APPENDIX H

WELL CONTROL CONTINGENCY PLAN (WCCP)

Liberty Project

Well Control Contingency Plan Outline

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APPENDIX H: Well Control Contingency Plan Outline

Well control is the process of maintaining pressure inside the drilled wellbore in a manner that prevents gas or fluids from underground reservoirs flowing into the wellbore and escaping to the environment in an uncontrolled manner. This plan outlines Hilcorp Alaska, LLC well control processes and contingency plans in the unlikely event well control is lost.

Hilcorp designs and executes operations such that no single operational error or equipment failure should lead to loss of well control. The foundation of Hilcorp's well integrity and well control philosophy is to maintain multiple barriers between any subsurface zone that can potentially flow and the environment.

Primary Well Control – Planning and Operational Protocols:

- Site Selection:

  The location of the well is selected to avoid or minimize the following shallow hazards:

  1. Shallow faults that extend to the mud line.
  2. Over pressured water sands created by rapid depositional environments.
  3. Over pressured gas sands pressured by biogenic gas from rapidly decaying biologic materials in rapid depositional environments.

- Pore Pressure / Fracture Gradient Information:

  Casing setting points and mud weights are based on reviewed and approved pore pressure / fracture gradient information. The data set can include 3-D seismic data, shallow seismic surveys, and known offset well information. Casing points and mud weights are planned to provide the maximum well control potential, isolation of shallow over pressured zones, and stabilize the borehole.

- Casing Design:

  Cased design loads are based on API guidelines and the Code of Federal Regulations depending on which set of requirements has the most stringent design and assurance protocol. Hilcorp will outline conventional well loads and survival loads to be placed on the casing strings based on the specific tubular function. Each well design will be checked for all anticipated burs, collapse, and tensile loads applied over the life of the well. Additional screening and confirmation applied to wells drilled in OCS waters is:

  1. Well designs, barriers, and cementing programs are developed with the involvement of a registered Professional Engineer.
  2. Minimum regulatory requirements for margins between pore pressure, mud weight, and fracture gradient are applied to the design.

Using these principles the well design has the required integrity to perform safely and without undue risk during conventional drilling scenarios and survive extreme loads placed on the system during well containment efforts.

- Pressure Control Equipment:

- Hilcorp specifies and maintains pressure control equipment in accordance with the AOGCC and BOEM regulations. The minimum compliance level is based on the stricter requirement for pressure control equipment. Specific requirements applied to pressure control equipment in Alaskan-OCS waters:
  1. Documentation and review of well control equipment / processes as specified in the regulations for permit approval.
  2. Confirmation by onsite BSEE witnessing of pressure testing of critical well control equipment in accordance with regulations.
  3. Testing of the casing and blowout preventer (BOP) equipment meets at a minimum of 500 psi above the maximum anticipated surface pressure (MASP) to demonstrate the equipment can successfully operate at the highest pressures expected in a well control event.
  4. The BOP is certified, independently reviewed, and approved by a 3rd party as being suitable for the given well design and well conditions.

  These minimum requirements provide very high levels of assurance the BOPs will operate in the planned manner if required.

- Operational Monitoring:

  Operational monitoring is conducted to minimize the potential of penetrating an overpressured zone resulting in a loss of hydrostatic overbalance.

  1. Flow checks are conducted with the pumps off to confirm the static mud weight overbalances formation pressures. This is done as often as necessary, and every connection at a minimum.
  2. Frequent pit drills and trip drills are planned and conducted to ensure crew competency.
  3. Drilling contractor and Hilcorp staff have relevant and current Well Control Certificates.
  4. Rig crews will be trained to monitor drilling parameters for signs of drilling into pressure.
  5. Mud loggers are rigged up and will continuously monitor gas readings.
  6. Pit Volume Totalizer will be electronic to allow many different rig site personnel to monitor pit levels (Driller, Mud logger, Company Man, Tool pusher, Derrickman).
  7. Flow detector paddle will be included in the flowline and monitored for increases in flow.
  8. Pressure While Drilling LWD sensor probe will be run with drilling bottom hole assemblies to determine the pressure at the bottom of the borehole real time. This will allow rig site team to identify an influx or a lightening of the fluid column which could lead to an influx.
  9. Mud weight will be checked continuously and overbalance to formation will be maintained at all times.

Secondary Well Control - BOP:

In the event primary well control is lost, a series of escalating responses are planned to regain primary well control by establishing borehole hydrostatic pressure above formation pore pressures.

The first response is to close the BOP. The rig will be equipped with a four ram and one annular design BOP. Three of the four rams will be able to close around the drill pipe being used to drill the well. The annular can be used to close around a range of pipe sizes. Once the BOP has been closed, conventional well control methods will be employed to reestablish hydrostatic overbalance. The steps include the wait and weight method, driller's method, and/or bullhead kill methods. If there is no pipe in the hole, or if the functions above fail, the shear rams will be closed and hydrostatic overbalance reestablished by a bull head kill.

Contingency Plan for Loss of Well Control:

In the unlikely event that well control is lost and a blowout occurs, despite these design and operational protocols, Hilcorp will initiate Incident Command and contingency / response equipment. This includes mobilizing Hilcorp's well ignition, source control, and relief well equipment. Hilcorp may also mobilize additional internal and external resources to fully plan and execute contingency response plans and operations.

There are two methods of regaining well control - well capping and relief well drilling. Well capping constitutes the best available and safest technology (BAST) for source control of a blowout. In the event of a blowout, Hilcorp would pursue both methods simultaneously; however, it is most likely well capping would provide source control first.

Source Control – Well Capping

Well capping response operations are highly dependent on the severity of the well control situation. Hilcorp has the ability to move specialized personnel and equipment, e.g., capping stack or cutting tools, to North Slope locations upon declaration of a well control event. The materials to execute control (e.g., junk shots, hot tapping, freezing, or crimping), are small enough that they can be quickly made available to remote locations, even by aircraft, as necessary.

Well capping is both compatible and feasible with drilling operations because the technology is applied at the surface. There are no sensitivities to well types, (e.g., extended reach drilling, horizontal), location, or time of year. Well capping support equipment that would be needed immediately will be staged on LDPI prior to drilling.

Well capping techniques have been applied both on land and at offshore locations and have historically proven successful in regaining well control within a short duration. Well capping techniques are preferred over the more time-consuming alternative of drilling a relief well.

Hilcorp maintains an operating agreement with Wild Well Control, Inc., a worldwide well control specialist organization that can assist in the intervention and resolution of a well control emergency. In

an actual blowout event, well capping operations would commence with Hilcorp's activation of Wild Well Control, Inc. and mobilization of key Incident Management Team personnel, as well as deployment of select equipment. Dynamic and surface well control methods may continue in the interim only if it is approved and safe to do so. If the well capping option were selected and approved, safe re- entry to the wellhead area would be established and rig equipment moved to allow safe access. If the rig moving system is unavailable or inactive, heavy bulldozers, block-and-tackle, and/or cranes would be used to remove the rig from the wellhead area. Once safe access is regained, well capping operations would commence.

The U.S. Bureau of Safety and Environmental Enforcement (BSEE) and SINTEF Civil and Environmental Engineering (Norway) data indicate that well capping technologies provide the shortest duration and most effective option for regaining well control and minimizing environmental impacts. This is seen in the more consistent application of well capping in response to well control events and the correspondingly shorter durations to successfully regain well control as compared to the few relief wells that have been attempted.

Source Control - Relief Well Location and Timing:

Hilcorp will have available one of the following two drilling units should the primary drilling unit be rendered unusable in the event of a blowout and a relief well become necessary:

1. Hilcorp owned rig with mast and drilling substructure rigged up at the relief well surface location prior to commencement of development/exploration drilling program.
2. Contract drilling rig physically located in the region.

In the event the relief rig is in the region, it will be broken down into smaller modules and transported to LDPI over an ice road (during winter) or via barge (during open water season). The time required to mobilize a relief rig is highly dependent upon the specific situation. Generalizations regarding the logistics and the time requirements can be made by assessing rig moves during normal operations. Rig moves along the road system occur routinely. Rigs are regularly transported along tundra ice, marine ice, and gravel roads. The time required to move a relief rig from a location within the North Slope road system to Liberty via an ice road would take approximately 30 days. Rigs are also moved by barge. During the open water season of 2010, a drill rig was barged from Northstar Island to West Dock in 10 days. A Manitowok model 555 crane was used to load drill rig components onto barges. Transportation of the rig was coordinated with regular barge traffic that occurs annually. The rig was transported on back-hauls of regularly scheduled supply barges. In that situation, dedicated barge traffic for rig transportation was not necessary. During an emergency, a dedicated barge could transport a relief rig in approximately 20 days.

During times of the year when neither barging nor ice roads are an option, the modules would wait at the closest possible departure point to LDPI. The times of year where transport to LDPI would not be possible are a limited to fall *freeze up* (when ice precludes travel by barge but the ice road is not yet complete) and spring *break up* (when the ice is deteriorating but it's not yet open water). These periods

of restricted travel to LDPI are dependent upon many factors which vary year to year. Sections 3.2.1 and 3.2.8 of the EIA detail these factors and provide historical durations of *freeze up* and *break up* in Foggy Island Bay. The relief rig mobilization time estimates are summarized in Table 5.2 of the DPP and Table 1 of this document.

The conductor, cellar, and starter wellhead will be preset for the relief well and will be located on the north end of the island. This relief well pre-work will be executed prior to drilling the reservoir section of the first well to reduce the critical path should a relief well become necessary.

The relief well will be designed to intercept the blowout well at or near TD to ensure a successful well kill. Spare tangible items such as casing, float equipment, multi-bowl wellhead sections, liner hangers, casing hangers, will be available in the region and will not cause additional time to mobilize to the relief well site. Spare intangible items such as cement, drilling materials and equipment, and drilling mud products will also be available in the region.

Table 1. Activities and estimated total duration from the start of a blowout to well killing through a relief well.

Company Owned Rig			
	MOB Time	Drilling to Intercept Point	Well Kill Operations
Duration	2 days	30 days	3 days
Comments	Time necessary to R/U diverter and warm up drilling rig.	Time needed to drill and case down to reservoir section.	Time necessary to R/U and conduct well kill pumping program.

Contract Rig			
	MOB Time	Drilling to Intercept Point	Well Kill Operations
Duration	20 to 30 days	30 days	3 days
Comments	Time required to contract rig and mobilize to relief well surface location (worst case) 20 days by barge or 30 days by ice road	Time needed to drill and case down to reservoir section.	Time necessary to R/U and conduct well kill pumping program.