Risk Based Inspection and extended inspection intervals

Dave Clarihew
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What we will cover

- What is RBI?
- The role of RBI in determining inspection intervals
- The RBI process
- Some limitations of RBI
- Questions
“A risk assessment and management process that is focussed on loss of containment of pressurised equipment in processing facilities, due to material deterioration. These risks are managed primarily through equipment inspection.”

- API RP580, *Risk Based Inspection*
Two Approved Codes of Practice originally issued under HSE Act

- *Pressure Equipment (Excluding Boilers), 2001*

Both reference AS/NZS 3788 *Pressure Equipment – In-service inspection*

Appendix F of *Pressure Equipment ACoP* defines requirements for in-service inspection – including extension of intervals beyond ‘nominal’.
AS/NZS 3788 Table 4.1 defines inspection requirements and periods for different pressure equipment and hazard levels including requirements for:

- Commissioning inspection
- First yearly inspection
- External inspection
- Internal inspection – nominal period
- Internal inspection – extended period

Without a suitable management system, the default inspection interval is 12 months (PE ACoP).

With a suitable management system, and suitable operating experience, inspection interval may be up to nominal maximum.
To extend inspection intervals beyond nominal, the PE ACoP requires

- Controller to have an ISO certified management system
- ITP to be recognised by the Secretary of Labour.

Recognition of the ITP requires, amongst other criteria, the use of “‘risk based inspection’ principles”.
**AS/NZS 3788:1996**
- Edition of standard when PE ACoP written.
- Contains no mention of Risk Based Inspection

**AS/NZS 3788:2006**
- Current edition of standard
- Risk Based Inspection is central, with Table 4.1 utilised when RBI is not.

**Summary**
- RBI is required to support extended inspection intervals
- Some ambiguity in applicability of AS/NZS 3788:2006
The RBI Process

First, a brief look at assessing risk
Definition of Risk

Risk = Likelihood x Consequence
Once risks have been assigned to assets and failure modes, decisions can be made on where resources are best applied.
What data do you need?

- What were the original design parameters?
- Materials of construction?
- Environment?
- Corrosion mitigations?
- Inspection history?

Validate data with those who know the asset
RBI Methodology - Example

Materials of construction?

Internal Microclimate
- Fluid composition & phase?
- Temperature & pressure?
- Flowing or static?

External Microclimate
- Coating condition?
- Insulated?
- Inland or coastal?
- Rainfall?
- Contaminants from adjacent process?
Consequences are specific to the Owner, the Asset, and often the Failure Mechanism

What are the consequences to your business?

Who could be injured?

How much would it cost to repair?

What would you lose while it was being repaired?

How would the local and wider environment be affected?
RBI Methodology - Assessment

Likelihood x Consequence = Risk

What is an acceptable risk for your business?
What is an acceptable risk for your stakeholders?
Who decides?

Appropriate levels of risk are documented in a risk matrix
RBI Methodology - Implementation

Set RBI Review Scope

Gather and Validate Data

Assess Likelihood of Failure

Assess Consequence of Failure

Develop Inspection Programme

Evaluate Risk
RBI Methodology - Implementation

1. Evaluate Risk
2. Develop Inspection Programme
3. Execute Inspection Programme
4. Assess Results
5. Assess Likelihood of Failure
6. Assess Consequence of Failure
7. Gather and Validate Data
8. Prepare Next Inspection Cycle
9. Update Database and review
10. Prepare Next Inspection Cycle
Benefits of RBI

- Optimises inspection methods, extent and frequency to address actual integrity risks to the plant - cost effectively.

- Process helps all stakeholders focus on asset integrity.

- Provides key information for management of the asset throughout its lifetime.

- Documents decision process and supporting data.

- Increases confidence in asset integrity.
Limitations

- Inspection management alone cannot assure integrity – RBI needs to be extended to Risk Directed Integrity Management.

- What if the inspection is the damage mechanism?
Sulphuric acid is commonly stored in tanks or vessels made of carbon steel.

Corrosion rates are very low – as long as concentrations remain in the 95–98% range and velocities are low.

Corrosion rates increase sharply if concentration drops.
What is the risk of inspection?

Risk = likelihood x consequence

- Likelihood of diluting acid into the severely corrosive range while cleaning is almost certain.
- Temporary pumping arrangements and presence of heavy vehicles increases likelihood of loss outside the tank.
- Consequences of cleaning also change relative to in-service conditions:
  - More people in the vicinity for longer periods
  - Different range of chemicals present – alkalis, inhibitors
Compare risks and benefits
- Cleaning and internal visual inspection, or
- Remain in service, with inspections from outside only, and
- Closely manage the environment – acid concentration.

Required integrity controls are not limited to inspections – process control and monitoring, and the supporting management systems, are critical too.

Note: internal inspection does not necessarily require internal access (AS/NZS 3788).
Summary

Inspection alone cannot assure integrity.

RBI can be a highly effective tool, but it does not provide a stand-alone, comprehensive integrity management process. It is best implemented in the context of Risk Directed Integrity Management.

RBI principles are required to be applied when assessing equipment for extended inspection intervals – but currently there are regulatory ambiguities, and clarification would be useful.
RBI is a process, not a project.