



## Introduction to Risk Assessment



## What is Risk Based Inspection (RBI)

Process of carrying out risk analysis to determine an optimum inspection plan



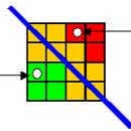
“A Rigorous Approach to Managing Pressure System Risk”





## Definitions

- **Risk** is the consideration of potential hazards, simultaneously accounting for both the likelihood and consequences of an event.
- **Risk Based Inspection** (RBI) is a systematic tool that helps users make informed business decisions regarding inspection and maintenance spending.

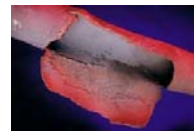
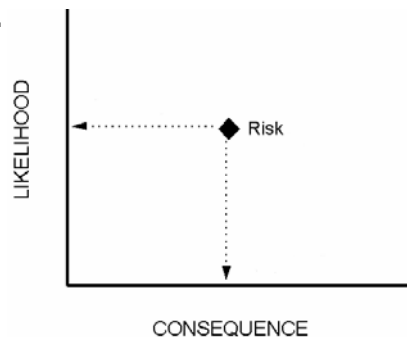


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## Measuring Risk

- **Risk** may be defined as the combination of likelihood and consequence of a failure.
- A means of illustrating risk is to display the likelihood and consequence factors on an X-Y plot.

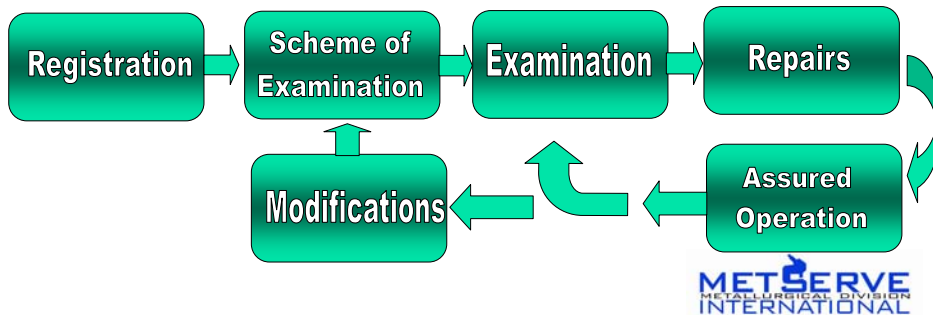


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## Traditional Asset Integrity System

- Prescriptive Schemes of Examination with little operation input
- Consequence of potential failure mechanisms not assessed
- Unacceptable number of unforeseen failures.



## Traditional Way

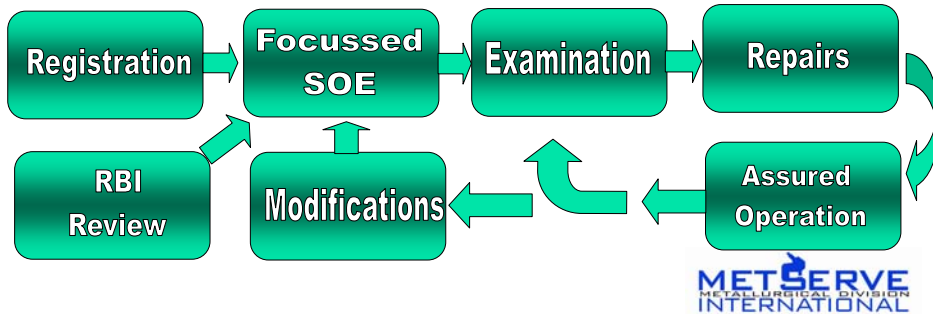


- The inspection results are generally reported to the plant engineers in raw form without an engineering / metallurgical evaluation .

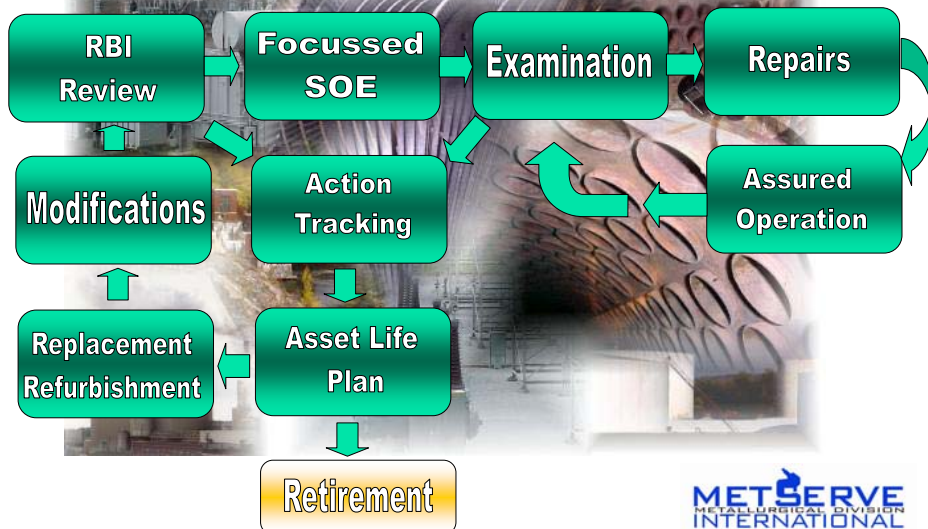


## Risk Based Asset Integrity System

- Focused Schemes of Examination
- Increased use of non-invasive techniques
- Significant cost savings
- Control of long term action & review.

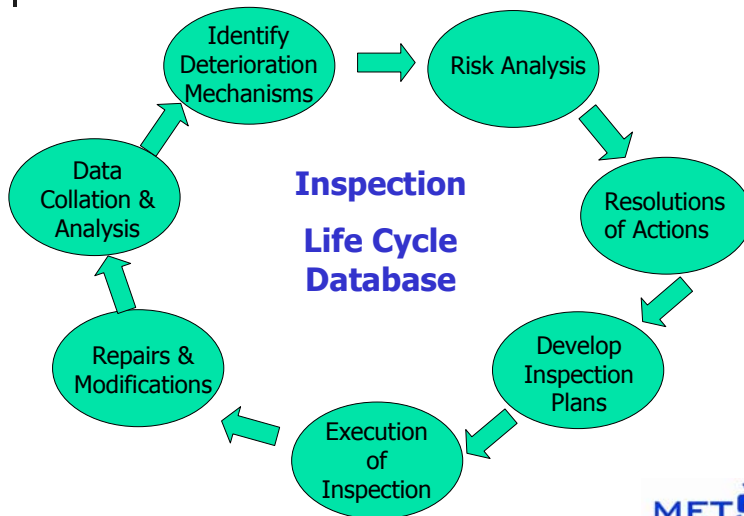


## Intergrated Asset Management System





## Methodology



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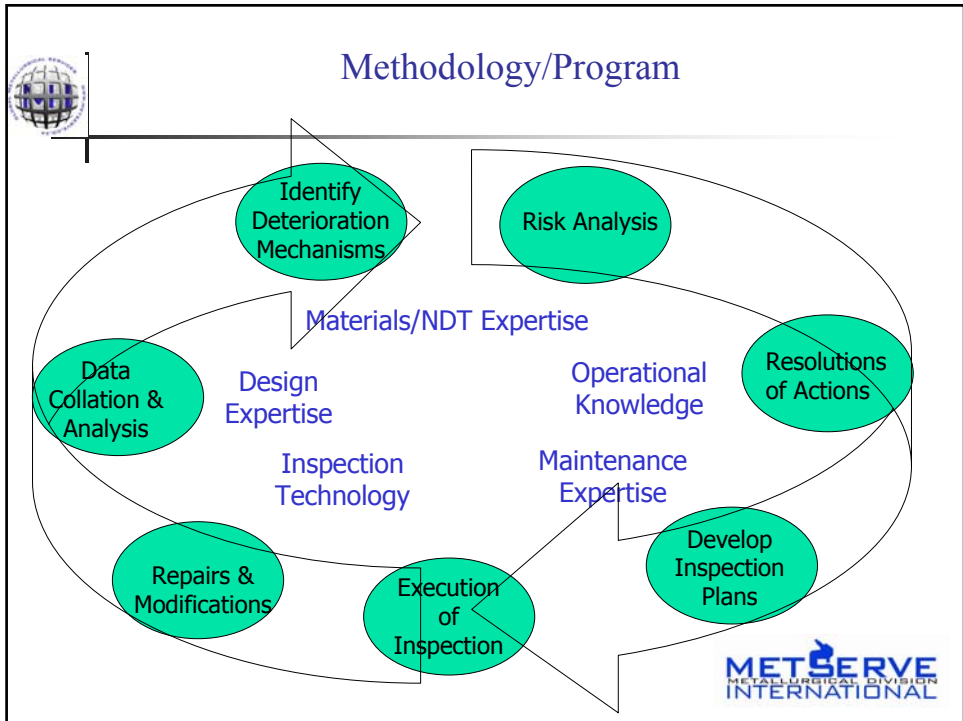


## The RBI Process

- Appoint joint PB Power & Client review team with necessary skills and knowledge utilising MetRisk Database.
- Review and confirm all relevant data to ensure thorough understanding of all operational and engineering issues
- Identify all possible deterioration mechanisms
- Carry out Risk Analysis
- Identify Actions



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## RiskMet Database

- Collect Data
- Review Data
- Identify Deterioration Mechanisms
- Identify Actions

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## Necessary Skills and Knowledge

- Plant operating conditions
- Plant operating history
- Future operation
- Maintenance history/philosophy
- Inspection History
- Inspection techniques and practices
- Material and deterioration mechanisms
- Equipment design
- Statutory requirements
- RBI team leadership
- Consequence of failure



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## Identify all possible deterioration mechanisms

- For each major component.
- Internal/external pressure deterioration
- Internal deterioration e.q.tubes
- Location of deterioration
- Rate of deterioration
- Likely failure mode
- Examining past inspection reports



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## Risk Analysis

- For each location where possible deterioration has been identified.
- Estimate the probability of failure.
- Consequence of failure.
  - Safety (injuries)
  - Environment
  - Business Impact -Reputation (Media coverage)
  - Assets/Revenue - Equipment Repair Cost  
utilisation - availability cost.

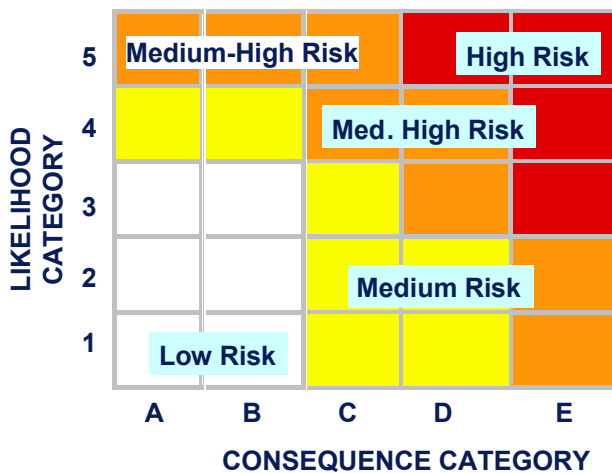


*Can you afford  
a failure?*

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## Semi-Quantitative Risk Matrix



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## Identify Actions

### ■ Actions

- Mitigating Actions
- Install isolation valves
- Change material of construction
- Add a spare unit
- Design Change
- Install leak detection system
- Instigate routine inspection
- Set up monitoring systems
- More detailed assessment
- Evaluate Creep Life
- Critical defect size determination

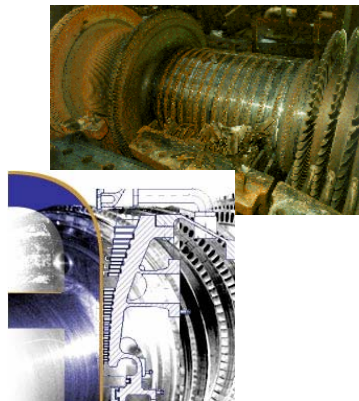


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## Develop Focused Schemes of Examination

- Split scheme between statutory and reliable requirements
- Highlight areas of particular concern
- Choose appropriate inspection technique for each identified mechanism and location
- Develop preventative measures
- Interim inspection and intervals



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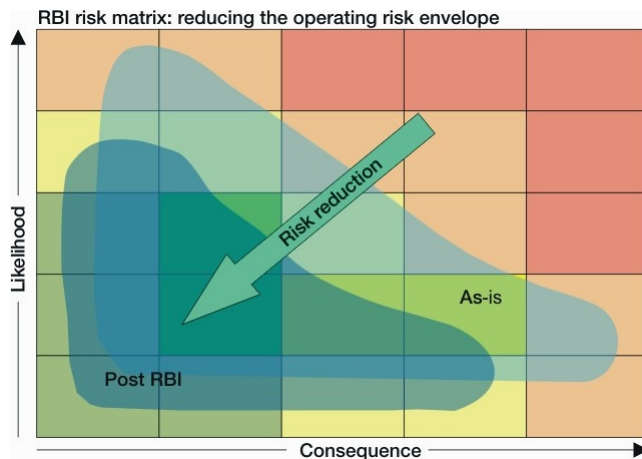


## 10% of the Equipment - 90% of Risk

- It is roughly estimated that 10% of the equipment in a plant contributes 90% of the risk. Consequently, if this 10% of the equipment is identified, testing and inspection activities can be focused meaningfully, rather than wasting effort on low-risk items.
- This results in improved safety, fewer forced outages, and reduced operational costs.



## Semi-Quantitative Risk Matrix





## Key Learning's

- Reduction in unplanned downtime-  
higher confidence in detecting the onset of deterioration
- Cost of getting it wrong once outweighs the saving of one exercise.

