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Reducing Operational Uncertainty

Using Asset Integrity Manager to achieve cost saving, safety improvement, and productivity

White Paper

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Introduction to Asset Integrity Management

Managing assets, in any industry, optimally has become crucial for organizations to stay competitive in today's global market. Industries are on the edge of a new trend in asset efficiency improvement, with the current pressures in realizing optimal value from their assets. The challenge for companies is the necessity of maintaining, and often increasing operational effectiveness, revenue, and customer satisfaction, while at the same time reducing capital, operating, and support costs.

Many old plants' assets are at risk of failure from age-related damage mechanisms requiring mitigation actions. These assets cannot be replaced and need to have their useful life extended. Therefore, the common challenge is to maintain production capability in a cost-effective way while preserving the integrity of those assets. Asset Integrity is the ability of an asset to perform its required function effectively and efficiently whilst protecting health, safety and the environment [1]. Asset Integrity Management (AIM) is the means of ensuring that the people, systems, processes and resources that deliver integrity are in place, in use and will perform when required over the whole lifecycle of the asset.

An effective AIM program provides assurance that a facility's equipment and assets are designed, fabricated, procured, installed and maintained in a manner appropriate for its intended application, throughout the life of the operation [2]. AIM will provide the foundation for Asset Performance Management (APM) to maximize business performance, Figure 1.

Figure 1 – Asset Integrity Management position in conjunction to safety and operational performance – Source: SPE [3]

As a risk management program, AIM focuses on the core elements of safety, environmental protection, reliability, regulatory compliance and data management [4].

Risk-based approach to Asset Integrity Management

Decisions within AIM regarding monitoring/inspection, repair, maintenance and replacement have traditionally been based on a range of practices including the prescriptive time-based approach, rule-based approach, condition-based approach or reactive maintenance [5]. Risk-based decision supporting tools are being recently developed in response to industry's need for optimum management of assets. Schematics of risk reduction using risk-based tools compared to traditional programs is illustrated in Figure 2. These tools provide asset owners with a basis for making decisions on often complex major investment issues. Whilst there will remain the need for traditional approaches to AIM, more advanced approaches are required to reflect the complexity of different assets, constraints operational conditions, and to operate at an optimal level within the competitive pressures faced by asset managers.

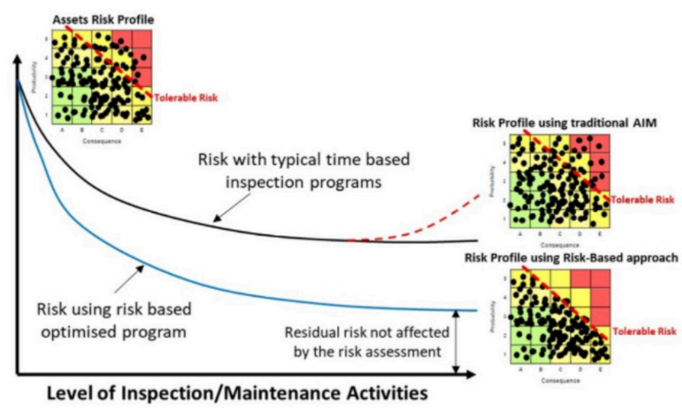


Figure 2 – Management of risk using risk-based approaches towards inspection and maintenance – Source: API 580 [6]

Risk-based approaches, as opposed to many other approaches, give operators flexibility in the management of their assets as a result of undertaking actions not on a fixed schedule or rule, but on some identified risk-based criteria to prioritize efforts. Risk-based inspection has been a major step forward in improving asset integrity and optimizing costs of inspection by focusing efforts on high risk systems and assets and preventing lost profit due to failures. The uptake of risk-based practices is growing as increased operational experience and a greater understanding of asset failures (and its consequences) lead asset owners to adopt a more informed approach to planning, targeting resources to reduce risk to as low as reasonably practicable (ALARP) [7].

Managing Risk by Reducing Operational uncertainty

One objective of AIM is to direct the management decision-making process of prioritizing resources to manage risk. Asset monitoring influences the uncertainty of the risk associated with equipment primarily by improving knowledge of the deterioration state and predictability of the probability of failure (PoF). Utilization of risk-based approach to AIM, provides a vehicle for continuously improving the inspection and maintenance of facilities and systematically reducing the risk, but secondary achievements will be life extension while reduction in OPEX and CAPEX are considered as long-term impact of this program [8]. Benefits of implementing such an effective AIM program is summarized in Figure 3.

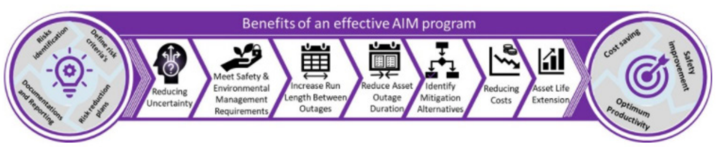


Figure 3 – Benefits of an effective AIM plan

An effective risk-based program identifies and measures the relative uncertainties associated with ascertaining the condition of the equipment. In this approach, risk is utilized to identify and prioritize when those uncertainties must be reduced, typically by improved knowledge though additional data. This is achieved by improved knowledge about the degradation rates and condition of equipment via inspection and other monitoring methods [9].

At the same time, any AIM planning should include cost-effective actions along with projected risk mitigation. Risk-driven plans also identify assets that do not require monitoring or some other form of mitigation because of the acceptable level of risk associated with the asset's current operational constraints. In this way, in addition to risk reductions and process safety improvements, risk-driven plans may result in cost reductions.

Risk management plans should be adjusted appropriately to offer the added advantage of identifying gaps or shortcomings in the effectiveness of commercially available inspection technologies and applications. In cases where technology cannot adequately and/or cost-effectively mitigate risk, other risk mitigation approaches can be implemented.

Achieving Lowest Life Cycle Cost with AIM

Reduction of risks to a lower level may not always be practical due to technology and cost constraints. An ALARP approach to risk management or other quantitative risk management approach may be necessary for such assets (or subcomponents). This approach uses a statistical approach to establish the optimum timing and extent of capital/operational expenditures when it comes to inspection/maintenance activities [7]. A risk analysis method of life cycle performance provides promising approach for economic justification of inspection, repair, rehabilitation and replacement decisions. The most practical and cost-effective risk mitigation strategy can then be developed for each asset (or its subcomponent). Inspection costs can be more effectively managed with the use of the risk-based plans to those areas or systems identified as a higher risk or targeted based on the strategy selected.

Consequently, this same strategy allows consideration for reduction of inspection activities in those areas that have a lower risk or where the inspection activity may have little or no effect on the associated risks. Another opportunity for managing inspection costs is by identifying items in the inspection plan that can be inspected non-intrusively on-stream. Non-intrusive inspection may contribute to increased uptime of the unit (increase run length between outages). Figure 4 below compares how both time-based and risk-based approach affect asset availability across a timeline.

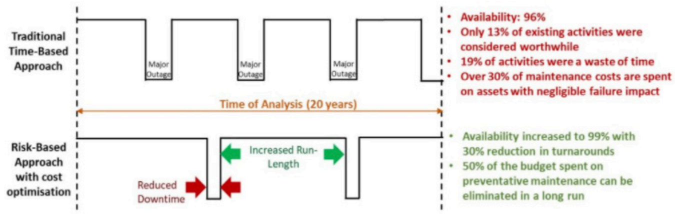
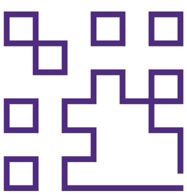


Figure 4 Example of comparison between time-based and risk-based approaches – Source: Inspectioneering, ARC and OEA [10, 11 and 12]

Digitalizing Asset Integrity Management



The risk-based management approach to AIM is based on a mathematical and statistical models using all asset data (from design, inspection, maintenance and operation). Using these swathes of data intelligently in conjunction with an AIM solution software allows tuning maintenance and inspection activity in response to changing reliability and commercial attributes of the asset or facility, minimize operational costs, reduce facility downtime and continuously demonstrate lowest total cost of ownership [11]. Asset owners need a common information system for AIM based on a modern Inspection Data Management System (IDMS). The IDMS and risk-based programs must be implemented with a clear, comprehensive plan. This will enable process expertise to align software elements with the organization’s work processes. Additional efficiencies can be gained by integrating the IDMS with the organization’s Computerized Maintenance Management System (CMMS) and Enterprise Resource Planning (ERP). Integrated applications reduce redundant data management efforts, improve workflows and information sharing, and enable visibility to insights generated by the IDMS system. These applications support risk-based and predictive decision-making practices to reduce operational uncertainty to achieve cost saving, safety improvement and productivity.

Siemens Energy PS Asset Integrity Management software

PS Asset Integrity Manager software, from Process & Safety Consulting, is an industry leading software for safety critical equipment, corrosion monitoring, fixed interval and risk-based inspection and mitigation planning. PS Asset Integrity Manager incorporates recent advances in technology, as described above, for optimizing inspection time and cost through real time analysis and bidirectional transfer of data with data loggers, spreadsheets, 2D & 3D MicroStation drawing or computer aided design software, CMMs and ERP systems. PS Asset Integrity Manager, backed by over 30 years of technology expertise, is now recognized as the leading solution provider for inspection data management and risk-based assessment with more than 1000 users and 100 installations worldwide.

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