HID Inspection Guide Offshore

Inspection of Maintenance Management

Contents

Summary

This guidance outlines an approach to inspection of dutyholders' arrangements for maintenance management, and the current key topic areas that inspectors should consider when inspecting this topic offshore. It also sets out criteria for satisfactory and unsatisfactory performance factors against which the duty holder performance will be rated for each of these areas. References are made to technical standards and guidance that inspectors will use to form opinion for legal compliance.

It is intended that this document can be used by Inspection Management Teams where a discipline specialist is not available, by focussing on the safety management systems aspects of this guide. Where a specialist is present offshore the technical aspects can be covered to a greater depth.

This guide solely focuses on topsides equipment which comes under the management of offshore platform personnel. The relevant offshore personnel would be maintenance supervisors (mechanical, electrical, instrumentation) and Offshore Inspection Engineers (OIEs). **For the purpose of this guide inspection of pressure systems will be included as an aspect of maintenance management.** The relevant supporting specialist teams from ED would therefore most likely be mechanical engineering, material and corrosion engineering and control / electrical engineering.

Separate guides will be produced which cover structures and the verification aspects of safety critical elements (SCEs). In addition the effects of the European Safety Directive are not covered in the guide – this will be reviewed following implementation.

Introduction

The aim of this Operational Guide (OG) is to provide information and guidance to offshore inspectors to support the delivery of consistent and effective maintenance management.

The maintenance and inspection of Safety Critical Elements (SCEs) is covered in this guide. In addition equipment which may not comprise any SCEs is covered, as there remains an absolute duty under the regulations described in the following paragraphs to ensure this work equipment is safe. It is important to consider maintenance of non-SCEs as part of the overall management system, and to consider the cumulative risk effects.

This guide highlights key areas to be covered during inspections, providing a framework for inspectors to judge compliance, assign performance ratings, and decide what enforcement action to take should they find legislative breaches. In doing so, it complements HSE's Enforcement Policy Statement (EPS) and Enforcement Management Model (EMM).

The Provision and Use of Work Equipment Regulations (PUWER) 1998 Regulation 5 requires employers to ensure that work equipment is maintained in an efficient state, in efficient working order and in good repair. The Offshore Installations Prevention of Fire and Explosion, and Emergency Response (PFEER) Regulations 1995, Regulation 19 re-iterates this duty for plant fitted to comply with these regulations.

In addition the Provision and Use of Work Equipment Regulations 1998 Regulation 6 requires that every employer shall ensure that work equipment exposed to conditions causing deterioration which is liable to result in dangerous situations, is inspected at suitable intervals and each time exceptional circumstances occur. This is to ensure that health and safety conditions are maintained, and that any deterioration can be remedied and detected in good time.

The maintenance management described in this Inspection Guide is the process, approach and implementation that the employer and/or duty holder used to fulfil these statutory obligations.

Maintenance, and its management, addresses how equipment is kept at or restored to an acceptable level of capability. The benchmark for 'acceptable' has components of safety, environmental impact, risk of subsequent failure and economic concerns.

This guide breaks the topic down into five core intervention areas as follows:

1. There is an accurate Asset Register that records all equipment installed.
2. There is a plant inspection regime which is being effectively delivered and on schedule

3. There is a planned maintenance system which is also being delivered on schedule.
4. There is an effective review process for maintenance that allows the plant to be resilient to changing operating profile and ageing of plant.
5. There is co-ordination, leadership, ownership and senior management engagement in maintenance management.

What is a Maintenance Management system?

A maintenance management system should deliver the effective inspection, maintenance and testing activities that assess the condition of plant, detect deterioration and remedy the identified shortcomings. The legislative foundation is illustrated in figure 1 and described on page 7 of this guide.

A maintenance management system is a living document requiring regular review to ensure it remains relevant to the maintained assets. Offshore plant maintenance has to evolve as the plant ages and should take account of the following considerations (amongst others):

- Changes to operating parameters and other relevant modifications.
- Experience gained in the operation of equipment should be incorporated into maintenance schemes (condition findings, failures, efficiency of performance etc).
- Improvements in technology through the equipment's life-cycle (eg equipment design, maintenance and inspection techniques).
- The tolerability and acceptance of failure and risk may change.

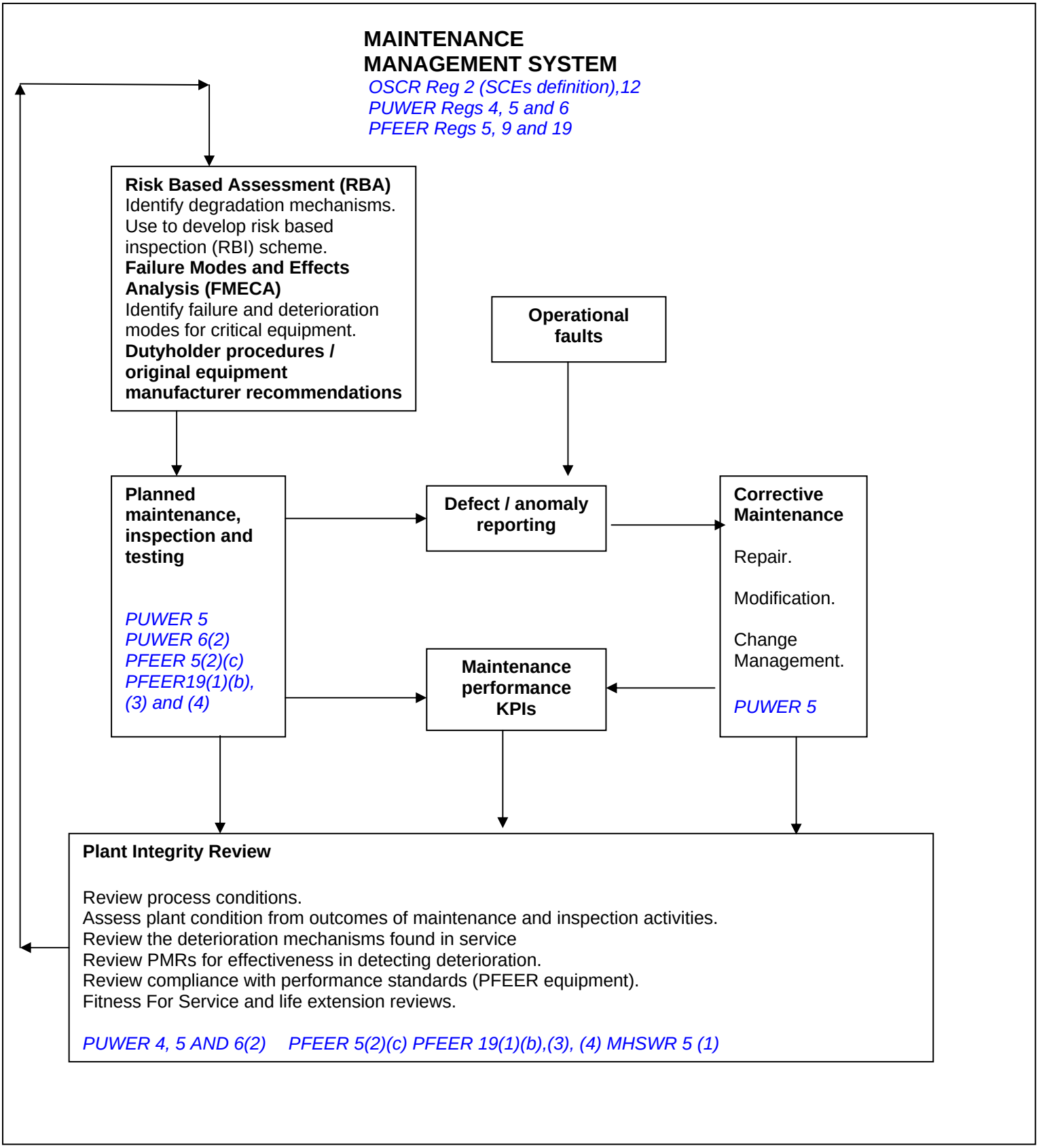

Figure 1 Legislative Basis for Maintenance Management

The HSE implemented Key Programme 3 (KP3) in 2007. The aim of KP3 was to ensure that duty holders effectively manage the risk of any failure of structure, plant, equipment or systems, which could either cause or contribute to, or prevent or limit the effect of, a major accident and/or cause fatalities. Its aims were as follows:

- For HSE to use all its regulatory and specialist resources to make an in-depth appraisal of duty holders' abilities to manage the integrity of their installations in a manner that takes adequate account of health and safety;
- To identify deficiencies in maintenance and other activities that underpin life-cycle integrity;
- To use HSE influence and, where necessary, formal enforcement powers, to ensure that legal requirements are met and that any deficiencies threatening integrity are remedied;
- To work with industry in a way that ensures good practice in integrity management, encourages continuous improvement and minimises the potential for accidents.

The underpinning question is, 'Is the maintenance function adequately targeted and adequately resourced in terms of people, time and finance?'. From a Major Accident Hazard perspective, this means;

- Is the planning of SCE maintenance efficient?
- Is the quality of maintenance acceptable?
- Is the performance of SCEs reliable?
- Are inspection and audit standards optimal?
- Is supervisory and engineering support solid?

There should be in place suitable Performance Standards, Verification Schemes and where necessary Written Schemes of Examination for systems and equipment.

This guide reinforces the aims of KP3 but also goes further to consider the whole maintenance and inspection management function, not just on SCEs.

Action

Inspection of this topic should include both inspection of the individual sections of this guide (listed as Appendices 1 to 5) and taking an overview of the sum of the individual sections, to establish a consistent and complete coverage of the topic.

In inspecting individual sections it may be necessary to have input from the relevant specialist inspectors where there are technical issues beyond the competence of the IMT inspector.

Success criteria are listed under the inspection topics (see Appendices 1 to 5); these cover the key issues that inspectors should consider when carrying out inspections against each section. In some instances, not all of the success criteria will apply so inspectors should make a judgement regarding which of these are relevant in each case. If the relevant success criteria cannot be met, inspectors should assess how serious the consequences of failure to comply could be. This will inform their decision

making in terms of the performance ratings that they assign and any enforcement action they take based on the findings of the inspection.

When carrying out inspections covered by this guidance inspectors should:

- check the key issues against their success criteria in Appendices 1 to 5;
- use the generic performance assessment descriptors in Appendix 6 to:
  - determine the appropriate performance rating; and
  - the initial enforcement expectation to use alongside the EMM.
- consider how and when the issues raised during an inspection are to be closed out and recorded using the COIN issues tab;
- assess the extent to which senior management leadership influences front-line safety
- where occupational health, safety and welfare concerns are encountered during an inspection, deal with such issues as a matter of routine and apply existing standards to determine what action to take in each case according to HSE's EPS and EMM.

Inspectors should use the generic performance assessment descriptors in Appendix 6 to determine the appropriate performance rating for each of the five sections of this guide. The appendices also give guidance on the initial enforcement expectation and should be used alongside the Enforcement Management Model (EMM). The local factors that apply in each case will ultimately determine the whether there should be any enforcement action. Consideration should be given as to how and when the issues raised during an inspection should be closed out. Inspectors must adhere to the relevant operational guidance (e.g. on use of the COIN issues tab).

Background

Relevant Legislation

- **Offshore Installations (Safety Case) Regulations 2005**
  - **Regulation 2 Interpretation** describes a 'safety-critical element' (SCE) as such parts of an installation and such of its plant the failure of which could cause or contribute substantially to or the purpose of which is to prevent, or limit the effect of a major accident.
  - **Regulation 12 Management of health and safety and control of major accident hazards** requires the dutyholder to demonstrate that all major accident risks have been evaluated and measures have been, or will be, taken to control those risks to ensure that the relevant statutory provisions will be complied with. The requirement of an adequate management system to achieve this is specified. Maintenance management is a clear component of this.

- **Provision and Use of Work Equipment Regulations (PUWER) 1998**
  - **Regulation 4 Suitability** requires employers to ensure that work equipment is so constructed or adapted as to be suitable for the purpose for which it is used or provided.

- **Regulation 5 Maintenance** requires employers to ensure that work equipment is maintained in an efficient state, in efficient working order and in good repair. All employers should also ensure that where machinery has a maintenance log, the log is kept up to date.
- **Regulation 6 Inspection** requires employers to ensure that work equipment exposed to conditions causing deterioration is inspected at suitable intervals, or after exceptional circumstances,

- **Offshore Installations Prevention of Fire and Explosion, and Emergency Response Regulations 1995 (PFEER)** specify the goals for the preventative and protective measures to manage fire and explosion and to secure emergency response and recognise that the responsibility to put into place measures necessary to achieve these goals is best placed with one person – the duty holder.

    - **Regulation 5** requires the duty holder to establish appropriate standards of performance to be attained by anything provided for ensuring effective evacuation, escape, recovery and rescue to avoid or minimise a major accident or other measures to protect people from a major accident involving fire and explosion.
    - **Regulation 9** requires the duty holder to take such measures necessary to prevent fire and explosion by, amongst others, ensuring the safe storage, handling and movement of flammable or explosive substances and preventing their uncontrolled release.
    - **Regulation 19** requires that plant fitted be so constructed as to be suitable and is maintained in an efficient state, in efficient working order and in good repair.

- **Management of Health and Safety at Work Regulations (MHSWR) 1999**
    - **Regulation 5(1)** Every Employer shall make and give such effect to such arrangements as are appropriate for the effective planning, organisation, control, monitoring and review of the preventive and protective measures.

Organisation

Targeting

The HID Business Plan 2012 – 15, section D.1 commits HID to deliver intervention plans at major hazard sites/operators. HID reports progress on the number of sites/operators inspected and topics completed against the plan. The guidance set out in SPC/Admin/85 details the arrangements for HID to monitor and report progress against plan.

Although the inspection may be carried out at any installation it is particularly important to carry this out where there are known issues that may affect maintenance management issues such as ageing equipment, major projects etc. It is essential to ensure that duty holders are robust in their assessment of the implications of these factors, that suitable mitigations are in place and that cumulative risk factors have been considered.

Timing

Inspectors should undertake maintenance management inspections as part of the agreed ED offshore intervention plan, when intelligence indicates intervention is necessary or when investigation due to incident is required.

Resources

Resource for the undertaking of maintenance management interventions will come from Discipline inspectors and Inspection Management Team inspectors as appropriate.

Recording & Reporting

The duty holder performance ratings should be entered on the Inspection Rating Form (IRF) tab of the relevant installation Intervention Plan Service Order. Findings should be recorded in the normal post inspection report and letter.

Contacts

ED Offshore: ED Mechanical, Materials and Corrosion and EC&I Specialist Inspectors

Appendix 1: Asset Register

Fundamental Requirement

Every employer shall ensure that work equipment is used only for operations for which, and under conditions for which, it is suitable. [PUWER Regulation 4]

Every employer shall ensure that work equipment is maintained in an efficient state, in efficient working order and in good repair. [PUWER Regulation 5]

The duty holder to establish appropriates standards of performance to be attained by anything provided for ensuring effective evacuation, escape, recovery and recue to avoid or minimise a major accident or other measures to protect people from a major accident involving fire and explosion [PFEER Regulation 5]

Success Criteria

The employer must know:

- What equipment is installed.
- Where appropriate what modification state the equipment is in.
- What the equipment's operating parameters are.
- Where appropriate what the performance standards are (PFEER SCEs).
- How the employer will maintain this installed equipment to be used in their operation.

Widespread practice is to have an asset register that forms the foundation of the maintenance management system (MMS). This register should be a live document and updated to address changes due to modification, enhancement, redundancy, upgrade and removal of equipment or components.

Category	Issues	Good Practice Found
MMS Data Quality	MMS have large amounts of spurious data as a result of 'daughter' work orders, work completed but not signed off, inadequate or inappropriate classification of safety- and non-safety-critical equipment.	Dedicated resources were provided to clean data in the MMS and ensure classification of SCEs/non-SCE as appropriate. Where MMS data has been cleansed backlog figures have been seen to reduce as a result of the removal of spurious workorders. Prioritisation of work, forward planning of resources maintenance tasks and managing backlog downwards becomes possible.

Key Regulations

- PUWER Reg 4 Suitability of Work Equipment
- PUWER Reg 5 Maintenance
- PFEER Reg 5 Assessment

Supporting Standards/ACoP or Guidance

- L22 Safe Use of Work Equipment
- L65 PFEER ACoP

Appendix 2: Plant Inspection

Fundamental Requirement

Every employer shall ensure that, where the safety of work equipment depends on the installation conditions, it is inspected after installation and before putting into service for the first time. [PUWER Regulation 6]

Every employer shall ensure that work equipment exposed to conditions causing deterioration which is liable to result in dangerous situations is inspected at suitable intervals and each time exceptional circumstances occur to ensure that health and safety conditions are maintained and that any deterioration can be remedied and detected in good time.[PUWER Regulation 6]

The duty holder to take such measures necessary to prevent fire and explosion by, amongst others, ensuring the safe storage, handling and movement of flammable or explosive substances and **preventing their uncontrolled release.** [PFEER Regulation 9]

Success Criteria

- Does the employer have an inspection programme?
- Is that inspection programme based on, and proportionate to, risk?
- Has that risk been assessed appropriately?
- Is that employer adequately resourcing that programme with suitably qualified and experienced personnel (SQEP)?
- Does the inspection programme find deterioration in good time – or are there corrective maintenance lists full of repairs?
- Is the inspection programme up to date? The benchmark is that inspection should be completely up to date.
- If inspection items cannot be completed, there should be an assessment of the risk this presents. Where the risk is acceptable, a deferral may be possible. It should be noted that if a risk-based assessment has been used to determine inspection intervals (particularly for SCEs) then this may be difficult to justify and will be challenged by HSE.
    - Non-SCE related inspections should have a level of risk assessment appropriate and proportionate to the likelihood and consequences of any failure.
    - Risk assessment must also be in place for the cumulative effect of inability to achieve the inspection programme.

Category	Issues	Good Practice Found
Inspection	As installations age, the level and rate of degradation of plant, structures and fabric increases rapidly. Inspection programmes can quickly fall behind and reducing the backlog in	The presence of inspection engineers back-to-back has been seen to contribute to effective corrosion and integrity management. Their knowledge of the plant and systems is seen to improve, assisting them in ensuring that their programmes are comprehensive and that line diagrams

	this respect will become difficult. In addition, the levels of data produced can be high and if not managed carefully to ensure continuity, onshore resources can be overwhelmed to the point where they cannot keep up.	etc are up to date. Their permanent presence on the installation can help ensures that the management and analysis of the data produced in effective and that actions generated from it are carried out.

Key Regulations

- PUWER Reg 6
- PFEER Reg 9

Supporting Standards/ACoP or Guidance

- L22 Safe Use of Work Equipment. PUWER ACOP paras 119-129
- Institute of Petroleum Guides 12 and 13
- API 510 (Pressure Vessel Maintenance, Repair etc)
- API 572 Pressure Vessel Inspection)
- API 570 (Piping Inspection Repair)
- API 580 (Risk Based Inspection)
- L65 PFEER ACoP

Appendix 3: Maintenance Execution

Fundamental Requirement

Every employer shall ensure that work equipment is maintained in an efficient state, in efficient working order and in good repair. [PUWER Regulation 5]

Every employer shall ensure that where any machinery has a maintenance log, it is kept up to date. [PUWER Regulation 5]

The duty holder to establish appropriates standards of performance to be attained by anything provided for ensuring effective evacuation, escape, recovery and recue to avoid or minimise a major accident or other measures to protect people from a major accident involving fire and explosion. [PFEER Regulation 5]

Plant fitted be so constructed as to be suitable and is maintained in an efficient state, in efficient working order and in good repair. [PFEER Regulation 19]

Success Criteria

- What maintenance philosophy is being used – and is it appropriate to the system?
- Does the underpinning reason for choosing a particular maintenance philosophy remain valid?
- Do circumstances, ageing, intensity of use or other factors require a review of the maintenance philosophy and change the approach to maintenance?

Maintenance Philosophy	**Advantages**	**Disadvantages**
Breakdown. Fix equipment when it fails	The very last vestiges of life are drained from every item. Where equipment is spared or duplicated and fails benignly eg filters, this may be appropriate.	Equipment failure may result in a dangerous situation
Preventive Maintenance. This technique aims to maintain equipment before anticipated failure based on hours-run or linked to the calendar.	This approach is only as effective as the quality of the anticipation. This will be based on operating experience, test data available and quality of monitoring.	You may end up taking equipment apart to find out why it's still working, and risk introducing faults that weren't previously there.
Condition-based. Monitor the condition of equipment through techniques like vibration analysis,	This technique enhances the predictive capacity of calendar based maintenance by individualising it for a given machine.	Processing inspection data to identify trends can be very time consuming. Planning and allocation is more difficult to manage.

thermography, lubricant analysis, material thickness measurements.		There is a risk of condition monitoring systems failing to detect incipient failure.

Benchmark

Maintenance consists of a series of discrete tasks for a given item of equipment.

All maintenance should be completed by the specified date in the management system.

Where maintenance will not be completed by the specified date, an assessment of the risk that this presents to ongoing safety must be made. Only where the risk is shown to be acceptable can the maintenance task be deferred. The magnitude of the risk dictates the level of scrutiny required in risk assessment.

Where equipment is found in a degraded condition an assessment must be carried out if the intention is to continue to operate the equipment. Such 'deviations' from the required standard must be robustly assessed by technical authorities with the correct levels of skills and experience.

Category	Issues	Good Practice Found
Risk Assessment and Mitigation Measures	Lack or risk assessment and formal authority for continued operation when SCEs are found to be degraded	A formal, robust management procedure exists which outlines the risk assessment process, levels of authority and technical expertise required to be involved and review requirements. The risk assessment is based on the role that the SCE plays in providing a barrier against MAHs and provides a sound basis for the implementation of any mitigation measures or additional barriers required. A register of the assessments is maintained and audited on a regular basis. It is possible that individual operational risk assessments may be adequate but overall, the combined risks posed may be too high. It is essential that a process is in place to carry out periodic overall reviews. It is essential that an appropriate level of expertise is included in the process and that the responsibility does not lie solely with offshore management. The part played by the failed SCE as a barrier to a major hazard incident, with reference to the major hazard analysis in the safety case, should be referenced if necessary.

Planning	The ability to plan is undermined by complexities in the levels of breakdowns, deferrals, project work requiring resources, bed space and manpower availability. Computerised maintenance management systems (MMS) can be slow to operate, have poor functionality, contain high levels of spurious data and be poorly understood by the maintenance personnel.	Where maintenance backlog is low or being driven down, a common characteristic is the existence of a strong planning function. This will include both onshore and offshore resources who not only extract maintenance schedules from the MMS but categorise and prioritise it. They develop ongoing plans (7 day, 14 day, 1 month, 3 month) which includes consideration of project work, drilling programmes, peripheral resource requirements (eg scaffolding, rope access), bed availability, manpower levels. These plans are then implemented by the offshore management and problems/pinch points can be properly managed. This also has the effect of improving the quality of reporting and overall installation management onshore. The offshore planning role is important in ensuring coordination with both operations, projects and maintenance management. The planning function is also essential in assisting in managing corrective work and reducing its impact on planned maintenance.
Definition of Backlog	Backlog is defined in many different ways across the industry. Maintenance can be shifted into backlog based on, say, a fixed period after the due date or a 'window' after the fixed period. The window can be based on the maintenance interval or equipment criticality. Onshore and offshore personnel may have different understandings of the definition. The more complex definitions make decisions deferral decisions more complex and management of backlog more difficult.	The ability to manage backlog downwards has been seen to be accompanied by a decision to simplify its definition to 'any maintenance not completed within a fixed period of the due date. This period will be based on a combination of factors including equipment criticality and maintenance interval. The definition makes scheduling and overall planning simpler and assists in ranking by criticality. A simple definition of backlog will assist senior management in their understanding of maintenance management issues and clarify resource requirements.

Management System

Systems are invariably computer-based databases. Many organisations have their own proprietary corporate systems, although there is widespread use of industry-standard packages such as SAP or Maximo. Each system will possess a subtle difference between definitions of what is overdue, in backlog or deferred. Questions to ask;

- Is the IT infrastructure capable of supporting the system as its users want, or at least need?
- Where appropriate, is there a coherent plan in place to ensure data is not lost when transferring systems?
- Can staff, offshore and onshore, provide a consistent definition of what the maintenance status is?
- Where a backlog exists, how long would it take to clear?
- Is there a coherent and credible plan for liquidating backlog maintenance?
- Are the Technical Authorities involved in assessing risks from backlog?
- What is stopping maintenance from being completed?
- Are there particular pinch-points in backlog management – eg specialist trade availability, spares availability, downtime required but not allowed for?

Accompanying Discipline Inspectors

Subject discipline inspectors may delve deeper into the management systems to consider such areas as follows:

Mechanical Systems

Pressure Sytems

Is there evidence of the following elements for maintenance of the hydrocarbon containment envelope:

- Does a written scheme of examination exist?(most follow a Pressure Systems Safety Regulations (PSSR) approach even though its not a legal requirement offshore)?
- Has a criticality analysis prioritised inspection? (where should inspection resource be focused)?
- Is Risk Based Inspection to the standards of API 580?
- Does the plan allow for NDE at scheduled intervals?
- Does the plan consider internal examination at scheduled intervals?
- Is small-bore tubing (SBT) inspected and audited?
- Are SCEs specifically flagged?

Rotating Equipment

Is there evidence of the following elements for maintenance of rotating equipment;

- Criticality analysis (where should maintenance resource be focused)

- Are ancillary systems, such as small-bore tubing containing hydrocarbons, included in the maintenance rather than being dealt with in isolation?
- Is condition-monitoring conducted irrespective of maintenance philosophy used – oil/coolant analysis and vibration analysis should be considered a minimum?
- Is a baseline of machine operation held eg run-down times, vibration spectrum?
- Are manufacturers' safety bulletins incorporated in the maintenance?
- Is condition-monitoring data trended?

Lifting Equipment

A separate Inspection Guide exists for lifting equipment. This should be referred to when considering maintenance of lifting equipment.

Electrical, Control & Instrumentation

A management system for instrumented process protection systems should include:

- Periodic proof testing (to written procedures) of all elements (including redundant elements) at a frequency determined by a reliability study to maintain the 'probability of failure on demand' below a level considered acceptable taking into account the consequences of failure.
- Repair of failures found by proof testing.
- Electrical - provision and maintenance of Ex electrical equipment, electrical power supply quality, maintenance of electrical system protection equipment.
- Mechanical control systems - maintenance, testing and change control of control systems of mechanical SCEs eg drill floor machinery.

Materials and Corrosion

A corrosion management system for the hydrocarbon containment system adopts a risked based inspection approach and includes the following:

- A contemporaneous list of safety critical elements and other plant which must be inspected and maintained from a safety perspective
- A Corrosion Threats Assessment (CTA) of all potentially hydrocarbon containing equipment
- A Risk Based Inspection programme based upon the assessed corrosion threats.
- The RBI programme is up to date, and missing items have been risk assessed.
- An inspection programme which identifies the deterioration mechanisms identified from the Risk Based Assessment.
- A Corrosion Management Strategy to address the issues highlighted in the CTA.
- Auditing of the above systems, and also the inspection data is audited.
- A Fabric Maintenance programme to ensure non-major accident hazard risks are safely managed.

Key Regulations

- PUWER Reg 5

- MHSWR Reg 3 and Reg 5

Supporting Standards/ACoP or Guidance

- L22 Safe Use of Work Equipment. PUWER ACOP paras 119-129
- "Best practice for risk based inspection as a part of plant integrity management" TWI and Royal & Sun Alliance Engineering, CRR 363/2001. http://www.hse.gov.uk/research/crr_htm/2001/crr01363.htm
- RR509 - Plant ageing: Management of equipment containing hazardous fluids or pressure. http://www.hse.gov.uk/research/rrhtm/rr509.htm

Appendix 4: Effective Review

Fundamental Requirement

The Maintenance Management System must remain appropriate to the plant throughout its operating life. Updates, modifications, new equipment, new operating profile, ageing equipment, obsolescence, change in climate and location for mobile units must all be considered and where necessary changes made to maintenance applied.

The Management of Health and Safety at Work Regulations state that every employer shall make and give such effect to such arrangements as are appropriate for the effective planning, organisation, control, monitoring and review of the preventive and protective measures.

Success Criteria

Have changes in plant operating profile (flows, fluids, pressures, temperatures etc) been taken into account in the current maintenance management system?

Have system architectures or installations changed so that more demand is made on 'providing' systems like power generation, hydraulic power, compressed air, firemain, HVAC, instrument air?

Has operating experience on this plant been used to adapt and hone maintenance schedules and approach?

Has operating experience from the wider industry been incorporated?

Key Performance Indicators should be available that allow a detailed review of the maintenance system effectiveness and allows trends to be analysed. These should include, but not be limited to;

- Number of deferrals.
- Maintenance beyond due date (backlog).
- SCE availability.
- Ratio of preventive to corrective maintenance.
- Deviations from required performance standard of equipment.

If a duty holder can not demonstrate these KPIs, how can they show that they are fulfilling their statutory obligation to maintain and assess the risk of continued operation of their plant?

Communication of status of SCEs/maintenance system data and reporting	Communication of maintenance system data to the offshore workforce. The greatest demotivator is to feel that you are working in a vacuum with no knowledge or understanding of how good or bad things are.	Provision of 'understandable' data on maintenance system and SCE status to the offshore workforce. This can include: - graphs showing backlog trends, levels of breakdowns and correctives etc and progress towards targets; - bar charts showing backlog, breakdowns etc by discipline area; - status of SCEs, ie impaired with current mitigation measures in place; - information giving reasons for poor performance.

Reporting	Reporting the status of the maintenance system effectiveness and SCE integrity.	Senior management ensure that the reports provided include the appropriate metrics to give a full picture of maintenance system status, eg data on not only corrective work in backlog, but the level of day to day breakdowns which impact on planned maintenance or data on pipework inspection programmes and corrosion management status. This improves understanding of the system performance. Regular audits of integrity management systems including SCE maintenance management will assist in ensuring that the reporting systems are effective.
Analysis of availability	Relatively few dutyholders measure availability and ensure that the systems are meeting their performance standards. The analysis of availabilities is important in that maintenance intervals are based on availability and reliability data for the equipment. Where maintenance backlog is high this is an indication that the overall reliability of SCEs may be lower than required.	Availabilities can be measured by a once yearly, monthly, weekly or daily on line analysis. In order to achieve an online analysis, rather than by reviewing long text on work orders, a fault code system is provided. Such analysis has been shown to be practicable and should be the aim of all SCE assurance strategies (see examples below). Measuring availabilities will not only assure the performance of these systems but it will assist in identifying specific components and equipment that are failing.

Accompanying Discipline Inspectors

Subject discipline inspectors may be directed to follow deeper analysis of maintenance management review, including;

Mechanical Systems

Have the following been completed or discounted in the review process, for example?

- Review possible failure and deterioration mechanisms
- Review the probability of detecting deterioration– adequacy of the inspection
- techniques
- Fitness For Service studies – remnant life / de-rate pressure?
- Equipment renewal policy

Electrical, Control & Instrumentation

Have the following been completed or discounted in the review process?

- Has power system quality been considered? Does the addition of variable speed drives in particular cause harmonic distortion of power supplies?
- Re-evaluation of proof-test frequencies based on operational experience
- Review of demand rates against design assumptions
- Testing after changes to hardware or software
- Documented management and control of changes to hardware or software
- Documented management and control of overrides/bypasses
- Periodic visual inspections of all hardware elements
- Periodic instrument calibration
- Analysis of any discrepancies between expected behaviour and actual behaviour

Materials and Corrosion

A review of the corrosion management framework detailed in the previous section.

Key Regulations :

Management of Health and Safety at Work Regulations 1999, Regulation 5, Health and Safety Arrangements

Supporting Standards/ACoP or Guidance

- API 579 / BS 7910 / DNV F-101 Fitness-for-service

Appendix 5: Leadership, ownership and coordination

Fundamental Requirement

The provision and maintenance of plant and systems of work that are, so far as is reasonably practicable, safe and without risks to health.

Success Criteria

For an organisation's systems to support an objective of first-class management of health and safety, senior leadership must ensure that;

- They understand the hazard profile of the organisation and there are systems in place that take account of human factors as well as technical issues to ensure that risks are adequately controlled.
- There is a system in place for developing and maintaining appropriate levels of management and employee competence.
- Reliable performance indicators are in place and they reflect the hazards to which staff are exposed.
- The accident/incident/near-miss investigation procedure is designed to discover the root causes and ensure corrective action is taken to prevent them happening again.
- They encourage all staff to look for and discuss health and safety issues; good and bad.
- Systems ensure integrity of design and construction.
- Systems ensure the integrity of the existing plant and its operation and maintenance.
- Control of organisational and technical change is robust.
- Reviews and audits are comprehensive and not just tracking.

Category	Issues	Good Practice Found
Supervision	The issue of supervision falls into three areas: • the regular presence of offshore management on the plant is very important; • regular visits by onshore senior management with an agenda to challenge • major hazard control; • regular visits by TAs offshore.	Senior and executive management making regular visits to all of their assets, communicating company strategies and plans, listening to issues directly from the workforce, gaining an understanding of problems with SCEs, testing and verification leads to improved performance. Technical authorities visiting their installations on a regular basis. They get involved in the work going on on the plant, become known to the supervisors and technicians, improve communications, their knowledge of the plant and systems for which they are responsible and their effectiveness in solving problems and involvement in incident management.

Key Regulations

- Health and Safety at Work Act Section 2(2)(a)
- Health and Safety at Work Act Section 37

Supporting Standards/ACoP or Guidance

- Leadership for the Major Hazard Industries INDG277 (Rev 1)
- Successful management of Health and Safety HSG65

Appendix 6: Dutyholder Performance Assessment

When inspecting the Maintenance Management topic each of the sub topic areas (Appendices 1-5) will have to be assessed on whether the risk control measures implemented lead to compliance with the relevant legislation. This decision will be made in the same way as for other inspection topics by comparing the standard of control achieved against the relevant benchmarks and applying the principles of EMM.

The inspection will reach conclusions on overall effectiveness of the dutyholder's systems. These should be recorded using the generic performance assessment descriptors listed in the table below. Those dutyholders who either do not have systems, or have system that are substantially ineffective will fall in the very poor or unacceptable categories. Where systems are in place but there is evidence of controls that are ineffective or inappropriate, it will fall in the poor category.

EXTREME	SUBSTANTIAL	MODERATE	NOMINAL	NONE	NONE
TOPIC PERFORMANCE SCORE					
60	50	40	30	20	10
Unacceptable	Very Poor	Poor	Broadly Compliant	Fully Compliant	Exemplary
Unacceptably far below relevant minimum legal requirements. Most success criteria are not met. Degree of non-compliance extreme and widespread. Failure to recognise issues, their significance, and to demonstrate adequate commitment to take remedial action.	Substantially below the relevant minimum legal requirements. Many success criteria are not fully met. Degree of non-compliance substantial. Failures not recognised, with limited commitment to take remedial action.	Significantly below the relevant minimum legal requirements. Several success criteria are not fully met. Degree of non-compliance significant. Limited recognition of the essential relevant components of effective health and safety management, but demonstrate commitment to take remedial action	Meets most of the relevant minimum legal requirements. Most success criteria are fully met. Degree of non-compliance minor and easily remedied. Management recognise essential relevant components of effective health and safety management, and commitment to improve standards.	Meets the relevant minimum legal requirements. All success criteria are fully met. Management competent and able to demonstrate adequate identification of the principal risks, implementation of the necessary control measures, confirmation that these are used effectively; and subject to review.	Exceeds the relevant minimal legal requirements. All success criteria are fully met. Management competent, enthusiastic, and proactive in devising and implementing effective safety management system to 'good practice' or above standard. Actively seek to further improve standards.
EMM INITIAL ENFORCEMENT EXPECTATION					
Prosecution / Enforcement Notice.	Enforcement Notice / Letter.	Enforcement Notice / Letter.	Letter / Verbal warning.	None.	None.

Further Guidance on Performance Assessment Descriptors for Maintenance Management

- Unacceptable- There is little or no evidence that the required success criteria for any of the sub topics inspected are being met. There is evidence that the

- Very Poor- There is some evidence that the required success criteria for some of the sub topics inspected are being partly met. There is evidence that it is highly likely that the control measures for providing effective maintenance management will fail.

- Poor- There is some evidence that the required success criteria for some of the sub topics inspected are being met. There is evidence that it is likely that the control measures for providing effective maintenance management will fail in some areas.

- Broadly Compliant- There is evidence that the required success criteria for all the sub topics inspected are just being met. There is evidence that the control measures for providing effective maintenance management should be successful.

- Fully Compliant- There is evidence that the required success criteria for all the sub topics inspected are being met in full. There is evidence that the control measures for providing effective maintenance management are successful.

- Exemplary- There is clear evidence that the required success criteria for all the sub topics inspected are being met in full or exceeded. It is clearly evident that the required control measures for providing effective maintenance management are successful.