

Abstracts**Flow Restrictions in Water-Cooled Generator Stator Coils – Prevention, Diagnosis and Removal****Robert Svoboda and Russell Chetwynd****Part 2: Detection of Flow Restrictions in Water-Cooled Generator Stator Coils**

Useful methods for detecting flow restrictions in stator bar cooling channels are the review of operating parameters and history vs. original design, of generator cooling water chemistry, of strainer and filter clogging history and of results from diagnostic chemical cleaning, as well as monitoring of stator water flow vs. pressure drop, individual stator bar water flow measurements, monitoring of on-line stator temperatures, visual inspections, and DC Hipot testing. A combination of these methods can be selected under consideration of plant specific hardware features and the cost-to-benefit relation.

A proactive approach to detecting flow restrictions is recommended in order to permit advanced planning of corrective action, thus reducing the risk of unplanned maintenance downtime, or even component failure. Managing flow restrictions at an early stage reduces the risk of severe plugging of conductors, which may be very difficult to remove later on.

Donald A. Palmer, Pascale Bénézeth, and John M. Simonson**The Solubility of Copper Oxides around the Water/Steam Cycle**

This paper summarizes an extensive laboratory scale experimental study of the solubility of cupric and cuprous oxides in water over a wide range of temperature (25–350 °C) and pH in the presence of various chemical agents (NaOH, NH₃, B(OH)₃, H₃PO₄, (OHCH₂)₃CNH₂, (OHCH₂)₃CN(OHCH₂CH₃)₂, HF₃CSO₃, HNO₃ and mixtures thereof), and in steam to 400 °C as a function of pressure. The results of this study show large discrepancies exist in previous data in the literature, especially at high temperatures for cuprous oxide, where the current solubilities are orders of magnitude lower. The solubilities of both oxides in water under power plant operating conditions are highly pH dependent, particularly above 100 °C, but are pH independent in steam, where the dependence on temperature is slight and the effect of pressure is only significant above 300 °C. The effect of temperature (i.e., during startup) on solubility at constant pH_{25 °C} is surprisingly large and varied. The effects of the added chemicals are discussed, particularly those due to ammonia in the case of cuprous oxide. Finally, the role of oxygen is mentioned, including its effect on the solubility of copper metal.

Des McInnes

Tarong Energy's Experience of Copper Mobilisation through a Drum Unit Cycle

Comprehensive preparation of the unit's water and steam cycles was completed prior to the implementation of oxygenated treatment on the 4 x 350 MW drum units at Tarong Power Station. Despite the completion of chemical cleans on the HP feedwater systems, boiler water walls and pendant superheaters prior to conversion, significant loss of turbine capacity and efficiency occurred. Tarong Energy and EPRI entered into a collaborative investigation into the capacity and efficiency losses, causes and source of the problems. The project utilised EPRI and Tarong Energy resources as well as independent contractors. This paper describes the symptoms and investigations, including on-line measurement, sampling, steam path auditing, turbine inspection and other indicative methods, used to positively identify the source and mobilisation of rogue copper.

Geoff J. Bignold and Graham P. Quirk

Corrosion Monitoring of LP Blade Materials in a 500 MW Steam Turbine

Steam turbine blade and disc failures have occurred from time to time throughout the world. Although they are rare events, the implications for safety, for repair costs and for loss of availability are severe. Current operational and maintenance practices for any particular turbine design may be based on many years of satisfactory service. However, recent deregulation of the power industry in the UK and forthcoming deregulation in the USA may have an effect on operational and reliability issues, as changing operational demands are placed upon power generators through economic forces.

In the UK in the 1990s with deregulation and privatisation of power generation, the introduction of high efficiency gas-fired stations transformed the profile of the industry. The nuclear stations (which can only operate safely and economically under base load conditions), the gas-fired stations, and those coal-fired stations that have been fitted with flue gas desulphurisation (FGD) systems, accounted for the majority of base load supply. The remaining coal-fired stations were, therefore, forced towards operating for peak demand rather than base load. They have had to develop operating procedures that enable them to provide power flexibly and economically with rapid response to variable demand. One of these procedures covers running up the unit to stable conditions before power is produced.

This paper gives an account of the research carried out over 7 months to confirm the risks of turbine damage, which was essentially due to corrosion during the startup sequence. On-line corrosion monitoring with the electrochemical noise technique was used with probes installed directly within the low pressure (LP) section of an operating 500 MW turbine. Pitting corrosion at the turbine blade root had been found to be the primary factor in the onset of stress corrosion cracking (SCC), which eventually caused the failure of a turbine blade with very serious consequences for the unit. Determining the causes and reducing the occurrences of pitting activity would mitigate the risk of blade failure due to SCC.

The early results showed that the corrosion in this unit did indeed occur predominantly during the startup sequence, coinciding with the presence of chloride contamination in the condensate, which was sprayed onto the final stage for blade cooling. After the Phase 1 monitoring programme, engineering modifications were completed on the spray system to eliminate the risk of spraying with contaminated condensate. The corrosion monitoring then continued for a further 4 months and demonstrated that the rate of the corrosion had been very significantly reduced. This quantitative demonstration of reduction of corrosion activity enabled rescheduling of ultrasonic inspections of the blade roots, with a consequent increase in station availability.

Hans-Peter Seifert, Stefan Ritter, and John Hickling
Research and Service Experience with Environmentally Assisted Cracking of Low-Alloy Steel Pressure-Boundary Components under LWR Conditions

Environmentally assisted cracking (EAC) of carbon and low-alloy steels has been identified as a possible degradation mechanism for pressure vessels and piping in nuclear power plants. Selected aspects of research and service experience with EAC of these materials in high-temperature water are reviewed, with special emphasis on the primary pressure-boundary components of boiling water reactors (BWRs). The main factors controlling EAC susceptibility under light water reactor conditions are discussed with regard to both crack initiation and crack growth. The adequacy and conservatism of the current "BWRVIP-60 SCC disposition lines" and "ASME Section XI reference fatigue crack growth curves" are evaluated in the context of recent research results, e.g., on the effect of so-called "ripple loading", or of water chemistry transients. Finally, the relevant operating experience is summarized and compared with the background knowledge which has been accumulated in laboratory experiments over the last 30 years.

Please send me copies of the following articles published in your February 2004 journal issue (US\$10 per copy, minimum order US\$15) as PDF files by E-mail (E-mail address required):

-
- Flow Restrictions in Water-Cooled Generator Stator Coils – Prevention, Diagnosis and Removal
Robert Svoboda and Russell Chetwynd
Part 2: Detection of Flow Restrictions in Water-Cooled Generator Stator Coils
-
- Donald A. Palmer, Pascale Bénézech, and John M. Simonson
The Solubility of Copper Oxides around the Water/Steam Cycle
-
- Des McInnes
Tarong Energy's Experience of Copper Mobilisation through a Drum Unit Cycle
-
- Geoff J. Bignold and Graham P. Quirk
Corrosion Monitoring of LP Blade Materials in a 500 MW Steam Turbine
-
- Hans-Peter Seifert, Stefan Ritter, and John Hickling
Research and Service Experience with Environmentally Assisted Cracking of Low-Alloy Steel
Pressure-Boundary Components under LWR Conditions
-
- Kurzfassungen der englischen Beiträge
-
- Please send me the February 2004 issue of your journal (US\$15 per copy) by surface mail
-
- Please send me the February 2004 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):

E-mail address:

Charge my credit card:

Master/Eurocard

VISA

Amex

Card Holder's Address (City)

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

Name of Cardholder as Printed on the Card:

Signature: Date:

Mail this form to: PowerPlant Chemistry GmbH
P.O. Box 169
68806 Neulussheim, Germany

Fax this form to: +49-6205-37883