

# ACC Corrosion

## Chemistry Options To Address FAC (like) Corrosion

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# Sister Units

- ▶ Both triple pressure HRSG 1:1 configuration supplying steam to steam turbine with ACC.
- ▶ Both were not inspected from commercial until 11 years later.
- ▶ Both noted FAC (like) corrosion in the upper ducts.
- ▶ Unit A operates intermittently and B mostly base load until pass few years cycling.

# Scaffolding is required for the upper duct inspections



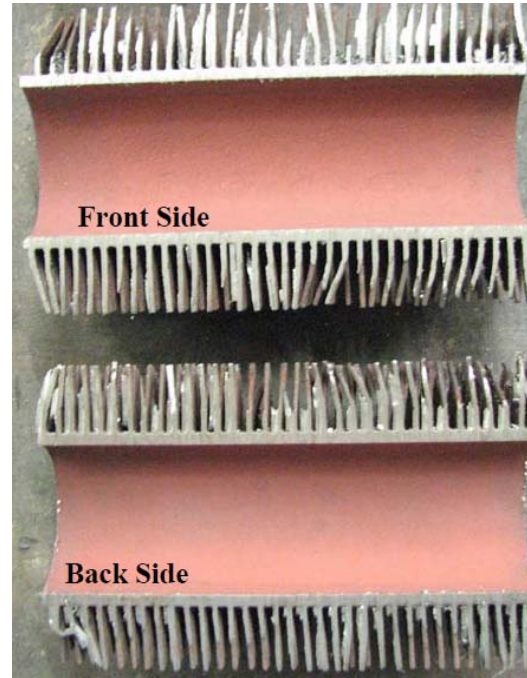
Due to the cost to erect scaffolding the ACC were not inspected. When inspected FAC like corrosion was noted in the upper ducts And transition ducting from the steam turbine.

# Plant A

- ▶ Air inleakage monitoring
  1. Plant did not perform GEA vacuum decline testing since commercial.
  2. Plant does not monitor air removal exhaust flow (SCFM)
- ▶ Based on monoethanolamine (MEA) experience switched during 2012. A
- ▶ Approximately 15% ammonium hydroxide and 5% MEA to maintain the feedwater pH between 9.4 and 9.8.
- ▶ Due to intermittent operation began Anodamine filming amine program 2013 to provide better off line protection to steam turbine and condenser

# Prior To Chemistry Change

- ▶ Tube specimen removed from HP evaporator
- ▶ The tube hot side accumulated internal deposits was 9 mg/cm<sup>2</sup> (8.7 g/ft<sup>2</sup>).
- ▶ There was no evidence of under-deposit corrosion seen in any of the areas examined.
- ▶ Minor pitting with a maximum pit depth of 0.005" on the ID surface of the tube.



A through wall 17 inch crack was found below the bearing area at the exhaust of the LP steam turbine last stage into the steam turbine exhaust trunk to the ACC



This crack is through wall and should have been an issue with air in-leakage and high condensate pump discharge dissolved oxygen hence the recommendation of proper cycle chemistry monitoring instruments.

# Upper Duct



As found 2011 inspection



MEA/Anodamine treatment 2016



Turbine exhaust duct where the ACC transition  
branches into two ducts to 1-2 & 3-4



As found 2011 inspection



MEA/Anodamine treatment 2016



Turbine exhaust duct, steam turbine condensate duct drain down going towards the ACC duct transition branches



As found 2011 inspection



MEA/Anodamine treatment 2016

Inlet vanes into the #1 upper duct with previous areas with FAC that has been passivated



As found 2011 inspection



MEA/Anodamine treatment 2016

## Isolation valve to ACC duct #4 just below the entry into duct #3



As found 2011 inspection



MEA/Anodamine treatment 2016

The #1 duct inspection showing water beading from the Anodamine treatment and passivation of tube inlet and lower duct metal surface



# Plant B

- ▶ Air inleakage monitoring
  1. Plant did not perform GEA vacuum decline testing since commercial.
  2. Plant does not monitor air removal exhaust flow (SCFM)
- ▶ Based on monoethanolamine (MEA) experience switched during 2012.
- ▶ Considering change to Anodamine filming amine program after gathering baseline chemistry
- ▶ Approximately 15% ammonium hydroxide and 5% MEA to maintain the feedwater pH between 9.4 and 9.8.



# Tube Specimen from HP Evaporator



# Prior To Chemistry Change

- ▶ Tube specimen removed from HP evaporator
- ▶ The tube hot side accumulated internal deposits was 8.9 g/ft<sup>2</sup> cold side 8.5 g/ft<sup>2</sup>
- ▶ Areas with pitting were passivated.
- ▶ Minor pitting with a maximum pit depth of 0.005" on the ID surface of the tube.

Tube after bead blast cleaning





Turbine exhaust duct, steam turbine condensate duct drain  
down going towards the ACC duct transition branches



As found 2011 inspection



Monoethanolamine (MEA) treatment 2016

# Steam turbine expansion joint protective shroud



As found 2011 inspection



Monoethanolamine (MEA) treatment 2016

# Turbine exhaust duct where the ACC transition branches into two ducts to 1-2 & 3-4



As found 2011 inspection



Monoethanolamine (MEA) treatment 2016

# Turbine exhaust duct where the ACC transition branches into two ducts to 1-2 & 3-4



As found 2011 inspection



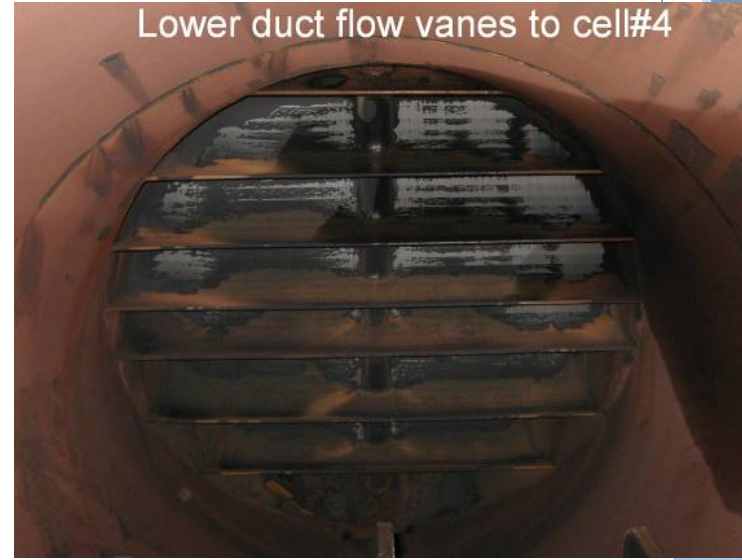
Monoethanolamine (MEA) treatment 2016



# The ACC transition branches into duct 4



As found 2011 inspection



Monoethanolamine (MEA) treatment 2016

# Upper flow guide into the #1 duct



As found 2011 inspection



Monoethanolamine (MEA) treatment 2016

# Upper #1 Duct



As found 2011 inspection



Monoethanolamine (MEA) treatment 2016



# Upper #1 Duct



As found 2011 inspection



Monoethanolamine (MEA) treatment 2016



As found 2011 inspection



Monoethanolamine (MEA)  
treatment 2016

# Options for evaluating base line chemistry program

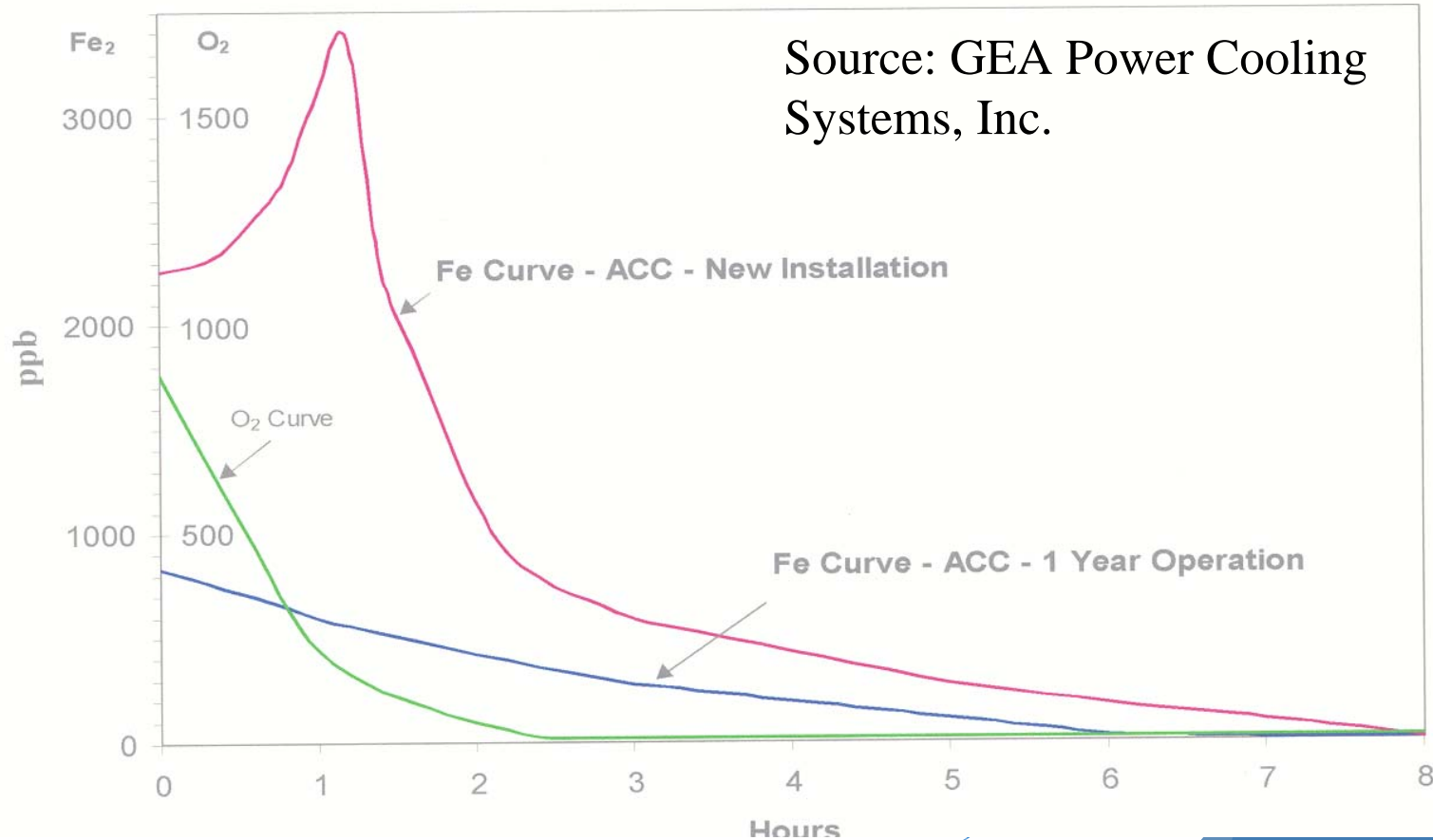
- ▶ Grab sampling of iron
- ▶ Unit inspection of as current and future condition assessments
- ▶ Continuous monitoring of the unit especially during start up
- ▶ Bore scope inspection of the area and riser tubes below the belly pan
- ▶ Tube specimen from the HP first row evaporator prior to chemistry change

# Steam drum Economizer Inspection





# Typical Iron & Oxygen Content ACC Condensate during Start-Up

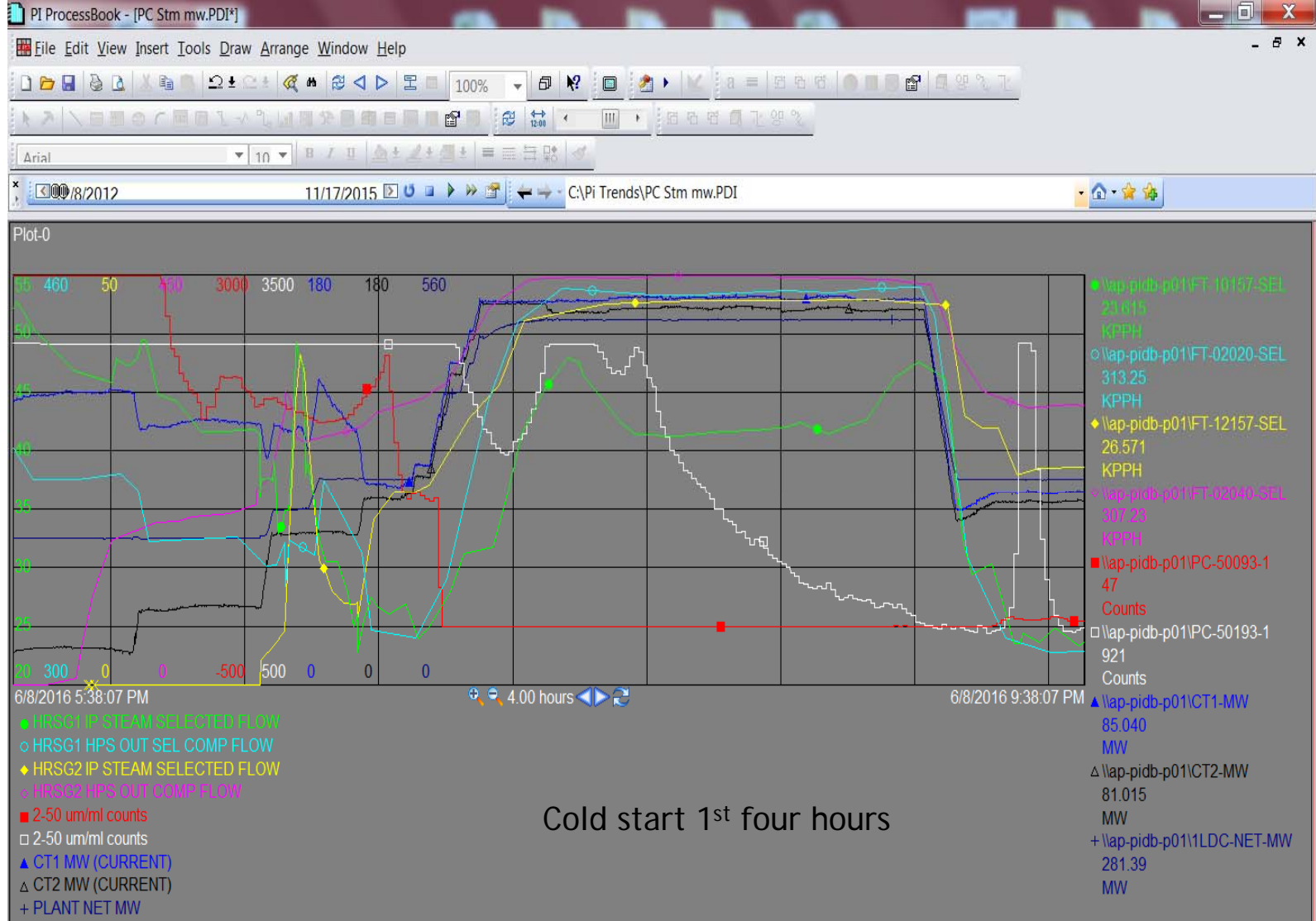


# Example of Start up

# Chart comments

- ▶ Lower left shows color information
- ▶ Steam flow to capture steam/water flow prior to steam turbine going on line. During this period steam is bypassing directly to the condenser.
- ▶ Also shown is M/Watts for the CT's and ST that later reflects drop in particle counter numbers (white and red indications).





Ready

Server Time

NUM

9:40 AM

