

<b>SECTION A. Project Title: High-Resolution Experiments for Extended LOFC and Steam Ingress Accidents in HTGRs – University of Michigan</b>
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<b>SECTION B. Project Description</b>
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The University of Michigan, in collaboration with George Washington University and Idaho National Laboratory, proposes to focus on steam ingress phenomena following a Steam Generator (SG) tube rupture event, and natural circulation of hot helium plumes and jets within the reactor vessel during an extended loss of forced circulation (LOFC) accident. The goals of the project are to better understand water/steam ingress and extended LOFC accidents, and provide high-resolution measurements of fluid flows in these accidents for computational fluid dynamics (CFD) model validation. The specific tasks are to: (1) experimentally investigate, using an existing integral-effect test facility with some improvements, the steam-ingress accident caused by a postulated SG tube rupture initiating event; (2) carry out integral-effect tests for the extended LOFC accident to study the establishment of global natural circulation flow in the primary loop; (3) design, based on a scaling analysis, and construct a separate-effect test facility to study the complex helium flows in the core and hot plenum during the extended LOFC accident; and (4) perform detailed, high-resolution, separate-effects experiments using results obtained in Task (2) as boundary/initial conditions.

<b>SECTION C. Environmental Aspects / Potential Sources of Impact</b>
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**Chemical Use/Storage** – High purity (99.9% to 99.999%) helium gas will be used in the experiments. The exact amount of helium to be used for each experiment is to be determined. However, the amount is expected to be small, on the order of 10 to 100 grams. Typically, two to three helium gas cylinders would be stored in the laboratory when running experiments.

**Air Emissions** – A very small amount (from sub-ppm to 10 ppm level) of hydrogen and carbon monoxide can be generated for graphite oxidation due to steam at relatively high temperatures. Their concentration levels are to be measured in the experiments. After each experimental run, the helium gas with very low levels of hydrogen and carbon monoxide would be released to the atmosphere through a fume hood. All air emissions from this project will be covered under the University's Renewable Operating Permit.

The project will work with the University of Michigan's Office of Environment, Health & Safety to develop a procedure to handle the use and disposal of gases. Gases will be properly managed. The University does have programs in place for existing laboratories for their proper storage and use.

<b>SECTION D. Determine the Level of Environmental Review (or Documentation) and Reference(s):</b> Identify the applicable categorical exclusion from 10 CFR 1021, Appendix B, give the appropriate justification, and the approval date.
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Note: 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, including requirements of DOE orders; 2) require siting and construction or major expansion of waste storage, disposal, recovery, or treatment facilities; 3) disturb hazardous substances, pollutants, contaminants, or CERCLA-excluded petroleum and natural gas products that pre-exist in the environment such that there would be uncontrolled or unpermitted releases; 4) adversely affect environmentally sensitive resources. In addition, no extraordinary circumstances related to the proposal exist which would affect the significance of the action, and the action is not "connected" nor "related" (40 CFR 1508.25(a)(1) and (2), respectively) to other actions with potentially or cumulatively significant impacts.

**References:** 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 development.

**Justification:** The activity consists of university-scale research activities aimed at better understanding water/steam ingress and extended LOFC accidents in high temperature gas-cooled reactors (HTGRs).

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 08/03/2018