

# Enhanced Replacement Pressurizer Heaters

## Background

In March 2010, a plant shut down due to primary coolant leakage from an axially-oriented flaw in a pressurizer heater well insert (also known as a heater well or heater sleeve). Root cause analyses determined that the leakage was caused by primary water stress corrosion cracking (PWSCC) that had initiated at the outside diameter surface of a stainless steel heater sheath.

Based on the March 2010 heater sheath failure, Westinghouse recommends (via Technical Bulletin TB-11-8, Revision 1) that plants remove and replace all nonfunctional pressurizer heaters at the next convenient opportunity. Westinghouse also recommends that plants treat their replacement heaters thermally and mechanically in order to minimize potential future occurrences of stainless steel pressurizer heater sheath stress corrosion cracking.

## Description

Westinghouse used its position as an original equipment manufacturer and integrated recent industry experience to develop and offer

enhanced replacement pressurizer heaters that mitigate stainless steel heater sheaths' susceptibility to stress corrosion cracking.

Westinghouse's enhanced replacement heaters are single-unit, direct immersion, straight tubular sheath-type heaters designed, analyzed and fabricated according to the Class 1 rules of Section III of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code. The heaters possess corrosion-resistant austenitic stainless steel sheaths with welded end plugs at their upper ends and welded electrical adaptors at their lower ends. To facilitate heater replacement, the enhanced replacement heaters are dimensionally and electrically equivalent to existing (original) pressurizer heater designs.

Following the swaging (cold-working) process used during fabrication to compress the internal heater insulation, Westinghouse heat treats (anneals) the enhanced replacement heaters to mitigate the effects of cold work on the austenitic stainless steel sheath material. Next, the heaters undergo a surface conditioning process to introduce a compressive residual stress layer at

the outer diameter surfaces of the heater sheaths. Together, the annealing and surface conditioning processes mitigate the heaters' susceptibility to PWSCC.

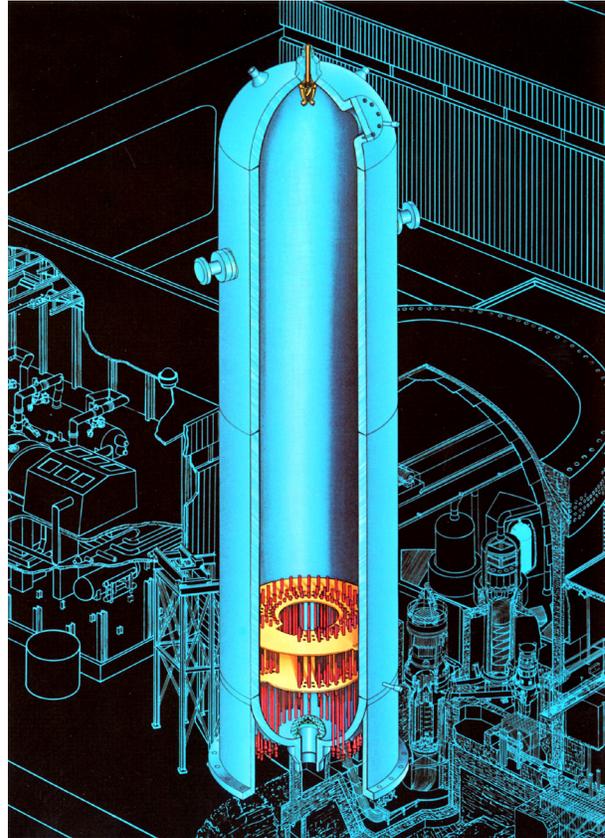
Westinghouse tests all completed, enhanced replacement heaters for straightness so that they provide proper heater well insert and heater support plate fit-up. Westinghouse also electrically tests the heaters for dielectric strength and insulation resistance.

## Benefits

Westinghouse's enhanced replacement heaters provide a reliable, high-quality replacement option for existing pressurizer heaters. The enhanced replacement heater design reduces risk by mitigating the potential of stainless steel heater sheath PWSCC.

## Experience

Westinghouse has supplied pressurizer heaters for more than 40 years and currently manufactures enhanced replacement pressurizer heaters for U.S. plants, as well as enhanced pressurizer heaters for the new AP1000® pressurized water reactor plants.



**Westinghouse pressurizer**

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