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Abstracts

Darryl A. Rosario, S. S. (Stan) Tang, Peter C. Riccardella, David W. Gandy, and Ramaswamy (Vis) Viswanathan
Evaluation of LP Rotor Rim-Attachment Cracking Using LPRimLife

Stress corrosion cracking (SCC) in the blade attachment region of low-pressure (LP) turbine rotors has emerged as one of the most significant problems affecting both nuclear and fossil steam turbines today. To assist turbine operators in evaluating the remaining life of LP rotors with known or suspected cracking, an easy-to-use PC-based computer program, *LPRimLife*, was developed for EPRI by Structural Integrity Associates. The first phase of development, incorporating the methodology for evaluating cracking in General Electric (GE) dovetail (straddle-mount) attachments, was completed in 1999 [1]. The second phase, which included evaluation of cracking in Westinghouse axial-entry (steeple) attachments, was completed in 2000 [2]. The third phase, to address cracking in GE multi-pin-finger attachments, is currently under way.

Since initial development, the *LPRimLife* computer code has been successfully employed at nuclear and fossil plants, providing the basis for deferring or eliminating major unscheduled and costly repairs, such as "pressure plating," which would have significantly extended the outages. Deferring unscheduled repairs for even one more fuel cycle allows for advance planning to evaluate and select the most-effective repair/replacement option and lead time needed for procurement of appropriate materials/services. In today's competitive marketplace with ever-tightening outage schedules, timely application of *LPRimLife* has resulted in significant cost savings to utilities.

This paper provides a summary of the *LPRimLife* program methodology, software features and recent utility applications.

Jørgen Peter Jensen and Karol Daucik
Solubility of Sodium Chloride in Superheated Steam

The solubility of sodium chloride in superheated steam was investigated in laboratory-scale experiments up to 20 MPa and 475 °C. These experiments were carried out using a dynamic method where deionized steam was passed through a packed bed of salt crystals in a 500 mL Hastelloy autoclave. The residence time of the steam in the salt bed was sufficient to saturate the steam with the salt. The steam samples were cooled and analyzed by ion chromatography.

Correlations based on temperature and density were selected to describe the solubility of sodium chloride in superheated steam. The density dependence is much stronger than the temperature dependence. By using these correlations, it is possible to estimate the solubility of salt in steam at lower densities than those used in the experiments.

Enthalpy-entropy diagrams are given that show the steam expansion line in turbines, including curves for constant concentration of sodium chloride solubility in steam. These can be used to analyze where in the steam cycle this salt may deposit.

Vitaly A. Prisyazhniuk
Condensation of Steam

An equation for nucleation kinetics in steam condensation has been derived, the equation taking into account the concurrent and independent functioning of two nucleation mechanisms: the homogeneous one and the heterogeneous one. The equation is a most general-purpose one and includes all the previously known condensation models as special cases. It is shown how the equation can be used in analyzing the process of steam condensation in the condenser of an industrial steam-turbine plant, and in working out new ways of raising the efficiency of the condenser, as well as of the steam-turbine plant as a whole.

Kevin J. Shields and R. Barry Dooley
Chemical Cleaning's Role in Tube Failure Prevention and Correction

Properly applied, chemical cleaning is a valuable tool used to prevent tube failures involving overheating and corrosion due to waterside deposits. In many cases, however, cleaning becomes yet an additional cost associated with correction of tube failure incidents. Discussion is focused on approaches taken to appraise tube waterside cleanliness and determine the need to clean, as typically practiced in conventional fossil plants. Also presented is an assessment of the suitability and limitations of these approaches to plants with heat recovery steam generator (HRSG) units.

George J. Verib
Sodium to Phosphate Ratios

Phosphate chemistry is widely used in fossil-fired utility boilers and many of these phosphate programs use the sodium to phosphate ratio as the controlling parameter. This paper steps through the fundamental chemical analyses to determine a systems Na/PO_4 ratio. A mathematical equation is introduced to simply calculate the ratio using the pH and phosphate concentration. This equation is also used to build graphs to chart the boiler's phosphate chemistry. By looking at the dynamic nature of the chemistry, boiler health can be determined.

Ernest Beinrohr, Walter Labhart, and Eric V. Maughan
Heavy Metal Discharge from Coal-Fired Power Plants – How Does This Affect the Environment and Cost-Effective Production of Electric Power?

Although heavy metals are naturally occurring elements, there are rather draconian laws, imposed by global authorities and institutions, which forbid their discharge from industry into the environment.

Most of these elements have limits of concentration which are not readily measured by standard laboratory techniques. Even if measurable, how may these contaminants be adequately dealt with?

Fossil-fired power plants without a dry-ashing facility suffer the risk of accidental discharge of undesired heavy metals leached from the disposed ash via the wet-ashing disposal system.

This paper investigates:

- a continuous method of rapid identification and measurement of heavy metals and
- an economical method for the safe removal and disposal of these contaminants.

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