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The April 15th (03:30pm) model calculated standoff with 10 centralizers, open-hole caliper data was used, and the cement volume was increased from ~50 bbls to ~60 bbls. This resulted in potential channeling and a GFP of 7.65 (moderate). The centralizer outer diameter (OD) used in the model of 8.662 inches was incorrect. The actual centralizer OD was 10.75 inches and the under-reamed hole had a washed out diameter of ~10 inches. Had the correct diameter centralizer been used the standoff would have increased and it would have reduced the extent of potential channeling in the open hole.

To reduce the GFP and the potential for channeling the April 15th (06:12pm) model used 21 centralizers and the centralizer OD was changed to 10.125 inches. This eliminated the channeling and reduced the GFP to 2.56 (minor). Note that not all assumptions in the Halliburton model runs are known since the investigation team only had the model summary and not the individual input screens. CSI's 21-centralizer model predicted channeling and a GFP of ~10 (severe), which is not consistent with Halliburton's April 15th (06:12pm) model. This discrepancy is likely related to Halliburton assuming 70% standoff above the top centralizer and CSI assuming 40%. The CSI assumption is more conservative. The most accurate method is to have the model calculate the standoff.

On April 18th (11:25am) 7 centralizers were modeled and centralizer standoff was calculated for above and below the top centralizer. The centralizer OD used in the model again was incorrect at 8.662 inches instead of the correct 10.75 inches. These assumptions resulted in potential for channeling and a GFP of 10.29 (severe).

For all the Halliburton modeling runs from April 14th through April 18th, the assumed pore pressure to calculate the GFP was 13.97 - 14.0 ppg. The depths of the sands changed from 17,700ft MD to 18,200ft MD as shown on Table 2. Table 1 indicates the actual sands known. The investigation team was unable to clarify why 13.97ppg pressure was used at 18,200ft when the pore pressure is estimated at 12.6 ppg using log data (MDT runs). When the correct pore pressure is used (12.6 ppg at 18,200') the GFP is ~1 or "minor" versus the severe GFP potential using 13.97 ppg. The 14.0ppg sand used in the modeling at 17,700ft was likely referring to the M57C sand (likely brine), however the pore pressure was measured with GeoTap at 14.1ppg. Again the investigation team was unable to clarify why 14.0ppg pressure was used for the 17,700ft sand.

Both the long string and liner had near identical modeling results for maximum equivalent circulating density (ECD) and therefore had the same risk for cement placement as shown in Table 2. For either the long string or liner case the same centralizers, shoe, and float collar would have been used.

Table 1: Sands Identified on the Macondo well:

Sand Name	pore press ppg	LWD		Wireline		
		top md	bottom md	top md	bottom md	
M57B	14.15	17451.0	17453.0	17467.0	17489.0	Identified as a possible hydrocarbon June 2010 not a measured pressure
M57C	14.15	17684.0	17692.5	17700.0	17708.5	Most likely brine per GOM petrophysical review. GeoTap pressure reading
M56A	13.1	17788.0	17780.5	17804.0	17806.5	MDT
M56D	12.6	18051.0	18073.0	18067.0	18089.0	MDT
M56E	12.6	18104.0	18175.0	18120.0	18191.0	MDT
M56F	12.6	18201.5	18222.5	18217.5	18238.5	not measured

Note: All data comes from BP petrophysical review done on 25-May-2010.

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