

# Implementing a Risk-Based Inspection (RBI) Program: A Step-by-step Checklist

- ✔ **Determine which pieces of equipment and piping will be part of the program and organize existing data**
  - Create a complete list of this equipment and piping
  - Collect the PFDs and P&IDs for all of this equipment and piping
  - Gather any available drawings that provide further insight into the piping or equipment layout
  - Retrieve all existing corrosion and inspection data for these assets
  
- ✔ **Gather detailed data for all equipment and piping to be included**
  - Metallurgy
    - Material
    - Original thickness of the metal
    - Design pressure and temperature
  - Process fluid details
    - Chemicals included in the process stream
    - Composition of the process stream
  - Operating conditions
    - Normal operating temperature and pressure
      - ▶ If a range is used, apply worst-case values when making calculations
    - Climate zone – coastal, arid, seasonal, temperate
      - ▶ Is there potential for freezing during some parts of the year?
      - ▶ Is there a heightened potential for moisture under insulation?
      - ▶ Is the air or rainwater brackish?
    - Note whether each piece of equipment and piping is insulated or not
  - Have all detailed data confirmed in the field or by plant professionals with the highest level of day-to-day familiarity with the equipment and piping
  
- ✔ **Perform an assessment on the criticality of all equipment and piping to be included in the RBI program**
  - Determine the consequence of failure of each individual piece of equipment in the plant
    - Impact on health, safety, and the environment
  - Apply the existing company risk matrix structure to assign criticality scores

 **Separate equipment and piping into groups for efficient corrosion modeling and later inspection planning**

■ **Systems**

- Piping and equipment with the same process fluid
- Vulnerable to the same possible chemical attack mechanisms

■ **Corrosion loops**

- Piping and equipment within the same system that share the same metallurgy and operating conditions
- Vulnerable to the same cracking, pitting, and fracture damage mechanisms
- Expected to see the same or very similar rates of corrosion, cracking, and fatigue by the same mechanisms

■ **Inspection routes**

- Piping and equipment within the same corrosion loop that are geographically convenient to undergo inspection on a single inspection route within the plant
- Usually piping within the same pipe rack, not spanning a longer distance than can be walked down and inspected in a single workday
- Typically, tanks and pressure vessels geographically close enough to be inspected to a 90% coverage level in a single workday

 **Create and/or validate the plant corrosion model**

- Referring back to the data gathered at the beginning of the implementation process, use existing inspection reports to determine the real world (actual) corrosion rate and damage mechanisms that have been observed on each corrosion loop
- Relying on the metallurgy, process fluid, and operating condition data, determine the theoretical rate for other likely damage mechanisms for each corrosion loop – regardless of how slow the rate may be
- Consider the insulation status carefully to highlight areas where corrosion under insulation may become an issue. Further dividing these areas into their own inspection routes may be most beneficial

- ✔ **Calculate expected remaining life and probability of failure**
  - Calculate the minimum allowable thickness for piping within each corrosion loop
  - Calculate the minimum allowable thickness for each pressure vessel within each corrosion loop
  - Referring back to known and theoretical rates, calculate a value for the expected remaining life – based upon each damage mechanism
  - Consider the next 30, 60, 90, 180, 1 year, 3 year, 5 year, and 10 year probability of failure
  
- ✔ **Now that you have both consequence and probability of failure for each listed asset, determine the risk of each now as well as over time**
  
- ✔ **Using this new risk model and the corrosion model, create an inspection plan for each inspection route that**
  - Checks for all likely damage mechanisms
  - Provides a level of inspection coverage that will satisfactorily mitigate the risk by reducing the probability of a surprise leak
  - Prioritizes the items with the highest risk for more frequent inspections while reducing the amount of resources expended on low risk assets
  - Supports the success of the inspection team by efficiently routing their work
  
- ✔ **Assign qualified professional(s) to review the inspection reports collected as part of the program, flag any necessary work orders based on findings, and update the model as data on observed damage mechanisms becomes available or as any process, operating, or design condition is altered by projects**

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When implemented appropriately, a RBI program provides numerous advantages to both oil and gas industries as well as industries outside the hydrocarbon and chemical process industry.

Discover how one oil and gas producer was able to safely increase inspection intervals and save 64,000 man-hours through a successful RBI assessment.

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