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kill lines open, the Capping Stack provided an additional restriction to the flowing oil as evidenced by a pressure above ambient recorded within the Capping Stack. The riser in a similar manner provided additional resistance.

BP has suggested (BP's Preliminary Response to the Flow Rate and Volume Estimates Contained in Staff Working Paper No. 3, October 2010) that the integral estimate did not account for the erosion during the incident contending that this would yield an increasing flow with time. However, the steady decline in the BOP pressure is consistent with depletion of the reservoir and suggests that the erosion was not an important factor. In fact, Dr. Griffiths' work ("Oil Release from Macondo Well MC252 Following the Deepwater Horizon Accident," S. K. Griffiths, *Environ. Sci. Technol.*, 46 (10), 5616–5622, 2012) shows that the BOP data indicate that simple models can be formulated that do not include erosion and can well represent the BOP pressure data. In an attempt to account for some time period where the flow may have been reduced due to initially small flow paths, the integral presented within the DOE-NNSA Flow Analysis report assigned zero flow for the first two days of the incident when the well was flowing at a high rate to atmospheric conditions on the rig floor. I do not believe that erosion had a significant effect on overall flow from the well past the second day of the blowout.

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The pressure and flow data recorded during the Top Kill event allowed an independent estimate of the oil flow rate during that time period. I estimate that flow rate to be greater than 60,000 bopd. During the Top Kill, BP pumped heavy mud down the Macondo well in an effort to overcome the momentum of the hydrocarbons flowing up the wellbore, drive the hydrocarbons back down into the reservoir, and ultimately use a wellbore of heavy mud to "kill" the well.

In brief, using the known pump rates of heavy mud and the measured pressure readings from the BOP pressure gauge (PT-B) during the Top Kill event in a relatively simple calculation, I estimate a *lower bound* flow rate during the Top Kill on May 28, 2010 of 43,000 bopd. This bound assumes that there was zero flow of oil through the BOP during Top Kill. We know that this is conservative because Top Kill failed implying that the oil flow did not stop. If I estimate the flow of oil out of the well during the Top Kill procedure, I obtain an estimate of the flow for