

# DOE-ID NEPA CX DETERMINATION

**SECTION A. Project Title: Demonstrating Reactor Autonomous Control Framework using Graphite Exponential Pile – Massachusetts Institute of Technology**

**SECTION B. Project Description**

The Massachusetts Institute of Technology (MIT) proposes to develop a detection-prediction-feedback (DPF) framework for autonomous control of a nuclear system under normal as well as off-normal (accident) conditions. The tasks associated with this project are (1) Implementation of graphite exponential pile (GEP) control mechanism which includes design of the control rod actuators as well as safety evaluation and administrative approval; (2) Development of high-fidelity real-time prediction utilizing a machine-learning surrogate model that is refined and improved as measurement data is produced; (3) Development of the DPF framework including accounting for reactor kinetics for real-time prediction and system control feedback; and (4) Integrated experiments for demonstrating autonomous control. An existing GEP at MIT will be used.

**SECTION C. Environmental Aspects / Potential Sources of Impact**

Radioactive Material Use – The proposed project involves using the MIT GEP, which is fueled with natural uranium. The uranium fuel is entirely contained in the aluminum cladding, thus its alpha decay is no longer a concern. The GEP will be driven by a plutonium (Pu) – beryllium (Be) neutron source. The source usage will be well regulated by operating procedures, in order to follow the As Low As Reasonable Achievable (ALARA) radiation safety principle.

**SECTION D. Determine the Level of Environmental Review (or Documentation) and Reference(s):** Identify the applicable categorical exclusion from 10 CFR 1021, Appendix B, give the appropriate justification, and the approval date.

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 to demonstrate autonomous control of a nuclear system.

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 07/25/2019