Inspectioneering Journal

ASSET INTEGRITY INTELLIGENCE

# Best Practices for Implementing RBI Programs: A Technical Insight

**Robert Sladek,** *Technical Consultant at Becht*

**VOLUME 30, ISSUE 6**

NOVEMBER | DECEMBER 2024

# Best Practices for Implementing RBI Programs: A Technical Insight

**Robert Sladek,** *Technical Consultant at Becht*

## Introduction

Risk-based inspection (RBI) programs are integral to ensuring the robustness of industrial operations. However, implementing an effective RBI program requires careful planning, consideration of key factors, and adherence to best practices.

Semi-quantitative RBI is the most common approach in industry today. It requires less data and technical expertise than fully quantitative analysis (such as a quantitative risk assessment or QRA), making it more cost-effective to implement and maintain. Most semi-quantitative RBI software available today uses data from Inspection Data Management Systems (IDMS), easing the data requirement efforts. Since the calculations are based on data inputs, semi-quantitative RBI is more consistent than qualitative RBI, which relies heavily on subject matter expertise.

In this article, we delve into the technical nuances one should consider when developing, implementing, or maintaining a robust semi-quantitative RBI program.

The success of an RBI program hinges on several critical factors, with the development of a solid business case serving as the foundational step.

## Making a Business Case

The goal of any semi-quantitative RBI program should be **to optimize the inspection resources while maintaining asset integrity through effective inspections**. Experience has proven that there is no cookie-cutter approach to RBI.

The journey begins with defining the RBI program's objectives, scope, and methodologies. This includes selecting the appropriate software, and considering factors like covered asset types, damage mechanisms, and process streams. It is imperative to align the chosen methodology with industry best practices and local regulatory requirements.

RBI is an investment into a more cost-effective inspection program. The cost-savings occur over the life of the program. Concepts such as postponing physical internal inspections or focusing only on a small group of high-risk, difficult-to-inspect assets should be avoided. While these concepts are often attractive to those funding the program, they are shortsighted and undermine the "relative risk" intent of semi-quantitative RBI. More data points will improve the distribution which helps the user to calibrate the settings, thereby customizing the methodology to the site or company.

A common result of a successful RBI program is the systematic extension or replacement of physical, internal inspections with on-stream techniques. While this should not be the goal, it is a probable output resulting from the detailed review of operating conditions, damage mechanism identification and inspection history of each asset. An often-unexpected result is the shortening of inspection intervals due to unforeseen risks or damage mechanisms not previously considered.

Capturing the costs associated with maintaining the program is important when considering the overall value of an RBI approach. This is a living program that needs continual management and maintenance. Regular assessment updates are necessary to capture process changes and inspection findings. While the software solution may help this effort, each analysis requires skilled resources for review and approval.

## Defining the Program and Methodology Selection

The methodology and software solution chosen will impact the entire effort. API RP 581 is the only industry consensus semi-quantitative RBI methodology available today. However, other options exist and may be better suited for the site. The user should carefully consider the available options and understand the implementation and maintenance requirements of each approach. Additionally, the user should understand and evaluate the calculations used to ensure the software program performs as expected.

Software (while not required) helps standardize the approach and improve the repeatability of the program. Less popular software solutions may have limited industry exposure, which can limit the pool of knowledgeable resources and require more intensive training as staffing flows in and out of the inspection group. Embedded modules within an existing IDMS or connections with RBI software and other systems can be beneficial to the overall process safety approach while automating the data requirements for updating the analyses. Some solution providers maintain user groups that meet regularly to discuss issues and prioritize improvements to steer updates.

Building an RBI program manual is essential to the success and compliance of the program. This manual serves as a key resource for site personnel and should document the following:

- Adherence to all API RP 580 requirements (shall statements).
- Consideration of all API RP 580 recommendations (should statements).
- Methodology description as deployed.
- Software settings/customizations.
- Key performance indicators (KPI) and auditing protocols.
- Procedures for implementing and updating the assessment.

The program manual serves as a baseline resource for the implementation effort and requirements as the program evolves.

## Data Cleanup

Data integrity directly impacts the accuracy of risk assessments, necessitating comprehensive data validation and verification processes. The data requirements and tolerances can vary between methodologies. Locating and validating this data ahead of the implementation will improve success. Organize the following data sources and store them electronically for access by the implementation team.

**Design/Manufacturing Information:** Enter or update the required asset design data from manufacturer forms and drawings in the IDMS and organize these documents electronically for reference/auditing. The best resource for updating this data is in-house inspection personnel due to their site and asset knowledge. If external personnel are employed for the effort, they should have mechanical integrity experience. Field verification to validate the asset data and current condition may be required.

**Process Data:** Process data is integral to RBI and required for consequence analysis and damage mechanism assignment. Process data efforts related to RBI can include:

- Update the heat and material balance (HMB) and process flow diagrams (PFDs) based on potential operating scenarios.
- Include sample data for toxics, contaminants, and corrosives.
- Model the process fluids in the software, as required.
- Validate/update the process and instrumentation drawings (P&ID).
- Evaluate the Corrosion Control Documents (CCDs) after updates to the previous sources.

**Inspection History:** Detailed inspection history summaries are key to efficient RBI implementation and a robust mechanical integrity program. If your site does not have these summary documents, you should implement this industry best practice regardless of your RBI development plans. Consider whether you will use the measured corrosion monitoring data, calculated damage rates in your RBI program, or expert-provided damage rates. Also, consider that the alignment of corrosion monitoring locations (CML) with credible damage mechanisms is crucial to the accuracy of such data.

## Training the Resources

Equipping personnel with the necessary skills and knowledge will ensure efficient program execution. Each role on the team should understand how their inputs will impact the program.

- Prepare learning materials for all resources (internal and external).
- Train personnel as they begin working on project tasks.
- Consider outlining role qualifications and competency demonstrations.
- Audit the performance of all personnel, regardless of skill level.
- Request feedback and update the learning materials accordingly.
- Set refresher training intervals.

## Piloting the Program

No matter how well you have planned, getting it right the first time is always challenging. Consider a small pilot project to "work out the bugs" before a large-scale implementation. A pilot is a test of the program with the goal of learning about the implementation process. Feedback from the pilot phase informs necessary adjustments before full-scale implementation. You should plan to circle back to the pilot units once the configuration has normalized to capture any lessons learned. Adjusting too much during the pilot can lead to extended schedules and significant rework.

Piloting the RBI program allows for refining and validating methodologies and software configurations. It provides valuable insights into resource requirements, integration with existing systems, and the overall effectiveness of the program.

Keys to success include:

- Select a manageable yet representative set of assets (i.e., one or two units).
- Lock the scope before kick-off.
- Plan a contingency for both budget and schedule.
- Refine the deliverable specifications.

## Implementation and Documentation

Once the pilot phase is complete, site-wide implementation can proceed, accompanied by meticulous documentation of processes, methodologies, and outcomes. Assign an internal resource as RBI Lead or Champion to manage the program, track the project to completion, coordinate resources, and manage the program documentation.

For site-wide RBI implementation, consider staggering the units with the API time-based updates and turn-around schedules in mind. This can benefit overall maintenance costs by spreading unit updates over several years versus one or two. A plan for transitioning from time-based to risk-based inspection scheduling is also essential to prevent anomalous "overdue" inspections.

The assessment documentation serves as a reference for ongoing maintenance, future assessment updates, and regulatory compliance. The program should strive for completeness, compliance, and consistency with the RBI final documentation. Deliverables should be at a unit level.

In the case of RBI, completeness means enough information is available so that a separate group could use the documentation to recreate the assessment and have the same results.

## Going Live with RBI

Continuous personnel training and knowledge transfer are vital for sustaining RBI programs amidst workforce changes. Establishing clear protocols for updating, software updates, and documentation maintenance ensures program continuity and effectiveness. Regular reporting of program KPIs should highlight deficiencies

ahead of asset problems. Auditing the program and personnel performance will improve the overall health and effectiveness of the program.

Thoroughly vet all software updates prior to implementing the live software. The timing of updates should not impede regularly scheduled activities. Provide schedule contingency for software updates in case it goes slower than anticipated because they often do.

## Conclusion

Implementing an RBI program demands meticulous planning, robust methodologies, and effective resource management. By addressing key considerations and challenges, organizations can develop and sustain RBI programs that optimize costs, enhance maintenance practices, and ensure regulatory compliance. Adherence to best practices and continuous improvement are essential for long-term success in managing industrial risks. ■

---

For more information on this subject or the author, please email us at inquiries@inspectioneering.com.

## CONTRIBUTING AUTHOR

**Robert Sladek**

Rob Sladek has over 35 years of experience in the Mechanical Integrity industry, specializing in Risk-Based Inspection (RBI) and inspection programs for refining, petrochemical, and chemical operators. Over the past two decades, he has led mechanical integrity projects, including RBI implementations and reassessments, leveraging his expertise in project and data management. Rob currently supports Becht's Corrosion, Materials, and Integrity division as a technical consultant. He holds five API certifications and has contributed to API since 2012, assisting in the leadership of API 575, API 580, API 581, and the Inspection Summit.