

DIGITALPLANTSM

SOLUTION BY BENTLEY

AXSYS[®].Integrity

Introduction and Application

Some questions...?

What are the key items in the plant?

- Can be 1000's of tag items

What is the status of the plant after the last 10 years of operation?

How can maintenance be tasked to ensure maximum plant availability?

- without increasing the risk of unplanned outages
- and remaining in compliance of the regulatory regime

What are the consequences of doing nothing or deferring activities?

What is AXSYS.Integrity?

A system for assessment of engineering risk, life and integrity of pressure containing equipment used in energy production, chemical processing, storage and transportation of oil, gas, refined products and petrochemicals.

Joint Development Between



AXSYS.Integrity Vision

A software system to provide the link between plant performance and asset integrity...

A Risk Based Inspection tool, but more generally a platform for...

- ...establishing strategies for maximising plant availability.....

- ...providing inputs to the CAPEX/OPEX profile.....

- ... allowing asset owners to ask the 'what if' questions.....

Within a managed data environment

DIGITALPLANTSM

SOLUTION BY BENTLEY

RBI Approaches

Objectives of RBI Implementation

1. To adopt a risk focussed inspection approach:
 - Identify pertinent damage mechanisms.
 - Address ageing plant or process condition change issues.
 - Eliminate unnecessary or ineffective inspection.
 - Cost reduced inspection solution whilst maintaining safety.

2. To gain regulating authority approval for:
 - Extended running of pressure plant, especially for de-bottlenecking.
 - Defer internal examination or hydrotest.
 - World-wide trend towards 'due diligence'

3. Achieve auditable best practice, systematically addressing both safety and financial considerations.

4. Effectively manage inspection and historical data.

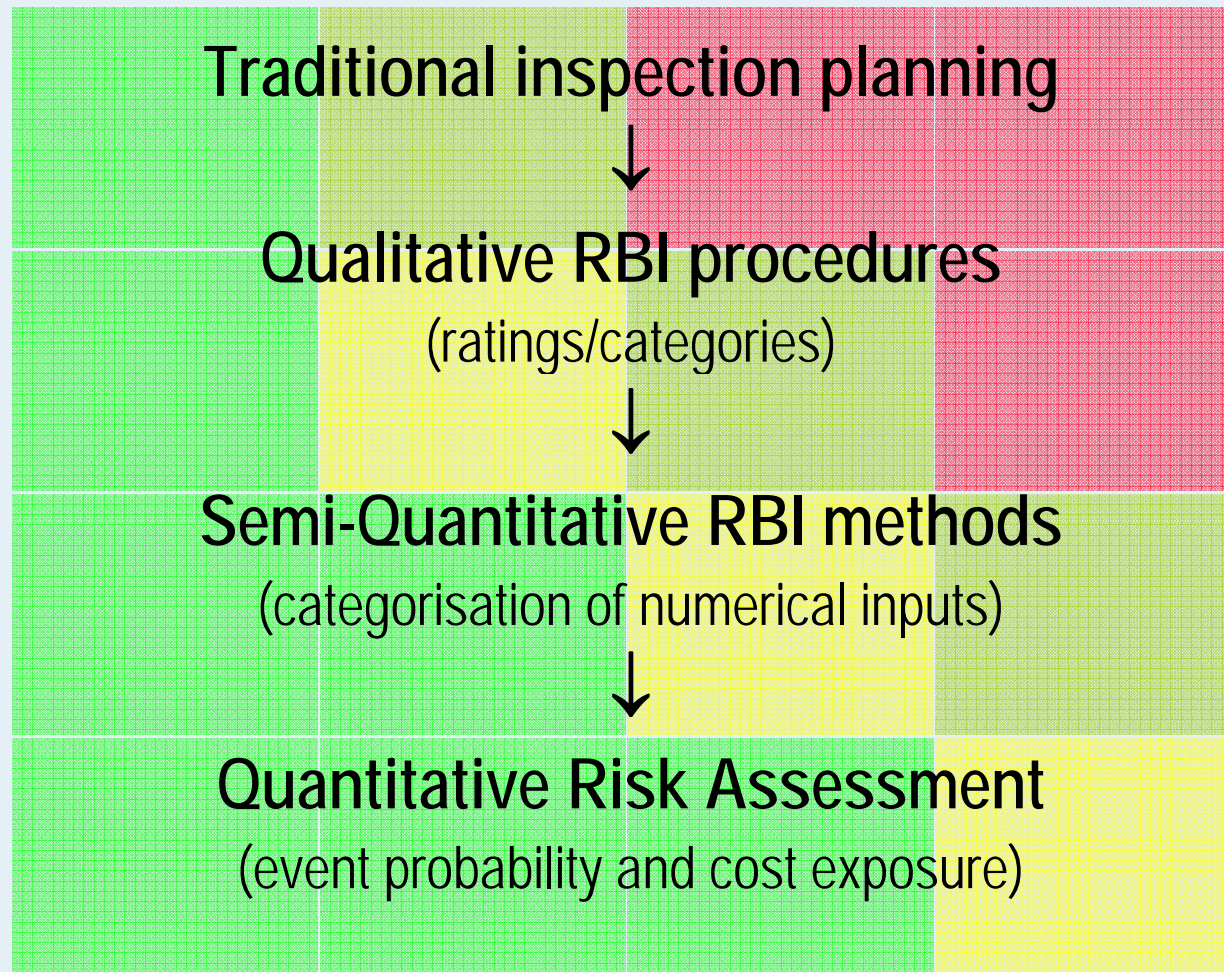
RISK as a Technical Term

The term “risk” is used in a TECHNICAL sense:

Risk = Likelihood of Failure × Consequence of Failure

The “risk” associated with failure is a combination of the likelihood of failure combined with the consequence of that failure.

RBI: Levels of Sophistication



RBI: Approaches

Qualitative: Expert judgement

- Useful for detailed analysis of small numbers of items
- Very dependent on assembled expertise
- Maybe 200-300 items...

Semi-Quantitative: Risk scoring based on calculations

- Useful for analysis of large numbers of items
- Useful for maximising usefulness of assembled expertise
- Maybe 100-10,000 items
- Calculations are rule based, and may be very sophisticated...

Quantitative: Definitive calculated risk

- Useful for detailed analysis of small number of items,
- probabilistic assessments of whole plant areas
- Expensive, because very detailed analysis

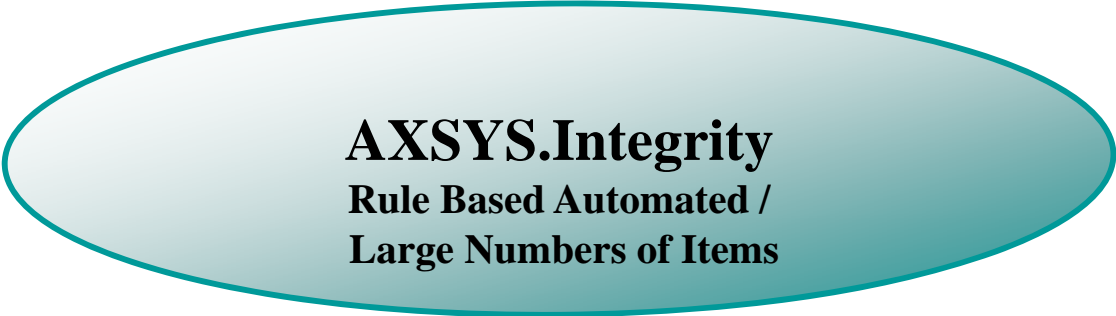
Risk Assessment Tools

Qualitative

Semi-Quantitative

Quantitative

Tools



AXSYS.Integrity
Rule Based Automated /
Large Numbers of Items

What does AXSYS.Integrity do...?

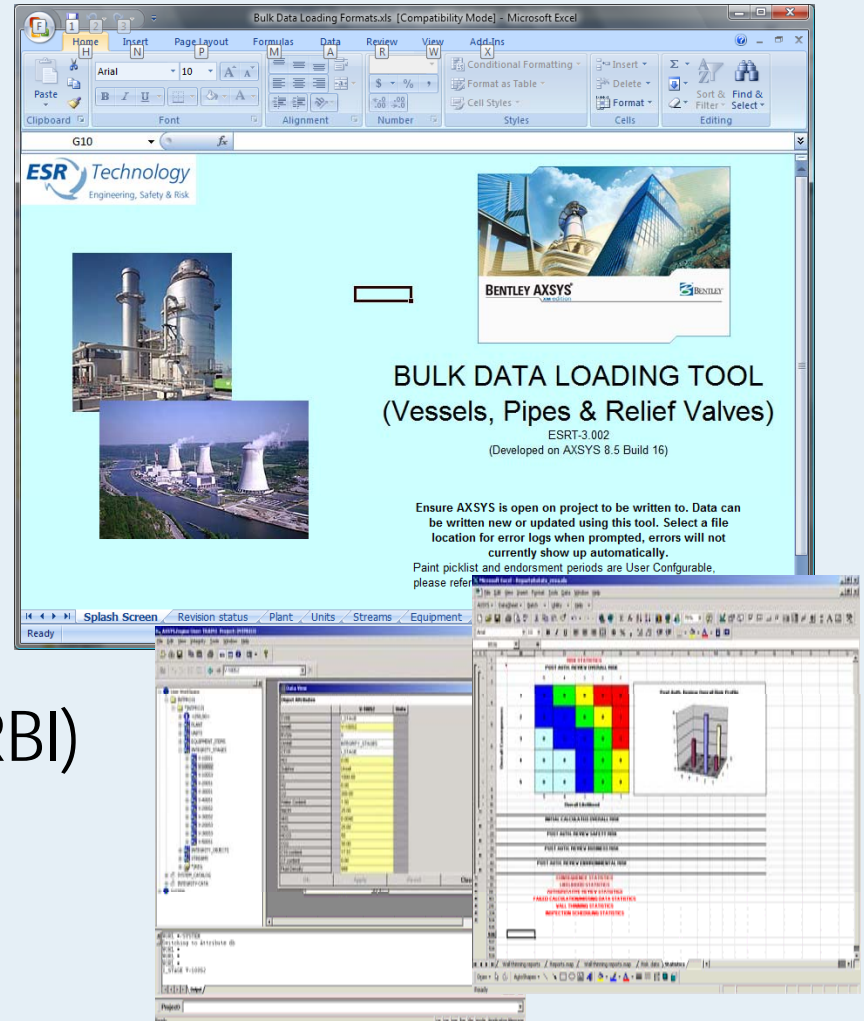
Definition of:

- probability of failure for each item of plant
- consequence of failure
- maintenance & inspection effectiveness

Risk mitigation methodology

Dependable basis for cost and benefit analysis

Output of inspection strategy and plans (RBI)



Likelihood Assessment

- Uses process stream data as input
- Considers full range of damage mechanisms – corrosion, erosion, creep, brittle fracture, fatigue, SCC, HIC, etc...
- Contains full database of code properties
- Designates a risk ranking to the various modes of failure
- Based on 40 yrs working in the structural integrity arena



Consequence Assessment

Safety

- toxic/explosive hazards
- population densities
- mitigation factor, eg gas detection, fire systems

Environmental

- contamination potential
- proximity to water courses
- mitigation factors, eg bunds, drains, isolation

Economic

- impact on plant production
- time to repair



Authoritative Review

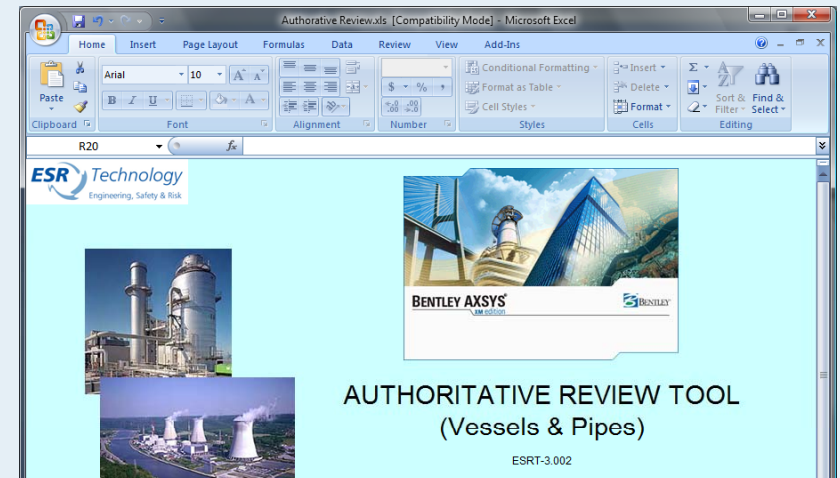
Allows input of new data

- measured corrosion data
- up to date inspection results
- dates of prior remedial actions, eg when last painted
- information on operating history

Filling any gaps

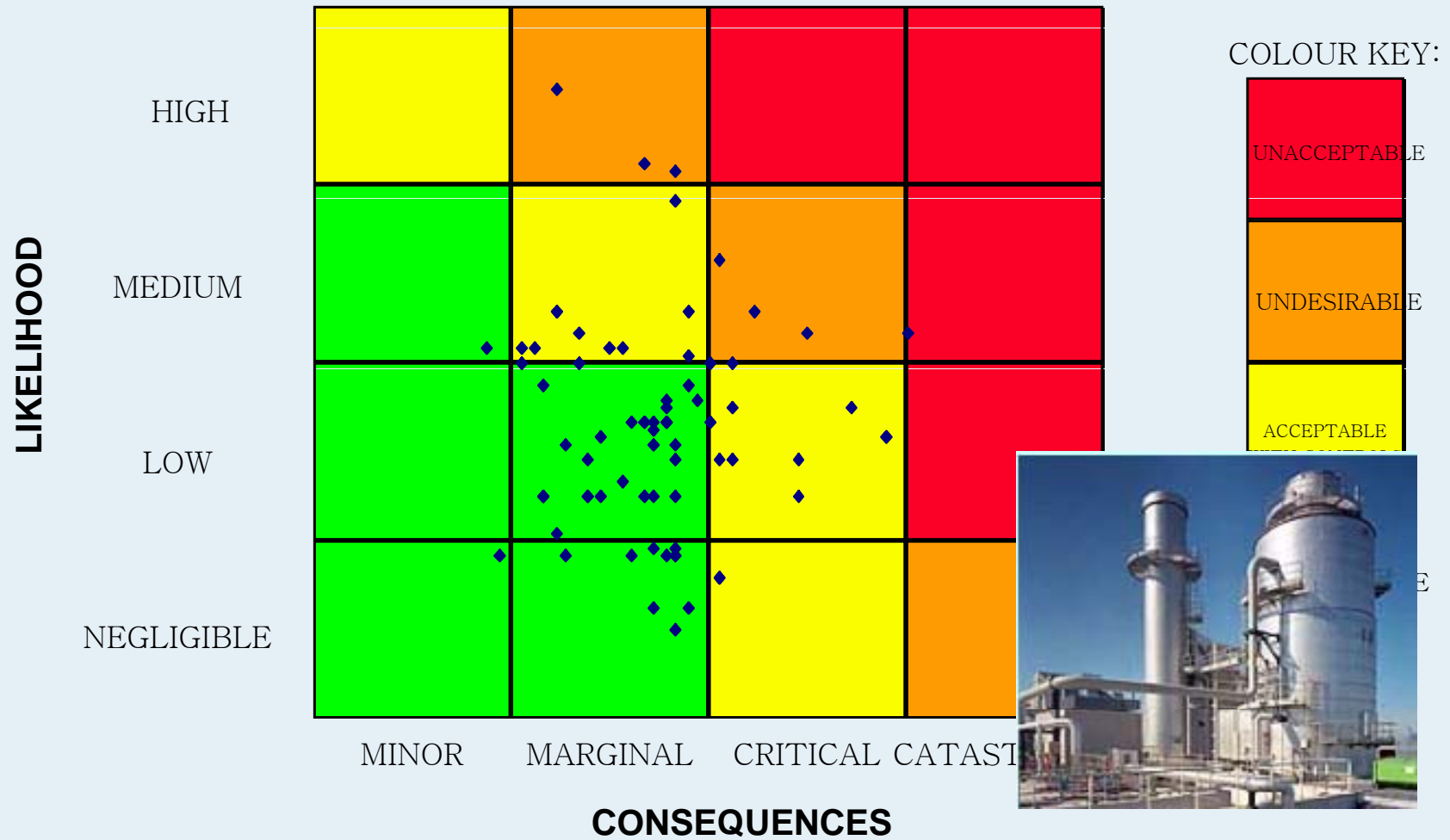
General approval of and commitment to input

Expert review



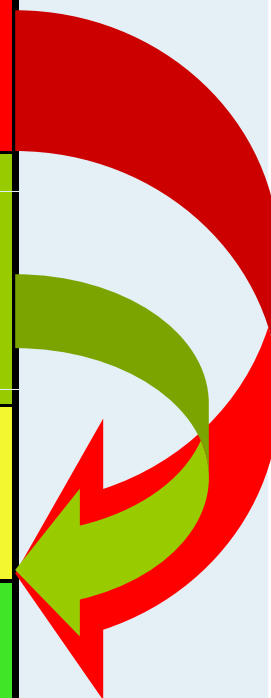
	Previous AR date	Previous AR comments	Previous AR sign off	Latest AR date	Latest AR comments	Latest AR sign off	Orig AR date	Prev AR date
1								
2								
3								
4	V-10051	1-May-2000 coatings	Joe Riggs	5/1/2000	coatings	Joe Riggs		
5	V-10052	1-May-2000 As per Stage 1	Joe Riggs	5/1/2000	As per Stage 1	Joe Riggs		
6	V-10053	1-May-2000 As per Stage 1	Joe Riggs	5/1/2000	As per Stage 1	Joe Riggs		
7	V-10054	1-May-2000 Stage 2 overall cor rate had not computed due to missing HIC rate, reverted to orig calc'd ammonium bisulphide cor rate. HIC susc downgraded on basis of map and process evidence (ref). Safety L_CONSEQUENCES downgraded after detail QRA	Joe Riggs	5/1/2000	Stage 2 overall cor rate had not computed due to missing HIC rate, reverted to orig calc'd ammonium bisulphide cor rate. HIC susc downgraded on basis of map and process evidence (ref). Safety L_CONSEQUENCES downgraded after detail QRA	Joe Riggs		

Use of the risk matrix.....



...to drive the actions....

Unacceptable risk	Urgent need to mitigate risk by Improved operating practices or controls Improved integrity management strategy Engineering measures to mitigate risk and/or consequences
Undesirable risk	Potential need to increase maintenance/inspection intervals or review inspection methods
Acceptable risk	Inspection strategy commensurate with turn around interval
Low risk	Possibility to defer or eliminate inspection subject to legislation or insurance



Outputs

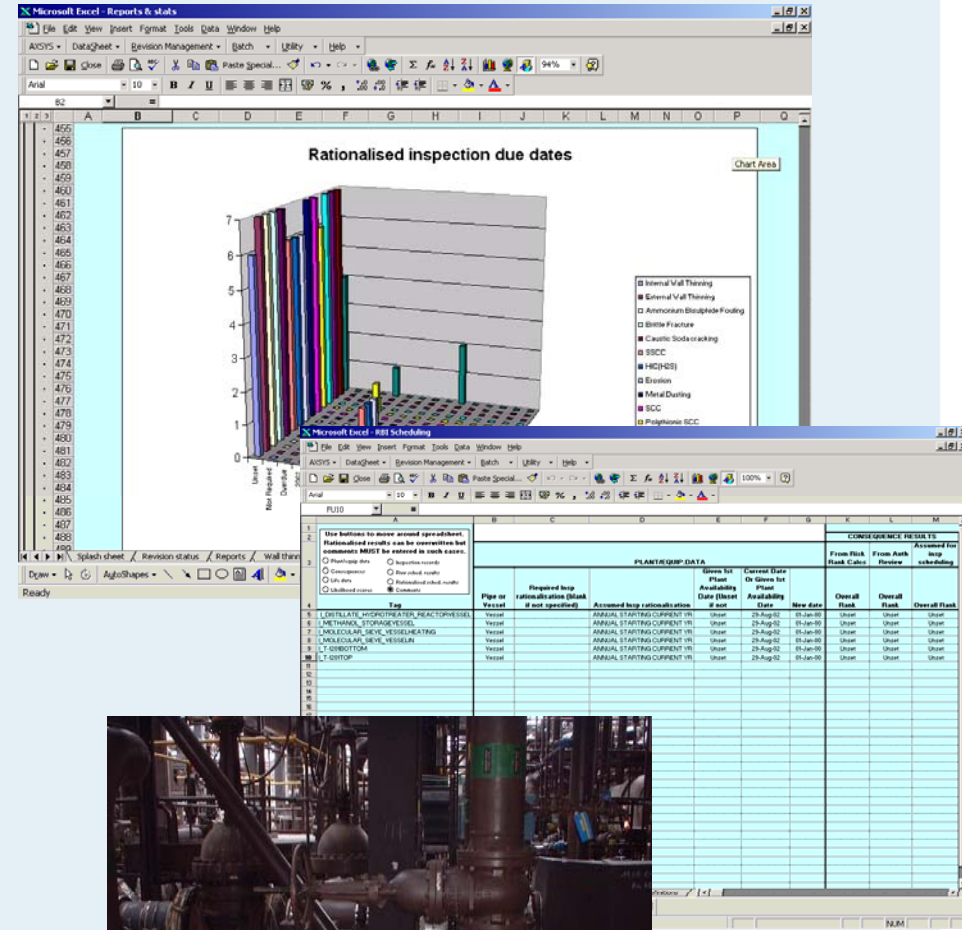
Risk based inspection (RBI) schedules

- when & how
- tied into planned outages

Identification of critical items

- need for CAPEX?
- mitigation strategies

Opportunity to manage the options



Why Use a Software Tool?

Allows a large number of components to be evaluated.

Provides a structured approach, for assessing the financial and safety risk associated with plant failures.

Demonstrates a clear link between:

- the assessed risk.
- the requirement for a control/ inspection.
- the timescales of the proposed control/inspection.

Facilitates comparison between alternative inspection strategies,.

Provides an audit trail for the basis of the decisions.

Allows easy updating.

Impact on Plant Availability

Management of the planned shutdowns

- the right actions
 - at the right time
 - looking for the right things
 - with the right equipment
- ... to minimise the impact.

Manage the risk of unplanned outages

- identify the high risk plant
- implement mitigation strategies

AXSYS.Integrity – Making the difference to plant management

Linking plant performance to equipment integrity

Identifying the priority actions, linking them to the benefits (\$\$\$'s)..... whilst maintaining safety, reliability and availability

Helping to answer the 'what if' questions

