



To: Jonathan Sprague
From: Hydraulic Kill Team: Kurt Mix, Ole Rygg, William Burch
Date: Sunday, May 09, 2010

Potential flow path options based on 3800 psi measured below BOP rams

- a) Full flow w/wellbore choke to seafloor
- b) Partial flow into weakest exposed formations (18" csg shoe) to seafloor

Assumptions:

- a. Flow Rate – model generated result based on well data
- b. Flowpath options
 - 1. 7" x 9 7/8" Annulus to seafloor
 - 2. 7" x 9 7/8" Annulus to seafloor plus weakest formation at 18" shoe
 - 3. 7" x 9 7/8" (internal flow path via float collar) to seabed
 - 4. 7" x 9 7/8" (internal flow path via float collar) to 16" liner top – then to weakest formation at 18" shoe
 - 5. Both annulus and internal flow path to seabed
 - 6. Both annulus and internal flow path to 16" liner top – then to weakest formation at 18" shoe
- c. Fracture gradient at the 18" shoe: 8969 ft tvd, 11.2 ppg, 5232 psi

Prior to the start of the requested simulation runs, a model calibration was performed by two separate modelers using two independent simulation models (SPT OLGA ABC and Add Energy OLGA Well Kill). Calibration results:

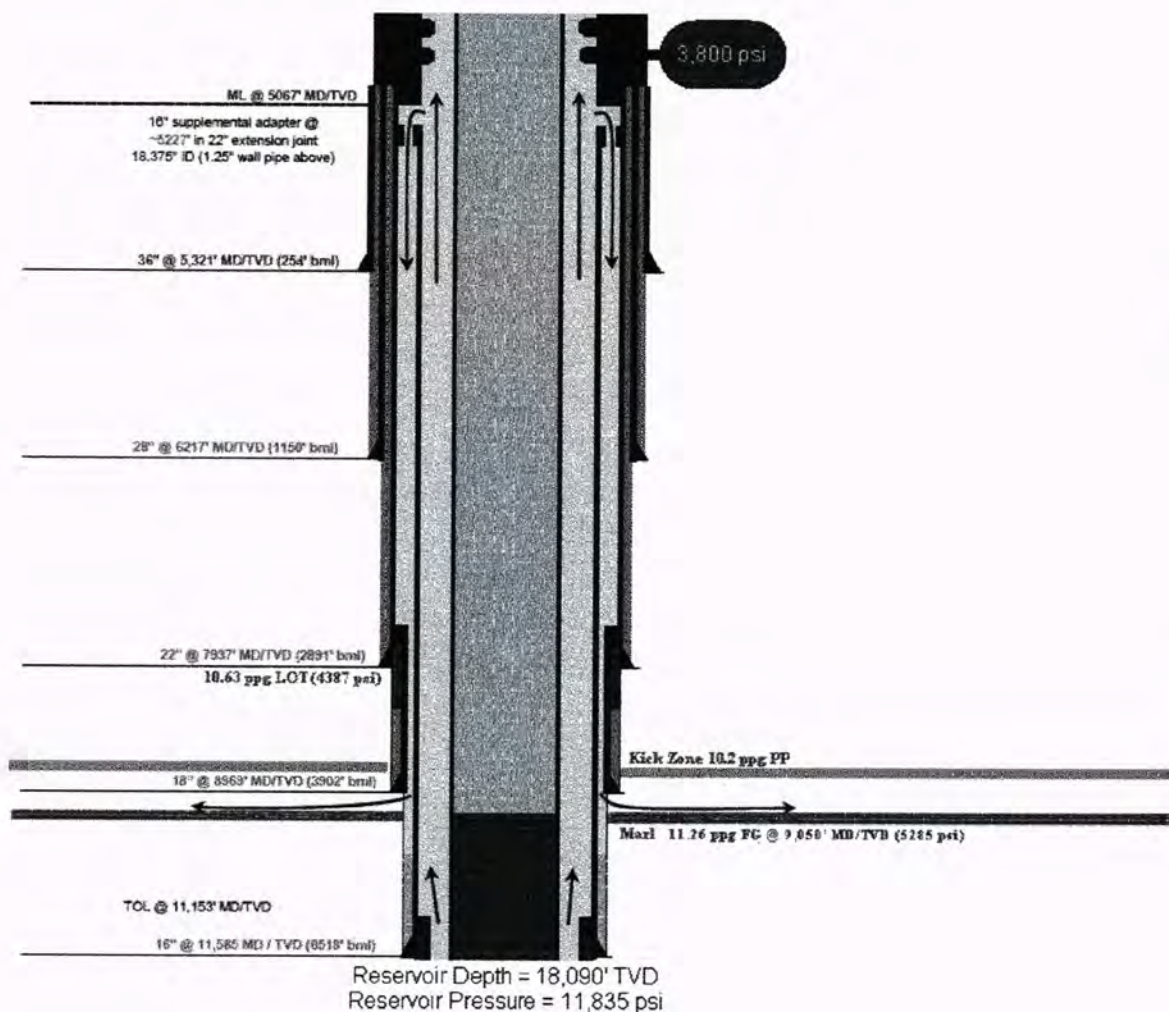
OLGA Well Kill	OLGA ABC
38,000 BOPD	53,500 BOPD
107 MMSCF/DAY	93 MMSCF/DAY.

Add Energy OLGA Well Kill will serve as the primary source of simulation data for this estimation due OLGA ABC single flow exit limitation.

Results:

Flow Path	Seabed	Back Pressure psi	Oil rate bopd	Gas rate mmscfd
Annulus	Unrestricted to seabed	2244	43000	120
Annulus	Current restrictions/measured	3800	37000	110
Annulus + Marl*	Current restrictions/measured	3800	37000	110
Casing	Unrestricted to seabed	2244	63000	180
Casing	Current restrictions/measured	3800	55000	160
Casing + Marl*	Current restrictions/measured	3800	55000	160
Both	Unrestricted to seabed	2244	87000	250
Both	Current restrictions/measured	3800	74000	210
Both + Marl*	Current restrictions/measured	3800	74000	210

* no potential underground flow possible under simulated conditions with 3800 psi



$$\begin{aligned}
 FBHP &= \frac{dP}{dz_{\text{hydrostatic}}} + \frac{dP}{dz_{\text{friction+acceleration}}} + FWHP \\
 &= 3589 \text{ psi} + 3829 \text{ psi} + 3650 \text{ psi} = 11068 \text{ psi} \\
 \text{Drawdown} &= 11835 \text{ psi} - 11068 \text{ psi} = 767 \text{ psi} \\
 \text{Flowrate} &= 767 \text{ psi} \times 50 \text{ bbl} / \text{d} / \text{psi} = 38,350 \text{ bbl} / \text{d}
 \end{aligned}$$

In order for flow at the 18" casing shoe, hydrostatic behind the shoe + FWHP has to exceed the fracture pressure. Hydrostatic of 3,916 ft column of 5.3 ppg oil = 1,079 psi.

$$1,079 \text{ psi} + 3,650 \text{ psi} = 4,729 \text{ psi} < 5,232 \text{ psi}$$

However, if the 18" liner hanger gave way and the 22" casing was exposed, the hydrostatic of 2,870 ft column of 5.3 ppg oil = 791 psi

$$791 \text{ psi} + 3650 \text{ psi} = 4,441 \text{ psi} > 4,387 \text{ psi}.$$