UNITED STATES DISTRICT COURT

EASTERN DISTRICT OF LOUISIANA

IN RE: OIL SPILL BY THE OIL RIG *DEEPWATER HORIZON* IN THE GULF OF MEXICO ON APRIL 20, 2010	Docket 10-MD-2179
	Section J
Applies to:	New Orleans, Louisiana
Docket 10-CV-02771, *IN RE: THE COMPLAINT AND PETITION OF TRITON ASSET LEASING GmbH, et al.*	October 17, 2013
Docket 10-CV-4536, *UNITED STATES OF AMERICA v. BP EXPLORATION & PRODUCTION, INC., et al.*	

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DAY 11, AFTERNOON SESSION
TRANSCRIPT OF NONJURY TRIAL BEFORE
THE HONORABLE CARL J. BARBIER
UNITED STATES DISTRICT JUDGE

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I N D E X

AFTERNOON SESSION

(October 17, 2013)

THE COURT: Please be seated, everyone.

All right, Ms. Cross.

MS. CROSS: Thank you, Your Honor.

SRDJAN NESIC,

having been duly sworn, testified as follows:

CROSS-EXAMINATION

BY MS. CROSS:

Q. Dr. Nesic, your transient simulations exploded after 10 to 12 days of modeling, right?

A. That's right. My transient simulations did not give realistic results after about 10 days -- beyond 10 days.

Q. Let's take a look at D-22800.

Dr. Nesic, these are images you included in your expert report that show your transient simulations of the blind shear ram, right?

A. That's correct.

Q. Let's take a look at 22801.

In your modeling files, you produced as the final image from your transient simulations what we see here in D-22801 with "11.1 days" written underneath it, right?

A. That's correct, I believe.

Q. And so by somewhere between 10.4 days here, the image on the left, and 11.1 days, the image on the right, your model

exploded, right?
A. Almost right, if I may offer just a small correction. The 10.4 days looks reasonable and all indicators were that that was a fine solution. And then when it went to 11.1 day, you can see that something very strange happened with the geometry that was slowly eroding and then it almost has a burst-out. And that is probably why I called it an "explosion," but in reality, those kind of situations are mathematically referred to as "divergence." They were not going towards a solution anymore. The mathematics has diverged from the physics.
Q. Your mesh in your CFD simulation stopped converging at that point, right?
A. That's right because this method is to remind --
THE WITNESS: Your Honor, in this method, you go one day and then you calculate erosion and then you modify the geometry a little and then go to the next day and do it again. In this instance, when we went from 10.4 to 11.1 days, something went really wrong in the modification. The geometry looked completely deformed unrealistically, so we discarded those data. We said, That's not valid; I'm not going to use it.
MS. CROSS: Could we have D-22800 again, please.
BY MS. CROSS:
Q. Now, in your expert report, in Figure 30, you presented a transient simulation from Day 14. By Day 14, you had decided

that your results were not valid, right?

A. I can't remember this particular version of the simulations, but that's what it seems; there was this bulge that was just not looking right. And if I remember this particular version -- we did many different ones with different flow rates. Typically, after Days 10 to 12 and beyond, things didn't look right.

Q. Now, you extrapolated from the 10 days of data you had from your transient modeling to the entire 35-day period that you say is the period of erosion, right?

A. It is correct to say that I have used a linear trend obtained on the first 10 days and used it to connect the points for my real geometries that I modeled with great detail, the real blind shear rams and casing shear rams, etc. That's true.

THE COURT: So the whole point of this transient modeling -- is that what you call it?

THE WITNESS: That's correct.

THE COURT: You said you knew what the starting point was and the ending point. You're trying to determine how quickly or how slowly the erosion occurred over that period of time?

THE WITNESS: I'm just trying to say, Should I draw a straight line? Or should it be like this or like that?

I didn't know how to connect those two points that were firm. These transient simulations told me the best way to do it is just to draw a straight line and connect them with a straight line across. That's all they gave me, the nature of the changes.

THE COURT: You could have different lines, obviously, to end up at the same place?

THE WITNESS: That's right. You could do it like this or like that, but it turned out to be a straight line.

Now, I didn't get a straight line to go all across because the simulation -- transient simulation stopped about a third of the way down, but that one was so straight that I was confident --

THE COURT: You just felt you were able to project what you had seen over the first 10 days?

THE WITNESS: Correct. Correct. That's correct, Your Honor. Then that's what we often have is limited data and then project into the future. This time, that was all I had. It looked straight and I projected straight. I had no reason to do something else.

BY MS. CROSS:

Q. Let's look at the results from your 10 days of transient modeling.

MS. CROSS: Could we please have D-22802.

BY MS. CROSS:

Q. Dr. Nesic, these are -- the black bullets here are your transient modeling results, right?

A. That is correct. Just the points, not the lines between.
Q. Correct.
Now, you didn't consider anything but a linear fit for those 10 data points; isn't that right?
A. Well, when I -- that's not exactly right, Ms. Cross.
I did look at the data. I had no prejudice that these data should come out straight or curved. I just didn't want intentionally to superimpose any expectations. I got 10 points -- by the way, not only these 10 points, but over and over again, it was a similar situation to this. They weren't a hundred percent straight, but when I looked at them and I said what is the best estimate and how could I best project these dots I see here, I thought the straight line was the simplest and the most logical answer. So I did think, Is there something that I could do that's better? And I concluded, No, there isn't; the straight line is the best.
Q. So you're testifying that you did consider fits other than a linear fit?
A. Well, whenever I looked at any set of data, all kind of possibilities come to my mind. I'm trained to do this, so when I see something that looks like a straight line, I try a straight line. When something looks like a parabola, which is different, I consider that. I often try different things. This was a very straight line. It had a correlation coefficient of 97.8 percent. That is a huge proof that this

was straight. Everything above this correlation coefficient of 70 percent is considered to be straight, and I had 97 percent.

Q. Dr. Nesic, prior to submitting your expert report, did you consider anything other than a linear fit?

A. Ms. Cross, if you mean by "consider" did I try other fits, I looked at this data, they looked straight to me. Of course, in my mind it passed, you know, does this look more like a hyperbola or something else? I dismissed that. I tried a straight line. I got a correlation that was very high and I said, This is enough. I did not play around with numbers and try hundreds of different curves and then decide which one I fancied. I took the simplest one and the most logical one, and that was a straight line.

Q. Now, the slope of the line, the pressure drop line, is a function of the erosion rate, right?

A. Yes, that is.

Q. It's sensitive to the erosion rate, right?

A. Yes, it is.

Q. The slope of the line changes depending on what your erosion rate is?

A. That is true.

MS. CROSS: Could we please have D-22803.

BY MS. CROSS:

Q. Dr. Nesic, Judge Barbier just asked you whether you could have fit these points with other lines. Do you recall that?

MR. BROCK: Your Honor, I'm going to object to this exhibit as having no foundation. This is not an exhibit that he has relied on. It's not an exhibit that will be sponsored by any other expert. For those reasons we don't think that this should be used in cross-examination.

THE COURT: What is this? Where did this come from?

MS. CROSS: Your Honor, this is a demonstrative simply showing that if you connected adjacent points, as you would with a line, there would be different lines you could choose. It's a demonstrative only. It's not evidence.

THE COURT: I'll let you use it with that explanation. Go ahead.

BY MS. CROSS:

Q. Dr. Nesic, looking at the first two points here, there's a line drawn through those first two points, right, that line that comes down all the way to a 70-kilopascal intercept with the X-axis, right?

A. Yes.

Q. That's a steeper slope than you are seeing for these data points 3 through 10, right?

A. That is what it appears to be on your rendering here.

MS. CROSS: Can we put up D-22804.

BY MS. CROSS:

Q. Actually, before we go here, you say in your report and you testified on your direct that for the pre- and post-erosion geometries, the pressure drop across the blind shear ram decreased due to erosion by a factor of 23 over the five-week period, right?

A. That sounds right.

Q. You didn't disclose any transient model runs where there was a 23-fold reduction in the pressure drop across the blind shear rams, right?

A. I did not because I never was able to run the transient simulation past typically 10 to 12 days.

MS. CROSS: Could we please have TREX-11735. Could you please highlight the far right column. Sorry, the far right freestanding column.

BY MS. CROSS:

Q. Dr. Nesic, this is your transient simulation results, all 10 data points, and the pressure drops that those transient modeling results gave you across the blind shear ram; isn't that right?

A. I suppose so. I'm not able to see the whole table clearly and then to -- but I will take your word for it.

Q. You saw this document in your deposition, right?

A. I maybe did, but this was two months ago and I don't remember every detail or every table that I ever seen, but it looks similar to what I think you showed me then.

Q. And the initial pressure drop that your transient modeling gave you between times zero and times 100,000 seconds is

11.3 psi, that first row up there, right?
A. The first box here in this column, yes, the uppermost one, yes.
Q. The erosion time that's faint in the background here goes from zero to 100,000 seconds and then goes all the way to 900,000 seconds, right?
A. Right, yeah, seems correct.
Q. That's approximately the 10 days that your transient modeling ran, right?
A. Again, I'm not able to do this mental math to divide all these things, but if that's what you determined when you did your math, I will take your word for that.
Q. So in your transient modeling, you saw a pressure drop across the blind shear ram from Day Zero to Day 10 of about 11 psi per day, right?
A. Well, according to these tables, it started out at 11.3 and then went down to 10.5.
Q. That's about a 7 percent decrease, from 11.3 to 10.5, in the pressure drop across the blind shear ram, right?
A. Again, I will have to do some mental math. Probably right, ballpark is correct.
Q. If you extrapolated your transient modeling results linearly, as you did, that would be a change in the relative pressure drop through the blind shear rams of about 25 percent, right?

A. No. That's where you made a mistake in that last leap of imagination. I have never meant that my transient simulations will exactly tell me what the slope of that line is by how many percents per each day it changes. That is because I knew the beginning and the end. I did not need to use the start point and you already shoot to get somewhere. I had that target. I knew where it was.

I just needed to know whether I'm going to go curveball to it or a straight hit or should I go high and then low. And that's all I took. I never took any individual change.

Because what happens here is that if I take a higher flow rate, these numbers change faster; if I take a lower flow rate, these numbers change slower. If I take higher density, this happens, so on and so forth.

So I did not try to extract any particular slope from here like you just implied. I extracted in just a way to connect my hard points.

Q. But you needed a slope to connect your pre- and your post-erosion geometries, right?

A. No. Ms. Cross, if you have two points and if you know that it's a straight line between them, you don't need to know *a priori* what slope that line is. It is defined by those two points. If I have only one point and I want to reach, see what will happen in 35 days, then I would need to know the point and the slope so I can fly down there and see what happened.

But I knew my target, I knew what the situation was. So I think there's a lot of misplaced arguments here where I'm asked about would the slope change with this and that. It didn't matter. I never claimed to use the actual slope because I did not need it.

MS. CROSS: Let's take a look at D-22804.

BY MS. CROSS:

Q. Plotted here are again your transient data points, the black points at the top, and a line that fits all of those data points. Plotted in blue is a decrease in pressure from 1 to 1/23, which is what you said the pressure drop over the blind shear rams was, right?

MR. BROCK: Again, Your Honor, I'll just object on foundation. This is not something that's been relied on or established by any expert. It's not --

THE COURT: Well, that's okay. It's in the form of a hypothetical. The witness can explain what he thinks about it.

MR. BROCK: Thank you.

BY MS. CROSS:

Q. So, Dr. Nesic, you see that for the data points that you had for your transient modeling, the 10 data points, the slope of the lines between Day Zero and 35 is much less steep than the slope that you say you calculated based on the pre-erosion geometry and the post-erosion geometry, which went from 1 to a factor of 1/23 of that pressure drop, right?

A. Ms. Cross, I have never generated this graph, so I'm not sure how you put this together, neither the basis.

I completely disagree with that. This is in my view comparing apples and oranges. I never claimed that my transient simulations gave me the slope exactly like I knew it was going to be from knowing the two geometries that I simulated. I never tried to predict that slope accurately so that I would match these things up.

All I needed to know -- I repeat that once more so it's very clear. I needed to know how to connect my initial state and my final state. What type of line should I use? Should I use a straight line or some other curved line? That was the only question I had. I repeat it is because I knew the end date -- the end state, I meant.

Q. Let's talk about the line, then, that you drew.

MS. CROSS: Could we please have the call-out of Figure 33, 11529R.35.1.US.

BY MS. CROSS:

Q. Now, Dr. Nesic, you talk about this line that you drew, right? This line that would go all the way down and this line here, right, a line from your blind shear ram on the 22nd of April? And you drew it down, and it's reflected here by these transparent blocks, right?

A. Yes. Ms. Cross, you finally just point a little more precisely. So we have to take one element at a time. If we take the blue bars, the blind shear rams, we start here and then we go straight down to that point there. So that's the line that I used. It's slightly corrected, but that's what it is, that's correct.

Q. Now, there's actually a different slope between April 22 and May 6 than between May 6 and May 27, right?

A. That is correct. Very slight difference, but that's right.

Q. So your line doesn't have the same slope for the period of erosion?

A. My line has a constant slope as long as -- and I said that in the session we had before lunch. As long as we have the same level of sand production, my line has the same slope.

Now, Dr. Vaziri, who I relied on for his opinions about the amount of sand produced, said that half of the sand was produced in the first two weeks and two-thirds were produced in the next three weeks. That is that very small adjustment I apply. So instead of having one line going from first to the last point, I have that very slight inflection there that reflects that two versus three weeks' time that Dr. Vaziri used. So it's a very small change.

I have obviously tried both. First I had one line with the same slope and then made this adjustment that I thought was justified. It was only a couple percent difference in the overall answer, so there was no big effect of that. But I thought it's fair to reflect his opinion about the amount of sand produced.

Q. So you changed the slope of your pressure drop based on information you relied on from Dr. Vaziri about the volume of sand concentration?

A. I have changed ever so slightly, and that's very easy to see. If you draw a straight line, you will see that it is a very small inflection of that slope to reflect that known sand production rate. If I knew that the sand production was constant throughout this period, if that was the information I had, I would have used just one single slope. Even in this case it's a very small deviation from that. I think -- I don't have personally that slide in front of me, but I'm sure that was the case.

Q. Let's take a look at the next slide, D-22805.

What you see here is what we drew that corresponds to your slope for April 22 to May 6 and then adjusts the slope for May 6 to May 27. Do you agree that that is the piecewise linear fit that you used?

A. Thank you for this, Ms. Cross. This actually exactly illustrates what I was trying to explain. So pictures always talk better in these types of situations.

So if I just had one single sand production rate, I would have used my straight line and connected the beginning to the end. Because I knew that there is -- the sand production was more intense in the first two weeks and then slightly less intense in the next three weeks, that is where I adjusted. If you see, this red line is a little more steep there, and then it straightens out. So what I'm doing there is making for that -- making that little adjustment to reflect Dr. Vaziri's opinion, which I think was realistic.

But in the big scheme of things, if you look at the overall picture, this overall pressure drop, which is all that matters, it's just a tiny little difference there that you get.

Q. You needed the slope of this line to draw the conclusions that you drew in Figure 34 about the impact of erosion on the flow rate, right?

A. No, Ms. Cross, I didn't need the slope of the line. What I needed is this overall envelope that goes on top. I needed to have this line over here, and that was then converted into the flow rate change.

That is -- if that's what you meant, then the answer is yes.

Q. The line you just pointed to, the line that you drew had a slope, right?

A. Well, whichever way you look at it, this top line is not straight because there's all these different elements that add up in different ways. So I didn't have a single slope from the beginning to end anyway because there are four different elements doing different things along this period of time. Each of them is linear, but then they don't add up in a simple way. So I think I explained it clearly in my report.

Q. Well, Dr. Nesic, focusing just on the blind shear ram, even for the blind shear ram points, so your blue points that go down, you have a piecewise linear fit. If you look at that red line, you don't have a straight linear fit for that element alone even.

A. I thought I answered that, but let me try again.

I have used a linear fit. The linear -- let's maybe call it a better name. I used a linear trend for change in pressure drop for the whole time when there was a constant sand production rate, and that was for the first two weeks and the next three weeks. So that's what I did there.

What you see here on your -- I have never drawn this in my report, but actually I've done both cases. The blue line that you have here and the red line, I've done them both, both exercises when I was making this. And I established that on the aggregate, when you add all these elements, not just the BSR, the difference was very small. I reached the same conclusion that the flow rate increased by a factor of almost 2. And the difference is just in the inflection of these lines and somewhere there in between.

Q. You believe that extrapolation of nonlinear functions beyond the modeling results that you have is unreliable, right?

A. I actually expressed that opinion in my deposition. I know we had that conversation. And it is notoriously dangerous to extrapolate nonlinear fits. It means to extrapolate something that's curvy beyond the data that you have. Because curves, all sorts of curves can do all sorts of funny behaviors once they let go, once you let them go beyond the data where you are tying them.

So that's why a common practice is that you use the simplest possible way to pass a line through the points because you -- that is the best guarantee that that same line is not going to misbehave when it goes past those first 10 days.

So I was very reluctant to use any other type of curve even if I thought for a second should I use something nonlinear. First it was very linear, and then I have this long experience with nonlinear fits. They are unreliable. You do not do that unless you have a very, very compelling case. Nothing of that was present here.

Q. If you had had 35 days of transient simulations, if your transient simulations had run for the entire period, you wouldn't have needed to fit a curve, right; you would have had the data?

A. Well, I would have still needed to fit a curve but now through 35 points if each point is one day. And indeed that would have been a preferred situation. I don't deny that.

MS. CROSS: Can we please have D-22806.

MR. BROCK: Your Honor, I apologize for interrupting. This is a call-out from the report of Dr. Bushnell. Dr. Bushnell is an expert that the United States withdrew. The use of his report is prohibited -- that's probably too strong a word, but violates your orders 11807 and 11352 where it's been determined that his report cannot be used in this trial.

THE COURT: Well, I don't understand the government to be offering his report. I wouldn't have known this was from Dr. Bushnell's report until you just told me.

In terms of putting it up on the screen for demonstrative purposes, as long as she doesn't try to go into what Dr. Bushnell said or did or anything along those lines, I think it's fine. It's just a diagram. You could draw it -- as other people have done, you could draw this on a chart over there.

MR. BROCK: We need to have some basis, though. The basis is Dr. Bushnell's report.

THE COURT: No, but a lawyer can draw something and ask the witness, does this make sense to you? Do you agree with this or not? That's the way I understand this is being used.

MS. CROSS: That is, Your Honor, how I intend to use it, not for anything Dr. Bushnell said.

THE COURT: All right.

BY MS. CROSS:

Q. Dr. Nesic, mathematically an exponential fit would have been a better fit to the transient modeling results you had, right?

A. If I may just try to restate what you just said.

Mathematically, that means if you calculate some measure as to how well, Your Honor, these points -- these two lines that you have, the blue and the red line, how well they pass through these points -- if you take this measure -- and there's a correlation coefficient. The line is 97.6 percent accurate, and then the exponential fit, I think Dr. Bushnell actually did write about that. I believe he has exactly the same graph in his report. I think it comes out from 97.6 to 98 or 99.

In any case, by naked eye or using these measures, you can see that both of those lines are spot on going through these points. The difference is immaterial.

Q. You recall saying in your deposition that the exponential fit was a better fit than a linear fit, right?

A. And I have just confirmed. I went back and did my calculations after the deposition, and I've reconstructed the erroneous formula that was offered in Bushnell's report. I made it right. I know what he meant, and I got it right. And I got an improvement of fit from 97.6 for my straight line to 98 or 99 point-something. So we are talking about immaterial differences.

Yes, 99 is better than 97.6. But in any case, those are very accurate fits, one slightly better than the other.

MS. CROSS: Your Honor, I move to strike the answer because Dr. Nesic did not address the correlation between his line and the data points in any way. This is improper surrebuttal.

THE WITNESS: You just used Bushnell's --

THE COURT: Wait a minute. I think you invited him to answer, so I'm not going to strike his answer.

MS. CROSS: D-22807, please.

BY MS. CROSS:

Q. Now, Dr. Nesic, there are other two-parameter fits you could have used for your data, right, and depicted here are five such fits. Do you see those?

MR. BROCK: I'm going to object again on foundation. The same objection I have been raising.

THE COURT: Okay.

THE WITNESS: Ms. Cross, I have never seen this in my life. I have no idea how you have constructed this or why you would do this. I honestly don't know what you mean to show here.

THE COURT: This is getting a little beyond what a lawyer would draw on the board.

MS. CROSS: Let me go one step further to a simpler drawing, then, Your Honor, if I may.

THE COURT: Why don't you do that.

MS. CROSS: Could I please see D-22809.

BY MS. CROSS:

Q. Dr. Nesic, if you had looked at other fits, they would have an impact on how quickly the relative pressure drop fell in the period from April 22 to May 27, right?

A. Ms. Cross, I'm again looking at this, and I have never seen this in my life either. I don't know what you are implying here. Plus, I have no understanding of how you are trying to connect what you just asked me with what I'm looking at here. This is something I have never seen before.

Q. If you had connected your pre-erosion geometry and your post-erosion geometry using a fit other than a linear fit, it would have had an impact on how quickly your pressure drop happened, right?

MR. BROCK: I'll just object as asked and answered. That's the same question that was just asked.

THE COURT: I sustain the objection.

BY MS. CROSS:

Q. Dr. Nesic, you're aware that there was pressure data from the response, right?

A. Yes, I know that there were various pressure measurements done at various points in time, correct.

Q. There were pressure drop measurements across the BOP, right?

A. That, I'm not aware of. At least I know there were some measurements and a gauge just below the BOP. I think it was referred to as the PT-B gauge, which was often discussed in various reports, but that's as far as I would go.

Q. So were you aware that on May 25 and at several other times during the Top Kill, May 25 through May 28, BP measured the pressure drops across each of the BOP elements, including the blind shear rams that you looked at?

A. As far as I understand the data available at the time of Top Kill and Junk Shot, that is after the period that I analyzed. And there were all kinds of complications there that were introduced by the Junk Shot as they pump these different things up and clog certain openings and not others.

So any measurements done at that period of time would have absolutely no clear connection with what I've done. I thought it was hard enough to figure out what happened before they started plugging some of these things up. I definitely never looked at what happened after the Junk Shot and then Top Kill.

Q. You didn't look at any pressure data points from any of the gauges used -- PT-B, PT-C, PT-K -- prior to May 27, which is in your erosion period, right?

A. Ms. Cross, I think we had this conversation at the deposition, and I said that for me the only gauge that would at least theoretically help me was the PT-B gauge and that I did look at it, but the accuracy of that gauge was not sufficient for me to compare with the pressure drops I was calculating.

That was a very coarse measurement, and the accuracy of that gauge was actually larger. The error associated with that gauge was actually larger than the pressure drops across the individual elements that I was modeling. So that was the only reason I have excluded it. Indeed, if it was more accurate, I would have used it, but that was not the case.

Q. So you don't know what the error rates for the PT-C and PT-K gauges were, do you?

A. I already commented in my deposition those were not the gauges I consider would offer relevant data for my calculations.

Q. You used your transient modeling to produce the results we saw before.

MS. CROSS: Could we have TREX-11732 again, please. Could we please have page 5. Could you please call out the highlighted column Cumulative Eroded Distance.

THE COURT: It's kind of blurry. Is there any way to sharpen that?

THE WITNESS: Your Honor, I think I know what I'm looking at.

THE COURT: If it's good enough for you, it's fine with me.

MR. BROCK: We'll have a hard time objecting if we can't see it. I can't see it.

MS. CROSS: Let me see quickly whether I can get a better version of it.

BY MS. CROSS:

Q. Dr. Nesic, can you read the column that says "Cumulative Eroded Distance"?

A. Yes.

Ms. Cross, if I'm not mistaken, I think we had this put up in the deposition and we looked at this data too. Right?

Q. Correct.

A. Thank you. Then I think I know what I'm looking at for sure.

Q. Again, this is your 10 days of transient modeling, and you have a cumulative eroded distance at the bottom of 3.98 times 10 to the minus 5. Do you see that?

A. Yes.

Q. That's about 1/400 of a millimeter that was your cumulative eroded distance for the blind shear ram for your transient modeling, right?

A. This is -- if I do a quick math, because you're putting me on the spot here, that's about 40 microns, which is 1/250 part of a millimeter. Yes, that's a very small distance in any case. So you weren't too far off.

01:54 **Q.** You testified about massive erosion. You wouldn't consider the transient modeling results here you got for the blind shear ram to reflect massive erosion, would you?
A. Well, no. A fraction of a millimeter is not massive erosion.

But, Ms. Cross, again, if I may refer to our discussion at the deposition, I explained to you this is an output from Fluent.

That's the package, Your Honor, we used.

Strangely enough -- and I couldn't do anything about it -- this package does not output a cumulative distance at any particular location. So if, say, we are simulating something like this, you would want to know what was the cumulative loss at that location. It averages out over the whole surface. So here it was a lot, but here it was nothing. So when it does that and averages it out, it kind of dilutes that number.

I explained to you that this is not the actual erosion depth at any given location. That is not something that I could get out of that package. It does not predict that.

In any case, that was immaterial for what I was trying to do. Erosion rate never played a role in me finding my final answer that we already discussed.
Q. Let's turn to the areas that you modeled. You didn't consider resistances to flow other than the four that you

talked about with Mr. Brock, right?
A. After considering all the resistances in that flow path -- so the first thing I looked at, where was the fluid going and what was in its way? After considering the flow path and looking at the physical evidence of erosion, we focused only on those four. So in that sense it is correct.
Q. You modeled each of the four areas separately, the blind shear rams, the casing shear rams, the upper annular, and the kinked riser, right?
A. That is correct.
Q. You didn't look at the impact of any upstream erosion on any part. Say, upstream erosion, upstream from the blind shear rams, you didn't assess the impact of any upstream erosion, right?
A. Just, please, if you can just define what you mean by "upstream erosion." I don't want to mistakenly answer that question.
Q. Let's call upstream anything below the BOP closer to the wellbore and the reservoir.
You didn't assess any impact of change in resistance anywhere in the wellbore or the reservoir on your blind shear ram calculations, right?
A. So if we are going that deep, no. My analysis only focused on the BOP and the kinked riser. So I never looked at any changes within the wellbore or in the reservoir. That was

not my charge. That wasn't the question I was trying to answer.

Now, we also have a couple elements below the casing shear rams in the BOP, the variable bore rams and the test rams. We looked at those, but given the flow path through those elements that was going through the drill pipe, these restrictions were from the outside but through the drill pipe was open, that didn't matter in the end. So that's why the first place where that flow going through drill pipe hits an obstacle was in the casing shear rams and then the blind shear rams and the upper annular and then the kink. So that's why we eliminated those bottom three valves that were being opened and closed at various points in time.

Q. But you're aware that there were resistances in the wellbore and in the reservoir that you didn't consider, right?

A. Yes, I am.

Q. Okay. You're aware of BP's analysis during the response that complete removal of the entire BOP and the riser would increase flow rates by only 15 to 30 percent, right?

A. Yes, I'm aware of that statement, but I'm not aware how that's relevant for what I did.

Q. Your conclusion about the increase in the flow rate is based on your assumption that the BOP and the kinked riser were the main restrictions to flow, right?

A. I'm sorry, I have to disagree with that. That's taking my words out of context. I did not assume that they were the main restrictions of flow. I write explicitly, assuming that they are the main restrictions of flow, the flow would have doubled. So I didn't say that I assumed that they are. I said if they are, then the flow would have doubled.

Q. Right. And I apologize if I took your words out of context. I believe your conclusion is, assuming the BOP and kinked riser were the main restrictions to flow in this period, Figure 34 shows that the flow rate would have almost doubled?

A. That's correct. Thank you, Ms. Cross.

Q. And if you had looked at other resistances, that conclusion could have changed, right?

A. Well, I did not do that exercise with any precision. My charge and my focus was to say what is the effect of the erosion of the BOP and the kinked riser on flow. I did not look anywhere below there, the wellbore or the reservoir. That is not what I am an expert on and that's not what I was asked to do.

But, however, one can say that, indeed, in such a long string of flow obstacles, the BOP is just one subset, and I understand that. So I keep coming back to the statement. My answer is about what type of restriction only the BOP and the kinked riser would do. I did not put it in context of the other obstacles in the flow path.

Q. Let's switch paths a little bit and turn to some of your inputs. Now, you say in your report that your "model assumes that hydrocarbon flow can be approximated as a two-phase flow, i.e., consisting of a single homogenous fluid phase."

Do you recall that?

A. Yes.

Q. In your modeling you were trying to model the flow of hydrocarbons through the BOP, right?

A. That was part of the work I did, yes.

Q. And the density has an impact on the rate of erosion, right?

A. The density of the fluid, is that what you are referring to, Ms. Cross?

Q. Yes.

A. The density of the fluid has some relatively small effect on the rate of erosion.

THE WITNESS: Because, Your Honor, a denser fluid kind of pulls the particle more effectively, whereas a lighter fluid kind of passes by it and doesn't drag them as much.

But that's not a huge effect, but it's there, Ms. Cross.

BY MS. CROSS:

Q. Right. So variations in the density of the fluid impact the pressure drop results you obtained through your modeling, right?

A. We have changed topics here now. The previous question was about erosion, so let me see, Ms. Cross. You say the denser fluid will have a different pressure drop through any given geometry?

Q. Right.

A. That is true. That is true.

Q. You used a density range for your modeling of 645 to 688 kilograms per meter cubed, right?

A. I believe that's true. I would have to check that, if that means anything. But, yeah, that sounds right from what I remember.

Q. I believe it's Footnote 5.

A. That's right. It was in a footnote. Okay.

Q. Those density values are representative of liquid oil only, not a combination of oil and gas, right?

A. Well, again, I believe we talked about this at the deposition.

THE WITNESS: Your Honor, this is complicated enough even if we assume that the fluid is just one fluid. We don't get into breaking it up into gas and liquid. That would have made it completely impossible to tackle.

So I have replaced that mixture of hydrocarbon, liquid hydrocarbons, and hydrocarbon gas with one generic fluid that represented both. That is a leap of imagination but one that we have to make if we are going to get any answer.

So, yes, I have used a single fluid to call it a fluid in my simulations. And it was incompressible in my calculations. It did not expand like a gas would. It was a constant density.

BY MS. CROSS:

Q. Okay. You were given that constant density range by counsel?

A. That is correct, in the sense that I've been told that their experts -- I believe the name is Whitson -- has provided the range of this fluid densities that I would use in my model. I never questioned that because that's not something I got into at all.

Q. The mixture density range that you used is not, in fact, Dr. Whitson's range for a mixture of oil and gas, is it?

A. I'm sorry, you would have to ask Dr. Whitson about that. I don't know. I was just given this number and I was told that this range is what I should be using. I did not ever communicate directly to Dr. Whitson at all about that.

Q. But you looked at BP's black oil tables from the response, right?

A. I'm sorry?

Q. You looked at BP black oil tables from the response, from June 11, 2010, right?

A. Well, with all due respect, I can't remember that particular table, no. I definitely don't recall that I looked at any particular set of tables. I know what black oil is, but that's the extent of that.

Q. Taking a look at page 64 of your report, your considered materials, you list the black oil tables from the equation of state for all temps, 11 June 2010?

A. Yes. I guess it was in the million things that I have reviewed over that period of time, but please understand I couldn't remember every table that I looked at and what it contained. That doesn't stick in my memory.

MS. CROSS: Can we please have D-22818.

BY MS. CROSS:

Q. Dr. Nesic, pulled out here from the BP black oil table from early June is the density value for oil only at 4084 psig, which is the approximate pressure of the bottom of the BOP, right?

A. I'm sorry, could you point to me on the screen what you --

Q. Sure.

A. There's too many numbers here for me to know exactly where you are pointing.

Q. At the top of the screen, you see your density range for the --

A. What I used, yeah.

Q. And then here is taken from BP's black oil table, 9732, the density range for oil only at 200 degrees Fahrenheit and 4084 psig?

A. Okay. That middle table there.

Q. Correct.

A. Okay.

Q. In the interest of having apples compared to apples, I converted the 41.22 pounds per foot cubed that were in the table according to the equation at the bottom.

Your density range is -- the oil-only density range from the BP black oil table falls in the middle of the density range that you used, right?

A. That's -- trusting that you got these numbers right, that's what it appears, yes.

Q. And the gas density, which is at the bottom, is over 400 kilograms per meters cubed less than the oil density, right?

A. Yes. Gas is typically lighter than the liquid, but again, I haven't looked at this in any detail.

Q. So if you had used a fluid mixture that took into account both oil and gas, you would have a different ratio of pressure drops as you present in Figure 33, right?

A. Ms. Cross, I just said I did not -- I mean, I know it's a hypothetical question, but I did not go through that exercise. I asked explicitly my counsel, what is the range of densities I have to use for this simple one fluid, which is characterizing both gas and liquid together and they told me that based on their other expert, Dr. Whitson's opinion, should be in the range 645 to 688 like you have it. That's the extent to which

I worried about that.

It wasn't my charge or my expertise to look at black oil and some gas and figure out what to do with it. Again, I think I explained that in my deposition very clear.

Q. Dr. Nesic, if the density range of oil and gas were substantially different than the range that you used, if it were, say, 500, you would have to speculate about the impact that would have on the ratio of pressure drops that you present in Figure 33, right?

A. Ms. Cross, I just refuse to speculate. I have done precise calculations. I really do not speculate about these things. They are too important. I have clearly listed the ranges of the parameters I have used. I told you where I got them from, and that's the extent to which I can answer that.

I don't speculate even when I'm doing this work in my study. I won't speculate now about that. I apologize. I just can't do that.

Q. No. Understood. But what you're saying is that if the combined density were 500, you can't say what the results would be, right?

A. I just can't -- these are enormously complicated calculations. I just can't eyeball them like that. That's not something I did. Some other people might, but I just can't do that here.

Q. You're not familiar with the gas expansion erosion

mechanism, right?
A. Can you rephrase that, please?
Q. Have you heard of the concept of gas expansion erosion?
A. Gas expansion erosion? Being an expert on erosion, that sounds like cavitation to me, but I'm not sure I --
(Discussion off the record.)
THE WITNESS: Cavitation. But, no, I'm not familiar with that particular term. I must admit that.
THE COURT: Cavitation, C-A-V-A --
THE WITNESS: That's correct, C-A-V like a cavity, and then -ation. Yes, cavitation. But it doesn't seem to be what you are asking me. I never heard of that particular term.
BY MS. CROSS:
Q. You didn't evaluate the impact of gas on erosion of any of the well parts or the BOP or the kinked riser, right?
A. Again, no, because I explained I only had a single fluid pulling all those particles along. I did not have -- it wasn't either a gas or a liquid. It was just one fluid that represented both. That's the extent. So direct answer to your question, no, I did not consider a gas, per se, no.
Q. Now, you relied on Dr. Vaziri's opinions regarding the duration of sanding. We talked about that earlier, right?
A. That's right. That was one of the two important considerations. One is physical evidence that I saw of erosion. The other one was Dr. Vaziri's opinion, that's right.

Q. Dr. Vaziri, to do his sand prediction analysis, used a BP proprietary program called ENHANS, E-N-H-A-N-S, right?

A. That's maybe what it was called. I know it was BP's proprietary program for sand production prediction and -- but then that's the extent that I know about it. I haven't used it. I haven't seen it. I actually never talked to Dr. Vaziri either about it.

Q. You didn't see any of the outputs from Dr. Vaziri's ENHANS modeling, did you?

A. Not that I recall. All I used from Dr. Vaziri are some very simple high-level statements, and that's the duration that you just asked me about. I also looked at his numbers for how much sand was there because I wanted to be sure that there is enough sand. That's the extent of that, and there was.

And the last thing was this half of the sand was produced in the first two weeks and the other half in the last three. That's the extent to it. I did not go and analyze. I'm not an expert for that. Anything else he did in great detail.

Q. Are you aware that ENHANS, the modeling program he used, doesn't predict the duration of a sanding event?

A. Ms. Cross, I thought I just said the three things I extracted from his work. And I never worked with him on ENHANS. I never asked him anything about it. I don't even know how it works. That is not something that I was part of, so I can't answer that question.

Q. You testified on direct that sand duration was predicted by Dr. Vaziri's modeling. You don't know that that's, in fact, the case, right?

A. No. I think what I said on direct was that I relied on Dr. Vaziri's opinion that sand production lasted at least until the end of May and I know that he used his experience, his understanding of this problem, as well as his software predictions, but I never said that he got it in any particular way. I have not been privileged to go and work with him on this at all. That wasn't what I was asked to do.

Q. So you're not aware that Dr. Vaziri had to rely on a flow rate and a permeability to make his predictions, are you?

MR. BROCK: Your Honor, I'm going to object. I think he has described what he knows about this.

THE COURT: Yes, he did. Sustained.

BY MS. CROSS:

Q. Dr. Nesic, you calculated the concentration of sand and oil for your modeling as a ratio of pounds of sand per barrel of oil, right?

A. That is correct. I really wanted to use his range of numbers he had for sand production divided with the range of hydrocarbon production rates. Remember, I didn't know what exactly it was, so I used a range of sand production, a range of oil production.

THE WITNESS: And I wanted to see, Your Honor, do I have enough sand there so that when I claim something was erosion, that in fact it was erosion. Because if I came up with some ridiculously small concentration of sand, I would have said, Well, this might not be right. Either there was no erosion, which we know it was, or the sand production rate was not correct.

Now, within reason, those two pieces of information did match up. When I used Dr. Vaziri's range for sand production, I used my range for hydrocarbon production, I came up with sand concentrations which are known to cause erosion. So I was confident that this was sufficient for me to move forward. I did not get a mismatch there.

Now, I never attempted to use a particular sand production rate and a particular hydrocarbon production rate to get a particular erosion rate. I knew I don't have that accuracy. And thanks to the methodology, I didn't need it.

Q. You actually inputted the same volume of sand for both flow rates, for 5,000 and 65,000 barrels per day, right?

A. Ms. Cross, I'm not sure I understand what you are exactly referring to, but if I may try to answer it. I think we talked about this in the deposition as well.

I wasn't aiming to get a particular concentration and then run with it and get something important out of it. I was trying to establish whether the sand concentration that came out of this ranges of numbers was within what one would assume to be an erosive condition because I didn't want to talk about erosion and make all these calculations if, in fact, there wasn't enough sand there to do erosion. That was the extent of that. And that was confirmed. So I hope this answers what you asked me.

Q. It does. Let's turn to one final area.

You focused on direct on the holes in the kinked riser, right?

A. Yes.

Q. You focused specifically in one of the pictures on the first two holes that were created, right?

A. Well, actually, my primary focus is the third hole, but I did talk about the first two as well, that's true.

Q. You also testified on direct that the erosion rates are different for different parts of the BOP and kinked riser, right?

A. That's right.

Q. You don't know what the erosion rate was on May 19 for anything, right? You don't know what it was for the blind shear ram?

A. The erosion rate, is that what you are asking me?

Q. Yes.

A. Actually, I don't know what the erosion rates at any given moment in time were in the whole period. That's not how my analysis went. I hope I made that point.

Q. So your conclusion that there was erosion causing a hole in the kinked riser on May 19 does not mean that there was erosion in the blind shear ram on that date, does it?

A. Well, yes, it does. I beg to differ there, Ms. Cross. We all know that the blind shear rams were eroding. We all know that the kink was eroding at the same time because the same sand with the same flow was carried through both. They don't live in two different universes so that one could do one thing for a while and another thing for another period of time. They were doing the same things at the same time because they were seeing the same sand carried by the same flow.

So long story short, if I see that a kinked riser developed a third hole after we had the first two the week before, I would have to assume that the blind shear rams, who were in the same system at the same time, have taken similar hits because there, too, the flow was having to curve left and right and go through tight passages.

Now, I'm not saying it was the same rate, Ms. Cross. I'm not saying everything is identical like some of the government experts are. I'm saying that it's safe to say the kink was eroding, the blind shear rams were eroding, and everything else that was eroding previously is still eroding. I think that's a commonsense statement.

MS. CROSS: Thank you. No further questions.

THE COURT: Redirect?

MR. BROCK: Yes, sir, just a couple.

REDIRECT EXAMINATION

BY MR. BROCK:

Q. Dr. Nesic, thank you for your patience and just a couple questions in follow-up.

MR. BROCK: If I can have D-23645, please. D-23645.

BY MR. BROCK:

Q. This is a demonstrative that we discussed earlier in your exam but which I did not identify. And I just want to call your attention to the second bullet point there that we actually discussed earlier, but we didn't offer this particular demonstrative.

One of the things you relied on from Dr. Vaziri was the conclusion that half of the sand was produced in the first two weeks and the remainder was produced by the end of May?

A. That's correct.

Q. Now, changing topics to components of the BOP that you analyzed. You did not undertake to study flow restrictions of the variable bore rams or the test rams after the period of your analysis; that is, if we get past the time of Top Kill, you didn't undertake to analyze whether or not the VBRs or the test rams were restrictions to flow?

A. That is correct.

Q. There were some questions asked of you about viscosity and

density. Do you recall those questions?
A. I think we talked density most of the time, yes.
Q. Density, yes. Can you tell the Court whether or not your model is sensitive to viscosity and density?
A. No, it is not. Actually, when one inputs the different densities, one still gets the same ratio for pressure drop change, one still gets the same ratio for flow increase. That is an analogous behavior to what I explained for flow rates. So the short answer is: No, my simulations were not sensitive to the density or viscosity changes, as I write in my report.
Q. You studied that for this case?
A. Indeed I did.
Q. Thank you. Last question. I want to go back to your testimony about the transient simulations and in particular about the linear trend you drew from the beginning and end points of your simulations. Is there an industry standard as to what to do in that circumstance; that is, in order -- an industry standard for working out whether the line is linear or has some other shape?
A. Probably not enshrined as a real standard, but anyone you would ask, if you showed him that sequence of points with that degree of linearity and asked him, Does this look like a straight line, for all practical and theoretical purposes, I think the answer would be, without a doubt, yes.
Q. Did you employ the same engineering standards for this

case in deriving the linear line as you would in your work as an erosion specialist?

A. Absolutely.

MR. BROCK: That's all I have. Thank you very much.

THE WITNESS: Thank you.

THE COURT: Thank you, sir.

THE WITNESS: Thank you.

THE COURT: BP and Anadarko can call their next witness.

MR. BROCK: BP and Anadarko will call as their next witness Dr. Momber, and I believe he is in the hall.

Your Honor, just for the purposes of informing the Court, Dr. Momber will be examined by Bridget O'Connor, one of my colleagues.

ANDREAS MOMBER,

having been duly sworn, testified as follows:

THE DEPUTY CLERK: State your full name and correct spelling for the record, please.

THE WITNESS: My name is Andreas Momber, the last name is M-O-M-B-E-R. First name is A-N-D-R-E-A-S.

MS. O'CONNOR: Your Honor, my name is Bridget O'Connor, here for BP and Anadarko. I will be doing the direct of Dr. Momber.

THE COURT: You may proceed.

VOIR DIRE

BY MS. O'CONNOR:

Q. Dr. Momber, you already introduced yourself to the Court. Where do you live?

A. I live in Hamburg, Germany.

Q. Is English your native language?

A. No, it is not.

Q. But you are fluent in English?

A. I guess so, yes.

Q. What do you do for a living?

A. I am the head of research and develop department of a German engineering company. I also am a lecturer at the Aachen University of Technology in the range of erosion. I also do consulting to the industry in terms of material degradation processes.

MS. O'CONNOR: If we can see D-24707, please.

BY MS. O'CONNOR:

Q. Dr. Momber, could you tell the Court about your educational background, please?

A. Yes, I will. I am -- from the point of view of my study, I am a process engineer. I studied at a German university in Weimar and I finished this with a diploma -- I think it is equivalent to a master's degree here -- in the field of heating cement.

I got a Ph.D. from the University of Leipzig as well in Germany on the topic of rehabilitation of concrete structures. And I also got a habilitation degree from the Aachen University of Technology for the erosion of geomaterials.

Q. Could you explain what the habilitation degree is?

A. Yes. The habilitation is an academic degree, actually the highest academic degree you could earn. And if you have it, it shows that you oversee a particular field of engineering, not just a particular topic or particular point, an entire field, and I was awarded the habilitation for the field of erosion of geomaterials.

Q. How long have you been working in the field --

THE COURT: Are you saying geomaterials?

THE WITNESS: Geomaterials, G-E-O materials.

BY MS. O'CONNOR:

Q. While we are on that subject, can you explain what do you mean by "geomaterials"?

A. What are mineral-based materials. That would include all the cement-based materials like cement, reinforced cement, concrete, mortar, but also rock materials and soil.

Q. Can you explain -- you mentioned both cement and concrete. Can you explain what is the difference between the two?

A. Well, with plain cement and a concrete, the major difference is that a cement doesn't contain any secondary solid phase in its structure. It's just solidified cement, whereas a concrete would include another secondary phase, what's being called aggregate materials of different sizes starting from very small one to rather large ones.

Q. The term "well cement," where would that fall within the range of cement to concrete?

A. Well, what is being called "well cement" here, it belongs to the cementitious materials, to the cement-based materials because the well cement here contains small aggregates, somehow situated between a plain cement and a concrete containing coarse aggregate materials. It's -- technically spoken, from my point of view, concrete contains very small pieces of aggregate materials.

Q. Getting back to your educational and work background, have you conducted research in your field?

A. In what field?

Q. In the field that you work and practice.

A. Yes, I did extensive research on material degradation processes in general and specifically on the erosion of cement-based materials, doing it for more than 20 years now.

Q. Have you published any of that work?

A. Yes. I have published extensively on this topic. I have published more than 120 peer-reviewed papers in my career, a number of textbooks where two of the textbooks are dedicated particularly to erosion of cement-based materials.

Q. Where specifically are you currently employed?

A. I am currently employed a company named Muehlhan situated in Germany. This is a company that provides engineering services to industry in general, including offshore oil and gas, including bridge constructions, including infrastructure structures and things like this.

Q. What is your role there?

A. Well, my role is that of the head of the research and development department. I oversee all the activities in the company -- it's worldwide active -- and I'm also responsible for training issues.

Q. Have you ever testified as an expert witness before?

A. No, I haven't.

Q. You were retained by BP as an expert in this litigation, though, right?

A. Yes.

Q. What were you asked to do?

A. I was asked to calculate, evaluate, to assess erosion rates in the well cement, and I was particularly asked to respond to the expert reports of Dr. Griffiths and of Dr. Dykhuizen.

Q. In undertaking that work, did you have the opportunity to review information about the Macondo well?

A. I had the opportunity, yes, and I did it. I reviewed quite some documents that are related to that case.

Q. Can you describe the types of information that you

reviewed in your work?
A. Yes. I reviewed expert reports from Phase One. I have reviewed other reports, like the Bly report or the chief counsel's report. I reviewed supporting literature. I reviewed scientific literature about the erosion of cement-based materials, just to name a few.
Q. Was the approach that you took in your work for this case consistent with the way you approach your work generally?
A. Yes, it is generally consistent with how I do approach problems like this.
Q. Based on your review, have you reached any opinions in this matter?
A. Yes. I have come up with two opinions, two core or two key opinions.
MS. O'CONNOR: If we could see D24708, please.
BY MS. O'CONNOR:
Q. Dr. Momber, could you tell the Court what opinions you have reached in this matter.
A. Well, the first opinion is that, assuming that the cement in the Macondo well was set, it is scientifically unsound and unproven that the cement could have been eroded in the time periods issued by the two experts, which would be roughly nine hours and 48 hours.
This is not plausible to me and this is not supported by any numbers from the scientific literature about the issue.

So the erosion rates required to meet that -- these time periods must have been orders of magnitudes larger than erosion rates that are usually known for this area.

The second opinion relates to the net pay change from Mr. Emilsen's report. I do not agree about the gradual net pay change issued by Dr. Griffiths, and I do not agree that the net pay change could have been the result of an erosion process. I rather think it's another process, and I suggested the hydraulic fragmentation as an alternative scenario.

Q. Dr. Momber --

MR. CERNICH: Your Honor, I would like to object to the second opinion.

THE COURT: Come to the microphone.

MR. CERNICH: Scott Cernich for the United States.

I'm objecting to the second opinion that Dr. Momber is offering. He is offering an opinion as to the failure mode of the cement on April 20 before hydrocarbons even reached the BOP. This is a Phase One matter; he is trying to redo expert work from Phase One, including Mr. Emilsen's work.

MS. O'CONNOR: Your Honor, the U.S. government moved this summer on this issue and Judge Shushan ruled that he was not -- his opinions were not Phase One opinions, including his second opinion, the hydraulic fragmentation. Their motion to strike his report was denied after her review of his report.

THE COURT: All right. I'll see where it goes.

Mr. Cernich, any particular areas of questions he gets into, you can object and I'll consider it at that time.

MR. CERNICH: Thank you, Your Honor.

BY MS. O'CONNOR:

Q. Dr. Momber, on the screen is D-24708. Does that slide accurately summarize the opinions that you reached in this matter?

A. Yes, it does.

Q. Have you also prepared an expert report in this case?

A. Yes, I did.

MS. O'CONNOR: Could we see TREX-11644.1, please.

BY MS. O'CONNOR:

Q. Is that the front page of your report?

A. Yes, that's the one.

MS. O'CONNOR: Your Honor, at this point I would offer Dr. Momber as an expert in cement erosion.

THE COURT: I don't believe there were any motions regarding this expert. correct?

MR. CERNICH: We have questions regarding Dr. Momber's specific qualifications. We'll take those up on cross.

THE COURT: Okay. I'm going to accept him and allow him to testify.

MS. O'CONNOR: We would also move that his expert report, TREX-11644, be admitted.

THE COURT: Any objection to that?

MR. CERNICH: Your Honor, I would like that to be subject to our objections regarding Dr. Momber's Phase One opinions.

THE COURT: Okay. We'll admit it subject to that.

DIRECT EXAMINATION

BY MS. O'CONNOR:

Q. Dr. Momber, could we please start by having you explain in general terms: How does cement erosion work?

A. Yes, sure. The erosion of the Macondo well, in particular, is the result of a particular erosion process which is called "slurry erosion," and by talking "slurry" I do not mean the cement slurry that was pumped into the well. I'm talking about a slurry consisting of a liquid, which is the hydrocarbon, and a solid suspended in the hydrocarbon, which are the sand particulates from the reservoir.

We have two phases in the erosion process. One phase is through the liquid, the high-speed -- the liquid flowing at a high speed will enter cracks, interfaces, and pores into the system and will generate damages. On the other side, the particles suspended in the liquid, they will impinge the surface of the cement working like a micro cutting tool and they will remove tiny particles from the cement in a successive manner.

Q. With that as a background, how did you approach your analysis of the question at hand in assessing cement erosion at the Macondo well after the blowout?

A. Can you repeat the question?

Q. How did you approach your analysis of cement erosion at Macondo for your work here?

A. Well, I first was trying to calculate erosion rates that are required to meet these two time marks offered by the experts, Dr. Griffiths and Dr. Dykhuizen. Then I compared those rates with rates that seems to be plausible to me from my scientific background and with rates that I found in the supporting scientific literature. That's basically the way I did it.

Q. You mentioned that you had reviewed some scientific literature on cement erosion. Can you describe the process that you followed for that review?

A. Yes, I can. First of all, the erosion rates I calculated for these two cases seemed very implausible to me. I did not find any support on those from my previous work. But I reviewed other scientific references from the literature. I started with reviewing papers about erosion of cement-based materials in general and finally found out that there is a number of eight papers which covers more than 200 different erosion scenarios can be related to that particular case in the Macondo well. I calculated all the erosion rates for all the more than 200 erosion scenarios, and then I related those erosion rates to the erosion rates I calculated for the requirements regarding Dr. Griffiths and Dr. Dykhuizen's time marks.

Q. The scientific articles that you reviewed, broadly speaking, what do those articles evaluate?

A. Well, those researchers investigated two issues. Issue Number 1 is those papers were about the development of erosion-resistant cement-based materials. The second issues those researchers investigated was what parameters might affect the erosion rates and how can these parameters be related?

Q. Based on your experience and also your review of the scientific literature, can you explain what are the factors that primarily determine erosion rates in cement or concrete materials?

A. Yes. So far, the slurry erosion that I just briefly described, you could subdivide the inferencing parameters into two groups. There's one group I call "process parameters." These parameters actually describe the loading process, the load. That would include the speed of flow, the angle of impingement. It would include the solid content of the flow, the size and the type of the solid particles.

The second group is a group I call "resistance parameters." They describe the resistance of the material. For the cement-based materials, these are basically the porosity, the water:cement ratio, the aggregate content, the aggregate size and distribution. But all those resistance parameters could actually be summarized in a single parameter, which is the compressive strengths, because any change in what I said -- porosity, etc., etc. -- will immediately be reflected in a change of the comprehensive strengths.

Q. In assessing the rate of erosion at the Macondo well specifically, what information did you need to know to do that?

A. Well, I would need information about the status of the cement in the well.

Q. Can you explain what you mean by "information about the status of the cement"? Specifically -- more specifically, what did you need to know?

A. I would actually need to know how much cement was in the well and how was it conditioned.

Q. Can you describe the cement barrier as you considered it in your analysis?

A. Well, yes, I considered the cement barrier the shoe track, between the reamer shoe and the float collar.

MS. O'CONNOR: If we could see TREX-11644.7.1, please.

BY MS. O'CONNOR:

Q. Dr. Momber, is this a figure from your report?

A. Yes.

Q. Using this figure, can you explain how you calculated the volume of the cement column or the cement barrier between the shoe and the float collar?

A. Yes, it was a simple procedure because it's a column and the lengths of the height of the column was known. It's 180 and 9 feet. And the diameter of the column was known as well -- it's roughly 6.1 inch -- and with those two parameters, it was easy to calculate the volume of cement being placed there.

Q. Why did you analyze only the cement in that shoe track area?

A. Because that was the flow path of the hydrocarbons through the shoe track.

Q. Was that the only place in the well where cement could have provided a barrier to flow?

A. No, this is not the only place. There's also cement in the annulus that could have provided a barrier to the flow.

Q. Turning now -- did you make any assumptions in your work about the condition of the cement for the purposes of your analysis?

A. Well, for the conditions of the cement, I made two basic assumptions. The first assumption is that cement had been set and the second assumption is that the cement structure was disturbed predamaged.

Q. The first assumption, to be clear, are you offering any opinions about whether or not the cement was set?

A. No, I do not offer any opinion. I just made an assumption

that the cement had been set.
Q. When you say "set," what do you mean by that?
A. What I mean is that the cement would have a particular compressive strength.
Q. What effect would the cement in the well have on the flow from the reservoir if it was set?
A. Well, it would act as a barrier to the flow.
Q. Why did you start with the assumption that the cement was set?
A. Well, that is basically because I was replying to Dr. Griffiths' expert report and I was trying to make the same assumptions and using the same procedures he used in his report. And while I went through his report, I found that he made assumptions on the status of the cement by mentioning that the cement was reasonably intact and provided at least an initial barrier to erosion as well.
MS. O'CONNOR: If we could see TREX-114854.12.3, please.
BY MS. O'CONNOR:
Q. Dr. Momber, is this the language from Dr. Griffiths' report that you were referring to?
A. Yes.
Q. Specifically, could you direct our attention to the language that you looked at in your finding a need to respond with the assumption that the cement was set?

A. Well, the cement barrier would provide no significant restriction to flow from the reservoir into the casing. And assuming that the cement remained reasonably intact, the likely mechanism for progressive failure is erosion.

Q. You also mentioned earlier that you were also responding to Dr. Dykhuizen's expert report. What were you responding to in his report with respect to cement erosion?

A. What I responded to his report in the way that he claimed that, after 48 hours, any erosion process would not be of any meaning to the flow -- the flow rate of the hydrocarbons.

Q. In addition to responding to those same assumptions that the government experts had made, was there any other evidence that you reviewed that confirmed to you that that was a reasonable assumption?

A. That the cement had been set?

Q. Right.

A. I might also refer to --

MR. CERNICH: Objection, Your Honor. Any opinions by Dr. Momber regarding his own analysis or consideration of why he thinks the cement was set was excluded by an order by Judge Shushan.

THE COURT: As being really Phase One?

MR. CERNICH: That's right. Judge Shushan's order said that Dr. Momber could simply assume the cement was set and that was the extent of the testimony that he could give on that.

THE COURT: We are certainly not going to retry in Phase Two whether the cement was or was not set. We heard a lot about that in Phase One, so I sustain the objection.

BY MS. O'CONNOR:

Q. Dr. Momber, you mentioned that compressive strength was one of the elements that you looked at in assessing the cement erosion after the blowout. Where did you get the information that you used about the compressive strength?

A. I got information from testing reports; one from the Chevron Laboratory, the other from Halliburton testing records.

MS. O'CONNOR: If we could see D-24709.

BY MS. O'CONNOR:

Q. Dr. Momber, is this the Chevron report that you looked at for the compressive strength information?

A. Yes.

MR. CERNICH: Your Honor --

BY MS. O'CONNOR:

Q. What information in that --

THE COURT: Wait, wait, wait.

MR. CERNICH: Because of the way the demonstrative is titled, I'm just going to make another objection regarding the reasonable -- any opinions --

THE COURT: It sounds like we are going right back into was the cement set or not, so I sustain the objection.

MS. O'CONNOR: Your Honor, Dr. Momber has said he is --

THE COURT: I sustain the objection.

BY MS. O'CONNOR:

Q. You mentioned a second assumption that you have made, which is that the cement structure was predisturbed. Can you explain what you meant by that?

A. What I meant by that is that there was a net of cracks --

MR. CERNICH: Your Honor, I'm going to object again. This testimony relates to the condition of the Macondo cement at the time of the blowout. This is continued Phase One testimony trying to retread everything that we spent two months here hearing about in Phase One.

MS. O'CONNOR: Your Honor, Dr. Momber is being very clear that he is not offering --

THE COURT: But wait a minute.

Whether the cement was set or not set was a significant issue in Phase One. It's one thing for the witness to be asked to assume that the cement was set for whatever reason or be told to assume that and then render opinions based on that. But if he is going to get into his view of whether that was reasonable or not reasonable, that's another issue. Because, then, he is basically giving his opinion as to whether the cement was set or not set, which is a Phase One issue and we are not going to go there. So I sustain the objection.

BY MS. O'CONNOR:

Q. Dr. Momber, I'm asking you now about the assumption that you expressed which is about the cement structure -- the predisturbance in the cement structure that you used in your calculations. Can you explain what you mean by "predisturbed"?

A. Well, I assumed that the structure of the cement was containing a net of cracks and voids and pores and of interfaces that would allow a particular volume of hydrocarbons to flow through it.

MS. O'CONNOR: Could we see TREX-11644.10.1, please.

BY MS. O'CONNOR:

Q. Is this a chart from your expert report, Dr. Momber?

A. Yes, it is.

Q. When you are looking at the cement erosion for your analysis, how do you use this information?

A. Well, for example, the Situation Number 3 would very well describe the condition of the cement in the first phase of the erosion process.

MR. CERNICH: Your Honor, I'm going to object again. Now Dr. Momber is providing further opinions on the condition of the Macondo cement at the bottom of the well.

MS. O'CONNOR: Your Honor, he is not saying -- my next question can clear that up if there's any confusion. He is not saying that this was the condition of the cement. He is saying, for the purposes of his analysis, he starts with this as his assumption.

THE COURT: All right. With that understanding, I will overrule the objection.

BY MS. O'CONNOR:

Q. Dr. Momber, is this illustration intended to represent what the cement in the Macondo well actually did look like?

A. No. It's an example how it could look like. It's representative of how it could look like.

Q. The channels that you describe that could have been in the cement, how do you take those channels into account in doing your calculations?

A. Well, for calculating the erosion rates required for the time frames of the two experts, I needed to know the volume and I just told how I calculated the volume of the cement. But if there's a crack, a void, and pore network into the cement, I must subtract the volume occupied by that net from the actual volume of the cement. That is how I considered the predisturbed structure in my calculations.

Q. So you subtract the volume for these channels. Can you explain how do you calculate a volume for these channels?

A. Yes, this is outlined in Appendix A of my report, and basically I combined well-known relationships from fluid mechanics from information provided in Mr. Emilsen's report about the net pay and about flow rates, and this procedure enabled me to calculate the volume of the correct net void and pore net.

MS. O'CONNOR: Could we see TREX-11644.28.1, please.

BY MS. O'CONNOR:

Q. Dr. Momber, is this another table, Table A1 from your expert report?

A. Yes.

Q. Can you explain here where the pressure drop calculations that you performed appear.

A. Well, it's on Line 4 and the basic result of the calculation is the last line, DF, where I was able to calculate the cross section that is correct, devising the volume of net void and correct network, and I related this to the volume of the cement and what I found out actually is that about 19 percent of the entire volume of the cement is occupied by this crack void network. And this is -- very well reflects the number in Mr. Emilsen's report who said about one-fifth, right, of the reservoir is exposed is actually a good proof of my calculation.

Q. You said, just to be clear for the record, you said 19, 1-9?

A. 19, 1-9, yes.

Q. At these percentages you have calculated, would the cement column still be providing a sizeable flow restriction?

A. Yes, it still would.

Q. Could you explain what your basis for that is?

A. First of all, this is not an unusual number for cement-based materials. As you can see from the table, it still provided a resistance to the flow in terms of pressure drop.

Q. Turning now to the reports of Dr. Griffiths and Dr. Dykhuizen, I think you stated earlier you reviewed both of their expert reports. Correct?

A. Yes.

Q. Have you also reviewed their deposition and trial testimony?

A. Yes, I did.

Q. Does Dr. Griffiths address cement erosion in his report?

A. Yes, he did.

Q. What is your understanding of what Dr. Griffiths' assumption or analysis was with respect to cement erosion?

A. Well, his assumption was, if the cement is in a reasonable shape, then it would take about nine hours to erode it almost completely.

Q. Did he have any other analysis relating to -- well, I guess, first of all, did you see any scientific basis in Dr. Griffiths' report for his conclusion that the cement would have eroded within nine hours?

A. No. I didn't see any scientific proof in terms of an erosion process.

Q. Did he have any other discussion --

MS. O'CONNOR: And I will ask if we could see TREX-11485R.12.4.

BY MS. O'CONNOR:

Q. Did he have any other discussion in that section about cement erosion?

A. Well, basically, Dr. Griffiths was using a procedure for the calculation of these nine hours, which, actually -- as a basis for his erosion assumption, which I actually could not agree upon. He is using the net pay numbers reported in Mr. Emilsen's report and he transferred them into PI numbers, and then he assumed a gradual increase in the PI numbers in the period between 9:00 p.m. and 9:30 p.m. that night. And he finally came up with a PI rate, and he extrapolated this rate was estimating just for a 30-minute duration. He extrapolated that rate linearly to a time frame after the 9:30 time mark which completely unknown conditions. So this is actually something that is not acceptable.

Q. Turning to Dr. Dykhuizen's report, TREX-11452.11.2, please. With respect to his discussion of erosion, did you see any scientific basis for Dr. Dykhuizen's position on erosion generally or cement erosion more specifically in his report?

A. No, I haven't seen any.

Q. Have you also reviewed Dr. Dykhuizen's discussion in his trial testimony about his analysis of cement erosion?

A. Yes.

Q. Did you see his --

MR. CERNICH: Your Honor, I'm going to object to any surrebuttal offered based on Dr. Dykhuizen's trial testimony at this time. Dr. Momber didn't have that testimony when he wrote his expert report.

MS. O'CONNOR: The question doesn't call for any new opinions. It's consistent with his existing opinions as to whether Dykhuizen's testimony --

THE COURT: Okay. I overrule the objection.

BY MS. O'CONNOR:

Q. Have you reviewed -- sorry. Have you reviewed Dr. Dykhuizen's trial testimony with respect to the analysis that he has done as to erosion or cement erosion?

A. Yes.

Q. Do you recall that he described that analysis as a hand wave or a wave to erosion?

A. Yes, I noted that.

Q. Turning to your analysis of Dr. Griffiths' and Dr. Dykhuizen's assumptions, can you describe your assessment and your comparison of those erosion rates to those that you were able to identify in the scientific literature?

A. Well, yes. I compared the numbers for the erosion rates that I found in the scientific literature, including my own investigations, with the erosion rates I calculated for the two cases being developed by Dr. Griffiths and by Dr. Dykhuizen.

I did a comparison erosion rate in terms of cubic feet per hour, did a comparison, and I found that the erosion rates required for Dr. Dykhuizen and Dr. Griffiths are far off the erosion rates known for cement-based materials even under extreme conditions. They must have been some orders of magnitudes higher.

MS. O'CONNOR: Could we see D-24238, please.

BY MS. O'CONNOR:

Q. Dr. Momber, did you prepare this graph to reflect the calculations and comparison that you have done in your analysis?

A. Yes, that's my graph.

Q. Can you explain to the Court, using this chart, what your opinions were based on that analysis.

A. Yes, I can do that.

This is a so-called ASHBY chart.

MR. CERNICH: Your Honor, may I object?

This chart is not in Dr. Momber's report. During his deposition, for the first time we learned about Dr. Momber doing an ASHBY analysis. He described an ASHBY chart. He admitted that it hadn't been disclosed, it wasn't included in his consideration materials or his modeling runs or anything of the type. This is the first time we have seen this. Now he is bringing it to court to explain his opinions.

I'm going to move to strike any testimony regarding this and ask that it be excluded.

MS. O'CONNOR: Your Honor, this chart was produced to the government on September 27. It was part of the group of demonstratives that they withdrew any objections to. I have their communication on that.

Moreover, in Dr. Momber's deposition, he discussed having -- that this relates to an ASHBY analysis.

THE COURT: I overrule the objection.

THE WITNESS: I might say that this graph is actually providing identical information to my table in my report. It's just another type of expressing them.

I don't know whether this one works. No. It's too far.

BY MS. O'CONNOR:

Q. I think you just turn to the right a little bit.

A. Well, in the graph, on the horizontal line you will find compressive strength numbers in psi.

Thank you.

Q. Does that work a little better for you?

A. Right. On the vertical scale you will find the erosion rates in cubic feet per hour. You will see two horizontal lines. These are the erosion rates I calculated for Dr. Griffiths' and Dr. Dykhuizen's approaches for the nine hours and the 24 hours. So it's about 3.42 cubic feet per hour and 0.64 cubic feet per hour.

Those data points here are the results of the references I reviewed. It doesn't look like this, but it's more than 200 data points here.

So basically the diagram shows that all the data points, even the largest one, which I just highlight here, are orders of magnitudes away from the erosion rates required for Dr. Griffiths' and Dr. Dykhuizen's approaches.

I also added an inclined line here. That line is actually based on my own research originally, but I found that one of the references I cited and I checked came out with a very similar one. And it shows the effects of the compressive strength changes on the erosion rates.

Even at rather low compressive strength numbers here on the left side of the graph, we see that there are still orders of magnitudes differences between real erosion rates and erosion rates required for Dr. Griffiths' and Dr. Dykhuizen's approaches.

BY MS. O'CONNOR:

Q. You mentioned in that explanation orders of magnitude difference. What do you mean by "orders of magnitude"?

A. One order of magnitude is a difference of 10 times, so two orders would be 100 times, etc.

MS. O'CONNOR: Could we see TREX-11644.16.1, please.

BY MS. O'CONNOR:

Q. You referred at the beginning of your explanation to your table in your report. Is this the table you were referring to?

A. This is the table from my report, yes.

Q. Table 6.1. Could you just to explain to the Court, where do you find the erosion rates that you had plotted in that graph we looked at a moment ago in this table?

A. The two upper erosion rates I calculated according to the scenario we were just discussing. These two.

And the lower part, those are the erosion rates I found in the reference literature. I said it's more than 200 cases I reviewed. But I also -- I only took the highest erosion rate from each individual reference and put this one into the table. So this actually the erosion rates that are known for cement-based materials, and those are the erosion rates that are required for Dr. Dykhuizen's and Dr. Griffiths' approaches.

MS. O'CONNOR: If we could go back to D-24238, please.

BY MS. O'CONNOR:

Q. Dr. Momber, besides aggregate, does well cement contain any other additives?

A. Yes, it does.

Q. Have you considered whether those additives would affect the erosion rates that you have considered here?

A. Well, I consider it in a way that any change in ingredients, whether it's the type of ingredients or the quantity of particular ingredients, will immediately affect the compressive strengths. So any change, any additional ingredients is being reflected by the compressive strengths. And because I have plot compressive strength numbers here on my X-axis, so those changes are being considered.

Q. Similarly, the difference as to whether you're looking at a cement or a concrete, how would that difference impact the analysis that you have done here?

A. Well, if we compare, let's say, a cement and a concrete in terms of slurry erosion, I might just repeat that a concrete is containing rather large aggregate particles, and the well cement in question here contains very small aggregate particles.

When it comes to the large aggregate particles, in the cement matrix they form a very weak interface between aggregate and cement matrix. It's highly porous. It is well known in cement and concrete technology. And those are preferred locations for the hydrocarbon penetrating the material to erode it.

On the other side, the well cement in question here containing these very tiny particles, the silica blend, these ingredient is actually added to the well cement in order to make it very dense, to generate a very low permeability, and this will actually increase the erosion resistance.

So if you compare a concrete and a well cement in terms of erosion by slurry erosion, the cement would have the lower resistance.

Q. Finally, Dr. Momber, based on your experience and your review of the scientific literature, is there anything that you have seen in the expert reports or trial testimony from Drs. Griffiths or Dykhuizen that provides a scientific basis for the cement erosion rates they have assumed in their estimates here?

A. No, I haven't seen any scientific base in terms of erosion investigations.

MS. O'CONNOR: Thank you, Dr. Momber. That's all I have.

THE WITNESS: Thank you.

THE COURT: Cross. What's your estimated time, Mr. Cernich?

MR. CERNICH: I'm hoping an hour or so.

THE COURT: Let's take a 15-minute recess.

THE DEPUTY CLERK: All rise.

(Recess.)

THE COURT: Please be seated, everyone.

Mr. Cernich, you may proceed.

MR. CERNICH: Scott Cernich on behalf of the United States. Dr. Momber, I have you on cross-examination.

CROSS-EXAMINATION

BY MR. CERNICH:

Q. First, as a matter of housekeeping, Dr. Momber, do you recall at your deposition there were a couple of mistakes you described as typographical errors in your report?

A. Yes.

MR. CERNICH: I would like to go to page 11 -- well, actually, let me do it this way, TREX-11644.0014. If we could have --

BY MR. CERNICH:

Q. On this page of your report you describe the float collar as being made of steel; is that right?

A. No. It is one of the typographical errors you mentioned. This is not right.

Q. You said that was a typographical error; you meant to write "aluminum" in your report?

A. Right, yes.

THE COURT: Where are you reading that? That's page 11? I know you gave the TREX number, but I'm looking at the report itself. Is that page 11?

MS. HIMMELHOCH: Yes, sir.

MR. CERNICH: Here it is. It's right down here towards the bottom of the page.

THE COURT: I see it, yes.

MR. CERNICH: It says "steel on the float collar."

THE COURT: Right.

BY MR. CERNICH:

Q. You're aware of that -- you were aware of that error before your deposition, correct?

A. Sorry?

Q. You were aware of that error before your deposition?

A. We noted it before my deposition, yes.

Q. But you didn't disclose it to anyone else, any of the other parties in the case until your deposition?

A. Me personally, no.

MR. CERNICH: Then if we could go to page 13. This is TREX-11644.0015. One page back, please, Don.

BY MR. CERNICH:

Q. Right here you say: "I have investigated erosion rates in concrete materials and exposed these materials to a high-speed slurry flow (like oil containing sand particles) at velocities of 180 feet per minute."

You told me at your deposition that that was a typo. It should have said 180 feet per second; is that right?

A. This is right, yes.

Q. So that's a 60-fold difference?

A. Yes.

Q. This particular study you're referencing here in your report, that is a study of concrete reinforced with steel fibers; isn't that right?

A. No, this is not completely right. I investigated two types of concrete. One was steel fibers, and the other one without steel fibers.

Q. The Macondo cement didn't have any steel fibers in it, did it?

A. No.

Q. Now, just to be clear, Dr. Momber, moving on, you didn't actually quantify any erosion rates for the Macondo cement assuming it was set; is that right?

A. I'm afraid I do not understand the question.

Q. You did not quantify erosion rates for the Macondo cement?

A. Well, I calculated erosion rates that are required in order to meet Dr. Griffiths' and Dr. Dykhuizen's approaches.

Q. You took Dr. Dykhuizen's and Dr. Griffiths' work and you implied an erosion rate based on their work; is that right?

A. An erosion rate required to meet the time limits that they mention in their reports, yes.

Q. But you're not offering any opinions on the actual quantitative erosion rate of any cement, assuming there was any cement in the Macondo well?

A. No, I did not do any calculations, if that was the question, that would precisely come up with a particular erosion rate for those conditions. Mainly for the reason because it's actually not possible to do this.

Q. In fact, according to you, assuming the cement was set, the erosion period of the cement in the Macondo well could have lasted for as little as a week?

A. Did I say that?

Q. It's written in your report. We can go there, too.

MR. CERNICH: TREX-11644.0020. If we could call out the top of the page there, please.

BY MR. CERNICH:

Q. You write here: "We do not know for certain if this lasted for a week or a month or longer."

There you are talking about what you call the erosion period of the cement; is that right?

A. Yes. And the focus is that I really do not know that for certain whatever period that might be.

Q. And you say that the final period after the -- what you call the erosion period, the effects of erosion are negligible?

A. Yes.

Q. Now, you, in your work here, attempted to compare the Macondo well cement to construction concrete materials?

A. Well, I compared two types of cement-based materials, two types which are technically concrete materials. One contains very small aggregates, and the others contain small aggregates plus larger aggregates. That was what I actually comparing.

Q. Since you didn't review any of the Phase One trial testimony in this case, you're not aware that any of -- you're not aware that none of the cement experts who testified in this courtroom referred to well cement as concrete at any point?

MS. O'CONNOR: Objection, Your Honor. On direct Mr. Cernich objected on the basis of bringing Phase One evidence in. I would object on the same basis. I think if we are not going to have Phase One evidence, we shouldn't have Phase One evidence.

THE COURT: I think this is different. First of all, he is on cross-examination. Second, he is asking him if he is -- it's sort of a hypothetical, I mean, if that's the case, whether the witness considered that.

Go ahead. Overrule the objection.

MR. CERNICH: Thank you, Your Honor.

THE WITNESS: Can you repeat, please, your question.

BY MR. CERNICH:

Q. You, Dr. Momber, didn't review any of the Phase One trial testimony in this case prior to writing your expert report; isn't that right?

A. Phase One? I reviewed Phase One records, yes.

Q. I said the Phase One trial transcripts.

A. Oh, okay. No.

Q. Because you didn't review those trial transcripts, you wouldn't know that none of the cement experts --

THE COURT: Why don't you -- I think instead of stating that as a fact, what I was getting into -- without getting into a debate of what the testimony showed or didn't show in Phase One, why don't you state it as a hypothetical. Okay?

MR. CERNICH: Sure, Your Honor.

BY MR. CERNICH:

Q. Are you aware whether any expert, cement expert in this case -- you are aware that there were a number of cement experts who testified in this case in Phase One, correct?

A. Yes.

Q. Are you aware that none of those experts --

THE COURT: Wait a minute. That's not stating a hypothetical. You're stating "are you aware" as a fact. Why don't you pose it to him "assuming this" and then whatever your question is, if you want to do that.

MR. CERNICH: Okay.

THE COURT: That will be the last time I help you phrase a question.

MR. CERNICH: Thank you, Your Honor. I appreciate it. I'm not quite sure how to phrase it as a hypothetical.

THE COURT: I can't help you anymore.

BY MR. CERNICH:

Q. My point is simply that -- I'll move on.

You're not offering any opinions on the actual flow rates from the Macondo well, are you?

A. No, I do not.

Q. And the entire scope of your report is solely a response to the reports of U.S. experts Dr. Griffiths and Dr. Dykhuizen?

A. Yes, that's basically what I have done.

Q. Isn't it true that Dr. Dykhuizen, in his report, never makes any reference to cement erosion at all?

A. He did not mention cement erosion particularly, this is true.

Q. And when Dr. Griffiths discusses erosion in his report, he is talking generally about all the possible restrictions that might be at the bottom of the well; he is not talking about cement specifically?

A. No, I don't agree on this. He is talking about cement specifically in a number of sentences. And in one footnote, as I understood it, he even paid special attention to the cement in the shoe track and neglected, in terms of wording, the other obstacles that might have been there. I don't agree.

Q. And his analysis lumps in all of those various possible restrictions in the well?

A. This is right, yes.

Q. I think we have established your entire analysis is based on the assumption that there was set cement in the Macondo shoe track?

A. It's an assumption I made, yes.

Q. Your focus is solely on the shoe track cement?

A. My focus is on the shoe track cement because that's where the flow path was.

03:39 **Q.** Now, on direct you said -- and I wrote this down -- that you needed to know how much cement was in the shoe track and the condition of that cement in order to do your analysis. Do you recall that testimony?

03:39 **A.** Yes.

03:39 **Q.** But you would admit that you're not an expert in the cementing issue and you cannot evaluate the condition of the cement in the shoe track?

03:39 **A.** No, that was outside the scope of my work. I made that assumption, that the cement must have been disturbed in terms of its structure because there is some evidence of this.

03:39 **Q.** You would also admit you're not an expert in the cementing issue?

03:40 **A.** I'm not an expert in the cementing issue, no.

03:40 **Q.** Now, you weren't retained in this case until 2012; is that right?

03:40 **A.** Yes, this is right.

03:40 **Q.** So when BP told the Oil Spill Commission that it is possible that cement remaining in the wellbore inhibited flow from the well, that wasn't based on any expert advice from you, was it?

03:40 **A.** When was that issued, that sentence?

03:40 **Q.** That was in October 2010.

03:40 **A.** No.

03:40 **Q.** You're not aware personally of any other cement erosion experts who may have helped BP with that press release, correct?

A. I'm not aware, no.

Q. Isn't it true, Dr. Momber, you have absolutely no experience or expertise with oil field cementing or oil field cement?

A. Difficult to answer. I do have experience for more than 20 years now with any type of cement-based materials. That would include plain cement; that would include cement containing small aggregates very similar to what you call a well cement, and it also includes concrete materials. So for this group of materials where the well cement, from my understanding, is just a part of, I have extensive experience.

Q. Let's break it down into the parts then. You don't have any experience in the process of oil field cementing, do you?

A. What do you mean, "with the process"?

Q. It's the same question I asked you at your deposition. You don't have any experience in the process of oil field cementing, how you conduct a cement job, an oil field cement job?

A. No.

Q. Prior to your work in this case, you had never studied the erosion of well cement; isn't that correct?

A. Again, it's not completely correct. I investigated erosion processes on materials that are very, very close to what you call -- what's been usually called here in this case well cement.

Q. But no erosion studies on well cement?

A. On what you really -- well, what is your definition of the "well cement," please?

MR. CERNICH: Could we go to Dr. Momber's deposition, please, page 26.

BY MR. CERNICH:

Q. I would like to go to lines 10 through 14.

"QUESTION: Have you ever studied erosion of well cement?

"ANSWER: No, I did not study the erosion of well cement. I studied erosion on similar materials."

Were you asked that question at your deposition?

MS. O'CONNOR: Your Honor, I think that is exactly what Dr. Momber just responded to that question here.

THE COURT: Okay. I think he has answered the question. Go ahead.

BY MR. CERNICH:

Q. You haven't published any articles on well cement, have you?

A. No.

Q. And the full extent of the -- of your review of the literature in the field of well cement was about four articles that you read after you were retained by BP and Anadarko in this case; isn't that right?

A. Can you please repeat the number you mentioned?

Q. About four papers, four articles.

A. No, it's more. Maybe just repeat the question.

Q. Yes. The full extent of your review of the literature in the field of well cement was about four papers that you read after you were retained by BP and Anadarko in this case?

A. Do you mean papers about erosion of cement?

Q. About well cement.

A. Oh, okay. Sorry. Yes. That might be, yes.

Q. Prior to your engagement by BP and Anadarko in this case, you had done no research regarding the ingredients or formulation of oil field well cements?

A. No.

Q. You have never taken any courses in oil field cementing?

A. No.

Q. You have never designed an oil well cement system, foam or otherwise?

A. No.

Q. You have never designed oil field cement slurry?

A. No.

Q. You have never tested a well cement slurry?

A. No, I did not do that, but the expertise requested for this particular case was my expertise on the erosion of cement-based material, of any type of cement-based material.

Q. Now, for the assumptions you make in your report regarding the Macondo cement, you rely on BP's Bly report and I think you also mentioned the Presidential Oil Spill Commission Chief Counsel's report?

A. Yes, I think so.

Q. Now, you testified on direct that you had reviewed information about the Macondo well and you had included in that list expert reports from Phase One. Do you recall that testimony?

A. Yeah.

Q. There's only one Phase One report that's listed on your considered list, isn't there?

MS. O'CONNOR: Objection, Your Honor. This is exactly what he -- what he objected to us trying to explain on direct examination. He is getting into actual evidence about the Phase One record on cement. I would object to that.

MR. CERNICH: Your Honor, Dr. Momber made a number of assumptions in his report to form his opinions, and all I'm establishing is what materials he reviewed from the Phase One record, if there are any.

THE COURT: I thought he said he didn't review the Phase One record. That's what I heard him say earlier. I don't know what you are going to ask him.

MR. CERNICH: What I'm asking is that he -- if you will give me a couple questions, I can -- he testified at his deposition that he hadn't reviewed any of the cement expert reports from Phase One.

MS. O'CONNOR: I would object. It's characterizing what he -- the point is is he going to ask questions about the Phase One record, which he has just started doing? If he is going to do that, then I object to that.

THE COURT: I sustain the objection.

MR. CERNICH: Your Honor, just briefly, I want to -- I'm not asking any questions about the Phase One record. I'm just establishing what Dr. Momber reviewed from the Phase One record that he based his assumptions on. He had to have some basis for these assumptions he makes in his report regarding the condition of the cement.

THE COURT: I thought he said it was based on something he read in Dr. -- which expert of yours?

MS. O'CONNOR: Drs. Griffiths and Dykhuizen.

THE COURT: What he read in there and he just assumed -- I think what this witness is saying, assuming the cement was set, these are my opinions.

MS. O'CONNOR: That's right.

THE COURT: You can certainly argue later whether that assumption is accurate or not accurate, whether there's a basis for it from the Phase One record or not.

BY MR. CERNICH:

Q. Now, in forming your opinions in this case, you looked at some Halliburton lab test results; isn't that correct?

A. Yes, this is correct.

Q. You cite those lab test results in your report as one of the pieces of evidence you rely on; isn't that correct?

A. I cited the numbers, yes.

MR. CERNICH: If we could go to TREX-7722, please.

THE COURT: Mr. Cernich, it sounds like this is what you objected to when BP's lawyer was questioning this witness. She wanted to go into this type of evidence and you objected and I sustained it. Now you're going to go there?

MR. CERNICH: No, Your Honor. These are the materials that Dr. Momber -- if we can get -- if all of Dr. Momber's opinions are excluded regarding whatever condition there was of the Macondo cement, we can move on through all of this.

THE COURT: Again, my understanding of this witness' testimony is he was asked to assume that. He assumed that, and then he stated his opinions. So I'm not going to retry the issue of whether the concrete was -- the cement was set or not set in this phase of the case. Okay?

MR. CERNICH: Very well, Your Honor.

BY MR. CERNICH:

Q. Now, Professor Momber, in forming your opinions, you compare compressive strengths of construction concrete with oil well cement?

A. Dr. Momber is the right --
Q. Dr. Momber, I'm sorry.
A. -- title, yes.
The question was, please? Can you please repeat it?
Q. Yes. You compare compressive strengths of construction concrete with the oil well cement for the Macondo well?
A. Well, no. I used compressive strength numbers from the concrete samples I found in the reference literature, right, and compressive strength numbers I found on the laboratory testing reports for the well cement, yes, in order to establish the resistance of these different types of materials.
Q. In forming those opinions, you looked at the Chevron cement lab tests?
A. Yes, I did.
MR. CERNICH: Your Honor, I'm moving into an area that relates directly to Dr. Momber's opinions. Dr. Momber looked at the Chevron cement testing to get compressive strengths that he used to compare to these articles that you saw that he testified about on direct. I would ask the Court's indulgence to at least explore this with Professor Momber. I can't examine -- if I can't examine these areas, then I would request that all such comparisons to lab testing on the Macondo cement be stricken from Professor Momber's report.
MS. O'CONNOR: The document that counsel is asking about is exactly what he objected to on direct, the Chevron lab

report. He objected to us going into that any further. Dr. Momber testified that he got compressive strength numbers from that document, and that's all that Dr. Momber was allowed to do about that document. And so I would object to him being able to explore it further when he himself has objected to that.

THE COURT: I sustain the objection.

BY MR. CERNICH:

Q. Dr. Momber, you have never conducted any investigations of erosion rates using oil and sand particles, have you?

A. No. The investigations I conducted in terms of slurry erosion, many contained water as a liquid and sand particles, but a difference would be, actually, the densities of the two different liquids, oil compared to water, and water has a higher densities, twice as high as that of the oil. And that would lead to a more aggressive erosion action if water is being considered in terms of oil. So using water-based erosion scenarios is not a bad choice in that case.

Q. But just to be clear, you have never conducted any investigations of erosion rates using oil and sand particles personally?

A. No.

Q. None of the literature you used for comparison in your expert report involves oil with sand particles, does it?

A. No, this is not true. For the concrete materials, yes, this is true.

Q. You have never performed erosion experiments on concrete materials enclosed inside of a pipe, have you?

A. Inside a pipe? Oh, I did it in the past.

Q. Just to make sure we are on the same page here, you have never performed erosion experiments on concrete materials enclosed inside of a pipe?

A. No.

Q. You have never performed erosion experiments on well cements whether inside or outside of a pipe?

A. No.

Q. Now, according to you, Dr. Momber, assuming, again, for the sake of argument, there was set cement in the well, it is not required that the cement be completely removed to eliminate its resistance to flow; isn't that right?

A. Yes.

Q. At some point there could be some amount of cement in the well providing only a negligible resistance to flow?

A. Yes.

Q. You have not quantified in any way how much or how little cement erosion would result in such negligible resistance?

A. No, I did not do this and it was not actually required regarding the very large differences I found out in my report in terms of the erosion rate, so it would not matter at all if there are 10 or 20 percent of the cement being left.

Q. You talked on your direct about the calculations that are contained in Appendix A to your report. Do you recall that?
A. Appendix A? Yes.
Q. And that single cylindrical flow path you modeled through the shoe track doesn't actually reflect the reality of the assumptions you make regarding the shoe track; is that right?
A. This is right, it was just being used for calculation purposes.
Q. Dr. Griffiths doesn't contend that there's a single cylindrical flow path through the shoe track, right?
A. He was not mentioning this, no.
Q. In fact, he doesn't posit any particular flow path for the shoe track, does he?
A. I don't think so, no, but regarding this question whether it's a single capillary type flow path or it's that net of cracks and pores and etc., I said this is not the point in terms of my calculation in Appendix A. The point is the total cross section, this is open to the flow and I can model that cross section by using one capillary -- that is what I did -- or I can use 10, 20, or whatever cracks and voids providing the same cross section.
So for doing calculations for simplifying the calculation process, I did this and this is physically sound, there is no doubt about it.
Q. But you don't have any specific evidence of what this

network of cracks and pores you describe in your report actually is? That's all an assumption?

A. Well, this is an assumption, yes.

Q. Now, when you do this calculation, you looked -- earlier you looked at your report and you had two different diameters of that cylindrical flow path. One was, I believe, 2.14 inches and one was 2 point -- 2.17 inches and 2.64 inches. Do you recall that from your report?

A. I think those numbers are right, yes.

Q. That less-than-half-an-inch difference between the diameters of those flow paths resulted in over a doubling of the flow rate; is that right?

A. Well, it refers to the difference in flow rate between 9:00 and 9:30, which is, I think, 12 standard barrels per minute and 27, yes.

Q. Which is over 17,000 stock tank barrels per day to over 38,000 stock tank barrels per day?

A. Maybe. I did not follow your calculation now.

Q. Now, in performing that calculation, you also made an assumption about productivity index scaling linearly to the exposed reservoir. Do you recall that?

A. Actually, this is not an assumption. This is a procedure that has been used by Mr. Emilsen. For example, he did as well linearly scaling the productivity index with the reservoir height. Dr. Griffiths particularly did it as well in estimating his erosion time. So this is actually a procedure that is used throughout the case by experts.

Q. But you never used this procedure before?

A. No.

MR. CERNICH: Your Honor, I have questions for cross-examination regarding the theory -- the hydraulic fragmentation theory that I objected to earlier. I would be happy to just skip those, but I would request that that new opinion be stricken from Dr. Momber's report and redacted if I'm not allowed to explore that on cross-examination.

MS. O'CONNOR: Your Honor, the hydraulic fragmentation opinion is in Dr. Momber's report. It's not a new opinion and it's specifically responsive to the footnote in Dr. Griffiths' report that we showed about the nine hours and his basis for the nine hours.

THE COURT: All right. Well, then, I guess I have to let Mr. Cernich ask his questions.

BY MR. CERNICH:

Q. Now, you contend that the over twofold increase in flow rates between 2130 and 2142 on April 20 results from a process called hydraulic fragmentation; isn't that right?

A. This is right, yes. And the thing is that this increase in flow rate related to the PI numbers occurred rather instantaneously -- is this the right word? -- in a stepwise fashion. It does not occur in a linear scale as being

04:01 mentioned by Dr. Griffiths. And this instantaneously increase in the flow rate could not be explained by any erosion process and so I put forward an alternative scenario. And, right, yes, this is the so-called "hydraulic fragmentation."

Q. You opine that this occurred before the hydrocarbons even reached the BOP on April 20, 2010; isn't that right?

A. I don't know. I assumed that to be happening at 9:30 at night.

Q. Well, Mr. Emilsen, who testified in Phase One, testified that the gas reached the surface at 2146. So that's before 2142; is that right?

A. Okay. Uh-huh.

MR. CERNICH: Your Honor, I would move to strike the theory of hydraulic fragmentation again, based on the fact that this theory that Professor Momber is putting forward occurred prior to the blowout and this is Phase One testimony. No one -- the words "hydraulic fragmentation" weren't uttered, as far as I am aware of, in Phase One at any point.

MS. O'CONNOR: Your Honor, this hydraulic fragmentation explanation is specifically responsive to the discussion in Dr. Griffiths' report at pages 11 and 12, where he posits that the change that occurred at 2130 -- or 9:30 -- on April 20 is the basis for him extrapolating out an erosion rate that allows him to conclude that cement erosion and all other erosion had completed by nine hours.

THE COURT: All right. All right. I'm not going to strike it.

Go ahead, Mr. Cernich. Continue.

BY MR. CERNICH:

Q. Now, in order -- as part of your calculation or your opinion regarding this hydraulic fragmentation, you were referring back to the work of BP's Phase One expert Morten Emilsen; isn't that correct?

A. Yes.

Q. That's where -- I believe you testified a few moments ago that's where this increase in net pay assumption came from?

A. I didn't get the question, I think, or the content of the question.

Q. The increase in net pay that was described by Mr. Emilsen in his Phase One report is the time period that you're trying to represent with this hydraulic fragmentation?

A. This instant change at about 9:30 from 13 feet up to 16.5 feet, yes, that must have been incurred by a sudden event, not something like an erosion process. That is actually my point.

Q. Now, are you aware that Mr. Emilsen testified during the Phase One trial that this increase in net pay resulted from washout?

A. I can't remember exactly.

MR. CERNICH: Can we go to Mr. Emilsen's Phase One trial testimony?

MS. O'CONNOR: Objection, Your Honor. We are again getting into the Phase One trial testimony and Phase One record that Mr. Cernich has objected to putting up the actual evidence of testimony in Phase One. We would object to that.

MR. CERNICH: Your Honor, Dr. Momber is trying to rewrite the Phase One record, and his opinion in this case is contradicted by the Phase One testimony of Mr. Emilsen.

THE COURT: Why don't you just point that out when you have a chance to brief it to me. We don't have to retry that here.

Okay. I sustain the objection.

BY MR. CERNICH:

Q. Dr. Momber, you have never performed any hydraulic fragmentation experiments inside of a confined pipe, have you?

A. No.

Q. You performed some calculations to translate some of your past work on hydraulic fragmentation to your work on the Macondo well; isn't that right?

A. That was too quick, sorry. Can you please repeat?

Q. Yes. You performed some calculations to translate some of your past work on hydraulic fragmentation to your work on the Macondo well?

A. Yes.

Q. And you used those calculations to confirm your opinions in this case?

A. Those calculations would support my opinion, yes.

Q. But those calculations weren't contained in your report?

A. In my report? No.

Q. They weren't produced with any of the materials that were produced to the parties along with your report?

A. No.

Q. You also did another calculation of the specific energy it would take to hydraulically fragment 189 feet of cement in the Macondo shoe track; isn't that right?

A. No, this is not another one; this is the one you just mentioned.

Q. So that's the same calculation?

A. Uh-huh.

MR. CERNICH: If we could go to Table 6.1 of Dr. Momber's report.

BY MR. CERNICH:

Q. I would like to briefly discuss a few of the references you have in that report. This is TREX-11644.016.

Dr. Momber, none of these experimental results you reference here in your report relate to well cement; is that correct?

A. Yeah, that's correct.

Q. They are all some type of construction concrete?

A. They are some type of construction concrete containing

04:07 different types and different sizes of aggregate materials.
04:07 **Q.** None of these were tested in a way that replicates the conditions on the Macondo well?
04:07 **A.** They were all tested in terms of slurry and high-speed liquid erosion.
04:08 **Q.** But none of them were tested in a combined wellbore with a metal pipe, correct?
04:08 **A.** Right.
04:08 **MR. CERNICH:** If we could go to TREX-11647, please.
04:08 **BY MR. CERNICH:**
04:08 **Q.** This paper by Dr. Binici, "Effect of Crushed Ceramic and Basaltic Pumice as Fine Aggregates on Concrete Mortars Properties," that's one of the references you cite in your report?
04:08 **A.** Yes.
04:08 **Q.** This study examines concretes made with crushed ceramic and crushed basaltic pumice; is that right?
04:08 **A.** This is right, yes.
04:08 **Q.** But the Macondo cement contained neither of those substances?
04:08 **A.** No.
04:08 **MR. CERNICH:** Could we go to 11648.0001.
04:08 **BY MR. CERNICH:**
04:08 **Q.** This is a paper titled "Hydraulic Erosion of Concrete by a Submerged Jet" from 2001, and this is another one of the

references in Table 6.1 in your report?
A. Yes.
Q. This deals with hydraulic erosion of concrete in civil engineering and marine engineering applications; is that right?
A. I think so. Did you just read it from the paper?
Q. Yes.
MR. CERNICH: If we could go to the call-out.
BY MR. CERNICH:
Q. Do you see the "Hydraulic erosion of concrete is often found in civil and marine engineering construction"?
A. Right.
Q. That's the type of concrete that this paper is dealing with?
A. Yes.
Q. The Macondo cement isn't a civil engineering or marine engineering application, is it?
A. No, it is not.
Q. You don't know what the components of the concrete mixture are in this paper, correct?
A. I can't remember on this particular paper.
Q. Do you recall --
A. Maybe we can check it out. I can't remember.
Q. Do you recall that the components of the concrete mixture aren't actually listed in the paper?
A. I'm not sure.

MR. CERNICH: Could we go back from the call-out, please, back to the full page. Can we call out this section right here, please.

BY MR. CERNICH:

Q. Here, it says: "The angle of attack is of fundamental importance in predicting the hydraulic erosion of a concrete construction in an engineering application."

Did I read that correctly?

A. Yes.

Q. But nowhere in your report do you compare the angle of attack of the Macondo cement to the concrete in the study, do you?

A. Well, the angle of attack in the Macondo well is not a known parameter, particularly if you consider the situation of the flow path -- the locations and the structure of the flow paths in that cement, there is no way to define any particular angle of attack.

And the more than 200 erosion situations I discussed in my paper, they cover a wide range of angle of attacks starting from very shallow ones up to particular angles. So the unknown situation that many angles of impingement could occur in the Macondo well because of the structure of the flow path is very, very represented by the numbers I cited in my report, the same as with other inferencing parameters like the flow speed as another example.

Q. But you agree that the angle of attack is of fundamental importance in predicting the hydraulic erosion of concrete?

A. I agree on this and I mention again I considered the changes in angle of impingement by investigating papers that -- at varying angles of impingement.

MR. CERNICH: Could we go to 11649, please.

BY MR. CERNICH:

Q. This is another paper you reference in your report, titled "Abrasion Erosion of Concrete by Water-Borne Sand."

Did I read that correctly?

A. Yes.

Q. This paper is dated 2006?

A. Yes.

Q. This is the paper that you cite in Table 6.1 of your report that you say is closest to the specific erosion scenario on the Macondo well, correct?

A. Yeah.

Q. This study doesn't examine well cement, does it?

A. No.

Q. In fact, it investigates hydraulic structures like spillway aprons and spilling basins?

A. It investigated cement-based composite, and again I might stress this point: These are the materials, the cement-based materials -- you call them "concrete" -- that are closest to the material in the Macondo well, what you call a "well cement." They might differ in one or the other parameter; for example, the aggregate size. That's okay, but those are the closest one and they are close in some way to the well cement.

And again, considering concrete materials with the large aggregate is a conservative approach because this type of material, under slurry erosion condition, will erode faster than the material type -- as you call "the well cement" -- which is very fine particles creating a very dense structure. That's actually the point.

I agree completely the mixtures are not equal, but by investigating concrete materials with large aggregate, I feel very comfortable to be on the conservative side. That's actually the point.

Q. The authors here actually investigated slabs of construction concrete; isn't that right?

A. Sorry?

Q. The authors of this article investigated slabs of construction concrete?

A. All right. Uh-huh.

Q. Do you agree with that?

A. I agree with that.

Q. And the components of the material used in this study included fly ash; do you recall that?

A. Yes.

Q. And river sand?

A. Yes.
Q. And crushed basalt coarse aggregate?
A. Yes.
Q. And a super-plasticizer?
A. Yes.
Q. And none of those components were components of the Macondo cement, were they?
A. No, but I might refer to my direct examination here and might repeat: The particular composition where it plays a role regarding the erosion resistance, but it's finally the compressive strengths that counts as a resistance parameter. That's what I was using as a resistance parameter against the erosion of these materials.
Q. So you were comparing compressive strengths?
A. Yes.
Q. You were comparing compressive strengths of the concretes that were listed in Table 6.1 with the Chevron report that you reference in your expert report?
A. As an example. And it is well known in many erosion studies, not just for slurry erosion but for other erosion types as well, that the compressive strength is a parameter that can characterize the erosion resistance of cement-based material. And particularly the study of Liu, et al., showed that very clear changes in the compressive strengths will change erosion rates. It's a very well-known engineering

approach from erosion science and engineering.

Q. Now, in this paper, Dr. Momber, the concrete that was tested was cured for 28 and 56 days in a humidity-controlled room; isn't that right?

A. Right. Maybe. I just trust you, what you said.

Q. And, but the Macondo cement was only in place for about 16 hours before the negative pressure test, correct?

A. Yeah, I think that's correct.

Q. Could we go to Figure 3?

A. Sorry. This is not the time frame I was using for comparing the erosion results. It is not about 16 hours after the cement has been placed. I'm talking about the time period 21 hours after the cement-placing process has been done. So I'm talking not about this time period.

Q. Okay. So 21 hours, you would agree, is a lot less than 28 or 56 days?

A. This is right, but, again, the curing or the hardening time changes in hardening time. What does it mean? It just means that compressive strengths changed. I did not refer to whether the cement has been hardened for 20 hours or 20 days because this is not important. Important is actually what was the compressive strengths after those time periods. Those are the numbers I used, and it is not important how long the curing time took.

Q. You don't know what the compressive strength of the cement at the bottom of the Macondo well was for the time period that you are examining, do you?

A. I don't know that and anyone else wouldn't know that.

Q. You don't know if it had zero compressive strength? You don't know. You don't know anything about the condition of the shoe track cement? Isn't that what you testified about earlier?

A. Well, I know the compressive testing strength testing results from the sources we just discussed from Halliburton and from Chevron. And those testing scenarios were designed to be as close as possible to the situation in the Macondo well in terms of the pressure, in terms of the temperature, in terms of the temperature ramp. So those are numbers I really could use that gives me a feeling about compressive strength numbers I could expect. I do not know the precise numbers. No one else knows it. But I have numbers available that would tell me, Okay, if it's that low, that maybe any erosion process would be obvious, but that was not the case. So there is information available.

Q. But all of that is your gloss going back and looking at the evidence from Phase One and forming your own new opinions about what you think, Dr. Momber, about the compressive strength of the Macondo cement?

MS. O'CONNOR: Objection, Your Honor. He has made clear that he started his analysis with the assumption as to the set cement, and he has not actually been permitted to testify about Phase One evidence. So he has not put any "gloss" on it, and we would object to that question.

MR. CERNICH: Your Honor, Dr. Momber just testified that he used the Halliburton test results and the Chevron test results to form his opinions regarding the Macondo cement in this case. I would again move to strike those opinions.

THE COURT: Did you make your own analysis of the compressive strength of the cement? Or did you just take something that you got from this Chevron report?

THE WITNESS: I just took the numbers from the Chevron report. I did not --

THE COURT: Sustain the objection.

MR. CERNICH: Let me ask my question again, Dr. Momber.

BY MR. CERNICH:

Q. You don't know the compressive strength of the cement at the bottom of the Macondo well?

THE COURT: I think he just answered that question by answering my question.

MR. CERNICH: Okay. Thank you.

BY MR. CERNICH:

Q. Now, just a couple more things on this article.

Figure 3 in this article, this is a diagram of the process that was used for the experiment on the concrete slabs in this case, right?

A. Yes.

Q. You would agree that this doesn't replicate the conditions at the bottom of the Macondo well?

A. Not precisely, and I do not believe that any test you would develop in terms of erosion could a hundred percent duplicate the situation in the Macondo well in terms of erosion because that was just not known. This is a scenario very well replicating a slurry erosion process of a cement-based surface by a mixture of, in that case, water and some sand in it.

MR. CERNICH: One more thing on this article. Could we go to 11649.0007. Here in the conclusions -- if we could call out the "Conclusions" section here, please.

BY MR. CERNICH:

Q. The author here writes: "Test Data - the data obtained indicated that the splitting tensile strength is a more effective predictive factor than compressive and flexural strength in determining concrete abrasion erosion resistance to water-borne sand."

Did I read that correctly?

A. Yes.

Q. You didn't do anything to quantify the splitting tensile strength of the cement that was used on the Macondo well, did you?

A. No.

But he didn't say that the compressive strength does not have any meaning. I just want to make that clear.

Q. But it did say it's a more effective predictive factor than compressive --

A. More effective, but compressive strength itself is also effective.

Q. One more item, Dr. Momber. You -- during your direct examination, you said that you could compare the Macondo cement to the concrete that you've worked with because it contained -- the Macondo cement contained sand and you described that as an aggregate, correct?

A. I'm not sure what I said. It's sand, but it's a silica blend.

Q. It's a silica blend. Okay.

And that silica blend is a very fine silica blend?

A. That's right.

Q. There's silica flour, correct?

A. Yeah.

Q. And 200 mesh silica sand, right?

A. 200 mesh and I think also 100 mesh.

Q. You have never used silica flour in any of your experimental work on concretes, have you?

A. No, I think that's not right. In the technology called high-strength concrete, a material is called silica dust -- I think this is the same material you're talking about -- is being added to the concrete material in order to increase its strength. And I remember at least one study I did on the erosion of such a material which contained that silica dust is just another designation. A study I performed and I think I even published the results.

Q. Did you recall that study since your deposition?

A. I'm not sure what I mentioned -- I'm not sure whether you asked me even that.

MR. CERNICH: Could we go to Dr. Momber's deposition at page 338. If we could go to lines 12 through 23.

I have the wrong citation. Can we go to 338 of Dr. Momber's deposition at line 15.

BY MR. CERNICH:

Q. Here we go.

"**QUESTION:** Have you ever used silica flour in any of your experimental work on concretes?

"**ANSWER:** No, I haven't used this particular material, but I was dealing with small aggregate."

Do you recall giving that answer at your deposition?

A. Yeah. I certainly have given that answer and I probably was not, at that particular moment, aware that with the -- recalling small aggregate where it was, in fact, that silica dust, but now it came back in my mind.

Q. As far as 200-mesh sand, you have only used that in cavitation erosion experiments; is that right?

A. Right.

Q. But the erosion process you propose for the Macondo cement is not cavitation erosion, is it?

A. This is right.

MR. CERNICH: Thank you, Dr. Momber. That's all I have.

THE COURT: Thank you.

Any redirect?

MS. O'CONNOR: No, Your Honor.

THE COURT: Thank you. Okay, sir, you are finished.

THE WITNESS: Thank you very much.

THE COURT: BP and Anadarko may call their next witness.

MR. BROCK: Yes, Your Honor, our next witness is Dr. Adrian Johnson and he is in the hall and we will get him. Actually he is in the back of the courtroom, even better, but he's on his way up here.

ADRIAN JOHNSON,

having been duly sworn, testified as follows:

THE DEPUTY CLERK: State your full name and correct spelling for the record, please.

THE WITNESS: My name is Adrian Johnson, and it's spelled A-D-R-I-A-N J-O-H-N-S-O-N.

VOIR DIRE

BY MR. REGAN:

Q. Matt Regan on behalf of BP and Anadarko. And, Dr. Johnson, I have you on direct examination.

Dr. Johnson, where do you live?

A. I live just outside London in the UK.

Q. What do you do for a living?

A. I'm a consultant engineer. I'm consultancy manager for a consultancy and software company called FEESA, in Farmborough, in the UK.

Q. Dr. Johnson, were you retained as an expert to testify in this case, retained by BP and Anadarko?

A. I was, yes.

Q. Have you ever testified as an expert before?

A. I have not.

MR. REGAN: Can you put up D-24618.

BY MR. REGAN:

Q. Dr. Johnson, could you briefly describe your educational background for the Court.

A. Yeah, sure. I have a degree in mechanical engineering, specializing in maritime and offshore engineering. I went on from doing my degree to do a Ph.D. in mechanical engineering, where I studied complex turbulent flows. I also have -- I'm a chartered engineer, which I think is equivalent to a professional engineer in the United States. And a member of the Institute of Mechanical Engineers.

Q. Could you walk the Court briefly through your professional history or your professional background.

A. Yeah, sure. After my Ph.D. -- well, while writing up my Ph.D., I joined the oil and gas industry in 1989. I joined BP. I was there for 10 years, and in that time I spent about the first three years in research at BP Sunbury, where I was studying things such as the behavior of risers, drill pipes, drill pipe protectors, some erosion work, various bits of valve work and multiphase flow, that sort of thing.

Q. What did you do after leaving BP?

A. Well, after the research part of BP, about three years afterwards I went into the engineering side where I was basically doing consultancy work mainly, and it was looking at the thermal hydraulics of pipelines and production systems.

Q. Now, after you left BP, what did you do?

A. After leaving BP, I set up -- which was in 1999, I set up my own consultancy, and I worked for a number of different clients over an 11-year period looking at, again, thermal hydraulics of pipelines and production systems.

Q. When did you join your current employer, FEESA?

A. I joined FEESA in 2010 as consultancy manager.

Q. How would you describe, Dr. Johnson, the focus of your professional work in the oil and gas industry over this past 20 years?

A. The focus since after the research part was radiant hydraulics, thermal hydraulics of pipeline and production systems all the way through, always associated with the fluid behavior of oil and gas.

Q. Just to orient us, when you use the word "hydraulics" or "hydraulic behavior of oil and gas," what do you mean by that?

A. I mean the connection between the pressure flow rate and temperature of the flowing system, sometimes single-phase, sometimes multiphase. And it's all about tracking the physics of that -- of the fluids through whatever system we're studying.

Q. On the demonstrative and in your expert report, you talk about working in an area called "flow assurance." Could you explain what that means.

A. Yes. Flow assurance is looking at a flowing system, usually a production system, what we do at FEESA, to establish if there are going to be any thermal or hydraulic issues that need to be -- that the client needs to be made aware of.

Q. And again, by "flowing system," are you referring to the pipes and valves and other mechanical devices?

A. By "flowing system," I'm -- in a production context I'm referring -- we look at from the reservoir right up the well, through a network of flow lines potentially, or it could be a single flow line back to a production system, and up to some point maybe on the production system, like a floating production system.

Q. What type of projects will you typically work on in your current role at FEESA?

A. Most of what we do is production, oil and gas production. A lot of the work we do is at the early stage of projects, looking at the big questions, the multibillion-dollar questions. So how a system is going to work, whether it's going to work, how it's going to be put together.

And these vary from single well systems that might be in deep water or shallow water through to multiple well systems looking at hundreds of wells all tied together in a big network that could be -- some will be on land, some in deep water. It varies a great deal.

Q. Does your work include looking at existing systems, multiphase flow in existing systems in addition to looking at the design of systems?

A. Yes, it does, absolutely. We look at operating systems as well.

So our work will go right through from the very early stages, like, say, sometimes an appraisal where very little is known, right through to the operations where we are modeling the actual systems that are existing and looking at how they behave.

Q. Beyond your education, Dr. Johnson, and your professional experience, are there any particular tools that you will

typically use in this work?
A. Yes. In FEESA we have an in-house software called "Maximus," which is a detailed thermal hydraulic multiphase simulator. It has the capability to model flow through one well or all -- multiple wells, through complex networks. It has the ability to go through life of field, so it can step through the life of a field or, in this case, the 86 days.
So most of our work revolves around using Maximus for -- I think we have about 24 clients at the moment.
Q. What was Maximus developed to do? What is its purpose?
A. Its purpose is to do the software work I have just been describing and to model in detail the behavior of fluids in some oil and gas production system.
Q. What type of companies or clients would typically use FEESA or FEESA's Maximus software?
A. We do work for, like I say, about 24 clients at the moment. Companies, the oil and gas majors, such as Statoil, Chevron, ConocoPhillips, BP, Woodside, British Gas, those sorts of large companies.
We also do work for the engineering contract companies, Exodus, Genesis, those kinds of companies. And also some of the smaller consultancies as well.
Q. This Maximus simulator, is it the type of thing you can just buy off the shelf and go start using?
A. Oh, no. No. It's not Microsoft Word. You can't just

pick it up and start using it. It's a very complex piece of software that does some very complex analysis of the physics of flow through a system, and it's important to have training in its use.

Q. Has the Maximus simulator been field-tested and validated in the oil industry since its introduction?

A. Oh, yes. Yeah. We have validated it against numerous operating systems, numerous operating well systems as well.

Q. Just to be clear, it's not something you developed purely for purposes of this litigation?

A. Oh, no, no. We developed it at the incorporation of our company in 2001 and have been using it on many, many projects since then, yeah. It's what we do every day, is that sort of work.

Q. Dr. Johnson, could you let the Court know, what were you asked to do in this litigation?

A. I was asked to examine the work of Dr. Dykhuizen and Dr. Griffiths, their expert reports, and give technical comments on those.

Q. So I take it you looked at the expert reports that were submitted by Dr. Dykhuizen and Dr. Griffiths. Is that correct?

A. That's correct, yes.

Q. Did you use, again, any particular tools in your technical review?

A. I used Maximus because that's the tool we use, and we know it's a very accurate and reliable piece of software.

I also used some of their spreadsheets that they produced to do various calculations; and where they didn't produce spreadsheets to us, I recreated the calculations and did them that way.

Q. In your work for this matter, Dr. Johnson, did you go and physically look at or observe any of the evidence that was recovered from the Macondo well?

A. Yes. In September last year I went down to Michoud and looked at all the evidence in the various evidence yards down there.

Q. Material from the BOP and other material recovered?

A. I looked at all the drill pipes, all the rams, all the capping stack parts. I went up the cherry-picker and looked inside all the different housings in the BOP. I looked at all the erosion that's happening in there. I inspected the bore. I inspected the LMRP and saw all the materials, like Junk Shot materials, that were found in the BP.

Q. Dr. Johnson, have you prepared an expert report in this matter that contains your opinions?

A. I have, yes.

MR. REGAN: If we can bring up TREX-11488.

BY MR. REGAN:

Q. Are we displaying on the screen, Dr. Johnson, the cover page of your expert report in this matter?

A. Yes, you are.

MR. REGAN: Your Honor, at this time I would offer Dr. Johnson as an expert in multiphase thermal hydraulic modeling and the analysis of multiphase hydrocarbon flow in flow systems.

THE COURT: Any objection?

MR. CERNICH: Subject to cross, no objection.

THE COURT: All right. I'll accept him.

MR. REGAN: Your Honor, I will offer Dr. Johnson's expert report, TREX-11488.

THE COURT: That's admitted.

MR. REGAN: If we could pull up D-24703.

DIRECT EXAMINATION

BY MR. REGAN:

Q. Dr. Johnson, have you prepared a demonstrative that summarizes your expert report in substance here on one page?

A. Yes, I have. Yes.

Q. Can you briefly review the principal opinions you have reached in this matter.

A. Sure. Yes. Well, the top bullet point on there makes the overriding conclusion, really, of this work, that you can't use the government's hydraulic methods to get any kind of cumulative release estimate from the -- to any reasonable degree of engineering certainty.

There are many inputs that are needed into a hydraulic model, and those inputs in this case are changing through time. That puts huge uncertainty on the whole problem. Now, that uncertainty can't be handled by simply calculating what's going on on one day, on July 15, and then basically extrapolating that backwards over the 86 days.

Q. In addition to that first primary opinion that you have just set forth, did you reach some additional specific opinions about the work and opinions of Dr. Griffiths?

A. I did, yes. Yes.

Q. What are those?

A. Well, they are listed here. And Dr. Griffiths doesn't account for any variations in PI profile and he should have done to take account of uncertainty in this case. He is relying on PT-B data to do his calculations. He has no data between the 20th of April, at the time of the blowout, and 8th of May, when the first PT-B data appears. He extrapolates back from existing PT-B data, which has no physical basis.

He doesn't take account of the change in multiphase effects in the well. He knows what's going on on July 15 to some degree, but the changes that those multiphase effects will have going back in time in the dual flow paths have a significant effect on the trend in flow rate through that well. He didn't take account of that.

He also really doesn't validate his model in any way. He has no validation. He really hasn't got the data to validate it. He does present a validation, but it isn't really any validation.

Q. Similarly, in addition to your overall opinion, do you have some specific comments on the opinions of Dr. Dykhuizen?

A. Yes, I do. Yes.

Q. Could you briefly just highlight those for the Court before we get into detail.

A. Sure. Yeah. Well, on the bottom of the slide, there are two points there. Dr. Dykhuizen did a similar extrapolation back that Dr. Griffiths did from July 15 for his cumulative estimate. But he also did two point estimates using Top Hat flow rates and Top Kill flow rates.

Dr. Dykhuizen himself admits that his Top Hat flow rates -- I think I heard last Monday he said they were especially inaccurate. I totally agree with that.

The Top Kill flow rates, I think he said, were very inaccurate. I would go even further than that and say they were especially inaccurate as well.

Q. Dr. Johnson, could you briefly just explain, as we turn to some of the detail of your work, why does the oil industry use hydraulic models in looking at multiphase flow?

A. Well, the first point is we use hydraulic models that are used regularly throughout the industry because it's important to have something that's validated. When you are doing this sort of work where you are investigating what's gone on, you have to start on the right foot, you have to start from something that's clearly validated and is accepted in the industry.

But then what's going on in a well. Most wells are multiphase, almost all wells. And what's going on in a well is very complex. The multiphase behavior in a well, especially in this case where we have got dual flow paths, is very complex. And that needs to be modeled correctly to get all the correct effects.

Q. Now, in using models to look at an oil and gas well, are you trying to examine the physics of what's going on in the system?

A. That's right, yeah. We are trying to look at the physics of what's going on in the system and track that physics, track what's happening to the fluids as we go through a well or through any other flowing system.

Q. The Court has heard from a number of witnesses about pressure drops and changes in pressure drops and temperatures. But just briefly in your own words could you explain what you mean by trying to track the physics of flow through a system.

A. Sure. What we are primarily -- well, what we are interested in in this case, of course, is, what is the flow out of the reservoir? That's our question.

To get that, what we need to know is what is the back pressure on the reservoir; and to know that, we need to know what the pressure drops are as we go up the well. And to know that, we need to fully model the physics of the fluids as we go up the well and take account of any detailed geometry as we go up the well, such as the dual flow paths created by the drill pipe in the well.

Q. Are there different kinds of physical pressure losses or drops that are occurring in a vertical well like Macondo?

A. There are, yes. The pressure drops -- there are various pressure drop components in the calculation. They are the gravitational pressure drop, which is the pressure drop that occurs purely because of elevation change and density differences in the fluids. There's a frictional pressure drop, which occurs because of interfacial slip of fluids over either surfaces or over each other. And also included in that are turbulent losses. And then there's the accelerational pressure drops, which are caused by fluids when they accelerate for some reason.

Q. These three general types of pressure drops -- gravitational, frictional, and accelerational -- do they relate to one another?

A. Yeah, absolutely. You have to calculate them all at the same time because as we move up that well, all of these things are changing, and they all affect each other. So we need to be calculating all three of those simultaneously as we integrate up the well.

Q. Is that what is happening in the models? You are trying to make all of these calculations at the same time? Is that why they were developed?
A. That's right, yes. So we are doing that full integration across whatever the system is simultaneously, yes, so that we get the correct answer.
Q. Dr. Johnson, did Dr. Griffiths use an industry standard model to arrive at his cumulative estimate?
A. No, he didn't. No.
Q. Did Dr. Dykhuizen use an industry standard hydraulic model to arrive at his cumulative estimate?
A. No, he didn't. No.
Q. In your work, did you prepare a thermal hydraulic model to aid you in reaching your opinions?
A. I did, yes. I prepared a Maximus model as part of the work.
Q. Can you just explain briefly, how did you use your thermal model, your hydraulic model in your work for this case?
A. The Maximus model -- or models, should I say -- we did six of them, I think -- or five or six -- were used to compare primarily with Dr. Griffiths' work.
Q. Why did you use an industry standard model rather than develop a custom approach for this problem?
A. There's a lot of uncertainty in this whole problem. I mean, that is the great thing -- I'm sorry, not great. That's

the wrong word to use -- but that is the big thing about the Macondo case, is that there is an enormous amount of uncertainty.

The only way to check what the impact of that uncertainty is on how much oil came out of that well is to use a detailed thermal hydraulic model in which you can adjust various input parameters and test out the effects of that uncertainty. And, of course, like we said before, you know, Maximus is validated, so we don't have to worry about the fact that it's doing the right thing. We know that from many projects.

Q. Let's then turn just in a very general way to what you modeled.

MR. REGAN: Can we bring up D-23398.

BY MR. REGAN:

Q. Now, Dr. Johnson, as you see here in this demonstrative D-23398, does this represent the type of information that you need in your work to try to prepare an accurate flow rate estimate using hydraulic methods?

A. Yes. Yes, it does. Yes.

Q. Could you explain to the Court, orient us in terms of what you have put together here on this slide.

A. Sure. Well, in the middle we have here a schematic of the well. We are interested in this primary flow path of the production casing. Also in there, of course, we have a drill pipe.

Now, our big question is: How much oil is coming out of this reservoir? That's what we want to know, the mass flow rate of oil coming out of the reservoir.

As that oil is traveling up the well -- and we've represented it by this yellow line here -- it travels up the well, the conditions of that oil change, the phases of that oil change, the flow regimes change. And then it reaches the bottom of the drill pipe, and at that point we've got two flow paths through which it can go. It can either go up the drill pipe or it can go up the annulus. So the flow splits at that point.

On the left-hand side we have all the inputs we require to this model to do a rigorous accurate model of this system.

On the right-hand side we have all the effects, the various inputs and changes through the system going to have, so they're the changes as that oil and gas moves up the well.

Q. We won't go through each of the elements on the chart, but, for example, when you talk about flow path geometry or flow path characteristics, what are you referring to there?

A. Well, of course, one of the first things we need to do in building a model is know all the sizes, all the lengths, all the diameters of the drill pipe and the casing. Because we have an annulus in there, which is the space between the drill pipe and the production casing. That's far more restrictive than an equivalent cross-sectional area would be because you have got the surfaces over which the fluid is flowing are far greater than they would be for a simple pipe. So we need to take that sort of thing into account.

Q. How about the issue of -- you have on there "hydraulic diameter." What is that referring to?

A. As I say, that refers to the annulus and how we handle the annulus. We use a standard method that we have been doing for years, you can find in many, many textbooks.

Q. Why does temperature matter?

A. Temperature matters because as the fluids travel up the well, the temperature changes and the pressure changes. As the pressure and temperature changes, the phases will change. So you get gas coming out of solution, you'll get the fluids speeding up, you'll get phase changes, which cause flow regime changes. And all of these things lead to pressure changes and also temperature changes as well. As gas expands you get a temperature drop just due to that.

So it's very important to get the temperature right to enable you to model properly what the fluids are doing as you move up that well. And then that has an effect on the pressure, which has an effect on the back pressure on the reservoir, which ultimately has an effect on how much oil is coming out of that reservoir.

Q. You also have an input for fluids, and you have composition or equation of state. Briefly, what do you mean by fluids as an input?

A. By "fluids" we mean we need a composition, as you say. It's all the materials that are in a particular oil and gas. So it's describing all the different components. And we need an equation of state to dictate -- to model how those fluids are going to react to changes in pressure, temperature, volume. And this all has an enormous impact on what happens as we go up the well, which has an enormous impact on the pressure drops in the well, which has an enormous impact on how much oil comes out of the reservoir.

Q. The fluids at some point in the flow path are multiphase; is that correct?

A. Yes.

Q. Have you prepared a demonstrative to try to illustrate for the Court what multiphase behavior you might see in this well?

A. I have, yes.

MR. REGAN: If we could pull up D-23396A.

BY MR. REGAN:

Q. Dr. Johnson, what are we looking at here on this demonstrative?

A. What this is, on the right-hand side of this demonstrative we have a schematic of -- schematic animation of what goes on in the Macondo well. On the outside we have the production casing. This here you can see is the drill pipe within the production casing.

As the oil comes up from the reservoir, it starts off single phase, so it's just all oil. As pressures and temperatures change as we move up this well, the gas starts to come out of the oil as we move through the bubble point, and you can see that represented here as bubbles.

As we go further up, more bubbles come out. The bubbles start to coalesce as the pressures and temperatures change again until you get to the point you've got so much gas that it changes the flow regime from a bubble flow regime to an annular flow regime.

In an annular flow regime we have gas going up the central core, often at very high velocity; we have oil going up the walls, and sometimes, under certain conditions, going down the walls as well. And we have oil droplets in the gas core, and those oil droplets are coming off the walls and going back onto the walls.

Now, in this you can see here we have the two flow paths, and those two flow paths, you can get different behaviors in them. And that affects the pressure across that drill pipe annulus section, which obviously, as I have said before, affects the pressure at the bottom of the well, which affects the amount of oil coming up the well.

You can see here we have depicted different velocities going through the drill pipe and annulus, and that's because, like I say, you have different conditions in those two flow paths.

Q. How, Dr. Johnson, do you then account for these type of complicated phenomena when you are trying to model a flow system?

A. We use industry-standard tools to do it. It's a very complex system to model, so we need to use a rigorous thermal hydraulic validated model to do it.

MR. REGAN: If we can go back, then, to D-23398.

BY MR. REGAN:

Q. Dr. Johnson, what you have on the right side here of the page is entitled "The Effect of Inputs on the Physics of Multiphase Flow."

A. Uh-huh.

Q. Can you just briefly relate what we just saw in terms of your animation to what you are representing here?

A. Yes. So as we move up the well and go from single phase to bubble and then bubble to annular flow, we are having phase changes in there. So we are getting gas coming out of the oil.

Those changes from bubble to annular, etc., are flow regime changes. They are examples of different flow regimes. Those affect the changes in pressure in the well. They affect the changes in temperature in the well as well as heat loss to the surroundings of the well, of course. And all the pressures and temperatures are affecting fluid properties.

Now, all of these things that you see here in yellow, they are all very interactive. You can't just say one leads to the other, which leads to the other. They all affect each other, and they all need to be modeled in detail to capture the physics of that flow as it travels up the well.

Q. Dr. Johnson, would you need clarity of these inputs to model the flow rate for just a single point in time?

A. Yes, you would. Yes, yes.

Q. What if you were attempting to use hydraulic methods to model flow over a long period of time? What additional complications does that lead to in hydraulic modeling?

A. Well, in this case we have lots of changes in the system. We have geometric changes, we have temperature changes, we potentially have flow path characteristic changes, productivity index changes, pressure changes.

So you need to do a rigorous model for each point in time that you are going to try and calculate a flow rate.

Q. In your opinion, Dr. Johnson, is there sufficient information available from Macondo during the 86-day time period to arrive at a reliable and accurate calculation or estimate using this type of method?

A. There's not really. There's a lot of information available, but there's a lot of uncertainty around that information. And that's the real problem here, is trying to get a good range or a tight range of outputs from a wide range of inputs is just not possible.

Q. Dr. Johnson, are you offering an opinion about what the actual total cumulative number of barrels released from Macondo was?

A. No, I'm not.

Q. Why not?

A. Because I don't believe it can be done using hydraulic methods for the well alone.

Q. Is it your opinion, Dr. Johnson, that there were changes over time at Macondo?

A. Oh, undoubtedly, yes.

Q. Have you prepared a demonstrative that identifies some of the changes that you have appreciated from your review of the records?

A. I have, yes.

Q. Have you prepared a demonstrative that identifies some of the changes that you have appreciated from your review of the records?

A. I have, yes.

MR. REGAN: If we could call up D-24656.

BY MR. REGAN:

Q. If we can kind of take this demonstrative in thirds, Dr. Johnson. Could you first explain, what have you put forth here on the top third of your demonstrative?

A. The top third of the demonstrative indicates all the things we know something about. We are fairly certain when they occurred and what occurred. So we know we have a good handle on what the PI was at the time of the blowout. We have a reasonable handle on what the PI was at the end of the incident on July 15. We know Top Kill occurred. We know rams were activated, those sorts of things.

Q. What do you have represented, then, in the middle third of Demonstrative 24656?

A. The middle third shows all the uncertainty really. It shows the things we know something about but we don't know everything, so changes are happening over time to these things.

Q. Can you give the Court just a few examples that you have listed here?

A. Well, a prime example is the top one, which is the PI profile over time. We know that PI was about 10 -- well, 9.4 at the time of the blowout. We get that evidence from Mr. Emilsen's work, Appendix W of the Bly report. We know the PI at the end of the incident on July 15 was much greater than that, somewhere 40, 50, somewhere in that range. I don't think there's an awful lot of dispute of this sort of change. But what we don't know is how it changed between those two points. Great uncertainty on that.

Q. By PI -- we will talk about it in a minute -- you are referring to productivity index?

A. Productivity index, yes. So it's the measure of how much is going to come out of a reservoir for a given pressure drop over the reservoir to the bottom hole.

Q. What are some of the other uncertainties that you identify as you look at this problem?

A. Well, looking at PT-B data, for example, one of the problems there is we don't have any PT-B data prior to May 8 and then when we do have PT-B data, determining what that PT-B data means is not possible. It reflects everything that's going on in the system, so you can't say what a change means there.

Q. You reference erosion in the wellbore, erosion in the BOP, and the Court has heard today from some other experts on those topics, so let's go to the next one.

Drill pipe -- detachment of drill pipe dropped, what are you referring to there?

A. Well, we know the drill pipe that was going through the BOP and -- about 3,000-odd feet down into the well. We know that detached from the bottom of the BOP at some point in time. Indications seem to be that it detached probably by Top Kill or during Top Kill, but that's uncertain. Then once detached, what happened to it? When did it drop?

We know it dropped by the end of the incident because we found it further down the well by lead impression block tests, but when it happened, we don't know, and whether it moved around in the well, we don't know even.

Q. Let's pull up D-24631 on this topic you just mentioned about drill pipe location.

MR. REGAN: D-24631.

BY MR. REGAN:

Q. What we have here are some pictures of a drill pipe -- let me -- Dr. Johnson, why don't you explain to the Court, what are we looking at here?

A. What we have here is on the left we have a picture from my report which I took when visiting Michoud. This is the bottom of the section of drill pipe that was found in the BOP going from the bottom of the BOP up to the casing shear ram. They call it Drill Pipe 148.

As you can see, the rest of the drill pipe is detached and we can tell from this that there was some flow over the drill pipe for some time after it detached because all these edges are smoothed off. So we know there was an erosive flow over that after that drill pipe detached.

Q. What do you have here on the right side of the page?

A. The right side of the page is a picture -- again, it's in my report, but it's taken from a slide pack that was produced after the -- what we call the fishing exercise with a lead impression block where they dropped a block filled with lead down into the well to find what was down there. And they found that -- at a certain depth they found the top of the drill pipe, and that's represented by the drill pipe sitting here partway down the well.

Q. That operation that you just described, that took place in September after the well was killed, correct?

A. That's right, yes. So it's after the well has stopped flowing.

Q. If you could bring this back to hydraulic analysis. What's the impact of the drill pipe dropping at some point in time on a hydraulic analysis?

A. It's an uncertainty. We don't know when it happened, whether it happened consistently, so whether it dropped and stayed there or whether it came back up. But it's a restriction in the well, a changing restriction in the well and a change of those flow paths in the well, the dual flow paths we talked about. And that's all going to affect the physics of the flow, which is going to affect the back pressure on the reservoir, which is going to affect the amount of oil that comes out of the reservoir.

MR. REGAN: If we could go back to D-24656.

BY MR. REGAN:

Q. You also list on here "impact of Top Kill Junk Shot on BOP." What does that refer to?

A. Well, 26th of May to the 28th of May, there were three Top Kill attempts. During those Top Kill attempts, they injected Junk Shots where they were putting various sizes, shapes, and hardnesses of material into the BOP, pumping them into the BOP in an attempt to block the BOP. The idea is they wanted to change the restriction in the BOP.

MR. REGAN: If we could pull up D-23410.

BY MR. REGAN:

Q. What are we seeing here on this demonstrative, Dr. Johnson?

A. Well, on the left you see a picture of the BOP and LMRP. And down here we have -- the little red box is where Drill Pipe 148 that I referred to was sitting when the BOP was recovered.

The pictures on the right, they all show -- they are my pictures I took at Michoud of all the Junk Shot material that was found in that Drill Pipe 148, like I say, various sizes, shapes, hardness of materials. Also up there there's what appears to be cement that was found in Drill Pipe 148, suggesting possibly that the bottom hole was still changing fairly late in the incident.

Q. Okay. Sorry.

A. I was going to say also, this is just a small sample of the contents of the BOP. Sitting to the left of these pictures in the container at Michoud, there was some -- probably 40 buckets full, these plastic buckets full of Junk Shot material that were recovered from the BOP.

Q. From the standpoint of someone looking to do a hydraulic calculation of cumulative flow, what's the impact of 40 buckets of Junk Shot material being found in the BOP after it was recovered?

A. Again, it's uncertainty. We don't know -- obviously that was all there at the end, but we don't know how much was there at various points between Top Kill and the end of the incident and how that changed over time. We don't know how the Junk Shot moved around in the BOP and changed restrictions in the BOP. So it just adds uncertainty to what's going on.

Q. Was there Junk Shot material found inside the drill pipe that was in the BOP?

A. Yes. As I say, in Drill Pipe 148, yes.

Q. Was there additional material other than Junk Shot material found inside that drill pipe?

A. Oh, yes, there was. There was -- yeah.

Q. Did you take a picture of that?

A. I did. Yeah. Very nice picture.

MR. REGAN: D-23411. I think we have a zoom on this. There we are.

BY MR. REGAN:

Q. All right, Dr. Johnson. What are we looking at here?

A. Well, you remember the end of the drill pipe I showed earlier with the eroded end where the drill pipe in the well detached? Well, this is about a foot up inside that drill pipe. So they have chopped the end of the drill pipe off and you see a cut end there. And here you see one of the VBR or test ram elements or teeth that has fallen off -- it's probably from the test ram. It's fallen off and gone up inside the drill pipe and then gradually wedged itself harder and harder in there.

All of the Junk Shot material I've referred to and showed pictures of was above this test ram element. It was in that space above the test ram element between there and the casing shear ram. We also see here some Junk Shot material stuck in behind this test ram element, which suggests that things were moving around after the test ram fell apart.

Q. Again, Dr. Johnson, the fact that you see this physical evidence after the fact, what does it mean to someone doing a hydraulic analysis of flow over time?

A. Well, this drill pipe was a flow path at some point in time. We know that by virtue of the fact that there's erosion patterns on the bottom of the casing shear ram -- one of the casing shear ram blades. It's a very clear, circular pattern.

Now, when it's full of Junk Shot, as we -- as it is here or was, and when it's got parts of the test ram jammed in it, that is going to be a restriction on that flow path. So this is a change in the flow path over time that's occurring.

Q. Go back to D-24656, which is your timeline.

So, Dr. Johnson, how did Dr. Griffiths and Dr. Dykhuizen approach these uncertainties that you have just gone through in arriving at their cumulative flow estimates?

A. They didn't.

Q. What did Dr. Griffiths and Dr. -- how did Dr. Griffiths and Dr. Dykhuizen, in general terms, arrive at their cumulative flows?

A. What they did was they took data from the capping stack period on July 15, right at the end of incident here, a few hours of data, and did an analysis of that data. In Dr. Griffiths' case, he did sort of a curved fitting exercise to get a what he calls discharge coefficients throughout the system.

Dr. Dykhuizen did a number of capping stack analyses to get flow rates of the capping stack time. They then took those analyses and basically extrapolated them back in time using various assumptions, keeping pretty much everything constant apart from reservoir pressure and, in Dr. Griffiths' case, PT-B pressure as well.

Q. Does Dr. Dykhuizen's use of constant July 15 values resolve the uncertainties that you believe took place over the course of those 86 days?

A. No. It ignores them.

Q. Dr. Griffiths, does his use of a constant PI and a constant wellbore geometry, does that resolve the uncertainties that you have identified were present over 86 days?

A. No. Again, it pretty much ignores them.

Q. So what, then, is the impact of the assumptions made by Dr. Dykhuizen and Griffiths, these use of constant values, on the accuracy of the cumulative flow estimates that they have opined on?

A. Well, it means their estimates are going to be -- because they are using constants from the end, it means their estimates are going to be at the high end of an estimate. It means that their estimates are really very, very inaccurate.

Q. I would like to turn now to some of the more specific opinions you have about Dr. Griffiths' model or method.

MR. REGAN: If we could go to D-23400.

BY MR. REGAN:

Q. Now, in your review of Dr. Griffiths' method of arriving at a cumulative release, did he use flow path geometry changes as an input in his best estimate case?

A. No, he has no geometry inputs in his method.

Q. Did Dr. Griffiths use changes in flow path characteristics as an input in his best estimate case?

A. No, he has no input for flow path characteristics at all.

Q. Did Dr. Griffiths use temperature changes over time in arriving at his best estimate case?

A. No, he has no input for temperature in his method.

Q. Did Dr. Griffiths analyze changes in fluid properties over time in arriving at his best estimate case?

A. No, he didn't. He has no input for fluid properties.

Q. Did Dr. Griffiths study changes in multiphase flow over time in arriving at his best estimate case?

A. No, he didn't. No, he can't take account of multiphase changes through time.

Q. So with respect to what Dr. Griffiths did do, what did he do in using productivity index?

A. He calculated the productivity index for July 15, as I said a minute ago, from the set of data from the capping stack period, a few hours of data, and then kept that productivity index perfectly constant through the previous 86 days.

MR. REGAN: If we could turn, then, to D-24373.

BY MR. REGAN:

Q. Dr. Johnson, do you recognize what we have set forth here on D-24373?

A. Yes. On the left there, that's a diagram from Dr. Griffiths' own report.

Q. Could you briefly explain in your own words how Dr. Griffiths -- what methodology he used to try to arrive at a cumulative flow estimate as represented here on this demonstrative?

A. Excuse me. Yes. Like I say, he used the data from July 15, a few hours of data, and he calculated from a regression analysis a curve fitting, effectively. He calculated a series of discharge coefficients, which are shown here in these boxes. And so we have the productivity index, a discharge coefficient for the well, discharge coefficient for the BOP, and a couple of others further up.

Q. What data did Dr. Griffiths use or information to arrive at these unknown parameters?

A. The data from that July 15, a few hours of July 15 and a little bit on July 14.

Q. Once Dr. Griffiths arrived at these parameters, what did he do with them?

A. He locked them in basically. He kept them constant. So here we have -- sorry, one thing I did forget to mention, though. At the same time as calculating those parameters, he calculates the flow rates as well. But he locks the parameters in and keeps them constant back through time.

Q. So what well geometry do Dr. Griffiths' discharge coefficients represent?

A. The well geometry on July 15, whatever that was.

Q. What BOP conditions do Dr. Griffiths' discharge coefficients represent?

A. The BOP conditions on July 15, whatever that was.

Q. What drill pipe conditions do Dr. Griffiths' coefficients represent?

A. The same, the July 15 conditions.

Q. In your opinion, Dr. Johnson, would discharge coefficients estimates on July 15 inform you in any way about the state of the well on all the days prior to July 15?

A. No. No, not at all.

Q. So let's turn now to after Dr. Griffiths arrives at these July 15 constants, how does he then use them in arriving at a best estimate cumulative release figure?

A. What he does, he uses PT-B data and -- from May 8 to July 15 and he uses reservoir pressure linearly declining over the 86 days and he uses his K-well and his PI, keeping them fixed as he calculated them for July 15, and then just does a calculation based on those two pressures and those two constants.

Q. By using a fixed PI or productivity index and a fixed K-well, what assumption is Dr. Griffiths making in his best estimate?

A. He is assuming nothing changed in the well or the bottom hole or the reservoir. He feels that he is accounting for changes in the BOP by using PT-B data, but what he doesn't recognize is that that PT-B data is really showing all the changes throughout the system, not just BOP changes, and it -- but he's keeping all the other changes constant, so he is keeping all the other things constant.

Q. Let's turn to productivity index.

MR. REGAN: Can we bring up D-23394A.

BY MR. REGAN:

Q. Again, just for orientation purposes, can you again show us what are we talking about when we use this term "productivity index"?

A. The productivity index is basically how much oil the reservoir is going to produce into the bottom of the well. So with a far-field reservoir pressure and a bottom hole pressure, you can say what the flow from that reservoir is going to be.

Q. Now, you have mentioned a second ago that Dr. Griffiths holds this PI number constant in his best estimate. In your experience in working in the oil and gas industry and looking at these questions, would it be normal to have a PI remain constant in a flowing well?

A. We work with wells every day, and I can't think of a well where we have ever had a constant PI.

Q. Was there information available about the PI for Macondo outside of what Dr. Griffiths calculated on July 15?

A. Yes, there was. As I mentioned earlier, there's evidence from Mr. Emilsen's work in Appendix W of the Bly report.

Q. Does Dr. Griffiths acknowledge in his expert report in this case that there is a different PI at the outset of the incident?

A. He acknowledges it, but he explains it away by misinterpretation of Mr. Emilsen's report.

Q. What is the range of value of that PI at the outset of the incident?

A. It's just below 10, it's 9.4.

Q. How does Dr. Griffiths get from a PI of 9.4 to his constant value of 43.8?

A. He says that all of the changes in the system, regardless of what they are, happened -- well, originally he was saying in 8.6 hours, so he extrapolates -- he misunderstands Mr. Emilsen's work and based on that does an extrapolation to arrive at 8.6 hours when he is going to hit that 43.8 figure and then he keeps 43.8 for the rest of the time, for the rest of the 86 days.

Q. Briefly, why do you believe Dr. Griffiths has mischaracterized and misunderstood Mr. Emilsen's simulation work?

A. What Mr. Emilsen did was he was looking at -- used an OLGA Well-Kill to look at drill string pressure data and trying to match that and he -- to match it, he was adjusting the net pay of the reservoir, so how much of the reservoir is exposed to flow. And he needed a constant net pay of 13 prior to the shutdown of the mud pumps at 9:30 before -- just leading up to the blowout. And then after the mud pump shut down at that particular point in time, he needed a net pay of 16.5 feet, but he kept that constant and he got a very good match up to the data keeping those two things constant with just that one step change.

Q. Does Mr. Emilsen's work support what Dr. Griffiths says, that there is a 25 percent change of net pay or effective PI between 9:00 and 9:30?

A. No, it doesn't. No, it says he needs a step change when the mud pumps shut down.

Q. Understanding that in his expert report, Dr. Griffiths used a nine-hour time period, have you reviewed Dr. Griffiths' testimony here at trial about the time frame he now applies?

A. Yeah. I believe he is saying now that it's about 36 hours.

Q. In your work, Dr. Johnson, what is your opinion about the potential PIs or productivity index or indices that could apply over the 86-day time period?

A. Well, the path between those two points of about 10 and some higher value in the 40s, 50s at the end of the incident is very uncertain and there's potentially an infinite number of paths you can draw that will fit the available data.

Q. What do you mean by that, that there are other PIs that will fit the available data? What do you mean by that?

A. Well, you can draw various PI paths between those two points of 10 and 40, 50, whatever, and using Dr. Griffiths' own methods and using his calculation, calculate how much of a restriction change in the BOP you would need to still match the PT-B data given any PI path.

What I found from doing those calculations, testing out whether the PI paths are credible or not -- this was a real test of that -- was that I needed a change in the effective opening of the BOP from about 3 inches to about 3 1/2 inches, so about a half-inch change just to account for changes in PT-B over that whole 86 days.

Q. Now, in your report did you prepare a chart that shows some of these alternative PI profiles that also match the data?

A. I did, yes.

MR. REGAN: Can we have TREX-11488.12.1.

BY MR. REGAN:

Q. Dr. Johnson, first of all, what do we have on the Y-axis and the X-axis of this chart?

A. This shows -- on the vertical axis we have productivity index, and on the horizontal axis we have time in days since the blowout.

Q. What is the black line, the flat black line at the top?

A. The flat black line at the top is Dr. Griffiths' PI profile, constant PI profile of 43.8.

Q. What is the red line which you have labeled Path A?

A. Well, that's just an assumption of how we might get from 10 at the time of the blowout up to 43.8 using but not endorsing Dr. Griffiths' PI value.

Q. So that's an interpolation, you are basically going from one data point to a second data point?

A. Yeah, just a pure linear interpolation.

Q. Is there any data that you have seen that might give an indication of a PI value in between April 20 and July 15?

A. Yeah. Dr. Zaldivar did a piece of work looking at the slugging in the riser due to the movement of the riser between May 13 and May 20, and it's a very repeatable slugging pattern.

I looked at the slugging at the end of the riser myself. I looked at some video myself, and it's very repeatable. And that -- using his flow rates of around 30,000 barrels a day, let's say, in Dr. Griffiths' method, that implies a PI of about 10 on Day 30.

Q. So what you have represented here as the green line, Path B, is that a PI that would be consistent with the -- Dr. Zaldivar's work?

A. Yes, that's right. So we have a PI of 10 at the blowout, PI of 10 at the time of Dr. Zaldivar mid-May, mid to latish May. So we've got a constant PI between those two points and then some linear interpolation again up to the --

Q. The reason you have just a straight line going up from that point is that you have no other data?

A. No, that's right. So it's just a pure linear interpolation between three points in this case. But, yeah, I mean, that PI profile could follow many other paths and probably didn't follow a straight line. That's probably not what it did.

Q. Did you quantify the impact of these other PI profiles that also matched the data on Dr. Griffiths' method of calculating cumulative estimate?

A. I did, yes, sir.

MR. REGAN: TREX-11488.14.2.

BY MR. REGAN:

Q. Again, using the legend that you just walked us through of constant PI, Path A and Path B, can you tell the Court what happens to Dr. Griffiths' method if you use these different PI assumptions? What happens to his cumulative flow estimate?

A. Well, his cumulative flow estimate for the constant PI is 5 million barrels. If we go to Path A, it reduces down to -- using Dr. Griffiths' own method, this reduces down to 4.2 million barrels, so that's .8 of a million barrels less. If we go to Path B, it reduces down to 3.7 million barrels, which is 1.3 million barrels less.

Q. The only thing you are changing in Dr. Griffiths' method here is the profile of PI over time; is that right?

A. That's right, yes.

Q. That has an -- up to a 1.3-million-barrel estimate on his estimate, under your analysis?

A. Yeah, just that one change in his method and that still matches the data. That still matches all available data.

Q. What does that suggest to you in your opinion, Dr. Johnson, that you can match different PI profiles and have this type of variance in the best estimate, or at least from Dr. Griffiths' way of doing the calculations?

A. It suggests that there's a huge range of input uncertainty, which gives a huge range of output uncertainty.

Q. Turn to a second one of the elements used in Dr. Griffiths' methodology, and that is PT-B. I think as you said earlier, is there a period of time where there is no PT-B BOP pressure data?

A. Yes, that's right. PT-B data exists between May 8 and July 15 with some gaps in there as well, but there's nothing before May 8.

Q. Does Dr. Griffiths require PT-B values in order to calculate his best estimate?

A. He does, yes.

Q. So what pressure did Dr. Griffiths use for PT-B in this period of 18 days where there is no data?

A. What he did, he took the PT-B data that was available and removed some points like Top Kill, and when the second battery change-out was about to happen, things like that, and then did a straight line fit through that data and just extrapolated back that straight line fit until it hit the time zero point, so it hit 20th of April and he took that as the PT-B value at time zero.

Q. Is there, in fact, pressure data available that you examined, Dr. Johnson, that Dr. Griffiths could have used to determine where to start his PT-B pressure?

A. Yeah, there's a point from the end of the Sperry-Sun data that Dr. Emilsen -- sorry, Mr. Emilsen used as well, which if you take that -- I think it was 5786 psi, that last point. If you take that point and you do a calculation of the head in the drill pipe from the measurement point down to the bottom of the drill pipe and then calculate the head from that point up to the bottom of the BOP, you come out with a value of about 8700 psi at the bottom of the BOP at the time of the blowout.

Q. So you used drill pipe pressure and did a calculation to determine what would the mud line pressure be as of the point in time where you had drill pipe pressure; is that right?

A. That's right, yes.

Q. Did you, Dr. Johnson, see any other expert from the United States who similarly provided a calculation of what PT-B pressure could have been as of the night of April 20?

A. Yes. Dr. Pooladi-Darvish did a similar calculation.

Q. Did he come up with a similar number?

A. Yes, he came up with pretty much the same number.

MR. REGAN: If we could look at TREX-11653.27.4.

BY MR. REGAN:

Q. Is this Figure 16, Dr. Johnson, what you were referring to about Dr. Pooladi-Darvish's calculation?

A. Yes, that's right. And you can see that he has about 8700 psi at the top here going down to the first PT-B data on May 8 and with a linear interpolation between the two.

Q. Now I'd like to go back, then, to your report, TREX-11488.17.4. Again, Dr. Johnson, what are we looking at here in Figure 5 of your report?

A. This is the PT-B data profile. So the solid red line that's up and down and all over the place is the PT-B data profile. The black dotted line is a linear interpolation between -- well, it's my extrapolation of that data to get the same number, essentially, as Dr. Griffiths' 4300 psi times zero. And the red dotted line is a linear interpolation from the point implied by the Sperry-Sun data down to the first May 8 point.

Q. So the red dotted line on Figure 5 represents starting at a number around 8700 psi and drawing a straight line down to the first PT-B data, correct?

A. Yes, it's just a pure linear interpolation.

Q. The black line is what Dr. Griffiths used, correct?

A. Yes, that's based on the linear extrapolation.

Q. Dr. Johnson, did you quantify the effect that it would have on Dr. Griffiths' cumulative estimate if you used this PT-B extrapolation from 8700 instead of what he did use?

A. Yes, I did. Yes.

MR. REGAN: If we can bring up D-24634.

BY MR. REGAN:

Q. Again, while this is coming up, what variable or element of Dr. Griffiths' work are you changing here?

A. I'm just changing that one assumption about the starting PT-B pressure and the trend down to the first May 8.

Q. So are you using his constant PI?

05:29 **A.** Yes, I'm using all of his assumptions, constant PI, PT-B offset, etc., all his constants -- K-well, you name it. All the same assumptions.

05:30 **Q.** What is the impact on Dr. Griffiths' cumulative estimate if, instead of using his extrapolated PT-B data, you instead start at 8700 psi?

05:30 **A.** You see on the table here the top row is Dr. Griffiths' results. And starting at 4300 psi, he gets a cumulative release over that period up to May 8 of 1 million barrels. Using the 8700 psi starting point, you get a cumulative release of 500,000 barrels. It's a 50 percent difference in those two numbers. That 500,000-barrel difference represents a 10 percent difference in Dr. Griffiths' cumulative estimate.

05:30 **Q.** The fact that you can have a 50 percent difference in the flow rate estimate for those 18 days where there is no data, what does that suggest to you, Dr. Johnson, about Dr. Griffiths' method?

05:30 **A.** It just says, again, there's huge uncertainty there which makes the method unreliable to get a cumulative estimate.

05:31 **Q.** As you have here, negative 10 percent -- is that the uncertainty change to the total cumulative release?

05:31 **A.** The negative 10 percent is to the total cumulative release, yes. So that's 500,000 barrels.

05:31 **Q.** What did Dr. Griffiths estimate as his uncertainty for this pre-May 8 time period?

A. He estimated minus 3.3 percent to plus .9. That's shown in the top right of that table.

Q. In your opinion, has Dr. Griffiths accurately captured the uncertainty that exists in his estimate, given the absence of data?

A. No. He should have used this point and explored various paths between that point, and he would have found that he has a much wider uncertainty range than he actually came up with.

Q. We talked about just changing the PI assumption of holding something constant. And now you've addressed what happens if you just change the PT-B data in that first 18 days where there is no data. Did you calculate the impact of both of those inputs together on Dr. Griffiths' analysis?

A. I did, yes. I combined those two assumptions into Dr. Griffiths' method and looked at the number.

MR. REGAN: Can we pull up TREX-11488.19.3.

BY MR. REGAN:

Q. Dr. Johnson, can you just quickly walk the Court through what you have calculated here in this Table 2 in your report?

A. Well, some of these numbers you have seen before. But what we have got here is the constant PI with Dr. Griffiths' PT-B extrapolation producing a 5 million-barrel estimate. If we combine the two assumptions that we have just talked about, which is varying PI along Path B and the starting from 8700 psi with the linear interpolation down to the first May 8 pressure data point, you come down to a 3.4 million-barrel release, which you can see is a large difference there.

Q. Just to change the PI, Path B, that's the one that matches Dr. Zaldivar's work?

A. That's correct, yes. The green line in my Figure 1.

Q. Just using that PI and then starting at 8700 psi and using Dr. Griffiths' method, you calculate a total release -- using his method -- of 3.4?

A. Yes, yes, yes.

Q. I would like to turn now to PT-B data after May 8. Did you review the data that existed from May 8 through the end of the flow period?

A. Yes, I did. Yes.

Q. You looked at some of the raw data; is that right?

A. I looked at all the raw data, yes.

MR. REGAN: Could you pull up TREX-11488.29.1.

BY MR. REGAN:

Q. Is this a figure from your report that plots the raw data?

A. Yes. This is Figure 10 from my report. On there is all of the data points that were available to me. In total, there's some 200,000 -- in excess of 200,000 data points on there, and I think some of those 200,000 go off past July 15, but I have only shown up to July 15 on there.

Q. I think I misspoke. This includes -- as it says in the legend, it includes an adjustment. You're again using

Dr. Griffiths' -- what he believes the appropriate correction should be, right?
A. Yes, that's correct. I have used Dr. Griffiths' corrections.
Q. The Court has heard a fair amount about PT-B, but in your words, Dr. Johnson, what does the pressure reading on PT-B represent?
A. It represents all the changes going on through the system. So whether they are changes in the BOP, the riser, the well upstream of PT-B, or bottom hole and reservoir, it's reflecting all of those changes through the system.
Q. Dr. Griffiths, in his report, claims that the PT-B data after May 8 perfectly captures any erosion above the pressure gauge -- that is, downstream of the PT-B pressure gauge -- and reflects that erosion. Do you agree with that opinion of Dr. Griffiths?
A. No, he can't say that.
Q. Why not?
A. Because like I say, it reflects all changes in the system. So any change downstream of PT-B will be reflected in PT-B data, but so will all the changes upstream. You can't, from looking at the data, decide what changes in that data are due to what changes in the system.
Q. Did you see variations in the PT-B data from May 8 forward?

A. Yes, many. Yes.
Q. Are you able to rule out whether these variations are gauge error or physical behavior inside the well system?
A. No, not at all. They could be either.
Q. Dr. Griffiths opined that the changes in the data between May 8 and, I believe, May 19 were nonphysical. Do you agree with that?
A. No, not at all.
Q. Why do you disagree with Dr. Griffiths' statement these must be nonphysical changes?
A. Well, the changes are way outside the error bars that he and other people have put on the PT-B gauge, for one thing. You have only got to look at the Top Kill period and you can see that there are changes going on there due to Top Kill. So, no, I don't agree with that at all.
Q. Dr. Griffiths also says in his report that, in order to have changes below the gauge, upstream, and changes above the gauge, that is downstream, in order to have changes in both places, you would need some sort of fantastic coincidence for that to be reflected in the PT-B. Do you agree with that?
MR. CERNICH: Objection, Your Honor, this is outside Dr. Johnson's expert report. This is surrebuttal.
MR. REGAN: I think it's entirely consistent with -- I think it's in maybe Section 4 of his report.
THE COURT: I overrule the objection.

BY MR. REGAN:

Q. I asked you, Dr. Johnson, if you agree with Dr. Griffiths' proposition that PT-B data, in order for it to reflect both upstream and downstream, you need a fantastic coincidence. Do you agree with it?

A. No, I don't. I think he is looking at it from the wrong direction. I say PT-B data reflect all the changes going on in the system, and we don't know -- there's a lot of uncertainty around those changes. So, no -- and one of the points that illustrates that or enforces my opinion there is that this is one system. It's all connected. So any flow that's coming out the reservoir and going up that well is affecting everything as you go up the well and through the BOP. So to say there's a change in the flow from the reservoir and that will pass through the BOP -- so it's going to cause changes in the BOP potentially. It's going to cause erosion. It's going to move things around in the BOP like Junk Shots and drill pipe. So there's all sorts of changes that could happen because of changes further up the system. So, no, I don't agree with that.

Q. Let's turn now to another of Dr. Griffiths' July 15 constant coefficients, which he calls K-well or the wellbore discharge coefficient.

Did you review how Dr. Griffiths uses this K-well in his best estimate?

A. Yes, I did, yes.

Q. Did you test the use of a constant wellbore discharge coefficient?

A. I did, yes. Yes.

Q. Have you prepared a demonstrative to help explain to the Court how you conducted an evaluation of this?

A. I have, yes.

MR. REGAN: If we could pull up D-24659.

BY MR. REGAN:

Q. Dr. Johnson, what do we see here on the left side of D-24659?

A. The left side of this slide shows what Dr. Griffiths did. So he has got a reservoir pressure, PT-B pressure, a constant PI, and a constant K-well. So everything constant through that system.

Q. What did you do to test the impact of Dr. Griffiths' use of a constant wellbore or a constant -- what he calls "K-well"?

A. I built a Maximus model in our software, which was a detailed model incorporating all the things we discussed earlier, all those details of geometry, fluids, flow path characteristics, thermal behavior, etc. -- to model the physics of the system, the multiphase behavior as you travel up this well into the drill pipe and around the drill pipe through the annulus. I used his constant PI in there, but other than that, it was just modeling properly the well. So I wasn't keeping things constant.

Q. So the only variable -- or "coefficient" is a better way to put it. The only coefficient you are testing here is K-well; is that correct?

A. It's just testing K-well. So I'm keeping his PI -- or rather, a PI consistent with his flow rate, I should say, but keeping it constant through time. And I'm doing two assumptions. I'm saying, Well, the drill pipe could be at the top of the well or it could be partway down the well.

I'm looking at how that affects things as well.

Q. What did you observe when you used your multiphase model for the wellbore but all of Dr. Griffiths' other coefficients in terms of the way his cumulative estimate turned out?

A. Well, his cumulative estimate gives a -- by necessity, really, because he has just got a decreasing pressure drop across that system -- produces decreasing flow rates. But when you take account of the physics and the changes in the well, you actually get an increase in flow rate instead.

Q. So are you referring to the trend in flow?

A. Yes, the trend in flow. We looked at two points in time for this comparison. We looked at July 15 and May 8 and looked at the trend between those two points.

Q. What do you believe caused this reversal of Dr. Griffiths' flow trend even using his approach to the problem?

A. It's due to the multiphase effects in these dual flow paths in the well.

Q. Let me pull up D-24629, which is a figure out of your report.

Dr. Johnson, can you explain: What do we have on the Y-axis and X-axis in Figure 8A?

A. Yes, sure. The vertical axis is the oil flow rate in thousands of barrels per day, and the horizontal axis is the PT-B pressure, and we doing a sensitivity analysis basically of a range of PT-B pressures.

Q. Let's first focus on the dotted lines. What are the dotted blue and red lines?

A. The dotted blue line is Dr. Griffiths' method for May 8.

Q. What's the dotted red line?

A. The dotted red line is Dr. Griffiths' method for July 15.

Q. What is the dark black arrow between those two lines? What does that represent?

A. The black arrow represents the change in flow rate for Dr. Griffiths from the May 8 PT-B pressure point, operating point, down to the July 15 operating point.

Q. So that's just his model running the way he has designed it?

A. Yes. Yes, that's his method -- using his method, yes.

Q. Now, if you can orient us, what's the solid blue line and the solid red line?

A. The solid blue line are the results from the Maximus model. The solid blue line is May 8 again, and the solid red line is July 15. So those are the results from the Maximus model. As you see, they don't follow the same simple quadratic behavior, and this bump in curve, if you like, is due to flow rate regime changes in those new flow paths and the effect they have on the flow rate in the well.

Q. And what is the green line, then? What does that mean?

A. The green line, similar to the black line, is just joining the operating points for May 8 from the Maximus modeling to July 15.

Q. Based on what you saw the data show after you just changed Dr. Griffiths' one coefficient of a constant well and instead substituted in drill pipe high and drill pipe low and multiphase flows, what did that lead you to conclude about Dr. Griffiths' method?

A. Well, it led me to conclude that you can't hold K-well constant, and it led me to conclude that the flow rate trends -- just changing that one assumption is different. It goes up instead of down.

Q. Now, Dr. Griffiths has what he calls "alternative methods"; is that right?

A. He does, yes.

Q. Have you studied what Dr. Griffiths has presented as his alternative methods?

A. I have, yes.

Q. Do you have an opinion about whether Dr. Griffiths' alternative methods validate his best estimate?

A. I do, yes. They are no validation of his best estimate at all. He has got a circular argument there. He uses the same coefficients, and all they do is really validate his arithmetic, show that he has added 2 and 2 together and got 4. It doesn't say 4 is the right answer. It doesn't validate his estimate at all.

MR. REGAN: If we could bring up D-24377.

BY MR. REGAN:

Q. Dr. Johnson, could you again explain for the Court what has Dr. Griffiths presented in terms of his approach to doing a best estimate Alternate 1 and Alternative 2?

A. Sure. Just briefly, we have gone through his calculation of these coefficients for July 15 based on July 15 data, and he uses those same coefficients for all three methods. And the best estimate method, he has a reservoir pressure at the bottom and a PT-B pressure at the top and keeps constant PI and constant K-well. In his Alternative 1 method, he uses reservoir at the bottom and a C-pressure at the top and uses the same PI, the same K-well and K-BOP calculated for 15th of July.

In his Alternative 2 method, he uses the PT-B pressure and the C-pressure and uses the same K-BOP that he used for the other method as well. So it's not really a validation at all.

Q. Did Dr. Griffiths prepare an alternative case of his cumulative release where he had one of these constant discharge coefficients actually vary over time?

A. No, no, he didn't.

Q. Did Dr. Griffiths prepare an alternative case where two of these discharge coefficients were varying over time?

A. No, he did not.

Q. Did he explain in his rebuttal report what the impact would be on his 5 million-barrel cumulative estimate if, in fact, two of these constants -- that is, one below the BOP and one above -- in fact, varied over time?

A. Yes, he did. He put a sentence in there explaining that.

MR. REGAN: If we could bring up TREX-11486R.12.6.

BY MR. REGAN:

Q. This is from Dr. Griffiths' rebuttal report and, Dr. Johnson, if you could read for us in the bottom line, what did Dr. Griffiths say about his best estimate and his alternative cases if, in fact, there was --

A. He says -- well, I'll just read that.

He says: "And if both the PI and BOP varies, then all three of my cases would yield a cumulative discharge that differs from the true value."

So what he is saying there is: He can't do it. He can't use his method to do this.

MR. CERNICH: Objection, Your Honor. I object to this. By definition, this is surrebuttal. We are talking about Dr. Griffiths' rebuttal report and interpreting it.

MR. REGAN: I think there's about 25 cases --

THE COURT: Overruled.

BY MR. REGAN:

Q. Dr. Johnson, if you could again maybe start from the beginning: What does this statement mean -- the statement you see in Dr. Griffiths' report, what does it mean about the method he has used to arrive at a cumulative estimate?

A. It means that he doesn't know enough -- and he can't know enough using this method -- to arrive at a reliable cumulative estimate.

Q. Dr. Johnson, in your experience, do you think it is likely that the PI -- that is, a value below the BOP -- and the BOP discharge -- that is, above the PT-B -- do you believe it's likely that they stayed constant for 86 days?

A. No, I don't. Given all the changes we know went on in that system, I can't believe they stayed constant for 86 days.

Q. If they weren't constant for 86 days, is Dr. Griffiths' method flawed?

A. It is.

Q. I turn now to some of the specific opinions you have about Dr. Dykhuizen.

MR. REGAN: Your Honor, I probably have about 20 minutes.

THE COURT: We are going to finish, whatever it takes. You might want to move it along.

BY MR. REGAN:

Q. Dr. Johnson, with respect to Dr. Dykhuizen's cumulative estimates, are the flaws you have just testified about with respect to Dr. Griffiths, do they apply to Dr. Dykhuizen?

A. Yes, many of them do. He held things pretty much constant over the 86 days apart from reservoir pressure.

Q. Do you recall what error bar Dr. Dykhuizen put on his 5 million-barrel cumulative estimate?

A. In his original report? He didn't. He couldn't put one on it.

Q. Did you hear in his testimony at trial the error bar that he now assigns to his cumulative estimate?

A. Yes, I did. It was plus 20 percent and minus 30 percent.

Q. Do you agree that Dr. Dykhuizen's cumulative estimate has an error bar of at least plus 20 and minus 30?

A. Well, I think his cumulative estimate is at the top end of all estimates by virtue of the fact of the assumptions he has made. So I'm not sure plus 20 is correct, but I can state certainly that the error bar below that is greater than 30 percent. So I would expect it to be far greater than minus 30 percent.

Q. Why do you believe Dr. Dykhuizen's error bar should be even greater than 30 percent on the low end?

A. For all the reasons we have just discussed, all the changes through the system that aren't accounted for in that method that he used.

Q. You saw that Dr. Dykhuizen cited Dr. Griffiths in his report?

A. He did, yes.

Q. Does Dr. Griffiths, in your view, give anyone any more certainty about what the appropriate cumulative release is?

A. No, no, because I don't believe Dr. Griffiths' estimate is in any way correct anyway.

Q. Let's briefly turn to two specific additional estimates that Dr. Dykhuizen testified about.

First, did you hear Dr. Dykhuizen and see in his report that he has a Top Hat flow rate calculation?

A. Yes, I did.

Q. What do you recall Dr. Dykhuizen testified to about the accuracy of his Top Hat estimate?

A. He said it was especially inaccurate, on Monday last week.

Q. Do you agree with Dr. Dykhuizen's description?

A. Yes, I do. I think it is especially inaccurate.

Q. Why do you believe his Top Hat estimate is especially inaccurate?

A. Because there isn't enough -- there are far too many uncertainties around that estimate to be able to give an estimate to any reasonable engineering certainty.

Q. Now, with respect to his Top Hat estimate, I want to focus on what we call the flow-out of the bottom of the Top Hat or what's been referred to as "the skirt." Do you have criticisms of Dr. Dykhuizen's estimate of the amount of flow out of the skirt?

A. Yes, I do.

Q. What are your criticisms of his estimate there?

A. Well, it is a hugely uncertain calculation. I think Dr. Dykhuizen recognized this during the response, and I think he recognizes it now as well. It's subject to great bounds of uncertainty around what the exit of the skirt is at the bottom of the Top Hat. We don't know that. We don't know how much of a seal at the bottom of the Top Hat was missing. We don't know the shape. We could make some description of the shape into that exit of the Top Hat, but the Top Hat was tilted and it throws huge uncertainty on calculating the exit.

And also the pressure in the Top Hat. I calculated that he needed to change that pressure in the Top Hat by half a psi, and I halved the estimate out of that skirt and that just says it's totally unreliable.

Q. Dr. Johnson, you had some calculations where you were trying to determine how Dr. Dykhuizen was arriving at his skirt flow; is that right?

A. I did, yes.

Q. Did you have to correct those calculations after seeing Dr. Dykhuizen's rebuttal report?
A. Yes. Yes. He pointed out in the rebuttal report that I had misunderstood the velocity used for the K-value that he used. Normally, we'd use a velocity upstream. When I have measured K-values in the past, I have always used the upstream velocity, because that's usually the one you can measure easily. And I used a K-value consistent with that, which wasn't consistent with what Dr. Dykhuizen used. So we had a misunderstanding there. He pointed that out for me and I'm grateful to him for that, and I corrected that calculation.
Q. When you revised your calculation, did it in any way change your opinion about the Top Hat skirt calculation?
A. The numbers changed, but it really didn't change my opinion about the total inaccuracy of that method, no.
Q. Dr. Dykhuizen also estimated a lower bound for Top Hat; is that correct?
A. He does, yes.
Q. Do you think that his lower bound estimate is reliable and appropriate?
A. No, no, it's a lower bound for a point in time at the end of the Top Hat period, but he doesn't -- he applies it throughout the whole of the Top Hat period. Whereas, by applying it to the collection flow rate of 25,000 barrels a day at the end of the Top Hat period. Whereas the collection flow

rate throughout the Top Hat period was varying considerably and it was increasing over that period.
Q. If, in fact, flow was increasing over time rather than decreasing over time, is Dr. Dykhuizen's assumptions on his lower bound accurate?
A. No, it isn't. The lower bound changes over time.
Q. Finally, turning to Dr. Dykhuizen's Top Kill flow rate calculation, what was Dr. Dykhuizen's opinion about the accuracy of his Top Kill calculation?
A. I believe he said it was very inaccurate.
Q. Do you agree with Dr. Dykhuizen?
A. Yes, I do. In fact, I would say I would give it as much inaccuracy, if not more, than the Top Hat calculation.
Q. With respect to the way that Dr. Dykhuizen makes this Top Kill calculation, what are some of the key uncertainties in his method or in his equation?
A. Well, in his Equation 5 in his report, he needs to make assumptions about the changes in restriction in the BOP and he assumes those are constant between the Top Hat Kill -- sorry, the Top Kill period and the period after Top Kill. He needs to make assumptions about where the mud is going in the BOP in the well. And he assumes that all the mud being pumped in during Top Kill is going up through the BOP.
Now, if he doesn't know that -- and I assert that he doesn't know that -- then he hasn't got a flow rate on which to

base the lower bound calculation nor his best estimate calculation.

He also needs to know the oil flow rate during Top Kill, and how can he know that? I can't see how he could know that.

Q. If Dr. Dykhuizen is not correct that all mud that was pumped into the BOP went up and out of the BOP and that no changes occurred in the BOP resistance during Top Kill, is his Top Kill estimate reliable?

A. No, not at all.

Q. Again, you saw -- how many buckets of material were pulled out of the BOP from Top Kill?

A. I estimated, just from looking at them, something like 40 buckets full of material.

Q. Does that suggest to you that there would be changes in resistances inside the BOP during Top Kill?

A. It does, yeah. We don't know what that Top Kill material was doing over time over the Top Kill period, how it was moving around.

Q. Dr. Dykhuizen has a lower bound calculation that he ascribes to Top Kill. You saw that in his report?

A. I did, yes.

Q. Did you investigate whether that is a true lower bound?

A. Yes, I did, yes.

Q. Can you just briefly tell the Court, what did you do?

A. I did a second calculation using his spreadsheet -- I just took his spreadsheet that he did provide to us -- and I changed the inputs from the pressure and multiflow rate data for the 28th of May Top Kill period, the Top Kill 3, to the ones for Top Kill 1 on the 26th of May. And doing that, I got a different result. I got the result of about 32-, 33,000 barrels a day.

Q. What was Dr. Dykhuizen's lower bound when he used the third Top Kill, Top Kill 3?

A. He got a result of 434,000 barrels a day.

Q. So you used his exact methodology, just on a different Top Kill event?

A. Yes, exactly.

Q. Even with your 32,000-barrel calculation, using Dr. Dykhuizen's method, do you think that's an accurate calculation?

A. No, because it's subject to all those uncertainties of where the mud is going and what erosion is going on in the BOP, things like that, so we don't know, we don't know a lot of what's going on. So, no, it isn't accurate.

Q. In his rebuttal report did Dr. Dykhuizen agree that you had accurately calculated that the lower bound would be lower if you used May 26 data instead of May 28 data?

A. Yes, he agreed with me on that. Yes.

Q. Dr. Johnson, based on your review of Dr. Dykhuizen's

Top Hat and Top Kill flow rate calculations, do you believe that they provide any support for the line that Dr. Dykhuizen has drawn from July 15 to April 20 in his cumulative estimate?

A. No, not at all. They are far, far too inaccurate.

MR. REGAN: Thank you, Dr. Johnson.

THE WITNESS: Thank you.

THE COURT: Who is going to do the cross?

MR. BENSON: I will, Your Honor, Tom Benson for the United States.

THE COURT: How much time do you think?

MR. BENSON: I think it will be a while, Your Honor, certainly probably more than an hour.

THE COURT: All right. I was really hoping to finish this witness today.

MR. BENSON: I can start.

THE COURT: Let's go about 30 minutes and see where we are. Maybe I can push you along.

CROSS-EXAMINATION

BY MR. BENSON:

Q. Good afternoon, Dr. Johnson. Tom Benson on behalf of the United States, and I have you on cross-examination.

A. Good afternoon.

Q. Dr. Johnson, let's talk about your company's involvement with BP over the years. I think you testified FEESA was started in about 2001?

A. That's correct, yes.

Q. BP has been a significant client of FEESA ever since, right?

A. Well, they have been a client of FEESA. They were very significant at the beginning. We don't -- apart from this *Deepwater Horizon* work, we don't do any work for them at the moment.

Q. There's a brochure that FEESA provides to potential clients, right, that's available on the Web site?

A. Yes, that's correct.

Q. If there's 19 projects that FEESA has worked on listed in that brochure, five of those are BP projects, right?

A. That's correct, yes. But we have 24 clients at the moment, and that's an old list. I would suggest that the number of projects we have done for BP is a very, very small proportion.

Q. Now, FEESA wasn't asked to help during the response, was it?

A. You are correct. No, it wasn't.

Q. We heard a lot about Maximus in your direct exam. We will talk more about Maximus today and perhaps tomorrow.

A. Sure.

Q. BP didn't use Maximus for any purpose during the response, did it?

A. I don't know.

Q. Would you know if they had?

A. We might not. They have a license. They have people experienced in using Maximus, so they wouldn't necessarily come to us if they were using it in the response.

Q. Sir, you would be interested if they had used it during the response, wouldn't you?

A. Yes. But like I say, they wouldn't necessarily come to us because they have experienced users.

Q. BP hired FEESA for Macondo-specific work in fall of 2011, correct?

A. Yes. In November 2011, yes.

Q. As of the time of your deposition in July of this year, you estimated that FEESA had billed about 1.5 million pounds for the Macondo work, right?

A. Yes. I think that's correct, yes.

Q. That's about $2.4 million?

A. Probably, yes, yeah, without doing the calculation, something like that.

Q. That figure represents about half of FEESA's annual revenue, doesn't it?

A. No, because that's not over a year. Actually, in the last financial year I think it accounted for about a third, the work we did on this account, about a third of our revenue.

Q. Now, Dr. Johnson, you personally have a stake in the outcome of this case as well, don't you?

MR. REGAN: Your Honor, I object to this. At a certain point we are getting fairly irrelevant to the scope of the opinions.

MR. BENSON: I think I'm allowed to inquire into bias, Your Honor. I can give another question.

THE COURT: I overrule the objection.

BY MR. BENSON:

Q. Let me ask a more specific question, Dr. Johnson. You personally own a significant amount of BP stock, correct?

A. I do own about 13,000 shares, yeah. I wouldn't describe that as particularly significant. It's not going to change my life.

Q. It's worth more than a half a million dollars, right?

A. Oh, no. No, no, no. I think you're an order of magnitude out there. It's about -- that stock, all those shares are worth about 50,000 pounds.

Q. What's the current stock price for BP?

A. I don't know. I haven't looked for a long time.

THE COURT: We have gone too far afield. If you have some substantive questions for the witness -- let's move on.

MR. BENSON: I will, Your Honor.

BY MR. BENSON:

Q. We talked a little bit about the point estimates that you criticized on behalf of Dr. Griffiths and Dr. Dykhuizen. First let's get out you agree that there was sufficient data at the

end of the incident to estimate the flow rate, don't you?
A. Yes. I've seen many people's estimates of flow rate for July 15 during the capping stack period, yes.
Q. So you're not making any criticism of Dr. Griffiths' final day flow rate estimate of 53,000 barrels, are you?
A. It's at the higher end of some of the estimates that I have seen, but it's in the range, yes.
Q. And same with Dr. Dykhuizen. You're not making any criticism of his final day flow rate estimate of 53,000, are you?
A. The same comment, the same comment as I just gave.
Q. Now, let's talk about Dr. Dykhuizen's Top Kill calculations which you were just speaking about with Mr. Regan.
You understand Dr. Dykhuizen calculated a best estimate at the time of Top Kill of about 60,000 barrels per day, correct?
A. I understand that, yes.
Q. In your expert report you did not offer an opinion on whether that estimate was correct, did you?
A. I didn't, but in my deposition I did state that I don't believe it.
Q. So there's nothing in your expert report that says this is incorrect, right?
A. I believe it's highly inaccurate and incorrect.
Q. You didn't say that in your expert report. That's all I'm

asking you.

A. I don't think that statement is in my expert report, no.

Q. Let's talk about Dr. Dykhuizen's Top Hat calculation for a minute.

MR. BENSON: If we could have demonstrative D-21267, please.

BY MR. BENSON:

Q. This is a version the Court has seen before.

Dr. Johnson, you understand there were three flow paths during the Top Hat period, right?

A. Yes, that's correct.

Q. Some oil was being collected to the ship, right?

A. To the *Discoverer Enterprise*, yes.

Q. Some oil was coming out the vents, right?

A. Correct, yes.

Q. And then some oil was coming out the skirt?

A. Yes.

Q. You're not presenting an opinion on whether Dr. Dykhuizen's vent flow calculation was inaccurate, are you?

A. I repeated Dr. Dykhuizen's vent flow calculation. In making the same assumptions as him of homogeneous flow and certain vents being open, I arrived at about the same number for vent flow.

Q. The same with the collection numbers. You're not offering any objection to the collection numbers that Dr. Dykhuizen used, are you?

A. Yes, I am.

Q. How is that?

A. He only uses the collection number at the end of the Top Hat period. I think I mentioned this in my direct. And that's not correct because that relies on the assumption of a decreasing flow rate through time. And I have proven that the flow rate wasn't decreasing through time if you take account of all the multiphase effects in the dual flow paths in the well. So he should have used the actual collection data through the Top Hat period, and he didn't do that.

Q. You would agree that there's about two weeks of collection data where they're consistently collecting about 25,000 barrels per day, correct?

A. Yes. It's something like that approaching the end of the Top Hat period.

Q. You would agree that there was some flow coming out the skirt, correct?

A. Yes. Video evidence shows that there was volume of flow coming out the skirt.

Q. So everyone can see that.

You talked a little bit about your skirt flow calculation on your direct exam. And you made a mistake in doing your skirt flow calculation the first time around, right?

A. Yes. Like I said in my direct, I had a misunderstanding of what Dr. Dykhuizen had used in the way of velocities for the K values.

Q. Your report is incorrect when you say that Dr. Dykhuizen's skirt flow calculation was off by an order of magnitude, right?

A. Well, I still believe that skirt flow calculation to be very, very inaccurate because of all the uncertainties that I mentioned in my direct.

Q. With your correction after you got Dr. Dykhuizen's information and you corrected your own results, your results from the skirt flow alone went from being about 2,000 to about 30,000; isn't that right?

A. Yes, that's correct. But like I say, that is subject to all those huge uncertainties about geometry of the skirt and the pressure in the Top Hat. And that is using Dr. Dykhuizen's assumptions about that geometry and about the Top Hat pressure. So if we change those by small amounts -- like I say, if I change the pressure by half a psi in the Top Hat, I halve the estimate coming out of that skirt.

Q. If you halve the estimate coming out of the skirt, what's the total flow that Dr. Dykhuizen would calculate, it's still about 60,000 barrels per day, right?

A. Sorry. Can you repeat that question?

Q. Sure.

MR. BENSON: If we could have the prior demonstrative back up, please, which is 21267. Thank you.

BY MR. BENSON:

Q. So when you calculated the skirt flow calculation, you calculated 30,000. And so the total that you could use, that skirt flow calculation, you get over 70,000 for the total Top Hat, right?

A. Like I say, I don't believe that 30,000. I think the calculation is highly inaccurate. I mean, we only have to look at the end period, when Dr. Dykhuizen's calculating a lower bound of 43 using vent flow and collection data at the end of the Top Hat period. Yet a short period after that, when the capping stack is on, he calculates a flow rate out the well of 53. So it suggests there's about 10,000 maybe coming out the skirt, something like that, at the most.

Q. But that wasn't your calculation, was it, Dr. Johnson? Your qualification was 30,000 coming out the skirt, based on Dr. Dykhuizen's method, correct?

A. Like I say, it's an unreliable -- that whole calculation is totally unreliable. Dr. Dykhuizen -- it appears Dr. Dykhuizen is no longer relying on it. He is relying on essentially a guess of 20,000. I don't believe the 20,000, even, for reasons I've just said.

Q. My question is simply this: If you use 30,000 for your skirt flow calculation, you get a total of over 70,000, right?

A. I repeat what I said before. It's just not a reliable calculation.

Yes, you can add the numbers together, yes, and you will get that sort of number, but I don't agree with that. I don't agree with the total.

Q. Understanding you don't agree with it, if you then cut that skirt flow calculation in half and get 15,000, you are still close to 60,000 barrels per day, aren't you?

A. At the end of the Top Hat period, yes. And only at the end of the Top Hat period.

Q. Let's turn to your criticism of Dr. Griffiths' cumulative discharge estimate, and I want to start by talking about your Maximus modeling.

I think what you said in your direct was that your intent was to test what you call and what Dr. Griffiths called K-well, which is his discharge coefficient for the wellbore. Is that --

A. Yes. He uses a constant discharge coefficient for the wellbore.

Q. You were trying to match your model to what Dr. Griffiths did in his model, right?

A. Yes. I was trying to use a rigorous thermal hydraulic model for the well to check the assumption of everything in the well being constant through 86 days, that's correct.

Q. Your intention was to use the same PI that Dr. Griffiths used and the same other basic parameters that Dr. Griffiths used other than the constant K-well, right?

A. Yes. I was examining just that one change, just the change by using a proper model instead of a spreadsheet calculation, yeah.

Q. So if there were differences between what you modeled and what Dr. Griffiths modeled other than the constant K-well, that would affect whether your results are valid for pointing out the point that you were trying to make, right?

A. Well, I was examining that one change. As we discussed in direct, we examined single changes and the effect of those single changes, and that was one of those single changes.

We could have gone on and varied PI in the Maximus model and varied various other things in the Maximus model and come out with very different numbers. You are highlighting here, I think, the uncertainty, the whole uncertainty around this calculation. And that's the problem with this, that all of the inputs are enormously uncertain, and how they change through time is enormously uncertain; and that leads to an enormous amount of uncertainty on the estimate that comes out.

Q. I don't think that was my question, Dr. Johnson.

A. Sorry.

Q. My question is simply you're trying to model -- you're trying to replicate Dr. Griffiths' model by changing one parameter and seeing what effect that has, right?

A. Yes. That was what we were doing, was just trying to check the effect of one parameter, yes.

Q. You built your version of the Griffiths model based on a flow rate of 55,000 stock tank barrels on the last day, right?
A. I forget the exact number, but, yeah, it was the number that I believe Dr. Griffiths used.
Q. So if Dr. Griffiths actually calculated a number of 53,000 barrels on the last day and you used 55,000, that would be a discrepancy in matching your model to Dr. Griffiths' model, correct?
A. Well, what we did was -- Dr. Griffiths didn't produce his spreadsheet to us, so we re-created his spreadsheet. It wasn't a big deal, and it took about a morning to put together a spreadsheet that did what he did.
So we did that, and then we used that spreadsheet, and we made sure it replicated his flow rate profile and produced his 5-million-barrel-a-day estimate. And then we compared that to the Maximus model, using the same capping stack flow rate for that 15th of July period.
Q. My question, Dr. Johnson, is, if you, in replicating the Griffiths model, used 55,000 for the last day and Dr. Griffiths used 53,000 for the last day, there's a discrepancy there, right?
A. Yes. But the comparison is still internally consistent, so I think it still proves the point about K-well.
Q. Let me ask you a question about the PI that you used. You understand Dr. Griffiths' PI for the last day was about

44 barrels per psi, right?
A. Yeah. 43.8 standard barrels per day per psi.
Q. The PI that you used in your model was either 57 or 59, depending on which iteration, right?
A. Yes. And if we used different -- slightly different flow rates, we needed a slightly different PI to match his -- whatever that flow rate was. Yes, that's correct.
Q. So again, you have a different PI than Dr. Griffiths used in your model?
A. Yes. That's because we are modeling the wellbore correctly, of course.
Q. You also used a different fluid characterization. You testified on direct that when you used Maximus, you need a fluid characterization in the EOS, correct?
A. Yes, that's right. You need a composition and equation of state.
Q. You used a different composition in your Maximus modeling than any other expert used in this case; isn't that right?
A. We used the Schlumberger sample, yes. We compared it with one of the others and didn't find an awful lot of difference in the comparisons we did.
Q. You understand that BP had an expert in fluid characterization, named Dr. Whitson, testify at trial, right?
A. I understand that, yes.
Q. He created his own fluid characterization for this case,

right?

A. Yes, that's what I understand.

Q. You didn't use that fluid characterization?

A. No, I didn't.

Q. You didn't use Dr. Zick's fluid characterization?

A. That's correct.

Q. Zick, Z-I-C-K.

A. That's correct.

Q. You didn't try to match the fluid characterization Dr. Griffiths got by looking at the collected oil from the ships, did you?

A. No.

Q. As you say, you used one fluid sample. And I believe that is Schlumberger Sample 106. Is that right?

A. I believe that's correct, yeah, from memory.

Q. That's a sample that neither Dr. Whitson nor Dr. Zick used in their -- in building their EOS, isn't it?

A. I'm not that familiar with either of their work to be able to comment on that.

Q. In your Maximus modeling you assumed a single-stage separation process, didn't you?

A. Yes, effectively.

MR. BENSON: If we can have Demonstrative 21271, please. If we can call out the column on the very right here.

MR. REGAN: I interpose an objection to the demonstrative because I don't think there's any foundation as to who actually created these spreadsheets that are used -- there's a series of these demonstratives -- who created them. And as best I can figure out, it was a consultant that worked for one of the testifying experts for the U.S., but there's been no foundation in trial laid for them. I object to them on that basis.

THE COURT: What's the source of this?

MR. BENSON: It's modeling files that Dr. Johnson produced to the United States. We had to convert them into something we could read. And because, as Mr. Regan says, we did that through the help of one of our experts. There's no great mystery here. We talked about this at his deposition. He has seen these spreadsheets before. They were an exhibit in his deposition. There was no objection to them at that time as being misleading or otherwise inaccurate.

MR. REGAN: Your Honor, Dr. Pooladi-Darvish has already testified --

THE COURT: Speak into the microphone.

MR. REGAN: Pardon me, Your Honor. There's been no foundation laid for these spreadsheets. As counsel has just made clear, they're not Dr. Johnson's work; it's somebody else's work. I don't know what fact he is going through on this slide per se, but all of them are infected by the same problem.

THE COURT: I sustain the objection.

MR. BENSON: Take that down, please.

BY MR. BENSON:

Q. So, Dr. Johnson, you testified a moment ago that the flash assumption used a single-stage flash for your Maximus work in this case, correct?

A. Yes. That's correct, essentially, yes.

Q. That's another difference between you and Dr. Griffiths, right? He uses a multistage flash in his calculations?

A. Yes. I believe so, yes.

Q. That could have a difference of about 10 percent in terms of the standard barrels at the surface you get, right?

A. Yes. Yeah. The multistage flash process is usually used for a production facility where you can control what's going on in flashing the fluids over a number of stages. That's not what we are doing here. So, yeah, it could make a difference in volume.

Q. The original question was, it could make a difference of about 10 percent. You would have no reason to disagree with that?

MR. REGAN: Your Honor, Dr. Johnson is not here as one of the experts who have testified to you at length about this question. He used a process which he has already testified to, but he is not here to testify about this other issue that's been talked about by Dr. Whitson, Dr. Zick, and perhaps even others.

MR. BENSON: With respect, Your Honor, this isn't another issue. This goes to the Maximus modeling that Dr. Johnson did. That's all I'm talking about.

MR. REGAN: He's testified as to what he did. Now you are asking him, well, what should you do? How would it impact it, and what would be the impact of these things?

We have had hours of testimony on this already.

THE COURT: I sustain the objection.

BY MR. BENSON:

Q. Dr. Johnson, Maximus is not typically -- sorry.

I believe you testified on direct Maximus is typically used in the design phase of production systems. Is that right?

A. All through design phases and into the operations of actual operating oil and gas systems and wells, yes.

Q. You are not aware of any instance of using Maximus to model a system after it has failed, are you?

A. I can't honestly say. No, I'm not aware of one. No.

Q. You're certainly not aware of any instance of anyone using Maximus to model a system after a blowout, are you?

A. No, I'm not. But, I mean, the physics of the system are important, and the physics of the system is what we are modeling in Maximus. So there's no reason why Maximus couldn't be used for doing this sort of work. It's used every day in modeling wells. We model thousands of different oil and gas wells around the world.

Q. Now, you would admit that the range of uncertainty for Maximus in looking at multiphase flow is going to be on the order of plus or minus 10 percent, correct?

A. It depends what quantities you are talking about. Can you define which quantities?

Q. How about if we are talking about in terms of barrels of oil, stock tank barrels?

A. I think we discussed this at my deposition. Usually for any multiphase flow simulation -- it doesn't matter whether it's Maximus, OLGA, PIPESIM, any of these proprietary models -- a pressure calculation in a multiphase flow system is going to be accurate to about plus or minus 10 percent. So a flow rate calculation, I think I said in deposition, was going to be a few percent error bounds on it given that multiphase simulation isn't an exact science.

Q. When you say a few percent, you mean a few percent on top of that plus or minus 10 percent?

A. Oh, no, no, no. No. If the pressure calculation is 10 percent, then the flow rate calculation based on pressures is going to be a few percent.

Q. Now let's talk a little bit of how the Maximus model works. Did you run the Maximus model yourself in this case?

A. Well, originally it was run by Dr. Martin Watson. The original modeling was done by him. And I have run the model many times since then myself.

Q. You did modeling runs for this specific case?

A. I've run the model, but the modeling runs in my report were done by Dr. Watson.

Q. The Maximus model that Dr. Watson ran for your work in this case depend on a piece of software called OLGA S, correct?

A. In this case we used OLGA S, yes, as the flow correlation embedded within Maximus.

Q. As you said, that's the multiphase flow correlation piece of software that you used in Maximus, right?

A. Well, OLGA is a transient software that is owned by Schlumberger now, and it's probably the leading software, leading transient multiphase simulation software in the industry, in the oil and gas industry. They produce, along with that or aside to that, a steady-state point estimate -- point calculating software; and we have what we call a "DLL," which is a piece -- that piece of software embedded in Maximus is one of about 20 flow correlations we can use.

Q. The way it works is, OLGA S is sort of a standalone piece within Maximus; Maximus provides OLGA S inputs; and OLGA S provides outputs, such as pressure and flow rate. Right?

A. No, it doesn't provide flow rate. It provides pressure gradients, holdups, and flow regime information.

Q. Because OLGA S is sold and marketed by another company, as far as you're concerned it's a black box, right?

A. Like any software company -- a wise software company doesn't make their source code privy to -- to make people privy to their source code. So, yes, we don't know what's in their source code. But like I say, it's widely accepted around the oil and gas industry as being very reliable.

Q. When you use Maximus, the flow regimes that you get would be dictated by the OLGA S software, right?

A. Yes, the flow regime would come from OLGA.

Q. It's your opinion that the differences -- I believe you said this on direct -- the differences between Maximus and Dr. Griffiths' work come from differences in treatment of flow regimes. Isn't that right?

A. It's to do with the multiphase effects in the dual flow paths and the effect they have on the pressure drop in those dual flow paths and, therefore, the oil flowing from the well. One of the elements of that, yes, is the flow regimes and the pressure gradients.

Q. That's information you get from OLGA S, right?

A. Yes. That comes out of the OLGA S correlation, yes.

Q. Were you in court for Dr. Blunt's testimony last week, Dr. Johnson?

A. No, I wasn't there.

Q. So you didn't hear him say that he didn't want to rely on black box software for his work in this case?

06:26 **A.** I didn't hear that, no.

06:26 **Q.** Now, let's turn to how you modeled the flow path in Maximus. You would agree that Maximus is a one-dimensional model, right?

06:26 **A.** Yes, that's correct.

06:26 **Q.** What we are talking about here with the dual flow paths is the drill pipe inside the production casing, right?

06:26 **A.** Yes, that's right. We have dual flow paths represented by a drill pipe inside the production casing at whatever point it is in the system, yes.

06:26 **Q.** We have a pipe within a bigger pipe, right?

06:26 **A.** That's correct, yes.

06:26 **Q.** You are not aware of any instance where FEESA has used Maximus to model a drill pipe within a larger production casing, are you?

06:27 **A.** Well, we have done a lot of work modeling pipe within pipe, flow of pipe within pipe for such things as heat exchanging contraflow systems. So we have done similar things, yes, many times.

06:27 **Q.** But never a case with a drill pipe inside a production casing, correct?

06:27 **A.** Well, it's a pipe within a pipe. It really doesn't matter whether it's a drill pipe or what it is; it's pipe within pipe.

06:27 **MR. BENSON:** Could we have Demonstrative 21272, please.

BY MR. BENSON:

Q. Dr. Johnson, on the left-hand side we have an image from your expert report, right?

A. Yes, I believe so. I think that's from Appendix B probably, or C. I forget which.

Q. This depicts the actual geometry of the system and what you call the drill pipe high case, correct?

A. Yes, that's correct.

Q. So here we have the drill pipe and we have the larger casing. Then on the right-hand side we have a visual depiction of how you model this system in MAXIMUS, right?

A. Yes. On the right-hand side what you have is -- it looks like a screenshot from the graphical user interface of MAXIMUS, so that's how we piece all these objects together as we are building a model, yes. But behind each of the objects in there -- so each of the pipes, each of the connectors, each of the sources, etc. -- is a lot of information about each of those objects' dimensions and flow correlations, heat transfer details, all that sort of thing.

Q. I'm just looking at the basic geometry here. The way you model in MAXIMUS a pipe within a pipe is to model two pipes in parallel, right?

A. Yes, that's correct.

MR. BENSON: Your Honor, I'm reminded it's been half an hour. I don't know if this is a good time or --

THE COURT: I'll tell you when to stop. Just keep going.

MR. BENSON: Thank you, Your Honor.

Could we have TREX-11562, please. If we can call up the upper right-hand corner, please.

BY MR. BENSON:

Q. Dr. Johnson, we have talked about --

THE COURT: Go ahead.

BY MR. BENSON:

Q. Dr. Johnson, this has the dimensions for your drill pipe high case, correct?

A. Yeah. I don't remember all the dimensions, but I see a lot of dimensions up there, yes. I'll take your word for it that they are.

MR. BENSON: If we can have the second page of TREX-11562.

BY MR. BENSON:

Q. Again, calling out the upper right, these are the dimensions for your drill pipe low case; is that right?

A. Again, many dimensions, I'll take your word for it that they are the dimensions in the model.

Q. Now, you would agree that cross-sectional area is going to be proportional to flow rate, right?

A. Well, you have to be careful here because we -- if you're talking about the annulus, then it's not just all about cross-sectional area. You need to take account of the -- what we call the wetted perimeter as well. When flow goes through a pipe, we have the cross-sectional area, which is important, but we also have the surface of the pipe, which is effectively adding drag to the fluid, if you like to think of it as that, and causing pressure drop.

When we've got the annulus, we have not only got the cross-sectional area, but we have also got the -- more surface area over which the fluids are traveling. So we've got the inside of the casing and the outside of the drill pipe in this case, and it's very important to take into account that additional surface area over which the fluids are flowing and we do that by a method -- it's a commonly used method in the industry, a method called hydraulic diameter.

Q. I think you've anticipated me a little bit here, Dr. Johnson. Let me just walk back to my question first and then we will get into the hydraulic diameter.

You agree that cross-sectional area is important to flow rate?

MR. REGAN: Asked and answered, Your Honor.

THE COURT: I think he did. I think he just answered that.

MR. BENSON: I wasn't sure I got an answer, but I will take it if I got it.

BY MR. BENSON:

Q. In your modeling, Dr. Johnson, you used what you just referred to, the concept of hydraulic diameter, correct?

A. Yes, that's correct.

Q. That technique is going to understate the cross-sectional area for the production casing, correct?

A. No, that's not correct.

Q. Let's look at an example, if we could.

MR. BENSON: If we could have Demonstrative 21266, please.

BY MR. BENSON:

Q. This is just an example looking at your drill pipe high case and looking at the part of that system where we have the 9 7/8-inch casing and the 5 1/2-inch pipe. Okay, Dr. Johnson?

MR. REGAN: Your Honor, I just need to pose an objection. Obviously I don't -- I'm not objecting to geometry, but there's a phrase on this slide that's unattributed to somebody, and I don't think there's any testimony --

THE COURT: All right. I'll tell you what, how much time do you have left, Mr. Benson?

MR. BENSON: I'm guessing we are about halfway through, Your Honor.

THE COURT: We are not going to be able to finish tonight. We have a couple other matters we need to discuss, so maybe this is a good place to stop. We will stop here and resume at 8:00 a.m in the morning.

I'm sorry we couldn't get to finish it this evening.

THE WITNESS: That's okay.

THE COURT: We have a couple of matters we need to discuss, though, before tomorrow.

You're finished for the evening, so you can step down, sir.

THE WITNESS: Thank you.

THE COURT: BP has filed a number of pleadings -- well, several. There's a memorandum and a couple of letter briefs, it looks like, all apparently dealing with the issues of the proper scope of the government's planned rebuttal case for tomorrow. So you want to talk about that briefly right now?

MR. BROCK: Mr. Langan will cover that.

MS. HIMMELHOCH: Your Honor, I think we can make short shrift of one of those. The letter regarding the video designations, we had told them we were going to sleep on it and get back to them. We have slept on it. We do not intend to offer those segments --

THE COURT: You slept during the trial?

MS. HIMMELHOCH: No, of course not, Your Honor. No. We had an exchange yesterday. We told them we would get back to them today. We're getting back to them, and the answer is we are not planning to play those video segments. So you can take that one off your to-do list.

THE COURT: That's the letter brief today regarding certain video clips. So that's moot, right?

MS. HIMMELHOCH: Yes, Your Honor.

THE COURT: You have won one, Mr. Langan.

MR. LANGAN: So far so good, Your Honor.

THE COURT: I think I understand your arguments.

Let me hear from the government, if you don't mind. I know they haven't responded in writing, but I want to get their response.

Here's the issue to me as far as I can see it. BP makes the argument that based on some earlier rulings by Judge Shushan and based on the law, really, that the government should not be allowed to, in effect, buttress any deficiencies in its case in chief with evidence that was available and could and should have been produced -- or introduced during the government's case in chief by means of so-called rebuttal witnesses.

I'm pretty much stating your opinion?

MR. LANGAN: It does, Your Honor, yeah, the law and the prior rulings in this case.

THE COURT: Right. Right. On the other hand, rebuttal is just that. You can use that to properly criticize, critique, if you will, the -- BP's and Anadarko's case in chief, but not just to buttress -- not to buttress your case. I have looked at some of the issues here. It seems to me that clearly some of the reports -- some of the opinions expressed by -- is it Rogers or Roegiers?

MS. HIMMELHOCH: Roegiers, Your Honor.

THE COURT: Dr. Roegiers and Dr. Huffman clearly seem to me to appear to be evidence that could and should have been introduced by the government in its case in chief. I don't understand why you didn't, but for some reason the government chose not to. You can't just hold that out and expect to get it in in the form of a rebuttal case. So I'll let you respond to that.

MS. KING: Your Honor, Rachel King for the United States.

The opinions that --

THE COURT: Put that on so we can hear you better.

MS. KING: Your Honor, Dr. Roegiers and Dr. Huffman are responding to Dr. Blunt and Dr. Zimmerman's use of the compressibility value of 6. In particular they're responding to Dr. Zimmerman's arguments about the validity of the core tests.

THE COURT: But you are really trying to buttress or introduce evidence to support Dr. Kelkar's assumption that it was 12 or the use of 12 instead of 6. That was available data. Why didn't the government introduce that in its case in chief?

I don't understand how you think you could hold that out as rebuttal.

MS. KING: Your Honor --

THE COURT: It was available to you. It wasn't a surprise. I mean, your expert said it was 12. If you wanted to support that, you could have and should have done that in your case in chief, it seems to me.

MS. KING: During the case in chief we did support that value. Dr. Kelkar testified about why 12 was the correct value of compressibility.

THE COURT: He did. That's in evidence, but now you are trying to introduce other, additional evidence through two additional experts to say why they think he used the right number. That's not critiquing or that's not rebutting the BP case; that's supporting your case.

MS. KING: The thrust of their opinions, Your Honor, is that the core tests relied upon by Dr. Zimmerman are unreliable.

THE COURT: That's a different issue. I think you can go there. But that's different than the affirmative -- attempt to prove affirmatively that 12 is the right number.

MS. KING: Absolutely, Your Honor, and we do intend to comply fully with Judge Shushan's order --

THE COURT: Maybe we are arguing about nothing here. But BP says you haven't complied, that you haven't, for example, redacted these things out of their reports.

MS. KING: Well, Your Honor, what has been redacted from the reports is all support, all affirmative support for a value of 12. And so what's been redacted from the reports includes a complete appendix from the Roegiers report, and those are the affirmative calculations that Judge Shushan specifically refers to in her order as stricken, and those have been completely removed from Dr. Roegiers' report.

Now, today -- rather, Monday, in the midst of trial, BP comes to us and says that they believe there's an additional affirmative support for 12 microsips in the Roegiers report; but what they are pointing to is, in fact, a portion of Dr. Roegiers' report where he is talking about the core data. He is saying that tight curves in this figure that he is referring to don't match the core data; and he is saying, therefore, he thinks the core data is unreliable. Now, BP never produced --

THE COURT: Meaning the sidewall cores?

MS. KING: Exactly.

THE COURT: Again, that's different than what I'm talking about.

MS. KING: But these are the redactions that BP -- that BP is --

THE COURT: I think Ms. Karis wants to say something. She wants to preempt Mr. Langan here.

Are you going to yield time to her, Mr. Langan?

MR. LANGAN: Absolutely. It's her witness, Your Honor, so it's perfectly appropriate.

THE COURT: All right. Yeah.

MS. KARIS: I think Your Honor has got it exactly right. We have no criticism or no objection to the United States' experts. We have cumulativeness issues, and we'll address that separately tomorrow, depending on how the testimony comes in. But we have no objection to them criticizing the basis for the sips. That is still in the report. That complies with Judge Shushan's order. That is not our issue.

However, the United States has left in Dr. Roegiers' report and Dr. Huffman's report statements that were in support of why they now, as part of rebuttal, are sponsoring a new number, the number of 12, which Dr. Kelkar put forth. It's their statements about why 12 being reasonable or unreasonable -- reasonable, as they conclude -- to support Dr. Kelkar is what we have objected to.

So the issue of we raised this Monday, it's correct we raised it Monday, but the order has been out there for a while and the redactions should take place. It's the United States' obligation to comply with the Court's order and to take the 12 out. That's what we are asking, and affirmative statements --

THE COURT: Here's what we're going to do. I have made my view pretty clear, I think, on what I think is proper rebuttal and what's not. So I expect the government to comply with that when they present these witnesses tomorrow. To the extent they try to go beyond that, you can raise an objection. I will rule on it at the time.

Meanwhile, I'm not going to -- the reports themselves can be offered. We are not going to put them into evidence until we are sure that all the necessary redactions are made. Okay?

MS. KARIS: Thank you, Your Honor.

THE COURT: That may be after they testify. Okay?

MS. KING: Can we respond in writing to the motion?

THE COURT: If you care to, but I doubt you are going to change my mind.

MR. BROCK: Judge Barbier, I was going to let you know that Dr. Johnson is our last witness. We don't have other videotape. We will be ready to "officiantly" rest tomorrow morning when Dr. Johnson concludes and to move into the rebuttal case.

THE COURT: The government, you need to have your witnesses here tomorrow morning.

MS. HIMMELHOCH: We will, Your Honor, and we have every reason to believe we'll complete tomorrow evening.

MR. DOYEN: Your Honor, a bit of housekeeping. Mike

Doyen for Transocean and the aligned parties.

THE COURT: There's some issue regarding some dispute over exhibits relating to the expert Iain Adams?

MR. DOYEN: That's correct, Your Honor. We have been trying to find a sensible point to impose upon the Court. I know you're trying to get this all done this week. I just won't be here tomorrow, so we were hoping to take this up before. If it's inconvenient for the Court to do it now, I'll have one of my colleagues --

THE COURT: Refresh my recollection. What was the nature of his testimony, again?

MR. DOYEN: You may remember on the last day, BP came in and said they would call Adams and perhaps Gibson. Mr. Adams testified it was reasonable not to use the BOP-on-BOP, that it wasn't ready --

THE COURT: I remember Mr. Adams, certainly, yes. He was the -- yeah, okay, I remember him.

MR. DOYEN: So there's one little issue, Your Honor, there's only one issue that pertains to four call-outs.

THE COURT: These are exhibits that you wish to introduce?

MR. DOYEN: That BP is introducing. And we've talked --

THE COURT: You object to them?

MR. DOYEN: Yes, Your Honor.

THE COURT: Four exhibits?

MR. DOYEN: There's four call-outs, all from one exhibit. The exhibit is Mr. Gibson's report.

MS. KARIS: No. That's not entirely accurate.

MR. DOYEN: I will state my part. Maybe there's some other exhibit they're talking about.

THE COURT: What is your objection?

MR. DOYEN: There are four pages they want to put in from Mr. Gibson's report.

THE COURT: Remind me who Mr. Gibson is.

MR. DOYEN: So Mr. Gibson was a witness who did not testify because BP did not call him. They had always announced that he would be testifying before Adams that came in in the morning. I'm sure the Court has read it. I came fully prepared to cross-examine him on Thursday. They said, We are going to switch the order, we'll call Adams; maybe we'll call Gibson, maybe we won't.

They never called Gibson, so his report is not coming into evidence. Mr. Adams said in his report, I looked at Mr. Gibson's report. I rely on it. I think it's reasonable, well done, etc., etc.

THE COURT: Okay.

MR. DOYEN: Okay. I, therefore, put up one sentence from Mr. Gibson's report, said, Do you agree with this?

Yes.

We offer that one sentence.

On redirect, counsel then put up three additional sentences from Mr. Gibson's report, perhaps under the rule of completeness, giving some additional context. I made no objection to that and have no objection to that.

But in addition to those three sentences from Mr. Gibson's report that BP asked Mr. Adams about, said, Do you agree with this?

Yes. Yes.

They want to put in the entire page that that sentence comes from from Mr. Gibson's report for, as far as I can see, no good reason. It's just a back-door way into getting in a chunk of Mr. Gibson's report. The way to get in Mr. Gibson's report was to do what they said they would do at the beginning of the week and the middle of the week, which was to call Mr. Gibson and offer the report.

THE COURT: I understand. Let me hear from Ms. Karis.

MR. DOYEN: Thank you, Your Honor.

MS. KARIS: I'm going to try to get through this quickly.

Mr. Doyen, as he correctly pointed out, was the one that elected to go into Mr. Gibson's opinions with Mr. Adams. There are pages and pages of the transcript, 1130 on, where he begins by saying he relied on Mr. Gibson, here's what Mr. Gibson said in his report. He uses the TREX. He goes through Mr. Gibson's opinion.

In fact, if you look up the submission of the aligned parties in their response for a summary judgment, they quote extensively Mr. Adams referencing Mr. Gibson. On redirect, following up on what Mr. Doyen had done, I asked Mr. Adams, for completeness, about those opinions and used the pages from Mr. Gibson's report that that testimony that Mr. Doyen asked about, what the basis was for that.

What we are now offering -- we are not offering the entire report, to be clear. What we are offering is where the call-out came from and where we referenced the page during the testimony, to put only those pages into the record. And we established a rule in Phase One, as I understood it -- and I have here the e-mails from this in which Mr. Barr and Mr. Carter, counsel for Transocean, asked at the very beginning, they said -- this is in March of 2012. They said: "If a party offers an entire exhibit, we believe for context it's appropriate to put not only the page or call-out but the entire page."

This is the agreement we had in Phase One. Here's a quote from Mr. Barr, page 1663. It says -- he is saying: "Almost all of them are individual pages. I would like to propose we can offer the page, not only the call-out displayed for context."

That is exactly what we are doing. I am just asking to put in the call-out with the page for context.

THE COURT: Obviously I haven't looked at what you have in your hand, so I don't know if it's necessary for context or not. Often it is, but --

MR. DOYEN: Your Honor, what we will do -- and I don't think this needs to be ruled on tonight as far as we are concerned. What we have made is --

THE COURT: You know what, why don't we do it this way. I know the issue is you are not going to be here tomorrow. Right?

MR. DOYEN: Yes, Your Honor, that's the problem.

THE COURT: Why don't we do this. This is something that pertains to the first segment. We don't have to resolve this tonight. Why don't you-all each submit just informally directly to Ben tonight or whatever --

MR. DOYEN: We've got them as we think they should come in. She's got them as she thinks --

THE COURT: Give them to Ben. We will look at it. I will rule on it. Okay?

MS. KARIS: Your Honor, I am happy to give the transcripts that I just referenced --

THE COURT: That's fine. Give them to Ben, please. Thank you.

MR. DOYEN: Thank you, Your Honor.

06:48 **THE COURT:** All right. Any other matters?

06:48 **MR. BROCK:** Thanks for the extra 30 minutes today. I think that gives us a chance tomorrow.

06:48 **THE COURT:** Long day. Thanks, everybody, for hanging in there. We will see you tomorrow morning.

06:48 **THE DEPUTY CLERK:** All rise.

06:48 (Proceedings adjourned.)

06:48 * * *

CERTIFICATE

I, Toni Doyle Tusa, CCR, FCRR, Official Court Reporter for the United States District Court, Eastern District of Louisiana, do hereby certify that the foregoing is a true and correct transcript, to the best of my ability and understanding, from the record of the proceedings in the above-entitled matter.

s/ Toni Doyle Tusa
Toni Doyle Tusa, CCR, FCRR
Official Court Reporter

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