How offshore inspection scores reveal major accident prevention measures

Learning lessons from 147 offshore inspection letters sent to duty holders in 2019

SALUS

Contents

Foreword

Dear reader,

Who is the better lifeguard? Steve argued it was him, having rescued two people during his career, winning a bravery award and having his photo in the local newspaper, displayed proudly above his parents' mantelpiece. Michael had never had to rescue anyone. Not even close. His argument was this was precisely why he was the best lifeguard. He had never allowed an incident to happen, brashly concluding: "Good lifeguards should never get wet."

"Good lifeguards should never get wet."

I don't understand enough about lifeguarding to know who was correct, and I certainly wouldn't want a lifeguard to think twice about how jumping into rescue me may tarnish their own record. But what I do understand is that preventing an incident is a far more effective way of saving lives than by controlling or mitigating the consequences of an event that is already happening.

Each year, the Energy Division of the UK Health & Safety Executive (HSE) visits over 100 offshore oil and gas installations to carry out inspections on a wide range of topics. If a topic inspection finds poor performance, the HSE writes to the duty holder outlining the action they need to take to improve. In 2019, 147 letters of this nature were sent. These letters contain a wealth of information but are out of reach to everyone other than the recipient. The valuable information contained within them could be used to help prevent major accidents across this industry and beyond. Extracting further value from these letters has not been possible. Until now.

Following a Freedom of Information request to the HSE, Salus Technical obtained the 147 inspection letters issued in 2019. I thank the HSE for their efforts in providing us with this data. The Salus team then set about the painstaking process of reviewing the content of these letters and compiling them into an anonymised database. The output of our work is this document which presents the findings and provides you with actionable advice on how to avoid the same pitfalls. The team worked tirelessly to complete this work along with me. Their work, if appropriately actioned, may help to prevent the next major accident from ever taking place.

In return for this, I ask only one thing of you. Once you have finished reading this document, immediately implement one thing based on what you have learned. Without delay. Not passed onto someone else to pick up or left until next month's meeting.

Please do not underestimate the impact that the action you take today may have. What you decide to do after reading this document may be critical in saving a life.

David Jamieson
Founder, Salus Technical

“The time for action is now. It’s never too late to do something.”

Antoine de Saint-Exupéry

Can we predict when major accidents will happen?

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Process safety is not the absence of an incident, it is the presence of effective barriers.

What is a major accident?

Major accidents include events such as fires and explosions, ship collisions, and dropped objects. They have resulted in the loss of thousands of lives worldwide. Process safety is what we all do to prevent major incidents and yet we get it wrong all the time.

That's right: incident investigations into major accidents that have taken place across many industries in different parts of the world uncover remarkably similar underlying causes again and again.

Perhaps the hazards were not fully identified, the risks were not understood, or the controls that were supposed to be in place were not being managed. It may be that lessons were not being learned from previous events, there were gaps in the management of competency, deviations from procedures and safe working practices had become normalised, management systems weren't effectively implemented, or changes weren't being managed.

Without realising it, increased reliance was being placed upon the people working on the front line – and all it took was a little bad luck on the day for an incident to occur. Preventing major accidents is difficult, and its initiating events can be invisible to the eye.

Weak signals

When was the last time that a warning light on your car's dashboard turned on? What action did you take? Although nothing has yet happened, a warning light on your dashboard is usually a sign that something bad may be just around the corner. It is telling you to act now to prevent an incident. This is known as a weak signal. But how do we find the weak signals in major hazard industries such as the offshore oil and gas industry?

Incident investigations often find that there were notable signs that a problem was developing long before the day of the incident. We must actively seek out these weak signals and take action when we find them.

Examples of weak signals include large amounts of overdue maintenance, abnormal readings from equipment or non-compliances found during an inspection. Some of these may seem unimportant on their own, but it is crucial that we remain alert and vigilant to them.

Process safety is not the absence of an incident, it is the presence of effective barriers. Weak signals tell us that there may be problems with our barriers and that a major accident may be just around the corner.

How are we performing as an industry?

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How are we performing as an industry?

The UK oil and gas industry is in its sixth decade of offshore production and is forecast to continue operating into the 2030s and perhaps beyond. Reflecting on the progress in offshore safety over the past three decades, it is clear that the sector has made considerable improvements in the management of health and safety.

In 2019, there were zero fatal injuries and only three major hydrocarbon releases. In 2020, there weren't any fatal injuries or major releases. These statistics make for excellent reading. But if we dig a little deeper, we can see the weak signals which show we can't take this performance for granted.

If we scratch below the surface, the weak signals from 2019 reveal themselves...

1 in 4

offshore inspections found aspects of the duty holders' operation which were significantly below the standard expected in the regulations, on average *

Once every 2 weeks

an enforcement action was raised against duty holders by the regulator (either prohibition or improvement notices), on average *

Once every 5 days

there was an unplanned hydrocarbon release (classified as major, significant or minor based upon their severity), on average *

* **HSE Offshore Statistics & Regulatory Activity Report 2020**
https://www.hse.gov.uk/offshore/statistics/hsr2020.pdf

How are we performing as an industry?

2019 successes

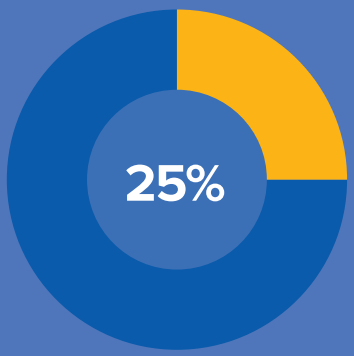
2020 successes

2019		2020
0	Fatalities	0
3	Major releases	0

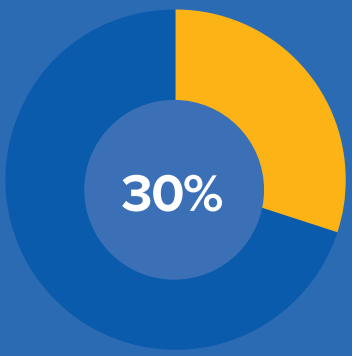
2019 weak signals

2020 weak signals

2019		2020
218	Dangerous occurrences †	172
61	Hydrocarbon releases topsides	63
18	Pipeline releases	16
17	Well releases	7
113	Non-hydrocarbon releases	86



Offshore inspections topics found to be significantly below the standards expected by the regulator.



Offshore inspections topics found to be significantly below the standards expected by the regulator.

† Dangerous occurrences are defined in the RIDDOR Regulations https://www.hse.gov.uk/riddor/dangerous-occurences.htm

“Action is the foundational key to all success.”

Pablo Picasso

What is the role of the HSE in preventing major accidents?

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The Energy Division

30%

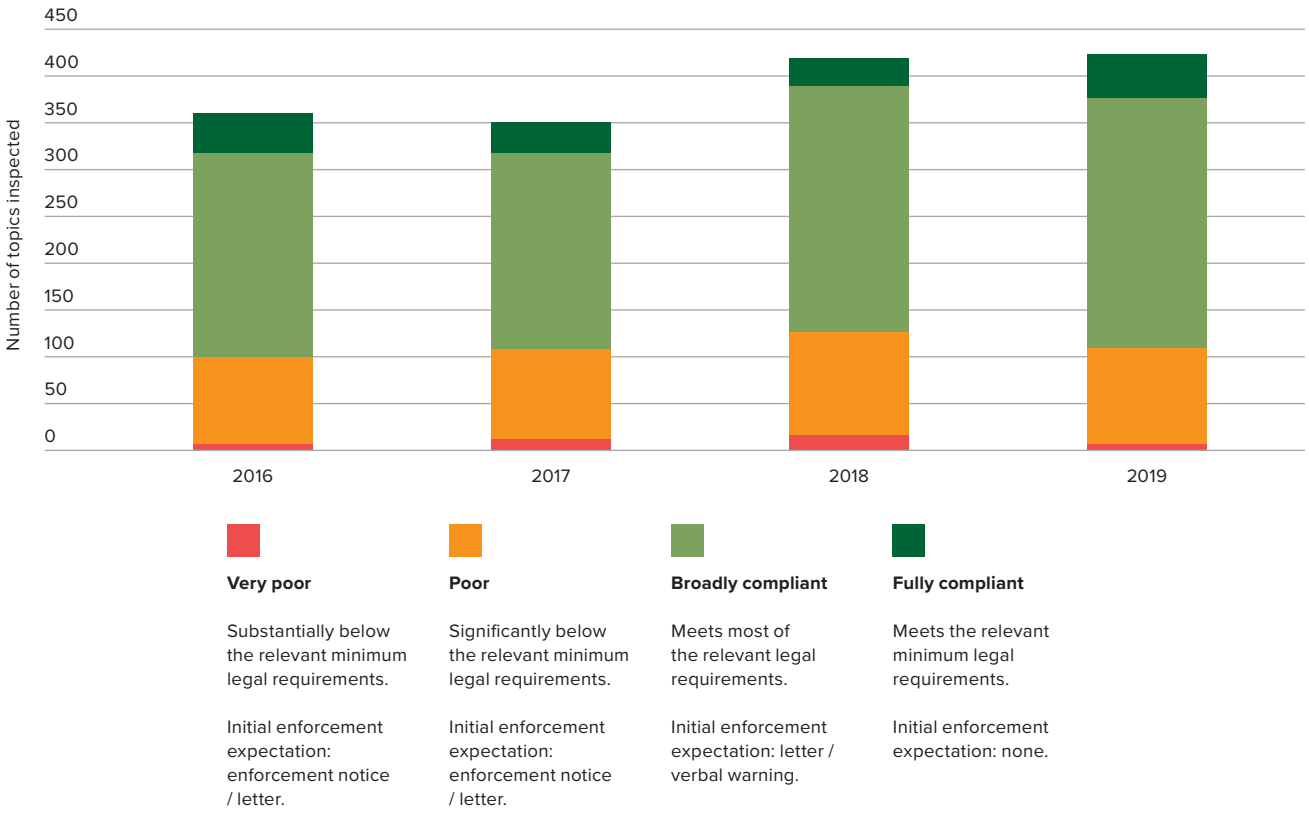
of the topics assessed in 2016-2019 resulted in a poor or very poor score.

The UK Health and Safety Executive's (HSE) Energy Division (ED) is responsible for regulating health and safety offshore. Each of the several hundred offshore installations in the UK require their Offshore Safety Case to be assessed and accepted by the HSE before operations can commence and again before any major changes come into effect. While in operation, the ED inspect these offshore installations throughout their operating life.

Over 100 offshore inspections take place each year, where a team of specialist inspectors visit offshore via helicopter and inspect duty holders on specific topics including maintenance, operational risk assessment and control of work. In a typical year, close to 1,000 matters of non-compliance with the regulations will be identified.

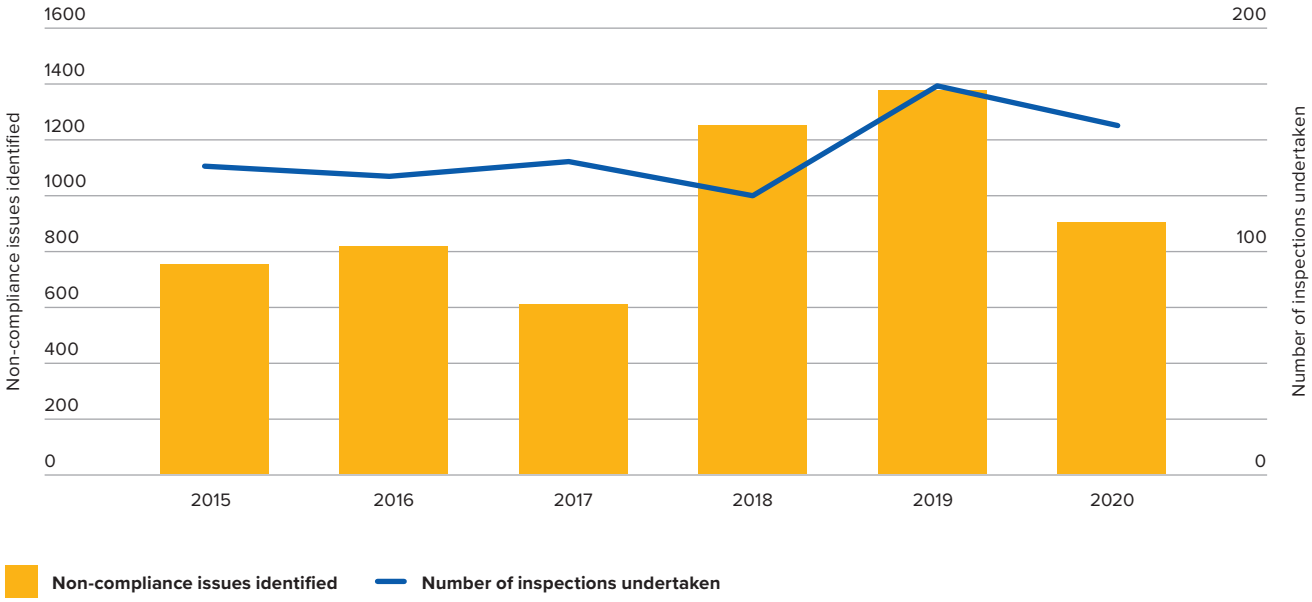
The topics inspected are given a score ranging from exemplary to unacceptable. Those that are unacceptable are often subject to enforcement action from the regulator, and have not been included within the scope of this document. There were no instances of exemplary in 2019. On average, 30% of topics assessed result in a very poor or poor score meaning that they fall below the standard expected in the regulations. Each item found in this category is raised as a non-compliance. In these cases, the regulator will usually write to the duty holder outlining the shortcoming and the action required to resolve the situation.

Offshore topic inspection scores 2016-2019 *



What is the role of the HSE in preventing major accidents?

Non-compliance issues identified and inspections undertaken per year *



These non-compliance findings offer crucial insights into how duty holders fail to manage safety. Unfortunately, at present, only the recipient of the letter has access to these findings, resulting in a gravely missed opportunity for other duty holders to learn valuable lessons from their peers.

*** HSE Offshore Statistics & Regulatory Activity Report 2020**
https://www.hse.gov.uk/offshore/statistics/hsr2020.pdf

“Be the change that you wish to see in the world.”

Mahatma Gandhi

What was the scope of our research?

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What was the scope of our research?

Seizing an opportunity to learn from the findings shown on pages 10 and 11, Salus Technical issued a freedom of information request to the HSE to obtain the letters distributed to duty holders in 2019 with the aim of analysing these letters to gather key insights (reoccurrences, themes etc.) into the non-compliances faced by duty holders. The year 2019 was chosen as it was the most recent year unaffected by the COVID-19 pandemic, and where all of the findings had been resolved by duty holders, meaning that all letters could be shared.

The letters were examined and compiled into an anonymised database so that duty holders or installations could not be identified. The findings and actions were subsequently studied in depth with a particular focus on identifying reoccurring findings.

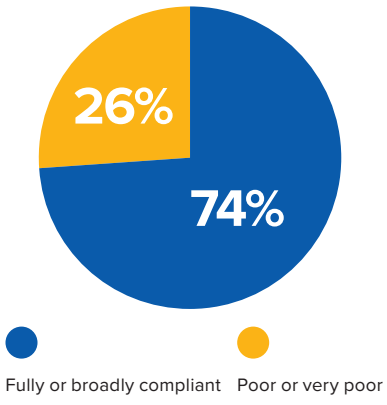
Summary of duty holder performance in 2019

174

inspections undertaken.

426

topic inspection scores assigned.



1062

non-compliance issues identified.

147

letters issued.

26

enforcement notices.

0

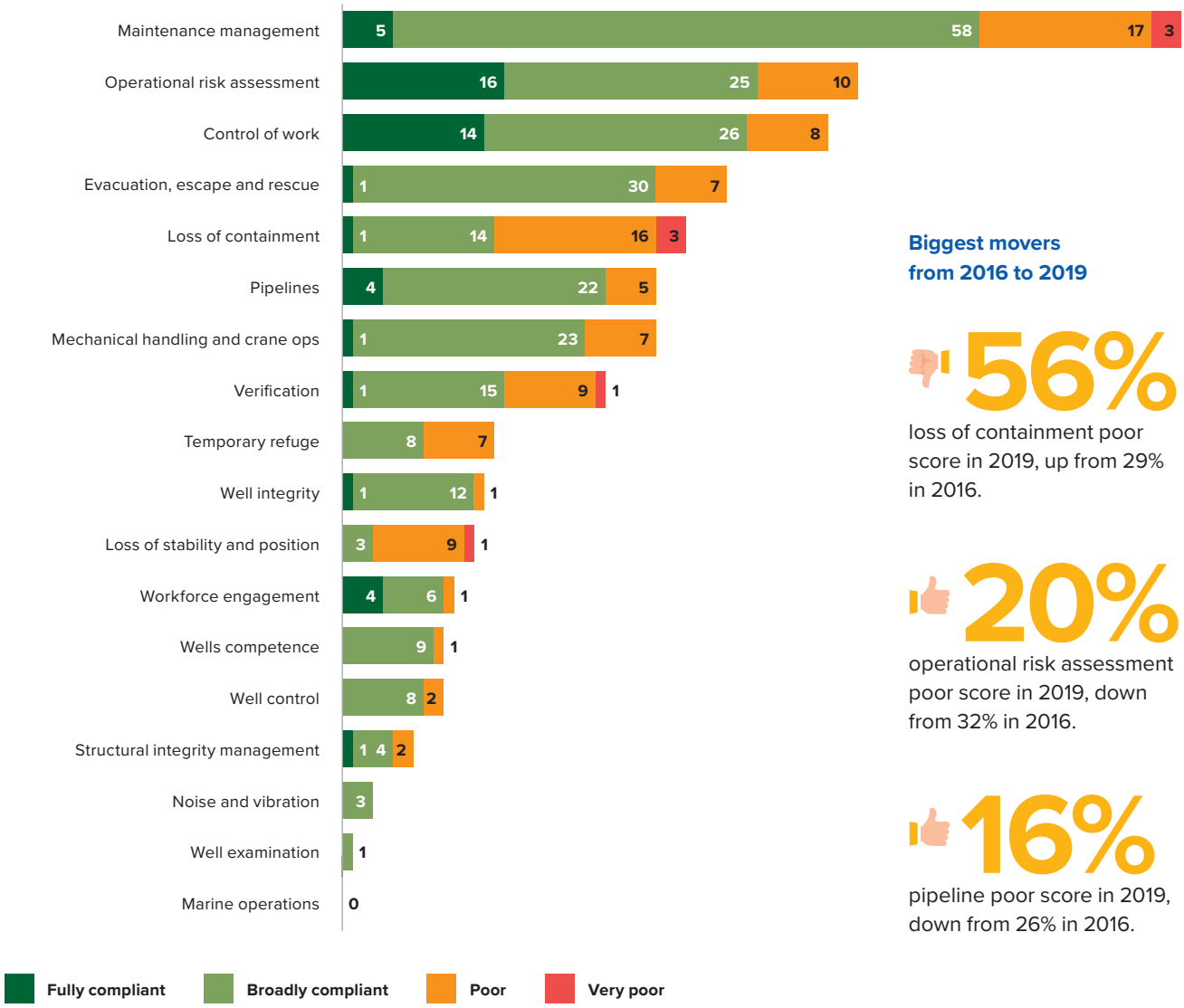
prosecution cases.

Inspection topics

The graph below provides a breakdown of the scores assigned to each topic assessed by the HSE in 2019. It should be noted that a larger proportion of inspections are allocated to topics such as maintenance management and operational risk assessments due to historically poor operator performance in these areas.

Most topics have dedicated inspection guides available on the HSE's website which clearly describe the success criteria for each topic. These are an invaluable resource.

Offshore topic inspections and scores 2019 *



Biggest movers from 2016 to 2019

56%
loss of containment poor score in 2019, up from 29% in 2016.

20%
operational risk assessment poor score in 2019, down from 32% in 2016.

16%
pipeline poor score in 2019, down from 26% in 2016.

* **HSE Offshore Statistics & Regulatory Activity Report 2020**
https://www.hse.gov.uk/offshore/statistics/hsr2020.pdf

“You are what you do. Not what you say you’ll do.”

Carl Jung

Results

18

inspection topics assessed.

1062

non-compliances found.

147

letters issued to

56

duty holders.

Reoccurring findings

This section presents the reoccurring findings that have been identified for each of the inspection topics assessed in 2019.

A reoccurring non-compliance has been defined as a *non-compliance issue that has been raised by the regulator to multiple duty holders*. In some cases, more than half a dozen duty holders were written to on the same matter. This points to underlying issues faced across industry. It is important these are shared.

The applicable success criteria from the HSE inspection guides have been included to help provide context for each finding. The full list of guidance documents can be found here: www.hse.gov.uk/offshore/inspection.htm

There are recurring findings that could be assigned to multiple inspection topics due to the similarities in the success criteria. To avoid any repetition, each finding has been assigned to only a single topic.

No reoccurring findings were found for the following topics:

- Well integrity
- Well control
- Well examination.

Maintenance management

Maintaining the integrity of plant and equipment is an essential requirement for safety. A robust Maintenance Management System (MMS) should deliver effective inspection, maintenance and testing activities that assess the condition of the plant. It should detect deterioration and remedy the identified shortcomings. Identifying the necessary inspection and maintenance requirements reduces the likelihood of a significant incident as a result of failure of plant or equipment.

Success criteria source

HSE, ED Inspection Guide Offshore, Inspection of Maintenance Management

www.hse.gov.uk/offshore/ed-maintenance-management.pdf

Success criteria	Reoccurring findings
There should be a coherent plan for liquidating the backlog of maintenance.	Fabric maintenance anomalies had not been actioned and remained in backlog; had not been given sufficient priority; or had been conducted inadequately. Areas of coating break down and corrosion had not been actioned and remained in back log.
MMS data should have prioritisation for work orders.	Work orders were found within the MMS which were not assigned the correct criticality or priority.
The planning of Safety and Environmentally Critical Equipment (SECE) maintenance should be efficient.	Planned and corrective SECE maintenance work scopes that could not be supported or executed were being deferred without appropriate justification.
An assessment of the risk presented by a deferral request for work orders must be given.	Justification on deferral requests was either not given or was not satisfactory.
Proof test regimes in place should carry out periodic testing of all elements.	Proof test regimes in place were insufficient regarding the frequency and the testing itself, as the testing procedures would only prove part of the equipment functionality, rather than its full functionality.

Operational risk assessment

Success criteria source

HSE, ED Inspection Guide Offshore, Inspection of Operational Risk Assessment

www.hse.gov.uk/offshore/ed-operational-risk-assessment.pdf

An Operational Risk Assessment (ORA) is required where there is an intention to operate safety and environment critical equipment outside its normal operating envelope, or with control devices not functioning as designed. This includes any changes to organisational capability that may compromise the safe operation of the installation. The most common trigger for an ORA is the identification of an impairment to a Safety and Environmental Critical Element (SECE).

Success criteria	Reoccurring findings
An ORA procedure should detail: • When it is to be used • Shortcomings and impairments that trigger an ORA • A clear methodology to be followed when assessing the risks • Roles, responsibilities including approval of ORAs • ORA action tracking, monitoring, review and close out • An assessment of cumulative risk	There was a lack of ORAs for degraded safety critical equipment even when this was a requirement stated in the ORA procedure. The process of identifying the risks associated with faulty safety critical equipment and the identification of applicable Major Accident Hazards (MAHs) are not understood by the personnel undertaking ORAs. No criteria were in place to determine when it is necessary to carry out a cumulative risk assessment, how it is assessed or who is responsible for carrying out and approving such an assessment.
There should be a practical application of ORA procedure including onshore (technical authority) involvement and awareness of roles and responsibilities.	There was no formal training in the ORA procedure, leading to individuals not following the ORA process. A lack of representation from various teams (operations, maintenance etc.) during the ORA process led to poor assessment and communication of risk.
Inspection of ORA output: the assessment should make clear any time limits on adopting temporary remedial measures and when the fault or failure must be rectified including its priority.	The validity period of the ORA was based upon the time taken to make the repair, rather than being risk-based. When the validity period was not met, extensions had no justification.
Monitoring and auditing of ORA remedial actions should be put in place.	The mitigation measures identified through the ORAs were not being implemented. There were no monitoring arrangements in place to ensure the mitigation measures that were identified through the ORA process were implemented.

Control of work

Maintenance and project activities can significantly increase safety risks. Effective work control arrangements such as Permit To Work (PTW) and task risk management when followed, control the risks arising from high-risk work activities.

Success criteria source

HSE, ED Inspection Guide Offshore, Inspection of Control of Work arrangements

www.hse.gov.uk/offshore/ed-control-of-work.pdf

Success criteria	Reoccurring findings
The duty holder should be able to demonstrate how the implementation and effectiveness of the PTW system will be measured e.g., a periodic inspection of the work activity and of a sample of permits to ensure proper completion and effective use.	There is no system in place for the regular monitoring of process plant isolations and reinstatement activities, to identify non-compliances with the procedures in place and to identify any necessary improvements. Such monitoring would be expected to be frequent, and carried out by a person (or persons) local to the site, and familiar with the tasks.
Personnel undertaking work should be familiar with the hazards and controls of the work. These should be detailed on the toolbox talk.	The control measures detailed on the toolbox talks were inadequate for the tasks being carried out. This resulted in personnel standing on hatched areas while crane operations were taking place, or personnel being unsure of the control measures for the manual handling of equipment.
Work should be appropriately supervised to ensure it is completed to the required standard.	Supervision arrangements in place during the conduct of process operational tasks and control of work were inadequate.
Safe Systems of Work (SSOW) should demonstrate that suitable and sufficient risk assessments have been conducted and the control measures are implemented.	There were failures in implementing SSOW to control attendant vessel movements and operations, or to maintain the condition of deck plates which were progressively worsening.
Duty holders must demonstrate the training, qualifications, skills and level of competence requirements for: • those issuing permits • those doing work under permits, and • those monitoring, reviewing performance etc. Effective training is essential to achieve quality and consistency in the use of the PTW system. There should be successive levels of training for those involved.	There was inadequate training of personnel involved in the isolation and re-instatement of plant and the PTW processes in place.

Evacuation, escape and rescue

Success criteria source

HSE, ED Offshore Emergency Response Inspection Guide

www.hse.gov.uk/offshore/ed-evacuation-escape-rescue.pdf

Offshore emergency response systems should be designed to mitigate the immediate aftermath of an event that has either escalated, or has the potential to escalate, into a major accident. An effective emergency response ensures that, in the event of an incident, the organisation is adequately prepared for all necessary actions which may be required for the protection of the public, personnel, environment and the asset.

Success criteria	Reoccurring findings
The offshore safety induction should provide sufficient content on the emergency arrangements and ensure each person is familiar with and has received sufficient practical training with all emergency equipment.	Offshore safety inductions failed to provide the necessary training and give clear instructions to personnel on board in relation to operating marine equipment such as escape systems. Personnel of note who are specifically not given training and information regarding Life Saving Equipment (LSE) are infrequent visitors and specialist vendors.
Throw-over life rafts should be easy to launch, and personnel (at the very least core crew) should be able to talk through the launching procedure of personal descent devices.	Members of the core crew found it difficult or revealed a lack of understanding of the raft launching and painter transfer process.
Risk assessments under Prevention of Fire and Explosion, and Emergency Response (PFEER) Reg. 5 should appropriately be reviewed / revised periodically and when changes in major accident risk profile make it necessary.	PFEER Reg. 5 risk assessments – which are sometimes included as part of the safety case – were not being revised as the installation aged and changes were being made. Therefore, they no longer accurately represented the risks from major accidents on the installation.
Each muster area should be provided with sufficient access and egress routes to ensure that safe entrance to the area and exit from it for evacuation purposes is possible for the duration of any emergency.	Access and egress routes were compromised either due to poor housekeeping around escape equipment, storing equipment in escape hatches, or due to damaged / corroded gratings.
Measures should be provided to protect persons from fire and explosion and to ensure effective evacuation, escape, recovery and recovery / rescue.	Incompatible grating materials (composite or Fibre Reinforced Plastic (FRP) / Glass Reinforced Plastic (GRP)) were being used which would compromise egress routes in a hydrocarbon fire incident.
Risk assessments should include the determination of the number, capacity and specification of evacuation and escape systems, and PPE / LSE.	Donut-launch stations did not clearly indicate the safe number of personnel that could use the attachment points at any one time. Additionally, there were no controls in place to restrict the numbers of people using the attachment points during an escape.

Evacuation, escape and rescue continued...

Success criteria	Reoccurring findings
Risk assessments should demonstrate that all credible foreseeable major incident events that could lead to the need for emergency response have been identified.	There was no clear demonstration that the current emergency response arrangements remained suitable to deal with a Hydrogen Sulfide (H_2S) threat to personnel on board the platform.
An emergency response plan should contain details of ensuring suitable and frequent emergency response drills and exercises are in place which are being carried out.	Although being performed, there were no formal procedures for the planning and conducting of emergency response drills. Records of emergency response drills and exercises failed to demonstrate that emergency response arrangements and procedures are tested as often as they should be, or that lessons from drills were being captured.
Alarms and communication arrangements should ensure alarm noise levels are checked to ensure members of the workforce are made aware of alarms and can communicate clearly.	Noise levels produced by the emergency alarms were too loud on certain areas on the installation which had severely restricted the ability of personnel to communicate clearly and react to any instructions from the control room.
An effective system should also be in place to ensure that emergency equipment such as alarms are fit-for-purpose and working effectively throughout the installation.	Work orders raised had no instructions or information on how to carry out the work for redundancy testing, thus making it unclear how the performance standards were being met.
There should be enough trained and competent coxswains allocated to Totally Enclosed Motor Propelled Survival Craft (TEMPSC), with consideration for some redundancy in the event of one or more allocated coxswains being incapacitated in the emergency.	Emergency response team compositions are insufficient and lacked the presence of backup or assistant coxswain for the lifeboats who could take over emergency duties if required.
Muster areas should be clearly identified, and their access routes and location indicated by clear suitable signage. All signs should be legible, understandable, and informative.	There was minimal signage to direct personnel to the Temporary Refuge (TR), life rafts and escape to sea facilities. Emergency signage on some of the LSE were unclear making it easy to become disorientated and miss key routes back into the TR or pass LSE. The escape signage around the installation was unclear due to arrows to the mustering locations and fire exits pointing in opposite directions.

Loss of containment

Success criteria source

HSE, ED Inspection Guide Offshore, Inspection of Loss of Containment (LOC)

www.hse.gov.uk/omar/assets/docs/inspection-of-loss-of-containment.pdf

Major fires and explosions are initiated by releases of hydrocarbons. As such, the effective design and implementation of measures to prevent hydrocarbons' releases is fundamentally important. Releases can occur from either failure of the asset itself due to corrosion, abrasion or fracture, or because of failures of maintenance e.g., poor practice when breaking and re-making joints, or insufficient operational controls.

Success criteria	Reoccurring findings
It is essential that any changes to the design, arising during the construction phase, are subject to formal management of change controls including risk assessment and are well documented and controlled.	Management of Change (MOC) procedures were not being implemented following changes to installation hardware and software; personnel developing their own set of rules and workarounds; and changes to the organisation roles and responsibilities.
The duty holder should have an alarm management strategy which takes into account the guidance set out in EEMUA 191 or BS EN 62682.	Alarm rates were in excess of those recommended by relevant industry guidance, e.g., EEMUA 191 and BS EN 62682.
The duty holder should have a process in place for updating and managing the alarm and trip settings on their installations.	There were insufficient Key Performance Indicators (KPIs) in place for monitoring and reviewing alarm system performance. Alarm system performance should be benchmarked against KPIs as described in EEMUA 191 or BS EN 62682.
Where operating tasks are identified as safety critical, they should be subject to more thorough analysis to ensure that the risks of human error are appropriately assessed. Associated operating procedures should reflect the outputs from such studies.	Operating procedures for safety critical tasks either had not highlighted or contained all the safety critical steps necessary to maintain the health and safety of all personnel. Procedures were inaccurate in reflecting how tasks were being carried out in reality.
Operating procedures should be regularly reviewed and updated, involving users of the procedures as well as appropriate technical staff.	There were no arrangements in place for the monitoring or auditing of operating procedures for safety critical tasks. Other procedures were either not being updated following reviews and changes or it could not be demonstrated that updates were being carried out.
Duty holders should have arrangements in place to ensure effective process operator handover including a procedure which specifies the requirements for handover.	There were either no shift handovers procedures in place, or procedures were not being followed adequately such that handovers were being conducted ineffectively via communications through email or informally through group handover sessions (instead of 1 to 1 discussions).

Loss of containment continued...

Success criteria	Reoccurring findings
The duty holder should have carried out appropriate hazard identification and assessment studies so that all process hazards have been identified, assessed and suitable measures selected.	The existing Hazard and Operability (HAZOP) studies (and other safety studies) did not fully assess all foreseeable hazardous conditions and suitable control measures. In particular, potentially hazardous conditions which may occur during plant start-up and / or shutdown had not been identified and assessed.
The duty holder should have a maintenance strategy in place for routine testing / replacement of relief devices and also a system for retention of test records for audit purposes. A register of relief devices should also be maintained and contain critical information such as, but not be limited to, sizing basis, set-pressure and minimum required orifice size.	Inspections revealed that Pressure Safety Valves (PSVs) and Pressure Relief Valves (PRVs) in operation were not documented. This led to a lack of testing and re-certification of these valves.
The duty holder should have a procedure in place for the application of overrides.	There was no process or procedure for managing and risk assessing the consequence of both short term and long term inhibits / isolations to the functionality of safety critical elements or systems.
The integrity of Small Bore Tubing (SBT) system should be addressed within the management system over its whole life cycle. Responsibility for carrying out policy should be allocated to technical authorities within the management system, and monitoring of the implementation of the policy included within the technical audit programme.	Sections of SBT on live plant and machinery and any spare component parts were not being managed in an efficient state. Note: procedures relating to the management of SBT should be developed in accordance with the Energy Institute guidance (Guidelines for the Design, Installation and Management of Small Bore Tubing Assemblies, 2nd Edition, May 2013).
There should be effective process safety leadership on the installation.	Personnel with leadership responsibilities had not received training in either safety leadership or human factors relating to control of Major Accident Hazards (MAHs). Leadership field visits and assessments were inadequate to demonstrate effective planning, organising, control, monitoring, and review of preventive and protective measures.

Human factors

Success criteria source

HSE, ED The Offshore Management of Human Factors Inspection Guide

www.hse.gov.uk/offshore/ed-human-factors.pdf

Human factors (HF) is an integrated discipline which applies psychological and physiological principles to the engineering and design of products, processes and systems with the goal of managing the risk of human error. The primary goal of HF is to reduce the likelihood and consequences of human failure where it could lead to, or fail to mitigate, a Major Accident Hazard (MAH).

Success criteria	Reoccurring findings
There should be a formal process for managing Safety and Critical Task Analysis (SCTA).	There was no corporate methodology for SCTA in line with relevant good practice using an appropriate methodology. The way in which HF was integrated into the MAH risk assessment process was not defined.
There should be a full range of tasks identified for the installation.	Safety critical task lists were either not created or had been created too early in the asset's life cycle and did not accurately represent what constitutes the full critical task inventory.
The duty holder should be able to demonstrate that the HF methods used to analyse tasks on the installation are well understood.	Task analysis and human reliability analysis had not been used to understand which key steps are vulnerable to human error and the controls required to guard against these errors.
The output of the SCTA process should be adequate.	Performance influencing factors which are the characteristics that influence human performance, were not identified within the SCTA process as such no actions were taken to optimise them.
There should be experience and training in place for HF for the lead analyst and the participants.	There was a lack of HF awareness training for personnel. There was a lack of senior managers responsible for the oversight, management and proactive delivery of a HF programme.

Pipelines

Offshore pipeline systems transport chemicals including hydrocarbons. Maintaining the integrity of the system is of utmost importance as hydrocarbon releases have the potential to be catastrophic for the workforce on offshore installations and other users of the sea. Pipelines can be subject to a range of degradation mechanisms e.g., corrosion, erosion, embrittlement and dropped objects.

Success criteria source

HSE, ED The Offshore Pipeline Integrity Management Inspection Guide

www.hse.gov.uk/offshore/pipelines-integrity-management-inspection.pdf

Success criteria	Reoccurring findings
There should be corrosion management and procedures in place.	Corrosion was inadequately managed and equipment had areas on them that were subject to corrosion and breakdown. This equipment includes: emergency shutdown valves, pig launchers, receivers, trap vent pipework, valves, and bolts.
There should be a monitoring system in place for Corrosion Under Insulation (CUI).	There was either no, or an inadequate CUI strategy in place.
Emergency exercises should be conducted for pipeline riser scenarios.	There was a lack of evidence for the testing of the arrangements and procedures in relation to pipeline and riser incidents.
There should be pipeline emergency procedures in place which contain adequate arrangements for dealing with the consequences of a major accident.	Pipeline emergency response or operating procedures did not contain the emergency arrangements in relation to methanol or hydrocarbon pipeline releases.
There should be appropriate leak detection measures in place for maintenance.	No arrangements were in place for the detection of a gas leak within the caisson risers.
There should be evidence to show that inspections are carried out to validate condition monitoring assessments.	No records of the inspection and monitoring of the caisson (and caisson risers) were in place to show that their condition could be verified.
It should be ensured that Subsea Isolation Valves (SSIVs) are inspected and tested to performance standards at suitable intervals.	Testing was not being conducted following the periodicity stated in the performance standards of SSIVs.
There should be an up-to-date Major Accident Prevention Document (MAPD) that identifies risks to pipeline and control measures and describes arrangements, behaviours and systems that exist in practice.	The MAPD does not contain adequate information in relation to the methanol pipelines / methanol conveying cores in umbilicals. Note: following legislative changes, pipelines conveying methanol, including methanol conveying cores in umbilicals, are now considered to be major accident hazard pipelines (as defined in the Pipelines Safety Regulations 1996).

Mechanical handling and crane ops

Success criteria source

HSE, ED Inspection of Mechanical Handling & Crane Operations

www.hse.gov.uk/offshore/ed-mechanical-handling-and-crane-operations.pdf

Mechanical handling operations are those activities which involve the movement of a load using work equipment. This work equipment can be that which is either manually operated or power operated. When a mechanical handling operation requires a load to be raised or lowered then the required work equipment becomes lifting equipment and the activity can be considered to be a lifting operation. Effective work control arrangements are required to control the risks associated with lifting operations.

Success criteria	Reoccurring findings
Site specific hazards and weather conditions should be discussed and understood.	The sea state limits for crane operations were either not suitable at the installation site or did not detail the mitigations in place if crane operations were conducted beyond the environmental condition limits.

SECE management

Safety and Environment Critical Elements (SECEs) are those parts of the plant whose failure could cause or contribute substantially to a major accident or is present to prevent, or limit the effect of a major accident hazard. It is essential for good safety management that safety and environmentally critical equipment are maintained in good working order.

Success criteria source

HSE, The Offshore SECE Management and Verification Inspection Guide

www.hse.gov.uk/offshore/ed-sece-management-and-verification.pdf

Success criteria	Reoccurring findings
A SECE review should consider all aspects of SECE's condition e.g., Operational Risk Assessments (ORAs).	Following a SECE's degradation and performance standard failure, ORAs were either not being conducted at all or had failed to provide clear information on the mitigations that were in place and thus had not effectively risk assessed the potential impacts on the installations.
There should be means of demonstrating SECE suitability based on their function, reliability, and availability.	SECE suitability and compliance with performance standard objectives could not be demonstrated either due to: a lack of evidence of documented work; a lack of maintenance conducted for degrading equipment; or a lack of requirement to test the functional requirements as part of the SECE assurance routine. Performance standards had also lacked detail on how to measure the reliability and availability of SECEs adequately.
The duty holder shall undertake availability and reliability assessments of SECEs.	Assessment on availability and reliability written in SECE performance standards were either not being conducted or it could not be demonstrated that they were being conducted.
There should be alignment between the performance standards and the assurance activities and there should be a clearly defined pass or fail criteria for testing.	Performance standards or assurance activities did not contain clear guidance on pass or fail criteria for any of the testing or maintenance conducted.
A SECE review should consider all aspects of SECE condition e.g., maintenance deferrals.	There were many overdue SECE work orders falling into backlog without being risk assessed and deferred due to incorrect prioritisation of safety instrumented functions in the Maintenance Management System (MMS). SECEs were also going into unassessed backlog due to coding errors or failures in the MMS.

SECE management continued...

Success criteria	Reoccurring findings
The standard of performance should be held within the MMS, and there should also be alignment between the SECE performance standard and the MMS.	MMS were not aligned with the SECE performance standards e.g., there were no details for emergency shutdown levels, or the testing of high and low voltage circuit breakers.
The duty holder must own the assurance routines and assess the installation's SECEs.	Assurance routines were not being managed correctly as job plans were either difficult to locate, ambiguous, or information was held by a third party company and not available to the duty holder.
Successful management of major hazards requires that SECEs are correctly identified.	There was a failure to consider all the equipment within the SECE system boundary (such as failing to consider the pipe ram locking system for the well control system SECE). This meant that functional requirements and performance standards were not being written.

Temporary refuge

The Temporary Refuge (TR) is a place provided on an offshore installation where personnel can take refuge for a predetermined period while investigations, emergency response, and evacuation preplanning are undertaken. For all persons onboard an offshore installation, the consequences of poor TR integrity management can be catastrophic.

Success criteria source

HSE, ED Inspection Guide Offshore, Inspection of Temporary Refuge Integrity (TRI)

www.hse.gov.uk/offshore/ed-temporary-refuge-integrity.pdf

Success criteria	Reoccurring findings
Installation personnel carry out checks on the effectiveness of emergency shutdown procedures, including operation and testing of external door closure and shut down.	There were no demonstrations of the TR suitability to ensure that the TR fully shuts in response to fire and gas detection signals on the installation. Door frames were also leaking meaning that doors were unable to be fully shut to form a complete seal, thus failing to meet the performance standards.
Design allows TR and all associated equipment (including dampers) to be adequately maintained, inspected and tested.	There were failures in demonstrating the suitable damper closure times for the purpose of sealing in the TR. This was due to damper closure tests not being conducted or test records not clearly detailing the closure times observed.
If HSE Offshore Information Notes and other relevant guidance is not used, alternative arrangements should be in place to achieve equivalent standards of performance.	Requirements from the HSE Offshore Information Notes were not being met in relation to fire damper failure acceptance rates and Heating, Ventilation, and Air Conditioning (HVAC) gas detection strategies. Ref: HSE, Testing regime for offshore TR-HVAC fire dampers & TR pressurisation requirements https://www.hse.gov.uk/offshore/trhvac.pdf

Loss of stability and position

Success criteria source

HSE, ED Inspection Guide Offshore, Inspection of Maritime Integrity (Loss of Stability & Position)

www.hse.gov.uk/offshore/ed-loss-of-stability-and-positioning.pdf

The stability of a floating installation is of the utmost importance. A lack of basic understanding of stability and the control of stability can and has led to major maritime disasters. The control of stability is safety critical and as such a system must be in place which will enable the stability of the installation to be calculated under all conditions, including total loss of power.

Success criteria	Reoccurring findings
There should be a procedure in place to ensure that the watertight integrity is maintained when there are no personnel present.	There was lack of understanding and instructions on how to operate watertight doors. The Maritime and Coastguards Marine Guidance Note MGN 35 should be referenced when creating instructions to ensure that personnel who must pass through these doors are trained in their use and that clear instructions for use are developed and available.
There should be detection of a mooring line failure.	The emergency response plan for mooring system failure lacked clarity. Triggers for emergency actions were not clear and not related to the offset limits identified to ensure what actions to be taken and when.

Workforce engagement

All workers are entitled to work in environments where risks to their health and safety are properly controlled. Under health and safety law, the primary responsibility for this is down to employers. Employers have a duty to consult with their employees, or their representatives, on health and safety matters. Workforce engagement looks at the arrangements in place for the election of safety representatives to ensure the organisation is committed to an effective and evident safety culture.

Success criteria source

HSE, ED Inspection Guide Offshore, Offshore Workforce Engagement Inspection Guide

www.hse.gov.uk/offshore/ed-offshore-inspection-guide-workforce-engagement.pdf

Success criteria	Reoccurring findings
Constituencies should be established that are appropriate for the size and type of the installation.	There was insufficient information for personnel to determine their relevant constituency and safety representative. All new arrivals who will be there for over 48 hours should be put into a constituency and informed of about their safety representatives.
Elected safety representatives should be provided with appropriate training.	Elected safety representatives were not given training post-appointment and several others needed refresher training and / or incident investigation training, as identified by the procedures in place.
The safety committee meeting should be held at least once every three months.	Safety committee meetings were not being held every three months.
Elected safety representatives are entitled (upon request) to be supplied, by or on behalf of the installation manager, a written summary of the main features of the safety case or revision.	Safety representatives were not consulted with regards to the revision, review or preparation of the installation's safety case.

Wells competence

Success criteria source

HSE, ED The Offshore Wells Personnel Competency Management System Inspection Guide

www.hse.gov.uk/offshore/ed-well-competence.pdf

The workers assigned the responsibility of carrying out well operations should receive appropriate training (including on-the-job training), initial and refresher, information, and appropriate supervision. The installation duty holder or well operator (when the well is being worked on other than from an installation) should ensure all employees allocated tasks related to well operations are capable of carrying out these tasks.

Success criteria	Reoccurring findings
There should be written procedures in place for safety critical tasks involving wells.	Personnel performing a safety critical operation (e.g., slick line and E-line perforations with pressure control equipment, coiled tubing) did not have sufficient procedures and instructions for securing the well in the event of a well control incident.
The duty holder should be able to demonstrate how the competencies of staff is assessed.	There was evidence that competency profiles for well personnel and non-well personnel were incomplete (the level of skills and knowledge required to perform well integrity tasks in a competent manner were not identified). There were no assurance processes in place to identify the suitability of the competency scheme for wells.

Structural integrity management

Structural failure as a result of overloading, ageing, damage due to accidental events or from fabrication defects could cause the immediate total loss of an installation, with little chance of survival. Duty holders must be able to demonstrate that there is a management system in place to ensure structural integrity is maintained throughout the lifecycle of the installation.

Success criteria source

HSE, ED The Offshore Structural Integrity Management Inspection Guide

www.hse.gov.uk/offshore/structural-integrity-inspection-guide.pdf

Success criteria	Reoccurring findings
The duty holder should have the latest as-built drawings for all structures.	Drawings for structures required updating to the current version due to incorrect information or changes made.
The duty holder should have data to create work packs.	Work packs contained different equipment tag numbers to that of which were on the plant site, or contained wrong information which would cause the incorrect assessment of corrosion threats on pipelines.
Original design life should include ageing and life extension.	Life extension studies had either not been conducted or had been conducted poorly. Equipment on the platform had become obsolete due to the lack of identification of the impacts of obsolescence to safety, or had not been maintained due to the lack of a fabric maintenance strategy.

Health risk management

Success criteria source

HSE, ED The Offshore Health Risk Management Inspection Guide

www.hse.gov.uk/offshore/ed-offshore-inspection-guide-health-risk-management.pdf

Offshore workers are exposed to a range of health hazards. The aim of health risk management is to prevent or control exposure to these health risks by recognising health hazards (physical, chemical, biological and ergonomic), evaluating the risk and establishing appropriate control measures.

Success criteria	Reoccurring findings
There should be a health risk assessment process in place.	Noise actions plans were not developed to determine organisational and technical measures appropriate to all high noise activities, in order to ensure that workers are only exposed to noise at as low a level as is reasonably practicable. These plans should record the actions taken or intended, with timescales and allocation of responsibility. Inadequate risk assessments related to health, in particular radiological and legionella risks, were either not up-to-date or failed to correctly identify controls. Appropriate protection measures for the use of hazardous substances in line with the requirements of the Material Safety Data Sheet (MSDS) and subsequent Control of Substances Hazardous to Health (COSHH) assessment were not provided.
An Industrial Hygiene (IH) strategy in place and communicated, IH improvement plan and IH Key Performance Indicators (KPIs) in place to monitor performance. Organisational roles and responsibilities related to IH should have been identified.	Formal plans and monitoring arrangements for managing occupational health and COSHH assessments were missing.

Marine operations

The management of marine operations is a specialist subject that is often overlooked as a major accident hazard. A collision between a vessel and an installation has the potential to result in a major accident with a large number of casualties. As such, duty holders should have in place arrangements to ensure suitable vessels are selected for the intended operation and that the vessels meet minimum standards for safe operations and station keeping.

Success criteria source

HSE, ED The Offshore Marine Operations Inspection Guide

www.hse.gov.uk/offshore/ed-offshore-inspection-guide-marine-operations.pdf

Success criteria	Reoccurring findings
Checklists should be used as a control measure for the operation of attendant vessels.	There was poor management in the way attendant vessel checklists were being carried out. Issues included checklists not being conducted thoroughly, systematically, or holistically from the 500-metre vessel entry point to the final position. Additionally, completed checklists were either uncontrolled or required further improvements.
The duty holder should have identified the number and competence of crew is appropriate for the operations to be undertaken.	Safe and overnight manning levels had not been defined or were not being followed as stated in the safety case. This included manning levels being either exceeded or insufficient as normal operations had continued throughout the night, or personnel overstaying throughout the night.
There should be a collision risk management system in place which includes a means of identifying passing vessels which may collide with the installation in sufficient time to take appropriate action.	There was a lack of evidence to demonstrate that the collision detection arrangements in place from either the installation or attendant vessel were sufficient. This is because passing vessels were not being detected at ranges which provide enough time to take appropriate action.

COSHH

Success criteria source

HSE, ED The Offshore Control of Substances Hazardous to Health (COSHH) Inspection Guide

www.hse.gov.uk/offshore/ed-offshore-inspection-guide-coshh.pdf

Control of Substances Hazardous to Health (COSHH) is a law which requires employers to control substances hazardous to health. Common substances include hazardous chemicals which are stored in stock, paint, dust, and nitrogen. COSHH requires employers to conduct risk assessments to: identify substances which are hazardous to health; methods of prevention, mitigation and control of those hazards; ensuring methods are followed and appropriate level of monitoring and surveillance is available; and planning for emergencies.

Success criteria	Reoccurring findings
There should be suitable and efficient COSHH risk assessments in place.	COSHH risk assessments had either not been conducted, had been missing, or were not holistic in their coverage relation to the chemicals that were in stock, and how to deal with unplanned releases in emergency scenarios.
There should be a suitable and sufficient risk assessment of the work activity, with steps to be taken to control exposure.	Effective measures to ensure a suitable and sufficient risk assessment of the hazards associated with nitrogen asphyxiation were not identified.

Fire protection

Active Fire Protection (AFP) systems such as water sprinkler and spray systems are widely used offshore for the protection of process plant and equipment. The duty of the AFP may be to extinguish the fire, control the fire, or provide exposure protection to prevent domino effects. AFPs require to be well maintained to ensure reliability.

Success criteria source

HSE, ED The Offshore Active Fire Protection Inspection Guide

www.hse.gov.uk/offshore/ed-active-fire-protection.pdf

Success criteria	Reoccurring findings
The operator should have specific maintenance programs and calibration procedures for AFP equipment. These procedures should reflect manufacturer's specifications.	AFPs including the foam and deluge systems were not maintained in line with the requirements of their performance standards. Assurance activities related to fire water pumps were not aligned to performance standards. It was not clear how each type of fire and gas detector was to be tested. Job plans and work orders had not detailed what needed to be measured, and how the work is to be completed and recorded. There were inadequate assurance testing schemes in place for installation Emergency Shut Down Valves (ESDVs) that are not aligned with performance standard requirements.
To prevent riser and ESDV damage, they should have means to protect them from fire-related scenarios.	There was poor management and inspections of Passive Fire Protection (PFP) on ESDVs, for reasons including: PFP not being listed in the PS and therefore having no maintenance routine associated with it; 5-yearly inspections were not being carried out; and PFP being partially submerged in water.
The duty holder should be able to demonstrate how the competency of personnel and vendors using active fire protection equipment is assured.	Information, instructions and training to supervisors and technicians for completing assurance activities related to fire water pumps were not adequate.

Audit, monitoring and review

Success criteria source

HSE, ED The Offshore Audit, Monitoring and Review Inspection Guide

www.hse.gov.uk/offshore/ed-audit-monitoring-review.pdf

An organisation's audit, monitoring and review arrangements provide evidence on the adequacy and effectiveness of the organisation's safety management system. In addition to this, the audit and monitoring programs in place assist with learning lessons and ensuring that improvements and changes are implemented and embedded.

Success criteria	Reoccurring findings
Audit and monitoring systems should comprise of various levels, covering a specified depth and frequency of audit / monitoring.	There were no arrangements in place for audits at various levels (i.e., level 1 – on site, level 2 – operations management and level 3 – corporate audits) to ensure that appropriate monitoring is in place.

Aviation (helideck operations)

There are a number of risks associated with offshore helicopter operations from maloperation to adverse weather conditions. As such, duty holders must ensure that procedures are established for helideck operations, including the landing and take-off of helicopters, refuelling, are without risks to health and safety. A competent person should be appointed, who will be responsible for the day-to-day management of the offshore installation helideck, in control of the associated helideck operations, and the helideck crew.

Success criteria source

HSE, ED Aviation (Helideck Operations) Inspection Guide

www.hse.gov.uk/offshore/aviation-helideck-operations-inspection-guide.pdf

Success criteria	Reoccurring findings
The helideck team should be competent for their responsibilities.	There were an insufficient number of operations crew trained in Helicopter Landing Officer (HLO) and coxswain roles. This was either due to a reduction in the installation's workforce or lack of redundancy if members were not available to fulfil these roles. Arrangements should be reviewed to ensure sufficient numbers of such persons are available on the installation and are competent to undertake these duties.

“Your future hasn’t been written yet. No one’s has! Your future is whatever you make it. So, make it a good one!”

Doc Brown, Back to the Future III

Actions for leaders

SALUS

Process safety is what we all do to prevent major accidents.

Are you doing all that you can?

Prevention of major accidents requires visible and positive safety leadership. It is likely that the recurring findings raised in this report will also apply to other duty holders and operators. The findings were across the board, and related to People, Plant and Process barriers. These findings were from 2019 but we know that in 2023, the regulator is telling us that, not only do we still have these challenges, but the pandemic made many of them worse. There is no room for complacency. After reading this report, we would ask leaders to consider the following questions:

- How confident are you that these findings wouldn't apply to your operation?
- Are you providing frontline workers with the right level of resources, time, competence and procedures to tackle these issues?
- For each key inspection topic, have you defined Key Performance Indicators (KPIs) that are visible and understood throughout your organisation?
- Has the workforce been suitably engaged with your management of process safety?
- Is your workforce aware of your asset's Major Accident Hazards (MAHs)?
- Through robust audit and assurance, can you find your own areas of improvement before the regulator?

Key themes from this document

While the findings have been categorised by inspection topic, there are clear themes that have emerged throughout. These are:

Training and competence	No one deliberately acts unsafely. There must be a general awareness of process safety throughout an organisation so that personnel can understand how their actions can impact on safety. The workforce must be competent to perform their role and be provided with adequate support and resources.
Risk assessment	Risk assessments must be robust, performed at the right time, and with the right people present. The cumulative risk across an installation must be understood at all times.
SECE	There should be a clear link between performance standards and the Maintenance Management System (MMS). There should be robust procedures in place to risk assess Safety and Environmentally Critical Equipment (SECE) impairments and backlog.
Human factors	Human factors should be implemented across the organisation and clear training provided for those that need it. There should be a procedure in place for Safety Critical Task Analysis (SCTA). Safety critical procedures should be subject to SCTA as appropriate.
Emergency response	Emergency response risk assessments and plans should be up to date, understood by all personnel, and regularly drilled.

Want to start actioning the findings of this report? Download our **free** duty holders' assurance checklists bit.ly/SalusHSE

About Salus Technical

Salus Technical is a process safety software and consultancy firm which works with customers to help them understand and manage the risks of major accidents. Ultimately our goal is to increase the competencies of individuals, teams and organisations, fostering a culture of continuous safety improvement across the industry.

We offer three complementary services: process safety engineering support, a range of tailored and on-demand training courses, and two software packages – Bowtie Master and Task Analysis.

We have extensive experience of working in-house for duty holders and service companies, giving us a real insight into the legislative and technical requirements including navigating safety case regulations, as well as the challenges and pain-points of this sector. We work collaboratively with customers, helping the workforce to gain the necessary process safety engineering awareness and competence in a straightforward, people-centred approach.

Since Salus Technical launched in 2019, the firm has supported oil and gas operators with technical safety engineering on a variety of brownfield, greenfield and decommissioning projects, and is increasingly supporting a wider range of emerging and renewable energies as part of the energy transition.

Authors

David Jamieson

David has worked in the UK offshore industry for over ten years as a process safety engineer and is the founder of Salus Technical. He has supported half a dozen duty holders with process safety by providing engineering support, developing key procedures, or facilitating Hazard Identification (HAZID) and Hazard and Operability (HAZOP) workshops. He is passionate about process safety and believes that by giving everyone working in the UK offshore industry an awareness of how their role impacts process safety is one of the most effective ways to prevent major accidents. He would love for the outcome of this work to lead to inspection letters being released to the public domain, allowing all duty holders the opportunity to learn from them.

Andrea Ferdinands

Andrea is a safety engineer with over 12 years of experience in process safety management. She has worked with operators based in the UK, Europe, and North America to produce procedures, best practice and safety studies related to process safety management. She believes the lessons learned from these inspections, if actioned, could make a real difference to front line safety.

While every effort has been made to ensure the accuracy of the information in this publication, Salus Technical will not assume liability for any use of this document. Each offshore installation is inspected on its own merits by the competent authority on a case-by-case basis.

This document is intended as additional advice and is not a substitute for The Offshore Installations (Offshore Safety Directive) (Safety Case etc.) Regulations 2015 or any related regulations or publications; it has been written by the industry for the industry.

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