Asset management

Ageing assets: problems, solutions and life extension

In common with many other hard-pressed UK industrial sectors, the process industry faces the twin challenges of managing ageing assets under an ever-increasing burden of safety legislation, while trying to guarantee and maximise continued production. To achieve this, many process businesses are increasingly investing in a robust Asset Management (AM) strategy, enabling them to achieve the optimal balance between cost, risk and performance throughout the life cycle of their facilities.

The philosophy behind AM is to identify, align and develop tools, technologies and techniques for assessment, diagnostics and prognostics that enable management during the lifetime of an asset. The approach also allows users to minimise unwanted events that can arise from system, sub-system or component faults; or failures due to damage, degradation or environmental impacts at any time.

> "This holistic approach means that the owner of an asset can manage key phases and unexpected abnormalities more quickly and easily than conventional methods allow."

It also means that the effects of changes to operations – which might include higher or lower pressures or temperatures, different environmental conditions or process changes – can be assessed and their effects on the life of the plant accounted for.

Proactive maintenance

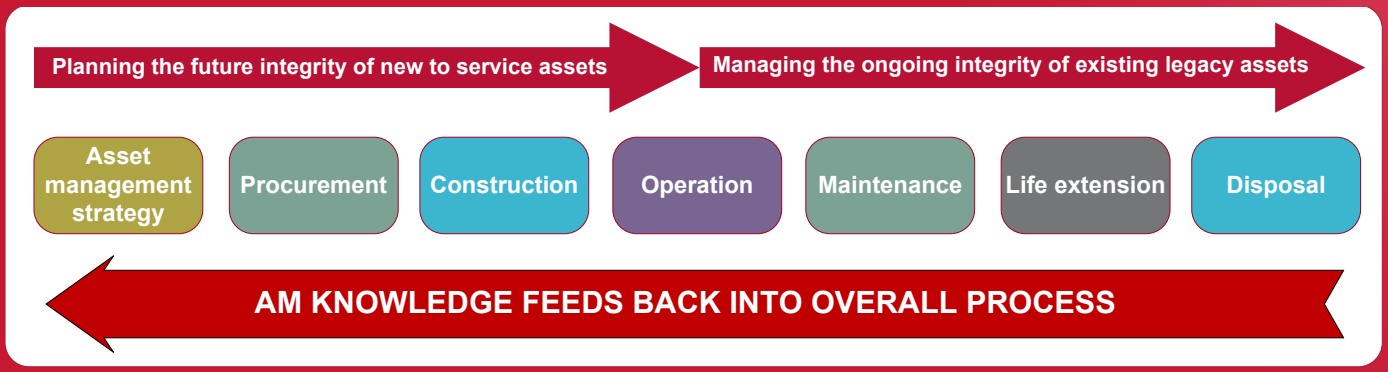
The AM methodology also enables the assessment and diagnosis of events that could detrimentally affect the safe and productive operation of the asset. This includes estimation of event severity, Remaining Useful Life (RUL) and confidence parameters for the affected system or systems.

Maintenance workers, safety personnel, maintainers and logisticians can take advantage of the estimated RUL and appropriate profiles to allow proactive and pre-emptive, rather than reactive, maintenance. It can also be used for improving the real time picture of an asset's status to give advanced visibility on-site or from a remote location.

Creating an effective strategy

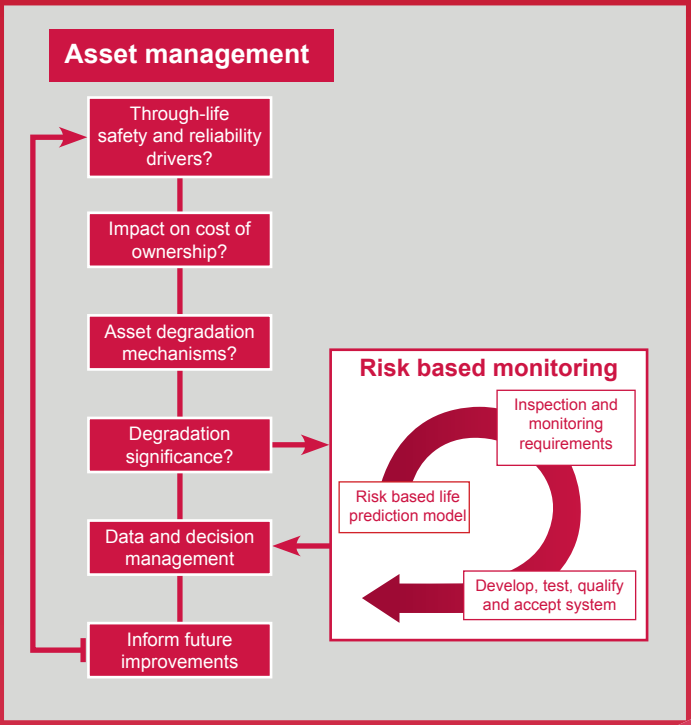
To make decisions regarding AM, input is needed from a variety of sources including design and usage requirements, asset degradation processes, human factors and legislative or environmental compliance.

However, to be truly effective, an AM strategy needs to be considered during the design, procurement and construction phases of a plant. Also, as the diagram below shows, the strategy should involve the continuous feedback of gathered operational knowledge throughout the life of the facility. In this way the AM strategy can evolve to an optimum level and cope with changing circumstances.



Risk based inspection

Asset Management can also be linked to Risk Based Inspection (RBI) techniques, as shown below, to enable a robust data acquisition and decision making process.



The fundamental premise here is that the 'through-life safety and reliability drivers' are identified and understood. The sensitivities to cost and the degradation mechanisms affecting these drivers also need to be understood. It is then possible to predict how the plant will degrade over time and therefore define an inspection regime to maintain safety and reliability.

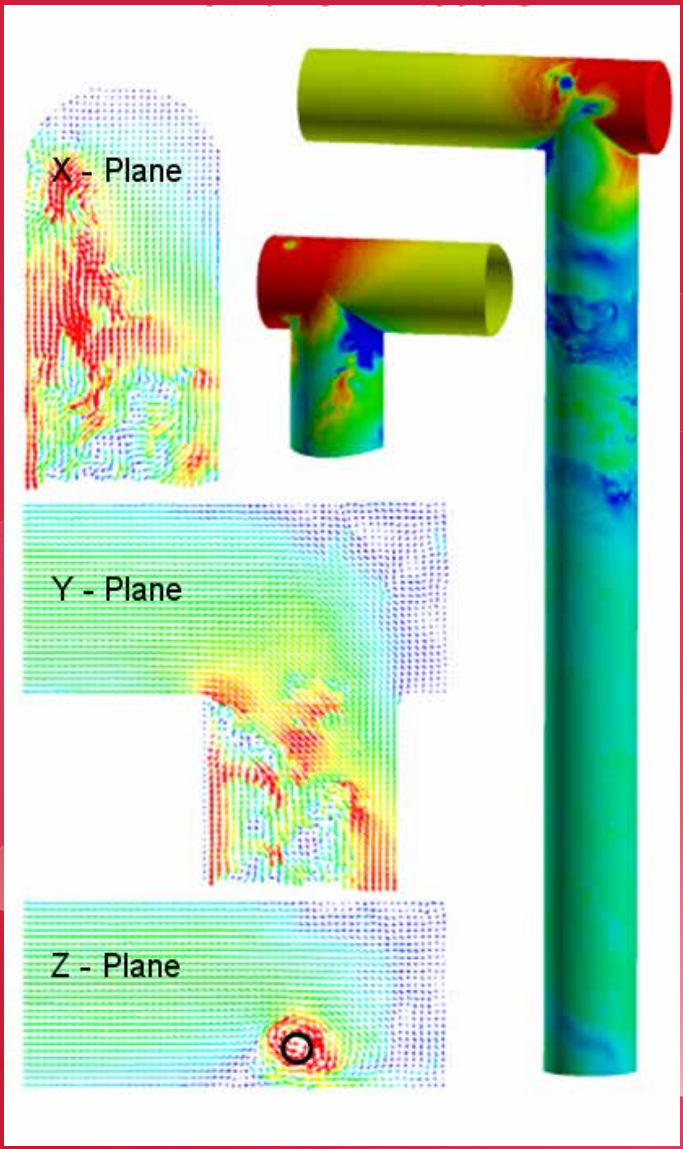
The final part of the picture is to use the gathered data on the state of the system to make AM decisions and to implement any future improvements that would yield significant safety, cost or reliability enhancements.

AM in practice

A good example of the application of AM in process plant is in dealing with pipework systems. These often suffer failures as a result of poor design which can lead to vibration and thermal fatigue.

Flow-induced vibration (the vibration of pipework caused by process flows via mechanisms such as vortex shedding, turbulence, pulsation and acoustic resonance) is one particular problem that is notoriously difficult to design against. Usually designers would follow guidelines from, for example, the Energy Institute, to screen-out problems. However, these are not always comprehensive and where flow-induced vibration does occur, detailed Computational Fluid Dynamics calculations are needed to diagnose the problem. Once the vibration has been eliminated, an AM programme should be put in place to monitor the pipework and other similar connections to prevent any further problems.

The figure below shows a pipework connection that suffered from flow induced vibration that was not indicated by the guidelines. Detailed Computational Fluid Dynamics (CFD) calculations were needed to diagnose the problem as unsteady vortex interactions under certain process conditions. Modifications to the process conditions were made to eliminate this vibration and an AM programme put in place to monitor this and other similar pipework connections to prevent any further problems.



Not managing the integrity of process plant effectively could have serious consequences. An integrated AM strategy provides operators with the insight and understanding they need to monitor key risks to assets, and todevelop maintenance and inspection regimes with minimal impact on production.

For more information on how we can add value to your critical assets, systems and processes, please contact:

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