

ASSESSMENT OF EPRI WATER CHEMISTRY GUIDELINES FOR NEW NUCLEAR POWER PLANTS

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ABSTRACT

Water chemistry control technologies for nuclear power plants have been significantly enhanced over the past few decades to improve material and equipment reliability and fuel performance, and to minimize radionuclide production and transport. Chemistry Guidelines have been developed by the Electric Power Research Institute (EPRI) for currently operating plants and have been intermittently revised over the past twenty-five years for the protection of systems and components and for radiation management. As new plants are being designed for improved safety and increased power production, it is important to ensure that the designs consider implementation of state-of-the-art, industry developed water chemistry controls. In parallel, the industry will need to consider and update water chemistry guidelines as well as plant startup and operational strategies based on the advanced plant designs.

EPRI has performed assessments of water chemistry control guidance or assumptions provided in design and licensing documents for several advanced plant designs. These designs include:

- Westinghouse AP1000 Pressurized Water Reactor
- AREVA US-EPR Pressurized Water Reactor
- Mitsubishi Nuclear Energy Systems/Mitsubishi Heavy Industries Advanced Pressurized Water Reactor
- Korea Hydro and Nuclear Power APR1400 Pressurized Water Reactor
- Toshiba Advanced Boiling Water Reactor (ABWR)
- General Electric-Hitachi Economic Simplified Boiling Water Reactor (ESBWR)

The intent of these assessments was to identify key design differences in each of the new plant designs relative to the current operating fleet and to identify differences in water chemistry specifications or design assumptions provided in design and licensing documents for the plants in comparison to current EPRI Water Chemistry Guidelines. This paper provides a summary of the key results of these assessments.

The fundamental design and operation of the advanced plants is similar to the currently operating fleet. As such, the new plants are judged to be capable of maintaining water chemistry in accordance with existing EPRI water chemistry guidelines. However, it is important to resolve inconsistencies and knowledge gaps identified in the assessments to ensure water chemistry control guidance is optimized for the new plant designs. Additionally, the current EPRI guidelines do not specifically address water chemistry controls during pre-operational system lay-up, Hot Functional Testing, initial plant start up and early plant operations. Optimized water chemistry controls during these phases can provide significant long-term benefits in both equipment reliability and source term minimization.