Top tips for building effective maintenance systems

Asset reliability is essential to the safe and optimum performance of critical equipment in upstream oil and gas, set against the backdrop of rising operational costs in a volatile and highly regulated environment.

Maintenance supervisors are under constant pressure to preserve asset integrity and ensure that equipment is performing at full capacity for prolonged intervals, irrespective of infrastructure which has extended beyond their intended operational life.

Absoft has extensive experience in the design and implementation of integrated maintenance management systems in SAP®, which optimises asset reliability and performance in compliance with NORSOK Z008, ISO14224 and the Norwegian Petroleum Standards.

There is no 'one size fits all' approach, but we have put together our five top tips from over 20 years' of building effective maintenance system in SAP, which were proven to be effective in upstream oil and gas.

1. Define a clear technical hierarchy

Defining a clear and uniform technical hierarchy can underpin effective scheduling of corrective and preventative maintenance. The technical hierarchy provides a means of identifying components and the function of equipment throughout an entire asset. Each technical hierarchy consists of multiple equipment items and it is essential that the interdependencies between equipment are known because of the knock on effect that equipment malfunction can have on connecting components.

With thousands of interconnecting parts, the challenge to define a clear technical hierarchy is to achieve an appropriate level of detail during the blueprint stage. Executing maintenance activity at the 'nuts and bolt' level can increase information handling and overload, whereas defining the technical hierarchy at too high a level makes it difficult to locate problems to a specific function or equipment tag.

Our SAP PM solutions are proven to:

- Safeguard people, assets and the environment
- Comply with regulatory industry standards
- Minimise unplanned shutdowns and maximise equipment uptime
- Prioritise maintenance based on the consequences and probability of equipment failure
- Reduce the associated costs of equipment failure and operation downtime
- Protect corporate reputation through safe and compliant operations

Absoft recognise two methods of standardising technical hierarchy structures; SFI Group System and NORSOK ZDP-002. These coding structures are similar and can be recorded in SAP as functional locations; where the first level of code is a prefix to identify the installation or asset (RG01), followed by various sub-levels to identify the system and major functions (RG01-1099 for piping and line tags).

Key considerations to define a technical hierarchy are to:

- Identify all installed systems from technical drawings and P&IDs
- Identify key equipment and crossover functionality between systems
- Develop a numbering convention system to effectively tag equipment
- Develop a hierarchy for coding equipment which does not form part of the main tags

Functional Location	
Rig 01	**Description**
RG01	Rig 01
RG01-10	Drilling
RG01-1099PIPEANDLINES	Piping and Line Tags

2. Define a clear maintenance strategy

Developing a clear maintenance strategy is essential before the design and build of maintenance management systems in SAP. Over the years, Absoft has gained experience of several frameworks and two in particular are Reliability Centered Maintenance (RCM) and the Generic Maintenance Concept (GMC).

Reliability Centered Maintenance (RCM) is an engineering framework used to define a complete maintenance regime, which establishes guidelines for safe minimum levels of maintenance, whereas Generic Maintenance Concept (GMC) establishes standard procedures for equipment operating under similar conditions. Maintenance strategies can vary dependent on the different types of asset and there is no preferred approach in oil and gas, however, SAP can support planning and scheduling by providing a holistic view of work orders and their status.

The following factors are worth considering when developing a maintenance strategy:

- Awareness of the manufacturer's recommendations and warranty conditions which will influence the frequency of inspection and maintenance

- Adherence to industry standards which will recommend maintenance strategies for particular categories of equipment

- Risk based analysis should be carried out with a focus on critical equipment

- Refer to both corporate and industry wide knowledge to determine the key measures and outcomes of polices such as Reliability Centred Maintenance

3. Prioritise maintenance using the consequences and probability of failure matrix

Effective maintenance systems should assist in the prioritisation of work for equipment which directly impacts on safe and efficient operations, but how do you prioritise between multiple safety critical elements which require remedial maintenance?

NORSOK Z008 guidelines include classifying the consequences of equipment malfunction against the probability of failure. An assessment is made on the impact that equipment failure will have on the asset including the likelihood of occurrence, if preventative maintenance is delayed. Absoft has experience of several risk assessment techniques, including Failure Mode Effect and Criticality Analysis (FMECA) and Risk Based Inspection (RBI) which are recommended to provide an in-depth evaluation of the probability of equipment failure.

The consequences and probability of failure matrix is an effective framework for scoring and categorising risk.

When scoring the probability of failure, it is worth considering whether there are duplicate components or parallel systems in place, referred to as redundancy factors, which can act as a fail-safe.

Absoft recommend the following to assess the consequences of failure and prioritise maintenance:

- Classify the consequences of failure criteria (HSE, production loss, cost)

- Standardise rules for scoring the consequences and probability of failure (high, low)

- Assess redundancy factors and tag equipment with parallel systems

- Score equipment and assign to tags

- Prioritise corrective maintenance for equipment with the highest consequences and probability of failure

- Schedule adequate repair time based of the probability of failure

Risk Matrix

Consequence	Probability				
	A	B	C	D	E
I	Significant	Significant	Significant	Higher	Moderate
II	Significant	Significant	Higher	Moderate	Low
III	Higher	Higher	Moderate	Low	Low
IV	Moderate	Low	Low	Low	Low

Significant = Health, Safety, Environmental Risk

Higher = Business Production Loss Risk

Moderate = Intitial (unmitigated) Risk

Low = Residual (mitigated) Risk

4. Develop maintenance procedures for scheduled and deferred maintenance

Having identified the maintenance priorities using the consequences and probability of failure matrix, it is important to take immediate remedial action to mitigate the risk.

Operating in volatile environments can cause unexpected delays, where a change in weather conditions offshore for example can postpone planned maintenance. Under these circumstances, authorised personnel can assess the impact of deferring maintenance and explore the option to switch between parallel systems, decrease the operating capacity of failing equipment, or proceed to shutdown.

Should the need arise to postpone scheduled work, maintenance procedures should involve a risk assessment to:

- Determine how long the work can be safely deferred based on the probability of failure
- Assess the actions required to mitigate the risk
- Determine a suitable deadline to reschedule the work
- Actively monitor and report on approaching deadlines

Building maintenance systems in SAP offers the functionality to report on work order statuses and approve deferrals. This functionality provides greater visibility of planned maintenance and helps to reschedule corrective work.
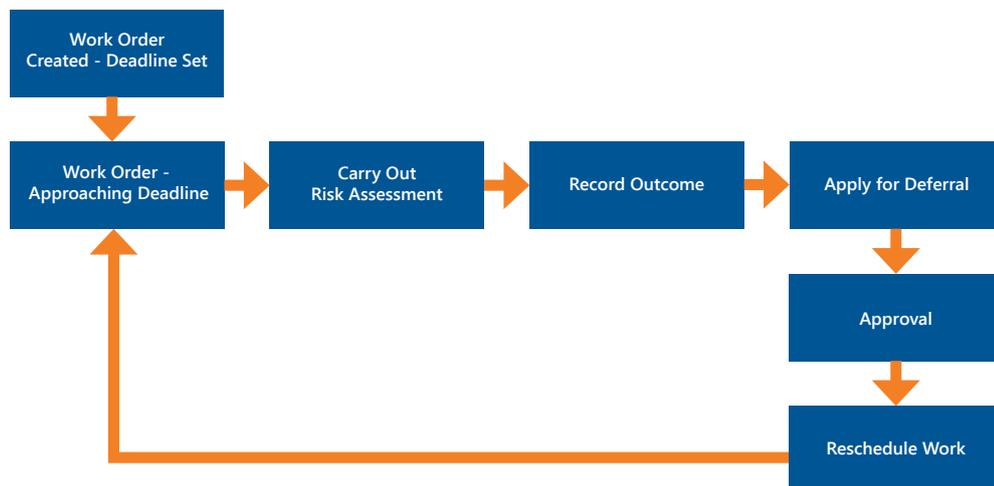
5. Defining and reporting Key Performance Indicators (KPIs)

Performance standards define the operational limits of critical equipment. Engineers must be aware of these standards to detect abnormalities in performance and to ensure that safety critical equipment does not fail to meet operating parameters.

When building effective maintenance systems, measurable KPIs must be defined with reference to performance standards and the results should be clearly visible for internal maintenance planning and external reporting for industry compliance.

SAP offers the functionality to customise maintenance plans and include performance standards by linking documentation to functional locations and equipment tags. Trigger mechanisms can also be implemented in SAP to identify deviations between actual readings and performance standards, to prioritise further investigation and corrective work.

The following should be considered to record data accurately for reporting:

- Procedures are clearly documented and understood by the workforce
- The method to record the work requires minimal effort so it can be easily repeated
- Regular reviews are performed to ensure that data entry is in the correct standard
- Procedures are in place to monitor KPI's and ensure action is taken to improve performance
- Functions are available to record failure occurrences and production losses where appropriate
- Cost implications are included in analysis of performance
- KPI's are clearly aligned to overall maintenance goals, including industry standards

Conclusion

Building effective maintenance systems in SAP provide maintenance supervisors with the capability to itemise equipment by components, functionality and interdependencies between parallel fail-safe systems.

Documenting critical equipment at this level provides a holistic approach towards corrective and preventative maintenance, whilst using the data and reporting functionality in SAP to prioritise maintenance and safely defer work in compliance with corporate and industry standards.

These are just a selection of our top tips for building effective maintenance systems using SAP. If you would like to discuss your company's specific maintenance requirements in more detail, do not hesitate to contact Absoft.

About Absoft

Absoft is an SAP dedicated specialist, established in 1991. Our SAP expertise, pre-configured templates, solutions and accelerators mean we deliver the best business and technical solutions for your individual needs to the highest standards of quality, quickly.

We are the only SAP partner to specialise in upstream oil and gas. We are working with leading players in the industry and have been for over 20 years', uniquely combining business process, oil and gas and SAP expertise to deliver best practice solutions globally.

If you are working with SAP then Absoft can save your business time and money, leading to increased revenue and bottom line impact. Absoft's track record for delivering value for upstream oil and gas companies and our support clients is unrivalled.

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