
*Cook Inlet Ice Monitoring and
Operations Curtailment Plan*

BUCCANEER ALASKA OPERATIONS, LLC

**Cook Inlet Exploratory Drilling
Program**

Prepared for



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Disclaimer: This Ice Management Operation and Curtailment Plan (IMOCP) has been composed to address in detail the potential ice conditions and hazards that could impact the proposed winter drilling locations. Buccaneer is providing the IMOCP for the sole purpose of supplemental information. The plan is not mandated, nor is the content prescribed by regulation. Buccaneer's IMOCP is to be implemented under the direction of the company's Drilling Supervisor, who has the primary responsibility for safe operations. The safe operation of Buccaneer's Cook Inlet Drilling Program is inclusive of ensuring the necessary oil spill response capability.

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Section 1: Introduction

The Buccaneer Alaska Operations, LLC (Buccaneer) Cook Inlet Ice Monitoring and Operations Curtailment Plan (IMOCP, or Plan) has been developed to document methods Buccaneer will employ to monitor environmental conditions and the precautionary measures that will be employed when ice conditions in Cook Inlet would potentially limit spill response operations. Each year, drilling operations are planned to continue through the open water season when open pack ice conditions are less than 10% concentration in the vicinity of the rig. Initiation of operations in the Northern part of Cook Inlet (north of the Forelands) will begin in early April and run through October in any given year. When permitted, operations in the southern part of Cook Inlet will continue all year in less than 10% ice concentrations in the vicinity of the rig. Buccaneer will not drill ahead into liquid hydrocarbon-bearing formations or proceed with well testing and logging when, in the vicinity of the rig, conditions reach over 10% ice concentration.

This Plan augments the realistic maximum response operating limitations (RMROL) identified in Buccaneer's Oil Discharge Prevention and Contingency Plan (ODPCP), identifying the conditions in which Buccaneer may suspend operations due to reduced oil spill response capability.

This IMOCP is arranged to:

- Identify critical operations and rig design specifications
- Identify ice conditions that would result in the potential curtailment of operations
- Identify measures used to monitor developing ice conditions

This Plan identifies certain drilling activities designated as critical operations and discusses plans to delay, limit or cease these operations when ice conditions develop that may potentially impact spill response capability. This Plan describes the decision-making process and identifies the lines of authority, responsibility and accountability for successfully handling critical operations.

Certain drilling operations are more likely than others to generate conditions that could lead to a well control incident or other incident that could result in harm to people, assets, or the environment. This is particularly the case when subsurface formations capable of flowing formation fluids into the wellbore are exposed, or when the well has encountered abnormal pressures.

No contingency plan can adequately cover all conceivable situations and circumstances, nor is this Plan intended to be a substitute for good judgment and experience in dealing with unexpected situations. This Plan is intended as a guideline for the Drilling Supervisor, who maintains responsibility for curtailment of critical operations.

Section 2: Critical Operations

Both planned and unplanned critical operations could trigger curtailment under this Plan.

Planned Critical Operations

Planned critical operations are designed to occur during the exploration drilling program in the Cook Inlet.

Planned critical operations may include:

- Drilling into a zone capable of flowing oil and/or gas
- Conducting certain operations in a well where zones capable of flowing oil and/or gas are exposed or are anticipated to become exposed such as:
 - Coring (whole or sidewall cores)
 - Pulling out of the hole with the drill string
 - Wireline logging in the open hole
 - Running casing, circulating and cementing
 - Continuing to drill after a well-related event (e.g., a kick)

Not all of these planned critical operations will necessarily be conducted or encountered on each well during the exploration drilling program. Data collection and testing requirements will vary from well to well depending on previous results from offsets and the defined exploration objective for the well.

Unplanned Critical Operations

Certain operations are not planned in the normal course of drilling exploration wells, but they could be undertaken should situations arise in which they are required. If these unplanned operations are deemed to increase the risk of harm to people, assets, or the environment they may be curtailed depending on the level of risk involved. Such operations could include:

- Searching for lost items in the well
- Cutting and pulling casing/ milling casing window
- Open hole sidetracking
- Drilling into a lost circulation zone
- Perforating
- Remedial well work
- Conducting well control operations (e.g., circulating a kick out of the hole)

The following are operations that could be considered critical depending on the well status and conditions at the time:

- Re-entering a suspended or temporarily abandoned well
- Accidental or unintentional riser disconnect

- Significant fuel spill
- Rig fire

Should these conditions be encountered, the severity and potential impact will be evaluated on a case-by-case basis and operations may be curtailed while dealing with them using safe methods and procedures. Again, good judgment is the key for dealing with such situations. Buccaneer does not intend to perform planned or unplanned critical operations where ice coverage would exceed 10% in the vicinity of the rig.

Buccaneer plans to use the drill rig *Endeavour – Spirit of Independence* to drill the wells described in the revised Buccaneer Plan of Operations. This rig is capable of operating in Cook Inlet in less than 10% ice coverage in the vicinity of the rig as planned (summers in Northern Cook Inlet / winters in Southern Cook Inlet) on a year round basis (see Table 1 below).

The Buccaneer operations in Cook Inlet will comply with the requirements of AOGCC, ADEC, and API RP 53, 65 Part 2 and 75 and other applicable regulations and notices including those regarding the avoidance of potential drilling hazards, safety, and pollution control. Primary safety measures include inflow detection and well control, monitoring for lost circulation and seepage loss, and casing and cementing program designs will be the primary safety measures. Primary pollution prevention measures include the contaminated and non-contaminated drain systems, the mud drain system, and the oily water processing system.

TABLE 1: RIG DESCRIPTION

Rig Basics		Rig Construction/Refurbishment Details	
Rig Name:	<i>Endeavour – Spirit of Independence</i>	Classification:	ABS
Rig Manager:	Transocean Ltd.	Rig Design:	LeTourneau Class 116-C
Rig Owner:	Transocean Ltd.	Built By:	UIE Scotland Shipyard
		Delivery Year:	1983
Competitive Rig:	Yes	Last Dry Dock:	UIE Scotland Shipyard
		Refurbishment:	1985, 2004
Rig Type:	Jackup	Flag:	Panama
Jackup Type:	Independent Leg Cantilever	Operating Parameters	
Rig Design:	LeTourneau Class 116-C	Max Water Depth:	300 ft
Rated Water Depth:	300 ft	Max Drilling Depth:	25,000 ft
Drilling Depth:	25,000 ft	Leg Penetration:	35 ft
Capacities		Transit Speed:	4 kt average tow speed
Max Towing Variable:	4,238.21 kips	Design Conditions:	48 ft wave in 300 ft wave depth 100 miles per hour (mph) winds
Normal Jacking:	4,217.93 kips	Operating Systems	
Emergency Jacking:	7,129 kips	BOP:	13-5/8" Cameron 10,000 psi
Drilling:	8,890 kips (at max hook load)	BOP Handling:	2 x tandem hoists for 13-5/8"
Liquid Mud:	2,017 bbl	Control System:	Koomey type 80, 30,000 psi
Bulk Mud:	5,680 cubic feet (cu ft) total	Choke & Kill:	10,000 psi x 3-1/16"
Bulk Cement:	4,260 cu ft total	Diverter:	49-1/2 inches 1600 psi WP
Sack Material:	1,400 sacks	Main Dimensions/Draft/Displacement	
Drillwater:	115,330 bbl	Length:	299.67 ft
Potable Water:	1,493 bbl	Breadth:	228.67 ft
Fuel Oil:	3,392 bbl	Depth of platform:	26 ft
Pipe Racks:	6,162 square ft (sq ft)	Legs:	347.50 ft
Rig Equipment Details		Spud Tanks:	46 ft diameter
Derrick:	Continental Emsco 160 ft high with 1,604,167 pounds (lbs).	Leg Spacing:	Longitude 129 ft; Transverse 142 ft
Drawworks:	National Oilwell 1625 DE 3,000 Hp	Ocean Transit Draft:	15.82 ft
Rotary Table:	National D-495 49 ^{1/2} 1,000 Hp	Field Transit Draft:	49.60 ft
Mud Pumps:	3 x National Oilwell 12-P-160 triplex each driven by two GE 752 Hi-Torque DC traction motors, rated to 5,000 pounds per square inch (psi), 1,600 Hp	Cantilever Reach:	60 ft aft stern
		Transit Displacement:	5,745 tons

Section 3: Monitoring Measures

The NOAA Marine Ice Atlas for Cook Inlet, Alaska (2001) describes the variables and their fluctuations that play roles in the stages of ice development in Cook Inlet. Page 13 of the Atlas summarizes the variables that influence sea ice formation as primarily dependent upon two factors:

- Ambient on-land daily mean air temperature falls below 20 degrees Fahrenheit (F) locally
- Sustained sea water temperatures of below 30 degrees F

To monitor environmental conditions in the Cook Inlet region, Buccaneer would consult with several sources of information on sea ice development, some of which are listed below.

The Anchorage NOAA National Weather Service (NWS)

The NWS provides the most reliable information for marine forecast as well as sea ice analysis and forecast. NWS would be Buccaneer's primary source of information for marine forecasts.

These forecasts are available to the public and may be accessed at the following website:

<http://pafc.arh.noaa.gov/marfctst.php>.

This site provides:

- 24hr Surface Forecast
- 48hr Surface Forecast
- 96hr Surface Forecast
- Sea-State Analysis
- Significant Wave Forecast
- 96hr Wind/Wave Forecast
- 48hr Wave Period Forecast
- 96hr Wave Period Forecast
- 48hr 500mb Forecast
- 96hr 500mb Forecast
- Graphic analyses of sea surface temperature and ice forecasts.

Sea ice analyses are available at <http://pafc.arh.noaa.gov/ice.php>. Scheduled sea ice analyses as well as five-day sea ice forecasts are produced Monday, Wednesday and Friday.

- Cook Inlet Sea Ice Analysis
- Five (5) Day Sea Ice Forecast
- Sea Surface Temperature Analysis

The NOAA NWS website ice advisory information is found at http://arctic.arh.noaa.gov/ice_advisory.php.

The National Ice Center

Additional information is available through the National Ice Center. The National Ice Center serves maritime interests around the world and aligns products and services from the National Oceanic and Atmospheric Administration (NOAA), the U.S. Department of the Navy, and the U.S. Coast Guard. The National Ice Center also provides a daily overview of the information from these agencies at the following link:

http://www.natice.noaa.gov/products/products_on_demand.html.

Weather Monitoring and Documentation

Upon arrival of the Rig Endeavour to the COSMO #1 location, Buccaneer will initiate monitoring and documenting the ambient local mean air temperature and sustained seawater temperatures at the drilling site. This information shall be documented in a daily log aboard the rig along with the sea ice analyses and forecasts obtained from the NWS. The Drilling Supervisor or his designee will be responsible for collecting and reviewing all weather, ice and tidal/current data on a daily (or more often as appropriate) basis. Any concerns raised will be communicated to Buccaneer management through existing communication procedures.

Ice observations will be taken from onboard the rig as part of the daily weather monitoring. Buccaneer will coordinate with NWS to establish a camera onboard the rig to monitor ice development. Buccaneer will coordinate with the Sea Ice Program Lead at the NWS to provide regular information on sea ice concentration in the vicinity of the rig. The NWS is preparing a study of ice development in Cook Inlet based on air and water temperatures at Kenai (Nikiski) and Anchorage. From the study they plan on developing a temperature-based ice-forecasting tool for ice development, which Buccaneer intends to use when available.

In the event ice coverage approaches 10% in the vicinity of the rig, Buccaneer will coordinate closely with CISPRI to ensure continued response capability. Buccaneer will consider the forecast for the area, inclusive of water temperature, wind speed and direction, and air temperature, as well as tidal stage and current speed.

An appropriate monitoring device will be established on the rig to provide for constant ambient air temperature readings. Buccaneer will coordinate with NWS to determine the best product to monitor ambient air temperature on the Rig.

Southwest Alaska Pilots Association

Buccaneer will also communicate with the local marine pilots through the Southwest Alaska Pilots Association (SWAPA) on sea ice development and conditions. The pilots provide the best consistent source of real-time observations, as well as estimations of ice coverage, throughout the whole of Cook Inlet. The NWS and U.S. Coast Guard also depend on SWAPA observations of sea ice conditions and development, as well as their estimations of percent ice coverage.

The Coastal Data Information Program

Integrative Oceanography Division Station 175 is located 7 nautical miles west of Anchor Point. This buoy is part of the U.S. Army Corp's Coastal Data and Information Program or (CDIP and NOAA's National Data Buoy Center Network (NDBC). The buoy provides real time and historic data on its current status, most recent location, instrument description, and most recent water depth (MLLW). The measured parameters include: wave energy and direction, and sea temperature. This data may be accessed at the following link:

http://cdip.ucsd.edu/?nav=historic&sub=data&units=metric&tz=UTC&pub=public&map_stati=1,2,3&stn=175&stream=p1

Buccaneer will gather data for consideration from the buoy. This information will be maintained in a daily record in the rig log.

Section 4: Circumstances/Conditions Requiring Curtailment

Several situations could arise under which drilling operations may be curtailed, suspended, or terminated. These are listed and discussed briefly below.

Curtailment operations may include the following as appropriate to the circumstances:

- Equipment preparation to curtail operations
- Decision to cease drilling
- Hanging off drill string or otherwise suspending the well

The curtailment of critical operations as a result of severe weather or local ice coverage (or for any other reason) is the responsibility of the Drilling Supervisor.

Sea Ice

Cook Inlet sea ice conditions are subject to seasonal, diurnal, and weather-driven temperatures. At a salinity of about 35 ppt and a temperature of -1.9°C (28.6°F), sea ice begins to develop. There is a range in the stage of development in ice and well as a range in the concentration of ice coverage. The stage of sea ice development provides a general indication of the ice thickness and its integrity, or density. There are many different names given to the varying ice stages. NOAA has established a guide that will be used by observers to document ice conditions. Descriptions of these ice development stages are provided in NOAA's *Observers Guide to Sea Ice* (http://archive.orr.noaa.gov/book_shelf/695_seaice.pdf). This document describes the various stages of ice development and the associated characteristics.

Different ice conditions affect spill response differently. New ice (frazil, grease, slush, or shuga), or nilas would not limit response vessel transit, and appropriately selected skimmers and response equipment, tactically applied, are also capable of operating sufficiently in these conditions. From the 15th of December through the 15th of March, the mean ice conditions in the Cook Inlet are characterized as ice-free in the area south of the forelands (Marine Ice Atlas for Cook Inlet, Alaska 2001). However, Buccaneer will be prepared to suspend operations if warranted by >10% ice conditions coverage in the vicinity.

Buccaneer will coordinate with CISPRI Operations personnel to ensure the capability of response equipment in consideration of the ice stage and trajectories. If the environmental conditions become unseasonably cold with water temperatures in the southern part of Cook Inlet dropping well below that necessary for ice formation, Buccaneer will make a determination on the appropriate curtailment needs in consideration of the forecast.

Wind and currents can result in ice movement that creates an unsafe condition for response vessels. The primary wind direction during the months of November through April is from the northeast. Winds from this direction will serve to push any ice that survives south of the Forelands to the western side of the Inlet (away from Buccaneer's operations).

If conditions or forecasts indicate that young ice concentrations may exceed 10 % coverage in the vicinity of the rig, Buccaneer will prepare to suspend operations until these conditions are within the acceptable limits of <10% coverage.

Unavailability of Materials, Personnel, and / or Equipment

Curtailed operations may also result from any of the following developments not necessarily related to ice conditions, or combinations thereof:

- Limited availability and/or capability of critical oil containment and cleanup equipment
- Significant increase in oil spill control system response time (response equipment may be staged nearby if this becomes an issue)
- Transportation for personnel, supplies and oil spill containment and cleanup equipment not readily available
- Well control equipment, marine safety systems, fire detection, firefighting or any other health, safety, security and environment (HSSE) critical systems that become inoperable or do not meet minimum standards

Section 5: Curtailment Decision Process

The decision process and the roles and responsibilities for dealing with ice hazards are provided here. The Drilling Supervisor has the primary responsibility for curtailment of critical operations and notification of curtailment to appropriate authorities, contractor management and Buccaneer management. The Drilling Supervisor will communicate in advance to Buccaneer management any concerns due to forecasts or current conditions whenever possible; in such a case Buccaneer management may choose to instruct the Drilling Supervisor to commence curtailment of critical operations for a period.

Key points of contact for determination of ice conditions in the inlet include:

- National Weather Service (NWS) Ice Desk
- Southwest Alaska Pilots' Association (SWAPA)
- Cook Inlet Spill Prevention and Response Inc. (CISPRI)
- United States Coast Guard (USCG)

The following personnel may be consulted by the Drilling Supervisor in determining when and how curtailment of critical operations will be undertaken:

- CISPRI – Spill Response Technician
- Onsite Installation Manager (OIM)

Curtailment Decision Protocol

The curtailment decision protocol is described below.

- Monitor site conditions
- When ice concentrations exceed 10% within 0.5 miles of the rig (subject to tidal motion and current direction), the Drilling Supervisor initiates curtailment operations.
 - The Drilling Supervisor may choose to initiate curtailment of critical operations prior to ice concentrations entering within any pre-established distance for any reason. Any pre-established distance is only a guideline to assist with the decision-making process.

Section 6: Documentation and Reporting

Notification of Buccaneer’s decision for curtailment will be made to AOGCC, ADNR and ADEC agency representatives as soon as practical in consideration of safety of the crew, the environment, and the rig. Notification may be made by the Drilling Supervisor (or designee) or by Buccaneer management. It is most likely that agency notification will be made in writing after the rig has resumed critical operations, however Buccaneer will notify the agencies as per regulations regarding curtailment of operations.

Responsible personnel will be trained on their roles and responsibilities described within this IMOCP.

All operation curtailment decisions will be documented on the rig’s log. The Drilling Supervisor shall ensure that agencies are notified. The following contacts shall be notified of curtailment operations.

AOGCC	Jim Regg, Petroleum Engineer	jim.regg@alaska.gov 793-1236
ADEC	Dianne Munson, Environmental Specialist	dianne.munson@alaska.gov 269-3080

Section 7: Ice and Weather Information Resources

NOAA NDBC Buoy:

http://cdip.ucsd.edu/?nav=historic&sub=data&units=metric&tz=UTC&pub=public&map_stati=1,2,3&stn=175&stream=p1

NOAAs *Observers Guide to Sea Ice*: (http://archive.orr.noaa.gov/book_shelf/695_seaice.pdf)

The NOAA NWS website ice advisory information is found at: http://arctic.arh.noaa.gov/ice_advisory.php.

Sea ice analyses are available at: <http://pafc.arh.noaa.gov/ice.php>.

National Ice Center: http://www.natice.noaa.gov/products/products_on_demand.html.

SWAPA: <http://www.swpilots.com/> Phone (907) 235-8783 Fax (907) 235-6119

USCG Anchorage, Homer