Institute of Corrosion
Aberdeen Branch

Corrosion Awareness Day
INTRODUCTION
Integrity Management

- What is it?
  - Lack of a clear definition and peoples’ understanding of it varies markedly and depends on the services they provide
  - Maintenance is clearly part of the integrity management process but at CAN this isn’t an area we get involved in so doesn’t really get considered in OUR definition of IM

- My non technical definition is
  - All the activities that are conducted with the aim of reducing leaks
  - More corrosion management than integrity management but since this is an ICorr day I feel I can get away with that!!

- One of the best documents is published by the Energy Institute “Guidance for Corrosion Management in Oil and Gas Production and Processing” from which many of the following figures have been taken
- HSE (regulator) have stated that they see this document as best practice and if you are not doing things in accordance with it your going to be made to justify it
It is widely recognised within the oil and gas industry that effective management of corrosion will contribute towards the maintenance of asset integrity and achieve the following benefits:

- Compliance with statutory and corporate safety, health and environmental requirements;
- Reduction in safety and environmental hazard from leaks and structural failures;
- Increased plant availability, improving income;
- Reduction in unplanned maintenance, reducing costs;
- Reduction in deferment costs;
- Optimisation of mitigation, monitoring and inspection costs, and
- Improvement in the working environment with associated benefits.
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Cyclic Process

Opportunities to improve at each step

Requires everyone to contribute on how things can be done better

Figure 1: The basic corrosion management process model
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GOAL: Effective policies and strategies set a clear direction for the organisation to follow in the elimination of safety related risk and improvement of operational reliability

- At a corporate level this is most likely to be presented as part of the HSE Policy
- Contains lots of good intention but perhaps misses the point of operating companies which is to produce oil and gas
- Certainly not suggesting companies do anything dangerous but the most frequent question we get asked is “is it safe for on-going use?”
- The “nitty gritty” will exist in separate documents like Corrosion Management Strategies and Corrosion Control Schemes
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GOAL: Effective management structure and corrosion management practices are required to deliver the policy and strategy

- It may seem obvious but people need to know where they sit in the structure and what their role is and what they are responsible for (NOTE RESPONSIBLE DOESN’T MEAN YOU HAVE TO DO IT YOURSELF!)
- Typically documents are Job Descriptions (although these are often difficult to keep up to date especially for people who progress from within) which detail individuals roles and high level integrity management documentation which details the roles involved in the delivery
- Competence is key
- This starts from the bottom up – if the TA inputting data into the Inspection Management Database doesn’t do a good job then no-one else can either!
- Don’t have the attitude – “that isn’t my job”. If you find a problem tell someone
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Corrosion risk assessment and planning

known as RBA or RBI

**GOAL:** To identify the corrosion threats and rank the risks they present and plan appropriately for their effective avoidance or mitigation

- First step is to identify all those items that require assessment – safety critical items, safety related items - Pressure vessels and pipework predominantly
- Corrosion circuits for pipework
- Need to identify the following
  - Corrosion Threats
  - Likelihood of failure
  - Consequence of failure (safety, business, environmental)
- Derive inspection frequency & plan accordingly
- Plan mitigation and monitoring activities
GOAL: To ensure effective implementation of the plans and analysis of the implementation and monitoring data leading to timely corrective action where necessary

- Implementation covers both the mitigation and the monitoring and inspection activities
- This is the core element of corrosion management
- Information needs to be reviewed and assessed by competent people
- Reports need to be generated and circulated to relevant people
- Results need to be fed back into the corrosion management system to ensure continuous improvement
GOAL: Performance should be measured against agreed standards to reveal when and where improvement is needed

- Reactive and Proactive
- Key Performance Indicators (KPIs)
- Include both corrosion and management factors, e.g.
  - Corrosion rate is < x mm/yr
  - % of inspections completed as per plan
  - Anomalies reviewed within specified timeframe
GOAL: The organisation can learn from all relevant experience, apply the lessons and achieve continuous improvement

- Organisations should undertake systematic reviews of performance based on data from the monitoring of system performance and from independent audits.
- I’d also argue that there can be great benefits from internal audits as well.
- Reviews should involve all key players and contractors and be endorsed by a level of management with the authority to implement any changes deemed necessary.
GOAL: To provide an independent and objective comparison between the corrosion management system requirements and the system as implemented to enable corrective action and improvement.

Scope of the audit should ensure
- All essential elements are contained in the corrosion management system
- Implemented activities are suitable barriers to the threats / suitable for measuring performance
- Activities are implemented in accordance with procedures

EI Document contains an audit checklist that can either be used as is or modified accordingly.
<table>
<thead>
<tr>
<th>Section</th>
<th>Question</th>
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</thead>
<tbody>
<tr>
<td>1.0</td>
<td><strong>CORROSION MANAGEMENT SYSTEM</strong></td>
</tr>
<tr>
<td>1.1</td>
<td>Is there a documented corrosion management system based on a defined management model?</td>
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<tr>
<td>1.2</td>
<td>Is the scope of the system’s application defined?</td>
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<tr>
<td>2.1</td>
<td><strong>CORROSION POLICY</strong></td>
</tr>
<tr>
<td>2.1.1</td>
<td>Is there a company policy for corrosion management (or including corrosion management) that deals with risk associated with:</td>
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<td></td>
<td>– health and safety?</td>
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<td>– environmental protection?</td>
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<tr>
<td>2.1.2</td>
<td>Does it clearly state objectives for corrosion control?</td>
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<td>2.1.3</td>
<td>Does the policy address risks to business profitability and business interruption but in a way that does not conflict with the management of risks to health, safety and the environment?</td>
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<tr>
<td>2.1.4</td>
<td>Does it clearly state expectations and objectives by which compliance with the policy may be measured?</td>
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<tr>
<td>2.1.5</td>
<td>Do health, safety and environmental objectives take precedence over commercial objectives?</td>
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<td>2.1.6</td>
<td>Does the policy demonstrate management commitment to corrosion control?</td>
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<td></td>
<td>Is the policy issued on the authority of the most senior manager of the facility?</td>
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<tr>
<td>2.1.7</td>
<td>Is there evidence of an awareness of this policy at all levels within the organisation?</td>
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<td></td>
<td>– senior management?</td>
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<td></td>
<td>– engineers and technicians?</td>
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<td></td>
<td>– offshore staff?</td>
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<tr>
<td>2.1.8</td>
<td>Are the personnel committed to the policy?</td>
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<tr>
<td>2.2</td>
<td><strong>CORROSION STRATEGY</strong></td>
</tr>
<tr>
<td>2.2.1</td>
<td>Is there a documented corrosion strategy for the asset?</td>
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<tr>
<td></td>
<td>Does it provide the method(s) by which the policy is implemented?</td>
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<tr>
<td>2.2.2</td>
<td>Does it place responsibility for corrosion management?</td>
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<td></td>
<td>Does it define the links between all parties involved, including:</td>
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<td>– operations?</td>
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Summary

- Integrity Management is a feedback system.
Useful Information

- Energy Institute “Guidance for corrosion management in oil and gas production and processing” and associated documents (corrosion threats handbook, external corrosion awareness handbook)
- HSE “Key Programme 3 – Asset Integrity” July 2009
- Asset Integrity Toolkit – UKOOA
- “Plant Ageing” RR509 TWI et al for the HSE
- API 580 & 581
It doesn’t matter how robust the systems / processes identified earlier are if the information isn’t accurate.

Integrity Management and Inspection Contractors should be controlled copy holders of P&IDs, corrosion control schemes etc etc

P&IDs should be kept up to date to reflect changes offshore – obvious but you’d be amazed how out of date these can be!!

Isometrics should accurately reflect the pipework and be consistent with the inspection management database

Vessel design documentation needed to assess the corrosion risks and for any FFS assessments – changes of ownership often mean this isn’t the case
WHAT HAPPENS WHEN IT GOES WRONG? (a few examples!)

- New MOL Pump bypass cooler installed (single point of failure for entire field ~ 50K BPD). P&IDs never updated, equipment not in the maintenance management system & no CRA in place. Small leak discovered but luckily sealed itself when bolts torqued up. Everything now in place but turns out tubes were specified on availability rather than corrosion resistance which will cause issues in the future.

- New gas compression train installed (high pressure gas and multiple vessels) 2008 time. P&IDs still not part of controlled copy set – captured by CAN as only a single asset project.

- Separator bridle pipework failed. Why? Internal corrosion issue was known about and had been reported as an anomaly. A spool replacement was carried out but did not cover this anomaly which was then subsequently closed in error. System error as anomalies not visibly tagged offshore as well as isometric not being accurate.
WHAT HAPPENS WHEN IT GOES WRONG? (a few examples!) cont

- Some corroded items can be seen which all demonstrate a “failure” in the integrity management system. They include
  - Preferential weld corrosion – failure of the inhibitor to protect the weld + system failure as this was a longstanding known problem and yet nothing was done about it. Inhibitor replaced due to “green” issues but CAN insisted on weld inhibition testing
  - Produced water failure – inspection failure as not picked up before leak occurred and RBA failure as frequency too long
  - CISCC – Lube oil rundown tank made out of 304L but not painted. Tank insulated and operating ~ 50oC and located on the exposed roof of the platform. System failure – tank not covered by inspection plans / RBAs & Materials issue. Tank repaired and TSA coated to prevent re-occurrence.
  - Cunifer failures – System is too large for effective inspection strategy but not safety critical so can be wrapped if a small leak develops. Large number of failures attributed to erosion implying materials issue as operating outwith the envelope but also an operational issue due to lack of hypochlorite which may be a factor in the failures.
SUMMARY

- Integrity Management is a TEAM EFFORT
- You may not think your input is important but it is
- Attitude is just as important as aptitude
- If you come across anything in your job that you don’t think is right – bring it to the attention of someone who is in a position to provide an answer or can do something about it
- Doing a poor job just to get it done is never acceptable.
ANY QUESTIONS?