

DOE-ID NEPA CX DETERMINATION

Idaho National Laboratory

SECTION A. Project Title: TREAT Sodium Loop Cartridge

SECTION B. Project Description and Purpose:

Researchers use the Transient Reactor Test (TREAT) facility at Idaho National Laboratory (INL) to induce nuclear heating in experiments to simulate power cooling mismatch conditions in nuclear reactors. These types of experiments, known as transient tests, expose engineering scale specimens to conditions simulating postulated accidents in nuclear power plants.

The TREAT reactor ready sodium loop cartridge (RR NLC) supports configurations for conducting liquid metal cooled fuel safety research experiments with up to seven uranium or plutonium bearing fresh or pre irradiated fuel pins. The RR NLC offers prototypic liquid metal cooled fast reactor thermal hydraulic conditions, supplies heating and sodium re melt capabilities, facilitates using test fuel motion diagnostics, supports test instrumentation, and contains experiment associated hazards.

The RR NLC will serve multiple missions. However, this environmental checklist (EC) covers one experiment module configuration to house the seven fuel pin bundle. This bundle configuration serves as the limiting dimension for the loop test section. This bundle holder can be readily replaced with several different experiment holder configurations. This EC only covers designing, fabricating, prototype testing, and installing the RR-NLC. Projects using the RR_NLC require project specific ECs.

The RR NLC enables integral effects irradiation tests pertaining to fuel safety research for liquid metal cooled reactor specimens. In situ instrumentation and post irradiation examination (PIE) deliver test data. TerraPower, LLC will design, fabricate, and test the a prototype of the RR-NLC. The prototype NLC will be operated at TerraPower facilities and will be tested to show compliance to design requirements, aid in defining operating procedures for the RR NLC, create an operator training platform, and demonstrate expected performance characteristics. The project will then move the functional loop cartridge to INL facilities after completing prototype testing.

Testing the prototype loops involves developing and finalizing operating procedures and includes shakedown testing, which involves a variety of system and component tests on the test loop. Design activities and operating procedures incorporate these test results. Shakedown testing includes the following activities:

- Filling the loop, including sodium cleanup
- Pre-heating the loop
- Checking loop instrumentation
- Starting (including restart), controlling (including flowrate transients), and shutting down the pump
- Managing loop enclosure heat, including pump cooling if applicable
- Operating the loop over a range of temperatures and flows
- Checking loop data acquisition
- Demonstrating loop safety interlock (loop pressure, loop temperature, pump temperature, electric load, etc.)
- Shutting down and cooling the loop
- Inserting and withdrawing the test section from the loop.

Successful testing contributes to producing the equipment specification needed for procuring and deploying a fully capable RR-NLC.

This EC covers designing and fabricating the functional RR-NLC including activities listed below:

- Procuring critical components
- Fabricating safety-grade loop for TREAT insertion
- Sodium conditioning of reactor-ready loop
- Delivering reactor-ready loop to TREAT.

After sodium conditioning, the project ships the RR-NLC to TREAT for installation. Facility modifications for installing the RR-NLC, such as relocating equipment and supplying electric power, may be needed. INL also plans to install the equipment listed below to allow the RR NLC to function as an integrated system:

- In cell loop handling and manipulation at the Hot Fuel Examination Facility (HFEF)
- Sodium charging and experiment loading capability
- Experiment calibration vehicle(s)
- TREAT NLC control console
- TREAT NLC support equipment.

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The support activities listed above have not been fully developed and require revising this EC prior to initiating those actions.

SECTION C. Environmental Aspects or Potential Sources of Impact:

Air Emissions

Vehicles delivering the RR-NLC to TREAT from TerraPower, LLC. facilities will emit exhaust.

Project activities have the potential to release hazardous and chemical contaminants into the air. The proposed action will require an Air Permitting Applicability Determination (APAD).

Operating the RR-NLC has the potential to generate radiological and chemical emissions from irradiation experiments in TREAT and destructive and non-destructive PIE at MFC. These experiments require project specific review under the National Environmental Policy Act (NEPA) and preparation of project specific ECs. However, air emissions are anticipated to be minor, and concentrations would not exceed the current monitored air emissions from these facilities.

The TREAT irradiation activities are not modifications in accordance with Idaho Administrative Procedures Act (IDAPA) 58.01.01.201 and 40 Code of Federal Regulation (CFR) 61 Subpart H. TREAT 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 Environmental Support and Services staff. All radionuclide release data (isotope specific in curies) directly associated with this proposal will be calculated and provided to the Environmental Support organization.

In 2018, the effective dose equivalent to the offsite maximally exposed individual (MEI) from all operations at the INL Site was calculated as 1.02 E-02 mrem/yr, which is 0.10% of the 10-mrem/yr federal standard and was calculated using all sources that emitted radionuclides to the environment from the INL site. The additional increment in emissions from the proposed action would not significantly change the total site-wide MEI dose. Therefore, the emissions are bounded by the analysis in the 1995 EIS, which estimated the annual cumulative doses to the maximally exposed worker, offsite maximally exposed individual (MEI), and the collective population from DOE's decision to implement the preferred alternative (DOE 1995a, Volume 2, Table 5.7-4). The potential air emissions and human health impacts associated with the proposed action would be smaller than and are bounded by the impacts presented in the 1995 PEIS.

Disturbing Cultural or Biological Resources

TREAT (MFC-720) is eligible for listing on the National Register of Historic Places and (NRHP) is considered a Category 1 historic property. All federal undertakings (projects involving federal funding or property) associated with this historic property must undergo cultural resource review (CRR).

Generating and Managing Waste

Transporting the RR-NLC prototype loop to INL and installing it in TREAT has the potential to generate industrial waste such as PPE, packaging material, and general construction waste. Conditioning the sodium has the potential to generate hazardous waste. None of the activities associated with testing the prototype loop are anticipated to generate radioactive waste.

Operating the RR-NLC for projects beyond the prototype has the potential to generate radioactive waste, including radioactive sodium. The amounts and types of radioactive waste generated during operation depend on the type and characteristics of experiments proposed for irradiation in TREAT. These experiments require project specific ECs to evaluate the types and amounts of waste they will generate. These experiments have the potential to generate remote handled low-level waste in facilities conducting the examination of the experiments. Improved operating practices should preclude generation of remote-handled mixed waste, transuranic waste, and mixed transuranic waste.

Releasing Contaminants

Chemicals will be used and will be submitted to chemical inventory lists with associated Safety Data Sheets (SDSs) for approval prior to use. The Facility Chemical Coordinator will enter these chemicals into the INL Chemical Management Database. All chemicals will be managed in accordance with laboratory procedures. When dispositioning surplus chemicals, project personnel must contact the facility Chemical Coordinator for disposition instructions.

Although not anticipated, there is a potential for spills when using chemicals or fueling equipment. In the event of a spill, notify facility Environmental Staff. If Environmental Staff cannot be contacted, report the release to the Spill Notification Team (208-241-6400). Clean up the spill and turn over spill cleanup materials to WGS.

Using, Reusing, and Conserving Natural Resources

All materials will be reused and recycled where economically practicable. All applicable waste will be diverted from disposal in the landfill where conditions allow.

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The project will divert all applicable waste from disposal in the landfill when possible. Program personnel will use every opportunity to recycle, reuse, and recover materials, including beryllium, and divert waste from the landfill when possible. The program will practice sustainable acquisition, as appropriate and practicable, by procuring construction materials that are energy efficient, water efficient, are bio-based in content, environmentally preferable, non-ozone depleting, have recycled content, and are non-toxic or less-toxic alternatives (<http://www.sftool.gov/GreenProcurement>).

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 (40 CFR 1508.25(a)(1)) and is not related to other actions with individually insignificant but cumulatively significant impacts (40 CFR 1608.27(b)(7)).

References: 10 CFR 1021, Appendix B to subpart D, items B1.24, "Property transfers", B1.31, "Installation or relocation of machinery and equipment", and B3.6, "Small-scale research and development, laboratory operations, and pilot projects."

Justification: The proposed R&D activities are consistent with CX B1.24 "Transfer, lease, disposition, or acquisition of interests in personal property (including, but not limited to, equipment and materials) or real property (including, but not limited to, permanent structures and land), provided that under reasonably foreseeable uses (1) there would be no potential for release of substances at a level, or in a form, that could pose a threat to public health or the environment and (2) the covered actions would not have the potential to cause a significant change in impacts from before the transfer, lease, disposition, or acquisition of interests;"

B1.31, "Installation or relocation and operation of machinery and equipment (including, but not limited to, laboratory equipment, electronic hardware, manufacturing machinery, maintenance equipment, and health and safety equipment), provided that uses of the installed or relocated items are consistent with the general missions of the receiving structure. Covered actions include modifications to an existing building, within or contiguous to a previously disturbed or developed area, that are necessary for equipment installation and relocation. Such modifications would not appreciably increase the footprint or height of the existing building or have the potential to cause significant changes to the type and magnitude of environmental impacts;" and

B3.6, "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."

Is the project funded by the American Recovery and Reinvestment Act of 2009 (Recovery Act) Yes No

Approved by Jason Sturm, DOE-ID NEPA Compliance Officer on: 1/14/20