

# Phoenix 1: Drilling Mud Plan from APD

## VIII. MUD PROGRAM

### A. Mud Characteristics and Components

| <u>RKB Depth Interval (ft)</u> | <u>Hole Size (in)</u> | <u>Mud Weight (lbs/gal)</u> | <u>Mud System</u>   |
|--------------------------------|-----------------------|-----------------------------|---|
| 0 - 328                        | 42                    | 9.0                         | Freshwater/gel/caustic soda (generic mud #6).<br>Funnel viscosity 80-150. *<br><br><u>Anticipated Components:</u><br><br>barite (if needed)<br>bentonite (30-40 ppb)<br>caustic soda (1-2 ppb)<br>soda ash (0.5-1 ppb)<br>sodium bicarbonate (0.5-1 ppb)<br><br><u>Contingency Components:</u><br><br>Ben-Ex (0.05-0.1 ppb)<br>(acrylic polymer)  |
| 328- 875                       | 26                    | 9.0                         | Freshwater/gel/caustic soda (generic mud #6).<br>Funnel viscosity 60-120. *<br><br><u>Anticipated Components:</u><br><br>barite (if needed)<br>bentonite (30-40 ppb)<br>caustic soda (1-2 ppb)<br>soda ash (0.5-1 ppb)<br>sodium bicarbonate (0.5-1 ppb)<br><br><u>Contingency Components:</u><br><br>Ben-Ex (0.05-0.1 ppb)<br>(acrylic polymer)<br>drilling detergent<br>(0.01-0.04 gal/bbl)<br>(sodium salt of aliphatic sulfate) |

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\* Mud temperatures will be controlled by the use of heat exchangers and other technics to minimize thawing of the permafrost.

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| <u>RKB Depth Interval (ft)</u> | <u>Hole Size (in)</u> | <u>Mud Weight (lbs/gal)</u> | <u>Mud System</u>  |
|--------------------------------|-----------------------|-----------------------------|--|
| 875-3075                       | 17 1/2                | 9.0- 9.1                    | <p>Freshwater/gel/caustic soda (generic mud #6).<br/>Funnel viscosity 50-70. *</p> <p><u>Anticipated Components:</u></p> <p>barite (1f needed)<br/>bentonite (25-35 ppb)<br/>caustic soda (1-2 ppb)<br/>soda ash (0.5-1 ppb)<br/>sodium bicarbonate (0.5-1 ppb)</p> <p><u>Contingency Components:</u></p> <p>Ben-Ex (0.05-0.1 ppb)<br/>drilling detergent (0.01-0.04 gal/bbl)<br/>Drispac Superlo (0.1-0.5 ppb)<br/>(cellulose polymer)</p>  |
| 3075-7643                      | 12 1/4                | 9.1-10.0                    | <p>Freshwater/lignosulfonate (generic mud #8).<br/>Funnel viscosity 40-50,<br/>pH 10-11.2,<br/>API fluid loss 4-6 cc.</p> <p><u>Anticipated Components:</u></p> <p>barite (35-100 ppb)<br/>bentonite (15-25 ppb)<br/>caustic soda (2-4 ppb)<br/>lignosulfonate (3-5 ppb)<br/>lignite (3-5 ppb)<br/>Drispac Superlo (0.1-0.4 ppb)<br/>(cellulose polymer)<br/>Soltex (2-4 ppb)<br/>(sodium asphalt sulfonate)<br/>lime (0.2-0.4 ppb)</p> <p><u>Contingency Components:</u></p> <p>Mineral oil base spotting fluid<br/>(To be used in case of stuck drill pipe. Concentration in water base mud to be limited to less than 2 percent. All possible spot material to be caught and segregated from the mud system.)</p> |

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| <u>RKB Depth Interval (ft)</u> | <u>Hole Size (in)</u> | <u>Mud Weight (lbs/gal)</u> | <u>Mud System</u>   |
|--------------------------------|-----------------------|-----------------------------|---|
|                                |                       |                             | LDB (< 0.001 gal/bbl)<br>(aluminum stearate in propoxylated oleyl alcohol)  |
| 7643-9900                      | 8 1/2                 | 10.0-10.3                   | Freshwater/lignosulfonate<br>(generic mud #8).<br>Funnel viscosity 40-50,<br>pH 10.0-11.2,<br>API fluid loss 3-5 cc.  |
|                                |                       |                             | <u>Anticipated Components:</u><br><br>barite (70-140 ppb)<br>bentonite (15-25 ppb)<br>caustic soda (2-4 ppb)<br>lignosulfonate (4-6 ppb)<br>Drispac Superlo (0.1-0.5 ppb)<br>(cellulose polymer)<br>Soltex (4-6 ppb)<br>(sodium asphalt sulfonate)<br>lime (0.2-0.4 ppb)  |
|                                |                       |                             | <u>Contingency Components:</u><br><br>Torq Trim II, B1t Lube II,<br>Lubra-Sal (0.1-0.4 gal/bbl)<br>(vegetable oil base<br>proprietary product)<br><br>Zinc carbonate (0.2-2 ppb)<br>(H <sub>2</sub> S scavenger)<br>Mineral oil base spotting fluid<br>(< 2 percent)<br>LDB (< 0.001 gal/bbl)<br>(aluminum stearate in<br>propoxylated oleyl alcohol) |

B. Minimum Mud Requirements

The following minimum quantities of mud materials are sufficient to effect a 2-lb/gal increase in mud density. Actual anticipated quantities of material on board will greatly exceed these minimum quantities. The anticipated minimum quantity of barite is 12,000 sacks.

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| Hole Size (in) | 42  | 26  | 17-1/2 | 12-1/4 | 8-1/2 |
|----------------|-----|-----|--------|--------|-------|
| RKB Depth (ft) | 328 | 875 | 3075   | 7643   | 9900  |

Product

|                     |      |      |      |      |      |
|---------------------|------|------|------|------|------|
| barite (sx)         | 1400 | 1400 | 2000 | 2200 | 1600 |
| bentonite (sx)      | 200  | 200  | 200  | 150  | 100  |
| caustic soda (sx)   | 50   | 50   | 50   | 50   | 50   |
| lignosulfonate (sx) | 50   | 50   | 50   | 100  | 100  |
| lignite (sx)        | 50   | 50   | 50   | 100  | 100  |
| soda ash (sx)       | 20   | 20   | 20   | 20   | 20   |
| lime (sx)           | 20   | 20   | 20   | 20   | 20   |

Because of the difficulty with resupply of these materials, Tenneco anticipates carrying a large excess stock of mud materials aboard the SSDC. In an emergency situation, resupply can be accomplished by air or over-ice transport from Prudhoe Bay.

C. Daily Testing Requirements

A qualified mud engineer will be on board at all times during drilling operations. The mud will be tested during each tour in accordance with procedures in API RP 13 B. When discharging mud or cuttings, the static sheen test will be performed daily.

Samples will be collected at the point of greatest depth for each of the two generic mud types. These samples will be submitted for laboratory analysis, as specified in General NPDES Permit Number AKG284000 (Beaufort Sea).

IX. BLOWOUT PREVENTION

A. Drilling Procedure

A 60-in caisson will be set to a depth of about 55 ft BML prior to spud to serve as a cellar for the subsea wellhead. A wellhead centralizing ring will be located at about 40 ft BML.

A synopsis of the drilling procedure for the well will be as follows:

1. Drill 17.5-in hole to 160 ft BML, 328 ft RKB. Open hole in stages to 42-in OD.
2. Set 30-in structural casing at 328 ft RKB. Nipple up 30-in riser and diverter system (Figures 7 and 8).

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