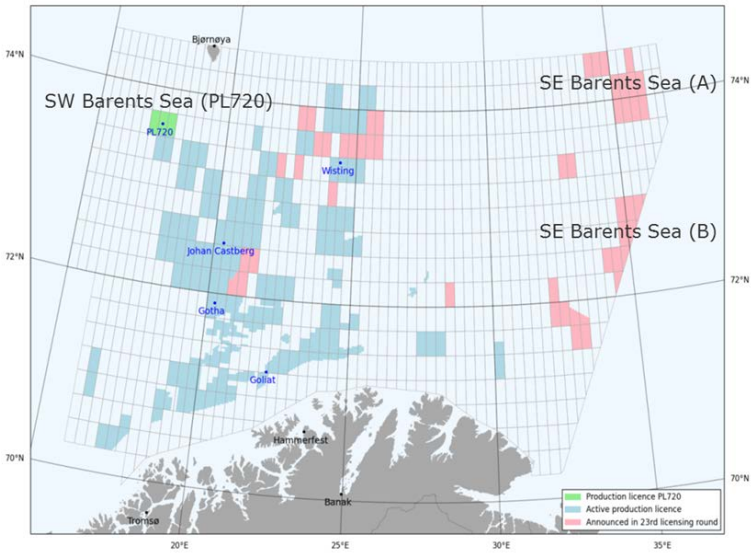
Beredskap under leting i Barentshavet

Barents Sea Exploration Collaboration (BaSEC) er et industrisamarbeid for å forberede leteoperasjoner i Barentshavet. BaSECs siktemål er å koordinere operatører og komme med anbefalinger om tiltak som kan danne grunnlag for sikker og effektiv letevirksomhet i Barentshavet. BaSEC har 16 medlemmer, alle operatører på norsk sokkel. BaSEC bygger sine rapporter på beste tilgjengelige kunnskap og på den brede erfaring disse 16 selskapene har fra operasjoner på norsk sokkel og i andre områder med tilsvarende forhold.

Et av spørsmålene som reises i forbindelse med utlysningen av de nye områdene i Barentshavet er avstanden til land og hvilken betydning for beredskapen dette kan ha under leteoperasjoner i Barentshavet.



Figur 1: Kart over lisenser i Barentshavet og hvilke områder rapportene omhandler

I denne rapporten tar BaSEC for seg hvilke følger avstanden til land og andre fysiske forhold kan ha for operasjoner i områdene definert som A og B på kartet i figur 1. I tillegg er det utarbeidet en egen rapport for området benevnt PL720 i det sør-vestlige Barentshavet for å sikre at alle forhold i Barentshavet hensyntas. Konklusjonene fra denne rapporten gis til slutt i dette sammendraget.

Formålet med rapportene er å gi områdespesifikke analyser av hva som kreves for å ha et fullgodt og effektivt beredskapssystem og identifisere mangler i forhold til gjeldendende reguleringer og industristandarder. Vurderingen skjer i forhold til et sett av definerte risikosituasjoner. Denne analysen omfatter imidlertid ikke oljevern – det spørsmålet blir analysert i sammenheng med miljørisikoanalysen (som publiseres mot slutten av april 2016). Rapporten baserer seg også på forutsetninger i andre BaSEC rapporter, slik som rapporten om fysisk miljø i Barentshavet sørøst.

Rapportens anbefalinger er et resultat av et tett samarbeid mellom BaSEC og en rekke andre aktører på sokkelen. Den bygger også videre på tidligere arbeid i regi av Norsk Olje og Gass, slik som «HSE challenges in the High North».

God beredskap er mulig hele året

Reguleringer og standarder på norsk sokkel gir for det meste funksjonelle krav. Rapporten tar utgangspunkt i at et gap i forhold til disse funksjonelle kravene oppstår når man må ha ytterligere teknologiske eller operasjonelle tiltak for å oppfylle forventningen i et funksjonelt krav. BaSEC ser at de gap som er identifisert er felles for område A og B, men at område A fordi det er lenger fra land blir gapet noe større for dette området når det kommer til evakueringstid for eksempel. Kravet til vinterisering vil være likt for begge områdene.

På grunn av avstanden til land må ressurser på feltet selv, slik som stand-by fartøy, spille en mer fremtredende rolle enn det som er vanlig i andre områder på norsk sokkel.

De fleste krav i nåværende regelverk for beredskap er vurdert kan oppfylles gjennom etablert utstyr, planer og prosedyrer. Det er identifisert 12 kategorier av krav hvor det vurderes å anbefale ytterligere tiltak for at krav og beste praksis skal være tilfredsstilte. Basert på disse funnene gis det en anbefaling om å innføre tre nye ytelseskrav som vil adressere de utfordringene som er identifisert:

- Personell skal så langt det er operativt forsvarlig bli hentet fra livbåt innen 24 timer etter denne er satt ut
- Det skal være mulig gå redde personer fra sjø innen 8 minutter etter personell i sjø er oppdaget
- Hvis helikopteret har måtte nødlande utenfor riggens sikkerhetssone (500 m) skal personer i sjø bli reddet så fort som mulig og senest innen 4 timer

BaSECs rapport om fysisk miljø dokumenterer at risiko for sjøis er lav, og risiko for isfjell er veldig lav. Likevel må denne risikoen tas høyde for og det anbefales etablering av et system for overvåking og håndtering av sjøis og isfjell.

En forutsetning for beredskapsanbefalingene er at helikopterbasen etableres på land. Dette fordi:

- Dagens helikopter kan, med noen modifikasjoner, fly til og fra område A
- En etablering av et landingspunkt midtveis mellom land og rigg er lite hensiktsmessig ettersom dette ikke vesentlig øker den operasjonelle evnen i en ulykkessituasjon. Et slikt landingspunkt introduserer derimot ytterligere risiko gjennom landing på og letting på en mobil enhet
- Helikopterbaser vil bli lokalisert på land på en hensiktsmessig måte for de ulike operasjonsområdene

I forhold til de foreslåtte endringene er det også identifiserte konkrete tiltak for å sikre at beredskapen under operasjonen er på det ønskelige nivået. Dette inkluderer forslag til utstyr, trening av personell og begrensninger i forhold til hvor og når operasjoner kan gjennomføres ombord på riggen under bestemte forhold.

Rapporten konkluderer derfor med at vinteroperasjoner er mulig utfra beredskapshensyn, men krever at operatørene gjennomfører tiltak for å vinterisere utstyr og etablerer nødvendige operasjonelle prosedyrer. Operasjoner i sommersesongen vil imidlertid ha mindre operasjonelle utfordringer, mindre behov for vinterisering og høyere regularitet.

For Barentshavet sørvest så er forholdene på noen områder annerledes enn i Barentshavet sørøst. Det er:

- Det er lavere sannsynlighet for sjøis og isfjell
- Større tilgjengelighet av utstyr og annen infrastruktur for beredskapsformål
- Basert på værdata fra Bjørnøya antas det større utfordringer knytte til tåke

Rapporten for Barentshavet sørvest gir noen få anbefalinger til operasjonelle tiltak utover de som gis for Barentshavet sørøst. Dette gjelder spesielt en anbefaling om økt meteorologisk overvåking av tåke. Et slikt tiltak vil styrke værvarslingen for området som sådan. Ellers er alle endringer i ytelseskrav foreslått for Barentshavet sørøst også gjort gjeldende for områder i sørvest med tilsvarende avstand fra land.

DNV·GL

BASEC SSEPA BARENTS SEA 23 R AREA

Report - SSEPA Barents Sea (23 R - South East)

Barents Sea Exploration Collaboration

Report No.: 2015-0606, Rev. 1
Document No.: 1RI9SV4-4
Date: 2016-03-14

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Report title:	Report - SSEPA Barents Sea 23 R South East	BDL Safety Operations
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Applicable contract(s) governing the provision of this Report:

Objective:

In relation to the BaSEC program and the upcoming 23rd licencing round (23 R), DNVGL has been requested to do a site specific emergency preparedness analysis (SSEPA) for two of the south areas in the licencing round.

The main objective of the work has been to identify site specific challenges that impact the establishment of an adequate level of emergency response, identify gaps towards regulatory requirements and industry standards with respect to handling defined emergency situations, and finally to identify mitigating measures relevant for handling of the site specific challenges.

Prepared by:	Verified by: on behalf of	Approved by:
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1 EXECUTIVE SUMMARY

The oil companies Statoil, Eni Norge, Lundin Norway, OMV, and Engie (GDF SUEZ) have started a program to collaborate and optimize exploration and operations in the Barents Sea called the *Barents Sea Exploration Collaboration* (BaSEC)[1]. The program covers the whole Barents Sea, but with a special focus on the areas included in the 23rd licensing round.

In relation to the BaSEC program and the upcoming 23rd licencing round, DNVGL has been requested to do a site specific emergency preparedness analysis (SSEPA) for two areas in the licencing round.

The main objective of the work has been to identify site specific challenges that may impact the establishment of an adequate level of emergency response, and to identify gaps towards regulatory requirements and industry standards with respect to handling defined emergency situations under the site specific conditions. Based on the results of the assessments recommendations and mitigating measures with respect to managing the site specific challenges are given. The analysis has been workshop based, with DNV GL leading, facilitating and reporting the work. The work has considered the recommendations from the NOROG work seminars on HSE challenges in the High North, and has proposed additional recommendations to the ones presented in the NOROG project report.

Remoteness is identified as a key challenge for both area A and B, but where area A is significantly longer from shore and infrastructure than area B. Remoteness creates significant challenges with respect to ensuring a robust level of emergency response. This is particularly related to external rescue resources such as Search and Rescue helicopters, which will have longer response times. Relatively long periods of reduced visibility due to fog may lower the possibility for the helicopter to land on the rig. It has been a basic assumption and recommendation that a helicopter base will be established onshore, to reduce the helicopter flight distance as much as practically possible.

Another important compensating measure is that the field dedicated resources, in particular the Stand By Vessel, will need to be given a more extensive role in rescue operations and serving as an integral part of the area emergency preparedness. This includes precautionary down manning, Medevac and first aid, rescue after helicopter accidents in the sea and also rescue from life boats or sea after an emergency evacuation from the rig.

For both areas operations during the summer season are less challenging than winter season operations. Winter season operations will require adequate winterization of a drilling rig and field dedicated vessels. In addition winter season operations may experience more operational limitations and possibly increased down time due to harsh polar weather (heavy snow fall, polar lows, troughs[3],) and low temperatures. In the winter season marine icing conditions may occur in both areas. This represents additional operational challenges and potentially also negative impact on safety critical systems, like lifeboats and launching systems. Marine icing is more critical for ships than for the drilling rig.

Both areas will need a system for sea ice management, including a system for ice detection, surveillance and proper procedures for alert and response according to approaching ice threats. Area A has a higher probability for occurrence of sea ice than area B.

[1] Since the start of this study the BaSEC group has been extended to 16 companies

[3] A trough can resemble a Polar low, but consists in reality of thick snow clouds which produce very poor visibility. It forms as the Gulf Stream carries warm water north. Big temperature differences between sea and air produce "seething" air conditions with much precipitation and thick clouds. Onshore storm winds and thunder often accompany a trough, ref. PSA – Status og Signaler 2013-14

The current regulations and standards mostly give functional requirements. Gaps have therefore been considered to arise where site specific challenges require additional technological or operational measures to fulfil the expectations in the defined performance requirements. Where possible, quantification of the efficiency of the emergency response, in terms of response time and capacity, has been used in the gap assessment.

The same types of gaps are identified for Area A and B. However, there are differences since area A is more remote, which cause the deviation from industry targets for rescue response times and capacity from shore based resources to be larger for area A than for area B. The need for compensating measures on winterization is considered to be the same for both areas for all season operations.

The work has identified 12 main categories of challenges and gaps. Technical and operational mitigating measures and recommendations have been proposed for the site specific challenges and associated gaps. The main categories of gaps and challenges, with associated measures are:

Requirement to keep rig safety system operational at all times (PSA; The Facilities Regulations §8): This requirement is challenged by the environmental conditions on site, such as low temperatures, polar lows, troughs, marine icing and reduced visibility (fog, heavy snow fall). Mitigating measures focus on the need for winterization gap assessment for rig and vessels according to season, obtain critical weather information and manage operations accordingly and competence requirement for weather contractor.

Requirement to implement well control measures (PSA; The Activities Regulations §§85-86): Immediate well control measures will be implemented according to normal procedures, and is not considered to represent a gap. However, the work group considered that implementing well control measures over a prolonged period could represent three relevant challenges:

- Controlling well by mud weight: This was considered to be potentially challenged if the rig runs out of kill mud due to long supply routes to shore and lack of storage space onboard.
- Install capping stack in water depths relevant for area A and B
- Drilling relief well in winter conditions and shallow reservoir during presence of sea ice (time consuming)

Mitigating measures focus on availability of critical equipment and supplies, application of available capping technology at the locations and planning for relief well drilling in winter season.

Requirement to safely abandon well (PSA; The Activities regulations §88 and the Facilities Regulations §48): If well control problems occur prior to or during the winter season, the rig will need to move off location if sea ice is approaching. The ice management plan should contain criteria for when to carry out a move-off, e.g. with respect to amount of ice approaching. The rig can return when the sea ice has drifted off location. However the ice seasons have shown to last for several weeks proving that this might become difficult. Thus, safe abandonment of the well will need to reflect the timelines for approaching sea ice, and the length of the period for which sea ice can be on the location. Mitigating measures focus on availability of required equipment and interface with ice risk management plans.

Requirement to evacuate personnel to safe area (PSA; The Activities regulations §77 and OMV internal requirement): The remote location with few vessels and installations in the area require more attention on how to rescue personnel to a safe location after evacuation by lifeboats, and for protection against hypothermia until they are rescued. Rescue methods need to cover both rescue from lifeboats and from the sea. Mitigating measures focus on improving protection against hypothermia, efficient search and tracking of missing personnel, methods for rescue from sea and competence and training

requirement for SBV and AWSAR helicopter crew. It will also be important to investigate the possibilities that dynamic bridge connections between the SBV and the rig may serve as a means of evacuation. Crane and personnel basket may be used as a means for precautionary down manning to SBV.

Requirement for safe transport (PSA; The Activities regulations §17): The remote location and with few vessels and installations in the area require more attention to how rescue personnel after a helicopter accident outside the rig's safety zone. Currently there has not been defined a specific performance requirement for this emergency response action, equivalent to the requirement for rescue after helicopter ditch inside the rig safety zone as defined in Norwegian Oil and Gas Guideline 064. Mitigating measures focus on improving protection against hypothermia, onshore helicopter base reducing flight distance and response times, efficient search and tracking of missing personnel, requirement to SAR operational readiness and operational limitations on scheduling of transport flights.

Requirement for hospital and emergency hospital to provide prudent first aid and medical treatment (PSA; The Facilities regulations §59-60): The remote location will cause longer response times for AWSAR helicopter to carry out medevac. In addition flight conditions, and in particular reduced visibility, may reduce the possibility for AWSAR to land on the rig. This may require sustained medical treatment onboard the rig and also in the helicopter during the flight to shore. Mitigating measures focus on increasing the capacity of medical equipment and medics on board the rig, use of Telemedicine and medical doctor in the AWSAR helicopter.

Requirement to handle defined emergency situations (PSA; The Activities regulations, §73): Due to remoteness and periods with reduced visibility which may impair the possibility for the helicopter to land on the rig, the response time for medical evacuation (due to occupational accidents, acute illnesses and major accidents) will be longer. The performance requirement in the NOROG 064 Guideline for medevac to hospital within 180 minutes is not met for location A and B. Mitigating measures focus on establishing a new helicopter base onshore, methods for transfer of patients from the rig to the SBV, and training and competence for SBV and rig crew.

Requirement for safe and efficient rescue of man over board (PSA; The Activities regulations 41): Lower water temperature and reduced visibility require additional measures to ensure that personnel who fall overboard can be rescued safely and efficiently to avoid hypothermia. Mitigating measures focus on protection against hypothermia, efficient tracking of person in sea, and training of MOB crew on site.

Requirement to monitor inside safety zone and outside the rig's zone for threats (PSA; The Management regulations, §57): The risk of approaching sea ice and ice bergs require additional measures for monitoring the area around the rig, and to define appropriate response actions. Mitigating measures focus on ice detection and monitoring systems, ice risk management plans, and ensuring sea ice and ice berg competence.

Requirement for SBV to perform emergency response efforts according to defined requirements (Statoil internal emergency response requirement, WR1156): Due to the remoteness and limited maritime and offshore activity in the area, the workgroup have identified that the rescue resources located in the field will have a more important role with respect to handling immediate emergency response needs compared to North Sea operations. In particular the SBV will increase its importance as being an emergency response resource. Mitigating measures focus on equipment onboard SBV to meet additional requirements for Medevac and rescue, relevant on site training for SBV personnel and to map if one SBV is sufficient.

Requirement to ensure safety of MOB personnel before initiating rescue operation (IMO SOLAS, Chapter 3, §17.1) and requirement to not expose personnel to unnecessary danger during rescue and danger limitation (Statoil internal requirement WR1156): Rescue personnel may be exposed to harsh conditions during rescue and combat operation outdoors, an in particular during extended duration of rescue operation. This can represent a health risk, and may also reduce the efficiency of the rescue operation. Mitigating measures focus on robust dimensioning om MOB crew, additional MOB crews to allow for rotation, suitable PPE for arctic conditions, and training for on-site conditions.

Requirement to pick up entire helicopter crew within 120 minutes for helicopter accident within rig safety zone (NOROG 064 Guideline): The Guideline defines a requirement to pick up a full helicopter (max 21 persons) from the sea in case of a helicopter ditch inside the rig safety zone within 120 minutes. The requirement is met with MOB boat or FRDC as recue resources when these can be launched. If MOB boat or FRDC cannot be launched and AWSAR is the main resource, this requirement is not met for Area A. The requirement can be achieved with AWSAR for area B with reduced number of people in the helicopter (max 10 persons). Mitigating measures focus on new helicopter base onshore to reduce flight time, efficient search and tracking of persons in sea, protection against hypothermia, winterization of rescue equipment and operational limitations on transport flights.

Even though the NOROG 064 Guideline is only valid for areas with area emergency response, which is not the case for areas A and B, the reference is used for good practice in the site specific analysis.

ISO 19906 for Arctic offshore structures:

The standard *ISO 19906 for Arctic offshore structures* is not applicable for mobile drilling units, but has nevertheless been used as informative guidance to identify areas that are relevant to consider for emergency response in areas A and B. From the review of this standard, the following requirements have been identified as relevant to consider:

- Requirement for installation to be able to move off in case of failure of the ice management system
- Requirement to have an alternative muster location that is equipped for cold climate
- Requirement for appropriate forecasting and monitoring of the physical environmental conditions affecting the reliability and performance of the EER system
- Requirement for the evacuation system to have a provision on board for retrieval of personnel, including injured personnel from the sea or ice.
- Requirement that personnel shall have appropriate protective equipment during the EER process.
- The offshore facility operator shall have competency for evaluating the risk associated with the physical environmental conditions on the EER system.

With this basis, it is concluded that due to the long distance from shore and few other installations or vessels in the area the emergency response resources located at field will have a more important role in establishing a robust emergency response. In particular the SBV will become more important, and establishing best practice for rescue operations, competence requirements and training on site and in cooperation with rig and AWSAR helicopter will be important to fulfil this role.

Security:

The major site specific challenge related to security is increased focus from NGOs (non-governmental organizations). These groups focus heavily on oil and gas activity in the Barents Sea. Plans should be prepared and people trained to handle such situations. It will be required to clarify the juridical status of the safety zone prior to start-up of operations, in addition to the procedure for how to engage police authority on the rig.

New performance requirements:

New performance requirements have been established where existing performance requirements do not cover the site specific challenges. Hence, three new performance requirements to be used in planning and dimensioning emergency response for the areas have been proposed as shown below:

***(i): Target should be to rescue personnel from lifeboats within 24 hours after lifeboats have been launched*.** The intention with the requirement is to stress that the operators have a responsibility to ensure evacuation to a safe area, extending beyond evacuation with lifeboats. Due to the remoteness and environmental conditions, in particular low temperature and possible marine icing on the lifeboats, for areas A and B it is considered that personnel need to be rescued from the lifeboats in order to be in a safe area. The time limits shall also reduce the possible build up and impact of marine icing. It is recommended that the BaSEC Health and Working environment group carries out an assessment of survivability in a life boat for 24 hours in high seas.

(ii): In man over board situations, personnel shall be rescued from the sea within 8 minutes after man over board is detected. Survival in case of a man over board accident strongly depends on how quickly a person can be rescued from the sea. The low water temperature and possible low visibility at location A and B further underlines the need for immediate response in case a person falls over board. The work group considered that the SBV and rig to have a level of preparedness that relatively easy will meet a 24/7 time requirement to rescue a person from the sea within 8 minutes after alert of the accident, and the requirement is therefore not limited to periods where work above sea is ongoing.

(iii):* Persons in the sea following helicopter ditch outside the safety zone: The helicopter passengers and crew shall be picked up from sea as soon as possible but at latest within 4hrs.*** The intention is to clarify that the operator has a responsibility for safe transport to and from the offshore installation, both inside and outside the safety zone. The proposed 4 hour criterion is equivalent to the requirement for rescue inside the safety zone, but with an extended time requirement. The requirement reflects implementation of additional mitigating measures proposed from the study. It should be noted that the survival suits to be applied are certified to protect against hypothermia for up to 6 hours in Barents Sea conditions

2 INTRODUCTION

2.1 Scope and purpose

The oil companies Statoil, Eni Norge, Lundin Norway, OMV, and Engie (GDF SUEZ) have started a program to collaborate and optimize exploration and operations in the Barents Sea called the *Barents Sea Exploration Collaboration* (BaSEC). The program covers the whole Barents Sea, but with a special focus on the areas included in the 23rd licensing round.

In relation to the BaSEC program and the upcoming 23rd licencing round, DNVGL has been requested to do a site specific emergency preparedness analysis (SSEPA) for two of the areas in the licencing round. Figure 2-1 shows the location of the two areas, Area A and Area B which are the ones that will be analysed. In addition area C and D will be analysed with respect flight and sailing times and distances.

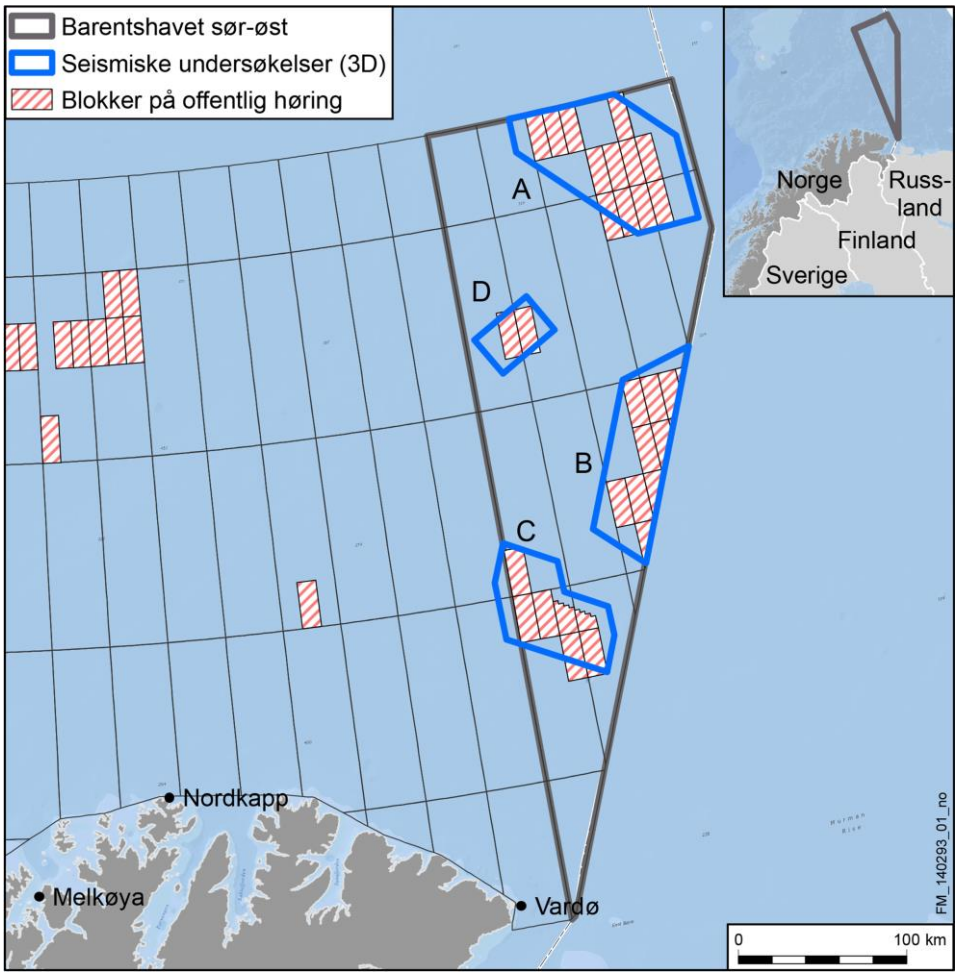


Figure 2-1 Barents Sea south east and the 23rd licencing round fields, ref. /4/

The purpose of this SSEPA has been to:

- Identify dimensioning DSHAs and site specific challenges such as specific environmental conditions at the drilling location, e.g. metocean parameters, seasonal variations, distance to shore, availability of emergency preparedness resources, and presence of sea ice etc.
- Review and compare performance requirements from regulatory regimes and internal requirements in the companies.

- Perform a gap assessment of performance requirements with basis in how the Barents Sea conditions affect the adequacy, functionality and availability of how the emergency response measures are able to meet the performance requirements.
- Identify, discuss and document mitigation measures, inadequate requirements, gaps towards industry standards.

The work is workshop based, with DNV GL leading the work in addition to preparing and facilitating workshops and reporting.

2.2 Limitations

- The analysis is not related to a specific or named drilling rig or standby vessels. Some general assumptions regarding the capabilities and requirements for rigs and vessels included in the assessments are presented to define a representative exploration drilling scenario.
- Oil spill contingency has not been part of scope.
- The assessment is limited to site specific challenges.
- Transit mode is not included.
- Dimensioning of the Emergency Preparedness Organisation on board the rig is not part of scope.
- Bjørnøya and Svalbard is considered to be too far away from both areas and has therefore not been considered as relevant resources in an emergency situation.
- There will be no drilling in hydrocarbon zones when the observable ice edge is closer than 50 km from the location.
- The assessment uses as scenario with one single rig operating in each area. The benefit of how having simultaneous operations from several operators within an area is not assessed or included in the analysis. The analysis is hence conservative in this perspective, as the support from additional resources from neighbouring rigs is not considered. On a note to this, it is expected that operators as far as practically possible will cooperate and seek to support each other's operations in the region to share competence and resources for a robust emergency preparedness concept.

3 ABBREVIATIONS

AIS	Automatic Identification System
AWOS	Automated Weather Observing System
AWSAR	All-Weather Search and Rescue
DPO	Dynamic Positioning Operator
DSHA	Defined Situations of Hazards and Accidents
EERA	Escape, Evacuation and Rescue Analysis
EPA	Emergency Preparedness Analysis
FRDC	Fast Rescue Daughter Craft
H_s	Significant wave height
IM	Ice Management
LQ	Living Quarter
MCR	Main Control Room
MOB	Man over board
NGO	Non-Governmental Organisations
NOROG	Norsk Olje og Gass
NVG	Night Vision Googles
PLB	Personnel Locator Beacon
POB	Personnel On Board
PS	Performance Standard
JRCC	Joint Rescue Coordination Centre (no: Hovedredningssentalen)
SAR	Search and Rescue
SBV	Standby Vessel
SSEPA	Site Specific Emergency Preparedness Analysis

4 METHODOLOGY

The SSEPA consists of three main parts:

- Review of DSHAs to identify site specific aspects, conditions and challenges
- Review of performance requirements relevant to the updated DSHAs
- Identify and discuss mitigation measures

Figure 4-1 presents the work flow for this analysis. More details and participation lists from the workshops are presented below the figure.

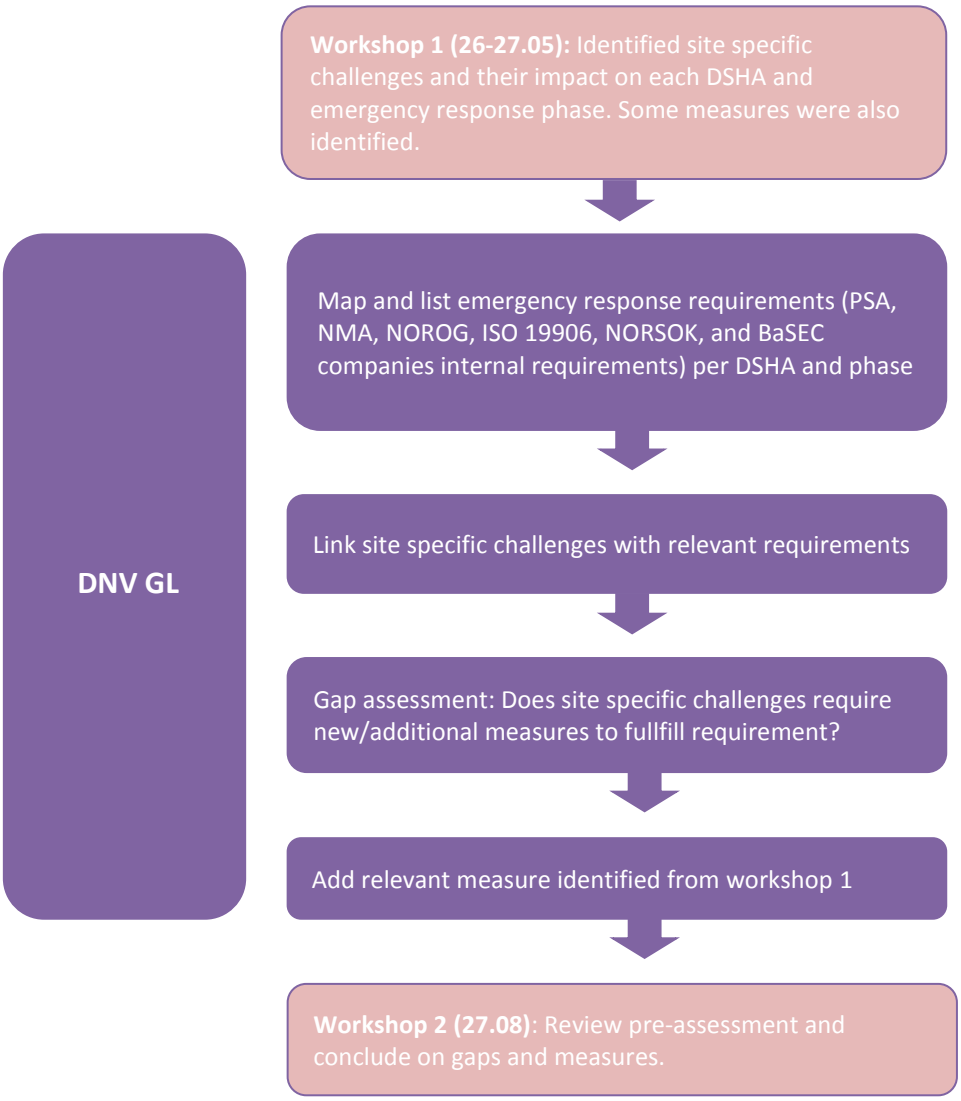


Figure 4-1 Methodology for gap assessment and identification of mitigation measures

During Workshop 1 the DSHAs were reviewed to identify possible site specific challenges due to location and climatic factors. Ice and metocean data (ref. /22/) together with experience from similar projects and response time calculations was used as input. The list of participants is shown in Table 4-1.

Table 4-1 Participant list for Workshop 1, May 26th and May 27th 2015

Name	Company	Both days
Silje Røsnes	GDF SUEZ	x
Jan Vidar Markmanrud	Lundin Norway AS	x
Sigmund Andrè Hertzberg	Lundin Norway AS	x
Stig Sandal	GDF SUEZ	x
Kai Abrahamsen	Transocean	x
Ole Hansen	Eni Norge AS	x
Frank Berland	OIM Odfjell Drilling	x
Frode Refsland	Transocean	x
Jørn Toverud	OIM Transocean	x
Erik Hamremoen	Statoil	x
Åshild T. Skjærseth	Statoil	Only 26/5
Leif Magne Sjokolt	Statoil	x
Ovar Aarsland	Statoil	Only 26/5
Anders Bergsli	Statoil	x
Kenneth Eik	Statoil	x
Jan Fredrik Dale	Transocean	x
Jens Lunden	Statoil	x
Svein Olav Drangeid	OMV	x
Knut Eltvik	GDF SUEZ	x
Børre Paaske	DNVGL	x
Espen Funnemark	DNVGL	x
Tina Sætrum	DNVGL	x

In the second workshop August 27 2015, emergency response requirements, gaps towards industry standards and potential mitigation measures were discussed. Prior to this workshop, DNV GL carried out an analysis of potential gaps towards regulatory requirements, relevant industry standards and the BaSEC companies internal requirements for emergency response. The basis for the review was the following:

- PSA Management, Activities and Facilities regulations
- Norwegian Maritime Authority, *Forskrift om evakuerings- og redningsredskaper på flyttbare innretninger (redningsforskriften),* 10 July 2007
- Norwegian Maritime Authority regulation 1239/93 "Risk analyses for mobile offshore units"
- International Convention for the Safety of Life at Sea (SOLAS), Chapter III

In addition the performance requirements from the following standards were listed and used as informative basis:

- OLF Guideline 064 Etablering av områdeberedskap
- OLF Guideline 016 Medisinsk beredskap
- OLF Guideline 096 Mann over bord beredskap[4]
- ISO 19906 Arctic Offshore (to the extent that this is applicable to mobile offshore units)
- Internal requirements for emergency response for the BaSEC companies

[4] Please note that NOROG 096 has been withdrawn and replaced by 064 (area preparedness) and 088 (permit to work). As these standards do not specify the manning of MOB team, the reference to 096 is still used.

All the identified gaps were classified as being *red*, *yellow* or *green*. The intention with the categories /colour coding is to prioritize the different gaps with respect to required efforts for further work to implement joint solutions and close the gaps. A description of the coding is presented below.

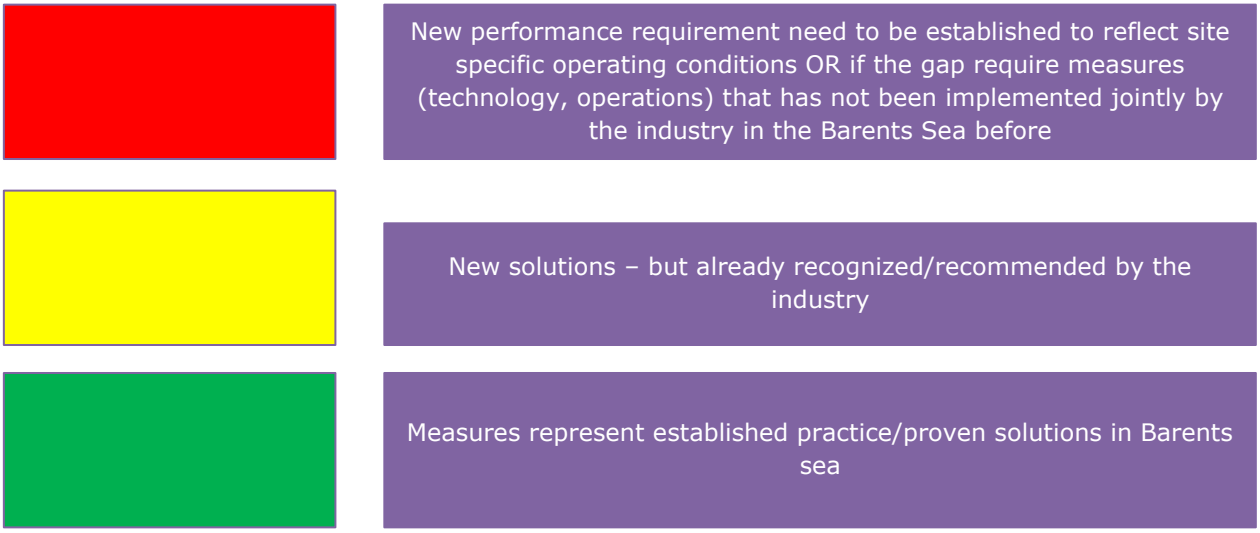


Table 4-2 lists the participants in workshop 2.

Table 4-2 Participant list for Workshop 2, August 27th 2015

Name	Company
Jan Vidar Markmanrud	Lundin Norway AS
Sigmund Andrè Hertzberg	Lundin Norway AS
Kai Abrahamsen	Transocean
Frank Berland	OIM Odfjell Drilling
Frode Refsland	Transocean
Jørn Toverud	OIM Transocean
Erik Hamremoen	Statoil
Åshild T. Skjærseth	Statoil
Leif Magne Sjokolt	Statoil
Ovar Aarsland	Statoil
Anders Bergsli	Statoil
Kenneth Eik	Statoil
Jens Lunden	Statoil
Svein Olav Drangeid	OMV
Sindre Eltvik	Transocean
Børre Paaske	DNVGL
Espen Funnemark	DNVGL
Tina Sætrum	DNVGL

5 SYSTEM DESCRIPTION

The scenario that is assessed in this report is a drilling rig carrying out exploration drilling in areas A and B with a standby-boat close to the rig. Furthermore, helicopter is defined as the primary evacuation mean, and will be used as an evacuation means during an emergency event if it is possible to evacuate by helicopter.

There will be no drilling in hydrocarbon zones when the observable ice edge (defined as 40 % ice concentration, ref. Stortingsmelding 38) is closer than 50 km from the location. Marginal Ice Zone is defined as the transition area between the open ocean and the continuous ice cover. It consists of individual ice floes of varying sizes.

The fields in question, some details/assumptions for rig and vessels and descriptions of available emergency response resources are shown in the following subchapters.

5.1 The fields

The fields are related to the 23rd licencing round and are located southeast in the Barents Sea. This area is the first new area that is opened at the Norwegian continental shelf since 1994. The distance from Area A2 to Vardø is approximately 477 km (258 nm), and to Area B2 it is around 322 km (174 nm). The estimated flight time (140 knots) from Area A2 to Vardø is 110 min, and the flight time from Area B2 to Vardø is 75 min. The expected sailing times from Vardø (15 knots) are 17.2 hours for area A2 and 11.6 hours for Area B2.

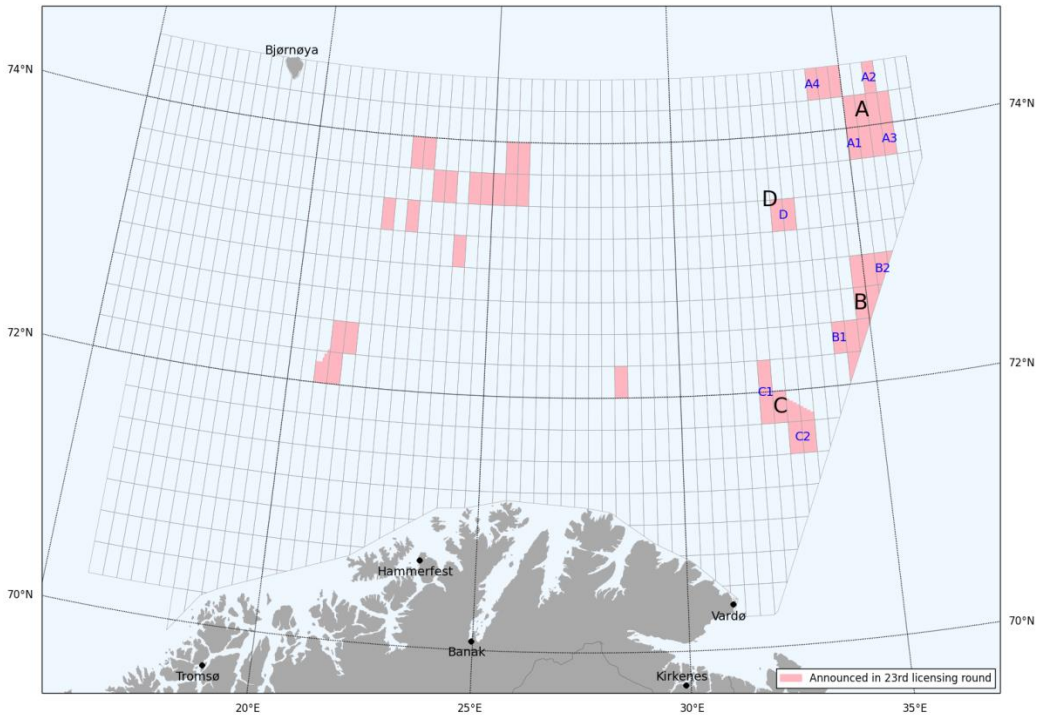


Figure 5-1 Licences in the southeast Barents Sea

The exact location of Area A and Area B, which are relevant for this assessment, are presented in Table 5-1. Coordinates of possible onshore locations are presented in Table 5-2.

Table 5-1 Coordinates for the areas

Area	Latitude	Longitude

Area	Latitude	Longitude
A1	73.875 N	35.167 E
A2	74.375 N	35.833 E
A3	73.875 N	36.167 E
A4	74.375 N	34.167 E
B1	72.375 N	34.167 E
B2	72.875 N	35.500 E

Table 5-2 Coordinates for some relevant onshore locations

Area	Latitude	Longitude
Vardø	70,35 N	31,05 E
Kirkenes	69,73 N	29,89 E
Banak	70,07 N	24,97 E
Hammerfest	70,68 N	23,67 E

Table 5-3 presents flight distances from different locations onshore to areas A, B and C. Vardø has been included only to reflect distances on behalf of other possible shore locations along the North Eastern coastline. Flight distances above 300 nm is not considered feasible with existing helicopter technology. Distances between 200-300 nm is feasible with existing helicopter technology, but with reductions in number of passengers to reduce weight. As an example the existing Sikorsky S-92 helicopters fly with 6-8 passengers for a distance of 265 nm, and with upgraded helicopters the number of passengers is expected to increase to 10. The limitations on the AWSAR helicopters will be the similar, but to a lesser degree than for transport helicopters, ref. /24/.

Table 5-3- Flight distances (nm/km) to locations A, B, C and D

Area	Banak	Hammerfest	Kirkenes	Vardø
A1	297 nm 550 km	285 nm 527 km	269 nm 497 km	226 nm 418 km
A2	326 nm 605 km	321 nm 578 km	301 nm 557 km	258 nm 477 km
B1	226 nm 418 km	225 nm 416 km	180 nm 333 km	136 nm 252 km
B2	263 nm 486 km	259 nm 479 km	218 nm 404 km	174 nm 322 km
C1	183 nm 338 km	182 nm 337 km	144 nm 267 km	102 nm 188 km
C2	184 nm 341 km	190 nm 352 km	130 nm 241 km	86 nm 159 km
D	250 nm 463 km	237 nm 439 km	227 nm 421 km	186 nm 344 km

Table 5-4 and Table 5-5 presents the expected flight and sailing times to the different areas. Please note that the calculated times does not consider mobilization time and that the speeds are assumed constant.

Table 5-4 Flight time (minutes), one way, no mobilization time etc. (helicopter speed-over-ground: 140 knots)

	A1	A2	A3	A4	B1	B2	C1	C2	D

	A1	A2	A3	A4	B1	B2	C1	C2	D
Banak	127	140	133	133	97	113	78	79	107
Hammerfest	122	134	128	125	96	111	78	82	101
Kirkenes	115	129	118	125	77	94	62	56	97
Vardø	97	110	100	107	58	74	44	37	80

Table 5-5- Sailing time (minutes), one way, no mobilization time etc. (ERV speed 15 knots)

	A1	A2	A3	A4	B1	B2	C1	C2	D
Kirkenes	1094	1222	1121	1188	736	888	599	535	935
Vardø	902	1030	929	996	544	696	407	343	743

5.2 Communication

Communication with rig from shore will be via satellite communication systems INMARSAT and Iridium, by use of a VSAT communication terminal.

Communication with helicopter and shore will be via VHF and Iridium, and the same between helicopter and rig.

Communication between rig, SBV and helicopter and MOB/rescue boats will be via VHF

Band with available on the location will be mapped with a satellite coverage study. It is assumed that a band with of 8 Mbps is available for the rig

5.3 Rig and vessels

Drilling rig:

No specific drilling rig is defined for the study, but some basic assumptions have been made:

- Drilling rig is assumed to be of a semi-sub configuration designed and equipment for operating in harsh conditions, with station-keeping by DP or anchor moored.
- It is assumed that equipment is designed according to prevailing standards.
- The rig is assumed to be designed and equipped for harsh conditions. Specific winterization requirement will be determined for each operation.
- The rig itself is intended to be relocated in accidental scenarios which are threatening the rig.
- The rig has a radar that covers min. 20 nm.
- Rig POB: 140 persons

Standby vessel:

- Radar covers min. 20 nm.
- Equipped with MOB system (typical wave limitation H_s 3m), and possibly a fast rescue craft (FRDC, wave typical height limitation H_s 6m).

Supply vessels:

- Examples of location of shore base are Kirkenes, Berlevåg or Vardø

5.4 Emergency response resources

5.4.1 Transport helicopter

The transport helicopter to be used for flights to Area A / Area B is assumed to have flight speed equivalent to a Super Puma H-225/Sikorsky S-92, i.e.140 knots.

5.4.2 AWSAR helicopter

For the purpose of this study the cases with AWSAR helicopters have used a location of the onshore that reduces the distance to the locations A and B as much as practically possible. The AWSAR will be used for emergency situations, and is assumed to have a flight speed in emergency situation of 140 knots.

The helicopter needs to be equipped with auxiliary fuel tanks, to be able to operate in the area. It is manned by rescue man, winch man, medical doctor and 2 pilots, and has a capacity to rescue 21 persons. The helicopter may take up to 4 stretchers at the same time.

When there are transport helicopter flights to Area A/Area B the mobilisation time for the helicopter is 15 minutes. The rest of the 24-hours the mobilisation time are 45 minutes. It is assumed that the doctor has the same mobilisation time as the rest of the helicopter crew.

The helicopter is assumed to meet requirements for operating all year round in the Barents Sea, and will have de-icing equipment. There is work ongoing to implement night vision googles (NVG).

5.4.3 Standby vessels

For this analysis it is assumed that the standby vessels have MOB-boat, radar available and possibly a FRDC (Fast Rescue Daughter Craft). For winter season operations or all year it is assumed that the SBV will have a winterization notation, with arrangements for anti-icing and de-icing, heating of spaces with important equipment etc.

5.4.4 Ice monitoring

Ice monitoring will be performed onshore with an ice surveillance contractor, which is often the same as the weather forecasting contractor. The ice surveillance contractor will provide satellite detection and tracking of sea ice and icebergs, marginal ice zone forecasting, iceberg forecasting and air reconnaissance (fixed wing or helicopter).

5.4.5 Onshore on duty doctor

The on duty doctor has the overall responsibility for medical treatment on board the rig. When the registered nurse offshore makes contact regarding a patient the on duty doctor takes over responsibility for medical treatment. Together with the registered nurse they decide on further treatment. The on duty doctor is responsible for the treatment and resources until the patient arrive at the hospital.

5.5 Public resources

5.5.1 Kirkenes Hospital

Kirkenes hospital will be the normal hospital for patients transferred to shore, as this is the hospital nearest to Area A/Area B. For more severe injuries, other specialist hospitals may be used.

5.5.2 Hammerfest Hospital

Hammerfest hospital will be used as an alternative hospital for patients transferred to shore, it will be used as an alternative to the Kirkenes Hospital. For more severe injuries, other specialist hospitals may be used.

5.5.3 University Hospital of Northern Norway

The rig will have extended cooperation with the University Hospital of Northern Norway (UNN) in Tromsø. It should be evaluated whether telemedicine equipment is to be installed on board the rig with assistance from UNN. Alternatively, the rig could have a permanent doctor on board.

5.5.4 SeaKing, Banak

The Sea King in Banak is a national rescue resource, and the operators will plan for use of this resource in their emergency planning. Mobilization is normally via the JRCC (Joint Rescue Coordination Centre) in Bodø.

The Sea King has operational limitations regarding the ability to fly directly to the locations, and will need an intermediate fuel stop on shore to reach Area and B.. From mid-2019 the new AW101 national SAR helicopters are planned to be operational out of Banak, significantly increasing the rescue capability compared to existing Sea King helicopter.

6 DSHA REVIEW

The defined situations of hazard and accident (DSHA) used in this assessment were initially based on the situations used for a generic EPA for a semi-submersible drilling rig updated in 2015 (ref. /1/). Based on discussions in workshop 1 the generic DSHA-list was updated to include two site specific DSHAs:

10b: Helicopter accident into the sea "en route"

11b: Sea ice and ice berg threats

Both these DSHAs require performance requirements and emergency response measures that differ from the generic DSHAs for 10a Helicopter accident into the sea within safety zone, and 11a Ship and other objects on collision course.

#	DSHA name
0	General DSHA
1	Shallow gas blowout
2	Well kick
3	Subsea blowout
4	Topside blowout and uncontrolled releases of hydrocarbons
5	HC release in well test area
6	Toxic gas release
7	Fire in accommodation
8	Fire/explosion in the machinery spaces/fire in utility areas
9	Helicopter accident on installation (at helideck area)
10a	Helicopter accident into the sea within safety zone
10b	Helicopter accident into the sea "en route"
11a	Ship and other objects on collision course
11b	Sea ice and ice berg threats
12	Structural failure
13	Loss of position
14	Loss of stability
*15**	*Loss of control in transit*
16	Evacuation and rescue
17	Occupational accidents/acute illness
18	Man overboard situations
19	Fire/explosion in mud treatment areas
20	Security threats

*): DSHA 15 is not part of scope for this study

An evaluation of each DSHA is described in the following sections.

In the following a summary of the most important preconditions and site specific challenges related to each DSHA are given.

6.1 DSHA 0: General site specific challenges

This DSHA is included for identifying all general challenges applicable for all DSHAs. The following table summarizes challenges which are relevant for all DSHAs. The implication of the different challenges has been discussed for each DSHA specifically in sections 0 to 6.21

Table 6-1 Summary of general site specific challenges

Phase	Remoteness	Metocean (wind, waves, fog, polar lows, icing)	Sea ice Ice bergs	Communication	Other
Alert	• Unstable/limited broadband satellite coverage	• Icing of antennas, radars and outdoor PA speakers • Uncertain weather forecasts • Mustering in outdoor areas • Disturbance in satellite communication	• Insufficient ice surveillance system • Uncertain ice charts	• Limited availability for transfer of video/pictures to/from scene. • Helicopter communication • Technical requirements for antennas • Several parties involved – ensure common situation understanding.	• Lack of common standards, procedures and guide lines • Alert to Russian authorities • Routines for managing safety related information for new challenges (e.g ice risk). • Competence and organization wrt. information transfer. • Process/routines for requiring assistance from Police.
Danger Limitation	• Flight safety • Limited access to resources/aids	• Hypothermia • Winterization of consequence limiting barriers (firewater, gas detectors etc.) • Prolonged outdoor operations in cold climate to handle DSHA	• Availability of vessels for operations in ice(class) • Move off location in time	• Telemedicine ; unclear specifications	• Medical Competence offshore; competence and capacity • Training for response in cold climate • Training personnel for handling hypothermia • Medevac with personnel basket
Rescue	• Response time external resources (AWSAR helicopter and vessels) • Range/capacity limitations for helicopters • Flight safety • Forward storage of emergency response equipment. • Adapt work operations	• Response time • Search for missing persons • Pick-up time more critical • MOB rescue in cold climate • Hypothermia • Availability of vessels to operate in icing conditions • Darkness • Personnel transportation device/capsule training on use of FRDC (daughter craft) – qualification of SBV for the "stand by" operation. • Type of rescue equipment	• Availability of vessels for operations in ice (class) • Use of MOB boat in ice covered waters or when ice bergs are present	• Limited communication capabilities; availability for transfer of video/pictures to/from scene.	• Lack of common standards, procedures and guidelines • Capacity on hospitals • Cooperation with Russian authorities • Russian military activity close to the border • Requirement for Medical competence on SBV • Training personnel for transportation with basket • Competence of MOB boat responsible

Phase	Remoteness	Metocean (wind, waves, fog, polar lows, icing)	Sea ice Ice bergs	Communication	Other
	according to availability of helicopter.	• Electrical lights on board rig and SBV • Personnel experience and training			
Evacuation	• Response/capacity for dry evacuation • Rescue from life boats	• Survival in low temperature in lifeboat/raft • Icing of wet evacuation means • Darkness • Personnel basket as emans of evacuation • Mustering location outdoor/indoor according to weather conditions.	• No wet evacuation in sea ice conditions	-	• Lack of common standards, procedures and guide lines • Standby vessel. • 2nd line response; reception of personnel onshore (hotel, media contacts, accommodation). Coordinate resources onshore. Coordinate with public rescue resources.
Normalization	• Response time/availability for external resources	• Delay	• Delay	-	-

Joint Rescue Coordination Centre (JRCC) in Bodø will normally be leading and coordinating the use of rescue resources in an large scale emergency response situation. With respect to communication with the resources at the location A or B they will do this directly via satellite communication, or via a local coordinator (Coast Guard, Orion or Rescue helicopter).

For the purpose of capacity of the satellite communication the limitation of bandwidth in the area is managed by prioritizing the different consumers of the bandwidth according to their criticality. Telemedicine will have priority. Bandwidth (Mbps) applied for operations in the area has been from 4 Mbps which has been experienced to less than what has been practically required, and up to 8-12 Mbps where 8 Mbps has shown to be sufficient, ref./21/.

6.2 DSHA 1: Shallow gas blowout

Shallow gas blowouts occur as a result of hitting a pocket of gas during top hole drilling. Top hole drilling is performed without the use of a marine riser and with a non-return valve in the drill string. As a consequence of this, a shallow gas blowout can occur subsea.

The site specific challenges are evaluated to be the same for Area A and Area B for this DSHA. One challenge is that the reservoirs are unknown and not explored earlier, which creates more uncertainty with respect to performance of the drilling operation and well characteristics. The reservoirs in the regions for Area A and Area B are expected to be shallow and have a short pilot section, which gives a limited margin before reservoir is reached and therefore shorter detection and response times in case a gas pocket is hit.

If the rig is moored and a shallow gas blowout occurs an external vessel may not be available in the area to tow the rig away from location (if rig does not have sufficient propulsion to move off location by itself).

It is not expected to be any seasonal variation for Area A and Area B related to shallow gas blowouts.

6.3 DSHA 2: Well kick

During drilling, it is possible that the pore pressure is higher than estimated or that the pressure in the well is lower than expected. If the pore pressure is higher than the well pressure, reservoir fluid will flow in. This is lighter than drilling mud, and as it partly fills the annulus, it will reduce the average density there, so that the static pressure at the bottom of the well drops. Then the reservoir fluid will flow in more quickly and the density of the fluid in the annulus will decrease even more. This is called a "kick" and may quickly come out of control. Well release occurs if oil or gas flows from the well from some point were flow was not intended and the flow was stopped by use of the barrier system that is available on the well at the time the incident starts. Loss of well control occurs if one of the well control safety barriers fails.

Well kick can occur due to inadequate geological data, inappropriate drilling practices, equipment failure, failure/loss of DP, mud characteristics, formation pressure.

The site specific challenges are evaluated to be the same for Area A and Area B for this DSHA and are mainly linked to the possibility of hitting hydrates.

Some of the reservoirs in Area A and Area B are expected to be shallow, with a short distance from the reservoir to the well head. This means that less mud will be used, giving shorter response times to detect a situation with loss of well control.

To control well kick additional supplies from shore of mud, chemicals etc. may be required if too much mud is lost in the formation. The remote location will increase the supply delivery times from shore, compared to other locations on the NCS. Additional mud stored on the rig or vessels may compensate for this, in addition to availability on the shore bases closest to the two locations.

It is not expected to be any seasonal variation for Area A and Area B related to well kick.

6.4 DSHA 3: Subsea blowout

A blowout is the uncontrolled release of hydrocarbons from a well after all pressure control systems and barriers have failed. For subsea blowouts the hydrocarbons are released to the sea due to failure in the subsea systems. The release of a blowout cannot be controlled by the predefined well barriers. Releases may occur from various locations below the sea level.

Subsea blowout can occur due to inadequate geological data, inappropriate drilling practices, equipment failure, failure/loss of DP, mud characteristics, formation pressure.

Identified challenges related to blowout for Area A and Area B are unknown reservoirs – still this is not "Barents sea specific", and approaching sea ice or ice bergs that require a disconnect and move off. Sea ice or ice bergs may ultimately impact marine riser/drill string causing release of well fluids. There will be no drilling in hydrocarbon zones when the observable ice edge is closer than 50 km from the location. Ice impact on the drill string may be due to a failure in the ice surveillance and ice management system and failure to isolate well and move off in time, since the overall strategy is to shut down operations and move off location if ice is detected within the defined ice risk zones.

Area A has experienced sea ice in 20 of the last 41 years. Since area B is more south, the occurrence of sea ice in that area will hence be somewhat lower. The frequency of having an ice berg ice inside the rig safety zone (500m radius) for area A is about 1 per 500 year, ref. /22/.

Sea ice and small ice bergs may damage the drill string; this includes small pieces of ice which can have high impact load on the drill string in harsh weather. Ice management includes marginal ice zone monitoring by satellite and forecasting provided by an Ice Surveillance Contractor. Further action should be taken to prevent ice from impacting the blowout scenario. This includes to establishing: criteria for when the rig has to move off location; a system for marginal ice zone surveillance and alert; and, criteria for how close to the marginal ice zone the rig may operate.

Closing the BOP will normally be used to regain control of a well kick and stop the blowout. If the BOP fails to close on signal from the rig, it may be closed via other measures e.g. acoustic signal, or "hot stab" function where an ROV uses a hydraulic coupling directly on the BOP to close it. This will require specific equipment available on the rig, in addition to back-up from shore. If the operation cannot be done from the rig itself, additional vessels and equipment will need to be brought from shore. Transport time from shore will be longer than for other locations on the NCS.

If a well kick cannot be controlled by closing the BOP, a subsea blowout may be controlled by e.g. installing a capping stack and/or drilling a relief well, use of kill mud, etc. The remote location will increase the logistical challenges and response time for mobilizing a rig for drilling a relief well. The NORSOK requirement is to start relief well drilling 12 days after the decision is made wrt the operation. In addition to the transport logistics, the relatively shallow water at the location is considered to be a challenge for installing the capping stack. Installing the capping stack may be facilitated with standardized subsea equipment that interfaces with the capping stack. Vessels with specific equipment and capabilities will be required for both these operations, and also potentially for operations during winter season.

Area A and Area B are located in an area of the Barents Sea where there are no other permanent installations and normally few other drilling rigs. Identification of other rigs that will operate in the same area when drilling at Area A and Area B will be a benefit in this context. Rigs mobilized for relief well drilling may need to meet requirements for all year operations in Barents Sea conditions. It may be considered to use two different rigs for relief well drilling; one to start up the drilling and then a fully winterized rig to take over if required due to the seasonal challenges changing along the operation.

The probability for ice impact will be higher during the season when the ice edge moves closer to the two locations, typically from October to April/May.

6.5 DSHA 4: Topside blowout

A blowout is the uncontrolled release of hydrocarbons from a well after all barriers have failed. The release of a blowout cannot be controlled by the predefined well barriers. Releases may occur from various locations including on the drill floor, in mud treatment areas and from the mud gas separator.

Topside blowouts can occur due to inadequate geological data, inappropriate drilling practices, equipment failure, failure/loss of DP, mud characteristics, and formation pressure. The consequences are likely to be personnel injuries, release to sea, or fire and/or explosion.

The site specific challenges for this DSHA are similar to the ones already mentioned for DSHA 1, DSHA 2, and DSHA 3. The ignition probability for gas clouds originating from a topside blowout may increase due to more winterization by electrical heating, increasing the amount of potential ignition sources on the rig.

6.6 DSHA 5: HC release in well test area

During well testing, hydrocarbons are produced to the rig and although the equipment itself does not contain a large inventory. However, if well isolation fails following a release, the whole reservoir would be available to fuel the event. Leaks may occur from the pipe work, flanges or other equipment as for any section of hydrocarbon containing process equipment.

Site specific challenges for this DSHA are the same for Area A and Area B. During the dark season it can be difficult to visually detect a leak and at the same time it will prove difficult to visually detect whether HC is spilled to the sea. However, there are detectors which will detect a leak and most likely it will be possible for personnel to hear it as well.

Another challenge is that the well test equipment has to be designed to be used in atmospheric icing conditions and low air temperatures, and hence it is required that there are specified cold climate requirements and winterization manuals for well test equipment.

6.7 DSHA 6: Toxic gas release

A blowout or well release may contain hydrogen sulphide (H_2S) which is a flammable and extremely toxic gas. On the rig, H_2S is hazardous to workers and may also causes sulphide-stress-corrosion cracking of materials. It is assumed that all the drilling equipment intended to be used in the well is H_2S resistant.

For Area A and Area B, no new toxic gases are expected to be introduced. There is also low probability of H_2S on the fields. Identified site specific challenges are:

- Unknown subsurface/reservoirs (not Barents Sea specific).
- Enclosed rigs cannot ventilate gas as good as open rigs, and the toxic gas will be trapped inside.
- Longer mobilization time for receiving back up H_2S kit from shore.

- Muster personnel outdoor due to H_2S indication in cold climate. It may be possible to muster at the helideck since it is elevated, but indoor mustering in cold climate is preferred. During the winter months or in low air temperatures it may be challenging to muster personnel outside for longer periods.

6.8 DSHA 7: Fire in accommodation

There are especially three areas that are considered to be the most likely source of accommodation fires:

- **Cabin Fire** - Cabins contain combustible material and use of electrical equipment may result in ignition. Site specific challenges for Area A and Area B are increased use of electrical heating in the accommodations due to the cold air temperatures.
- **Galley Fire** - Cooking presents a potential fire hazard and a galley fire could ultimately destroy the galley. Smoke from the fire may spread throughout the accommodation. The probability of such fires to spread is low and hence there is minimal potential for galley fires to develop into major accidents.
- **Laundry Fire** - Drying overalls with residual oil traces present a fire risk, as does accumulation of lint in the dryer exhausts. A laundry fire is unlikely to spread beyond the compartment since the combustible inventory is limited and the construction is fire-rated, however the accommodation could become smoke logged.

It has been identified (ref. DSHA 16) that for some rigs there is lower quality of the survival suits stored at the life boat stations than the personal survival suits stored in the cabins. The survival suits stored at the lifeboat stations is designed according to SOLAS while the personal survival suits are adapted to conditions in the Barents Sea and certified according to NS EN ISO 15027. A fire in the accommodation can hence prevent personnel from bringing their personal survival suit from the cabins. It should therefore be considered to also provide survival suits at the lifeboat stations that are adapted to conditions in the Barents Sea.

If a fire occurs in the accommodation module, it has to be decided whether mustering should be at the lifeboat stations or at alternative mustering areas indoors. Alternative indoor mustering is required if accommodation is unavailable for a longer period. The cold climate forces alternative muster areas to be equipped for stay during extended periods for down manning with helicopter or other means.

The effect of the seasonal variations for this DSHA is the same as for DSHA 6 wrt mustering of personnel outdoors. No differences between area A and B are identified.

6.9 DSHA 8: Fire/explosion in the machinery spaces/fire in utility areas

Generator room fires may be initiated with a fractured fuel line or any leak from the fuel system getting into contact with a hot surface such as an exhaust manifold. Oily rags left close to or in contact with hot machinery surfaces can also initiate small fires in machinery spaces.

Site specific challenges for Area A and Area B are similar. For both places there will be an increased storage of helifuel and other substances on board the rig which may increase the duration and extent of a fire in the utility areas. Furthermore the high heating demand in low temperatures may increase the possibility for overheating of the boilers at the rig, but this is assessed to have a limited effect.

It is not identified any seasonal variations, or differences between Area A and Area B for this DSHA.

The workgroup commented that external support for firefighting cannot be expected due to the remote locations, implying that the rig's own firefighting personnel will have to be engaged in fire fighting for a longer period and the rig will need to handle the situation with own resources.

6.10 DSHA 9: Helicopter accident on installation (at helideck area)

The DSHA covers helicopter accident on the rig during landing or take-off that might lead to fatalities/injuries, damage to structure and assets, fire/explosion on helideck or fire/explosion on the rig. Possible scenarios with respect to helicopter crashes are heavy landing or crash onto the helideck, with potential for a subsequent fire; crash into the control room/bridge due to overshooting the helideck, with potential for impairment of the upper LQ due to the resulting fire; crash onto other areas of the rig.

For operations in Area A and Area B it is may be more flights compared to when drilling on other parts of the NCS, since each flight will have less passengers due to the length of the flights. As an example Statoil/Transocean operated with a maximum of 13 persons in the helicopter for transport to the Hoop area, compared to the full capacity of 21 persons.

A site specific challenge identified for Area A and Area B is that the fire water/foam may freeze when flushed onto the helideck in low temperatures. This should be checked when onsite and compensating measures should be implemented if necessary. Fire water in low temperature can also be a hazard for personnel, causing hypothermia, if they are not rescued to warm areas.

It is required that all floating rigs have helideck netting to prevent helicopter and personnel to slide. The rigs should also consider winterizing access and escaping ways, and removing snow/ice to avoid slips and falls. This is normally part of the winterization manuals for the rigs.

If the helideck is unavailable to due fog/reduced visibility or due to the crashed helicopter, on may need to transfer injured personnel from the dedicated hoisting area on the rig to the SBV by use of basket. The injured personnel can then be hoisted from the SBV to the helicopter.

6.11 DSHA 10: Helicopter accident into the sea

This DSHA is normally limited to helicopter accidents into the sea within the rig safety zone. Inside the rig safety zone the rig's 1st line emergency response resources and the SBV will be mobilized to rescue personnel in sea, and provide first aid.

In the NOROG 064 guideline there are no specific requirements for response to helicopter accidents outside the rig safety zone. It has been generally concluded for operations on the NCS that the availability of AWSAR helicopter resources has been sufficient to meet the time requirement for rescue of personnel from sea requirement also for accidents outside the rig safety zone. For the locations A and B considered in this SSEPA this will be different due to the remoteness and longer flight/response times for the AWSAR helicopters.

In this perspective it was decided by the workgroup to split this DSHA into helicopter accidents into the sea inside (10a) and outside (10b) the safety zone.

6.11.1 DSHA 10a: Helicopter accident into the sea within the safety zone

If a helicopter ditches into sea inside the 500 m safety zone of the rig, personnel on board shall perform emergency procedures. The helicopter may capsize and/or sink and personnel being able to escape from the overturned helicopter will be left in the sea. Personnel will be able to survive in their survival suits for some hours, depending on type of survival suit, personal condition and sea temperature.

The challenges for Area A and Area B are identified to be similar, but the response time from shore will be lower for Area B due to the shorter distance. The challenges which were identified are:

- Reduced availability of AWSAR and MOB/FRDC due to bad weather. The AWSAR may be unavailable due to flight conditions, leaving the MOB/FRDC as the only means of rescuing personnel from the sea. If wave height exceeds the operational limit for the MOB/FRDC these cannot be launched, and then AWSAR will be the mean to rescue personnel from sea. Longer flight times reduce the capability for the AWSAR to rescue personnel within the 120 minutes requirement. This will put limitations on number of persons the transport helicopter can have on board when MOB/FRDC cannot be launched. Alternatively one may halt all transport flights if wave height is above limit for launching of MOB/FRDC.
- Difficult to localize personnel in fog/snow/reduced visibility, but helicopter passenger survival suits do have VHF tracking (AIS) and homing capability (121,5 Mhz).
- Low air/sea temperatures will expose the FRDC/MOB crew during the operation to rescue personnel from sea.
- Winterization of MOB boat; icing on hook and need for "de-icing" if rescue equipment prior to helicopter landing. Cranes, winches and hydraulic equipment forming a part of the rescue system must also be winterized and tested prior to helicopter landings.
- This DSHA is affected by seasonal variations in air and sea temperature, and is more challenging during the cold season. Area A is more remote than area B, and hence is more affected with respect to the response time and availability of the AWSAR.
- There are large variations in the training and competence of the SBV crew, and how efficient they respond to emergency situations. It will be needed to state clearly the requirements to the SBV in their emergency response role, and requirements related to training.
- Heavy fog impairs visibility and in particular limits the possibility to take off and land, and is more present during the summer months. Other weather conditions that may cause poor flight conditions are atmospheric icing, polar lows, strong winds and heavy snowfall. All these conditions are more present during the autumn and winter months, typically from October to March/April. Reduced visibility due to lack of daylight varies with season.

6.11.2 DSHA 10b: Helicopter accident into the sea "en route"

If a helicopter ditches into the sea when en route to the rig, personnel on board the helicopter will normally evacuate into the sea or/and into the helicopter rafts. On the NCS it is the responsibility of the national resources to cater for the emergency response and rescue outside the installation's 500m safety zone. The operators do also have responsibility for safe transport to/from the rig, normally handled by use of the SAR helicopter supporting the rig(s).

The helicopter may capsize and/or sink and personnel being able to escape from the overturned helicopter will be left in the sea. Personnel will be able to survive in their survival suits for some hours, depending on type of survival suit, personal condition and sea temperature. It is assumed that all personnel have survival suits designed and certified for use in Barents Sea conditions.

The helicopter VHF communication with shore/rig will be a limiting factor due to the nature of VHF signals, this with the result that the helicopter will be out of VHF range for part of the flight. This normally for when the rig is outside approximately 150 nm from shore. This is mitigated by use of Iridium satellite phone and tracking. The tracking is done by active monitoring by the helicopter operator. The VHF transmitter/receiver antenna on the rig needs to have an optimum position and the effect of the VHF set needs to be high.

The site specific challenges for 10a are also relevant for 10b. The seasonal variations are as for DSHA 10a.

6.12 DSHA 11: Ship and other objects on collision course, including sea ice and ice bergs

This DSHA does traditionally cover both ships and other objects on collision course. Sea ice and ice bergs may also be categorised as "drifting objects", but since these objects represent hazards with specific measures to prevent and mitigate the DSHA is split into DSHA 11a "Ship and other objects on collision course", and DSHA 11b "Sea ice and ice berg threats".

6.12.1 DSHA 11a: Ship and other objects on collision course

Typical collision scenarios are collision with passing vessel (supply vessels, fishing vessel), collision with other rigs/vessels due to power blackout, positioning failure or collision with other drifting object.

The maritime surveillance is reduced compared to the North Sea, and will be more reliant on the radar mounted on the SBV or the rig to detect ships or objects on collision course. As an example, Statoil Maritime Control Central will in the North Sea in many cases give pre-warning to installations about vessels on possible collision course 60 minutes prior to estimated time of collision. This is different from the fact that most rigs use the NOROG 064 Guideline related to detection of vessel on collision course within 50 minutes prior to a possible collision. This may give reduce the time available to establish correct response, in particular since there will be less time available to decide whether a vessel is on collision course or not.

The time line and actions for a vessel on collision course are presented in section 7.2.8.

Offshore activities and exploration drilling is a new activity in this part of the Barents Sea, and the importance of the 500m safety zone around the rig may not be clearly understood, and lead to vessels operating closer to the installation than what is normal practice. An important action to avoid ship collisions is to establish contact and communication with approaching vessels. However, language problems may reduce the quality of such communication. In the workshop is was commented that the

AIS coverage was reduced for some areas of the Barents Sea, and this may lead to more difficulties in identifying which ship is approaching, and to establish necessary communication.

The majority of the ship traffic in Area A and B is fishing activity with e.g. large trawlers. Figure 6-1 provides a plot of fishing vessel activity in August 2012, based on available AIS data. Area A and B have experinced crossings of oil tankers going the Northern Sea Route north of Novaja Semlja, and this is a seasonal a activity reflecting when the NSR may be open for passage, ref. Figure 6-2. The tanker traffic may increase in the future, however this is uncertain. In additions some special vessels (ice breakers, seismic vessels, research vessels) that follow the border towards Russian economic zone, close to area C and D. The ship traffic is generally much lower in this area than in the North Sea. The majority of the ship activity in the area is fishing vessels. These vessels are more challenging to detect early with radar compared to e.g. larger tankers. The fishing vessels in the area are mostly of the size 1000 - 5000 GT according to AIS data for 2012.

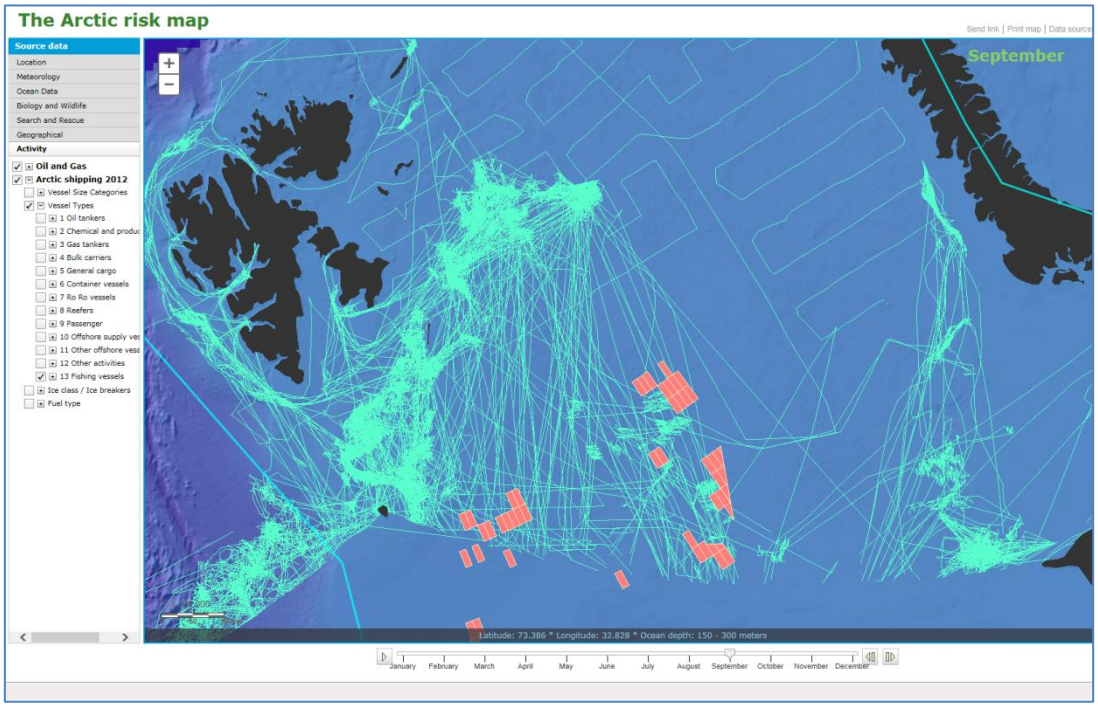


Figure 6-1. AIS data showing fishing vessels for September 2012 from DNV GL's Arctic Risk Map.

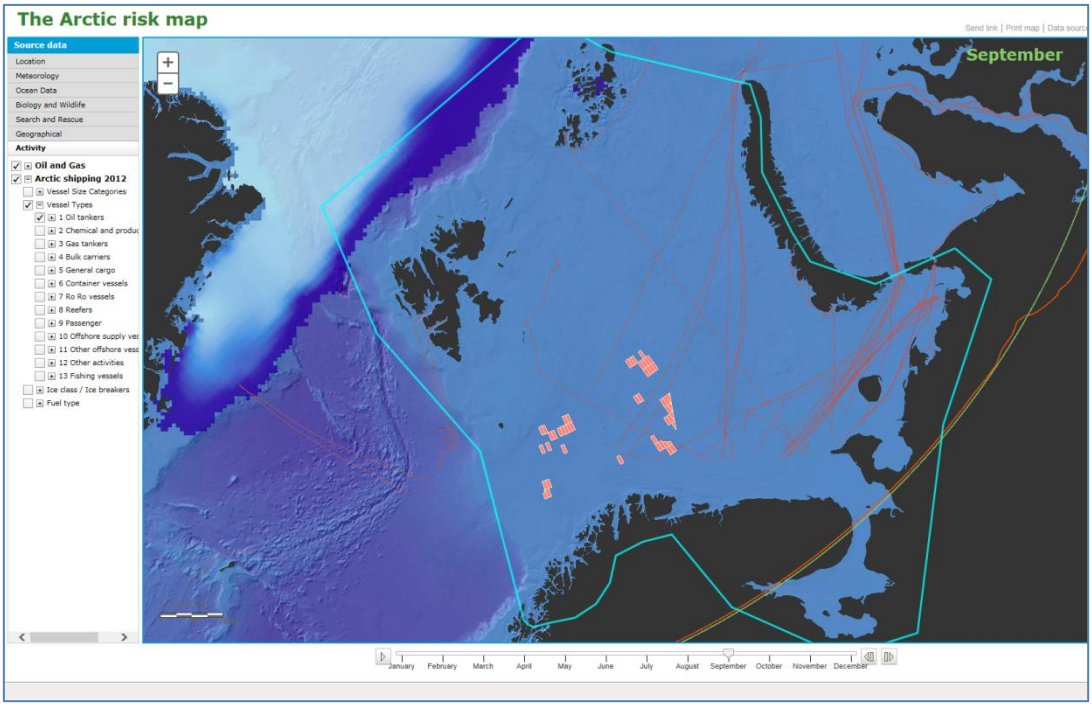


Figure 6-2. AIS data for Oil tankers, September 2012 from DNV GL's Arctic Risk Map.

The vessel traffic is, in general, lower in the South-eastern Barents Sea compared to the other areas on the NCS. In addition, the border to Russia is close, especially for Area B. It was discussed during the workshop that there can can be a blind zone on the Russian side of the border which may pose difficulties to having control over the ship traffic in the area.

BaSEC members with experiences from operations in the Barents Sea say that some of the drilling rigs have used large standby vessels and supply vessels. If collision occurs between the rig and one of these vessels, the design loads on the rig might be exceeded.

6.12.2 DSHA 11b: Sea ice and ice berg threats

For locations A and B sea ice or icebergs will represent site specific collision scenarios, with a higher probability for this in area A than for area B.

The major challenge being identified for Area A is sea ice or ice bergs with the potential to cause collisons The annual probability of an ice berg being within a 500 m radius from a random point in the area is estimated to 1 per 500 years, and sea ice has been present in 20 of the last 41 years. The last year sea ice was observed in area A was in 2003/2004, ref. /22/.

Figure 6-3 and Figure 6-4 shows the average extension of the sea ice (> 10% sea ice concentration) on April and September 2011, respectively.

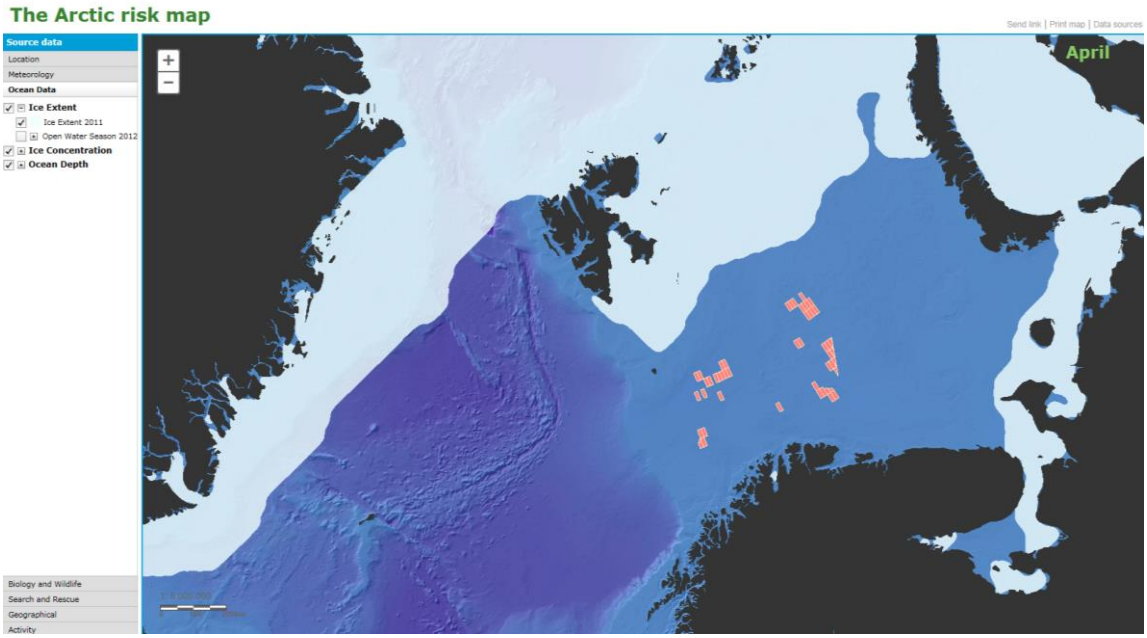


Figure 6-3 Example – average extension of sea ice (> 10% ice concentration) in April 2011, from DNV GL's Arctic Risk Map.

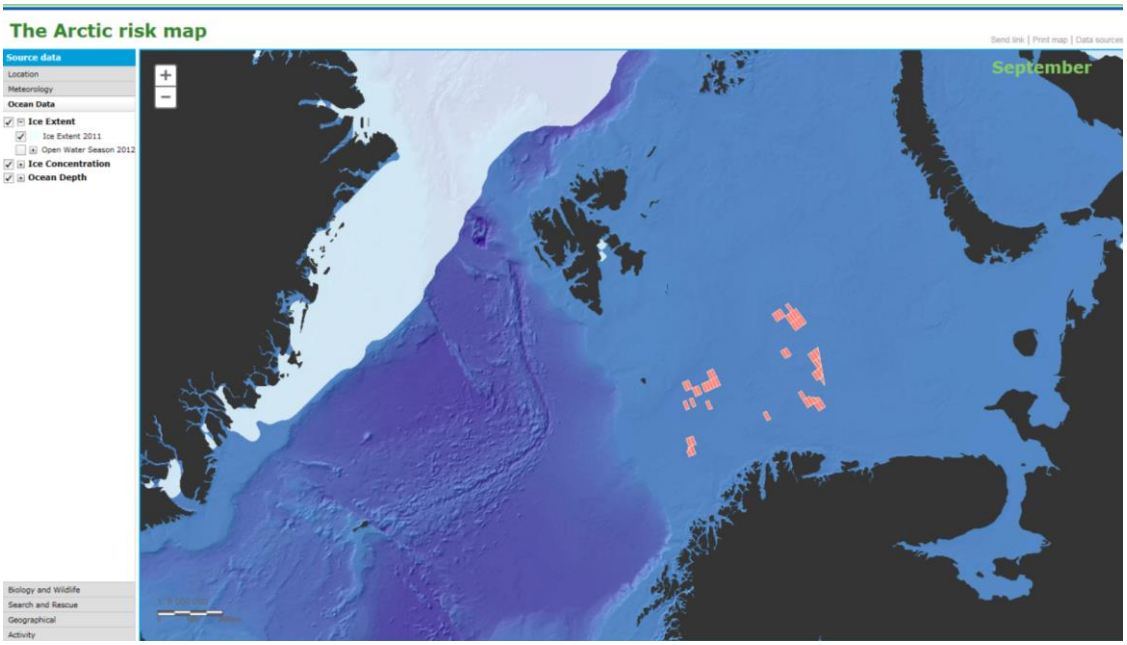


Figure 6-4 Example – average extension of sea ice (> 10% ice concentration) in September 2011, from DNV GL's Arctic Risk Map.

The main principle to handle ice threats is to implement an ice surveillance and detection system, and ultimately move the rig off location if sea ice/ice bergs is present within a defined radius. The actions on board in response to different ice threats need to be determined by an ice risk assessment. The SBV, or other dedicated vessel(s), may be used to manage approaching sea ice/ice berg to reduce the probability of collision. Collisions with sea ice/ice bergs are a result of ice objects not being detected, failure of ice management operations or failure of the rig to move off location. In particular small icebergs (growlers,

bergy bits) will be difficult to detect on radar and with satellite, and can therefore go undetected until impact with the rig. The probability of presence of ice bergs is high when the sea ice is approaching as it drifts along with the sea ice, but ice bergs may also appear independent of the drifting sea ice.

It is assumed that the rigs applied for operations in the area are not designed for operations in sea ice conditions, and will therefore move off location if sea ice or ice bergs are approaching. Dynamically positioned rigs will have a benefit compared to anchor moored rigs in this sense, as the anchor moored rigs will have limited ability to move off location (typically 100 m) without emergency disconnect of anchors. In addition the current life boats are not designed to be used in sea ice conditions, which also require the rig to avoid sea ice conditions.

If the drilling rig decides to disconnect from the well due to sea ice is approaching, the well may need to be abandoned for several weeks if the ice remains in the area. The well needs to be left in a *safe condition for this prolonged period,* meaning that no reservoir fluids or drilling mud shall be released after it is abandoned.

Operational experience from East Coast of Canada demonstrates that insufficient ice surveillance system has led to undetected relatively large icebergs in close proximity to a drilling rig, triggering shutdown and disconnection (July 2015).

6.13 DSHA 12: Structural failure

Structural failure is defined as the loss of ability of the rig's primary structure to carry the imposed design loads and/or extreme environmental loads. Two incidents of semi-submersible capsize due to structural failure have occurred: the *Transocean 3* in 1974 and the *Alexander Kielland* in 1980.

Possible causes of structural failure include:

- Corrosion
- Fatigue
- Construction/ design errors
- Improper loading or placement
- Ship collision
- Ice bergs and ice loads
- Rough weather
- Unsecured anchors on bolster

The site specific challenges for Area A and Area B discussed for DSHAs 11a and 11b are considered to be relevant also for DSHA 12.

In addition, extremely low temperatures may cause brittle failure of materials, but this may be mitigated by operational measures e.g. to move away of the area in this situation. The 100 year minimum temperatures in Area A is about -34^{o}C (ref. /22/).

When carrying out e.g. lifting operations, unexpected change in weather conditions (polar lows, wind, wave, visibility) it will not be sufficient time to secure crane and load which may lead to swinging/falling load accidents. In the workshop it was considered that such incidents will be avoided by following normal operational measures for securing crane and load. However it was stated that clear limitations on

allowable activities has be established with respect to foreseeable changes in weather conditions. About 13 polar lows can be expected for the entire Norwegian part of the Barents Sea, per winter, ref. /23/.

6.14 DSHA 13: Loss of position

Loss of position implies that the rig deviates from the specified location when the red limit is crossed; this limit is specified with an exact angle.

DP operated rig

Loss of position on DP is in this analysis defined as critical loss of position, where recovery of position by DP operator has not been achieved, i.e. the red limit has been passed.

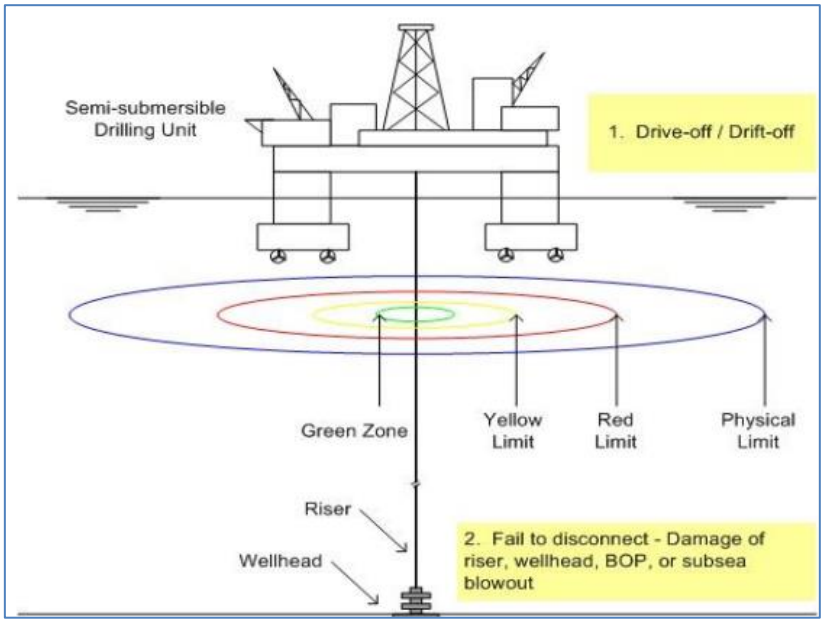


Figure 6-5 DP drilling operation, limits are not to scale, ref. /3/

Large excursions imply that the rig deviates from the specified location more than what is operationally tolerable. Possible failure modes are leading to loss of position are:

- Drive-off (abnormal thrusters force driving the vessel away from the target)
- Drift-off (insufficient thrusters force resulting in a drifting vessel
- Force-off (loss of position scenario due to extreme environmental forces). This is especially relevant for operations in new areas.

The site specific challenges identified for DP operated rigs are the same for Area A and Area B. The identified challenges are the following:

- Satellite to DP system not available/unstable, this can be due to reduced satellite coverage and that antennas are placed in a temporary shadow on the rig.
- GPS satellite coverage in high latitudes - GPS satellites have an inclination of 55 degrees, Russian GLONAS has slightly higher inclination, and European Galileo is planned to include polar orbiting satellites (not operational yet). The challenge with an orbital inclination of 55 degrees is that the coverage gets more limited the further north one goes. Even in Kristiansand (58 degrees north) one has only GPS satellites in the south / southeast / southwest, giving limited triangulation / geometry and thus gradually poorer precision the further north you are.

- Icing on GPS position transponders, impairing position indication/instruments/systems.

The fact that the satellites gradually come lower on the horizon will also mean that the signal must pass through thicker layers of ionosphere can disrupt the electromagnetic signal. It is not certain how much this affects the precision. Experience from drilling campaigns at similar latitudes in the Barents Sea, have not reported this to be a challenge

For DP rigs, rapid worsening of weather conditions, for example as a Polar low, may cause the DP system to misinterpret/override indications and DPO needs some time to understand and respond to the situation. DP system will need to be to be tuned to local patterns of changes in weather, and settings and logics are to be reflected in DPO training.

In April 2015 offshore East Coast of Canada, a rig had to make a rapid shutdown and disconnection due to big heave motions. The magnitude of the waves had not been forecasted and hence not being prepared for.

Moored rig

For moored rigs breakage of anchor lines can occur. If two or more anchors break, the result may be that the rig loses its position. Generally, mooring failures on a semi-submersible is not necessarily considered as a major hazard, unless disconnection from well fails and causes a blowout or collision with an adjacent structure or vessel is possible. Although considered possible, no collision events have occurred in the North Sea as the result of mooring line failure on semi-submersibles.

Examples of possible causes of anchor line breakages on moored rigs are:

- Wrong weather forecasts
    - less certain at high latitudes
    - unexpected high motions (role, heave) on the rig
- Ice berg impact on anchor chains (only relevant for Area A)
- Brittle fractions in anchor chains in extreme low temperatures

Normally, during the summer months icing will not occur and neither will sea ice or icebergs appear, but the other challenges mentioned will not be influenced by the seasons.

6.15 DSHA 14: Loss of stability

The most frequent accidental events that could lead to loss of stability are collisions, fire/explosions and extreme weather. Wrong weight distribution causing a larger angle of heel may also, conservatively, lead to impairment of the supporting structure. A stability failure may occur due to one or a combination of the following events:

- Ballast system failure (Due to human error or malfunction of equipment, ballast water can flow uncontrolled between tanks and/ or from sea to tank)
- Sea water leak in double bottom
- Collision - covered by DSHA 11
- Load displacement
- Structural failure - covered by DSHA 12
- Fluid/bulk operation failure

- Blowouts (subsea, topside or shallow gas) – covered by DSHA 1, DSHA 3, DSHA 4

Site specific challenges for Area A and Area B, are:

- Freezing of ballast system. Some rigs have heating in the ballast systems, while others have the ballast system below the water line and hence will never reach sub-zero air temperatures. For rigs having the ballast systems above the water line it should be ensured that it is winterized with heat tracing.
- Fire water/deluge in freezing conditions. The foam contains water and therefore deluge may freeze at low temperatures when flushed onto the rig. Heat from a fire will most likely prevent the deluge from freezing, but it may still be a problem if it is used for other purposes. Technical data for foam should therefore be checked and measures implemented if necessary to prevent foam from freezing.
- Heavy marine icing and snow. Checking the need for removal of ice and snow should be included in the daily checklists for the area responsible and more specifically, ice which could pose a threat as dropped object should be included in these checklists.
- Unexpected change in weather – deck loads that are not secured may be displaced and thereby causing the centre of gravity of the rig to change. In addition, deck loads may be larger than normal due to longer supply routes (logistics).
- Collision with iceberg or sea ice (more relevant for Area A than B).
- SBVs operating during the periods with marine icing, typically October to April, will need to have de-ice capabilities.

6.16 DSHA 15: Loss of control in transit

Loss of control in transit includes all the situations that can occur during the transit to the drilling location. These situations may for instance be loss of stability, loss of desired transport direction (machinery failure) or towline failures.

These events are not part of the scope for this analysis and are therefore not discussed further.

6.17 DSHA 16: Evacuation and rescue

Evacuation is listed as a separate DSHA in this analysis since this is relevant for most of the other specific DSHAs. In addition, this DSHA is introduced due to specific challenges and potential hazardous events being imposed by evacuation of the rig. The main means of evacuation are:

- Helicopter (dry evacuation)
- Lifeboats (wet evacuation)
- Escape chute / life rafts (wet evacuation)
- Directly to sea (wet evacuation)

Dry evacuation with helicopter is the primary means of evacuation. If the situation makes it impossible for the helicopter to land (dry evacuation), or the time required for helicopter evacuation is not sufficient, wet evacuation will be considered.

Site specific challenges (using lifeboats and/or rafts) for Area A and B, are:

Dry evacuation and down manning/precautionary evacuation

- Evacuation using helicopter is challenging due to the long distances to/from shore implying long flight times, which in turn reduces the rescue capacity within given timelines specified in existing NOROG 064 guideline. Distances from shore exceeding 300 nm is considered to be outside the limit with the flight/helicopter technology that is available today. This implies that new a new SAR base closer to location A and B has to be established, to ensure shortest possible flight distance. It should also be considered to start helicopter evacuation earlier than usual or to fly personnel to other installations in the area if such are present.
- Availability of helicopter to land on the rig may be reduced due to reduced visibility due to fog (summer), polar lows and heavy snowfall (autumn/winter). Heavy atmospheric icing or freezing conditions can also be a challenge. Strong winds will be a similar challenge as for other parts of the NCS.
- There is little/no infrastructure in the area. Neither no binding agreements on co-operation with other rigs in the area exists. Hence, the total availability of evacuation infrastructure is less compared to other parts of the NCS.
- Rescue operations on location A and B will be time consuming. Manning the helicopter base with two crews per helicopter, enables the helicopters to be operational for longer periods with less limitation on required rest for the crew members. The extra helicopter crew will be stationed onshore, thus crew changes will take place there.

Crane transfer basket/capsule for personnel to SBV may be used as an alternative to dry evacuation with helicopter. It must be ensured that sufficient training in use of this solution is given, and that this training is initiated as early as possible.

In emergency situations the SBV can give shelter for all personnel on board the rig. Reduced visibility due to heavy snow or fog may complicate transfer with basket to SBV. Bridge connection from the SBV to the rig may be a solution, but this requires specially designed SBVs, and modifications on the rig (bridge landing area, POB control systems linked to the bridge etc.). Such solutions should be further evaluated for use in the Barents Sea. A recent JIP on Walk to Work has developed industry guidance to assist offshore facility operators in achieving safe and efficient personnel transport to/from their facilities via a gangway system on a floating structure, ref./25/.

If available, the Sea King at Banak may be scrambled by the Joint Rescue Coordination Centre. However this and other national resources need to be included as available resources, but not as basis for the

The reduced availability of the AWSAR helicopters will make the overall evacuation and rescue concept more dependent on the resources present on the field; SBV, basket and means for wet evacuation. This has to be reflected in the overall dimensioning and training of the emergency response organization, including each individual crew member on board the rig.

Wet evacuation

For wet evacuation the following site specific challenges are identified:

1) Icing: Icing on launch equipment and lifeboats/chutes/rafts prior to launching. It is assumed that the lifeboats, life rafts and MOB boats with launching arrangements are kept free from ice and snow, making this equipment fully accessible and operable independent of weather conditions.

2) Visibility of drop zone: Snow and fog may be a challenge with regard to clearing the drop zone before dropping life boats.

3) Sea ice: No means of wet evacuation are approved for operation in sea ice conditions. The rig has to move off location if sea ice enters the area since evacuation in sea ice conditions is not relevant.

4) Rescue from the sea: Water temperature is not expected to change the requirement of rescuing 5-25% POB within 120 min, as the survival suits being certified for cold climate according to NS EN ISO 15027 have sufficient insulating capacity, ref. NOROG 064 Guideline. It is assumed that personnel are wearing survival suits. It is however recommended that minimum 50% (70) survival suits are of the type certified for use in cold climate (Sea Air Barents),, not only those stored in the LQ cabins and lifeboat stations of "non-cold climate" type. Furthermore, the lifeboat stability due to icing after launching is challenging. The potential of marine icing on lifeboats and whether this may impact the stability of the lifeboats needs to be investigated further. It is discussed whether sea water washing over the lifeboats will avoid icing or not.

5) Rescue of personnel from lifeboats. Personnel are normally considered safe when successfully evacuated with lifeboats. However, for location A and B the long distance to shore in combination with no other infrastructure offshore will require special attention to rescuing personnel from the lifeboats to a safe location. Icing on hull, hatches, air intakes and other external equipment of lifeboats will build up over time. Safe and efficient transfer from lifeboats to a safe location, such as an SBV, will be an important risk reducing measure for the evacuation concept.

   Personnel may be brought to a safe location in three ways:

   a. Transfer to supply vessel directly from lifeboat

   b. Towing to shore

   c. Hoisting to AWSAR, and transfer to stand by vessel or transfer to shore.

There are weather limitations for using MOB boats, FRDC and AWSAR. Weather conditions may reduce the availability of these resources for rescuing personnel from lifeboats. Due to distance to shore and sea conditions, towing to shore is not preferred. It should be considered to use an SBV suited for picking up lifeboats from the sea enabling recovery of personnel faster and more efficiently from the lifeboats. Response times and capacities for option c above are presented in section 7.

For personnel ending up in the sea after an evacuation, hypothermia was identified as the main challenge. Hypothermia can occur due to late rescue of personnel if helicopter and MOB/FRDC is unavailable. Calculations show that the requirement (ref. NOROG 064 Guideline) for rescue from the sea is not met with use of AWSAR in case of wet evacuation for Area A, while for Area B with limitations on the number of passengers on board the helicopter, the NOROG 064 Guideline requirement will be met. It should therefore be considered to always have an SBV with FRDC on board to be able to rescue personnel in harsh weather conditions. Further, the personal survival suits available in the LQ have been modified to suit conditions in the Barents Sea, but the survival suits at the lifeboat stations are as mentioned only regular ship suits as specified in SOLAS. It should therefore be included in procedures that personnel always bring their survival suit from the cabin if possible during an evacuation. Furthermore it should be considered to provide minimum 50% (70) survival suits adapted to the Barents Sea also at the lifeboat stations.

The environmental conditions in Area A and Area B during the winter months have high impact on the evacuation and rescue of personnel. Many of the above mentioned challenges, e.g. sea ice, icing, etc., will initially not be relevant during the summer months. Even though the summer months are usually milder, an evacuation and rescue situation may prove critical due to remoteness. Note that there may be annual variations with milder winters and cold/snow may be experienced during the summer.

6.18 DSHA 17: Occupational accidents/acute illness

This DSHA includes occupational accidents (accidents with no potential to cause fatalities outside the immediate area of the incident) and acute illnesses (food and potable water contamination and events independent of work and rig conditions, e.g. heart attack, cardiac arrest, and stroke). Occupational accidents or acute illnesses related to operations in Area A and area B, may be caused by:

- Falling ice from heights (challenging to remove ice on structures and equipment)
- Ice causing slippery surfaces/gangways/stairs/ladders
- Ice accumulation on containers lifted from supply vessel (ice falls off)
- Hypothermia
- Cold/frost bite/freezing of extremities
- Low temperatures / darkness having impact on personnel both physically and psychologically

The following specific challenges for Area A and B were identified in the workshop:

- AWSAR not available for landing on the rig due to difficult/unacceptable flight conditions (e.g. reduced visibility due to fog or heavy snowfall, freezing rain etc.)
- Longer transport times to hospital. Due to the distance to e.g. Hammerfest, Tromsø or Kirkenes, the time for transportation to hospital may be longer than elsewhere in Norway, and exceeding the 180 minutes' guideline of bringing personnel to hospital. To compensate for this it is important to facilitate the use of telemedicine on the rig/hospital as early as possible and to utilise all new/modern medical technology in training. Further, it must be ensured that there is competence offshore to conduct treatment initiated through telemedicine and that training includes connecting to doctor on duty when solutions for telemedicine are used. The registered nurses need to be certified/re-certified wrt competence and experience within anaesthesia and sufficient acute and pre-hospital training. Adequate training should be given both to the first aiders and the registered nurses. It can also be considered to have more defined health requirements for personnel working at the most remote locations, to reduce the possibility for acute illnesses.
- Longer time to evacuate personnel in case of epidemics. Need to have plans for how to treat and isolate personnel with epidemics offshore
- Risk for not being able to pick up patients with helicopter at the rig due to flight conditions, in particular reduced visibility.

Operations and work tasks on the rig with an increased risk potential should be avoided if the AWSAR helicopter is available during the planned work period to perform medevac.

In the summer months the temperatures are normally higher and with less rough weather, and hence the risk for occupational accidents and acute illnesses is lower than during the winter months. However,

it should be noted that there may be annual variations with milder winters and cold/snow during the summer.

6.19 DSHA 18: Man overboard situations

This DSHA covers primarily incidents where personnel working over the sea accidentally fall into the sea. Other personnel may fall into the sea caused by external influence such as wind and missing/damaged structure (e.g. missing grating or railings).

The site specific challenges are already covered by DSHA 10a *Helicopter accident into the sea within the safety zone*, ref. section 6.11.1.

6.20 DSHA 19: Fire/explosion in mud treatment areas

When drilling mud sometimes carries combustible gas from the well and up onto the rig. This may lead to the formation of an ignitable cloud if not ventilated sufficiently. In other situations oil based mud is used when drilling and vapour from the mud may be formed leading to ignitable gas clouds if not ventilated. Overheating of rotating equipment and/or hot work in areas with oil based mud may also cause a fire or an explosion.

Other possible scenarios for this DSHA are

- Flammable gas can be released from the shale shakers,
- Fire/explosion in the mud pit area due to build-up of gaseous atmosphere in the mud tank when oil is present in the mud;
- Fire/explosion on the drill floor due to release from mud return system and/or hazardous drains.

The site specific challenges are covered by DSHA 8 *Fire/explosion in the machinery spaces/fire in utility areas* (see ch. 6.9)

6.21 DSHA 20: Security threats

Security threats are situations with unauthorized access to rig or safety zone, or interference with the operations. This may be threats and criminal acts against the installation and operations. Further, security risk may also be an issue at supply/helicopter bases such as airports and ports onshore. Plans have to be implemented, and personnel have to be trained to handle such situations. Finally, there should be requirements to harbour and heliport operators to establish proper security measures.

The major site specific challenge related to security is the increased focus from NGOs (non-governmental organizations). These groups usually put great focus on oil and gas activity in the Barents Sea. Plans should be prepared and people trained to handle such situations. It will be required to clarify the juridical status of the safety zone prior to start-up of operations, in addition to procedure for how to engage police authority on the rig.

Exploration drilling in location A and B will represent a new activity in an area close to the maritime separation line towards the Russian economic zone, and may attract interest from parties that not have direct relations to the exploration activity.

Experience from the Statoil Hoop/Apollo/Atlantis campaign, Shells campaign in the Chuckchi Sea and towards seismic vessels heading towards the northeast Greenland demonstrates that it should be expected high attention and possible interference from NGOs for the future exploration drilling activities in the area.

7 EFFICIENCY ASSESSMENT

NOROG guideline 064 establishes response time and capacity for rescue of personnel in a set of defined emergency situations. This section gives an efficiency analysis of relevant NOROG 064 requirements related to rescue of personnel in Area A and Area B. Note that assumptions given in this chapter regarding times, locations, capacities, routines, etc are included to enable calculation of response times and rescue capacities, which may need to be reviewed and validated at a later stage.

Please note that 064 is a guideline, and does not represent mandatory requirements but rather an industry practice definition. In addition some cases not related to requirements have been included, as this information will give important decision support to the OIM (e.g. early evacuation of personnel).

This section is included to illustrate response times and rescue capacity that can be expected in evacuation and rescue situations. Area A and Area B will be evaluated in separate sections. The efficiency assessment was used during workshop 1 and is also a part of the gap assessment performed in section 8.

7.1 Assumptions

The efficiency assessments have been carried out under the following assumptions:

Helicopter:

- AWSAR contracted and located in locations such as Vardø/Berlevåg/Kirkenes.
- Winching one person from lifeboat takes 3 mins.
- Winching one person from water takes 3 mins.
- Helicopters fly in a straight line from heliport to rig.
- AWSAR speed is assumed to be 140 knots
- AWSAR mobilization time is 15 mins. whenever there is a transport flight to Area A/Area B. At other times the mobilization time is 45 minutes. Although a 15 minutes response time can be accommodated during daytime (e.g. between 0800-2000 hrs), but this is not accounted for in this analyses.
- It is assumed that the on duty doctor has the same mobilisation time as the rest of the helicopter crew. In the calculations, 30 mins mobilisation time has been conservatively used
- Flight times do not account for favourable/unfavourable wind conditions (assuming wind does not change during a round trip)
- Turnaround on helideck/heliport takes on 20 minutes, including fuelling, boarding / loading.
- Transfer patient from helicopter to ambulance takes 10 min.
- The AWSAR may have to burn fuel before it can start rescuing all personnel in one operation from the sea, as result of a helicopter accident a short distance from shore
- Time for possible helicopter crew change has not been included in the efficiency assessment.
- Number of passengers in AWSAR per flight for area A is 8 persons.
- Number of passengers in AWSAR per flight for area B is 10 persons.

Rig and interface with SBV:

- Transporting up to 9 persons in a personnel basket from the rig to the standby vessel will take 5 min.

MOB-boat, rescue and ambulance:

- Rescue of one person from water takes 3 mins.
- MOB-boat mobilized and launched within 5 mins. when ongoing work above sea.
- MOB-boat mobilized and launched within 15 mins. when no work above sea.
- Loading a MOB-boat, get all passengers out and re-launch it takes 15 mins.
- Ambulance from heliport onshore to hospital takes 8 min (example from Kirkenes). Time depends on where the helicopter lands with the patient(s).

7.2 Area A

The reference point in Area A being used is Area A2 in coordinates 74.375 N, 35.833 E.

7.2.1 Medical evacuation/Transport to hospital

Requirement 00.09.R:

Personnel witch cannot be given satisfactory medical treatment on the rig shall be transported to hospital in a swift and safe manner and within 3 hours after need is identified.

The requirement corresponds to requirement in NOROG 064 Guideline.

Resources:

- AWSAR in Vardø (example)

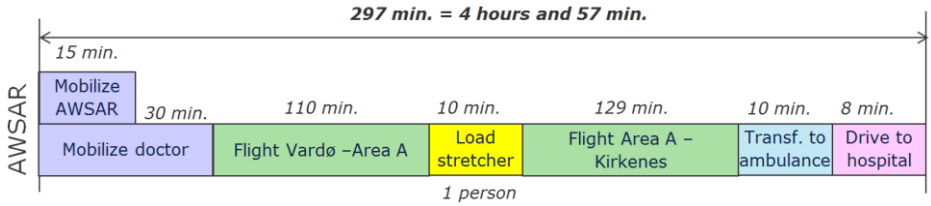


Figure 7-1 Transport to hospital using AWSAR in time period with ongoing helicopter transport

Transport to hospital is estimated to take 4 hours and 57 min. The NOROG requirement is not met.

In the calculations it is assumed that the doctor will have to mobilize. One option is then to let the rig registered nurse follow the patient in the helicopter. This has to be based on a medical judgement. In dense fog crane transfer basket may be used to transport personnel to the stand by vessel where it is easier for the helicopter to pick them up (by winch), or transport them to an area with less fog for pick up.

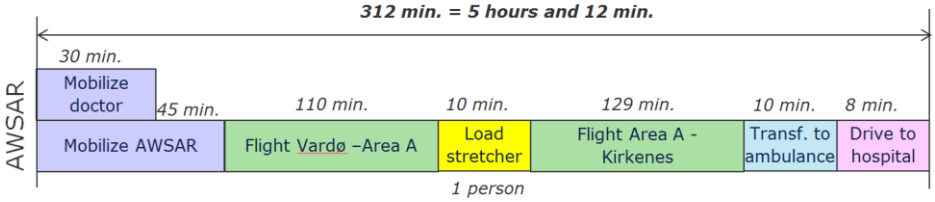


Figure 7-2 Transport to hospital using AWSAR in time period without ongoing helicopter transport.

Transport to hospital is estimated to take 5 hours and 12 min when there is no ongoing helicopter transport.

7.2.2 Medical evacuation following a helicopter accident on installation

Requirement:

It is not explicitly stated that the time requirement for transport to hospital, ref. section 7.3.1, applies for this DSHA.

Resources:

- AWSAR in Vardø (example)

The AWSAR is equipped to transport at least 3 stretchers. The calculation of response time will be as for "Medical evacuation/transport to hospital". Some additional time will be required, as the helicopter deck may be unavailable due to the crash, and winch has to be used. Boarding and securing 4 patients will also add some extra time. The additional time has not been quantified.

7.2.3 Helicopter accident into sea – inside safety zone

Requirement 10.01.R:

It shall be possible to pick up the helicopter passenger from the sea in case of a helicopter crash inside the rig safety zone (21 persons within 120 min.)

The requirement corresponds to requirement in NOROG 064 Guideline and WR1156 (nYK.25).

Resources:

- MOB-boat (weather limitations)
- Standby vessel MOB-boat (weather limitations)
- AWSAR

If the weather conditions does not allow MOB-boats to be launched, or the accident is outside the 500-m zone, the AWSAR has to rescue all persons.

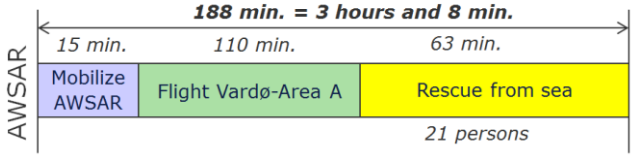


Figure 7-3 Helicopter accident into sea, inside safety zone, using AWSAR

The AWSAR will not be able to meet the requirement. In cases where the MOB-boats cannot be launched they will not be able to rescue any people within 120 minutes since it will take 125 minutes for them to arrive at the location. The requirement will not be met even if the number of passengers in the helicopter is reduced. Ordinary transport helicopter flights need to be halted in conditions where MOB/FRDC is not available at the field.

It should be noted that a full helicopter of 21 persons is used as basis in the calculations. It is expected that number of passengers in the helicopter will be reduced due to the flight distance of about 260 nm from shore to area A2.

If there is an FRDC at the field (when the standby vessel with FRDC is present) and the weather limitations for launch is not exceeded, the requirement is met by this single resource alone. Rescue of 21 persons will take 78 minutes.

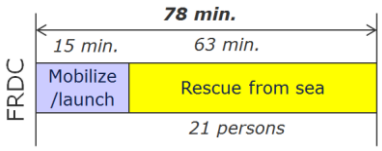


Figure 7-4 Helicopter accident into sea, inside safety zone, using FRDC

If there is a standby vessel without FRDC, both the MOB-boat at the standby vessel and drilling rig has been utilized to meet the requirement.

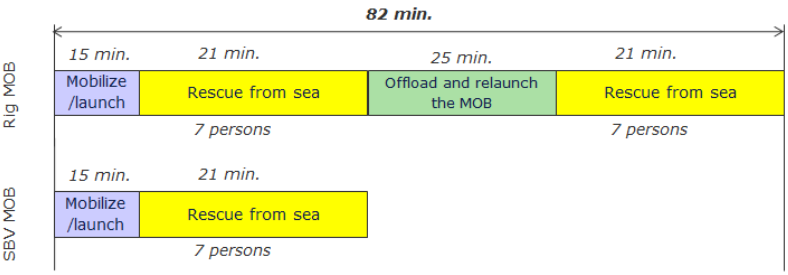


Figure 7-5 Helicopter accident into sea, inside safety zone, using two MOB-boats

This DSHA is strictly dependant on the weather conditions. It is not considered a problem for the emergency preparedness, as the number of passengers in the transport helicopter can be reduced, to meet the requirement. However, this represents a challenge since it will require more helicopter flights and the crew change may be delayed. Another option to meet this requirement will be to only allow helicopter transport as long as the weather is within criteria for use of MOB/FRDC

A FRDC is able to operate in worse weather conditions than a MOB-boat, and may increase the availability of transport helicopter.

7.2.4 Helicopter accident into sea – en route

Requirement:

There exists no requirement for rescue en route.

Resources:

- AWSAR

The helicopter may have to burn fuel to be able to rescue all 21 persons close to shore due to weight. However, in an emergency they will try to be creative to solve the rescue operation, including use of raft drop kit

Time wise, the worst case scenario is a helicopter ditch near the installation, but too far from the installation to get assistance from FRDC/MOB. The rescue operation may take up to 188 min, if AWSAR is the only resource being available. Assistance from the Standby vessel may improve the time estimate.

With regard to helicopter weight (fuel) a ditch closer to shore is the worst case scenario. The pilots may decide to rescue half the personnel, transport them to an installation or to shore before rescuing the rest. Or they may fly to burn fuel before the rescue starts. This will not take more time than flying to Area A. The time for this has not been quantified, due to lot of uncertainties, but is expected to take less than 188 min.

It should be noted that a full helicopter of 21 persons is used as basis here. It is expected that number of passengers in the helicopter will be reduced due to the flight distance of about 260 nm from shore to area A2.

Explanation in NOROG 064 Guideline's 120-min. requirement:
"If the survival suit is tested according to Norsk olje og gass/NS-EN ISO 15027, the safety-factor for critical hypothermia exceeds 1,5. It is emphasised that the safety factor is based on time to critical hypothermia, as this is the only condition to be documented by objective tests. Drowning and other life threatening circumstances, second to falling into the sea, is hard to map with objective tests. These circumstances are therefore covered by the safety factor".

7.2.5 Evacuation to sea – rescue from sea

Requirement (taken from *NOROG 064 Guideline*):

It shall be possible to pick up personnel from the sea in case of an emergency evacuation within 120 min.

The deterministic approach described in the guideline has been used, as the number of personnel in sea following an emergency evacuation has not been quantified in the risk analysis. The calculations below are based on rescue of 7 persons (5% of POB) from sea, and rescue of 35 persons (25% of POB) from sea.

Resources:

- Standby vessel MOB-boat (weather limitations)
- AWSAR

The results show that the most efficient measure to rescue personnel from sea after an emergency situation is a Standby vessel with FRDC or MOB boat.

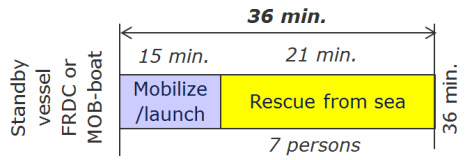


Figure 7-6 Emergency evacuation (5% POB), rescue from sea using a FRDC or MOB boat

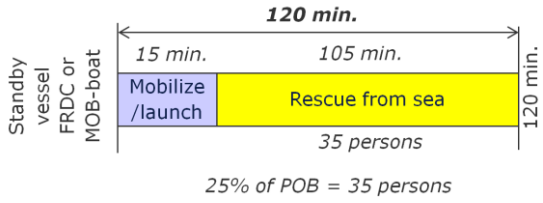


Figure 7-7 Emergency evacuation (25% POB), rescue from sea using a FRDC or MOB boat

If the weather condition does not allow MOB-boats to be launched, the AWSAR has to rescue all persons.

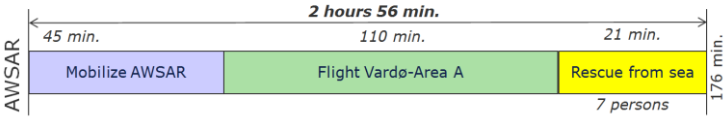


Figure 7-8 Emergency evacuation (5% POB), rescue from sea using AWSAR

It will take long time to rescue all personnel with one AWSAR, exceeding the time requirement with 56 minutes (approximately 50%).

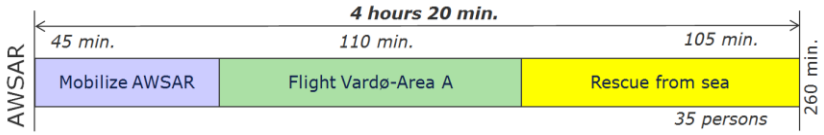


Figure 7-9 Emergency evacuation (25% POB), rescue from sea using AWSAR

It will take long time to rescue all personnel with one AWSAR, exceeding the time requirement with 2 hours and 20 minutes (over 100%). Time for refuelling of the helicopter is not included in the time estimate, and will cause the time requirement to be exceeded further.

The efficiency assessment concludes that the NOROG requirement is met in weather conditions where MOB/FRDC can be launched. With AWSAR the requirement is not met.

Explanation to requirement, ref. NOROG 064 Guideline:
"If the survival suit is tested according to Norsk olje og gass/NS-EN ISO 15027, the safety-factor for critical hypothermia exceeds 1,5. It is emphasised that the safety factor is based on time to critical hypothermia, as this is the only condition to be documented by objective tests. Drowning and other life threatening circumstances, second to falling into the sea, is hard to map with objective tests. These circumstances are therefore covered by the safety factor".

7.2.6 Evacuation to sea – rescue from lifeboat

Requirement:
There is no time requirement for rescuing personnel out of the lifeboats. Personnel are considered safe in lifeboat.

Resources:

- AWSAR in Vardø (example)
- FRDC from SBV

Personnel are usually considered safe when inside the lifeboats. A calculation has been made to illustrate the time needed to rescue all personnel from lifeboat to shore, using the AWSAR helicopters to pick up from sea or lifeboat. The number of passengers in the helicopter will be reduced due to distance and weight considerations, and it is assumed that the AWSAR can take maximum 8 passengers for per flight. This operation is estimated to take more than 100 hours if only one AWSAR is used (as an example placed in Vardø). If an additional AWSAR located in Hammerfest is included, it is estimated that the time requirement to complete the operation is about 55 hours. If a third SAR helicopter, such as the SeaKing at Banak is included, the rescue time may be reduced down to 42 hours. This operation is considered a risky operation, as winching personnel up from a lifeboat is a difficult operation. Pilots should therefore inspect the lifeboats to be familiar with the design of the lifeboats.

In practice it is expected that rescue from lifeboats will be handled with a combination of AWSAR and SBV. The AWSAR will transfer personnel from the lifeboat to the SBV, and the SBV will use its FRDC to rescue personnel from the lifeboats. A time estimate for rescue of 140 persons from lifeboats with the use of FRDC and transfer to SBV is about 10 hours, assuming 3 minutes to resource transfer a person to the FRDC, and 25 minutes for offloading to the SBV and re-launching. This is an operation which there exists little operational experience from, and it is a recommendation from this study that SBVs shall be required to have documented plans for rescue of personnel from lifeboats, and with associated training

requirements and dimensioning of crew. Similar will be relevant for training of helicopter crew for rescue from lifeboats.

7.2.7 Early evacuation

Requirement:
There is no time requirement for early evacuation.

Resources:

- AWSAR in Vardø (example)
- Transport helicopter (may be available)

Evacuation by helicopter to shore will take a long time due to the distance from shore.

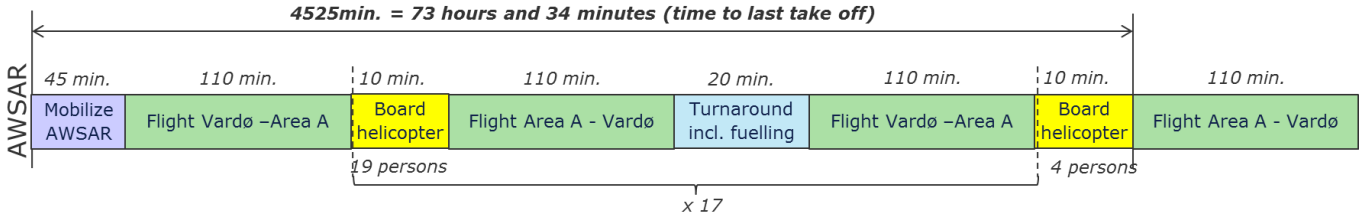
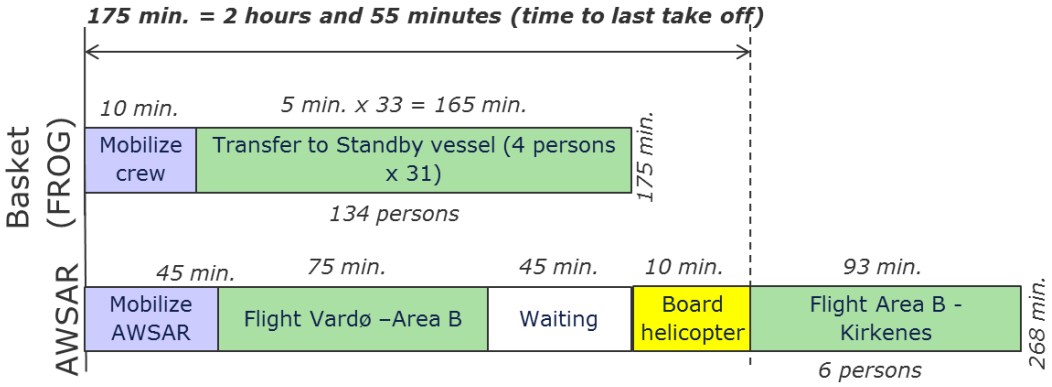


Figure 7-10 Early evacuation to Vardø (example), using AWSAR

Transporting all personnel to Vardø, using one AWSAR will take 73 hours and 34 min with 8 passengers per flight, measured to the time the last helicopter takes off from the installation. With one additional AWSAR or SAR helicopter involved in the early evacuation, time to perform early evacuation may be reduced down to around 44 hours, and with two additional helicopters down to around 36 hours.

It is more efficient to transport personnel to the standby vessel by using the personnel basket. The crane operation and flag man cannot be transferred by basket, and will have to be transferred by another resource. Hence it has been assumed that 6 persons (including crane operator and flag man) will be evacuated by helicopter, after the rest have been transferred by basket to the standby vessel. The time until the helicopter takes off will be 2 hours and 55 min.

The personnel on board the rig has to be informed and prepared for the plan, since this is not a normal practice on NCS.



20

Figure 7-11 Early evacuation to SBV, using personnel basket and AWSAR.

7.2.8 Vessel/object on collision course

Requirement 08.02A:

Vessels on collision course shall be observed in time to make necessary decisions and actions (evacuation/relocations).

Vessel

The typical velocity is 13-15 knots for tank vessels and 24 knots for container vessels.

Assumed a vessel with the velocity of 24 knots, the radar coverage has to be 20 nm to be able to observe the vessel 50 min. prior to closest point of approach (approach within 500 m zone).

The figure below show an example of how a decision time line for vessel on collision course could be, based on the existing requirements and likely duration of activities. This should be confirmed by the rig. Note that the example shows the time line for a DP rig and that for moored rigs the relocation will take more time.

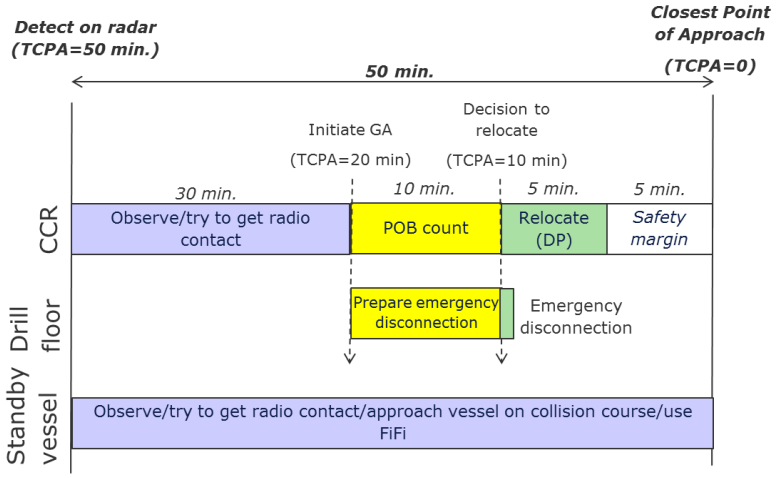


Figure 7-12 EXAMPLE - Vessel on collision course, time line for decisions and actions

7.3 Area B

The reference point in Area B being used is Area B2 in coordinates 72.875 N, 35.500 E.

7.3.1 Medical evacuation/Transport to hospital

Requirement 00.09.R:

Personnel witch cannot be given satisfactory medical treatment on the rig shall be transported to hospital in a swift and safe manner and within 3 hours after need is identified.

The requirement corresponds to requirement in NOROG 064 Guideline.

Resources:

- AWSAR in Vardø (example)

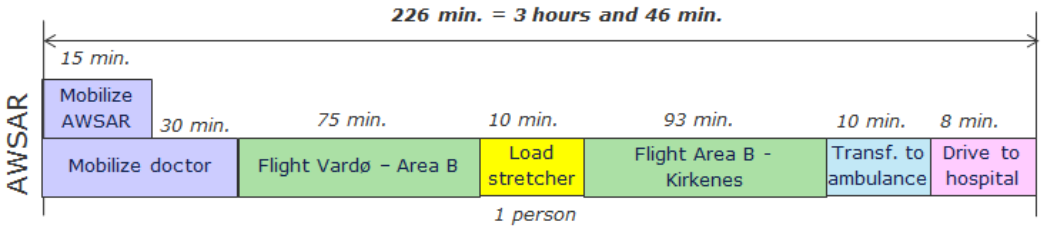


Figure 7-13 Transport to hospital using AWSAR in time period with ongoing helicopter transport

Transport to hospital is estimated to take 3 hours and 46 min. The NOROG 064 Guideline requirement is not met.

In the calculations it is assumed that the doctor will have to mobilize. One option is then to let the rig registered nurse follow the patient in the helicopter. This has to be based on a medical judgement. In dense fog crane transfer basket may be used to transport personnel to the stand by vessel where it is easier for the helicopter to pick them up (by winch), or transport them to an area with less fog for pick up.

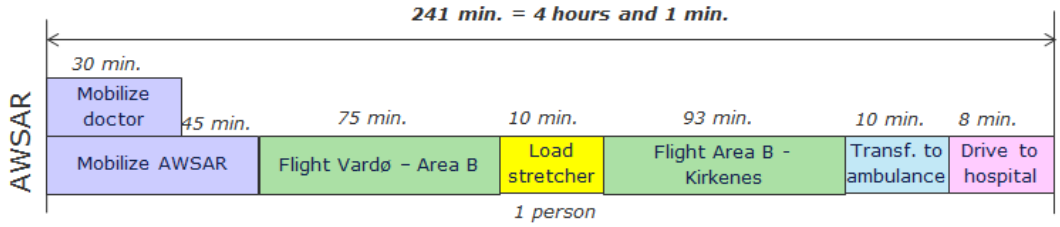


Figure 7-14 Transport to hospital using AWSAR in time period without ongoing helicopter transport.

Transport to hospital is estimated to take 4 hours and 1 min when there is no ongoing helicopter transport.

7.3.2 Medical evacuation following a helicopter accident on installation

Requirement:

It is not explicitly said that the time requirement for transport to hospital, ref. section 7.3.1, applies for this DSHA.

Resources:

- AWSAR in Vardø (example)

The AWSAR is equipped to transport at least 3 stretchers. The calculation of response time will be as for "Medical evacuation/transport to hospital". Some additional time will be required, as the helicopter deck may be unavailable due to the crash, and winch has to be used. Boarding and securing 4 patients will also add some extra time. The additional time has not been quantified.

7.3.3 Helicopter accident into sea – inside safety zone

Requirement 10.01.R:

It shall be possible to pick up the helicopter passenger from the sea in case of a helicopter crash inside the rig safety zone (21 persons within 120 min.)

The requirement corresponds to requirement in NOROG 064 Guideline and WR1156 (nYK.25).

Resources:

- MOB-boat (weather limitations)
- Standby vessel MOB-boat (weather limitations)
- AWSAR

If the weather conditions does not allow MOB-boats to be launched, or the accident is outside the 500m safety zone, the AWSAR has to rescue all persons.

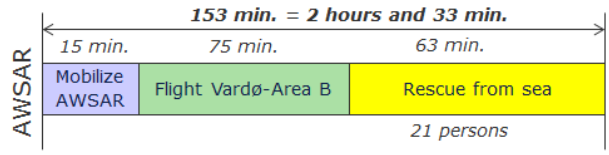


Figure 7-15 Helicopter accident into sea, inside safety zone, using AWSAR

The AWSAR will not be able to meet the requirement. In cases where the MOB-boats cannot be launched the helicopter passengers will have to be reduced to meet this requirement.

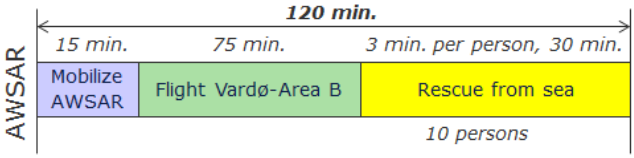


Figure 7-16 Helicopter accident into sea, inside safety zone, using AWSAR – reduced number of passengers to meet requirement

As illustrated by the figure above, the total number of persons in the helicopter cannot exceed 10 persons, if the AWSAR is the only resource for rescue. The number of passengers is then 8 persons. It should be assessed how increased number of helicopter flights to cater for reduced passenger number increases the helicopter transport risk, and whether instead ordinary transport helicopter flights need to be halted in conditions where MOB/FRDC is not available at field. The individual risk for personnel is independent of number of flights/passengers per flight. Another option to meet this requirement can be to only allow helicopter transport as long as the weather is within criteria for use of MOB/FRDC.

If there is an FRDC at the field (when the standby vessel with FRDC is present) and the weather limitations for launch is not exceeded, the requirement is met by this single resource alone. Rescue of 21 persons will take 78 minutes.

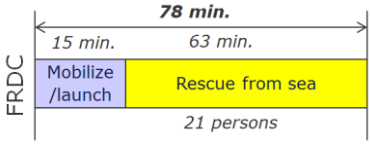


Figure 7-17 Helicopter accident into sea, inside the safety zone, using FRDC

If there is a standby vessel without FRDC, both the MOB-boat at the standby vessel and drilling rig has been utilized to meet the requirement.

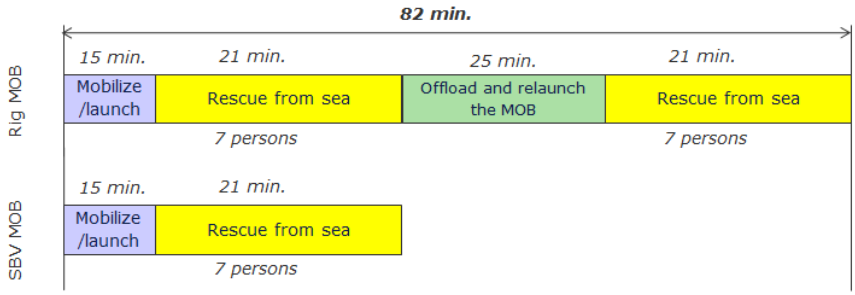


Figure 7-18 Helicopter accident into sea, inside the safety zone, using two MOB-boats

This DSHA is strictly dependant on the weather conditions. It is not considered a problem to the emergency preparedness, as the number of passengers in the transport helicopter can be reduced to 5 persons, to meet the requirement. This is represents a challenge since it will require more helicopter flights and the crew change may be delayed.

A FRDC is able to operate in worse weather conditions than a MOB-boat, and may increase the availability of transport helicopter.

7.3.4 Helicopter accident into sea – en route

Requirement:
There exists no requirement for rescue en route.

Resources:

- AWSAR

The helicopter may have to burn fuel to be able to rescue all 21 persons close to shore, due to weight. However, in an emergency they will try to be creative to solve the rescue operation, including use of raft drop kit.

Time wise, the worst case scenario is a helicopter ditch near the installation, but too far from the installation to get assistance from FRDC/MOB. The rescue operation may take up to 153 min, if AWSAR is the only resource being available. Assistance from the SBV may improve the time estimate.

With regard to helicopter weight (fuel) a ditch closer to shore is the worst case scenario. The pilots may decide to rescue half the personnel, transport them to an installation or to shore before rescuing the rest. Or they may fly to burn fuel before the rescue starts. This will not take more time than flying to Area A. The time for this has not been quantified, due to lot of uncertainties, but is expected to take less than 153 min.

Explanation in NOROG 064 Guideline's 120-min. requirement:
"If the survival suit is tested according to Norsk olje og gass/NS-EN ISO 15027, the safety-factor for critical hypothermia exceeds 1,5. It is emphasised that the safety factor is based on time to critical hypothermia, as this is the only condition to be documented by objective tests. Drowning and other life threatening circumstances, second to falling into the sea, is hard to map with objective tests. These circumstances are therefore covered by the safety factor".

7.3.5 Evacuation to sea – rescue from the sea

Requirement (taken from *NOROG 064 Guideline*):

It shall be possible to pick up personnel from the sea in case of an emergency evacuation within 120 min.

The deterministic approach described in the guideline has been used, as the number of personnel in sea following an emergency evacuation has not been quantified in the risk analysis. The calculations below are based on rescue of 7 persons (5% of POB) from sea and rescue of 35 persons (25% of POB) from sea.

Resources:

- Standby vessel MOB-boat (weather limitations)
- AWSAR

The results show that the most efficient measure to rescue personnel from sea after an emergency situation is a Standby vessel with FRDC or MOB boat.

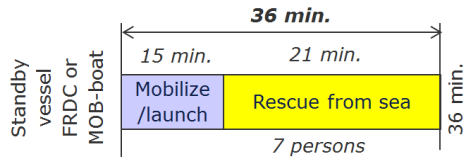


Figure 7-19 Emergency evacuation (5% POB), rescue from the sea using a FRDC or MOB boat

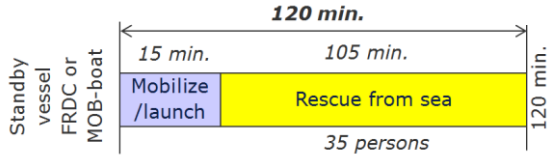


Figure 7-20 Emergency evacuation (25% POB), rescue from the sea using a FRDC or MOB boat

If the weather condition does not allow MOB-boats to be launched the AWSAR has to rescue all persons.

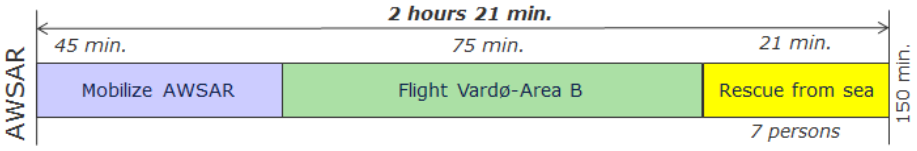


Figure 7-21 Emergency evacuation (5% POB), rescue from sea using AWSAR

It will take long time to rescue all personnel with one AWSAR, exceeding the time requirement with 21 minutes (approximately 15%).

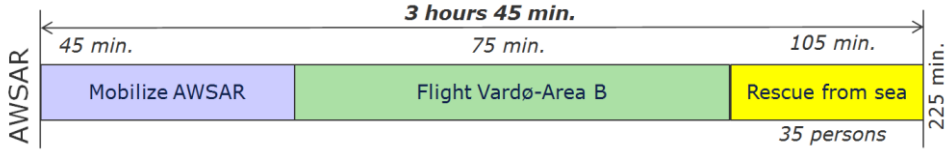


Figure 7-22 Emergency evacuation (25% POB), rescue from sea using AWSAR

It will take long time to rescue all personnel with one AWSAR, exceeding the time requirement with 1 hour and 45 minutes (almost 90%).

The efficiency assessment concludes that the NOROG requirement is met in weather conditions where MOB/FRDC can be launched. With AWSAR the requirement is not met.

Explanation to requirement, ref. NOROG 064 Guideline:
"If the survival suit is tested according to Norsk olje og gass/NS-EN ISO 15027, the safety-factor for critical hypothermia exceeds 1,5. It is emphasised that the safety factor is based on time to critical hypothermia, as this is the only condition to be documented by objective tests. Drowning and other life threatening circumstances, second to falling into the sea, is hard to map with objective tests. These circumstances are therefore covered by the safety factor".

7.3.6 Evacuation to sea – rescue from lifeboat

Requirement:

There is no time requirement for rescuing personnel out of the lifeboats. Personnel are considered safe in lifeboat.

Resources:

- AWSAR in Vardø (example)
- FRDC from SBV

Personnel are usually considered safe when inside the lifeboats. A calculation has been made to illustrate the time needed to rescue all personnel from lifeboat to shore, using the AWSAR helicopters to pick up from sea or lifeboat. The number of passengers in the helicopter will be reduced due to distance and weight considerations, and it is assumed that the AWSAR can take maximum 10 passengers for per flight. This operation is estimated to take more than 64 hours if only one AWSAR is used (as an example placed in Vardø). If an additional AWSAR located in Hammerfest is included, it is estimated that the time requirement to complete the operation is about 37 hours. If a third SAR helicopter, such as the SeaKing at Banak is included, the rescue time may be reduced down to 29 hours. This operation is considered a risky operation, as winching personnel up from a lifeboat is a difficult operation. Pilots should therefore inspect the lifeboats to be familiar with the design of the lifeboats.

In practice it is expected that rescue from lifeboats will be handled with a combination of AWSAR and SBV. The AWSAR will transfer personnel from the lifeboat to the SBV, and the SBV will use its FRDC to rescue personnel from the lifeboats. A time estimate for rescue of 140 persons from lifeboats with the use of FRDC and transfer to SBV is about 10 hours, assuming 3 minutes to resource transfer a person to the FRDC, and 25 minutes for offloading to the SBV and re-launching. This is an operation which there exists little operational experience from, and it is a recommendation from this study that SBVs shall be required to have documented plans for rescue of personnel from lifeboats, and with associated training requirements and dimensioning of crew. Similar will be relevant for training of helicopter crew for rescue from lifeboats.

7.3.7 Early evacuation

Requirement:
There is no time requirement for early evacuation.

Resources:

- AWSAR in Vardø (example)
- Transport helicopter (may be available)

Evacuation by helicopter to shore will take a long time due to the distance from shore.

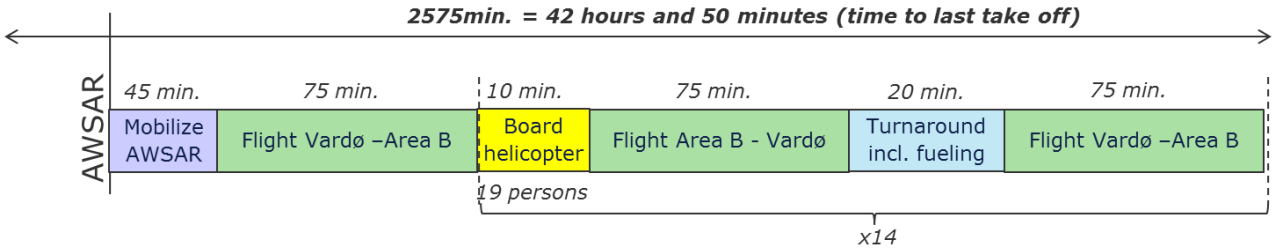


Figure 7-23 Early evacuation to Vardø (example), using AWSAR

Transporting all personnel to Vardø, using one AWSAR will take 43 hours with 10 passengers per flight, measured to the time the last helicopter takes off from the installation. With one additional AWSAR or SAR helicopter involved in the early evacuation, time to perform early evacuation may be reduced down to around 24 hours, and with two additional helicopters down to around 19 hours.

It is more efficient to transport personnel to the standby vessel by using the personnel basket. The crane operation and flag man cannot be transferred by basket, and will have to be transferred by another resource. Hence it has been assumed that 6 persons (including crane operator and flag man) will be evacuated by helicopter, after the rest have been transferred by basket to the standby vessel. The time until the helicopter takes off will be 2 hours and 55 min.

The personnel on board the rig has to be informed and prepared for the plan, since this is not a normal practice on NCS.

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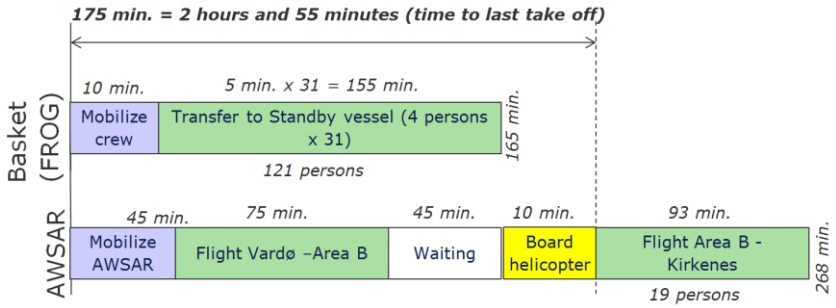

Figure 7-24 Early evacuation to SBV, using personnel basket and AWSAR.

7.3.8 Vessel/object on collision course

The time estimates related to vessel on collision course the scenario will be the same as for Area A. See section 7.2.8 for details.

8 GAP ASSESSMENT

In the gap assessment the site specific challenges presented in Section 6 have been assessed wrt compliance with performance requirements from regulations and standards. Areas where there is considered to be a gap between the required performance and the available level of performance have been identified in areas A and B,.

In addition, the challenges for which there is not established any performance requirements covering the site specific challenges, or where performance requirements are inadequate or not specific, have been identified.

The gap assessment has identified new or additional measures to compensate for the site specific challenges identified in the DSHA review in Section 6. Additional mitigating measures and recommendations are listed in section 8.2.

The assessment includes gaps towards the following standards and requirements:

- PSA Activities and Facilities regulations (ref. /13/ and /14/)
- OLF Guideline 064 Etablering av områdeberedskap (ref. /6/)
- OLF Guideline 016 Medisinsk beredskap (ref. /7/)
- OLF Guideline 096 Mann over bord beredskap[5] (ref. /8/)
- ISO 19906 Arctic Offshore (to the extent that this is applicable to mobile offshore units) (ref. /9/)
- Internal requirements for BaSEC companies; GDF Suez (ref. /10/), Lundin (ref. /11/), OMV (ref. /12/), and Statoil (ref. /5/).

The gap assessment is performed on an informative basis, as some of the standards above are not mandatory for the drilling operations in Area A and B.

The regulations and standards mostly give functional requirements. Gaps have therefore been considered to arise where site specific challenges require additional technological or operational measures to fulfil the expectations in the defined performance requirements. Wherever possible, quantification of the efficiency of the emergency response, in terms of response time and capacity, has been used in the gap assessment.

8.1 National and international standards, guidelines and regulations

The gap assessment has evaluated a total of 160 requirements. Fifty-seven gaps were identified and were classified as either green, yellow or red. 13 were marked as red, 2 as yellow, and 42 as green. The gap classification is given in Figure 8-1 below (see chapter 4 for further details).

[5] Please note that NOROG 096 Guideline has been withdrawn and replaced by 064 (area preparedness) and 088 (permit to work). As these standards do not specify the manning of MOB team, the reference to 096 is still used.

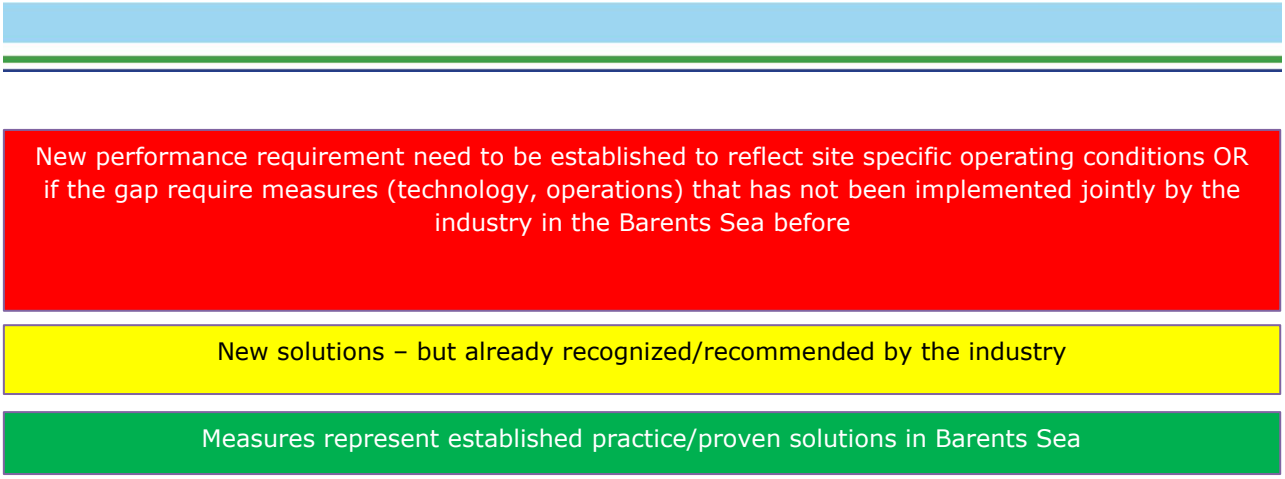

Figure 8-1 Classification of gaps

The intention with the categories /colour coding is to prioritize the different gaps with respect to required efforts for further work to implement joint solutions and close the gaps. A description of the coding is presented below. All the identified gaps need to be handled, but some are more important to focus on at this stage. These are the gaps where recommended measures are less mature or represent solutions that have not been jointly implemented by the industry.

The identified gaps are based on the experience and competence of the work group, and as such represent the subjective assessment of this group. The recommendations and prioritizations are initial, and may change based on new knowledge and experience that is gained in the further work to develop adequate emergency preparedness for the operations.

The requirements (97 in total) for which no gaps have been identified are not affected by the site specific conditions and challenges. Most of the non-gap requirements are related to general principles for emergency preparedness. Example of such requirements are; "The emergency hospital shall be ready for immediate use" and "The EER system shall not pose hazards to the safety of personnel undertaking drills".

The majority of the identified gaps are related to DSHA 0 – *General*, 10a and b – *Helicopter accident into the sea*, 11a and b – *Ship/other objects and sea ice/ice bergs on collision course*, and 16 – *Evacuation and rescue*. Cold climate and need for winterization of safety critical systems are the main reasons for gaps towards requirements. The long distances from Area A and B to the shore, and lack of area emergency preparedness and infrastructure, introduces long response times and the response time requirements are exceeded. The long distance is considered as the biggest challenge, as is seen from the efficiency assessment in section 7.

The same types of gaps are more or less identified for Area A and B. The difference is mainly caused by the fact that Area A is more remote compared to B, and hence the deviation from targets for response times and capacity is larger for Area A than for B. The need for compensating measures on winterization is considered to be the same for both areas for all season operations. Both areas will need to include ice risk management plans, and such plans have to cater for the higher occurrence of sea ice in area A than for B.

The identified gaps are divided into 12 main categories of requirements:

Requirement to keep rig safety system operational at all times (PSA; The Facilities Regulations §8): This requirement is challenged by the environmental conditions at the locations at the site, such as low temperatures, polar lows, troughs, marine icing and reduced visibility (fog, snow fall). This gap will be mitigated by a combination of technical measures for winterization of safety systems and operational measures included in the winterization manual, see details in section 9. Planning operations

to the summer season will reduce the impact from polar lows, marine icing and low temperatures significantly.

Both location A and B have had short periods of heavy and extreme marine icing. In an emergency response context this is specifically considered to be a concern for icing on lifeboats and lifeboat launch equipment. Vessels are more exposed to marine icing than rigs, and vessel winterization for marine icing will be important for operations during winter season. See section 9 for recommendations and compensating measures.

Requirement to implement well control measures (PSA; The Activities Regulations §§85-86): Immediate well control measures will be implemented according to normal procedures, and is not considered to represent a gap.

However, the work group also included discussion on how to sustain well control measures over prolonged period, where three areas where considered:

- Controlling well by mud weight: This was considered to be potentially challenged if the rig runs out of kill mud due to long supply routes to shore.
- Install capping stack in water depths relevant for area A and B: For capping stack installation area A and B, as most other parts of the NCS, represents relatively shallow water depths where post installing of a capping stack will require other and new approaches than those applied for installation from a position directly above the wellhead.
- Drilling relief well: If well control problems occur prior to or during the winter season, relief well drilling with a fully winterized drilling rig might be required, and also with assistance of a complete system for ice management including ice breakers and an ice classed drilling rig. This represents a complex and unknown operation for operators on NCS. Drilling of a relief well represents a low probability scenario, where other well control measures have failed. Shallow waters will require long well paths, and potentially conflict with Russian economic zone if the optimal path is considered to be from that direction.

Requirement to safely abandon well (PSA; The Activities regulations §88 and the Facilities Regulations §48): If well control problems occur prior to or during the winter season, the rig will need to move off location if sea ice is approaching. The rig can return when the sea ice has drifted off location, however the ice season have shown to last for several weeks. Thus, safe abandonment of the well will need to reflect the timelines for approaching sea ice, and the length of the period for which sea ice can be on the location.

Requirement to evacuate personnel to safe area (PSA; The Activities regulations §77 and OMV internal requirement, ref. /12/): The remote location and with few vessels and installations in the area require more attention to how to bring personnel to a safe location after evacuation, and for protection against hypothermia until they are rescued. Rescue methods need to cover both rescuing from the lifeboats and from the sea. The efficiency assessment for rescue of personnel in sea shows that the time and capacity requirement for rescue of personnel from the sea after an evacuation as defined in NOROG Guideline 064 is not met if the SBV cannot launch its MOB boat or FRDC. Assuming a rig with freefall lifeboats and a POB of 140, the requirement is to pick up 7 persons within two hours. This is met

for both areas A and B with the SBV's MOB boat or FRDC. With use of AWSAR the requirement is exceeded with 21 minutes for area B and 56 minutes for area A. Compensating measures are suggested in section 9.

Requirement for safe transport (PSA Activity regulation §17): The remote location and with few vessels and installations in the area require more attention to how rescue personnel after a helicopter accident outside the rig safety zone. Currently there has not been defined a specific performance requirement for this emergency response action, equivalent to the requirement for rescue after helicopter ditch inside the rig safety zone as defined in NOROG Guideline 064. A proposed performance requirement and emergency response measures for rescue after helicopter accidents outside the rig safety zone are given in section 9.

Requirement for safe and efficient rescue of man over board (PSA; The Activities regulations 41): Lower water temperature and reduced visibility require additional measures to ensure that personnel who fall overboard can be rescued safely and efficiently. NOROG guideline 064 states a performance requirement to rescue man over board during work over sea, within 8 minutes. A new performance measurement for continuous man over board rescue response, and mitigating measures is proposed in section 9. This also includes additional measures for persons doing work above sea.

Requirement for hospital and emergency hospital to provide prudent first aid and medical treatment (PSA; The Facilities regulations §§59-60): The remote location will cause longer response times for AWSAR helicopter to carry out medevac. In addition to flight conditions, in particular reduced visibility, will reduce the possibility for AWSAR to land on the rig. This will require sustained medical treatment onboard the rig and also during the helicopter flight to shore.

Requirement to handle defined emergency situations (PSA; The Activities regulations, §73): Due to remoteness and periods with reduced visibility unavailability of helicopter due to flight conditions, medical evacuation (due to occupational accidents, acute illnesses and major accidents), the response times will be longer.. The performance requirement in the NOROG 064 Guideline for Medevac to hospital within 180 minutes is not met for location A and B. Compensating measures for medical evacuation is given in section 9.

Requirement to monitor safety zone and outside zone for threats (PSA; The Management regulations, §57): The risk of approaching sea ice and ice bergs require additional measures for monitoring the area around the rig, and to define appropriate response actions.

Requirement for SBV to perform emergency response efforts according to defined requirements (Statoil internal emergency response requirement, WR1156): Due to the remoteness and limited maritime and offshore activity in the area, the workgroup have identified that the rescue resources located in the field will have a more important role with respect to handling immediate emergency response needs. In particular the SBV will increase its importance further for

handling of medevac, down manning/precautionary evacuation, rescue from sea or lifeboat after evacuation and rescue after helicopter accident.

Requirement to ensure safety of MOB personnel before initiating rescue operation (IMO SOLAS, Chapter 3, §17.1) and requirement to not expose personnel to unnecessary danger during rescue and danger limitation (Statoil internal requirement WR1156): Rescue personnel may be exposed to harsh conditions during rescue and combat operation outdoors.

Requirement to pick up entire helicopter crew within 120 minutes for helicopter accident within rig safety zone (NOROG 064 Guideline): The guideline defines a requirement to pick up a full helicopter (max 21 persons) from sea in case of a helicopter ditch inside the rig safety zone within 120 minutes. The requirement is met with MOB boat or FRDC as recue resources when these can be launched. If MOB boat or FRDC cannot be launched and AWSAR is the main resource, this requirement is not met for Area A. The requirement can be achieved with AWSAR for area B with reduced number of people in the helicopter (max 10 persons). The requirement is not possible to be met for Area A, since mobilization and flight time alone exceeds 120 min.

The standard ***ISO 19906 for Arctic offshore structures*** is not applicable for mobile drilling units, but is used as informative guidance to identify areas that is also relevant to consider for emergency response on location A and B. From the review of this standard, the following requirements have been identified as relevant to consider:

- Requirement for installation to be able to move off in case of failure of the ice management system
- Requirement to have an alternative muster location that is equipped for cold climate
- Requirement for appropriate forecasting and monitoring of the physical environmental conditions affecting the reliability and performance of the EER system
- Requirement for the evacuation system to have a provision on board for retrieval of personnel, including injured personnel from the sea or ice.
- Requirement that personnel shall have appropriate protective equipment during the EER process.
- The offshore facility operator shall have competency for evaluating the risk associated with the physical environmental conditions on the EER system.

Emergency response measures to meet these requirements are proposed in section 9.

8.2 BaSEC partners' company specific performance requirements

Internal emergency response requirements from BaSEC partners have been compared identify possible gaps. The following documents have been reviewed:

1. **GDF Suez,** Emergency preparedness Assessment PL607 Byrkje, 7218/8-1, 2013

2. **Lundin Norway AS**, Site Specific Risk and Emergency Preparedness Analysis PL 609, Well 7220/11-3 (Alta), P609-LUN-S-RA-3009, 2015
3. **OMV**: Acona, SITE SPECIFIC EMERGENCY PREPAREDNESS ANALYSIS FOR WISTING MAIN – PL537, 600324, 2014 (OMV)
4. **Statoil**, WR1156 – Beredskap på norsk sokkel, egenopererte innretninger.

Documents 1-3 focus on compliance with NOROG 064 requirements and available area emergency preparedness resources in relation to site-specific discussions. The documents do not discuss internal handling of emergency response situation onboard the rig. Document no. 3 also discusses specifically the ability to evacuate in case of an epidemic onboard the rig, rescue from lifeboats and ability to take care of evacuated personnel and next of kin onshore.

Document no. 4 contains mainly non site-specific requirements, except from:

- Platform design and fixed safety systems should be the primary emergency resources for the facility.
- Personnel performing work above sea shall be picked up from sea before hypothermia.
- Personnel should not be exposed to unnecessary danger. Using response personnel for rescue or combat, the response manager should carefully consider the risk potential with regard to risk of injury or loss of life before personnel are sent into danger areas.
- SBV shall carry out emergency efforts pursuant to defined requirements.

These requirements have been used as basis for the review of requirements and gap assessment, see Appendix A.

9 MITIGATION MEASURES AND RECOMMENDATIONS

9.1 Main findings

During Workshop 2 (August 27th 2015) mitigation measures to close gaps were discussed and identified. A summary of the main discussions from the workshop is presented below.

The main findings are presented in Table 9-1, and the complete table can be found in Appendix A. The mitigation measures in the table are both technical and operational. The identification numbers presented in the rightmost column are the same numbers as being used in the table in Appendix A. The mitigation measures presented in this chapter are the ones being related to gaps classified as either red or yellow. In addition, important measures to close some green gaps have been identified in order to meet the requirements.

Table 9-1 Mitigation measures and recommendations

Requirement	Site specific issue to be mitigated to meet requirement	Mitigation measures	DSHA	Log sheet No./ Gap Category
Requirement to keep rig safety system operational at all times (PSA; Facilities Regulations §8)	• Cold environment effect on safety systems reduce their functionality or availability	**Technical** • Winterization gap assessment according to season of operation to be carried out. • Winterization of safety barriers/safety systems (technology or operational measures, consider season of operation). • Winterization gap assessment of SBV and PSV, according to season of operation and use in emergency situations. Requirements should be adapted to specifications for the rig. • AWOS installed on the rig **Operational** • Seasonal operations according to rig specification. • Winterization manuals and operations • Winterization manual; ensure lifeboats are operational in relevant weather conditions, remove snow/ice. • Adapt activity level onboard according to operating conditions/environmental conditions and status on safety- and EER systems • Relocate rig out of the area in case approaching critical environmental conditions (e.g. extreme weather). • Operational limitations (environmental conditions) for EER equipment to be defined, and procedures for precautionary measures (activity control, down manning due to extreme weather) when EER system cannot be operated. • Training of weather forecast contractor	0	1, 11
Requirement to safely abandon well (PSA; Activities regulations §88 and Facilities Regulations §48):	• Well control problems during sea ice season, which can last for several months	**Technical** • Two independent mechanical plugs and cement, for which equipment should be available at all times on the rig or SBV • Equipment for temporarily abandon well available within mobilization times identified in ice risk management plan. • If well has to be left for longer period during sea ice without isolation by plugs; monitor BOP integrity with ROV/ice breaker. **Operational** • Ice risk management plan to reflect procedures and time requirement for temporarily abandoning well (ice drift pattern, response times).	2	3

Requirement	Site specific issue to be mitigated to meet requirement	Mitigation measures	DSH A	Log sheet No./ Gap Category
Requirement to implement well control measures (PSA; Activities Regulations §85-86)	a) Long supply routes for critical equipment b) Install capping stack in water depth for location A and B c) Drill relief well during winter season, and in shallow water	**a) Technical** • Ensure sufficient mud supply according to well conditions and logistical supply times. Need rigs with sufficient deck/storage capacity.I11 **b) Technical** • Evaluation of available capping stack technology, including installation, for water depths relevant for area A and B. • Evaluation of logistics and mobilization plan for capping stack installation in area A and B. **c) Technical** • DP rigs recommended for drilling relief wells in shallow reservoirs. **Operational** • Obtain an overview of rigs being available for relief well drilling (so that 12 days requirement can be achieved, type of rigs, plan for utilization of available rigs, should include plan to contract harsh environment/all year rig for Barents Sea operations). Include ice breakers/ice management vessels, and ice classed drilling rig in the relief well drilling plan.	3, 4	4
Requirement to evacuate personnel to safe area (PSA; Activities regulations §77): Requirement for rescue of personnel in sea after evacuation (NOROG Guideline 064) – not mandatory in areas without area emergency response.	• Remoteness and few other vessels and installations in area. • AWSAR long response time and reduced capacity due to long distance from shore. • Low temperature; reduced survival time in sea after evacuation • NOROG requirement is met for conventional and free fall in weather conditions where MOB/FRDC can be launched. Requirement is not met with AWSAR.	**New performance requirement: Target should be to rescue personnel from lifeboats within 24 hrs after lifeboats have been launched.** **Technical** • Move off location or use crane transfer basket for personnel or bridge type connection to SBV to avoid use of lifeboats. • 50% backup survival suits certified for Barents sea conditions stored at all mustering/lifeboat stations. • PLB (AIS/121.5 VHF) for entire crew • AIS/121.5 VHF tracker on SBV • Hand held AIS/121.5 tracker in MOB-boat. Verify that the tracker can be used in an open MOB-boat. • Transfer of personnel from lifeboat to stand by vessel: Preferred method is to pick up from sea by SBV MOB boat or hoisting to helicopter from lifeboat or sea. **Operational** • SBVs required to have documented plans for rescue of personnel from	16	5, 6, 7, 8, 10

Requirement	Site specific issue to be mitigated to meet requirement	Mitigation measures	DSH A	Log sheet No./ Gap Category
		lifeboats. • SBV training requirements for rescue of personnel from sea and lifeboat. • Training of SBV personnel on site. • SBV MOB crew; required to have two MOB crews and also exchange of personnel/additional team for prolonged periods of work outdoor. • Training of helicopter crew for rescue from lifeboats • SBV may be used to escort/tow lifeboats towards shore, to reduce flight distance for helicopter from shore.		
Requirement for safe transport (PSA; Activities regulations §17).	• Helicopter accidents outside the rig safety zone/en route • Remoteness and few other vessels and installations in area. • AWSAR long response time and reduced capacity due to long distance from shore. • Lower water temperature reduces time to reach hypothermia. • Challenging search conditions; darkness and reduced visibility • New performance requirement need to be established. • Requirement to pick up before hypothermia, within 120 minutes is not met, ref. NOROG 064, still the requirement is not specified in NOROG 064.	**New performance requirement: Persons in the sea following helicopter ditch outside the safety zone. The helicopter passengers and crew shall be picked up from sea as soon as possible but at latest within 4hrs.** (Survival suits certified according to NS-EN ISO 15027/NOROG 094 for use in Barents Sea are documented to protect against hypothermia for 6 hours) **Technical** • New helicopter base onshore, located to reduce helicopter flight time • PLB (AIS/121.5 VHF) on survival suits • Additional thermal clothing required ("vams" or similar) and to be defined as mandatory PPE. • Night Vision Goggles (NVG) available for SAR-crew. • AWSAR helicopters must be AWSAR-equipped with the latest safety / localization equipment (eg. AIS tracking) • AWSAR helicopter to bring along drop kit to release to personnel in sea. • National SAR (Banak and Hammerfest) will be additional resources, Banak SAR will be upgraded from 2019 with increased capacity and reach (however not included in dimensioning). **Operational** • Limit passenger flights transport flights during day light, if possible (facilitates emergency ditch, not relevant for SAR operation). • The AWSAR helicopters to be operational during all passenger flights to meet the 4hrs requirement.	10b	9
Requirement for safe and efficient rescue of man over board (PSA; Activities regulations 41): Personnel performing work above sea shall be picked	• Low water and air temperature reduces time for getting hypothermia • Rescue/launch of MOB-boat: Hydraulic systems in outdoor areas in low temperatures • Icing on MOB-boat and	**New performance requirement proposed: In man over board situations, personnel shall be rescued from the sea within 8 minutes after man over board is detected.** **Technical** • Personnel tracking system on people working above sea (other system than PLB on survival suits) • Use of survival suit for work above sea	18	12

Requirement	Site specific issue to be mitigated to meet requirement	Mitigation measures	DSH A	Log sheet No./ Gap Category
up from sea before hypothermia.	connection hook for lifting boat to vessel/rig. • Visual contact can be challenging in darkness/fog/snow/reduced visibility	**Operational** • Establish best practice for launching and pick up of MOB boats. Relevant training of SBV MOB crew on site, in realistic conditions. • Training requirements for MOB personnel. Training of MOB personnel on site. • Winterization manual for MOB boat		
Requirement for SBV to perform emergency response efforts according to defined requirements **(Statoil internal emergency response requirement, WR1156):**	• Extended use of SBV for Medevac, down manning, lifting with crane transfer basket for personnel, MOB-operations, rescue from sea after helicopter accident.	**Technical** • Equipment onboard SBV to meet additional requirements for Medevac, down manning and rescue after evacuation. **Operational** • On-site training for SBV personnel on rescue operations and down manning, where relevant, and also focus on cooperation with AWSAR-helicopter and rig crew. • Challenging to cover all operations for one single SBV vessel. Evaluate the need for more than one vessel on site.	10, 16, 18	150
Requirement for hospital and emergency hospital to provide prudent first aid and medical treatment (PSA; Facilities regulations §59-60) The hospital and emergency hospital shall be equipped such that it can provide prudent first aid and medical treatment.	Longer response time for AWSAR due to distance from shore, and AWSAR not available due to flight conditions may increase need for sustained medical treatment on rig and in helicopter.	**Technical** • Medical equipment onboard need to reflect possibility for unavailability of the helicopter, or longer time for transport to shore. • Telemedicine (specification for area A and B due to remoteness/flight times to be given by the BaSEC Health and working environment group) **Operational** • Two medics offshore (one additional on rig or rig SBV, with training for cold climate and remote operations). • Medical doctor, preferably anesthetic doctor onboard AWSAR-helicopter.	0	14

Requirement	Site specific issue to be mitigated to meet requirement	Mitigation measures	DSH A	Log sheet No./ Gap Category
Requirement to handle defined emergency situations (PSA; Activities regulations, §73) **NOROG 064 Guideline: Medical evacuation within 180 minutes**	• Longer response times or helicopter not available or able to land on rig due to flight conditions (reduced visibility). • Helicopter deck unavailable due crash on helideck. Medical evacuation, both due to occupational accidents, acute illnesses and major accidents (i.e. helicopter accident on installation) will have longer response times The performance requirement in the NOROG 064 guideline for Medevac to hospital within 180 minutes is not met for location A and B.	As above, in addition: **Technical** • New helicopter base onshore, located to reduce helicopter flight time To enable Medevac if helicopter cannot land on rig: • Crane transfer basket to be used for transfer of stretchers, Medic and injured persons to SBV in case helicopter cannot land due to fog/weather change. • SBV need to have dedicated landing area for crane transfer basket for personnel. **Operational** • First aid resources at SBV vessel need to be adapted to its importance in the rescue strategy (strengthened with one Medic from the rig or medic stationed on SBV). • Training of SBV personnel, and cooperation with SBV and Rig. • Training of rig crew (crane operator, deck crew, and medic) in use of crane transfer basket for personnel. • Weather limitations for use of crane transfer basket for personnel (wind, wave, visibility) must be established.	9	15
Requirement to monitor safety zone and outside zone for threats (PSA; Management regulations, §57):	The potential for approaching sea ice and ice bergs require additional measures for monitoring the area around the rig, and to define appropriate response actions.	**Technical** • Ice detection and monitoring system. Required resources defined based on specification from ice risk management plan. Evaluate use of measures on rig, SBV and use of fixed wing/helicopters for detection and monitoring. It is recommended to use local competence on forecasting services. • Awaiting results from CIRFA project in ice surveillance methods. **Operational** • Establish ice risk management plan, detection and monitoring, identify hazards and establish response procedures. • Sea ice and ice berg competence available		18

Requirement	Site specific issue to be mitigated to meet requirement	Mitigation measures	DSH A	Log sheet No./ Gap Category
Requirement to ensure safety of MOB personnel before initiating rescue operation (IMO SOLAS, Chapter 3, §17.1) **Requirement to not expose personnel to unnecessary danger during rescue and combat (Statoil internal requirement WR1156):**	Rescue personnel will be exposed to harsh conditions during rescue and combat operation outdoor, and combat and rescue operations may require extended periods of outdoor work.	**Technical** • PPE/Clothing for low temperatures for emergency response organization, in particular MOB crews**.** **Operational** • Additional MOB-crews mobilized if operations is extended • Robust team sizes, and considering need for additional crews/crew change. • On site training in cold climate emergency operations		13, 151
Requirement to pick up entire helicopter crew within 120 minutes for helicopter accident within rig safety zone (NOROG 064 Guideline): The NOROG 064 guideline puts a requirement to pick up a full helicopter (max 21 persons) from sea in case of a helicopter ditch inside the rig safety zone. Not mandatory	The requirement is met with MOB boat or FRDC as recue resources. If MOB boat or FRDC cannot be launched and AWSAR is the main resource this requirement is not met for Area A. The requirement can be achieved with AWSAR for area B with reduced number of people in the helicopter (max 10 persons,).	**Technical** • New helicopter base onshore, located to reduce helicopter flight time • PLB (AIS/121.5 VHF) on survival suits • Additional thermal clothing required ("vams" or similar) and to be defined as mandatory PPE. • Night Vision Goggles (NVG) available for SAR-crew. • AWSAR helicopters must be AWSAR-equipped with the latest safety / localization equipment (e.g. AIS tracking) • AWSAR helicopter to bring along drop kit to release to personnel in sea. • National SAR (Banak and Hammerfest) will be additional resource. Banak to be upgraded from 2019 with increased capacity and reach (however not included in dimensioning). • Winterization of MOB boat; icing on hook and need for "de-icing" if rescue equipment prior to helicopter landing. Cranes, winches and hydraulic equipment forming a part of the rescue system must also be winterized and tested prior to helicopter landings. **Operational** • Area A: No transport helicopter flights if MOB/FRDC cannot be launched. • Area B: Reduce helicopter capacity to 8 passengers if MOB/FRDC cannot be launched • Procedures need to be in place to ensure the standby vessel alerts if wave height increases above requirement, and flights have to be stopped. • Limit passenger flights transport flights during day light, if possible (facilitates rescue after emergency ditch, not relevant for AWSAR operation). • AWSAR-helicopters to be operational during all passenger flights to meet		10a

Requirement	Site specific issue to be mitigated to meet requirement	Mitigation measures	DSHA	Log sheet No./ Gap Category
		the 4hrs requirement.		

The use of a midway platform (or vessel) as an offshore fuelling/logistic/SAR base for helicopters has been discussed as a measure to increase the offshore rescue and transport capacity. The intention of the midway platform with fuelling capacity could be to reduce response times and increase helicopter rescue/transport effectiveness. During this process is it was agreed that with implementation of the suggested new performance requirements and associated emergency response measures to meet these requirements, the need for other mitigating measures to compensate for the longer distances from shore, such as a midway platform, is not required for area A and B. Thus eliminating the increased risk linked to helicopter operations to, on and from the midway platform. In addition it was considered that the investment/operating cost and timing constraints using a midway platform also support the alternate solution with use of new performance requirements and associated emergency response measures, for the exploration part in the southern Barents Sea. Hence the use of a midway platform is not further covered in this report.

9.2 ISO standard 19906 for Arctic offshore structures

The standard *ISO 19906 for Arctic offshore structures* is not applicable for mobile drilling units, but has been used as informative guidance to identify areas that is also relevant to consider for emergency response on location A and B. From the review of this standard, a few requirements have been identified as relevant to consider. Proposed measures to meet these requirements are included below.

- Requirement for installation to be able to move off in case of failure of the ice management system:

  ISO - 1. Ice management system according to log sheet no. 18 in Table 9-1

  ISO - 2. It is assumed that the rig shall not operate in sea ice, and that here will not be any sea ice inside the safety zone. The rig is disconnected and moved off location if sea ice is approaching within defined distances.

- Requirement to have an alternative muster location that is equipped for cold climate

  ISO - 3. Alternative mustering locations must accommodate for cold climate/harsh weather, also alternative mustering location (e.g by use of Kocoverk etc.)

- Requirement for appropriate forecasting and monitoring of the physical environmental conditions affecting the reliability and performance of the EER system

  ISO - 4. AWOS to be installed on rig

  ISO - 5. Improved weather forecasts:

  - Polar low forecasts; probability for polar lows to occur (under implementation).
  - Five new wave scan buoys, and four ice rigs monitoring ice drift is now being implemented.
  - Training of weather forecast contractor

- Requirement for the evacuation system to have a provision on board for retrieval of personnel, including injured personnel from the sea or ice.

  ISO - 6. PLB (AIS/121.5 VHF) on survival suits

  ISO - 7. AIS tracker in helicopter, on SBV and handheld for use in MOB boat.

  ISO - 8. Training of SBV crew in rescue of personnel from sea and lifeboat

ISO - 9. Preferred method is to pick up from sea by SBV MOB boat or hoisting to helicopter from lifeboat or sea. Evaluate other methods for rescue for personnel from sea and transfer of personnel from lifeboat to stand by vessel (use of entry nets, DACON scoop, slip to pick if life boats in aft of SBV vessel etc.).

- Requirement that personnel shall have appropriate protective equipment during the EER process.

  ISO - 10. Survival suits certified for Barents Sea conditions stored at lifeboat stations

- The offshore facility operator shall have competency for evaluating the risk associated with the physical environmental conditions on the EER system.

  ISO - 11. Training of DPO to understand weather dynamics.

  ISO - 12. Training in cold climate effects on operations.

  ISO - 13. Ice risk competence available.

  ISO - 14. Weather protection report.

9.3 Actions and recommendations not directly linked to gaps

Table 9-2 presents other actions and recommendations that were identified and not being directly linked up to any gaps but which could contribute to improved safety performance and emergency preparedness for the areas considered in this study.

Table 9-2 Other actions and recommendations and not directly linked to gaps

No.	Log sheet reference (appendix A)	Action/recommendation
1	1	It is recommended that BaSEC Rig-group will identify safety critical equipment and requirements for winterization of these.
2	1	It is recommended that BaSEC Rig-group evaluates how to apply DNV GL Winterization standard for area A and B.
3	5	It is recommended that the BaSEC Healthand Working environment group do an assessment of survivability of evacuees in a life boat for 24 hours in high seas.
4	9	It is recommended that the BaSEC Working environment group to evaluate survivability using survival suits in the sea within 4 hours criteria.
5	4	Shallow reservoirs: In principle this is not different from other parts of NCS, but in order to reduce risk further for the two locations, it is recommended to perform drilling operations with similar approach as HPHT-wells; including workshops on kick-detection and that the Duty holder/operator gives pre-approval of competence for critical personnel.

		For shallow reservoir wells one should also closely map well parameters to detect possible kicks as early as possible
6	5	Evaluate FRDC vs. standard MOB boat in area A/B conditions wrt. vulnerability for marine icing. The workgroup consider FRDC to be more suitable for search operations over larger areas. This is to be used as basis for decision whether FRDC shall be required.
7	5	Transfer of personnel from lifeboat to SBV: Preferred method is to pick up from sea by SBV MOB boat or hoisting to helicopter from lifeboat or sea. Evaluate other methods for rescue of personnel from sea and transfer of personnel from lifeboat to stand by vessel (use of entry nets, DACON scoop, slip to pick if life boats in aft of SBV vessel etc.), operational limitations for these methods and best practices.
8	5	Evaluate use of crane transfer basket for personnel to SBV to avoid use of lifeboats in case of evacuation; describe best practice for operation and operational limitations. Define competence and training requirements for SBV personnel and need for training with rig crew.
9	11	Icing on lifeboats need to be further assessment; there is a need for more documentation on the scale and effect of icing on lifeboats. Include results from ongoing test program on the Icing-on-lifeboats research project, including full scale tests.
10	-	It will be required that contractor's equipment on the rig also is included in the winterization. An example is specification of cold climate requirements and winterization manuals for well test equipment.
11	-	Long distance implies flight time for helicopters which should be considered in planning and/or compensated for. It should be considered to start helicopter evacuation earlier than what is current practice or to fly personnel to other installations in the area if such are present.
12	-	Plans should be prepared and people trained to handle interference from NGOs in the operations. It will be required to clarify the juridical status of the safety zone prior to start-up of operations, in addition to procedure for how to engage police authority on the rig.
13	-	The supply bases, ports and terminals need to be ISPS secure
14	-	In order to reduce the need for medical evacuation one should consider specific personnel selection criteria for offshore work at areas A and B. Training and introduction for challenges working in cold/remote areas.
15	-	It is recommended that the BaSEC partners coordinate their planning for onshore personnel reception and next of kin reception centre, to make best use of the local resources.
16	87	Training of DPO to understand weather dynamics.

9.4 New performance requirements

New performance requirements have been established where existing performance requirements does not cover the site specific challenges. Hence, three new performance requirements to be used in planning and dimensioning emergency response for the areas have been proposed as shown below.

Target should be to rescue personnel from lifeboats within 24 hours after lifeboats have been launched.

The intention with the requirement is to stress that the operators have a responsibility to ensure evacuation to a safe area, extending beyond evacuation with lifeboats. Due to the remoteness and environmental conditions, in particular low temperature and possible marine icing on the lifeboats, for areas A and B it is considered that personnel need to be rescued from the lifeboats in order to be in a safe area. The time limits shall also reduce the possible build up and impact of marine icing. It is recommended that the BaSEC Health and Working environment group carries out an assessment of survivability in a life boat for 24 hours in high seas.

In man over board situations, personnel shall be rescued from the sea within 8 minutes after man over board is detected. Survival in case of a man over board accident strongly depends on how quickly a person can be rescued from the sea. The low water temperature and possible low visibility at location A and B further underlines the need for immediate response in case a person falls over board. The work group considered that the SBV and rig to have a level of preparedness that relatively easy will meet a 24/7 time requirement to rescue a person from the sea within 8 minutes after alert of the accident, and the requirement is therefore not limited to periods where work above sea is ongoing.

Persons in the sea following helicopter ditch outside the safety zone. The helicopter passengers and crew shall be picked up from sea as soon as possible but at latest within 4hrs. The intention is to clarify that the operator has a responsibility for safe transport to and from the offshore installation, both inside and outside the safety zone. The proposed 4 hour criterion is equivalent to the requirement for rescue inside the safety zone, but with an extended time requirement. The time requirement of four hours reflects implementation of the additional mitigating measures as described in Table 9-1. It should be noted that the survival suits to be applied are certified to protect against hypothermia for up to 6 hours in Barents Sea conditions.

9.5 Integration of recommendations from NOROG project on HSE challenges in the High North

In 2010 a project regarding HSE challenges in the north was started by NOROG. A summary report of the project was published in the spring 2015 (ref. /20/). This report has been used and discussed during both of the workshops, and some of the findings from the work have been used as a basis for some of the mitigation measures being proposed in this SSEPA. The mitigating measures identified in the NOROG project and being included in this study, are listed below.

Helicopter emergency preparedness and logistics

SAR helicopters must be AWSAR-equipped with the latest safety / localization equipment, e.g. AIS tracking (HEL-2 ref. /20/). Night Vision Goggles (NVG) for SAR-crew during rescue operations should also be considered (HEL-15 ref. /20/). These measures will ease the SAR operations.

The benefit of transferring medical data / picture (telemedicine) during helicopter flights must be evaluated against cost (HEL-12 ref. /20/). During the workshop it was also discussed that a medical doctor in helicopter might be more beneficial.

Emergency preparedness (Evacuation)

In regards to the recommendation to identify alternative evacuation location (BER-5 ref. /20/) it is considered as important and necessary to involve the SBV to a larger extent in the emergency response activities than in other parts of the NCS. This is mainly due to the remoteness, long response times and weather conditions. Downmanning/evacuation can be performed by use of crane transfer basket for personnel or SBV in situations where the weather conditions make other evacuation methods unavailable.

In accordance to NOROG (BER-9 ref. /20/) it was agreed during the workshop that there should be personnel location beacon (AIS/GPS) on all of the survival suits on board the drilling rig.

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APPENDIX A
Workshop log - Gap assessment and mitigation measures

The table below shows the requirements that have been identified to have a gap. Suggested technical and operational mitigation measures to enclose or reduce the gaps are presented in the columns to the right. The color coding that is shown to the right in the table are in accordance with the information in section 4 Methodology (p. 9).

Coding for the different emergency phases are; phase A - Alarm, D - Danger limitation, R - Rescue, E - Evacuation, N - Normalization, and G - General.

No.	DSHA	Requirement/statement/guideline	Reference	Gap	Phase	Comment/reason for gap	Changes to equipment/technology required	Changes to mode of operations required
1	0	The rig's safety systems shall be operational at all times. In case of failures, compensating measures shall be implemented, so that the level of emergency preparedness remains acceptable.	/14/ §8	Yes	A, D, R	• Requirement to winterized design (line detectors in fog/snow, deluge/firewater in low temperatures) • Visual observations in darkness, fog, snow. • Not able to visually detect whether unburnt hydrocarbons is spilled to sea. • Blackout/loss of power supply in (extreme) low temperatures.	• Winterization gap assessment, according to season of operation. • Evaluate relevance of/how to apply DNV GL Winterization standard for area A and B. • BaSEC Rig-group will identify safety critical equipment and requirements for winterization. • Winterization of safety barriers/safety systems (technology or operational measures, consider season of operation). • Winterization gap assessment of SBV and PSV, according to season of operation and use in emergency situations. Requirements should be adapted to specifications for the rig.	• Seasonal operations according to rig specification. • Winterization manuals and operations • Activity level according to operating conditions/environmental conditions. • Relocate rig out of area with approaching critical environmental conditions (e.g. extreme weather).
2	0	Platform design and fixed safety systems should be the primary emergency resources for the facility.	Statoil /5/, nOB2	Yes	D	Cold climate effects on safety systems	• Winterization of equipment • BaSEC Rig-group will identify safety critical equipment and requirements for winterization.	Winterization manual
3	2	The well should be secured before it is abandoned in order to maintain well integrity.	/13/ §88 and /14/ §48	Yes	D	Abandon well in ice season/due to approaching ice	• Two independent mechanical plugs and cement. Should be available at all times on the rig / SBV • BOP	• Ice risk management plan to reflect temporarily abandoning well (ice drift pattern, response times). • Plan for safely abandon well temporarily according to approaching sea ice, in line with ice risk management plan. • Equipment for temporarily abandon well available within mobilization times identified in ice risk management plan.

No.	DSHA	Requirement/statement/guideline	Reference	Gap	Phase	Comment/reason for gap	Changes to equipment/technology required	Changes to mode of operations required
4	3, 4	Well control measures shall be implemented immediately upon loss of well control.	/13/ §85-86	Yes	D	• Shallow reservoirs give shorter response times. • **Remoteness -** Will the rig have logistical capacity to have all well control supplies (mud, chemicals etc.) onboard and available (longer supply routes)? • **Installing capping stack** in ice conditions (whole year operations)? • Time available to install capping stack or drill relief well wrt. presence of ice/distance to ice edge ? • **Availability of rig for drilling of relief well,** with harsh environment/winterization capabilities. Expected needed to be a DP rig, where one will need to drill a long section. • Challenging relief well path due to shallow reservoirs, and possible conflict with Russian economic zone.	• Evaluation of available capping stack technology, including installation, for water depths relevant for area A and B. • DP rigs recommended for combination shallow reservoirs and drilling of relief well. • Monitor BOP integrity with ROV/ice breaker.	• Shallow reservoirs: Closely mapping well parameters to detect possible kicks as early as possible. Perform operations with similar approach as HPHT-wells; workshops on kick-detection. Duty holder/operator gives pre-approval of competence for critical personnel. In principle not different from other parts of NCS. • Ensure sufficient mud supply according to well conditions and logistical supply times. Need rigs with sufficient deck/storage capacity. • Establish plan for contracting rig for relief well drilling in harsh environment/all year for Barents Sea operations to ensure that 12 days requirement can be achieved. • Plan for utilization of available rigs should include evaluation of using ice breakers, ice management vessels, and ice classed drilling rigs. • In case of well control problems when sea ice is approaching, BOP will be closed and rig move off location. • Evaluation of logistics and mobilization plan for capping stack installation in area A and B.

No.	DSHA	Requirement/statement/guideline	Reference	Gap	Phase	Comment/reason for gap	Changes to equipment/technology required	Changes to mode of operations required
5	16	Evacuation methods shall be designed to protect personnel from the effects of the incident and arctic or cold region environment until recovered to a rescue platform. **Establish new time requirement for rescue from lifeboat after evacuation: target is to rescue from lifeboats within 24 hrs (5 days, ref. IMO Polar code).** **(Comment: time requirement does also limit extent on marine icing on lifeboats.)**	/9/, /13/ §77	Yes	E	Remoteness from shore -few other vessels and installations in area. Survival in low temperature in lifeboat/raft Survival in sea after evacuation	• Move off location or down manning/evacuation by use of crane transfer basket for personnel to SBV or bridge type connection to avoid use of lifeboats. • Transfer of personnel from lifeboat to stand by vessel: Preferred solution: Pick up from sea by SBV MOB boat or hoisting to helicopter from lifeboat or sea. Training and exercises is necessary. Pick up / hoisting from lifeboat is more challenging than from sea • Evaluate/test other methods for transfer of personnel from lifeboat to stand by vessel; entry nets, DACON scoop, slip to pick if life boats in aft of SBV vessel etc. • Evaluate survivability in lifeboats for 24hrs in high sea states. • SBV to escort lifeboats (on own power) towards shore. Possible to tow lifeboats? AWSAR helicopters fly from onshore base towards approaching lifeboats for pick-up • Survival suits certified for Barents Sea conditions stored at all mustering/lifeboat stations. • Evaluate (open) FRDC vs. standard MOB boat in area A/B conditions wrt. vulnerability for marine icing. FRDC considered being better for search operations over larger areas. To be used as basis for decision whether FRDC shall be required.	• SBVs are required to have documented plans for rescue of personnel from lifeboats. • Training of SBV personnel on site. • SBV is required to have two MOB crews onboard and also exchange of personnel/ additional team. • Training of helicopter crew for rescue from lifeboats.
6	16	Rescue platforms shall have equipment and capabilities suitable for locating and recovering evacuees.	/9/	Yes	E		• Evaluate methods for transfer of personnel from sea to stand by vessel; entry nets, DACON scoop, slip to pick if life boats in aft of SBV vessel. • AIS/121.5 VHF tracker on SBV (Based on ref. /20/)	SBV training requirements for rescue of personnel from sea.
7	16	Recovery of crew from lifeboats after an evacuation. The intent is to recover personnel safely from lifeboats after an evacuation. No time limit, but the recovery operation should be swift.	OMV /12/	Yes	E	Not site specific. The recovery time might increase in Area A and Area B compared to other locations.	As for requirement 5	As for requirement 5

No.	DSHA	Requirement/statement/guideline	Reference	Gap	Phase	Comment/reason for gap	Changes to equipment/technology required	Changes to mode of operations required
8	16	Personnel in sea after evacuation: It shall be possible to rescue the number of people who are determined based on risk analysis within 120 minutes, provided that everyone has access to a survival suit, whether they have used primary evacuation, or got directly to the fleet or to the sea. If not quantified in risk analysis, the following criteria may be used: Rig with conventional lifeboats, without a bridge, whatever staffing level: 25% of POB that injured persons (not higher than 1 full lifeboat) sea / damaged lifeboat. Rig with free fall lifeboats: 5% of POB	/6/	Yes	E	• NOROG requirement is met for conventional and free fall in weather conditions where MOB/FRDC can be launched. • With AWSAR the requirement is not met. • Remoteness and helicopter longer response times	• Evaluate methods for transfer of personnel from sea to stand by vessel; entry nets, DACON scoop, slip to pick if life boats in aft of SBV vessel. • Hoisting to helicopter from sea. • Survival suits certified for Barents sea conditions stored at all mustering/lifeboat stations. • PLB (AIS/121.5 VHF) for entire crew	• SBVs required to have documented plans for rescue of personnel from lifeboats. • Training of SBV personnel on site. • Training of helicopter crew
9	10b	Persons in the sea following helicopter ditch outside the safety zone shall be picked up from sea before hypothermia. Suggested time requirement is 4hrs.	/13/ § 17	Yes	R	• Requirement to pick up before hypothermia, within 120 minutes is not met, ref. NOROG 064, still the requirement is not specificed in NOROG 064. 6 hours may be used as time for hypotherimia with Barents Sea/certified according to NS-EN ISO 15027/NOROG 094. • Lower water temperature reduces time to reach hypothermia. • New performance requirement need to be established. • Companies responsible for the whole transport process, i.e. also including outside the safety zone	• AIS/121.5 PLB on survival suit, being available in LQ and at lifeboat (Based on ref. /20/) • Additional thermal clothing required (no: "vams"). Should be defined as PPE. Check 4hrs survivability with BaSEC Working environment group. • Night Vision Goggles (NVG) for SAR-crew during rescue operations. (Based on ref. /20/) • AWSAR helicopters must be AWSAR-equipped with the latest safety / localization equipment (e.g. AIS tracking) (Based on ref. /20/) • Bring along drop kit to release to personnel in sea.	• Limit passenger flights transport flights during day light, if possible (facilitates emergency ditch, not relevant for SAR operation). • AWSAR-helicopters to be operational during all passenger flights to meet the 4hrs requirement.
10	10, 1	Rescue boats shall be equipped for: :• Search for persons in the water, with appropriate equipment for search, in accordance with scheduled search patterns, for people in daylight and when visibility is poor .• Communication with appropriate equipment for communication with relevant units, vessels, installations, helicopter. The rescue of people in the sea.	/8/	Yes	R	• It may be difficult to localize personnel in fog/snow/reduced visibility. • It is assumed that the MOB-boat equipment are according to requirement (both for the rig and standby vessels).	Hand held AIS/121.5 tracker in MOB-boat. Verify that the tracker can be used in an open MOB-boat.	Winterization manual for MOB boat

No.	DSHA	Requirement/statement/guideline	Reference	Gap	Phase	Comment/reason for gap	Changes to equipment/technology required	Changes to mode of operations required
11	16	The design of rescue systems shall be compatible with the design of the evacuation system, in the context of the physical environment of the arctic or cold region.	/9/, /14/ §8	Yes	R		• Icing on lifeboats to be clarified; need more documentation. Time requirement for rescue from lifeboat will contribute to reducing criticality of marine icing on lifeboats. Awaiting finalization of test program on the Icing-on-lifeboats research project, including full scale tests. • Enhance launching equipment's performance in cold climate	• Operational criteria for EER equipment to be defined. • Winterization manual; ensure lifeboats are operational in relevant weather conditions, remove snow/ice. • Procedures for precautionary measures (activity control, down manning due to extreme weather) when EER system cannot be operated.
12	18	Personnel performing work above sea shall be picked up from sea before hypothermia.	Statoil /5/, nYK.24	Yes	R	• Hypothermia - what kind of protective suit is used? • Low water temperature reduces time for hypothermia • Rescue/launch of MOB-boat: Hydraulic systems in outdoor areas in low temperatures - how does it perform? • Icing on MOB-boat and connection hook for lifting boat to vessel/rig. • Visual contact can be challenging in darkness/fog/snow/reduced visibility	• Personnel tracking system on people working above sea, other AIS system than PLB on survival suits. • Use of survival suit for work above sea.	• Establish 24h capability/capacity to rescue personnel from sea within 8 minutes for man over board, after accident is detected, irrespective of weather conditions. SBV MOB will be relevant resource to use. This requirement should also be valid not only for Man-overboard-situations. • Establish best practice for launching and pick up of MOB boats. Relevant training of SBV MOB crew on site, in realistic conditions.
150	10, 16, 18	Emergency preparedness vessel shall carry out emergency efforts pursuant to defined requirements.	Statoil /5/, nYK.21	Yes	R	• Extended use of SBV for Medevac, down manning, lifting with crane transfer basket for personnel, MOB-operations, rescue from sea after helicopter accident. • Challenging to cover all operations for one single vessel Evaluate the need for more than one vessel on site	Equipment onboard SBV to meet additional requirements for Medevac, down manning and rescue after evacuation.	On-site training for rescue operations and down manning, where relevant, and also focus on cooperation with AWSAR-helicopter and rig crew.
14	0	The hospital and emergency hospital shall be equipped such that it can provide prudent first aid and medical treatment.	/14/ §59 §60	Yes	R	AWSAR Helicopter not available due to flight conditions may increase time needed to be spent on rig	• Medical equipment onboard need to reflect possibility for unavailability of the helicopter, or longer time for transport to shore. • Telemedicine (specification for area A and B due to remoteness/flight times to be given from BaSEC Health and working environment)	• Two medics offshore (on rig, or rig SBV, with training for cold climate and remote operations. • Medical doctor, preferably anaestethic doctor onboard AWSAR-helicopter; "multipurpose crew")

No.	DSHA	Requirement/statement/guideline	Reference	Gap	Phase	Comment/reason for gap	Changes to equipment/technology required	Changes to mode of operations required
15	9	Helicopter accident on installation: 1 dead, 3 seriously injured and 4 minor injuries form the basis for all installations.	/13/ §73, /6/	Yes	R	• Longer response times or helicopter not available due to flight conditions. AWSAR and National SAR take longer time than North Sea. • Helicopter deck unavailable due crash on helideck.	• Medevac via SBV to helicopter: • Use of crane transfer basket for transfer of stretchers, Medic and injured persons in case helicopter cannot land due to fog/weather change. Weather limitations for use of basket (wind, wave, visibility) must be established. • SBV need to have dedicated landing area for the crane transfer basket for personnel. • First aid resources at SBV vessel need to be adapted to its importance in the rescue strategy (strengthened with one Medic from the rig). • Alternative hoisting location on rig	• Training of SBV personnel, and cooperation with SBV and Rig. • Training of rig crew (crane operator, deck crew, medic) in use of crane transfer basket for personnel.
13	0	Personnel should not be exposed to unnecessary danger. Using response personnel for rescue or combat, the response manager should carefully consider the risk potential with regard to risk of injury or loss of life before personnel are sent into danger areas.	Statoil /5/, nOB7	Yes	D	Extended periods of outdoor work in low temp and/or exposed to low water temperature due to the DSHA in question	PPE and appropriate clothing for cold climate, in particular MOB crews.	• Robust team sizes, and considering need for additional crews/crew change. • On-site training in cold climate emergency operations
16	0	The communication system shall operate under all emergency scenarios, taking into account geography, distance and environment (within the operational network offshore, onshore, standby vessel support, on the platform). Two independent systems for external communication.	/9/, /18/	Yes	A	• Icing on antennas. • Satellites coverage can be possible challenges (VSAT)	• VSAT communication equipment, INMARSAT and Iridium satellite systems. • Satellite coverage study for VSAT. • Define bandwidth requirement according to need in an emergency situation (telemedicine minimum 0.5-1 Mbps, video conferencing, audio/phone, etc.). Confirm availability of communication satellite. Prioritization of telemedicine when required.	• Winterization manual for communication equipment (VSAT)
17	0	The field operator shall monitor all activity inside safety zones. The operator shall furthermore keep under observation what happens outside the zones when such activity may entail danger to the safety of the petroleum activities.	/16/, §57 /6/	Yes	A	See DSHA 11a, 11b and 20	See DSHA 11a, 11b and 20	See DSHA 11a, 11b and 20

No.	DSHA	Requirement/statement/guideline	Reference	Gap	Phase	Comment/reason for gap	Changes to equipment/technology required	Changes to mode of operations required
18	11b	The field operator shall monitor all activity inside safety zones. The operator shall furthermore keep under observation what happens outside the zones when such activity may entail danger to the safety of the petroleum activities.	/16/, §57 /6/	Yes	A	• Ice detection and surveillance • Unexpected changes in ice conditions – ice objects not discovered. • Ice bergs not detected on radar or deviating from prognosis drift path.	• Ice detection and monitoring system. Required resources defined based on specification from ice risk management plan. Evaluate use of measures on rig, SBV and use of fixed wing/helicopters for detection and monitoring. It is recommended to use local competence on forecasting services. • Awaiting results from CIRFA project on ice surveillance methods.	• Establish ice risk management plan, detection and monitoring, identify hazards and establish response procedures. • Training on how to judge results from ice surveillance
32	11a, 11b	The ability for a floating structure to move off location, the time that is required to do so, and acceptable levels of operational downtime shall be considered to ensure that the structure can move off site without incident if there is a failure of the ice management system.	/9/	Yes	A, D	• Ice bergs not detected on radar or deviating from prognosis drift path. • Reduced AIS coverage; difficult to identify vessels. • Normally harder to detect ice on collision course than vessel on collision course.	• Ice detection and monitoring system. Required resources defined based on specification from ice risk management plan. • Awaiting results from CIRFA project in ice surveillance methods.	• Assumed that there will not be any sea ice inside the safety zone. The rig is disconnected and moved off location if sea ice is approaching. • Ice risk management plan: Ice berg within safety zone (Ice risk assessment and ice management plan for the area to be established; shut down and disconnect according to T-times and safety zones). • Disconnect for sea ice; need to leave well in a "safe condition" for several weeks. • Ice risk management plan shall include plans for planned, accelerated and emergency disconnect. Disconnection timelines defined according to ice risk management plan.
47	5	The rig's safety systems shall be operational at all times. In case of failures, compensating measures shall be implemented, so that the level of emergency preparedness remains acceptable.	/14/ §8	Yes	A, D, R	• Difficult to visually detect whether unburnt hydrocarbons is spilled to sea during well test (darkness, fog, snow), but not worse than in other areas on the NCS.		
59	0	The emergency response organization should be designed to fit the facility's operation mode.	Statoil /5/, nOB9	Yes	E			• Competence onboard to cater for site specific conditions (weather conditions, ice risks, medic/first aid,…) • Rig crew with sufficient experience and competence to understand requirements

No.	DSHA	Requirement/statement/guideline	Reference	Gap	Phase	Comment/reason for gap	Changes to equipment/technology required	Changes to mode of operations required
								to operations in the area
66	6	On installations with H2S in the well stream all gas leakages shall be treated as H2S leakages until this is disproved.	Statoil /5/, nUB.7	Yes	D	• Muster personnel outdoor due to H2S indication in cold climate. It may be preferable to selected mustering at helideck since it is elevated, but indoor mustering in cold climate is preferred. During the winter months or if it is cold air temperatures it may be challenging to muster personnel outside for longer periods. • Longer mobilization time for back up H2S kit from shore.	• Alternative inside or weather protected muster station of personnel in case of toxic gas in the ventilation system. • Additional H2S kit stored onboard, if H2S is considered relevant.	
76	1	In case of a shallow gas blowout, it shall be attempted to kill the well by use of kill mud.	/13/ §85	Yes	D	Remoteness - Will the rig have logistical capacity to have all well control supplies (mud, chemicals etc.) onboard and available (longer supply routes)?	Shallow gas require limited amount of mud	Ensure sufficient mud supply according to well conditions and logistical supply times. Rigs should have large deck space. Requirement that rigs are 3rd generation ?
78	2	Well control team shall within 3 minutes initiate effective measures to secure the well.	/5/, nYK.17 and /13/ §88	Yes	D	Ice loads on marine riser/drill string (in case ice not detected; bergy bits), causing loss of containment	• Ice risk management plan • BOP closure by acoustic signal	Assumed not to operate in sea ice conditions.
82	4, 5, 6, 19	The production shall be stopped immediately and deluge released on confirmed gas leakage.	Statoil /5/, nUB.5	Yes	D	• Line detectors in fog/snow, and winterization of deluge/foam in low temperatures. • Issues related to icing/use of Fi-Fi; frozen drain system/icing on rig.	• Winterization of deluge system and drain system • Ensure foam is approved for low temperature • "Environmental friendly foam" ?	Winterization manual for deluge system.
83	7, 8	If a fire occurs, cargo and bunkering operations shall be stopped.	Statoil /5/, nUB.3	Yes	D	Increased storage loads of helifuel (ice surveillance, additional fuelling offshore for transport flights, rescue operations)	Ensure fire fighting equipment is adequate with respect to storage volumes.	Note: Ensure helifuel storage reflects requirements for ice surveillance, rescue operations/SAR and additional re-fuelling for transport helicopters.

No.	DSHA	Requirement/statement/guideline	Reference	Gap	Phase	Comment/reason for gap	Changes to equipment/technology required	Changes to mode of operations required
84	11a	Vessel on collision course: The facility shall be notified of vessels on possible collision course (i.e. nearest passing point within the safety zone) as early as possible and at least 50 minutes before possible collision point.	/6/	Yes	D	• Vessels on collision course shall be detected at latest 50 minutes before potential impact to make necessary decisions and actions (evacuation/relocations). Larger drifting vessels/installations shall be detected when 20 nm away. Smaller drifting vessels/drifting objects shall be detected when 12 nm away (Ref. /5/ WR1156, nYK.13). • Outside area for Statoil Maritime control center. • Military and fishing vessel traffic in the neighboring country, Russia, which one cannot control. • Possible future oil and gas activity on Russian side. • Darkness	• Secure that at least one high mounted radar with 360 coverage on the rig is included as maritime traffic control. • Radar on SBV. • Rig to utilize data from AIS Sat II for traffic monitoring, as a supplement to radar. Evaluate use of Vardø VTS for traffic monitoring based on AIS data.	Vessel traffic and collision risk analyses
85	0	Facilities shall have defined safe areas for mustering for all personnel.	/9/ and /5/, nOB4	Yes	E	Alternative mustering station in outdoor/cold areas	Mustering locations must be accommodated for cold climate/harsh weather, also alternative mustering location.	
86	0	The offshore installation shall incorporate provisions for appropriate forecasting and monitoring of the physical environmental conditions affecting the reliability and performance of the EER system.	/9/	Yes	E	• More uncertain weather forecasts. • Polar lows not detected until 1-2 days before they may appear at location.	• AWOS to be installed • Training of weather forecast contractor • Polar low forecasts; assessing the probability for polar lows to occur. • Five new wave scan buoys, and four ice rigs monitoring ice drift to increase quality of weather forecasts	• Define operational limits for EER functions in relation to sea ice, marine icing, and visibility. • Winterization manual for EER equipment.
87	0	The offshore facility operator shall have competency for evaluating the risk associated with the physical environmental conditions on the EER system.	/9/	Yes	E	• DPO unfamiliar with weather pattern/dynamics. • Sea ice and ice bergs is new as a threat • Cold climate (extreme low temp, marine icing, atmospheric icing)		• Winterization manual. • Ice risk management plan • Training of DPO to understand weather dynamics. • Training in cold climate effects on operations. • Ice risk competence available. • Weather protection report.
89	16	Appropriate emergency escape lighting shall be provided to illuminate routes leading to the TR, taking into account icing and/or snow accumulations and the direction of scape.	/9/	Yes	E	Winterization of access and escape ways to helideck;	Winterization of escape ways	Winterization manual for escape ways

No.	DSHA	Requirement/statement/guideline	Reference	Gap	Phase	Comment/reason for gap	Changes to equipment/technology required	Changes to mode of operations required
						remove snow/ice.		
91	16	Exit doors, stairways and ladders shall be appropriately designed and maintained accessible, taking into account icing and/or snow accumulations and the direction of escape.	/9/	Yes	E		Winterization of access ways	Winterization manual.
92	16	A TR impairment analysis shall be performed as part of the EER analysis, taking into account the aspects of impairment including ice and other physical environmental conditions that can delay evacuation. It is not necessary that a TR be usable under all incident scenarios, provided contingency plans are in place to ensure the safety of personnel.	/9/	Yes	E	Assumed no operation in sea covered with ice (0% ice is assumed).		• Operational criteria for EER equipment. • Procedures for down manning due to extreme weather. • Move off location if sea ice approaches
57	0	A temporary refuge (TR) shall be provided except where the EER analysis or risk assessments demonstrate that one (or more) is not required.	/9/	Yes	E	Longer endurance of TR may be required if evacuation is not possible due to weather conditions. Alternative is to stop operations if weather conditions make EER system unavailable.	TR endurance adapted to availability of evacuation means.	• Operational criteria for EER equipment. • Procedures for down manning due to extreme weather.
93	16	Personnel moving from the TR or muster station to the primary embarkation areas shall be protected from the installation hazards and environment.	/9/	Yes	E	The layout of the rig will have an impact the environmental exposure.	Mustering locations must be accommodated for cold climate/harsh weather, also alternative mustering location.	Winterization manual
94	16	The design and selection of evacuation method(s) shall include a risk assessment of the lowest probability of incurring casualties, taking into account the range of credible physical environmental conditions during emergency, precautionary and scenario drill evacuations.	/9/	Yes	E	• Assumed that there will not be any sea ice inside the safety zone. • Helicopters may be unavailable due to flight conditions or long response time.	• Down manning/evacuation by use of crane transfer basket for personnel or SBV (Based on ref. /20/) • Transfer of personnel from lifeboats/sea to stand by vessel.	• Operational criteria for EER equipment. • Procedures for down manning due to extreme weather. • The rig is disconnected and moved off location if sea ice is approaching.
95	16	Evacuation methods (e.g. boarding, securing, deployment, clearing the hazard zone, etc.) shall be designed to perform reliably for the credible environmental, operational and accident condition combinations as determined by the EER analysis.	/9/	Yes	E	• Availability of helicopter; distance from shore and flight conditions. • Assumed that there will not be any sea ice inside the safety zone. The rig is disconnected and moved off location if sea ice is approaching.	• Down manning/evacuation by use of crane transfer basket for personnel or SBV (Based on ref. /20/) • Transfer of personnel from lifeboats/sea to stand by vessel. • Bridge connection to SBV.	• Operational criteria for EER equipment. • Procedures for down manning due to extreme weather.
102	16	The design integrity of each independent method of evacuation shall be assessed in terms of impact with other evacuation methods, the installation, environmental	/9/	Yes	E	Assumed that there will not be any sea ice inside the safety zone. The rig is disconnected and moved off location if sea ice		• Operational criteria for EER equipment. • Procedures for down manning due to extreme

No.	DSHA	Requirement/statement/guideline	Reference	Gap	Phase	Comment/reason for gap	Changes to equipment/technology required	Changes to mode of operations required
		conditions including the ice cover, and rescue craft.				is approaching.		weather.
105	16	The evacuation system shall have a provision on board for retrieval of personnel, including injured personnel from the sea or ice.	/9/	Yes	E		• Personnel location beacon (AIS/GPS) (Based on ref. /20/) • Transfer of personnel from lifeboat to stand by vessel: • Evaluate methods for transfer of personnel from sea to stand by vessel; entry nets, DACON scoop, slip to pick if life boats in aft of SBV vessel. • Hoisting to helicopter from lifeboat or sea. • SBV to have system for pick up and towing of lifeboats	Training of SBV personnel
106	16	A means shall be available to recover evacuees from the sea, the ice, or from evacuation systems, onto a rescue platform.	/9/	Yes	E		• Personnel location beacon (AIS/GPS) (Based on ref. /20/) • Transfer of personnel from sea to stand by vessel. • Evaluate methods for transfer of personnel from sea to stand by vessel; entry nets, DACON scoop, slip to pick if life boats in aft of SBV vessel. • Hoisting to helicopter from sea.	Training of SBV personnel
107	16	The provisions for EER shall be designed, assessed and ultimately implemented accounting for hardware design, personnel competence and EER procedures and controls. The emergency response plan developed from these components accounts for all specified credible hazard scenarios.	/9/	Yes	E	General - part of BaSEC SSEPA		Update emergency response plans based on SSEPA
109	16	The duty holder shall ensure that the equipment provided for the purpose of protecting personnel during the EER process satisfies the performance standards and is maintained in a state of readiness;	/9/	Yes	E	• Low temperatures/cold climate. • Long exposure time for water in low temp.	• Survival suits according to Barents • Sea specifications at all locations onboard.	
110	7, 16	Personal protective equipment (PPE), as determined by the EER analysis, shall be provided for personnel in sufficient numbers. Deployment locations shall include the living quarters and other strategic areas.	/9/	Yes	E	• Some rigs there is lower quality of the survival suits stored at the life boat stations than the personal survival suits stored in the cabins. • The survival suits stored at the lifeboat stations is designed according to SOLAS while the	Survival suits at the lifeboat stations that are adapted to conditions in the Barents Sea.	

No.	DSHA	Requirement/statement/guideline	Reference	Gap	Phase	Comment/reason for gap	Changes to equipment/technology required	Changes to mode of operations required
						personal survival suits are adapted to conditions in the Barents Sea. • A fire in the accommodation can hence prevent personnel from bringing their personal survival suit from the cabins.		
111	16	Externally stored PPE shall account for extreme cold temperatures and snow and ice accumulations. The requirement for heating storage areas shall be assessed.	/9/	Yes	E		Winterization of safety systems	Winterization manual
112	16	Escape routes, stairways and ladders shall be sized to take into account bulky cold weather PPE and the maximum flow of personnel in emergencies.	/9/	Yes	E			Winterization manual
114	16	As determined by the EER analysis, there shall be strategically located muster stations sized to accommodate all personnel on board, taking into account the environmental conditions.	/9/	Yes	E	Muster station is inside.	Mustering locations must be accommodated for cold climate/harsh weather, also alternative mustering location.	
130	18	On facilities where own MOB is the primary emergency response during work over open sea one shall during verification exercises determine the facility's limitations for launching / hoisting MOB.	/8/	Yes	R	There exist no clear limitations for MOB/FRDC launch. Hydraulic systems in outside areas in low temperatures	Winterization of MOB boat and launching equipment	Operational criteria for EER equipment.
136	16	The methods of evacuation (whether installation or non-installation based) shall be assessed in the EER analysis according to the number, location, orientation and means used.	/9/	Yes	E		• Down manning/evacuation by use of crane transfer basket for personnel or SBV (Based on ref. /20/) • Transfer of personnel from lifeboats/sea to stand by vessel.	• Operational criteria for EER equipment. • Procedures for down manning due to extreme weather. • Winterization manual.
143	20	The JRCC shall be notified within 5 minutes on orders from the OIM	/13/ §77	Yes	A	Unclear jurisdiction to approve police on Rig (flag state etc.)		Apply and define for rig safety zone prior to arrival on location. Apply experience from Hoop area.
141	18	Facilities shall at all times have two independent MOB boat systems for quick and cautious rescue of personnel who fall into the sea. This equipment shall not subject the rescue personnel or the personnel to be rescued to unacceptable risk. The two independent MOB boat systems must have dedicated crews.	/6/ /8/	Yes	R		Winterization of MOB boat and launch equipment	Winterization manual
145	16	The evacuation system shall be designed such that it is visible and identifiable and provides location information to search and recovery platforms under design	/9/	Yes	E		Winterization of safety systems	Winterization manual

No.	DSHA	Requirement/statement/guideline	Reference	Gap	Phase	Comment/reason for gap	Changes to equipment/technology required	Changes to mode of operations required
		installation hazard and environmental conditions.						
146	16	Occupant space and restraint design shall consider bulky cold-region PPE, the distribution of individuals and their mass as well as acceleration.	/9/	Yes	E		Winterization of safety systems	Winterization manual
147	16	The design of the boarding area layout for the evacuation methods, and the launching equipment and method, shall consider the safety of personnel during emergency use as well as during drills and maintenance.	/9/	Yes	E		Winterization of safety systems	Winterization manual
148	16	The design integrity of the rescue system shall ensure that evacuees are recovered in the prevailing physical environmental conditions.	/9/	Yes	E	Similar to NOROG 064, but more specific.		
149	16	The EER system shall be designed to achieve a consistent level of safety and effective operation throughout the complete range of physical environmental (i.e. climatic, ocean and ice) conditions expected for a given location over the design service life of the installation. Conditions shall include, but not be limited to, the following environmental factors and any associated issues affecting the performance and reliability of the EER system: air temperatures, including wind chill; natural light anticipated; wind; sea spray and atmospheric icing; visibility; cold open water; ice-wave combinations; sea state; local residual, wind-driven and tidal currents; ice and snow conditions.	/9/	Yes	G	These have been used as guidewords to identify site specific challenges	Covered by other measures	Covered by other measures
151	18	Ensure safety of rescue personnel (MOB crew) before initiating rescue operation.	/18/, ch. 3, § 17.1	Yes	R	• Extended periods of outdoor work in low temp due to the DSHA • Hypothermia	PPE/Clothing for low temperatures	Additional MOB-crews mobilized if operations is extended
152	10a	Helicopter accident in sea: In a helicopter crash in the sea within the safety zone, the capacity should be sufficient to save all people in a full helicopter (currently 21 people) over 120 minutes.	/6/	Yes	R	• Pick up requirement met by MOB/FRDC. • Area A: Requirement not met by AWSAR. • Area B: Requirement met by AWSAR if helicopter capacity is reduced to 8 passengers (total pax 10). • Low water temperature reduces time to reach hypothermia. • There are weather limitations for using both MOB-vessels,	• AIS VHF tracking beacon on survival suit, in addition to 121.5 emergency frequency. (Based on ref. /20/) • Winterization of FRDC and MOB boat, including launching equipment. • Additional thermal clothing ("vams"). • SAR helicopters must be AWSAR-equipped with the latest safety / localization equipment (eg. AIS tracking) • Night Vision Goggles (NVG) for	• Area A: No transport helicopter flights if MOB/FRDC cannot be launched. • Area B: Reduce helicopter capacity to 8 passengers if MOB/FRDC cannot be launched • Clearly define requirements to SBV in their emergency response role. Requirements to training. • Procedures need to be in

No.	DSHA	Requirement/statement/guideline	Reference	Gap	Phase	Comment/reason for gap	Changes to equipment/technology required	Changes to mode of operations required
						FRDC and AWSAR. Weather conditions may reduce the availability of these resources, and therefore put operational restrictions for the rig and number of personnel in a transport helicopter. • Comment (from GL064): Adequate safety factor if the suit has been tested according to NOROG / ISO 15027	SAR-crew during rescue operations • Evaluate use of techniques such as DACON scoop for rescue from sea. Test and qualification of equipment in relevant operating conditions is required (waves, visibility, marine icing etc.), use of SBV crane for rescue from sea.	place to ensure the standby vessel alerts airport if wave height increases above requirement, and flights have to be stopped. • Training requirements for SBV crew, as they will be more determinant for the rescue operations when AWSAR does not have sufficient response time/capacity. • Training requirement for SAR crew and cooperation with SBV and rig crew.
153	16	Lifesaving appliances exposed to freezing environments shall be protected and regularly inspected.	/9/	Yes	R		Winterization of safety systems	• Winterization of safety systems • Stability of lifeboat due to icing after launching. The potential of marine icing on lifeboats and whether this may impact the stability of the lifeboats needs to be investigated further.
154	17	Personnel injury/illness with need for external assistance, emergency medical response: External support within 60 minutes. • Defined as the time from the need for emergency medical assistance is identified and help arrives to the patient. Prior to this, there will be a period of initial diagnosis and needs clarification. • Defined as the time from the need for emergency medical assistance is identified and help arrives to the patient. Prior to this, there will be a period of initial diagnosis and needs clarification. • Emergency medical response may include resources that already exist on the rig such as drugs for thrombolysis and expertise to such treatment. When this is not the case, the requirement for emergency medical response includes also external resources	/6/	Yes	R	• No external assistance within 60 min. • Telemedicine – limited availability of broadband satellite communication. • Acute medical response may include resources already located on the installation, for example medicine for thrombolytic treatment and competence for such treatment. If such resources are not available the requirement for acute medical response will also include external resources	Covered by resources on the rig	Consider personnel selection criteria. Training and introduction for challenges working in cold/remote areas. Evaluate need for additional medic onboard

No.	DSHA	Requirement/statement/guideline	Reference	Gap	Phase	Comment/reason for gap	Changes to equipment/technology required	Changes to mode of operations required
155	17	Personnel injury/illness with need for external assistance, emergency medical transport time: transport to hospital within 180 min from decision is taken. • Defined as the time from decision to send ashore are taken to the patient arrive at the hospital. • Transportation time should not exceed 3 hours. • The requirement for emergency medical transport is relevant both for serious illness and injury.	/6/	Yes	R	• Requirement of 3 hours is not met. See efficiency assessment. • AWSAR not available due to flight conditions. • Longer transport time to hospital. Due to the distance to Hammerfest/Vardø/Kirkenes, the time for transportation to hospital may be longer than what is normal further south, and exceeding the requirement of 180 minutes from notification to person is at hospital. • Longer time to evacuate personnel in case of epidemics. Need to treat/isolate personnel with epidemics offshore. • Defined as the time from decision for transportation is taken to arrival at hospital. The requirement is relevant both for serious illness and injury. GL064 require capacity of 2 persons. The AWSAR helicopter has capacity for 3 stretchers.	• Telemedicine; define required telemedicine capacity, and required bandwidth to deliver this capacity (specification to be defined by BaSEC Health and working environmental group). • Medical supply onboard to reflect possible delayed Medevac. • Benefit of transferring medical data / picture (telemedicine) during helicopter flights must be evaluated against cost. Having a medical doctor onboard the helicopter is considered more beneficial. (Based on ref. /20/)	• Consider personnel selection criteria. Training and introduction for challenges working in cold/remote areas. • Adjust work operations wrt. availability of helicopter transport • Additional medic on board • Medical doctor/anaestethic doctor on AWSAR helicopter. • Precautionary procedures for epidemics onboard.
68	7,8,0	Fire with need for external assistance: Capacity of external cooling in the event of fire shall be designed according to assumptions made in the risk analysis.	/6/	Yes	D	Extended periods of fire fighting with own personnel – cannot expect to have external support for fire fighting.		Increase number personnel in fire team, to reflect possibility for longer periods of action.
70	9	If a helicopter crashes on the installation the helideck manning shall immediately initiate fire fighting and rescue.	Statoil /5/, nUB.2	Yes	D	• Extended periods of fire fighting with own personnel – cannot expect to have external support for fire fighting. • Fire water in low temperature, also causing hypothermia if personnel are not brought to a warm area		Increase number of personnel in fire team to adapt to longer action times.
73	10, 18	With the purpose of taking care of their own safety there must be rig specific requirements for clothing and equipment for MOB crew. See IMO/SOLAS MSC 70/23.	/8/	Yes	R	Low temperatures/cold climate exposure for MOB crew. Long exposure time for water in low temp.	Rescue/MOB suits according to environmental conditions	Evaluate need for extra MOB team in order to accommodate for crew change.

No.	DSHA	Requirement/statement/guideline	Reference	Gap	Phase	Comment/reason for gap	Changes to equipment/technology required	Changes to mode of operations required
80	13	Drilling personnel shall prepare for disconnection when alerted about loss of position.	/14/ §49	Yes	D	Wrong weather forecasts – unexpected heave/movements and not able to compensate in time. See No. 87.		Need to train DPOs in recognizing weather patterns/typical changes in weather such as polar low
88	16	Each independent method (type) of evacuation shall accommodate the full complement of personnel on-board (POB) the installation, including visitors, under any emergency scenario requiring evacuation.	/9/	Yes	E	Not part of scope to update EER analysis.	Down manning/evacuation by use of crane transfer basket for personnel or SBV Transfer of personnel from lifeboats/sea to stand by vessel. Bridge connection to SBV.	Operational criteria for EER equipment. Procedures for down manning due to extreme weather. Winterization manual.
120	16, 18	Rescue systems shall be designed to ensure that evacuees can be rescued in the event that they do not clear the hazard zone.	/9/	Yes	E	Lights are provided to clear the drop zone. Assumed no operation in sea covered with ice (0% ice is assumed).	All survival suits to be of the type certified for use in cold climate, not only those stored in the LQ cabins of "non-cold climate" type Transfer of personnel from lifeboats/sea to stand by vessel.	Training of SBV personnel
123	17	An injured person shall immediately be transported to a safe area after rescue, where if necessary further qualified treatment is given to stabilize and normalize the condition.	Statoil /5/, nYK.27	Yes	R			• Ensure medic has competence for treating frost bite. • Ensure medic is competent wrt. hypothermia. Evaluate need for additional medic onboard

The table below shows the requirements that have been identified to ***not*** have a gap. Suggested technical and operational mitigation measures to enclose or reduce the gaps are presented in the columns to the right.

Coding for the different emergency phases are; phase A - Alarm, D - Danger limitation, R - Rescue, E - Evacuation, N - Normalization, and G - General.

No.	DSHA	Requirement/statement/guideline	Reference	Gap	Phase	Comment/reason for gap	Changes to equipment/technology required	Changes to mode of operations required
19	0	The emergency hospital shall be ready for immediate use.	/14/ §60	No	R			
20	0	Saving lives should be top priority and should be basic and recognizable in all of our principles and requirements for emergency preparedness and training of management and crew.	Statoil /5/, nOB1	No	G	Not site specific.		
21	0	It should be short, few and clearly defined lines of communication in emergency response organization.	Statoil /5/, nOB10	No	G	Not site specific.		
22	0	Contingency expertise should be multi-skilled to ensure a robust and flexible emergency response organization.	Statoil /5/, nOB12	No	G	Not site specific.		
23	0	Contingency plans must be based on analyzes.	Statoil /5/, nOB13	NA	G	Not part of scope to assess emergency plan.		
24	0	Message from CCR to alarm and response team shall be given within 30 seconds after received warning.	Statoil /5/, nYK.2	No	A			
25	0	CCR to follow up general alarm with PA announcement within 1 minute.	/13/ §77	No	A	Industry practice based on PSA Activities regulation		
26	0	Fire fighting shall be effectuated immediately if a fire occurs during hot work.	Statoil /5/, nYK.20	No	D	Not site specific		
27	0	There shall be a system that documents the technical condition and operational availability for the primary emergency resources.	Statoil /5/, nOB3	No	G	Not site specific. Not part of scope.		
28	0	The emergency preparedness management shall muster within 3 minutes after PA alert.	Statoil /5/, nYK.14	No	D	Not site specific		
29	0	Emergency control center shall be mobilized within 3 minutes after notification of an accident.	/13/ §77	No	D	Industry practice based on PSA Activities regulation		
30	0	The on-scene commander shall establish on scene center within 5 minutes after PA message.	Statoil /5/, nYK.15	No	D	Not site specific		
31	0	Search and rescue team shall be ready at the muster place within 7 minutes after PA message.	Statoil /5/, nYK.16	No	D	Not site specific		
33	0	The CCR shall immediately be notified of accidental situations. In a situation of hazard or accident the CCR shall be notified before combat of the situation is started.	Statoil /5/, nYK.3	No	A	Not site specific.		
34	0	Feedback from alarm and response team to CCR shall be given within 2 minutes after 'check and report' message from CCR.	Statoil /5/, nYK.4	No	A	Not site specific.		
35	0	An acknowledged situation of hazard or accident shall be notified to the OIM/captain within 3 minutes.	Statoil /5/, nYK.6	No	A	Not site specific.		
36	0	An automatically detected situation of hazard or accident shall be perceived by the CCR within 30 seconds.	Statoil /5/, nYK.1	No	A	Not site specific		
37	0	When a situation of hazard or accident is under control	Statoil /5/,	No	N	Not site specific		

No.	DSHA	Requirement/statement/guideline	Reference	Gap	Phase	Comment/reason for gap	Changes to equipment/technology required	Changes to mode of operations required
		normal operation shall be established as soon as possible in consultation with 2. line UPN.	nYK.28					
38	0	The standby vessel and the Joint Rescue Coordination Centre (JRCC) shall be notified within 3 minutes after a decision of notification has been made by the OIM.	/13/ §77 and /5/, nYK.7	No	A	Resources will be contacted as early as possible (even before a confirmed need, and rather be de-mobilized if necessary).		
39	0	Helicopter resources shall be alerted within 3 minutes after the decision is taken.	Statoil /5/, nYK.8	No	A	• Not site specific. Recourses will be contacted as early as possible (even before a confirmed need, and rather be de-mobilized if necessary). • Not site specific. Helicopter resources will be notified through JRCC by the CCR.		
40	0	Vessels in the area shall be alerted within 3 minutes after the decision is taken.	Statoil /5/, nYK.9	No	A	Not site specific.		
41	0	It shall be possible for the medic to perform advanced lifesaving first-aid within 10 minutes after an accident situation. If necessary the patient shall be continuously monitored.	GDF Suez /10/	No	R	Not site specific.		
42	0	A personnel overview system able to discover if persons are missing shall be established.	Statoil /5/, nYK.22	No	R	Not site specific.		
43	0	Use of emergency responders should be decided by the emergency management. Exemptions in relation to this principle should be stated in the current DSHA.	Statoil /5/, nOB6	No	A	Not site specific.		
44	0	The emergency response organization shall be designed according to the facility's emergency preparedness analysis.	Statoil /5/, nOB8	No	G	Not site specific.		
45	0	There should be adequate training for the crew to ensure that they are competent and comfortable with their own situation. Risk during training should be considered (section 6.2.1). To avoid unnecessary exposure to risk, stricter weather limitations (stricter than the weather conditions they require that emergency resources can operate effectively under) are often used during exercise and training. If the gap is too large the exercise does not get the right effect and verification through exercises are not real. If the gap is too small, the risk exposure is unnecessarily large. The aim should be to conduct training under marginal conditions as well, see weather limitations for work over the sea (section 7.2), taking into account the safety of crew and boat. Normally the MOB boat crew has an exercise with launching, as long as weather conditions allows. There should be at least 5 trainings with launching per year. This can be compensated by a training center on shore.		N	G			

No.	DSHA	Requirement/statement/guideline	Reference	Gap	Phase	Comment/reason for gap	Changes to equipment/technology required	Changes to mode of operations required
46	0	There must be acceptance criteria for risk of exposure of personnel and material during training and exercises. As a minimum basis for establishing acceptance criteria are; weather conditions, light conditions, personnel training / level of knowledge and willingness to participate. Decision making for acceptance / commissioning of offshore training shall be described. There must be rig specific criteria for when training can be conducted.	/8/	No	G	Not site specific. Prepare criteria for training MOB- team, based on acceptance criteria. Responsibility with regard to initiation of training has to be described.		
48	0	The installation emergency response organization shall be documented and summarized (e.g. in a station bill), and posted at strategic locations throughout the installation.	/9/	No	G	Not site specific. Assumed to be according to requirement.		
49	0	The operator shall ensure that all personnel on board the installation are adequately familiar with the operator's safety management system, including the emergency EER response plans and hardware systems, and that they are adequately trained and competent in accordance with their safety related responsibilities and duties.	/9/	No	G	Not site specific. Assumed to be according to requirement. Not part of scope to review management system.		
50	0	Main rescue center (JRCC) and 2 line in Statoil shall be alerted within 8 minutes.	Statoil /5/, nYK.11	No	A	Not site specific.		
51	0	Personnel shall be given appropriate installation-specific EER education, training and/or drills and their competency maintained and regularly tested. Training shall take into account the ice and open water operating environments.	/9/	No	G	Not site specific.		
52	0	The installation design shall provide for testing the EER system through a systematic program of emergency scenario drills with specific pre-planned learning objectives in a realistic manner.	/9/	No	E	Not site specific. Assumed to be according to requirement. Not part of scope to review management system and training program.		
53	0	The EER system shall not pose hazards to the safety of personnel undertaking drills.	/9/	No	E	Not site specific.		
54	0	The condition of the installation, the process controls and detection status shall also be provided in the TR.	/9/	No	A	Not site specific. Assumed to be according to requirement.		
55	0	Muster stations shall be capable of communicating with the on-scene commander following the general or abandonment alarm.	/9/	No	A	Not site specific. Assumed to be according to requirement.		
56	0	Emergency information and signs shall account for language/culture differences and be strategically located throughout the EER system.	/9/	No	E	Not site specific.		
58	0	Power supplies shall be available to allow all safety-critical equipment to perform their emergency functions for the required duration.	/9/	NA	G	Not part of scope to assess performance standards for safety- critical equipment.		
60	1	The ROV operator shall alert the driller immediately upon indications of a shallow gas blowout.	/13/ §77	No	A	Industry practice based on PSA Activities regulation		
61	2	Driller shall react immediately, and then alert tool pusher if there are indications of inflow/abnormal parameters.	/13/ §77	No	A	Industry practice based on PSA Activities regulation		

No.	DSHA	Requirement/statement/guideline	Reference	Gap	Phase	Comment/reason for gap	Changes to equipment/technology required	Changes to mode of operations required
63	3,4	On floaters with wells located beneath the platform emergency shutdown, disconnection and relocation shall start within 10 minutes.	Statoil /5/, nYK.18	No	D	Not site specific		
64	4, 5, 6, 19	In an emergency preparedness situation following a gas leakage the area shall be measured free of gas by the fire and gas system before the first search or rescue team is sent into the area wearing portable gas meters.	Statoil /5/, nUB.6	No	R	Not site specific		
65	4, 5, 6, 19	Ignition sources in the affected area shall be isolated on confirmed gas leakage.	Statoil /5/, nUB.8	No	D	Not site specific		
67	7, 8	Public address announcements, visual and audible communications, including external communications, shall be operable from the TR and wherever identified as necessary.	/9/	No	A	Not site specific.		
69	8	If a fire occurs in the processing or drilling plant, it shall be acknowledged that the fire is put out and that the area is depressurized before personnel is allowed access to the area. Pressure shall be lower than 0.5 bar.	Statoil /5/, nUB.4	No	D			
71	9	The emergency response team shall be notified by the CCR within 1 minute after confirmed helicopter accident.	/13/ §77	No	A	Industry practice based on PSA Activities regulation		
72	9	The CCR shall be notified within 30 seconds after observation of a helicopter accident on the rig.	/13/ §77	No	A	Industry practice based on PSA Activities regulation		
74	10, 18	Launching and hoisting from rig should preferably be done by crane; however, the method that gives the overall safest operation for the individual rig should be used. It should be facilitated to use alternative cranes, for example crane maintenance-hold, or davit on standby vessels. If alternative cranes are not available, it must be ensured compensatory measures.	/8/	No	R	Not site specific. It is assumed that the MOB-boat equipment are according to requirement (both for the rig and standby vessels).		
75	10, 18	MOB boats on standby vessels should also be certified and prepared for hoisting crane directly to the rig (ref. requirements for safety factor).	/8/	No	R	Not site specific.		
77	11	Vessel on collision course: Decision on evacuation should be taken so early that it can be implemented with a certain time margin in relation to anticipated results stage. Normally this would imply at least 25 minutes before likely collision.	/6/	No	E	It is assumed that move off location is preferred to launching life boats.	Possible to install anchor chain "cutter"	
79	12	For detected structural damages necessary compensating actions shall be implemented within 24 hours to prevent deterioration of the situation.	/13/ §77 and /5/, nYK.29	No	D	Assumes necessary personnel and equipment can be brought to the installation by helicopter.		
81	14	OIM and driller shall be alerted immediately by MCR in case of stability problems.	/13/ §77	No	A	Not site specific. Industry practice based on PSA Activities regulation		
90	16	Evacuation methods shall be designed and located to minimize the effect of the surrounding ice cover in their deployment and movement beyond the incident hazard	/9/	NA	E	Assumed that there will not be any sea ice inside the safety zone. The rig is disconnected		

No.	DSHA	Requirement/statement/guideline	Reference	Gap	Phase	Comment/reason for gap	Changes to equipment/technology required	Changes to mode of operations required
		zone.				and moved off location if sea ice is approaching.		
96	16	EER HAZID studies shall identify and record major accident hazards and their consequences in so far as they can influence the selection of EER system design, components, support services and procedures; determine environmental factors that can influence the selection of EER system design, component specifications and support services or affect related procedures; establish the safety-critical systems and their elements on which the EER system performance standards shall be based; establish risk levels (acceptable, ALARP or unacceptable) for application during ranking of various system design options to achieve or improve the targets; provide primary input to risk and failure mode and effect analyses, which when undertaken shall demonstrate that risks to personnel during the EER process are ALARP.	/9/	No	G	Covered by BaSEC SSEPA		
97	16	To ensure that the EER system integrity is maintained, risk analysis shall be updated for changes impacting the HSE case, or the assumed or actual external EER resources and their capabilities.	/9/	NA	G	Not part of scope to verify QRA and EPA.		
98	16	The selected components and procedures of the EER system for any offshore installation in ice covered waters shall be determined by a formal assessment that documents a fully auditable decision trail.	/9/	NA	E	Assumed no operation in sea covered with ice (0% ice is assumed).		
99	16	The EER system design shall take into consideration the requirement for regular inspection, maintenance and testing, including functionality readiness assessments.	/9/	No	E	Assessing the management/ maintenance system not part of scope.		
100	16	Relevant parts of the EER system (e.g. escape routes, evacuation boarding areas) as determined by the EER analysis shall be illuminated for the required duration to perform the functions required by EER.	/9/	No	E	Escape routes illuminated according to requirement. Snow/ice not expected to reduce the effect of illumination.		
101	16	The need for, and numbers, types and storage locations of, personal protective devices shall be determined in the EER analysis.	/9/	No	E	Not site specific.		
103	16	Evacuee PPE shall include devices to facilitate evacuee movement from the sea to ice floes, if required by EER analysis.	/9/	NA	E	Assumed no operation in sea covered with ice (0% ice is assumed).		
104	16	If evacuation onto solid ice is part of the EER strategy, the evacuees shall have adequate clothing, footwear and traction devices to provide protection and mobility until rescued.	/9/	NA	E	Assumed no operation in sea covered with ice (0% ice is assumed).		
108	16	There shall be as many independent evacuation systems and configurations as needed in accordance with the EER analysis.	/9/	No	E	No site specific issues.		

No.	DSHA	Requirement/statement/guideline	Reference	Gap	Phase	Comment/reason for gap	Changes to equipment/technology required	Changes to mode of operations required
113	16	If determined by EER analysis, the evacuation method shall be capable of being operated by personnel donning respiration protection for launches in toxic atmospheres (e.g. smoke, H2S) in cases where pressurized access routes have not been provided.	/9/	No	E			
115	16	The EER system shall be continuously monitored, maintained and improved or corrected against the determined performance standard. The specific EER system on a given installation shall be installed, tested and operated based on the established performance standards.	/9/	No	G			
116	16	It shall be possible to evacuate the rig within 15 minutes after decision to evacuate (initiation of evacuation alarm) has been made.	/15/	No	E	Not site specific	Lifeboats Transfer of personnel from lifeboats/sea to stand by vessel. Bridge connection to SBV.	Opertional criteria for EER equipment. Procedures for down manning due to extreme weather. Winterization manual.
117	16	In an emergency situation all personnel must muster to safe areas. Muster area for personnel without emergency tasks are the lifeboat stations. All personnel should have survival suits on.	Statoil /5/, nOB5	No	E			
118	16	Sufficient means of evacuation shall be available for a safe and organized evacuation of all personnel on board.	Statoil /5/, nYK.26	No	E			
119	16	Dry evacuation shall be prioritized before wet evacuation.	OMV /12/	No	E			
121	17	Advanced first aider and first aid personnel at the installation shall be alerted within 2 minutes after discovery of life-threatening injury or illness.	Statoil /5/, nYK.10	No	A			
122	17	Lifesaving first aid shall be effectuated within 3 minutes.	Statoil /5/, nYK.23	No	R			
124	17	Personnel to perform medical treatment and medical first aid shall have no other simultaneous emergency tasks that may conflict with processing tasks on board.	/7/	No	R			Evaluate need for additional medic onboard

No.	DSHA	Requirement/statement/guideline	Reference	Gap	Phase	Comment/reason for gap	Changes to equipment/technology required	Changes to mode of operations required
125	17	Personnel with medical liability shall be qualified in accordance with: Regulation No. 687 of 09.05.2003 concerning qualification requirements and certificate rights for personnel on Norwegian ships, fishing vessels and mobile offshore units §3-2 (9) Personnel with first aid responsibility shall be qualified in accordance with: Regulation No. 687 of 09.05.2003 concerning qualification requirements and certificate rights for personnel on Norwegian ships, fishing vessels and mobile offshore units §3-2 (8) Repetition requirements for personnel with medical treatment (*) and first responsibility in accordance. 002: NOROG Guidelines for Safety and Emergency Training - Chapter 4 By "medical treatment" in this context means the same as discussed / required in STCW 95 for ship officers.	/7/	No	R	Not site specific. External assistance is not available within 60 min. The competence onboard will therefore be improved.	External resources not required - covered by offshore medic.	
126	17	All electronic devices must be available to be operated in marine conditions (resistant to moisture).	/7/	No	G			
127	17	Recommended drugs, medical equipment- and supplies on standby vessels on Norwegian continental shelf in accordance with the list.	/7/	No	R	Not site specific.		
128	18	Efforts to ensure immediate alert of 'man overboard' shall be established when work above sea is performed.	Statoil /5/, nYK.12	N	A	Not site specific.		
129	18	During launching and hoisting there must be rig specific procedures and definitions, including requirements for the use of risk assessments, as well as for use of Safe Job Analysis (SJA) for special operations.	/8/	No	R	Not site specific. It is not part of DNV GL scope to assess the procedures.		
131	18	There must be rig specific limitations for work over the sea. The procedures should state who is responsible for monitoring and alert if weather condition changes and the limits are exceeded.	/8/	No	A	Not site specific. The DPO is watching the weather and alerting the OIM if there are changes. There are some uncertainties regarding limitations for launching MOB-boat. It has to be check whether the limitations for work above sea are more precise.		Need to train DPOs in recognizing weather patterns/typical changes in weather such as polar low.
132	18	When working over sea the person who falls into the sea should be picked up within 8 min. from the first alarm of the accident. Rescue must be dimensioned for 1 person.	/14/ §41, /9/ and /6/	No	R	The preparedness to be dimensioned according to 1 person falling over board. If people are going to work above sea and insulating suits		

No.	DSHA	Requirement/statement/guideline	Reference	Gap	Phase	Comment/reason for gap	Changes to equipment/technology required	Changes to mode of operations required
						are used, one can theoretically increase the acceptable response time to some extent (ref. GL064).		
133	18	Inspection and maintenance of MOB boats should be covered in the rig maintenance system. Responsibility for the equipment operational availability should be placed. Maintenance must be oriented towards that MOB boats shall be operative with high availability.	/8/	No	G	Not site specific. It is not part of DNV GL scope to assess the maintenance program.		
134	0	It shall be possible to maintain a temporary refuge for all persons on board for at least 30 minutes, in order that it will be possible to await further development of the accident, combat the accident and if necessary carry out an evacuation by sea from this area.	/17/ § 21	No	E		TR endurance adapted to availability of evacuation means. Mustering locations must be accommodated for cold climate/harsh weather, also alternative mustering location.	Operational criteria for EER equipment. Procedures for down manning due to extreme weather.
135	9	In the event of a helicopter breakdown on the helideck, the HLO shall function as on-scene commander until the on-scene commander arrives. HLO shall communicate with ECC via the radio operator.	/7/	No	D	Not site specific		
137	18	The MOB-boat (rescue boat) shall be launched safely within 5 minutes of the sounding of alarm	/15/ §16	No	R	Not site specific		
138	18	The MOB-crew and the standby vessel must be notified and be in close standby before work over sea starts. The MOB-crew must have work tasks that enable them to meet the requirements at all times while there is work above sea.	/19/	No	A	Not site specific		
139	18	Measures to assure immediate alert to the ECC, in case of man over board, shall be established before work over open sea.	/19/	No	A	Not site specific		
140	18	At MOB-situations, Hawkeye/spotter shall immediately notify radio operator and at the same time keep eye contact with the person in the sea.	/19/	No	A	Not site specific		
142	18	At least one MOB boat shall be provided in a safe location on board within a separate launching arrangement or in appropriate place where the rescue boat is readily reached by at least two deck cranes intended for use in such launching operations. Launching of the rescue boat shall not impede the launching of lifeboats and life rafts	/15/ §16	No	R	Not site specific		
144	20	The client/owner's onshore emergency organization shall be warned within 5 minutes on orders from the OIM	/13/ §77	No	A	Not site specific		
62	1	When facing the risk of shallow gas, special measures must	/13/ 83	No	D	Shallow reservoirs/little		

No.	DSHA	Requirement/statement/guideline	Reference	Gap	Phase	Comment/reason for gap	Changes to equipment/technology required	Changes to mode of operations required
		be implemented.				warning time, but not "arctic specific"		

About DNV GL

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