Offshore Caring - Safety Management

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ABSTRACT

The paper is concerned with integrating the management of caring and safety in an offshore project in order that a pro-active method would be available. It is aimed at minimising any adverse effects of the project activities on the environment. After introducing the background, a brief review of safety management is performed before examining the influences of major disasters. Major disasters relating to Piper Alpha and Deepwater Horizon are discussed. Treatments of environmental impact are considered before proposing the Offshore Caring-Safety Management (OCSM) approach. The main conclusion is that pro-active attitude will assist in caring the environment and be safer while minimising reactive thinking.

Keywords: *Caring and safety management, hazard, risk, offshore*

1. INTRODUCTION

In the early days of offshore hydrocarbon exploration and exploitation, the safety of offshore instillations was addressed by following the experience ship safety approach. This is not surprising as searching and producing of oil was taking a new step in going from onshore operations to working in the waters. In practice, this was not a direct adaptation as there were some key differences, such as ships float and used mainly for transportation while offshore instillations were attached to the ground and did work. As offshore hydrocarbon activities progressed from shallow waters to deep waters , the drilling and production were being done by “rigs” under the names of jack ups, semi submersibles and FPSO (Floating Production Storage Offloading) vessels, see for example Rendal (2010). Little attention was paid to the adverse effects of these activities. The paper will highlight treatment of ship safety, influence of offshore disasters, consider how environmental impact is being tackled and examine possible approaches before proposing the Offshore Caring -Safety Management (OCSM) approach for offshore application.

2. HIGHLIGHT OF SHIP SAFETY MANAGEMENT

The treatment of ship safety is based on evolutionary approach which makes minor changes to existing regulations using the lessons learnt from failures or accidents which have occurred in practical operations. Once the failure information is examined and analysed, the recommended agreed decisions would be responded by the relevant authorities and the practical implementation is achieved using fresh prescriptive regulations. It should be noted that this regulatory approach assumes that safety is absolute and this is a fundamental weakness which will be discussed later.

Significant changes have been made in ship safety when major disasters occurred and most influential ones include:

• Sinking of passenger ship Titanic, leading to SOLAS (Safety Of Life At Sea) regulations, IMO (2004).

• Capsizing of Ro Ro ferry the Herald of Free Enterprise, DTp (1987)

• Grounding of Exxon Vadis in Alaska leading to OPA 90 (Oil Pollution Act) which require tankers to have double hull if the operators plan to ship oil into USA, US Coast Guard (1990).

In the light of these disasters, many research studies have been performed by operators, classification societies, industry and academics. The more important maritime ones involve greater use of risk based methods, Vassalos (2009), Formal Safety Assessment (FSA), IMO (1996) and Goal Based Standard (GBS), IMO (2004). These methods are focused on ship safety and have had little direct influence on offshore oil and gas operations.

In recent years great attention is being paid to safety management that is putting greater emphasis on management, see Kuo (1998) for details on various aspects of maritime safety management.

3. APPROACH TO OFFSHORE SAFETY

In the early days of offshore hydrocarbon exploration and exploitation, the safety of offshore instillations was addressed by following the experience ship safety approach. This is not surprising as searching and producing of oil was taking a new step in going from onshore operations to working in the waters. In practice, this was not a direct adaptation as there were some key differences, such as ships float and used mainly for transportation while offshore instillations were attached to the ground and did work. As offshore hydrocarbon activities progressed from shallow waters to deep waters, the drilling and production were being done by Mobile Offshore Drilling Unit (MODU) that include semi - submersibles and later FPSOs.

Deficiencies were noted in applying ship approach but no significant changes made until the explosion of jacket structure Piper Alpha in the North Sea in 1988, HSE (1990). More recently explosion and fire of semi-submersible Deepwater Horizon and followed by oil spillage from the Macondo well in the Gulf of Mexico in 2010, US Coast Guard (2012). Further discussion of their impact will be summarised in the next two sections.

4. IMPACT OF PIPER ALPHA DISASTER IN 1988

In spite of incompatibilities the adapted ship safety approach it was continued to be used with minor modifications. It was only the major disaster of Piper Alpha in the North Sea and subsequent Public Inquiry of Lord Cullen that enabled the introduction of alternative approach, see HSE (1992). The Cullen report made 106 recommendations and the most significant being the approach based on the goal setting concept which is applied in other industries such as nuclear power industry. The offshore hydrocarbon industry adopted the name safety case approach. The principal aim was to make the operator think about safety and share responsibility for safety. In the practical implementation of the safety case approach, the operator defines the safety goal to be achieved and how the goal will be met to a national authority, in the UK it is Health and Safety Executive (HSE). HSE accepts the safety case but do not give its approval. To verify the operator is doing what has been written in the report, the HSE inspectors will make regular inspection visits and they can stop the instillation's production if they find the operators are not doing what has been given in the submitted report.

The most significant outcomes of using the safety case approach have been to change the operator's safety attitude and culture and have

great responsibility. Although the safety case approach has been in existence for nearly 27 years there is scope for improvement when the environmental impact is taken into account.

5. EFFECT OF DEEPWATER HORIZON DISASTER IN 2010

The Deepwater Horizon was a MODU working in the Macondo field off the coast of Louisiana in the Gulf of Mexico. The operator was BP and the main contractors were Transocean and Halliburton who had various responsibilities. The former owned and operated the MODU and the latter on drilling activities.

There was a blow out at the wellhead and the equipment known as BOP (Blow Out Preventer) did not stop the surging oil and gas. A major explosion and fire occurred on Deepwater Horizon in April 2010 leading to death to 11 of 126 people working on board. Oil was spilling into ocean to a record quantity until July 2010 before the well was re-capped.

Figure.1 Explosion and fire of Deepwater Horizon

The effect of the explosion and oil spillage shock the oil and gas industry as well as the nation. As oil spillage continued, event was on top of America's media agenda and a number of committees were set up or re-organised to investigate this incident, a key one is given by National Commission (2012). A good discussion of the event can be found in the book by Sutton (2014). The outcome of the major oil spillage is more regulations that require the operators to implement a SEMS (Safety and Environmental Management System) program, see Sutton (2014) for a summary of key steps involved.

There are many reasons for this failure and the main reason is understood to be the failures of the management in the wider sense. These range from pressure to minimise cost though ineffective communication arrangement to sound decision making.

6. ADDRESSING OFFSHORE ENVIRONMENTAL IMPACT

The methods of addressing environmental impact are at present based on prescriptive regulatory principle and the level of their implementation depend on the countries having the rights to the continental shelves There are two popular methods used in both the maritime and offshore industries. One method focuses on controlling pollution and discharges by regulations. The other covers broader scope and comes under the name of Environmental Impact Assessment (EIA). These will now be briefly considered

a) Pollution related regulations

Similar to the use of prescriptive regulations to address safety, there are now well- established prescriptive regulations for dealing with pollution. The high profile ones are concerned with oil pollution caused by crude oil tankers, e.g. MARPOL, IMO (2006) and Oil Pollution Act 1990, OPA 90 (1990) and US Coast Guard (1990). There are also regulations concerned with other types of pollution, e.g. discharges into the atmosphere. In the offshore hydrocarbon activities, for example, there are regulations associated with disposal of drilling cuttings, flair of gas and decommissioning of offshore installations.

The merits and drawbacks concerning the use of these regulations for addressing environmental impact are basically the same as those outlined for safety. The exception is that there are more maritime safety experience and data than what are available to address offshore environmental impacts. This in turn can be difficult in devising balanced EI regulations.

b) EIA and its usage

With growing interest in environmental issues in the past four decades and recognition that all development activities need to achieve sustainability, fresh legislations have been formulated in attempt to reach a proper balance between industrial developments and their effects on the environment. The outcome has been that large projects have to perform an EIA, e.g. a new building and how it will affect the environment.

An EIA assesses the possible positive or negative impacts a proposed project may have on the environment that include physical, social and economic effects. The EIA use is particularly valuable to decision makers regarding the viability of the project. The EIA process can be represented by a flow diagram with blocks such as project background, identifying key impacts, evaluating their significance, consulting the public, communicating findings in the form of environmental statements and decision making. There has been extensive work in EIA and further information can be found for examples in Therivel & Morris (2009) and Glasson et al (2009).

For oil and gas activities in the UKCS, DECC (2014) gives information including a concise summary on the EIA legislations, guidance on how to meet the requirements and the aspects needing interaction with the UK Department of Energy and Climate Change (DECC). In general it is DECC which considers environmental impact and when safety issues arise, the UK Health and Safety Executive would be involved.

7. POSSIBLE OPTIONS FORWARD

Main possible options forward for integrating offshore environmental impact with safety management include:

a) Introducing more stringent regulations

Since prescriptive regulatory approach has played a very important role and it is continuingly being applied, the authorities can introduce more stringent regulations to control the EI of offshore hydrocarbon activities. The key merit of this option is that it can show to the public that “something has been firmly done”. The main drawback is that EI, like safety, is not an absolute entity. It is most unlikely that this option would not be fully effective. In addition all weaknesses of prescriptive regulatory approach would be present, see Kuo (2007).

b) Performing an EIA

Introduce EIA to offshore hydrocarbon activities would enable many aspects of environmental impact to be examined more fully. The key merits include: EI would receive full attention at an early stage and effort to minimise its effects could be incorporated; the process would assist in educating everyone on how EI can be treated. The main drawback is that existing EIA covers a huge number of factors ranging from economic and political to social and culture that technological aspects receive limited attention. For this reason EIA, in the existing form, may be too “global” for interface with safety management and this in turn leads to the danger for EI and safety management being treated separately. Other drawbacks include: difficulties in obtaining reliable input data for the assessment, time needed to do an EIA for an offshore activity and the need to train more people in applying EIA methodology from an engineering stand point.

c) Preparing an environmental impact case

The safety management of offshore installations in UKCS has evolved from implementing prescriptive regulatory approach to using safety case concept, and it is possible to ask the operators to prepare an Environmental Impact Case in a similar way to a safety case.

The main merit is that environmental impact would be given focused attention like safety and this ensures that the various critical issues are examined more closely and in greater depth. This is turn would increase greater awareness of potential adverse effects of specific operations on the offshore environment. The main drawback is the danger that safety management and EI could go by different routes due to many different angles the issues can be addressed and this is undesirable as it is only when they are considered together that the true benefits can be achieved. Other drawbacks include: duplication of effort and conflict between the two entities.

8. WHICH WAY FORWARD?

It can be seen from the previous section that all the options have merits and drawbacks. For these reasons, none of three methods, in the present form, would justify the development efforts in integrating environment impact with safety management. Furthermore, to reduce environmental impact tends to be a responsive mind set.

For an approach that can take into account the integration of safety management and impact on the offshore environment, there is a need to explore fresh and innovative treatments. In addition, the successful approach must meet, as best as possible, the following criteria:

- Be pro-active in addressing offshore environment
- Can take into account non-absolute nature of safety and caring
- The role of human action, attitude, behaviour must be transparent
- Able to integrate caring management and safety management
- Would be usable in practical situations

9. PROPOSING AN OCSM APPROACH

The approach is called Offshore Caring - Safety Management (OSCM) and it is developed from the use the Generic Management System Circuit (GMSC) unit to generate a standard safety case, Kuo (2007). The basic GMSC unit is made up of two principal parts as shown in Figure 2. One is a common management system circuit and the other is a specific process scheme. present form, would justify the development efforts in integrating environment impact with safety management. Furthermore, to reduce environmental impact tends to be a responsive mind set.

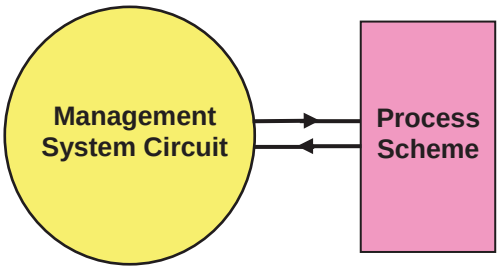

Figure 2 Basic unit of Generic Management System Circuit (GSMC)

The management system circuit has five elements. It begins by defining the goals and performance criteria before organising resources and activities to ensure the goals can be met. The process scheme is then implemented. The results obtained are measured against the performance criteria before reviewing the feedback and lessons learnt as well as documenting the experience gained. These five elements are placed on a revolving circuit so as to ensure improvement is continuous and iteration is introduced via feedback from the review element to the define element.

The process scheme can take any form depending on the situation in question. For the caring- safety management method the two schemes are caring and safety, see Figure 3.

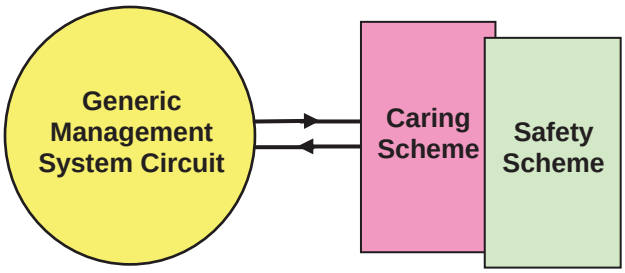

Figure 3 GMSC with caring and safety schemes

The scheme has four main steps of: identifying hazards, assess the risk level of the hazards, reduce the intolerable risk levels of hazards and prepare for emergencies. The resulting arrangement for GMSC for safety and environmental impact is shown in Figure 4.

The next section highlights how caring is integrated with safety management.

- Define the goals for caring and safety.
- Define a set of performance criteria that involve technological and human factors

Element 2: ORGANISE

A number of activities are involved and include for example

- Planning and scheduling of activities
- Identify sources of information

Element 3: IMPLEMENT

This element is concerned with the implementation of the caring-safety scheme. This scheme involves identify options, opportunities and hazards. Their risk levels are then assessed and reduced as appropriate. This is followed by preparing for special situations and generation of results.

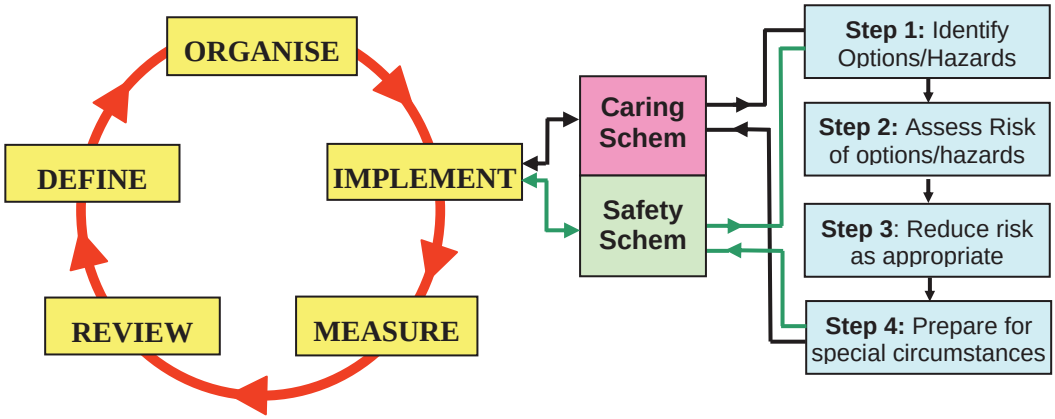

Figure 4 Sketch showing GMSC for caring – safety schemes

10. INTEGRATING CARING AND SAFETY MANAGEMENT

There are five main elements in the GMSC

Element 1: DEFINE

There are two tasks to be performed in this element.

Element 4: MEASURE

The results obtained should be measured against the performance criteria defined in Element 1.

Element 5: REVIEW

Following from the previous elements the review would cover analysis of the lessons learnt, exploring scope for improvement and

benchmarking. On completion of review information would be feedback to Element 1 for further iteration if required.

A mind map for OCSM approach is given in Figure 5.

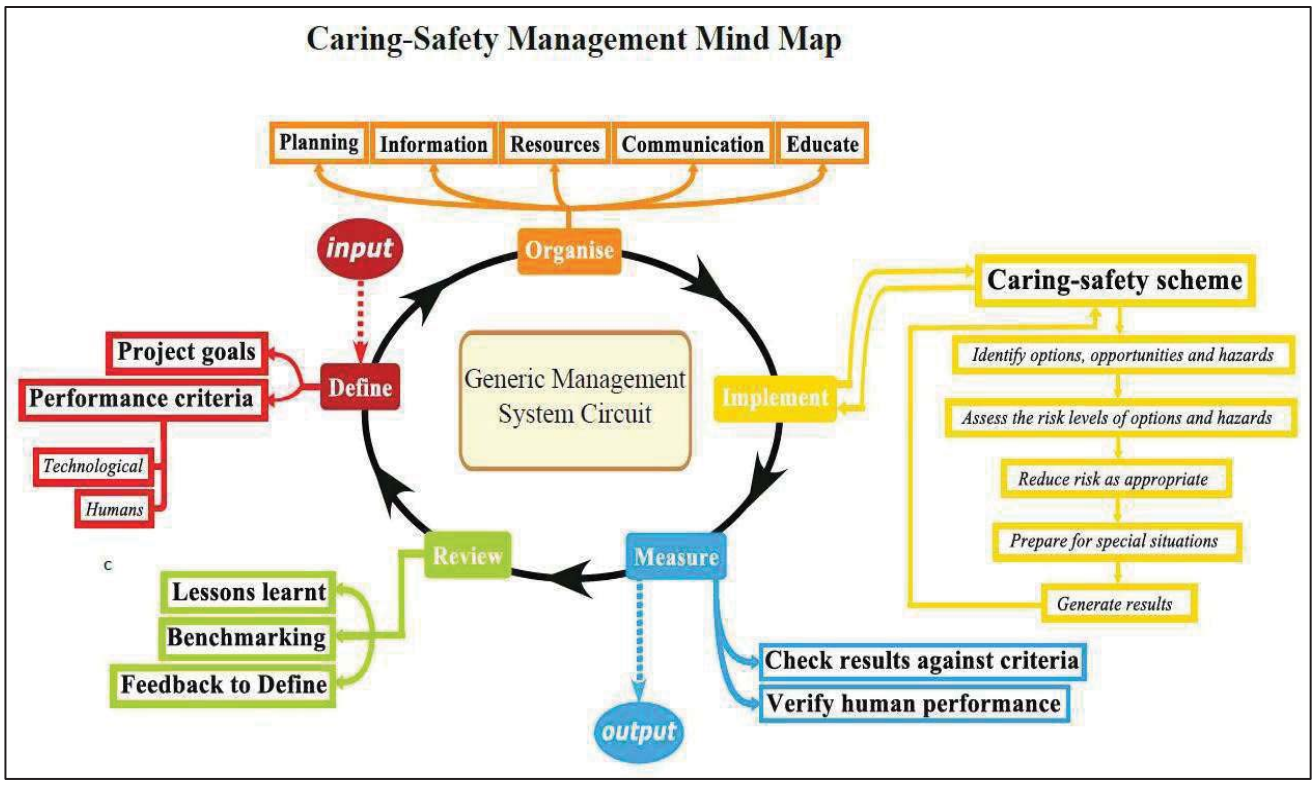

Figure.5 A mind map of an Offshore Caring-Safety Management approach

11. DISCUSSION

The following items deserve brief discussion.

- Integrating caring and safety

Safety is generally treated as a single entity and with demands to prevent pollution from offshore operations the efforts are devoted to minimising environmental impact. This means a responsive attitude is adopted. There is a need to change the way we think by integrating caring with safety. Caring is a pro-active response. There a number of ways in achieving the integration and this can be done through a combined caring and safety management approach. Caring task can be implemented at concept and initial design phases of a product's life cycle. This would lead to savings in time and costs.

- The roles of education and training

When a new procedure or working practice is being introduced in many activities it is quite common to hear people express opinions like: "We need to give the staff or team training". The word education is never mentioned. One would question why this is the case? There are many reasons and some examples include: They associate training with doing something practical; they think education is going to school, college or university; they have given little thought about the roles of education and training. Education and training have many similarities but also differences. A key difference is on the emphasis. Education focuses on achieving competence and involves developing and changing attitudes and behaviours of those concerned. Training

concentrates on improving a person's efficiency in doing a specific tasks, see Kuo (1998).

In practice, education and training go together. E & T has a dual role of generating a positive safety culture & enhancing capability. Indeed, training alone has several serious weaknesses. The key ones include: no insight into the task being trained to do; lack of ability to correct minor deviation from routine.

12. CONCLUSIONS

There are three main conclusions to be draw:

Firstly, caring and safety are non- absolute entities in that there are no right or wrong answer to a situation so long as the goals are met and a generic management system is needed to ensure consistent and effective solutions are obtained in its usage.

Secondly, there is a tendency to put emphasis on reducing environment impact which is a responsive approach and it would be better to use a pro-active approach via integrating caring management with safety management.

Thirdly, successful practical application of technological advances require the active support of a positive caring and safety culture coupled continuing focused efforts in education and training.

13. ACKNOWLEDGEMENTS

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14. REFERENCE

DECC, 2014, "Environmental legislation", Website of UK Department of Energy and Climate Change.

DTp, 1987, "MV Herald of Free Enterprise- Fatal Accident Investigation (The Sheen report).", HMSO Report of Court No.8074, UK Department of Transport.

Glasson, J, et all, 2009, "Introduction to environmental impact assessment", SPON Press, London, 1999

HSE, 1990, "The Public Inquiry into the Piper Alpha disaster (The Cullen report)", HSMO Cm1310.

HSE, 1992, "A Guide to Offshore Installation (Safety Case) Regulations", UK Health and Safety Executive, HMSO, L30. 110E. ISBN: 9-280141-83-X.

IMO, 1995, "Formal Safety Assessment (FSA)" Submitted by the UK Government to the 65th Session of IMO's Maritime Safety Committee, Agenda Item24.

IMO, 2006, "MARPOL (Marine Pollution regulations)",International Maritime Organisation Publication IC520C. ISBN: 9-280142-16-X 200.

IMO, 2004, "Goal based standards (GBS)". Submitted by the IMO council (89) to the 79th Session of IMO's Maritime Safety Committee.

IMO, 2004, "SOLAS (Safety Of Life At Sea)" International Maritime Organisation Publication ID 1110E, ISBN: 9-280141-83-X.

Kuo, C 1998 "Managing ship safety", LLP Ltd, ISBN: 1 85978 841 6.

Kuo, C, 2007, "Safety management and its maritime application", The Nautical Institute, ISBN: 1 870077 83 0.

National commission, 2011, "National commission on BP Deepwater Horizon oil spill and offshore drilling", Report for President.

Randall, R, 2010, "Elements of Ocean engineering", SNAME publication, ISBN: 978-0-939773-77-0.

Sutton, I, 2014, "Offshore safety management", Elsevier 2014, ISBN: 978-0-323-26206-4.

Therivel, R & Morris, P, 2009, "Methods of environmental impact assessment", Routledge-Taylor & Francis Group, London.

US Coast Guard, 1990, "Oil Pollution Act 90", US Coast Guard, Washington DC.

Vassalos, D, 2009, "Risk-based ship design", Springer 2009. ISBN: 978-3-540-89041-6.