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Preparing for 2 MW Operation of the SNS First Target Station

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Upgrades to the Spallation Neutron Source will double the power capability of the accelerator complex to enable operation of the new Second Target Station and increase power to the existing First Target Station (FTS). The Proton Power Upgrade (PPU) project achieves this with a 30% increase in proton energy along with higher current. Presently the FTS operates at 1.4 MW of 60 Hz pulses of 1.0 GeV protons. PPU project scope prepares the FTS for reliable operation with 2.0 MW of 60 Hz pulses of 1.3 GeV protons. The lifetime of the FTS is also extended to 60 years –20 more than originally envisioned. An overview of the evaluations and upgrades to prepare the FTS for 2 MW operation will be presented.

FTS Systems' PPU project scope PPU includes both re-evaluations of design bases and upgrades to achieve the beam power goal. A requirement is that no more than four target module replacements per year are needed; fewer are desired and achievable. Most of the FTS was designed for 2 MW with 1.0 GeV protons with the target module an exception. A redesign of the target is underway that exploits gas injection techniques to improve fatigue life and reduce cavitation damage erosion, two power dependent phenomena that risk target leaks. The gas injection rate will be higher than presently deployed, thus requiring new supply systems, methods to reduce gas hold-up in the mercury process piping, and measures to assure mercury will be contained under postulated accident scenarios.

Higher proton energy distributes heating power in the target station differently. Design basis temperatures, thermal stress and utility heat loads are being re-evaluated. Projected radiation damage to permanent components and accumulated radionuclide inventory have been examined. Impacts of PPU operation on the facility's safety basis are being addressed.

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