Cleaning Air-Cooled Condensers Case Studies

ACC Users Group
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Case 1: Leaking Tubes

Yellowstone Power Plant
Air Cooled Condenser
Case 1: Leaking Tubes

• Each module contains
  • 1 fan
  • 6 finned tube bundles
• ACC has 10 module consisting of
  • 8 condensing cells
  • 2 reflux cells
• Finned tube bundles have
  • 211 galvanized coated carbon steel oval tubes in a 3 tube arrangement
Case 1: Leaking Tubes

- The ACC has 10 fans
  - 26 foot
  - 10 bladed
  - 2 speed gear reduced motor
- Fans turn at
  - 125 RPM – fast mode
  - 63 RPM – slow mode
- Fan motors have reverse contacts
  - Reverse fans in severe winter
Case 1: Leaking Tubes

Center of ACC
Case 1: Leaking Tubes

Tubes – Frozen and Degraded from Debris Trapped Behind Support Beams
Case 1: Leaking Tubes

Frozen Burst Tube
Case 1: Leaking Tubes

Holes in Top of Tube Connections to Steam Header
Case 1: Leaking Tubes

Removal of Outer Tubes – Gain Access to Inner Row Tube Leaks
Case 1: Leaking Tubes

Leaks in Tubes at Lower Condensate Header Connections

East Side of "H" ACC Reflux Cell
Case 1: Leaking Tubes

Environmental problems

• Wind
• Debris
  • Cotton from cottonwood trees
  • Ash
  • Coke dust
  • Other debris
• Cold weather
• Hot weather
Case 1: Leaking Tubes

YPP’s Solutions

- Use of underground cable shrink wrap and aluminum duct tape
  - Patch major leaks in tubes
- Use of sleeve inserts and outer sleeves
  - Fix tube to header connection leaks
- Sandblasting and pressure washing of tubes
  - Remove debris from finned areas
YPP’s Solutions Continued

- Use of epoxy paints
  - Help preserve and close pin hole leaks
    - Steam header connections
    - Condensate headers
- Wind Fence
- Wind Wall
Case 1: Leaking Tubes

Cable Shrink Wrap – Repair Major Holes in Tubes
Case 1: Leaking Tubes

Tube Sleeve Inserts and Outer Couplers
Case 1: Leaking Tubes

Epoxy Paint

Holes in Tube Headers

Holes Repaired and Epoxy Painted
Case 1: Leaking Tubes

Wind Fence
Case 1: Leaking Tubes

Wind Wall
Plant Conditions

- Plant burns coker gas from refinery
- Steam produced sent back to refinery
- Harsh winter partially froze coker gas line
  - Created blockage in the line
  - High pressure behind the blockage
Case 2: Cleaning with Biodegradable Degreaser

Problem

• When blockage broke free
  • Pressurized oil leaked through the Loop Seal Stack
  • Oil covered
    • Outside surface of the ACC unit
    • Surrounding areas
Case 2: Cleaning with Biodegradable Degreaser

Oil on Surface of Unit
Case 2: Cleaning with Biodegradable Degreaser

Oil Covers Unit
Case 2: Cleaning with Biodegradable Degreaser

Additional Problem

- Truck spilled fly ash near the ACC unit
- Ash sucked into the ACC fans
- Under side of fins coated with oil and ash
- Oil acted like a glue
Case 2: Cleaning with Biodegradable Degreaser

Ash Covers Fins Underneath Unit
Initial Attempt to Clean

- Plant attempted to clean unit using:
  - Cleaning system installed with unit
  - High pressure water
- Cleaning was unsuccessful
Cleaning using De-Greaser

- ACC cleaning system brought to plant
  - Capable of higher pressure – adjustable
- Bundles presoaked with bio-degradable degreaser
- Unit cleaned using a higher pressure with ACC cleaning system
Case 2: Cleaning with Biodegradable Degreaser

ACC Cleaning System
Case 2: Cleaning with Biodegradable Degreaser

ACC Cleaning System: Riding the Rails
Case 2: Cleaning with Biodegradable Degreaser

View from Inside Unit
Case 2: Cleaning with Biodegradable Degreaser

Results
Case 2: Cleaning with Biodegradable Degreaser

Results
Case 2: Cleaning with Biodegradable Degreaser

Results
Case 3: ACC Vertical Unit Cleaning Solution

Haverhill

• Issue – unable to effectively clean unit
• Standard ACC cleaning system did not fit
• Had to modify entire unit
• Cleaning system had to fit between fans and unit
• Vertical ACC unit
• Consists of 78 fans
• Rectangular structure
• Fans on each of the 4 sides
• Fans are 2 high on each side
• ACC structure on the top of Main Building
Case 3: ACC Vertical Unit Cleaning Solution
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Standard ACC Cleaning Equipment
Case 3: ACC Vertical Unit Cleaning Solution

ACC System Modifications
Case 3: ACC Vertical Unit Cleaning Solution

ACC System Installation
Case 3: ACC Vertical Unit Cleaning Solution

ACC System Installation
Case 3: ACC Vertical Unit Cleaning Solution

ACC System Installation
Questions