NSOAF
Summary Report Multinational audit
Maintaining Safe Operations

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1 Executive Summary

The Multi National Audit addressed *Maintaining Safe Operations* with emphasis on elder offshore installations that, if possible, had experienced a change in operatorship/duty holder.

The main objective for the MNA was to ensure that all relevant lessons with respect to maintenance of safety critical barriers (focused on technical barriers) learned by the NSOAF members, are communicated to the industry.

In performing the audits, it was found important to establish a common set of questions, but still adapt the focus to local legislation and language. This approach contributed to getting the information from all levels in the organisations audited, and at the same time making it possible to look for similarities and differences in findings.

The audits were performed as all operators and duty holders (DHs) were addressing lower oil price by making efficiency and cost savings.

In the audits, it was agreed to also include management in the process, addressing leadership and cultural aspects of maintaining safe operations.

This report seeks to communicate lessons learned by identifying “Good practice” and “Poor Practice” described in Chapter 2.

**Good practice**
- Strong and determined leadership on both corporate/strategical and operational level is key to maintaining safe operations, especially in the demanding contextual situation described for this MNA, balancing the strategies on safety and efficiency and cost in a prudent manner.
- A well-organized Computerised Maintenance Management System (CMMS) is crucial for planning, executing, reporting and analysing maintenance and integrity.
- The Maintenance Management System (MMS) and maintenance organisation should undergo periodic reviews and the Management of Change (MOC) process.
- A high focus on uptime and production reliability was expected to be found, and the audits confirm this as a key factor in operational priorities.
- Senior management is involved together with the OIM in offshore decisions regarding maintenance. The workforce is also involved.
- Most audit teams report that the operators work to establish and maintain a balanced policy for maintaining the integrity for the installation with medium and long-term perspective.
- The operator/duty holder is monitoring and handling overdue and upcoming maintenance tasks, using the information to assess resource needs.

**Poor practice**
- Several organisations have limited or no overall strategy for Maintenance Management.
- Decisions on integrity issues are taken by the operations teams.
- There are limited requirements for competence in the operations team, and the organisations struggle to demonstrate the competence in key roles, like the Technical Authority role.
- A high focus on uptime and production reliability may lead to pressure on the organisation to keep producing when shutting down the facility is a safer option.
- Audits identified quality issues in handling of deferrals of planned maintenance.
- **The Risk Management** processes often fail to identify the correct severity level. For example, a major injury will be assumed rather than a single fatality or multiple fatalities, even for process safety issues. This means that the correct risk controls may not be identified. Such risk
assessment failings are often found in Control of Work, which means that permits sometimes do not protect workers from the most significant hazards. For Operational Risk Assessments, failures in identifying the correct level of severity mean that the failings do not get the management oversight that they should and the additional risk controls are unlikely to restore an ALARP level of risk control. Given that there may be many ORAs in place on some installations, the combination of several insufficient risk assessments is likely to have an adverse impact on cumulative risk management.

- Some MNAs found that the Operational Risk Assessments are used as tool for keeping installations in operation instead of shutting down when the cumulative risk becomes too great.
- Even after years and decades of operations, the CMMS content/data do have quality issues, as wrong classification of equipment, lack of Specific Maintenance Procedures, parts of the Corrective Maintenance being handled outside the system (CMMS) etc.
- The data recorded in the CMMS is not used for analysis and improvements in a systematic manner.
- Most operators/duty holders have no systematic checks of completed maintenance work, but have informal processes involving checks of work performed by personnel.
- Inadequate processes for monitoring/auditing/reviewing/investigating their own processes, hence limiting the ability to improve and implement learnings.
- Poor management of redundant or decommissioned equipment, as well as management of temporary repairs to equipment/systems in use as instead of being removed, it is often left in place so that it still requires some maintenance, which would be more usefully applied to equipment that is still in use. The redundant equipment is often so closely associated with live plant that workers may mistake live plant for redundant plant.

The audits also identified challenges in operating old installations, especially working to establish and maintain a balance between short-term and long-term strategic goals. It is also a challenge to ensure the Process Safety competency in the form of suitable and sufficient information, instruction, training and supervision for directly employed and contractor staff.

In the audits, it was also noted a large range of changes to cover for the MoC process (as referenced above under good practice). The system requirements in the management system must cover small changes like an interval change on a maintenance task, but must also support the management of changes to organisations and contractors at the same time.

A key finding of the UKCS Maintaining Safe Operations Leadership Audits/In-Depth MSO initiative is that 6 out of the 8 duty holders inspected did not appear to have reached a level of compliance that was worthy of maintenance. Fundamental systemic failings were revealed when inspecting against such important Inspection Guides such as Operational Risk Assessment; Control of Work, Maintenance Management; SECE Management and Verification etc.

The nature of these failings suggests that they were not caused by the “Lower for Longer”/“Lower Forever” oil price environment. Instead, it appears that these failings may have been present for years and that the duty holder’s own assurance systems did not reveal them, or that the issues were not addressed. The findings also raise the question as to what it was about our approach to planning and undertaking the MSO inspections that meant we found deficiencies that had previously been hidden in plain sight.

HSE has now presented its MSO findings at several different Oil & Gas UK (OGUK) forums and has not been challenged on the significance of the systemic SEMS failings that have been identified. An early response from the OGUK’s Wells Forum has been to request HSE input to a workshop on risk management. This was, in part, OGUK’s response to HSE’s finding that on the same installations, Wells ORAs had been found to have been risk assessed less effectively than non-wells ORAs.
2 Introduction

During 2015 and 2016, the NSOAF members met to discuss common challenges for the Oil and Gas industry in their respective countries. The challenges related to maintaining and operating aging installations in a lower oil price environment was selected as a topic for further work and follow-up.

This generated the basis for a series of audits (Multi National Audits — MNA) in 2017 with a common set of issues and questions. Each member country adapted the questions to their local regulatory regime and their language. They then conducted their audits as part of their regular audit/supervisory program. This report describes the audit process and summarizes the findings and learnings from the MNAs.

The findings from the Audits are presented in this report as Good or Poor practices to indicate areas of improvement and potential for experience transfer.

2.1 Maintaining safe operations – context, objective and template considerations

The objectives of the MNA were to ensure that all relevant lessons with respect to maintenance of safety critical barriers (focused on technical and SEMS barriers) learned by the NSOAF members from the audits, are communicated to the industry, and implemented in the North Sea.

The overall MNA goal is related to evaluating the companies’ ambitions and priorities in view of managing major accident risk and maintaining safe operations in times of major cost reductions and massive efficiency programs as a response to the recent changes in the revenue, due to a significantly lower oil price.

The audit teams have engaged in a dialogue with the senior/corporate management. In preparing for this dialogue, the context of the operation of the installation has been evaluated by some of the national teams. An understanding of the field economics, and the ability to maintain the income-stream predicted in the business case for the asset is an important condition for understanding the context of the operational situation.

Based on information gained from the dialogue with senior/corporate management, the MNA dug deeper into the companies’ maintenance management processes to verify how maintenance related strategies, goals and requirements, and development of associated performance indicators for maintenance management, support compliance with regulations as well as the companies’ management system and reinforce overall safety objectives and requirements. Key questions like the following were addressed:

- Is there sufficient balance and priority between budget, resources, goals and requirements?
- Is there sufficient balance between actual needs (resources, organisation, capacity, competence) and the companies’ strategies, goals and requirements?

Integrity Management/Maintenance Management is regarded as crucial to major accident risk, and will have relevance to risk for both personnel, environment assets. Maintenance related causes have been important factors in the development of major accidents in the past, hence the topic does have a major accident risk reduction potential for the industry in all the member countries.
The agreed focus of the MNA has also been on risk understanding and communication; methods and means to help understanding the overall risk picture. With that backdrop, the overall topic/questions for the audit interviews have focused on:

- **Managements role**, involvement and risk understanding in key processes that contribute to maintaining safe and efficient operations
- **Risk and barrier management** as integral part of the maintenance process (throughout the maintenance management loop – based on Deming’s “plan-do-check-act”)
- **The company’s own follow-up and continuous improvement processes** that are established to maintain safe and efficient operations

The complete template/audit guide was developed, built up by the blocs and the process as shown in this template model.

This report will present identified **good and poor practice** for all the elements in the template model (Plan-Do-Check-Act model presented below), and **major learnings for the industry and for the regulators** from the MNA process.

To communicate the intention and focus of the audit, the team developed a model based on the maintenance management process and how the different elements can be assessed. This approach is further described in chapter 2.2.

To make the results from the work comparable, the team agreed on the following criteria for selection of objects to audit:
- Platforms past design life
- Production platforms
- Changes in ownership
- Offshore facilities only
2.2 Maintenance Management

Historically, inadequate maintenance and maintenance related activities have been seen to play a role in major accidents, hence the topic may have major accident risk reduction potential for the industry in all the member UKCS countries.

In theory, three aspects of maintenance are important in relation to safe operations:
1. Incidents that lead to an injury of the persons involved in performing the work
2. Errors in planning, execution or control of the work performed (erroneous execution)
3. Missing or delayed maintenance (maintenance activities not done!)

The first (1) leads to lost time injuries, while (2) and (3) may result in major accidents – often linked to a fault hidden in the system over years.

The issues related to Maintenance Management are also relevant to the NSOAF members due to the significant cost reductions in the industry as a response to significantly lower oil price.

Integrity Management and Maintenance Management are crucial in control and handling of major accident risk, as for risk for personnel, the environment and the assets. The figure below gives an overview of the main elements in the MNA.

![Figure 1. Maintenance Management](image-url)
2.3 Involved in the activities

The following representatives were involved in the audit preparations and documentation:

<table>
<thead>
<tr>
<th>Name</th>
<th>Country</th>
<th>Organisation</th>
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</thead>
<tbody>
<tr>
<td>Sigve Knudsen</td>
<td>Norway</td>
<td>Petroleum Safety Authority, Norway</td>
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<tr>
<td>Ole Jørgen Melleby</td>
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<tr>
<td>Else Riis Rasmussen</td>
<td>Norway</td>
<td>Petroleum Safety Authority, Norway</td>
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<tr>
<td>Eivind Jåsund</td>
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<tr>
<td>David T. Walker</td>
<td>United Kingdom</td>
<td>Health and Safety Executive, UK</td>
</tr>
<tr>
<td>Mark Alderson</td>
<td>United Kingdom</td>
<td>Health and Safety Executive, UK</td>
</tr>
<tr>
<td>Kurt Machetanz</td>
<td>Germany</td>
<td>Landesamt für Bergbau, Energie und Geologie, Dienstsitz Clausthal</td>
</tr>
<tr>
<td>Liam Murphy</td>
<td>Ireland</td>
<td>Commission for Regulation of Utilities, Petroleum Safety Framework</td>
</tr>
<tr>
<td>Ben Browne</td>
<td>Ireland</td>
<td>Commission for Regulation of Utilities, Petroleum Safety Framework</td>
</tr>
<tr>
<td>Arnold V.de Groot</td>
<td>The Netherlands</td>
<td>State Supervision of Mines</td>
</tr>
<tr>
<td>Arthur van Dalen</td>
<td>The Netherlands</td>
<td>State Supervision of Mines</td>
</tr>
<tr>
<td>(planning only)</td>
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</tr>
<tr>
<td>Mohamed El Halimi</td>
<td>Denmark</td>
<td>Danish Working Environment Authority</td>
</tr>
<tr>
<td>Lars Møller</td>
<td>Denmark</td>
<td>Danish Working Environment Authority</td>
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Several auditors/inspectors were involved in the auditing activities in each country.

The audit process is outlined in chapter 7, Appendix 2.
2.4 Definitions and terms

This chapter includes definitions and clarifications required for the reader to understand differences in regulations, definitions and terminology that may differ between the countries and have influence on the understanding of the results of the MNA. All other terms and definitions used in the text, are commonly used across the industry.

**UK: Independent Verification**

Installations operating on the UK continental shelf must be provided with a Verification Scheme, which fulfils the requirements of the 2015 Safety Case regulations and certain aspects of PFEER.

The schemes require that duty holders identify Safety and Environmental Critical Elements (SECE) and set standards for them. SECEs included in Verification Schemes are related to systems. Once the elements have been identified standards for their operation and maintenance must be set, and conformance with them ensured during the operation of the unit.

Verification schemes require input from Independent and Competent Persons (ICPs) who must be independent from the operational organization of the duty holder, and during the development of the schemes it is expected that discussion will take place between the ICP and the compiler of the scheme.

**UK: Independent Audit**

A duty holder who prepares a safety case must include in the safety case sufficient particulars to demonstrate that their management system is adequate to ensure that the relevant statutory provisions will be complied with; and that the management of arrangements with contractors and sub-contractors is satisfactory; the duty holder has established adequate arrangements for audit and for the making of reports of the audit. “Audit” means systematic assessment of the adequacy of the management system to achieve the purpose referred above and are carried out by a person who is sufficiently independent of the system (but who may be employed by the duty holder) to ensure that such assessment is objective.

**Norway: Verifications**

The responsible party shall determine the need for and scope of verifications, as well as the verification method and its degree of independence, to document compliance with requirements in the health, safety and environment legislation. When verifications are deemed necessary, they shall be carried out according to a comprehensive and unambiguous verification programme and verification basis.

The operator shall establish the verification basis for the overall activities after assessing the scope, method and degree of independence of the verification. The operator shall also carry out an overall assessment of the results of the verifications that have been carried out.

Source: Norway, from Framework regulations, section 19.
2.5 Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>CM</td>
<td>Corrective Maintenance: maintenance carried out after fault recognition and intended to put an item into a state in which it can perform a required function. From: EN 13306: 2010</td>
</tr>
<tr>
<td>CMMS</td>
<td>Computerised Maintenance Management System. (Example SAP, Maximo or similar software system).</td>
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<tr>
<td>DH</td>
<td>Duty Holder (UK term)</td>
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<tr>
<td>IRF</td>
<td>International Regulators Forum</td>
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<tr>
<td>MOC</td>
<td>Management of Change</td>
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<tr>
<td>MNA</td>
<td>Multi National Audit</td>
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<tr>
<td>MSO</td>
<td>Maintaining Safe Operations</td>
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<tr>
<td>NSOAF</td>
<td>North Sea Offshore Authorities Forum</td>
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<tr>
<td>OIM</td>
<td>Offshore Installation Manager</td>
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<tr>
<td>PDCA</td>
<td>Plan – Do – Check – Act Common term for a management loop as described by W. Edwards Deming.</td>
</tr>
<tr>
<td>PM</td>
<td>Preventive Maintenance: maintenance carried out at predetermined intervals or according to prescribed criteria and intended to reduce the probability of failure or the degradation of the functioning of an item From: EN 13306: 2010 PM are normally managed by a CMMS.</td>
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<tr>
<td>SECE</td>
<td>Safety or Environmental Critical Element</td>
</tr>
<tr>
<td>SMA</td>
<td>Safety Management System</td>
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<tr>
<td>TA</td>
<td>Technical Authority Role in organisation; the Technical Authority (TA) is responsible for the technical assurance and compliance of a given system or group of equipment are kept in line with company, corporate, national and international standards and guidelines.</td>
</tr>
<tr>
<td>CMMS</td>
<td>Computerised Maintenance Management System. (Example SAP, Maximo or similar software system).</td>
</tr>
</tbody>
</table>
3 Audit findings related to maintaining safe operations

3.1 Leadership

Good Process Safety Leadership on both corporate/strategic and operational level is key to maintaining safe operations, especially in the demanding context described for this MNA, balancing the strategies on safety, efficiency and cost in a prudent manner. Leaders are important players in the management of major accident risk and the importance of management’s role is confirmed, among other things, in accident investigations where management and leadership often emerge as critical underlying causes.

Leaders have the responsibility, set the course, allocate resources, follow up and motivate for the desired development. It is of great importance what information leaders seek, how they interpret hazard signals, how they reward work with positive effects on major accident risk, how they assess the consequences of their strategic decisions on major accident risk and how they integrate management of major accident risk in the company’s business management. The management’s decisions and initiatives define framework conditions that are important in reducing major accident risk. Leadership and actions taken by management also have a strong impact on the culture of the organisation.

The central element of the MNA model (fig 1) is therefore Leadership. This element addresses leadership responsibility; work processes for planning and implementation of supervision of own organisation and of contractors. Examples of supervision can be regular meetings, reviews, meetings with safety delegates and unions, follow up of performance as well as audits, verifications, inspections, self-assessments etc. The leadership element naturally relates to all the other following elements of the model.

As a basis for our assessment of these topics, the audit teams have engaged a dialogue with the senior/corporate management. In preparing for these meetings/interviews the context of the operation of the installation has been evaluated by some of the national teams. An understanding of the field economics, and the ability to maintain the income-stream predicted in the business case for the asset is important in understanding the contexts of “Maintaining Safe Operations”.

The MNA ambition related to the leadership element has been to evaluate managements “understanding of the total risk picture” in company’s own follow-up activities (monitoring, verifications, audits, improvements). Typical questions asked to this element were:

- What is the basis of the company’s plans for self-monitoring, verification and follow-up of the maintenance management process?
- Do the leadership’s monitoring-, verification and follow-up programmes sufficiently reflect strategies, goals, requirements and context?
- How are the resource needs in terms of experience, skills and knowledge monitored, verified, followed-up and improved, in view of aging installations and context?
- How is the effect of the program monitored, verified, followed-up and improved?
- How are the criteria for the plan including effect of changes and re-planning activities monitored, verified and followed-up, evaluated and monitored?
- How is execution of work according to plan/program — including quality in reporting — monitored, verified, followed-up, evaluated and improved?
- How are the criteria, quality and processes for use of analyses and their results monitored, verified, followed-up, evaluated and improved?
- Are there sufficient break-down and communication of strategy, goals and requirements to influence and support daily work?
Audits can show leadership from senior management through:
- direct involvement in asset integrity issues,
- follow up of priorities,
- follow up of daily/weekly report on status,
- visibility through regular management visits
- presence in decision making and risk management.

**General findings**
Risk management is vital to safe operation of O&G facilities, however today most of the processes and tools used are made for individual tasks and do not communicate well aspects of cumulative risk. This makes it difficult for operational decision makers to get the total risk picture. It also makes communication of risk and prioritization of corrective actions or operational adjustments more difficult. Further work on this issue is recommended to support operational processes, and to stimulate risk information transfer between onshore and offshore.

MNAs also show that there are shortcomings in information flow. Information flow from management to operating require attention to ensure that their messages flow down their organisation and are implemented effectively. Attention should also be given to the flow of good and bad news back up to the leadership from audits, monitoring activities, KPIs and management visits.

The integrated safety perspective covering both the environmental risk as well as risk to personnel and the installation is also less visible than the perspective of personnel safety. Further follow up of the barrier management processes linked to barriers preventing pollution, through audits and our communication may contribute to make this more visible in the operational priorities.

In times of cost cutting, training and competence development and maintenance is under pressure. MNA findings show a need for follow-up of provision of information, instruction, training & supervision for a range of risk control systems. Follow up of the safety representative’s ability to undertake their roles due to pressure on training budgets and time will need to be part of this.

**Good practice**
- Focus from management on work processes for follow-up of safety and integrity.
- Activities to improve health, safety and the environment, are viewed jointly and holistically.
- Risk assessment approval system by internal “independent” authority (technical authority).
- The leaders work to maintain a systematic and critical focus on their own HSE activities.
- Management involve the workforce in critical decision processes.

**Poor practice**
- With small organisations of limited capacity, there were a lot of “one person” responsibilities. In other words, one person can have multiple roles in the organisation, hence making the organisation vulnerable to the loss of key personnel and so non-resilient.
- Some audits also report instances where the safety representatives not were able to adequately undertake their roles.
- Training and competence development is under pressure.
- Postponement of safety critical maintenance.
- Some of the MNAs showed organisations with none or few relevant audits on their system for maintenance management.
3.2 Strategies, Goals and Requirements

This issue addresses the company’s processes for ensuring that the maintenance related strategies, goals and requirements, and development of associated performance indicators for maintenance management, comply and reinforce overall safety objectives and requirements.

The overall MNA goal related to this element was to evaluate the company’s ambitions and priorities in view of asset integrity and managing major accident risk, considering the selected MNA context. Hence, four main topics formed the basis for the questionnaire guideline on this element:

1. Is there sufficient balance and priority between budget, resources, goals and requirements?
2. Is there sufficient balance between actual needs (resources, organisation, capacity, competence) and the companies’ strategies, goals and requirements?

Further, a high focus on uptime and production reliability was expected to be found, and the audits confirm this as a key factor in operational priorities.

**Good practice**

- In general, the audit found that the date set/fixed for the cessation of production, or lifetime extension have stronger impact on strategic discussions and maintenance decisions than oil price.
- Most audit teams report that the operators work to establish and maintain a balanced policy for maintaining the integrity for the installation with medium and long-term perspective.

**Poor practice**

- Decisions on modifications and/or repairs (permanent and temporary) is often taken on an operational level in the organisation with the intention to save cost and reduce downtime. This may challenge the medium to long-term perspective and limit the technical analysis behind these decisions.
- Some audits find that the operator/duty holder does not have an overarching maintenance policy/procedure in place which sets out clear roles and responsibilities, records retention arrangements, process for updating maintenance procedures and the content required for check sheets. The current arrangement is that the description of the maintenance policy is set out in a number of different documents.
- Limited overview from KPIs generated out of the maintenance system.
- The office organisation is small, many tasks and knowledge lie with one person, hence the organisation is vulnerable to the failure of employees.

Discussions with asset managers and operational management gave a clear picture that the organisation is always optimistic and hoping for a decision about further extension of lifetime. In times when lifetime is unclear, strategic asset management decisions are postponed and it seems like there is «no clear direction» from local management. Audits indicate that local (asset) management is reluctant to make decisions or perform studies before a decision on lifetime has been communicated.

Audits even demonstrated that local management avoided making or updating studies or documents like maintenance strategy and safety strategy until a decision was given by corporate management. Considering the importance of these documents as basis for a lifetime decision, this contributes to an increased uncertainty, as the studies are evaluation of condition and integrity of the installation and core systems.

In the MNAs, we saw that the organisations have an operational approach to challenges arising, and that «Findings are driving priorities». For example, the operational team utilized system/equipment redundancy, without adjusting neither system/equipment criticality, nor the priorities in the maintenance program.

Findings driving priorities were established and formalized in processes, as some operators have «Blue – light» meetings when they have significant findings, reprioritizing their plans in order to handle the situation and get
back into full production. These processes identify the key risks but limits the robustness for changes in circumstances.

3.3 Resource Management

The MNA goal was to evaluate the companies’ processes for balancing resource needs, strategies, goals, requirements and budgets.

In evaluating the resources management processes, the MNAs also focused on the issue of competence. How does the operator/duty holder secure that experience, skills and maintenance related knowledge assessed and maintained at a satisfactory level in view of aging installation and installation context?

Good practice

- In general, we found that the change in the oil price and profitability of the operation have made several/most operators insource activities to their maintenance and inspection staff, hence reducing the work performed by the contractors. Operators are also expressing a strong preference to keep knowledge within the company and get the quality expected from the work performed.
- The changes made to the operational organisation also imply that more of the maintenance planning and system (CMMS) management have been moved to the office onshore. The change has both pros and cons.
  - Some operators report that they have been able to reduce maintenance backlog by improved planning and better use of resources.
- Some MNAs report that the organisation is struggling to keep the ownership to the asset and the equipment. However, they consider that this is a key value, but changes in operatorship, preparation for decommissioning and cost reductions are challenging this.
- Based on review of data in the CMMS and interviews with senior personnel, including the OIMs, some operators report that they have enough resources to adequately meet their maintenance requirements. Reporting of KPIs on maintenance backlog support these observations.
- The competence management systems for operations personnel shown to the NSOAF audit teams were robust, up to date and appeared to address the competencies for the role sampled.

Poor practice

- Some of the audits have identified the inability of the operators/duty holder to demonstrate competence for technical roles in their organisation, sometimes even at the level of the Technical Authority (TA) role. Some MNAs found that the TA resources appeared stretched and that the demand for capacity was increasing.
- The changes made to the operational organisation also imply that more of the maintenance planning and system (CMMS) management have been moved to the office onshore. The change has both pros and cons.
  - Others report on quality issues linked to planning. In other words, an increased need for re-planning the work packages coming from the onshore team due to lack of quality and or installation specific knowledge.
- Based on review of data in the CMMS and interviews with senior personnel, including the OIMs, some operators revealed that they don’t have enough resources to adequately meet their maintenance requirements. Reporting of KPIs on maintenance backlog support these observations.
- Documentation is also an important resource in preparing, planning and execution of maintenance. In some countries, the duty holder/operator had failed to update essential documentation (i.e. P&IDs).

3.4 Maintenance Program
This issue includes work processes for development, updating and improvement of preventive maintenance programmes, inspection programmes, programme for condition assessment and testing, etc. In this report, the term preventive maintenance (PM) have been used as a designation for these programmes combined (see definition in section 2.5).

The following five topics formed the basis for the questions linked to this element:

- Does the program and test methods reveal the actual technical condition of safety critical equipment?
- Is it a structured basis for the selection of the SCEs and performance requirements?
- Are the criteria set for the asset register sufficient to manage the SCEs?
- Are the test methods adequate to detect errors?
- How is the effect of the program monitored, verified, followed-up and improved?

The MNAs all assessed the maintenance program as well as the processes oriented to keep the maintenance program updated and relevant, as well as the role the PM program have, in view of the actual technical condition and the overall risk picture.

**Good practice:**

- The operators/duty holders all use a CMMS tool to manage their maintenance activities, including work-order management/approvals etc.
- The system can generate reports and performance indicators (KPIs) for review and analysis
- All MNAs report an established process for managing maintenance backlog.
- The CMMS also (in most cases) include the programmed inspection activities.

**Poor practice:**

**Data quality and systematics:**

- Several of the audits indicate that data reporting (of maintenance execution) are not systematic, and that data format (often text strings) make a poor basis for analysis. Several teams report also that relevant information is available but in various data systems, making the prioritization and understanding of cumulative risk more complicated. Audits also report that data from maintenance (feedback from work orders) were not properly analysed and actual experience was not used as feedback into the planning.
- The use of the data: It is not always analysed for reliability or availability even though such information may be available. There also seems to be some misunderstanding in the difference between availability and reliability.
- Some audits also report that the Maintenance procedures did not include sufficient information to control the risk of incidents that could foreseeably arise from maintenance, as well as inadequate identification of safety critical tasks.
- Safety Environmental Critical Elements (SECEs) are addressed and given special attention. However, some audits revealed limited level of detail in work orders, and procedures for maintenance of SECEs. This means that work orders do not include test requirements, as valve closing times or other test data, resulting in tests being performed and evaluated by the best judgement of the personnel, and not versus the actual requirements given in design documentation and in barrier analysis.
- Some audits found SECE equipment not uniquely identified in the CMMS. This makes control of barrier integrity almost impossible.
- Several audits report that the duty holder/operators had limited efforts directed to controlling and updating the data quality of the CMMS, thus the likelihood of misunderstandings, misinterpretations, omissions etc. Most of these errors identified could easily have been found by the operator/duty holder’s own organisation.
- In a few audits, auditors also found Corrective maintenance outside of the CMMS, and in one case reported that the maintenance management system did not store relevant data on maintenance, reporting and that performance criteria was only partly available in several documents/data sources.
Technical issues:

- Some audits revealed ineffective management of small bore tubing (SBT) including missing plugs on gauges, indicating a higher risk for Hydrocarbon leakages.
- Certified equipment where in some audits found to be very close to the expire date, and in some cases the certification of the lifting equipment was expired without this being identified by the CMMS system.
- The management of structural integrity is a key issue for all late life fields. The MNA showed a span of performance from where the operator/duty holder failed to demonstrate the effective management of structural integrity for their installation, to operators with significant investments in upgrades on structural integrity and/or coating/fabric maintenance.
- Some old installations have redundant equipment, or equipment decommissioned in-situ. This equipment was in some cases poorly managed, resulting in redundant equipment representing a maintenance burden and integrity risk.

Other Issues:

- Some MNAs revealed that duty holders had failed to review their written schemes of examination for Risk Based Inspection schemes, which could increase the risk loss of containment of hydrocarbons etc.

3.5 Maintenance Planning

This element focuses on work processes for short-term, medium-term and long-term planning of maintenance activities (including day-to-day coordination, individual work-tasks (work orders), short-term plans (monthly and weekly plans, medium- and long-term plans. (e.g. 3 months, 2 years, 5 years, etc.).

The overall MNA aim related to this element was to evaluate the company’s maintenance planning in view of the overall risk picture. As support to the detailed questionnaire guideline the following five topics were established:

- Are the priorities based on the overall/total risk picture?
- Is the planning a structured and multidiscipline approach involving both on-and offshore?
- Are the planning and priority processes risk based?
- Are maintenance procedures of sufficient quality?
- How are the criteria for the plan including effect of changes and re-planning activities monitored, verified and followed-up, evaluated and monitored?

Planning of maintenance activities include planning of:

- Preventive activities
- Corrective activities
- Inspection activities
- Activities related to corrosion management and fabric maintenance.

Consequently, the complexity is high and understanding of risk and communication of this understanding to the executing element in the organisation, and back to the planning and management functions is vital to safe operation.
**Good practice:**

- All companies report that a CMMS is crucial for planning, executing, reporting and analysing the maintenance and integrity.
- Most companies have moved the planning function to shore and are preparing work plans based on the expected work load in the planning horizon. Plans for 12 months, 3 months and the coming shift (2 or 3 weeks) were kept updated. However, these changes have both pros and cons, but some operators report that they have been able to reduce maintenance backlog by improved planning and better use of resources.
- Simultaneous operations are also an important consideration in operational planning and decision making. All companies report that the OIM will be the one making the decision on how much work can be performed simultaneously.
- Most operators/duty holders report a system for monitoring of overdue and upcoming maintenance.
- Safety critical functions and equipment prioritized and maintained accordingly.

**Poor practice:**

- Repair strategies are important elements of corrective maintenance in late life fields. Reports indicate a complex mix between just doing things right the first time, by changing out or renewal if equipment or systems are off standard, rather than generate a report accepting a substandard situation.
- Most companies have moved the planning function to onshore and are preparing work plans based on the expected work-load on the planning horizon. Plans for 12 months, 3 months and the coming rota (2 or 3 weeks) were kept updated. However, planning quality seemed to vary, as some companies report a larger share of re-planning that need to be done before the work can be executed. Some claim that this is caused focus in cost reduction has led to changes in work processes for planning, reducing asset specific knowledge.
- Deferral of maintenance activities are done in all operating organisations. In these deferral processes risk understanding, and handling are important. Most operators/duty holders assess risk for each deferral but fail to evaluate the combined risk of all deferrals and how operational corrective actions jointly contribute to the risk level. One audit reported that a deferral process was not used, work order where allowed to fall overdue and were prioritised each week on this basis. This operator, however, operated with almost no backlog on safety critical maintenance.
- Some audits report that the operators/duty holders defer maintenance without formal risk assessments according to MMS.

### 3.6 Execution and reporting

This element focuses on preparations, implementation, control and termination/supplementary work of preventive and corrective maintenance, including registration of data/equipment history after completed maintenance on systems and equipment. Further, work processes for gathering and qualifying safety-related maintenance data, preparation and distribution of reports, statistics etc for maintenance units and management.

The MNA aim related to execution and reporting was to evaluate execution in view of company’s processes related to risk understanding and communication. (Communication of risk information to relevant personnel). Further to evaluate quality in reporting routines. As support to the detailed questionnaire guidelines the following five topics were established:

- Is execution founded on suitable and sufficient risk understanding, competence, and how the work and priorities will influence the total risk picture?
- Is relevant documentation available and sufficiently detailed?
- Do the reporting requirements reflect the actual need for details to help understand the technical condition?
• Is the reporting of sufficient quality to ensure a correct basis for analyses of the actual technical condition?
• How is execution of work according to plan/program — including quality in reporting — monitored, verified, followed-up, evaluated and improved

Execution of work was included as a theme in the audit questionnaire, to assess how risk were communicated and understood by the personnel performing the work. The verification of quality is also of importance as failures introduced to systems or equipment may introduce additional risk to the operation.

**Good practice:**
• The audits included interview with offshore staff and contractors. The interviews showed that the operators/duty holder have highly experienced staff, most of whom have worked on the platform for a several years. They also showed low turnover of staff and contractor personnel.
• Personnel demonstrated a high level of competence for maintenance staff and a high degree of familiarity with the plant and equipment.
• One company reported a systematic approach to supervision of quality in execution of maintenance work. Third party work is more often checked by direct supervision and review of reports.

**Poor practice:**
• Most operators/duty holders have no systematic checks of completed maintenance work, but have informal processes involving checks of work performed by personnel.
• Reporting of work performed in the CMMS system is normally done by the personnel executing the work, but most operators/duty holders still have a negative reporting of the preventive activities. Negative reporting means that they are just “ticking off” PM and only reporting work done. The only report technical condition issues as corrective work orders if the PM activity reveals equipment failures. This practice reduces the possibility to trend failure development such as safety valve closing time. Moreover, it also represents a risk of unnecessary backlog due to a lack of actual information out of the maintenance system.
• Several of the audits indicate a strategy of temporary repair to systems such as process piping using “polymer wrapping” of some certified third-party system. Each repair represents a reinstatement of system integrity. However extended use and this type of repairs ending as “longer term temporary”, they add risk to the overall system integrity.
• The decisions to make temporary repairs are normally taken lower in the organisations and may not be given sufficient system engineering attention, resulting in limited evaluation of the cumulative risk of having several or many such repairs.

### 3.7 Analysis

The topic addresses implementation of analyses of:

1. Maintenance activities
2. Empirical data. For example, analyses of undesired events that have arisen during maintenance work, analyses based on statistics, trends on failures in safety-critical equipment and safety systems, analyses of casual relations in the event of an increase in outstanding, corrective maintenance etc.

The MNA ambition related to this element was to evaluate how the use of analyses results were used as input to decisions and improvement proposals. As support to the detailed questionnaire guideline, the following four topics were established:

- Management contribution - what do management request in terms of analyses, and what are the triggers to initiate analysis of data.
• What processes and what competence are in place to ensure a realistic picture of the actual condition of safety critical equipment (SCE).
• Are clear criteria/triggers established for when to analyse – including roles & responsibilities.

The part of the PCDA loop described in chapter 3.1 seems to be the most complicated part for operating organisations to do in a systematic way.

**Good practice:**
• All operators/duty holders report that they use some sort of KPI review, to monitor performance of production availability/reliability. Most commonly, overdue work orders are monitored as KPIs on a weekly basis.
• KPIS and other information from the CMMS reporting are also used in planning meetings and safety meetings at different levels in the organisations.
• Some operators/duty holders focus on failure analysis and backlog management, in order to improve the maintenance program over time
• Most operators/duty holders perform periodic reviews of availability and reliability, and/or of safety-critical barriers. These processes often appeared to be relevant and extensive.
• Several operators/duty holders have developed extensive systems to visualise and communicate barrier health, providing leaders with live barrier status information (“dashboard”).

**Poor practice:**
• Senior Management indicate that they have sufficient information available to them via KPI and other metrics to have a good understanding of the risk picture on the platform at a given time. However, the quality of data and suitability of the KPIs to assess major accident risks have not been assessed or evaluated in detail.
• Audits also indicate that the balance in use of KPIs are important, as communicated by some supervisors that sophisticated KPI systems may in fact be swamping company management (top and middle) with too much information, limiting their ability to be able to process the information properly.
• Some operators/duty holders report that maintenance analysis is difficult due to a lack of overview and actual data reported.
• Some reports in the CMMS systems are used to monitor performance of safety-barriers. However, audits of these data indicate that test results (successful tests and test failures) were reported while failure of the barrier in use was handled as corrective work orders and hence not included in the test log. Lack of systematic description of test procedure and test failure criteria were also an issue in several of the audits.

3.8 Verification and Audits and Management of Change (MOC)

This element addresses leadership responsibility; work processes for planning and implementation of supervision of own organisation and of contractors. Examples of supervision can be audits, verifications, inspections, self-assessments etc.

The MNA ambition related to this element has been to evaluate managements “understanding of the total risk picture” in the company’s own follow-up activities (monitoring, verifications, audits, improvements).

As support to the detailed questionnaire guideline the following four topics were established:
• What is the basis for the company’s plans for own monitoring, verification and follow-up of the maintenance management process?
• Do the leadership’s monitoring-, verification and follow-up programmes sufficiently reflect strategies, goals, requirements and context?
• How are the resource needs in terms of experience, skills and knowledge monitored, verified, followed-up and improved, in view of aging installations and context?
• How is the effect of the program monitored, verified, followed-up and improved?
• How are the criteria for the plan including effect of changes and re-planning activities monitored, verified and followed-up, evaluated and monitored?
• How is execution of work according to plan/program — including quality in reporting — monitored, verified, followed-up, evaluated and improved?
• How are the criteria, quality and processes for use of analyses and their results monitored, verified, followed-up, evaluated and improved?
• Are there sufficient break-down and communication of strategy, goals and requirements to influence and support daily work?

Several of the NSOAF audits were performed under regulatory regimes requiring independent verifications by a third party. Reports show that these independent verification is embraced as external check on the system.

The HSE in the UK report that a number of operators/duty holders are having difficulties reaching an acceptable level of safety in their operations – it is also clear that a great deal of good work is being done by the inspectors during the NSOAF activity to raise standards to levels which are worthy of maintenance. Thus, MSO is not just about maintaining safe operations, it is about enabling duty holders to attain suitable operational standards worthy of maintenance.

**Good practice:**
- Senior management have a very active dialogue with the OIM in offshore decisions regarding maintenance priorities and integrity issues. They are also consulted on all operational risk assessments.
- Most audits report the use of MOC (Management of Change) processes, to handle changes from normal operation.

**Poor practice:**
- The NSOAF audits indicate that the operators/duty holders don’t use audits as a systematic tool to follow up and improve the maintenance management system and/or the processes involving maintenance management. Spot checks in the CMMS system done as part of the NSOAF audits found quality issues on data and reporting, that an internal quality review or system audit would have identified.
- There appears to be weaknesses in the systems operator/duty holders use to ensure that their messages flow down the organisation and are implemented effectively and in the flow of good and bad news back up to the leadership (audit, monitoring, KPIs, management visits, etc.).
- Most audits report the use of MOC (Management of Change) processes, to handle changes from normal operation. Operational Risk Assessments (ORAs) were used as a tool to assess risk when SECEs have a failure or are impaired. However, in some instances these ORAs seemed to be used to justify continued operation until a permanent repair can be made and some had been in place for years, with little sign of a permanent fix.

The complexity of the MOC process is worth a note, as the process must cover all changes from a change in the PM program, e.g. a change in the interval on one unit/equipment, as well as handle complex organisational changes like restructuring due to a change in field economics, and technical changes like major modifications to an installation.
3.9 Technical Integrity

A key result expectation in “Maintaining Safe Operations” is to maintain acceptable technical integrity of the structure and process facilities. In many companies, the barrier management systematics have been applied and are monitored and tools have been developed to visualize barrier status. Work-orders related to these barriers are given special attention by management and the operational decision makers.

A significant effort has been put into these processes and they are improving in quality and precision. However, a continued attention by the authorities will contribute to further competence development and improved follow up of the integrity of these system on the installations.

**Good practice**
- Barrier management and systems to make barrier status/integrity visual.
- Source of ignition controls are also an important factor in the barrier management. This is the need to maintain the integrity of EX equipment according to recognized standards (ATEX).
- Leaks and “diffuse leaks” from process valves, flanges and process piping are a growing factor in old systems, but some audits show that “diffuse leaks” (aka “Weeps and seeps” seem to be given effective attention by management and the operational decision makers.

**Poor practice**
- Procedures for “Locked Open and Locked Close” (LOLC) of valves are important factors in maintaining safe operations. The issue was identified in several audits as maintenance of the system and the LOLC physical locking bands/straps are challenging.
- Some audits identified Safety critical instrumentation that:
  - Was not marked or maintained properly.
  - ESD valves that did not have a documented routine to test their closure.
  - The emergency lighting tests performed during some of the NSOAF audits, indicated failures like lights not working or batteries not lasting to requirements.
- Some companies had problems in demonstrating the effective management of structural integrity.
- The issue of redundant equipment also is a key technical aspect identified. Redundant equipment, and or decommissioned equipment left in place are not being managed properly, hence representing a maintenance burden and integrity risk.
4 Major learnings from the MNA

The MNA process, performance and results provide learning opportunities on multiple levels. Here we have discussed the learnings for the industry as well as the regulators.

4.1 Learnings for the industry

The MNA provide regular/audit/inspection findings for each installation and organisation audited. The reference for the audit teams have been the local/national regulations and requirements relevant. Several of the operators/duty holders audited have operations on several continental shelves, and the learnings from one part of the North Sea should be relevant for their other operating assets and their organisations.

Reviewing the joint report, as well as the reports of relevance form each individual audit will provide arenas of learning across borders, but requires an initiative from the industry

Specific issues recommended for follow-up by the industry:

- The need to develop an effective and demonstrable approach to Process Safety Leadership.
- The use of internal audits to assess the precision and quality of data in the CMMS are considering a major learning that are easy to transfer and it will give benefit as well as a safety improvement.
- Another issue identified as a common challenge are that the operator/duty holders have little explicit guidance in relation to quality assurance, supervision and sample checking of the correct execution of safety critical maintenance. The use of temporary repair methods, and their impact on system and installation integrity and risk

4.2 Learnings for the regulators

Regulators in the NSOAF countries have through this MNA process already shared experience and established arenas for discussion and experience transfer.

The approach of focussing on the capability of companies in terms of Process Safety Leadership has proved to be both revealing and offering the potential for impact. MNAs that have put the assessment of the effectiveness of company leadership as a key objective appear to have succeeded in engaging company leaders in the need to improve in some SMS areas that are most important in addressing the underlying causes of failure rather than just symptoms.

The MNA approach, which requires effective multi-disciplinary teamwork, extensive planning and a systematic and targeted approach to inspection, appears to have resulted in the identification of more significant systemic SMS failures than “normal” inspections. Significantly more regulatory resource is required for the MSO Audits, but this appears to be balanced by the opportunity for increased regulatory impact. Where the MSO Audit approach has proved to be more revealing of companies’ systemic SMS failings that had not been identified, or dealt with previously, the regulator needs to consider how the MSO Audit approach can be adapted to make such penetrating inspections the norm.

The engagement of company leaders in the MSO audits stimulated a challenge to one regulator to provide balanced feedback instead of just identification of failure. Providing both verbal and written feedback on relative strengths is a cultural challenge to most regulators. In attempting to do that though, it appears that this may be an effective mechanism for sharing more widely, via industry forums, on “what good looks like”. This means that opportunities for improvement identified by the regulator can be shared across different companies. This is an obvious potential regulatory efficiency. Furthermore, discussion between regulator and company of the latter’s relative strengths and weaknesses should prove helpful in targeting future inspections so that they test the strengths and focus on the weaknesses. This should enable regulatory impact to be demonstrated through the companies demonstrably changing their weaknesses into strengths.
Safety culture has been identified as being key for compliance. However, this is a difficult subject to regulate. Review of the way to progress this suggests that regulators should be challenging companies to be able to demonstrate good Process Safety Leadership as this would in turn help develop a suitable safety culture.

The MNA audit have provided a good arena to discuss issues liked to audits/inspections of fields in late life, in the context of good operational practices and maintenance management. Keeping the theme active with several planning meetings, getting inspiration and information from the other member countries.

The combination of risk management and maintenance is a key issue in managing late life and maintaining safe operation, however the integrity of the installation and systems form a sound basis for all risk assessments.

Follow up of verification schemes and internal audits performed within the operators/duty holders organisations is key in making the industry controlling its own risk, and improving continually.

In performing the audits with several organisations/operators/duty holders also gives a good basis for comparison and understanding of issues of relevance for the late life installation. The information shared also gives the other members knowledge, in order to develop audit themes and questions to identify issues earlier as some areas have matured more.

Specific issues from the MNA experiences:

**Positive**
- Time with CEO and/or top management provide useful insight in the organisation and its priorities
- The use of joint question sets provides guidance and consistency in performing the audits
- The interviews with the onshore support team becomes more important as more of planning and system work is performed at the operators/duty holder’s office location. Time and resources should be allocated accordingly.
- Advance documentation, provide good insight and essential preparations, but requires significant resources to read and evaluate
- Offshore, the time with OIM, safety rep, maintenance/operations staff is vital in understanding the maintenance management processes and decision making.

**Negative**
- These audits are resource demanding, significant work involved in preparing, executing, reporting and following up on the findings
- To provide the audit teams with enough time to prepare are a challenge.
4.3 Further work

Most NSOAF members plan to follow up on the findings from these MNA audits, and if relevant perform more audits of operators/duty holders that operate late life fields/installations.

A common response among the operators/duty holders has been for them to review and revise their organisational relationships with their key contractors. This appeared to be an area where it was relatively easy to identify cost efficiencies. The NSOAF audits have focused on this from the operator/duty holder perspective. Future work should focus on contractor capability and contract frames for safe and sustained organisational capability.

A long list of individual technical issues identified and discussed during the MNAs could be made, however each report states this clearly and gives the operator/duty holder clear guidance of actions to take. From the overall perspective from the audits, one major issue stands out. The processes of evaluating the overall technical conditions or the facility including all elements and systems. It is not clear to our audit teams how they determine and maintain a “picture” of the risks involved in the current level of technical condition. This is a complex issue and requires further attention and follow up.

4.4 Communication of results and learnings

The results from the MNA process will be used in communication with several stakeholders. The work with the MNA has required significant resources, and the use of the results in communication and follow up is vital in getting the effect wanted.

It will be communicated through several channels:

a) To the industry via conferences and seminars
b) The MNA main points will also be communicated on the web pages of the NSOAF member countries.

In addition, most NSOAF countries will follow up the work through their audit/inspection planning for the coming period. Follow up of issues as presented in this report, as well as follow up of individual operators/duty holders and installation will be based on the MNA findings/results.
Appendices – Country reports (not to be published)

Appendix A – Country report, UK HSE (not to be published)

**Summary:**

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<tr>
<th>Category</th>
<th>Description</th>
<th>Comments</th>
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<tr>
<td>Number of audits</td>
<td>8 x audits were performed</td>
<td>As of January 2018</td>
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<tr>
<td>Operators involved</td>
<td>8 x operators were audited</td>
<td>12 should have been completed by 31st March 2018</td>
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<tr>
<td>Number of inspectors/auditors involved</td>
<td>37 regulatory &amp; specialist inspectors</td>
<td>The audits were undertaken by the inspectors usually assigned to each duty holder with some support a SMS specialist for the leadership component</td>
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<td>Man hours used within the regulators organisation</td>
<td>4600 man hours</td>
<td>This work is cost recoverable for HSE</td>
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**Activity summary**

The audits began in May 2016 and will be continued into the 2018-19 financial year. This report is based upon the eight audits undertaken between May 2016 and January 2018. A template was devised to ensure consistency and to help answer some basic questions on the management of maintenance backlogs that were a concern to key HSE stakeholders.

A key aspect of the audits was the inclusion of a leadership component. The purpose of this was to obtain the view of the most senior leader of each duty holder on how they were addressing the challenges associated with oil price down turn while ensuring that they retained the capability to manage major accident hazards. These leadership inspections took the form of a meeting between the senior leader and their team and the core HSE inspection team, including a senior regulator leader and a safety management systems specialist. Although the leadership inspections involved the use of a question set, we advised the duty holders that we were expecting an open conversation rather than the use of extensive presentation slides. The question set was provided in advance and tended to result in some very open and informative discussions.

The main inspection template was provided to the duty holders in advance of the onshore phase of the inspection. This was to provide time for them to answer it themselves from their perspective, which would then inform HSE’s lines of questioning. In addition to answering the questions on the template, some of the audits were targeted by extensive examination of the Safety Case and Independent Competent Person reports relating to the status of the SECEs/SECEs. This often resulted in the identification of significant hardware issues that could be investigated and resolved in the
onshore phase of the inspection, or offshore if necessary. Four key inspection guides: Maintenance Management, SECE Management & Verification, Operational Risk Assessments and Control of Work were also used to focus the audits.

The Onshore phase of the inspection was held after the Leadership meeting. The Onshore inspection typically took place at the duty holder’s offices over two days and involved up to seven regulatory and specialist inspectors. The inspection covered the Template, issues identified from the Safe Case/ICP report examination and other issues such as ORA risk assessments etc.

The Offshore phases of the audits were typically undertaken within two weeks of the onshore phase. Usually two x IMT inspectors and two or three specialist inspectors comprised the offshore audit team. All the teams were led by an IMT Team Leader. The offshore audits usually involved two nights on the installations by the 4/5 inspector teams. The offshore findings were discussed with the duty holder’s offshore management team and safety representatives at the conclusion of the visit followed by a half a day of feedback and discussion with the onshore management team.

During the pilot leadership inspection, the duty holder’s senior leader suggested that it would be helpful if HSE could provide balanced feedback identifying areas of systemic compliance. This is not something that HSE typically does in writing, particularly in offshore inspection. A “Strengths, Weaknesses, Opportunities & Threats analysis (“SWOT”) was used to provide the balanced feedback. This was sent as a letter to the duty holder and followed up with a half-day meeting in which the significance of the analysis was discussed. The duty holder leadership advised that the SWOT analysis had been very well received, particularly by the elected safety representatives and other offshore personnel.

**Major findings**

The early audit focused on the use of the Templates and “scored” against them. As the audits progressed, the templates were still used, but they were not scored. All of the audits did though score against the Inspection Guides that were used: [http://www.hse.gov.uk/offshore/inspection.htm](http://www.hse.gov.uk/offshore/inspection.htm)

Table 1 shows the Template categories that were used in all of the audits together with the scores for each category for those audits that scores were given.

Significant non-compliances identified by HSE inspections are classified as “issues”. There are a number of issue categories and these are used in relation to all of HSE’s offshore inspection findings. Issues are tracked for closure on HSE’s database. Table 2 shows the issues and categories identified on each MSO audit. The modal number of issues identified per inspection was more than 10. This in itself is a higher number than routine inspections usually identify. Given the original premise of the intervention it is perhaps not surprising that “Maintenance Management” issues are the most numerous. However, Plant Integrity, Risk Profiling, Operating Procedures, Leadership & Management and Verification also account for several issues of non-compliance.

For 75% of the audits, the Inspection Guide scores were dominated by “40”/“Poor” scores. These related to key IG subjects such as Control of Work (ie permit to work and safe isolation and reinstatement of plant), Loss of Containment, Operational Risk Assessments, Maintenance Management and SECE Management and Verification. A 40 score does not mean that a duty holders system is completely flawed, instead it means that the inspection revealed deficiency in a system’s
Table 2: Number and category of issues identified in each inspection operation that the Enforcement

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<td><strong>4</strong></td>
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<td></td>
<td></td>
<td><strong>106</strong></td>
<td><strong>2</strong></td>
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</table>

Management Model’s initial enforcement expectation would be for formal enforcement action in the form of an improvement notice: [http://www.hse.gov.uk/enforce/enforcement-management-model.htm](http://www.hse.gov.uk/enforce/enforcement-management-model.htm)
Even though the scores represent a sample of a system, the fact that several of the duty holders inspected received several such scores is suggestive that there are some deep-seated and fundamental SMS failures.

The Leadership elements of the inspections have revealed:

- All the duty holders (DHs) are addressing the low oil price by making efficiency and cost savings without significant cuts to either manpower or operational budgets (except where justified by improved efficiency and removal of waste) and with a clear commitment to maintain or improve safety. In particular, most have been clear that frontline maintenance and associated operations have not been cut in any significant way and a number pointed to areas of extra frontline spending. However, we should have a sense of unease about this and ensure the inspections/MSO outcomes confirm or challenge the effectiveness of these approaches;

- A number of DHs are having difficulty reaching levels of safety in their operations which are worthy of maintenance – this is to a large extent a result of the MSO selection process. It's also clear that a great deal of good work is being done by our inspectors to raise standards to levels which are worthy of maintenance. Thus, MSO is not just about maintaining safe operations, it is about enabling DHs to attain suitable standards worthy of maintenance. While this situation may be obvious from an overview of our DHs, the MSO interventions have helped to bring this into sharp focus, suggesting a need for a wider strategy and approach to address this situation;

- There appears to be substantive weaknesses in the systems DHs use to ensure that their messages flow down the organisation and are implemented effectively and in the flow of good and bad news back up to the leadership (audit, monitoring, KPIs, management visits, etc). A number of DHs recognise at least some of their weaknesses in these areas and are attempting to address them. However, there is also a clear need for us to help them define and articulate what good looks like. Allied to this, a number of the DHs recognise that an effective culture is central to improving and maintaining standards and they are working hard to improve it by, for example, using the low oil price environment to ensure closer working with contractors and by bringing members of contractor workforce in-house. However, relative to plant and processes and other people issues culture is nebulous and it is clear that they struggle with it. We as an organisation could be doing more to help the industry address this issue;

- A common response among DHs to “lower for longer” has been for them to review and revise their organisational relationships with their key contractors. This appeared to be an area where it was relatively easy to identify cost efficiencies. The MSO inspections have focussed on this from a DH perspective. Future HSE interventions will focus on contractor capability and we may reintroduce focal point inspectors for key contractor companies so that we can assess their capability to pay their part in achieving sustained organisational capability with whichever DH they are working for.

Common deficiencies identified:

- Failure to update P&IDs.
- Operating Procedures unsuitable and not produced using Safety Critical Task Analysis principles.
- Inability to demonstrate competence for technical roles, sometimes at up to technical authority (ie senior) role.
- Ineffective management of small bore tubing (SBT) including missing plugs on gauges.
- Failure to review written schemes of examination for Risk Based Inspection schemes.
• **Failure to undertake effective audit and review** or a range of key risk control systems relating to hardware and/or procedures etc and including maintenance and verification systems.

• Failures to demonstrate the effective management of structural integrity.

• Maintenance management databases not being correctly populated and/or updated.

• Control of Work (Permit to work) failings, including risk assessments/risk controls that are not suitable and sufficient and/or failure to follow own CoW procedures.

• **Operational Risk Assessments** (ORAs, Deviations etc): Inadequate procedures, risk assessments inadequate, risk controls inadequate or not applied. Insufficient consideration of cumulative effects. Difference in standards between ORAs for wells and other plant and equipment (ie lower standard for wells in some instances). This is a key issue given the common use or ORAs to justify continued operations with impaired SECEs.

• **Inadequate provision of information, instruction, training & supervision** for a range of risk control systems and also in relation to safety representatives not being able to adequately undertake their roles.

• Maintenance procedures not sufficient to control the risk of HCRs and other incidents that could foreseeablely arise from maintenance. Inadequate identification of safety critical tasks.

• Deferrals: inadequate risk assessments most common failing, but at least one DH had a deferrals process that was not fit for purpose.

• Failure to risk assess for attendant vessel collisions that could result in damage to risers or impact on structural integrity. Inadequate provision for the management of attendant vessel movements in the 500 metre zone.

• Review and revision of verification schemes not being undertaken.

• **Redundant equipment** not being managed so that it represented a maintenance burden and integrity risk.

• **Inspection work** not up to date, including in relation to CUI and structural failure mechanisms.

Common themes appear to be failings in risk assessment/risk management across a range of risk control systems, together with weakness in audit/monitor/review and information/instruction/training/supervision provision in relation to both directly employed personnel and contractor staff.

**Challenges and learnings from the MNA**

A literal challenge came from one of the duty holder leaders who suggested that HSE might be able to obtain improved impact by providing more balanced feedback rather than focusing solely on failure. We addressed this point using a “Strengths, Weaknesses, Opportunities and Threats” (“SWOT”) analysis (Table 3). It was found that the provision of such balanced feedback, particularly in terms of the “Strengths” did represent something of a challenge for inspectors because of concern that such observation would be used in defence of potential legal proceedings, including appeals against improvement and prohibition notices. Duty holders advised us that the SWOT approach had a positive effect on their offshore elected safety representatives (ESRs) in that they were involved in
Relative Strengths
- Flat Management Structure – easier to have good line of sight
- Logical structured approach to cost reduction
- Safety Representative portal – good source of information
- Key contractors work in same building
- Handled recent Ns maturely and got a lot of buy in from employees
- Safety Critical maintenance planning, looking for opportunities and potential threats to the schedule.
- Implementation of new procedures taking in to account SCTA.
- In-house CRO training for new project equipment.
- Management of DH personnel competency via their CPP folders.
- RBI system
- Plans for better integration of existing databases
- Trailling new inspection techniques for technically challenging areas
- Safety Critical maintenance planning, looking for opportunities and potential threats to the schedule.
- Open learning attitude

Relative Weaknesses
- Small management team so a risk to continuity if key players were unavailable (Integrity Manager and Maintenance and Reliability Manager).
- Maintenance Instructions not up to same SCT standards of Production procedures
- Suitability/comprehensiveness of written instructions and results recording associated with safety critical element maintenance
- Wells SCT deferrals have poor risk assessment
- Lack of contingency planning for Wells incidents
- High volume of inspection and remedial work as a legacy of the previous, weak structural inspection programme.
- Redundant equipment taking up inspection resource that could be better deployed.
- Risk perception associated with safety critical maintenance deferrals.
- Contingency planning in the event of a task going wrong.
- Potential network gaps (small organisation)
- Compliance rather than effectiveness and compliance verification

Potential Opportunities
- Safety Representatives engaged in MAH prevention and keen to do more.
- Use ICP more to validate design and inspection planning.
- Delta V simulator for project to improve process understanding, troubleshoot problems and optimise operations. Project allowing baselining of new vessels and pipework in process stream.
- Removal of redundant equipment post-project will reduce costs and simplify plant layout.
- Re-vamp area inspections to bring in OES from other installations, safety reps or other non-inspection personnel to have a ‘fresh eyes’ approach.
- Use of verifiers: ‘fresh eyes’ on what is safety critical – focus on what is important and improve holistic understanding.
- Use of interaction of TAs and offshore personnel to improve operational understanding designed to enhance resilience – consistent with a systems approach to aging assets.

Potential Threats
- A lot of Legacy activities plus new Activities – how will the small team / limited financial resources achieve what is needed?
- Wells Team appear not fully integrated with rest of business for Risk Management.
- Lack of complete line lists creating “known unknowns” e.g. insulated lines
- Subsea inspection history and unknowns due to incomplete inspections.
- Management of small bore tubing across the installation prior to an inspection campaign being carried out to assess the condition. (Also open ends on systems).
- Sand Management associated with the second stage separation units introducing increased risks to personnel.
- Concentrate on learning from others (with a similar approach) without looking at the wider lessons – e.g. barrier approach and resilience.

Table 3: SWOT analysis developed in the Pilot MSO inspection much of the work associated with “Relative Strengths” and the recognition of their effective work by the HSE reinforced their own perceptions of being engaged in risk control improvement in an integral way.

The MSO inspections were more resource intensive than routine inspections. The teams were typically double the size of standard teams, required the involvement of senior managers and were led by team leaders, which is not usually the case.

The leadership element of the MSO inspections also meant that there was more than the routine commitment of resources by the duty holder. They had to have their senior leaders prepared for the initial leadership inspection, the onshore feedback of the inspection findings and finally a meeting to discuss the balanced feedback.

Recommendations for follow-up

MODU Inspection

All of HSE’s MNA’s focused on production operators and their installations. Given the reductions in days rates, the stacking of mobile offshore drilling units, the loss through scrapping of older units, loss of experienced personnel and changes in activity, such as increased plugging and abandonment work, it would appear logical to select from MODU operators for inspection.

Focus on Contractor role

Some production operators are claiming major changes in efficiency, with one indicating that lift costs per barrel of oil have gone from $116 to $37. Changed arrangements with contractor companies are one major source of such efficiencies. It will be necessary to undertake more inspection of contractor management to ensure that these changes are not impacting upon duty holder and contractor companies to play their part in the management of major accident hazards.
Leadership and Culture

HSE has subtly changed the emphasis of the MSO MNA interventions to highlight the linkage between effective leadership and actual MAH risk control capability as seen on the installations. The attached presentation was used as part of this initiative at a recent meeting of Oil and Gas UK’s Operator’s Council. It was repeated at the Contractor’s Council the same week, so HSE’s message was very clear. Slide 11 of the attached presentation illustrates the suggested linkage between leadership and symptoms and underlying safety management systems failings. HSE will continue to focus on these leadership factors, which are in effect the “culture” of an organisation.

Development of better informed Duty Holder Intervention Strategies

The focus on identifying duty holder SMS weaknesses and relative strengths, has helped to focus our longer term intervention strategies. We can check their views on our opinion of them and we can develop an intervention strategy so that our inspection plans can test their relative strengths and focus on their weaknesses. The SWOT analysis may be a little complex for these purposes and so we are using simple Red – Amber – Green classifications relating to our opinion of the EMM risk gap:

<table>
<thead>
<tr>
<th>Risk Gap</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asset Integrity</td>
<td>Large, but plan is now in place on jackets and FM -- issue is funding.</td>
</tr>
<tr>
<td>Leadership</td>
<td>Small but need to take action on understanding and contact level</td>
</tr>
<tr>
<td>Incident Investigation</td>
<td>Medium, use of third party shows lack of ownership</td>
</tr>
<tr>
<td>Emergency Response</td>
<td>Small</td>
</tr>
<tr>
<td>People and Competence</td>
<td>Medium, focus on contractors required</td>
</tr>
<tr>
<td>Audit Monitoring and KPIs</td>
<td>Large – “big” issues missed by Audit and not a significant HSE focus</td>
</tr>
<tr>
<td>Verification</td>
<td>Small</td>
</tr>
<tr>
<td>Risk Assessment</td>
<td>Large, but reducing – Still separate WORA and ORA processes, but improvements seen in ORA and cumulative risk processes</td>
</tr>
<tr>
<td>Procedures</td>
<td>Medium – Maintenance and Production plans, but many issues found with Procedures in previous inspections</td>
</tr>
<tr>
<td>Control of Work</td>
<td>Large – 4 INs linked to this area</td>
</tr>
<tr>
<td>Management of Change</td>
<td>Medium – more information needed</td>
</tr>
<tr>
<td>Design</td>
<td>Medium - 1 IN linked to this area and number of examples where design was not fit for purpose</td>
</tr>
</tbody>
</table>

This then drives the focus of the intervention plans over the next 3 years or so with the expectation that the duty holder undertakes the necessary improvements so that red goes to green:
Immediate Action

- Leadership education on HSE role with respect to DH and contact levels with HSE

Top Priority Areas for Next Three Years

- Audit, Monitoring and KPIs - inspect effectiveness of Audit process and KPI system
- Risk Assessment – inspect effectiveness of new WORA and ORA procedures and Deferrals
- Control of Work – inspect new permit system and control of contractors
- Asset Integrity – inspect ongoing Inspection (jackets) and FM work on A and B. Cranes on all assets
- Design – Fitness for purpose of equipment and modifications
- Procedures - inspect implementation of Maintenance Job Plans /Operating Procedures and SCTA

Secondary Areas for Next Three Years

- People and Competence – inspect Contractor and Subcontractor competence
- Management of Change – inspect effectiveness of MOC
- Incident Investigation – inspect system in detail, use of 3rd Party is wrong

Monitoring Areas for Next Three Years

Inspect these areas on an exceptional basis if there are incidents/complaints/or matters of evident concern come up on an inspection

- Leadership
- Emergency Response
- Verification

Resourcing

Ensure take-over of super major onshore & offshore assets and commissioning of FPSO doesn’t have an impact on existing assets safety performance - Capex or OPEX availability or Availability of Key Personnel
Appendix B – Country report, Ireland CRU (not to be published)

Summary:

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of audits</td>
<td>1 audits was performed</td>
<td>Input from other inspections, CRU database, account analyses and projects</td>
</tr>
<tr>
<td>Operators involved</td>
<td>1 operator was audited</td>
<td>Based on the TOR</td>
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<tr>
<td>Number of inspectors/auditors involved</td>
<td>4</td>
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</tr>
<tr>
<td>Man hours used within the regulators organisation</td>
<td>132 man hours</td>
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Activity summary
CRU visited 1 duty holder and 1 offshore installations operated by this operator. The installation had a steel jacket structure and one was a 40-year-old installation.

A letter of notification of the audit and an inspection scope was sent in advance of the inspection requesting documents together with a leadership, onshore and offshore question set.

The inspection structure was a full day onshore segment with the CEO and senior management of the installation and also the shore based maintenance planner. The onshore inspection was based on checklist which had been completed by the operator in advance. This was followed by a two-day offshore inspection focusing on maintenance and maintaining safe operations, the inspection team sat down with the OIM and verified the answers provided to the offshore question set as the OIM is the only manager offshore.

The CRU had held previous inspections on similar topics to this inspection, such as operational risk assessment, and used the output from these inspections to inform the scope for this maintaining safe operations inspection.

The operator was cooperative and open in their discussion with the inspection team. The CRU has noted upward curve of improvement in operations since first engagement on these topics, in particular in relation to maintenance record keeping, risk assessment and verification activities.

Major findings

Management aspects: observations
Resources from a maintenance perspective appeared adequate and well managed. The backlog had remained constant over the last number of years with only exceptional instances where it had risen significantly.

Small number of approved contractors who have a long history of working on the platform

The operator has highly experienced staff, most of whom have worked on the platform for a number of years. Also, low turnover of staff and contractor personnel.
The CEO/senior management team have sufficient information available to them via KPI and other metrics to have a good understanding of the risk picture on the platform at a given time.

OIM involvement and knowledge of the day to day work was positive. Also, his engagement with the workforce. Direct line into the OIM and senior management team including CEO.

**Strategic aspects: observations**
The competence management system was robust, up to date and appeared to address the competencies for the role sampled. It set out 56 competences for the production technician role. It was an external competence management system accredited by an international qualification authority.

The OIM actively involved in maintenance planning, attend weekly planning meeting.

A Traffic light system generated on a weekly which highlights overdue and upcoming maintenance.

A plant register for all plant, including tagging of safety critical items.

Checklists for recording of maintenance results.

No overarching maintenance procedure is in place which sets out clear roles and responsibilities, records retention arrangements, process for updating maintenance procedures and the content required for check sheets.

No work orders are generated, or information on failures and repairs are recorded for corrective maintenance work that is identified by means other than following scheduled maintenance routine from the MMS (e.g. bursting discs). There was no policy in place to manage redundant equipment.

**Technical aspects: observations**
Comprehensive system for spares management with the maintenance systems.

The ORA process was robust and well understood and was used appropriately.

Inconsistencies were identified in the MMS between the maintenance interval and the next due test, with the latter being too late to meet the interval requirements (e.g. MACs, gas detection, TR HVAC dampers).

It was unclear for the reliability review where the information for active systems was coming from, as pass/fail is not being recorded in some instances and sufficient history is not available.

Recording of results – pass/fail is not always applied consistently. The tracking of the actions from these audits was not a formalized process.

**ATEX**
Quality of loop wiring diagrams and paperwork is hampering progress at ATEX. In addition, this difficulty in inspection ATEX plant due to requirement to do it during a shutdown.

The process for Management and execution of Ex inspection activities was not robust.

**LOLC**
A number of valves inspected on the platform were not locked and had no lock in place as required on the corresponding register and piping and instrumentation diagram (P&ID) and a number of valves were locked in a manner which would still allow them to be turned.
Safety Critical ESD valves were identified with no MMS routine to test their closure.

**Challenges and learnings from the MNA**

**Workload at CRU**

The challenge from a weather perspective in carrying out an inspection so late in the year, the original inspection had to be cancelled due to a hurricane.

**Recommendations for follow-up**

Apply the NSOAF Maintaining Safe Operations inspection to an onshore facility in 2018.

Continue to follow up on maintenance, risk assessment and verification at future inspections of the installation.

Follow up with a more in depth ATEX inspection in 2018.
Appendix C – Country report, NL SSM (not to be published)

Summary:

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<th>Category</th>
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<td>Based on the TOR</td>
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<tr>
<td>Number of inspectors/auditors involved</td>
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<td></td>
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<tr>
<td>Man hours used within the regulators organisation</td>
<td>60 man hours</td>
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Activity summary
SSM visit 3 duty holders and 3 offshore installations operated by these duty holders. The choice what duty holders and what installations were based on the MNA TOR. One installation had a concrete gravity based structure what is rare on the Dutch sector, one was a very old installation several times handed over to a new operator and third party operated for a while. And one installation was quite new and specific build for shallow gas.

To reduce time we used the available information from the SSM database. We focused on a good preparation and an open discussion in the DH office. Offshore we did a reality check. The Dutch installations are small and have a limited staff on board. We checked how the communication was secured between the offshore staff and the office. All senior staff is normally in the office and the offshore team exist from an OIM and technicians.

The DH where open and cooperative. There is a strong focus on executing the maintenance program and give proper feedback to the system by competent persons.

There is only limited backlog on non-safety critical equipment and no or very limited backlog on SECE’s. Maintenance programs are risk based.

Major findings

Management aspects: observations
Leadership from senior management by strong involvement in asset integrity, daily / weekly report on status and regular management visits

The focus to do things right the first time

A balanced policy for maintaining the integrity for the medium and long-term.

Independent verification is embraced as external check on the system.

Ownership is still there but how long? New operators, decommissioning, cut in cost.

Strategic aspects: observations
Policy of operators to be in charge of maintenance and inspection, no integrated service contractor. Strong preference to keep knowledge in the company and get the quality you want.

Basic design is important for the operational phase. Choice of materials and platform layout for maintenance and operations.

Review original design against current standards.
A good MMS is crucial to monitor the asset status.
There is still a good balance between budget and the requirements to ensure the integrity.

**Technical aspects: observations**
The Dutch approach still present: hands on and focus on basic maintenance and inspection as planned in the MMS by competent personnel.

Just do things right and change out or renew if it is off standard, rather than generate a report accepting a substandard situation.

A good MMS is crucial for planning, executing, reporting and analysing the maintenance and integrity.

The MMS and maintenance organisation should be considered as an asset itself which include periodic reviews and the MOC process.

**Challenges and learnings from the MNA**
Change of team lead mid 2017
Reporting back the duty holders by using a new inspection template.
Workload at SSM, including re-positioning the SSM organisation.

**Recommendations for follow-up**
Audit, but against to what reference or standard? We used our standards and regulations. Do we get a harmonised picture around the North Sea?

Difficult to rate the questions with H-M-I, the questions are generic.
Appendix D – Country report, Denmark, DWEA (not to be published)

Summary:

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<th>Category</th>
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<th>Comments</th>
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</thead>
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<td>One onshore meeting and offshore visits on two installations.</td>
</tr>
<tr>
<td>Operators involved</td>
<td>1 operator was audited</td>
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</tr>
<tr>
<td>Number of inspectors/auditors involved</td>
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</tr>
<tr>
<td>Man hours used within the regulators organisation</td>
<td>Xxx man hours</td>
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</table>

Activity summary
The audits were carried out as a routine Danish Working Environment Authority supervisory visit to the installations.

A letter of notification of the audits was sent requesting different documentation as described in the template of the Multinational audit.

The audit was opened with an onshore meeting with the senior management of the chosen installations and different supporting departments in the organisation.

The onshore staff described and explained how the organisation was built up and how the cooperation between the different units was. A special focus was made on the maintenance organisation and system.

A new maintenance system was being implemented on the different installations which should ensure a more efficient maintenance of the installations and a system which is aligned to the actual situation in the sector.

The system describes the procedures with regards to managing the maintenance tasks and the requirements and procedures for deferrals of maintenance tasks.

Major findings
The major findings of the audits include the lack in the deferral process of maintenance tasks. The system and procedures describes how any deferral should be handled which includes involvement of onshore organisation. Some deferrals were not approved and a new deadline for maintenance of the equipment was not in place.

Auditing the backlog of the maintenance projects showed that the size of backlog on the different installations differs and showed that it could be a big challenge on one installation and not on another though it was the same operator.

One of the installations audited showed that the backlog was very high and would take almost a year to be up to date. Deferrals and approval of deferrals was also a challenge since many of these has not
been approved by the onshore organisation as per procedure. The approval process includes a risk assessment of operation of the equipment without the given maintenance.

**Challenges and learnings from the MNA**

The audit showed an indication of lack of maintenance on some installations. Most importantly is that the maintenance and priority could vary between the installations operated by the same operator. The procedures on maintenance management are not always followed and several examples of deviations could therefore be found.

The oil price plays an important role on the life time extension of the various installations. A low oil price may result in a poor management of maintenance and could in worst case lead to long list of backlog which would require a longer period months or maybe year to overcome.

Despite the long list of backlog the operator is still convinced that the installation is operated safely and not with risks of major hazard.

**Recommendations for follow-up**

Based on the challenges and learnings from the MNA the DWEA will follow up on the maintenance projects on the audited installations and the audit may be carried out on other installations in the Danish continental shelf.
Appendix E – Country report, Germany, LBEG (not to be published)

Summary:

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Comments</th>
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</thead>
<tbody>
<tr>
<td>Number of audits</td>
<td>2 audits were performed</td>
<td>2 onshore and 2 offshore visits</td>
</tr>
<tr>
<td>Operators involved</td>
<td>2 operators were audited</td>
<td>TOR based</td>
</tr>
<tr>
<td>Number of inspectors/auditors involved</td>
<td>2 x 2</td>
<td></td>
</tr>
<tr>
<td>Man hours (mh) used within the regulators organisation</td>
<td>5 days prep. 1 person (40 mh) 4 days audits 2 persons (64 mh). Total: about 100 mh</td>
<td>The audits can be seen as part of the regular inspection programs to a certain extent</td>
</tr>
</tbody>
</table>

Activity summary

LBEG intended to convince itself that the duty holders operate state of the art Maintenance Management Systems (MMS) and have the internal structures suitable to maintain the platforms and facilities including the Safety and Environment Critical Elements (SECES).

LBEG put special emphasis on understanding the organisation and structure of the maintenance systems and to interview the relevant employees onshore and offshore with regard to the practical implementation of the Maintenance Management Systems.

The duty holders were very open, cooperative and even grateful to get the opportunity to demonstrate that their work and maintenance standard to the authority representatives and to receive feedback on that.

LBEG could convince itself that the companies have functioning and modern Maintenance Management Systems (MMS).

It can be expected that the assets on the platform and especially the Safety and Environmental Critical Elements (SECES) are professionally kept, maintained and repaired.

Major observations and remarks

The audited companies are operating modern and consistent Maintenance Management Systems (MMS) based on proven software modules. IBM Maximo and SAP) providing a high level of transparency.

In one case, the Safety and Environmental Critical Elements (SECES) were not specifically marked within the system so that the maintenance status of the SECES was not visible on first sight which is desirable. Also, the implementation of the MMS was not yet completely software based but partly still manual.
In another case it was observed that different software systems were used in the same company and the MMS had no connection to the other technical and commercial software systems. This is not seen as a safety hazard, but it is also not an ideal configuration.

The companies are aware that there is still room for improvement and plan to work on it.

Several interviewees in both companies emphasized that maintenance is definitely treated as a key issue with no financial restrictions - for example due to a low oil price - are hampering its adequate implementation.

The audited persons left a highly motivated and informed impression.

**Recommendations for follow up**

LBEG will keep track of further improvements of the Maintenance Management Systems of the companies. We experienced this focused, well prepared and internationally agreed theme specific audit as highly effective and informative. The same message was given to us also by the companies.

Therefore, we recommend repeating such exercises on other important themes of common interest within a multinational NSOAF frame.
Appendix F – Country report, Norway (not to be published)

Summary:

<table>
<thead>
<tr>
<th>Category:</th>
<th>Description:</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of audits</td>
<td>3 audits were performed</td>
<td>Onshore meeting, including interviews of management and onshore support staff, and offshore visits with verifications in the CMMS.</td>
</tr>
<tr>
<td>Operators involved</td>
<td>2 operators were audited</td>
<td></td>
</tr>
<tr>
<td>Number of inspectors/auditors</td>
<td>5 for the onshore part</td>
<td></td>
</tr>
<tr>
<td>involved</td>
<td>4 on the offshore visit</td>
<td></td>
</tr>
<tr>
<td>Man-hours used within the</td>
<td>Approximately 450 man-hours per audit.</td>
<td>A total of approx. 2000 man-hours have been allocated to the NSOAF MNA activity in 2017.</td>
</tr>
<tr>
<td>regulators organisation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Activity summary
The audits were carried out as a regular maintenance management audits by the Petroleum Safety Authority Norway. The audits included a visit to the onshore management- and support organisation, as well as a visit to the installations.

A letter of notification of the audits was sent requesting different documentation as described in the template of the Multinational audit.

The audit was opened with an onshore meeting with the senior management of the chosen installations and different supporting departments in the organisation.

The onshore staff described and explained how the organisation was built up and how the cooperation between the different units was. A special focus was made on the maintenance planning and prioritisation and how they use their CMMS tool in combination with their work processes.

Major findings
The major findings of the audits include the unclear strategic direction liked to the lifetime, or the closing of production. Management in the operator’s organisation expressed a clear expectation that additional project/modification activity would have to be performed prior to further lifetime extensions. However, the uncertainty on the decision and the timing of such a decision generates an uncertainty in prioritisation of maintenance and operational activities.

It is also a finding that the process for approval of life time extension is also important in the evaluation of necessary project/modification activity that would have to be performed prior to further lifetime extensions, in order to make the installation robust extended lifetime. Both Management and safety delegates supported this finding.

Auditing the backlog of the maintenance projects showed that the size of backlog on the different installations differs in volume (manhours and/or workorders), but the data showed that safety critical equipment/barriers are given attention. The processes of managing the barriers are extensive and involves all levels of the organisations.
Challenges and learnings from the MNA
The audits indicated of lack of maintenance for some installations. Most importantly is that the maintenance and priority could vary between the installations operated by the same operator.

The audits showed that the companies have a broad portfolio of systems and work processes directed towards maintenance management and safe operation. However, the MNAs and other audits of old installations have showed several deviations from company’s own procedures and requirements related to:

- level of details in data,
- reporting of maintenance history
- reporting of condition as well as technical follow up
- quality in data on equipment and maintenance history,

making the information in the CMMS a limited basis for analysis, prioritization and risk understanding.

The audits also revealed limited use of company internal verifications, assessments of KPIs and other activities to identify deviations and ensuring the value of the maintenance management.

The following findings have been identified prior to the MNAs in the “Main priority Late Life” Project within the PSA, but the MNAs have confirmed the relevance and importance of the findings:

- Risk assessments are performed when there is an equipment failure, or a system is down however the overall accumulated risk form all these individual assessments are not evaluated and communicated to the same extent.
- KPIs used in the organisation are mostly directed towards efficiency, and less on integrity and/or quality of the maintenance program or the work performed.
- For the safety solutions of “yesterday” it is essential that the technical condition is kept at a high level.
- The organisation’s common understanding of the importance of maintaining the integrity of safety critical elements /barriers during the entire lifetime is essential as a basis for prioritising necessary maintenance and modifications.
- In late life, changing operating conditions and modifications, with mix of new and old equipment, increases the need for platform-specific expertise to understand all risk
- Systems and equipment are maintained but the maintenance is optimized at an operational level.
- Temporary repairs are used on piping systems including hydrocarbon systems. The total use of these temporary repair methods is extensive on some installations, making the total system integrity difficult to assess. Most of these repair methods also limit the possibility to inspect the system as a total.
- The operator report limited access to spares and competence about old equipment and systems (incl. software).
- Corrosion under Insulation is an issue relevant for most operations.
- In general, the total amount and backlog of maintenance increases in late life (RNNP study 2016).

Recommendations for follow-up
Based on the challenges and learnings from the MNA fields in late life will be given special attention in the audit selection and planning process within the PSA Norway.
6 Appendix 1 – Terms of Reference for the MNA

Date: April 4, 2016.

TERMS OF REFERENCE FOR THE NSOAF AUDIT:
Maintaining Safe and efficient Operations

Purpose of this document:
This document sets the framework for conducting a multi-national audit on “Maintaining Safe and efficient Operations” by the NSOAF members.

Introduction:
During the fall of 2015, and the spring of 2016 NSOAF members have met to discuss common challenges for the Oil and Gas industry in their respective countries. The challenges related to maintaining and operating aging installations and as challenges for further work and follow-up.

Maintenance related causes have been important factors in the development of major accidents in the past, hence the topic does have a major accident risk reduction potential for the industry in all the member countries.

The issues related to Maintenance Management are also relevant to the NSOAF members due to the significant cost reductions going on as a response to the recent changes in the revenue, due to a significantly lower oil price.

Integrity Management/Maintenance Management is crucial to major accident risk, and will have relevance to risk for both personnel, the environment and the assets.

Objective:
To ensure that all relevant lessons with respect to maintenance of safety critical barriers (focused on technical barriers) learned by the NSOAF members, are communicated to the industry, and implemented in the North Sea.

MNA focus and theme:
The agreed focus of the MNA will be on transportation of risk understanding; methods and means to help understanding the overall risk picture. This includes amongst other safety Critical Elements with emphasis on how barrier thinking (theoretical background) and how companies have implemented systematics in barrier management. Further aspects like Asset register, Selection of SECE, Data from testing and use (incl. the theoretical background, Performance Assurance - incl. ICB (Independent Verification Body) role and acceptance will be included.

In order to communicate the intention and focus of the audit, the team plan to develop a model based on how the role of the SECEs are represented in the maintenance management loop and how SECE can be addressed in a barrier perspective.

Context of the MNA:
To evaluate similar operations and make results comparable, the team agreed on the following criteria for selection of objects to audit:
- Platforms older than their original design life.
- Production platforms
- Platforms that have been taken over by a new company (if possible)
- Offshore facilities only (May use results for onshore facilities later)

Scope:
Perform the Multi-National Audit (MNA) for 1-4 players in each member country, and combine the results/findings from all member countries in one summary report. Communicate and follow-up findings with the industry to secure implementation of learnings.

The plan is outlined below.

**Phase 1 – Preparations**
WG meeting in Dublin (completed)
Share relevant examples and reference documents.
Agree on TOR.
Get approval from the NSOAF Plenary Meeting.

**Phase 2 – Planning:**
- Notice (Official) letter – one page, with reference to NSOAF audit.
- Feedback from the companies about date – give X weeks notice
  - Named contact person
  - Ask for documentation, limited volume
  - Ask for their statement on “Safe Operations” – Partnership expectations to the Operators?
- Preparations:
  - Review received documentation
  - Who do we address
  - Senior Management – maintenance management in light of safe operations
  - Partnership?
  - Combination of offshore and onshore (Management) activity – meeting close to offshore travel
- Final preparation meeting – November 16th 2016 in Copenhagen (tentative).

**Phase 3 – MNA execution:**
- Onshore (Part 1)
  - Start-up meeting: Onshore
  - Management interviews – suggest similar roles to interview
  - Summary meeting
- Offshore
  - Verification in the plant
  - Verification in CMMS system
- Onshore (Part 2)
  - Management interviews – ask for management’s perception of audit
  - Summary of findings
- Reporting of audit findings (one report for each audit)
- Summary report form NSOF team to all companies involved

**Phase 4 – Summary:**
- Summary of findings from each NSOAF member to the WG.
- Summary report form NSOF team to all companies involved
- Summary of lessons learned from the MNA process and suggestions for further work (internal NSOAF summary)
Schedule and Plan:
Planning in 2016
• E-mail correspondence
• If required a planning meeting in November 2016

Execution 2017
• Norway/UK to run pilot audit (Q1 2017)
• Meeting prior to execution (after pilot)
• Number of audits – minimum 1, maximum 3
• Final report Q2 2018

International Team Assignments and Responsibilities:

Team Co-ordinator: Country: Norway
Responsibilities:
1. Secure and assign resources for the activity
2. To develop an overall plan
3. To identify the tasks required for achieving the objectives
4. To assist and facilitate discussions with relevant parties
5. To advise the NSOAF HS&E Working Group of any significant obstacles
6. Seek approval for the MNA from the NSOAF Plenary
7. Encountered and advise of any impact on the objectives and planning
8. Perform national audits
9. To issue the final report to the NSOAF HS&E Working Group

Assistant Co-ordinator: Country: UK
Responsibilities:
1. Secure and assign resources for the activity
2. To assist the team co-ordinator in any of the team Co-ordinator responsibilities
3. To identify and prepare a list of all required documentation and reference material
4. Perform national audits
5. To co-ordinate the preparation of the draft report.

Team Members: Denmark, Germany Ireland and Netherlands
Responsibilities:
1. Secure and assign resources for the activity
2. Participate in the planning phase:
   a. Comment on the circulated documents
   b. Participate in meetings
3. Perform national audits
4. Participate in the work with the final report

References
1. Barrier note – PSA
2. SINTEF report – Maintenance Management and Barrier Management (English translation)
3. HSE – Maintenance Management Inspection Guide
4. EU directive
5. ISO 9001 standard
6. Other relevant standards – barriers
7. Company standards
### Appendix 2 – Outline of the audit process

<table>
<thead>
<tr>
<th>Activity no.</th>
<th>Description:</th>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Planning meeting</td>
<td>Adjusting to national regulations and local language.</td>
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<tr>
<td></td>
<td>Selection of themes and development of questionnaire.</td>
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<td>2</td>
<td>Selection of operators/duty holder and installations</td>
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<td>3</td>
<td>Notification letter incl. request for documentation</td>
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<td>4</td>
<td>Document review</td>
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<tr>
<td>5</td>
<td>Execution of Land/office part of MNA.</td>
<td>In operator’s/duty holder’s office.</td>
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<td></td>
<td>• 1 day, presentation by Asset Management Team</td>
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<td></td>
<td>• 1,5 days of interviews of Onshore Operations support personnel</td>
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<td></td>
<td>• 1/2 day, verification in Maintenance Management System</td>
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<td></td>
<td><strong>Interviews (typical roles):</strong></td>
<td></td>
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<tr>
<td></td>
<td>• Onshore Interviews:</td>
<td></td>
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<tr>
<td></td>
<td>• Production Director</td>
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<td></td>
<td>• Ops manager</td>
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<td></td>
<td>• Technical Manager for the field (Integrity)</td>
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<td></td>
<td>• Inspection/CUI/Static Mech. Equipment.</td>
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<td></td>
<td>• Maintenance Manager</td>
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<td>• Maintenance Engineer</td>
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<td>6</td>
<td>Offshore verifications</td>
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<td></td>
<td>3 days including interviews and verification in CMMS system</td>
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<td></td>
<td>Preliminary summary meeting including on- and offshore organisation</td>
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<td></td>
<td><strong>Interviews (typical roles):</strong></td>
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<tr>
<td></td>
<td>• Meeting with OIM and Main Safety Delegate (upon arrival)</td>
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<td></td>
<td>• Interview w/main Safety Delegate</td>
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<td></td>
<td>• Meeting with safety delegates (Statoil and contractors)</td>
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<td></td>
<td>• Interview with Operations and Maintenance Supervisor and Supervisor Planned Maintenance</td>
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<td></td>
<td>• Interview tech. responsible Mech. and Aut.</td>
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<td></td>
<td>• Interview Drilling Contractor</td>
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<tr>
<td></td>
<td>• Interview tech. personnel</td>
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<td></td>
<td>• Inspection of the facilities</td>
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<td></td>
<td>• Review in CMMS and the system for management of deviations and findings</td>
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<td></td>
<td>Onshore participation via video</td>
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<tr>
<td>7</td>
<td>Reporting, Audit report</td>
<td>Publication of report.</td>
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<td>(within 4 weeks)</td>
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<tr>
<td>8</td>
<td>Follow-up activities as needed.</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Joint reporting from the MNA.</td>
<td></td>
</tr>
</tbody>
</table>