

NSOAF

Summary Report Multinational audit

Maintaining Safe Operations



Foto: Wintershall Norge AS

Sigve Knudsen - Norway
Mohamed El Halimi - Denmark
Lars Møller - Denmark
Kurt Machetanz - Germany
Arnold V. de Groot - The Netherlands
David T. Walker - United Kingdom

Mark Alderson - United Kingdom
Liam Murphy - Ireland
Ben Browne - Ireland
Else Riis Rasmussen - Norway
Ole Jørgen Melleby - Norway
Eivind Jåsund - Norway



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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.

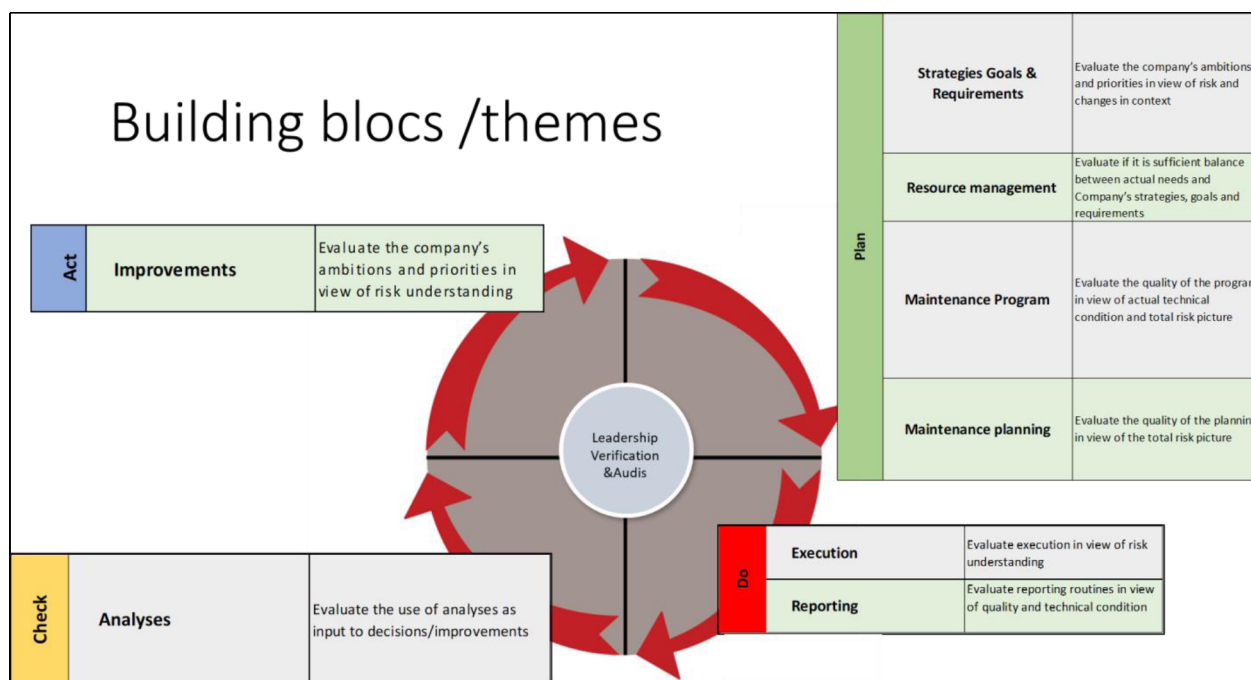


Figure 1. Maintenance Management

2.3 Involved in the activities

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

Name	Country	Organisation
Sigve Knudsen	Norway (NSOAF H&S WG Lead)	Petroleum Safety Authority, Norway
Ole Jørgen Melleby	Norway (MNA Project Lead)	Petroleum Safety Authority, Norway
Else Riis Rasmussen	Norway	Petroleum Safety Authority, Norway
Eivind Jåsund	Norway	Petroleum Safety Authority, Norway
David T. Walker	United Kingdom	Health and Safety Executive, UK
Mark Alderson	United Kingdom	Health and Safety Executive, UK
Kurt Machetanz	Germany	Landesamt für Bergbau, Energie und Geologie, Dienstsitz Clausthal
Liam Murphy	Ireland	Commission for Regulation of Utilities, Petroleum Safety Framework
Ben Browne	Ireland	Commission for Regulation of Utilities, Petroleum Safety Framework
Arnold V.de Groot	The Netherlands	State Supervision of Mines
Arthur van Dalen (planning only)	The Netherlands	State Supervision of Mines
Mohamed El Halimi	Denmark	Danish Working Environment Authority
Lars Møller	Denmark	Danish Working Environment Authority

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

Abbreviation	Description:
CM	<p>Corrective Maintenance:</p> <p>maintenance carried out after fault recognition and intended to put an item into a state in which it can perform a required function.</p> <p>From: EN 13306: 2010</p>
CMMS	<p>Computerised Maintenance Management System.</p> <p>(Example SAP, Maximo or similar software system).</p>
DH	Duty Holder (UK term)
IRF	International Regulators Forum
MOC	Management of Change
MNA	Multi National Audit
MSO	Maintaining Safe Operations
NSOAF	North Sea Offshore Authorities Forum
OIM	Offshore Installation Manager
PDCA	<p>Plan – Do – Check – Act</p> <p>Common term for a management loop as described by W. Edwards Deming.</p>
PM	<p>Preventive Maintenance:</p> <p>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</p> <p>From: EN 13306: 2010</p> <p>PM are normally managed by a CMMS.</p>
SECE	Safety or Environmental Critical Element
SMA	Safety Management System
TA	<p>Technical Authority</p> <p>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.</p>
CMMS	<p>Computerised Maintenance Management System.</p> <p>(Example SAP, Maximo or similar software system).</p>

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 and 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 indicates 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 from 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 linked 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.

5 Appendices – Country reports (not to be published)

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

Date: 06/07/2018