# Enhanced Emergency Preparedness through Cooperation between Offshore Fields and Installations

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**Abstract**

Industry guidelines for establishment of emergency preparedness cooperation have been prepared. The first examples of such cooperation are due to be implemented in mid 2001. The main purpose of such cooperation between platforms and operator companies within a geographical area is to improve the utilisation of available means of rescue and other external intervention resources. A risk based approach has been taken for the establishment of guidelines and requirements to emergency preparedness actions and systems. The risk of severe injury or serious illness has for the first time been included in such risk assessments. This has demonstrated that the need for rapid advanced medical assistance and transit to hospital is much more frequent than accidents that will require rescue of personnel in the sea, from man over board cases, helicopter ditch or emergency evacuation. With regard to accidental events, the industry has made great steps in preventive measures and they now have low statistical frequency.

## 1. Introduction

### 1.1 Background

A project was initiated in 1998, under the auspices of OLF, in order to collect and systematise experience from the use of standby vessels. The study showed that the petroleum industry spends considerable amounts of money on standby vessels. It was also shown that there were significant differences in the amount spent per company on standby vessels, calculated per offshore position. The results from of the survey led to the conclusion that there was no uniform practice. In the subsequent phase emphasis was therefore put on developing such a practice whenever feasible.

This conincided with an initiative from the Norwegian Petroleum Directorate, which expressed:

- Concern that individual initiatives by different companies could lead to unco-ordinated and uncontrolled changes in established industrial practice.
- A wish for the industry to analyse and document established practice for the use of standby vessels on the Norwegian Continental Shelf.

The working group concluded that it is natural to look for greater consistency among fields in larger areas (common infrastructure, same climate) and that there should be focus on developing uniform practice and collaboration in emergency preparedness within given geographical areas.

Two pilot projects have been conducted in parallel with the establishment of industry guidelines. The OLF project group has acted as a forum for the exchange of experience and as a means of harmonising the work of the two pilot projects. The work of the pilot projects also forms an important part of the basis for drawing up joint requirements for the establishment of emergency preparedness for the industry. The pilot studies are concerned with the following areas:

- Haltenbanken (i.e. Njord, Draugen, Åsgard, Heidrun and Norne)
- The “southern fields” (i.e. the Ekofisk area, Valhall, Ula and Gyda)

## 1.2 Purpose

The purpose of the project has been to establish a norm and guidelines for the development of area-based emergency preparedness plans. This is based on the assumption that such area-based solutions will give overall preparedness on a level at least equivalent to that afforded by current arrangements, or better.

Although mobile and normally unmanned installations were not included in the survey, mobile platforms have been incorporated in the area-based preparedness concept. They can form part of contingency plans when operating in an area where joint preparedness is already in force, based on established production activity.

Implementation of area-based emergency preparedness depends on requirements and solutions being coordinated and standardised within as well as between different areas, to an altogether greater extent than that indicated in the 1998 survey. With a view to this, considerable effort has therefore been put into standardising Defined situations of hazard and accident (DFUs) and contingency requirements, as an essential foundation for the development of area-based preparedness.

Detailed explanations for the selection of DFUs and the technical arguments for the establishment of requirements are documented separately in “Guidelines for the Establishment of Area-Based Emergency Preparedness” (OLF, 2000). The guidelines also indicate how cost sharing should be effected.

### 1.3 Limitations

Area-based emergency preparedness entails the operators of installations and/or fields in a given area entering into formal collaboration with a view to sharing emergency response resources in a delimited area, primarily those involving the use of external airborne and/or maritime resources.

Area-based emergency preparedness is thus related to contingency plans for DFUs which can be handled with the help of external airborne and/or maritime resources, in other words where response requirements allow time for “outside” mobilisation and response, in relation to the platform’s own resources.

There is one exception to this, concerning the rescue of personnel who fall into the sea during work over the sea. The proposed requirements in this case are such that external resources cannot respond promptly enough. The inclusion of this DFU is nevertheless justified by the need to establish a common industrial practice for the emergency response measures for which the installations themselves must assume responsibility, when area-based emergency preparedness comes into force.

## 2. Emergency Preparedness Requirements

### 2.1 Authorities’ Emergency Preparedness Requirements

The authorities’ mandatory requirements for emergency preparedness are set out in Section 9-2 of the Petroleum Act as well as the Emergency Preparedness regulations. These regulations will be superceeded by new regulations from 2002, but the the main principles are the same.

Current legislation calls for medical preparedness on the installation as well as support functions from the onshore emergency organisation. External assistance in the transport ashore of seriously sick and injured personnel has not been a part of normal preparedness.

The industry has taken special steps to enhance preparedness, taking into account the growing focus on, and impact of, the increasing age level of employees. It was therefore considered necessary to stipulate medical preparedness requirements in regard to external assistance, over and above the minimum requirements set by the authorities, to meet the need for transportation ashore of seriously sick and injured personnel.

### 2.2 The Industry’s Interpretation of the Requirements for an Adequate Level of Safety

The following interpretation forms the point of departure for the current work on area-based emergency preparedness:

- In any safety evaluation, analysed risk is an important parameter. The risk concept has two dimensions, probability and consequence. In the choice of factors for achieving an adequate level of safety, emphasis may be put on measures designed to reduce both probability and consequence.

- Perceived risk must also be taken into account as far as possible. In cases where analysed risk and experienced risk give contrary conclusions, analysed risk should be critically assessed to ensure that the analysis is representative for all aspects. If the analysis is found to be sufficiently comprehensive, analysed risk should be given the greatest weight.
- Other regulations indicate that probability-reducing measures should be prioritised when possible.
- If the probability of accidents has been significantly reduced, this may show that an adequate level of safety is achievable even though the scope of preparedness is reduced.

During the last 15-20 years, the industry has invested considerable effort in reducing the probability of accidents and incidents through technical, organisational and operational measures. In current regulations there is clear prioritisation of measures:

1st priority: Measures designed to reduce the probability of accidental events

2nd priority: Measures designed to reduce the potential consequences of accidental events

By way of example we can compare the frequency of man overboard accidents, where the Phase 1 (OLF, 1999) report gives the following comparable values:

- Average number of MOB accidents in the period 1975-82: 3 accidents a year
- Average number of MOB accidents in the period 1989-98: fewer than 1 accident a year

In addition, 4 cases of emergency evacuation from installation to sea have taken place on the Norwegian Continental Shelf (since 1970), distributed in time as shown below:

- 3 cases in the period 1975-80
- 1 case in 1986

Similar trends can be shown for most of the relevant DFUs, with two exceptions; ships on a collision course and medical evacuation of personnel to onshore. In both cases reporting and data collection are inadequate, so that there is no satisfactory basis for indicating trends. For these two DFUs, moreover, the petroleum industry has little opportunity of influencing the probability of accidents or illness.

As a result of the emphasis on preventive safety, the industry believes that the authorities' requirements for responsible activity and an acceptable level of overall safety have been satisfied through the contingency measures proposed as solutions for area-based preparedness.

## 2.3 Defined Situations of Hazard and Accident

Norms and Guidelines for Area-Based Emergency Preparedness cover the DFUs incorporated in area preparedness. This means that those DFUs with platform-internal causes, e.g. emergency evacuation, will only be treated as DFUs in relation to the need for external resources. Purely internal DFUs, e.g. gas leaks, are not considered at all. Events to be considered as potential DFUs are set out below:

1. Man overboard during work over sea
2. Personnel in the sea as a result of helicopter accident
3. Personnel in the sea during emergency evacuation
4. Risk of collision
5. Critical oil spill
6. Fire requiring external assistance
7. Emergency medical case requiring external assistance

The DFUs are applicable to production installations, mobile installations and normally unmanned installations.

## 2.4 Accident Frequency, General Overview

This section summarises the frequencies of relevant hazard and accident situations in order to illustrate relative frequency of occurrence. In these calculations, values from the period 1989-99 have mainly been used. For those accidental events with low frequency (0.1 per year and lower), mainly emergency evacuation, we have drawn on experience data from a longer period. This frequency should be considered an upper limit.

Figure 1 presents the annual frequencies of accidental events and hazard situations, based exclusively on historical experience data on events.

The values refer to DFU occurrence frequencies and therefore has no direct relation to risk of death or injury. For example, only 1 of the 7 cases of man overboard resulted in a fatality. The occurrence of different DFUs may be characterised as follows:

- There is about 1 man overboard event on the Norwegian Shelf per year in total.
- There is about 1 event every other year which, in connection with helicopter traffic, results in a larger number of people requiring rescue from the sea.
- There are about 1-2 events a year involving risk of collision, either ships on a collision course or drifting vessels/objects. A recent project (NPD, 2001) has documented that the frequency of observed vessels on a collision course has increased recently, and may be in the order of 6-8 per year. This may indicate that there has been some underreporting earlier.
- There has been one extensive accidental oil spill on the Norwegian Shelf, in 1977. A few minor accidental spills occur each year (typically under 100 $m^3$, rarely up to 1000 $m^3$). A tentative estimate is 3 events per year in this category.
- The number of personal injuries so serious that urgent transport ashore is decisive for life and limb is about 1 event per year. The highest frequency is serious illness requiring emergency medical assistance, a little over 1 event per month.

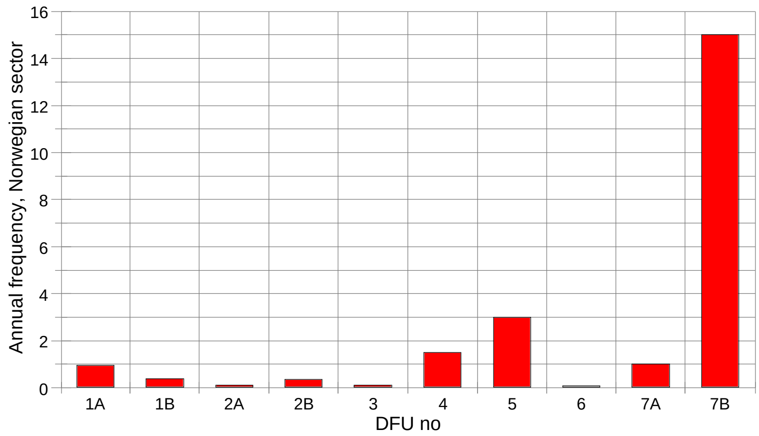


**Figure 1 Illustration of annual frequencies of events, Norwegian Shelf as a whole**

# 3. Area-Based Preparedness, Scope and Establishment

## 3.1 Conditions for Installation Preparedness

The implementation of area-based emergency preparedness may mean that DFUs, effectiveness requirements and contingency solutions on individual installations will have to be modified in the interests of achieving comprehensive overall preparedness. Responsibility for overall preparedness will still lie with the operator in each case.

One of the most important DFUs in relation to the implementation of area-based emergency preparedness is DFU1, man overboard during work over the sea. The following conditions must be met if an installation is to take part in any collective preparedness:

- Man overboard preparedness must be fully covered by the installation's own emergency response resources, i.e. by MOB-boat(s) and crews with the necessary training and practice. Emphasis should be put on the need for regular training and exercises, to ensure that this preparedness is established and maintained at a high level. A common industry standard is being prepared.
- Considerable weight will be attached to inspection and testing of the installation's own MOB-preparedness equipment and to preventive maintenance, with a view to obtaining a high level of readiness.
- Man overboard preparedness must be maintained exclusively by means of the installation's own emergency response resources. This also applies to mobile installations participating in area-based preparedness.

Account has also been taken of the fact that thrombolytic equipment (and associated competence) is a solution currently being introduced on the majority of installations on the Norwegian Shelf. The presence of such equipment is therefore taken to be the norm.

If the requisite equipment and competence is present on the installation, no external resources will be needed to meet this contingency, but the provision of speedy transportation ashore will still be a requirement. It is not a prerequisite for area-based emergency preparedness that such equipment and competence should be available on the installation. In its absence, the corresponding function must be covered through external resources.

### 3.2 Determining the Extent of an Area

When determining the extent of an area, the following factors must be taken into consideration:

- Available contingency resources on the installations in the area for DFU1 and DFU7
- Available infrastructure in the area
- The maximum geographical coverage that the common resources can provide

Contingency resources in an area must be selected and specified in such a way as to satisfy effectiveness requirements for all relevant DFUs for each of the installations in the area covered by area-based preparedness. Effectiveness requirements for potential DFUs are shown in Table 2. It is assumed that contingency resources in an area will normally comprise:

- 1 offshore-based SAR helicopter
- 1 or more standby vessels

It should be emphasised that there is no requirement to have an SAR helicopter in an area. If this particular resource is to be incorporated, there must also be a installation which has, or where there can readily be provided, a helicopter hangar for parking the helicopter.

## 4. Performing an Emergency Preparedness Analysis for an Area

### 4.1 Review of DFUs

When an emergency preparedness analysis is to be performed for an area, the first step is to determine the relevant DFUs for the area. The basis for this is the general list of potential DFUs already set out. Steps for determining specific DFUs for the area:

1. Determine the main characteristics for all installations included in the area
2. Review general DFUs to determine which are relevant, including specification of input from risk analyses for installations in the area
3. Evaluate other accidental events
4. Define specific DFUs

Weight must be attached to the following points:

- Not all potential DFUs are necessarily dimensioning for all installations

- If a DFU is dimensioning for at least one installation, it is dimensioning for joint emergency preparedness in the area.

## 4.2 Established Area-Based Preparedness Requirements

A summary of the area-based preparedness requirements for production installations is given in Table 1.

**Table 1 Overview of capacity requirements and effectiveness requirements**

| *DFU* | *Capacity* | *Performance Standard* | *Comments* |
|---|---|---|---|
| 1. Man overboard during work over sea | 1 | 8 min | From time of alarm |
| 2. Personnel in the sea as a result of helicopter accident | 21 | 120 min | Capacity must correspond to full helicopter |
| 3. Personnel in the sea during emergency evacuation | 1) | 120 min | Risk based |
| 4. Risk of collision | | | |
| • ship in motion | - | 50 min | |
| • drifting object | - | 20 n.m. | 12 n.m. for smaller ship |
| 5. Critical oil spill | 2) | 2) | Risk based, based on environmental risk analysis |
| 6. Fire requiring external assistance | 3) | 3) | Risk based, only when required from QRA |
| 7. Emergency medical case requiring external assistance | | | |
| • emergency medical response time [4] | 1 | 60 min | Start of emergency medical treatment on installation, using own or external resources |
| • transport to hospital [5] | 2 | 180 min | Time until arrival at hospital from the time the need for transport is identified |

Notes:

1) Based on data from quantitative risk analyses.

2) Capacity and requirements based on environmental risk and preparedness analysis

3) Based on premises in quantitative risk analyses

4) Applies only to serious illness

5) Applies to both serious illness and injury

For search and rescue of a larger number of persons in the sea, DFU2 and DFU3 are relevant. Whichever of these two DFUs contains the highest requirement will give the dimensioning basis. For most installations it will be DFU2, helicopter accident, which will give the dimensioning value, i.e. 21 persons, the current maximum number of people in a helicopter.

DFU3 relates to organised evacuation in which all personnel are wearing survival suits, including those who have to evacuate by life-raft or jump into the sea. The requirement specifies that survival suits must be located in such a way that any groups who, as envisaged in the risk analysis, may be prevented from reaching their muster stations will have access to the suits during escape. Scenarios can be imagined that are so dramatic that some people will panic and jump totally uncontrolled into the sea. Such conditions are not included in the DFUs.

### 4.3 Meeting Emergency Preparedness Requirements

In accordance with the relevant regulations, emergency preparedness requirements must be met in full for all DFUs. This applies to all the DFUs in question, but particularly so in regard to the rescue of persons in the sea.

There are differences between the relevant solutions in regard to how vulnerable they are in relation to environmental conditions. The use of SAR helicopters offers the best conditions for rescuing persons in the sea even during the most serious weather conditions, provided they are wearing survival suits so that they can withstand waiting for the helicopter. Experience data from actual events in helicopter traffic and general experience data from operation of the public rescue services confirm this.

For the use of rescue helicopters, the total availability of rescue helicopters should be assessed, including the public rescue services and offshore-based helicopters.

If no helicopter is available, MOB boats from the installation and standby vessels will be the relevant response measures, possibly in combination with other resources. MOB boats are more vulnerable and have greater limitations in relation to extreme weather and wave conditions.

Man overboard preparedness on the installations is very significant for DFU1, since time waiting for resources from area-based preparedness will normally be too long to be able to rely on these resources.

### 4.4 The Analysis Process

Figure 2 shows how emergency preparedness analysis for an area is performed by:

- establishing DFUs for all installations from the list of potential DFUs.
- establishing specific requirements for all installations, including capacity requirements.
- establishing contingency solution for the area.
- evaluating if all specific requirements have been met for all installations.
- checking if it is possible to satisfy any outstanding requirements within the defined area. The area may need to be redefined.
- modifying the contingency solution if necessary in order to meet the specific requirements.

Note again that it is the DFU with the most comprehensive requirements which will be dimensioning for the resource in question. This applies to all emergency preparedness resources.

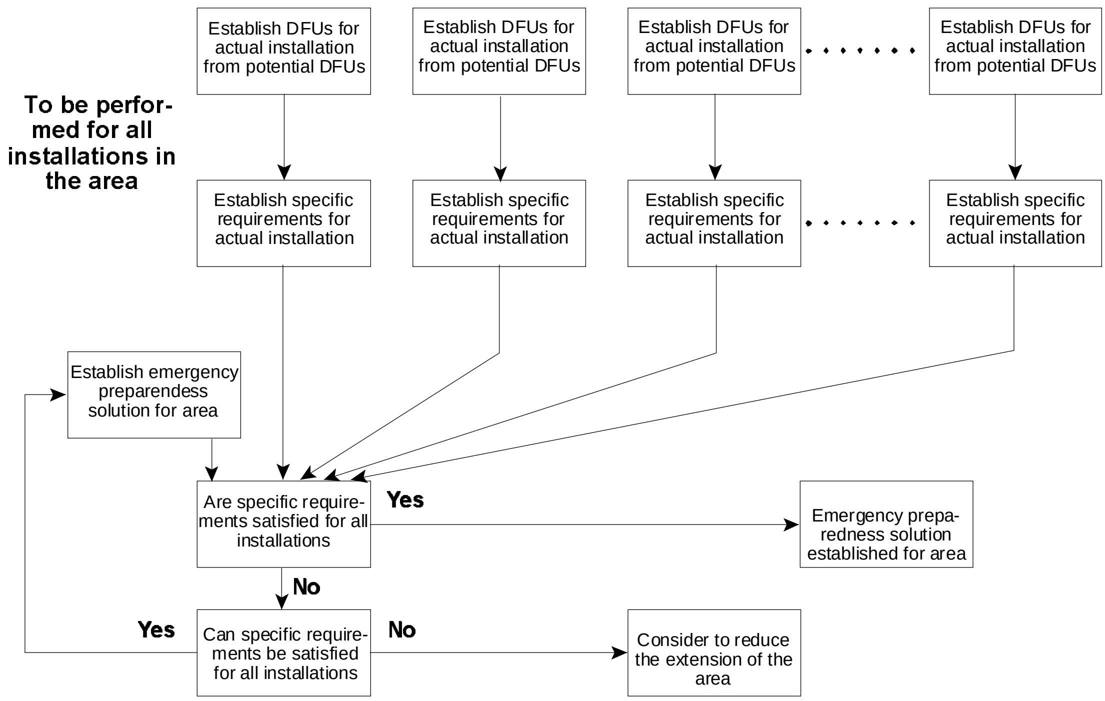


**Figure 2 Simplified process diagram for emergency preparedness analysis for an area**

## 5. Conclusions

The stated purpose for the project was to establish area-based emergency preparedness solutions which will provide an overall level of preparedness at least equivalent to, or better than, that afforded by current provisions.

Choice of DFUs – in a risk based context, capacity requirements and effectiveness requirements are the primary parameters in determining the level of overall preparedness.

An overall evaluation of the provisions shows that:

- Serious illness (DFU7) has so much higher frequency that improvement for this DFU significantly exceeds the possible negative effects related to other DFUs.
- Those DFUs where area-based emergency preparedness, in unfavourable conditions, may lead to poorer preparedness have, with one exception, such low frequency that consequences in general are negligible for the Norwegian Shelf as a whole.

It has therefore been concluded (OLF, 2000) that the overall effect of implementing area-based emergency preparedness on a wide basis on the Norwegian Continental Shelf may lead to the saving of about 2 (statistical) lives per year altogether.

## 6. Ackowledgement

This report has been prepared by a working group from OLF, with members from BP Amoco, Norsk Hydro, Norske Shell, OLF, Phillips Petroleum Company Norway and Statoil. The contributions from these representative are gratefully acknowledged.

## 7. References

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## 8. Abbreviations

| | |
|---|---|
| DFU | Defined Situation of Hazard and Accident |
| FRC | Fast Rescue Craft (MOB boat) |
| MOB | Man overboard |
| n.m. | Nautical mile |
| NOFO | Norwegian Operators' Oil Spill Control Association? |
| NORSOK | The competitive standing of the Norwegian offshore sector |
| NUI | Normally unmanned installation |
| OLF | Norwegian Oil Industry Association |
| POB | Persons on board |
| SAR | Search and Rescue |
| SBV | Standby vessel |
| VSKTB | Operator's Emergency Preparedness Requirements |

**Author biography**

Jan Erik Vinnem is a self employed special adviser in risk management, and part time professor in risk assessment. Previously he has worked for TotalFinaElf, Statoil, NTNU and SINTEF. He has also worked for many years in risk and emergency preparedness consultancy.