[6450-01]

U.S. DEPARTMENT OF ENERGY

FINDING OF NO SIGNIFICANT IMPACT FOR IMPORT OF RUSSIAN PU-238 FUEL

AGENCY: U.S. Department of Energy (DOE)

ACTION: Finding of No Significant Impact

SUMMARY: DOE has prepared an Environmental Assessment (EA), DOE/EA-0841, for the import of plutonium-238 (Pu-238) from the Russian Federation (Russia). The EA addresses the impacts of environmental consequences of importing Pu-238 fuel from Russia, and of initial transport to and processing of such fuel within the United States (U.S.), as necessary, to add the fuel to the existing U.S. inventory. Based on the analysis in the EA, DOE has determined that the proposed action does not constitute a major Federal action significantly affecting the quality of the human environment within the meaning of the National Environmental Policy Act (NEPA) of 1969. Therefore, an environmental impact statement (EIS) is not required and the Department is issuing this Finding of No Significant Impact (FONSI).

PUBLIC AVAILABILITY: Single copies of the EA and FONSI are available from:

Mr. Edward Mastal
U.S. Department of Energy
Office of Special Applications
Mail Stop NE-53
Washington, D.C. 20545
Phone: (301) 353-4362

For further information on the NEPA process, contact:

Carol M. Borgstrom
U. S. Department of Energy
Office of NEPA Oversight
1000 Independence Avenue, S. W.
Washington D. C. 20685
(202) 586-4600 or (800) 472-2756

BACKGROUND: DOE develops and provides Pu-238 fueled energy systems for space mission applications. Pu-238 is used to provide a long-term reliable source of heat which can be converted into electricity when installed in radioisotope thermoelectric generators (RTGs). The RTGs provide onboard electrical power for National Aeronautics and Space Administration (NASA) spacecraft. In addition, radioisotope heater units (RHUs) fueled with Pu-238 provide local heating of spacecraft components. The use of Pu-238 fueled RTGs and RHUs in space applications is a proven technology in which safety considerations have been an inherent part of their design, development, and deployment. Future NASA missions for which RTGs and RHUs are being considered include the Cassini mission, scheduled for launch in 1997, and missions in the time frame beyond that date.

PROPOSED ACTION: The proposed action is to import up to 40 kg of Pu-238 fuel (in the dioxide form) from Russia over the next 5 years to supplement the current U.S. inventory. The proposed action includes the transportation of Russian Pu-238 in 5 kg increments by Russian flagged vessels from St. Petersburg, Russia, to a U.S. port of entry. The U.S. would supply Mound 1 Kilowatt Thermal (KW) Packages for these shipments. The Mound 1 KW Packages are certified by DOE and the U.S. Department of Transportation (DOT) for domestic and international Pu-238 transport. From the U.S. port of entry, the shipments would be transported by

DOE Safe Secure Trailer (SST) to either the Savannah River Site (SRS) in South Carolina or the Los Alamos National Laboratory (LANL) in New Mexico. Any imported fuel not meeting U.S. specifications would undergo limited processing at SRS, as described in a previous EA, Radioisotope Heat Source Fuel Processing and Fabrication (DOE/EA-0534), and be added to that portion of the existing U.S. Pu-238 inventory located at SRS. This processing would remove any impurities from the Russian fuel. It is expected that only the first 5 kg of the 40 kg would require processing at SRS, although the impacts of transporting all 40 kg of Pu-238 to SRS for processing and storage have been analyzed. Imported Pu-238 meeting U.S. specifications would be added to that portion of the existing U.S. Pu-238 inventory located at LANL.

ENVIRONMENTAL IMPACTS: The environmental impacts of the proposed action resulting from normal operations and potential accidents have been evaluated with the focus on the effects of the proposed action on the ocean environment and the U.S. affected environment (port of entry, highway transportation routes, LANL, and SRS). The environmental consequences presented are bounding in that the results reflect the transport of 40 kg of imported Pu-238 from the preferred port-of-entry (Hampton Roads, VA) to either SRS or LANL. The results are applicable to all of the port facilities at Hampton Roads.

Normal Operation Impacts of Proposed Action

Under normal handling and transport conditions the potential hazard posed by the Pu-238 fuel would be the external exposure to gamma and neutron radiation to

package handlers, transport crew, and the general public. The incident-free transportation risks are estimated to be 1.5×10^{-3} and 3.6×10^{-3} latent cancer fatalities for transport to SRS and LANL, respectively.

The environmental impacts at SRS of processing the entire, existing U.S. Pu-238 inventory (64 kg) have been addressed in DOE/EA-0534. These impacts consisted of increasing the offsite doses due to SRS operations by less than 1 percent. The impacts of processing up to an additional 40 kg of Pu-238 under this proposed action would increase the 1 percent by a factor of 0.63, for a cumulative increase of about 2 percent.

The volumes of transuranic (TRU) waste and low-level radioactive waste (LLW) to be generated at SRS as a result of the action addressed in DOE/EA-0534 was estimated to be 94 and 396 cubic meters per year, respectively, representing about 8 and 1.3 percent of the TRU and LLW, respectively, generated at SRS on an annual basis in past years. Processing up to an additional 40 kg of Pu-238 under this proposed action would increase these impacts by a factor of 0.63, corresponding to an additional increase in TRU and LLW volumes of about 59 and 250 cubic meters annually for the processing period of up to five years.

The environmental consequences at LANL of handling the entire, existing U.S. Pu-238 inventory (64 kg) have been addressed in DOE/EA-0534. These consequences consisted of increasing the offsite doses due to LANL operations by less than 0.00002 percent. The impacts of handling up to an additional 40 kg of Pu-238 under this proposed action would increase the 0.00002 percent by a factor of 0.63, for a cumulative increase of about 0.00003 percent.

The TRU waste volume at LANL (DOE/EA-0534) was estimated to be 25 drums per year, representing about 3.5 percent of the TRU waste generated annually at LANL. The handling and storage of up to an additional 40 kg Pu-238 under this proposed action would increase the TRU waste volume by approximately 15 drums.

Accident Impacts of Proposed Action

Due to the design safety features of the Mound 1 KW Package and the manner in which it would be handled and stowed onboard ship, only the most severe ship accident could result in a release of radioactive material. This accident, which has a probability estimated to be in the range of 7.8×10^{-9} to 1.1×10^{-8} per port call, would consist of a collision coupled with a fire in the port. The resulting risk, which represents the total for all ocean shipments (eight shipments of 5 kg each), was estimated to be 2.4×10^{-4} latent cancer fatalities.

Should the Mound 1 KW Package be lost at sea, long-term containment of the fuel would be expected due to the low corrosion rates of the stainless-steel used in the package's construction. Should the package containment be breached, studies of the behavior of Pu-238 heat source components in the ocean environment indicate that the heat of radioactive decay promotes incrustation by mineral deposits from the seawater, further reducing the possibility of release. If a release of Pu-238 should occur, the oxide nature of the Pu-238 would result in a low dissolution rate. Further, the aquatic chemistry of plutonium is such that it preferentially binds with the sediment rather than remaining dissolved.

Radioactive material could be released from the safe secure trailer (SST) in only the most severe accident (a category VII accident). The probability of a severity category VII accident for each highway transport route considered, accounting for the distance travelled in each population density zone, is 2.1 x 10^{-7} for transport to SRS and 8.3 x 10^{-7} for shipment to LANL. The resulting accident risks, in terms of latent cancer fatalities and traffic fatalities (resulting from nonradiological accidents), are estimated to be 8.6 x 10^{-4} and 3.6 x 10^{-3} fatalities for transport (ocean and highway) to SRS and LANL, respectively. In both cases the nonradiological traffic fatalities are the highest contributor to accident risk.

The risk of postulated accidents at SRS resulting from processing of the entire existing U.S. Pu-238 inventory have been addressed in DOE/EA-0534. The largest contributor to risk was found to be abnormal low-energy events at the Scrap Recovery Facility involving process equipment leaks, transfer errors, overflows, and spills. The resulting risk contribution would be 1.7 x 10^{-2} fatalities per year during the processing period. The risk of accidents from processing up to an additional 40 kg (5 kg nominal, up to a maximum of 40 kg) at SRS under this proposed action would increase this risk contribution by a factor of up to 0.63.

The risk of postulated accidents at LANL resulting from handling the entire existing U.S. Pu-238 inventory has been addressed in DOE/EA-0534. The largest contributor to risk was found to be an accident scenario involving a fire in one of the glove boxes (probability of occurrence of less than 10^{-4} per year). The corresponding risk from this accident would be 4.7 X 10^{-7} fatalities per year.

The risk of accidents from handling up to an additional 40 kg at LANL under this proposed action would increase this risk contribution by a factor of up to 0.63 (7.5×10^{-7} fatalities per year).

Cumulative Transportation Impacts

The port facilities at Hampton Roads, VA, have been used to receive and handle foreign research reactor spent fuel for subsequent highway transport to SRS. The total risk associated with these shipments are estimated to be approximately 0.79 fatalities. The transportation risks (incident-free and accident risks combined) of the current proposed action are estimated to be 2.4×10^{-3} to 7.2×10^{-3} for shipments to SRS or LANL. Combined with the transportation risks of the past and future additional spent fuel shipments through Hampton Roads, the cumulative transportation risks would increase less than 1 percent to about 0.80 fatalities. Again, note that most of this risk has already been incurred with the previous spent fuel shipments with no accident consequences.

ALTERNATIVES: DOE has considered a number of alternatives to the proposed action. These include alternatives to production and sources of supply, and alternative ports of entry for transporting Pu-238 for the proposed action. Potential near-term Pu-238 production and supply alternatives to supplement the current supply of Pu-238 include the following:

The K-Reactor alternative consists of dedicated production in the K-Reactor at SRS. The use of K-Reactor solely for Pu-238 production would result in a prohibitively high unit cost of the Pu-238 compared to the proposed action and other alternatives.

Preliminary discussions concerning the alternative to purchase Pu-238 from Great Britain indicate that only small quantities (less than kg quantities) of Pu-238 could be made available from Great Britain in the near term. Large quantities would require extensive investments by Great Britain in its processing facilities which would require several years to construct. Several years would also be required for actual production operations. Further discussions between the U.S. and Great Britain would be required before this option could be considered.

Preliminary discussions concerning the alternative to purchase Pu-238 from France indicate that Pu-238 could be made available from France in the late 1990s. Extensive facility modifications would be required plus actual production operations. Further discussions between the U.S. and France would be required before this option could be considered.

The No Action Alternative consists of not purchasing the Russian Pu-238 fuel, and not supplying Pu-238 by other alternatives. Under the No Action Alternative, projected Pu-238 mission requirements through the year 2000 would not be satisfied with the current U.S. inventory and some of the space missions considering use of Pu-238, as planned by NASA, would not be feasible.

Transportation Alternatives:

The proposed action could be carried out using alternative U.S. ports of entry for subsequent shipment to either SRS or LANL. DOE identified 36 civilian and U.S. Naval ports of entry for consideration as alternatives. All 36 ports were

considered adequate. Transportation risks, including those due to ocean and highway transport under both incident-free and accident conditions, were evaluated using the HIGHWAY 3.0 and RADTRAN 4.0 computer codes.

The transportation risks and relative risks of all the alternatives considered were found to be small, with the risk to a member of the public less than 10^{-7} (probability of fatality). The risks were dominated by the contributions of highway traffic fatalities and incident-free worker radiation exposure, rather than by accidents involving the release of Pu-238 fuel. The contribution of port accidents to the total risk of any given alternative was found to be approximately 10 percent.

Norfolk Naval Base at Hampton Roads, VA, was identified as the preferred port of entry for the proposed action because this location has a number of commercial and U.S. Naval port facilities that could maximize DOE's flexibility. The Hampton Roads alternative has a full time port risk management staff and is experienced in handling cargo vessels importing foreign radioactive material, such as spent fuel. The presence of the U.S. Naval port facilities would increase safety and help to assure the secure transfer of cargo from the Russian vessel to the Safe Secure Trailers (SSTs) in preparation for highway transport. In addition, the emergency response capabilities available at those port facilities would be advantageous in the event of an accident.

DETERMINATION: Based on the analysis in the EA, DOE has determined that the proposed import of Russian Pu-238 fuel and the initial transport and processing of such fuel within the U.S., as necessary, to add the fuel to the existing U.S. inventory do not constitute a major Federal action significantly affecting the quality of the human environment within the meaning of the National Environmental Policy Act of 1969. Therefore, an environmental impact statement is not required.

Issued this 25th day of June 1993.

Peter N. Brush
Acting Assistant Secretary
Environment, Safety and Health