Technical Session
Challenges and Lesson Learnt in Maturing Technology in an Ageing Facility

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Introduction

• Mercury Removal Unit (MRU) has been installed (in one of the Terminal) since year 2006 and not in service for the last 10 years.

• PETRONAS has developed HycaPure™ Hg Condensate adsorbent for mercury removal in liquid condensate. It has been integrated into intended operating environment (existing MRU) and operated for more than 6 months continuously.

• During the preparation to bring MRU system back into service in 2017, we have encountered multiple project and technology challenges that later successfully resolved to ensure smooth commissioning and operation period.
Chronology of Event

First Start-up Attempt
- Feb 2017
  - MRU A leak at outlet gasket
  - MRU C outlet valves jammed closed
  - Coalescer C leak during pressure test
  - Coalescer A & B minor leak
  - Coalescer C LCV positioner not functioning

Second Start-up Attempt
- Apr 2017
  - Replacement of related gaskets / o-ring / LCV positioner completed
  - Coalescer A/B/C pressure test passed
  - Coalescer C leak when export pump online

Third Start-up Attempt
- Dec 2017
  - Resolved all the leak root cause
  - Improvement on introduction of Hydrocarbon into the system
  - Successfully commission and startup the system without any leak incident

Performance Monitoring
- May 2018
  Successfully and safely achieved performance test monitoring for 6 months to demonstrate and proven the capability and efficiency of HycaPure condensate technology
Challenges & Observations

- **Mechanical integrity of the system**
  - *Ageing facilities and lack of preservation*
  
  As there is no demand for continuous operation of MRU system, leading to infrequent maintenance and preservation has resulted in the early ageing of the facilities.
Filter Vessel Quick Opening Closure Findings summary

- Draw bolt arm misaligned or not in upright elevation causing yoke misaligned and difficult to clamp for closing.
- Draw bolt collar are bent/damage or found to have off centred from the collar groove.
- Draw bolt has been misalign (left & right measurement from centre not similar). So the yoke are not centred on the closure hence unable to drawn up symmetrically.
- Corrosion was found on the yoke & sub
- Cone assembly on the pressure warning device was found being modified, 2 units of the pressure warning fitting are bent to a side
- Thread for the draw bolts & the slug are not in good condition
- Draw bolt arm misaligned or not in upright elevation causing yoke misaligned and difficult to clamp for closing
Challenges & Observations

- **Contaminants and fluctuation of pressure and flow during startup**
  - *Improvement during commissioning and start up to minimize the risk of leaking*
  
  Ageing facilities has resulted in increment of risk of leaking. During commissioning, extra precautions of slow flow introduction to prevent sudden pressure spike and continuous close monitoring are included to assure the smooth startup of the entire MRU system.

Fluctuation of Flow (m$^3$/hr) data
Challenges & Observations

- **Requirement of competent manpower to undertake the work**
  - *Need to re-allied to original vendor supplier for proper installation and box up*
    Due to less of knowledge and experience in the installation and box up for Quick Opening Closure type vessels, original vendor supplier is engaged to ensure the correctness and integrity of the installation.

- **Inconsistent condensate specification from offshore**
  - *Capability and efficiency of HycaPure condensate performance despite higher Mercury coming from offshore*
    During the Performance Test Monitoring, it has demonstrated its mercury removal capability with excellent reliability and durability of ≥ 98% efficiency despite higher mercury inlet and spike occurrence.
- Average mercury inlet concentration is between 300-500 ppb (at times spikes up to 3000-5000 ppb).
- MRU was designed to remove Hg from 750 ppb down to ≤150 ppb (80% removal).
- Current outlet mercury concentration for the MRU is ≤2 ppb (after continuously operating for ~6 months).
Way Forward and Achievement

- **Engage Experienced Contractor**
  We have worked closely with experienced contractor for the inspection, repair, cleaning and box up activity to ensure proper handling and box up.

- **Extra precautions**
  Slow flow introduction and continuous close monitoring are included during the startup of the MRU system.

- **Achievement**
  We managed to start up the MRU system successfully and tested our Hycapure condensate capability and performance for more than 6 months.