Nuclear Integrated Services (NIS)
Nuclear Services Power Uprating

Background

Nuclear Integrated Services (NIS) has extensive experience solving technical, licensing and operational issues for operating nuclear plants, including power uprating.

Description

Power uprate projects require a thorough understanding of the overall nuclear plant design and operation, including the nuclear steam supply system (NSSS) and the balance-of-plant thermal cycle, original plant licensing bases, environmental impacts, equipment aging impacts, available margins and regulatory requirements. NIS is a leader in power uprates with over 25 years of experience and has developed a formal process for performing uprate evaluations based on lessons learned from previous uprates, Request for Additional Information databases, Institute of Nuclear Power Operations lessons learned and industry operating experience. This process has been used to perform evaluations at recently completed power uprates. The process begins with a feasibility study, performed jointly with the NSSS vendor, which provides the plant owner with a high-level evaluation of the plant's uprate capability and uprate level(s) by identifying required modifications, strategies and cost-to-benefit estimates. The execution of an uprate project completes the work scope that is identified by the feasibility study.

Benefits

This study, usually performed jointly with the NSSS vendor, could provide the following inputs to the uprate decision-making process:

- The feasibility of uprating the NSSS power as it affects systems and components.
- The optimum balance between the uprate power benefits and the costs of required plant modifications.
- Available margins to design limits of non-NSSS systems and components under normal, transient and accident conditions at the uprated power levels.
- Further analyses required in the following phase of the uprate project to justify the proposed uprate and provide budgetary estimates for each.
- Plant modifications necessary to accomplish the desired uprating, together with order-of magnitude cost and schedule estimates.
- Potential impact the uprating may have on existing surveillance or scheduled maintenance requirements.
- Potential impact the uprating may have on selected key components' service life
- Evaluate the environmental impact, especially from thermal discharge, of the desired uprate.

Uprate Completion

The execution of an uprate project completes the work scope identified by the feasibility study. The work is typically divided into two phases: the detailed engineering and licensing phase and the implementation phase.

During the detailed engineering and licensing phase, the NIS team issues engineering evaluations and calculations to demonstrate that the design basis of components and systems is acceptable at the uprated power level. The team, working with the NSSS vendor, would also prepare and issue a detailed engineering report in which are documented the acceptability of the core power uprate value and the evaluation of the impact of the uprate on margins. In addition, input is provided to the integrated licensing report for submittal to the U.S. Nuclear Regulatory Commission. The licensing report sections are developed incorporating the guidance provided in NRC Document RS-001, Revision 0, for review of uprate applications, enhancing consistency, quality and completeness of the reviews.

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During the implementation phase, the joint NIS-NSSS vendor team prepares necessary setpoint and scaling calculations, develops design changes and installs modifications, as needed, performs piping vibration monitoring evaluations, develops power ascension plans,; and identifies procedure and program changes.

Experience

The NIS team has the experience and qualified resources to perform the major portion of the work needed to evaluate and license an increase to a plant's power rating. Working with the NSSS vendor, the NIS team have assisted many owners with developing uprate strategies for all three categories of uprates:

- Margin uncertainty recovery (MUR) uprates, which take advantage of more accurate instrument measurement of feedwater flow resulting in slightly greater than a one percent uprate.
- Stretch power uprates (SPUs), which typically result in power level increases up to seven percent. SPUs typically do not require major modifications.
- Extended power uprates (EPUs), which increase the power output of the plant beyond "stretch" rating (between seven and 20 percent). EPUs may require significant plant modifications.

NIS has performed uprates and studies on more than 70 nuclear units, adding approximately 4,000 MW to the U.S. grid.

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