Cairn Oil & Gas

Managing Asset Integrity using Traffic Light
Overview – Mangala Operations

- Typical of 35 PRODUCTION WELL PADS
- Typical of 5 Typical of 18 WELL PADS

- Mangala Processing Terminal
- Oil Export
- Production Fluids
- Power Fluid
- Injection Water
- Condensate
- Fuel gas
- Water Supply

- Mangala Well Pads
- Thumbl Water Well Pad
- Raageshwari Gas Terminal
- Raageshwari Well Pads

- Bhagyam (15 WP) 100/114 P, 32/41 I
- Aishwarya (8 WP) 29/36 P, 13/14 I
Field Description – Surface Facilities

- **Area**: 1.6 sq. kms (400 acres)
- **Three processing trains**
  - 180,000 bopd & 680 kbfpd
- **Heat source : Steam Boilers (5+2)**
  - Steam generation -115 TPH/ boiler
  - HP for power generation
  - MP steam for process heat
  - LP steam for other utilities
  - Advantage of steam - pollution free, efficient
- **Captive power - STG (4 +1)**
  - 12 MW per STG
- **Oil Storage Capacity - (4 +2)**
  - Each Tank 122,000 bbls
- **Produce Water Treatment**
  - Capacity of 500,000 bwpd
- **Secure Landfill - Haz. & Non-Haz.**
  - Total 185,000 m³ capacity
- **Solar Evaporation Pond of 62,830 cu.m**
Key Elements of AI Management
Mechanical Integrity

Hardware barriers implemented by the oil and gas industry for process safety can be broadly categorized under eight hardware barrier categories:

Category 1: Structural Integrity
Category 2: Process Containment
Category 3: Ignition Control
Category 4: Detection Systems
Category 5: Protection Systems – including deluge and firewater systems
Category 6: Shutdown Systems – including operational well isolation and drilling well control equipment
Category 7: Emergency Response
Category 8: Life-saving Equipment – including evacuation systems

* i.e. processes and procedures within the Management System elements
Key Elements of AI Management
Mechanical Integrity

Category 2, Process Containment

- Pressure Vessels
- Heat Exchangers
- Rotating Equipment
- Tanks
- Piping Systems
- Pipelines
- Relief Systems
- Boilers

- Integrity of an Asset
  - Ability of the equipment to perform its required function in a safe, effective and efficient manner

- Integrity Breach
  - Degradation of equipment (Vessels, Pipelines, Structural etc.)

- Can be maintained by
  - Adequate inspections
  - Identifying weak signal
  - Analyzing the root cause
  - Corrective action
Overview

- Risk assessment and Risk Based Inspection (RBI)
- Inspection (Advanced technologies)
- Maintenance (Reliability, predictive and preventive strategies)
- Inspection and Maintenance Planning
- Non-Destructive and Material Testing
- Remaining Life Calculations
- Regulatory Compliance
- HSE strategies
- Document Management and Control
- Training in industry codes, standards and regulations
Equipment integrity is based on RBI assessment

- 1316 - P&ID
- 19403 Piping Isometrics
- 90 Corrosion Loops
- 1900 Equipment

Pipelines
Total Nos. 121 (Piggable-61 / Non-piggable 62)

Corrosion Coupons
More than 500 locations is being monitored.
Comprehensive chemical treatment plan in plat to combat corrosion

- Total 446
  - Low CR (< 3 mpy): 13
  - Moderate CR (3 - 4.9 mpy): 19
  - High CR (5 - 10 mpy): 19
  - Severe CR (>10 mpy): 19

- API 161
  - 12

- ISO 91
  - 2

- ISO 149
  - 13
  - 11

- NPT 45
  - 6
  - 6
  - 3
Traffic lights – Objectives

- Differentiate - Poor and good performance;

- Identify change of performance over time in relation to identified areas of poor performance i.e. better, worse, no change;

- Consistency of performance;

- Information sharing across/between groups;
Risk Based Inspection (RBI)

Data and information collection → Consequences of failure → Probability of failure → Risk ranking → Inspection plan → Mitigation (if any) → Reassessment

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**Risk assessment process**

- **Data and information collection**
- **Consequences of failure**
- **Probability of failure**
- **Risk ranking**
- **Inspection plan**
- **Mitigation (if any)**
- **Reassessment**

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### Appendix C: Risk Potential Matrix

<table>
<thead>
<tr>
<th>SEVERITY</th>
<th>PEOPLE</th>
<th>ASSETS</th>
<th>ENVIRON</th>
<th>MONEY</th>
<th>RECOVERY</th>
<th>IMPACT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3</td>
<td>Low Risk</td>
<td>Managed by routine procedures</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-6</td>
<td>Moderate Risk</td>
<td>Slightly managed responsibility</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>7-12</td>
<td>High Risk</td>
<td>Needs management attention</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13-25</td>
<td>Extreme Risk</td>
<td>Special plan required</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Severity**:
  - 1: Critical
  - 2: Major
  - 3: Moderate
  - 4: Minor
  - 5: Low

- **Probability of failure**:
  - 1: Very high
  - 2: High
  - 3: medium
  - 4: Low
  - 5: Very low

- **Consequences of failure**:
  - 1: High
  - 2: Moderate
  - 3: Low
  - 4: Very low

- **Inspection plan**:
  - 1: Routine
  - 2: Special

- **Reassessment**:
  - 1: Yearly
  - 2: Biennial
  - 3: Annual
  - 4: Special

**Legend**:
- Red: Critical
- Orange: High
- Yellow: Moderate
- Green: Low
Eliminate high risks through inspections;

- deterioration type and mechanism,
- rate of deterioration,
- probability of identifying and detecting deterioration and predicting future deterioration states with inspection technique(s),
- tolerance of the equipment to the type of deterioration.
To prioritize the inspections and corrective action

Internal corrosion due to;
- Fluid corrosivity
- Coating damage
- Breach of operating window
- Inadequate Chemical treatment
- H2S related issues

External corrosion due to;
- Coating damages
- Inadequate ICCP

Water circuits are more corrosive than other fluids

Breach of operating window

Idling without preservation initiates and promotes UDC/MIC

External corrosion

Injection Water

Lower velocity - solid accumulation and UDC

Inadequate Chemical treatment

Inadequate ICCP

Red-flags

Max. red flags 15*

* Higher value indicates more risk.
- Visual
- UT Scanning (A & B Scan)
- Hardness Survey
- Long Range UT (LRUT)
- Intelligent Pigging for Pipelines
- Phased array inspection - H$_2$S environmental Weld Joint
- Corrosion Coupon / probe Monitoring
- Acoustic Emission – In-service inspection of Tanks Bottom plate
- SLOFEC technique – Intrusive inspection of Tanks Bottom plate
- Other Non Destructive Techniques (Radiography, Dye checks, MPT, Metallography, SEM, EDS etc)
Corrosion Coupons

- 500+ Corrosion Coupons placed at strategic locations to identify corrosion in the system

- Corrosion retrieval frequency based on the finding (ranges from 60 days to 270 days)

- Adjust chemical treatment based on the findings - target to limit the corrosion rates to < 3 mpy

- Effective monitoring resulted in optimization of chemicals and improvement in corrosion rates
### Corrosion Coupons (Reporting)

#### Corrosion Coupons Report

**Period:** 25-Oct-17 to 30-Nov-17

<table>
<thead>
<tr>
<th>Corrosion Rate</th>
<th>No. of Coupons</th>
<th>Service</th>
<th>Total No.</th>
<th>&gt;10 mpy</th>
<th>5-10 mpy</th>
<th>&lt;5 mpy</th>
<th>&lt;3 mpy</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;10 mpy</td>
<td>7</td>
<td>Power Fluid</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>4</td>
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<tr>
<td>5-10 mpy</td>
<td>12</td>
<td>Production Fluid</td>
<td>78</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>19</td>
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<tr>
<td>3-5 mpy</td>
<td>7</td>
<td>Injection Water</td>
<td>29</td>
<td>4</td>
<td>2</td>
<td>5</td>
<td>18</td>
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<tr>
<td>&lt;3 mpy</td>
<td>80</td>
<td>Process Gas</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Others</td>
<td>5</td>
<td>Others</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SL</th>
<th>Tag No.</th>
<th>Installed on</th>
<th>Retrieved on</th>
<th>Duration (Days)</th>
<th>Corrosion Rate (mpy)</th>
<th>Well No. / Location</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AWP0302</td>
<td>16-Aug-17</td>
<td>5-Nov-17</td>
<td>81</td>
<td>9.67/9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>AWP0303</td>
<td>17-Aug-17</td>
<td>5-Nov-17</td>
<td>80</td>
<td>5.93/1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>AWP0304</td>
<td>15-Aug-17</td>
<td>5-Nov-17</td>
<td>82</td>
<td>6.19/0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>AWP0305</td>
<td>6-Aug-17</td>
<td>29-Oct-17</td>
<td>76</td>
<td>13.3/97</td>
<td>Well 46</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>AWP0307</td>
<td>14-Aug-17</td>
<td>29-Oct-17</td>
<td>76</td>
<td>1.82/07</td>
<td>Well 27</td>
<td></td>
</tr>
</tbody>
</table>

**Location Details**

- **Well No.:** MPT
- **Operating fluid:** PW
- **Pump type:** Produced Water Pump
- **Wellpad No.:** MPT
- **Location:** Produced Water Pump
- **B-scan Result:**

#### Corrosion Coupon Retrieval and Inspection Details

<table>
<thead>
<tr>
<th>SL</th>
<th>Dates / Duration (days)</th>
<th>Coupons Corrosion Rates (mpy)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Installed</td>
<td>Retrieved</td>
</tr>
<tr>
<td>5</td>
<td>19-Nov-15</td>
<td>17-Mar-16</td>
</tr>
<tr>
<td>6</td>
<td>17-Mar-16</td>
<td>18-May-16</td>
</tr>
<tr>
<td>7</td>
<td>16-May-16</td>
<td>01-Nov-16</td>
</tr>
<tr>
<td>8</td>
<td>1-Nov-16</td>
<td>22-Mar-17</td>
</tr>
<tr>
<td>9</td>
<td>22-Mar-17</td>
<td>21-Sep-17</td>
</tr>
</tbody>
</table>

#### KPA Location

<table>
<thead>
<tr>
<th>Corrosion Coupon Analysis Data</th>
<th>KPI</th>
<th>Achieved</th>
<th>Status</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Corrosion rates (GCR)</td>
<td></td>
<td>72%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrosion coupons analysis (total M3A)</td>
<td></td>
<td></td>
<td>74 o/o 103 locations</td>
<td></td>
</tr>
<tr>
<td>Cumulative status Corrosion Coupon - MPT</td>
<td>&lt;3 mpy</td>
<td>75%</td>
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<td></td>
</tr>
<tr>
<td>Cumulative status Corrosion Coupon - MWP</td>
<td>&lt;3 mpy</td>
<td>80%</td>
<td></td>
<td></td>
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<tr>
<td>Cumulative status Corrosion Coupon - BWP</td>
<td>&lt;3 mpy</td>
<td>89%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cumulative status Corrosion Coupon - AWP</td>
<td>&lt;3 mpy</td>
<td>98%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
B-Scan Inspection

- B-scan UT inspection being carried out in view of UDC / MIC damage mechanism.
- Findings are color coded on the isometrics, color coded on the cross sections views of the piping - (results below indicates a narrow band at the bottom affected)
- Results are captured in the database with traffic lights for effective tracking / monitoring and rectification.
Traffic lights indicate the healthiness status of the pipelines.

Goal is to turn yellow, ambers, and red into green by:

- Inspections (IP - Piggable)
- ICDA - ECDA assessments (Non-piggable)
- Repairs / Replacements based on the findings
Pipeline – IP Reports

- Once in every 5 years
- All anomalies > 30% are recorded in an anomalies register
- Color coded based on the extent of damage / ERF
- Repairs are planned and executed

<table>
<thead>
<tr>
<th>Line Description</th>
<th>U/S GW Distance, m</th>
<th>Joint Number</th>
<th>Feature</th>
<th>Feature Type</th>
<th>Anomaly Dimension Class</th>
<th>Orientation O’Clock</th>
<th>WT, mm</th>
<th>Axial Length, mm</th>
<th>Width, mm</th>
<th>Depth, %</th>
<th>Surface Location</th>
<th>ERF (AGNE</th>
<th>Pipeline Pressure (Bar)</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 inch to WP11 to MPT, Crude Oil Line</td>
<td>82,707</td>
<td>220,006</td>
<td>6,512</td>
<td>13.072</td>
<td>Metal Loss</td>
<td>Corrosion</td>
<td>Circular</td>
<td>0.244</td>
<td>14.3</td>
<td>42</td>
<td>88</td>
<td>54</td>
<td>Internal</td>
</tr>
<tr>
<td>18 inch to WP11 to WPLB Water Injection Line</td>
<td>38,428</td>
<td>95,000</td>
<td>4,342</td>
<td>5,266</td>
<td>Metal Loss</td>
<td>Corrosion</td>
<td>General</td>
<td>0.222</td>
<td>14.3</td>
<td>78</td>
<td>191</td>
<td>51</td>
<td>External</td>
</tr>
<tr>
<td>10 inch WPT to MPT, Crude Oil Line</td>
<td>1413,376</td>
<td>1405,000</td>
<td>2,092</td>
<td>3,942</td>
<td>Metal Loss</td>
<td>Corrosion</td>
<td>General</td>
<td>0.404</td>
<td>11,100</td>
<td>440</td>
<td>390</td>
<td>35</td>
<td>External</td>
</tr>
<tr>
<td>24 inch BW15 to MPT, Crude Oil Line</td>
<td>2146,765</td>
<td>2030</td>
<td>6,059</td>
<td>11,783</td>
<td>Metal Loss</td>
<td>Corrosion</td>
<td>Circular</td>
<td>0.256</td>
<td>9.3</td>
<td>24</td>
<td>71</td>
<td>56</td>
<td>Internal</td>
</tr>
<tr>
<td>24 inch BW15 to MPT, Crude Oil Line</td>
<td>2158,546</td>
<td>2040</td>
<td>6,036</td>
<td>11,831</td>
<td>Metal Loss</td>
<td>Corrosion</td>
<td>General</td>
<td>0.249</td>
<td>9.3</td>
<td>22</td>
<td>169</td>
<td>57</td>
<td>Internal</td>
</tr>
<tr>
<td>24 inch BW15 to MPT, Crude Oil Line</td>
<td>2439,592</td>
<td>2280</td>
<td>0.03</td>
<td>12,075</td>
<td>Metal Loss</td>
<td>Corrosion</td>
<td>Circular</td>
<td>0.249</td>
<td>9.3</td>
<td>18</td>
<td>110</td>
<td>56</td>
<td>Internal</td>
</tr>
<tr>
<td>24 inch BW15 to MPT, Crude Oil Line</td>
<td>2539,289</td>
<td>2370</td>
<td>0.066</td>
<td>12,349</td>
<td>Metal Loss</td>
<td>Corrosion</td>
<td>Circular</td>
<td>0.254</td>
<td>9.3</td>
<td>22</td>
<td>65</td>
<td>53</td>
<td>Internal</td>
</tr>
<tr>
<td>24 inch BW15 to MPT, Crude Oil Line</td>
<td>3928,952</td>
<td>3570</td>
<td>6,019</td>
<td>12,56</td>
<td>Metal Loss</td>
<td>Corrosion</td>
<td>Circular</td>
<td>0.264</td>
<td>9.3</td>
<td>13</td>
<td>117</td>
<td>58</td>
<td>Internal</td>
</tr>
</tbody>
</table>
Managing Tank Integrity

- Frequency of the tank inspections ranges between 5-10 years, based on the service and historical findings
- Tanks bottom plates are inspected using SLOFEC technique
- Findings are mapped using color coding based on the extent of damage
- All inspected tanks have been observed in acceptable conditions with very minimal signs of corrosion
Chemical Treatment

- Comprehensive Chemical treatment program for maintaining the quality of fluid and avoiding degradation due to internal corrosion.

- Changes are made in Biocides and Corrosion inhibitor based on the SRB, Fe content and Fe pick-up analysis and corrosion coupons findings.

- SRB findings are color mapped and is further calculated as per KPI targets.

KPI data shown is not current data.
Monitoring H₂S threat

- Asset not originally designed for H₂S – Predominantly Non-NACE Carbon Steel material
- Various studies put the assets in Zone-1 (Low to Moderate risk)

**Monitoring activities:**

- Hardness monitoring of the weld joints, HAZ and Parent metal
- PAUT of the weld joint

**Mitigation Activities:**

H₂S scavenger dosing

<table>
<thead>
<tr>
<th>S.No</th>
<th>Well No</th>
<th>H₂S PP (psi) Sept 2017</th>
<th>Hardness (BHN)</th>
<th>Scav Dosing status</th>
<th>Last month</th>
<th>This month</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M009</td>
<td>SD</td>
<td>201</td>
<td>Off</td>
<td>P2</td>
<td>P2</td>
</tr>
<tr>
<td>2</td>
<td>M010</td>
<td>0.00</td>
<td>185</td>
<td>On</td>
<td>P2</td>
<td>P2</td>
</tr>
<tr>
<td>3</td>
<td>M011</td>
<td>0.04</td>
<td>190</td>
<td>On</td>
<td>P1</td>
<td>P1</td>
</tr>
<tr>
<td>4</td>
<td>M013</td>
<td>0.02</td>
<td>183</td>
<td>On</td>
<td>P2</td>
<td>P2</td>
</tr>
<tr>
<td>5</td>
<td>M017</td>
<td>0.01</td>
<td>259</td>
<td>On</td>
<td>P1</td>
<td>P1</td>
</tr>
<tr>
<td>6</td>
<td>M019</td>
<td>0.10</td>
<td>203</td>
<td>On</td>
<td>P2</td>
<td>P2</td>
</tr>
<tr>
<td>7</td>
<td>M020</td>
<td>0.05</td>
<td>219</td>
<td>Off</td>
<td>P2</td>
<td>P2</td>
</tr>
<tr>
<td>8</td>
<td>M021</td>
<td>0.03</td>
<td>209</td>
<td>On</td>
<td>P2</td>
<td>P2</td>
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<td>9</td>
<td>M022</td>
<td>0.08</td>
<td>192</td>
<td>Off</td>
<td>P2</td>
<td>P2</td>
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<tr>
<td>10</td>
<td>M023</td>
<td>0.12</td>
<td>206</td>
<td>On</td>
<td>P2</td>
<td>P2</td>
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<tr>
<td>11</td>
<td>M025</td>
<td>0.07</td>
<td>244</td>
<td>Off</td>
<td>ND</td>
<td>P1</td>
</tr>
<tr>
<td>12</td>
<td>M026</td>
<td>0.02</td>
<td>191</td>
<td>On</td>
<td>P2</td>
<td>P2</td>
</tr>
</tbody>
</table>

**H₂S Scavenger Injection Status**

- Dosing in P1 wells: 100% (93% effective), 13 c/o 14 wells
- Dosing in P2 wells: 100% (83% effective), 53 c/o 64 wells

KPI data shown is not current data
Anomalies Management

- All anomalies are evaluated and documented in SAP and anomalies register.
- Each anomaly is risk assessed and CoF and PoF is assigned.
- Job categorization is done.
- Prioritization is based on the overall risk.

Record of Anomalies

<table>
<thead>
<tr>
<th>System and Distribution of Anomalies</th>
<th>Number</th>
<th>Failure Probability</th>
<th>Job Category of Corrective Action</th>
<th>Type</th>
<th>Number</th>
<th>Responsible Person</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical Injection System (CC, Qualit. Monitoring Injection)</td>
<td>22</td>
<td>Very High</td>
<td>Cat. 1</td>
<td>Large</td>
<td>141</td>
<td>FM/RL</td>
</tr>
<tr>
<td>Fire Water System</td>
<td>4</td>
<td>High</td>
<td>Cat. 2</td>
<td>Related to Piping</td>
<td>31</td>
<td>BCW</td>
</tr>
<tr>
<td>Tanks</td>
<td>14</td>
<td>Medium</td>
<td>Cat. 3a</td>
<td>Related to CP System</td>
<td>18</td>
<td>BM-MPT</td>
</tr>
<tr>
<td>Process Piping</td>
<td>24</td>
<td>Low</td>
<td>Cat. 3b</td>
<td>Related to Piping</td>
<td>6</td>
<td>FA-MPT</td>
</tr>
<tr>
<td>Pipelines</td>
<td>39</td>
<td>Very Low</td>
<td>Cat. 4</td>
<td>Related to Piping / Coating</td>
<td>23</td>
<td>LAI</td>
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<tr>
<td>Process Equipment</td>
<td>88</td>
<td>Total</td>
<td>Cat. 5</td>
<td>Related to Insulation</td>
<td>25</td>
<td>HSE</td>
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<tr>
<td>MI (Mechanical Insulation Joints)</td>
<td>36</td>
<td>Total</td>
<td>Cat. 6</td>
<td>Related to Fabrication / support</td>
<td>5</td>
<td>PMI</td>
</tr>
<tr>
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<td></td>
<td></td>
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</tr>
</tbody>
</table>

- W & T Pipelines
  - Declaration required for bellhole inspection of Non-sliggable W & T sour lines.
  - Observation Date: 07/Dec/16
  - Notification No: 0000156
  - Failure Probability: High

- 250 W&F-1001-18
  - High thickness reduction observed in injection water W&F Header: "Dip Leg 1 Nominal: 21.44mm & Observed: 14.08mm"
  - Observation Date: 07-May-15
  - Notification No: 0001576
  - Failure Probability: Very High

- 375 W&F-1001-18
  - Observation Date: 07-May-15
  - Notification No: 0001577
  - Failure Probability: Very High
<table>
<thead>
<tr>
<th>SL</th>
<th>Description</th>
<th>Mitigation</th>
<th>Description - Indicator</th>
<th>Current Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sourcing of the MBA field</td>
<td>H2S scavenging Monitoring for H2S related degradation</td>
<td>Green: 100% P1 and P2 wells Amber: 100% P1 &amp; &lt;90% P2 Red: &lt;90% P1 &amp; P2</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>MIJ Failures</td>
<td>Replacement of MIJ with internally coated spool and proving insulation joints</td>
<td>Green: Rectification &gt; 90% P1 Amber: Rectification &gt; 80% P1 Red: Rectification &lt; 80% P1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Dead Legs and Stagnant Lines</td>
<td>Replacement / elimination of dead legs / external wrapping</td>
<td>Green: Rectification &gt;90% Amber: Rectification between 80-90% Red: Rectification &lt;80%</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Non Functional ICCP System</td>
<td>Revamp of ICCP system</td>
<td>Green: Protection of all pipelines Amber: &gt;90%, &lt;100% Red: &lt;90%</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>PW / IW – Internal Corrosion</td>
<td>Replacement / external wrapping</td>
<td>Green: Rectification &gt; 90% P1 Amber: Rectification &gt; 80% P1 Red: Rectification &lt; 80% P1</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Internal Inspection – Tanks / Vessels</td>
<td>Isolate and offer Tanks / Pressure vessels for inspection</td>
<td>Green: &gt;90% P1 and P2 wells Amber: &gt;90% P1 &amp; &lt;90% P2 Red: &lt;90% P1 &amp; P2</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Non-Piggable pipelines</td>
<td>Flow control Flushing / Draining / Chemical injection ECDA / ICDA Study</td>
<td>Green: &gt;90% Compliance Amber: &gt;80%, &lt;90% Red: &lt;80%</td>
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</tr>
<tr>
<td>8</td>
<td>Chemical Injection Quill Failures</td>
<td>Change material of construction Use chemical compatible with existing metallurgy</td>
<td>Green: Rectification &gt;90% Amber: Rectification between 80-90% Red: Rectification &lt;80%</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Small Bore Piping Failures</td>
<td>Eliminate vibrations Provide braces / supports at SBC</td>
<td>Green: &gt;90% P1 Amber: &gt;80%, &lt;90% P1 Red: &lt;80% P1</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Preservation of Redundant Equipment</td>
<td>Proper preservation and regular monitoring</td>
<td>Green: &gt;90% Compliance Amber: &gt;80%, &lt;90% Red: &lt;80%</td>
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</tr>
<tr>
<td>SL</td>
<td>Description</td>
<td>Risk / Mitigation</td>
<td>Current Status</td>
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</tr>
<tr>
<td>1</td>
<td>Liquidation of Inspection Tasks as per RBI</td>
<td>Thickness monitoring</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>B-scan survey</td>
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<tr>
<td>2</td>
<td>ICCP monitoring</td>
<td>Monthly survey of Tanks and Pipelines covered by ICCP protection</td>
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<td></td>
</tr>
<tr>
<td>3</td>
<td>Assessment of Failures</td>
<td>Detailed analysis</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Issue of recommendations</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Liquidation of recommendations</td>
<td></td>
<td></td>
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<tr>
<td>4</td>
<td>Rectification of Insulation Damages</td>
<td>Leading to CUI</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Damaged insulation to be replaced</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Corrosion Coupons – Retrieval and Assessment</td>
<td>Identifying cause of corrosion</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Suggesting remedial actions</td>
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<tr>
<td></td>
<td></td>
<td>Follow up for completion of actions</td>
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</tr>
<tr>
<td>6</td>
<td>P-1 Wells with pH$_2$S &gt; 0.05 psi</td>
<td>H$_2$S Scavenging to eliminate SSC in equipment and piping / Hardness monitoring</td>
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</tr>
<tr>
<td>7</td>
<td>P-1/2 Wells with pH$_2$S &lt; 0.05 psi</td>
<td>H$_2$S Scavenging to eliminate SSC in equipment and piping / Hardness monitoring</td>
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</tr>
<tr>
<td>8</td>
<td>Liquidation of all pending recommendations (Anomalies rectifications)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Intelligent pigging of Pipelines</td>
<td>Ensure integrity of Pipelines</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Smart View- Dashboard

Numbers shown is not the actual site data
Smart View - Dashboard

- Maintenance Schedule Attainment - Last Week: 32%
- Capacity Planning Schedule Loading - Last Week: 100%
- % Emergency/Urgent WOs - YTD Emergency: 8%
- Proactive Vs Reactive Count Current Year
- Maintenance Cost Materials ($) - YTD: 7,731,000
  Last Year Total Cost: 11,722,624
- Expected Stock out Material Count As On Date: 1471
- WOs Waiting for Shutdown Count As On Date
  Critical WOs Count: 0
- Notification Rate (per day) Count - YTD: 74
  Last Year Count: 92
- Notification Quality Rate - YTD: 69%
- Incorrect Use of WOs Count - YTD: 903
  Material Cost: $3,049,452

Numbers shown is not the actual site data