Ensuring Safe and Reliable Continuous Power Operations: PUR-1 Water Cooling System Upgrade

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Collaborators: N/A

Program: Reactor Upgrades

ABSTRACT:

Following a 10x power uprate and the return to an active operational cycle, a heat exchanger replacement is required to maintain the bulk coolant temperature within the bounds of the Technical Specification limit at the PUR-1. The heat exchanger replacement project will ensure safety and availability of the PUR-1 for long duration operational cycles and applicability to the largest possible customer base.

The Purdue University Reactor Number One is a small research reactor located in Northwestern Indiana. Built in 1962, the facility was designed to operate at a steady state power level of 10 kW. For its first 54 years, the facility was licensed at a reduced power level of 1 kW. As part of the 2008 license renewal, a power uprate was requested to facilitate an enhanced flux and enable new research space. In October of 2016, the increased power level was approved with a licensed Scram setpoint of 12 kW and steady state operations at 10 kW. Due to other major facility upgrades, the reactor has been tested up to 20% of the full power setting. At this reactor power, there is a $0.40°C/hr$ temperature rise in the bulk coolant volume. At full power, a temperature increase rate of $2°C/hour$ may be seen. With a normal starting temperature of $25°C$ and a Technical Specification bulk coolant temperature limit of $30°C$, the reactor can operate for an estimated maximum of two hours before the Heat Exchanger activates. The current heat exchanger has demonstrated inconsistent and unpredictable operation, which will necessitate early shutdown. This proposal requests a replacement of the heat exchanger and associated water process system in order to ensure the safe and continuous operation of the PUR-1.

Operations at the PUR-1 center around teaching and research, however, the full capability of the facility is limited by coolant temperature increase at fully licensed power levels. Through a replacement of the heat exchanger, the facility will be able to access fluence required for meaningful research applications.