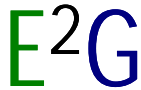




Risk Based Inspection, Beyond Implementation to Integration

Lynne Kaley
The Equity Engineering Group, Inc.



The Equity
Engineering
Group, Inc.



Outline

- Introduction to RBI
- API RBI Overview (API 581)
- API RP 580 Brief Overview
- Link with RP 579 FFS
- Brief on Status of RP 571 Damage Mechanisms
- Interaction with existing Codes & Standards
 - (API 510, 579 & 653)
- Direction of API RBI User Group Activities



Introduction to Risk Based Inspection



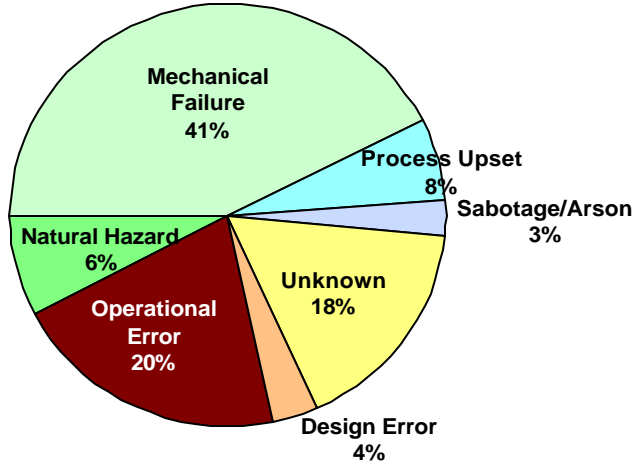
Motivation for RBI

- Most inspection codes/standards based on Likelihood of Failure (LOF), not Consequence of Failure (COF)
- Reduce risk of high consequence failures
- Improve the cost effectiveness of inspection and maintenance resources
- Provide a basis for shifting resources from lower to higher risk equipment
- Measure and understand the risks associated with current inspection programs
- Measure risk reduction as a result of inspection practices



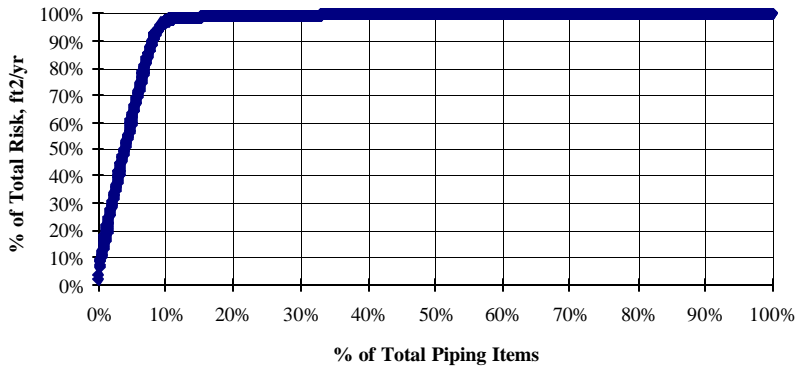
Where Inspection Can Help

About half of the containment losses in a typical petrochemical process plant can be influenced by inspection activities



Quantitative Risk Ranking

% of Total Risk vs. % of Piping Items
Ethylene Plant, 1958 Pipe Segments



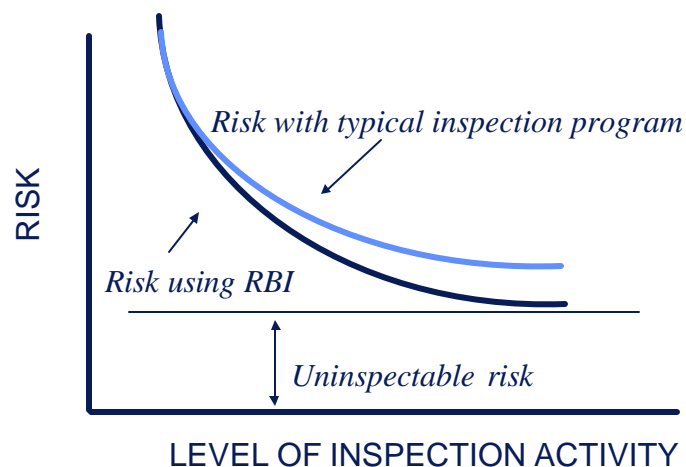


RBI Capabilities

- Evaluate current inspection plans to determine priorities for inspections
- Evaluate future plans for decision making
- Evaluate changes to basic operations as they affect equipment integrity
- Identify critical contributors to risk that may otherwise be overlooked
- Establish economic optimum levels of inspection as weighed against risk reduction
- Incorporate “Acceptable Risk” levels

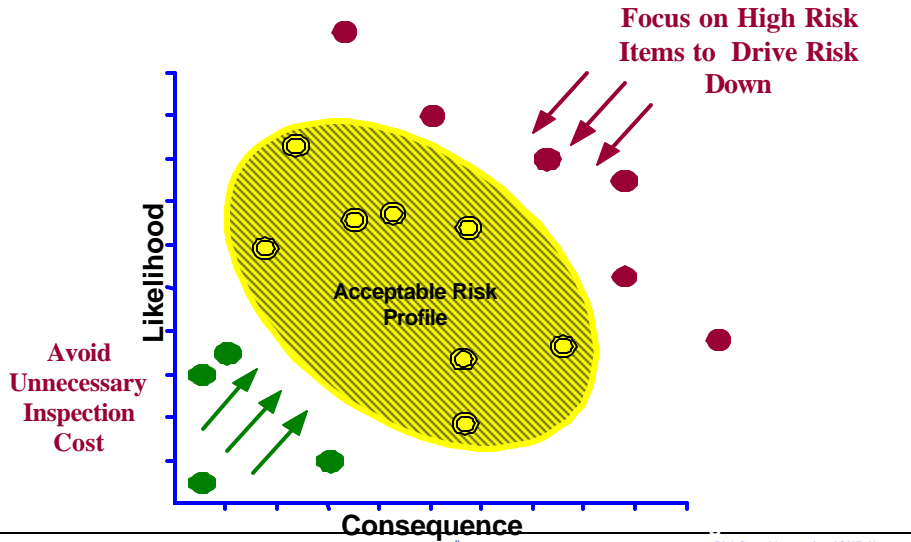


Management of Risk Using RBI





Managing Risk Acceptable Profile

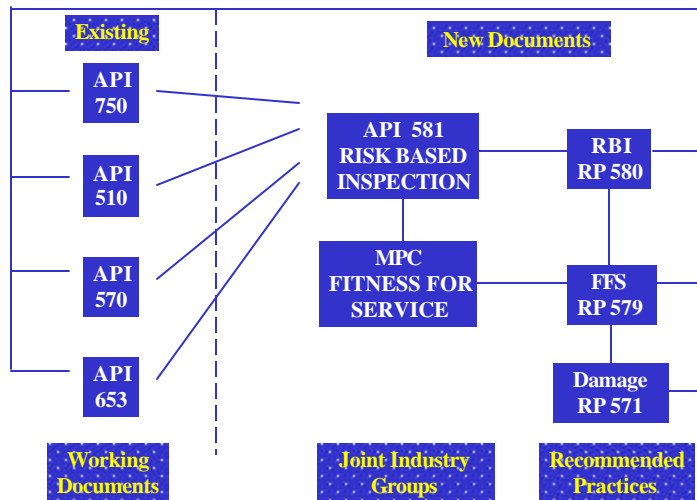


The Equity Engineering Group, Inc., 2003

Risk Based Inspection ASME, Houston



Relationship Between API Documents



The Equity Engineering Group, Inc., 2003

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Risk Based Inspection ASME, Houston



API 581



Overview of API 581

Table of Contents

- Section 0 – Introduction
- Section 1 – Scope
- Section 2 – References and Bibliography
- Section 3 – Definitions and Abbreviations
- Section 4 – Risk Analysis
- Section 5 – Qualitative Approaches to RBI
- Section 6 – Overview of Quantitative RBI



Overview of API 581

Table of Contents

- *Section 7 – Consequence Analysis*
- *Section 8 – Likelihood Analysis*
- *Section 9 – Development of Inspection Programs to Reduce Risk*
- Section 10 – Plant Database Structure
- *Section 11 – Damage Modules*
- Appendices



Overview of API 581

Table of Contents

- Appendix A – Workbook for Qualitative Risk Based Inspection
- Appendix B – Workbook for Semi-Qualitative Risk Based Inspection Analysis
- Appendix C – Workbook for Quantitative Risk Based Inspection Analysis
- Appendix D – Workbook for Management Systems Evaluation



Overview of API 581

Table of Contents

- Appendix E – OSHA 1910 and EPA Hazardous Chemicals List
- Appendix F – Comparison of API and ASME Risk Based Inspection
- *Appendix – Thinning Damage Module*
- *Appendix H – Stress Corrosion Cracking Damage Module*
- *Appendix I – High Temperature Hydrogen Attack (HTHA) Damage Module*



Overview of API 581

Table of Contents

- *Appendix J – Furnace Tube Damage Module*
- *Appendix K – Mechanical Fatigue (Piping only) Damage Module*
- *Appendix L – Brittle Fracture Damage Module*
- *Appendix M – Equipment Linings Damage Module*
- *Appendix N – External Damage Damage Module*

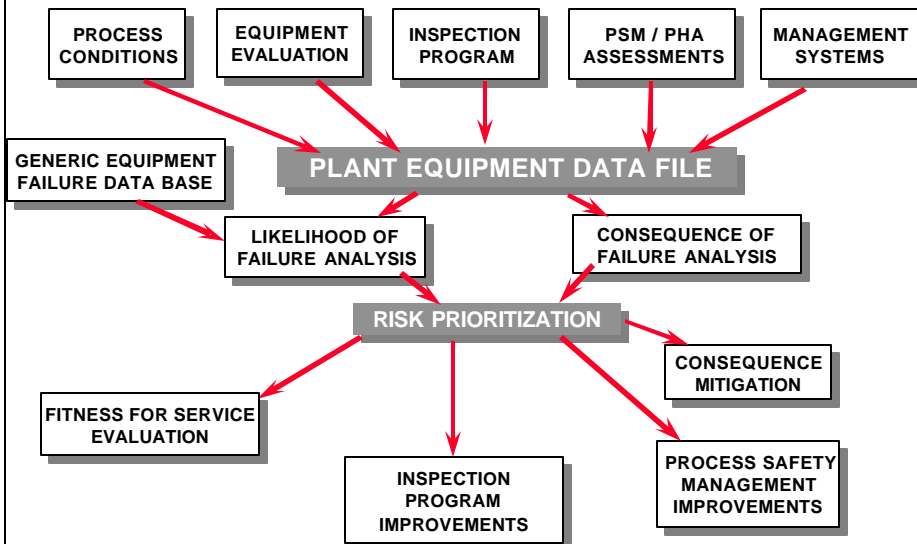


RBI Covers

- Reactors
- Pressure Vessels
- Piping
- Furnaces
- Pumps
- Compressors
- Heat Exchangers
- Storage Tanks



Quantitative Risk Based Inspection





Limitations of RBI

- Human error
- Natural disasters
- External events (e.g., collisions or falling objects)
- Secondary effects from nearby units
- Deliberate acts (e.g., sabotage)
- Inherent risk in handling hazardous materials
- Fundamental limitations of the inspection method
- Design Errors
- Unknown/Unidentified Mechanisms of Deterioration



Definitions

- **Risk** is a concept that allows people to view potential hazards in a way that simultaneously accounts for both the likelihood and consequences of an event.
- **Failure** is a leak to the atmosphere or breach of containment
- **Risk Based Inspection (RBI)** is a systematic tool that helps users make informed business decisions regarding inspection and maintenance spending.



Measuring Risk

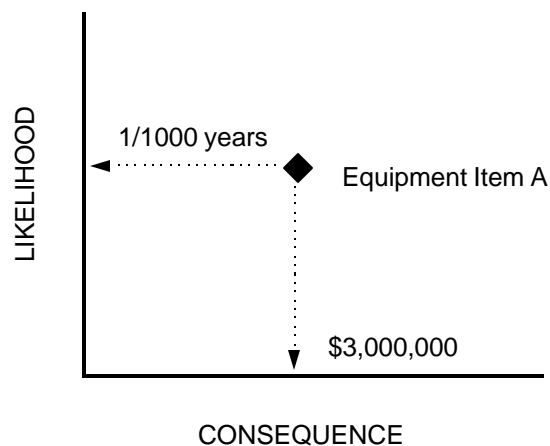
- Risk Defined:

$$\text{LIKELIHOOD OF EVENT} \times \text{CONSEQUENCE} = \text{RISK}$$

- A simple way to measure a risk is to display both likelihood and consequence together on an X-Y plot.

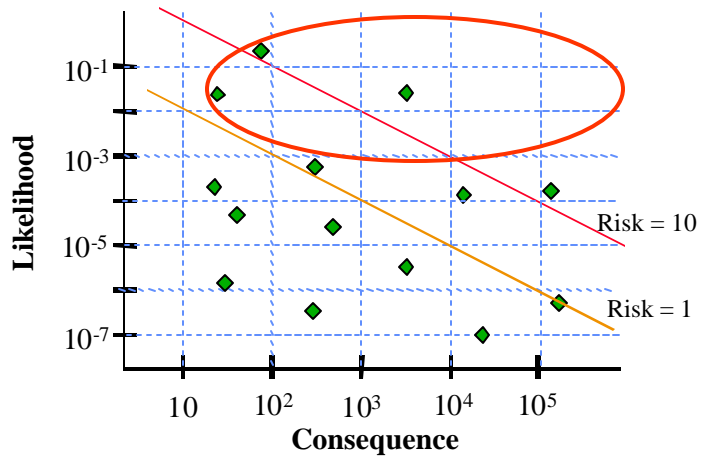


Likelihood and Consequence





Iso-Risk Lines



API RBI Risk Matrix

Likelihood Category	Consequence Category				
	A	B	C	D	E
5	Medium High		High		
4					
3					
2	Low		Medium		
1					



RBI Likelihood Analysis

- **Intended for relative measures and rankings**
- Rate/Severity of damage identified by user
- Probability of leak calculated by software
 - Event/Failure - refers to a leak at a pressure boundary
- Likelihood reported by the Damage Factor (DF)
 - Damage Factor is the extent to which the specific item is expected to fail compared with the average population (Range 1 to 5,000)
- Reported as Damage factor and Likelihood (Probability) of Failure



Inspection and Risk

The likelihood of a failure can be controlled by:

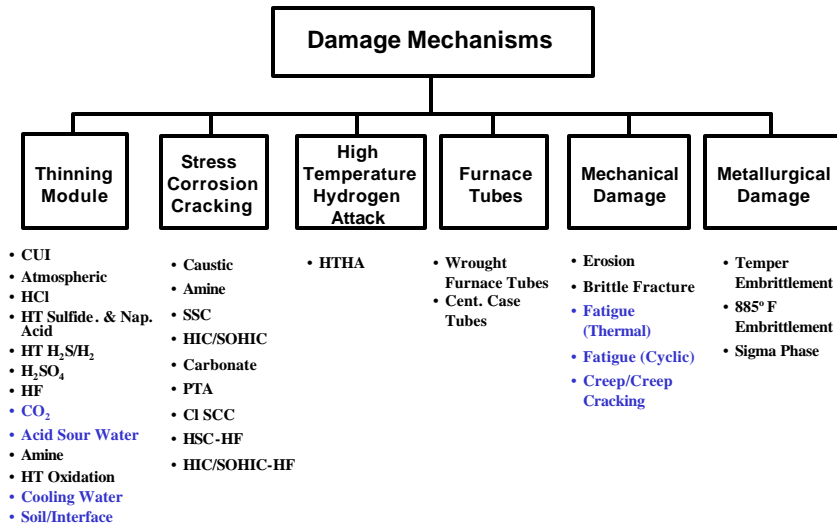
- Recognizing the types of **damage possible** in process equipment

AND

- Using the correct **inspection method** at the right location and frequency to find it.



API RP 581 Damage Modules



Key Input Requirements

- Material of Construction (pressure containment, not liner)
- Process Operation/Upset Conditions
 - Temperature
 - Corrosive elements and concentrations
- Damage Mechanism(s) active
 - Including Localized vs. General corrosion
- Years in Service/Installation
- Thickness (at start of services/installation)
- Corrosion Rate/Damage Severity
- Inspection Effectiveness/Number of Inspections



Damage Factor Calculation

1. Screen for damage mechanisms and establish an expected damage rate (normal and upset operating conditions).
2. Determine the effectiveness of inspection programs in confirming damage levels and damage rates.
3. Calculate the effect of the inspection program on improving the confidence level in the damage rate.
4. Calculate the probability that a given level of damage will exceed the damage tolerance of the equipment and result in failure.
5. Calculate the Damage factor (DF).
6. Calculate the composite DF for all damage mechanisms.

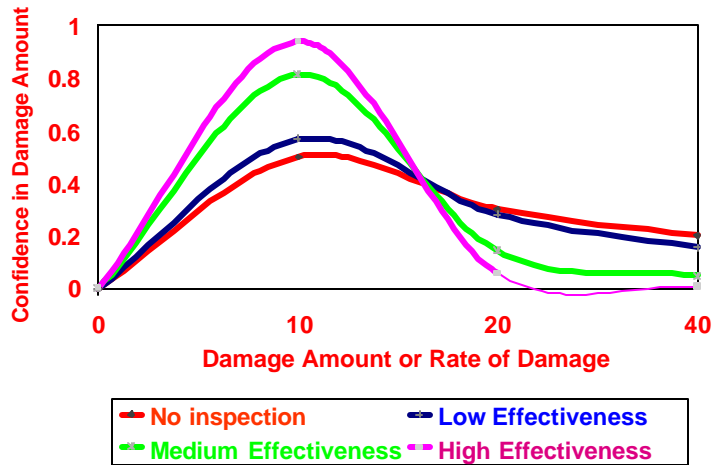


Effectiveness Categories

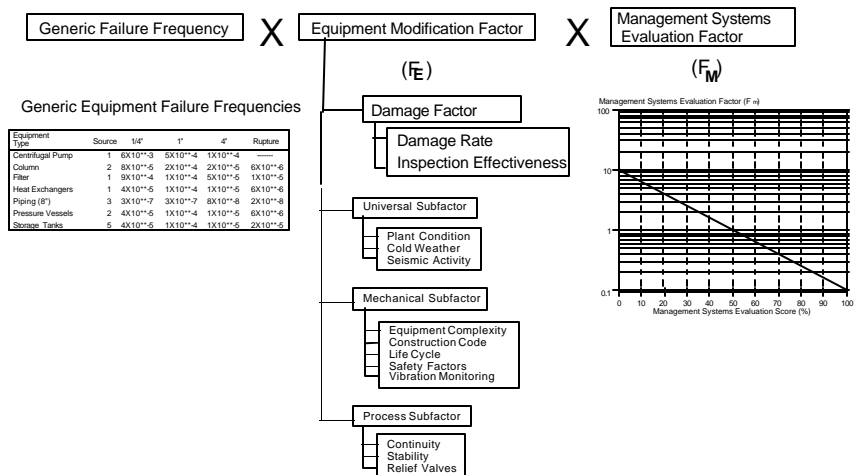
- A - Highly Effective** Inspection methods correctly identify the anticipated in-service damage in nearly every case.
- B - Usually Effective** The inspection methods will correctly identify the true damage state most of the time.
- C - Fairly Effective** The inspection methods will correctly identify the true damage state about half of the time.
- D - Poorly Effective** The inspection method will provide little information to correctly identify the true damage state.
- E - Ineffective** The inspection method will provide almost no information that will correctly identify the true damage state.



Effect of Inspection on Likelihood and Risk



Likelihood of Failure Calculation





Assessing Consequences of Failure

- Determine Consequence of equipment based on the significance of failure
 - Loss of containment
 - Safety and health impact
 - Environmental impact
 - Production losses
 - Maintenance and reconstruction costs
 - Other functional failures for production impact
- Units of Measure
 - Safety impact for personnel, equipment damage impact, ft²/yr
 - Financial consequences



Inspection Planning Methodology

- Inspection reduces the expected likelihood of failure
- The likelihood of failure due to such damage is a function of four factors:
 - Damage mechanism and resulting type of damage
 - Rate of damage progression and escalation of risk
 - Probability of detecting damage and predicting future damage states with inspection techniques
 - Tolerance of the equipment to the type of damage



Options for Inspection Planning Approach

- Fix when equipment fails or break
- Conduct a full inspection on all equipment at fixed intervals (primarily vessels, piping is often neglected)
- Compliance based with the codes / law
- Condition based approach (Likelihood of failure)
- Risk based approach
 - Qualitative
 - Quantitative



Objectives of an Inspection Program

- Prioritization of equipment and piping for inspection
- Develop a specific inspection plan for equipment/piping
- Minimize downtime during turnarounds
- Identify on-stream inspection candidates
- Achieve more effective use of resources
- Assess the impact of turnarounds deferrals
- Special Emphasis inspection programs

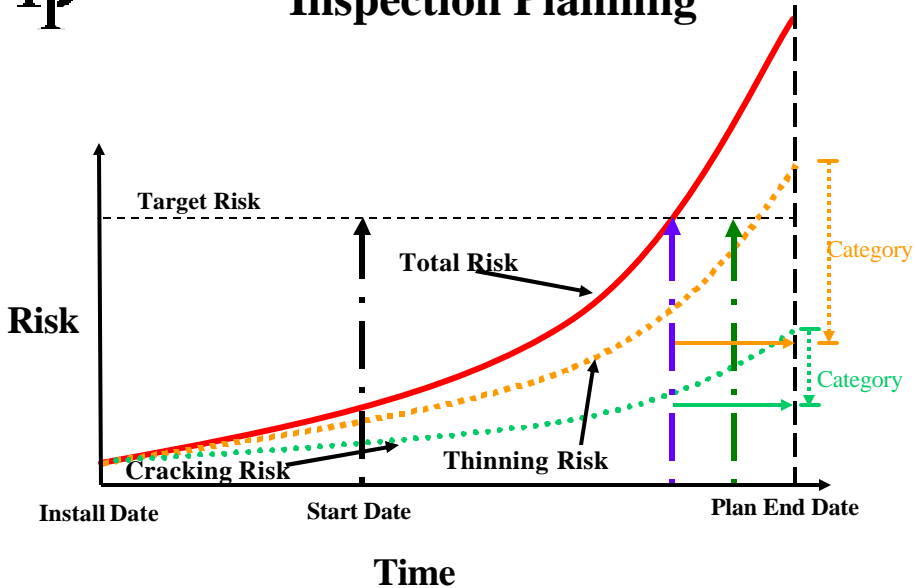


Inspection Planning

- Required User Inputs
 - Plan Ending Date
 - Target Criteria
 - Damage Factor
 - Risk, ft^2/yr
 - Risk, $\$/\text{yr}$



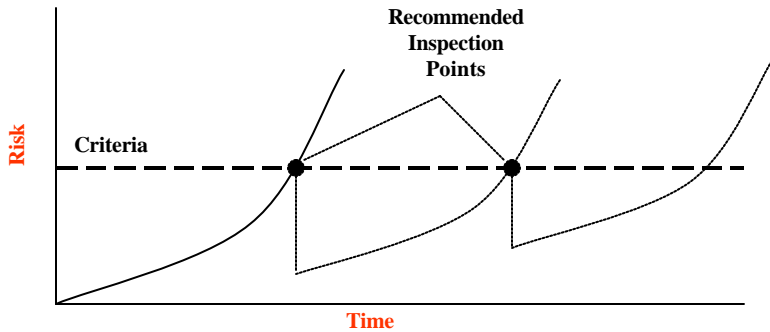
Inspection Planning



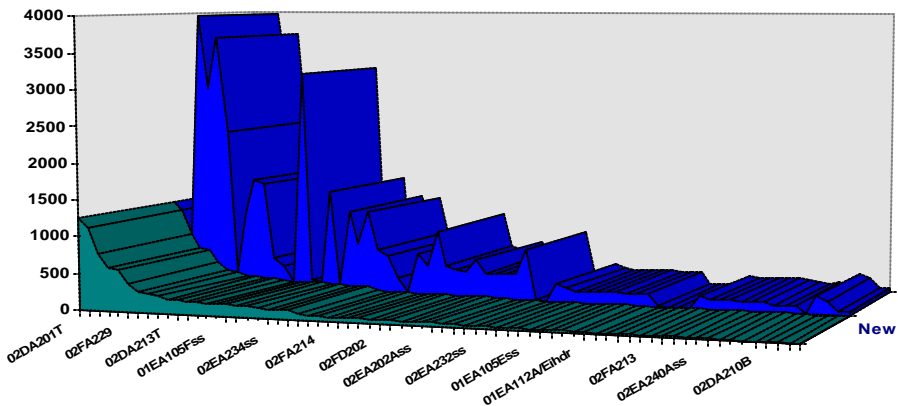


Inspection Planning

- Risk will increase until the date of inspection. The calculated risk will decrease after RBI inspection plan is implemented.

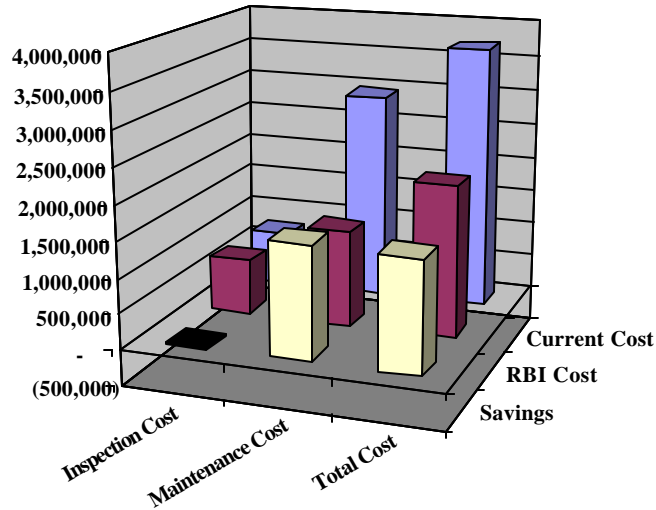


Inspection Planning





Inspection Planning

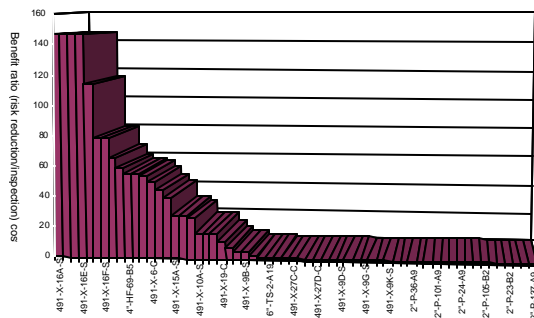


Cost Benefit

- Cost Benefit Ratio is the Relationship between Risk Reduction as a result of an activity and the Cost of that activity or

$$\text{CBA Ratio} = \Delta \text{Risk} / \text{Mitigation Cost}$$

- Ranking for prioritization of activities



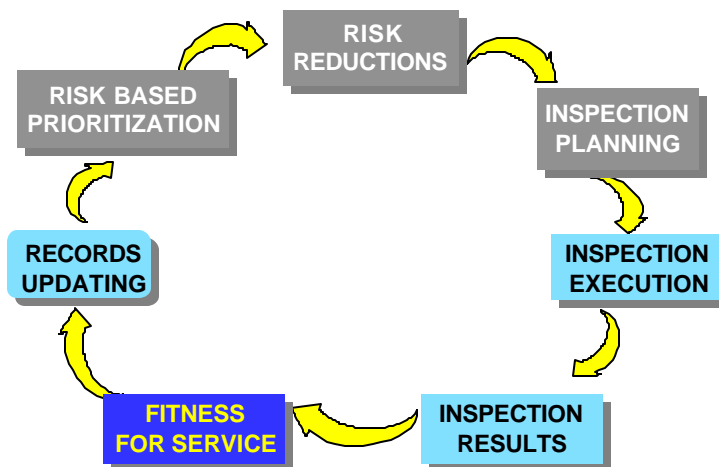


Changing Risk through Inspection

- Changing inspection **frequencies**
- Changing inspection **scope / thoroughness**
- Changing inspection **tools / techniques**
- Changing inspection **practices** (internal vs. external)



RBI Fit Into Current Practices





RBI Program Considerations

- Changing operating conditions or key process variables can impact the analysis and require re-evaluation
- Each plant must identify the changes or additional data that will trigger the need for re-analysis:
 - Management of Change procedure
 - Modification of process operation
 - Non-normal operating condition impacting susceptibility of damage mechanisms
 - Updated information and findings from inspection



RBI Summary

- RBI is an equipment screening process to allow the user to handle large amounts of equipment at one time
- As a screening method, consistency is more important than accuracy
- A more complex (FFS-like) analysis is often desired but is not necessary for screening purposes
- Necessary to understand the damage basis of any analysis or approach to realize benefits and limitations
- RBI requires expertise and documentation for addressing lack of accurate data available



API 580



API RP 580 Development Group

- **Group Composition (1997-2002)**
 - Owner/User representatives from 22+ refining, chemical and exploration companies
 - International representation
 - Disciplines represented:
 - Mechanical engineers
 - Materials/Corrosion engineers
 - NDE specialists
 - Inspection program and MI responsible professionals



Overview of API 580

Contents

- **Foreword**
- **Section 1 – Introduction, Purpose and Scope**
- Section 2 – References
- Section 3 – Definitions and Acronyms
- Section 4 – Basic Concepts
- Section 5 – Introduction to Risk Based Inspection
- Section 6 – **Planning the RBI Assessment**
- Section 7 – **Data and Information Collection for RBI Assessment**



Overview of API 580

Contents

- Section 8 – **Identifying Deterioration Mechanisms and Failure Modes**
- Section 9 – Assessing Probability of Failure
- Section 10 - Assessing Consequence of Failure
- Section 11 – Risk Determination, Assessment and Management
- Section 12 – **Risk Management with Inspection Activities**
- Section 13 – Other Risk Mitigation Activities
- Section 14 – **Reassessment and Updating RBI Assessments**



Overview of API 580

Contents

- Section 15 – **Roles, Responsibilities, Training and Qualifications**
- Section 16 – **RBI Documentation and Record Keeping**
- **Appendix A – Deterioration Mechanisms**



API RP 580 Foreword

- Intended to provide guidance
- Not intended to:
 - Supplant other practices that have proven satisfactory
 - Discourage innovation and originality in inspection of facilities
 - Be a substitute for the judgement of a responsible, qualified inspector or engineer.
 - Be construed as a code of rules, regulations, or minimum safe practices.
- A supplement to API Codes and Standards
 - API 510 Pressure Vessel Inspection Code
 - API 570 Piping Inspection Code
 - API 653 Tank Inspection, Repair, Alteration and Reconstruction



API RP 580 Foreword

- The Codes and Standards provide the latitude to:
 - Plan an inspection strategy
 - Increase or decrease the code designated inspection frequencies based on the results of a RBI assessment.
- The assessment must:
 - **Systematically** evaluate **both** the probability of failure and the associated consequence of failure
 - The probability of failure assessment must be based on all forms of deterioration that could reasonably be expected to affect the piece of equipment in the particular service.
 - Refer to respective codes for specific requirements
 - **API RP 580 is a guide for users in properly performing such a RBI assessment**

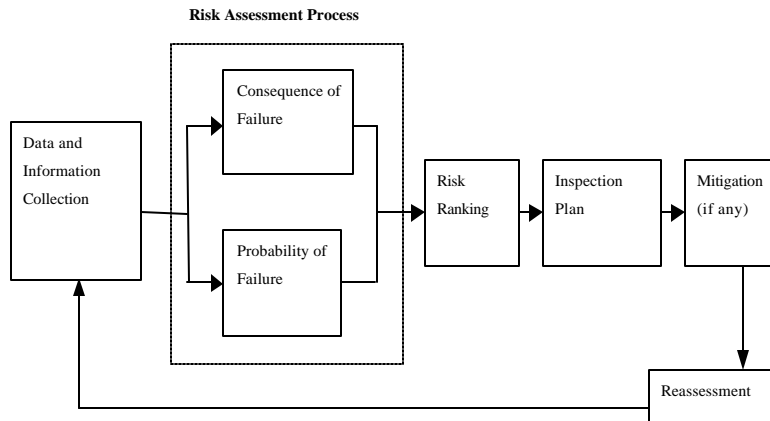


Introduction, Purpose and Scope

- RBI will **not compensate** for:
 - Inaccurate or missing information
 - Inadequate designs or faulty equipment installation
 - Operating outside the acceptable design envelope
 - Not effectively executing the plans
 - Lack of qualified personnel or teamwork
 - Lack of sound engineering or operational judgment



Introduction to Risk Based Inspection



Identifying Deterioration Mechanisms and Failure Modes

- Categorized into Four (4) Types of Damage
 - Thinning (includes internal and external)
 - Stress Corrosion Cracking
 - Metallurgical and Environmental
 - Mechanical
- Refer to Appendix A (RP 580) for summary of damage causes
- Refer to API 571 for more detailed guidance



Assessing Probability of Failure

- Probability of a specific adverse consequence
 - From a loss of containment due to a deterioration mechanism(s)
 - $POF \times \text{Probability of scenario} = \text{Probability of specific consequence}$
 - Should address all possible failure mechanisms
 - Should address multiple mechanisms considering conditions
 - Must be credible, repeatable, well-documented
 - Units of measure should include frequency, quantitative or qualitative



Assessing Probability of Failure

- Should consider
 - Deterioration mechanisms
 - Potential, reasonably expected
 - Susceptibility and rate
 - Inspection effectiveness
 - Quantify the effectiveness of the past inspection and maintenance program and a proposed future inspection and maintenance program.
 - Determine the probability that with the current condition, continued deterioration at the predicted/expected rate will exceed the damage tolerance of the equipment and result in a failure.
 - The failure mode (e.g. small leak, large leak, equipment rupture) should also be determined based on the deterioration mechanism.
 - Determine the probability of more than one failure mode and combine the risks.



Assessing Consequences of Failure

- Discriminate items based on the significance of a potential failure
 - Loss of containment
 - Safety and health impact
 - Environmental impact
 - Production losses
 - Maintenance and reconstruction costs
 - Other functional failures can be included
- Units of Measure
 - Safety, cost, affected area, environmental, volume of fluid released, etc.



Documentation and Record Keeping

- Sufficient to:
 - Recreate the assessment if needed
 - Update the assessment

By those **not** involved in the
original assessment!



API RP 579



Fitness-For-Service

- FFS assessment is a multi-disciplinary engineering analysis of equipment to determine whether it is fit for continued service, typically until the next shutdown
- The equipment may contain flaws, not meet current design standards, or be subjected to more severe operating conditions than current design
- The product of a FFS assessment is a decision to run as is, alter, repair, monitor, or replace; guidance on an inspection interval is also provided



Example of FFS - Locally Thinned Areas

- Local Thin Areas (LTAs) found in a process vessel during a shut-down in the top head and cylindrical shell section
 - All LTAs had non-uniform thickness profiles; maximum depth found equal to 50% of t_{min} , located in largest LTA
 - Dimensions of largest LTA (in the cylinder) were 23 inches in the circumferential direction by 31 inches in the longitudinal direction
- FFS assessment using API 579 performed
 - Largest LTA partially repaired to avoid lowering of MAWP
 - Other LTAs found acceptable without repair
 - Changes made to vessel internals and process conditions to eliminate future damage
 - Inspection interval set in accordance with in-service code
- Vessel safely operated for 8 years without incident, results from last inspection indicate metal loss is not occurring



Applications for FFS

- Reactive Fitness for Service
 - Need to understand what caused damage
 - Select appropriate NDE characterization method
 - Assess future damage rate to obtain remaining life
 - Select proper monitoring and mitigation methods
- Proactive Fitness for Service
 - What are the potential degradation mechanisms?
 - What level of degradation is tolerable?
 - What level of remaining safety factor is acceptable?
 - What is the consequence of a failure?
 - Leak versus rupture?



Pre-Service Deficiencies

- Material production flaws: laps, laminations, voids, segregation, shrinks, cracks
- Welding related flaws: lack of penetration and fusion, delayed hydrogen cracking, slag, undercut, porosity
- Fabrication related flaws: out-of-roundness, forming cracks, lamellar tearing
- Heat treatment related flaws or embrittlement: reheat cracking, sensitization, sigma phase embrittlement, 885F embrittlement



In-Service Damage Types

- Corrosion
 - General Corrosion
 - Localized Corrosion
 - Pitting, Crevice, And Grooving Corrosion
- Cracking
 - Planar Cracks
 - Branched Cracks
- Metallurgical Changes & **Hydrogen Effects**
- **Distortion**



Summary FFS

- Safety can be maintained while operating equipment with flaws as long as an assessment is performed in accordance with standardized rules to determine acceptability
- API 579 provides these rules for damage mechanisms commonly encountered in the refining and petrochemical industry
- To date, well over 1,000 FFS assessments have been performed in the refining petrochemical industry without incident



RBI/FFS - Complementary Technologies

- Refining and Chemical plants may have thousands of pressure vessels and piping circuits
- RBI screening allows identification/ranking of high risk and low risk equipment to allocate resources accordingly
- Uses simplified models for damage and consequences and works at the equipment level
- A simplified methodology is used due to the volume of data and many damage mechanisms possible
- RBI assessment identifies deferral and elimination of equipment for inspection/testing/maintenance
- Identifies equipment items needing more attention



RBI/FFS - Complementary Technologies

- Interrelated technologies:
 - RBI used for multiple equipment/components at unit level
 - FFS used on individual equipment at component level
- Both require an understanding of damage or current condition to evaluate properly
- Assessment of remaining life and appropriate mitigation/monitoring methods
- FFS after RBI based on:
 - High risk equipment where known damage is nearing “retirement”
 - High likelihood equipment where FFS is used to calculate a more precise retirement date
 - The results of the FFS are used to update RBI assessment and appropriate inspection/monitoring strategies



Example of Complimentary RBI/FFS

- Perform RBI analysis for a large process unit
- Identify the top risk equipment driven by high likelihood
- Build FFS models for equipment for equipment and assess probability of failure and remaining life
- Update RBI assessment with quantitative FFS result
- Use the updated Risk to set next inspection interval and inspection



Future Directions

- FFS (API 579)
 - New damage types being added (hot spots, SOHIC/HIC) and existing methods updated (pitting)
 - Incorporation of RBI consequences to set FCA, RSF, partial safety factors, etc.
- RBI
 - Likelihood models to link more closely with FFS
 - Improvements of HTHA and Furnace models
 - Addition of additional damage mechanisms and equipment types
- An opportunity for improvement is to make RBI screening models and API 579 Level 1 consistent
- As use of both technologies spreads, a dynamic link between RBI analysis and FFS



Summary

- Properly integrated, Companies can improve:
 - Optimization of plant resources
 - Equipment availability, safety, and ROI
- Both FFS and RBI:
 - Address aging equipment
 - Provide proactive equipment assessment, often are handled separately
 - Are linked by damage mechanism and both have limitations due to NDE and consideration for future damage rate
 - Require properly trained highly-skilled resources
- Require Mechanical, Inspection, Materials and Operation disciplines to work together



API 571



Introduction To API 571

Overview

- **Damage Mechanisms**
 - Goal is to provide background information to inspection/mechanical personnel
 - Original basis: API Guide for Inspection of Refinery Equipment - Chapter 2 on damage
 - It attempts to support all of the other existing and newly developing API inspection related documents
 - Study aid for API Inspector Certifications
- **Organized into three major sections**
 - Process flow diagrams
 - Damage mechanism description
 - NDE methods for detection and assessment



Damage Mechanisms Considerations

- Material of Construction (general and specific information including heat treatment, chemistry, strength level, etc.)
- Service environment (normal and upset, trace amounts of corrosives, concentration, cycles, carryover, leaking valves, and particularly human factors, etc.)
- Frequency and rate of damage
- Mitigating factors (coking, crack closure, residual stresses, coatings, chemical additives, water wash)
- Warning systems/data such as online monitoring or probes
- Previous inspections findings and the effectiveness for detection of damage
- Morphology of the damage



Process Descriptions

- Simplified Process Flow Diagrams (PFD's) with most common material/damage mechanisms identified



Damage Mechanism Description

- Over 60 damage mechanisms common to the refining and petrochemical industry are included and placed into one of the five general categories
 - Corrosion (general and localized)
 - Stress corrosion cracking
 - Mechanical
 - Metallurgical
 - Other



Damage Mechanisms - Corrosion

- CUI
- High temp S and Nap acid
- High temperature H_2/H_2S
- Sulfuric acid
- HF
- Sour water
- Amine
- Caustic
- HCl
- Oxidation
- Na/V
- Ammonia
- Boiler water/condensate
- Hot flue gas
- Flue gas dewpoint
- Galvanic
- Crevice and underdeposit
- Graphitic of cast iron
- Soil
- CO_2
- Cooling water
- Atmospheric
- Biological



General Outline for Damage Mechanism Descriptions

- Description
 - Critical factors
 - Affected units or equipment
 - Expected damage (rates, etc.)
- Prevention & Mitigation
- Damage mode (specific key words) - localized, general, subsurface, surface, branched, property degradation
- Pictures - macro and micro



RP 571 Summary

- Intended to replace or supplement:
 - Appendix G in RP 579
 - Appendix A in RP 580
 - Appendix G-N in API 581
- Due for release in 2004



API Working Documents (API 510, 570, 653)



Relationship with API Inspection Codes and Standards

- API-RP 580 Risk Based Inspection Recommended Practice has been integrated with:
 - API-510 Pressure Vessel Inspection Code
 - API-570 In-Service Piping Inspection Code
 - API-653 Storage Tank Inspection Standard



API Working Documents

- RBI results can be used to establish an inspection strategy and better define the following:
 - The most appropriate inspection method based on the expected forms of degradation
 - The appropriate frequency for internal, external, and on-stream inspections
 - The extent of inspection coverage
 - The prevention and mitigation steps to reduce the likelihood and consequence



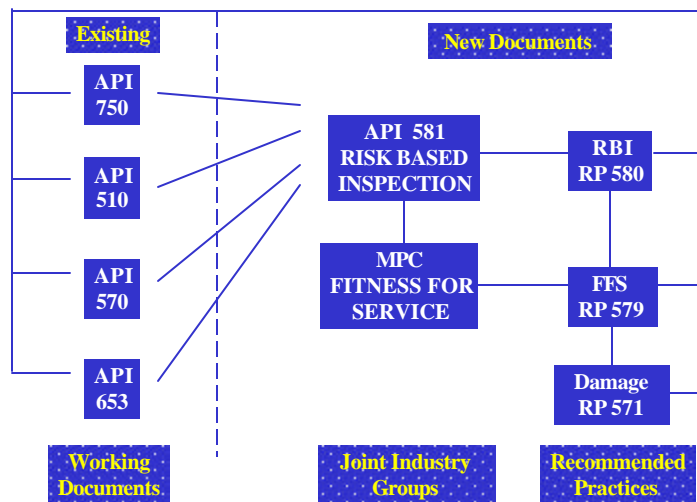
API Working Documents

- An RBI assessment may be used to increase or decrease the inspection interval.
- RBI assessments shall be reviewed and approved by a pressure vessel engineer and authorized pressure vessel inspector at intervals not to exceed 10 years or as defined in referenced Table....
- MOC - The likelihood of failure assessment should be repeated each time equipment or process changes are made that could significantly affect degradation rates or cause premature failure (API 510).

API Future Directions of the API In-Service Inspection Codes

- Need a firm understanding of potential damage mechanisms (API 571)
- Use RBI API (581 and RP 580) to set interval, scope, method for inspection, supplemented by appropriate monitoring (e.g. API 572, 574, 575, API 571)
- If flaws or damage are found, use FFS (API 579) to assess acceptability for typically one operating period, can be re-endorsed for future operating periods
- Current in-service inspection codes (API 510/570/653) will allow use of RBI & FFS at the option of the owner/user

API Relationship Between API Documents





Direction of API RBI User Group Activities



API RBI User Group

ADGAS	DNV	Petrobras
Amerada Hess	Dow	Portuguese Welding
BP	SGS (Shell)	Petro-Canada
Berwanger	Flint Hills Res.	Placid Refining
ChevronTexaco	Italian Welding Inst.	Saudi Aramco
Citgo	JGC Plantech	Suncor
Coastal, Aruba	Lyondell Equistar	Sunoco
ConocoPhillips	Marathon Ashland	TotalElfAtofina



Objective of API RBI Project

- Create an RBI **Methodology** for the Petroleum and Petrochemical Industry along with a User-Friendly **Software** package that includes **RBI Analysis**. The software will come complete with **User Manuals, Technical Manuals, and Training** for implementation by Sponsor Group Members.



API RBI Project

- Project initiated August 1993 with 16 sponsors
- 24 sponsor companies as of January 2003
- Project Value of **\$2,750,000** over 10 years
- Currently functioning as a User Group
- E²G as the primary contractor starting November 2001



Version 5.0 - Web Based Software

- Minimize system dependencies and conflicts
- Improve software distribution and maintenance
- Decrease software development time and cost
- Decrease new technology implementation time and cost
- Implement a software quality control program to reduce the incidents of bugs
- Implement data and user security
- Version 5.0 scheduled for Completion December 2003



Development of Schedule

- New Damage modules (1/1/03)
- Tank Module (1/31/04)
- Heat Exchanger bundle module (1/31/04)
- PRV module (7/1/04)
- Boiler module (12/31/04)
- Additional module improvements/additions (12/31/04)



Version 5.0 Improvements

- J-Tree Navigation Capabilities
- Corporation/Plant/Unit added to database structure
- Addition of Case (Date Stamping)
- Multiple Operating Condition capabilities
- ASTM Material Properties Database
- Code T_{min} Calculator
- Improved Inspection Planning Module



Summary of API RBI UG Direction

- Version 5.0 Software due for release January 1, 2004
- Technology improvements
- Multi-User, Three Tier Platform
- Database capabilities available for Access, MySQL, SQLServer, Oracle
- Additional Equipment modules in available in 2004



Q&A Discussion