

Offshore Division Strategy for Electrical / Control & Instrumentation Safety (OSD3.5)

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Offshore Division (OSD) Electrical / Control Instrumentation Safety

OSD3.5 works to implement HSE's strategy and OSD's strategy with respect to electrical / control and instrumentation disciplines. These disciplines have an impact on the management of risk associated with major accident scenarios (e.g. SCR05) including fire, explosion, capsized and ship collision. These disciplines also have an impact on occupational safety related to electrical danger (e.g. EAWR 1998) and the suitability of work equipment (e.g. PUWER).

This strategy will be reviewed by August 2010 or earlier on significant changes to HSE's or OSD's structure or strategy

Our Aims

- To support the policy of HSC/HSE for the control of Major Accident Hazards offshore
- To support the policy of HSC / HSE with respect to occupational safety
- To engage with, and command respect from our stakeholders
- To be fair, consistent, and transparent in our dealings with dutyholders
- To be a well resourced source of expertise in electrical, control, instrumentation and communications in offshore applications
- To participate as part of a multidisciplinary team in Offshore Safety Case Assessment, inspection, and investigation
- To stimulate Research and Development for the prevention of accidents related to electrical safety and control system integrity
- To maintain awareness of current developments in offshore electrical safety and in offshore control system and communications safety integrity.
- To inform the Offshore Industry of developments in offshore electrical safety and in offshore control system and communications safety integrity.

How we achieve our aims

To support the policy of HSC/HSE and OSD strategy in relational to major accident hazards

- We are concerned with control system integrity safety issues particularly in terms of the prevention of loss of containment of hydrocarbon inventories, loss of stability and loss of station keeping
- We are concerned with the integrity issues in terms of instrumented emergency response systems and communications
- We provide a centre of specialist expertise, relevant to the offshore industry, in electrical, control, instrumentation and communications ;

- Our work directly supports the DSO (Departmental Strategic Objective) target (formerly known as public sector agreement or PSA) for reduction in offshore hydrocarbon releases through:
 - Investigations (primarily loss of containment of hydrocarbons)
 - Inspection
 - Safety case assessment
 - Giving technical advice and producing guidance on offshore instrument based safety systems
 - Promoting inherent safety in new designs
 - Input to relevant codes, standards and industry guidance.

To support the policy of HSE and OSD strategy in relation to occupational safety

- We are concerned with the integrity issues in relation to electrical systems and control systems for machinery (e.g. drill floor pipe handling)
- We provide a centre of specialist expertise, relevant to the offshore industry, in electrical, control, instrumentation and communications ;

To engage with, and command respect from our stakeholders

- Inspection prioritisation takes account of current key programmes and other OSD projects. We also prioritise topics based on statistical evidence and experience from inspections and investigations.

To be fair, consistent, and transparent in our dealings with dutyholders

- We develop and use internal guidance to ensure consistency and transparency in our dealings with dutyholders
- The main guidance we use as a basis for safety case assessment is available on the internet or otherwise publicly available ([GASCET](#)).
- The main guidance we use as a basis for inspection is available on the internet or otherwise publicly available ([Safety Notices](#), [SPCs](#), [Guidance Notes](#) and [Offshore Information Sheets](#))

To be a well resourced source of expertise in electrical and control safety for offshore applications

- We employ suitably competent and experienced staff (chartered engineer or equivalent and mostly electrical or instrument engineers). In line with HSE's Investor in People status, we provide relevant training in line with OSD divisional strategy.
- It is unrealistic to expect any individual to be an expert in all disciplines addressed by OSD3.5. We make use of other suitably competent staff in HSL as required for assessment and investigative work.
- We participate in pan HSE fora in relation to electrical and control developments and incidents
- We support other divisions of HSE where our expertise is formally requested.
- We liaise with other agencies (BERR, Police, MAIB, AAIB) in accordance with the relevant Memoranda of Understanding

To participate as part of a multidisciplinary team in Offshore Safety Case Assessment, inspection, and investigation

Safety case assessment

- OSD's involvement in assessment as a whole will reduce as a natural outcome of the new safety case regulations.
- We conduct our assessments in accordance with the [Safety Case Handling and Assessment Manual](#) (SCHAM), [Assessment Principles for Offshore Safety Cases](#) (APOSC), and other relevant codes, standards and guidance.
- We aim to complete assessment before acceptance of a safety case. However safety case assessment is primarily an offline exercise. We utilise prioritised Post Acceptance Inspection Topics (PAITs) to propose matters for inspection

Inspection

- We contribute our expertise as appropriate in the execution of Key Programmes.
- Inspections of dutyholder's management systems, policies, evidence of good design, implementation of standards, codes and the adoption of good practice at land-based offices are an important aspect of inspection.
- We use intelligence from safety case assessment, investigations and dangerous occurrence reports (RIDDOR) as inputs to prioritising inspections.

Investigation

- We consider RIDDOR reports and proactively contact the relevant Inspection Management Team (IMT) as required to initiate investigation.
- We encourage IMTs to contact us automatically when an incident has occurred.

To stimulate Research and Development for the prevention of major accident hazards

- We identify knowledge gaps, which require research to assist the industry to prevent major accident hazards, and encourage the industry to take forward such research. See Appendix 1.

To maintain awareness of current developments in Electrical Safety and Control System Integrity

- We use HSE's Electrical / Control and Instrumentation network to talk regularly to those in other parts of HSE about how they conduct their work to identify any gaps in our knowledge..
- We contribute to major onshore hydrocarbon incident investigations (e.g. Buncefield)

To inform the Offshore Industry of developments in safety topics related to electrical and control disciplines

- We provide input to joint industry guidance relevant to the topic, EI guidance on EX equipment maintenance strategies (e.g. OGOCIN)

- We give technical advice via HSE Infoline for day to day enquiries, and those arising from the Offshore Europe Exhibition HSE Stand.
- We promote inherent safety in design by making the industry aware of new inherently safer developments in design.
- We support developments in technical standards

Our aspirations for the future

Feedback suggests that some classes of problem recur in design, modification, operation and maintenance which we intend to address by further inspection.

Design

- **Drill floor machinery.** There is an increasing trend for remote control of drill floor machinery. The associated control systems are substantially more complex than those with which the drilling industry is familiar. Experience has shown that remote controlled machinery eliminates some risks but introduces new ones. In conjunction with colleagues in the well operations section we will inspect drill floor machinery and discuss associated issues with drilling trade associations and suppliers.
- **Hazard and risk analysis for plant protection.** We note a trend to increased reliance on instrumented systems to protect older infrastructure from new high pressure tie backs. We are involved in the development of industry guidance for instrumented protective systems for the protection of process plant (Energy Industries Council Guidance on IEC61511).
- **Inherent safety in process design.** We will keep in touch with developments in the main design houses, so that inherent safety can be implemented early in a project.
- **International design issues.** Recent experience has shown that process engineering designs originating outside the UK do not reflect the required UK regulatory standards of health and safety, nor the UK industry guidance, nor good UK industry practice.
- **Dynamic positioning (DP) and similar control systems.** Unlike process shutdown systems and process shutdown systems DP and similar control systems have no context-free safe state. The implementation of DP systems is governed by International marine standards. Nevertheless there have been incidents related to deficiencies in the design and implementation of the associated control systems. We will continue to support colleagues in the relevant marine sections in relation to these issues.
- **Diving rebreathers.** There is an increasing trend for divers to use re-breathing systems. The motivations for this include operating cost (expensive gas is recovered rather than released to sea) and the absence of expired bubbles. The rebreathing systems generally contain micro-processor based control systems. We will support our diving inspection colleagues in relation to the rebreather control systems

Modification

- **Ageing installations.** We will contribute to Guidance on how we will tackle problems posed by ageing installations being planned by OSD3 as a whole.
- **Safety Integrity Levels and their application.** The number of tie-backs of new production wells to existing facilities is increasing. The reception facilities cannot always easily accommodate the new pressure relief requirements without an extensive revamp of the HP Flare disposal system. Increasingly reliance is being placed upon instrumented protective systems for over-pressure protection. We anticipate an increasing need to monitor / review the functional safety assessments associated with such developments. We are revising guidance in relation to instrumented protection of remote facilities
- **Turbine Control Systems.** Over the last 15 years typically greater than 10% of all fires on UK installations have related to turbines and there have been several turbine explosions. Turbine control systems do not generally segregate safety functions from operational functions. This increases the criticality of procedural controls during modification of the control system. We will support our fire and explosion colleagues in relation to turbine incidents where control functions may be an issue.
- **Operational risk assessment** We will input to guidance being produced by the Fire & Explosion topic team on operational risk assessment. This needs to include partial reinstatement; dealing with design legacy (and aspects of design which are not written down) e.g. relying on a risk assessment if isolation is not adequate to OIAC guidance.
- **How to tackle human failure to be aware of hazards/risks.** This is the cause of many incidents, e.g. water flushing on Scott. A toolkit is required of questions that inspectors could ask where the nature of the answer would suggest whether the respondent / dutyholder/system was thinking widely enough or was complacent.

Maintenance

- **Maintenance of Ex Equipment.** Recent changes to international standards for maintenance of Ex equipment have led to an extremely diverse range of approaches. OSD3.5 helped the Energy Institute (EI) to develop guidance for this area. We will continue to monitor progress
- **Audit of barriers.** One of the outcomes of KP3 is a project on the audit of barriers. This is concerned with inspecting and stimulating dutyholders' ability to audit themselves and to make improvements to both the barriers themselves and their audit process itself. We are currently taking part in a pilot exercise.
- **Guidance on how to inspect audits** and what HSE expects. This is in the development stage as an outcome of KP3.

To maintain awareness of current developments in Electrical Safety / Control System Integrity

- We will keep in touch with what is going on/developments in the main design houses, so that this may be influenced early.

Appendix 1 : Research Strategy

OSD3.5 works to implement HSE's strategy on research. The last approved strategy on the intranet is the 'statement for the implementation of the chief scientific adviser's guidelines 2005' but there is no current equivalent. OSD3.5 also works to implement OSD's strategy with respect to research as stated in the Offshore Division plan. OSD3.5 may initiate research in relation to specific incidents and may also initiate research programmes. OSD3.5 is not currently executing any general research programmes. The principles that determine whether OSD3.5 would take the lead in proposing and developing a research programme are

- **Specificity to offshore safety.** The topic is one where the issues are primarily related to the offshore installations or where the majority of associated risk is specific to offshore installations.
- **Absence of relevant studies.** The topic should be one where there are gaps / deficiencies in the reported literature and standards.
- **Generality.** OSD3.5 is not a design house. Where the relevant principles are well understood it is not OSD3.5's intention to undertake research on specific designs. If there are concerns about specific designs there are other regulatory routes to obtain assurance about the suitability of a specific design.
- **Significance.** The risks associated with the topic should warrant the cost associated with the research project.

Major Accident Topics

Ignition Hazards OSD3.5 has not been able to identify any research into the integrity of ageing Ex electrical equipment. Some of the applicable standards were first issued only a few years before some of the offshore installations were constructed. Corrosion has been noted on some Exd junction boxes but there is no benchmark for determining whether the Exd integrity is compromised. The corrosion issues are likely to be enhanced in the salty marine environment on offshore installations. Thus this issue satisfies the criteria identified. OSD3.5 would like to propose research in this area.

Software Design Techniques . OSD3.5 has actively dissuaded dutyholders from implementing high integrity safety functions using software. The dissuasive arguments have been based on the difficulty of establishing within reasonable project timescales and with sufficient confidence that the control system will meet its target integrity. Recently OSD3.5 encountered claims that Object Oriented software in two systems subject as a combination would deliver a function with SIL 3 integrity. The same issue could also arise with respect to onshore safety systems so at this stage OSD3.5 is not proposing research in this area.

Occupational Safety

Electrical Distribution Networks. Many offshore distribution networks are similar to those encountered onshore. However OSD3.5 has identified three characteristics which can be significantly different. These are size, presence of IS limiters and the use of unearthed "IT" distribution.

IS Limiters. These devices are used as an alternative to upgrading switchboards and / or installing electrical reactors. They are used when space is at a premium and generating capacity has increased as may occur on older offshore installations when new process plant is added. They operate using sensing instruments to ignite an explosive fuse to break high currents. They are novel and OSD3.5 is not aware of statistical field studies of their effectiveness. Several offshore installations have these fitted. OSD3.5 would like further field data on these devices but does not believe an external research project is necessarily required.

Harmonics. The size of electrical distribution networks on offshore installations is much smaller than onshore networks. Accordingly the significance of harmonics generated by equipment such as variable speed drives can be much greater. Harmonics can lead to increased heating particularly in transformers. The issues are not new but an incident with a floatel on DP in Australia indicated the significance of ensuring that equipment is properly rated to accommodate harmonics. OSD3.5 believes the principles for managing harmonic issues are well understood. However there may be issues due to some designers lacking awareness. OSD3.5 does not propose research into this area at present.

Unearthed "IT" Distribution Networks. These networks are rarely used onshore. They have the benefit of surviving a first electrical fault. However there are issues related to identification that a first fault has occurred. For many years "IT" distribution was mandated by codes for oil tankers and similar vessels but the detailed basis for this requirement was not clearly stated. Several FPSO's and most MODUs use IT distribution systems. Because of their rarity onshore there is a lack of familiarity with some aspects of "IT" distribution systems. Guidance produced by the IET does address "IT" systems. Accordingly OSD3.5 does not believe that there is a significant gap in the standards in relation to the principles of operation of "IT" systems and does not propose research in this area.