Combining qualitative and quantitative RBI

ABB helped to successfully complete a significant number of Risk Based Inspection (RBI) reviews using Meridium® RBI software.

The client, a leading chemical manufacturer operates a MTBE and Methanol plant in the Middle East.

Meridium’s® RBI software is used to carry out RBI reviews, and had a program of over 700 items to review over a five year period. They recognised that if the inputs were not considered carefully then the software could give unrealistic recommendations, often leading to inappropriate schemes of examination.

ABB were engaged to facilitate and lead the implementation of an initial batch (120 items) of their RBI programme for the site using the Meridium® software. The aim of this was to provide experience and training to their engineering staff so that they could continue on with the RBI program independently.

**Solution**
ABB project managed and facilitated the RBI reviews. The project was completed in two stages, an initial planning stage phase 1, followed by the implementation stage phase 2.

**Planning stage**
The planning stage ensured that there was sufficient information and resource available to carry out the RBI review project and produced a detailed action plan to achieve project completion within the required tight timescales. Prior to ABB’s involvement, the Meridium® software system was utilised to carry out a criticality study for all items of equipment. These were completed by a multi-discipline team to ensure accuracy and consistency of information.

The consequences in terms of safety, environmental, production impact and economic repair were all considered against the likelihood of failure and a criticality number was calculated by the Meridium® program. Items were then assigned to one of three categories A, B, or C, based on their criticality rating, with category A being the most critical. RBI’s using Meridium® had been completed previously for all category ‘A’ items identified from the criticality study.
The ABB scope for this project was 80% of all category B items, see the following table for numbers:

<table>
<thead>
<tr>
<th>2009 RBI</th>
<th>2010 RBI plan</th>
<th>Future RBI</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEOH Plant</td>
<td>MTBE Plant</td>
<td></td>
</tr>
<tr>
<td>100% of cat A's</td>
<td>80% of cat B's</td>
<td>40-50% of cat C+</td>
</tr>
<tr>
<td>56-off</td>
<td>70 from 86 B's</td>
<td>from 266 C's</td>
</tr>
<tr>
<td>52-off</td>
<td>50 from 66 B's</td>
<td>from 219 C's</td>
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Implementation
The Implementation phase involved three parts:

- Meridium® RBI software training to ABB and the client’s project personnel
- Corrosion Loop reviews to identify deterioration mechanisms for the equipment RBI’s
- RBI reviews of the 120 items of equipment using the Meridium® software system

Training:
Meridium® training was carried out to allow project team members to confidently use the software system for completion of the RBI reviews and any future updates or additional RBI reviews. Training in the software and RBI methodology was also given, allowing the engineers to be part of the project team and to learn and experience best practice.

Corrosion loop review:
This involved reviewing and validating 30 existing corrosion loops developed by the client and identifying their generic deterioration mechanisms. Deterioration mechanisms for the 120 RBI items within these corrosion loops were then identified to facilitate the Meridium® RBI process. Corrosion rates were also identified by ABB for implementation into the Meridium® RBI reviews.

RBI reviews:
From the 120 items planned for RBI review, 132 items of equipment were actually completed thereby exceeding plan by 10%. These additional items were identified for potential completion to make best use of the project resources as program allowed. The items reviewed included:

- 80 heat exchangers
- 37 pressure vessels
- 6 columns
- 3 storage tanks

Recommendations from the study included:

- Carry out quantitative NDT techniques for heat exchanger tube inspections to monitor for tube corrosion / thinning
- Check the inspection planning schedule for the RBI reviewed items to pick up those that have reduced inspection interval and hence an earlier inspection date than original
- Review and decide inspection policy for items with the option for none-intrusive inspection
- Purchase of an ultrasound detection device ‘Ultraprobe’ to detect vacuum leaks and other potential operational / maintenance uses

The project was completed on time against a tight schedule and delivered RBI reviews that were accurate and appropriate. The added benefit was the training and experience received allowing the client to continue with future RBI’s to the required standard.

Benefits of the RBI study
- Reduced total inspection costs - increased inspection intervals and non-invasive techniques
- Provides a foundation for ongoing maintenance strategy for the equipment
- Prioritised key items
- Identified and eliminated unnecessary / excessive inspections
- Improved plant reliability

Benefits of ABB training and facilitation
- Developed in house capability for ongoing RBI program and new projects
- Accessed ABB’s knowledge and experience in inspections and materials
- ABB coaching and mentoring during the program
- Ensured realistic outputs from RBI by challenging the software inputs
- Peer review by ABB gave the client feedback on best practice integrity / inspection management
- Exceeded planned completion of RBI’d items by 10% (132 vs 120 plan) and within required program