



# **Process Safety Leadership**

Findings of Energy Division Inspection Programme

February 2025

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# Glossary

ALE	Ageing Life Extension
CBT	Computer Based Training
CMAPP	Corporate Major Accident Prevention Policy
COMAH	Control of Major Accident Hazards
CoP	Cessation of Production
DLR	Defined Life Repair
EMM	Enforcement Management Model
ESR	Elected Safety Representatives
HCR	Hydrocarbon Release
HSE	Health and Safety Executive
ICP	Independent Competent Person
IMT	Inspection Management Team
LOF	Life of Field
LOPC	Loss of Primary Containment
MAH	Major Accident Hazard
MOC	Management of Change
NED	Non-Executive Director
NPI	Non-Production Installation
OEUK	Offshore Energies UK
ORA	Operational Risk Assessment
POB	Persons On Board
PPSL	Principles of Process Safety Leadership

PSIP	Process Safety Improvement Plan
PSLG	Process Safety Leadership Group
PSLP	Process Safety Leadership Principles
PSPI	Process Safety Performance Indicators
RACI	Responsible, Accountable, Consulted, Informed
SCR	Safety Case Regulations
SECE	Safety and Environmental Critical Element
SEMS	Safety and Environmental Management System
TA	Technical Authority
TOR	Terms of Reference
UKCS	United Kingdom Continental Shelf

# Executive Summary

Failures in effective process safety leadership / process safety management can be linked to historical Major Accident Hazard (MAH) events such as Piper Alpha, Buncefield and Texas City amongst others. In 2018, HSE flagged concerns to the offshore industry regarding stagnating safety performance and challenged industry to respond leading to the adoption of the Principles of Process Safety Leadership (PPSL).

In January 2022, HSE Energy Division initiated a targeted inspection programme across a sample of the UKCS production operators to assess how industry had responded to the challenge laid out in 2018.

A total of 13 operators were inspected by the end of the inspection programme in May 2024 with an additional inspection conducted in October 2024. The organisations sampled covered the range of operating models in the UKCS and the different types of installations in use.

Inspections were conducted using established HSE guidance on Major Hazard Leadership and carried out by a dedicated core team to ensure consistency of approach and comparison of performance. Benchmarking of Duty Holders against their industry peers was not conducted, neither were scores assigned.

## Main Findings

As a collective, industry demonstrated a strong understanding of the importance of effective process safety leadership and there were examples of good practice observed.

There were however several consistent themes from the programme, all of which have room for improvement.

The themes were not unique to individual organisations and there is potential for industry collaboration on certain areas to drive improvement.

### Strengths

- Senior leaders understand their responsibilities for MAH management and were clear on their expectations and exhibiting the correct behaviours.
- MAH performance is regularly reviewed at leadership meetings.
- Industry has responded positively to the initiative and proactively engaged with HSE and industry peers.

- Significant time and effort has been invested by organisations into assessing their own performance against the principles and identification of any gaps. Improvement plans have been developed and are now being resourced and targeted at the key areas.
- Increased collaboration between organisations with greater sharing of lessons learned from the inspection programme, discussion of areas of good practice and areas for improvement. This is a significant improvement on previous industry interaction and should be built upon by extension into other areas of learning, e.g. incidents and high-potential events.
- Workforce engagement and utilisation of the Elected Safety Representative (ESR) function is a strong positive. Clear two-way communication and messaging to the frontline work force on expected standards of behaviour.

### **Weaknesses**

- Industry has reached ‘normalisation of deviance’ with organisations more willing to accept degradation of MAH barriers without acting. Knowledge and appreciation of the overall risk profile is improving. Work in areas such as maintenance backlog reviews has helped, but further work is required in order to fully understand where an organisation may be exposed.
- Cumulative risk continues to be a challenge. All organisations have developed cumulative risk tools but continue to struggle with demonstrating robust assessment and recording of decisions including where the decision made was to not intervene and cease production.
- Audit and assurance is ineffective and is failing to identify areas of weakness. Organisations have not fully implemented industry guidance in this area. Weaknesses in the audit and assurance systems is preventing senior leaders from being assured of the ongoing effectiveness and suitability of the Safety and Environmental Management System (SEMS) and the Corporate Major Accident Prevention Policy (CMAPP).
- Industry headcount has reduced significantly with many organisations potentially under-resourced in critical areas, which is having a direct impact on MAH management. There is increasing evidence that competency within the workforce has reduced.
- Increase in the number of new recruits in industry (commonly referred to as ‘green hats’) is placing a burden on the offshore workforce. Insufficient time is being spent as part of the contractor on-boarding arrangements to ensure competency of individuals and correct behaviours.
- Contractor engagement remains focused on personal safety with limited consideration of the impact that contracting organisations can have on MAH management.
- Effective process safety leadership is being driven by individuals instead of an ingrained part of the organisational structure or culture.
- There is an absence of a structured MAH competency framework and training for senior leaders.

- There are early indications of a drop-off in workforce understanding and appreciation of MAH risk. Industry needs to ensure that the workforce remains fully engaged and that efforts are made to provide the relevant awareness training.
- Learning and improving. The PSLP inspection programme has not identified any new themes which have not been identified by HSE previously either through routine inspections or other key programmes such as KP3 [1] and KP4 [2]. Gaps in understanding can be linked to the loss of corporate knowledge / memory as a result of headcount reduction or change in personnel responsibilities.

### **Opportunities for Industry Collaboration**

Regulation 32 of the Offshore Installations (Offshore Safety Directive) (Safety Case etc) Regulations 2015 requires Duty Holders to co-operate with a view to driving improvement in MAH management.

All organisations are facing similar challenges around ageing installations, reduction in resources and financial pressures. Industry has demonstrated through the Process Safety Leadership Principles (PSLP) inspection programme and the Maintenance Backlog initiative that they can drive improvement through collaboration.

Senior leaders should therefore consider how their organisations can collaborate further on the weaknesses identified above and elsewhere in this report to drive continuous improvement.

Potential areas for consideration:

- Contractor engagement and management. There are a limited number of service companies providing the majority of services within the UKCS. There is benefit of bringing them together as a collective to discuss the areas of concern and potential collective working or improvements.
- Forward planning of work fronts and major campaigns. The lack of long-term lookahead is impacting on industries ability to secure adequate competent resources. Collaboration between organisations and contracting companies to establish long-term opportunities will likely aid the situation.
- Continue to develop and broaden good practice. Companies should look to engage with, and support, the various initiatives currently underway with industry to share knowledge and learning. Existing resources, e.g. audit and assurance, should be reinvigorated.
- Consistency in MAH training and competency frameworks. The commonality of MAH risks across the basin gives an opportunity for a standardised approach to be adopted.

## Background

In the aftermath of Buncefield, the onshore Process Safety Leadership Group (PSLG) created the PPSL with the aim of improving process safety within their allied industries, specifically targeting the senior leaders of industry. Until 2019, the offshore oil and gas industry had no equivalent.

In 2018, HSE flagged concern regarding stagnating (if not deteriorating) safety performance in the UKCS. Hydrocarbon release (HCR) performance had plateaued with a peak of 6 major<sup>1</sup> releases. Routine inspections and reactive investigations conducted by HSE continued to identify that failings could be traced to ineffective process safety leadership.

In response to HSE concerns, industry agreed to adopt an offshore equivalent of the PPSL [see Figure 1] and which were then re-affirmed in 2023. At the time of adoption, HSE committed to undertaking a series of targeted inspections from 2020 onwards with the aim of determining how individual organisations were embedding the principles within their business and how industry, as a collective, was driving improvement. Due to the COVID pandemic in 2020/ 2021, the inspection programme was delayed, ultimately commencing in January 2022.



**Figure 1 – Industry Adopted Principles of Process Safety Leadership**

<sup>1</sup> A major HCR is deemed to be that of sufficient rate and / or duration that has the potential to escalate into an MAH event.



# HSE Inspection Programme

## Identifying Duty Holders

In identifying Duty Holders to be subject to a targeted inspection, HSE proceeded on the basis of:

- Maximising regulatory impact to organisations present in the UKCS by targeting the higher risk areas present in the basin.
- Striving to inspect the 'breadth' of the operator types present in the basin wherever possible, i.e., large scale operator down to smaller new entrant or single installation operator.
- Inspecting operators of sufficient size and / or influence within the UKCS in order to engage the remaining organisations via output / feedback.

With regards to maximising regulatory impact through targeting of higher risk areas, the following additional aspects were taken into consideration:

- Inspection history including enforcement, hydrocarbon releases (frequency, type and size) and other RIDDOR reportable events.
- Installation Persons On Board (POB) allowances (risks to persons).
- Installation ages and current lifecycle forecast, e.g., predicted Cessation of Production (CoP) date.
- Design life (as identified in safety case) versus operational life and consideration of Ageing Life Extension (ALE) work.

Following due consideration of the above points and after internal consultation, thirteen (13) duty holders were initially identified for inspection. Duty Holders have not been identified in this report.

## Conducting the inspections

The inspection programme was conducted over the period January 2022 to May 2024. Six (6) inspections were conducted between January 2022 and March 2023, with the remaining seven (7) completed between April 2023 and May 2024.

An additional inspection was conducted in October 2024 but was separate to the core programme. The findings of that inspection have however been considered in the conclusions made in this report.

Inspections, wherever possible, were completed by a dedicated core team of specialist inspectors from the following disciplines:

- Process Safety / Process Engineering
- Fire, Explosion and Risk Assessment
- Mechanical

In addition to the above disciplines, the IMT focal point inspector also formed part of the inspection team for their Duty Holder. Conducting the inspection using the same core team ensured consistency of approach and allowed for fair comparisons to be made between Duty Holders over the course of the programme.

All inspections followed a consistent framework, utilising the COMAH Major Hazard Leadership Intervention tool [3] as a basis and supplemented with internal intelligence on individual Duty Holders. In advance of inspections commencing, Duty Holders were afforded the opportunity to provide HSE with any documentation they felt relevant as well as provide an overview presentation of how they complied with the leadership principles.

A breadth of Duty Holder personnel were interviewed as part of each inspection, starting at the top of the organisation (CMAPP signatory) through to the ESR to ensure “boardroom to control room”. By the end of the programme, in excess of 160 interviews had been completed.

## **Feedback on Performance**

Duty Holders were provided feedback on their performance on completion of the inspection. Feedback was in the form of a presentation which covered both areas of good practice and potential areas for improvement or further consideration.

Where regulatory compliance gaps were identified, enforcement action was taken in accordance with the Enforcement Management Model (EMM).

Benchmarking of Duty Holders did not form part of the HSE objectives and as such no Duty Holder was advised of their relative performance against their peers. Inspection scores were also not assigned given the wide scope of the inspection.

## **Industry Reflections on HSE Approach**

As part of the process, all Duty Holders were afforded the opportunity to provide feedback on their individual inspections or the programme itself, including where improvements could be made by HSE.

Feedback from individual organisations resulted in alterations of HSE’s approach over the course of the programme. These changes were made to make the process more efficient and did not alter the depth of inspections conducted.

Feedback from the programme was broadly positive with only one organisation citing it as a negative experience. Key themes were:

- Appreciation of HSE engagement at senior levels in the organisation.
- Inspections had shifted the focus internally, requiring companies and individuals to reflect on their own practices.
- Interviews were conducted in a positive manner, focussing on open discussion and dialogue.
- HSE focus had resulted in greater engagement and collaboration between industry peers.

## **Regulatory Focus Beyond 2024**

The targeted inspection programme will not continue beyond 2024. Consideration was given to extending the process to owners / operators of Non-Production Installations (NPI) however the benefit of doing so was not considered commensurate to the level of effort required by both industry and HSE.

Terminology will also change with HSE now referring to Major Hazard Leadership instead of Process Safety Leadership.

Major Hazard Leadership will continue to be a focus for HSE through the following mechanisms:

- Routine inspections as part of the annual intervention plan either by IMT focal point inspectors or relevant topic specialists.
- Annual review process (formerly Major Hazard Management Review). Senior leaders will be required to demonstrate their ongoing commitment to the principles including how they are embedding them within their organisation and supporting the wider industry.
- Targeted in-depth leadership inspections will continue to be carried out where HSE identifies a requirement to do so.

HSE will continue to engage with relevant industry stakeholders to ensure continual focus and improvement. Anonymous feedback will be provided on any common trends or themes that HSE identifies through its routine intervention process.

## HSE Findings

In assessing Duty Holder compliance against the principles, the COMAH Major Hazard Leadership Tool was used as a baseline. Duty Holder performance was also assessed against the framework arrangements outlined in the agreed PPSL, namely:

- Process safety accountabilities should be defined and championed at the senior leadership team level, and all should be held accountable for process safety leadership and performance.
- At least one senior leader should be fully conversant in process safety management in order to advise the leadership team of the status of process safety risk management within the organisation and of the process safety implications of their decisions.
- Appropriate resources should be made available to ensure a high standard of process safety management throughout the organisation and staff with process safety management responsibilities should have or develop an appropriate level of competence.
- Organisations should develop a programme for the promotion of process safety by active senior management engagement with the workforce, both direct and contract staff, to underline the importance of process safety leadership and to support the maintenance of a positive process safety culture within the organisation.
- Systems and arrangements should be in place to ensure the active involvement of the workforce in the design of process safety controls and in the review of process safety performance.
- Business risks relating to process safety should be assessed and reviewed using an appropriate business risk analysis methodology.
- Leading and lagging process safety indicators should be set for the organisation and reviewed to ensure they remain appropriate for the needs of the business. Information on process safety performance should be routinely reviewed by the senior leadership team.
- Companies should actively engage with others within their sector and elsewhere to share good practice and information on process safety incidents that may benefit others. Companies should have mechanisms and arrangements in place to incorporate learning from others within their organisation.
- Systems and arrangements should be in place to ensure the retention of corporate knowledge relating to process safety management. Such arrangements should include information on the basis of safety design concept of the plant and processes, plant and process changes, and any past incidents that have impacted on process safety integrity and the improvements adopted to prevent a recurrence.

For ease of understanding and interpretation, findings have not been listed against each individual principle and instead have been structured around common areas.

## Process Safety Management and MAH Management

Good process safety management practices will support effective MAH management.

Process safety management and MAH management are used interchangeably throughout the report depending on the context of the discussion point.

## Impact of Size and Nature of Duty Holder

The inspection programme was successful in targeting the breadth of Duty Holders present in the UKCS. Ranging from large international organisations with multiple assets through to independent operators with a single operational asset in the UKCS as well as those organisations operating installations on behalf of others.

### Size and Nature of the Duty Holder

The size and nature of the Duty Holder is an influencing factor on process safety performance and the success of embedding the principles.

The majority of organisations are actively striving to improve and had invested significant time and effort into assessing their own vulnerabilities / areas of weaknesses in advance of the HSE inspection.

All Duty Holders were found to have areas for further improvement as well as exhibiting examples of good practice. Key takeaways from the inspection around the impact of Duty Holder size were:

- Larger organisations had more mature process safety management arrangements in place. This could act as a hinderance to improvement due to the belief that their systems were the “best in class”.
- Smaller organisations were more agile in making improvements or introducing new ways of working. Updates to corporate systems could be enacted much quicker than their larger counterparts, especially where larger organisations operated under a wider corporate system as opposed to UK specific requirements.
- Senior leaders at the larger organisations are afforded less opportunities for engagement with the workforce given the demands placed on their time though this improved over the course of the programme.
- The operating model does impact on a Duty Holders ability to manage risk whether as a result of lack of resource, reliance on 3<sup>rd</sup> party organisations or financial constraints.
- Parent organisations (larger corporate entity) and licensees are having a direct impact on the management of risk within the UKCS. The impact can be positive or negative

depending on the approach taken and the primary focus of the other organisation, e.g. financial oversight only or robust corporate audit arrangements.

### Key Challenges

All organisations faced the same challenges regardless of their size. Challenges were ageing assets, reduction in available competent resources and financial pressures.

## CMAPP Implementation

All Duty Holders had a CMAPP in place as per the requirements of the Offshore Installations (Offshore Safety Directive) (Safety Case etc) Regulations 2015 (SCR 2015). Whilst the CMAPP requirements are clearly defined in legislation, there were several concerns identified.

- Variance in CMAPP content. In some instances, the CMAPP did not meet the legislative requirements.
- Ambiguity in responsibilities for implementation of the CMAPP or responsibility for implementation at an inappropriate level in the organisation, i.e., signatory did not have sufficient authority within the organisation to implement change or was the incorrect signatory.
- CMAPP is not treated as a live document and is only reviewed / updated in the event of a change in leadership signatory.
- Ambiguity around how the CMAPP provisions are applied through the SEMS leading to the SEMS diverging from the arrangements detailed within the CMAPP. There was also an increasing burden of evidence that the SEMS were diverging from that defined within the accepted safety case(s).
- Failure to ensure the ongoing suitability of the CMAPP. Implicit assumption that compliance against the CMAPP is assured through SEMS compliance.
- Inability to demonstrate how SEMS compliance assures CMAPP compliance and therefore how they meet the requirements of Regulation 7(6)(b) of SCR 2015, i.e., assuring effectiveness of the policy.

Duty Holders should:

- Review their CMAPP against the requirements of Schedule 1 of SCR 2015 to ensure that the necessary information is included.
- Ensure that the signatory of the CMAPP is at an appropriate level of the organisation.
- Establish an effective means for ensuring the ongoing review of the suitability of the CMAPP. This may be done in parallel to, or as part of, the standard audit and assurance process [refer to later discussions on audit and assurance].

- Ensure that there are mechanisms in place for demonstrating the ongoing suitability and effectiveness of the CMAPP to the senior leadership team. Senior leaders should ensure that they are being provided with the requisite demonstrations or seek to challenge where this is not taking place.

## Leadership

### Accountability and Responsibility

Accountability for MAH management lay with a member of the senior leadership team with responsibility for ensuring effective MAH management devolved to lower levels in the organisation.

Senior leadership teams included at least one member from an operational background who was well versed in the concept of MAH risk and management. There were examples where the most senior person in the organisation did not have an operational / MAH background or experience. Accountability for MAH management was then delegated to the most appropriate individual within the leadership team.

### Senior leadership competency in process safety management

There were no instances where individuals on the senior leadership team were fully competent with regards process safety management.

Expertise would be sought from elsewhere in the organisation or through specialist 3<sup>rd</sup> parties. When asked who they would seek advice from with regards to process safety management, there were different answers from different interviewees even within the same organisation.

The most successful organisations had dedicated resources for process safety management which were clearly identified. Smaller organisations struggled in this area and were reliant on support from 3<sup>rd</sup> parties which was not always possible and no guarantee of success.

### Board oversight of MAH management

The most senior individual in the UK Duty Holder organisation (generally the CMAPP signatory) was also found to be a board member raising questions over whether the board had sufficient independent oversight on MAH management.

In larger organisations, board oversight did not present any concerns with the exemplar approach being to have independent committees chaired by Non-Executive Directors (NED) who regularly challenged the UK leadership team and held them to account on MAH management.

In the smaller organisations this was not possible, resulting in less oversight and a potential for increased exposure to risk. This independent challenge can be achieved through improved engagement and collaboration with partners or licensees.

Duty Holders should:

- Ensure that where there is insufficient process safety competence within the senior leadership team that it is readily available elsewhere in the organisation. The resources should be clearly identified and given sufficient authority to intervene when necessary.
- Establish suitable support arrangements with competent 3<sup>rd</sup> party organisations where the relevant expertise and / or competence does not exist within their own organisation. Duty Holders should ensure that they have arrangements in place for assuring the competency of those organisations they appoint to support their activities.
- Consider whether there is sufficient independent oversight and challenge provided by the board to the UK management team. Where the size of this organisation does not lend itself to this, alternative means for achieving the same objective should be implemented.

## Leadership Behaviours and Expectations

### Clearly defined roles and responsibilities for MAH management

Job descriptions for senior leaders were not in place for the majority of the organisations. Where these did exist, they were out of date and did not clearly identify responsibilities for MAH management.

Improvement was seen as the inspection programme progressed, but weaknesses remained. Job descriptions contained generic statements and, in some instances, prepared by those already in-post as opposed to organisational defined roles and responsibilities.

The higher performing organisations were those where annual objectives were defined for both the organisation and the individual, e.g., reduction in maintenance backlog burden, implementation of process safety improvement plans. Individuals were then held to account on delivery of these objectives.

Co-ordination of objectives between the organisation and individuals resulted in common goals and significant progress in the target areas.

Leadership process safety behaviours were not defined at the majority of organisations. Where they were defined, there was no demonstration of how these were monitored and assessed.



## Criticality of individuals

Effective process safety leadership was found to be dependent on the individual and not driven by the corporate structure.

Clear examples were identified at both ends of the spectrum, i.e., leaders who were effective in setting the direction and driving change versus those who were passive (or resistant) and fostered the wrong behaviours elsewhere in the organisation.

Notable examples were:

- Tacit resistance to change at leadership level and failing to recognise the impact that this resistance was having.
- Production enhancing activities, e.g. infill drilling, taking place at the cost of bed space and impacting critical functions, e.g. inspection and maintenance.
- Production uptime / stability prioritised over safety critical inspections.
- Prioritisation of revenue generation over execution of maintenance backlog reduction, e.g., sub-letting of walk-to-work vessel as opposed to self-use due to net profit for organisation.

In each of these examples, senior leaders were party to the decisions being made and contrary to the expected behaviours.

Leadership behaviours are critical to success and should be taken into consideration when appointing individuals to role [refer to later discussion on organisational change and succession planning].

Rotation of senior leadership positions was commonplace at those organisations owned by a larger corporate entity. The UK organisation has no influence over the individuals being appointed and so needs to ensure that others in the leadership team exhibit the correct behaviours and are comfortable in challenging those above them.

Duty Holders should:

- Review the job descriptions for the leadership team and amend to include responsibilities relating to MAH management. Responsibilities should be specific and appropriate for the role.
- Establish clear objectives for senior leaders. These should be linked to the corporate objectives and targeted at driving improvement in MAH management.
- Define what process safety behaviours are expected of leaders within their organisations and include this within their recruitment / appointment process.
- Consider how the required behaviours will be measured and demonstrated including the provision of training to address any deficiencies.

## Leadership Competence and Training

### Competency framework for leaders

Demonstration of MAH competency is predominantly based upon experience as opposed to any structured competency framework.

Only one organisation had a competency assessment process in place for its senior leaders. This organisation also required regular reassessment and demonstration of competence. Evidence of the competence had to have been demonstrated within the previous few years.

The absence of a structured MAH competency framework was not limited to senior leaders. Key positions elsewhere in the organisations also had no structured arrangements in place. In a limited number of instances, individuals were found to have been appointed to position with gaps in their experience and competence regarding MAH management.

An increasing number of organisations have started to identify onshore roles as “safety critical” but were unable to provide a meaningful description of what this meant. They could not demonstrate the means through which they assured competency, a markedly different approach to offshore safety critical roles.

Organisations have recognised that there is a gap across industry in relation to this area, particularly around MAH awareness and training. Proactive steps have been taken with a large proportion of organisations electing to send senior leaders to practical fire / explosion demonstrations at Spadeadam. This awareness training has been extended to the workforce and is being considered for extending to key contractors.

While the approach is to be commended, it is awareness training only and is not a substitute for a structured competence programme. Other training offerings, e.g. COGENT Skills and IChemE, have also been used but feedback on the relevance of these was mixed. HSE has not participated in any of these courses and cannot comment on their suitability or effectiveness.

Duty Holders should:

- Establish a process safety / MAH management competency framework for leaders that is linked to their role in the organisation. Training programmes should also be established to allow any deficiencies to be addressed.

## Leadership Engagement & Performance Monitoring

### Importance of process safety and MAH management reviews

Process safety and MAH management were a fundamental discussion point at all levels in the organisations.

Structured meeting cadences were in place with relevant information being fed upwards. There was no evidence that information was intentionally being withheld from leaders.

Examples were found where information was being filtered via “middle manager permafrost” but these did not give rise to any risk. The filtering of messages was found to be occurring due to the human nature of individuals as opposed to concern over senior leadership response to bad news.

Meeting cadences were similar across all organisations. Excluding normal daily operational meetings, good practice was found to be senior leaders participating in the following:

- Monthly meetings dedicated to risk reviews and MAH performance.
- Quarterly performance reviews.
- Incident review panels / boards.

For organisations with multiple sites (or significant interests in other fields), the amount of information to be covered was significant with variance in the information presented between sites. This presented challenges with ensuring that key relevant information was being reviewed and appropriate action taken. Decisions taken and actions required as a result of these meetings were rarely recorded.

Senior leaders were found to be active participants in the meetings and looked to challenge / question the information being presented to seek reassurance on its veracity. The success of this challenge was however hindered by the duration of the meetings, depth of information involved and the competence of the leaders themselves.

All organisations had Process Safety Performance Indicators (PSPI) to some extent, but these were biased towards lagging indicators such as Tier 1 and Tier 2 Loss of Primary Containment (LOPC) events (API RP 754 [4] or IOGP 456 [5] definitions). These high-level indicators were also linked to corporate performance and incentivised bonus structures. Leading PSPI were found to be in the minority with a number of organisations found to not have any in place.

Success was observed in those organisations where both leading and lagging indicators had been established and were being used to drive change / improvement. Examples

included allocation of additional resources (financial and people) to address such areas as backlog of Management of Change (MOC), actions from safety studies etc.

Duty Holders should:

- Formalise the meeting cadence and set clear expectations on the information to presented, particularly volume and criticality, and that it is done consistently. Consideration should be given to developing Terms of Reference (TOR) for these meetings.
- Ensure that information presented to the leadership team is clear, unambiguous, and unfiltered. Pre-read material should be provided in advance of the meetings.
- Allow sufficient time for meetings and discussion. Senior leaders should ensure that they dedicate sufficient time ahead of the meeting to familiarise themselves with the material provided.
- Record any key decisions or actions taken as a result of the meetings. Actions should be tracked to closure.
- Establish a set of leading and lagging PSPI suitable for the organisation and ensure that formal review mechanisms are in place. The PSPI should aid driving of improvements and be kept under continual review for their ongoing suitability.

### **Due Diligence**

There is an increasing trend of installations transitioning between operators either as a result of mergers or acquisitions. These mergers and acquisitions are being driven by business opportunities / needs and there is a lack of rigour in the due diligence process.

This is often resulting in organisations failing to understand or identify the risks / challenges that they are inheriting. Failures to understand the risks and challenges is also a direct result of inadequacies in transfer of asset knowledge (documentation, records etc).

Should an organisation elect to undertake mergers or acquisitions of assets, then they should ensure that they have suitable arrangements in place for (a) transfer of knowledge and (b) undertaking of robust technical assessments.

Senior leaders should ensure that rigorous assessments take place as part of a MOC process, and that sufficient resource (time and people) are provided to complete the assessments.

Organisations who are appointed Duty Holders on behalf of others should ensure that they have similar suitable arrangements in place for their organisation.

## Audit and Assurance

### Ineffective Audit and Assurance arrangements

Audit and assurance remains one of the weakest areas across industry.

While the audit and assurance arrangements were found to be generally aligned to the hierarchy outlined in the OEUK Assurance Guidelines [6], all organisations were found to be failing to implement it effectively to some extent.

The majority of organisations were unable to demonstrate how they assured the ongoing suitability and effectiveness of their SEMS (and CMAPP) through their audit and assurance programme including providing the necessary demonstrations to leadership. Common areas of concern were:

- Failure to deliver annual audit and assurance plans / schedules. The failures to deliver the audits was a result of inadequate prioritisation and lack of resources. Participation of Technical Authorities (TA) and the availability of independent auditors was a concern across all organisations.
- Inability to demonstrate a risk-based approach to audit and assurance.
- No organisation had an effective means for ensuring a systematic review of incident history, regulatory findings, previous audit findings etc.
- Audits failing to identify risk gaps and a reliance on compliance-based audits as opposed to a systematic review on the adequacy of the systems or procedures. For example, the majority of Duty Holders focussed on assessing procedural compliance as opposed to assuring that the procedures themselves were fit for purpose and in accordance with recognised guidance, standards, or legislation.
- Increasing frequency of frontline compliance or active monitoring but failing to consider the suitability of the approach, e.g. 'tick-box' instead of open questions, the competency of those undertaking the checks or areas being targeted, e.g. low-risk activity versus high-risk activity.
- Findings from audits were not being actioned or delivered in a timely manner.
- Senior leaders were not being provided with an accurate representation of the gaps present giving a false perspective on the effectiveness of the system. In at least one instance, the UK organisation was subject to a corporate audit by the parent organisation which identified significant deficiencies which had not been flagged through their own assurance process.
- Failure to challenge the audit findings particularly where high levels of compliance were continually being recorded.

In a limited number of instances, there was a lack of appreciation of the importance of an effective audit and assurance process. The most extreme example observed was the

removal of the Audit & Assurance Manager as part of a restructure with the responsibilities of that role not re-assigned.

### **Misinterpretation of the role of the regulator with regards audit and assurance**

HSE are being considered as a line of defence and are being relied upon to identify a Duty Holder's failings.

Industry has recognised that challenges exist and there are examples of attempts to improve performance, e.g., use of data analytics, application of regulatory inspection guides etc. These improvements are still in their infancy and their impact has not yet been assessed.

Duty Holders should:

- Assess their audit and assurance process against the requirements and recommendations of the OEUK Assurance Guidelines to ensure compliance and take any action necessary to address deficiencies.
- Provide resources to deliver the audit and assurance process. Senior leaders should ensure that an individual within the organisation is accountable for the process and is provided with the necessary resources and champion the importance of audit and assurance.
- Maximise the use of other resources to assure the effectiveness of their systems or drive improvements. For example, findings from the Independent Competent Person (ICP) as part of the verification process will provide additional insight to gaps that may not otherwise be identified.
- Review their process for collation and review of findings from all audit and assurance activities including how they are communicated to the senior leadership team. Senior leaders should ensure that they are being provided with an adequate demonstration of the effectiveness of the system.
- Leaders should look to challenge findings including those where no issues were found, i.e. "challenge the consistently green".

## **Risk Management**

### **Risk Identification**

Few companies had a corporate risk register in place, instead focusing on risks at an installation / site level. Senior leaders had visibility of the risks through regular review sessions but there was a lack of clarity on how risks would be escalated or the point at which leadership intervention would occur. There were a number of instances where risks were found to be long-term with no meaningful progress, indicative of either complacency within the organisation or incorrect risk identification.

A variety of risk registers were found to exist even with single organisations. Departments were operating their own risk registers to help drive their own priorities which were not linked to the company risk management tools. They were therefore not being subject to the same level of challenge or review by the asset or senior leadership team.

Several Duty Holders had combined business (financial / production), organisational and process safety risks into one register. While ensuring that all risks were visible, there was an absence of prioritisation and, in some instances, mis-categorisation of risk, e.g. process safety risk classified as a production risk.

Some risks were found to be impossible to realise due to inherent technical / engineered safeguards already present and so were simply being added as means to bring a concern to the senior leadership team.

Duty Holders should:

- Conduct a review of their risk management process and ensure that mechanisms are in place for the escalation of risks in the organisation commensurate to the consequence.
- Avoid the use of multiple risk registers in the organisation. Where this is required, they should ensure that all risks are subject to review either by the asset or senior leadership team.
- Ensure that all risks are correctly categorised and that safety related risks are clearly identifiable from other risks. Care should be taken in assigning the risk category, e.g., a loss of personnel / corporate knowledge may be assigned as an organisational risk but may actually present a safety risk.

## Cumulative Risk

### **Cumulative risk remains a challenge for all organisations.**

Various tools have been developed to address the problem but are subjective in their application and reviews are not guided by any frameworks. The outcomes / decisions of reviews are not being recorded.

Thresholds for change in barrier status are arbitrary and giving false indications of barrier health and are undermining confidence in the tools. Examples were seen where the barrier health was indicating healthy ('green') but underlying data included areas of concerns and emerging threats which went unnoticed. Some Duty Holders had elected to escalate the visibility of certain metrics, e.g. pipework integrity threats, as they were being masked by the tool(s) in use.

Conversely, barriers were unhealthy ('red') due to unrealistically low thresholds, e.g., single Operational Risk Assessment (ORA) on any Safety-Environmental Critical Element (SECE), which made achieving a healthy barrier unlikely.

Barriers were found to remain 'red' on a consistent basis with no meaningful action, leading to complacency in the organisations.

Data underpinning the tools is predominantly that which can be easily pulled from other systems, e.g. maintenance system, and so generally related to 'hardware' type issues. Other 'softer' data, e.g. competency levels, SEMS compliance etc, was difficult to gather and was typically not considered. Where it was used, 'softer' data was found to lag and so did not give a true reflection of the condition at the time of review, again giving a false impression.

Duty Holders did not have a full appreciation of the risks and challenges facing the organisation. Maintenance backlog was a specific example highlighted through both the PSLP inspection programme and the parallel work being conducted by HSE.

By failing to fully understand the risk, organisations were unable to identify the priority areas to maximise risk reduction.

Correct targeting of risk reduction measures is of greater importance when limited by resources and funding. One organisation modified their risk assessment tools to allow the change in risk profile to be visualised and aid work prioritisation.

### **Tolerance to risk**

There is an increased tolerance to risk and normalisation of deviance. Organisations are tolerating increasing degradation of MAH barriers and not showing effective resolution.

In one instance, an installation was found to be operating in the 'red' zone for c. 6 months by the Duty Holders own metrics. In another example, an installation decided not to execute any pipework repairs, instead relying on justifying extension of Defined Life Repairs (DLR) beyond their design life and offshore personnel having a misconceived belief that they were "better than steel".

Duty Holders should:

- Establish clear frameworks for cumulative risk reviews and ensure that any decisions made are formally recorded. Reference should be made to OEUK Cumulative Risk guidance [7] to ensure that the principles outlined in that document are being followed.
- Assure themselves that cumulative risk reviews are of sufficient depth and quality such that any underlying deterioration in metrics are identified.



- Assess how the ‘people’ and ‘process’ (‘softer’ metrics) are considered in their cumulative risk tools and how this information can be easily transferred into the tools and valid at the time of review.
- Ensure that the risk picture for their organisation is fully understood and visible to the leadership team.
- Consider how to ensure that work prioritisation is conducted on the basis of risk reduction to allow for effective targeting of resources at key areas.
- Reflect on their own tolerability to risk and how this is translating to the work force including prioritisation of work.

## Organisational Change & Resourcing

### Organisational Change

Organisational change had occurred in all organisations inspected as part of the programme.

Changes had occurred in two distinct periods, resulting in a significant reduction in onshore headcount [>50% in some instances]. The principles of appropriate guidance, e.g., CHIS7 [8], were found to have been followed in most cases with all organisations planning to conduct post-implementation reviews. Even with recognised guidance being followed, there were a number of consistent themes.

Job descriptions were either absent or incomplete at the start of the restructure leading to failures in role mapping from one organisational set-up to the next.

Failures in the role mapping process resulted in key responsibilities being lost and not backfilled. In one organisation, the role of audit manager was removed, and responsibilities not re-assigned, creating a significant gap in a critical SEMS assurance process.

Restructures failed to adequately consider the additional burden being placed on individuals. No assessments had been made on the capacity of individuals to absorb an increased workload nor their competency to take on the additional responsibility. Individuals were often being asked to cover subjects outside their area of expertise and not supported by the wider organisation including the absence of a structured training / competency development programme.

Senior leaders were not exempt from the changes. Management restructures had occurred at a number of organisations including instances of a reduction in the size of the leadership team. Leaders were becoming responsible for greater areas of the business, and in turn more reliant on their direct reports.

Good practice was observed by formalising MAH responsibilities through development and update of RACI charts as part of the organisational change. The RACI charts were not

limited to the asset team. They were extended to all areas of the business and built at a departmental and position level, thereby recognising that all parts of the organisation have a role to play in MAH management.

Duty Holders should:

- Identify the roles within their organisation that have the potential to influence / impact MAH management and ensure that suitable job descriptions are in place.
- Assess the impact of any re-organisation activity that they have undertaken including the identification of any gaps or resource strain. Where organisations are about to embark on any organisational restructure, they should ensure that an adequate role mapping exercise is conducted and follow the principles of CHIS7.

## Resourcing

### Industry resources

Resourcing and competency is a collective issue and is one of the key challenges facing the industry.

Onshore resourcing was found to be at critical levels with a number of organisations potentially already under-resourced. The reduced headcount is impacting organisations' ability to comply with the requirements of their accepted safety case (or their own SEMS) and is having a direct impact on MAH management. Examples observed included failure to assess overdue integrity issues and ineffective audit and assurance.

Organisations are attempting to reverse this position in key areas. This has generally been unsuccessful with less resources now available in industry. As a result, there is greater reliance on 3<sup>rd</sup> party contractors which is causing an additional burden of monitoring contractor performance [refer to later discussion].

In terms of good practice, organisations are trying to bolster their resilience and have introduced new roles in key areas, particularly around process safety management. Upskilling of certain roles, e.g. Health and Safety Advisors, is also occurring. While upskilling of resources is a positive, care needs to be taken to ensure that individuals are not overburdened.

Offshore headcount has not been affected to the same extent as onshore. Duty Holders who operate installations that have reached (or are reaching) end of life have experienced an increased turnover of personnel.

This has led to loss of knowledge and has impacted on delivery of critical activities, e.g. planned maintenance. Uncertainties on future employment can also have an unintended

negative effect on safety culture. To combat the loss of personnel, some organisations have offered incentives to ensure retention of staff.

### **Consistent concern on impact of headcount reduction**

The reduction in headcount and the associated loss of competency and corporate knowledge was the primary concern of both onshore and offshore personnel.

While competencies can be built over time, the loss of corporate knowledge is the biggest challenge, and no organisation had an effective means for managing this risk.

Reduction in headcount, combined with an ageing workforce, is placing a greater emphasis on succession planning. Where succession planning was taking place, this was driven by individuals and not aided by any corporate system. Successful succession planning is also reliant on clear job descriptions and a structured training / competency programme which has already been identified as an area for improvement.

As discussed previously, effective process safety leadership is being driven by individuals as opposed to the corporate system. In identifying individuals for promotion and further development, equal focus should be placed on assessing their leadership / process safety behaviours as well as their technical competence.

Duty Holders should:

- Review their arrangements for the retention of corporate knowledge and implement any necessary improvements. A large proportion of the corporate memory lies with individuals and is not held within any corporate system. Duty Holders should identify the best mechanisms for sharing this knowledge.
- Ensure that they have suitable arrangements in place for succession planning and that these consider both behaviours and technical competence.
- Develop a plan for managing the transition to CoP to maximise the potential for staff retention and maintaining the focus on process safety. Workforce communication / engagement plans should be put in place and the leadership should remain alert to any early warning signs of decreased safety performance.

## **Contractor Management & Engagement**

Duty Holder senior leaders are regularly engaging with their counterparts from the contractor community including undertaking of joint leadership visits and review of contractor performance.

## Contractor engagement on MAH

Engagement continues to be focussed primarily on personal safety with insufficient consideration of process safety performance / MAH management.

All organisations have expectations of their own employees but could not demonstrate how they assure similar behaviours from their contractors.

One area of good practice observed was the TA engaging with those key contractors who impact on MAH management, e.g. inspection and fabric maintenance, and clearly identifying the expectations and standards to be achieved. Another area of good practice was the involvement of key contractors in process safety leadership discussions and away days.

The reduction in headcount is increasing reliance on specialist companies to support delivery of critical activities, e.g. pipework inspections and assessments. Key areas to be considered in adopting this approach are:

- Clearly defining the scope of the work to be undertaken and the expectation on quality and timeliness of deliverables.
- Providing sufficient oversight and verification of the technical activities being undertaken especially where this is impacting on safety critical systems.
- Avoiding over-reliance on specialist companies and de-skilling of the Duty Holder work force.

Significant changes to the contracted provider(s) of critical functions, e.g. manning, inspection, maintenance etc, has a direct impact on MAH management. Organisations could not demonstrate that they had sufficiently robust arrangements in place to manage this change process and undertake suitable due diligence.

The use of contractors provides the Duty Holder with the resource flexibility to meet their needs, however, this will only be effective if a suitable assessment is undertaken and competent resource is provided and managed accordingly.

Where contractor personnel are being used to fulfil short-term work activities, insufficient time is being afforded to ensure onboarding of personnel and setting expectations including provision of any MAH awareness training.

Anecdotal evidence suggests that this is a direct result of the contractual arrangements in place which define the point at which organisations and personnel are compensated. The absence of long-term forward plans was further compounding the issue with an inability to recruit due to the lack of job security, resulting in constant turnover of personnel.

Various operating models were observed in the basin including outsourcing TA support to 3<sup>rd</sup> party organisations. Concerns identified with this operating model were ensuring expedited support when required and participation of TA in audit and assurance activities, but no evidence was found of this having an impact on MAH management.

The increasing 'green hat' population was a consistent concern from all inspections. Examples were cited where personnel were arriving offshore without the correct competencies or exhibiting the wrong behaviours. It was noted that there has been an increase in the numbers of 'green hats' that are not only new to the installations but new to the industry. This increases the risks associated with an insufficient onboarding process.

This situation is being exacerbated by (a) lack of adequate assurance or oversight from Duty Holders [refer to previous discussions on audit and assurance], (b) contractual arrangements and (c) absence of long-term forward plans.

Duty Holders should:

- Ensure that contractor performance reviews addresses process safety performance and / or MAH management. Inclusion of process safety performance and associated metrics within contractual arrangements should be considered.
- Review their own audit and assurance processes in relation to contractor oversight and verification. Competent personnel should be involved in these audit / verification activities and not limited solely to the contract holder.
- Consider how they engage with their contractor organisations on MAH management, ensuring alignment of expectations and provision of adequate support to the 'green hat' population.

## Process Safety Improvement Plans

### Driving continuous improvement

Process Safety Improvement Plans (PSIP) are good practice and demonstrate a commitment to continuous improvement.

Development of PSIP was a significant improvement area over the duration of the programme. The more successful PSIP were those based upon the organisations own gap analysis against the leadership principles and other intelligence, e.g., incidents, audit findings.

While development of improvement plans was a positive, organisations were found to be overly ambitious both in scope and delivery. The PSIP were typically not prioritised, with organisations attempting to deliver all scopes in an unrealistic time frame. There was also

generally a failure to ensure that the plan was adequately resourced and capable of being delivered alongside normal operational activities.

Senior leadership oversight of the PSIP was variable between the organisations sampled. The most effective method identified was where senior leaders championed relevant areas of improvement and regularly reviewed progress.

Workforce knowledge of the improvement plan was found to be lacking in the majority of inspections. Improvement plans were being delivered by onshore personnel with limited involvement or discussion with the offshore teams. A common discussion point with the work force was the constant change being observed, often with little awareness of the reasons for change [similar finding to sharing and learning from incidents].

Duty Holders should:

- Ensure that they have a process safety improvement plan in place. The plan should be on a continuous rolling basis and prioritised on the basis of risk. Senior leaders should ensure that sufficient resources (including funding) are provided to ensure delivery of the plan and conduct regular reviews against progress.
- Engage with the work force in the development and delivery of the improvement plans. The work force should be consulted on the potential areas for improvement and kept informed of progress in areas that they may affect them, e.g. introduction or change to corporate procedures / systems.

## Sharing and Learning

Dissemination of information from incidents was not an area of concern. All organisations had robust arrangements in place for ready sharing of information. Senior leaders were also found to be playing an active part in incident reviews.

Most organisations were adept at addressing the immediate cause of incidents, taking prompt action to make improvements. They were less successful in ensuring that the underlying and root causes of incidents were fully understood, and the learnings embedded within the organisation. Numerous examples were seen where similar repeat failures were occurring, sometimes within a relatively short period of time.

The failure to learn from previous incidents is a direct result of an inadequate corporate memory and ineffective communication or a lack of willingness to change.

Most organisations do not have an effective central repository of incident history and instead are reliant on the memory of individuals. The absence of incident history is being compounded by the transition of the work force and a reduced MAH awareness and appreciation.

Communication and education of the work force in relation to the underlying and root causes of incidents was variable. Where changes are made to systems / processes as a direct result of an incident, the most successful organisations rolled out the changes at the front line, sending personnel offshore to explain the reasons for change.

### **Learning and sharing with industry**

An area of improvement across industry is in relation to the external sharing of incidents and lessons learned.

All organisations are successful at pulling in incident history from others but are not as proactive at sharing outwards.

There is evidence of information being shared however this is occurring within a limited group, e.g. Health and Safety Managers, but there is continued reticence to wider sharing.

There are a limited number of contractor organisations operating in the basin and have personnel supporting different Duty Holders and installations.

Sharing of incident information and lessons learned with contractors was found to be a potential area of weakness and also represents a missed opportunity for the basin for greater sharing of information or learning of good practice elsewhere.

Duty Holders should:

- Consider how they retain the corporate history in relation to incidents and how this information is shared with the work force.
- Ensure that they have effective arrangements for the roll-out of changes to systems / processes especially where the changes are made as a direct result of an incident. Organisations should avoid simply sending out amendments to SEMS processes / procedures without ensuring that they are fully understood.
- Engage with the wider industry and look to share incident information and lessons learned. Senior leaders should actively encourage sharing and look to remove any barriers that may prevent it from taking place.
- Assess how they share incident information with their key contractors, particularly where their personnel are involved.

## Workforce Engagement

### Leadership engagement at the front line

Senior leadership engagement with the front-line work force was the strongest area of performance. Feedback from the workforce was generally positive and there were no significant areas of concern.

Duty Holders should ensure that they maintain the good practice observed by:

- Continuing to engage at the front-line and utilise the structured visit guides now in place.
- Maintaining an 'open-door' approach and encouraging workforce feedback on process safety improvements.
- Demonstrating effective leadership by acting on concerns raised by the workforce and providing feedback on actions taken.
- Ensuring that MAH management remains a key topic of visits and that senior leaders play a part in assuring the health of the preventative and mitigative barriers, i.e. undertaking audit and assurance activities.
- Ensuring active participation by other senior leaders, e.g. HR personnel, in the visits to address specific concerns.
- Considering the use of culture surveys and other formalised methods for engagement of the workforce.

There is emerging evidence that there is an erosion of MAH appreciation and understanding within the workforce. This trend is not limited to contractors and is also affecting staff positions. In one organisation, it was stated that new apprentices and graduates had no knowledge of Piper Alpha and were more aware of more recent events, e.g. Macondo.

Organisations have identified this deterioration and are attempting to address through improvements, such as:

- Improved MAH awareness training via combination of practical demonstrations and use of virtual reality.
- Development of specific process safety competency training and assessment of frontline staff including Computer Based Training (CBT) or dedicated applications.
- Identification of impact of roles on MAH event and engagement with staff on how they play their part.

The success (or otherwise) of these improvements cannot yet be determined and leaders should continue to assure themselves that they have an effective process safety culture



onboard their installations. Senior leaders should be particularly aware of the challenges presented by the transition towards CoP.

Communication of MAH performance at an installation level was found to be a challenge in all organisations. The challenge is stemming from uncertainty regarding the level of information to share instead of a lack of willingness to share.

Organisations are attempting to find the balance of sharing sufficient information but also ensuring that it can be understood by the majority of the workforce.

One opportunity for improvement in this area is the utilisation of the ESR function to meet this purpose. Organisations should ensure that they are sharing sufficient detail on MAH performance with the ESR such that they can communicate any issues to their constituents but also present any challenges or recommendations for improvement to the offshore and onshore leadership.

## **Ageing Life Extension and Cessation of Production**

ALE and integrity management was a consistent theme from all inspections. The majority of assets in the UKCS are now operating beyond their design life and Duty Holders have still not completed the relevant studies and, in some examples, failed to submit material changes to their accepted safety cases.

PSLP inspection findings in relation to ALE and integrity management are similar to those identified in previous HSE key programmes, namely KP3 and KP4.

Uncertainty remains with industry regarding CoP dates for installations. The absence of a definitive (or continually changing) CoP date is leading to failure to commit funds and delays in execution of work. Most organisations were unable to demonstrate that they had a Life of Field (LOF) plan for the assets and so could not demonstrate there was sufficient investment to ensure integrity through to decommissioning and dismantlement.

Uncertainty in CoP and the potential impact on workforce retention was also found to be a significant area of concern across all organisations [refer to previous discussions on workforce engagement and organisational change].

Duty Holders should:

- Conduct ALE studies where installation design life has been exceeded and consider developing LOF plans for the installations. Where installations are being operated beyond their original design life, material changes to accepted safety cases should be submitted in compliance with legislative requirements.
- Senior leaders should ensure that relevant studies are being conducted and that the findings from the studies are actioned. This may include ensuring that sufficient

funding is available over the remainder of field life, recognising the increasing integrity burden as installations age.

- Senior leaders should be aware of the risks associated with uncertainty in CoP dates. They should ensure that this uncertainty does not compromise maintenance of the asset and that adequate resources, including funding, are available.

## References

- [1] HSE Publication 'Key Programme 3 – Asset Integrity Programme', available from <https://www.hse.gov.uk/offshore/assets/docs/kp3.pdf>
- [2] HSE Publication 'Key Programme 4 (KP4) – Ageing and life extension programme', available from <https://www.hse.gov.uk/offshore/assets/docs/kp4-report.pdf>
- [3] HSE guidance document 'Major Hazard Leadership Intervention Tool', available from <https://www.hse.gov.uk/comah/assets/docs/major-hazard-leadership-intervention-tool.pdf>
- [4] API Recommended Practice 754 'Process Safety Performance Indicators for the Refining and Petrochemical Industries', 3<sup>rd</sup> Edition, August 2021
- [5] IOGP Report 456 'Process Safety – Recommended practice on Key Performance Indicators', Revision 3, May 2023
- [6] OEUK Assurance Guidelines, Issue 1, November 2020
- [7] OEUK Cumulative Risk Guidelines, Issue 1, November 2016
- [8] HSE Chemical Information Sheet No CHIS7 'Organisational change and major accident hazards', available from <https://www.hse.gov.uk/pubns/chis7.pdf>



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