Aging reactor safety system replacement at the Breazeale Nuclear Reactor at Penn State

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ABSTRACT:

The PSU Breazeale Reactor control console consists of an analog/digital hybrid system, with all required safety functions performed by an analog reactor safety system (RSS), and all redundant safety functions, operator interface, and auxiliary functions performed by a digital distributed control system (DCS). A 2017 DOE NEUP reactor infrastructure grant provided funding to replace the analog and digital systems, although the replacement of the analog RSS is not yet complete because it requires a license amendment from the NRC. The Breazeale reactor staff has successfully programmed and installed the upgraded digital DCS, which went online in 2021, and has purchased the digital RSS for the planned upgrade.

The 2017 NEUP grant did not include funding for the replacement of the wide range and power range channels which provide reactor power and fuel temperature input to both the RSS and DCS. These channels were installed ca.1991 and are manufactured by Thermo Gammametrics. This company no longer supports the research reactor market. The ageing of these channels has resulted in unplanned scrams and forced reductions in maximum power, affecting the reliability of the reactor console. This, in turn, affects the critical work that we do, including education and training, criticality safety support for nuclear utilities, internal and external faculty research, and electronics irradiation for defense contractors, among many others. In this proposal, we seek to replace the entire wide range channel, including the fission chamber (33 years old), amplifier, and drawer, as well as the power range drawer. The new equipment will be procured from Paragon Energy Solutions to meet the exact specifications of the existing equipment, thereby eliminating the need for a license amendment and simplifying the change review (50.59) process. It is ideal for this work to be performed as soon as possible in order to reduce further reduction in reactor reliability and to have the new channels installed before the license amendment is received for the digital RSS upgrade. We received all the quotes for the items, and the vendor developed a detailed review of the items. The scope of work outlined herein intends to capture the relevant requirements. There will be no personnel or indirect charges to this project. All personnel and other charges are at no cost to this project. The total project cost will be **$911,300.**