



4 Executive Summary

During the *Deepwater Horizon* response, United States government officials⁷ and members of the Flow Rate Technical Group Plume Team⁸ noted that in May 2010 there was slug flow at the end of the *Deepwater Horizon* riser. Slug flow is a pattern of flow that is characterized by alternate flows of liquid and gas. Slug flow is a common problem in the oil and gas industry and is studied during the design and operation of multiphase pipelines.

Based on a review and analysis of plume videos, there is clear evidence of slug flow, i.e., alternating oil-dominant flow (appearing as a dark, almost black, plume) and gas-dominant flow (appearing as a light, almost white, plume), from the end of the DWH riser. This phenomenon was observed between May 13 and May 20, 2010. If slug flow were not present, the plume would have appeared as a uniform mixture of oil and gas, as can be observed from ROV video footage after May 20, 2010.

The characteristics of the slug flow at the Riser End changed over time; similarly, the period and range of motion of the riser also changed over time. This created a unique signature in the pattern of slug flow observed at the outlet. The signature of the slug flow, riser motion, and the flow through the riser are intricately linked. Knowing the signature and riser motion from the ROV footage, I was able to calculate the flow rate through the riser.

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⁷ MS172-037049; Deposition of Lars Herbst, Vol. 1, October 10, 2012, 208.20-211.11; Deposition of Adm. Thad Allen, Vol. 1, September 24, 2012, 330-23-333.10.

⁸ MDL Dep. Ex. 9183 at 10, 66, 68, 110, 135, 140, 145, 146, 150.

⁹ BP-NZN-2179MOL04996577.

¹⁰ The period is the duration of one cycle of the vertical oscillating motion of the riser.