Appendix K

Ice Management Plan

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ICE MANAGEMENT PLAN
Chukchi Sea

Submitted to:

U. S. Department of the Interior
Bureau of Ocean Energy
Management, Regulation and
Enforcement
Alaska OCS Region

Submitted by:
Shell Gulf of Mexico Inc.

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I. INTRODUCTION

SCOPE

A Critical Operations and Curtailment Plan (COCP) will be in place for the Shell Gulf of Mexico Inc. (Shell) Chukchi Sea Exploration Drilling Program. As part of the COCP, this Ice Management Plan (IMP) has been developed. The description of notification of curtailment (an excerpt from the COCP) is presented in Attachment 1.

The IMP addresses the following activities:

- Vessels
- Shell Ice and Weather Advisory Center (SIWAC)
- Ice Alerts and Procedures
- Ice Management Philosophy
- Well Suspension Procedures
- Mooring System Recovery and Release
- Moving onto the Drill Site
- Training

The IMP:

- Defines Roles and Responsibilities
- Establishes Alert Levels; and
- Establishes Responses to Alert Levels.

The IMP facilitates appropriate decision-making and responses to the threat of hazardous ice and procedures set forth in the IMP prevent damage or harm to personnel, assets, or the environment.

Nothing in this document takes away the authority and accountability of the Master(s) of the vessels for the safety of their personnel and vessels and for protection of the environment.

This plan is not a substitute for good judgment.

Guidance Note: This document is not intended to contain detailed procedures. Detailed procedures are contained within the vessel-specific operating manuals.

II. DEFINITIONS

A. Roles and Responsibilities

<u>Responsibilities have been defined for key personnel in section V. In addition to the defined personnel, the following positions have a role in IMP,</u>

Chief Officer /Second Officer/Third Officer	In addition to regular duties will assist the Ice Advisor (IA)
Shell Drilling Superintendent	Shell's Drilling Superintendent is the senior Shell shore-based manager responsible for all Shell well operations offshore Alaska.
Noble Drilling Superintendent	The senior shore-based manager (Alaska). Liaising with the Shell Drilling Superintendent.

B. Definitions and Abbreviations

AHTS	Anchor Handling Tug Supply
API	American Petroleum Institute
BOEMRE	Bureau of Ocean Energy Management, Regulation and Enforcement
BOP	blowout preventer
CFR	Code of Federal Regulations
COCP	Critical Operations and Curtailment Plan
cm	centimeter(s)
Discoverer	Turret-moored Drillship Motor Vessel (M/V) *Noble Discoverer*
DNV	Det Norske Veritas
Fennica	*M/V Fennica*
ft	foot/feet
FTP	file transfer protocol
FY	First-year ice. Sea ice of not more than one winter's growth, developing from young ice; 12 inches (in.) (30 centimeters [cm]) or greater. It may be subdivided into thin FY – sometimes referred to as white ice, medium FY and thick FY.
GFS	Global Forecast System
GIS	Geographic Information System
Hazardous Ice	Ice, which due to its size, stage of development, concentration, set and drift is considered to be a threat to the safety of personnel, the drilling vessel and well operations. Close proximity of an ice feature regardless of its set and drift may be determined to be hazardous ice. Guidance Note: Sea state as well as visibility may influence what is categorized as hazardous ice.
HOS	hang-off sub
HT	Hazard Time. The estimated time it will take for hazardous ice to reach the drill site.
IA	Ice Advisor
IMO	International Maritime Organization
IMP	Ice Management Plan

IMV	Ice management vessel. Any ice class vessel tasked with ice management duties in support of the drilling vessel. This includes the primary ice management vessel (IMV) and the ice class Anchor Handling Tug Supply (AHTS)
in.	inch(es)
Kulluk	conical drilling unit *Kulluk*
LMRP	Lower Marine Riser Package
m	meter(s)
MODU	Mobile Offshore Drilling Unit
MT	Move-off Time. The time required to clear decks on the anchor handler recover all anchors conventionally and move off the drill site in an orderly fashion.
M/V	Motor Vessel
MY	Multi-year ice. OI which has survived at least two summers' melt. Hummocks are smoother than on SY and the ice is almost salt-free. Where bare, this ice is usually blue in color. The melt pattern consists of large interconnecting, irregular puddles and a well developed drainage system.
NOAA	National Oceanic and Atmospheric Administration
OI	Old ice. Sea ice which has survived at least one summer's melt. Topographic features generally are smoother than FY. It may be subdivided into SY and multiyear ice.
OSR	Oil Spill Response
OSV	Offshore Supply Vessel
PIC	Person in Charge
RP	Recommended Practice
SAR	Synthetic Aperture Radar
Shell	Shell Gulf of Mexico Inc.
SIWAC	Shell Ice and Weather Advisory Center located in Anchorage. The center develops forecasts from various sources, and disseminates same.
Support Vessels	Includes all vessels defined in this plan (IMV/OSR/AHTS/OSV).
SY	Second-year ice. OI which has survived only one summer's melt. Thicker than FY, it stands higher out of the water. In contrast to MY, summer melting produces a regular pattern of numerous small puddles. Bare patches and puddles are usually greenish-blue.
ST	Secure Time. The time required to secure the well, disconnect the Lower Marine Riser Package (LMRP) from the blowout preventer (BOP), recover and secure the riser.
TD	total depth
T-Time	Total Time. The sum of ST + MT.
Tor Viking	*M/V Tor Viking*
U.S.	United States
USCG	United States Coast Guard
VMT	Vessel Management Team. This team is headed by the Vessel Master and includes the Shell Drilling Foreman, Noble Drilling Superintendent, Drilling Vessel IA and the Chief Engineer.

III. VESSELS COVERED BY IMP

- Drillship - Motor Vessel (M/V) Noble *Discoverer (Discoverer)*
- Primary Ice Management Vessel (IMV) - the *M/V Fennica* (or similar)
- Secondary Ice Management Vessel and Anchor Handler – the M/V *Tor Viking* (or similar) –

<u>Drillship *Discoverer*</u>

The *Discoverer* is a true, self-contained drillship. Station keeping is accomplished using the turret-moored, 8-point anchor system. The underwater fairleads prevent ice fouling of the anchor lines. Turret mooring allows orientation of vessel's bow into the prevailing ice drift direction to present minimum hull exposure to drifting ice. The vessel is rotated around the turret by hydraulic jacks. Rotation can be augmented by the use of the fitted bow and stern thrusters.

The hull has been strengthened for ice resistance. Ice-strengthened sponsons have been retrofitted to the ship's hull.

The *Discoverer* is classed by Det Norske Veritas (DNV) as a Mobile Offshore Drilling Unit (MODU) for worldwide service. It is a "1A1 Ship-Shaped Drilling Unit l" and is capable of performing drilling operations offshore Alaska. The *Discoverer* has been issued with a DNV Appendix to Class stating:

> "*the structural strength and material quality of the 'Ice Belt' formed by the sponsons below the 8950mm A/B level, have been reviewed against the requirements for the DNV ICE-05 Additional Class Notation and found to meet those requirements (as contained in DNV Rules for Classification of Ships, Pt 5 Ch 1, July 2006) for a design temperature of -15 degrees C*."

The *Discoverer* will comply with the requirements of 30 CFR Part 250.417, the IMO, the USCG and DNV. All drilling operations will be conducted under the provisions of 30 CFR Part 250 Subpart D, API RP 53, 65 Part 2 and 75 and other applicable regulations and notices including those regarding the avoidance of potential drilling hazards and safety and pollution control. Such measures as inflow detection and well control, monitoring for loss of circulation and seepage loss, and casing design will be the primary safety measures. Primary pollution prevention measures are the contaminated and non-contaminated drain systems, the mud drain system, and the oily water processing system.

Structurally, this is comparable to Canmar drillships used safely and successfully in exploration campaigns in the Beaufort and Chukchi Seas into the 1990s.

Additional specifications on the drillship are provided in Attachment 2.

Drillship Principal Dimensions

Dimension	*Discoverer*	
Length Overall	514 ft	156.7 m
Draft	27 ft	8.2 m
Width	85 ft	26 m

Ice Management Vessels

Ice management support to the drillship will be provided by the *Fennica* (or similar) and *Tor Viking* (or similar). The drillship will be supported by these IMVs from the beginning of the campaign until the vessel departs the area. A description of these vessels is provided in Attachment 2.

Ice Management Vessel Principal Dimensions

Dimension	*Fennica*	*Tor Viking*
Length Overall	380 ft (116 m)	275 ft (83.7 m)
Draft	27 ft (8.4 m)	20 ft (6.0 m)
Width	85 ft (26 m)	59 ft (18.0 m)

Primary Ice Management Vessel

The *Fennica* (or similar vessel) is designated as the primary IMV. The *Fennica* is classed by the DNV as +1A1. Designed for the management, maintenance and service of offshore oil wells, the 380-ft (116-m) *Fennica* is a multipurpose vessel specialized in marine construction and icebreaking. *Fennica* is equipped with diesel-electric propulsion systems and their innovative combination of capabilities, based on extensive design and engineering work, facilitates use of these systems in arctic conditions.

Secondary Ice Management Vessel / Anchor Handler

Tor Viking is designated as the secondary IMV and anchor handler. Designed for the management, anchor handling, and maintenance and service of offshore oil wells, the 275-ft (83.7-m) *Tor Viking* is a multipurpose vessel specialized in marine construction and icebreaking.

Guidance Note: IMVs supporting the drilling vessel may be deployed to assist other vessels, as operations and ice conditions dictate. Diverting ice management resources away from the drilling vessel may require a curtailment of activities. This decision shall be made jointly by the Shell Drilling Foremen and the Master on the drilling vessel. The onshore Shell Drilling Superintendent (in consultation with the Noble Drilling Superintendent) will endorse the plan or set priorities if agreement cannot be reached at the field level.

IV. SHELL ICE AND WEATHER ADVISORY CENTER

SIWAC is an integrated forecasting service staffed 24/7 by industry-leading specialists under Shell contract in Anchorage, Alaska. SIWAC's primary function is to provide current and forecast ice and weather conditions directly to field operations and planning managers during the operational season. SIWAC provides information to decision makers and field principals to help them minimize risks when operating in the presence of ice. To provide quality and accurate information, SIWAC depends on skilled forecasters, subscription and public satellite imagery, numerical models, field observations, Geographic Information System (GIS) software tools, and a robust communication network.

SIWAC ICE DATA INPUTS

Ice forecasts are developed and issued daily. The Lead Ice Analyst compiles available data from subscription, specialized, and public services in ArcMAP (GIS Software) such as:

- MDA RadarSat 2 imagery
- MODIS satellite
- Canadian Ice Services
- National Ice Center
- Contract weather services
- Field observations
- IceNav images

Data Transmission

Effective communication of SIWAC ice and weather guidance and reciprocal feedback and field observations requires a robust and capable data network. The drilling vessel and IMVs are equipped with high-speed data and voice satellite service that has been proven to perform well in the U.S. Chukchi and Beaufort Seas.

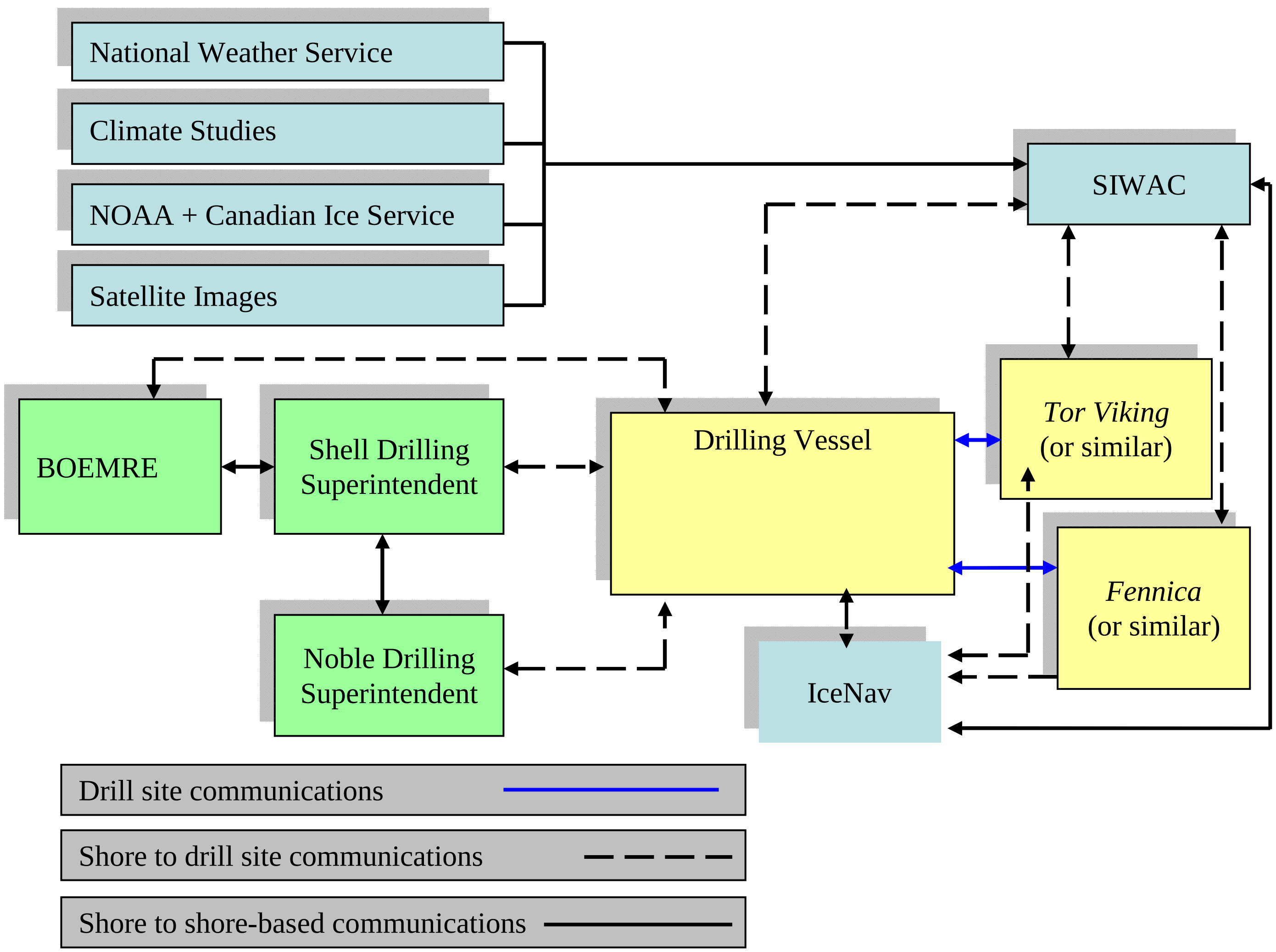
Data, including satellite imagery and observations, are relayed through a file transfer protocol (FTP) site between SIWAC and the field vessels using automated processes. This keeps both the field and forecasters continuously refreshed with the latest information. In addition, SIWAC maintains a secure website that allows direct, on demand access to all forecast reports and data products.

Additional information about SIWAC is in Attachment 3.

Ice Information Flow Chart

NOTE: The following graphic, Ice Management Communications Flow Chart, depicts the constant two-way communication that would occur between the various components of the system.

Ice Management Communications Flow Chart



NOAA = National Oceanic and Atmospheric Administration
BOEMRE = Bureau of Ocean Energy Management, Regulation and Enforcement

Guidance Note: Additional information regarding ice may be requested by the Master of the drilling vessel. Any means appropriate to the circumstances shall be used to provide this information. Where this information is to be obtained by aerial reconnaissance, the Shell Drilling Foreman will liaise with Shell Logistics to provide the appropriate resources.

V. ICE ALERT LEVELS AND PROCEDURES

These procedures define five Alert Levels that are linked to the time that hazardous ice is forecast to be at the drilling vessel location, and the time required to secure the well and move the drilling vessel off location if it becomes necessary. Roles, responsibilities and actions required are specified according to the Alert Level.

Ice Alert Levels

ALERT LEVEL	TIME CALCULATION	STATUS
Green	(HT – T-Time) is greater than 24 hours	Normal operations
Blue	(HT – T-Time) is greater than 12 hours and less than 24 hours	Initiate risk assessment. Validate secure times and move times.
Yellow	(HT – T-Time) is greater than 6 hours and less than 12 hours	Limited well operations in line with COCP. Commence securing well.
Red	(HT – MT) is less than 6 hours	Well-Securing Operations Completed. Commence anchor recovery operations.
Black	Drill site evacuated	Move drilling vessel to a safe location.

HT = Hazard Time
MT = Move-off Time
T-Time = Total Time

Guidance Note: If HT becomes greater than T-Time at any time, well securement and drill site evacuation contingency plans will be implemented.

Ice Alert Roles and Responsibilities

The following table summarizes roles, responsibilities and actions required for each Ice Alert Level.

Alert	Drilling Vessel Master	Drilling Vessel IA	IMV IA (Shell)	IMV Master	Noble Drilling Superintendent	Shell Drilling Foreman
ROLES AND RESPONSIBILITIES FOR ALL ALERT LEVELS	The Drilling Vessel Master is the person in charge (PIC) of the drilling vessel. He is the final authority in regards to safety of the vessel, crew and complement. All changes of Alert level are issued by the Master. The responsibility to evacuate the drill site in response to a hazard rests with the Master Evaluates information from SIWAC, IAs and Vessel Management Team (VMT) Establishes Ice Alert Level and directs ice management operations. Establishes MTs in conjunction with the IMV Masters. Ensure Alert Level status is broadcast to fleet and internally throughout drilling vessel at intervals dependent on Alert Level or at change of alert Level	Collates and evaluates information from the SIWAC, IMV IAs and VMT Advises Master in establishing Ice Alert Level. Correlates Secure Time (ST) with information from rig operations. Establishes HT and MT in conjunction with IMVs and drilling vessel and advises Master and VMT. Works in conjunction with IAs on IMVs to develop and establish effective ice management strategies and advises Drilling Vessel Master. Ensures current ice drift is broadcast to fleet and liaises with SIWAC	The IA is Shell's representative onboard the IMVs and is the primary contact for all communications with the Drilling Vessel Master. He advises the IMV Master in executing the ice management strategies. Works in conjunction with Master of IMVs to determine the local ice conditions and hazardous ice. Works in conjunction with Drilling Vessel IA and Master of IMVs to develop and implement effective ice management strategies. Provides feedback on effectiveness of strategy and reports any anomalies pertaining to ice.	The Master is the PIC of the IMVs. He is the final authority in regards to safety of the vessel, crew and complement. Evaluates advice from the SIWAC and IA (drilling vessel & IMVs). Works in conjunction with IA on drilling vessel and IA of IMVs to develop and execute effective ice management strategies within the capability of the vessel. Provides feedback on effectiveness of the strategy to the IA on the IMVs. Reports to IMVs IA any condition which inhibits vessel performance	The Noble Drilling Superintendent is the on-site supervisor responsible for all rig functions and drilling-related operations aboard the drilling vessel. Establishes ST & informs VMT of ST and well conditions. Validates drilling team is aware of their duties under present Ice Alert Level. Validates well secure contingency plans	The Drilling Foreman is the senior on-site Shell supervisor with responsibility for overseeing drilling and well operations and for initiating spill response as the On-site Incident Commander for spills originating from the well site. Validates well ST in conjunction with the Rig Superintendent. Informs Drilling Vessel Master and Noble Drilling Superintendent regarding ongoing & upcoming critical operations and curtailment plans. Communicates status of well and Ice Alert level to Shell shore-based management Under the authority of the Shell Drilling Superintendent the Shell Drilling Foreman may raise the Ice Alert Level at any time, He may order the suspension of drilling operations, securing of the well.

Alert	Condition	VMT Comms Frequency	Drilling Vessel Master	Drilling Vessel IA	IMV IA (Shell)	IMV Master	Noble Drilling Superintendent	Shell Drilling Foreman
Green	(HT – T-Time) is greater than 24 hours	Every 24 hours, or more frequently as needed	Discharges duties as per accountabilities	Discharges duties as per accountabilities	Discharges duties as per accountabilities	Discharges duties as per accountabilities	Discharges duties as per accountabilities	Discharges duties as per accountabilities
Blue	(HT – T-Time) is greater than 12 hours and less than 24 hours	Every 12 hours, or more frequently as needed	Ensures readiness to execute contingency plans. Ensures primary IMV is available to execute Ice Management strategies for the given ice regime. Ensures anchor handling tug supply (AHTS) IMV readiness to manage ice and anchor handling operations.	Establish Ice Management Strategies in conjunction with IMVs and IA onboard IMVs.	Establishes Ice Management Strategies in conjunction with IMV Master and Drilling Vessel IA Validate readiness of IMV to execute ice management strategy	Executes Ice Management Strategies in conjunction with IA on IMVs Establishes and states readiness of IMV to execute ice management strategy	Establishes ST and assesses upcoming well operations for changes to ST Informs VMT of ST and well conditions Validates securing contingency plans Evaluates ongoing & upcoming stage of drilling program with regard to ST and COCP	Validates ST in conjunction with the Rig Superintendent Informs Drilling Vessel Master and Noble Drilling Superintendent regarding ongoing & upcoming COCP Reports Alert changes to Shell shore-based management
Yellow	(HT – T-Time) is greater than 6 hours and less than 12 hours	Every 6 hours, or more frequently as needed	Directs ice management operations Establishes and Validates MT Establishes departure strategy Ensures Alert status is broadcast to fleet and internally at 1-hour intervals or at change of Alert Level	Establishes HT & advises Master & VMT Works in conjunction with IA on IMVs to initiate ice management strategies Ensures current ice drift is broadcast to fleet	Implements ice management strategies as directed by Drilling Vessel Master in conjunction with IMV Master Provides feedback on effectiveness of strategy	Executes ice management strategies as directed by Drilling Vessel Master and IA on IMV Provides feedback on effectiveness of the strategy	Commences securing well in accordance with agreed upon plan, informs VMT of progress	Monitors Well Securing Operations and effectiveness of ice management operations Communicates overall drilling vessel status to Shell shore management
Red	(HT – MT) is less than 6 hours	Every hour	Initiates departure plans following confirmation from Rig Superintendent that lower marine riser package (LMRP) has been retrieved and secured and guide wires are released Ensures Alert Level status is broadcast to fleet and internally Directs IMV and AHTS activities	Assess effectiveness of Ice Management Strategy in line with ongoing operations, Assist Drilling Vessel Master as needed Ensures current ice drift is broadcast to fleet during anchor recovery operations	Continues to implement ice management strategies in support of drilling vessel and anchor recovery operations	Executes ice management strategies and or activities associated with releasing the drilling vessel from moorings as directed by Drilling Vessel Master and IMV IA	Confirms well is secured and that LMRP is disconnected, retrieved & secured Commences securing drill floor for departure from site	Monitors rig securing operations and departure plan Communicates status to Shell shore management Organizes additional support as needed for site departure operations (for example logistics)
Black	Drill site evacuated	As needed	Directs IMV support operations leading to safe departure from drill site to pre-agreed safe area Complies with all regulatory reporting requirements (internal and external) Works with VMT and IA and IMVs to establish further course of action	Continues to monitor ice conditions. Works in conjunction with IA on IMVs during transit Provides Master of Drilling Vessel and VMT with information to aid further decision making	Advises IMV Master on operations leading to safe transit from drill site to pre-agreed safe area Provides information to Drilling Vessel Master to aid further decision making	Works under direction of the Drilling Vessel Master and IMV IA during transit	Confirms drill floor and associated areas are secured and ready to depart drill site Provides information to Master and VMT to aid further decision making	Informs Shell shore management of evacuation Complies with all regulatory reporting requirements (internal and external) Provides information to Master and VMT to aid further decision making

VI. ICE MANAGEMENT PHILOSOPHY

An effective IMP is designed to enable execution of the exploration program, with the appropriate barriers in place to manage and mitigate against risks that are specific to exploration drilling operation in offshore Alaska (in this case, threat of ice). Additionally, the IMP identifies the "top" event caused by the failure of barriers and addresses the procedures to deal with consequences of escalation.

The "top" event, for the purpose of the IMP, is a yellow alert level that triggers the commencement of well suspension operations. This section addresses the activities associated with ice management as a barrier to the top event.

The strategy to prevent the top event is to have the following elements as effective barriers:

- proper equipment,
- skilled people,
- appropriate information, and
- work processes.

The key elements identified above are discussed herein.

Proper Equipment

- The IMVs will be capable IMVs, with the appropriate ice strengthening, and have been contracted to support the exploration campaign.
- IceNav: The drilling vessel and IMVs will be outfitted with IceNav Equipment (Enhanced radar imaging of ice)
- *Tor Viking* (or similar vessel) is a high specification anchor handling vessel and will be the primary anchor handling vessel.
- *Fennica* (or similar vessel) designated as the primary IMV has anchor handling capability and could be used to supplement *Tor Viking* if needed.

Skilled People

- The drilling vessel and IMVs will carry specialist IA, in addition to the regular crew complement.
- The drilling vessel and the *Fennica* (or similar vessel) will have two IAs onboard providing 24/7 coverage.
- The IAs supporting the exploration campaign will have documented experience of having performed ice management activities associated with supporting exploration activities.
- SIWAC will be staffed with world-class industry-acknowledged experts in weather, satellite and Ice Synoptic analysis.
- IMVs will have crews with ice management experience.

Appropriate Information

A multi-layered, systematic approach is taken to provide relevant information from SIWAC with a feedback loop from the vessels using:

- Wide Area Satellite Imagery
- High Resolution Satellite Imagery
- Meteorological Buoys
- Field Observation
- Numerical Models
- Local Radar
- Vessels are outfitted with Fit-for-Purpose Data and Communications link.

Work Processes

A systematic approach for risk mitigation is adopted by developing effective work processes.

- Development of effective ice management strategies based on available information (global and local)
- Deployment of assets to deliver strategy
  - Threat sectors identified
  - Assess manageability of ice feature
  - Appropriate management of ice feature (breaking/deflecting)
  - Primary IMV deployed at an effective perimeter to reduce floes to manageable size in advance of HT
- Scheduled VMT meetings (frequency dictated by Alert levels)
- Planning/Coordination meetings with specific focus on Ice Alert Levels

VII. WELL SUSPENSION PROCEDURES.

Effectiveness of the IMP depends on accurately establishing HT, ST and MT. Secure Time is time taken to secure the well, disconnect and retrieve the LMRP.

As part of securing the well, well suspension procedures will be established. These procedures will supplement the detailed well securing procedures that will be contained within the Rig Operations Procedures and will be specific to securing the well in response to the threat of hazardous ice.

Return to the drill site following exit due to the threat of hazardous ice is covered in Section IX.

Examples of well suspension options and procedures are presented in Attachment 4.

A. Well Suspension Options

Securing and suspending the well can be accomplished by several means. The base case is to suspend the well by plugging, (mechanical or cement). The chosen option or combination thereof will be dependent upon well conditions, environmental conditions, and (or) equipment limitations. Shell will employ the most effective suspension procedure under the specific circumstances at the time.

Relevant information associated with well suspension will be documented in the daily drilling reports. The BOEMRE field representative will be apprised, and relevant records will be submitted to BOEMRE.

Potential well suspension options are listed in the following table.

	Mechanical Plugging	Drillpipe Hang-off	Pull Out of Hole	Shearing Drill Pipe	Dropping String
Time Required / Preference	Requires most time. Is the base case procedure for securement.	Less time than plugging	Potentially less time depending upon position in hole.	Least amount of time ;Stuck pipe contingency	Comparable to shearing drillpipe. Contingency to cope with mechanical hoisting failure
Provides Wellbore Isolation	Yes	Yes (blind/shears closed)	Yes (blind/shears closed)	Yes (blind/shears closed)	Yes (blind/shears closed)
Hang-off Sub (HOS) Required	No	Yes (Emergency Drill Pipe Hang-off Tool)	No	No	No
Packers / Bridge Plug Required	Yes	No	No	No	No
Potential to Leave String in Hole	Yes, if suspended below packer.	Yes	No	Yes, but access to pump through sheared string is questionable.	String in hole but requires fishing trip and overshot to circulate
Remarks	Mechanical plugs are preferred method in cased hole.	In this case no downhole plugging has been assumed.	This method is acceptable in situations where casing has been run and cemented, but not drilled out yet. Pipe can be pulled and blind/shears closed without further containment.	Contingency for stuck pipe situation	Contingency to cope with mechanical hoisting failure
Advantages	Provides complete wellbore isolation. Equipment readily available.	Provides wellbore isolation via blind/shear rams. Equipment readily available. Can be done in a timely manner. Leaves kill string in place for potential well control requirements.	Requires less time in situations where casing has been run but not drilled out, or if already out of the hole as noted above, for logging or changing BHA.	Quickest way to secure the well and prepare for move-off	Next to shearing, quickest way to prepare rig for move-off. Also leaves the top of the string in the hole undamaged and ready for recovery or circulating via overshot and packoff
Disadvantages	Takes longer. Packers require additional tripping. Cementing requires mixing / pumping time and introduces potential for contamination.	No downhole wellbore isolation.	Not a preferred method with open hole conditions because no pipe is left in the hole for potential well control methods. No downhole wellbore isolation.	Potential to leave a deformed pipe profile complicating fishing and circulating operations	No downhole isolation is accomplished. Requires fishing trip to reestablish downhole circulation

VIII. MOORING SYSTEM RELEASE/ RECOVERY

A. Conditions Present to Initiate Mooring System Release and Recovery

This section addresses mooring system release and recovery if ice conditions have triggered an Ice Alert Level of yellow and escalated to a red. The following discussion assumes the well has been secured and all recoverable well-related equipment has been retrieved.

B. Release Options

Mooring system release /recovery can be accomplished by several means. The base case is to recover moorings in the conventional manner. The selection of a specific release option and the execution of the procedures rest with the Drilling Vessel Master who informs the VMT. Potential options are listed in the table below.

Mooring System Release/ Recovery

	Conventional Anchor Retrieval	Rig Anchor Release (RAR)	Running off Wires
Time Required / Preference	Requires most time. Is the base case procedure for retrieval	Less time than conventional recovery	Contingency plan if RARs fail to activate.
Advantages	System is intact. Ready for redeployment	Reduced MT	None
Disadvantages	None	Increased redeployment time. Requires back up equipment. Potential loss of buoys. Relies on activation by acoustic release.	Complicates redeployment. High potential for seabed fouling. Potential to compromise system.

IX. MOVING ONTO OR RETURNING TO THE DRILL SITE

The authority to move on to or return to the drill site will be issued by the Shell Drilling Superintendent with the concurrence of the Rig Manager. Relevant regulatory authorities will be notified in accordance with the requirements.

Upon authorization, the final decision to move on to or return to the drill site is dependent upon the Drilling Vessel Master and the VMT who are able to assess the various parameters properly with input from the IMV Masters and IA to determine the practicality of the decision.

X. TRAINING

All personnel will be made aware of their roles and responsibilities within this IMP through a training session on each vessel. This training will include a table-top exercise, which will be executed prior to beginning operations to provide exposure to and test communications and procedures of the COCP and the IMP. Participants at the table-top exercise will include:

- Shell and Drilling leadership
- Rig Crews (both Drilling and Marine Operations staff)
- Oil Spill Response (OSR) representative
- SIWAC representatives
- BOEMRE operations representatives
- IMVs
- IAs
- Alaska Logistics (Marine and Aviation) Representatives

Observations from the table-top exercise will be documented.

XI. ATTACHMENTS

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Attachment 1 – Extract from Critical Operations Curtailment Plan

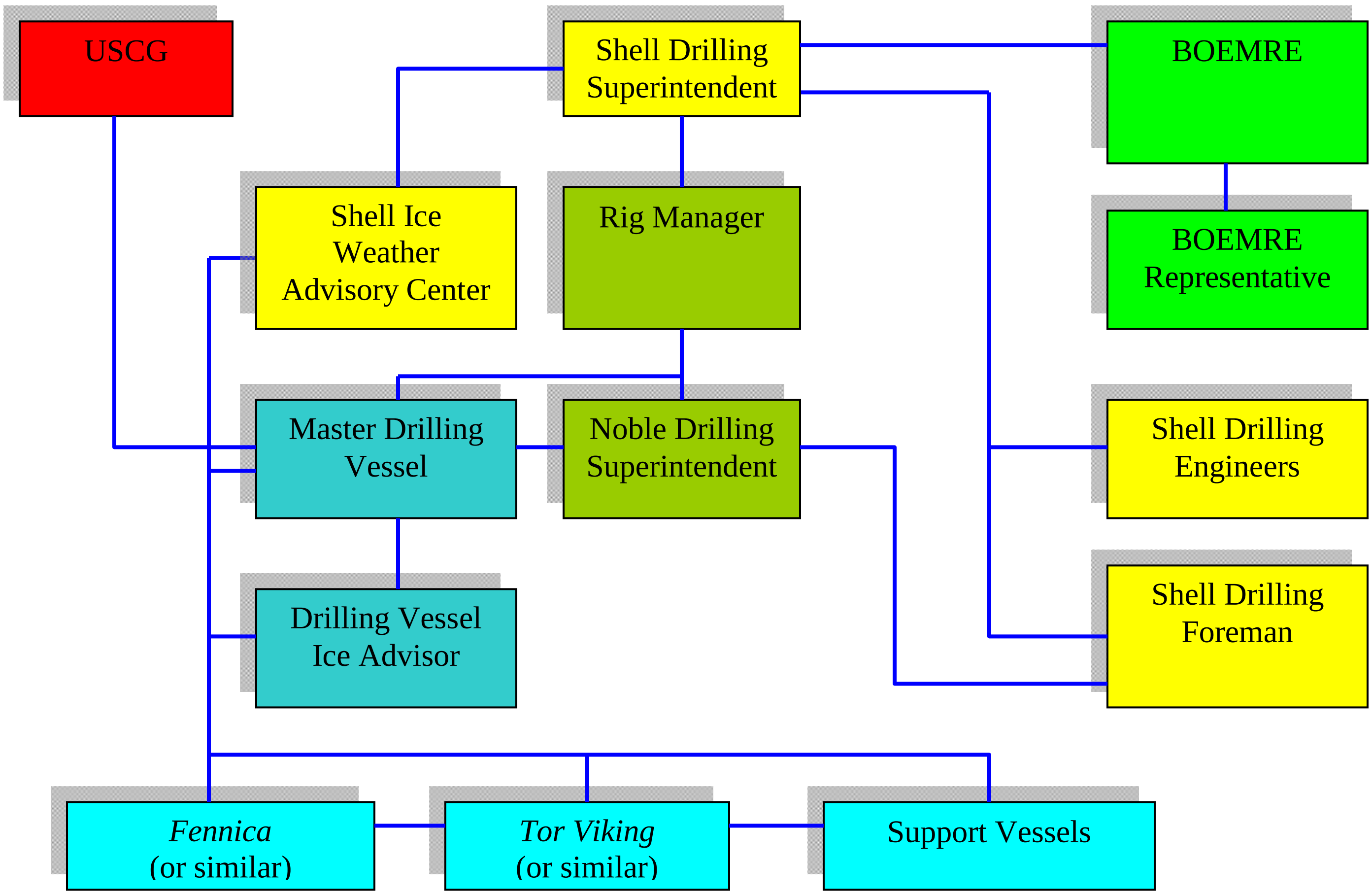
Per Section 10 of the COCP:

Notification of the decision for curtailments requiring the rig to disconnect from the well and depart location will be made as soon as practical, but not to interfere with the safety of the crew, environment, or vessel. This notification will be made either verbally to a representative on site or by telephone to a BOEMRE representative on duty; the notification may also be made in written form through the use of fax or email.

All operations curtailment decisions will be documented on the Shell Daily Operations Report. This information will be conveyed to BOEMRE on a weekly basis via the Well Activity Report and at the end of the well operations as part of the End of Operations Report.

The following flow chart depicts notifications in the event of curtailment.

Curtailment Notification Flow Chart (Attachment 1 continued)



Attachment 2 - Vessel Descriptions

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Discoverer Specifications

DISCOVERER **SPECIFICATIONS**	
TYPE-DESIGN	Drillship - Sonat Offshore Drilling *Discoverer* Class
SHAPE	Monohull with sponsons added for ice-resistance[1]
SHIP BUILDERS & YEAR	Namura Zonshno Shipyard, Osaka, Japan - hull number 355
YEAR OF HULL CONSTRUCTION	1965
YEAR OF CONVERSION	1976
DATE OF LAST DRY-DOCKING	2010

DISCOVERER **DIMENSIONS**		
LENGTH	514 ft	156.7 m
LENGTH BETWEEN PERPINDICULARS (LBP)	486 ft	148.2 m
WIDTH	85 ft	26 m
MAXIMUM (MAX) HEIGHT (ABOVE KEEL)	274 ft	83.7 m
HEIGHT OF DERRICK ABOVE RIG FLOOR	175 ft	53.3 m

DISCOVERER **MOORING EQUIPMENT**	
Anchor pattern symmetric 8 points system. The unit is fitted with Sonat Offshore Drilling patented roller turret mooring system giving the unit the ability to maintain favorable heading without an interruption of the drilling operations	
ANCHORS	Stevpris New Generation 7,000 kilograms (kg) each (ea) 15,400 pounds (lb) ea
ANCHOR LINES	Chain Wire Combination
SIZE/GRADE	2.75-in. wire 3-in. ORQ Chain
LENGTH	2,750 ft (838 m) wire + 1,150 ft (351 m) chain (useable) per anchor

DISCOVERER **OPERATING WATER DEPTH**		
MAX WATER DEPTH	1,000 ft (305 m) with present equipment (can be outfitted to 2,500 ft [762 m])	
MAX DRILLING DEPTH	20,000 ft	6,098 m

Table 1.c-2 *Discoverer* Specifications (continued)	
DRAW WORKS	EMSCO E-2,100 - 1,600 horsepower (hp)
ROTARY	National C-495 with 49 ½ -in. opening
MUD PUMPS	2 ea. Continental Emsco Model FB-1600 Triplex Mud Pumps
DERRICK	Pyramid 170 ft. with 1,300,000 lb nominal capacity
PIPE RACKING	BJ 3-arm system
DRILL STING COMPENSATOR	Shaffer 400,000 lb with 18-ft (5.5 m) stroke
RISER TENSIONS	8 ea. 80,000 lb Shaffer 50-ft (15.2 m) stroke tensioners
CROWN BLOCK	Pyramid with 9 ea. 60-in. (1.5 m) diameter sheaves rated at 1,330,000 lb
TRAVELING BLOCK	Continental - Emsco RA60-6
BLOWOUT PREVENTOR (BOP)	Cameron Type U 18 ¾ -in. (48 cm) x 10,000 pounds per square in. (psi)
RISER	Cameron RCK type, 21-in. (53 cm)
TOP DRIVE	Varco TDS-3S, with GE-752 motor, 500 ton
BOP HANDLING	Hydraulic skid based system, drill floor

***DISCOVERER* DISPLACEMENT**	
FULL LOAD	20,253 metric tons (mt)
DRILLING	18,780 mt (Drilling, max load, deep hole, deep water)

***DISCOVERER* DRAUGHT**		
DRAFT AT LOAD LINE	27 ft	8.20 m
TRANSIT	27 ft (fully loaded, operating , departure)	8.20 m
DRILLING	25.16 ft	7.67 m

***DISCOVERER* HELIDECK**	
MAXIMUM HELICOPTER SIZE	Sikorsky 92N
FUEL STORAGE	2 ea. 720-gallon tanks

***DISCOVERER* ACCOMODATIONS**	
NUMBER OF BEDS	140
SEWAGE TREATMENT UNIT	Hamworthy ST-10

***DISCOVERER* PROPULSION EQUIPMENT**	
PROPELLER	1 ea 15 ft 7-in. (4.8 m) diameter, fixed blade
PROPULSION DRIVE UNIT	Marine Diesel, 6 cylinder, 2 cycle, Crosshead type
HORSEPOWER	7,200 hp @ 135 revolutions per minute (RPM)
TRANSIT SPEED	8 knots

GENERAL STORAGE CAPACITIES	
SACK STORAGE AREA	934 cubic meters (m³)
BULK STORAGE	
Bentonite / Barite	180 m³ - 4 tanks
Bulk Cement	180 m³ - 4 tanks
LIQUID MUD	
Active	1,200 barrels (bbl)
Reserve	1,200 bbl
Total	2,400 bbl
POTABLE WATER	1,670 bbl / 265.5 m³ (aft peak can be used as add. pot water tank)
DRILL WATER	5,798 bbl / 921.7 m³
FUEL OIL	6,497 bbl / 1,033 m³

[1] Sponsons designed and constructed to meet requirements of Det Norske Veritas (DNV) Additional Class Notation ICE-05.

***Fennica* Specifications**

FINSTASHIP

OFFSHORE

Powerful, high-tech, multipurpose vessels for global underwater oil field construction

Designed for the management, maintenance and service of offshore oil wells, the 97-metre Botnica is a multipurpose vessel specialised in marine construction and icebreaking, as are the 116-metre vessels Fennica and Nordica. They are equipped with diesel-electric propulsion systems and their innovative combination of capabilities, based on extensive design and engineering work, facilitates their use in both arctic and tropical conditions. All three of these multipurpose vessels are highly advanced, powerful and extremely well designed and built.

Unique technology for demanding conditions

These vessels are ideal for offshore operations. The working deck is about 1,000 m², making it exceptionally large and level for ships of this length. The deck was designed for fast equipment changes. Depending on the ship, such equipment may range from simple deck cranes to a 160-tonne pedestal active heave compensated crane, or from deepwater installation equipment to pipe-laying systems, underwater machinery control or the towing and installation of large pipelines.

With their 15,000 kW power output and 230-tonne bollard pull, the Nordica and the Fennica are ideal for seabed ploughing and towing, and they are also fully equipped for anchor-handling operations. The ships' main engine and generator solution makes it possible to perform heavy-duty maintenance tasks without affecting their operating ability.

Both the Fennica and the Nordica are also equipped with a stern roller.

Accurate, safe and highly suitable

The Botnica's moon pool and the large size of its working deck make this ship highly suitable for a variety of offshore operations. Different types of special tools and structures can be installed on the working deck. The attributes of the Botnica, a class 3 DP ship, are in keeping with the strict rules and stipulations demanded in oil well management, as well as the requirements on oil fields set by the Norwegian Maritime Directorate.

The multipurpose icebreakers are equipped with Kongsberg Simrad's Dynamic Positioning (DP) system, which has five independent control units operating their main propellers and three bow thrusters. Even in a sector in which ocean vessels equipped with DP systems are a normal sight, these vessels have performed their tasks exceptionally well in terms of manoeuvrability and accuracy. Their unusual asymmetrical and spacious navigation bridge was designed with an eye to the requirements placed on the ship's multiple applications, both on the open sea and in icebreaking and towing operations.

The vessels have a separate deck for the clients' use, with cabins and offices and a separate data network. The high quality facilities accommodate a total of 45-47 guests, depending on the ship.

Fennica

Dimensions
Length 116.00 m
Beam 26.00 m
Draught 8.40 m max.
Built 1993
Max. speed 16 knots

Class
DnV + 1A1 – Tug Supply Vessel – SF – EO – Icebreaker polar – 10, Dynpos, AUTR, Helideck

Dynpos
Simrad ADP 702

Accommodation
82 persons
24 cabins for client use (47 persons)
Client's offices: 1 operation centre on 4th bridge deck, 1 x 20 m² office

Helideck
Superpuma or similar

Deck
Working deck area 1090 m²
Anchor handling/winch
Aquamaster TAW 3000/3000 E

Machinery
Main engines
2 x Wärtsilä Diesel, Vasa 16V 32, each 6000 kW
2 x Wärtsilä Diesel, Vasa 12V 32, each 4500 kW
Generators
ABB Strömberg Drives
2 x HSG 1120 MP8, power 8.314 kVA, Volt 6.3 KV, speed750 rpm
2 x HSG 900 LR8, power 6.235 kVA, Volt 6.3 KV, speed 750 rpm
Propellers
2 x HSSOL 18/1654, output 7.500 kW each, ABB Strömberg Drives
2x Aquamater-Rauma US ARC 1, 7500 kW each,
FP propellers, variable RPM
Bow thrusters
3 x Brunvoll FV-80 LTC-2250, VP propellers 1.050 kW each

Bollard pull 234 tons

Crane(s) (optional)
Stb 30 tons/38 metre jib
Port 15 tons
A-frame 120 tons

Navigation Equipment
Robertson ECDIS Navigation System
Doppler speed log
Loran C
GPS
Fiber optic gyros
Differential GPS Gyro.
Navintra Ecdis
Direction finder
Echo sounder
Facsimile recorder

Communication Equipment
1 x Skanti TRP 8400D MF/HF SSB, including all GMDSS requirements
1 x Watch receiver
1 x Aero VHF. Helicopter communication
6 x VHF
1 x Navtex receiver
1 x Inmarsat B satellite comm. system
VSAT online satellite comm. system
3 x UHF walkie-talkie
3 x VHF walkie-talkie
2 x Freefloat EPRIB, 121,5 and 406 MHz
2 x Distress transponders, 96 Hz
Call signal OJAD

Nordica

Dimensions
Length 116.00 m
Beam 26.00 m
Draught 8.40 m max.
Built 1994
Max. speed 16 knots

Class
DnV + 1A1 – Tug Supply Vessel – SF – EO – Icebreaker polar – 10, Dynpos, AUTR, Helideck

Dynpos
Simrad ADP 702

Accommodation
82 persons
24 cabins for client use (47 persons)
Client's offices: 1 operation centre on 4th bridge deck, 1 x 20 m² office

Helideck
Superpuma or similar

Deck
Working deck area 1090 m²
Anchor handling/towing winch
Aquamaster TAW 3000/3000 E

Machinery
Main engines
2 x Wärtsilä Diesel, Vasa 16V 32, each 6000 kW
2 x Wärtsilä Diesel, Vasa 12V 32, each 4500 kW
Generators
ABB Strömberg Drives
2 x HSG 1120 MP8, power 8.314 kVA, Volt 6.3 KV, speed750 rpm
2 x HSG 900 LR8, power 6.235 kVA, Volt 6.3 KV, speed 750 rpm
Propellers
2 x HSSOL 18/1654, output 7.500 kW each, ABB Strömberg Drives
2x Aquamater-Rauma US ARC 1, 7500 kW each,
FP propellers, variable RPM
Bow thrusters
3 x Brunvoll FV-80 LTC-2250, VP propellers 1.050 kW each

Bollard pull 234 tons

Main crane (optional)
Lifting capacity 160 T/9 m
30 T/32 m
Main winch Active Heave Compensated Constant Tension
Heave amplitude + 3,5 m double part
+ 7 m single part
Operating depth 500 m–160 T (double part)
1000 m–80 T (single part)
Aux winch 10 T, 33 m, Constant Tension
Tugger winches 2 x 4 T Constant Tension
Port 15 tons

A-frame (optional) 120 tons

Navigation Equipment
Navintra ECDIS Navigation System
Doppler speed log
Loran C
GPS
Fiber Optic Gyros
Differential GPS Gyro.
Direction finder
Echo sounder
Facsimile recorder

Communication Equipment
1 x Skanti TRP 8400D MF/HF SSB, including all GMDSS requirements
1 x Watch receiver
1 x Aero VHF. Helicopter communication
6 x VHF
1 x Navtex receiver
1 x Inmarsat B satellite comm. system
VSAT online satellite comm. system
3 x UHF walkie-talkie
3 x VHF walkie-talkie
2 x Freefloat EPRIB, 121,5 and 406 MHz
2 x Distress transponders, 96 Hz
Call signal OJAE

Botnica

Dimensions
Length 96.70 m
Beam 24.00 m
Draught 7.2 to 8.5 m
Built 1998
Max. speed 15 knots

Class
DnV + 1A1 – Supply Vessel – SF – EO – Icebreaker Ice – 10,
Dynpos AUTRO, RPS
NMD Mobile offshore Units, DP UNIT, with equipment class 3

Dynpos
Simrad SDP22 + SDP12 backup
2 x HIPAP combined SSBL/MULBL hydroacoustic system
2 x Seatex DPS DGPS combined GPS/Glonass

Accommodation
72 persons
24 cabins for client use (45 pers.)
2 x client's office

Helideck
Superpuma or similar

Deck
Working deck area 1000 m²

Machinery
Main engines
12 x Caterpillar 3512B, 1257 kW, 1500 rpm
Main generators
6 x ABB-AMG 560, 2850 kVA, 3,3 kV 3 N, 50 Hz
Emergency generators
1 x Caterpillar 3406, 200 kW, 400 V, 3 N, 50 Hz
Main propulsion
Stern 2 x 5000 kW Azipod, FP
Bow thrusters
3 x Brunvol tunnel, variable pitch á 1150 kW

Bollard pull 117 tons

Crane(s) (optional)
1 x Hydralift, 160 tons
1 x 15 tons

Main cranes
Lifting capacity 160 T/9 m
30 T/32 m
Main winch Active Heave Compensated Constant Tension
Heave amplitude + 4 m double part
+ 8 m single part
Operating Depth 550 m–160 T (double part)
1100 m– 80 (single part)
Aux winch 10 T, 33 m, Constant Tension

Moonpool 6.5 x 6.5 metres

Navigation and communication equipment
GMDSS
Inmarsat B
VSAT online satellite comm. system
Call signal OJAK

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e-mail: maritime@gdv.no
www.gdv.no

Tor Viking Specifications

AHTS/Icebreaker Tor Viking II- Main Characteristics
Design: KMAR 808 AHTS/ ICEBREAKER (Now; MOSSMAR)
Classification: DnV,+1A1, SUPPLY, SF, TUG ICEBREAKER ICE-10, DK(+) EO HELDK-SH DYNPOS-AUTR HL(2,8) W1-OC
Built / Delivered: Havyard Leirvik, Norway - 03/2000
Registered / Flag: Skärhamn, Sweden

Dimensions
Length Over All (LOA): 83.70 metres
Length between p.p.: 75.20 metres
Breadth, moulded: 18.00 metres
Depth, moulded: 8.50 metres
Draught (scantling): 7.20 metres
Draught (design): 6.00 metres
Freeboard (design): 2.50 metres
Dead Weight: 2,528 tonnes
Light Ship: 4,289 tonnes
Gross: 3,382 tonnes
Net: 1,145 tonnes

Capacities
Dry Bulk: 283 m 3 in 4 tanks - totalling 10,000 ft 3
Pot Water: 724 m 3
Drill Water / Ballast: 1,205 m 3
Brine: 400 m 3 – SG 2.5
Oil Based Mud: 612 m 3 – SG 2.8
Base Oil: 242 m 3
Fuel Oil: 1,190 m 3 Marine Gas Oil (Diesel)
Urea: 94 m 3
Diesel Overflow: 21 m 3 with alarm
Diesel Service / Settling: 2 x 20 m 3
Deck Load: Abt 1,350 ts
Deck Area: 603 m 2 / 40.20 m x 15.0 m
All products in dedicated tanks – no dual purpose tanks

Propulsion
Main Engine: MAK 18,300 BHP - 4 eng (father/son) 2 x 3,840 kW + 2 x 2,880 kW = 13,440 kW
Thrusters: Bow 1,200 BHP in tunnel (Electr) + 1,200 BHP 360 deg retractable = 2,400 BHP: Stern 1,200 BHP in tunnel
Bollard Pull: Bollard Pull: 202 continuous (DnV certified) / Abt. 210 max pull
Speed/Consumption: 16 knots – Abt. 42.7 MT / 24 hrs at 6.0 metres draught , 12 knots – Abt. 25.0 MT

Towing & Anchorhandling Equipment
AHT Winch: Brattvaag towing/anchorhandling winch 400 ts pull / 550 ts brake holding caps
AHT Drum: One of 1,400 mm dia. x 3,750 dia x (1,250 mm + 1,250 mm) length
Wire Capacity: 2 x 1,900 metres of 77 mm wire or 2 x 1,650 metres of 83 mm wire
AH Drum: One of 1,400 mm dia. x 3,750 mm dia. x 3,000 mm length
Wire Capacity: 4,100 metres of 83 mm wire
Winch Control: TOWCON 2000 Automatic Control with printer
Pennant Reels: One off 2 x 1,500 m of 77 mm wire or 2 x 1,300 m of 83 mm wire capacity
: One off 3,400 m of 77 mm wire or 1 x 3,100 m of 83 mm wire capacity
Large Reel Inner Core: 1,500 mm dia
Cable Lifters: 2 x 76 mm and 2 x 84 mm onboard
Chain Lockers: 2 x 129 m 3 / giving abt 2 x 6,000 ft of 3 inch chain
Shark Jaws: 2 pairs of Karm Forks arranged for chain up to 165 mm dia / 750 ts SWL
Inserts for handling of 65, 75, 85, 100, and 120 mm dia. wire/chain
Stern Roller: One of 3,5 metres dia. x 6.0 metres length – SWL 500 ts
Guide Pins: 2 pairs Karm Fork Hydraulic pins – SWL 170 ts

Deck Equipment
Capstans: 2 x 15 ts pull
Tugger Winches: 2 x 15 ts pull
Smit Brackets: One bracket on B Deck Forward – SWL 250 ts
Cranes: 1 hydraulic crane on fore cargo deck giving 6 / 12 ts at 20/10 m arm (360 degr) : 1 telescopic crane on aft cargo deck giving 1.5 / 3 ts at 15/10 m arm (360 degr) : 1 hydraulic crane on for-castle deck for stores etc
Windlass: 1 hydraulic windlass / mooring winch. 2 declutch-able drums 46 mm K3 chain

Accommodation: Accommodation of a total of 23 persons, including crew.
All accommodation equipped with air-condition and humidification facilities.

Dynamic Positioning
The vessel is equipped with Kongsberg Simrad SDP 21 Redundant DP System – GreenDP

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Attachment 3 – Shell Ice and Weather Advisory Center

Operational Support Overview

Safe and efficient offshore operations in the Arctic are contingent upon quality and timely ice and weather forecasts. Using state-of-the art satellite technology, large areas of the Beaufort and Chukchi Seas are monitored remotely by the SIWAC to track and forecast movement of ice and make estimates of ice type and concentration.

Synthetic Aperture Radar (SAR) instruments on board the RADARSAT 2 satellite are contracted to acquire necessary images of sea ice over areas of interest several times per week. These images are transmitted to ground stations, processed, and made available for analysis within hours of acquisition. Interpretation of the ice edge and features are performed by experienced specialists using powerful mapping software to produce ice charts that are considerably more detailed than those available from national ice centers. These charts are then distributed to operational personnel and planning managers.

Knowing the location and composition of the ice at any given moment is a valuable tool. However, it is important to forecast how the ice may change over time. A complementary component of ice forecasting is quality weather information. Weather conditions in the Arctic are among the most severe on the planet and can change dramatically over a short time. The National Weather Service does not provide measurements and forecasts that sufficiently resolve the conditions over small areas or short time spans in the Arctic offshore. Therefore, dedicated meteorologists with Arctic forecasting experience are employed full time to produce accurate snapshots of the current conditions and reliable forecasts of weather conditions into the future.

Using the Global Forecast System (GFS) numerical weather model as a starting point, the meteorologists produce a high resolution grid in proprietary modeling software of weather parameters, such as atmospheric pressure, wind speed, and wave height that have been corrected based on local observations and weather instrumentation from Shell's vessels at sea, meteorological buoys, and coastal weather stations. The result is a model that accurately reflects current and forecast weather conditions over short distances in the Beaufort and Chukchi Seas, making marine operations and vessel transits safer and more responsible. Without this innovative forecast effort, weather products from other sources tend to describe the average or general conditions that one could expect over large areas, such as the entire U.S. Beaufort Sea, which results in reports of local conditions rarely matching what is forecast for the specific areas of operations.

The wind vectors, a set of points indicating the speed and direction of the wind distributed over the Beaufort and Chukchi Seas, and other output from the weather model are applied to the ice charts in the mapping software. This allows the ice analyst to assess the effect of wind and weather systems on the future movement and development of the ice.

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Attachment 4 – Well suspension Options and Contingencies

In all the following well suspension scenarios, the assumption is that a determination has been made by the Shell Drilling Superintendent, the Shell Drilling Foreman, the Drilling Superintendent, the Drilling Vessel Master and the VMT that a hazard exists and the well should be suspended. The Shell Drilling Foreman and the Drilling Superintendent in conjunction with the Shell Drilling Engineer and the Shell Drilling Superintendent will have analyzed the trip time, borehole stability, well control issues, operational parameters, depth of hole, and time available to decide upon the contingency steps most appropriate for well securement, and a detailed procedure will have been worked up. The Shell Drilling Foreman then presents the procedure to the BOEMRE Field Representative aboard the drilling vessel for comment and concurrence.

<u>Well Suspension Scenario 1 – Mechanical Plugging</u>

1. After determining that the well should be suspended under the assumptions described above, the Shell Drilling Foreman orders the Noble Drilling Superintendent to stop all normal drilling operations and to commence circulating the hole.
2. The driller completes circulating at minimum a full “bottoms up.”
3. The drilling assembly is pulled out of the hole and a mechanical packer suitable to the last casing or liner size is made up on the bottom of the drill string.
4. The packer is tripped in the hole, set approximately 200 ft above the last casing or liner shoe depth and pressure tested.
5. Depending on actual water depth, sufficient pipe is pulled to enable having the end of the string 200 ft above the top of the packer when hung off in the wellhead via the hang-off sub (HOS).
6. A full-opening safety valve and an inside blowout preventer (BOP) are made up in the top of the drill pipe, and one additional joint is added above these valves. The HOS is installed in the top of this joint. (The full opening safety valve is left in the *<u>open</u>* position.)
7. The HOS assembly is run in the hole on drill pipe to land the HOS in the wellhead bowl.
8. The proper hydraulic fluid volume to actuate the BOP stack is confirmed by the Subsea Engineer and the system operating pressure is checked. Pipe rams in the BOP are closed on the HOS profile. The drill pipe is backed out from the HOS and the landing string is pulled from the riser. The blind/shear rams are closed and locked above the HOS. BOP failsafe valves are all left in the closed position.
9. The master bushings are removed and the riser spider is installed.
10. The diverter handling tool is made up and the diverter assembly is laid down.
11. The riser landing joint is made up into the slip joint inner barrel. The slip joint inner barrel is collapsed and the inner barrel is locked.
12. BOP stack functions are blocked, and the LMRP connector is unlocked.

13. The LMRP is pulled off the top of the BOP with the block motion compensator and riser tensioners.
14. Once the Shell Drilling Foreman has ascertained that the LMRP is released from the BOP, he advises the Drilling Vessel Master that he is free to initiate (or continue) mooring recovery and departure procedures.
15. The drill crew and Subsea Engineer pull the landing joint to surface. The landing joint, slip joint and riser are then layed down and the LMRP is secured on deck.
16. The Drilling Vessel Master confirms with the IA that the Ice Alert Level has reached “red” status (ice hazard is due to arrive within 6 hours of completing anticipated mooring recovery time). The Drilling Vessel Master advises the Drilling Superintendent to have the Subsea Engineer shear guidelines loose from the top of the BOP guideposts and to retrieve the lines to surface.
17. The drill floor and moonpool area are cleared and inspected in preparation for mobilizing the drilling vessel.
18. All decisions and supporting facts are recorded on the Daily Report and issued to the BOEMRE, SIWAC, and the normal distribution list.

Well Suspension Scenario 2 – Drillpipe Hang-off

1. After determining that the well should be suspended, the Shell Drilling Foreman orders the Drilling Superintendent to stop all normal drilling operations and to commence circulating the hole.
2. The driller completes circulating at minimum a full “bottoms up.”
3. A pill of heavy, kill-weight drilling mud is mixed and spotted at total depth (TD), then the rig pulls the bottomhole assembly back into the casing such that the bit will be at least 200 ft above the shoe when the pipe has been hung off on the BOP rams.
4. After pulling the proper distance into the casing, a full-opening safety valve and an inside BOP are made up in the top of the drillpipe. (The full opening safety valve is left in the *open* position.) One additional joint of drillpipe is added above these valves and all connections made up properly.
5. Drill pipe is added to the top of the single, but the connection at the hang-off point is not fully tightened.
6. The drill string is lowered back into the well with the loose connection positioned just above a pipe ram.
7. The proper hydraulic fluid volume to actuate the BOP stack is confirmed by the Drilling Superintendent and the system operating pressure is checked. Pipe rams in the BOP just below the loose drill pipe connection are closed. The drill string is lowered until all string weight is resting on the closed pipe ram. The loose connection is backed off and the remaining drill pipe is pulled from the riser. The blind/shear rams are closed and locked above the backed off drill pipe. BOP failsafe valves are all left in the closed position.
8. Proceed with steps 9 through 18 as indicated in Scenario 1 above.

<u>Well Suspension Scenario 3 – Pull Out of Hole:</u>

It is assumed the wellbore is isolated from the formation (i.e., a casing string has been run and cemented, but not yet drilled out). A drilling assembly has been run in the hole to the top of cement.

1. After determining that the well should be suspended, the Shell Drilling Foreman orders the Drilling Superintendent to pull out of the hole.
2. After pulling out of the hole, the proper hydraulic fluid volume to actuate the BOP stack is confirmed by the Drilling Superintendent and the system operating pressure is checked.
3. The blind/shear rams are closed and locked. BOP fail-safe valves are left in the *<u>closed</u>* position.
4. Proceed with steps 9 through 18 as indicated in scenarios 1 and 2 above.

<u>Well Suspension Scenario 4 – Shearing Drill Pipe</u>

It is assumed the drill string is stuck and unable to be pulled from the hole.

1. After determining that the well should be suspended, the Shell Drilling Foreman orders the Drilling Superintendent to circulate at minimum a full "bottoms up" (assuming circulation is possible).
2. While circulating, the Drilling Superintendent and the Toolpusher calculate the location of the drill string tool joints below the rotary.
3. Once circulation is completed the proper hydraulic fluid volume to actuate the BOP stack is confirmed by the Drilling Superintendent and the system operating pressure is checked.
4. Pipe rams are closed under the nearest connection.
5. The drill string is slacked down until all string weight is resting on the closed ram or the string weight has been transferred to the point at which pipe is stuck.
6. The blind/shear rams are closed, shearing the drill string above the hang-off point. The blind/shear rams are locked closed. BOP fail-safe valves are left in the *<u>closed</u>* position.
7. The cut section of drill string is pulled to surface.
8. Proceed with steps 9 through 18 as indicated in scenarios 1 and 2 above.

<u>Well Suspension Scenario 5 – Dropping String</u>

It is assumed that there has been a failure to the rig's hoisting capability; for example, failure of the drawworks to be able to pick up or position the string by lifting, and an approaching hazard has been identified. (Dropping the string is normally associated with being unable to shear the pipe across the shear rams, whether it is in the form of drill collars or heavywall casing, etc., and comes into play more often with a dynamically positioned vessel in a "drive off" situation.) Under most all circumstances with encroaching ice (barring mechanical failure), there is adequate time to trip drill collars out of the hole if across the stack or to install a crossover and run casing past the stack on drill pipe and then utilize a conventional hang-off tool.)

1. After determining that the well should be suspended and the string dropped because of a mechanical failure, the Shell Drilling Foreman orders the Drilling Superintendent to circulate at minimum a full bottoms up (if circulation is possible).
2. Once circulation is completed the proper hydraulic fluid volume to actuate the BOP annulars is confirmed by the Drilling Superintendent and the system operating pressure is checked.
3. Operating pressure for both annulars is increased to maximum, and both annulars are closed.
4. The string is slacked down until all string weight is supported by the closed annular elements.
5. Elevators are unlatched.
6. Opening pressure is applied to the annulars, releasing their hold upon the string and allowing it to fall downhole.
7. The blind/shear rams are closed and locked. BOP failsafe valves are left in the closed position.
8. At this point, the BOP stack functions are blocked, and the LMRP connector is unlocked. The LMRP is pulled off the top of the BOP with the riser tensioners alone, allowing it to clear the BOP sufficiently to enable moving off location.
9. Note that in this circumstance the LMRP may be left hanging until the hoisting capabilities of the rig have been restored. Movement off location will thus have to take water depth into consideration and clearance between the bottom of the LMRP and the seabed.
10. Once hoisting capabilities have been restored, proceed beginning with step 9 in the scenarios above to get the diverter and slip joint layed down and the LMRP secured on deck.