Defence in Depth Module

First Barrier: Cement Job

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Safety Talks

Defence in Depth Module

First Barrier: Cement Job Support Material

Script

Located 77 kilometres off the coast of Louisiana the huge floating drilling rig called the Deepwater Horizon had just completed drilling an ultra-deep well.

The bottom of the well was five and a half kilometres below sea level.

The Macondo blowout resulted in the death of eleven people, as well as an environmental catastrophe. This was the biggest oil spill in US history, twenty times the size of the Exxon Valdez oil spill in Alaska.

In this program I'll be analysing the failure of the barriers or controls that should have prevented the Macondo blowout in the Gulf of Mexico. If any one of these barriers had worked as intended, the blowout would not have occurred. In examining why they all failed, I'll be looking at how independent the barriers were, or rather, how interdependent they were. The barriers behaved like falling dominos. Once one fell, all the others followed. What happened at Macondo was the failure of the system of defence in depth. It wasn't just one or two barriers that failed, but the whole system.

The first barrier was a physical barrier - a cement plug.

Once the Macondo team had finished the drilling, they had to cement the bottom of the well to secure it, to prevent the oil and gas at the bottom, from entering the well and rising upwards when the drilling rig departed. This involved pumping cement down the casing, round the corner and up the sides.

If the cement gets into the right position and sets in the way it's supposed to, it should prevent the well from flowing under pretty much all circumstances.

The BP engineers made a number of decisions about the final design of the well, and about the design of the cement job itself which, they knew, increased the risk that the cement job would fail. They did this for commercial reasons and they did it believing that if the cement job did fail, a subsequent well integrity test would pick this up, and that if the worst came to the worst, a piece of equipment known as the blowout preventer could be brought into operation to prevent the blowout. This was in the thinking of several people who were interviewed subsequent to the accident. They said that, in the back of their minds, their **justification for accepting the higher risk of failure of the cement job was the reliance on subsequent barriers.** This was

the **first element of the dependence** amongst these barriers. They were accepting that the first barrier might fail because they **assumed** that subsequent barriers would work.

The cement did fail. Unfortunately, the engineers believed it had worked and they announced that the cement job was successful. So now it was up to subsequent barriers or controls to prevent disaster.

Suggested Discussion Questions and Answers

1. How could the job system be changed to ensure dependency is checked?
    - Identify all major hazard risks employing 'defence in depth' and review independence of controls. Document and schedule regular audits
    - During job planning stages recheck identified independence. The job does not proceed unless independence is confirmed and signed off.
    - Any proposed changes to controls are, under change management, reviewed for impact on other controls
2. Are we protected and what do we have to do to ensure independence and the integrity of defence in depth?
    - Group discussion