OPTIMIZING ASSET RELIABILITY TO DRIVE BUSINESS RESULTS

A White Paper

for the Power Industry

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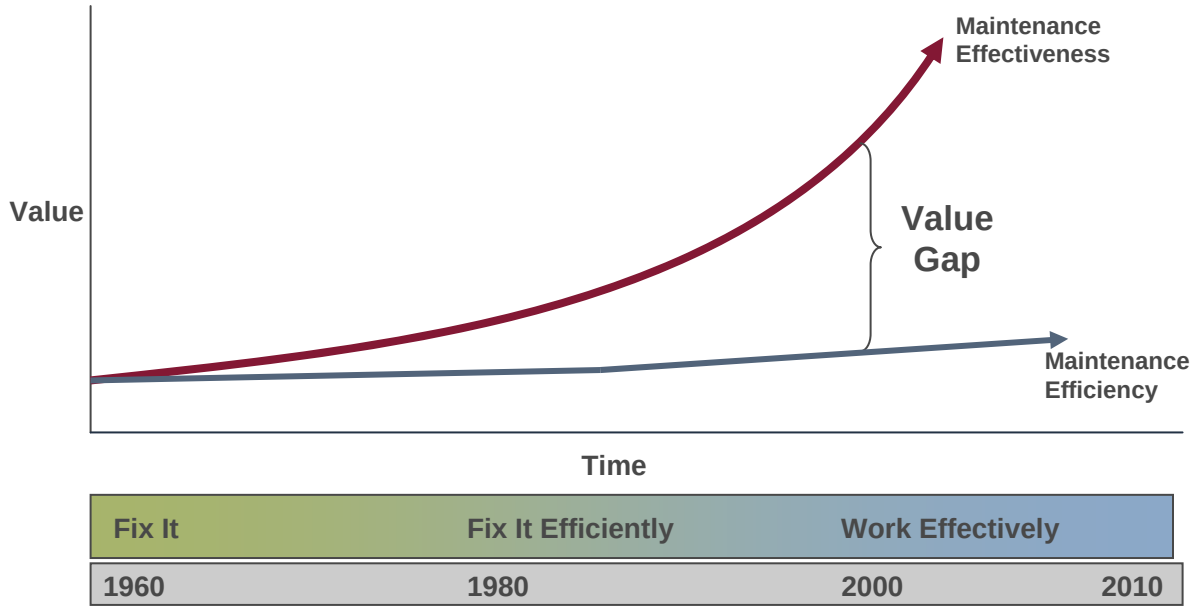
The approach to maintenance in the power industry has dramatically changed in recent years. Maintenance has been elevated to strategic levels in the organization because the goal of long-term profitability is strongly connected to the reliability of company assets. To gain a competitive advantage, companies have recognized equipment reliability as a strategic component in their plans for future success. Maintenance goals are now aligned with company goals to achieve higher returns on asset investments, to increase output and revenue, and to ensure safety and environmental integrity. Now more than ever, with shrinking budgets and fewer resources, maintenance requires innovative solutions to maximize equipment reliability while optimizing cost efficiencies.

But realizing the full strategic value of maintenance to a company's bottom line cannot be done through incremental improvements in efficiency. Organizations need to be thinking about how they can improve maintenance effectiveness by focus on doing the right work. The real value is in recognizing how to do the right work – that is the maintenance tasks that represent the minimum amount of work to ensure that a given asset delivers the performance needed.



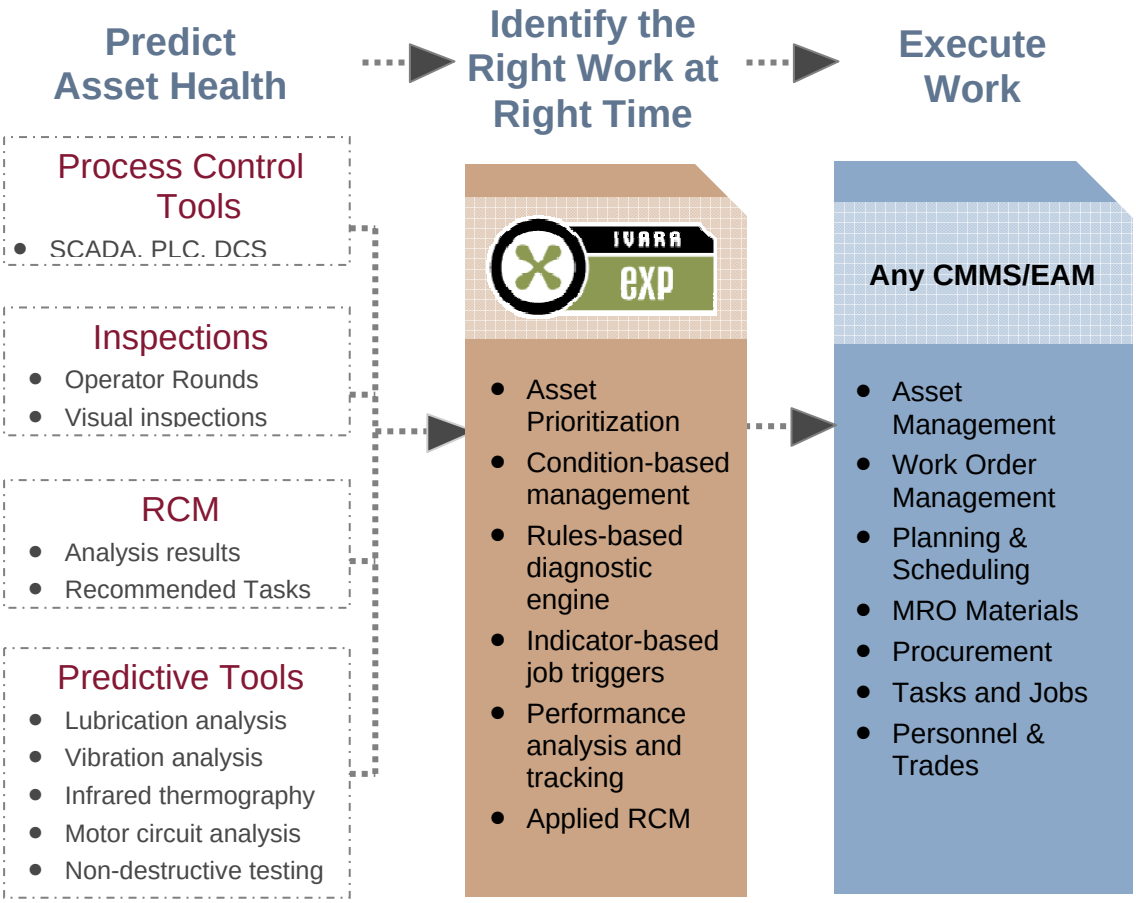
The Maintenance Value Gap

To improve reliability, most power plants are using, or have experience with, various reliability practices such as Reliability Centered Maintenance (RCM), Maintenance Task Analysis (MTA), predictive maintenance technologies such as oil analysis and thermography and software such as Computerized Maintenance Management Systems (CMMS). These capabilities no longer represent leading edge thinking in maintenance, but rather, they now represent the baseline from which thought leaders in this field have progressed.

The next step in achieving improved maintenance effectiveness is to move toward a reliability culture within maintenance. Establishing solid work identification methodologies and introducing

condition monitoring is a great first step in this effort. Leading companies are employing advancements in reliability and maintenance practices and deploying enabling reliability technology to support the move to proactive, condition based maintenance. Achieving and sustaining improved levels of reliability will help manage maintenance costs more effectively.

Ivara EXP reliability software supports proactive, condition-based maintenance. In fact, this software directly links all of your sources of condition monitoring to CMMS and Enterprise Asset Management (EAM) systems. Ivara EXP reliability software also captures the asset maintenance program knowledge of maintenance gurus that are in short supply in power plants today. The software leverages investments in MRO's Maximo or any other CMMS since it addresses the necessary upfront strategic planning, work identification and ongoing condition monitoring to feed the CMMS the right work at the right time.



How reliability software fits in

ADDRESSING THE CHALLENGES FACING MAINTENANCE ORGANIZATIONS

Optimizing equipment reliability within manageable costs is not easy. Maintenance organizations in the power industry are faced with many challenges amidst restructuring and consolidation of electrical-generating power plants. Business models are changing. Where price was once determined by cost plus profit, today, profit is determined by a set price less costs. So, cost management has a direct impact on profitability.

Power plants are now taking drastic cost-cutting measures, like reducing engineering staff by 10-25%, forcing maintenance and reliability organizations to do more with less. At the same time, many companies are struggling to capture the enormous amount of knowledge lost as experienced maintenance workers retire.

CAPTURING THE KNOWLEDGE OF THE AGING WORKFORCE

According to the Hudson Institute's latest study of the state of the workforce in North America, more than 30-40% of maintenance trades people will be retiring over the next 5 years. This problem is particularly acute in the power industry where estimates are as high as 50%. During their twenty to forty years on the job, trades people collect a wealth of knowledge that is rarely documented or transferred to others. Well-seasoned maintenance veterans are intimate with their equipment and can quickly repair equipment to avoid downtime.

This knowledge includes asset prioritization, asset indicator targets, inspection knowledge and general know-how pertaining to the maintenance of the assets. This critical information is often just memorized by the employee or manually recorded in black handbooks. All of this knowledge is lost, as employees retire, in companies that are unable to systematically collect the information as the employee performs his/her job.

Employee knowledge stored only in handbooks will be lost

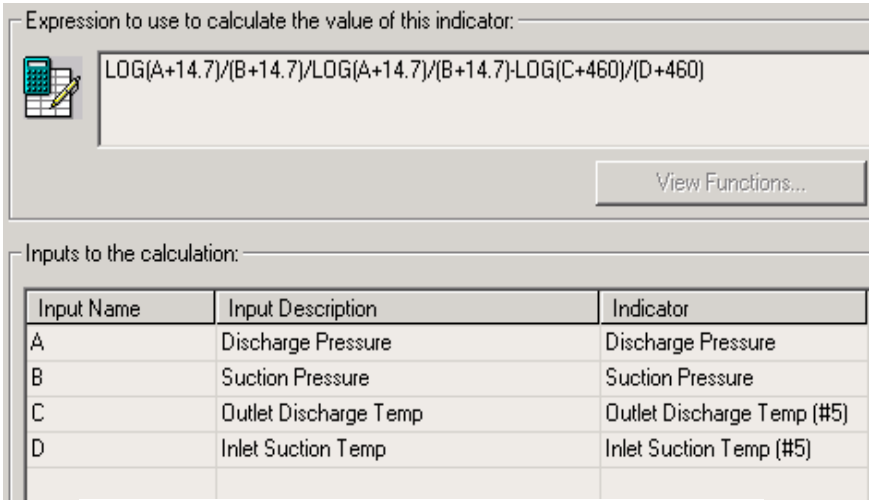
According to the Nuclear Energy Institute, 25% to 30% of the nuclear industry's workers will be eligible to retire in the next five years. This magnifies the problem of capturing the knowledge of the aging workforce before they retire. At the same time fewer people are entering the trades. Apprenticeship programs are at their lowest levels ever. Enrollment at educational institutions has dropped by two-thirds over the past 10 years.

The nuclear power industry will soon be faced with the prospect of insufficient personnel to support advanced reactors and the regulatory operations of existing reactors. The end result is that utilities may find themselves with few employees on hand to run plants just as they are seeking ways to extend their equipment lifespans.

The Nuclear Regulatory Commission expects at least 85% of the 103 nuclear plants in the US will try to renew their operating licenses. Many utilities are scrambling to find fresh talent just as the industry prepares to expand its operations.

Ivara EXP can help to address the issue of the aging workforce. Years of asset maintenance program experience can be captured within the software including;

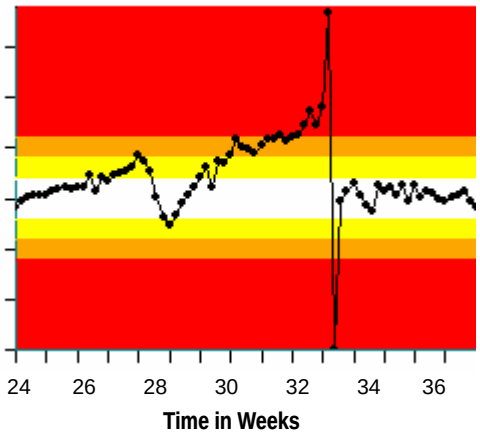
- the specific targets for normal and non-normal ranges of condition data, from simple numeric values to more complex rules-based engineering calculations as specified by the expert
- recommendations on the specific work that needs to be done to prevent failure and optimize asset performance.



Ivara EXP reliability software captures the knowledge of your maintenance experts and eliminates manual calculations

The result of the automated analysis and comparison of indicator conditions is displayed as flashing alarms, drawing attention to those indicators that have fallen outside of the normal condition.

And automatic charting of asset health indicators allows trends to be easily noticed. Even better, alarm notices can also be communicated via e-mail or text pager as soon as an alarm range is reached.



Condition Indicator Graph

DOING MORE WITH LESS, THE EFFICIENT WAY TO OPTIMIZE RELIABILITY

Management teams are quickly realizing that they need to do more with less people and they need to provide people with the necessary tools to effectively perform their duties to optimize equipment reliability. While Computerized Maintenance Management Systems (CMMS) enable Maintenance to be more efficient in executing maintenance work, they do not address the necessary upfront analysis of condition data required to identify the proper work to perform. Ivara EXP reliability software replaces the manual effort now used to collect and analyze condition data.

Reducing the reliance on engineers to analyze condition data is critical in the power industry where equipment failure can be catastrophic. Recall the Three Mile Island reactor accident - one of the worst U.S. nuclear power plant accidents ever. The Nuclear Energy Institute stated

that the cause of this accident was a combination of equipment failure, inadequately designed instrumentation and the inability of the plant operators to understand the reactor's condition. Today, to comply with government regulations, engineers in the power industry have been very diligent in collecting and storing equipment condition data. But this activity requires the analysis of masses of data each day, and the work is often performed by many engineers, aiming to isolate potential problems before equipment failure or loss of output occurs.

Ivara EXP automates the process of collecting and analyzing vast amounts of condition data so that the preventive or corrective work that needs to be done is executed in a timely manner – more effectively managing failures and freeing up engineers to perform more mission-critical tasks.

Tradesman performing manual calculations to assess equipment condition

Tradesman collecting readings using Ivara EXP reliability software on handheld device - with instantaneous feedback on alarm conditions.

Nuclear sites are expending significant engineering resources to comply with regulations because failure to comply could result in the revoking of the operating license of the offending nuclear facility. Today, software is available that automates the process of collecting and analyzing the vast amounts of condition data required by this regulation, triggering alarms and recommending the work to be done when asset health indicators fall outside of targets.

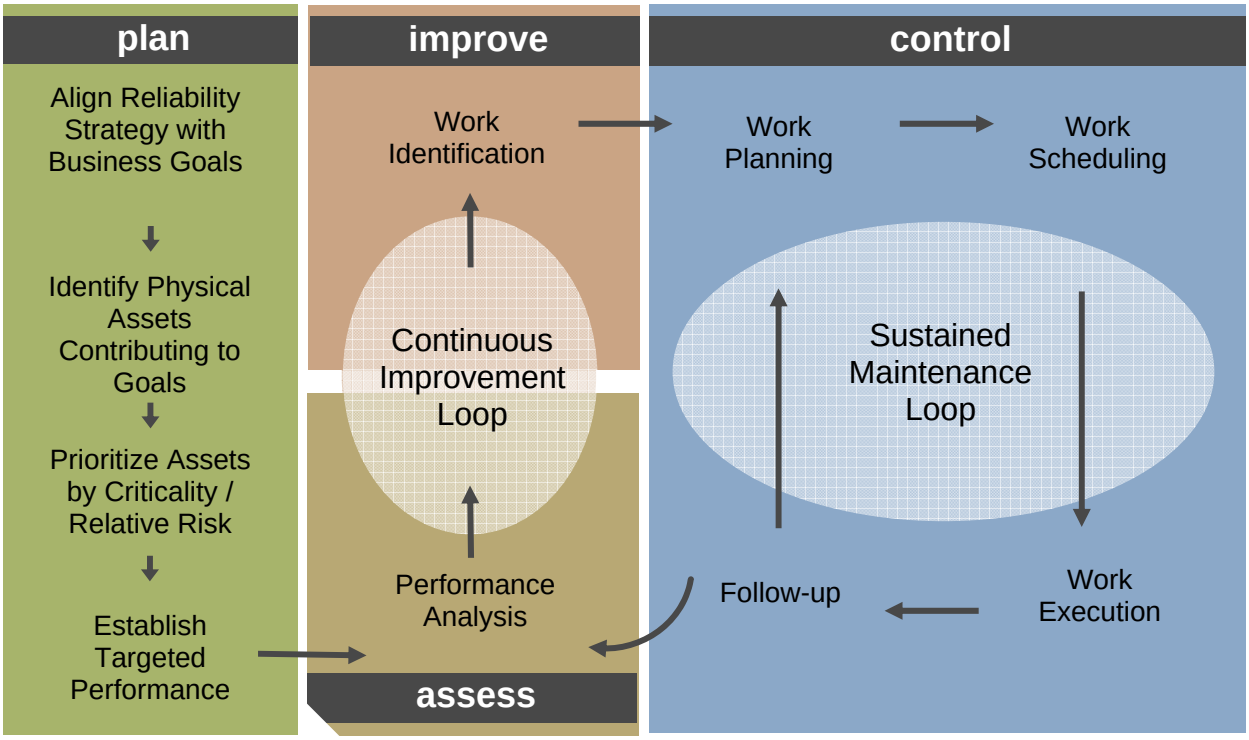
Ivara EXP manages all asset health data, from online predictive to RCM findings and also visual inspection data from engineering walkdowns and operator rounds. EXP then analyses the data – comparing various data points to get a true picture of the operating health of the equipment. Engineers no longer need to remember, or spend time repeating, manual calculations because software can perform the calculations automatically and then present the results visually as flashing alarms.

Condition monitoring alone is diminished in value if the data is not analyzed and utilized to trigger the right work at the right time. Ivara EXP analyses the data and then directly links the results to a CMMS, triggering the recommended action. Ivara EXP adds value to any CMMS

since it addresses the necessary upfront work identification and ongoing optimization of the equipment maintenance program.

THE UNDERLYING BUSINESS PROCESS FOR RELIABILITY

Like any business process, the equipment reliability process requires a disciplined approach, where people do the things they need to do in order to achieve optimal levels of asset reliability. When supported by reliability software and practices, a reliability focused maintenance process will help to further enhance and sustain a proactive work culture. Proven quality management principles should guide the business process in order to achieve optimal levels of reliability. The stages of plan, assess, improve and control can be applied to the maintenance process.



Asset Reliability Process

In the plan stage, maintenance goals are aligned with the business goals of the company – a well-laid out reliability strategy and plan is developed to help reach company goals. Since business units or areas within a company tend to exhibit differing stages of proactive maintenance, the plan leverages the tools and capabilities already in place and then moves it forward with formalized reliability practices. The plan identifies the assets at highest risk to the company (those that matter a lot when they fail and are failing a lot), and establishes specific performance targets for those assets.

The assess stage measures and analyzes the actual performance of the asset and prioritizes any gaps in performance. Performance gaps are functional failures or the inability to meet performance requirements set for an asset. The fundamental requirement of measuring

performance remains the key to achieving day-to-day business objectives. Management and leadership guru, Peter Drucker, once said: “It is not possible to manage what you cannot control and you cannot control what you cannot measure”. With visible performance metrics, awareness of current performance against company goals is maximized. It is the visibility of performance metrics that drives corrective actions, verifies gap closure and fosters a culture of continuous improvement.

In the improve stage, today, more advanced methodologies are being selected to evaluate and improve equipment maintenance programs. Proper work identification is the cornerstone of reliability improvement. Methodologies, typically founded in RCM principles, guide the fundamental shift from conventional time-based maintenance to a reliability driven maintenance approach. The risk to the company and the opportunity to improve reliability differs from asset to asset, so different methodologies are employed.

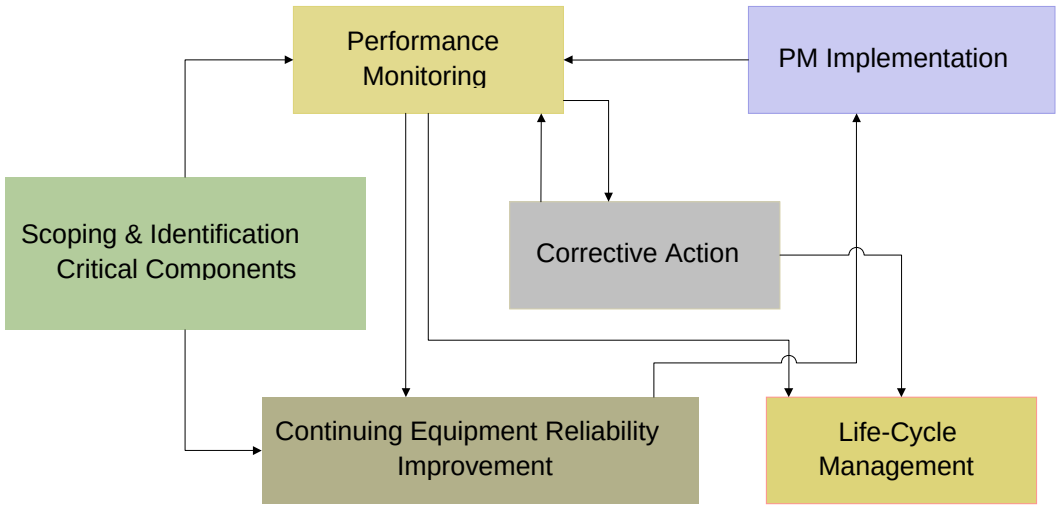
RCM2, developed by John Moubray of Aladon Ltd., is an advanced version of the original RCM process and is the most rigorous form of work identification available today. As such, RCM2 should be used first for the highest priority assets while less structured methods, including various FMEA techniques, Maintenance Task Analysis (MTA) and Partial RCM for Single Failure Analysis, can be used to quickly build or enhance your asset maintenance program for the balance of company assets. The resulting maintenance program for an asset may include a mix of preventive maintenance, predictive maintenance and run-to-failure decisions.

Finally, the control stage efficiently plans, schedules, executes and follows up on the work identified. The control stage of the process provides valuable information back to the assess stage in terms of the actual performance of assets, resulting in a continuous improvement loop that optimizes asset reliability.

PROCESS GUIDELINES FOR THE NUCLEAR POWER INDUSTRY

Establishing a well defined process to assist member utilities in maintaining high levels of safe and reliable plant operation in an efficient manner, the Institute of Nuclear Power Operations (INPO) has integrated and coordinated a broad range of asset reliability activities into one process description that demonstrate the stages of plan, assess, improve and control. This process is documented in INPO AP 913 (Equipment Reliability Process Description). AP-913 provides reliability process requirements based on risk management. The activities in this process include:

- Evaluate important station equipment
- Develop & implement long-term equipment health plans
- Monitor equipment performance and condition, and
- Make continuing adjustments/improvements to the maintenance program.



INPO AP 913 Equipment Reliability Process

The Nuclear Regulatory Commission (NRC) Maintenance Rule – 10CFR50.65 provides requirements for monitoring the effectiveness of maintenance at nuclear power plants. The Maintenance Rule dictates that nuclear plants monitor the performance and condition of structures, systems and components (SSC) against established goals, in a manner sufficient to provide reasonable assurance that the structures, systems and components are capable of fulfilling their intended functions.

AP-913 is process oriented, while 10CFR50.65 measures outcome. The implementation of AP-913 and 10CFR50.65 with asset reliability software tools and practices is useful in any industry, and leading organizations are using equipment and process reliability as the strategy to drive business results.

CONCLUSION

Over the next two to five years, emerging reliability software will boost the move to increased efficiency in optimizing reliability. Since the largest cost center in a utility is typically the maintenance function, it is vital that maintenance and engineering organizations do more with less.

So how do these companies obtain a return on their biggest balance sheet assets? Efficient asset reliability is the key and through the implementation of formalized reliability business processes coupled with the required practices and enabling technology, utility companies will succeed in lowering the costs of ever-improving reliability. Asset reliability improves plant output and uptime, creates higher customer service levels, reduces costs, ensures a safe environment and enables companies to verify and demonstrate their compliance with industry regulations. Optimizing asset reliability at the lowest cost is smart business.

For more information, call Ivara toll-free at 877-746-3787.