AWESOME stories

EXPLOSION at DEEPWATER HORIZON

This U.S. Coast Guard photo depicts efforts to deal with the aftermath of the 20 April 2010 explosion aboard the oil rig "Deepwater Horizon." The efforts ultimately failed when another explosion, on the 22nd of April, caused "Deepwater Horizon" to sink. The incident occurred at the Macondo Well in the Gulf of Mexico. Public-domain photo online via the U.S. Coast Guard.

Drilling for oil in the Gulf of Mexico is expensive. BP's efforts, to find oil at Mississippi Canyon 252, were taking longer than company managers expected. Instead of 21 days, which the crew had anticipated, it was taking six weeks.

Mike Williams, in charge of Deepwater Horizon's computers and electrical systems, was part of the rig's crew. Employed by Transocean, Deepwater's owner, Williams and his colleagues had recently drilled the world's deepest oil well (at a vertical depth of 35,050 feet in the Gulf of Mexico's Tiber Oil Field).

People on board the platform were experienced individuals who knew their jobs. In seven years, none of the 126 crew members had been seriously injured. Given the potential for problems on a working oil rig, that safety record was a worthy achievement.

However ... according to Williams ... not all was well. One of the rig's vital pieces of safety equipment was damaged. The "blowout preventer" - often referred to as a BOP - is located near the sea bed. It seals a well shut so the crew can test pressure and well integrity. A key component of the blowout preventer is the "annular," a rubber gasket capable of closing tightly around the drill pipe.

During a test aboard Deepwater Horizon, while the rubber gasket was tightly closed, someone accidentally applied huge amounts of force to the mechanism. The accidental force pushed about fifteen feet of drill pipe through the closed blowout preventer.

No one knew for sure whether the incident had caused a problem until a crewman, who was monitoring drilling fluid, found something which had risen to the surface. Mike Williams tells us what it was:

> *He discovered chunks of rubber in the drilling fluid. He thought it was important enough to gather this double handful of chunks of rubber and bring them into the driller shack. I recall asking the supervisor if this was out of the ordinary. And he says, "Oh, it's no big deal." And I thought, "How can it be not a big deal? There's chunks of our seal is now missing."*

That event took place about four weeks before the explosion.

There was another issue with the blowout preventer, according to Williams.

Operated from the surface, even though it's on the sea bed, the blowout preventer has two control pods. One of those pods serves as a back-up. Williams recalls it had lost some of its function in the weeks prior to April 20th. (Investigators later determined the blowout preventer had both a weak battery, and a hydraulic leak, among other problems.)

On that fateful day, some of BP's managers were on the rig to congratulate the crew for such a long period of injury-free work. Since Deepwater Horizon's job was almost finished, it was a good time to rejoice. All that remained was to seal the well closed since another rig would extract the oil.

During a safety meeting, while the crew was discussing how Transocean would close the well, a BP manager disagreed with the recommended process. Williams says he was at the meeting:

> *I had the BP company man sitting directly beside me. And he literally perked up and said "Well my process is different. And I think we're gonna do it this way." And they kind of lined out how he thought it should go that day. So there was sort of a chest-bumping kind of deal. The communication seemed to break down as to who was ultimately in charge.*

To shed more light on this conversation, let's look at the National Commission's Report to the President:

> *During the rig's daily 7:30 a.m. operations conference call to BP in Houston* [on April 20, 2010], engineer [Brian] *Morel* [from BP], *discussed the good news that the final cement job at the bottom of the Macondo well had gone fine. To ensure the job did not have problems, a three-man Schlumberger team was scheduled to fly out to the rig later that day, able to perform a suite of tests to examine the well's new bottom cement seal* [to make sure it was holding properly].
>
> *According to the BP team's plan, if the cementing went smoothly, as it had, they could skip Schlumberger's cement evaluation. Generally, the completion rig would perform this test when it reopened the well to produce the oil the exploratory drilling had discovered.*
>
> *The decision was made* [by BP] *to send the Schlumberger team home on the 11:00 a.m. helicopter, thus saving time and the $128,000 fee. As BP Wells Team Leader John Guide noted, "Everyone involved with the job on the rig site was completely satisfied with the* [cementing] *job."* (See "Report to the President," at pages 19 and 20 of the online PDF version.)

According to Williams, the well would therefore be closed following BP's procedures. Crew members doing the job would have to rely on the blowout preventer - the same device which had lost some of its rubber gasket material four weeks previously.

When a well is temporarily closed, two large cement plugs are positioned inside the well pipe. One of the plugs is located near the bottom of the pipe. Another plug is located father up the pipe.

The plugs are separated by thick drilling mud which helps to keep the natural gas and oil in the ground until the oil-pumping rig begins to remove the raw product. (See the bottom-left drawing on this illustration by Emmett Mayer II and Dan Shea from the New Orleans *Times Picayune*. Note the drawing does not pass muster with scientists. It was designed to merely give the public a general idea how this complicated process works.)

If the cement plugs are not firmly in place, natural gas could rocket through the pipe and cause an explosion. Were that to happen, the blowout preventer - which weighs about 400-tons - is designed to force the rocketing natural gas back down to the well head so it doesn't escape to the surface. The system also has other fail-safe mechanisms.

Just before 10 p.m., on the night of April 20, a huge surge of explosive gas (which turned out to be methane) suddenly got loose from below the sea bed. For whatever reason - perhaps because there was insufficient drilling mud separating them or the plugs were not firmly in place - the cement did not hold.

Inhibiting the crew's ability to deal with the situation:

> *...an alarm system designed to alert the crew and prevent combustible gases from reaching potential sources of ignition had been deliberately disabled.*

According to news reports, such action happens frequently - on various rigs - to prevent false alarms from disturbing crew members while they're asleep.

Rocketing its way up the pipe, the gas blew through Deepwater's blowout preventer. Initially, no one could say for sure why the gas was not contained (or why the blowout preventer had failed). Later, investigators from CSB (the U.S. Chemical Safety Board) concluded that the "drill pipe buckled due to a mechanism known as 'effective compression.'"

The failure allowed potentially explosive material to quickly travel through the whole pipe. If no one immediately activated the Emergency Disconnect System - as Andrea Fleytas, Deepwater's Dynamic Positioning Operator, later testified - the explosive material would reach the rig where it was relatively easy to find an ignition source.

Once at the rig's platform, the escaping gas did what gas can do. It caused an explosion.

A quote from the National Commission's "Report to the President" puts the size of the explosion in perspective:

> *At the Commission's November 8, 2010, hearing, a representative from Transocean likened it to "a 550-ton freight train hitting the rig floor," followed by what he described as "a jet engine's worth of gas coming out of the rotary."* (See "Report" at page 130 of the PDF online version.]

See Alignments to State and Common Core standards for this story online at:
http://www.awesomestories.com/asset/AcademicAlignment/EXPLOSION-at-DEEPWATER-HORIZON-Deepwater-Horizon-Disaster-in-the-Gulf

See Learning Tasks for this story online at:
http://www.awesomestories.com/asset/AcademicActivities/EXPLOSION-at-DEEPWATER-HORIZON-Deepwater-Horizon-Disaster-in-the-Gulf

Media Stream

Explosion at Deepwater Horizon

April 21, 2010 photo by U.S. Coast Guard depicting efforts to contain the blaze at "Deepwater Horizon," following an explosion the prior day. Public Domain.
View this asset at:
http://www.awesomestories.com/asset/view/Explosion-at-Deepwater-Horizon

Deepwater Horizon Explosion - Coast Guard Video

U.S. Coast Guard Video - 100421-G-XXXXL - Deepwater Horizon fire. Clip online, courtesy USGS.
View this asset at:
http://www.awesomestories.com/asset/view/Deepwater-Horizon-Explosion-Coast-Guard-Video

Mike Williams on Deepwater Horizon - 60 Minutes

Video clip from the *60 Minutes* interview with Mike Williams, aired on 16 May 2010. Clip online, courtesy *60 Minutes* and CBS Channel at YouTube.
View this asset at:
http://www.awesomestories.com/asset/view/Mike-Williams-on-Deepwater-Horizon-60-Minutes

Problems with the Blowout Preventer - 60 Minutes

Video clip from the *60 Minutes* interview with Mike Williams, aired on 16 May 2010. Clip online, courtesy *60 Minutes* and CBS Channel at YouTube.
View this asset at:
http://www.awesomestories.com/asset/view/Problems-with-the-Blowout-Preventer-60-Minutes