

Abstracts**Use of an Inert Fluorescent Tracer for Diagnostics in Utility Boilers**

Martin R. Godfrey

Case histories of the use of disodium naphthalene disulfonic acid as an inert fluorescent tracer in electric utility boilers are presented. The tracer has proven to be thermally stable in utility cycles at drum pressures as high as 17.9 MPa (2 600 psi) and at saturation temperature of about 357 °C. The non-volatile tracer was used to measure a variety of hydraulic parameters in both conventional coal-fired units and heat recovery steam generators. Diagnostic measurements performed include determination of the mass of liquid water in operating boilers, the rate of loss of concentrated boiler water and the consumption of phosphate internal treatment chemistry. On-line measurement of the fluorescent tracer concentration in drum water was used to automatically control the injection of a traced phosphate internal treatment formulation using simple deadband control.

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Steam Cycle Chemistry and Air-Cooled Condensers

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Recently, an increased number of failures in air-cooled condensers have been reported. This paper presents brief information about flow-accelerated corrosion in these large cycle components. In particular, exhaust steam ducts and any high-velocity piping may be subject to flow-accelerated corrosion as well as areas of high turbulences and two-phase flow. The most important options for mitigating flow-accelerated corrosion and in this way for reducing flow-accelerated corrosion induced iron transport are suggested.

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VGB Primary and Secondary Side Water Chemistry Guidelines for PWR Plants

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The recent revision of the VGB Water Chemistry Guidelines was issued in 2005 and published in the second half of 2006. These guidelines are based on the primary and secondary side operating chemistry experience with all Siemens designed pressurized water reactors gained since the beginning of the 1980s. These guidelines cover

- For the primary side chemistry
 - Modified lithium boron chemistry,
 - Zinc chemistry for dose rate reduction,
 - Enriched boric acid (EBA) chemistry for high duty core design
- For the secondary side chemistry
 - High all-volatile treatment (AVT) chemistry (high pH operation)
 - Oxygen injection in the secondary side

Especially for the secondary side chemistry, compared with the water chemistry guidelines of other organizations worldwide, these Guidelines are less stringent, providing more operational flexibility to the plant operation, and can be applied for all new designs of steam generators with egg-crates or broached hole tube supports and with I 690TT or I 800 tubing materials.

This paper gives an overview of the 2006 revision of the VGB Water Chemistry Guidelines for PWR plants and describes the fundamental goals of water chemistry operation strategies. In addition, the reasons for the selected control parameters and action levels, to achieve an adequate plant performance, are presented based on the operating experience.

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Condenser Tube Failure Prevention in Fossil Plants

Kevin J. Shields

Cycle chemistry personnel frequently identify condenser tube leaks as an area of significant concern in the fossil plants for which they are responsible. This concern is reflected in the fact that contamination due to cooling water ingress from leaking condenser tubes is a root cause of some well-understood yet all too frequently experienced chemistry-related damage mechanisms. Investigation indicated that there were deficiencies in approaches taken by organizations to understand and minimize the impacts of condenser tube leaks on fossil unit availability and performance. To address these needs, the Electric Power Research Institute (EPRI) initiated work on a comprehensive manual dealing with the subject of condenser tube failures (CTFs) in 2004. This report provides member organizations with needed technical background on condensers and the science involved in the various forms of CTF which may be encountered. In addition, it outlines the culture and managerial approach needed to minimize the impact of tube failures on unit availability. Development of the manual confirmed that there is an overwhelming body of information pertaining to damage in condenser tubes and related condenser components such as tubesheets and waterboxes. Further, although the technical understanding of damage mechanisms is generally good, past efforts were collectively deficient in that they did not emphasize the practical, action-oriented steps needed to effectively deal with the various forms of damage. The EPRI CTF manual identifies all known damage mechanisms that affect condenser tubes. For each major damage type, there is a discussion of the features of damage, susceptible materials, susceptible environments, most common locations, mechanism, root causes, methods of determining the extent of damage, actions needed to prevent or mitigate repeat failures, and possible ramifications to the unit. It also provides supporting technical information that will help users implement recommended actions.

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VGB Water Chemistry Guidelines for BWR Plants: Principles and Recommended Goals

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This paper gives an overview of the 2006 revision of the VGB Water Chemistry Guidelines for boiler water reactor (BWR) plants. The guidelines specify "classic" normal water chemistry (NWC) operation with an oxidizing environment. Fundamental goals of water chemistry operation strategies are described. Underlying assumptions and criteria for NWC operation of BWR plants are outlined and recommended goals and action levels of the VGB Water Chemistry Guidelines are described.

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Redox Stress Control Using @T ORP™

Peter D. Hicks

The protection and life extension of boiler assets should be primary drivers for water chemistry control in these hot water systems. This includes complicated boiler feedwater and condensate systems. Low-temperature oxidation-reduction potential (ORP) measurements have now become fairly common in many utility boiler systems. Some systems have struggled to maintain recommended room temperature ORP values, and these low-temperature ORP systems often do not detect the true reduction/oxidation stress that is found under operating temperatures in these utility feedwater systems.

Using ORP technologies for high-temperature and -pressure evaluations, as compared to low-temperature ORP solutions, provides a much better technical solution to managing redox stress in boiler systems. The reasons for these enhancements are presented in this paper. Examples are given of why this at-temperature (@T) ORP technology can be used to understand, monitor and control redox (reduction/oxidation) stress events.

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