

Development of a Risk Based Inspection Implementation Manual



Tony Scribner – Materials Technology Institute

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Agenda

- The process MTI used to develop and roll out the manual
- An overview of its contents
- Summary

Introduction

- The chemical industry is facing increasingly tougher safety, environmental and mechanical integrity regulations
AND
- The challenges associated with the need to improve competitiveness.

Introduction

- It is crucial to manage operational risks through the use of
 - effective technology and
 - best practices for inspection and maintenance planning.

Introduction

- MTI is a non-profit Institute that serves its member companies from the chemical, refining and allied industries.
- It is a unique organization whose members include both producing and servicing companies.
- Both brought unique perspectives to bear on a recent MTI project to develop an RBI manual

Purpose of Manual

- Present a “tutorial” or “how to” on Risk Based Inspection for the Process Industry.
- Enable operating companies to understand Risk Based Inspection, both its benefits and limitations.
- This book goes beyond promoting a methodology or Assessment Tool.

Purpose of Manual (con't.)

- Confusion about RBI
- RBI vendors are providing mixed messages
- RBI Payback is high
- Accelerate the learning about RBI
- Provide a continuum during people turnover
- Increase potential margins from:
 - Regulatory Requirements
 - Aging Facilities
 - Enhance Mechanical Integrity through RBI
 - Increase Safety through Mechanical Integrity

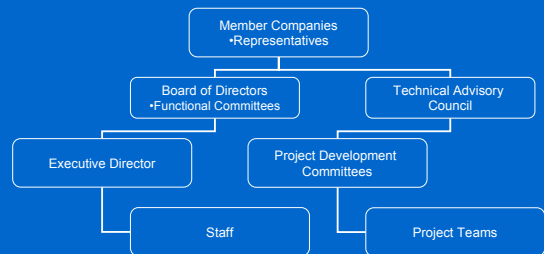
Development Process

- The concept was brought to the MTI Project Development Committee by a member company representative.
- The PDC formed a Project Team to
 - review the idea
 - sharpen the focus
 - write and roll out the book
- Deviated from a normal MTI project
 - Work was performed by volunteers from within the member companies of MTI rather than by a contractor.

Development Process (con't)

- The Technical Advisory Council of MTI was responsible for approval of the technical merit of the project.

MTI Organization



Development Details

- The book was written by four authors.
 - Ricardo Valbuena was primary
- At least eight other people reviewed and helped edit the document.
- An outside editor supported final editing
- Published by MTI in 2005
- The project took slightly more than two years

The Product



A Book of Lessons Learned

- The book was written by a group of engineers that have experience in
 - Development of RBI Programs
 - Development of RBI Software
 - Using RBI in the course of their jobs
 - What does and does not work

Table of Contents

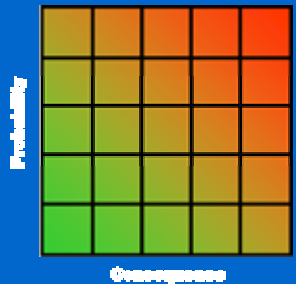
- Table of Contents
- Definitions
- 1. What is Risk Based Inspection?
- 2. Benefits and Limitations of Risk Based Inspection vs. Conventional Inspection
- 3. How to Demonstrate the Value of RBI vs. Conventional Inspection Strategies
- 4. How to Implement Risk Based Inspection
- RBI Considerations in Plant Design
- 6. Training and Competence Requirements for RBI Team Members

Table of Contents (con't.)

- 5. 7. RBI – An Insurer's Perspective
- 8. RBI Developments in Europe
- 9. Impact of RBI on existing PSM/Mechanical Integrity Concepts
- 10. RBI, RCM and Reliability Improvements
- 11. Barriers to the Implementation of RBI Programs
- 12. What an optimal RBI Assessment Software Tool should do for you?
- 13. Applying RBI to Relief Valves

Defining Risk Based Inspection

- Risk Based Inspection (RBI) is a systematic approach to the *management of inspection programs* by prioritizing equipment inspection activities.



Defining Risk Based Inspection

- The approach consists of a detailed inspection, corrosion, material, process, plant operations and consequence analysis
 - to identify and mitigate risk and
 - to make informed decisions on inspection frequencies, level of detail and methods of non destructive evaluations.

Risk

Risk in the context of RBI is the combination of likelihood and consequence of failure.

Likelihood or probability of failure is driven by material damage mechanisms, their rate of progression, the tolerance of the equipment to damage, and the amount and type of inspection activities that have been performed in the past.

Consequence is the outcome of a failure that may be expressed, for example, in terms of safety to personnel, economic loss, or damage to the environment.

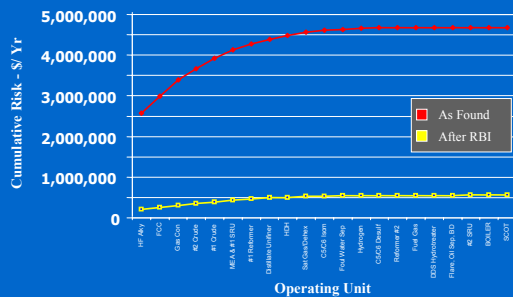
Benefits of Risk Based Inspection

- Identify and manage the largest risk contributors.
- Focus the inspection program so that the proper amount of inspection is being planned for each asset.
- Determine where inspection alone will not adequately manage the risk and identify other appropriate means to reduce risk.
- Achieve the shift of inspection and maintenance resources to provide a higher level of coverage on the high-risk items and an appropriate effort on lower risk equipment.

Benefits of Risk Based Inspection

- Determine the required level of inspection effectiveness to minimize over inspection and under inspection.
- Challenge the types of inspections in the current program.
- The effect of alternative inspections strategies can be studied.
- RBI uses objective, reproducible methodologies to assess risk and establish inspection plans.
- Comparisons can be done within a plant or between plants to determine priorities and relative benefits of changing strategies.
- RBI data and tools can be used in a variety of studies, and sensitivity and "what-if" analyses of interest to plant management.

Cumulative Risk by Operating Unit



Risk Reduction

Selection of inspection:

- Technique
- Coverage
- Frequency

Increased inspection may not be enough to reduce the risks in all cases

- Material changes
- Operational changes
- Instrument upgrades

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Cost Benefit Analysis

- Reduction of inspection costs as a result of equipment being removed from upcoming scheduled turnarounds
- Reduction of maintenance costs as a result of equipment being removed from upcoming scheduled turnarounds
- Increased production time as a result of inspecting less equipment (i.e. shorter turnarounds)
- Use of non intrusive inspections instead of intrusive inspections

How to Implement Risk Based Inspection

1. Selection of the Acceptance Criteria
2. Selection of the Plant for assessment
3. Perform the risk assessment to identify the main risks associated with the facility
4. Develop an Inspection Plan for each item designed to reduce the risks
5. Update the Inspection Plans on a defined basis

Quality Checks

- Determine what is driving the high likelihood items
- Determine what is driving the high consequence items
- Serious Errors – data that predicts an incorrectly low likelihood or consequence
- Run sensitivity analysis to examine expert opinions and data accuracy

RBI Considerations in Plant Design

- Using RBI during the Design Stages of a plant can provide many benefits.
- This process will involve experts from Research and Development, Design, Engineering & Construction disciplines combined with operating, maintenance and inspection personnel.
- Use more conservative criteria to compensate for lack of equipment history and industry experience.
- Use RBI as early into the design process as possible.
- This can result in important design, process and materials of construction changes which have prevented in-service damage and unnecessary inspections.

Training and Competence Requirements

- Training of staff in RBI is fundamental for the correct:
 - Analysis
 - Inspection planning
 - Evergreening
- Competent team staffing is critical
 - Management sponsorship is critical
 - A dynamic site champion to lead the team
 - Keeping management informed (cost & benefit)

“This project is so important we can't let things that are more important interfere with it.”



Training and Competence Requirements (con't)

- Team Staffing
 - Do not forget to include R&D and/or Process Chemists.
- Additional Data for Review
 - Do not forget to look at the feed-stocks, up-stream processes and recycle streams when deciding on possible failure mechanisms
 - Review the Management of Change documentation since the last process review
 - HAZOP and FMEA techniques
 - Use the Technology Creep Reviews

Impact of RBI on existing PSM Mechanical Integrity Concepts

- The Risk Based Inspection program should be considered as an integral part of the site Mechanical Integrity Program
- In the US and many other countries Process Safety Management is an initiative mandated by a regulatory body.
- In other organizations it is a corporate driven initiative to improve the safety of the operating facilities.
- The RBI program must meet all of the appropriate requirements of the PSM program.

Barriers to the Implementation of RBI Programs

- Regulatory
- Insurers
- Organizational / Cultural
- Resources
- Technology / Software
- Data

Summary

- MTI has taken an innovative approach to develop a timely manual on a topic of interest to its member companies and the broader Chemical Process Industry.
- The book, "Implementing and Evergreening RBI in Process Plants", has been published and is available to the general public.
- The next focus will be on how to "evergreen" the book itself.