OFFSHORE SAFETY MANAGEMENT
CHAPTER 7

1st Edition

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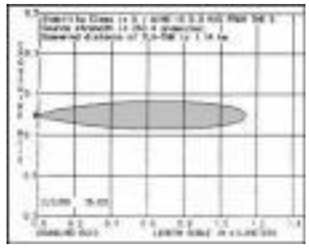

INTRODUCTION

The previous chapter to do with Safety Cases referred to the importance of Formal Safety Assessments (FSA). An FSA is a technical assessment carried out to determine the likelihood and impact of high consequence events and to help develop corrective actions. Most FSA work is done during the design of an offshore facility because that is the time when major changes to equipment design and layout can be made without having to carry out expensive retro-fit work.

This chapter provides some more information and guidance to do with a typical FSA. It must be stressed that what is provided here is only an overview of the elements of a Formal Safety Assessment. Whole books — often very large books — have been written on each of the topics that make up an FSA.

The International Maritime Organization (IMO 2002) identifies the following five stages in the development of an FSA.

1. Identification of hazards (a list of all relevant accident scenarios with potential causes and outcomes);
2. Assessment of risks;
3. Identification of control options;
4. Cost benefit assessment for each risk control option; and
5. Recommendations for decision-making.

Further guidance is provided in ISO 31010: Risk Management - Risk Assessment Techniques (ISO 2009).

An FSA should,

- Show that all pertinent regulations and standards have been addressed.
- Demonstrate that all reasonably practicable steps have been taken to ensure the safety of employees in the event of an emergency and during their transit to a place of safety. It should demonstrate in particular that the integrity of the temporary refuge, escape and evacuation routes is maintained in the case of a major accident event, and that all reasonably practicable steps have been taken to ensure the safety of employees in the event of an emergency and during transit to a place of safety.
- Both qualitative and quantitative methods of analysis can be applied to the assessment of risk.
- It should identify the technical and other control measures that are necessary to reduce that risk to a level that is as low as reasonably practicable.
- Show that performance standards have been established.
- Show that performance is measured against those performance standards as part of the company's inspection, maintenance and safety management systems.
- That there is periodic review of the FSA process by which the performance standards were established and maintained, including checks that the right things are being measured.

PHILOSOPHIES

Although not part of the formal FSA structure, it is good practice to write technical and management philosophies at the start of a project. Philosophies can be written for each design or operational activity such as material handling, blowdown and the preparation of drilling programs. A philosophy will generally consider issues such as:

- The physical scope of work and boundary conditions for the project and the FSA. For example, the work may be confined to just the facility's topsides, with subsea engineering being excluded.
- The standards and codes to be followed. They can be internal to the company or from an outside organization such as the API. The philosophy should also identify pertinent rules and regulations from bodies such as BOEMRE, the Coast Guard and the EPA.
- The modeling techniques to be used.

Table 7.1 provides an example of a high level Technical and Process Safety Philosophy.

Table 7.1
Technical and Process Safety Philosophy

This philosophy outlines the general requirements to prevent personal injury or loss of life and to protect the facility from fire, explosion and process hazards. Prevention of personal injury or loss of life, physical damage to property, and escalation of the environmental impact shall be the primary consideration in the design and construction of the project. Design and construction of safety inherent features and protective measures shall be provided for all phases of operation. The primary philosophy is to follow the principles of inherent safety. This implies a systematic effort to apply the principles of "hazard elimination", "minimization / intensification", "hazard substitution", "moderation / attenuation" and "simplification". However, additional controls will still be required to control a hazardous situation, prevent escalation, and mitigate the risk to people, environmental, asset and reputation. Preferably, these safeguards will be passive or active engineered controls rather than administrative controls (*i.e.,* dependent on direct human intervention). Personnel are to be trained to manage operational activities with the highest regards for safe procedures and to react properly in the event of emergencies. To ensure safety of the facilities, personnel will properly inspect, maintain and test operate periodically the equipment with strict compliance to operation and safety procedures. Operation and safety procedures will be developed and continuously improved based on experience to help prevent and if not eliminate hazardous conditions. Each principal area or system will be addressed by using the Government Rules and Regulations, applicable Rules and Standards, American Codes and Standards, and API Recommended Practices. Where several controlling documents appear to apply, a risk based approach will be adopted to ensure that an equivalent level of safety is achieved.

Other philosophies, such as that to do with material handling, are likely to be much longer than what is shown in Table 7.1.

A philosophy will not generally contain detailed specification information such as the required width of access routes or the range of sea states; that type of information can be found either in the Assumptions Register, or in detailed design procedures.

Elements of an FSA

An FSA is built around a suite of technical analyses of a wide range of topics. Some of those topics are listed below and then discussed in greater detail. Other items, such as the facility's Emergency Shutdown Procedure, Health Analysis and the Blowdown Philosophy could be added to the above list.

- Assumptions Register
- Hazards Register
- Quantitative Risk Assessment (QRA)
- Facility Layout and Equipment Arrangement
- Flare and Radiation
- Material Handling Risk Assessment / Dropped Objects
- Transportation
- Fire and Gas Detection
- Gas Dispersion Analysis
- Fire and Explosion Analysis
- Escape, Evacuation and Rescue
- Non-Hydrocarbon Chemicals
- Greenhouse Gas Emissions
- Noise and Vibration
- Human Factors Engineering
- Reliability, Availability and Maintainability (RAM)

Assumptions Register

The Assumptions Register contains a list of the assumptions used to develop the Formal Safety Assessment and its matching safety case. The design philosophies already discussed will contain many of the assumptions used on projects.

The justification for the assumptions made should be provided. Generally, the justification will come from one of three sources.

1. A public report such as the *Offshore Hydrocarbon Release Statistics and Analysis, 2002* (HSE 2002) that provides information on leak and ignition frequencies.
2. An industry data base such as the *Offshore Reliability Data Handbook* (SINTEF 2009) or *The Update of Loss of Containment Data for Offshore Pipelines*.
3. The company's own internal sources of information and statistics.

Some of the topics that are typically found in the Assumptions Register are listed below.

Deck Type

The results of blast and gas dispersion analyses vary significantly depending on whether the deck is plate or grate. Therefore the assumptions made as to the type of deck to be used in various parts of the platform need to be made explicit.

Numbers of Personnel and their Locations

The Assumptions Register should specify how many people are on the platform, and where they are most likely to be located. An estimate as to peak manning loads, say during drilling, should also be provided.

Leak Size and Frequencies

The assumptions made as to the size of leaks from flanges, fittings, piping, instruments and vessels need to be documented. Similarly, an estimate as to the frequency with which leaks can occur is required. The frequency value will generally vary inversely with hole size.

Transportation Logistics

An estimate regarding the number of journeys to be made by helicopters, work boats and other forms of transportation is required. The consequence of accidents should be estimated. Assumptions to do with ship collisions (including pleasure boats that may be present) should be made clear. Factors to consider include the speeds at which collisions may occur, and whether collisions occur while boats are maneuvering or drifting.

Lifting Operations

Assumptions to do with lifting operations need to be spelled out as a basis for the Material Handling study. Issues to be itemized include:

- The types of lifting devices (monorails, platform cranes and chain hoists);
- The use of cranes on service boats (if available);
- Areas for potential dropped objects (including subsea); and
- Loading and unloading supply boats.

Guidance should be provided as to the percentage of drops that occur over the deck, over the side (into the sea), and onto a work boat.

Rescue and Recovery Operations

Assumptions as to the effectiveness of emergency response and rescue operations need to be spelled out.

MetOcean Data

The Assumptions Register should contain meteorological information, covering both normal and extreme weather conditions. The information should include:

- Mean wind speed;
- Stability class;
- Sea conditions and loop currents;
- Mean air temperature; and
- Mean humidity.

Structural Failure Time

Assumptions have to be made regarding the time it takes for steel structures to fail when they are exposed to fire. An example is provided in Table 7.2.