BOILER FAILURE ANALYSIS & RECOMMENDATION

Trouble starts with the start of a New Boiler and complete elimination is like a daydream. We need to accommodate and survive with best operational & efficiency parameters and minimum failure and downtime.

A LIST of CHRONIC TROUBLES & REASONS

1. **Erosion of Tubes in Bed Coils**
    a. Two phase Flow Accelerated Corrosion – FAC in Bed Coils due to improper / disturbed circulation, Tube failed at Upper Half Portion in Bottom Coil
    b. High Bed Fluidization gas velocity (maximum allowed <2.5 m/s)
    c. Wrong location of Fuel Nozzle
    d. Gap between bed coil & fuel nozzle

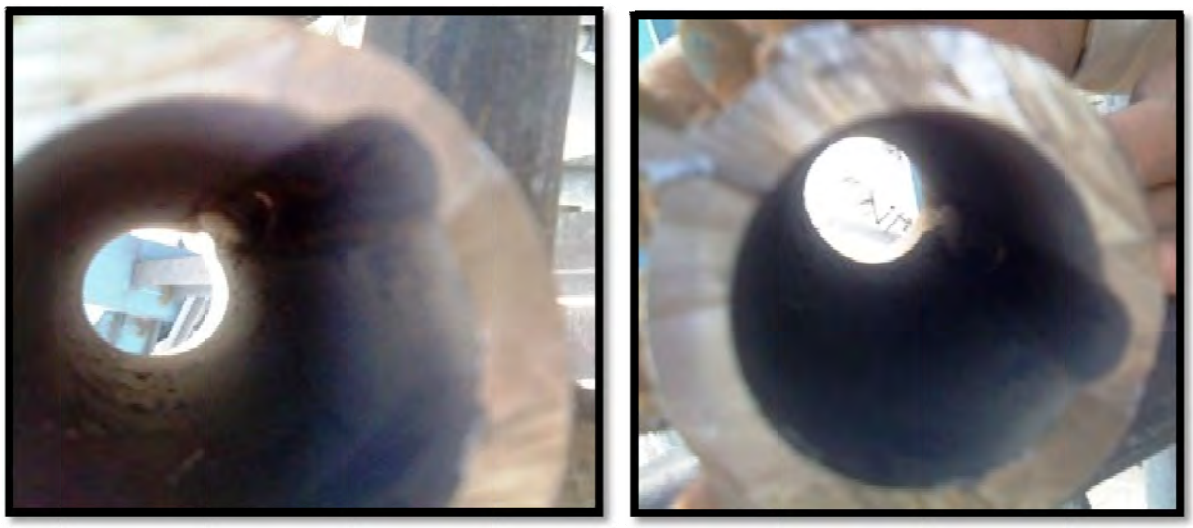
MAJORITY OF BED COIL FAILURES DUE TO IMPROPER CIRCULATION & FLOW ACCELERATED CORROSION (FAC)

1. AFBC BOILER - WORKING PRESSURE 87KG/CM2g

This is not Caustic Gouging, it's TWO PHASE FAC.

Boiler Water Chemistry used is All Volatile Treatment

Bed Coil Failure, Mainly due to Improper/Disturbed Circulation & High Heat Flux by High GCV Imported Coal firing, Corrected by RIFLE TUBES



Tube failed location is exactly 12 O'clock position

2. AFBC BOILER - WORKING PRESSURE 67KG/CM2g

This is not Caustic Gouging, it's TWO PHASE FAC.

Boiler Water Chemistry used is All Volatile Treatment

Bed Coil Failure, Mainly due to Improper / Disturbed Circulation & High Heat Flux with Rice Husk firing

BEFORE CUT IN TWO HALVES, EROSION BY HIGH METAL TEMPERATURE

BOTTOM HALF PORTION AFTER CUT IN TWO HALVES, INTERNAL DEPOSITION BY IMPROPER CIRCULATION

Tube failed location is exactly 12 O'clock position

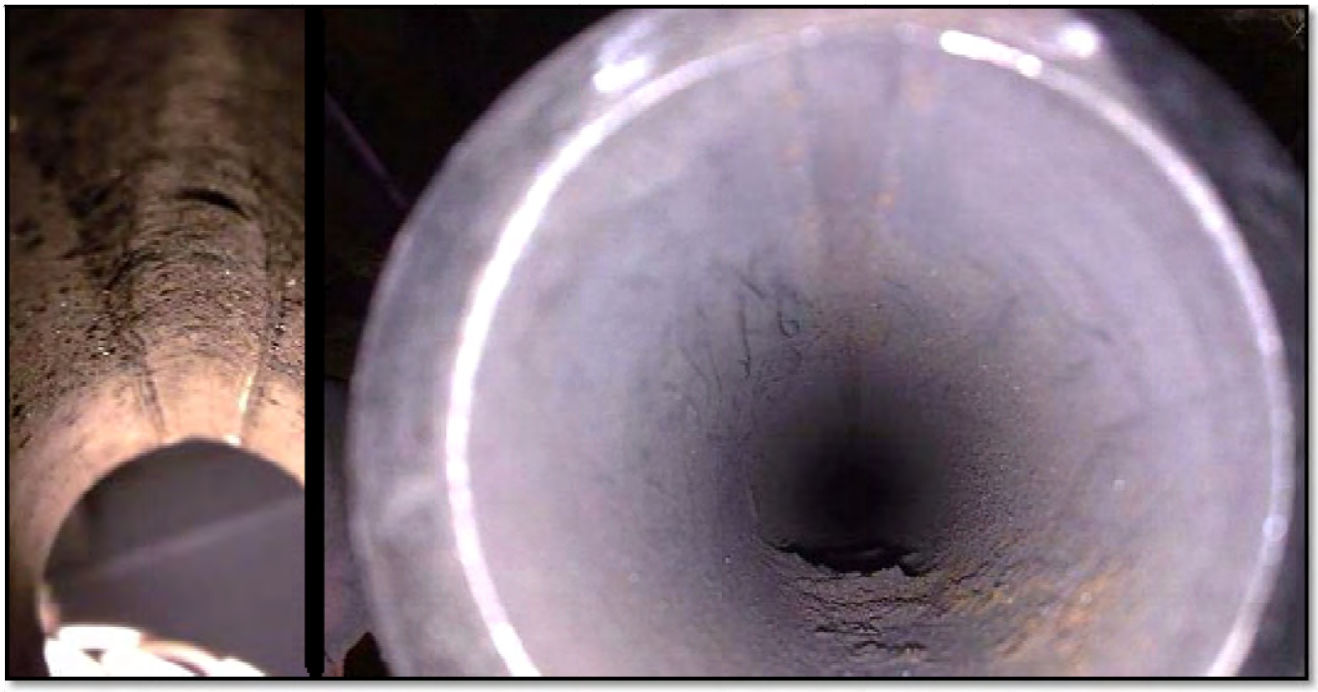
TOP HALF PORTION AFTER CUT IN TWO HALVES, DEEP GROOVE BY FAC & IMPROPER CIRCULATION

3. AFBC BOILER - WORKING PRESSURE 32KG/CM2g

Bed Coil Failure, Mainly due to Improper / Disturbed Circulation

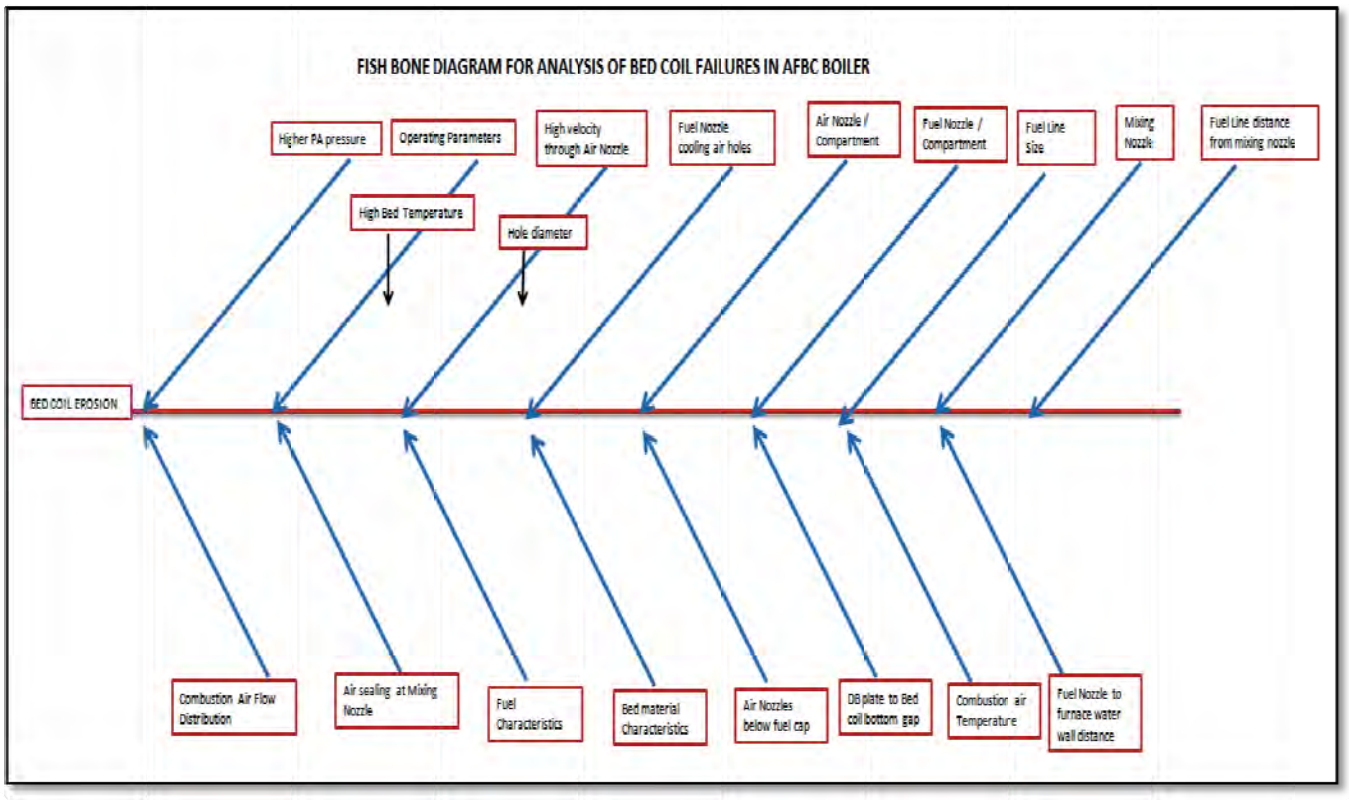
Tube failed location is exactly 12 O'clock position

NOTE: Most of the Improper / Disturbed Circulation Failures are converted to Erosion Failures to avoid design failure highlights.



Tube failed location is exactly 12 O'clock position

FISHBONE DIAGRAM FOR BED COIL FAILURE DUE TO OTHER REASON



4. STOKER FIRED BOILER - WORKING PRESSURE 45 KG/CM2g

This is not Caustic Gouging, it's TWO PHASE FAC.

Boiler Water Chemistry used is All Volatile Treatment

Riser going to Steam Drum Failure, Mainly due to Improper Circulation, Piping layout with more bends, Corrected by change in Riser Piping Material from Carbon Steel to Alloy Steel.

2. Erosion of Tubes in Boiler Bank, Evaporator

a. High Flue gas velocity (maximum allowed <18 m/s)
b. Improper sealing of Bank tubes & Fin plate with drum
c. Improper baffle & sealing of Flue gas partition plate
d. Wrong location & design of Flue gas partition plate

3. Ash Accumulation in Goose-Neck, Superheater & Gas Outlet Duct

a. Less Gap in-between Goose-neck tubes & Superheater bottom
b. Improper alignment of superheater coils
c. Channeling & Improper Gas distribution across Superheater
d. Unwanted Lugs, Scrap, Debris in this zone
e. Secondary combustion in Superheater Zone
f. Non-Performed Secondary Air Curtain & Nozzle
g. Less Residence time & Low Furnace height
h. No Soot blower installation
i. Wrong Baffle plate & duct design in Gas Outlet Duct

4. High Steam Temperature Superheater Pickup

a. Fuel carryover & combustion in Superheater Zone
b. More Fines in Fuels
c. Change in Free board combustion area in AFBC Boiler
   NOTE: Free board combustion is inversely proportional to Bed coil area
d. Large Superheater heating surface area
e. Non-Performed Secondary Air Curtain & Nozzle

5. Unachieved Guaranteed & Designed Parameters

a. Location of Auxiliary Power consumption inputs measurement
b. High Attemperator Spray water for Steam temperature control
c. Air outlet temperature at Air Preheater
d. Feed water temperature at Economiser outlet
e. High gas temperature drop across ESP
f. Secondary air fan overloading for desired curtain air pressure
g. High Emission from ESP (Pollution control equipment)
h. High Unburnt in Bottom & Fly ash
i. High Backend (APH gas outlet) gas temperature

6. Air Pre Heater (APH) Choking & Erosion

a. Channeling & Improper Gas distribution across all APH tubes
b. Wrong Baffle plate design at APH Inlet & APH Outlet
c. High APH Tube Length

AFBC BOILER DESIGN PROCEDURE

AFBC Boiler designed few step:-

1. Select Boiler Pressure, Temperature, Capacity, Fuel, Other Parameter & Efficiency
2. Calculate the Air flow, Fuel Gas Flow, Gas Flow requirements
3. Select Fuel Nozzle size & Calculate number of Fuel nozzles
4. Select Flue gas flow & Fluidization velocity
5. Calculate Bed coil area and Number of Compartment
6. Select Furnace width & depth
7. Heat transfer in bed coil area, Calculate number of Air nozzles & DB Plate profile
8. Consider gas residence time is ≥ 2.5 sec
9. Many more other activities in continuation

M/s Unite Energy Corporation LLP is keen to provide the Spares, Sales & Services, Retrofit & Site Repairs of Boiler & Auxiliaries, Performance Evaluation, Shop & Site Fabrication, Erection & Commissioning, Design Modification & Feasibility Study, Consultancy & troubleshooting support to mitigate the irregularities in the plant, minimize breakdown & downtime and improvise design & system performance to improve the overall plant's health and performance.

Regards

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