Carolina, transport the CASTOR casks by train to SRS, place the CASTOR casks in a secure storage facility, remove the SNF from the CASTOR casks, process the SNF, and dispose or store the resulting waste forms, including the uranium, until appropriate disposal facilities are available. The *Spent Nuclear Fuel from Germany EA* considered three alternatives: the No-Action Alternative, the H-Area Alternative, and the L-Area Alternative. The H-Area Alternative (so named because most activities would involve H-Area facilities) includes three processing options (Vitrification Option, LEU Waste Option, and LEU/Thorium Waste Option) that use H-Canyon to differing extents; DOE would use only one of these options if DOE decides to implement the H-Area Alternative. Under the L-Area Alternative (so named because the alternative would involve mostly L-Area facilities), DOE would install and operate a Melt and Dilute processing capability in L-Area. DOE would use existing and planned SRS infrastructure and facilities to process the SNF from Germany. High-level radioactive waste (HLW) canisters produced under the H-Area Alternative or multi-canister overpacks (MCO) produced under the L-Area Alternative would be stored at SRS pending off-site disposition.

If DOE implements the proposed action, the shipping campaign would involve about 30 shipments over approximately a 3.5-year period to transport 455 CASTOR casks containing the SNF from Germany aboard chartered ships across the Atlantic Ocean to Joint Base Charleston-Weapons Station. From Joint Base Charleston-Weapons Station, DOE would transport the CASTOR casks to SRS on dedicated trains. DOE would store the SNF in the CASTOR casks in secure storage areas in H- or L-Area until processing facilities are ready and processing would not interfere with other missions.

The SNF is in the form of HEU, LEU, and thorium kernels embedded in a graphite (carbon) matrix. The kernels need to be removed from the graphite matrix before they can be processed. In the *Spent Nuclear Fuel from Germany EA*, DOE evaluated two methods for removing the graphite surrounding the fuel kernels (referred to as carbon digestion), a molten salt digestion process and a vapor digestion process. Under the H-Area Alternative, DOE evaluated three options for processing the kernels after carbon digestion:

- The Vitrification Option provides for dissolution of the kernels in H-Canyon with direct transfer of the entire dissolver solution to the existing SRS Liquid Nuclear Waste Facilities. Under this option, the high-activity fraction of the dissolver solution would be dispositioned as vitrified high-level radioactive waste and the low-activity fraction as low-level radioactive waste saltstone.
- The LEU Waste Option provides for dissolution of the kernels in H-Canyon followed by solvent extraction in H-Canyon to separate the uranium. The resulting uranium solution would be down-blended and grouted (i.e., solidified by mixing with cement) to meet acceptance criteria for disposal as low-level radioactive waste. The thorium, other actinides, and fission products remaining in the dissolver solution would be processed through the Liquid Nuclear Waste Facilities into high- and low-level radioactive waste, the same as for the Vitrification Option.

- The LEU/Thorium Waste Option provides for dissolution of the kernels in H-Canyon followed by solvent extraction in H-Canyon for separation of the uranium and thorium. The resulting uranium/thorium solution would be down-blended and grouted to meet acceptance criteria for disposal as low-level radioactive waste. The other actinides and fission products remaining in the dissolver solution would be processed through the Liquid Nuclear Waste Facilities into high- and low-level radioactive waste, the same as for the Vitrification Option.

Under the L-Area Alternative, the kernels would be down-blended and converted to a uranium-aluminum alloy in a Melt and Dilute process in L-Area. The resulting ingots would be stored in concrete overpacks on a pad in L-Area awaiting final disposition. Unlike the H-Area Alternative, the kernels would not be dissolved prior to final processing.

DOE would make some modifications to the interiors of existing facilities (specifically, H-Canyon or the L-Area Material Storage Facility) to implement these alternatives or options. In addition, construction of storage pads for cask storage and minor onsite road construction would be required. For the H-Area Alternative, LEU Waste and LEU/Thorium Waste Options, DOE would construct a separate uranium solidification building in H-Area. For the L-Area Alternative, DOE would build a sand filter, fan room, stack, and truck bay in L-Area. Processing, from kernel dissolution through production of the final waste form, would take slightly less than 5 years for the H-Area Alternative Vitrification Option, and approximately 5 years for the LEU Waste and LEU/Thorium Waste Options. Processing for the L-Area Alternative would take approximately 7 years.

Potential Environmental Impacts

The analyses in the *Spent Nuclear Fuel from Germany EA* show that the proposed receipt of SNF from Germany and any of the proposed alternatives, options, or technologies for storage and processing in the U.S. entails little or no risk to human health or to the quality of the environment. Activities related to the Proposed Action at SRS would largely occur in existing industrial areas far from offsite areas. In addition, little land would be disturbed, contaminated water would not be discharged, and resource use would be low. New air emissions at SRS may require a permit review but would be a small percentage of Aiken County emissions. No latent cancer fatalities would be expected among the ships' crews, workers unloading containers from the ships, ground transportation personnel, workers at SRS, or the public. Projected waste volumes would be within waste management capacities, including storage of HLW canisters or MCOs at SRS until disposal facilities are available. Therefore, minimal or no impacts are expected. As indicated by the preliminary hazard analysis of impacts from accidents associated with the action alternatives, the risks are likely well within the scope of accident scenarios and consequences evaluated in existing safety documents.

External Review and Comments

DOE announced preparation of the EA in a Notice of Intent (NOI), conducted public scoping and public comment periods, and held a public scoping meeting and a public meeting on the *Draft EA*. DOE announced its intent to prepare the *Spent Nuclear Fuel from Germany EA* with

publication of the NOI in the *Federal Register* on June 4, 2014 (79 FR 32256). The public scoping period opened with the publication of the NOI, and closed on July 21, 2014. A public scoping meeting was held on June 24, 2014, in North Augusta, South Carolina. DOE considered all scoping comments in developing the *Draft EA*.

DOE announced the availability of the *Draft EA* in the *Federal Register* on January 25, 2016 (81 FR 4023). DOE provided email notification of the availability of the *Draft EA*, advertised availability in local newspapers, and posted the *Draft EA* on DOE websites. DOE informed the States of South Carolina, Georgia, and Nevada of the availability of the EA and solicited their comments. DOE also held a public meeting on the *Draft EA* on February 4, 2016, in North Augusta, South Carolina. In response to stakeholder requests, the original 45-day public comment period was extended to March 25, 2016.

Ninety comment documents containing over 245 comments were received during the public comment period. Appendix B to the *Spent Nuclear Fuel from Germany EA* includes copies of the comment documents with specific comments identified, and provides summary comments and summary responses to comments. DOE considered all comments received in preparing the final *Spent Nuclear Fuel from Germany EA*.

DETERMINATION:

DOE's Proposed Action is to receive, store, process, and dispose certain SNF containing U.S.-origin HEU that was irradiated in a research and development program of the Federal Republic of Germany (Germany). This SNF was irradiated for research and development purposes in experimental and demonstration reactors in Germany. If the current feasibility studies show adequate promise, and DOE and Germany decide to proceed with the project, DOE would accept this SNF at SRS for storage, processing and disposition. The U.S.-origin HEU was provided to Germany between 1965 and 1988 and return of the SNF to the U.S. would support the U.S. policy objective to reduce, and eventually eliminate, HEU from civil commerce, consistent with U.S. nonproliferation policy.

The potential environmental impacts associated with the transport, storage and processing of SNF from Germany using any of the proposed alternatives, options, or technologies evaluated in the *Spent Nuclear Fuel from Germany EA* entail minor impacts and low risks, and do not constitute a major Federal action significantly affecting the quality of the human environment within the context of NEPA (42 U.S.C. 4321), the Council on Environmental Quality NEPA regulations (40 CFR 1500-1508), and the DOE NEPA implementing regulations (10 CFR 1021). Therefore, based on the analysis in the *Spent Nuclear Fuel from Germany EA*, an environmental impact statement is not required.

This FONSI is not a decision to select any alternative or to proceed with the proposed project. DOE would continue to conduct research and development and technology maturation studies, paid for by Germany, to further refine the carbon digestion process and the engineering and safety requirements for implementation of the action alternatives, including modification of existing facilities and installation of new capabilities that may be required. As these studies proceed, DOE will provide updates at the Savannah River Site Citizens Advisory Board meetings, and to other stakeholders, about the progress of technology development and any decisions on acceptance of the material.

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