

## N208. Getting Ready to Replace the Steam Generators at Doel 3

Doel 3 is a 928 MWe three-loop PWR built in Belgium by Tractionel Engineering. It began commercial operation in 1982. The plant's steam generators, fabricated by Framatome, have Inconel 600 U-tubes. Refurbishing and repair work first began in 1983. To date, some 4% of the tubes have been plugged and 50 tubes sleeved.

Siemens/KWU was chosen from a large number of international competitors to supply steam generators for the three units, and a contract was signed in December 1989. The final decision to opt for Siemens' steam generators was largely based on their use of Incoloy 800 for the tubes. Even though tenders included as possible alloys both Inconel 690 TT and Incoloy 800, the latter was selected as the best material. Siemens has successfully used it for about 20 years. The steam generator replacement project comprises the following elements:

- Complete planning and preparation for replacement.
- Complete quality assurance and quality control.
- Removal of the old and installation of new units.
- Design, construction, and installation of all temporary hoisting and tilting equipment.
- Supply of new piping sections for the reactor coolant, main steam and feedwater lines.
- Supply of the thermal insulation for the steam generators.
- Dismantling and reinstallation of secondary-side piping systems.
- All activities related to the primary piping system, including optical survey, cutting and machining, welding, and decontamination of the remaining pipe ends.
- Removal and reinstallation of the thermal insulation.

**Full-Scale Mock-Up.** Training for the replacement work will make use of a 1:1 mock-up of the lower portion of the steam generator (primary channel head with a section of primary piping and the steam generator support) including obstacles in the relevant area. It will also be used for qualifying equipment and operators, and sharpening their skills under realistic conditions, particularly in areas of high dose, such as cutting, machining, and welding of primary piping.

**Reducing Exposures.** The principal measure used to minimize dose levels is local decontamination of the coolant pipe. The inner surface of the pipe in the area where work is performed is cleaned by mechanical blasting. Special remote-controlled manipulators which can be quickly fitted and removed will be used. In conjunction with the welding process, this will ensure substantial reduction of local dose rates.

In general, meticulous planning, strict adherence to the ALARA principle, thorough training, and the use of proven technologies will be necessary to minimize dose to workers in a project of this scale.

*Taken from, "Getting Ready to Replace the Steam Generators at Doel 3," Christian Hillrichs, Nuclear Engineering International, September 1992, p. 34.*