PREVENTION AND CONTAINMENT OF DEEPWATER OIL WELL BLOWOUTS

Khaled F. Chalha (CHE) / Yasser Al Banna (CVE) / Nouran Arafat (CHE) / Omar Sherif (MCE)

Situation and Problem

Deepwater (depths greater than 1500 ft) offshore operations with a potential blowout possibility initiating at the wellhead that contains the Blowout preventer (BOP). The BOP is present at the seabed and is connected to a riser pipe above it, and to the wellbore below it. Riser pipe connects BOP to oil platform. A blowout could pose a significant risk to human lives, environment, and material assets [1].

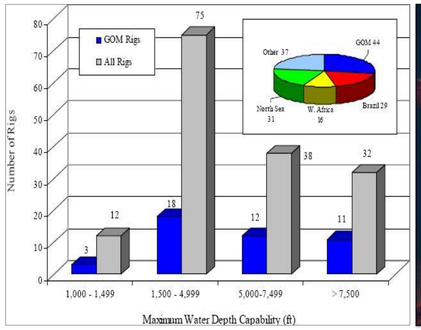

Figure 1: Deepwater wells depths and locations [2]

Figure 2: BP oil spill top view [3]

An important case study in this project was the Deepwater Horizon blowout . Solutions proposed are substantially influenced by the incident. The project addresses the following critical questions:

-What improvements can be made to an existing system to prevent the occurrence of a blowout or reduce risks to ALARA?

- What measures must be taken in case a blowout occurs?

References

[1]Per Holand, Offshore Blowouts: Causes and Control, Houston, Texas: Gulf Publishing Company, 1997.
[2]"Drilling and Development," 2010. [Online]. Available: http://www.geographic.org .[Accessed: Dec. 5, 2013].
[3]"Important BP Oil Spill Lawsuit Update ," 2013. [Online]. Available: httphttp://www.prweb.com. [Accessed: Dec. 5, 2013].
[4]"Investigating the Cause of the Deep water Horizon Blowout," Jun. 21,2010. [Online]. Available: http://graphics8.nytimes.com . [Accessed: Dec. 3, 2013].
[5]"BP oil spill: the official Deep water Horizon disaster timeline," Sept. 9, 2010. [Online]. Available: http://www.theguardian.com. [Accessed: Nov.28, 2013]
[6] "BP Considers a New Way to Seal the Well: The Static Kill." Jul. 20 2010. [Online]. Available: http://oilprice.com. [Accessed: Dec. 7, 2013].
[7] D. Schneider, "How to Drill A Relief Well", [webpage], (2010 July), Available at HTTP: http://spectrum.ieee.org

Prevention

Improvement of BOP

- Addition of an extra shear ram
- Better shear ram material: TiC
- Drill pipe centralization system
- Manual control by remotely vehicles

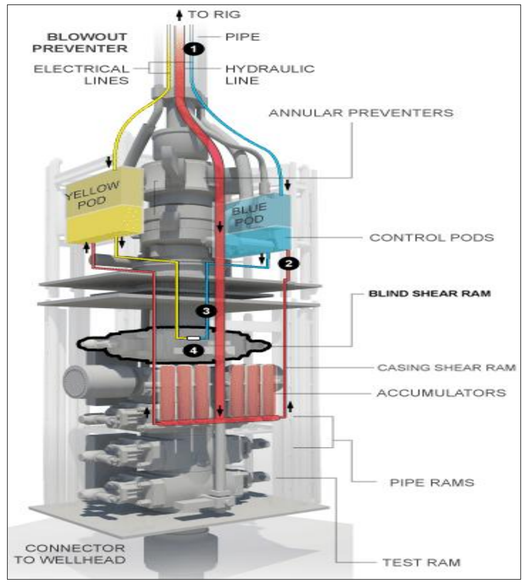

Figure 3: BOP structure [4]

Improvement of Riser

- Flow monitoring system in riser
- Riser dismantling system from platform

Are the solutions feasible ?

Cost-Benefit analysis suggests that solutions are feasible as they are minor improvements. Solutions are also not time consuming as they are installed prior to the BOP installation.

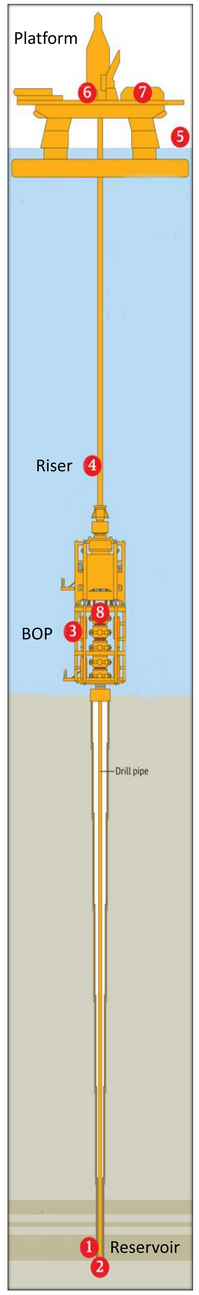

Figure 4: Deepwater system [5]

Containment

BOP Capping stack

- BOP capping stack placed on standby ready to be used if blowout occurs
- Capping stack equipped with nitrogen gas and methanol pumps
- Capping stack may take from a few hours to 48 hours to be attached depending on blowout conditions

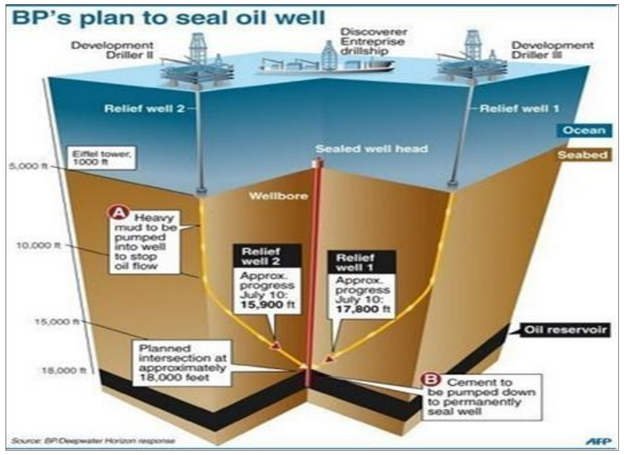

Figure 4: Relief well [6]

Relief wells

- Dual relief wells drilled in to depths of 14,000-18,000 ft. to intercept blown-out well
- Relief well pipes pump mud and cement to permanently seal off well [7]

Are the solutions feasible ?

Relief wells are the safest solution to kill the well. Cost-Benefit analysis is acceptable, but drilling the wells is time consuming. Capping stack can be used as a temporary solution while the wells are being drilled.