U. S. Chemical Safety and Hazard Investigation Board
RECOMMENDATION STATUS CHANGE SUMMARY

Report:	Macondo Blowout and Explosion
Recommendation Number:	2010-10-I-OS-R10
Date Issued:	April 20, 2016
Recipient:	Ocean Energy Safety Institute (OESI)
New Status:	Closed—Acceptable Action
of Status Change:	October 26, 2021

Recommendation Text:

Conduct further study on riser gas unloading scenarios, testing, and modeling and publish a white paper containing technical guidance that communicates findings and makes recommendations for industry safety improvements.

Board Status Change Decision:

A. Rationale for Recommendation

On April 20, 2010, a multiple-fatality incident occurred at the Macondo oil well approximately 50 miles off the coast of Louisiana in the Gulf of Mexico during temporary well-abandonment activities on the Deepwater Horizon (DWH) drilling rig. Control of the well was lost, resulting in a blowout; the uncontrolled release of oil and gas (hydrocarbons) from the well. On the rig, the hydrocarbons found an ignition source. The resulting explosions and fire led to the deaths of 11 individuals, serious physical injuries to 17 others[1], the evacuation of 115 individuals from the rig, the sinking of the Deepwater Horizon, and massive marine and coastal damage from approximately 4 million barrels of released hydrocarbons.

As a part of its investigation, the U.S. Chemical Safety and Hazard Investigation Board (CSB) examined the mechanisms that caused the Macondo well blowout and explosion. The CSB determined that the "incident progressed from a gas-in-riser event ultimately to an uncontrolled blowout after the crew's well control actions and the physical well barriers (e.g., the BOP [Blowout Preventer] and diverter system) were unable to mitigate the hazardous conditions created once hydrocarbons entered the riser" and noted that "this is a hazardous situation because riser gas migration toward the rig may be nearly undetectable and can rapidly change from a seemingly stable condition to an extremely high flow rate, releasing large amounts of gas on the drilling rig that can ignite and explode[2]." Consequently, the Board issued a recommendation to

[1] The injury numbers presented here match those reported to the US Coast Guard as required by 33 C.F.R. § 146.30 on form CG-2692 *Report of Marine Accident, Injury or Death*. The 17 physical injuries represented here reflect the individuals that received immediate hospitalization as a result of the incident.
The actual number of injured from the Macondo incident is somewhat ambiguous, as a number of additional individuals sought medical treatments in the weeks following the blowout. In December 2014, Transocean noted 63 bodily injury claims pending in the state and federal courts in Louisiana and Texas.

[2] CSB Macondo Report, Volume III. Section 1.3, page 35.

the Ocean Energy Safety Institute (OESI), an organization established to facilitate research and development, training, and implementation in the areas of offshore drilling safety, blowout containment and oil spill response, to study riser gas unloading scenarios and issue a white paper containing technical guidance that communicates findings and makes recommendations for industry safety improvements.

B. Response to the Recommendation

In April of 2021, OESI communicated to the CSB that the OESI, Texas A&M University (TAMU) and Louisiana State University (LSU) collaborative partnership had completed its three-year riser gas unloading research study funded by the National Academies Gulf Research Program (GRP). The study found that:

- Multiphase flow experiments conducted as part of this research demonstrated the capability of downhole fiber optic sensors to detect a potential gas influx in real-time in a 5000+ foot deep wellbore. Current kick detection methods primarily utilize surface measurements and do not always reliably detect a gas influx. The proposed application of distributed fiber optic sensing overcomes this key limitation of conventional kick detection methods, by providing real-time distributed downhole data for accurate and reliable monitoring.
- The two-phase flow experiments conducted in this research provide critical insights for understanding the flow dynamics in offshore drilling riser conditions, and the results provide an indication of how quickly gas can migrate in a marine riser scenario, warranting further investigation for the sake of effective well control.
- The time dependent gas influx absorption and desorption from non-aqueous muds (used in the most riser gas events) were also investigated, and the findings have indicated the potential for minimizing peak gas discharge rate at the surface through optimization of the operational parameters.
- Numerical modeling of flow experiments resulted in the development of three computer programs to predict pressure behavior and gas and drilling fluid flow rates from the test well during the circulation of the injected gas. These computer programs can be very useful for the deepwater rig crews to properly handle a gas-in-riser event or to help professionals develop operational procedures or standards regarding gas-in-riser operations.

OESI also noted that the GRP report has been made public, the results of this research have been published via papers presented at several technical conferences and that "Deepwater Riser Gas Handling Guidelines" are currently being developed. These guidelines will be added as an appendix to the International Association of Drilling Contractors *Deepwater Well Control Guidelines*.

C. Board Analysis and Decision

Based on the above information, the Board voted to change the status of CSB Recommendation No. 2010-10-I-OS-R10 to: "Closed—Acceptable Action."