

Steps to Developing an Effective Integrated Corrosion Management Program to Minimise Costs & Extend Life

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Abstract

An integrated corrosion management program should be part of the overall asset management and preservation program and should not be treated as/in a separate system. Integrity of assets is a characteristic of sound and safe performance for which it was designed. Other subsets of the overall integrity management program include, *e.g.*, mechanical damage and operating stress.

This keynote outlines steps for developing an effective integrated corrosion management program with the aim to minimise costs and to extend life whilst reducing the risk for failure. Cost implications of inadequate corrosion control include both direct and indirect costs, which are correlated. For example, inadequate coating maintenance (direct cost) will lead to increased maintenance and repair costs later (indirect costs), which often outweigh the initial costs of simply maintaining the adequate condition of the coatings.

The implementation of an integrated corrosion management program, that result in the reduction/elimination of corrosion related damage/deterioration of assets, will not only assist in compliance with regulatory requirements but also has a direct effect on the assets overall economic performance.

Background

Asset management is the lifecycle management of physical assets to achieve stated outputs of the enterprise [1]. It is best described as a process: Plan-Do-Check-Act (DPCA process). For good asset management to have a chance of success, the corporate culture and all levels of the leadership need to embrace the framework, which can be based on four key principles: 1) Capabilities – what the asset can do, 2) Output Focus – performance measures for the Capability, 3) Learning Organisation – continuous improvement and, 4) Level of Assurance – uncertainty of Output. The Asset Management Council has summarised the DPCA Process and the key principles as their logo, presented in Figure 1.

Based on the DPCA process and the key principles, it is possible to design asset maintenance and asset management processes, an example of the Asset Management Council model of the asset management process is given in Figure 2, the box labelled integrated support outlines the asset maintenance part of the system .

Figure 1: Graphical display of Asset Management, Asset Management Council

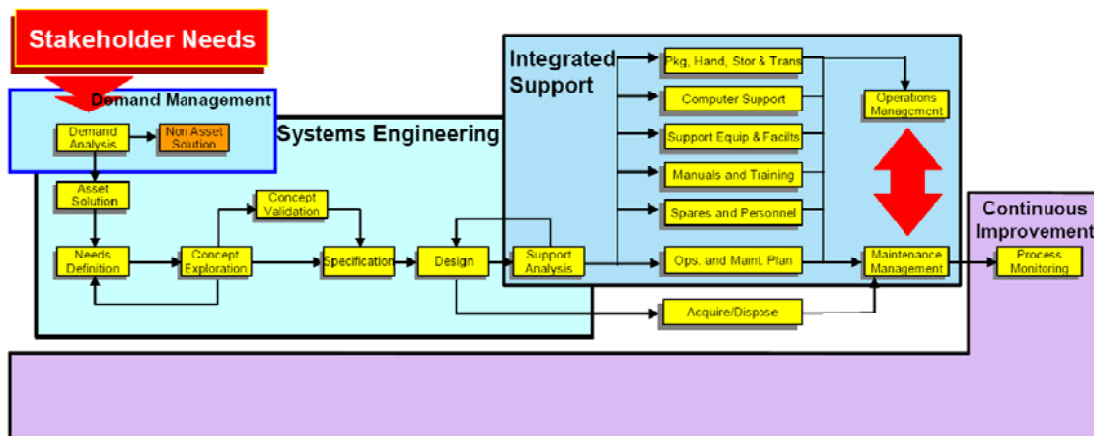


Figure 2: Asset Management Council model for Asset Management

The World Corrosion Organisation White Paper written by Gunter Schmitt states that “Corrosion is so prevalent and it takes so many forms that its occurrence and associated costs never will be completely eliminated; however, all studies (of the cost of corrosion) estimate that 25 to 30% of annual corrosion costs could be saved if optimum corrosion management practices were employed [2]”. Given that the cost of corrosion, *e.g.*, in the oil & gas industry translates to 0.3 to 0.5US\$ per barrel of oil equivalent (boe) [3], the potential savings in the oil and gas industry are enormous. In 2009, the total daily production for Chevron Australia was 165,000 barrels of oil, 29,000 barrels of LNG, and 2,6 billion cubic feet of Natural Gas (79,000 boe) [3], thus the cost of corrosion could be estimated between US\$82,000 to US\$200,000 per day. These figures demonstrate clearly that there is a strong financial incentive to integrate corrosion management into the overall asset management system to minimise the cost of corrosion.

Integrated Corrosion Management System

Corrosion management can be defined as the part of the overall management system, which is concerned with the development, implementation, review and maintenance of the corrosion policy. Capcis, in cooperation with European Oil & Gas producers wrote a review on corrosion management for offshore oil and gas processing in 2001 [4], which is the basis for this keynote. The basic corrosion management process outlined in this report is given in Figure 3. It is noteworthy that in Europe the corrosion management is governed by the health and safety authorities, since integrity and corrosion are closely related and have a high impact on operational safety and the wellbeing of the staff operating the assets.

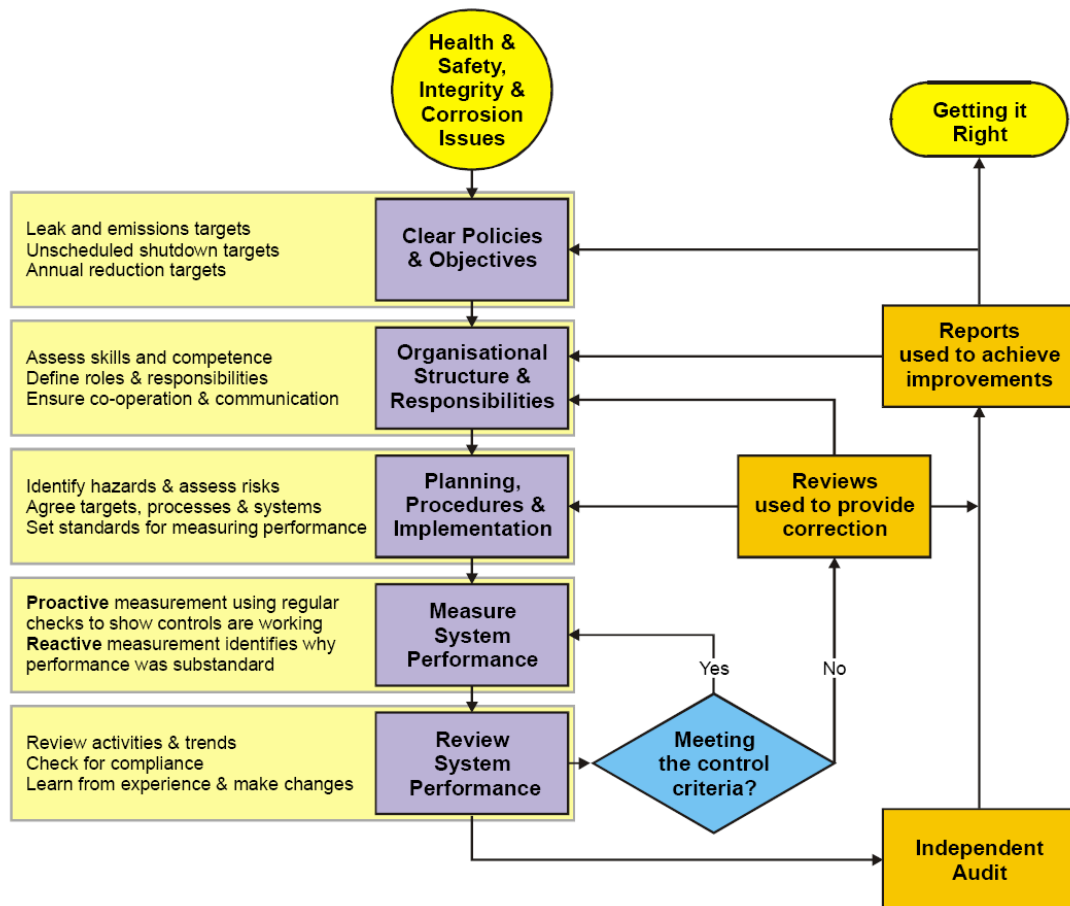


Figure 3: Review of corrosion management for offshore oil and gas processing, 2001, [4]

As can be seen from Figure 3, corrosion is not the main or only driver to ensure safe operation of the assets. It can be pointed out that the Asset Management Council PDCA process (Figure 1) can be applied straight to basic corrosion management process outlined in Figure 3. For organising corrosion management, an organisational culture of the 4 “Cs” can be applied: Control, Communication, Competence and Co-operation, which allows the PDCA Process to work efficiently.

- Control:
 - Allocate responsibilities and authority
 - Ensure that managers, supervisors and team leaders have the time and resources needed

- Identify key areas that require special expertise, e.g.
 - Corrosion inhibition
 - Use of Corrosion Resistant Alloys
 - Corrosion prediction
 - Cathodic protection
 - Microbiologically influenced corrosion problems, etc
- Communication
 - Provide written information on hazards, risks and preventative measures
 - Organise regular discussion meetings on issues
 - Ensure visibility of managers, supervisors and, when appropriate, specialists including contractors
 - Share experiences with external bodies
 - Dissemination of appropriate information to the correct people
- Competence
 - Management of corrosion risks requires all involved **to have qualifications, experience and expertise** appropriate to clearly defined duties and responsibilities
 - Training may be required to ensure that those having responsibility understand the issues
 - Seek out experienced personnel and external advisors for advice where necessary
 - Ensure all involved have appropriate training, understanding of the risks, understanding of the working practices and awareness of their own role, their own limitations and the limitations of those for whom they are responsible
 - Supervisor
 - Knowledge and understanding of the roles, responsibilities and corrosion management structure operated by the organisation
 - Experienced in successful review of processes and procedures
 - Experience of corrosion risk assessment and corrosion management techniques used offshore and is able to apply them
 - Corrosion Engineer
 - Familiar with relevant standards and specifications
 - Can identify, justify and apply measures required to minimise risks from corrosion
 - Has experience of corrosion risk assessments
 - Recognised professional qualifications?
Through the Australasian Corrosion Association, NACE International, ... ?
 - The use of Corrosion Awareness training programmes, aimed at the nonspecialist, has been found to improve overall levels of corrosion performance. An inspection technician, maintenance operator or process chemist, who has a better understanding of corrosion and material degradation ensures that:
 - Signs of corrosion/damage are recognised at an early stage - allowing remedial measures to be put in place before damage requires major work

- The reasons for the detailed requirements for inspection and monitoring are better understood – improving efficiency and cooperation
 - The effect of corrosion control measures are better understood – again improving efficiency and co-operation
- Co-operation
- Control of risks requires input from managers, designers, operational staff and maintenance engineers, inspection departments, corrosion engineers and consultants
 - Consult staff for opinions and involve staff in planning and reviewing performance
 - Co-ordinate with contractors
 - Co-ordinate with external bodies

Direct costs linked to corrosion management are, *e.g.*, costs related to inspection, chemical inhibition, corrosion monitoring and coating maintenance. Indirect costs that are linked to corrosion management are, *e.g.*, increased maintenance, deferred production, plant non-availability and logistics. The aim of a good corrosion management system has to be to find the right balance between the two categories, thus implementing an appropriate Corrosion management system that result in the reduction of corrosion related damages/deterioration of assets will not only assist in compliance with regulatory requirements but also has a direct effect on the assets overall economic performance. In other words, it provides “a double payback”. Figure 4 outlines the Planning and Implementation process as proposed by Capcis [4].

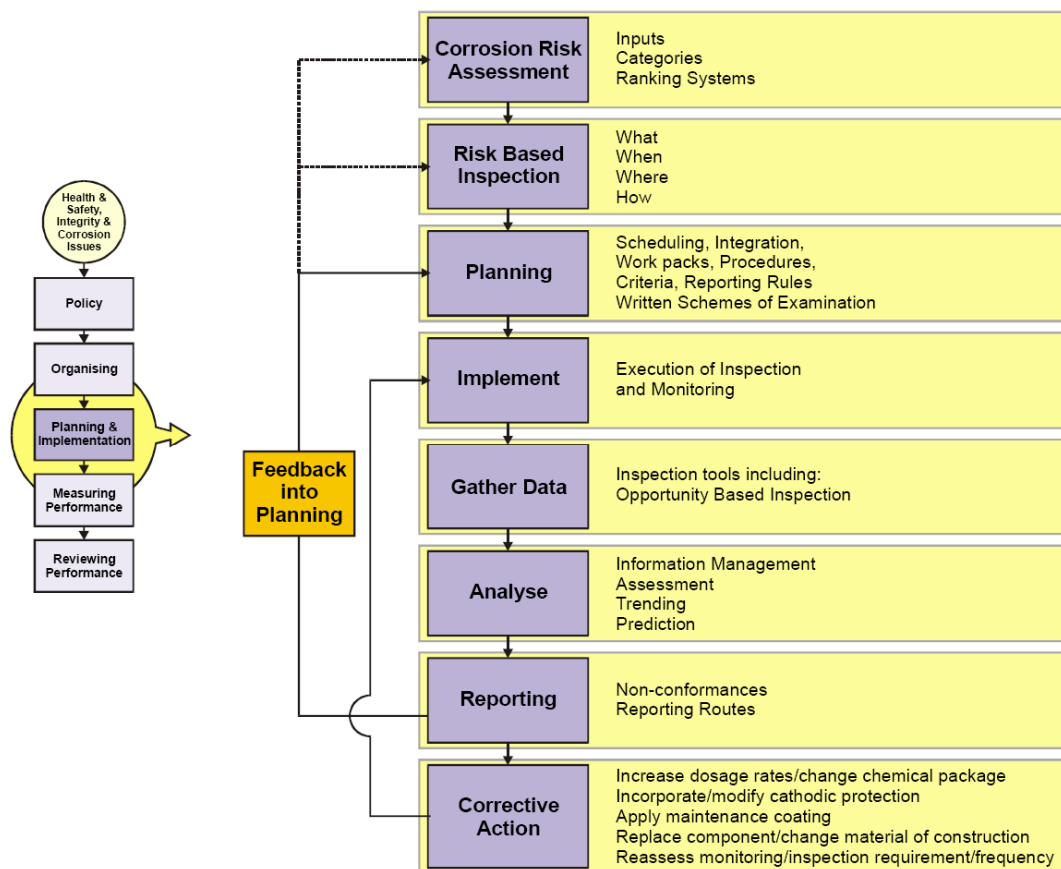


Figure 4: Planning and Implementation of a corrosion management system after [4]

Risk Based Inspection (RBI) is today a good tool for minimising both direct and indirect costs related to corrosion. However, for RBI to function, a good data on the historical performance of assets are a must, and each asset needs to be evaluated for the risk of corrosion related failures. A graphical summary for the development of corrosion management system for any given asset is given in Figure 5, [4].

Figure 5: Corrosion Management Process after [4]

The requirements of a risk based approach to corrosion management are a good understanding of the corrosion environment, understanding the changes in the system, and which changes would lead to increased corrosion risk. For automated systems, the relevant parameters that indicate the risk of corrosion need to be monitored and a system alarm should sound if the system is operated outside the safe framework. The implementation of such as system will allow for the development of pro-active measures – find a problem before it causes trouble. On-line and in-line monitoring devices are ideal for this purpose. For manual systems, training of staff is important so that concerns if system parameters are leaving the safe framework. But also learning from mistakes and historical data and experiences will help to implement measures after a problem has been identified, as it will reduce the risk of it repeating itself in the future.

Globally accessible data storage is of great value for any asset management system, including corrosion management. Although it is not strictly necessary to have computerised databases, it simplifies data analysis and continuous improvement of the system. Modern software will allow for data analysis, risk assessments plot trends within periods of operation, correlate trends from different monitoring/inspection techniques that allow the corrosion expert off site to follow the performance of the assets, located anywhere in the world. However, this requires training and raising awareness of the importance of collecting data accurately at plant operator level, so that the corrosion engineer has the best information available.

Summary

Today's corrosion engineer will often play part in a larger framework of asset management. It is important to include corrosion management into the overall asset integrity and management program, in order to achieve the optimum cost savings possible. Corrosion management should not be seen as a simple maintenance task, as maintenance budgets are often not linked to operational budgets and are only seen as costs to the organisation, rather than investment opportunities for cost reduction. It is, therefore, important for the corrosion engineer to be able to translate the risk of corrosion of a given asset into a monetary figure, as dollar values are the global language within each corporation which is understood by the CEO, Financial Services and the middle management.

The development of an integrated corrosion management system will improve reliability, extend service life (or tailor service life and needed), minimise unplanned shut-downs and maximise production without jeopardising safety. The initial high costs for the development and implementation are high, however, the lessons learned from current assets, if implemented for future developments of new facilities will easily offset these costs against these investments. After all, many corrosion problems can be engineered out at the design stage without significantly changing the CAPEX of the facility.

References

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