

SECTION A. Project Title: Radiant ATR Fuel Test (RAFT)

SECTION B. Project Description and Purpose:

This Idaho National Laboratory (INL) project involves the collaboration with Radiant Industries, Inc. (Radiant). Radiant is currently working toward deployment of Kaleidos, a helium gas cooled 3 megawatts thermal (MWth) microreactor, using tristructural isotropic (TRISO) fuel. Radiant plans to perform an irradiation experiment to inform fuel qualification and fuel safety criteria that will benefit deployment of the Kaleidos reactor design. The goals of the irradiation experiment are to provide irradiation performance data to qualify fuel for normal operating conditions, to support development and validation of fuel performance models, and to provide irradiated fuel and materials for post-irradiation examination (PIE) and safety testing. The experiment is designed to provide sufficient data to demonstrate the modified Radiant TRISO fuel particles, with larger uranium oxycarbide (UCO) kernels compared to those used in the Advanced Gas Reactor (AGR) experiment series, perform the same as or better than the AGR TRISO particles under irradiation conditions predicted for the Kaleidos reactor.

INL facilities include:

- Design: Engineering Research Office Building (EROB), IF-654
- Assembly: Advanced Fuels Facility (AFF), Materials Fuel Complex (MFC)-784, and Test Train Assembly Facility (TTAF), TRA-1626
- Irradiation: Advanced Test Reactor (ATR), TRA-670
- PIE: Irradiated Materials Characterization Laboratory (IMCL), MFC-1729, and Hot Fuel Examination Facility (HFEF), MFC-785

Tasks include:

Task 1: Experiment Design

- Scope. The purpose of final design and analysis is to finalize the design output documents drafted during preliminary design for the selected design option. This step will ensure both the programmatic and safety objectives of the experiments are achieved.
- Deliverable. Final design review presentation, drawings and engineering calculations and analysis report (ECAR) issued, data package issued.

Task 2: Capsule Fabrication

- Scope. The capsule fabrication phase of the experiment follows design output documents to guide fabrication and assembly of the experiment and related hardware.
- Deliverable. Experiment hardware fabrication completed.

Task 3: Specimen Fabrication

- Scope. The specimen fabrication phase provides TRISO fuel to be tested in the irradiation experiment, which will be provided by Radiant.
- Deliverable. Experiment specimens received at INL.

Task 4: Experiment Assembly

- Scope. In this activity, the specimens and experiment hardware are assembled to form the experiment assembly/test train. This is the final activity before the experiment is transferred/shipped to ATR for irradiation. The final inspections and verifications are performed on the fully assembled experiment and are documented in the as-built drawings.
- Deliverable. Experiment assembly completed, green tags approved for ATR insertion.

Task 5: Irradiation

- Scope. In this task, the assembled capsule with TRISO fuel will be irradiated in ATR per the experiment test plan.
- Deliverable. Online irradiation and fission product monitoring data will be uploaded to Nuclear Data Management and Analysis System (NDMAS). As-run irradiation reports will be completed after ATR irradiation cycles.

Task 6: PIE

- Scope. In this task, the specimens from the irradiation will be transferred to the MFC where they will undergo various procedures to provide the data specified in the experiment test plan.
- Deliverable. A PIE report will document the results of each exam.

Task 7: Final Report

- Upon completion or termination of this PTS, a final report will be developed by INL and Radiant, which will include the following information: (1) A final abstract; (2) technical results/accomplishments; (3) a list of PTS-generated Intellectual Property (Subject Inventions, Copyrights, Mask Works, and/or Trademarks); (4) a description of benefits to the DOE/NNSA; (5) a description of benefits

to the PTS Participant/s, industry, consumers/taxpayers, and/or U.S. economy.

- Deliverables. Final report. INL as project lead will have primary responsibility for this deliverable.

INL waste may include:

- Industrial – Steel and other metal scrap, <1kg
- Hazardous – Possible solvents from cleaning (e.g., alcohol, acetone, etc), ~<1L
- PPE, wipes – Gloves, tape, wipes, < 5 gallons
- Radioactive – 40 TRISO compacts, <1kg
- Low level – Swipes, catch cloths, etc, <1kg
- Mixed – N/A
- TRU – <1kg

SECTION C. Environmental Aspects or Potential Sources of Impact:

Air Emissions

Experiment irradiation and PIE will be performed at the ATR and MFC facilities. Air emissions would include minor amounts of radionuclides and toxic air pollutants. The irradiation in the ATR is not a modification in accordance with Idaho Administrative Procedures Act (IDAPA) 58.01.01.201 and 40 Code of Federal Regulation (CFR) 61 Subpart H. ATR radionuclide emissions are sampled and reported in accordance with Laboratory Wide Procedure (LWP)-8000 and 40 CFR 61 Subpart H. All experiments will be evaluated by ATR Environmental Support and Services staff, prior to insertion in the ATR. All radionuclide release data (isotope specific in curies) directly associated with this experiment will be calculated and provided to ATR Programs Environmental Support organization.

The irradiated specimens will be delivered to the MFC HFEF for disassembly and then undergo routine PIE before being sent to the Analytical Lab for analysis. All radionuclide release data associated with the PIE portion and analysis of this experiment will be recorded as part of the HFEF and Analytical Lab continuous stack monitors and provided to Programs Environmental Support organization. The PIE examination in HFEF and the analysis completed in the Analytical Lab is not a modification in accordance with Idaho Administrative Procedures Act (IDAPA) 58.01.01.201 and 40 Code of Federal Regulation (CFR) 61 Subpart H. Releases of radioactive airborne contaminants from these processes are not expected to result in an increase to the annual dose to the Maximum Exposed Individual (MEI).

All radionuclide release data associated with packaging compacts described in Revision 1 will be recorded as part of the HFEF continuous stack monitor and provided to Program Environmental Support organization. Packaging in HFEF is not a modification in accordance with Idaho Administrative Procedures Act (IDAPA) 58.01.01.201 and 40 Code of Federal Regulation (CFR) 61 Subpart H. Releases of radioactive airborne contaminants from these processes are not expected to result in an increase to the annual dose to the Maximum Exposed Individual (MEI).

Discharging to Surface-, Storm-, or Ground Water

NA

Disturbing Cultural or Biological Resources

Cultural: The proposed action meets the threshold of a federal undertaking as defined in 36 CFR 800.16(y). However, at this stage of the 66-month project, it will not cause effects to built environment or archaeological historic properties.

Generating and Managing Waste

When wastes are generated, how they are disposed can adversely affect the environment. Managing wastes appropriately and responsibly and implementing recycling or reuse practices, where feasible, during project activities can reduce the potential impact on the environment.

Releasing Contaminants

When chemicals are used during the project there is the potential for spills that could impact the environment (air, water, soil).

Using, Reusing, and Conserving Natural Resources

NA

DOE-ID NEPA CX DETERMINATION
Idaho National Laboratory

Page 3 of 3

CX Posting No.: DOE-ID-INL-25-013

SECTION D. Determine Recommended Level of Environmental Review, Identify Reference(s), and State Justification: Identify the applicable categorical exclusion from 10 Code of Federal Regulation (CFR) 1021, Appendix B, give the appropriate justification, and the approval date.

For Categorical Exclusions (CXs), the proposed action must not: (1) threaten a violation of applicable statutory, regulatory, or permit requirements for environmental, safety, and health, or similar requirements of Department of Energy (DOE) or Executive Orders; (2) require siting and construction or major expansion of waste storage, disposal, recovery, or treatment or facilities; (3) disturb hazardous substances, pollutants, contaminants, or Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-excluded petroleum and natural gas products that pre-exist in the environment such that there would be uncontrolled or unpermitted releases; (4) have the potential to cause significant impacts on environmentally sensitive resources (see 10 CFR 1021). In addition, no extraordinary circumstances related to the proposal exist that would affect the significance of the action. In addition, the action is not "connected" to other action actions and is not related to other actions with individually insignificant but cumulatively significant impacts.

References: B3.6 "Small-scale research and development, laboratory operations, and pilot projects"

Justification: Based on the purpose and need and description of the proposed action and potential environmental impacts, the proposed action fits within the class of actions that is listed in Appendix B CX B3.6. There are no extraordinary circumstances related to the proposed action that may affect the significance of the environmental effects of the proposal (10 CFR 1021.410(b)(2)). The proposed action has not been segmented to meet the definition of a categorical exclusion (10 CFR 1021.410(b)(3)). This proposal is not connected to other actions with potentially significant impacts, is not related to other actions with individually insignificant but cumulatively significant impacts, and is not precluded by 10 CFR 1021.211 concerning limitations on actions during preparation of an environmental impact statement (10 CFR 1021.410(b)(3)).

Authorizing the proposed action will not (1) threaten a violation of applicable statutory, regulatory, or permit requirements for environment, safety, and health, including DOE and/or Executive orders; (2) require siting of new facilities or expansion of existing facilities; (3) disturb hazardous substances, pollutants, or contaminants; (4) adversely affect environmentally sensitive resources; or (5) involve genetically engineered organisms, synthetic biology, governmentally designated noxious weeds, or invasive species.

B3.6 Small-scale research and development, laboratory operations, and pilot projects. Siting, construction, modification, operation, and decommissioning of facilities for small-scale research and development projects; conventional laboratory operations (such as preparation of chemical standards and sample analysis); and small-scale pilot projects (generally less than 2 years) frequently conducted to verify a concept before demonstration actions, provided that construction or modification would be within or contiguous to a previously disturbed or developed area (where active utilities and currently used roads are readily accessible). Not included in this category are demonstration actions, meaning actions that are undertaken at a scale to show whether a technology would be viable on a larger scale and suitable for commercial deployment.

Approved by Robert Douglas Herzog, DOE-ID NEPA Compliance Officer on: 6/10/2025