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UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF LOUISIANA

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IN RE: OIL SPILL BY THE OIL RIG *DEEPWATER HORIZON* IN THE GULF OF MEXICO ON APRIL 20, 2010 CIVIL	Docket No. MDL-2179 Section "J" New Orleans, LA Monday, October 7, 2013

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IN RE: THE COMPLAINT AND PETITION OF TRITON ASSET LEASING GmbH, ET AL	Docket No. 10-CV-2771 Section "J"

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UNITED STATES OF AMERICA V. BP EXPLORATION & PRODUCTION, INC., ET AL	Docket No. 10-CV-4536 Section "J"

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DAY 5, MORNING SESSION
TRANSCRIPT OF NON-JURY TRIAL PROCEEDINGS
HEARD BEFORE THE HONORABLE CARL J. BARBIER
UNITED STATES DISTRICT JUDGE

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I N D E X

P R O C E E D I N G S

(MONDAY, OCTOBER 7, 2013)

(MORNING SESSION)

(OPEN COURT.)

08:06:18 THE COURT: Good morning, everyone. Please be seated.
08:06:24 Well, condolences to you folks from Chicago. Luckily, Karen turned
08:06:38 out to be a fizzle; a shoo-shoo, as we call it down here. So
08:06:44 luckily it wasn't much. In fact, there was nothing to it. It was
08:06:47 a beautiful weekend.
08:06:48 Okay. Any preliminary matters before we proceed to
08:06:52 opening statements? I think we have 90 minutes per side?
08:06:56 MR. BROCK: Yes, sir.
08:06:57 THE COURT: I remind each side again, you do not have to
08:07:00 use all of your allotted time. You're welcome to yield some of it
08:07:05 back.
08:07:05 Okay. We will hear -- who is going to make the opening
08:07:08 for the government?
08:07:10 MR. O'ROURKE: Steve O'Rourke for the government.
08:07:12 THE COURT: All right. Mr. O'Rourke.
08:07:32 One second, Mr. O'Rourke. All right.
08:07:53 MR. O'ROURKE: Good morning, your Honor. Am I miked up
08:07:55 correctly here?
08:07:56 THE COURT: I think so.
08:07:57 MR. O'ROURKE: Can you hear me okay?

08:07:59 THE COURT: Yes.

08:08:00 MR. O'ROURKE: Your Honor, Steve O'Rourke for the United
08:08:02 States for the quantification segment, opening statement.

08:08:12 Your Honor, how much oil came out of the Macondo well?
08:08:15 The answer is 5 million barrels. We will present experts using
08:08:21 four different methodologies. Each of these comes to a similar
08:08:25 conclusion. They used data and information that were provided by
08:08:29 BP during the response action, and they each conclude that the rate
08:08:33 at the beginning was about 62,000 barrels of oil per day. By the
08:08:38 last day, July 15th, it was about 53,000 barrels of oil per day.
08:08:44 Added those days up, it was 5 million barrels.

08:08:47 Could we have the first demonstrative, please.
08:08:51 Demonstrative 21007. What will the defendants say, your Honor?
08:08:55 This is just a chart showing our experts at the top. They are just
08:08:59 listed in alphabetical order. The Y axis is the number of millions
08:09:04 of barrels of oil in total. You can see our experts all match up
08:09:09 at around 5 million barrels, but the defendant's experts are
08:09:12 substantially lower.

08:09:12 And the question for you, Judge, is why is there such a
08:09:15 difference. The answer has two parts. First, the defendant's
08:09:18 experts are disavowing data and information that BP provided to the
08:09:23 government during the response action. Second, they hypothesized a
08:09:28 period of weeks at the beginning, when only a little bit of oil was
08:09:32 coming out, that it couldn't get out of the wellbore and had to
08:09:35 slowly erode its way out over the course of weeks. The evidence

08:09:38 will show that those theories are not valid.

08:09:40 So I'll try to use less than 90 minutes, as you
08:09:46 suggested, I'll go for 89 minutes. But the outline of what I'm
08:09:50 going to say is, first, I'll talk about the relationship between
08:09:53 last week, the source control track, and how some of the source
08:09:57 control efforts provided data and information that could be used to
08:10:00 inform the question of quantity and flow rate. Second, we will go
08:10:03 to the four experts for the US and, where appropriate, compare them
08:10:06 to the defendant's experts, and at the very end just a little bit
08:10:09 about the defendant's case.

08:10:10 And, Judge, I'll be talking about the difference between
08:10:14 flow rates and flow quantities, and obviously there is a
08:10:16 difference. It's like if you jump in your car and take a ride for
08:10:19 an hour, even if your odometer is broken, if you've been looking at
08:10:23 the speedometer, if you've been driving 60 miles an hour for an
08:10:26 hour, you have a sense you've covered about 60 miles. So at the
08:10:29 beginning we will be looking at flow rates; later, total flow
08:10:32 quantities.

08:10:33 Can we have the next demonstrative, please. This is just
08:10:35 a timeline of the source control events, some of them you already
08:10:39 know about. At the beginning, explosion of the rig. You heard a
08:10:43 lot about the top kill last week at the end of May. Of course, you
08:10:47 heard about the capping stack last week of July 15th.

08:10:50 Some of the other data points on here, your Honor,
08:10:52 May 8th is when the BOP pressure gauge came online. It had been --

08:10:58 the data had been unavailable after the MUX cables blew out in the
08:11:03 explosion, but by May 8th, parties were able to get that
08:11:06 information and data from May 8th to the end. The Top Hat is also
08:11:10 on there starting on June 3rd, another device that provides us
08:11:14 information about flow rates.
08:11:19 Can we have the next demonstrative, please. This is just
08:11:23 some film footage from ROVs, remote operated vehicles, submarines
08:11:27 that were down there filming the flow April 23rd, the day after the
08:11:32 rig sank; about a week later on April 29th. Here we have mid-May
08:11:37 after the BOP pressure gauge is online. We should have June 3rd, I
08:11:42 believe, next; that's the day the riser was completely cut off.
08:11:47 Here is the Top Hat, not in place, but being moved around. And
08:11:53 July 14th, that's the top of the capping stack on the lower right.
08:11:56 That's the oil coming out the top of the capping stack before
08:11:59 shut-in.
08:12:04 Now, as you know, your Honor, some of the oil was
08:12:07 collected. So if we could have the next demonstrative, please.
08:12:12 This is the same timeline, but underneath we're superimposing
08:12:17 events where oil was collected. And this is just a stylized
08:12:24 diagram to show you which devices were collected, and you can see
08:12:27 the reds are insertion tube tools. The riser -- sorry, the Top
08:12:31 Hat, the Q4000 and the capping stack itself collected about
08:12:37 812,000 barrels of oil during the course of the spill.
08:12:41 And you may recall that BP moved for summary judgment off
08:12:45 of that number of barrels, and we stipulated that that was the

correct number of barrels as oil that was collected directly from the well to the vessels. So those data and information about collection rates are reliable.

And the question for you, your Honor, therefore, is not how much was collected, but how much was not.

And if we could have the next demonstrative, please. Again, just a stylized impression of how the flow started at around 62,000 barrels of oil per day and weighing down over time to 53,000 barrels at the end. Take out those parts that were collected, that leaves 4.2 million barrels released out of the five point million [verbatim] barrels that came out of the well.

So let's start by talking about the capping stack. As you know, it stopped the flow. We won't talk about whether BP should have had one, that was last week's topic. We're going to talk about the data that came from it this week. It was installed on July 12th, approved to be shut in on the 14th and then shut in on the 15th of July.

But that wasn't the end of the story, your Honor, because shutting in the well posed a risk of well broach; could there be a hole in the well with an underground blowout.

If we could have the next demonstrative, please. This is BP's demonstrative from their opening statement from the source control track where they explained to you that a fear of shutting in the well would be that burst disks or otherwise oil would come out of the outside of the well through the underground, through the

reservoir and become an uncontrollable underground blowout. So when the capping stack was installed, it had the same potential problem for an underground blowout. And how do we deal with this question? I think I just adjusted the mic better.

Could we go to the next slide, please. The way we dealt with this question was that the science advisors, the U.S. Geological Survey, they were all working on models to determine what the shut-in pressure should be. When you close the capping stack, you expect it to pressure up. A little bit like a garden hose; if you are watering the lawn and you close the valve in your hose, you hear the pressure building up, the hose tightens up when you shut it, you have a pressure buildup in the nozzle. If you don't get that pressure buildup, you know the hose has a leak or isn't connected to the house correctly or something.

Same with the capping stack of the well. When the capping stack was shut, it better pressure up. If it doesn't pressure up, you might have an underground blowout because the pressure is going out the side. So this test was developed. A simple green, yellow, red test. Green would be a high enough pressure to show well integrity, we can leave the well closed. Red meant reopen the well and restart the spill.

So this was a very significant time in the response action. The well was shut-in, and the question was whether we were going to reopen it or leave it closed. So we got data -- the government got data and information from BP during that crucial

time and relied on that data to run models.

When the well was shut-in, of course it pressured up into the yellow zone, the questionable zone. So Dr. Paul Hsieh, one of the witnesses who will come testify, ran a model overnight to see whether the capping stack could remain closed. He was able to model a case for well integrity using the data and the information on the assumptions that BP had given them.

Dr. Hsieh was not the only one involved. You heard last week some clips from the depositions of Dr. Hunter. Dr. Hunter will also come testify. He is our first witness. He led the science team. This was three laboratories, three of the national laboratories associated with DOE, Sandia, Lawrence Livermore, and this science team came to work on the response action. Why were they there? Because they run nuclear power plants which are full of pipes carrying fluids at high pressures, so they're experts in this field.

This Tri-Labs team was assembled to offer any assistance they could, and they were involved in the same pressure-up question, should we leave the -- can we leave the capping stack closed or must we reopen it.

The defendants might present a case to you that these Tri-Labs people were just political hacks, put there by the administration to generate a high flow rate. But Dr. Hunter will come and testify to you that there was no conspiracy, no administration agenda, they were there to try to get right answers

and to help.

What did BP think about these Tri-Labs people? BP's vice-president, Mike Mason, he said, "These were a terrific group of people who were," quote, "trying to support us in the efforts to stop the well." He said by e-mail that he enjoyed meeting with the, "nation's top scientists."

One of these Tri-Lab people took a look at the capping stack and tried to run a calculation to see how much flow was coming through it at the time, Dr. Dykhuizen. He is our second expert. You will hear from him today.

Could I have the next demonstrative, please. This is just a model of the capping stack.

Next slide, please. We thought this was a good model before we saw Mr. Lee with the Lego model last week. But this is what we have.

Can we have the next slide -- before the next slide -- that's fine. The next slide. So what we have here, Judge, is just a flow meter. A flow meter is nothing more than a pipe with a restriction in it with the pressure gauge below and a pressure gauge above. As the fluids flow through, they encounter the restriction and you just measure the drop in pressure. The pressure changed, it might be called delta P, delta P, pressure drop, but this is a simple fluid calculation, change in pressure times a K factor, K to represent the restriction, gives you the flow rate.

08:18:24 So next slide, please. Applying that simple equation to
08:18:29 the capping stack, you can see that the purpose of the capping
08:18:32 stack was to have the flow come out the choke line and eventually
08:18:35 have it shut.
08:18:36 Next slide, please. Shows that you have a pretty
08:18:39 uncomplicated pipe ladder that comes up, takes a right, takes a
08:18:43 left, takes a right. And you have the pressure differences because
08:18:47 there's a pressure gauge at the bottom of the BOP and it's a known
08:18:51 pressure in the ocean. Subtract those pressures, multiply by a K
08:18:56 factor, you get the flow rate.
08:18:57 And the next slide shows if you're Dr. Dykhuizen, which
08:19:00 is what the capping stack looks like, it's nothing more than a
08:19:03 bunch of K factors. He did the math to get 53,000 barrels of oil
08:19:08 per day. He will come and testify to you that this is an
08:19:11 undergraduate level problem.
08:19:12 Other experts for the United States are coming. They did
08:19:16 similar calculations, came up with similar rates for the last day.
08:19:19 And so did BP's in-house engineers at the time.
08:19:22 Can we have the next demonstrative, please. This is just
08:19:28 on the Y axis data flow rate in thousands of barrels per day. You
08:19:33 can see back in July of 2010, the green lines are BP's in-house
08:19:37 people coming up with numbers, give or take around 53,000 barrels
08:19:41 of oil per day. Our experts are coming to trial, still about
08:19:47 53,000 barrels of oil per day.
08:19:49 I won't show you every one of these exhibits, but a

08:19:51 1 couple of them. Next exhibit, please, which is TREX 2420. A
08:19:56 2 letter from BP's chief operating officer Doug Suttles to Admiral
08:20:00 3 Watson, the federal on-scene coordinator. Call out, please. BP is
08:20:05 4 telling the Admiral to rely on an assumption of 53,000 barrels of
08:20:11 5 oil per day in order to calculate flow rate and to figure out how
08:20:15 6 much dispersant to apply.
08:20:17 7 Next exhibit, please, which is 9491. These are
08:20:22 8 calculations performed by Adam Ballard. He came and testified last
08:20:26 9 week on the source control track. Back in July, using capping
08:20:30 10 stack data, he calculated 59- to 62,000 barrels of oil per day.
08:20:34 11 The next slide, please, which is TREX 11191. This is
08:20:40 12 Farah Saidi, in-house BP flow assurance engineer reporting to her
08:20:44 13 boss, Trevor Hill, the single point of accountability for well
08:20:47 14 integrity testing. Government prediction verified 51- to 54,000;
08:20:52 15 and Ms. Saidi also performed her own independent calculations,
08:20:56 16 getting 51,500 barrels of oil per day. I won't show you the
08:21:01 17 exhibit. It was on the demonstrative.
08:21:02 18 And the last one, the deposition of Richard Lynch.
08:21:06 19 Richard Lynch, BP's vice president in charge of containment,
08:21:10 20 including the capping stack. He testifies that once you had it
08:21:14 21 down to a single line and single choke and corresponding value and
08:21:19 22 the pressure, it's a direct calculation to flow rate. It's the
08:21:23 23 same as K factor times pressure change.
08:21:26 24 "Do you remember the results?
08:21:26 25 "Yes, about 56,000 barrels of oil per day.

"And do you have any reason to doubt that calculation?

"That's a pretty straight calculation, no, I don't."

So to summarize those with the next demonstrative, D-21010, back in 2010, the Tri-Labs team, BP all coming up with numbers around 53,000 barrels of oil per day. Today all of our experts have the same number.

The defendants will not present you a final day flow rate. They will nitpick at our experts, for sure, but they will not tell you what the actual flow rate was. They don't have any evidence on that.

So when BP wanted to shut in the well it relied on the National Labs' calculation, now they will tell you the National Labs were just there for political purposes and you shouldn't trust their results.

Let's talk about two other events in the source control timeline. The top kill, you heard enough about it last week. All I'll say is that pressure data from the top kill allowed a similar calculation, pressure drop times K factor. Dr. Dykhuizen will opine that the flow rate then was about 60,000 barrels of oil per day.

Turning to the Top Hat for another one of these flow meter-type calculations. Can we have the next demonstrative, please. A cartoon of the Top Hat. Next slices it open so we can see the inside. The point of this was to collect oil. You can see the oil comes up and goes up the top pipe, goes up to ships. About

20,000 barrels per day being collected. To keep the pressure positive, they also have vents out the top and a skirt out the bottom. And there's a pressure gauge inside. So, again, a pressure inside, a pressure outside, pressure drop, K factor. Dr. Dykhuizen will testify that about 60,000 barrels of oil per day coming out of the Top Hat, and the Top Hat was installed on June 3rd.

Can we have the next video, please. Here is video of the Top Hat just so you can get a sense of it. You can see the oil coming out of the skirt. You can barely see the Top Hat itself. And the reason I show you this is because on days when 20,000 barrels of oil per day were being collected to vessels, it looked like this; and on days when zero barrels were being collected to vessels, it looked like this. No difference with a 20,000-barrel change. And that's part of the reason that Dr. Dykhuizen was able to calculate his number.

The defendants got a call back to sort of the timeline of point estimates of flow. The defendants will call Dr. Zaldivar to offer one point estimate, flow out of the riser around May 13th to 16th. He comes with a lower number, about 30,000 barrels per day or so. Now, that might seem odd because last week BP's witnesses all testified that in early May it was impossible to come up with a flow rate, but he is going to come up with a flow rate now. More to the point, Dr. Zaldivar's model uses a model pipe that's half the size of the real pipe. So, short, his numbers are off by a

fact of two. If you correct for that, he is getting about 60,000 barrels of oil per day, similar to the calculations of Dr. Dykhuizen.

So could we have the next demonstrative, please, which is back to the source control timeline. So we've talked about three measurements of rate, sort of like the speedometer, if you will, capping stack, Top Hat, Top Kill. And on this sort of flow meter speedometer rates, the defendants are going to tell you that you need to know what's going on inside the wellbore to test those flow rate calculations, that there's restrictions in the wellbore and what have you. But when the cop pulls you over for speeding with the radar gun, he knows you're speeding. He doesn't need to know whether you're driving a V8 or a Slant-6, doesn't need to know if it's a standard or automatic, he's measured your speed.

We also have from here pressure data, collection rate data, and all of the information that BP provided to the government at the time of the capping stack shut-in, the crucial time of the response. With that information, we go on to the main question, part two of the opening: What is the total quantity released over the total period?

Can we have the next slide, please. Again, we have four different methods. Why four different methods? Because this is an unusual problem, so you use different lines of evidence to see if you can come to a rough agreement between the different lines of evidence. An unusual problem, luckily, because we don't always

have big oil spills where we have to calculate the flow rate.

So the four different methods, we have four different experts, and just -- this is sort of -- actually, I'm supposed to do this. May I approach?

Sorry about that.

This is just the same slide. I'll just leave it here sort of to show you where we are in the presentation. And you can see that when we talk about our expert, Dr. Griffiths, we will compare him to one the defendant's expert; the same with Dr. Kelkar, we will compare him to one of the defendant's experts.

And that's the order they're going to appear at the trial as well, and that's the order I will discuss them in this opening statement.

Can we have the next exhibit, please. This is the same slide I showed at the beginning with just experts in alphabetical order, but what we've added here is a line at 4.5 million barrels. And what does that represent? That's just taking the last day of flow, 53,000 barrels of oil per day on the last day, multiplying by 85 days, a little less than the total flow period. So that's there just as a gut check, what happens if you just take the last day, extrapolate back at the same rate for the entire time.

You can see that the experts for the United States are just slightly above, maybe 10 percent above a flat rate assumption of 53,000 barrels per day for the entire time. The defendant's experts are substantially below.

08:27:50 Now, why are ours a little bit higher than constant
08:27:53 discharge rate from beginning to end? Because of the concept of
08:27:57 reservoir depletion. Oil comes out of a reservoir faster at the
08:28:00 beginning, and as the pressure drops, the oil slows down. It's
08:28:04 like a balloon. If you have a balloon full of air and you let it
08:28:07 go, flies around all crazy and fast at first, but then lands on the
08:28:11 table and sputters when the pressure falls off and flow rate falls
08:28:15 off.

08:28:15 Can we have the next exhibit, please. This is, again,
08:28:18 about the concept of reservoirs depleting over time. You saw this
08:28:22 exhibit last week. BP writing to Admiral Landry.

08:28:27 Next page, please. And last week this was presented to
08:28:29 talk about whether BP was being accurate about its flow rate. But
08:28:32 I am presenting it just to show you this line. Declining flow over
08:28:37 time, reservoir depletion. The line on the bottom is just the blue
08:28:40 5,000 per day line. You can ignore that. We know that was a false
08:28:44 number. But the reservoirs deplete over time. You can expect the
08:28:49 flow rates to be higher at the beginning and to wane down over
08:28:54 time.

08:28:56 Now, the defendant's numbers are going to be
08:28:58 substantially lower than just the flat assumption of 53,000 barrels
08:29:02 per day. Ours are a little bit higher because of the reservoir
08:29:06 depletion.

08:29:06 Now, let's look at next exhibit, please. For our first
08:29:09 expert of total flow, Dr. Dykhuizen, this is his estimation of the

08:29:16 1 total flow, about 5 million barrels. And you can see the same
08:29:20 2 characteristic reservoir depletion over time. He ends on
08:29:24 3 53,000 barrels of oil per day, the measured flow rate from that
08:29:27 4 day, and he goes -- starts at 62,000 barrels of oil per day with
08:29:32 5 the decline of the reservoir depletion over time.
08:29:34 6 This bump in the middle is just the day the riser was cut
08:29:38 7 off. Removal of that entire restriction allowed the flow to jump
08:29:41 8 up about 3 to 4 percent. The little bump fall down at the end on
08:29:46 9 the right side of the chart is when they installed the capping
08:29:48 10 stack but hadn't closed it yet. The stack itself was a restriction
08:29:52 11 to slow down flow a little bit. And on the 15th, it closed.
08:29:56 12 One final thing before we move off of Dr. Dykhuizen. The
08:29:59 13 first two days, we have zero flow. That's how he addressed the
08:30:02 14 question the defendants will present about impediments to flow
08:30:07 15 inside the wellbore, the BOP and how they erode over time. He
08:30:11 16 assumes that the first two days had zero flow, no flow whatsoever.
08:30:16 17 And if we can have the next slide, please. So this is
08:30:20 18 April 22nd, this is one of the days when Dr. Dykhuizen assumed zero
08:30:24 19 barrels of oil coming out, zero flow dealing with the erosion over
08:30:29 20 time issue. As you can tell, there is oil coming out of this well.
08:30:32 21 So his assumption of zero barrels per day for the first two days is
08:30:35 22 a conservative one.
08:30:37 23 Can we go to the next slide, please. So we've talked
08:30:41 24 about Dr. Dykhuizen, and now we will talk about Dr. Griffiths, who
08:30:45 25 develops his own model calibrated to the capping stack, but using

08:30:50 the blowout preventer pressure gauge that came online on May 8th.
08:30:53 As appropriate, we're going to compare him with Dr. Gringarten and
08:30:56 some of the other experts for the defendants.
08:30:59 Dr. Griffiths is a senior scientist from Sandia. He's
08:31:03 using the same principle of pressure drops, but calibrated to the
08:31:06 BOP pressure gauge. During the response action, some people
08:31:11 questioned whether the BOP pressure gauge was reliable because it
08:31:15 had some vacillations. Dr. Gringarten for the defendants says it's
08:31:20 reliable. BP during the response action relied on it, and
08:31:24 Dr. Griffiths relies on it, too.
08:31:26 Two points about his work before we get into the details.
08:31:29 First, he developed his model specifically for this well, so unlike
08:31:33 some experts who pulled off-the-shelf software like OLGA or
08:31:37 MAXIMUS, he built his own model. And, second, he had that model
08:31:40 published in a peer-review journal. He did that outside of the
08:31:44 context of this lawsuit. Justice Department didn't hire him until
08:31:48 after he had sent his article in for publication.
08:31:51 If we could have the next slide, please. So last week
08:31:55 you heard Dr. Willson talk about modeling. You start with
08:31:57 conceptual of a model, then you turn it into a mathematical
08:32:01 equation. Here is the conceptual model Dr. Griffiths uses.
08:32:04 Reservoir pressure, BOP pressure. As the pressure drops, that's
08:32:09 how he calculates his flows.
08:32:11 If we can go to the next slide, please.
08:32:15 I'm going to use the laser pointer here and point to the

black dots in the middle. These are the BOP pressure gauge data; 94,000 data points. And you can see the pressure is up on the last day, the capping stack closes in. Using this model, he gets this reservoir depletion. Characteristic reservoir depleting over time.

Next slide, please. Shows converted into number of barrels of oil per day. Starts around 62,000, declines over time with characteristic reservoir depletion, lands at 53,000 barrels of oil per day.

And you can see his model is sensitive to events like when the riser was cut and when the capping stack was installed. And his result is about 5 million barrels of oil total.

Can we go back one second, please, to the previous slide.

And May 8th is the first data point, so you have to figure out what to do from April 20th to May 8th. What Dr. Griffiths did was continue the trend back based on the reservoir depletion.

Now, we can go to the next slide, please. Thank you. One other thing about Dr. Griffiths' work, he did three alternatives to his main analysis. His main analysis was a pressure drop from the reservoir to the BOP, but he also compared the pressure drop from the reservoir to the sea and from the BOP gauge to the sea. This gives an analysis of different pathways, and lets him analyze whether the wellbore and the BOP were changing over time in any way that would lead him to believe there was impediments to flow that were eroding. But because he gets a

constant steady flow and constant steady pressure over time in the wellbore and in the BOP and in the whole complex, it shows him that neither part of it is eroding in some rate other than the other part leading him to conclude that erosion was not a huge factor, at least after May 8th

Now, I am going to start talking about Dr. Gringarten, under Griffiths with Dr. Gringarten. We are going talk about him because he matches to the BOP pressure data as well. His cumulative flow is 2.4 up to 3 million barrels. And how does he get that low number? Three ways.

First, he starts by assuming a flow rate in order to calculate a flow rate. He assumes a flow rate of 45,000 barrels of oil per day on the last day, July 15th. He does not assume 53,000 barrels of oil per day, the measured flow rate on the last day. He uses two different assumptions: One, he uses 45,000 barrels of oil per day the entire time from Day 1 to the end, and that gives him 3 million barrels. Next, he assumes it starts at 30, about half the period, jumps up to 45 for the rest. That gives him a totally different number, 2.4 million barrels. So the starting assumption controls the output of his model.

And perhaps this is just by chance, but if you take the assumption of 30,000 barrels of oil per day, jumping to 45,000, and just add that starting assumption up, it's 3.26 million barrels. The exact same number that their own expert, Dr. Blunt, concluded. So his starting assumption is the other expert's conclusion. He

never runs a case assuming 53,000 barrels of oil per day. His model is not calibrated to that data point.

The second thing about Dr. Gringarten's model -- if we can have the next slide, please -- is that he assumes that pressure drops slowly at a linear rate per week. So what we have here is the blue line is Dr. Griffiths' work for the United States, it's the same line we just showed you in Dr. Griffiths' exhibit. The three red lines are Dr. Gringarten's analysis. You can see Dr. Griffiths ends at 53,000 barrels of oil per day, the measured rate; while Dr. Gringarten for the defendants ends in the mid 30s. Because of the assumptions, he ends at the wrong place.

You can see there's great agreement between the two experts that for the BOP data period from May 8th to the end, we have slow decline or a steady state of flow over that entire period. No vast increases or decreases. And so we'll get the same kind of flow trends, similar models, except the difference is they end at the wrong place and Dr. Griffiths ends at the right place.

Before May 8th is the other big difference. Dr. Griffiths takes the flow rate trend and brings it back, just tabulates the same trend. Dr. Gringarten comes along here on the same trend, which is the first data point so he just takes a left and bangs down to zero right there.

I'll show you the same information, but instead of being flow rate it will be pressure.

If we could have the next demonstrative, please. Again,

the gray data points are the BOP pressure. You can see right here this complication is top kill so the pressures were jumping up and down that day. But Dr. Griffiths takes the steady stay of pressures, pressure inside the BOP, carries it back to the beginning. Dr. Gringarten takes the same steady trend back to May 8th, bangs a right, and jumps up to this number up here. And what the number up here is, is between 8,000 and 9,000 psi inside the BOP. That's the pressure one minute before the explosion. The BOP is locked in, the well is pressured up so high pressure it's about to blowout. And Dr. Gringarten assumes that the pressure must have bled off slowly, (sound effect), over time for weeks until it landed at the pressure inside the BOP on May 8th. Dr. Gringarten -- Dr. Griffiths for the United States assumes that the pressure blew off in a blowout, fell quickly, and then stays steady for the time.

And if we can have the animation, please. So what we're going to have here is just two tires: One has a blowout and one has a slow leak. Which one seems more like this case? Do we have the slow leak of pressure just waning off over weeks? Or do we have the pressure inside the well one minute before the explosion, locked in the BOP, then we had a giant blowout that destroyed the rig, and the pressure fell quickly.

Dr. Gringarten doesn't really provide a reason for why these pressures decline at a perfectly linear rate or why his flows increase at a perfectly linear rate from the beginning of the

explosion up to May 8th. But the defendants provide two other experts to try to come up with a reason for that. This is the erosion takes a long time theory.

And there is no doubt that materials inside the wellbore, inside the BOP did erode. You saw the ram blocks in Phase 1, they were eroded. Neither of the experts of the defendants have come to testify to you as to a rate of how fast this erosion occurred. They don't have a rate, they just say it takes a long time.

But the slow erosion theory is contradicted by the evidence from Phase 1 of this trial. Dr. Momber will come for the defendants and tell you the cement in the wellbore was set up, was an impediment of flow, eroded slowly over time. No specific rate, just slowly over time.

If we could have the next slide, please. Dr. Momber is an expert in construction concrete. He's never done any oil field cementing. With those qualifications, he will tell you that the cement was set up; but in Phase 1, John Guide for BP said, "the cement obviously didn't set up." And BP's Phase 1 cement expert, Dr. Calvert, said, "The negative pressure test was conducted before the cement reached compressive strength, i.e. was not set up." The expert for the US, Mr. Benge, also said cement was not set up.

You can take that down, please.

The other expert on erosion, Dr. Nesic for the defendants, he will talk about erosion inside the blowout preventer saying that erosion of the metals took a long time. Weeks and

08:40:40 1 weeks.
08:40:42 2 Again, if we can have the next slide. The evidence in
08:40:45 3 Phase 1 doesn't agree with him. On the right, TREX No. 1, the Bly
08:40:50 4 Report tell us that the fluid velocity through the leaking annular
08:40:54 5 was reaching ordinance of magnitude greater than the velocity of
08:40:59 6 the steel. And BP's blowout preventer expert Mr. Shanks told us,
08:41:04 7 "Erosion of the drill pipes occurred in less than a second. Is
08:41:08 8 that true? Yeah, it would be something of that timeframe." So we
08:41:14 9 have metals eroding in less than a second in Phase 1. Now, in
08:41:16 10 Phase 2 we're going to have an expert tell you that metals in the
08:41:21 11 BOP eroded slowly over the course of weeks.
08:41:24 12 You can take that down.
08:41:25 13 And remember from Phase 1 the BOP rams did not close the
08:41:29 14 whole way, they squished on the drill pipe leaving a path for flow
08:41:33 15 to go through to erode. And you also remember from Phase 1 that
08:41:37 16 when you saw the ram blocks, it's not like the big ram blocks
08:41:41 17 eroded into this -- some big ole circle, like, a fire hose that
08:41:45 18 allowed the flow to come through. All it look was a little
08:41:48 19 erosion, the little erosion that you saw around the bend and the
08:41:51 20 corners and the little holes in the BOP, that was allowing
08:41:54 21 53,000 barrels of oil per day on the last day. Once you have a
08:41:58 22 pathway sufficient for flow, it doesn't matter if the pathway gets
08:42:02 23 any bigger, it only has to be enough to allow that flow. If it
08:42:06 24 eroded bigger, it wouldn't contribute to bigger flow.
08:42:10 25 Dr. Nesic tries to back up his erosion-takes-a-long-time

08:42:15 theory with a model. He tries to model 35 days of erosion. He is
08:42:19 going to admit that his model after 12 days exploded. That's his
08:42:24 words, not ours, that the model exploded and was not able to model
08:42:28 out any of the rest of the period. So instead of realizing that
08:42:32 his model didn't work, he decided to rely on the ten days that it
08:42:35 did work and extrapolate a linear trend after all of the parts
08:42:39 where his model didn't work after it exploded.
08:42:46 The third and final thing about Dr. Gringarten -- again,
08:42:49 we're comparing him to Dr. Griffiths because they used the BOP
08:42:52 pressure data. Dr. Gringarten will admit that his cumulative flow
08:42:56 estimate is entirely dependent on the number called permeability.
08:43:00 And permeability is a measure of how easily the oil can move
08:43:04 through the rocks inside the reservoir.
08:43:07 If we can have the next demonstrative, please, 21003.
08:43:12 This shows you on the Y axis permeability to millidarcies, mD -
08:43:18 millidarcies. BP's estimate's in green. Dr. Gringarten's estimate
08:43:23 down here at 238 millidarcies in red on the right. US experts in
08:43:29 blue. You can see the US experts are between four and 500
08:43:32 millidarcies. Going back to the beginning before the well was
08:43:36 drilled at predrill estimate, BP had that big range, but their
08:43:39 estimate was 500 millidarcies. After drilling, the post drilling
08:43:44 technical memorandum, you see that range there with a center around
08:43:49 400. You can see Levitan's assumptions. You can see how their
08:43:53 data putting the permeability up into the four, 500 million -- four
08:43:57 to 500 millidarcy range and Dr. Gringarten's number way down at

238.

And at the line of 300 is other evidence that's been provided by BP. They're at 300. That's their 30(b)(6) deposition. They have Dr. Emilsen who came in Phase 1, testified about the OLGA modeling. He was using 300 millidarcies.

If we can have the next slide, please. So between BP's own experts, there's a 25 percent difference.

If we can have the next slide, please. And this is the comparison of the results between Dr. Larsen for the US, Dr. Gringarten for the defendants. The dots on this, the red dots are measured data. They were measured with a wireline tool inside Macondo before the explosion. The lines on this are the models. You can see the green line labeled 116 millidarcies. That's Dr. Gringarten's, the defendant's expert's opinion about the permeability of the M56D layer, and you can see that he matches a data point or two on the far right.

The red line is Dr. Larsen's opinion that 500 millidarcy is the right number for the M56 layer, M56D layer. You can see that his red line matches virtually every data point. That's the reason why he believes the 500 millidarcies is the best estimate of permeability.

Again, permeability matters because Dr. Gringarten admits his permeability controls his flow. If you double this permeability, you double his total flow estimates.

Next slide, please. To summarize Dr. Gringarten and move

on, he assumes the flow rate of 45,000 barrels of oil per day, ignores the actual measured rate of 53,000 barrels of oil per day. He assumes that from April 20th to May 8th the pressure bled off at a slow leak instead of a blowout. His total quantities is directly proportional to the permeability and his permeability is too low.

Next slide, please. So we've been through two of the experts. I am going to go to on Dr. Kelkar and the third method. The methodology is called material balance. The defendant's expert, Dr. Blunt, also uses material balance, so we will compare the two to each other.

Material balance is the tool commonly used in the industry, and it is used when you have drilled a well and you flow the flow rate for awhile and measure the flow rate, and then you're trying to determine how much oil is in the reservoir so you can know how long this well is going to produce for planning purposes.

And the next slide is -- on the top of the next slide is the traditional material balance equation. The unknown is the original oil in place, how much oil is in that reservoir. The top of the equation of oil production is the produced oil out of the well, measured it, measured the flow rate, you know how fast it's going. Then you take the pressure drop and compressibility. We have it in yellow because compressibility is based on estimations, assumptions, so it's got some uncertainty in it.

In this case, Dr. Blunt for the defense and Dr. Kelkar for the United States, rearranged the equation, ninth grade

algebra, just solving a different variable. Solving the oil production of flow rate. And you can see the compressibility is still uncertain, and the original oil in place is still -- is now one of the inputs rather than the outputs. Of course, it has uncertainty.

Dr. Kelkar admits that there are uncertainties and he gets the large range, bounding between four-and-a-half and five-and-a-half million barrels. Million barrel range. Dr. Kelkar for the US would agree that if you wanted a pinpoint estimate, you would look to some of the other estimates that have more precision.

Dr. Blunt gets narrow range 3.26 million barrels, very precise. And how does he do that? He does it by making assumptions about the inputs, original oil in place, compressibility, and pressure drop. I'll start with compressibility, move on to original oil in place.

Dr. Blunt's cumulative number is dependent on compressibility. If you increase the compressibility, you increase the total number. And a component of compressibility is how compressible the rock in the reservoir is. So compressibility, as it sounds, is how much the rocks can be compressed. And the rocks have spaces in them, pores, P-O-R-E-S, and the pores have oil in them. So reservoir rocks are kind of like a teenage boy's face that have oily pores. And a measure of this compressibility is how much these can be squished down.

Dr. Blunt is going to rely on Dr. Zimmerman to tell you

that you should measure the compressibility with six microsips as the measurement. This is a post dock analysis and it's based on what's called rotary sidewall cores.

If we can have the next animation, please. This is just a schematic of a well being drilled. Can we press once, please. And when you're sampling rock you can take a -- can you animate it one time, please -- you can take a conventional core or a whole W-H-O-L-E, entire core and you get a sample that goes down. It's got a big diameter, long length, and in addition, it takes up the stratification of the rock.

The alternative is a sidewall core, rotary sidewall core. If we can animate it, please. That's a little plug going sideways. I'm holding out my thumb because these plugs are about an inch in diameter and inch or two thick. If you can animate again. You can see the orientation changes. The sidewall core doesn't pick up as much of the stratifications and some of the properties won't be the same.

So for Macondo, we only have sidewall cores, the small samples that go sideways instead of a whole core. BP didn't take the whole core for this well, saved them $7 million. May be a reasonable decision, but that doesn't mean this Court has to limit itself to slavishly following the sidewall cores.

So let's see what BP told themselves and the government about rock compressibility at the time the capping stack was installed at that crucial time of well integrity testing.

08:50:31 Can we have the next demonstrative, please, which we'll
08:50:34 call it the compressibility timeline. I won't go through each of
08:50:38 these exhibits, but you can see on July 6th, nine days before the
08:50:44 capping stack shut-in, BP's reservoir engineers talking with BP's
08:50:48 in-house rock compressibility experts about these rotary sidewall
08:50:53 cores and whether six microsips was a good number. Six was a
08:50:56 number that came out of the Weatherford testing, same data that BP
08:51:00 is relying on today.
08:51:01 The reservoir engineers questioned six microsips is too
08:51:04 low and discussed the inherent bias of these sidewall cores. They
08:51:08 decided that they should talk about upgrading the number based on
08:51:11 data from analog wells in the Gulf of Mexico. Because their
08:51:15 experience in the Gulf of Mexico shows them that the rotary
08:51:18 sidewall cores, the little plugs, don't represent the rock as well
08:51:22 as the conventional cores, the large cylinders, and you need to
08:51:26 double the estimates in the sidewall cores to get a more accurate
08:51:29 representation of the compressibility of the rock.
08:51:32 By July 8th -- by July 7th they reached an internal
08:51:38 consensus that 12 is a good number. And by July 8th they are
08:51:41 recommending it as the most likely case. I will show this exhibit
08:51:44 on July 8th, and one on the 9th, and one on the 16th.
08:51:47 Can we have the next exhibit, please. This is BP
08:51:49 internally deciding that 12 microsips is the most likely number.
08:51:53 That little "U" shaped thing, that's the Greek letter means micro.
08:51:58 Next exhibit, please. Here is Bob Merrill, Dr. Bob

Merrill of BP presenting to the government on July 9th -- next slide, please -- this case.

Assumptions: CR, rock compressibility, is 12 microsips. He is running sensitivities, you can see in the other yellow line, as low as six and as high as 18 microsips.

The defendants will bring Dr. Robert Merrill to this trial, and he may try to tell you that the 12 microsips was some sort of worst case scenario number. But you can see on this slide that he presented to the government, he was using 12 as the assumption with sensitivities running from 6 to 18. So if he tells you that 12 is the worst case scenario, what was that 18 there for?

You will also hear from Dr. Hsieh. He's the U.S. Geological Survey expert who is here to testify about the capping stack shut-in and the green and yellow and red pressure up numbers that he came up with. He attended this meeting. And he will tell you that neither Dr. Merrill nor anybody else from BP said that 12 microsips was a worst-case scenario number, that you should go with 6 microsips.

The last one of these exhibits on compressibility from the time of the capping stack shut-in.

Next exhibit, please, 8639.

Here, again, a presentation -- next slide, please -- from BP to the government, continuing to use 12 microsips as the base case. Base case, not worst case.

As I mentioned, the six microsips number was based on

08:53:33 Weatherford data from the three plugs taken from the well before
08:53:36 the explosion. Our experts in rebuttal will tell you that those
08:53:40 cores are not representative because it's just the three plugs to
08:53:43 cover a 90 feet well and that there's questions about how the
08:53:46 testing was performed; and that they agree, you should double the
08:53:50 sidewall to match the whole core and get a better number.
08:53:54 So this is Dr. Roegiers and Dr. Huffman in rebuttal.
08:53:58 Dr. Huffman, who you met in Phase One, was talking about pore
08:54:03 pressure. Here we will be talking about pore compressibility. And
08:54:06 we are calling him in rebuttal because we didn't know that BP was
08:54:09 going to renege on the information that they provided to the
08:54:11 government at the time of the capping stack.
08:54:13 In fact, when they wrote to the Oil Spill Commission to
08:54:16 state their case about why the official government estimate of
08:54:19 4.9 million barrels was not reliable, the complaint about the
08:54:23 reservoir properties but didn't tell us anything about the
08:54:27 compressibility of the oil.
08:54:29 So back to orient ourselves on our list of four experts,
08:54:33 we're on the third one, material balance with Dr. Kelkar. We are
08:54:36 comparing him to Dr. Blunt for his material balance. We've talked
08:54:39 about compressibility. I'll talk now about original oil in place,
08:54:42 and then we will be done with Dr. Kelkar and Dr. Blunt.
08:54:46 To calculate an original oil in place, you need a
08:54:50 shrinkage factor or formation volume factor. And what are we
08:54:54 talking about here? A barrel of oil down in the reservoir miles

under water under earth is under enormous pressure, and down there everything is liquid. Methane, the gas that comes out of your stove when you turn it on, a gas up here is dissolving the liquid down there.

And in the Clean Water Act, the penalty only applies to barrels. Barrels are defined as 42 gallons at 60 degrees Fahrenheit. It doesn't state what pressure. But in the industry there is a term called "stock-tank barrel." And this is 42 gallons at 60 degrees Fahrenheit at one atmosphere pressure or sea level pressure. And so we're using that industry definition here, even though it's not specifically required by the statute.

So both sides needed a way to convert from barrel in the reservoir, liquid, entirely liquid to barrel at the surface. And what happens is as these barrels come up and the pressure abates, the gas comes out, comes out a solution, off gases, so by the time they get to the surface of the water, a barrel down in the reservoir might be only half a barrel of liquid left.

In the industry, when you're producing oil from the reservoir, they do it in a controlled mechanically engineered fashion where they separate the gas out in multiple stages because they try to save the liquid and prevent it from off gassing. If you do it slowly and carefully, you can keep more liquid. If you do it quickly in one stage, you lose more liquid.

An analogy is a bottle of champagne. Where if you pop the champagne with a flourish and the cork flies out and everybody

cheers, but your champagne falls out on the floor. If you hold the bottle carefully and ease the cork out and it makes a little hissing sound, maybe it's not as dramatic, but you keep all of your champagne. So controlled separation is what they do in the industry.

In fact, if we can have the next exhibit, please. This is Dr. Blunt's expert report, TREX 11553, as redacted, and Dr. Blunt tells you that in the industry we use multistage separation. It's used by oil companies to maximize volume during normal production. They separate the oil and the gas through a deliberately engineered series of separators. Multistage separation is designed to produce as much oil as possible.

Having said that, Dr. Blunt is going to ask you to go with one stage separation, wants you to open the champagne bottle and have the champagne spray all over the place instead of multiple control stages of separation. And the reason for that is because it gives less oil. So since the defendants want less oil, Dr. Blunt is going to ask you to do the one-stage separation.

Now, the problems with that are if we're going to use the industry standard definition of a stock-tank barrel, we should use the industry practice of multiple separations. And second, in this case, when the oil was collected by the Top Hat and the other collection devices, it was brought to ships, and it was put through more than one stage of separation. And BP moved for summary judgment that those collection amounts were collected and that they

were accurate and they shouldn't count to penalty. So when they wanted credit for the collection, they used multistage separation, and we stipulated to that. But now that it's detrimental to them, they want you to use one-stage separation to keep the liquid fraction smaller.

One final twist on this separation issue and we will be done with it. Of course, in this case, the spilled oil wasn't separated mechanically, it was separated in the ocean. The off gassing occurred as the hydrocarbons flowed up through the sea. So both sides developed an oceanic separation model. And there's differences, and Dr. Zick for the US can testify about that, Dr. Whitson for the defendant.

But the biggest difference between them is Dr. Whitson decides to take ten percent off the top. He says that liquid fractions of the oil -- this is not off gassing, this is liquid factions of the oil -- if they dissolve into the sea, they don't count. What we're talking about here is something like benzene, a hazardous substance that can dissolve into the ocean. Butane, and you know butane is a liquid because if you've ever seen a cigarette lighter, it has liquid in it, that's butane. Dr. Whitson says that if butane and benzene dissolve into the ocean, they shouldn't count because they don't reach the surface. That pollution is still in the ocean. Of course it should still count.

We are talking about a legal issue, and that's why we moved for summary judgment on that issue, the ten percent that's

dissolved does count. And that's why we filed a motion that Dr. Whitson shouldn't be allowed to testify to legal conclusions about the ten percent and whether it counts under the statute. Since this is opening statement, I won't be arguing that, other than to note it.

So to try to summarize the oil in place, if we could have the next slide, please.

This is supposed to be helpful. It shows the reservoir barrels below being brought to the surface in the different ways. Single stage flash, the one the defendants want you to use, it's the one that gets the least oil, it's the one that's not consistent with industry practice. Multistage separation gets you 11 percent more barrels. It's consistent with industry practice. It's what was done in this case when BP wanted credit for the oil they collected.

On the right is the oceanic separations. There are two. It's not really relevant to our opening here today. But you can see that's about 13 percent more in single stage flashing. And the difference between Dr. Whitson and Zick is Dr. Whitson takes ten percent off of the oceanic to get himself back down to single flash just by saying: If it's dissolved, it doesn't count.

Next slide, please. To summarize Dr. Blunt's use of material balance, his original oil in place is too low because he used one-stage separation. Like Dr. Gringarten, his permeability is too low.

I won't talk about the pressure drops, but the third bullet point, compressibility, his compressibility number is too low based on rotary sidewall cores, it should be doubled and that would cause a significant increase in his calculations, about a million barrels.

And one final note on material balance, your Honor, before we move on, is that you don't have to decide all of these issues to decide this phase of the case. The defendants are going to try to make rock compressibility the issue in this phase. And it is an issue in this phase, but if you just decide that issue has too much uncertainty, you don't have to use the material balance methodology at all. Dr. Kelkar and Dr. Blunt both use material balance; different inputs, different results. If you choose -- if you find that there's too much uncertainty, then just don't use material balance. Go to one of the other methods out there.

Speaking of the other methods, I will turn to the final of our experts, Dr. Pooladi-Darvish. He is doing reservoir simulation. Reservoir simulation is another common tool in the industry, it's used to plan production. And in this case, Dr. Pooladi-Darvish used it to try to determine total flow quantity. So what he does is build his reservoir model -- again, a mathematical model -- trying to stimulate what might be the real reservoir conditions. And he has to calibrate his model, he calibrates it to a real world measure data points, the capping stack pressures, and the collection rates of the devices that were

collecting oil up to the sea level.

He creates a simulation, and if he can match those data points, those calibration points, then he feels he has a good match. So he comes up with a base case, runs it, matches the pressures, matches the collection rates. He's satisfied his base case shows a potential or real world reservoir condition, and it produces about five million barrels of oil over the total flow period. Again, about 800,000 of it collected.

But that's not where he stops, that's just his base case. He, then, tries to vary other parameters, reservoir parameters, to see if there's other sets of conditions that could match the pressure data, that match the collection data.

So if we can have the next slide, please. Here we have Dr. Pooladi-Darvish's methodology. On the column on the left, just the various parameters that he varies to try to see if there are other sets of reservoir conditions that can match the real world data. If you take a look at the third line down, permeability of 170 millidarcies, go to the next column, matching data "X," it did not match the data, so that's not a real world condition.

His base case is around the middle, but you can see that as he varies it, he has to match the pressure first, the third column he has to match the collection rates. And if he cannot match both the collection and the pressure rates, he calls it a bad match. If he can, it's a good match.

So he varies all of these 25 parameters to try to come up

09:04:04 with ways to match the real world measured calibration points, and
09:04:07 he comes up with many that do. So then he runs all of those good
09:04:12 case scenarios, acceptable ones, and each of them produces between
09:04:17 5 to 5.3 million barrels of total cumulative flow estimate.
09:04:24 So if we can have the next slide, please. Can we have
09:04:32 demonstrative D-21041, please. So we've been through each of our
09:04:39 four experts, your Honor, with the four different methods, four
09:04:42 different lines of evidence. Dr. Dykhuizen matched the capping
09:04:47 stack data; Dr. Griffiths using the BOP data; Dr. Kelkar using
09:04:50 material balance; Dr. Pooladi-Darvish using reservoir simulation.
09:04:54 They all match up at around 5 million barrels of oil total.
09:04:59 But it's not just our litigation experts who come to
09:05:05 numbers like that. You may remember the Flow Rate Technical Group,
09:05:10 Admiral Allen had that group put together when BP wasn't providing
09:05:14 information about flow rate, Dr. McNutt of the U.S. Geological
09:05:18 Survey, you saw their deposition testimony last week.
09:05:21 In the end, the Flow Rate Technical Group and the
09:05:24 Tri-Labs teams all came to consensus about 4.9 million barrels of
09:05:30 oil came out of the reservoir; the flow rate on the final day about
09:05:33 53,000 barrels of oil per day.
09:05:36 Dr. Hsieh, the witness who will testify here about the
09:05:39 capping stack shut-in, and the red, yellow, green pressure-up data
09:05:42 that he developed, he ran a model at 4.9 million barrels. That's
09:05:48 part of the Flow Rate Technical Group estimate.
09:05:50 But it wasn't, again, just -- not just our litigation

experts and other experts in the government.

Next exhibit, please. Here we have the Oil Spill Commission, the Presidential Commission, in October of 2010, reporting about the amount of the oil, callout please, and what they say there is an emerging consensus of government and independent scientists that roughly 5 million barrels of oil were released using different methods, these different groups of scientists arrived at the same approximate figure.

So we have an emerging consensus among government and academics, multiple lines of evidence coming out around 5 million barrels.

And just for comparison, if we can run the animation, please. How much oil is 5 million barrels? Just to compare it to the Valdez, it was 262,000 barrels. Animate, please. So what we have here is a Valdez worth of oil spilling out every four and a half days. And if you animate again, three of those were collected to the collection vessels, leaving you about 16 Exxon Valdezes spilled into the ocean in this case.

What are the defendants going to say about flow? We know what they said in the past.

Next demonstrative, please. BP repeatedly said -- this would be 21008. Thank you -- repeatedly said that it was important to know a flow rate and to know it right. That it was crucial, the heart of understanding. Source control efforts, that it was essential to know about source control efforts. I won't go through

these exhibits. There's the Oil Spill Response Plan which you saw last week, saying the first step was to -- priority issue was to know about the flow rates.

On the far right is BP's response for that Oil Spill Commission report, the one that said that there was an emerging consensus of 5 million barrels.

If we could have the next exhibit, please, which is 6192, BP's response to the Oil Spill Commission. BP says flow rate information is, "crucial to understanding the environmental impact shaping appropriate remediation plans."

And that's exactly the point, your Honor, this trial is not merely about the maximum penalty amount. Scientists are going to study this spill for decades. They've been studying the Valdez for decades. There's a natural resource damage assessment going on, and the total flow input is a very important input to the scientific studies to these assessments. Scientists from academic communities, BP's own scientists, people are using these published numbers as their inputs, about 5 million barrels, from Dr. Griffiths's work, from the flow rate work, from Dr. Crone's published work. So it is indeed important to get this information right, your Honor.

Now, despite saying about the importance of flow, we know that BP then lied to Congress about the flow, that's a given. Then they later told their shareholders in their SEC filings that the flow was 4 million barrels, 3.2 was collected. That's how they

told their shareholders what their penalty supposedly was. With those statements, they are going to come here and tell you that it wasn't 4 million, it was 3.26 million; or maybe if they go to Dr. Gringarten, it was 2.4 million.

And how do they get those numbers? Again, by abandoning the information from the response action and cherry-picking the data.

Could we have the almost last demonstrative, please. This is a vaguely titled demonstrative, "Inputs and Estimates, Then Versus Now." Let's see what some of these are. Rock compressibility. Then at the time of the capping stack shut-in, the time when it was being decided whether we could leave it shut in or reopen that valve and restart the spill, 12 microsips was the most likely estimate, it was the base case, the sensitivities were 6 to 18 microsips; now it's 6 is the base case and 12 is an outlier.

Permeability, before they drilled the well, after they drilled the well, their experts in Phase 1, 300 to 600; now Dr. Gringarten's going to say 238. The flow rate on July 15th, then internally BP's people coming up with 51- to 59,000, close agreement with the 53,000 barrel-per-day estimate of the government. Now they don't have everybody telling you the final day flow rate.

And, again, they were happy to rely on the Tri-Labs estimates when they were -- Tri-Lab's work when they were trying to

keep the capping stack closed, but now they're just going to nitpick at that same work and say it was political -- politically motivated.

How about the number of stages for separating the reservoir barrels of oil into surface water barrels of oil? When they wanted credit for the oil they collected, multiple stages of gas separation. When they wanted to minimize the amount of liquid for penalty purposes, single-stage separation.

Status of cement in the wellbore, Phase 1, not set; in Phase 2, set. Erosion of the BOP in Phase 1, less than a second to erode steel; now it takes weeks or more. Back then, they had reservoir engineers and rock mechanics experts working on this, they had people working on the response, their top people. And those people were working closely with the government responders that were the science team. With the exception of Dr. Merrill. That was then. Now none of them are here except for Dr. Merrill. We're bringing the people who were there at the time, Dr. Hsieh, Dykhuizen, Dr. Hunter.

And now they want you to rely on -- back to the top line, rock compressibility. They are going to try to make that the whole case. But again, if you decide you don't want to deal with the rock compressibility issue, just decline to go with material balance, decline to go with Dr. Blunt's method. And by fairness, you would have to decline to go with Dr. Kelkar for the U.S. if you decide not to use that method.

09:11:47 And the final slide, just showing you again, this is sort
09:11:51 of the summary that you've already seen. Flow rate estimates over
09:11:55 time gave us point ranges, the collections were exact, a little
09:12:01 period at the time of the beginning to account for erosion, and we
09:12:05 have the four different lines of evidence converging at about 5
09:12:08 million barrels of oil; again, using four different methods because
09:12:12 this is a unique problem, it's not and off-the-shelf problem, and
09:12:18 the results of the various lines of evidence is that 5 million
09:12:20 barrels came out of the well, 4.2 million barrels were spilled,
09:12:24 that's about 16 Exxon Valdez's worth spilled.
09:12:28 So at the close of the evidence, your Honor, we will ask
09:12:30 you to find as a fact that the beginning of the flow period, about
09:12:33 62,000 barrels of oil per day were coming out; that by the end,
09:12:37 about 53,000 barrels of oil per day were coming out. If you add
09:12:42 those days together, it was 5 million barrels.
09:12:44 Thank you, your Honor.
09:12:46 THE COURT: All right. Thank you. Mr. Brock.
09:12:53 MR. BROCK: Yes, your Honor. Your Honor, good morning.
09:13:40 Mike Brock presenting the opening statement on behalf of BP and
09:13:45 Anadarko.
09:13:47 One of the issues that we will be dealing with in this
09:13:49 case is the issue of uncertainty. Mr. O'Rourke indicated in his
09:13:56 opening that if there's too much uncertainty, that the Court may
09:14:00 use its discretion to disregard the opinions of experts to bring
09:14:07 you forward experts with such views. And we think that's an

09:14:12 important statement, because in the context of this case, BP will
09:14:18 present information that was -- and opinions based on known data;
09:14:26 known data before the spill and known data after the spill.
09:14:32 And as we will see in the development of the evidence,
09:14:34 the United States is going to present evidence that relates to a
09:14:38 day-by-day calculation over 86 days when we are in a position where
09:14:46 the wellbore is changing daily. Their methodology and their model
09:14:52 requires that they do that day-by-day calculation. The methodology
09:14:58 of Dr. Blunt and the methodology that Dr. Kelkar uses does not
09:15:05 require the precision that's needed to do a day-by-day calculation.
09:15:11 Their methodology looks at the oil in place before the
09:15:15 event, it looks at the oil in place after the event, and just
09:15:19 through the basic principle of conservation of mass allows us to
09:15:23 share with you the amount of oil that left the well. It's an
09:15:28 industry standard approach to resolving or solving a problem like
09:15:35 this.
09:15:36 So in this case and in this presentation today and
09:15:40 through the week, next couple of weeks, I think your Honor will be
09:15:44 faced with some choices about what is the right methodology, where
09:15:49 are the right and correct inputs being made based on data.
09:15:55 As your Honor is aware, it's BP's position that using the
09:15:59 material balance equation, that is the industry standard material
09:16:04 balance equation, that the amount of oil that left the well was
09:16:09 3.26 million stock-tank barrels.
09:16:15 This is a graphic, your Honor, that describes much of the

activity that we talked about last week during the source control trial. There are changes in the Macondo well that are occurring daily. We've characterized here some of the important events. April 22nd, the riser falls. April 28th, we'll talk about that later, two holes appear in the riser. That means that erosion is still occurring at that point. We will talk about slug flow, because through expert testimony, your Honor -- and some video that we will show you, your Honor will be able to see that during this period of time, there are periods of gas flow followed by oil flow, and this pattern can be characterized to bound the flow rate during that period of time.

On May the 19th, a third hole appears in the riser. The government's position and the way they're dealing with this case is that they want to say to the Court all of the erosion that took place in the well happened within nine hours. Then when we talked to them a little later, well, maybe it was 12 hours or 16 hours or a day. But essentially, in order for the government models to work, they have to explain away erosion in the well as having all occurred in the first few hours. And the evidence is going to be contrary to that.

You see some of the important events, other important events like Top Kill, the riser cut, and Top Hat.

Now, you heard a little bit about the methodology that the government used to arrive at its flow rate number. Essentially what occurred is that a calculation was made based on a very

complex geometry in the capping stack that allowed the scientists from BP and from the government to know that for the first time in the life of the flowing well three important issues: They were able to know at that point two pressures and then a known geometry between those pressures. And if you know that with precision, you can make an estimate of flow. And that's a pretty much an undisputed fact.

But Mr. O'Rourke showed you that very complex model of all of the turns and all of the K factors. Well, that's a calculation that you can make when you know all of those things with precision. And even when you do this calculation, it has an error bar or an error factor according to the government scientists of about 20 percent.

So the range that's being described here, even according to the testimony from the government experts, is something in the 48- to 58,000 barrels on the last day.

Now, how did the government get from this number, 53,000 barrels a day, to a total flow rate number? Well, basically what they did is they just drew a line back. They assumed depletion and they assumed that there were no changes in the well during this entire period of time. A fact that we're going to show you was not true. It was an assumption that they had to make in order to get a number.

This number here, this 63,000-barrel number that they've been referring to today, this is not a calculated number that's

based on anything other than the assumptions that are made here (INDICATING). This entire 86 days when changes in the wellbore are occurring that affect the ability of the well to flow, the government has pushed those to a side and assumed them away. It's one of the primary reasons that this hydraulics methodology is not the best approach to solving this problem.

And they recognize that. The government, your Honor, first came out with their flow rate estimate of around 5 million barrels on August the 2nd, 2010, after a few hours of work. This is the statement of Mr. -- of Dr. Dykhuizen, who you will hear from in this case. He is writing the next day a portion of the document that will eventually be the government's support for the 5 million barrel number, and he's acknowledging then -- this is in one of his drafts and we will see this later, this describes a fictional state since the model implicitly assumed that the well geometry does not change during the 85 days of the flowing well. In fact, many geometry changes occurred, including the riser, the kink, junk shots and erosion.

They knew when they issued the statement about total flow of 5 million barrels total on August the 2nd that they had not accounted for these factors. And you will hear that from Dr. Dykhuizen when he testifies.

So why is it that the material balance approach is better than trying to characterize flow on a day-by-day basis in an unknown system? It's a better approach, your Honor, we believe,

because in the material balance approach, Dr. Blunt is able to use information that is available before the event on April the 20th, 2010 and information that is collected after the event. And when you look at material balance, you don't have to say what the flow is on a day-by-day basis.

What is that information that is available to Dr. Blunt and to Dr. Kelkar? On April the 12th, there was a tool that went down into the well and it collected pressure data and fluid samples. That's going to be the pressure data that Dr. Blunt will use in his equation when he solves for the amount of oil that came out of the well.

There are also core samples that are taken on April the 14th, 2010. These core samples are industry standard core samples. They were collected by Schlumberger before the event, they were interpreted by Weatherford in an industry standard kind of way. This information is relied on in industry to help make predictions about the well, assuming that it's successfully drilled, and this information tells us that the compressibility of the rock -- we'll talk about that a lot in this case -- was in the range of 6 to 7, not 12.

These are not figures that BP has come up with after the fact. These are core samples that were taken before the event by Schlumberger and interpreted by Weatherford in an industry standard kind of way.

Then you've heard the information that's available for

after the event; that is, the final measured pressures that take place over in early August after the well is shut in. And Dr. Blunt is able to use these inputs along with what is known about the reservoir properties to identify the size of the reservoir, to identify the compressibility of the rock and the pressure change.

Now, Mr. O'Rourke made reference to this was a blowout, and so we know all of the air was out of the tire instantly. If your Honor thinks about this, you will see that's not really correct. Under any sort of scenario that you want to look at in this case, whether the flow is 5 million or 3 million, the ranges of oil in place for this well were something between, you know, maybe 2 and a half and 4 percent of the well flowed out during the 86 days. This is not an event where all of the oil was gone from the well instantly within nine hours. It flowed for a long time, but it's a fairly low percentage of the total volume of the well that has flowed.

So why is material balance something helpful to understanding this case? And I asked our experts to try to help us understand what's a good analogy to think about when we think about the material balance equation. The example that I think is useful to think about is that if you had a truck and it ran over a piece of glass and it had a slow leak, if you wanted to know how much air, compared to oil, but air left the tire over an 86-day period of time, what you would need to know is you would need to know how

much air was there before the event, you would need to know what the pressure was, and you would need to know how much air was there when you got to the end. And that is essentially what the material balance equation allows us to do.

Conversely, if you were trying to solve that problem with a hydraulics methodology, you would have to figure out everything that truck did over 86 days and you would have to make a calculation how much air left the truck on day 1, on day 5, on day 20, on day 36; and in a circumstance where there are changing conditions, is the hole getting better bigger, is it not getting bigger. These are the types of issues that are challenging if you're using this hydraulics methodology. And we are going to talk about that in a little more detail as we go through this.

I promise that this is the only formula that I will show you today. There are a lot of formulas in this case, but this is the essential of the material balance equation that's employed by Dr. Blunt and Dr. Kelkar.

And what do we need to know to solve the problem of how much oil was released? We need to know the oil volume connected to the well. We know that by virtue of seismic studies that were conducted before the blowout. And those seismic studies can be utilized to formulate the oil connected to the well.

There's a difference between our position and the government's position. Dr. Blunt has looked at these images in detail, and he understands that not all of the oil that is in the

reservoir is actually connected to the area where the well was drilled. There are areas of this reservoir that are not connected and cannot flow. He's used some very conservative assumptions on this, but the government assumes that it's a hundred percent. So that's one big difference that we have with the government.

On the compressibility of rock and fluids, we are using the measured data from rock samples that were taken in an industry standard kind of way before the event. And I'll get to this issue about the period of time when they were using 12. But if you remember Admiral Allen's testimony about first doing no harm, about being careful, about building in safety factors, during the period of time when they were talking about the shut-in of the well, they were building in a safety factor for that and they were making some assumptions to account for that safety factor that were larger or higher than the measured data.

As soon as the well was shut-in, when they were going to talk about the relief well, you'll see that BP went back to using the measured data of six, just as they had for the whole time before that.

And then there's pressure drop. We didn't hear anything about that in the plaintiff's opening, but it's a very important factor and one you will see where the government ignored one of the basic principles of science, and that is that hot things cool down. And when they're cool, they're heavier. And Dr. Blunt has made the appropriate adjustment for that. The government now admits that

09:29:51 they should have done that. Dr. Blunt has done it.

09:29:55 If we look at his opinions -- and we are going to look at
09:29:58 them in a little more detail when we circle back -- but it's
09:30:01 important to know that, of course, Dr. Kelkar agrees that this is
09:30:05 an appropriate approach, and at least one of the government's
09:30:10 experts agreed with Dr. Blunt on each of the values that he is
09:30:17 inputting into this case.

09:30:19 Dr. Kelkar agrees on pressure drop, and his range
09:30:25 includes Dr. Blunt's oil volume. Dr. Hsieh agrees on oil volume,
09:30:32 and Dr. Pooladi-Darvish agrees on the value of compressibility that
09:30:38 Dr. Blunt is using. In fact, Dr. Pooladi-Darvish's best case of
09:30:43 the ones that you saw uses a compressibility of six.

09:30:50 So we talked about uncertainty, and I want to address now
09:30:54 the issue of the uncertainty and the limitations that go with the
09:30:58 hydraulics analysis that the government is using here.

09:31:01 As we've talked about a good bit in this case, there are
09:31:05 a number of things that are going on in the well that need to be
09:31:10 known in order to be able to do this hydraulics calculation. If
09:31:15 you think about this particular case, we know that we have oil
09:31:21 entering the well here out of the reservoir, it's traveling up
09:31:26 through cement, a float collar, casing. We'll hear about drill
09:31:33 pipe that is in the path of flow that affects the flow. We have
09:31:39 the BOP components, and we will talk about the erosion of those
09:31:42 components and how that occurred over time, and the riser.

09:31:47 In order to do an appropriate hydraulics calculation,

your Honor, you would have to know these changes as they're occurring on a day-by-day basis. And the government, you will see, acknowledges that they cannot account for these many changes that are occurring.

Here is Dr. Dykhuizen talking about the uncertainties, even as late as June. And I'll just reference this statement again. "Without two pressures and a known geometry in between, it was impossible to calculate a flow rate." And he is talking here about a note that he sent to Tom Hunter and others trying to explain why he can't solve the problem in late June.

Here is a little more detail to that statement. "Any model has to not only assume various flow paths and resistances; it has to account for potential erosion during the long flowing time. Some of these are to approximate a complex process. The calculation of two-phase flow, the difference between gas and liquid. Some of these are to approximate unknown geometry." And he is saying, this is late June, "cannot use an inaccurate model to determine if the well is sound."

This is another statement that is made in one of the papers that was published by DOE talking about the period of time before there was the capping stack information. "DOE-NNSA Flow Team and other researchers directed by DOI were generally stymied in these attempts prior to the well shut-in." In other words, an accurate, helpful estimate of flow could not be done before the capping stack information was available.

09:34:08 You heard some information, your Honor, about some of
09:34:11 approaches that the government took that talked about the capping
09:34:14 stack and the Top Hat and how some of that data verifies what they
09:34:18 say now. In July of 2010, late July of 2010, after the capping
09:34:26 stack information was available, this is on a Monday, a meeting was
09:34:30 convened to look at the various methodologies that were underway by
09:34:35 the government to look at the issue of flow. They looked at four
09:34:41 well scenarios: They looked at video of the riser cut, they looked
09:34:44 at the Top Hat data and others, the acoustics and the well
09:34:49 integrity. And their conclusion was on this day, July the 26th,
09:34:54 none of these methods provide believable mass flow results. Too
09:35:00 many model uncertainties and/or data for quantitative analysis.
09:35:05 This is the same information, your Honor, that we presented to you
09:35:08 last week about the uncertainty of the information that was
09:35:12 available.
09:35:13 Now, this is July the 26th, 2010. As I referenced
09:35:20 earlier, the government came out with its number of approximately 5
09:35:24 million barrels on August the 2nd, 2010. How did they get from
09:35:31 July the 26th, saying none of the above methods provide a
09:35:36 believable mass flow result, to a number of 5 million barrels in
09:35:41 less than a week's time? I want to look at that timeline with you.
09:35:44 A meeting had been scheduled for Friday, August the --
09:35:52 July the 30th, to discuss the issue of flow rate. On Wednesday,
09:36:01 Marcia McNutt is writing to David Hayes saying, "I just got off a
09:36:05 call with Tom Hunter. We have to have a new flow rate by Friday.

He said that is coming from Secretary Chu and above." This is Wednesday, the 28th, after saying on the 26th, looking at those methodologies, we didn't have reliable information.

A couple of hours later, Secretary Chu to Marcia McNutt and Tom Hunter. "Just got off the phone from the daily 5:00 P.M. tag-ups with Secretary Napolitano. What we really need, hopefully by Friday, is the total amount that has leaked out since the beginning of the accident."

Just a little bit later. "This is becoming a very important meeting, as leadership in the government are expecting to be able to announce refined flow rates following the meeting." Still on the 28th.

On the evening of the 28th, Dr. Hunter, who we will hear from I think later today, says to Secretary Chu about this concept of coming up with a number by Friday, "This is on track, but it is unlikely we can get the full time frame analyzed from the beginning of the incident by Friday. We need to be sure that the logic and all of the events have been carefully reviewed. We can probably get the recent cap flow and correction. We will then need," what, "an event-by-event description to look at adjustment and overlay that by a depletion assumption."

That is, we need to look at all of these things that were going on in the well and on a day-by-day basis and account for those and see how they relate to what's being said now, this depletion assumption. "We need to assure that the pace for getting

these results is consistent with the subsequent need for accuracy."

Now, on July the 30th, this meeting was convened and these notes, your Honor, describe the process that the government went through to arrive at this number initially of something in the 5 million range. As I appreciate it, they're getting to the end of the meeting, they're saying, Let's convene on Tuesday or Wednesday of next week and focus on these questions that we've been talking about. And at that point Secretary Chu's Chief of Staff entered the room and said, "The cabinet wants to see the Oil Budget release this weekend and wants to get a new number tomorrow." They don't have a number yet. "So it can be in the papers tomorrow. There are wild rumors flying around about unaccounted for oil. The better we bound this, the better."

Marcia McNutt, "If that's our goal, we can do it tomorrow." Bill -- this is Bill Lehr who was working one of the work streams, "If you go with 50,000 you can have it done." Then Dr. Chu chimes in, "And then if we come down just a little bit right here, we can get the flow over time in time by backtracking from the current estimate." And that's basically, your Honor, what they did, and that is the flaw in the methodology that they've employed here. And I will show you just a little bit more on that in a second.

The Chief of Staff says, "Something is going out tomorrow, probably around 60. Even if we don't come up with something. Why is the White House pushing this? Not sure it's the

09:40:01 White House. There is a public discussion going on." Chu, "Does
09:40:04 it have to come out in the Sunday paper? Let's see where we are on
09:40:08 this tomorrow." Tom, "Let's use a 53 to 63 range." Bill Lehr,
09:40:14 "That would work." Tom Hunter, "Why not just go with 60?"
09:40:18 Secretary Chu, "Let's meet at one tomorrow and decide where we
09:40:21 are."

09:40:22 And Marcia McNutt here comes out with what really is --
09:40:27 becomes that first number. "We can also say it has changed over
09:40:32 time from a number near 60 to a number near 50 due to depletion."
09:40:36 This number right here, your Honor, 60,000 barrels a day, which is
09:40:40 what they're saying essentially where this well started, is not
09:40:44 based on a calculation or data that includes what happened during
09:40:50 the life of the well. It's picked by using what they know happened
09:40:55 at the end and then just translating that over to the beginning.

09:41:05 Now, on the evening of the 30th, Art Ratzel, who is the
09:41:10 author of the Ratzel Report says that "Tom," Tom Hunter, "had us do
09:41:15 a thought experiment last night of what the total oil release might
09:41:18 look like." It's a PowerPoint of four or five pages. And based on
09:41:26 that, they have this meeting on Saturday, and we have some notes
09:41:32 from that meeting, your Honor. This issue that we're talking about
09:41:37 on uncertainty they say that's still being worked out.

09:41:41 Now, this is not a calculation here. "Ten percent feels
09:41:45 better. Five percent too tight." That's the kind of precision
09:41:50 that they're using here to bound this with uncertainty which is
09:41:53 going to be really important in just a second.

09:41:55 And this statement right here is telling also. "As far
09:41:59 as U.S. government negotiations with BP, this is good enough."
09:42:06 This five million figure that they're using in this case now is one
09:42:11 that was designed to be a quick and dirty number for negotiation
09:42:16 purposes, but not good science.
09:42:20 Here again, they're talking about the reasons for this,
09:42:24 "The Oil Budget, we need to account for what's missing and damages.
09:42:29 They'll settle, so it doesn't matter."
09:42:34 Now, we're not saying that the scientists that were
09:42:39 working on this over this weekend were doing it with a bad purpose.
09:42:45 Indeed, they acknowledge in their subsequent reports and in their
09:42:50 depositions that they never thought that this number of 5 million
09:42:55 barrels was going to be something where it could be bound, you
09:43:02 know, with the uncertainties that were appropriate. This is what
09:43:04 the government came out with the next day. "Uncertainty plus or
09:43:09 minus ten percent, 4.9 million barrels have been released,
09:43:12 government scientists will continue to analyze the data and may be
09:43:16 able to further refine the estimate." They have never changed
09:43:19 their position from this right here (INDICATING).
09:43:21 And what's the flaw in it? The government has not
09:43:24 accounted for the events within the well on a day-by-day basis.
09:43:29 This is Dr. Dykhuizen's testimony. He was involved in
09:43:34 this process and in these meetings. And, your Honor, he did not
09:43:38 agree with this, the 5 million barrel calculation is
09:43:42 straightforward, presented in the report -- represented in the

report as being plus or minus ten percent. "I strongly disagreed with that part of the report. I wasn't the lead author. I disagreed with plus or minus ten percent. I said we could not apply any error bar on the five million, although it was a useful exercise to present, but I am not willing to stand behind my error bar."

Now, your Honor, he serves as an expert witness in this case. He has written what we've seen earlier. On August the 3rd, that this note -- note that this describes a fictional state because we're assuming that the geometry didn't change during the 85 days. This is the flow rates that they were coming up with in the Summer of 2010, acknowledging that geometric changes and corresponding effects occurred. We were assuming no erosion in the BOP. We have uncertainties about flow path. Is it up the annulus or the wellbore or both? All of these things that we've been talking about in this, the previous phase of this trial and this one are still relevant and pertinent to this discussion here.

We know though, your Honor, that significant changes did occur in the well. We know that there was cement testing that was begun in August of 2010. The relief well was intercepted and we did not find hydrocarbons in the annulus and that helped us understand the path of flow. The BOP was recovered in September of 2010. As I recall, the press release, the FBI had announced it had taken the BOP into custody. But the government has never used the erosion that was found within the BOP as part of its analysis.

09:45:29 A lead impression tool was sent down into the well in
09:45:34 September of 2010 to identify the location of the drill pipe that
09:45:38 had fallen down into the well, and that has a significant affect on
09:45:42 flow and that was not accounted for. And then we had further
09:45:45 evidence about the casing hanger seal being in pristine condition,
09:45:50 and that helping to support that the flow was not up the annulus.
09:45:53 But all of these things have been available since
09:45:58 September -- August of 2010, they're still not accounted for in the
09:46:01 government's work.
09:46:04 In January of 2011, Dr. McNutt recognizes this. The
09:46:12 information has come back from the BOP, BOP forensics. "I have new
09:46:17 information that I just learned about today that will have a
09:46:19 bearing on the flow rate." She is writing to Tom Hunter and
09:46:25 others, as I recall. "In looking at our final curve for flow rate
09:46:30 as a function of time, we do need to carefully consider the
09:46:33 competing processes of depletion of the reservoir, which cause flow
09:46:38 rates to decrease and possible widening of the flow path, which
09:46:41 causes it to increase."
09:46:43 And what does she say here, your Honor? This is January
09:46:46 of 2011. "The final curve may be peaked in the middle for all I
09:46:52 know." What she is saying there is we have not accounted for the
09:46:56 uncertainty. This is as late as January.
09:47:03 Hunter writes back, "Your comments have merit, but I
09:47:07 don't know what should be discussed via e-mail since there's no
09:47:10 such thing as confidential as I understand it. Let's be cautious

09:47:14 with another prediction, especially one with such great
09:47:17 uncertainty. The whole effort needs a systematic correlation of
09:47:20 data and forensics."
09:47:24 And she writes back, "I am assuming that in the end all
09:47:28 we want is a scientifically best defensible flow rate given all of
09:47:32 the various inputs we now have. Clearly, we would be remiss to
09:47:36 ignore this new evidence."
09:47:39 May of 2013 when the United States produces its reports,
09:47:45 "The cumulative estimate is more uncertain than the 53,000. I
09:47:49 represent that number to be --" we are going to look at his
09:47:53 testimony in just a second -- "plus or minus 30 percent. Biggest
09:47:58 factor that increases uncertainty is knowing when the erosional
09:48:02 process stopped. State of the BOP remained relatively constant."
09:48:07 That's an assumption, still assuming that. "Did not use forensic
09:48:11 evidence recovered from the BOP. Error of plus or minus
09:48:16 20 percent." That's referring to the 53,000 on the last day.
09:48:21 The point here is, the government and the way that it has
09:48:25 developed the evidence and the only way that it will work for them,
09:48:28 is to do something like this; that is, to assume that there weren't
09:48:35 significant restrictions to flow from the reservoir after a very
09:48:38 short period of time.
09:48:40 Now, we looked at Dr. Dykhuizen's testimony just a few
09:48:45 minutes ago, and you remember that Dr. Dykhuizen said that I was
09:48:50 not willing to stand behind the ten percent. In fact, at that
09:48:54 time, I wasn't willing to stand behind any number on the

uncertainty of the 5 million.

Now, he's had the opportunity to see Dr. Griffiths' work, he's seen Dr. Pooladi-Darvish's work, he's heard all of the things you have heard from the government, and based on that, he is acknowledging that based on information that we know now, lead impression tool, BOP cement testing, relief well, casing hanger, and assembly, things that could be uncertainties within the well, his number is still 5 million, acknowledging that these things could have occurred; but he's got a very, very different point of view now, your Honor, on what should we do about this important issue of uncertainty. And I want to play for you what we expect he will testify to here in court.

(WHEREUPON, THE VIDEO CLIP WAS PLAYED.)

"Q. Do you intend to provide an opinion about what the proper lower bound is for your estimate of 53,000 barrels per day on July 15th, 2010?

A. I've represented that number as being -- have a error of plus or minus 20 percent.

Q. And would you accept, then, a plus or minus 20 percent as being the -- representing the upper and lower -- proper upper and lower bounds for that estimate of 53,000 barrels per day?

A. That would be a reasonable assumption, yes.

Q. Similarly, with respect to the cumulative estimate of 5 million barrels, do you intend to express an expert opinion on the proper lower bound for that number?

09:50:47 A. That number is more uncertain than the 53,000. I
09:50:54 represent that number as being approximately plus or minus
09:50:58 30 percent of the integral, so that would be from
09:51:04 three-and-a-half to six-and-a-half million barrels.
09:51:08 Q. So is it your expert opinion, Dr. Dykhuizen, that the
09:51:11 range of cumulative flow is approximately three-and-a-half
09:51:16 million barrels to six-and-a-half million barrels with your
09:51:19 best estimate at 5 million barrels, correct?
09:51:24 A. Yes.
09:51:26 Q. And the reason -- what is the reason that you have a
09:51:28 higher error bound ratio of 30 percent for the cumulative flow
09:51:30 number than for your July 15th, 53,000-barrel number?
09:51:38 A. Biggest factor that increases my uncertainty is knowing
09:51:41 when the erosional processes stopped."
09:51:46 Dr. Dykhuizen now has said -- let me play this one last
09:51:52 clip here.
09:51:52 (WHEREUPON, THE VIDEO CLIP WAS PLAYED.)
09:51:55 "Q. Dr. Dykhuizen, have you seen any basis from the empirical
09:51:59 evidence that you looked at that there was an absence of
09:52:01 restrictions that would support a flow rate of 6.5 million
09:52:03 barrels out at Macondo in 87 days?
09:52:08 A. I see that -- previously you asked me my error bar on the
09:52:13 5 million barrels a day, and I said the error bar was as much
09:52:17 as 30 percent. I will admit that they're much more likely to
09:52:27 be a lower volume than a higher value. I think 6.5 million

barrels a day is much -- very unlikely 3.5 million barrels a day, the 30 percent lower has more likelihood than the 30 percent higher."

Just to summarize, Dr. Dykhuizen has looked at all of the work -- my clicker is not working, so I may just have to tell you to go to the next slide.

Dr. Dykhuizen has looked at all of the work that has been performed to date. He takes this 53,000 and he tells us that because he can't account for the erosional processes that he knows occurred, that his error bar on his five million barrel figure is 30 percent, plus or minus 30 percent. So that if you take 30 percent off of his number, which he says it's much more likely to be 30 percent less than it is 30 percent more, you get into the range that BP is talking about in this case.

And, importantly, there's only one way for this curve to work to get the 53,000 if he has significant error due to erosional processes in this range, and that is for the curve to be increasing as opposed to decreasing. And one of the important issues here, your Honor, is one of the things that we will be talking about when we look at the hydraulics methods, the area of dispute is largely going to be over here in the first four or five weeks after the blowout. We'll talk about that in a little more detail.

But one of the things that the experts for the United States acknowledge is, the further you look back, the less certain they are about the data and the information that they have back

here. They feel like -- they feel pretty good about this number, but the further they get back, the less certain they are about their estimate (INDICATING).

Now, we've talked about there being significant erosion over time. This is the government's report as it actually was published, and they're still saying in September of 2011 that our number implies that the well geometry did not change during the 86 days, when, in fact, we know that many geometry changes did occur.

And this is what we've heard from Dr. Dykhuizen. The reason for his high error bound of 30 percent for the cumulative flow number is that he doesn't know when the erosional processes stopped. Keep in mind that his bound -- his range now is 3.5 to 6.5, three million barrel difference in his range, but he acknowledges it's much more likely to be down at the bottom end of the range.

So we're going to bring to your Honor Dr. Srdjan Nesic, who is the one of the world's leading experts in metal erosion. I want to talk to you about him just briefly here.

He has looked at the geometries of four areas of the system in the BOP and in the kinked riser. What he's done is he has taken each of these systems and he has created models with the laser technology of what they were before and what they were after, and then he has modelled the changes that took place over time based on what is known about the sands production that was taking

place in the well. And I am going to talk about that in a little more detail here.

Let me have the next slide, please. So this just shows some things you've seen in the Phase 1 of the trial, your Honor. The upper annular preventer and the drill pipe were closed in on the day of the event. This shows you the significant erosion that takes place at that point in time.

Go to the next slide, please. This shows the erosion to the blind shear rams that occurred -- began to occur after the blind shear rams were shut-in. I believe the date for that is April the 2nd, if I recall.

All right. I think I'm back in business now.

Then the casing shear rams are the next issue that he looked at. These rams, your Honor, were shut-in on April the 29th. The government takes the position that all of the erosion had taken place, significant erosion that matters had taken place within nine hours, or a day, or 16 hours. I am not sure what they're going to say during the trial. This erosion cannot take place unless the well is still producing sand. That's what causes the erosion in the system. That's undisputed. You can see that erosion is still taking place in the system as late as the 29th.

And then we have significant information available to us from the riser. As your Honor will recall, there was a kink in the riser just after the riser comes out of the BOP. And the witnesses -- this was known at the time, it's known now. On April

09:58:28 1 the 22nd, there are no holes in the riser. Over on April the 28th,
09:58:33 2 there are two holes, and you can see here that they're identified
09:58:37 3 right here (INDICATING).
09:58:39 4 On May the 19th, on third hole appears in the kinked
09:58:46 5 riser. It's undisputed. The only way this can occur is that the
09:58:50 6 well is still producing sands. It is those sands that cause this
09:58:55 7 erosion. And so this is definitive evidence. Whatever is going on
09:59:01 8 here in terms of causing erosion to this BOP is also eroding the
09:59:05 9 elements and the components -- what's going on here with the riser
09:59:10 10 is also going on in the BOP.
09:59:11 11 So to say that there was no erosion after nine hours or a
09:59:16 12 day that matters, I think is different from the physical evidence
09:59:20 13 that we see here.
09:59:21 14 The government acknowledges this in an e-mail of the 19th
09:59:25 15 when that third hole appeared. The government said the appearance
09:59:29 16 of a third hole at the kink implies that the well is producing
09:59:34 17 sand.
09:59:34 18 So as I mentioned, Dr. Nesic has taken the components and
09:59:40 19 he's modelled them to show what happens as the sands erode and
09:59:48 20 cause holes in the various components. And this is just showing
09:59:52 21 how it lines up, his model does, with precisely the holes that we
09:59:59 22 see when we look at what happened in the riser. He will do this
10:00:03 23 with the other components that he measured and analyzed for
10:00:09 24 purposes of seeing how much change occurred to these components
10:00:14 25 over time.

10:00:15 And then the other thing he does, your Honor, that is very helpful, I think, to understanding the process, is that he also looks at what's the period of time that this erosion is taking place. If you just work backward in time, his view is there was significant erosion occurring to these components up through around May the 27th. There's some evidence of sands production after that, but he's conservatively chosen May the 27th. So over time, you can see by percentages, the significant erosion that's occurring from that period of time of April the 22nd to May the 27th.

10:01:02 And, your Honor, this is not something that the government accounts for. They don't have an expert on erosion to look at the physical components, the changes that occurred, and how those changes occurred over time. So I think that's going to be information I hope will be helpful to the Court in understanding this issue.

10:01:24 Now, there is a very important data point that we have in the case, based on what I mentioned earlier, a phenomenon called slug flow. And just to characterize this briefly. If we were looking at a straight pipe, there are various regimes of flow that can occur through a pipe when you have oil and gas mixed together. One is a stratified smooth where your gas is on top moving at a fairly slow speed, the gas is, and the oil, which is heavier, will be on the bottom of the pipe.

10:02:00 As the speed of the gas increases, you can see that

almost like the wind on a lake it will kick up waves like this, and that's called stratified waving.

As it continues to pick up speed, if the gas does, it will actually lift the oil and form what is referred to in the industry as a slug. And these are well understood hydraulics issues that engineers use in order to understand the production of oil and that type of thing.

So we're going to bring to your Honor Dr. Michael Zaldivar, who is an expert in this area, to describe how this occurs and what conditions must be present in order for this condition of slug flow to be present in a system. And what you'll hear is that there are only certain ranges of flow that are permitted -- that would permit the formation of slug flow.

This is the government's analysis of this issue back in July when this was seen, "Analysis of the short movies of the riser shows the existence of periods when the flow oscillates from pure gas to seemingly pure oil. This could be an indication of a slug flow regime. These periods of gas/oil fluctuation are in the range of minutes."

Now, this is just a brief video. This is actually accelerated to double speed, but I just wanted to show your Honor for today what slug flow looks like, and then how it's used to bound the amount of flow that's occurring during a period of time. So if you look at it right now, this is mostly oil and you can see now gas coming in, and this extends out a bit because the gas is

10:04:07 just driving it up this way (INDICATING). You're in a period of
10:04:11 gas production now. Then, if you look here, we're going to move
10:04:14 into a period of oil flow, and this angle is going to come down a
10:04:20 bit. And you're now in a period of primarily oil flow. And then
10:04:27 it will go back to a sequence of primarily the flow of gas. As you
10:04:34 can see here, it will go, the angle of this will be up a little
10:04:39 higher, now you're in a gas regime.
10:04:42 Now, this condition was observed during the period of
10:04:48 May 13th to May the 20th. Dr. Zaldivar has developed a computer
10:04:55 model or uses a detailed computer model of the riser system in
10:05:01 order to calculate the range of flow that would be required for
10:05:07 this slugging to be present. He's run over 1,000 simulations to
10:05:13 look at those ranges. And for this period of time, slug flow is
10:05:18 possible only between about 25 or 26, 25,000 and 36,000 barrels a
10:05:25 day. This cannot occur if you have very high flow rates. Slug
10:05:32 flow cannot be present under the conditions of this well.
10:05:37 Why is this important? This is important because this
10:05:40 demonstrates that at least during this period of time, the flow
10:05:46 rate is significantly less than the 53 or 63,000 barrels a day that
10:05:53 the government is advancing. Dr. Zaldivar is right. That line
10:05:59 that goes up, that we say goes up going back that we say should go
10:06:05 down going back, they can't make their line work if slug flow is
10:06:11 present and the rate is bounded around 30,000 barrels per day.
10:06:18 Issues with Dr. Griffiths. You heard a lot about
10:06:23 Dr. Griffiths today. One of the issues with him is that he assumes

something called a productivity index for the Macondo reservoir increases from less than nine stock-tank barrels a day to 43 stock-tank barrels a day in less than nine hours, and then never changes.

Now, this is an issue that we talked about a little bit, I think, in Phase One. Productivity index, just in short form, is the ability of the well or the reservoir to flow into the well. It's basically a calculation based on how many barrels will flow based on a one psi change in pressure. That's the calculation that's made.

For this particular well, calculations have been made that demonstrate that it's very high at the time of the event. In order for Dr. Griffiths' model to work, he's got to get that down instantly, within hours, to something in the range of nine.

And this is consistent with what we've looked at before in terms of not incorporating and not including all of the data.

Now, a second issue with Dr. Griffiths is that his reliance is on the PT-B -- something we call PT-B data. There is no PT-B data from April the 20th to May the 8th. And from our perspective, this is something that introduces significant uncertainty.

And this is the point I was making to your Honor earlier. The largest amount of the highest flows you calculate of your cumulative flow occur between April the 20th and May the 8th. That's the period of time for which Dr. Griffiths has no data.

10:08:22 There is no PT-B data during that time. None were measured between
10:08:27 April the 20th and May the 8th.
10:08:32 Now, a version of this chart was demonstrated to your
10:08:36 Honor earlier, and basically I think the implication was
10:08:39 Dr. Griffiths did the right thing because he just drew a straight
10:08:42 line back. Well, this is one of these areas, your Honor, we'll
10:08:45 talk about this in a little more detail in the case, but there is
10:08:49 measured data that can be converted to give the pressure that
10:08:55 existed during the initial hours right here. And what
10:09:02 Dr. Griffiths does is he chooses not to use the measured data. I
10:09:06 would think around 8600 psi.
10:09:08 Why does this matter? If this number, this measured
10:09:14 number is the appropriate number to use here, this pressure decline
10:09:19 right here can represent erosion in the BOP during that period of
10:09:27 time. And his flow rate number, then, would be one that should be
10:09:34 increasing instead of running across steady state or potentially
10:09:40 even going down due to depletion during that time.
10:09:43 So this measured data right here is something that we
10:09:47 will be talking about in the case in addition to some of other
10:09:50 measurements that are appropriate.
10:09:52 But this line right here, he just picked a spot and said,
10:09:57 "Well, that's basically the trend." Well, maybe that's a trend,
10:10:01 but this is the way he does it instead of using the measured data.
10:10:06 And one other issue with him is that he has to keep
10:10:11 something constant in order for his model to work. And what he's

told us is that if the PI index changes and the BOP varies; that is, things both above -- let me take a half a step back.

The PT-B gauge was one that started giving the teams data around May the 8th. It's at bottom of the BOP. So if the PI index, which are the events that would be occurring below the BOP, that's called upstream even though it's down, and the BOP vary, if they both change, then he can't get a true cumulative discharge. We will talk about those issues as we progress the case.

Now, you've heard a fair amount about Dr. Gringarten. I just want to mention him briefly. These are the lines that you saw from Dr. Gringarten in terms of his cases. This is a Dykhuizen number based on an error bar. The important thing here to note, and we will show you some other places where this is relevant, is that the flow rate numbers that Dr. Gringarten uses using his industry standard package, pass through the flow regime that existed during slug flow. It's also the case that if you use the 30 percent number of Dr. Dykhuizen, I'll show you this later, it also passes through there. So in terms of a consistency check on what works with what we know, this, works pretty well.

Now, that brings us to Dr. Blunt, your Honor. It is without question that Dr. Blunt is one of the foremost reservoir engineers in the world. He is presently professor and chairman emeritus at the Petroleum Engineering School at the Imperial College of London. I didn't know this before this case, but Imperial College of London is the MIT of the UK. This college has

10:12:33 been in the petroleum reservoir business for roughly 100 years.

10:12:39 Dr. Blunt, as you can see, has been acknowledged as a
10:12:44 Leader in this field, he has 200 plus scientific papers, and over
10:12:48 8,000 citations to his papers. He is well regarded in this field
10:12:54 and in this industry.

10:12:55 He has a good bit of experience and knowledge about how
10:13:01 the industry works. In fact, recently when Kuwait, when a Kuwaiti
10:13:08 national oil company wanted to understand some of the details of
10:13:11 its reservoir -- which they have actually the largest sandstone
10:13:16 reservoir in the world, same thing we're looking at here --
10:13:19 Dr. Blunt is the person they reached out to to help them understand
10:13:23 some of the details of their assets. This is the regard in which
10:13:28 he is held in the industry.

10:13:30 So I want to talk in a little detail about some of the
10:13:34 things that have been shared with you so far on the issues of
10:13:38 Dr. Blunt's opinion. The first issue here in terms of solving this
10:13:43 fairly simple equation is, how much oil is connected to the well?
10:13:48 We need to know the volume in order to be able to do that.

10:13:52 This is a picture of the seismic data that is utilized to
10:13:58 make that evaluation. In this area right here, the lighter colors
10:14:04 here, this is referred to as the fairway of the reservoir, right in
10:14:09 here. In this circle right here, your Honor, is where the Macondo
10:14:14 well was drilled. The lighter the material here, the thicker the
10:14:19 reservoir. So that's one of the principles that's followed here.

10:14:25 But this data is used with the understanding of the

10:14:29 geology along with pressure to understand what we have here.

10:14:34 This is a clay model that I just hope will help the Court
10:14:38 understand the issue of connectivity. Dr. Blunt is conservatively
10:14:43 using 112 million barrels that are connected. And what this
10:14:50 demonstrates, these would be channels, fairways of oil that are not
10:14:56 connected to the main reservoir, these purplish looking ones here
10:15:03 (INDICATING). The Macondo well is right down it in here so you can
10:15:06 see that it's connected the yellow, it's connected to the orange,
10:15:09 it's connected to the red; so it's connected to a lot of the volume
10:15:12 of the well but not all.

10:15:15 The government in their assumption says all of this is
10:15:18 connected. All of it. And Dr. Blunt says, I do this for a living,
10:15:23 that's not right. It's probably the case that a lot more than ten
10:15:28 percent is not connected to the well, but he very conservatively
10:15:33 uses a ten percent figure.

10:15:34 And this is just sort of a cutaway of what I was showing
10:15:37 here, this is just an exemplar. But you can see here that if these
10:15:41 are the channels, that the well would be connected to three, it
10:15:46 would be another piece of the well that would not be. And that's
10:15:48 how Dr. Blunt is looking at the connectivity issue.

10:15:52 One issue that sort of supports this idea is that in the
10:15:58 beginning before the drilling was ever undertaken, is that BP
10:16:05 planned to have three wells to, in order to recover the asset of
10:16:13 oil at this Macondo reservoir. Some of the reason for that is it
10:16:19 allows for faster production, but there's also the issue there of

connectivity.

Now, Dr. Blunt engaged also as part of his analysis in a pressure analysis. To help him understand the boundaries of the reservoir. And this just basically shows the fairway where most of the connected oil exists in terms of its thickness and the rock that they're looking at in this area.

Now, there was discussion about converting reservoir volume to surface oil. We agree that the analysis that the Court should undertake is to make a calculation about stock-tank barrels. There is going to be a dispute about how that should be done. The government would like for us to pay for barrels of oil based on the way in which they would have been produced commercially if the well had been successful and they were able to install all of the collection devices and the separators that they used to maximize the amount of oil that would come to surface. Our position is we should pay for what happened realistically in terms of the outcome.

And so what Dr. Blunt has done is he has said, here is fluid in the reservoir, you've got oil and gas that are coming up, you have oil at surface and gas at the surface, how do you go about making the calculation as to take the fluid in the reservoir, how much oil is that at the surface, what would the stock-tank barrel conversion be? And Dr. Blunt has used an industry standard methodology for this, he will share with your Honor that it's not ambiguous, you don't have to know the conditions day-by-day. It's realistic because what actually happens here is the gas actually

10:18:20 1 breaks out at the surface or close to the surface, and he believes
10:18:25 2 that this is a conservative and appropriate approach. But there
10:18:30 3 will certainly be evidence and dispute about that in this case.
10:18:33 4 So if we take just this first variable, oil volume
10:18:37 5 connected to the well, you can see here that Dr. Blunt's number
10:18:42 6 based on his conservative view that ten percent is not connected is
10:18:51 7 112. Pooladi-Darvish and Kelkar have higher numbers; Dr. Kelkar
10:18:56 8 actually has used 137, then he said, well, I'll meet you in the
10:19:01 9 middle or something to that effect, he came up with 124 in his
10:19:05 10 deposition. I probably overstated that, I am not sure how he got
10:19:11 11 the 124, but, anyway, that's where he is.
10:19:13 12 And if we look at what changes that makes to the overall
10:19:17 13 for Pooladi-Darvish, it takes him from five down to four. If we're
10:19:22 14 right about this that the connected value of the oil is 112, it
10:19:27 15 takes Pooladi-Darvish down to that number; and it would take Kelkar
10:19:31 16 less because he is starting a little less connected oil to 4.52.
10:19:36 17 Compressibility. We talked that about a little bit,
10:19:40 18 you've heard about it.
10:19:41 19 Where is my piece of sandstone?
10:19:50 20 So one of the things that we've talked about in this
10:19:53 21 case, your Honor, is the idea of production sands or trying to find
10:19:59 22 the sands. And one of the fascinating things about this case is
10:20:03 23 that the areas where production can be derived, these sandstones,
10:20:10 24 it's actually not a sand box down there, it's a very solid
10:20:15 25 sandstone. It's been compared for me, like think of the base of

10:20:24 the Statue of Liberty, that is the quality of the rock or sandstone
10:20:32 from which the oil is being produced.
10:20:34 But it's occurring at massively high pressures such that
10:20:38 you've got 13,000 feet of rock pressing on this sandstone
10:20:43 production area, and there are things that occur when you drill
10:20:49 into the well that affect how much the well will flow. And what we
10:20:55 need to know about this issue of compressibility is, what's the
10:21:00 compressibility of the fluid and what's the compressibility of the
10:21:04 grains of this sandstone.
10:21:09 And that's the issue that we're trying to understand in
10:21:12 terms of how the well will flow. It turns out it makes a very big
10:21:17 difference in the amount of oil that will be produced over time
10:21:22 given a specific change in pressure.
10:21:26 So if we drill a well into the sandstone, we have this
10:21:31 pressure that is coming down on the sandstone, the production area,
10:21:37 and what we see is that that rock is compressed because fluid has
10:21:44 expanded and escaped and there's more room. And the general
10:21:49 principle is the more compressible the rock, the higher the flow.
10:21:54 The more compressible, the higher the flow; or the less
10:21:57 compressible, the less the flow. And so the issue here is what is
10:22:01 the compressibility value of that rock.
10:22:06 Now, we are going to bring to you as referenced by the
10:22:11 United States Professor Robert Zimmerman, who is one of the
10:22:15 foremost experts in the world. He has written some of the
10:22:20 important text on the issue of rock compressibility. He has

written the book *Fundamentals of Rock Mechanics*. He knows rocks. And he has looked at the samples that were taken by Weatherford in an industry standard kind of way, measured in an industry standard kind of way. These samples are taken for commercial purposes, before the event, they are measured by Weatherford, and they come out, Weatherford's tests do, in the range of around 6.35.

Now, what are the things that are important to understand? I will say this also. The testimony will be that these are not the kind of rocks that have less strength if they're taken in the horizontal axis versus the vertical axis. There will be some very technical terms that we will use for these rocks, but the bottom line is there's not an issue with this being a rotary sidewall core because they're not, I think the word is, isotropic, they're not different in this dimension than they would be in the vertical dimension. But that will be an issue that we will talk about and it will be for the experts to explain.

The data confirms six microsips. This is an area which is largely quartz, you can see on the right this is the kind of quartz rock that exists at Macondo. On this side is a non-Macondo type rock. These the ductile materials here (INDICATING). And as you can see, if it's like Macondo here and you have compression, there's less space for these very solid, hard particles of quartz to move as opposed to what you see on the right.

Before the well was drilled, BP predicted that the microsips, the compressibility of the rock would be around six.

10:24:45 Dr. Pooladi-Darvish in his report uses microsips of
10:24:50 around six for his best case, as I referred to you in the
10:24:54 introduction.
10:24:55 Dr. Kelkar has written on the issue of the
10:24:59 compressibility of rock in the Gulf of Mexico. You can see here
10:25:03 that he is an author and he looks here at the ranges of
10:25:08 compressibility in the Gulf of Mexico. High and low extreme,
10:25:15 ranging from one to ten, with a medium of about three. And my
10:25:20 recollection is the study that is undertaken here is for rock that
10:25:26 is of about the same age as Macondo at a depth that is a little
10:25:31 less.
10:25:35 When Dr. Kelkar first filed his FRTG report, he is using
10:25:41 rock compressibility of 12 now. When he first wrote about this
10:25:46 issue in June of 2010, he wrote based on the known industry
10:25:53 standard data that it was a base case of about 5.61. That was his
10:25:59 conclusion prelitigation.
10:26:01 Now, you've heard some discussion about the use of 12
10:26:06 microsips during the response. I'll just remind the Court of what
10:26:10 you heard many times last week. The first "Do No Harm Principle"
10:26:14 to the approach to the interventions. First "Do No Harm".
10:26:21 During the period of time when they were looking a the
10:26:24 capping, using the capping stack to shut in the well, they were
10:26:27 running various models to look at whether or not it could be safely
10:26:33 done. And while they were in that exercise, they did use different
10:26:39 values in order to understand the risk that's being taken. No one

10:26:47 at BP that I know of said we believe that compressibility is
10:26:52 different than the known data in terms of what we got from
10:26:58 Weatherford, but we're going to build in a safety factor for this
10:27:03 test so that we can make sure that we don't do any harm. And that
10:27:09 safety test was important.
10:27:10 We will talk about some of these documents during the
10:27:13 case, these are some that you haven't seen. This is where BP is
10:27:17 taking, is showing that it's six microsips before the event; after
10:27:21 the well is shut-in on the 12th, BP goes back to using six again
10:27:27 for the drilling of the relief well.
10:27:30 And for the relief well, it's not about having a safety
10:27:32 factor, you have to be not too much, not too little, you have to
10:27:37 use the right number. And for the drilling of the relief well,
10:27:40 that's precisely what they're doing, they're using the known data.
10:27:45 There's no high jinx here on what BP is doing with 12 microsips.
10:27:50 This is just additional evidence that we will talk about.
10:27:52 BP's Steve Willson has said on July the sixth you can't
10:27:59 go much above six microsips and still honor the data. Honoring the
10:28:04 data, the test results that were done by Weatherford is what we're
10:28:08 doing here in terms of the company and it's what we'll do during
10:28:12 the trial, your Honor.
10:28:15 This is Bob Merrill to Paul Hsieh on July the 16th, the
10:28:18 measured compressibility is six based on the sidewall cores.
10:28:22 Planning the relief well, as I just mentioned, reservoir
10:28:26 parameters for simulation. This is a fancy way of saying six

10:28:31 microsips. Paul Hsieh notes, "BP preferring 10 to the minus six,
10:28:38 six microsips." This is BP's 30(b)(6) witness on the issue, Pinky
10:28:45 Vinson, "We were not using 18 to model the Macondo reservoir, six,
10:28:50 five to six is the compressibility of the Macondo reservoir. 12
10:28:55 and 18 are modeling assumptions looking at risks to shut in."
10:29:05 This is not inconsistent with what some of the government
10:29:07 experts who were present during the time were doing. This is from
10:29:10 Dr. Kelkar to Don Maclay, "It's true that we don't have any skin
10:29:14 factor in the model. Why? We are interested in predicting the
10:29:18 worst case scenarios." These scientists are factoring in for
10:29:23 safety for this shut-in.
10:29:27 Now, Dr. Kelkar wants to say now that he believes the
10:29:34 compressibility is 12. We showed you or showed you just a minute
10:29:41 ago the footnote in his report where he cites to a document and
10:29:44 says it's 12. This is Dr. Kelkar explaining his basis for 12.
10:29:44 (WHEREUPON, THE VIDEO CLIP WAS PLAYED.)
10:29:52 "Q. Do you have an opinion that the formation compressibility
10:29:55 for Macondo reservoir was 12 microsips?
10:29:59 A. That's my best guess.
10:30:00 Q. Is it just a guess?
10:30:03 A. Best educated guess."
10:30:06 The idea that microsips for compressibility is 12 is not
10:30:13 based on science, it's not based on data, Dr. Blunt's approach to
10:30:19 the issue of compressibility is.
10:30:22 It makes a big difference. This was cited to you earlier

10:30:28 in the United States' opening. If you use the right data it takes
10:30:37 Dr. Kelkar down to around 3.48 million stock-tank barrels; doesn't
10:30:43 change Pooladi-Darvish because he uses six in his best case.
10:30:48 Now, the third variable to this equation, your Honor, is
10:30:52 the issue of pressure drop. And what we're trying to solve for
10:30:58 here is what is the change in pressure at the reservoir from the
10:31:04 beginning of the event or before the event and then at the end of
10:31:08 the event.
10:31:09 And here that MDT tool that we talked about earlier that
10:31:14 went down into the well, took information about pressure before the
10:31:18 event. After the event we have a capping stack pressure and it's
10:31:23 around 6500 or a little more in this period of time July the 15th
10:31:30 to August the 3rd.
10:31:32 One of the things that's important is that this well,
10:31:37 it's well known that once the well is shut-in, pressure will
10:31:41 continue to increase for a period of time after the shut-in. The
10:31:45 well's been flowing, there is oil moving toward the reservoir at
10:31:51 the time of the shut-in. That will continue to build pressure.
10:31:55 What Dr. Blunt has done is he has in an industry standard
10:32:01 way modelled what that pressure would be once it had reached
10:32:06 equilibrium. It makes a small change in the calculation, not a big
10:32:10 one, but he's done it in the right kind of way.
10:32:13 So what we have is we have a reserve pressure that we
10:32:16 start with, we have a capping stack pressure that we know at the
10:32:20 end. Now what we have to do is say, using this pressure, we got to

10:32:24 make a conversion to here. And that's the challenge here. So that
10:32:29 we have the ending pressure, we've got to get to this pressure, not
10:32:32 this pressure (INDICATING). So you've got a column of fluid that's
10:32:35 in this well and it has a weight and it influences this final
10:32:40 pressure.
10:32:41 Now, what's the issue here? This fluid that is in the
10:32:46 well at shut-in is very, very hot, very hot. And as you know, hot
10:32:54 things are lighter than cool things, but it will cool down over
10:33:00 time after shut-in. It's just a second law of thermodynamics. Hot
10:33:07 things cool down. Colder fluids are denser so the pressure between
10:33:12 the capping stack and the reservoir is going to increase.
10:33:15 Now, Dr. Blunt has made this adjustment in the proper
10:33:21 kind of way. The United States acknowledged that this is a
10:33:24 phenomenon, but have not attempted to analyze it in an industry
10:33:29 standard kind of way like Dr. Blunt does. And so when you look at
10:33:34 his outcome, he's used the technique of reservoir engineering
10:33:39 appropriately to account for this cooling that takes place in the
10:33:44 wellbore, the fluid becoming heavier and then the pressure at the
10:33:50 reservoir is going to be higher at the end than the government
10:33:56 accounts for. And we're looking for pressure difference, so
10:34:01 Dr. Blunt's pressure difference is going to be less than the
10:34:05 pressure difference that is stated by the government experts.
10:34:09 And as you can see here, when you make this change, if
10:34:17 Dr. Pooladi-Darvish would have done it in the right way, it takes
10:34:21 him down to 3.26; for Dr. Kelkar, he makes the right change, it

takes him to 3.26.

The point here is this is the right methodology, we just got to get the inputs right. It's not that we have uncertainty about any of this, we have measured data on the compressibility of rock, we have measured data on pressure, we have industry standard kind of ways of looking at the reservoir before the event to determine the original oil in place. All of these things are standard procedures and there's not uncertainty with these. And you will hear from Dr. Blunt when he testifies, he's been conservative in his approach to figures.

Now, one of the other things that he's done is just to say, is there a way, a possible way that my work would result in a flow curve that passes through the slug flow band. And, in fact, he ran a model using known pressures and his total flow rate, and, in fact, this is something that is feasible, it is something that could work using his approach to the case.

Now, this is the slide that I showed you earlier, which reflects the government's methodology of basically starting with a number here, picking a number out here at the end, while ignoring all of this. And this is Dr. Zaldivar's slug flow range here (INDICATING). And I just want to show you this to hopefully this will make sense.

This is the approach that Dr. Gringarten takes in an industry standard kind of way. I want to mention to you that the model that Dr. Gringarten uses, he is one of the foremost experts

10:36:19 in the world on this topic, is one that is used frequently by
10:36:24 people in this business. It's a recognized model. The government
10:36:29 believes that it's a benefit that Dr. Griffiths has put together a
10:36:33 model just for this case. Our view of that is the opposite, our
10:36:38 view of that is doing something just for this case does not
10:36:44 demonstrate reliability in the same way that Dr. Gringarten's
10:36:47 approach to this does.
10:36:48 The other issue here, especially with Dr. Griffiths is
10:36:51 that it's important in reservoir engineering that you look at all
10:36:55 of the factors and you see do they match, do they work together, or
10:37:02 is there something that's inconsistent. And on the critical issue
10:37:05 of permeability that you heard about, that is derived from
10:37:09 information that was analyzed by Dr. Gringarten before the blowout
10:37:15 occurred, there was pressure and rate data from that MDT tool that
10:37:20 allows him to make this calculation and it also allows him to say,
10:37:25 is my permeability consistent with my outcome. I'll just give one
10:37:30 example there.
10:37:31 One of the issues with the government's expert approach
10:37:35 is that their permeability is way up in the sky, five, six, 700.
10:37:41 The problem is they haven't done a consistency check, because if
10:37:45 the permeability is 600, it affects the oil in place. It drives it
10:37:52 down. Because the faster the well would be, the well would have
10:37:58 the ability to flow based on the pressure data would mean that the
10:38:02 oil in place would be lower. So one of the things to look for
10:38:06 during the trial, your Honor, is is there consistency in the

10:38:10 numbers and what does this big number mean to another number. And
10:38:14 that's the kind of consistency check that's been done by
10:38:20 Dr. Gringarten and Dr. Blunt.
10:38:21 And our last point here is this is Dr. Dykhuizen
10:38:25 recognizing that significant erosion has to be accounted for up to
10:38:32 30 percent, he says, much more likely in this direction than in
10:38:38 this direction (INDICATING). This is the model, your Honor, that
10:38:42 makes sense for this case. Increasing flow over time due to
10:38:48 erosion, a significant factor that the government did not account
10:38:51 for.
10:38:52 Thank you very much.
10:38:59 THE COURT: All right. Let's take a 15-minute recess.
10:39:03 It's 10:40 now.
10:39:06 THE DEPUTY CLERK: All rise.
10:39:08 (WHEREUPON, A RECESS WAS TAKEN.)
11:01:11 (OPEN COURT.)
11:01:13 THE COURT: Okay. Mr. O'Rourke, where is he? There he
11:01:18 is.
11:01:18 MR. O'ROURKE: Sorry, your Honor, I was late from my
11:01:21 meeting with Judge Shushan.
11:01:23 THE COURT: Okay. I figured if I sent her into that room
11:01:26 you all would work it out before she got there if you knew she was
11:01:30 coming.
11:01:31 MR. O'ROURKE: Exactly what happened.
11:01:32 THE COURT: So you can call your first witness,

Mr. O'Rourke.

MR. CHAKERES: Good morning, your Honor, Nat Chakeres for the United States. For our first witness we would like to call Dr. Thomas Hunter.

THE DEPUTY CLERK: If you could stand up, please. Raise your right hand.

(WHEREUPON, THOMAS O. HUNTER, WAS SWORN IN AND TESTIFIED AS FOLLOWS:)

THE DEPUTY CLERK: Take a seat. If you'll state and spell your name for the record.

THE WITNESS: My name is Thomas O. Hunter, T-H-O-M-A-S, middle initial O, Hunter, H-U-N-T-E-R.

DIRECT EXAMINATION

BY MR. CHAKERES:

Q. May it please the Court, Dr. Hunter, what is your current position?

A. I am currently retired.

Q. What was your position in April of 2010?

A. In April 2010 I was director of Sandia National Laboratories and president of Sandia Corporation.

Q. And did that job status change during the Summer of 2010?

A. It did. In July, approximately July the 9th I retired from that position.

Q. And we'll talk a little bit more about what was going on at that time. But first, could you just briefly describe for the

court, what is Sandia National Laboratories?
A. Sandia National Laboratories is a Department of Energy laboratory, one of the largest, and it's one of 17 laboratories that provide science and engineering support for the nation. Sandia National Laboratories is what's known as a national security laboratory, which means its work revolves around central issues important to the nation's security.
Q. Do the National Security Laboratories just work on nuclear weapons?
A. The original formation of the National Security Laboratories was around nuclear weapons, and at Sandia today that's about 40 percent of the work. The rest of the work is in other areas beyond, very diverse set of multi-Program areas beyond nuclear weapons.
Q. Could you name just a few examples of the other areas that the laboratories have expertise in?
A. Sure. For example, we work heavily in nuclear non-proliferation, we work in energy, we work in areas of critical and national infrastructure and other areas that are deemed vital to the nation's security interest.
Q. You just mentioned energy, does that include fossil energy?
A. Yes. Sandia and other laboratories have some vital programs in fossil energy working with the Department of Energy. And we have made significant contributions in drilling and seismic detection in areas like that.

11:04:13 Q. Does Sandia have a history of responding to national
11:04:16 emergencies?
11:04:17 A. Sandia is one of the laboratories that is typically called. In
11:04:21 fact, the value statement for the laboratory talks about being the
11:04:24 lab called first to aid the nation when the nation needs scientific
11:04:29 and engineer support.
11:04:30 Q. Can you provide some examples of when that's happened in the
11:04:33 past?
11:04:33 A. Sure. There are numerous examples. The space shuttle disaster
11:04:37 in 2003 the *Challenger*, there was a question whether the
11:04:41 lightweight foam could perhaps damage the front leading surface of
11:04:45 the wing, and we did the analysis to show that's possible. We did
11:04:49 the investigation, I've forgotten the year, but we did the
11:04:52 investigation into the explosion of the *US IOWA*; and we were the,
11:04:56 one of our staff was, were the explosive experts disarmed the
11:05:00 Unabomber cabin in the 1990s.
11:05:04 Q. And thank you for that. Could you give your own technical
11:05:08 background?
11:05:08 A. Yes. I have a bachelors and masters degree -- by education I
11:05:14 have a bachelors and masters degree in mechanical engineer, Masters
11:05:17 in thermal and fluid sciences; subsequently returned to graduate
11:05:22 school and got a masters and Ph.D. in nuclear engineering. And
11:05:26 then I worked at the laboratory in various technical fields over
11:05:30 four decades.
11:05:30 Q. Can you give some examples of the technical fields you worked

11:05:34 in?
11:05:34 A. Sure. I began my career at Sandia Laboratories in underground
11:05:37 nuclear testing which, of course, no longer happens in this
11:05:40 country. And I worked in their basically the design and
11:05:44 containment of large scale field tests, in this case in Nevada. I
11:05:49 went on to work in various manners of energy, started a number of
11:05:53 the energy programs at Sandia. Worked in environmental technology
11:05:58 areas and then the nuclear non-proliferation. And then I headed
11:06:02 the nuclear weapons program at Sandia Laboratories, and then in
11:06:07 2005 I became the laboratory and president of the corporation --
11:06:11 laboratory director and president of the corporation.
11:06:13 Q. How much technical preparation went into the underground
11:06:17 nuclear tests that you were involved in?
11:06:19 A. Well, underground nuclear testing were large what we call field
11:06:24 test events, they had hundreds of engineers and technicians and
11:06:30 over a year in preparation, then on the order of four to six months
11:06:34 of fielding, which time then the tests was conducted.
11:06:38 Q. So you're familiar with large complex engineering projects?
11:06:41 A. Yes, I am. My career was largely around decisions related to
11:06:45 large scale engineering problems.
11:06:47 Q. And then you mentioned something about the nation's nuclear
11:06:51 stockpile. Could you just give a little bit more detail about your
11:06:55 involvement with safeguarding the nation's nuclear stockpile?
11:06:57 A. Sure. As I mentioned, I had two roles at Sandia which revolved
11:07:01 around that question. Sandia builds what are called the

non-nuclear components, which are all of the electronics and mechanical systems that go with nuclear weapons. And I had to manage those programs for five or six years.

But then as laboratory director, it is a statutory requirement to issue a letter, a personal letter which says this is to our best knowledge the true state of health of the nuclear weapon stockpile that we are responsible for. So that letter goes forward to the Secretary of Defense and Secretary of Energy. And ultimately to the President. And statutorily it can't be altered; in other words, the letter that I wrote, it basically goes unchanged.

Q. How is that independence manifested in the Sandia National Laboratories?

A. Well, the reason that the government chose in our case in 1949 to have these laboratories, was so they could get an independent objective technical opinion and support for critical national security areas. And so we try to foster a culture of always being objective and always supporting the nation by putting the nation first and doing every analysis in the most objective technical way that we can, and that means you have to arrive at your conclusions independently without influence.

Q. Do you yourself have experience in the oil and gas industry?

A. Yes, I have some. I am -- when I was a college student, which is sometime ago, I worked in Lake Charles, Louisiana as roustabout for a company called Pan American Petroleum, which I don't think

11:08:40 exists any longer. And so I lived in Lake Charles and worked in
11:08:45 the oil fields around southern -- around Lake Charles.
11:08:49 And then I have maintained contact with the industry in
11:08:53 different areas, we worked in drilling, we worked in seismic
11:08:57 analysis, and I served as an advisor to the University of Texas
11:09:01 petroleum engineering department in geotechnical matters in around
11:09:06 1990. And then of course I've been involved significant lately.
11:09:10 Q. Since the Gulf of Mexico disaster, have you done more work
11:09:15 related to offshore oil and gas exploration?
11:09:18 A. Yes, I have. I was asked by the Secretary of Interior to chair
11:09:22 a committee called the Ocean Energy Safety Advisory Committee, and
11:09:26 offshore energy safety advisory committee. And I chaired that
11:09:30 committee on the Secretary's behalf, and it was a committee of
11:09:35 industry individuals, government individuals and non-government
11:09:38 agencies; and our job was to look at the spectrum of activities
11:09:44 going on in offshore production and exploration and make
11:09:49 recommendations about ways to improve safety and operational
11:09:52 effectiveness. And that was a two-year assignment, which is
11:09:55 finished recently.
11:09:58 And in addition, I've been supporting other parts of the
11:10:01 Department of Interior by providing expertise on the new
11:10:05 containment technologies which are being provided for the Gulf, and
11:10:08 I actually was a reviewer of a recent containment exercise that
11:10:14 took place in the Gulf.
11:10:15 Q. I would like to move now to your involvement with the *Deepwater*

Horizon incident. And we'll get into the flurry of issues in a minute, but we're going to start with just providing some context for how flurry came out of the source control. How did you become involved in the response to the oil spill?

A. I became involved because as laboratory president I was observing things that are happening across the country. And some of our management individuals had sent in to the government at the request of the Undersecretary for National Security of Department of Energy some ideas that might be used to help stop the flow of oil from the well.

These ideas sparked some interest by different places back in Washington, and on one Friday -- and they knew me, so on one Friday evening late they called me and asked if I could explain some of the ideas, which I did; but they also asked me if I could start to assemble people to better understand the situation. And from that day I, basically, got involved and ultimately went to Houston and spent about 140 consecutive days on the effort.

Q. And what was the timeframe when you first arrived in Houston?

A. That call was on a Friday evening, I know that very well because I had to get a few people who were gathering pizzas and get them to their phones so we could have a meeting that evening.

But I went the following Tuesday, as I recall, and that would have been about May 3rd, 2nd or 3rd, something like that. And we had sent, we sent people to Houston to understand the situation on Saturday and then I went down to join them on Tuesday,

immediately following Tuesday.

Q. Did you make the lab's resources available to BP?

A. Yes. We made the lab's resources -- there were three labs that we formed a team from and that gave us a very important diversity, scientific diversity; and then we helped them in two ways, we sent people to Houston. We typically had half a dozen, sometimes a dozen people in the BP building in Houston working with the BP folks. And then we had reach back back to the laboratory so they could access experts on whatever topic they needed to get a better understanding of.

Q. What were the first things that your group was working on in Houston?

A. When we first went down, we, like everybody, was trying to understand what was happening with the well. And so the question was, how do we diagnosis what's going on in the well? So we spent our first few days trying to help and better refine methods to look inside the wellhead, look inside the riser pipe and see if one could determine what's happening.

We were keenly interested in, as was BP, in what was going on inside. And so our main effort in the first week or so was around diagnostics.

Q. Subsequent to that, did BP request any expertise from the labs?

A. Sure. BP viewed us, I believe, as a resource to help corroborate or even review some of their work about technical analyses they were doing, so they would ask us to do analyses on

occasion and they typically asked us, for example, for technologies that they might not have or that industry might not have. Examples would be high-powered, high better imaging gamma-ray diagnostics that could be used to image what's inside the pipe.

And so we looked at those in great detail. We even sent people out on the rigs with better gamma imaging plates to help try to get better pictures of the well.

So, yes, they asked us for different kinds of assistance including analyses.

Q. Can we bring up Exhibit 9916.3.1.US. Can you explain for the Court what this is?

A. Sure. This is an e-mail record, yes, and it's from Paul Tooms. Paul Tooms was a very close associate, he was with BP, very capable person who spent a lot of time with us. And he seemed to be involved in virtually all of the questions that -- significant technical questions. And Paul had spent some time with me one evening and we discussed analyses that we could do that might be helpful to them.

And he subsequently then wrote me, summarized those in an e-mail and sent them to me and they were then distributed to other people on our team. The person that you see the Margie Tatro was one of our team leads who was actually down in Houston a lot.

Q. And what kind of projects is Paul Tooms requesting with this e-mail?

A. This e-mail, I believe this e-mail was referring to a set of

11:15:11 calculations of the flow paths within the well. And basically it
11:15:17 was trying to understand what could be going on inside the well
11:15:20 with respect to flows that might be circulating around.
11:15:23 Q. Could we pull up Exhibit 9916.4.1.US. And are these the
11:15:33 questions that were sent?
11:15:34 A. Yeah, these are the summary of the questions, right, yes.
11:15:38 Q. And I think the Court's already seen a version of this exhibit,
11:15:41 and I think heard a lot of testimony about number four last week so
11:15:45 we won't repeat that.
11:15:47 Could we -- I just want to ask you about question No. 2.
11:15:50 Can you elaborate on what that request was to the labs?
11:15:53 A. Sure. There was a request, I believe there's a supporting
11:15:56 paragraph that went beyond this, but this request was that the well
11:16:02 is actually made up of different possible internal flow paths, the
11:16:06 well had concentric pipes inside, starting with the drill pipe and
11:16:10 then the production casing and then surrounding casings. And it's
11:16:12 conceivable the flow was going around in different paths within
11:16:15 there, as it ultimately came out through the wellbore. So the
11:16:19 question is what it might be doing inside.
11:16:21 So for a given rate of flow, which they provided us, they
11:16:23 asked us what could be the possible internal flow mechanisms? It
11:16:27 was definitely not a calculation of what the flow was out of the
11:16:29 well, it was a calculation of what's going on within the well that
11:16:32 might have to do with the flow paths.
11:16:34 Q. What kind of expertise would be needed to answer this question?

11:16:37 A. Well, I typically look at a problem like this in a couple of
11:16:42 ways: First is to provide some generalist who can look at it and
11:16:46 ask what are the real important parameters and what are the
11:16:48 important questions involved. And then some specialist, in this
11:16:52 case a specialist would be what I would called flow analyst or
11:16:57 people who understand fluid dynamics and fluid characteristics and
11:17:01 can do modeling. And so we brought both on board to deal with
11:17:07 these questions.
11:17:07 Q. So BP requested analyst expertise from the labs?
11:17:09 A. Yes, they did.
11:17:10 Q. Was Ron Dykhuizen one of the engineers you sent to work on this
11:17:14 project?
11:17:14 A. Dr. Ron Dykhuizen was I believe the first person we called in
11:17:18 response to these questions and other things related in
11:17:21 understanding flow.
11:17:21 Q. And why was that?
11:17:22 A. Well, Ron was known by many people there as an individual who
11:17:30 was a very good on fundamentals, he knew basically fluid flow, he
11:17:34 understands the concepts of flow, the theory of flow; but he also
11:17:38 could generate information in practical terms so that a working
11:17:43 team could get it in usable units in ways in which they could use
11:17:47 it to make decisions.
11:17:48 So we knew Ron to be both theoretically sound and
11:17:51 engineeringly practical.
11:17:52 Q. We can take down the exhibit.

Is Dr. Stewart Griffiths another Sandia Labs engineer?
A. He is.
Q. And do you know Dr. Griffiths?
A. I do.
Q. Did he become involved in the response later on?
A. He did. Stewart Griffiths, Dr. Stewart Griffiths was involved -- I believe he was mostly involved in some of the teams that looked at flow and looked at flow characteristics, and he was brought in by other members of the team.
Q. Could you describe what Dr. Griffiths' position at Sandia is -- was at the time?
A. I guess he's currently retired, but at the time, he was what's called a senior scientist. We have a technical ladder which includes -- parallel to management, we have a technical ladder from scientists to not being influenced by management work, but being able to focus on their scientific work. And he was a senior scientist, which except for a few fellows, which we had maybe three or four, he would be -- that would be the highest-ranking technical scientist level. They're called senior scientists.
Q. I would like to move now into how your role evolved during the course of the incident. First, did your role evolve over time?
A. Certainly. Our team's role and my personal role certainly evolved significantly from the time we started until the time we finished.
Q. If we could pull up demonstrative D-21500. Can you describe

what the government-led science team was?
A. Sure. The government-led science team was a team that was pulled together by -- I would credit pulling it together by Secretary Steve Chu and Secretary Ken Salazar. They pulled together a team of various individuals. Secretary Chu, of course, brought in the National Laboratories, you see three of those here. But then there were people from the U.S. Geological Survey and even one time someone from NASA, of which formed a team to try to sort out and help with the source control efforts. And Steve Chu asked if I would co-lead it with him, and I did.
Q. What did you do as the co-lead of the government-led science team?
A. Well, in the beginning, my personal role was to try to make sure we had the right expertise to deal with the questions we were faced with and to get the team assembled and support the team. As -- very quickly as time went on, I became the interface with BP on all pivotal questions that had to be faced. And I then became, and I believe in the eyes of the government I became the person that was to synthesize the work of the team, pull that together in a way that would provide a basis for decisions which the government would ultimately have to make, and then transmit it to BP through the instant Commander, incident commander Thad Allen.
Q. We can bring up the demonstrative. What were the types of problems and decisions that you were involved in solving?
A. Well, there were a wide number, but the best way to look at it

11:21:14 is I think to look at the major phases of the incident, and ask
11:21:20 what decisions had to be made. We -- of course, we were involved
11:21:25 in the decision about the termination of the Top Kill. We were
11:21:28 involved in the decision about the need for containment capacity.
11:21:33 We were involved in the decision for whether or not to put on the
11:21:38 capping stack. We were involved in the decision whether or not to
11:21:40 inject mud into the well, whether or not to put cement in the well,
11:21:44 how to do the plugging and abandonment. Every major decision,
11:21:48 essentially after about the first of June, required us rendering a
11:21:54 technical judgment and passing that on to Thad Allen through the
11:21:59 Secretary.
11:21:59 Q. And what were you specifically doing to help get that technical
11:22:02 judgment to the decision-makers?
11:22:04 A. Well, I found that I had to do a lot of work directly with BP.
11:22:08 BP chose to call me on many occasions and ask -- first of all, they
11:22:14 would say what they're thinking and they would then get my response
11:22:18 on what they were thinking, and we would talk about it and ask how
11:22:21 to proceed. And we would then -- then we would work with the rest
11:22:27 of the government and, in fact, with the rest of the BP in many
11:22:30 cases to sort out what would be the course of action. Typically
11:22:35 they went -- you know, a phone call, a conversation, then a -- made
11:22:40 the phone meeting with BP and our team, including the Secretaries
11:22:43 in many cases, and then discussion back and forth. And then,
11:22:47 finally, we would end up making our determination, sending it back
11:22:52 up to incident command.

11:22:54 Q. I would like to look at one example of that decision-making
11:22:58 process. Were you involved in the decision to go forward with the
11:23:02 well integrity test?
11:23:03 A. Yes. Certainly the well integrity test was, in my mind, the
11:23:07 pivotal event of controlling the well. And as I think you've all
11:23:13 heard, there was a period of containment that was happening where
11:23:17 the oil was being collected by different mechanisms with the ships
11:23:20 at the surface. But doing something different was clear because,
11:23:25 for example, we had no way to deal with hurricanes, should they
11:23:29 come, with the collection mechanisms. So it became clear something
11:23:33 else should be done.
11:23:34 So I got a call, I'm pretty sure it was Paul Tooms, I'm
11:23:38 quite sure it was Paul Tooms, we discussed -- before anybody else
11:23:41 had really put it on the table, we discussed the idea of going
11:23:45 ahead with the option to put the capping stack on. That, of
11:23:48 course, was a serious option -- serious decision, because we did
11:23:52 not know the well had integrity. And putting a cap on the well
11:23:56 that does not have integrity makes the situation worse.
11:23:58 So we -- he and I discussed the fact that it could be put
11:24:02 on -- possibly be put on, and the fact that it could then be either
11:24:08 open or closed. And we talked about what could be learned from the
11:24:11 test. And basically we then went around to design what became
11:24:15 known as the well integrity test. But the pivotal thing was
11:24:19 installation of the capping stack.
11:24:21 Q. If we can pull up Exhibit 141394. Dr. Hunter, do you recognize

this document?
A. Yes. This document is a cover letter, cover page for a test procedure which were done before every major activity, and this happens to be the one for the well integrity test by BP and signed off by -- I believe several of those signatures are government signatures.
Q. Was there engineering analysis that was done prior to the issuance of this procedure?
A. Sure. There was an enormous amount of engineering analysis. One of the questions was, you have this blowout preventer series on top of the well and you're going to add yet another one on top of it, and if you did that, is it stable, is it going to fall over. There was a tilt in the -- at the flex joint, and the question was is it all going to hang together. So we did a lot of analysis on that. Then if you shut the well in, it'll pressurize, and the question is will everything at the top of well hold the pressure.

And then one has to decide the key question, the absolute key question of the whole control of the well was if I shut it off, will it leak somewhere else. If it leaks somewhere else, you may lose control forever. So that was the pivotal question, so we devised a way to understand whether it was leaking somewhere else. Basically just like a garden hose; you put your finger at the top, the pressure would be high. But if it's leaking somewhere, the pressure is lower. So we were really worried about it leaking somewhere else.

11:26:04 Q. Were there criteria developed to assess whether you could
11:26:08 detect a leak somewhere else?
11:26:10 A. Absolutely. Our team developed criteria that would enable us
11:26:15 to make a decision on whether the test was working properly or not.
11:26:19 Q. And did BP agree to be bound by this criteria?
11:26:22 A. BP did agree. They were aware of the calculations we did and
11:26:28 the formation, and they agreed and put them into their test
11:26:32 procedure.
11:26:32 Q. If we could look at that. Go to -- call out 141394.4.1.US. Is
11:26:42 this what you were describing?
11:26:43 A. Yes, this is a curve. It's kind of become kind of a famous
11:26:46 curve around well integrity, and basically it says that if you
11:26:49 measure the pressure at the top of the well with the new cap, if
11:26:54 the pressure is really high, that's good news because the well is
11:26:58 not leaking down below. If you measure that pressure and the
11:27:01 pressure is very low, that's bad news because that means it's
11:27:05 leaking somewhere and you may be in trouble.
11:27:07 So what -- we devised this -- we calculated those points
11:27:14 that you see there based on estimates of flow through what are
11:27:18 known as the rupture disks, and it basically said if you had
11:27:25 5,000 psi reading of the gauge at the top, you only have six hours
11:27:30 to leave it shut in and then you have to do something else.
11:27:32 Whereas, if it was 8,000 psi, you have at least 48 hours, and it
11:27:37 was all based on how long it would take to flow 20,000 barrels out
11:27:41 into the rock.

11:27:42 Q. Who performed the calculations behind those red dots?
11:27:45 A. Combination. Ron Dykhuizen had done calculations of, for a
11:27:53 given pressure, how much flow would go through the rupture disks
11:27:58 and, hence, out into the rock. And then I and Marjorie Tatro did
11:28:03 the points that you see there, and then we went over them with Paul
11:28:08 Tooms of BP, and Paul Tooms liked the idea of making it simpler, so
11:28:13 he -- he suggested putting the color blocks.
11:28:16 So the dots are laboratory calculations, including my
11:28:20 role in leading the calculations and doing some of the
11:28:23 calculations, and then BP's acceptance of them.
11:28:26 Q. And does the document reflect that those calculations were
11:28:30 performed by National Laboratories?
11:28:32 A. At the bottom of the visual you see there, it basically says --
11:28:37 this would be BP writing saying the duration was calculated by the
11:28:40 National Lab flow analysts.
11:28:42 Q. Did BP ever ask to redo these calculations themselves?
11:28:45 A. No, these were unaltered. We did the dots. The change only
11:28:48 was to add the colors and put the blocks in.
11:28:51 Q. Thank you. We can pull that exhibit down. Now let's talk
11:28:56 about flow rate. Did your engineers work side by side with BP on
11:29:02 source control efforts?
11:29:03 A. On source control efforts, we worked virtually every day. The
11:29:06 task was really about source control.
11:29:09 Q. Did you work side by side with BP on flow rate modeling?
11:29:12 A. No, we didn't work with BP on flow. That wasn't one in which

11:29:15 we did collaboration with BP at all. They didn't ask us to do that
11:29:21 and we didn't get engaged with them on flow calculations.
11:29:24 Q. Had they asked, would you have engaged?
11:29:26 A. Sure, if they had asked. We liked working with them and we
11:29:32 liked their people, and we would have gladly sat down and worked
11:29:35 with them, but we were never asked to do so.
11:29:37 Q. Were would you interested in flow rate from a source control
11:29:40 perspective?
11:29:41 A. Oh, certainly. Flow rate -- when you face something like a
11:29:46 *Deepwater Horizon* or Macondo well that's blowing out, you want to
11:29:51 understand all you possibly can about it. There were all kinds of
11:29:53 questions, pressures, temperatures, condition inside the wellhead,
11:29:57 all of those things were unknown. But the flow is the dominant
11:30:00 characteristic of what is really happening, both to the wellhead
11:30:03 and the reservoir. So flow rate was actually a critical matter.
11:30:07 It's also critical in response efforts; that is, taking
11:30:10 oil back of the out of the water, critical in containment effort,
11:30:14 and it turns out to be a critical parameter in understanding well
11:30:17 integrity and, of course, reservoir performance. So we were keenly
11:30:20 interested in what the flow was. And I do think the public was
11:30:27 very interested in what was the flow.
11:30:28 Q. Were there any attempts made by National Labs' engineers during
11:30:34 the response to attempt to calculate flow rate?
11:30:36 A. By our team, the team that I led, there were two attempts; one
11:30:40 during the time of the Top Hat and one during the time of the

11:30:46 insulation and shutting of the capping stack.
11:30:48 Q. I would like if you could just walk through the facts of what
11:30:52 happened back then with each of those. First, could you describe
11:30:55 what happened with the Top Hat flow rate estimate?
11:30:57 A. Sure. The Top Hat was basically like a funnel upside down on
11:31:03 top of the well, and that funnel was collecting as much oil as it
11:31:07 could and sending it to the ship. It occurred to us, if you knew
11:31:11 how much oil was going to the ship, which was measured at the ship,
11:31:14 and you could estimate how much oil was coming out of the capping
11:31:18 stack in the other places where it was clearly leaking, because the
11:31:21 ship would not accept all of the oil that was coming through the
11:31:25 riser -- or the riser was taking all of the oil it could take, if
11:31:28 you could do that, you could make an estimate of the total amount
11:31:30 of flow by adding up those different features. So we undertook an
11:31:35 effort to try to estimate what the flow was out of the Top Hat.
11:31:41 Q. And what did you do with that estimate?
11:31:43 A. Well, that estimate was done in several different ways, and it
11:31:50 basically gave a range of results. And those -- that information
11:31:56 was put together into a package that was compared with a team
11:32:01 called the flow rate technical group that had been assembled under
11:32:05 Dr. Marcia McNutt. And we compared all of their methods and that
11:32:09 method and had a -- an engaged discussion, again, what would be
11:32:14 called a webinar or over the telephone, and we decided then to put
11:32:18 out -- I think it was the third government estimate that came out
11:32:24 in mid-June. So that heavily influenced particularly the high side

11:32:29 of the government estimate in June, mid-June.
11:32:31 Q. And what was that announced figure, do you recall?
11:32:35 A. As I recall and the way I remember pretty vividly was it was 35
11:32:40 to 60 plus, and there was a note that we wanted to be sure that we
11:32:44 thought there was more room on the high side than the low side.
11:32:48 Q. How was that flow calculation used in source control efforts
11:32:52 going forward?
11:32:53 A. Well, the biggest use of the estimate of the flow at that time
11:32:56 was to provide for containment. BP had committed themselves to
11:33:02 putting in place this enormous containment system, which means they
11:33:06 need better ways to collect the oil; that is, to gather the oil at
11:33:10 the wellhead, and they need better ways to pipe it around and get
11:33:14 it up to the ships. So they were in the process of putting a
11:33:17 massive containment system in place, and the capacity of which was
11:33:21 influenced by that calculation.
11:33:22 Q. When the Top Hat was installed, were you able to look at ROV
11:33:27 video footage of the Top Hat?
11:33:29 A. Sure, we looked at ROV videos of everything, every day.
11:33:33 Q. Could you see flow coming out of the skirt?
11:33:37 A. Oh, sure. The skirt, if you use those words, so that's around
11:33:43 the bottom of the funnel basically. And there was flow coming out
11:33:47 of the top going to the ship, flow coming out some ports that were
11:33:51 on the side of the funnel aiming up, and then there was flow
11:33:54 boiling out around the skirt, which couldn't make a seal, and the
11:33:59 ship couldn't accept it if it couldn't.

11:34:02 Q. Could you see any changes in that flow in the skirt changing
11:34:04 when the collection rates changed?
11:34:06 A. I didn't recall any significant change depending on collection
11:34:11 rate. There was a lot of flow coming out. And what was really
11:34:14 clear was lots of flow to the ship, lots of flow out the three open
11:34:18 ports that were on top. There were three -- I think there were
11:34:21 two- or three-inch valves on top, lots of flow coming out of those,
11:34:26 and then lots of flow coming out of the skirt. And that happened
11:34:28 all the time the Top Hat was on there.
11:34:30 Q. And if we could just look at Demonstrative D-21006.2. Is this
11:34:41 a visual depiction of what you just described?
11:34:44 A. This is the Top Hat. This is one of many Top Hats, but
11:34:47 basically what I was describing. And I have a laser pointer. So
11:34:51 this upside down funnel is over the top of the well. This is a big
11:34:55 flange on the well. And the idea was to -- this oil would normally
11:35:01 be coming out right there and going into the ocean, into the Gulf.
11:35:05 So when the Top Hat was on, oil was going up here. And then these
11:35:09 were ports that had to be put in the top, because if you closed it
11:35:13 off, it would pop off. The pressure would be too great, it would
11:35:16 just pop right off. So there were four ports, three of which were
11:35:20 open, and oil was coming out here.
11:35:22 But then since it didn't make a seal there and because
11:35:25 the pressures were still fairly inside, then the oil was coming out
11:35:28 and around. You had three places of oil exiting here, here at
11:35:32 three different holes, and here. And this is called the skirt.

11:35:37 And the skirt was always boiling oil, oil and gas.
11:35:42 Q. You can pull down that demonstrative, thank you.
11:35:46 What was the next effort to estimate flow by the flow
11:35:52 lab -- excuse me, the National Lab engineers under your direction?
11:35:55 A. The ones under my direction, we knew that the capping stack was
11:35:59 going to be installed after significant effort because we had, you
11:36:04 know, worked with BP to agree that the capping stack was the course
11:36:08 of action. In fact, James Dupree and I made a joint presentation
11:36:13 to the cabinet members of the government about desirability of
11:36:18 putting on the capping stack, and everyone accepted it. So it
11:36:21 became the course of action to put on the capping stack.
11:36:23 So we knew when the capping stack went off and during
11:36:26 those periods when the flow was controlled, you could make an
11:36:28 estimate of flow. And so basically the best way -- the best way to
11:36:34 determine flow is to have a known geometry and pressure readings on
11:36:38 both sides of it. And since we knew the pressure at the bottom of
11:36:42 the Gulf, we insisted and BP easily agreed to put pressure gauges
11:36:48 on the capping stack. So we knew that geometry would allow us to
11:36:52 make another and much better estimate of flow.
11:36:55 Q. Let's pull up Demonstrative D-21001.2. Can you describe --
11:37:05 A. Sure. This is the capping stack. It's hooked onto the well at
11:37:12 that flange I showed earlier down here. I am not sure it's exactly
11:37:16 right in the graphic. It's hooked to the well down here and bolted
11:37:20 on the big flange. Took this down and bolted it back on. That was
11:37:24 a heroic engineering effort that worked quite well.

11:37:27 Then the flow then could go up, except up here there is a
11:37:31 couple of blowout preventers, and they were shut, so nothing could
11:37:34 flow this way. And that means the flow, as in all blowout
11:37:39 preventer systems, the flow could go out here through what's called
11:37:43 a kill line. It's called kill because if you want to inject mud in
11:37:47 that, you kill a well by pumping mud in here.
11:37:49 It could either go out the kill line into the ocean or it
11:37:54 could go out through the choke valve into the ocean. The choke
11:37:57 valve was designed to be turned slowly round and around and around
11:38:02 by and ROV, and as it turned slowly, it closed and you could
11:38:06 measure the pressure then, which is being measured right in here.
11:38:08 You can measure the pressure as you close the valve. So the whole
11:38:12 plan of the well integrity test was to shut this line completely,
11:38:14 leave this shut, and then shut this valve methodically, a turn, a
11:38:20 turn, a turn, a quarter of turn, a turn, and then shut off the flow
11:38:25 and observe these pressure gauges.
11:38:27 And this is back to that curve that we showed earlier. If
11:38:31 this pressure gauge read really high, that's great. If it read
11:38:34 really low, you would open this back up because that's not great.
11:38:40 Q. Prior to the installation of the capping stack, did you ask the
11:38:45 engineers to prepare to calculate the flow rate?
11:38:47 A. I did, because it was clear since we had this idea that flow
11:38:51 was really important and we had this idea that with good data, we
11:38:56 could make a really good estimate of it, we knew the pressure
11:38:59 gauges were going to be good, or should be good, and we knew the

11:39:03 geometry was going to be pretty well defined. So I asked people to
11:39:06 get ready to do a calculation, because here comes some good data.
11:39:11 And that's what happened.
11:39:12 Q. And if we can look at call out 11280.1.1.US. Is this an e-mail
11:39:28 describing your instructions?
11:39:29 A. Yes. This is an e-mail to Dr. Ratzel, and I knew Art well, and
11:39:37 Art had been a director of engineering sciences, and I asked him --
11:39:41 I think this is on July 11 -- that, you know, this -- the capping
11:39:46 test is going to go on and it's going to give us this good data.
11:39:50 Would you get ready and have people stand up and get their models
11:39:53 in place and be prepared for the analyses. And so Art then turned
11:39:58 to the three different teams and instructed each team to get ready
11:40:03 and start setting up their computer models.
11:40:06 Q. We can pull that down. Thank you. Now, is that calculation
11:40:10 intended to be through the choke line as you described previously?
11:40:14 A. The calculation would be through both the choke and the kill
11:40:19 line. There would be basically the pressure -- it depends on which
11:40:23 one was open, but whichever one was open and knowing the pressures,
11:40:27 one can take and make a calculation based on the pressure reading.
11:40:30 Q. Aside from the calculation you instructed the engineers to
11:40:35 perform, did you yourself perform a separate calculation?
11:40:38 A. I did. I did a calculation myself. Immediately when the
11:40:44 pressure results were obtained from the kill line, there was an
11:40:49 interval of time in which the choke line had to be fixed, so it was
11:40:54 closed. So all of the flow went out the kill line. And there was

11:40:58 a time during that that the ship collected and then didn't collect,
11:41:03 and then I used that and my understanding of fluid flow to do a
11:41:08 calculation, which I documented and sent out.
11:41:11 Q. Did you share that calculation with BP?
11:41:13 A. I did. I sent -- the calculation was done on the 14th, I
11:41:19 think, of July, and I sent the calculation to the team, to the
11:41:24 people in the government, and I sent -- and I discussed the
11:41:28 calculation with BP, with Kent Wells from BP.
11:41:32 Q. Who is Kent Wells, to your understanding?
11:41:34 A. Kent Wells was the BP person that was assigned to both deal
11:41:38 with the public and the public statements and coordinate those
11:41:43 activities, and he was assigned to coordinate with us, the science
11:41:48 team. And so he was virtually a daily contact for us and he
11:41:52 provided a lot of my keen insight into what was going on to BP and
11:41:58 vice versa.
11:41:59 Q. Did he tell you anything in response to what you told him?
11:42:02 A. Well, I told Kent what I had calculated. And we had become, as
11:42:07 with many BP people, become quite close, and I told him what I
11:42:12 calculated. And his response, as I recall it, was to the effect
11:42:16 that he was -- he had hoped it would not be so high. But if I had
11:42:21 done it, he gave it some credibility.
11:42:24 Q. Did BP ever share any capping stack calculations with you?
11:42:27 A. Capping stack calculations of flow?
11:42:29 Q. Yes, sir.
11:42:29 A. No calculations of flow.

11:42:31 Q. These capping stack calculations that were performed in the
11:42:36 middle of July, is that what you testified?
11:42:38 A. Let's see. Our capping stack calculations were done -- the
11:42:43 first one was done by me on about the 14th. They were done through
11:42:48 the balance of July and culminated in the end of July.
11:42:52 Q. I would like you to walk through the process from the middle of
11:42:56 July to when those calculations were completed.
11:43:00 A. Sure. I gave everyone a heads-up back on the 11th, and the
11:43:06 heads-up was to get ready and get organized and get your models set
11:43:10 up. The data started coming in on the 14th, and I did the first
11:43:15 one and passed that on to the team. And then the team took the
11:43:22 data that came in strictly from the choke closure and started a
11:43:28 serious of calculations. There were three teams, and each team did
11:43:32 three different calculations. And then within that, they actually
11:43:36 go to different times.
11:43:37 So they did their calculations through that period, data
11:43:42 coming in about the 15th of July. But we knew we had to work with
11:43:47 a flow and technical group and look at their data, and they had
11:43:51 been working for months; in fact, since the end of May, they had
11:43:55 been working on their techniques to look at flow.
11:43:58 So basically what happened was our team pulled together
11:44:00 its assessments and got together its results. And then on about
11:44:06 the 26th of July, I had our team meet with me to go over the
11:44:11 results and we discussed it, and at or about that time, we decided
11:44:16 to issue a standard format for everyone to present their data.

That would be all of the teams that we had plus all of the other teams that were working on flow outside of our group. And we then got everyone together on a mega webinar, phone call with video, and we let each participant go through and present their flow methodology and their flow results.

And ours, which were done in that period of the last two weeks of July, were -- we were the last presenters. And then it was my job to moderate the meeting, coordinate the meeting. And we met on the 30th of July and then we met in final form on the 31st of July.

Q. Was the uncertainty related to those estimates discussed that meeting you just described?

A. And there were two meetings, on the 30th and the 31st of July, and, yes, uncertainty was discussed. Everyone had different views on uncertainty. And the team had a recommendation on uncertainty, and we then chose a position on uncertainty and sent that forward on about August 1st.

Q. Did the team members who disagreed express their views?

A. Oh, certainly. This was -- there was never an occasion which people didn't express different views. In fact, my career basically was about reconciling different views of complex topics. And this was a complex topic and there were a lot of different views, and there were different views about approaches and different views about the uncertainty. And they were expressed by people.

11:45:52 Q. Did Secretary Chu express his views in that -- in those
11:45:58 meetings?
11:45:58 A. Secretary Chu was working with us as both a Secretary, which
11:46:03 means he had a formal role in the government, but he was also
11:46:05 working with us as a practicing scientist. And he was -- he had a
11:46:10 view about uncertainty from looking at the data. But he also had a
11:46:14 view of the need for certainty and he expressed basically his
11:46:18 concern about what is good enough; and, that is, how good does it
11:46:23 have to be.
11:46:24 Q. Did his comments alter the results that ultimately came out of
11:46:28 those meetings?
11:46:29 A. No. The team -- the team came in with a recommendation for a
11:46:34 flow rate -- an integral flow rate over 87 days and for an
11:46:41 uncertainty, and that was the one that stood and became the federal
11:46:44 government estimate. It's a little hard to say exactly. I know
11:46:48 that was a recommendation that came on the 30th of July, and Steve
11:46:54 Chu was involved in the discussions, he was one of many with a view
11:46:58 about uncertainty and the approach to getting flow.
11:47:01 Q. And how was the final decision arrived at?
11:47:04 A. Well, again, my job, which was in almost all of the major
11:47:09 decision was to be the synthesizer of information both from BP and
11:47:12 from all of the government scientists.
11:47:17 And so basically I listened to all of the conversations,
11:47:24 pulled together what I thought was all of the data that surrounded
11:47:29 the leading estimate and then decided and offered to the group that

11:47:33 1 we go forward with this one estimate which came in from our team,
11:47:40 2 from the DOE national laboratory team, and then we had a discussion
11:47:45 3 of that, of those results and what it might mean, and I then
11:47:50 4 moderated and had lots of discussion with all of the people.
11:47:55 5 There was an enormous amount of people on these phone
11:47:57 6 calls, and everyone agreed that that could go forward as the
11:48:01 7 government approach. Then we wrote it up probably on the 1st of
11:48:06 8 August and got it through the system overnight and all of that, and
11:48:10 9 it came out on August the 2nd.
11:48:12 10 Q. Your role in moderating that debate, did you ever do anything
11:48:17 11 like that at Sandia?
11:48:19 12 A. Certainly. I actually think that was the element that I spent
11:48:26 13 a lot of time working on all through my career, because there are
11:48:30 14 always difficult topics, complex topics which you have to reconcile
11:48:36 15 and approach. And I believe it's the view of the government,
11:48:38 16 because they relied on me in many matters, I believe it was the
11:48:42 17 view of the government that I was a resource to be used to try to
11:48:47 18 get out of a diverse set of discussion a view that could be gone
11:48:52 19 forward and so that decisions could be made. So it was not
11:48:54 20 uncommon. We certainly saw that in my annual assessment of the
11:48:59 21 nuclear weapons stockpile. Very often, you had different opinions.
11:49:03 22 Q. Now, you testified at the beginning of your testimony that you
11:49:06 23 had retired July 9th, 2010.
11:49:09 24 A. That's correct.
11:49:09 25 Q. So who were you working for at that time?

11:49:12 A. After July 9th?
11:49:14 Q. Yes, sir.
11:49:15 A. I didn't work for anybody.
11:49:16 Q. What was your role in the response?
11:49:19 THE COURT: July 9th of 2010?
11:49:20 THE WITNESS: Ten, please. July 9, 2010, yes.
11:49:25 BY MR. CHAKERES:
11:49:26 Q. Can you describe how you fit into the response after your
11:49:29 retirement?
11:49:29 A. I don't know whether it was coincidence or not, but I didn't
11:49:32 plan to do this. Of course, I had planned a whole succession and
11:49:38 requirement. I had worked for 140 consecutive days, and on about
11:49:41 the 70th day, I retired.
11:49:44 After retirement, I -- I recall vividly that I got home
11:49:50 late from work because I left the office about ten, and I was able
11:49:55 to catch the six o'clock flight to Houston, so my retirement was a
11:49:59 really short night. So I was able to, then, devote full-time to
11:50:03 the effort and -- whether I was in Houston or not. And I was asked
11:50:08 to lead, in a stronger fashion, this science team and to get more
11:50:15 involved with BP and to get more involved with the government
11:50:18 members.
11:50:20 And so I spent virtually the next 70 days deeply
11:50:24 involved, leading the team, but deeply involved with what I would
11:50:27 call the key players, Commander Thad Allen and Ken Salazar and
11:50:33 Steve Chu. So my role intensified after I retired.

11:50:37 Q. And you testified about your role in moderating the debates.
11:50:40 Did BP ever ask you to moderate debates?
11:50:43 A. Oh, sure. It wasn't -- it was not -- BP was a talented group,
11:50:49 so they had -- I don't know about their internal disagreement, but
11:50:53 they would have disagreements with us and with the team in general.
11:50:56 Maybe they would have disagreements with the people on the ground,
11:50:59 disagreements with Secretary Chu, and they would have disagreements
11:51:02 with me. But there were occasions when you had to take the
11:51:05 disagreements and reach a decision.
11:51:07 So I recall, I think it was the occasion of what was
11:51:12 called the static diagnostic test which was a dead well injecting
11:51:17 mud in it. They asked me to come down to Houston to see if I could
11:51:20 moderate a meeting to bring things to a conclusion, which I did,
11:51:24 and we reached a conclusion and moved forward.
11:51:26 BP relied on me for that role of bringing people
11:51:29 together. And we also had external industry people that were in
11:51:34 the discussions as well.
11:51:35 Q. I want to go back real briefly to the July 30, 31st meetings.
11:51:44 Do you recall in your deposition being asked about a comment
11:51:47 Secretary Chu made about the estimate being good enough for
11:51:51 damages?
11:51:51 A. I do.
11:51:52 Q. Could you provide to the best of your recollection your
11:51:57 understanding of what Secretary Chu meant with that comment?
11:52:01 A. Well, I think Secretary Chu was -- and only he knows exactly

what he meant, but I believe he was talking about what is good enough. And he was saying basically that for purpose -- I can't remember the wording, whether the word was damages or the wording was negotiating with BP or whatever the wording was, he's saying that for that, plus or minus ten percent is good enough.

Q. I want to ask you a few more questions. So you've been involved in large scale complex engineering projects previously?

A. I have.

Q. How would you describe the pace at which engineer work was being done during the response?

A. Well, this was both exciting and intense. It was a significant amount of work had to be done. It was well organized work I thought, and our team, and working with BP, was a team that came together from three different institutions and they worked together seamlessly. No one really cared who they actually reported to because they were working long days, seven by 24.

And so it was intense but exciting. And a lot could get done in a reasonably short period of time. And people could stand up and be proud of what they did, and they did that on many, many occasions.

Q. Did you see the lines of communication between the team members, were those open?

A. Oh, the team members were in Houston sitting at same large conference tables, so those lines were certainly open all the time. They talked with me whether they were in Houston or not. The lines

11:53:41 with BP were certainly open. I don't know at what date it started,
11:53:47 but somewhere around June, and somewhere in June I was on the phone
11:53:51 call with leadership of BP every morning, seven o'clock Albuquerque
11:53:57 time every morning.
11:53:58 Q. And how was the pace of the work reflected in the tone of
11:54:01 conversations?
11:54:01 A. Well, if you've ever been in one of these environments, there
11:54:06 are always people who talk about it and it becomes kind of folklore
11:54:10 of things to talk about. "Boy, we're really under -- have a lot to
11:54:13 do here." But I think they're really saying, "We have a lot to do.
11:54:17 It's very important. We're glad we get the opportunity to do it.
11:54:21 It's not going to be easy, but we're up to it."
11:54:23 Q. Did you ever ask their engineers to sacrifice accuracy for
11:54:29 speed?
11:54:29 A. It's very unusual to sacrifice accuracy in this environment.
11:54:31 This is a culture of people who have probably one of the most
11:54:35 critical responsibilities in the country, that is the assurance of
11:54:38 the safety of nuclear weapons. And you have to build a culture,
11:54:42 you know, do it the best you can, don't cut corners where it might
11:54:47 make a difference.
11:54:48 So we didn't ask that to be the case. In fact, I -- you
11:54:54 know, we had requests to provide the data that we didn't meet
11:54:57 because my instruction was we can't quite get it done if we have to
11:55:02 sacrifice accuracy.
11:55:03 Q. One final question. You testified you're a retiree now, no

11:55:08 longer working for the national laboratories. Why did you decide
11:55:11 to come testify to the Court today?
11:55:13 A. Well, I didn't anticipate being in this role. I didn't
11:55:16 anticipate getting reengaged with the oil industry. It just
11:55:20 happened by circumstance.
11:55:22 But since -- particularly my last job, which is about
11:55:26 service to the nation, I just decided that three things were really
11:55:30 important to me: One was that I do everything I can to stop it
11:55:34 because it didn't seem like a good thing, it seemed like a very bad
11:55:37 thing that was happening, we need to stop it. So I was willing to
11:55:40 donate my time and go to Houston and do all that I did to help stop
11:55:44 it.
11:55:45 I also decided it was very important that the facts of
11:55:48 the matter and what really happened get brought out both in the
11:55:51 record and for posterity. And then thirdly, I decided that I would
11:55:57 do any reasonable thing I could to try to be sure that it didn't
11:56:01 happen again.
11:56:01 And the third of those reasons is why I worked with the
11:56:06 Department of Interior to work on the Oceanic Safety Committee and
11:56:11 the things that I do for them. But it was the second reason really
11:56:14 that I decided to get engaged in this process, because I think it's
11:56:17 critical that the facts, as we best know them, get out and become a
11:56:22 matter of public record.
11:56:25 MR. CHAKERES: Thank you, sir. And, your Honor, no
11:56:28 further questions.

11:56:28 THE COURT: All right. Why don't we go ahead and break
11:56:34 for lunch. It's about noon time. Let's come back at 1:15.
11:56:39 THE DEPUTY CLERK: All rise.
11:56:40 (WHEREUPON, A LUNCH RECESS WAS TAKEN.)

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REPORTER'S CERTIFICATE

I, Karen A. Ibos, CCR, Official Court Reporter, 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 and numbered matter.

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Karen A. Ibos, CCR, RPR, CRR, RMR
Official Court Reporter