Are Safety Cases past their sell by date? Can we make them more relevant?

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One of the responses to the Piper Alpha disaster on the 6 July 1988, which led to the death of 167 people, was the setting up of the Cullen Inquiry. The inquiry made 106 recommendations; the first of these was that, *"The Operator should be required by regulation to submit to the regulatory body a Safety Case in respect of each of its installations"*. Subsequently, the offshore safety case regime was introduced in the UK.

After the Deepwater Horizon drill rig explosion in the Gulf of Mexico in April 2010 the European Union enacted Directive 2013/30/EU on safety of offshore oil and gas operations, introducing the Safety Case concept throughout offshore Europe. In the UK, this led to the Offshore Installations (Offshore Safety Directive) (Safety Case etc) Regulations 2015 and the setting up of a new 'Competent Authority', the Offshore Safety Directorate regulator (OSDR), in which the Health and Safety Executive (HSE) and Business, Energy & Industrial Strategy (BEIS) work together. The new regime expanded on the concept of a major accident hazard by adding the requirement to consider 'major environmental impact' i.e. limited only to environmental impacts of major accidents. Other changes included the introduction of the Corporate Major Accident Prevention Policy and the expansion of the concept of safety critical elements to encompass safety and environmental critical elements.

There is concern, however, that despite the good intentions of this focus on safety, the Safety Case has become too unwieldy to be a useful document for anyone other than a Regulator or a safety professional.

This paper examines the benefits of the current regulatory regime and questions whether the current regime achieves the original purpose of Lord Cullen's recommendations. Is an 800+ page document of value to either personnel offshore and onshore or the Regulator? Does the production and maintenance of Safety Cases really improve offshore safety or is it simply a tool for keeping consultants and others busy in well-paid jobs, offering little if any real reduction in offshore risks? Suggestions are presented for increasing the value that well-written and accessible Safety Cases can offer to organisations, beyond the obvious value of an accepted Safety Case and a license to operate.

Key Words: Risk, Safety Case

Introduction

The offshore Safety Case regime was introduced in the UK following the Piper Alpha disaster on the 6 July 1988 which led to the death of 167 people. One of the responses to the disaster was the setting up of the Cullen inquiry which made 106 recommendations. The first of these was that *"The Operator should be required by regulation to submit to the regulatory body a Safety Case in respect of each of its installations" (Cullen, 1990).*

The authors of this paper are not suggesting a deregulation process as being proposed in the USA or the removal of the Safety Case regime. Rather we are suggesting that the current Safety Case regime has moved away from the original intent as laid out by Lord Cullen.

The key legislation and statutory provisions for Safety Cases are:

- Health and Safety at Work etc. Act 1974
- Health and Safety at Work etc. Act 1974 (Application outside Great Britain) Orders 1977 to 2013
- Wells (Design and the Offshore Installations and Wells (Design and Construction, etc.) Regulations 1996, (DCR)
- The offshore installations and pipeline works (management and administration) regulations 1995, (MAR)
- The Offshore Installations (Prevention of Fire and Explosion, and Emergency Response) Regulations 1995, (PFEER)
- The Pipelines Safety Regulations 1996, (PSR)

In addition, there is a considerable quantity of supporting documentation such as International standards, guidance documents from HSE and industry bodies such as the Energy Institute and Oil and Gas UK, amongst others.

Lord Cullen was clear that the Safety Case regime should be built on the goal setting regime consistent with the Health and Safety etc. Act 1974 and the concept of self-regulation. There is a growing perception that over time the Safety Case regime has changed. Originally the Safety Case challenged design and operational practice to demonstrate that risks are reduced to as low as reasonably practicable (ALARP). Today the perception is one of compliance with regulatory demands and a commensurate tick box application of the regulations. This we would argue is at best ill-advised and at worst dangerous.

Changes to the Safety Case Regime

In the Inquiry Report Lord Cullen stated the following:

"*The operator should be required by regulation to submit to the regulatory body a Safety Case in respect of each of its installations. The Safety Case should demonstrate that certain objectives have been met, including … that the potential major hazards of the installation and the risks to personnel thereon have been identified and appropriate controls provided."*

The definition of a major accident event or hazard has not changed significantly over the past 23 years (see Table 1), although in the 2015 regulations 'helicopter collision with the installation' has been removed from the definition and Major Environmental Incidents (MEI) have been added.

The clear focus of Safety Cases is on major hazards and not to try to cover all aspects of working life of personnel on the installation. However even though the focus of the regulations has not changed significantly over the years, the Safety Case regulations have changed and expanded in their scope; the latest revision meeting the requirements of the EU Offshore Safety Directive (EU, 2013). Over the years the number of regulations has increased from 17 to 41 and the number of schedules has grown from 8 to 14. Of particular interest with regards to the content of the Safety Case are the Schedules as these tend to be explicit i.e. prescriptive about what the Safety Case must contain. What has driven this expansion of regulations? Is there any evidence to show that this expansion in the regulations adds any value in terms of reducing the risks the workforce on the installation is exposed to? Or does it simply create additional work for the Regulator, verification bodies and associated technical specialists without adding material benefit?

The period between 1992 and 2005 can be considered as a time during which the regulatory framework bedded in. That changes occurred in 2005 is not surprising after a realisation of what was effective, what wasn't effective and what needed further clarification or was missed out the first time around. Between 2005 and 2015 along with an increase in public awareness of offshore safety there is also a substantial increase in the number of regulations. With the EU Offshore Safety Directive (EU, 2013) came the requirement to include aspects of the EU Directive within the regulations, however it seems that there was only addition to the regulations. Although there was a large amount of consultation during the development of the 2015 regulations there doesn't appear to have been any root and branch review of the value of the existing regulations in reducing major accidents. This leads the authors of this paper to question where the regulations will go next? And what will drive change, will this be after another offshore disaster or can change be made sooner?

Table 1 Definition of a Major Accident Hazard (MAH)

1992	2005	2015
Regulation 2	Regulation2	Regulation 2
(a) a fire, explosion or the release of a dangerous substance involving death or serious personal injury to persons on the installation or engaged in an activity on or in connection with it	(a) a fire, explosion or the release of a dangerous substance involving death or serious personal injury to persons on the installation or engaged in an activity on or in connection with it;	(a) an event involving a fire, explosion, loss of well control or the release of a dangerous substance causing, or with a significant potential to cause, death or serious personal injury to persons on the installation or engaged in an activity on or in connection with it;
(b) any event involving major damage to the structure of the installation or plant affixed thereto or any loss in the stability of the installation;	(b) an event involving major damage to the structure of the installation or plant affixed thereto or any loss in the stability of the installation;	(b) an event involving major damage to the structure of the installation or plant affixed to it or any loss in the stability of the installation causing, or with a significant potential to cause, death or serious personal injury to persons on the installation or engaged in an activity on or in connection with it;
(c) the collision of a helicopter with the installation;	(c) the collision of a helicopter with the installation;	
(d) the failure of life support systems for diving operations in connection with the installation, the detachment of a diving bell used for such operations or the trapping of a diver in a diving bell or other subsea chamber used for such operations; or	(d) the failure of life support systems for diving operations in connection with the installation, the detachment of a diving bell used for such operations or the trapping of a diver in a diving bell or other subsea chamber used for such operations; or	(c) the failure of life support systems for diving operations in connection with the installation, the detachment of a diving bell used for such operations or the trapping of a diver in a diving bell or other subsea chamber used for such operations;
(e) any other event arising from a work activity involving death or serious personal injury to five or more persons on the installation or engaged in an activity in connection with it.	(e) any other event arising from a work activity involving death or serious personal injury to five or more persons on the installation or engaged in an activity in connection with it.	(d) any other event arising from a work activity involving death or serious personal injury to five or more persons on the installation or engaged in an activity on or in connection with it; or

1992	2005	2015
		(e) any major environmental incident resulting from any event referred to in paragraph (a), (b) or (d),
		and for the purposes of determining whether an event constitutes a major accident under paragraph (a), (b) or (e), an installation that is normally unattended is to be treated as if it were attended; "major environmental incident" means an incident which results, or is likely to result, in significant adverse effects on the environment in accordance with Directive 2004/35/EC of the European Parliament and of the Council on environmental liability with regard to the prevention and remedying of environmental damage.

Who is the Safety Case for?

It is widely accepted that the process of writing a Safety Case during the design of an installation reduces the risk of major accidents happening during the lifetime of the installation. Updating of the Safety Case during the installations life-cycle through to decommissioning also reduces the risk of major accidents. Cullen alluded to the Safety Case being for the Operator to "*demonstrate this to the regulatory body*", but the authors of the paper argue that the world has moved on since 1992 and a document such as the Safety Case should be accessible by not only the regulator but a wider group of stakeholders including the workforce. Perhaps a document which is 800 to 1,000 pages long cannot target both of these audiences.

A potential solution to this conundrum could be that two documents are required, a full compliant Safety Case which satisfies the needs of the regulator that goes to the regulator (and anyone else connected with the installation who is interested) and a Safety Case 'Light' version which is more generally available and accessible to the non-specialist and the workforce. The 'Light' version would need careful consideration as the presentation of the information is as key to the documents usability as the information which goes into it.

A question that is often asked concerns the length of the Safety Case document. Does a Safety Case have to be as long as it is, and does it have the correct level of detail? In the UK, it is required that the document should be self-contained i.e. should contain all the information that the reader needs in order to assess whether the regulations are being met. This appears to be a questionable approach to take these days where nearly all information related to the design, operation and maintenance throughout the lifecycle of the installation is stored on searchable computer databases.

The process for approving a Safety Case for an installation involves its detailed review against the regulations by Technical Specialists in a variety of areas ranging from control and instrumentation through to Human Factors. It should be noted that once a Safety Case is accepted or approved it is accepted for the life of the installation. From the moment of acceptance, the Regulator can only comment on material changes and where the Operator is not compliant with their own Safety Case.

Why do you need a document which has to cater for all the technical specialists in great detail, when the specialists could be pointed to relevant information within a database? The self-contained approach means that the Safety Case must be written for the Technical Specialist, with each specialist requiring a level of detail suitable for their own specialism. This is illustrated by the proliferation of the Topic Specialist Guidance that is published on the OSDR website http://www.hse.gov.uk/osdr/safety-cases/safety-case-topic-specialist-assessment.htm as follows:

- Initial Review Template - production and non-production Safety Case
- Initial Review Template – non-production installation to be converted Safety Case
- Safety Case Diving Assessment Template
- Safety Case ECI Assessment Template
- Safety Case Emergency Response Assessment Template
- Environmental Information Assessment Template – Safety Case – Revised March 2016
- Environmental Operational Control Assessment Template Safety Case
- Fire, Explosion, & Risk Assessment (FERA) full topic assessment template (FTAT)
- PMTech12 - Fire, Explosion and Risk Assessment Safety Case Assessment Topic Guidance, version 2
- Management Systems and Verification Assessment Template
- Maritime Integrity

- Safety Case Materials and Corrosion Assessment Template
- Safety Case Mechanical Assessment Template
- Safety Case Occupational Health Assessment Template
- Pipelines
- Process Integrity
- Safety Case Structural Integrity Assessment Template
- Wells – Production Installations
- Wells – Non-Production Installations

The following examples help to illustrate why this "self-contained" approach inevitably leads to a growth in the Safety Case document and makes it less useful to the non-technical specialist.

The Process Integrity Specialist might be interested in the overpressure protection systems on an installation. How much detail of these systems should be included?

1. Details of process HAZIDS?
2. Details of process HAZOPS?
3. The nature and types of electronic overprotection system?
4. The nature and types of the relief valves?
5. The setpoints for the alarms of the overpressure protection system?
6. The setpoints for the trips on the overpressure protection system?
7. Specifying the reason for choosing one or more relief valves on a pressure vessel?
8. Specifying the controls in place for taking a relief valve offline for certification?
9. The orifice size and calculation for the relief valves to show that the relief valve is adequately sized?
10. The vent calculation to show that the vent system is sized correctly and the back pressure is acceptable?
11. The temperature drop that will occur when the relief valve lifts to show that design temperatures are not exceeded?
12. The piping and instrument (P&ID) of the system and its overpressure protections system?

All of the above is reasonable information but how much is required in a Safety Case? The question is how much detail is sufficient for demonstration to the Regulator or any other interested party that the installations risks have been identified and reduced to as low a reasonably practicable. Similarly, the Electrical Technical Specialist may be interested in:

- Details of the load analysis undertaken for the installation's electrical systems
- Details of discrimination/protection studies have been carried out to confirm the suitability of the electrical distribution arrangements and how the setting for electrical protection devices have been determined
- Details of the protection fitted to the main, auxiliary, standby and emergency generators
- Single line diagram of the electrical distribution system for the installation

Again, the issue is not whether this sort of information is important, it is whether the information within the context of a Safety Case is useful. If the Safety Case is solely for the Regulator then it is a compliance issue and the information needs to be included because it is of interest to the Technical Specialists and/or is a requirement of a relevant statutory provision. But it can be reasonably argued that much of the information of interest to specialists does not add value to the wider group of stakeholders in the context of major accident hazards.

Another concern that can arise is whether all the requirements of the relevant statutory provisions are useful to include in a Safety Case. A case in point is Schedule 1 of DCR. This schedule requires information to be provided on:

- Room temperature
- Floors, walls and ceilings of rooms
- Transparent or translucent surfaces
- Roofs (access)
- Natural and artificial lighting
- Windows and skylights
- Doors and gates
- Traffic routes
- Room dimensions and air space in rooms— freedom of movement in the workstation
- Rest rooms
- Outdoor workplaces
- Pregnant women and nursing mothers
- People with disabilities
- Sanitary facilities

- Showers and washing facilities
- Lavatories and washbasins

While this information is important does it belong in a Safety Case?

Surely it would be more useful for the Safety Case to be a focused document rather than a "catch-all" document. It would be beneficial if issues such as DCR Schedule 1 could be moved out of the Safety Case and addressed in a more appropriate document. Such an approach would enable the Safety Case to be slimmed down and focused. This approach would mean that one document can serve the differing requirements of different readers. Clearly a balance needs to be achieved between the detail that goes in the Safety Case and the ability to reference to additional documentation which is held separately to the Safety Case. Enabling third parties to have access to a wider document base other than the core "Safety Case" could be arranged, given the suitable application of information technology.

Safety and Environmental Management System (SEMS)

In the Cullen inquiry report Lord Cullen recommends that the Safety Case should "*demonstrate that the safety management system of the company and the installation are adequate to ensure that the design and operation of the installation and its equipment are safe. The safety management system of the company should set out the safety objectives, the system by which those objectives are achieved, the performance standards which are to be met and the means by which adherence to those standards are to be monitored*." He goes on to recommend that "*the operator should be required to satisfy itself by means of regular audits that its SMS is being adhered to. The regulatory body should be required regularly to review the operator's audit on a selective basis; and itself to carry out such further audit as it thinks fit; and by regular inspection verify that the output of the SMS is satisfactory*".

This appears to imply Safety Cases should simply state what the objects of the SEMS are and the means by which these objectives are achieved. It could be argued that this requirement could be met by the Corporate Major Accident Prevention Policy (CMAPP) together with a brief summary of the SEMS. However recent Safety Cases have SEMS which are well over 100 pages long and which contain a significant amount of detail for individual aspects of the SEMS in order to demonstrate compliance.

As another example, the information on the well examination scheme typically includes the following:

- A description of the verification process for the well design, construction, maintenance and repair and condition that, so far as reasonably practicable, there can be no unplanned escape of fluids and the risks to the health and safety of persons from it or anything in it, or in strata to which it is connected are ALARP.
- A description that states or confirms that the examination of information required under regulation on the design and construction of the well and the sub-surface environment, including the geological strata and formations, the fluids within them and any hazards which the strata and formations may contain.
- A description of the well examination process and arrangement in place for the examination of wells. This should include the examination during the design (well notification / activity program), construction phase (work in progress), and production phase. A flow diagram might be required as part of the description.
- A description of the arrangements for carrying out remedial action by the Operator.
- A description of the arrangements for reporting any instances of non-compliance of the Well Operator with the standards of the Well Examination scheme.
- A description that states or provides information about the review of the scheme. This should include the frequency and circumstances that will trigger a review of the scheme.

Regulation 11 of the 2015 Safety Case Regulations however states "*The Well Operator must establish a scheme (a "well examination scheme")*", (The National Archives, 2018). It does not appear to state that the scheme needs to be described in all its detail in the Safety Case. Indeed, it could be argued that for the Well Examination and the SECE Verification schemes a better approach would be one in which the Safety Case points to the schemes themselves, as it is the implementation of these schemes that independent third parties will be auditing.

How to improve Safety Cases

As described above, Safety Cases have, on occasion, become long winded documents which serve only as a compliance document for the Regulator and which, once it has achieved this purpose, appears to be of limited value to the personnel who work on the installation, i.e. the Safety Case sits on the proverbial shelf and has little operational relevance. However, the authors of this paper believe this is exactly the opposite of the purpose of the document and was not the intention of Lord Cullen. The document should be useful not only to the regulator and independent verifiers but also to the wider stakeholders throughout the lifecycle of the installation.

How could this objective be achieved? One approach would be to have a standardised Safety Case format such as produced by IADC with their HSE Case Guidelines. However, the authors believe that a standardised Safety Case is the wrong approach since completing an HSE Case based a pre-defined template has the potential to become a tick box exercise. The Safety Case should be

focused on Major Accident Hazards and Major Environmental Incidents. We suggest to achieve this the Safety and Environmental Critical Elements (SECEs) should be the core of the document. The Safety Case will only include the following information:

- the process by which the MAH, MEI and SECEs were identified
- the performance requirements of the SECEs
- how the performance standards were established
- how the performance standard is maintained and verified throughout the lifecycle of the installation.

We suggest that to achieve this a number of issues would need to be tackled in parallel.

1) Discussion over the relevant statutory provisions that must be addressed in the Safety Case and those that can be addressed in supplementary and supporting documents such as OPEPs, MAPDs, CMAPPs and perhaps new documents not yet defined.
2) Reaffirmation that the Safety Case should be clearly focused on MAHs and MEIs.
3) The structure of the Safety Case should be such that it addresses:
    - MAH and MEI identified through a defined risk identification and assessment process
    - SECEs for these MAHs and MEIs identified and defined through a defined process
    - The development and implementation of Performance Standards specifying Functionality, Availability, Reliability, Survivability, and Interconnectivity of the SECEs described through a defined process
    - Verification that the Performance Standards are met through a defined process. Where they are not met a defined verified process exists for returning the installation to the required status.
    - A high-level description of the management system process which enable the above to occur within the organisation and installation throughout the installation lifecycle.
4) Direct repetition of documents held within the corporate management system and SEMS should not be required. Instead the Safety Case should be able to link to these other documents with a suitable summary provided in the document.
5) The ability for the SEMS to reflect the company's system rather than the idealised process of the Plan, Do Check Act system, i.e. the management system should be that used by the workforce and not that described to meet the needs of the assessment templates.

With this approach Operators would still need to meet the requirement of the regulations, the regime would remain a goal setting regime, needing less prescription than currently exists and would make the Safety Case a useful document.

Could Information Technology provide a Solution?

The updating and management of Safety Cases has long been a point of inefficiency for operators and limits its usefulness for facility personnel. Over recent years information technology has advanced and its capability increased. Another approach for making Safety Cases more useful and easier to maintain could be to do away with the traditional PDF/word document Safety Case and use a Safety Case Management software / online system to present Safety Cases. Safety Case and document management software such as iSafetyCase, GSN, DocuNet and ASCE could help to bring safety cases back to being useful for the regulator and the operator as they have the ability to:

- Provide an integrated, interactive platform bringing the Safety Case to life and help make safety cases living documents.
- Be interactive with graphics and easily link information together including bowties and performance standards, making Safety Cases more accessible and appealing to the workforce whilst still retaining the information required by the regulator.
- Offer customisable views of the Safety Case depending on filters applied allowing the user to easily access the most relevant information to them and apply it to their daily operations.
- Offer an easier more efficient way to update Safety Cases, with the ability to receive comments and annotations from the workforce and update the Safety Case accordingly via a controlled process.
- Integrate with operational systems and processes and provide links to associated documents providing more information, allowing the main body of the Safety Case to focus on the major accident hazards and major environmental incidents.
- Incorporate training modules to accelerate learning for a changing workforce.

- Create PDF copies of any or all parts of the Safety Case as needed.

Although software / online systems would allow for easy access and viewing of supporting material and enable rapid and efficient 'roll out' to staff, the information presented within a Safety Case would still need to be refined to ensure these documents remain useful.

Conclusion

In this short paper, the authors are not suggesting that the current Safety Case regime should be scrapped. Rather we propose that the regime needs to re-focus and be reinvigorated. The focus should ruthlessly be on MAHs and MEIs and not be side-tracked by some of the statutory provisions that address wider HSE issues, not strictly relevant to MAHs and MEIs. We believe that this can achieve a slimmer, simpler Safety Case, providing a more useful document that addresses regulatory requirements and the needs of the workforce during the lifecycle of offshore oil and gas installations. However, this requires the Safety Case to be developed and take advantage of modern information technology solutions for presenting complex information. Our proposed approach is that the Safety Case becomes a central hub of information with explicit links to secondary information sources. Without a change of approach, the Safety Case will remain on the shelf unused and unread by most of the workforce, a document purely for the specialist.

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