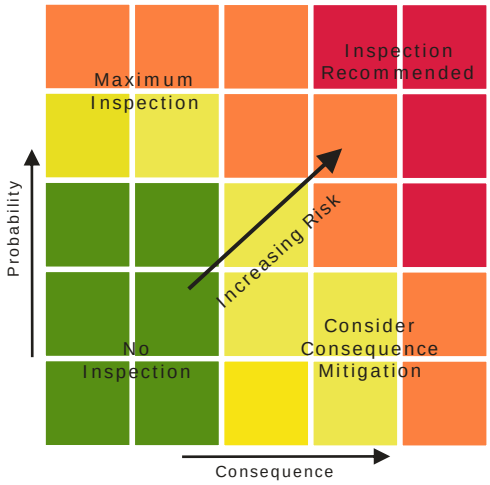
API Risk-Based Inspection



API RBI Risk Matrix – Optimizing Inspection Efforts

Why do Risk-Based Inspection?

Equipment availability is the key to profitability in the oil refining and petrochemical industries. The dominant risk factors are safety and lost production. The cost of getting it wrong - and the benefit of doing it right - more than outweighs the cost of doing a RBI study.

The Risk-Based Inspection (RBI) methodology developed by the American Petroleum Institute (API) combines quantitative and qualitative techniques in a streamlined, efficient approach to plant risk management. Because it was developed using state-of-the-art technology provided by a Joint Industry Project and standardized using the API ANSI consensus process, API RBI technology reflects today's best practices and the expertise of the best minds in the industry.

API RBI technology is the *de facto* standard for 21st century plant risk management and inspection planning.

Benefits of API RBI versus the competition

Integrated risk-based tool - Combines fixed equipment, heat exchangers, atmospheric storage tanks and pressure relief systems

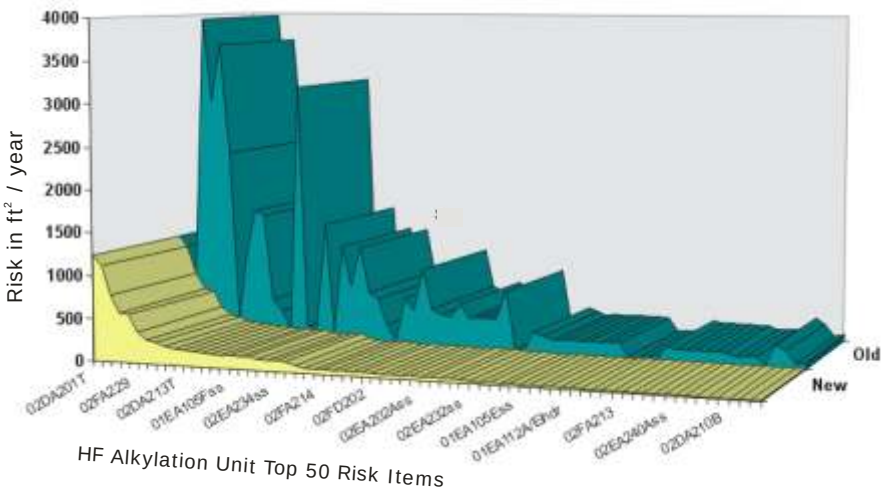
Integrated quantitative and qualitative approach - Offers the value of a quantitative approach with the same effort as a qualitative one, producing a more accurate risk calculation - minimizes the tendency to over-inspect and provides a more accurate likelihood of failure prediction for your equipment

Added value, practical - Uses a facilitated, qualitative work process that provides quantitative results for the same cost - because the process is streamlined, less hours from plant resources are required

RBI vs Traditional Inspection Plan

Risk reduction per $ spent with inspection program prior to RBI = 1.67 ft² per year/$

Risk reduction per $ spent with RBI program = 2.7 ft² per year/$



State-of-of-the-art technology - Based on funded technology provided by a Joint Industry Project with members from international refining and petrochemical companies.

Consensus-driven for the benefit of all - Based on a consensus process that combines documented technology, industry best practices, and owner-user experience with a balloting procedure to ensure approval and acceptance by industry experts

More objective and consistent than a strictly qualitative approach - Doesn't rely on “black box approaches” employed by commercially-driven organizations - API RBI technology supports conclusions with metrics and facts, providing more objectivity and consistency than proprietary systems

Defendable to regulatory organizations - API 581 documents the detailed implementation of an RBI study, using performance standards set out by API 580 - the technology is transparent enabling the calculations to be reproduced by different teams

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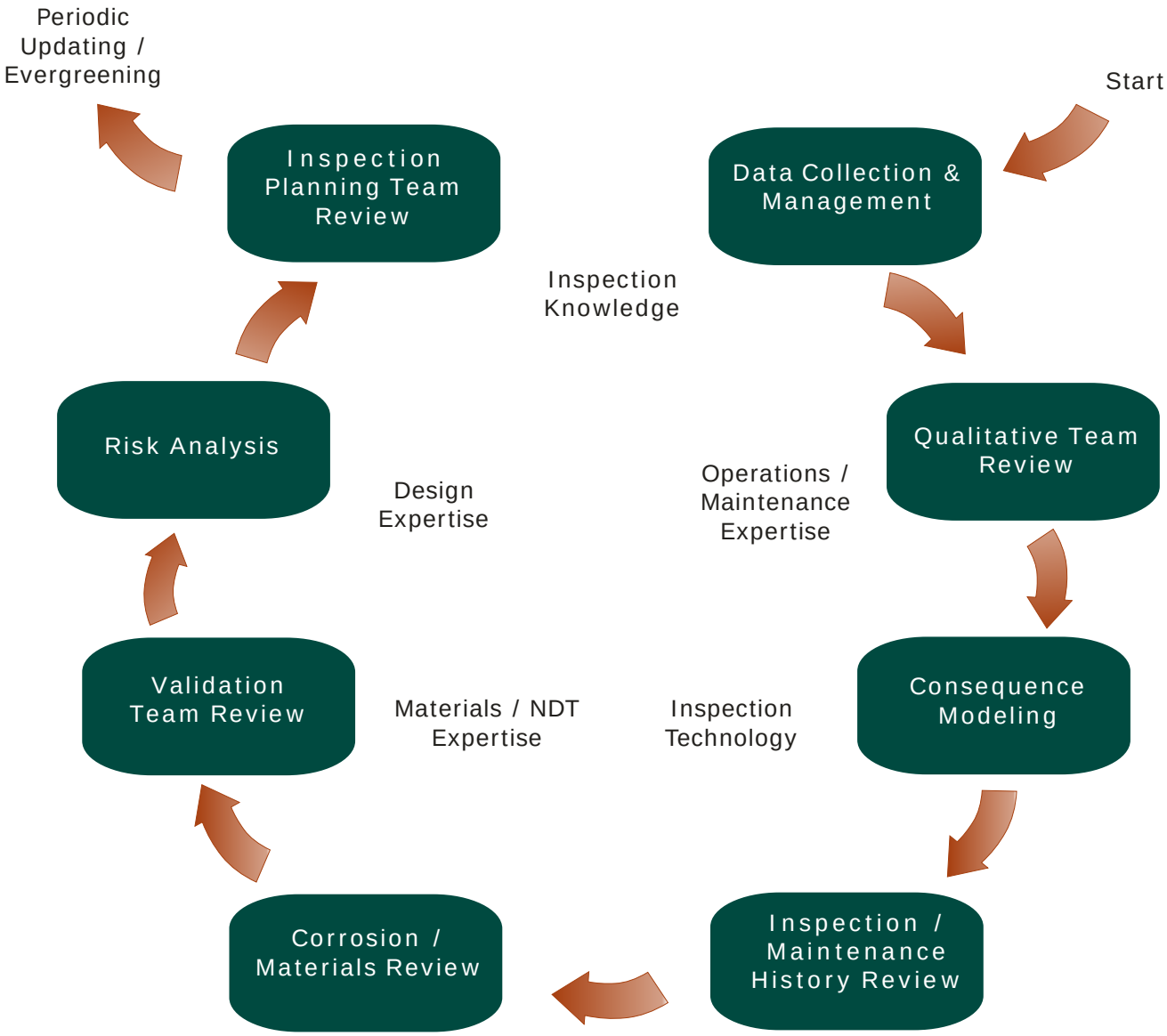
The API RBI Work Process



Data Collection & Management - Collect electronically available information, along with information gathered through discussions with plant personnel (25% of total time effort)

Qualitative Team Review - Use the experience of plant operations and reliability personnel to discuss operating conditions and known problem areas - structured, facilitated team reviews use plant personnel time more efficiently (2%)

Consequence Modeling - Determine the flammable and toxic characteristics of the process stream, and develop a safety, production and toxic impact for each component (15%)

Inspection and Maintenance History Review - Look for other potential problems, as well as supporting data for problems identified in the team review (20%)

Corrosion and Materials Analysis - Based on all the qualitative and quantitative data gathered, note the potential damage mechanisms and rate of damage through expert corrosion review (18%)

Validation Team Review - Assess all critical input data that drives risk and review it in a structured way (using PFDs) to validate its accuracy (2%)

Risk Analysis - Take all data from previous steps and review for consistency, filling in all the blanks to do a credible risk calculation (13%)

Inspection Planning Team Review - Resolve the risk ranking, studying risk drivers, and develop an inspection plan (5%)

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