

## Risk Based Inspection (RBI)

### For Oil & Gas, Power and Petrochemical Installations

Risk Based Inspection (RBI) is a systematic approach to create an accurate, well targeted inspection strategy based on risk. The inspection plans are developed to mitigate the specific failure mechanisms identified. It is applicable to offshore & onshore installations such as fixed or mobile units as well as FPSOs and pipelines.

#### Issues

The oil & gas, process industry handles a wide range of flammable and toxic materials which are potentially hazardous. To reduce the hazards to an acceptable level, the authorities through legislation, have imposed requirements on the management of plants and facilities, requiring it to demonstrate that it has identified the existing hazards and undertaken mandatory inspection and mitigation measures to prevent accidents. In the cyclic nature of the business, operators constantly find themselves having to balance between meeting the regulatory requirements to shutdown and avoiding business interruption. Those plants that succeed in operating more efficiently and reliably will be better positioned to ensure long term survival and success. Increasingly, innovative asset integrity strategies such as RBI are being implemented to meet these goals.

#### Solutions

VELOSI's Asset Operations Process is based on a risk-based strategy for maintenance and inspection planning (i.e. time based, condition-based, operational or corrective maintenance). These strategies are associated with company and plant objectives towards plant availability and safety. Risk-based methods like Reliability, Availability and Maintainability (RAM), Reliability Centred Maintenance (RCM) and Risk Based Inspection (RBI) can be used to rank systems and equipment and develop strategies for maintenance and inspection.

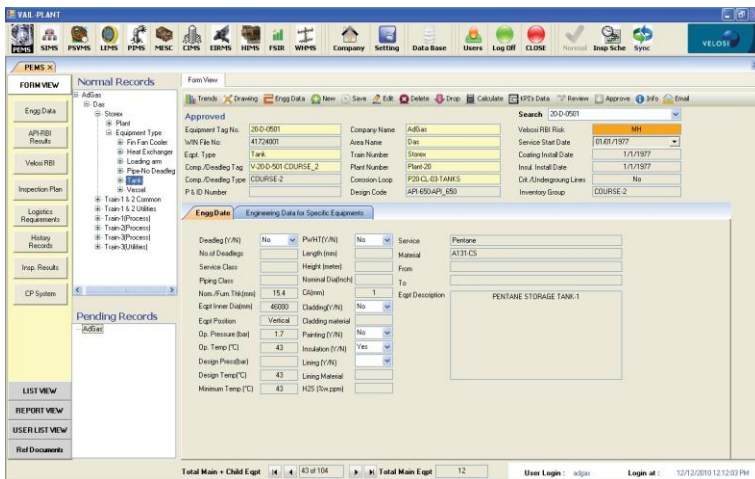


Minimize the lost production and downtime through building cost effective inspection program without compromising safety and the environment.

## Software tool for RBI Planning & Inspection Data Management

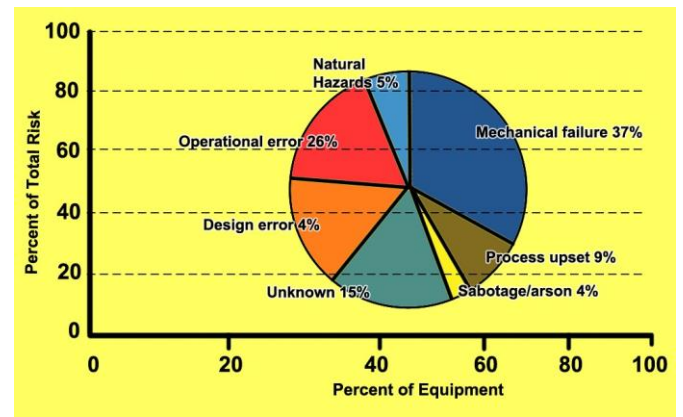
VELOSI has developed a sophisticated software suite called VAIL-Plant to assist in RBI Planning and Data Management. Major features include, not limited to,

- Inspection Knowledge Management
- Risk Management
- Inspection planning management
- Dashboard (trends)
- Plant Inspection Requirements (PIR's).
- Inspection Resource Planning
- Equipment Condition Monitoring
- Link documents and drawings to assets and allow viewing
- Classification of equipment type based on the plant hierarchy
- Equipment health monitoring
- Capture reliability data
- Inspection history recording
- Failure & replacements history data capturing
- Counting of failures/leaks against a customized filter and reporting
- Provides criticality assessment using API RBI quantitative & Velosi qualitative methodology
- Import & export of bulk data using standard format

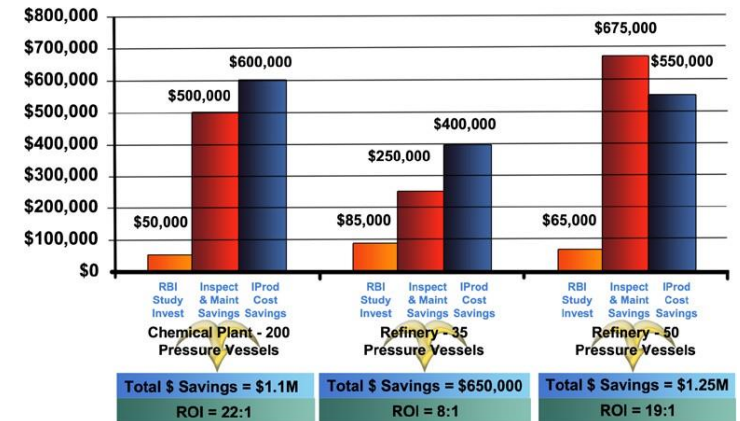


## RBI outcomes

- Risk ranking, risk matrix and pareto curves
- Risk driving degradation methods
- Probability of failure and consequences for each individual equipment item
- Calculates consequence to personnel, environment, production loss and material damage for ignited and unignited leaks
- Evaluation of the impact of changes in process conditions and materials on installation risk and inspection program
- Effect of inspection effectiveness and the number of inspections on the individual equipment item risk for a given period of time
- Inspection guidelines and detailed equipment inspection plans can be derived



Curve demonstrates how 80-90% of risk is contributed by only 10-20% of a plant's fixed equipment, while pie chart shows that mechanical failure contributes to more than 37% of process related releases.



Cost of Implementing RBI represents only minimum expenditure, when compared to the total savings that can be enjoyed.

## The benefits

- Establish risk ranking among individual equipment items in order to optimise inspection efforts and reduce costs
  - All pressure equipment contains flaws
  - Most flaws are innocuous; just a few may cause critical failures
  - Those critical flaws must be found cost effectively
- Extend inspection intervals beyond statutory requirements
- Potential for reduction of production loss during turnaround inspection
- Increase confidence in equipment integrity
- Established path to regulatory approval

## VELOSI's experience

- VELOSI's involvement with more than 50 studies world-wide of different process plants onshore, offshore topsides and pipelines, shows that application of RBI methodology can lead to more structured inspection regime and substantial cost savings for the oil & gas industry
- Cost savings are achieved from reduced time required for turn-around inspection, deferral of inspection and by specification of optimized online inspection to replace intrusive inspection