PowerPlant Chemistry® The Journal of All Power Plant Chemistry Areas

ISSN 1438-5325

English and German Edition December Volume 3 (2001), No. 12

Abstracts

Barry Dooley and Richard Tilley
Tube Failures in Conventional Fossil Plants and in HRSGs

Boiler tube failures in conventional fossil plants have continued unabated with deteriorating statistics over the last nine years. This has resulted not because of any technical unknowns, but is rather due to the changing competitive environment, consolidating organizations, and generally poor management of the technology. Both the technical tools and the management understanding have been developed and are available to aid utilities in reaching the lowest levels of availability loss since that seen in the late 1980s.

A similar suite of failures is occurring in the newer technology of heat recovery steam generators (HRSGs) with the added seriousness of flow-accelerated corrosion. Indeed chemically influenced failures are more predominant in HRSGs. While the technical understanding is not as mature as in conventional plants, and there are unique non-destructive evaluation issues which need to be overcome, this area also needs a comprehensive management approach immediately to prevent a number of failure areas becoming predominant (corrosion and thermal fatigue, and long-term overheating/creep).

Barry Dooley, Todd Kuntz, Warren McNaughton, Steve Paterson, Michael Pearson, and Kevin J. Shields
EPRI's Heat Recovery Steam Generator Tube Failure Manual

Heat recovery steam generator tubing in modern, multi-pressure, gas turbine exhaust heated units is susceptible to a wide variety of damage mechanisms such as fatigue, creep, flow accelerated corrosion, dew point corrosion, pitting, etc. A manual that describes the most common heat recovery steam generator tube failure mechanisms is being compiled. The manual documents the current knowledge of the causes and metallurgical characteristics of common failure mechanisms and how they can be prevented. This paper will provide an overview of EPRI's Heat Recovery Steam Generator Tube Failure Manual and will include case studies to demonstrate how the information in the manual can be used to prevent heat recovery steam generator tube failure either in the design, construction, operational, or in the mid- to near-end-of-life phases of a heat recovery steam generator.

Richard R. Harries and Michaell J. Willett
Flow-Accelerate Corrosion in HRSGs: Interdependence of Cycle Chemistry and Design

The rapid growth of combined cycle power plant with multipressure heat recovery steam generators has brought with it a number of cycle chemistry issues, one of which is flow-accelerated corrosion (FAC) in the low temperature circuits. The saturation temperatures of the low pressure evaporators (typically 4–8 bar, i.e., 140–170 °C) found in combine cycle power plants places these circuits at high risk of FAC if the cycle chemistry is not properly controlled, particularly if the design incorporates small radius bends containing two-phase steam / water mixtures. The application of an all-volatile treatment chemistry to low pressure circuits requires careful consideration and review of the whole steam/water circuit and its materials because of the high partition of ammonia into the steam phase at lower pressures.

The occurrence of FAC induced bend wall thinning and failures in the heat recovery steam generators in one station was attributed to operation with an all-volatile treatment chemistry, but was exacerbated by design features which produced high localized temperatures. Changes to the cycle chemistry and bend material have prevented further FAC failures. Examination of bends from other stations has shown evidence of FAC damage but not to a degree sufficient to require bend replacement within the life of the stations. Boiler design is a key feature in susceptibility to FAC. Examples are given of designs where potential failures have been identified and prevented through a rigorous process of specification, tender and design review. Solid alkali dosing is the preferred option for low pressure evaporator circuits and high ammonia all-volatile treatment can only be applied where all circuit materials and steam customer requirements are satisfied.

Matthias Meierer and Sigrid Harmgart
Fouling and Slagging Phenomena in Coal-Fired Boilers

Topics of the article are experience and studies of fouling and slagging phenomena in two boilers (220 MW each) with slag-tap-furnace at Grosskraftwerk Mannheim AG (GKM). Each of these boilers has four horizontal cyclones, two on each side, in opposed arrangement. In one case, the fouling of heating surfaces (convection tube bank) was very severe. The pressure drop over this heating surfaces increased to values so high, that the boiler was to reduce in load and finally to shut down. Samples of deposits on heating surfaces were taken at different locations in the boiler. Investigations were made about the physical and chemical parameters of these deposits. Additionally, the coals witch are fired in GKM were examined, especially their fouling and slagging behavior. Detailed information is given about the results of these examinations. Our results were compared with information in the technical literature.

In another case, the melting behavior of the coal became so difficult, that the ash did not flow any longer out of the furnace. Investigations of the coals that has been fired in this

period showed that the melting behavior of one coal has changed significantly. Hemisphere and flow temperature of this coal was too high. For a good operation of slag tap furnaces, it is necessary to know always the actual real ash melting behavior of the coal which is fired in the boiler.

Norbert Eimer and Matthias Meierer
Optimization of Chemical Process Engineering of Flue Gas Desulfurization Systems

Topic of the article is the experience and studies of the chemical processes in flue gas desulfurization plants in bituminous coal-fired power stations. Both the investigated flue gas desulfurization plants work in double-loop system (with two stages of different suspensions for the absorption of sulfur dioxide). Limestone is used as absorbens. The final product is powdered gypsum of high purity.

Over a period of more than ten years, different parameters (pH, liquid-to-gas ratio, oxidation-reduction potential, etc.) were registered and analyzed, especially those who influence the sulfur dioxide removal efficiency and the gypsum quality. Aims are a high removal efficiency parallel to minimum flue gas desulfurization plant energy and absorbens consumption. The realized optimization measures are described in detail.

Additionally, intensive investigations were made to improve the sulfite oxidation in the upper suspension loop. The pressure drop of the flue gas over the absorber tower is of main importance for the operation costs of a flue gas desulfurization plant. Information is given about the realized measures and the success referring to minimized incrustation and fouling. Especially the increase of the pressure drop over the absorber tower in different operation periods (since 1995) was significantly reduced.

PowerPlant Chemistry GmbH:

Please send me copies of the following articles published in your December journal issue (US$10 per copy, minimum order US$15) as PDF files by E-mail (E-mail address required):

Barry Dooley and Richard Tilley **Tube Failures in Conventional Fossil Plants and in HRSGs**	☐
Barry Dooley, Todd Kuntz, Warren McNaughton, Steve Paterson, Michael Pearson, and Kevin J. Shields **EPRI's Heat Recovery Steam Generator Tube Failure Manual**	☐
Richard R. Harries and Michaell J. Willett **Flow-Accelerate Corrosion in HRSGs: Interdependence of Cycle Chemistry and Design**	☐
Matthias Meierer and Sigrid Harmgart **Fouling and Slagging Phenomena in Coal-Fired Boilers**	☐
Norbert Eimer and Matthias Meierer **Optimization of Chemical Process Engineering of Flue Gas Desulfurization Systems**	☐
Please send me the December issue of your journal (US$15 per copy) by surface mail	☐
Please send me the December issue of your journal (US$20 per copy) by air mail	☐

Total: US$.....

Name: .....

Company: .....

Company address: .....

City: .....

Postal/ZIP code: .....

Country:

VAT Id. No. (EC countries only):

Fax number*: .....

E-mail address:

*** This information is voluntary and is requested to make any possibly required contact easier.**

Charge my credit card:

Master/Eurocard ☐
VISA ☐
Amex ☐ **Card Holder's Address (City)** .....

Credit Card Number: ..... **Expiration Date (MM/YY):** .....

Card Holder (Name): ..... **Date:** .....

Signature: .....

Mail this form to: **PowerPlant Chemistry GmbH**
P.O. Box 1269
68806 Neulussheim
Germany

Fax this form to: **+49-6205-37883**