North Sea Offshore Authorities Forum

Multi-National Audit

“Human and Organisational Factors in Well Control”

2012 - 2013

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1. Executive Summary

The Deepwater Horizon blowout at the Macondo well in 2010 was a salutary reminder to the worldwide offshore industry of the need for exemplary standards of well control. Although that disaster happened thousands of miles away from Europe, the lessons from it are just as applicable for operators and drilling contractors in the North Sea.

The North Sea Offshore Authorities Forum[1] (NSOAF), which consists of representatives of authorities responsible for regulating offshore activities in North West Europe, is therefore anxious that any findings from that disaster in the Gulf of Mexico be incorporated into the practises of those working under their jurisdictions. Although it is clear that considerable effort has been paid by the industry to address the operability of blowout preventers and the need for capping stacks for subsea wells, human and organisational factors have been identified as being equally influential in well control.

As a result, members of NSOAF carried out a multi-national audit (MNA) during 2013 to look at how the offshore operators and drilling contractors in the North Sea are incorporating the wide range of necessary human and organisational factors into their well control systems. Eleven separate audits were carried out. This report describes the background to the audit, explains the relevance of the various issues that were considered, and summarises the conditions found from the eleven audits that were undertaken. The results therefore provide a snapshot of well control standards in those topics across the North Sea, with clear identification of good and poor practises. NSOAF hopes that companies will reflect on the findings and use them in their continuous improvement process for these crucial aspects of offshore safety and environmental protection. The good practises recorded in this report should prove to be easily adoptable by others in the industry

The audit results supported the view that the industry was providing key well control personnel with clear and comprehensive ranges of relevant information, and with adequate designs of displays, control panels, alarm and data systems. Although there were some rigs where practises needed improvement, overall the control panel and associated engineering system aspects from the audit were good.

Similarly, those aspects linked to how drilling personnel would be able to make the right judgement and decision on well control issues were good. Encouragingly, the audit received strong assurance of the driller's authority to shut in wells when necessary. However, there was a broader range of performance here, and hence the need for those on the lower end to emulate the more advanced operators and drilling contractors, in particularly in the wider use of scenario-based training. The audit, though, identified a particular issue caused by the general shortage of experienced drilling personnel - the high activity level of the industry has contributed to accelerated promotions to key drilling positions, and there was widespread acknowledgement that this caused difficulty in securing adequate competence assurance programmes. This problem must not be ignored by industry

Although there was evidence of an industry culture of close monitoring of performance-related KPIs, disappointingly the MNA saw none that were specifically focused on well control. Moreover, with the strong emphasis of penalising underperformance in areas of such rig utilisation, "up –time" etc, the negative influence of such penalties in an environment where the early application of well control measures was ostensibly encouraged was not clear. This potential for perversely (and negatively) influencing sound well control management did not seem to have been sufficiently addressed by the industry.

There was only relatively weak evidence of how companies learn lessons from incidents, an area that has come under particular scrutiny since Macondo. Although most drilling contractors and their clients produced reports to learn from incidents, there was little to convince that those reports were receiving wider circulation or usage outside the constrained boundaries of the rig or platform in question, let alone spread wider within the industry.

Lastly, a potentially major weakness identified by the audit was the quality of the interfacing arrangements. Given the fundamental need for the client operator, the drilling contractor, and the numerous specialist contractors to all operate as a unit, the lack of clarity in the various levels of bridging and interfacing documentation/processes was

[1] NSOAF was created in 1987 and its membership is Denmark, Faroe Islands, Germany, Republic of Ireland, Netherlands, Norway, and the United Kingdom. The Forum exists to:

- exchange information, examples of best practice and lessons learnt from incidents
- develop common positions and joint initiatives
- reduce the difficulties due to differences in regulatory regimes and requirements
- harmonise standards where possible

a real concern. In particular, the lack of effective gap analysis in the client and drilling contractor systems/documentation that the audit often found was of concern, and needs to be addressed. For instance, any lack of clarity over who has the ultimate responsibility for shutting in the well could lead to unacceptable delays for such a crucial decision.

In conclusion, the audit found a range of approaches - some impressive, others less so - to the human and organisational factors in well control. The most worrying aspects of the audit results were those that covered issues relating to company systems and the way the various operators and their contractors interface. NSOAF therefore commends this report to the North Sea offshore industry, and asks that operators, their drilling contractors and their trade organisations take time to consider the various findings and to seek ways to implement the various good practises wider. NSOAF national regulators will be seeking opportunities to discuss the findings with their own national industry forums to ensure that the lessons learned about these crucial aspects of well control can be taken forward.

2. Introduction

On 20 April 2010, a blowout at the Macondo well in the Gulf of Mexico resulted in an explosion and fire on the Deepwater Horizon drilling rig. Eleven offshore workers lost their lives and another seventeen were injured. Hydrocarbons continued to flow from the reservoir for 87 days, with an estimated 4.9 million barrels of oil causing significant environmental, economic and social damage. The Deepwater Horizon disaster, coupled with the somewhat lower profile Montara blowout a few months earlier in the East Timor Sea north of Australia, gave rise to significant global concerns about the ability of the offshore oil & gas industry to manage its safety and environmental risks effectively, particularly in well control.

The North Sea, with over 500 oil & gas installations, has experienced severe offshore accidents in the past, including the disasters involving Alexander Kielland (1980) and Piper Alpha (1988). Even though European countries have strict safety requirements and regulatory regimes for well design, construction and well control, the North Sea offshore industry is not immune from the concerns arising from the Macondo and Montara blowouts.

The experience of the Deepwater Horizon caused European regulators to reflect on whether their current regulatory frameworks and practices were adequate to control the major hazard risks of blowouts. NSOAF considered the emerging findings from the investigations into both Macondo and Montara as information became available, including holding an extraordinary NSOAF Plenary meeting in December 2010. NSOAF concluded that considerable effort was being paid to address hardware failures such as the operability of blowout preventers (BOPs) and the need for capping stacks for subsea wells. However, NSOAF members were also concerned about the range of human and organisational factors that were being identified from both incidents as crucial aspects of well control[2].

As a result, NSOAF decided to carry out a multi-national audit (MNA) specifically on human and organisational factors in relation to well control, involving a sample of operators, drilling contractors and service companies on installations in the North Sea during 2012/13. The aim of the MNA was to undertake a coordinated assessment across the North Sea of how the offshore industry was focusing on human and organisational factors associated with well control, in order to identify current good practises and to help both industry and regulators learn lessons.

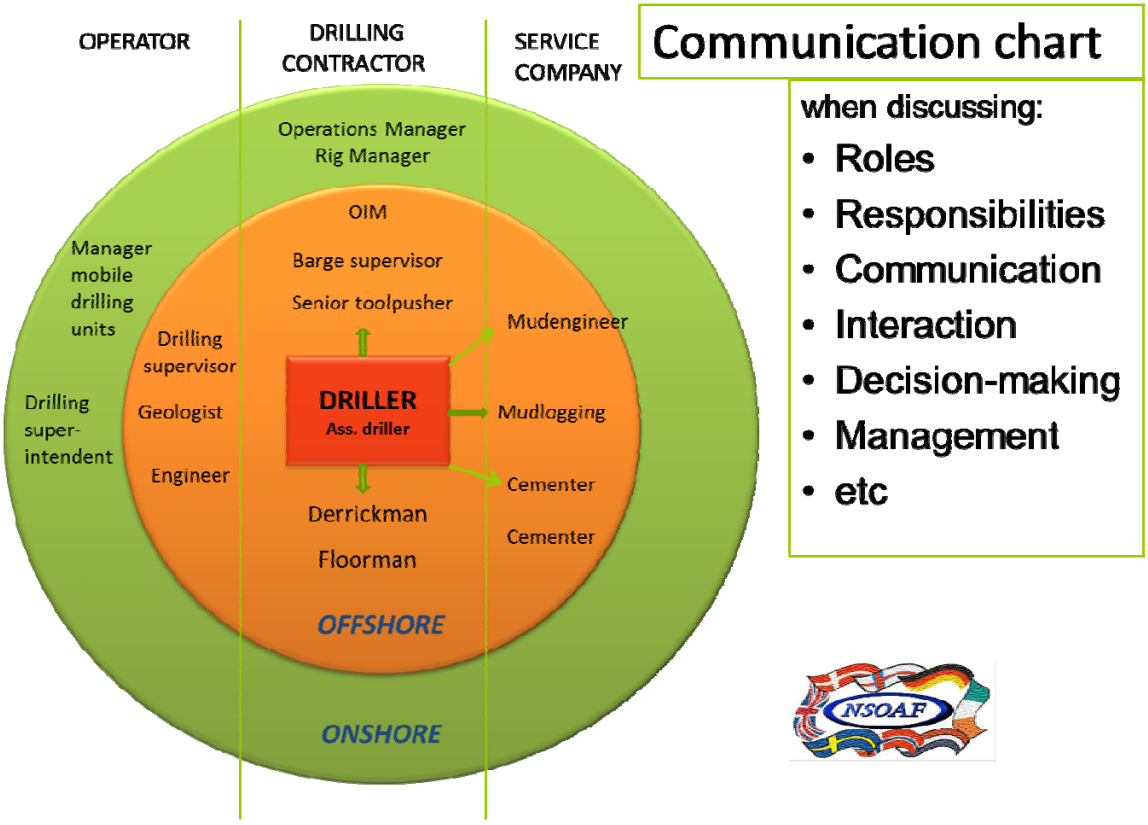
This report firstly explains the basis for the areas assessed by this MNA, and then describes the outcomes of this initiative.

[2] At the time of preparing this NSOAF MNA report, the US Chemical Safety Board has yet to publish their findings of the Deepwater Horizon incident investigation, particularly organizational and human factors. However, when available, that report may also serve as an additional reference in order to underline the key observations of this audit. In the meantime, though, Professor Andrew Hopkins' book *Disastrous Decisions: the human and organizational causes of the Gulf of Mexico blowout,* has been published, and he considers the realm of human and organizational factors that contributed to the disaster, going beyond previous commentary on this topic. He acknowledges that it is important to know what people did, but even more important to know why they did it. This book is therefore a good reference in the light of this audit.

3. The Importance of Human and Organisational Factors in Well Control

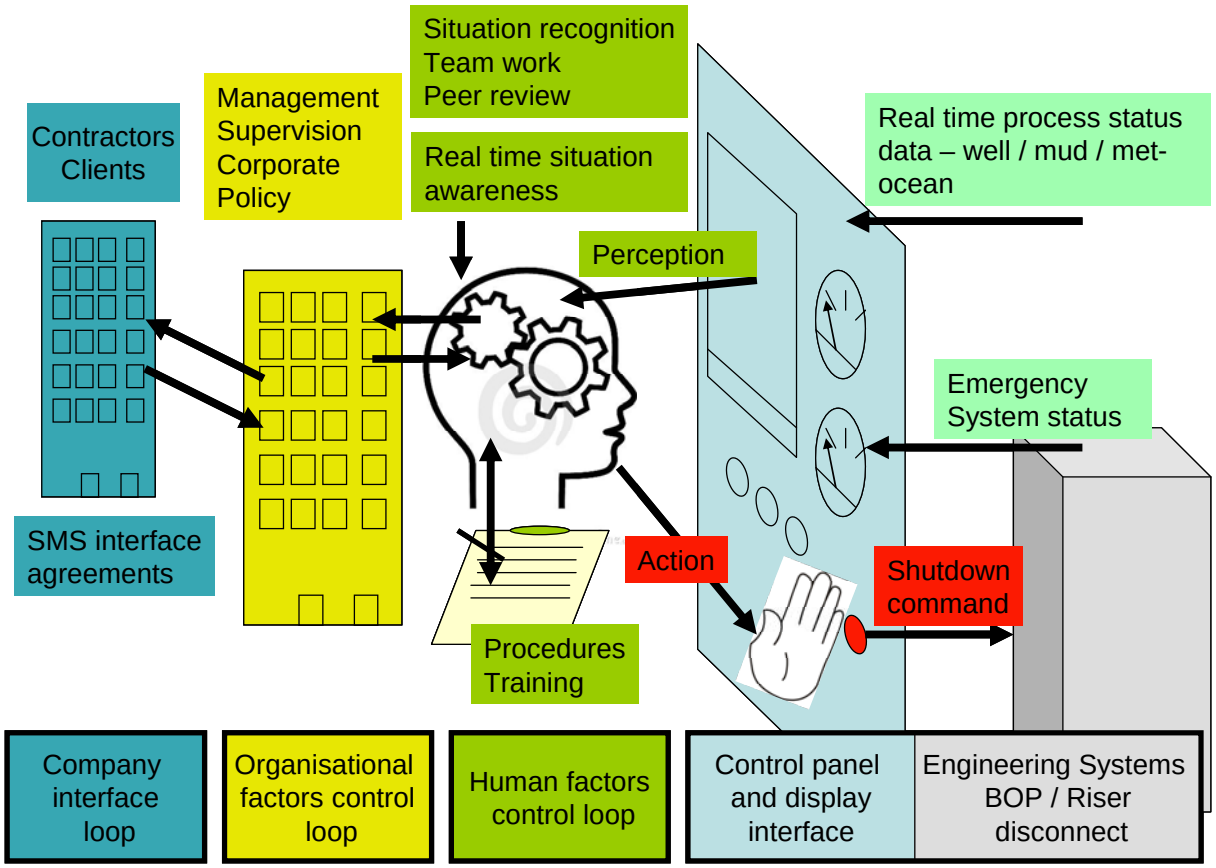
Drilling a well is a complex interaction of man and machine. To ensure the drilling operation is safe and successful, the drilling crew must continuously monitor displays and other information, and make decisions based on how they perceive and interpret that information. This “situational awareness”, of how circumstances are at the time and how they might develop in the future, is a crucial element. In the event of a loss of well control or loss of position of a mobile drilling rig, the most critical human element is the hand of the operator who presses the Blow out preventer (BOP) or emergency riser disconnect controls and the decision to initiate these actions has to be taken in due time to prevent a major accident. No amount of improvements to the BOP capability can overcome the situation in which no one presses the shut-in control until it is too late. Whereas the operation of the BOP can occur shortly after the decision to shut in, a riser disconnect may be even more challenging because it may require a number of tasks to be completed before action can be taken.

Moreover, such activities take place within a complex relationship of client and contractors, both onshore and offshore, and with an intermeshing system of different procedures, objectives, and technical monitoring arrangements as illustrated in the Communication Chart below. The relationship between all the people and organisations involved must be clear so that everyone knows and understands their role and can deliver their contribution competently.



When operations do not progress as expected or planned, these technical and human elements must all function as a single system to prevent a disaster. The challenge for human and organisational factors is to ensure that the final human element (the "hand on the button") is a reliable component in the emergency control/avoidance system. This process can be represented as four control loops:

Key control loops



(a) <u>The Engineering System / Control Panel Control Loop</u>.

- *The display of data about the well and the reservoir,*
- *Information about the environmental conditions – weather*
- *Status information about the equipment including emergency systems and "time to operate".*
- *Controls to operate the equipment.*
- *Controls to effect an emergency shutdown or disconnect*

(b) <u>The Human Factors Loop.</u>

- *A competent person or persons to monitor the control panel with the authorisation to shut down in an emergency*
- *The perception and comprehension of relevant information*
- *The availability and use of prepared procedures and task aids (for example checklists and decision flowcharts) to aid the operator in processing information, reaching decisions and taking appropriate action.*
- *The integration of a number of information flows into real time situational awareness that includes forward prediction of at least the "time to operate" for emergency systems.*
- *Emergency recognition that will result in human action to initiate the correct emergency protection equipment.*
- *Team working and peer-to-peer monitoring and review to support these processes.*

(c) <u>The Organisational Factors Loop.</u>

- *Management and oversight of the operator to support their activities and provide additional early warning of problems.*
- *The management of competence and training delivery.*

- *The audit and review of the safety management systems including procedures, checklists and other decision and action support procedures.*
- *Safety leadership that empowers the operator to act when necessary*
- *Systems to gather and disseminate learning opportunities (i.e. near misses)*

(d) The Company Interface Loop.

- *The safety management systems (SMS) interface documents and other agreements that specify who does what in normal, escalating and emergency situations.*
- *The provision of joint training in emergency scenarios to validate company interface arrangements.*
- *The monitoring and auditing of contractors at both an individual (for example competence) and organisational level (for example contractor safety management systems.*
- *The access to specialist services and advice.*
- *The contractual "environment" (deadlines, penalty clauses) in which the activity takes place that could influence the Human Factors loop.*

Further information on the effective response to well control demands is given in Annex 1.

4. The NSOAF Multi-National Audit

The NSOAF Health & Safety Working Group, chaired by Tom McLaren, developed the scope for an audit of offshore well control that reflected the four elements of the human and organisational factors control loop described above. To ensure consistency of approach across the NSOAF community, the MNA was based on common interview questionnaires (see Annex 2) used both onshore and offshore.

The MNA was carried out by offshore regulatory authorities from Netherlands, Denmark, Germany, Norway and the United Kingdom. Eleven separate audits were undertaken, across all participating countries in the North Sea. The audits covered a range of operators and drilling contractors and well service companies, covering platform based drilling, jack-up rigs and harsh environment semi-submersibles. Whilst only covering a relatively small number of such installations in the North Sea, the sample was considered reasonably representative of the industry as a whole, so the broad findings from the audit can have a wide relevance.

Audits commenced with an initial contact with the duty holders, operators and drilling contractors to introduce the purpose/scope of the audit. Key documentation was sought (e.g. HSE Safety Case, Rig Safety Management System, Emergency Management procedures, Blow Out Contingency plan, Bridging Documentation, and Organisational/Communication charts etc). This was usually followed by a more detailed Head Office visit, an offshore audit against the question sets and a close-out meeting to present and summarise the audit findings at Head Office. Existing national regulatory intervention powers were applied where appropriate.

Members of the NSOAF working group and the audit teams were:

Authority	NSOAF working group	Audit team
State Supervision of Mines (SSM), Netherlands	Vincent Claessens Michael de Vos Jos Marx	Joop Klok Michael de Vos
Danish Energy Agency (DEA)	Gert Neuchs Christensen Mohamed El Halimi	Gert Neuchs Christensen Mohamed El Halimi
State Authority for Mining, Energy & Geology (LBEG), Germany	Kurt Machetanz	Thomas Kaminiarz Kurt Machetanz Thomas Rückwald
Petroleum Safety Authority (PSA), Norway	Oyvind Tuntland Sigve Knudsen Jorunn Elise Tharaldsen Hilde-Karin Østnes	Sigve Knudsen Jorunn Elise Tharaldsen Hilde-Karin Østnes Kristen Kjeldstad Øyvind Lauridsen Elisabeth Lootz
Health & Safety Executive (HSE), United Kingdom	Tom McLaren Rob Miles Kathryn Mearns Steve Walker	Rob Miles Martin Anderson Iain Lambie

The following sections outline the findings from the question sets for each of the categories: Control Panel & Engineering System; Human Factors; Organisational Factors; Company Interface. The findings from the MNA are summarised under each category, concluding with examples of good and poor practice.

5. Control Panel & Engineering Systems - Findings from the Audit

The Control Panel/Engineering Systems loop of the audit addressed issues of clarity and comprehensiveness of the data available to the drilling personnel, and design and suitability of the controls used during well control.

In general, the audit found that displays and BOP controls were clearly labelled and unambiguous, and the crews reported that they were confident of being able to operate them in an emergency. All functions which were not in use were properly labelled (e.g. in red 'Not in Use').

Emergency systems were monitored for availability and functionality, and unlocked but protected, an example being a '*Think before you hit the button*' notice on Blind Shear Rams. The usual practice was for the Driller to set the alarms on various gauges to pre-warn of unplanned events and alert the crew to key changes in the drilling process.

Data and information regarding the well parameters were available in real time at a number of locations, e.g. driller's cabin, toolpusher's office, OIM's office, company rep's office, and these could be interrogated for trend history, even to the extent of identifying small changes in parameters. It is important to note that in such cases data on well parameters was sometimes coming from the same source and this could instil a false sense of security that there were two or more independent systems operating at the same time.

Good practice

Overall, many examples of good practise were observed in this element of the MNA, particularly clear displays, logical consistency of colour lights/coding, and clear labelling of emergency controls and changeable equipment such as rams. Other examples included:

- Easy availability of trend data, rather than numerical data, and drilling crews with the competency to interpret such data.
- Alarm settings for critical well situations discussed with all parties normally involved in the day-to-day operations of the well onboard the rig.
- "Fingerprinting" of systems to record the normal operating conditions and limits set against those.
- Crew trained in manual BOP operation should the power fail
- Installation of a slave set of BOP controls at the lifeboat/muster station assigned to the drill crew. This enabled the drill crew to go to muster and still shut in the BOP if required.
- One company reported 'glass cockpit' type switchable screens in the third generation of new builds and used new equipment assessments and work place mapping to consult users on display format and layout. This company had also recently sheared a pipe in an abandoned well to satisfy themselves that the BOP system had the required capability

Poor practice

There were, however, some examples of poor practice:

- Some alarms significant for safety were not clearly distinguished from other information
- The BOP and diverter panel in the driller's cabin used different colour codes for open and closed valves and valves in normal and abnormal position. Similar potential confusion was also apparent where ballast control screens were unnecessarily complicated and where visual information screens could not display trends and where the colours/readability were not clear.
- A firewater system requiring unnecessary password protected permissioning;
- A cementing unit used as an emergency circulation pump was not identified as a safety critical element;
- Poor management of false alarm problems, leading to crew perception/assumption that they were spurious.
- Extensive use of manual valves leading to ergonomic strain and uncomfortable working positions.
- No evidence of an action plan following a Human-Machine Interface (HMI) analysis.
- Potential problems with communication and understanding because the driller did not appear to be proficient in English

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6. Human Factors - Findings from the Audit

The Human Factors aspects of the audit addressed two key issues – the "situation awareness" of the drilling crew (and hence their ability to make the right decisions and actions in relation to well control), and their well control training/competency.

Situation Awareness, Decision-Making and Action

Overall, the drilling personnel who were interviewed were open, honest and knowledgeable about well control and the threats associated with the drilling process. The auditors reported that questions were answered confidently and with authority

It was clear that awareness of well performance was obtained from various information sources, with data usually presented in the Driller's Cabin and to Mud Loggers, Mud Engineer, Drill Crew and offices of the (Assistant) Rig Manager and the Drilling Supervisor. It was apparent that the practises were to ensure that changes to the drilling parameters or drilling fluid volumes would be immediately investigated, and mud levels checked manually. Further information was commonly available from previous wells, data sheets, drill speed logs, etc. and these would be used to narrow down the variations and uncertainties in well performance.

Every rig involved in the audit provided strong assurance that the Driller had the authority to shut in the well. It was stressed that there was no time pressure on drilling operations and anyone could stop the job and request a 'Time out'. For example, one cabin poster read "*Time out for safety. Remember that if you are in doubt about the well simply shut it in. It is your call. You do not need permission to secure the well*".

Some Well Control Manuals were not sufficiently rig specific and up-to-date (e.g. poor document control of well control manuals). It was also noted that more complex well control situations (i.e. volumetric) tended to be less extensively documented than Wait-Weight-Method and the Driller's method, and lacked detail and proper guidance.

Emergency Response Plans were invariably in place listing anticipated emergencies and an organization plan for each, including responsibilities for key personnel and a list of duties for those personnel to perform. A typical example from an audit indicated that after shutting in, the Driller would monitor the well and record pressure, checking for leaks and investigating the volumes gained in close coordination with those responsible for monitoring tank volumes. He would then inform the (Assistant) Rig Manager and the Drilling Supervisor and they would provide the necessary assistance in discussing the situation and comparing interpretations. Shore-based management would be informed and the offshore team would discuss which well-killing procedures should be used with the client Drilling Manager. Procedures and calculations would be checked and cross-checked both offshore and onshore. Complications could arise, though, if onshore support is not a 24 hr service.

Training and Competency

All personnel involved in the drilling process were reported to be trained to International Well Control Forum (IWCF) standards and in possession of a Well Control Certificate (at least to supervisor level). Well control drills were undertaken and documented.

The drilling contractors reported having training and competency matrices in place, including job descriptions with continuous evaluation and competency assurance and on-the-job training (OJT) books for selected drilling activities. One drilling contractor had a bespoke Competency Assurance System in place where personnel were assessed on actual performance by competent assessors. However, because of the general shortage of experienced drilling personnel, it was acknowledged that staff were often being promoted into positions early on in their training and development. This caused some organisations difficulties in keeping planned competency assurance programmes for drill crews fully effective
.
There was some variation in the type of drill training undertaken, ranging from Task and IWCF-focused to Scenario-based training. The audit identified a welcome movement from solely "routine" training towards the latter approach, which is designed to prepare the crew for the range of information and decisions they will face. The wider involvement of 3rd parties in that learning approach was also acknowledged as an improvement.

DWOP (Drilling Well On Paper) exercises [see Section 7 for more information] were considered an excellent way for identifying unfamiliar elements in the well programme and hence exploring the offshore crew competence. Any gaps could be addressed, for example by bespoke onshore courses or adding experienced supervisors to the offshore crew to support learning offshore until it was clear that the crew had the required competence. It was

acknowledged, though, that there was a need to extend scenarios to later phases and further handling of a loss of well control situation.

Good practice

In conclusion, there were many examples of good practise in the Human Factors aspect of well control, particularly the overall clear empowerment of the Driller to shut in the well, without seeking approval from more senior personnel, and the use of DWOP exercises to explore crew competence. Other examples included:

- Well control policies with a strong bias towards early shut in and then interpret events, recognising that such pre-emptive action is recoverable. This was coupled with a management practise of reinforcing and praising early shut-in. The driller was expected to act quickly, and this was emphasised as a core responsibility and they were accountable for failure to act, The MNA saw examples where such a policy was reinforced and validated by running regular unannounced drills, for example with mud flows being diverted or other parameters changed, and the time taken for the crew to react was measured.
- Drillers and Assistant Drillers closing a BOP several times a year during function tests after trips to increase their confidence to conduct such an action.
- Systems for on-the-job assessment of well control competence by experienced assessors, captured in a formal Competence Management System.
- Scenario based training both on and off the rig, which included 3rd parties and enabled testing of the communication line. It was important to start with a high quality DWOP, including representatives from the various disciplines and develop proactive well control exercises.

Poor practice

Examples of poor practice were:

- Training exclusively in routine exercises rather than also using scenario-based training. In some examples it was not clear that the training scenarios matched key decision points.
- Inadequacies in well control documentation, due to poor quality assurance, coverage and communication, affecting the ability of the Driller to respond effectively. Examples included:
    - gaps in the well control manual
    - conflicts between the drilling contractor's and operating company's well control manuals
    - the well control flow chart in the driller's shack not being in agreement with the well control manual from the drilling contractor.
- Lack of clarity over who was responsible for shutting-in the well and shearing if necessary. In this example, the Driller was clear it was his responsibility/decision but in the bridging document it was presented as a joint decision between the (Assistant) Rig Manager of the drilling contractor and the client

7. Organisational Factors and Company Interfaces - Findings from the Audit

The Organisational Factors Loop of the MNA addressed the safety management systems within the drilling contractor, their audit and review processes, safety leadership issues and how they disseminated lessons. The Company Interface loop encompassed the client/drilling contractor relationships, including processes for monitoring and auditing contractors and the provision of specialist services. This loop also explored the management of contractual issues that have the potential to negatively influence the Human Factors loop, such as the use of penalty clauses.

Because of the close links between drilling contractor management processes and the interface with the client and other contractors, this section of the report considers both the Organisational and the Company Interface loops together

Management Systems

Many of the responses reflected findings presented from the Human Factors Loop, which indicated a level of consistency from the management processes to front-line activities. Generally, well control handbooks had up-to-date procedures, and set out key operations in clear steps and included example calculations. Barrier management models based on Bow Ties were starting to be implemented, although in some cases still needed to be more widely communicated to personnel.

Procedures for maintenance and testing of drilling equipment were in place and there were no competing procedures for drilling and well intervention.

There was good awareness of the importance of 'Management of Change' (MoC) with, for instance, MoC processes clearly defined as a loop in the Well Delivery process, documented in a written procedure and signed off by the responsible persons when applied.

Some of the drilling companies were closely monitored on a range of Key Performance Indicators (KPIs), although in other cases these were lacking. There was evidence of benchmarking across companies and rigs, with weekly reports at safety meetings. It was notable, however, that these benchmarking exercises were orientated towards drilling progress and efficiency and there was little mention of KPIs for well control. There is the potential for such performance orientated KPIs to conflict with safety performance, as it was common practice to have penalties in place for underperformance (e.g. in relation to the downtime rate of drilling progress) but how this was being managed from a human factors perspective was not clear. In other words, there was a lack of attention as to how penalties for underperformance could influence the performance of the driller in relation to safety-related decision-making and behaviour at the front-line.

Safety Management System (SMS) Interface Issues

Despite the MNA finding drilling contractors who could clearly explain how the steps of the planning process between client and contractor were logically and systematically linked together, the audit identified considerable misgivings over formal interfacing arrangements and processes.

Drilling operations and well intervention were usually under the direct control of the drilling contractor but there was close involvement with the client who often maintained overall responsibility for installation safety. Although all the audited companies had bridging documents in place, the content and quality of these documents varied. Absolute clarity of the joint approach from what could be two separate SMS arrangements is therefore crucial, but the audit found that interfacing documents were often insufficiently verified and scrutinised by those who received and used them. There was often a lack of GAP analysis of the systems/standards used by the drilling contractor and client/operator, and this reflected a lack of attention at the contract stage to manuals and compliance. This was particularly evident in the interface documentation, which should seek compatibility between the drilling contractor manual and the operator manual. In one example, both the client and drilling contractor's well control manuals were in existence, and in another some key procedures referenced in the bridging document were not readily available. It is notable that training (and presumably competence) was not included in these arrangements. In yet another audit, there was no bridging document for handling well control and no cross check that the two sets of procedures (client and drilling contractor) were aligned. Document control issues were also identified as a common feature.

Given the potential for significant tensions between the client operating company's preferred method and that of the drilling contractor (as reported in one audit, and not thought to be unique), the lack of clarity in bridging documentation is a real concern. It is clearly essential to avoid the situation of a client company expected the drilling contractor to operate according to the client procedures yet with the drilling crew being trained in and operating according to the contractor's own procedures. The potential for conflict, and its resolution, requires close attention at the contract stage and then implemented in the bridging arrangements and documentation.

Drilling the Well On Paper (DWOP) was a common practice carried out onshore prior to commencement of drilling, and shared DWOPs were cited as playing a key role in verifying the client/drilling contractor company interface arrangements. Representatives at this activity would often include the client's representative (company man), the whole drill crew including new hires and key 3rd party contractors. Usually, the drilling contractor's manual takes precedence but where a client requested use of their own manual the DWOP becomes especially important. The DWOP served to plan the well, prepare task specific task sheets, validate the interface arrangements and team build. However, at least one company reported that not all personnel who should be involved in well drills are involved, and another company preferred not to DWOP, instead discussing the well plan on a smaller scale with individual contractors.

Audit and Review

Although company auditing arrangements were not covered in great depth within the NSOAF MNA, sufficient issues were highlighted to make the topic of "audit and review" worthy of further attention by the industry. Auditing seemed to focus on equipment, and on at least two rigs there was no evidence of audits being undertaken on the drilling contractor safety management systems (SMS). It was acknowledged by one company that auditing and verification of 3rd party contractors had been a weak area in the past and they were now pilot trialling a 3rd party audit and verification scheme. The MNA identified a lack of contractor audits of the client's management system before it is adapted as part of their SMS, which is a significant finding given the concerns expressed above on weaknesses in bridging arrangements. In one example, the Bridging Document stipulated that the client is required to conduct periodic auditing of the rig contractor and the service company's HSE management system, but the interviews with onshore personnel in the client organisation revealed that only one audit had been conducted since April 2011. There were substantial variations in audit planning for well control issues.

Lessons Learned

Most of the drilling companies and their clients produced 'learning from incidents reports' that were shared with the crew, One drilling contractor reported that after each well there was a period of formal "wash-up" and review where decisions and procedures were reviewed and lessons captured. This was done in collaboration with the client. The drivers for this were both commercial and safety as there were benefits to both, but the commercial drivers ensured it was done. Part of this learning process included use of their own events in scenarios and debriefs and the company was also part of an industry network for 'Lessons Learned'. However, the MNA found little evidence of lessons being spread much wider, either within the companies involved or to others in the industry.

At least one drilling contractor had no systematic way of processing and communicating learnings from previous drills or incidents. One client had also produced a learning lessons report that was not shared with the drilling contractor.

Good practice

There was some evidence of good practice. For example:

- Contracts allowed time for scenario-based well control exercises and ensuring that 'learning from incidents' reports were shared with crews.
- Bridging documents and emergency response plans where roles and responsibilities were clear and guidance addressed interfaces between client and contractor.
- Monitoring and auditing of contractors
- 3rd party contractors included in the interface arrangements
- Contracts with well control/capping service companies and other relevant specialist contractors arranged in advance to enable additional well control capabilities to be available within the shortest time possible when required

Poor practice

- No gap analysis between client and drilling contractor systems and documentation when arranging bridging arrangements, especially in relation to well control manuals and procedures
- Exclusion of 3rd party contractors from the interfacing arrangements.
- Well control manuals not sufficiently rig specific
- Missed opportunities to disseminate information about well control with no systematic way of processing and communicating lessons learned from previous drills or incidents
- Lack of KPIs relevant to well control issues
- KPIs solely commercially orientated rather than safety focused
- Lack of consideration of the human factor perspective of how clear penalties on drilling contractors for under performance (e.g. drilling time) can be a disincentive for prompt precautionary well control actions.
- MOC procedures was not covering changes to drilling and well operations
- No evidence of auditing of SMS issues or audits tended to focus on equipment.

ANNEX 1

Effective responses to well control demands

(a) Working back from the action of "pressing the button":

- The crew must know and agree who is to take the action
- They must know and agree when to take the action
- They must be confident that they have the full support of those above them in the action they take.
- They must be empowered to take the action in the time available.

(b) They must be confident that they are taking the right action.

To achieve the required level of confidence to shutdown or disconnect the person taking that action must have the best possible understanding of the situation along with the range likely of outcomes and options available. This requires training and experience, pre-planned and rehearsed scenarios that they can draw on to help them interpret the situation and procedures to guide them through that interpretation.

(c) They must have situational awareness.

To achieve the required situational awareness they need accurate and timely information from the displays and other equipment around them. The design of these displays should help them to rapidly assimilate the information and their training and procedures should help them reach an accurate situational awareness.

Before any activity is undertaken that could result in a situation that has the potential to become a major incident there must be in place the organisational foundations to create a safe and organised workplace. This will be the supervision, training, drills, procedures and equipment to ensure readiness. The equipment must function as intended and so this organisational preparedness includes monitoring, testing, verification, auditing, management of change and inspection. These safety management systems should be working "behind the scenes" to deliver the equipment, information and procedures well in advance of any requirement along with the appropriate level of independent audit and verification.

(d) They must be in an effective organisation.

Drilling is an activity that usually requires the coming together of a number of organisations: the driller, the client, specialist contractors. These organisations must agree their roles and responsibilities and those of their staff. They need to agree what information is shared, when and how and who is responsible for taking action, when and what. This cannot be done once problems occur, it must be done well in advance. These roles and responsibilities are usually set out in management interface documents and contracts and these must be sufficiently specific to provide guidance that can be followed without further clarification in the event of an emergency.

(e) Like every other critical element, the management interfaces should be tested and verified.

When wells are planned and the key stages agreed and rehearsed, for example when "drilling the well on paper", these safety management interface documents and other arrangements should also be included in these exercises and tested for a range of realistic scenarios as "desk top" exercises. Any gaps and other areas of confusion or conflict should be corrected and the new "verified" documents used as a basis for training and collaboration.

ANNEX 2

Audit questionnaire guideline

(a) The Engineering System / Control Panel control loop:

1. How is the necessary data about the well and the reservoir clearly displayed to the operator who requires it?
2. How is this data presented in a manner that enables them to establish and maintain effective situational awareness?
3. How is other real-time information such as weather and met-ocean conditions that influence the judgment on when to initiate shutdown action presented to the operator and in a clear and usable format?
4. How is information that describes the status and readiness of emergency systems including “time to operate” presented to the operator?
5. Are the controls to operate the equipment clearly labelled and functional?
6. Are the emergency controls clearly indentified and functional, i.e. not locked?
7. If there are multiple shutdown controls and/or levels of shutdown, are these clearly indentified?

(b) The Human Factors Loop.

1. How does the organisation ensure that there is always a competent person or persons with the responsibility to monitor the situation including the control panel and with the authorisation to shut down in an emergency?
2. How does the competence of this person enable them to fully understand the full range of the information presented to them and understand its importance?
3. Are there validated procedures and task aids (for example checklists and decision flowcharts) to aid the operator in processing information, reaching decisions and taking appropriate action.
4. How does the competent operator integrate of all of the appropriate information flows into a real time situational awareness?
5. Does this situational awareness include forward prediction that, at least matches but should exceed, the “time to operate” for emergency systems?
6. Can the operator demonstrate that they can recognise the early indications of an emergency situation and explain when this must result in action to initiate the correct emergency protection equipment?
7. Is it absolutely clear who takes this emergency action and are they provided with the necessary procedures and other decision aids to facilitate their action?
8. Are they given the authority to take this action in the time available?
9. Is the operator supported by team working and peer-to-peer monitoring and review?

(c) The Organisational Factors Loop.

1. What management systems are in place to support the operator responsible for monitoring the situation and making the shutdown action?
2. What are the management systems in place to provide oversight of operations and additional early warning of problems?
3. What is done to ensure the competence of operators including competence assurance and training delivery?
4. How does audit and review verify the safety management systems including procedures, check-lists and other decision and action support procedures?
5. How does safety leadership effectively empower the operator to act when necessary?
6. How does the organisation gather and disseminate learning opportunities from events, for example near misses, that occur within the organisation and elsewhere in the oil industry?
7. What evidence is there that learning information from events is influencing operations?

(d) The Company Interface Loop.

1. Are there in place agreed safety management systems (SMS) interface documents and other agreements that specify who does what in normal, escalating and emergency situations?
2. How are all those involved in emergency decisions made aware of these arrangements?
3. How have these interface arrangements and any other external joint actions been tested and verified?
4. What processes are there for the monitoring and auditing of contractors at both an individual (for example competence) and organisational level (for example contractor safety management systems?
5. How does the company provide access to specialist services and advice when it is needed?
6. Are there any contractual issues that could negatively influence the Human Factors loop, for example deadlines and/or penalty clauses that apply to the activity, and how are these potentially negative influences managed?