



BP's Deepwater Oil Spill - Response to DougR's Concerns - and Open Thread

Posted by [Gail the Actuary](#) on June 25, 2010 - 10:00am

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This is a guest post from Oil Drum commenter [shelburn](#), who is a retired manager for an offshore underwater service company. Shelburn also wrote a previous [guest post](#) related to the oil spill. - Gail

In this post, I would like to respond to [a long comment made by DougR](#) a few days ago, that has received a lot of publicity.

First, I will say that in one area we are in complete agreement. BP and the USCG have been less than forthcoming, and in doing so have hurt both themselves and the general public as all kinds of wild rumors and technical misinformation abound. Some of this misinformation results in harm to individuals and businesses as people suffer increased stress and tourists cancel vacations.

In this information vacuum it is easy to make wrong assumptions that lead to mistaken conclusions. It can be made worse if you have some degree of technical knowledge and verbiage and use that to make a case for a scenario that doesn't pass muster with actual engineering analysis but sounds highly authoritative to many people, some TV commentators and various politicians.

n't pass muster with actual engineering analysis but sounds highly authoritative to many people, some TV commentators and various politicians.

What eventually will happen is that the blow out preventer will literally tip over

DougR has made a case that he expects the BOP to tip over. He seems to base this on the following information.

- 1 – The well is leaking into the sediment below the mudline and that is undermining the foundation holding the BOP upright.
- 2 – In support of that theory he cites that BP cut off the broken riser to relieve pressure on the well.
- 3 – Currents are pushing on the BOP stack.
- 4 – He seems to believe the inclination or tilt of the BOP is increasing.

5 – The BOP, riser and well casing are eroding from the inside due to sand erosion further weakening the structure.

He weaves a visual picture of a 450 ton BOP waving around a hundred feet high supported by a thin piece of liner or well casing. Given that description it is understandable that people will believe the BOP is in immediate danger of collapse.

Looking at this from an engineering view point and using real data instead of conjecture and hyperbole I come to a much different conclusion.

The BOP is not in danger of tipping over.

Let look at each of his points.

1 – His theory seems to be that the well is blowing out the side about 1,000 feet below the mudline. I can understand, given the sparse and misleading information from BP and the USCG, how you could come to that conclusion. But let's look at the actual make-up of the casing that supports the wellhead and the BOP. Here is the data:

http://www.energy.gov/open/documents/3.1_Item_2_Macondo_Well_07_Jun_1900...

First a 36" casing, up to 2" thick was put down. It extends from the mud line to 255 feet down, as tall as a 25 story building.

Next a 28" casing was run from the mudline to 1,150 feet down, almost the height of the Empire State building.

This was followed by a 22" casing from the mudline 2,870 feet down, twice as deep as the World Trade Center was high.

All three of these casings were completely cemented together and they form a very solid base which is what supports the BOP. I won't detail the casing string below the 22" but is in the above pdf.

It is hard to envision any way the well would be able to leak out in the sediment between the mudline and the end of the 22" casing which is over a half mile down and well into formations below the mudline. At 1,000 feet there is a 1" thick pipe (the 22" casing) which is 100% cemented to another thick pipe (the 28" casing) which in turn is 100% cemented to the formation. Not much of a leak path there.

The immediate (first 1,000 feet) of well structure that remains is now also undoubtedly compromised.

There is no evidence that the foundation holding the BOP is being undermined or the upper portion of the casing (first 2,870 feet) is damaged. If you watch the leakage from under the LMRP cap you can see the oil and gas immediately start rising up at a pretty good velocity. If there were any oil or gas leaks anywhere near the BOP it would be very obvious as the leaks would look very much like the leakage from the cap and they would be quite visible as they flowed up around the BOP.

There are also occasional video shots of the lower part of the BOP and there is no sign of any seabed disturbance or subsidence. It looks pretty much like the earliest photos BP released.

The well pipes below the sea floor are broken and leaking

What may be helping to confuse the situation is that there are two more concentric “pipes” that run from the wellhead area down into the well.

A 16” casing string is suspended about 160 feet below the mudline and runs down to over a mile below the mudline. This piece of casing is also sealed to the 22” casing and hangs down from there. The “annular” space is inside the 16” casing between it and the liner.

A 9-7/8” liner was installed from the mudline to the bottom of the well. This liner reduces down to 7” before it reaches the bottom. It was through this liner that the well was expected to produce oil and gas.

The 16” casing has three rupture/burst disks subs installed and one of those is at about 980 feet down. It was this “disk” that Admiral Allen was referring to when he said it “failed”. This would indicate the “well pipes below the sea floor are broken and leaking”. But a rupture of that disk does **NOT** leak directly into the mud. It leaks inside the well casing.

The leak would have to migrate down to the bottom of the 18” casing - 3,902 feet below the mudline before it left the well. I expect that BP thinks they may have underground blowout at that level, which would leak into another formation, not up to the surface unless the cement jobs at the 18” casing or the 22” casing were also bad and those were fully tested and used.

DougR also supports his theory of downhole leaks by stating:

80 Barrels per minute is over 200,000 gallons per hour, over 115,000 barrels per day...did we see an increase over and above what was already leaking out of 115k bpd? ...we did not...it would have been a massive increase in order of multiples and this did not happen.

But three paragraphs above he contradicts himself stating:

Early that afternoon we saw a massive flow burst out of the riser "plume" area

and

Later on same day we saw a greatly increased flow out of the kink leaks

2 – DougR says BP cut off the riser to relieve the pressure but the timeline of the events indicates otherwise. BP had released the design of the LMRP cap well before they started the Top Kill.

If BP had thought they had a leakage problem requiring a pressure reduction, they would never have attempted a top kill. So the claim that they cut the riser to relieve the pressure doesn't fit

3 – There is very little current at 5,000 feet. There may be other forces acting on the BOP, like gravity, but the currents are minimal. It is easy to verify this just by watching the video of the oil leakage.

4 – DougR's claim is that the inclination of the BOP is increasing. There is no evidence of this.

Early discussions on TOD when BP released the first pictures talked about the fact that the BOP to well head connection appeared bent and the BOP looked tilted. The pictures at that time (very bad quality) seem to show a bend between the base of the wellhead and the bottom of the BOP. I haven't seen any evidence that this tilt has increased over time or that there is any less mud at the wellhead.

There is a good reason why the BOP wellhead connection could be bent and weakened. For over a day the DWH was without power and the 50,000 ton rig was anchored to the wellhead. The movements of the rig in the surface currents would have put a huge strain on the BOP stack.

Also, when the rig sank and the riser bent over it would also have put stress on the BOP. But the riser doesn't weigh as much as most people would think as it has floatation on it.

It would be a reasonably easy exercise, if you have all the data, to calculate the force that bending the riser would impart to the BOP and the well head. I'm sure that BP did that calculation and it didn't deter them from proceeding with the Top Kill.

The LMRP has a flexjoint where it connects to the BOP. I believe that flexjoint is designed to tip up to 7.5 or 10 degrees. Normally the LMRP is under some tension from the riser which tends to hold it straight. Without this support from the riser it will always tip to one side. So the LMRP will always have a substantial inclination, by design.

you may have noticed that some of the ROVs are using an inclinometer...and inclinometer is an instrument that measures "Incline" or tilt. The BOP is not supposed to be tilting...and after the riser clip off operation it has begun to...

The ROVs have been checking the bullseyes regularly, before and after the riser was cut. The box that DougR thinks is an inclinometer is likely some other instrument, probably ultrasonic. That would be backed up by another poster's observation that they had been cleaning the area where the box was being used. They could be checking the wall thickness at that point or trying to determine fluid flow. Both are more likely than an inclinometer reading.

5 - Erosion

I am convinced the erosion and compromising of the entire system is accelerating and attacking more key structural areas of the well, the blow out preventer and surrounding strata holding it all up and together.

I'm not sure if DougR is referring to internal pipeline erosion or external foundation erosion and I

may be doing him a disservice but there has been enough other discussion about internal erosion to try to correct some misconceptions.

When we have been talking about erosion we are talking about small restrictions that have been eroded where the oil flow has to pass small spaces. The most dramatic example was the increase in the leaks at the riser kink. They started at almost nothing and grew dramatically over time. A similar process was occurring inside the BOP.

There are a lot of variables that effect erosion but the biggest is velocity. The only place that there is erosion in this well is where there are tight restrictions which have high velocity and large pressure reductions. These seem to be inside the BOP and the riser kink when it was still there. The original cross section of the leak path was probably less than 0.20 sq in. With the very high velocity this restriction would have eroded very quickly. The five fold increase in the flow estimate in the first few days of the spill would be consistent with this theory as is the continuing increase in flow estimates. As the restriction enlarges the pressure drops and the erosion slows down. This is also consistent with various pressure readings at the bottom of the BOP, dropping from the "8,000 to 9,000 psi" to 4,400 psi on May 25.

The velocity inside the casing, liner, body of the BOP and the riser is relatively low. I doubt that it would be possible to detect the erosion on the casing or riser with the naked eye. It would take years of flow before there would be enough structural damage from internal erosion to cause any problems.

This is especially true for vertical or near vertical piping. In a horizontal pipe sediment can drop to the bottom and over time wear a groove on the bottom of the pipe, which is not the case here.

All of these things lead to only one place, a fully wide open well bore directly to the oil deposit...after that, it goes into the realm of "the worst things you can think of" The well may come completely apart as the inner liners fail. There is still a very long drill string in the well, that could literally come flying out...as I said...all the worst things you can think of are a possibility, but the very least damaging outcome as bad as it is, is that we are stuck with a wide open gusher blowing out 150,000 barrels a day of raw oil or more.

This statement brings together all DougR's suppositions. I'm not sure if he is actually that frightened himself or if he just enjoys scaring others, but his conclusions come pretty close to fear mongering.

Besides painting a picture of a completely out of control blowout (which is a true worst case), in his "very least damaging outcome" he pretty much doubles the amount of maximum flow that this well could produce according to analysis that has been presented on TOD by well experts.

Transparency Issues

If BP and the USG were more inclined to transparency, a lot of this aggravation could be avoided. You will never convince the conspiracy theorists; it is a life style they enjoy. But the MSM would not be quite as far out there if they were presented factual information, even if they couldn't understand it.

Just doing a quick review of this long post I came up with this list of questions BP or the USG

Have you found **any** seabed leaks of oil and gas?

Edit – Evidently this was answered by USCG at a press conference with an emphatic “No”. No seabed leak, no washing away of the well head foundation, no traction for the DougR theory.

Do you believe there are any leaks from the well into other formations? If so, which ones?

Has the inclination of the BOP changed? By how much?

Describe the “disk failure” at 1,000 feet.

Are you concerned about the structural integrity of the BOP?, wellhead?, the LMRP?, the casing?

Describe the formation levels.

What are the current pressure readings inside the BOP?, the historical readings?

Is there any indication of seabed movement at the base of the BOP?

What are the ROVs doing when they are looking at the seabed?

What is the little black box the ROVs place on the riser?

I could go on for pages. I understand that BP has legal reasons why they won't comment on the flow rates or what happened to cause the blowout. But there are reams of information that they could be providing the public.



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