Reactor Cooling System Upgrade for the University of Utah TRIGA Reactor (UUTR)

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Program: FY2020 Reactor Upgrades

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ABSTRACT:

Project Objectives, Tasks, and Goal:

The objectives of this proposal for the UUTR are to a) convert the cooling mechanism of the reactor from a passive to active system, and b) increase the cooling capacity of the reactor up to 1 MW thermal energy.

These objectives will be achieved through completion of the following tasks.

1) Perform in-depth assessments to define equipment specifications and installation design.
2) Purchase cooling system equipment and supplies.
3) Installation of new cooling system.
4) Tests and analysis of the installed cooling system.
5) Final reporting on the cooling system capability and effects on reactor operation and safety.

The successful accomplishment of the proposed objectives will achieve our **goal: Enabling much longer runtimes and higher daily neutron/gamma fluence, which will enhance capability for a wide range of research and development efforts that support the Nuclear Engineering Program, the University of Utah, partner institutions and laboratories, and the DOE-NE mission.** The UUTR is an integral core research facility available to researchers from across campus, other universities, laboratories, and industry. In addition, the upgrade will help the UUTR support research as it has recently applied to the DOE Nuclear Science User Facilities (NSUF) Program.. The upgrade to the cooling system is part of a greater long-term goal to ensure the UUTR as a valuable and cost-effective research and training focused facility. Facility upgrades include finishing the instrumentation and console upgrade in progress, uprating of power, and the opening of neutron beam ports to provide even more avenues of teaching, training, and research to the nuclear community.

Description:

Upgrading the cooling system of the UUTR will enhance performance and utility by allowing for the reactor to run for much longer periods at full power. It will also increase safety and operational reliability. Currently, at full power (100 kW), the reactor is only able to run for several hours (< 5 hrs) before water temperature rises to a level that requires reactor shutdown and subsequent passive cooling. The efficacy of the passive cooling method is influenced by ambient and outdoor temperatures, and the limited reactor operation time becomes prevalent in the summer months, when the temperature differential is smaller. The proposed new cooling system will provide active cooling up to 1 MW of thermal power, with cooling capacity being relatively independent of ambient temperatures. This will enable safely running the reactor for much longer times, which will make it of greater utility for a variety of experiments that require a reliable source of greater neutron fluences than the UUTR can currently provide. The neutron fluence is approximately linearly related to reactor power level and runtime. Assuming full power (100 kW), we anticipate that the proposed cooling system could provide a ~50 fold increase in neutron fluence per a 24-hr period. Upgrading the UUTR cooling system is an integral step to maintaining and opening new opportunities for user research, training, and supporting NSUF projects and the DOE-NE mission.