

RBI for Pressure Relief Devices

Technology & Software That Help Manage Risk & Reduce Costs

The regular inspection, testing and overhaul of pressure relief devices is needed to ensure proper PRD function upon demand. But when and how often do you need to inspect?

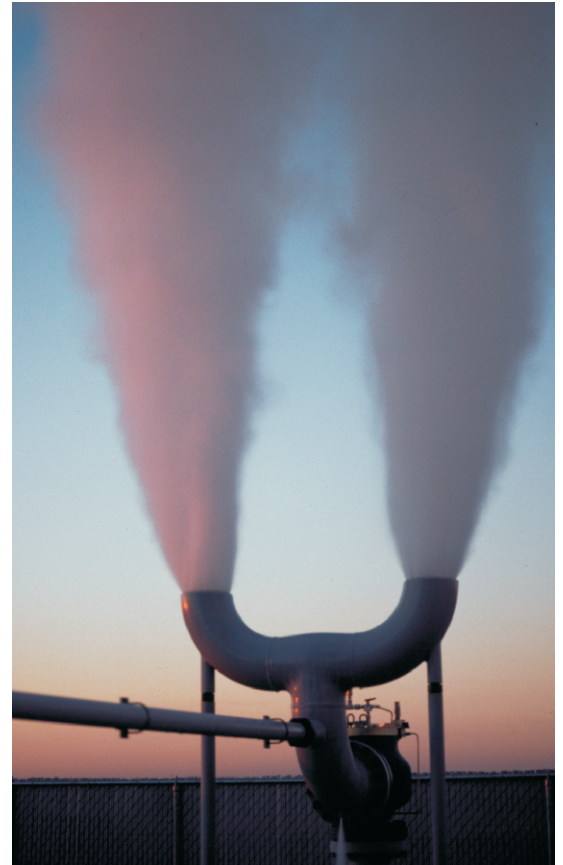
Most inspection programs do an adequate job of managing the unreliability of PRDs, without giving much consideration to the consequences of PRD failure to open or leak. Many plants inspect PRDs on preset intervals as recommended by inspection codes, such as NB-23 and API 510. These Codes allow increases in inspection interval based on the historical performance of the PRD, but significant increases in intervals over the preset values can take many years.

The use of API Risk-Based Inspection allows optimum intervals to be set based on the probability and consequences associated with PRD failure.

To improve prediction accuracy and gain industry acceptance, an API RBI technical working group, chaired by E²G's Phil Henry, developed new technology that includes a highly quantitative approach for determining individual PRD inspection intervals, allowing owner-users to design maintenance programs based on measured risk. This approach systematically prioritizes maintenance and inspection dollars by:

- Targeting the most critical PRD's
- Identifying longer inspection frequencies for lower risk PRD's
- Setting optimized intervals based on plant risk tolerance
- Focusing inspection on the most critical applications, reducing cost AND risk

This methodology is incorporated into API RBI and VCESage software. Typically, the PRD module is linked directly to the protected equipment. However, API PRD RBI can be performed without fixed equipment RBI. This new approach has the potential to significantly reduce maintenance costs without jeopardizing safety of the plant.



API PRD RBI: Highly Quantitative & More Accurate

API PRD RBI methodology, as documented in API 581, evaluates the criticality of PRDs, and sets inspection and testing frequencies accordingly. This approach, which is consistent with API 510 Pressure Vessel Inspection Code, employs extensive analysis in its calculations.

Extensive PRD Reliability/Failure Rate Database - Considers the fluid service, duration in service, and type of device, and provides default PRD failure rates backed by an extensive database of bench tests.

Criticality - Considers the overpressure scenarios (loss of cooling, fire, blocked discharge, etc.) applicable to each individual PRD.

- PRDs in critical services with highest demand rates should be inspected and tested more frequently than others.
- Some PRDs have a higher potential of overpressure upon failure to open on demand.

Integrated Consequence Analysis Package - Considers the fluid severity and hazard potential (flammable and toxic consequences) when evaluating loss of containment as a result of PRD failure to open. Also evaluates the consequence of PRD leakage.

Integrated System - Ties directly to the damage state of the equipment protected by the PRD. The criticality of the PRD increases as the condition of the protected equipment deteriorates over time.

Documented Inspection History - Updates the Default Probability of Failure using historical PRD inspection data for each PRD.

- Utilizes a modified Bayesian updating approach to utilize the knowledge gained from PRD inspection records.
- Grades inspection effectiveness when adjusting PRDs reliability.

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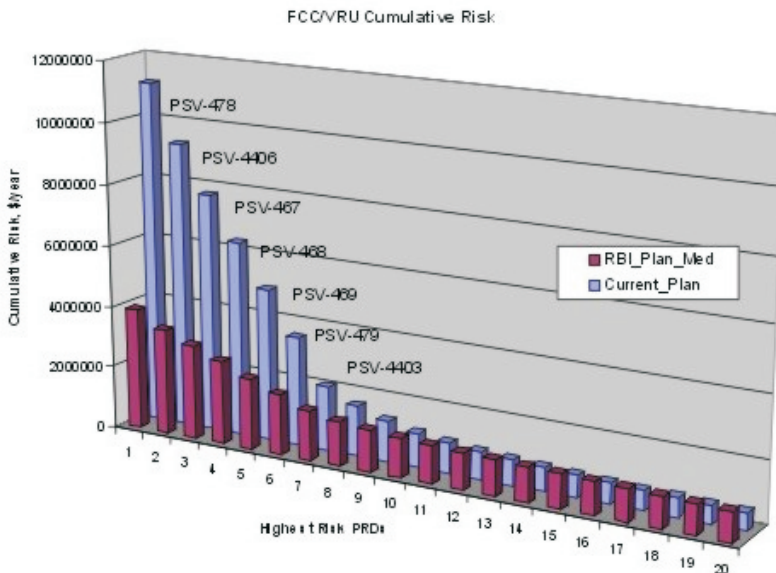
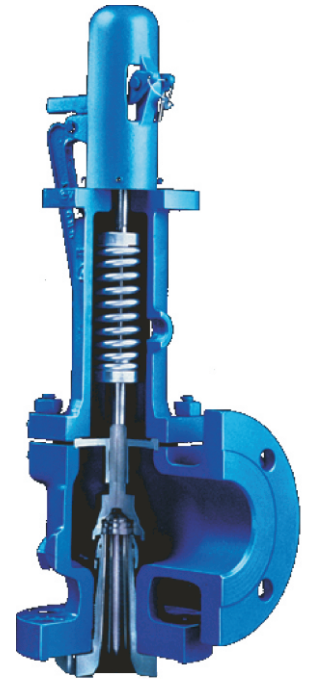
Implementing API PRD RBI at Your Plant

E²G can conduct a pilot study to demonstrate API PRD RBI technology, as well as provide site-wide implementation. Here's our process for implementation:

- Review the Process & Instrumentation Diagrams (P&ID)
- Review the pressure relief system design basis
- Gather and document past PRD testing and inspection histories
- Identify overpressure scenarios that could result in loss of containment
- Interview key process and operating personnel
- Determine the criticality of each PRD
- Evaluate the consequence of a PRD failing to open due to overpressure and leakage
- Calculate the optimum inspection interval based on the user's risk tolerance

The API methodology, available in API RBI software, is a highly quantitative approach to PRD RBI that provides in-depth documentation for your inspection plan. The calculations are not "black box" because the technology has been balloted and approved by the API peer review process and fully documented in API 581. The API 581 approach:

- Handles any pressure relief device, including conventional and pilot-operated relief devices, rupture disks and AST P/V devices.
- Provides default demand rates and overpressure potential as a function of the overpressure demand cases applicable for the PRD. Allows PRDs to be evaluated with consideration of other layers of protection.
- Allows users to provide personal reliability data in the form of Weibull parameters.
- Utilizes a fluid property solver that provides extensive fluid mixing capabilities from an extensive database of pure components and chemicals.
- Uses an internal consequence modeling package to evaluate the effects of fires, fireballs, BLEVEs, explosions and toxic releases on personnel and nearby equipment.
- Considers the effects of vibration, valve chatter and operating temperature on PRD reliability. Accounts for rupture disks installed in combination with pressure relief valves.



Impact on the Bottom Line

Many plants apply inspection intervals to PRDs in general agreement with API 510 and NBIC, without considering historical performance or potential risk. A recent site-wide implementation of PRD RBI resulted in significant maintenance cost savings and a payout under 1-1/2 years. A significant reduction in overall plant risk was also realized.

Contact Us

For more information on E²G products and services, please check our website at www.equityeng.com or contact Phil Henry at pahenry@equityeng.com and 216-283-6012 or Greg Alvarado at gcalvarado@equityeng.com and 281-537-8848.

Photos courtesy of AG Crosby

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