

ACC Corrosion/FAC

Introduction
to
Session on Chemistry and Corrosion

Fourth Annual ACC Users Group
Gillette, Wyoming
25th and 26th September 2012

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Corrosion/FAC in ACC and The Consequences

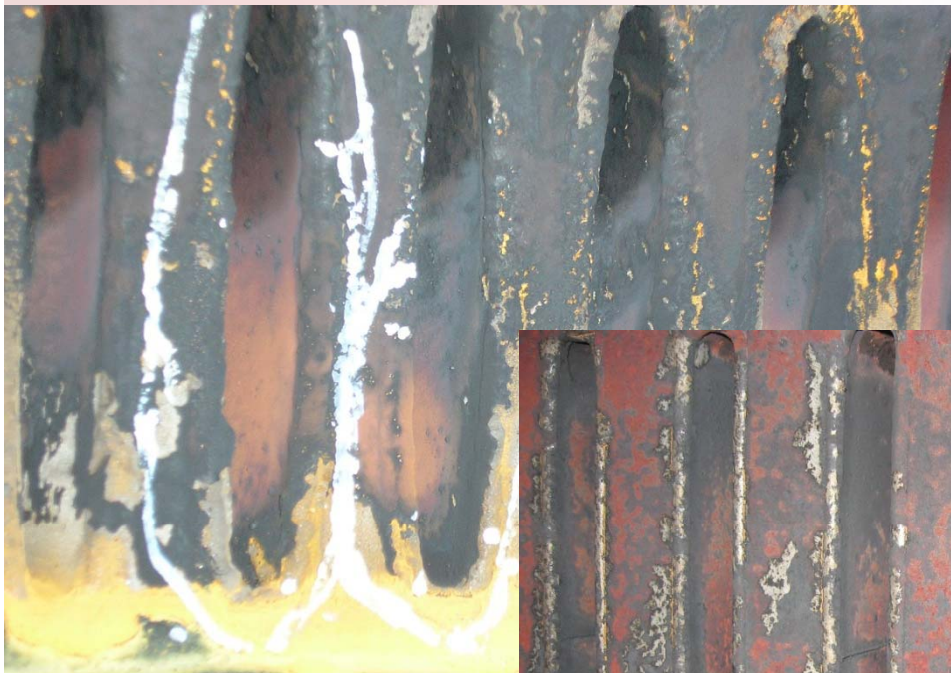
- **High concentrations of iron around the cycle**
 - **Boiler/HRSG deposits**
 - **Boiler/HRSG Tube Failures** (overheating and TF)
 - **Steam Turbine Deposits** (Including aluminum)
- **Need for Iron Removal Processes**
 - **Condensate Polishing and/or Filters**
- **Limitations around the cycle**
 - **Condensate polishing**
- **Overall an ACC “controls” the unit cycle chemistry**
 - **International Guidelines didn’t consider ACC or two-phase flow up to 2010** (IAPWS Volatile Guidance)

**There is an ACC Corrosion
Index to Categorize Corrosion
and Track Improvements**

DHACI

**(Dooley, Howell, Air-cooled Condenser,
Corrosion Index)**

We know what the Corrosion Looks Like



DHACI 3



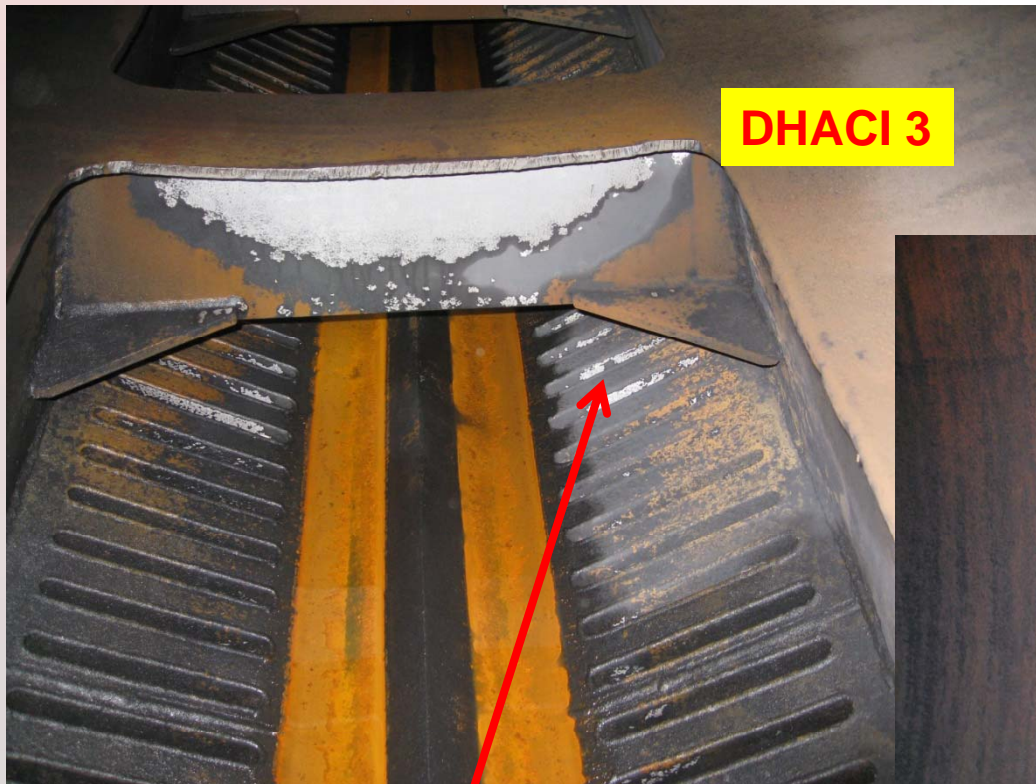
DHACI 4



DHACI 3

Inspections in China

650 MW Supercritical with Shuang Liang ACC. 15 Months.



DHACI 3

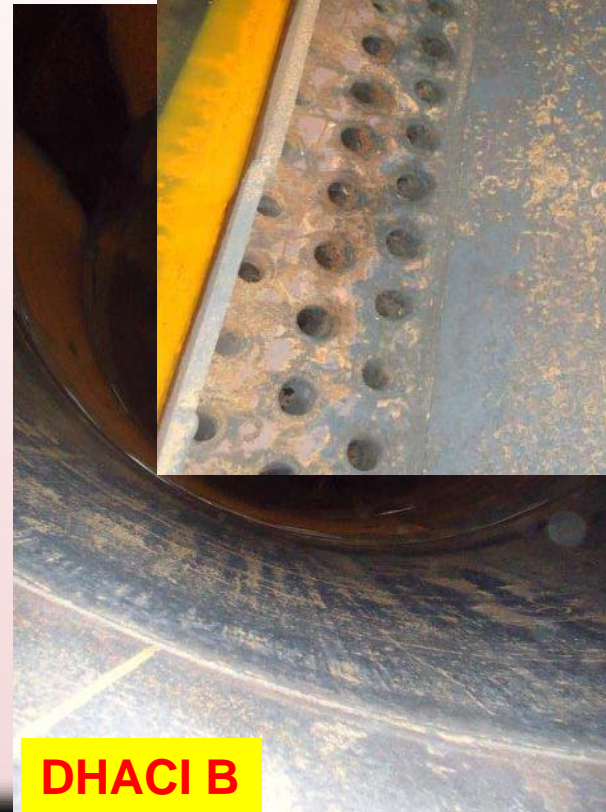
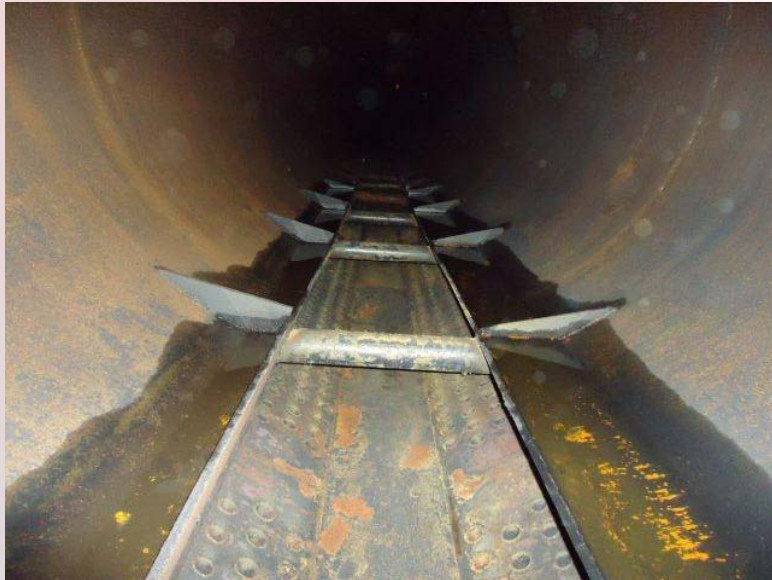
ACC Duct Work not Passivated



Concentration of Two-phase FAC beneath Supports

Inspection in India show the same Features

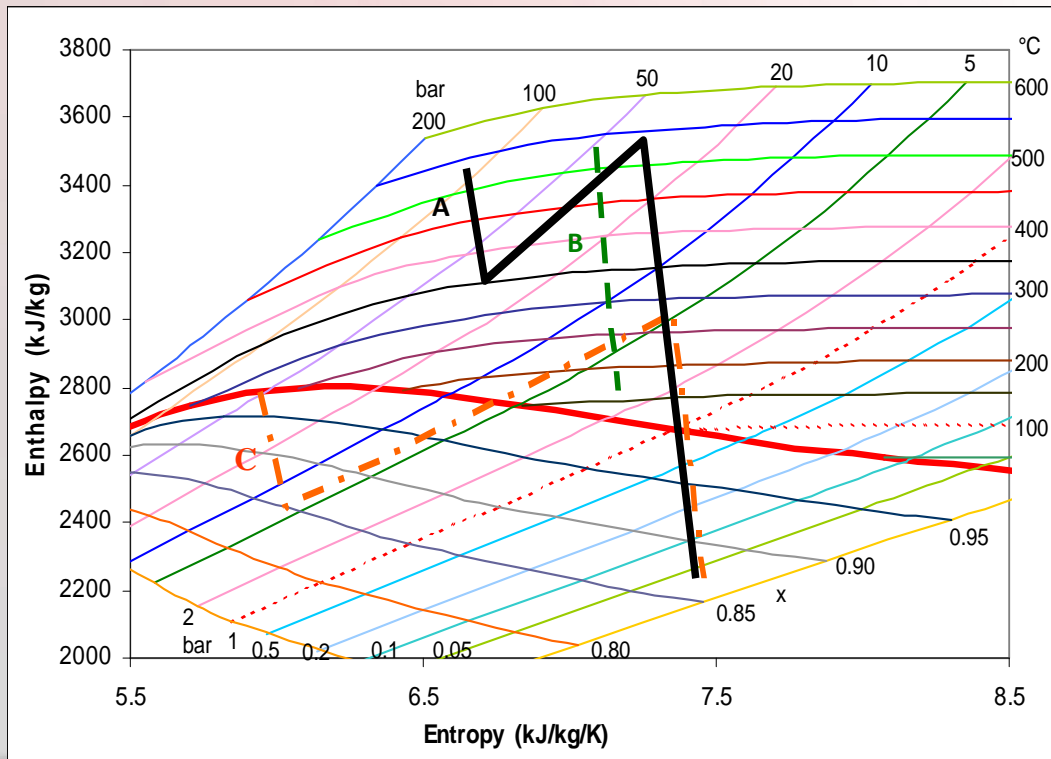
150 MW Fluidized Bed Unit with GEI ACC. 2000 hours.



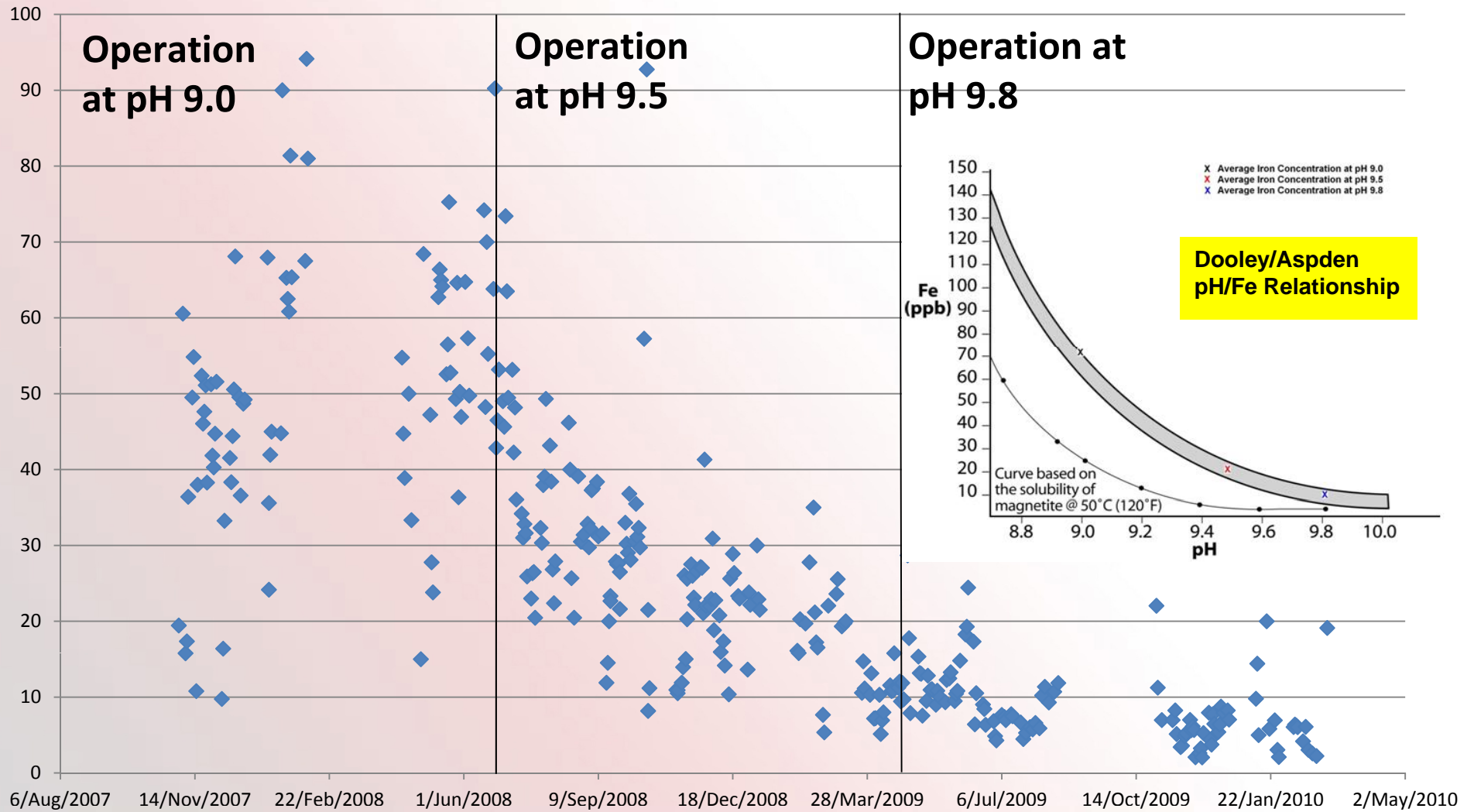
The PTZ Environment in the LP Steam Turbine is Completely Understood

Generation of the ACC Environment

Heterogeneous droplet Nucleation and Liquid Films on ST Blades
(Droplets and Liquid Films in the ACC vary from 0.1 – 50 microns and don't contain any oxygen until during shutdown)



Iron in Condensate (ug/L)



Source: Richardson and Joy, ACCUG 2011



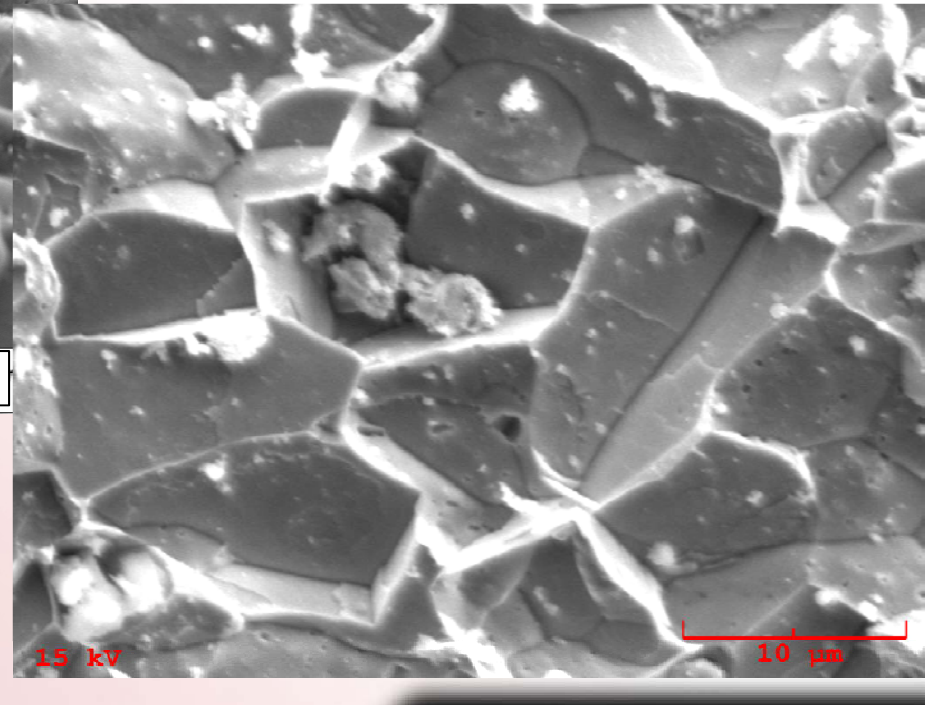
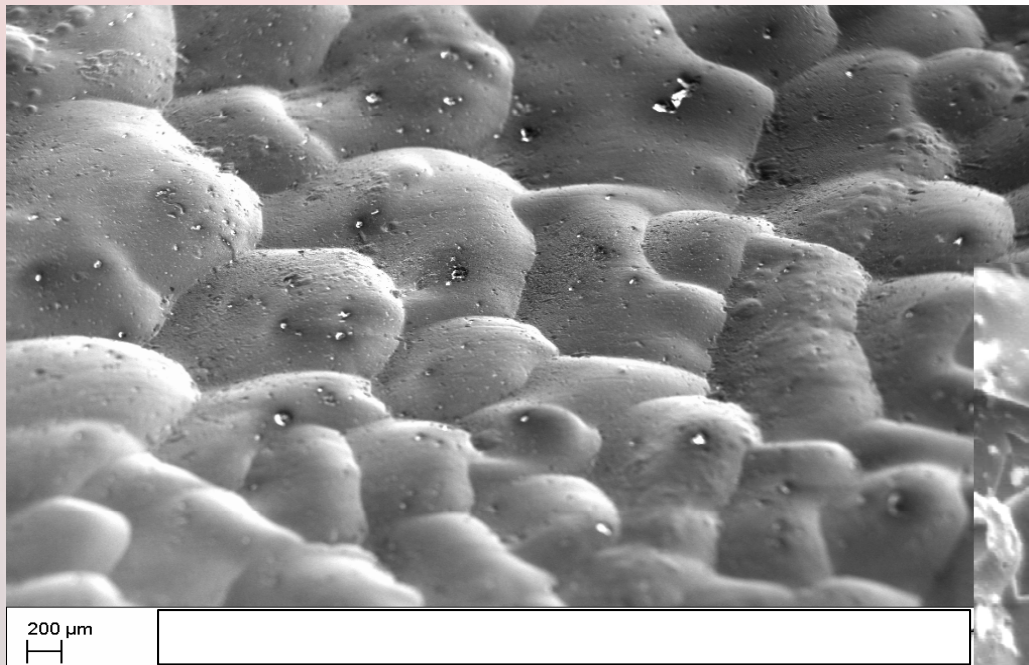
August 2011 Outage (2 Years with pH 9.8)



Summary from 2011 ACCUG

- **Some aspects relate to (LT Two-phase) FAC**
 - Adjacent black and white areas in severe turbulent areas
 - Increasing pH reduces damage
- **Some aspects don't** (normal FAC scalloped appearance and white areas on cross members is probably LDI)
- **Environment is known and has been measured** (one plant)
 - Two-phase mixture formed in PTZ of ST
 - Concentrating liquids (Higher in chloride/sulphate, organics)
 - Lower in pH
- **Clearly more tubes need to be analyzed**
- **Clearly we need to provide solutions which address the mechanism**

Typical Microscopic Appearance of FAC and ACC Corrosion



Do we Fully Understand the Environment and the Corrosion Mechanism?

Solutions are already being applied

Increase bulk pH up to 9.8

Increase local pH (amines)

Filters and condensate polishers

Coatings (epoxy), Sleeves, Inserts

Materials

Designs



Structural Integrity
Associates, Inc.

Cycle Chemistry Guidance for Plants with ACC

The International Association for the Properties of Water and Steam
Niagara Falls, Canada
July 2010

Technical Guidance Document:

**Volatile treatments for the steam-water circuits of fossil and
combined cycle/HRSG power plants**

Freely available and downloadable on IAPWS website

www.IAPWS.org

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