U. S. Chemical Safety and Hazard Investigation Board
RECOMMENDATIONS 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:	Open—Acceptable Response or Alternate Response
Date of Status Change:	January 29, 2020

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

[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. [*Form 10-K Annual Report*, 2014, pp 100, http://phx.corporateir.net/External.File?item=UGFyZW50SUQ9NTcxMDc3fENoaWxkSUQ9MjcyMzk1fFR5cGU9MQ==&t=1 (accessed March 26, 2016)]

rate, releasing large amounts of gas on the drilling rig that can ignite and explode[2]." Consequently, the Board issued a recommendation to the Ocean Energy Safety Institute (OESI) to study riser gas unloading scenarios and issue a white paper containing technical guidance that communicates findings and makes recommendations for industry safety improvements. OESI is an organization established to facilitate research and development and training in the areas of offshore drilling safety, blowout containment and oil spill response.

B. Response to the Recommendation

In June of 2016, OESI communicated to the CSB that it accepted the recommendation and was planning to utilize the academic partnership of OESI, Texas A&M University, the University of Houston, and the University of Texas - Austin to work together over the next thirty months to develop and study modeling efforts of these unloading events and subsequently publish a white paper. Funding for the project was to be sought from the Bureau of Safety and Environmental Enforcement (BSEE), the National Academies Gulf Research Program (GRP) and others.

In November of 2019, OESI communicated to the CSB that although BSEE declined to provide additional funding to address the subject of riser gas unloading, OESI worked to bring together novel teams and approaches at moving this research forward. Specifically, OESI brought together teams from Texas A&M University and Louisiana State University to develop a proposal for the GRP. That proposal "Experiments on Multiphase Flow of Live Muds in a Full-Scale Wellbore with Distributed Sensing for Kick and Gas-in-riser Detection/Mitigation", was selected in GRP's 2017 round of funding for a three-year project slated to be completed at the end of 2020.

To date numerous experimental studies have been undertaken in smaller scale laboratory models at Texas A&M University and on a full scale well at Louisiana State University to understand the basic fluid dynamics involved in riser gas unloading scenarios. This led to the formulation of various thermodynamic equations and correlations to depict the phenomena being observed so as to be better able to understand the conditions that can lead to kicks and methods that can be employed for their detection and mitigation. The focus in the final year of research is to develop equations of state for well kick situations; compare these equations to previously collected experimental data; incorporate heat transfer into the kick and solubility models to make them more applicable to offshore drilling conditions; and then publish the white paper.

C. Board Analysis and Decision

Based on the above information that substantial progress has already been made and the appearance that OESI will likely complete its work on this CSB Recommendation by the end of calendar year 2020 or in early 2021, the Board voted to change the status of CSB Recommendation No. 2010-10-I-OS-R10 to: "Open—Acceptable Response or Alternate Response."

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