



Office of Environmental Management U.S. Department of Energy

Categorical Exclusion Determination Form

Proposed Action Title: Transfer of the "Byproduct Utilization Program 500-Watt Electric (BUP-500) Radioisotope Thermoelectric Generator (RTG)" at the Oak Ridge National Laboratory (ORNL), in Oak Ridge, Tennessee, to Zeno Power Systems, Inc. CX-ORNL-567

Program or Field Office: Office of Environmental Management

Location(s) (City/County/State): Oak Ridge, Tennessee

Proposed Action Description:

The U.S. Department of Energy (DOE) proposes to transfer the Byproduct Utilization Program's (BUP) 500-watt electric radioisotope thermoelectric generator (RTG) from Oak Ridge, Tennessee to a commercial radiological facility in Pennsylvania. This "BUP-500" RTG is the largest RTG ever constructed and was developed by Teledyne Energy Systems for DOE in the 1980s in support of DOE's BUP and the Defense Energy Program. It was designed as a prototype to demonstrate the viability of an extremely reliable, long-life, maintenance-free power source. The BUP-500 is currently located at the Oak Ridge National Laboratory (ORNL) and has been in DOE-managed storage there since 1986. Transfer of the BUP-500 will be accomplished in a manner consistent with approved DOE transportation systems and will be stored at the Pennsylvania facility under contract to Zeno Power Systems, Inc. (Zeno). The Pennsylvania facility (hereinafter referred to as "Subcontractor"), has an active NRC agreement state license from the Pennsylvania Department of Environmental Protection allowing for receipt, possession, and processing of the BUP-500. All activities will be in accordance with this license and there will be no impacts in addition to those already considered under their existing licenses.

United Cleanup Oak Ridge LLC (UCOR), in coordination with a DOE Federal Driver, will transport the BUP-500 approximately 612 miles to the Subcontractor's site and be responsible for providing DOE-approved methods for safe transport. A Government Services Administration box truck will be used for the transport vehicle. Further information about the management of the transportation of the BUP-500 from ORNL

Categorical Exclusion(s) Applied:

B1.30 – Transfer actions

For the complete DOE National Environmental Policy Act regulations regarding categorical exclusions, including the full text of each categorical exclusion, see Subpart D of [10 CFR Part 1021](#).

Regulatory Requirements in 10 CFR 1021.410(b): (See full text in regulation)

The proposal fits within a class of actions that is listed in Appendix A or B to 10 CFR Part 1021, Subpart D.

To fit within the classes of actions listed in 10 CFR Part 1021, Subpart D, Appendix B, a proposal must be one that would not: (1) threaten a violation of applicable statutory, regulatory, or permit requirements for environment, safety, and health, or similar requirements of DOE or Executive Orders; (2) require siting and construction or major expansion of waste storage, disposal, recovery, or treatment facilities (including incinerators), but the proposal may include categorically excluded waste storage, disposal, recovery, or treatment actions or facilities; (3) disturb hazardous substances, pollutants, contaminants, or CERCLA-excluded petroleum and natural gas products that preexist in the environment such that there would be uncontrolled or unpermitted releases; (4) have the potential to cause significant impacts on environmentally sensitive resources, including, but not limited to, those listed in paragraph B(4) of 10 CFR Part 1021, Subpart D, Appendix B; (5) involve genetically engineered organisms, synthetic biology, governmentally designated noxious weeds, or invasive species, unless the proposed activity would be contained or confined in a manner designed and operated to prevent unauthorized release into the environment and conducted in accordance with applicable requirements, such as those listed in paragraph B(5) of 10 CFR Part 1021, Subpart D, Appendix B.

There are no extraordinary circumstances related to the proposal that may affect the significance of the environmental effects of the proposal.

The proposal has not been segmented to meet the definition of a categorical exclusion. This proposal is not connected to other actions with potentially significant impacts (40 CFR 1508.25(a)(1)), is not related to other actions with individually insignificant but cumulatively significant impacts (40 CFR 1508.27(b)(7)), and is not precluded by 40 CFR 1506.1 or 10 CFR 1021.211 concerning limitations on actions during preparation of an environmental impact statement.

Based on my review of the proposed action, I have determined that the proposed action fits within the specified class(es) of action, the other regulatory requirements set forth above are met, and the proposed action is hereby categorically excluded from further NEPA review.

NEPA Compliance Officer:

Elizabeth Phillips

Digitally signed by Elizabeth Phillips
Date: 2024.01.16 13:36:14 -05'00'

Date Determined: 1/16/2024

The U.S. Department of Energy (DOE) proposes to transfer the Byproduct Utilization Program's (BUP) 500-watt electric radioisotope thermoelectric generator (RTG) from Oak Ridge, Tennessee to a commercial radiological facility in Pennsylvania. This "BUP-500" RTG is the largest RTG ever constructed and was developed by Teledyne Energy Systems for DOE in the 1980s in support of DOE's BUP and the Defense Energy Program. It was designed as a prototype to demonstrate the viability of an extremely reliable, long-life, maintenance-free power source. The BUP-500 is currently located at the Oak Ridge National Laboratory (ORNL) and has been in DOE-managed storage there since 1986. Transfer of the BUP-500 will be accomplished in a manner consistent with approved DOE transportation systems and will be stored at the Pennsylvania facility under contract to Zeno Power Systems, Inc. (Zeno). The Pennsylvania facility (hereinafter referred to as "Subcontractor"), has an active NRC agreement state license from the Pennsylvania Department of Environmental Protection allowing for receipt, possession, and processing of the BUP-500. All activities will be in accordance with this license and there will be no impacts in addition to those already considered under their existing licenses.

United Cleanup Oak Ridge LLC (UCOR), in coordination with a DOE Federal Driver, will transport the BUP-500 approximately 612 miles to the Subcontractor's site and be responsible for providing DOE-approved methods for safe transport. A Government Services Administration box truck will be used for the transport vehicle. Further information about the management of the transportation of the BUP-500 from ORNL to Pennsylvania is addressed in the approved BUP-500 Transportation Plan (1,2). Upon receipt of the BUP-500 from UCOR by the Subcontractor, facility personnel will direct offloading and inspection of the BUP-500 to ensure it meets licensing conditions for acceptance and processing.

The U.S. Department of Defense (DOD) has awarded Zeno a contract to build and deploy demonstration RTGs to support DOD missions, fueled by the byproduct radioisotope strontium 90 (Sr-90). Zeno is a small business developing and supplying novel radioisotope power systems for long-lasting, stable thermal and electrical power, and has designed RTGs to beneficially reuse legacy Sr-90 byproduct material. Zeno's work will take place at the Subcontractor's site which has been included by DOE in the list of Nuclear Science User Facility Laboratories as a post-irradiation examination facility. This facility contains radioactive material processing capabilities within hot cells to allow complex operations to be performed using highly radioactive material. These assets make the Subcontractor uniquely suited to allow Zeno to safely retrieve the Sr-90 byproduct material from the BUP-500 to fabricate and assemble the Zeno RTGs.

There are no other known facilities currently available that routinely handle large quantities of Sr-90 byproduct material as contained in the BUP-500. Due to its current isotopic levels (449,648 curies of Sr-90 and 13.1 curies of cesium 137), it would take 25 to 30 years for the radioisotopes to decay to levels suitable for direct disposal at the Nevada National Security Site (3). Transferring the management of the BUP-500 to Zeno is a beneficial way to remove hazardous legacy material from ORNL and an opportunity for DOE to reduce its long-term waste liability, while supporting alternative uses of radioisotopes to help meet national security

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needs. Furthermore, this effort aligns with DOE-EM's mission to complete the safe cleanup of legacy waste nuclear materials.

Environmental Aspects or Potential Sources of Impact:

Air Emissions: Transportation activities use fossil fuels and release greenhouse gases (GHGs).

Travel from Oak Ridge, TN to PA (612 miles)

RTG is 8,000 pounds or 4 short tons

Emission Factor (EF) = 161.8 grams (g) CO₂ per short ton mile (4)

161.8 g CO₂/short-ton mile x 612 miles x 4 short tons = 396,086 g CO₂ or 396 kilograms (kg)

CO₂ (5)

For comparison, storage of the RTG in a 3,000 square foot space in a warehouse would generate 435 kg CO₂: (6)

6.1 kilowatt-hour (kWh)/ft² electrical energy consumed by warehouse annually, or 3000 ft² x

6.1 kWh/ft² = 18,300 kWh/year or 18.3 megawatt-hour (MWh)/year

0.793 kg CO₂/MWh x 18.3 MWh/year x 30 years = 434.3 kg CO₂

Other notes regarding air emissions:

The inconsequential amount of GHGs produced by the transport of the BUP-500 from Oak Ridge, Tennessee to Pennsylvania would not cause substantial long-term environmental impacts on climate change. Moreover, reuse of the BUP-500 to fuel new Zeno RTGs serves to add to the long-term knowledge base of radioisotope power systems as an alternative to fossil fuels as an energy source, which would reduce GHG emissions through the use of thermal energy for electricity production. In summary, the reuse of the BUP-500 fuel in Pennsylvania would be preferable over storing the BUP-500 in Oak Ridge for the next 30 years.

Discharging to Surface-, Storm-, or Ground Water: N/A

Disturbing Cultural or Biological Resources: N/A

Generating and Managing Waste: N/A

Releasing Contaminants: Though very unlikely, the potential exists for a release of contaminants during packaging and transportation activities (e.g., shipping accident). In the event of a transportation accident/incident, a coordinated effort would be implemented between the OREM, UCOR management, on-scene response organizations, and the affected jurisdiction(s) to provide timely, accurate, and candid information to protect public health and safety. OREM and UCOR Management would use a graded/scalable approach to determine the appropriate level of activation to support emergency public information, based on the severity and duration of emergency conditions. The OREM and UCOR Management Team would coordinate and disseminate emergency information to the public. If a transportation incident/accident resulted in damage to one or more packages, an on-scene damage assessment would be conducted. A package that has sustained minor damage may be loaded

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on a suitable trailer and continue the trip to a designated facility. If damage was severe or radiological contamination was present, the driver, in coordination with OREM, UCOR, and state and tribal officials, would determine the remedial action that provided the greatest level of public safety.

(1) DOE O 460.2B, Departmental Materials Transportation Management; DOE O 460.1A, Packaging and Transportation Safety; and DOE exemption for transportation in accordance with DOE G 460.1-1, Implementation Guide for Use with DOE O 460.1A, Packaging and Transportation Safety. The DOE exemption is necessary because the package was never fully approved as NRC-licensed Type B packaging.

(2) UCOR 2024. "BUP-500 Transportation Plan, Oak Ridge, Tennessee." UCOR-5668/R2, UCOR, Oak Ridge, Tennessee, January 2024.

(3) The Nevada National Security Site is the only waste disposal facility that has confirmed that the BUP-500 could be packaged to meet their waste acceptance criteria for disposal.

(4) EPA SmartWay: Shipper Partner Tool: Technical Documentation, 2013.

(5) Method for calculation from the Environmental Defense Fund, "The Green Freight Handbook: A Practical Guide for Development a Sustainable Freight Transportation Strategy for Business, February 9, 2019.

(6) Method for calculation from Meteor Space, "25+ Warehouse Energy Consumption Statistics You Need to Know" Available at: <https://www.meteorspace.com/25-warehouse-energy-consumption-statistics-you-need-to-know/>. Retrieved January 16, 2024.

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