Mothballing/ De-Mothballing Of Sulfur Recovery Unit

19th Oct 2015
Agenda

• Introduction
• Mothballing reasons and Objectives
• SRU process flow diagram
• Mothballing strategy
• Mothballing Highlights
• Monitoring during Mothballing
• De mothballing
• Conclusion
Introduction

**GASCO:**

- Major Gas processing operating company within ADNOC
- On and off shore gas processing

**Habshan complex:**

- Habshan and Bab division
- Habshan 5 division
Mothballing reasons and Objectives

- 10 SRU in Habshan (U-50/51/52/53/54/57/58/59/152/153) and 4 SRU’s in Habshan-5 (U-550/551/552/553).
- U-50/51: 3 stage Claus Process & the oldest in Habshan (400 TPD)
- Recovery very low (95-97 %) compared to 99% in other SRU’s of Habshan and 99.8 % in H-5 SRU’s
- At peak Sulfur production period (7500 TPD), no requirement of U-50
- Decision to mothball U-50 for
  - Available spare capacity in other SRU’s
  - Energy Savings
  - Reducing SO2 emissions (30% of total emissions)

- U50 mothballing from December 2013 to November 2014
U50 Process flow diagram

- Reaction furnace
- Three Claus reaction beds
- Waste heat reboiler
- 4 condensers
- Sulfur sump
- Incinerator
- Steam Driven Air Blower
- 5 preheaters
- PO4 dosing skid
- Degassing system
Mothballing strategy

• In House Procedure developed with references used:
  ➢ ADNOC PS 06029 Mothballing procedure
  ➢ Shell DEP 70.10.70.11-Gen (Preservation Of New And Old Equipment Standing Idle)

• The In house procedure developed with Inputs from Operations/ Maintenance/Inspection/ Rotary/ Process Engineering/ Instrumentation

• Discussion with original equipment manufacturers(OEM) for Rotating equipments
Mothballing strategy

- Entire unit divided into 8 loops based on service:
  - Loop 1: Acid gas to reaction furnace (50H101)
  - Loop 2: Fuel gas with reaction furnace (50H101)
  - Loop 3: Air line to reaction furnace (50H101)
  - Loop 4: Converters loop
  - Loop 5: BFW system
  - Loop 6: Steam Preheaters
  - Loop 7: Superheated steam to blower
  - Loop 8: Sulfur Sump (50V11)
Mothballing Highlights

- Unit shut down and complete Sweeping ensured for making system Sulfur free
- All Vessels emptied out completely
- All Valves/XV’s kept open and unit blinded (40 blinds)
- All PSV’s preserved with $N_2$ by keeping upstream isolation valves open.
- Reaction Furnace:
  - Opened and cleaned
  - Burners pulled out, cleaned, sand blasted and preserved with desulphurized diesel oil coating and wrapped in Plastic
  - Refractory inspected and minor repairs as required
  - Silica gel(35 Kgs) kept inside before boxing up
- Air Blower
  - Lube oil circulation kept on and pump switched over every month
  - Air suction blinded casing purged and maintained with N2
  - Cranking the rotors by 90° to 120° every week.
Mothballing Highlights (Continued)

- **Converters:**
  - During sweeping process it was monitored for abnormalities
  - Old catalyst retained inside converters.
  - Kept under N2 blanket

- **Steam and BFW systems:**
  - Drained and kept under N2 pressure.
  - LP steam (Jacketing steam) kept on

- **Sulfur Sump:**
  - Sump emptied out and kept under N2 blanket
  - Sump pumps were removed, cleaned, sand blasted plastic wrapped.

- **Incinerator:**
  - Kept running with minimum firing as stack is common with other unit incinerator.
Monitoring during Mothballing

- Inspection during mothballing period to monitor the corrosion
- N2 pressure monitoring for mothballing loops
  - Two times a day
  - To be filled by field operator
  - Mothballing monitoring audit being done
Monitoring during Mothballing (Continued)

<table>
<thead>
<tr>
<th>Date/Shift</th>
<th>Time</th>
<th>Loop 1 pressure (Barg)</th>
<th>Loop 2 pressure (Barg)</th>
<th>Loop 3 pressure (Barg)</th>
<th>Loop 4 pressure (Barg)</th>
<th>Loop 5 pressure (Barg)</th>
<th>Loop 6 pressure (Barg)</th>
<th>Loop 7 pressure (Barg)</th>
<th>Temp (°C)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>13/03 A8</td>
<td>8:00</td>
<td>0.3</td>
<td>0.38</td>
<td>0.5</td>
<td>0.35</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>0.3</td>
<td>350 Pr. increase</td>
</tr>
<tr>
<td></td>
<td>20:00</td>
<td>0.45</td>
<td>0.45</td>
<td>0.45</td>
<td>0.45</td>
<td>*</td>
<td>*</td>
<td>0.25</td>
<td></td>
<td>350 Pr. increase</td>
</tr>
<tr>
<td>14/03 A8</td>
<td>8:00</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>*</td>
<td>*</td>
<td>0.2</td>
<td></td>
<td>350 Pr. increase</td>
</tr>
<tr>
<td></td>
<td>20:00</td>
<td>0.45</td>
<td>0.45</td>
<td>0.45</td>
<td>0.45</td>
<td>*</td>
<td>*</td>
<td>0.2</td>
<td></td>
<td>350 Pr. increase</td>
</tr>
<tr>
<td>15/03 A8</td>
<td>8:00</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>*</td>
<td>*</td>
<td>0.3</td>
<td></td>
<td>350 Pr. increase</td>
</tr>
<tr>
<td></td>
<td>20:00</td>
<td>0.45</td>
<td>0.45</td>
<td>0.45</td>
<td>0.45</td>
<td>*</td>
<td>*</td>
<td>0.3</td>
<td></td>
<td>350 Pr. increase</td>
</tr>
<tr>
<td>16/03 C8</td>
<td>8:00</td>
<td>0.37</td>
<td>0.36</td>
<td>0.3</td>
<td>0.4</td>
<td>*</td>
<td>*</td>
<td>0.3</td>
<td></td>
<td>362 V111 Pr. increase</td>
</tr>
<tr>
<td></td>
<td>20:00</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.4</td>
<td>*</td>
<td>*</td>
<td>0.3</td>
<td></td>
<td>362 V111 Pr. increase</td>
</tr>
<tr>
<td>17/03 C8</td>
<td>8:00</td>
<td>0.27</td>
<td>0.42</td>
<td>0.48</td>
<td>0.36</td>
<td>0.35</td>
<td>*</td>
<td>*</td>
<td>0.3</td>
<td>344 Pr. increase</td>
</tr>
<tr>
<td></td>
<td>20:00</td>
<td>0.27</td>
<td>0.4</td>
<td>0.48</td>
<td>0.35</td>
<td>0.5</td>
<td>*</td>
<td>*</td>
<td>0.3</td>
<td>350 Pr. increase</td>
</tr>
<tr>
<td>18/03 C8</td>
<td>8:00</td>
<td>0.3</td>
<td>0.45</td>
<td>0.45</td>
<td>0.3</td>
<td>0.5</td>
<td>*</td>
<td>*</td>
<td>0.36</td>
<td>346</td>
</tr>
<tr>
<td></td>
<td>20:00</td>
<td>0.5</td>
<td>0.42</td>
<td>0.45</td>
<td>0.48</td>
<td>0.5</td>
<td>*</td>
<td>*</td>
<td>0.25</td>
<td>350 Pr. increase</td>
</tr>
</tbody>
</table>

Unit - 50 mothballing Pressure statistics
De mothballing

- Inspection of equipments
  - No corrosion found in the acid gas line from battery limit to reaction furnace 50H101. The only exception is the spool between 50V101 and the acid gas heater where negligible minor corrosion found.
  - No corrosion found in catalyst loop except minor one in the spool between 50V105 and 50E108 which found negligible.
  - BFW system, steam (No corrosion found).
  - sulfur rundown (No corrosion found)

- Packages reinstallation such as (PO4 skid)
- Sulfur pumps installation
- Removing Silica gel
- 50H101 cleaning, boxing up and main burner installation
- De-blinding and normal start up
Conclusion

• U50 mothballed from December 2013 to November 2014, run for seven months till July 2015.
• Performance test conducted in May 2015 (by sulfur experts) and no change in unit performance observed
• Based on the successful Mothballing, it was decided to proceed with Long term Mothballing of both U50/51 for a period of 2-3 years.
Thank you