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UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF LOUISIANA

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IN RE: OIL SPILL BY THE Docket No. MDL-2179
OIL RIG *DEEPWATER HORIZON* Section "J"
IN THE GULF OF MEXICO ON New Orleans, LA
APRIL 20, 2010 Wednesday, October 9, 2013
CIVIL

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

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UNITED STATES OF AMERICA Docket No. 10-CV-4536
V. Section "J"

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BP EXPLORATION & PRODUCTION,
INC., ET AL

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DAY 7, 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

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WITNESSES FOR THE GOVERNMENT:

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P R O C E E D I N G S

(WEDNESDAY, OCTOBER 9, 2013)

(MORNING, AFTERNOON SESSION)

(OPEN COURT.)

08:04:41 6 THE COURT: Good morning, everyone. Be seated. All
08:04:47 7 right. Let me make my announcement from our timekeepers.
08:04:57 8 According to them, we have, let's see, United States has used
08:05:02 9 7 hours and 49 minutes, has 37:11 remaining; BP has used 7 hours,
08:05:09 10 13 minutes, has 37:47 remaining.

08:05:15 11 Any other preliminary matters?

08:05:17 12 MR. BOLES: Yes, your Honor, if I may. Martin Boles for
08:05:19 13 BP and Anadarko. I would like to offer into evidence the exhibits
08:05:23 14 used in yesterday's cross-examination of Dr. Hsieh, which we
08:05:27 15 circulated last night and, to my knowledge, haven't been objected
08:05:30 16 to.

08:05:30 17 THE COURT: All right. Any objections? Hearing none,
08:05:33 18 those are admitted.

08:05:35 19 MR. BOLES: Thank you, your Honor.

08:05:36 20 THE COURT: Sure. Good. All right. Ms. Karis --

08:05:40 21 MS. KARIS: Good morning, your Honor.

08:05:42 22 THE COURT: -- you may resume. Dr. Zick, you're still
08:05:47 23 under oath. Okay?

08:05:47 24 THE WITNESS: Okay.

08:05:50 25 MS. KARIS: Heeding your advice from last week that we

08:05:51 1 don't have to use all of our time, I have attempted to cut some of
08:05:53 2 this, so that's the benefit of carrying over Dr. Zick.

08:05:53 3 Good morning.

08:05:53 4 THE WITNESS: Good morning.

08:05:59 5 MS. KARIS: For the record, Hariklia Karis, we're
08:05:59 6 resuming your cross-examination on behalf of BP and Anadarko.

08:05:59 7 CONTINUED CROSS-EXAMINATION

08:05:59 8 BY MS. KARIS:

08:06:05 9 Q. When we broke yesterday, we were talking about your EOS model
08:06:10 10 and whether it overpredicts stock-tank barrels. You compared your
08:06:18 11 EOS model to lab results that existed that contained a figure for
08:06:23 12 stock-tank barrels both for single-stage flash as well as
08:06:28 13 multistage flash, correct?

08:06:30 14 A. Yes.

08:06:30 15 Q. And there were four fluid samples that were tested at
08:06:35 16 single-stage flash, correct?

08:06:37 17 A. Correct.

08:06:37 18 Q. And in each of those four instances, your EOS model
08:06:43 19 overpredicted the shrinkage factor, correct?

08:06:46 20 A. No, that's not correct.

08:06:47 21 Q. Okay. Let's take a look at TREX 11495.1.1. And I realized I
08:07:03 22 forgot my glasses, so one second. Before we look at this chart,
08:07:20 23 would you agree with me that for all four of the multistage flash
08:07:25 24 tests that were conducted, your EOS model overpredicted the
08:07:32 25 stock-tank barrel figure?

08:07:34 1 A. Could you repeat the question?

08:07:36 2 Q. Sure. You talked about there being four samples that were
08:07:40 3 tested, correct?

08:07:40 4 A. Correct.

08:07:41 5 Q. And for multistage, or four-stage, which is the process that
08:07:46 6 you recommended -- or one of the processes that you recommended,
08:07:51 7 your EOS model overpredicted the shrinkage factor, as compared to
08:07:56 8 the lab tests?

08:07:57 9 A. By small amounts, yes.

08:07:59 10 Q. Okay.

08:08:07 11 THE COURT: Overpredicted, meaning predicted a greater
08:08:11 12 shrinkage than otherwise?

08:08:13 13 MS. KARIS: Correct.

08:08:14 14 BY MS. KARIS:

08:08:14 15 Q. And to be clear, Dr. Zick, by overpredicting, that results in a
08:08:19 16 large stock-tank barrel figure?

08:08:21 17 THE COURT: I heard it exactly opposite, that's why I
08:08:24 18 asked the question. Overpredicted the shrinkage to me means it
08:08:28 19 shrunk more. So it would be less stock-tank barrels. So you have
08:08:33 20 to clarify that.

08:08:35 21 MS. KARIS: Sure.

08:08:36 22 BY MS. KARIS:

08:08:37 23 Q. If you're overpredicting the shrinkage factor, what does that
08:08:41 24 result in with respect to stock-tank barrels?

08:08:44 25 A. That means more stock-tank barrels. The shrinkage factor as

08:08:51 1 used in the petroleum industry has a completely counterintuitive
08:08:58 2 meaning. The shrinkage factor is the shrunken volume divided by
08:09:06 3 the original volume. So the larger the shrinkage factor, really
08:09:11 4 the less the fluid has shrunk.

08:09:17 5 THE COURT: Clear as mud now.

08:09:19 6 THE WITNESS: Exactly.

08:09:20 7 THE COURT: I will have to take your word for that, I
08:09:22 8 guess.

08:09:23 9 MR. BROCK: Welcome to our world.

08:09:25 10 MS. KARIS: My feeling exactly, your Honor. A few weeks
08:09:27 11 ago, this meant nothing.

08:09:29 12 BY MS. KARIS:

08:09:30 13 Q. So just to be clear, because I know it's counterintuitive, it
08:09:33 14 remains counterintuitive to me, if your model overpredicts the
08:09:39 15 shrinkage factor, that would result in more stock-tank barrels,
08:09:45 16 correct?

08:09:46 17 A. Correct.

08:09:46 18 Q. Okay. And you agree that your EOS model overpredicts the
08:09:55 19 shrinkage factor for all of the samples that were tested at
08:10:00 20 four-stage flash, correct?

08:10:03 21 A. By small amounts, correct.

08:10:04 22 Q. And when you say by small amounts, approximately 3 percent, I
08:10:10 23 believe, is what you said previously?

08:10:11 24 A. Yes, something like that.

08:10:15 25 Q. And so that would be a 3 percent overprediction of whatever

08:10:19 1 cumulative number exists, correct?

08:10:22 2 A. That would be assuming that the laboratory data was 100 percent
08:10:26 3 reliable, which is not a certainty, by any means.

08:10:30 4 Q. But given that your EOS model is measured in part by its
08:10:38 5 ability to predict the lab data, that's what you're aiming to
08:10:43 6 achieve, match your model to the lab data, correct?

08:10:48 7 A. My attempt was to match my model to all 1,000 plus data points
08:10:55 8 that were available, not just those four shrinkage factors.

08:10:59 9 Q. Okay. But at least with respect to that one variable, we agree
08:11:02 10 that you are over what the lab data is, correct?

08:11:06 11 A. By small amounts, correct.

08:11:07 12 Q. I think we've established that. Let's move on, then. We don't
08:11:11 13 need to go through the specific details of this chart.

08:11:15 14 Now, you're aware that there were multiple equation of state
08:11:20 15 models that were created in connection with the Macondo oil spill,
08:11:25 16 correct?

08:11:26 17 A. Yes.

08:11:26 18 Q. You created one?

08:11:27 19 A. Correct.

08:11:28 20 Q. Dr. Whitson created one?

08:11:32 21 A. Correct.

08:11:33 22 Q. And, likewise, BP created one in the summer of 2010?

08:11:37 23 A. I believe they may have created two, but I've seen one of them.

08:11:43 24 Q. And it's your belief that yours is the best of all of the
08:11:50 25 equation of state models that exist, correct?

08:11:52 1 A. Overall, yes.

08:11:53 2 Q. Now, you're aware that the United States has multiple experts
08:11:58 3 in this case who were looking at the total volume of oil released
08:12:04 4 from the Macondo well, correct?

08:12:06 5 A. Yes.

08:12:06 6 Q. And you know who Dr. Dykhuizen is?

08:12:10 7 A. Yes.

08:12:11 8 Q. And Dr. Dykhuizen testified to this Court earlier this week.
08:12:16 9 Were you here when he testified?

08:12:18 10 A. Yes.

08:12:18 11 Q. And you know that although you believe your equation of state
08:12:22 12 model is the best, he did not use your model, correct?

08:12:26 13 A. Well, he did his modeling two years before I developed my
08:12:31 14 equation of state, so, correct.

08:12:33 15 Q. I understand. But he issued an expert report in March of this
08:12:38 16 year, correct?

08:12:41 17 A. Yes. But I believe that was based on his 2010 modeling, as far
08:12:46 18 as I know.

08:12:46 19 Q. And with the knowledge that you had an equation of state, he
08:12:52 20 relied on equation of state models done by Sandia Labs, correct?

08:12:58 21 A. I believe that's correct.

08:12:59 22 Q. And are you also aware of a different United States expert,
08:13:05 23 Dr. Pooladi-Darvish, who will be testifying here today, I believe?

08:13:09 24 A. Yes.

08:13:09 25 Q. And, likewise, although you believe your model is the best, he

08:13:13 1 did not use your model, correct?

08:13:16 2 A. As I understand it, his software was not capable of applying an
08:13:22 3 equation of state directly.

08:13:23 4 Q. Are you familiar with the Vasquez-Beggs fluid correlation?

08:13:28 5 A. That's not something I've used, no.

08:13:31 6 Q. That's the model that Dr. Pooladi-Darvish used to predict fluid
08:13:37 7 properties, correct?

08:13:39 8 A. I don't know.

08:13:40 9 Q. But you know at least that he, too, didn't use your model?

08:13:46 10 A. I am pretty sure that that's correct.

08:13:49 11 Q. And you're familiar with Dr. Kelkar?

08:13:53 12 A. I know the name.

08:13:56 13 Q. And he, too, is another expert for the United States who opined
08:14:01 14 on quantification issues in this case, correct?

08:14:04 15 A. Correct.

08:14:04 16 Q. Now, he did use your equation of state analysis for only part
08:14:10 17 of his opinions, correct?

08:14:14 18 A. I believe that's correct.

08:14:14 19 Q. You understand that he did a material balance analysis?

08:14:21 20 A. I am not sure of the details of all of his work.

08:14:25 21 Q. Do you know whether for his material balance analysis
08:14:29 22 Dr. Kelkar, rather than using your equation of state, used the
08:14:33 23 black oil tables that were created by BP in its -- in the equation
08:14:38 24 of state model it generated in the summer of 2010?

08:14:41 25 A. That's possible, but I don't know the details of his work.

08:14:46 1 Q. You have no reason to question that Dr. Kelkar, in fact, used
08:14:59 2 BP's generated black oil tables, based on BP's composition modeling
08:15:06 3 from the summer of 2010, correct?

08:15:08 4 A. I don't know.

08:15:08 5 Q. Now, you created your equation of state model in part because
08:15:16 6 you found, in your view, that BP's model did not predict fluid
08:15:22 7 properties as accurately as you felt appropriate, correct?

08:15:27 8 A. That's correct.

08:15:27 9 Q. And you could not confirm during your analysis the underlying
08:15:35 10 basis for BP's 2010 equation of state model, is that correct?

08:15:45 11 A. I don't know. That question is rather vague. Could you put
08:15:52 12 that differently?

08:15:53 13 Q. Sure. The reason you didn't rely on BP's 2010 equation of
08:15:57 14 state modeling is because you couldn't confirm the underlying
08:16:01 15 process used by BP to generate that equation of state model,
08:16:05 16 correct?

08:16:07 17 A. I would say that's fair.

08:16:09 18 Q. And, in fact, it's your view you could not recommend any other
08:16:15 19 government expert use BP's model, correct?

08:16:21 20 A. Well, more or less, although that was because when I began work
08:16:32 21 on the project, not knowing exactly how BP had generated that,
08:16:39 22 their equation of state, having not put together a data set of the
08:16:45 23 laboratory data with which I could test their equation of state, I
08:16:49 24 had no way of knowing whether it was at all accurate or not.

08:16:55 25 The only thing I could tell from the results that I had

08:16:59 1 seen of it was that it wasn't predicting an extremely near-critical
08:17:05 2 fluid, and so I felt that it probably was not as accurate as it
08:17:09 3 should be. But I didn't know exactly how good or how bad it was at
08:17:15 4 that time.

08:17:15 5 Q. And as a result, you didn't feel like you could recommend to
08:17:21 6 any other government expert that they use BP's model? Those are
08:17:27 7 your words, correct?

08:17:28 8 A. Correct. At least not at the time.

08:17:30 9 Q. And certainly not at the time of your deposition either,
08:17:34 10 correct?

08:17:36 11 A. Well, I think -- when I recommended that BP's model not be
08:17:51 12 used, that was at the start of my own work. I don't think I ever
08:17:58 13 said after my work was done whether BP's model was -- would be
08:18:03 14 adequate or not. I didn't really go back and look at it, although
08:18:11 15 I did make some calculations and I do feel that my equation of
08:18:16 16 state does predict the data better than BP's. And so I would
08:18:22 17 recommend mine over BP's. But I don't think anyone asked me
08:18:26 18 afterwards whether BP's model would be unacceptable or not.

08:18:33 19 Q. Even at the end, after looking at BP's model, looking at all of
08:18:38 20 the other models, you felt your model was better and, nonetheless,
08:18:42 21 U.S.'s expert's didn't rely on it, correct?

08:18:46 22 A. Some experts did.

08:18:47 23 Q. That would be Dr. Kelkar for a limited purpose, correct?

08:18:51 24 A. Yes.

08:18:52 25 Q. Dr. Griffiths, were you here when he testified?

08:18:58 1 A. No, I don't think I sat through his.

08:19:03 2 Q. Do you know that Dr. Griffiths, likewise, did not use your
08:19:08 3 model which you believe was best?

08:19:09 4 A. I believe that's correct, but I am not positive.

08:19:14 5 Q. Let's talk now about the separation process. You testified
08:19:27 6 yesterday that it's your opinion that the oceanic separation
08:19:32 7 process is the most appropriate process to use, correct?

08:19:36 8 A. Yes.

08:19:38 9 Q. And to quote you, that's because that's how fluids would be
08:19:42 10 separated by the conditions they would encounter in the ocean,
08:19:46 11 correct?

08:19:46 12 A. Correct.

08:19:47 13 Q. And you believed it was important that whatever process is used
08:19:56 14 here, separation process, that it reflects the conditions
08:20:01 15 encountered in the ocean, to use your words, correct?

08:20:08 16 A. I probably said something like that.

08:20:10 17 Q. Now, in discussing your decision to move from the four-stage
08:20:25 18 recommendation that you initially had to the oceanic separator
08:20:30 19 recommendation that you disclosed in your rebuttal report, you
08:20:34 20 concluded that the oceanic separator method would be the most
08:20:39 21 efficient separator process, correct?

08:20:42 22 A. Correct.

08:20:42 23 Q. And by most efficient, what you mean is that results in the
08:20:49 24 highest shrinkage factor, correct?

08:20:54 25 A. Yes, that's correct.

08:20:55 1 Q. And, again, counterintuitive; by highest shrinkage factor, the
08:21:00 2 one you're now recommending, that results in the most stock-tank
08:21:05 3 barrels, correct?

08:21:07 4 A. That's correct.

08:21:07 5 Q. Now, I believe you testified yesterday when you were shown the
08:21:20 6 chart from BP's opening that single-stage flash results in the
08:21:28 7 lowest stock-tank barrels, correct?

08:21:31 8 A. Of all of the separation processes that have been proposed
08:21:36 9 here, yes.

08:21:36 10 Q. But you're also familiar with the differential liberation
08:21:42 11 separation process?

08:21:43 12 A. If you're talking about the differential liberation experiments
08:21:48 13 that were run by Pencor, yes, I am aware of those.

08:21:52 14 Q. Reservoir oil can be converted to stock-tank oil through a
08:21:55 15 number of processes, including differential liberation expansions,
08:22:02 16 correct?

08:22:03 17 A. I wouldn't say that that's exactly correct.

08:22:05 18 Q. All right. Let's look at 11490R.25.4. Do you recognize this
08:22:19 19 excerpt from the expert report of Aaron Zick? First, do you
08:22:27 20 recognize it?

08:22:27 21 A. Yes.

08:22:28 22 Q. And you see there where I've highlighted the sentence I just
08:22:33 23 asked you, "Reservoir oil can be converted to stock-tank oil
08:22:36 24 through any number of processes, including differential liberation
08:22:41 25 expansions." Correct?

08:22:44 1 A. Well, this is true in general.

08:22:47 2 Q. All right. Now, the differential liberation experiments
08:22:53 3 process, which you discuss at length in your report, that actually
08:22:57 4 results in lower stock-tank barrel figures, correct?

08:23:05 5 A. Well --

08:23:07 6 Q. Is it correct?

08:23:08 7 A. I would not call the residual from that experiment, from the
08:23:11 8 Pencor differential liberation experiment stock-tank oil.

08:23:15 9 Q. Okay. Let's look at 11491R.20.1. Again 11491R.20.1. Do you
08:23:32 10 recognize this chart?

08:23:33 11 A. Yes.

08:23:35 12 Q. And, again, this is from your report. Correct?

08:23:38 13 A. That's correct.

08:23:38 14 Q. And this is looking at relative volume versus pressure,
08:23:46 15 correct?

08:23:47 16 A. Correct.

08:23:48 17 Q. And the relative volume, is that stock-tank barrels?

08:23:52 18 A. No.

08:23:53 19 Q. Is that a conversion for stock-tank barrels?

08:23:57 20 A. Not really.

08:24:02 21 Q. Can you tell the Court what the .3 is on the far left where it
08:24:09 22 says "pressure over relative volume," right here, .3, which is
08:24:13 23 where you say the data plot is. There are dots for data to be
08:24:17 24 clear. This is from the lab tests, correct?

08:24:19 25 A. Yes.

08:24:19 1 Q. And then you've got Zick's EOS in the blue line and then you've
08:24:25 2 got Whitson's EOS in the green line, correct?

08:24:29 3 A. Correct.

08:24:29 4 Q. And just tell the Court, right here, this .3, what is that?

08:24:36 5 A. That's the relative volume of the residual oil from this
08:24:41 6 experiment. But I would not call that stock-tank oil because this
08:24:46 7 experiment would -- mimics no process that the Macondo fluid would
08:24:53 8 ever undergo. This is the type of experiment that is designed to
08:24:58 9 see what would -- what residual oil would be left in the reservoir
08:25:04 10 if you blew the reservoir down all the way down to atmospheric
08:25:07 11 pressure, but that did not happen in this experiment or in this --
08:25:16 12 in the -- in what happened to the Macondo reservoir.

08:25:19 13 Q. So you believe that differential liberation figures do not
08:25:24 14 represent what actually happened at Macondo, correct?

08:25:30 15 A. Not one the reservoir, not within the well. And this
08:25:35 16 particular experiment doesn't apply to what happened outside of the
08:25:38 17 well. So this experiment applies to nothing that happened at the
08:25:42 18 Macondo reservoir.

08:25:43 19 Q. Okay. And now we're going to talk about what did happen at the
08:25:48 20 Macondo reservoir. You concluded, based on the need to represent
08:25:55 21 what actually happened, that the oceanic separator was the better
08:25:59 22 process to use, correct?

08:26:00 23 A. Correct.

08:26:00 24 Q. You concluded that after initially advocating, however, for a
08:26:18 25 four-stage process, correct?

08:26:22 1 A. Correct.

08:26:22 2 Q. And four-stage process is generally designed to be performed on
08:26:28 3 production platforms land based at ground level, correct?

08:26:36 4 A. Land based or on drilling platforms at sea, yes.

08:26:40 5 Q. And so the -- you didn't use the liberation process because
08:26:46 6 that's not what happened at Macondo, you told us, correct?

08:26:49 7 A. Well, technically a four-stage separation process or any
08:26:55 8 multistage separation process is a differential liberation process.

08:26:58 9 A single-stage separation is a differential liberation process.

08:27:03 10 All you mean by differential liberation is that after
08:27:09 11 each equilibration stage, all of the gas is removed and discarded.
08:27:15 12 The differential liberation experiment that you showed there
08:27:18 13 started with the first depletion pressure of 6,000 psi. That never
08:27:24 14 happened anywhere in the Macondo reservoir, so all of the rest of
08:27:27 15 the results from that experiment are completely irrelevant. The
08:27:33 16 differential liberations that occurred in the multistage separation
08:27:37 17 tests and the single-stage separation tests, those are legitimate.
08:27:43 18 But the additional differential liberation tests that you just put
08:27:50 19 up on the screen is totally irrelevant.

08:27:52 20 Q. We've moved away from the differential liberation. We're now
08:27:55 21 talking about the four stage.

08:27:56 22 A. Okay.

08:27:57 23 Q. Four stage, which was your initial recommendation, you agree
08:28:00 24 that that four-stage process is generally designed to be performed
08:28:04 25 at the surface on a production platform if it's land based, at

08:28:10 1 ground level? Those are your words, correct?

08:28:14 2 A. I may have said something like that. I don't recall saying
08:28:17 3 anything about land based.

08:28:18 4 Q. Okay. We can pull up 228 at 14 to 25, just to see if this
08:28:24 5 refreshes your recollection here. 228, lines 14 to 25 of
08:28:34 6 Dr. Zick's deposition.

08:28:42 7 Do you recall being asked the following question,
08:28:45 8 "Describe for me that four-stage process," and giving the following
08:28:50 9 answer, "The first stage is -- well, the four-stage process is
08:28:54 10 generally designed to be performed at the surface on a production
08:28:59 11 platform if it's out in the ocean or, you know, it's a land-based
08:29:05 12 well, just at the surface, you know, at ground level"?

08:29:09 13 THE COURT: Ms. Karis, that's a different question than
08:29:11 14 what you posed to the witness.

08:29:13 15 MS. KARIS: I'm sorry.

08:29:14 16 THE COURT: You left out some of the words when you posed
08:29:17 17 the question to the witness.

08:29:18 18 MS. KARIS: I apologize. Let me reask the question.
08:29:20 19 Maybe I can clarify.

08:29:21 20 THE COURT: You left out about out in the ocean, you
08:29:24 21 didn't pose that in your question.

08:29:26 22 MS. KARIS: I am happy to rephrase.

08:29:27 23 THE COURT: I think you should do that.

08:29:29 24 BY MS. KARIS:

08:29:29 25 Q. The four-stage process, that is for production platform that is

08:29:34 1 out in the ocean, the production platform is in the ocean and the
08:29:40 2 four-stage process is at the surface, correct?

08:29:45 3 A. That's usually correct. Although I believe you could also set
08:29:51 4 up separation equipment on the floor of the ocean. But I am not an
08:29:57 5 expert on production operations, so I am not exactly sure.

08:30:03 6 Q. The production platform is what you're referring to there is in
08:30:07 7 the ocean, not the water in the -- I mean not the oil in the ocean,
08:30:10 8 correct?

08:30:11 9 A. Correct.

08:30:11 10 Q. Now, you just said you are not an expert in production
08:30:19 11 operations, correct?

08:30:21 12 A. I wouldn't call myself an expert in that -- in those areas.

08:30:38 13 THE COURT: Let me ask a couple of questions, Ms. Karis,
08:30:41 14 so I can understand.

08:30:43 15 MS. KARIS: Absolutely.

08:30:44 16 THE COURT: Dr. Zick, can you tell me, if you can tell
08:30:48 17 me, what is the normal or customary manner or methodology that's
08:30:55 18 used in the industry to perform this process?

08:31:02 19 THE WITNESS: Well, normally when an oil company produces
08:31:06 20 oil, they would like to stabilize as much of the oil as possible in
08:31:14 21 the stock-tank conditions. And so they will normally set up some
08:31:19 22 sort of multistage separation process at the surface somewhere.

08:31:24 23 THE COURT: So that would be -- which of the methods you
08:31:28 24 discussed, you've told us about, which method would that be with?

08:31:33 25 THE WITNESS: The four-stage separation process.

08:31:38 1 THE COURT: So from your testimony or from your
08:31:42 2 perspective, do I understand that the issue comes down to whether
08:31:46 3 that's the appropriate methodology for the Court to apply the
08:31:52 4 calculated stock-tank barrels or, instead, this oceanic
08:31:58 5 methodology, because we know that the oil escaped before it got to
08:32:07 6 the surface via a riser in this instance? Am I understanding that
08:32:11 7 correctly?

08:32:13 8 THE WITNESS: There are basically three choices: Those
08:32:15 9 two choices and then the single-stage choice. The single-stage
08:32:21 10 choice would not be used for production purposes. It's a simple
08:32:28 11 process, but very inefficient. I believe some of BP's experts have
08:32:33 12 applied the single stage.

08:32:35 13 THE COURT: I want to understand what your opinion is,
08:32:39 14 since you're testifying now. They'll testify, I'm sure.

08:32:42 15 THE WITNESS: My opinion is that either the oceanic
08:32:47 16 model, as I've proposed it, or the four-stage separation model,
08:32:52 17 either of those would be appropriate, depending on whether you
08:32:56 18 would like to mimic the behavior that the ocean might have imposed
08:33:03 19 upon the fluids or mimic the behavior that BP would have imposed
08:33:13 20 upon the fluids had they produced it in the normal fashion.

08:33:18 21 THE COURT: Okay. Go ahead, Ms. Karis, I'm sorry to
08:33:20 22 interrupt.

08:33:21 23 MS. KARIS: Thank you, your Honor.

08:33:22 24 BY MS. KARIS:

08:33:23 25 Q. To be clear, Dr. Zick, BP did not produce the Macondo well in

08:33:29 1 the normal fashion. That's not what actually occurred here,
08:33:32 2 correct?

08:33:32 3 A. Except for the collection operations, that's correct.

08:33:34 4 Q. So the collection operations, that was what you would call the
08:33:39 5 normal fashion. But with respect to what was released, that was
08:33:43 6 not released in the normal production fashion, correct?

08:33:48 7 A. That's correct.

08:33:48 8 THE COURT: Which separation process did they use for the
08:33:51 9 collection -- collected oil?

08:33:56 10 THE WITNESS: The two collection ships used multistage
08:33:58 11 separation processes, but they weren't the four-stage process that
08:34:03 12 BP had analyzed in the labs. They were simpler processes, I think
08:34:10 13 two-stage separations followed by a cooling stage. They weren't --
08:34:17 14 they were almost as efficient as the four-stage process but not
08:34:20 15 quite.

08:34:20 16 THE COURT: Okay.

08:34:21 17 BY MS. KARIS:

08:34:22 18 Q. I think that may have cured my next question, which is BP did
08:34:25 19 not use the four-stage separation process, even for the collection
08:34:30 20 amount, correct?

08:34:31 21 A. That's true. But the collection vessels I don't believe were
08:34:40 22 designed to -- for long-term production purposes.

08:34:48 23 Q. Okay. Just to wrap this point up, neither in the conditions
08:34:53 24 that actually existed was there the four-stage separation process
08:34:57 25 used, nor in the collection was the four-stage process used,

08:35:03 1 correct?

08:35:04 2 A. That's correct. Although the separation vessels did use
08:35:07 3 multistage separation.

08:35:08 4 Q. And by "multistage" I think you just said in two-stage
08:35:12 5 separation process?

08:35:13 6 A. I think that's correct.

08:35:14 7 Q. Now, let's talk about your oceanic separator. Your ocean
08:35:23 8 separator takes into account the pressures and the temperatures in
08:35:26 9 the Gulf of Mexico that the hydrocarbons encountered, correct?

08:35:31 10 A. I believe that's correct. I used the same temperature and
08:35:34 11 pressure profiles proposed by Dr. Whitson. He cited some, I don't
08:35:43 12 know, database that he got those profiles from, and I had no reason
08:35:47 13 to doubt that they were from the Gulf of Mexico.

08:35:50 14 Q. And while you take account of the pressures and the
08:35:54 15 temperatures in the Gulf of Mexico that the hydrocarbons
08:35:57 16 encountered, you do not take account the composition of the ocean,
08:36:02 17 the water elements, correct?

08:36:04 18 A. That's correct.

08:36:04 19 Q. Now, when you're describing your ocean separator, you described
08:36:16 20 the water phase interfering with the oil and gas phases to keep
08:36:21 21 them isolated, correct?

08:36:25 22 A. That would be my physical interpretation of my mathematical
08:36:29 23 model of the assumptions behind my mathematical model.

08:36:32 24 Q. So to be clear, the assumptions behind the mathematical model
08:36:36 25 is you're using the water for purposes of keeping the oil and the

08:36:40 1 gas separated, correct?

08:36:42 2 A. Well, in my mathematical model there is no appearance of water
08:36:46 3 at all, but it has certain assumptions to it. And to justify the
08:36:54 4 assumptions of any mathematical model, you try to come up with some
08:36:58 5 possible physical explanations. And one possible physical
08:37:02 6 explanation is that the water keeps the oil and the gas isolated
08:37:07 7 from each other.

08:37:08 8 Q. And so while your model doesn't necessarily use the water, an
08:37:12 9 explanation that you took into account in reaching your opinions
08:37:16 10 here is an opinion that you held that the water keeps the oil and
08:37:19 11 gas separated while it's traveling through the Gulf, correct?

08:37:28 12 A. Whether I would call that an opinion or just a possible
08:37:33 13 explanation.

08:37:35 14 Q. Whichever you want to call it.

08:37:36 15 A. I would call it a possible explanation.

08:37:39 16 Q. So you did account for the possible explanation and used the
08:37:42 17 water for that purpose at least, correct?

08:37:44 18 A. Correct.

08:37:44 19 Q. Now, your ocean separator process does not take into account
08:37:49 20 the solubility of the hydrocarbons in water, correct?

08:37:53 21 A. That's correct.

08:37:53 22 Q. You agree, however, that during the spill the hydrocarbons were
08:38:03 23 interacting with the water?

08:38:05 24 A. Yes, that's correct.

08:38:08 25 Q. And you agree that when hydrocarbons interact with the

08:38:11 1 seawater, some of the hydrocarbons would dissolve into that
08:38:14 2 seawater, correct?

08:38:15 3 A. Yes, I think that's undeniable, but we don't know how long it
08:38:21 4 would take. And, furthermore, all hydrocarbon components have some
08:38:32 5 solubility in water. If you wait long enough, all of the
08:38:37 6 hydrocarbons that were spilled into the Gulf of Mexico would
08:38:40 7 dissolve in the water given the fact that the extent of the ocean
08:38:44 8 is infinite. And so I think that, for purposes of defining the
08:38:53 9 stock-tank oil, you need to either -- I mean, there's no clear-cut
08:39:01 10 line of deciding how much should you allow to dissolve because you
08:39:04 11 could dissolve all of it. So for purposes of defining the
08:39:08 12 stock-tank oil, I feel that you shouldn't take that solution into
08:39:13 13 account.

08:39:14 14 Q. Now, that's one area where you and Dr. Whitson disagree. He
08:39:18 15 accounts for the solubility and he does take that into account in
08:39:22 16 his conversion, correct?

08:39:23 17 A. Well, in a way. He selectively takes that into consideration
08:39:27 18 because he allows the hydrocarbons to dissolve from the -- from his
08:39:32 19 resulting stock-tank oil, but he doesn't allow the hydrocarbons to
08:39:36 20 dissolve from his separated gas. If he allowed the C1 to C3 to
08:39:45 21 dissolve from his separated gas, the remainder of that separated
08:39:49 22 gas would be a liquid at all of the conditions within the ocean,
08:39:53 23 and he doesn't add the volume of that liquid back into his
08:40:00 24 stock-tank oil. So he allows selective dissolution.

08:40:06 25 In fact, if you took the entire Macondo live fluid and

08:40:11 1 you removed all of the C1 and C3 to allow that to dissolve in the
08:40:18 2 ocean, all of the remaining C4 plus would be a liquid at all
08:40:23 3 conditions within the ocean including stock-tank conditions, and
08:40:28 4 you'd end up with actually much more volume of resulting oil than
08:40:35 5 you would get from either the four-stage separation or my oceanic
08:40:41 6 separation process.

08:40:42 7 I just don't feel that taking into account the
08:40:46 8 dissolution of hydrocarbons in the water is appropriate for
08:40:51 9 defining the stock-tank oil.

08:40:53 10 Q. Now, Dr. Whitson will be here actually tomorrow to explain
08:40:57 11 exactly what he did, and why he did or didn't account for certain
08:41:04 12 dissolving of hydrocarbons; but you don't disagree that the process
08:41:08 13 of hydrocarbons dissolving actually did take place? You don't
08:41:12 14 disagree on that premise, correct?

08:41:14 15 A. I don't doubt that. I just don't know how long it took, and I
08:41:22 16 would argue that any stock-tank oil that you put into the water,
08:41:27 17 say, from the spill of a ship, would start to dissolve in the water
08:41:33 18 right away.

08:41:34 19 Q. Okay.

08:41:34 20 A. And the remainder of the oil that didn't dissolve within some
08:41:44 21 given timeframe, I would no longer call that stock-tank oil. You
08:41:47 22 could call that weathered oil, you could call that oil-slick oil,
08:41:53 23 but it wouldn't be the original stock-tank oil.

08:41:57 24 Q. Now, your oceanic separator, you're aware that not a single
08:42:06 25 expert retained by the United States uses or relies on that

08:42:11 1 separator process, correct?

08:42:15 2 A. I am not sure if that's true or not. Dr. Kelkar may have
08:42:22 3 considered it, but you would have to ask him.

08:42:25 4 Q. And Dr. Kelkar is coming today. But is it correct sitting here
08:42:29 5 you are not aware of a single expert from the United States that
08:42:32 6 relied on your oceanic separator, correct?

08:42:36 7 A. I don't know.

08:42:38 8 Q. Now, you testified yesterday that you were critical of
08:42:43 9 Dr. Blunt for using the single-phase flash -- single-stage flash,
08:42:50 10 correct?

08:42:50 11 A. Correct.

08:42:50 12 Q. Are you aware of what method Dr. Dykhuizen, on behalf of the
08:42:58 13 United States, used in reaching his opinions in this case? Yes
08:43:09 14 or no, are you aware?

08:43:10 15 A. I am not completely aware, no.

08:43:12 16 Q. If we can pull up Dr. Dykhuizen's testimony at 1469, lines 19
08:43:17 17 to 24. You were here when Dr. Dykhuizen testified, correct?

08:43:27 18 A. For part of his testimony, yes.

08:43:29 19 Q. And were you here when he was asked, "Did you use a particular
08:43:34 20 type of flash process to convert your mass oil flow rates into a
08:43:40 21 stock-tank barrel flow rate?" And he answered, "Yes, we did." And
08:43:44 22 then he was asked, "What did you use?" And he answered, "We used a
08:43:48 23 single-stage flash." Correct?

08:43:50 24 A. I wasn't here for that part of his testimony.

08:43:54 25 Q. So Dr. Dykhuizen, likewise, used, at least according to his

08:43:58 1 testimony, a single-stage flash, correct?

08:44:02 2 A. Apparently. But as I mentioned yesterday, when engineers are
08:44:06 3 asked to do a calculation and they have no idea what type of
08:44:15 4 production separation was used or would be used, they typically
08:44:23 5 have nothing better to assume than a single-stage flash. So I'm
08:44:27 6 sure that's why he used that method because --

08:44:31 7 Q. So --

08:44:32 8 A. -- he was not given a more realistic separation scheme.

08:44:38 9 Q. So you think after two years of working on this matter, three
08:44:43 10 years actually, Dr. Dykhuizen had no idea what type of production
08:44:49 11 separation process was used and that's why he used a single stage
08:44:54 12 separational process?

08:44:56 13 A. That's --

08:44:57 14 Q. Is that your testimony?

08:44:58 15 A. That's likely.

08:45:08 16 Q. Now, let's talk a little bit further about the single-stage
08:45:12 17 flash that Dr. Dykhuizen used and Dr. Blunt used. First, as an
08:45:17 18 initial matter, you agree that is the simplest method for
08:45:20 19 converting reservoir barrels to stock-tank barrels, correct?

08:45:24 20 A. Yes.

08:45:24 21 Q. And you agree that the total composition of fluid exiting the
08:45:34 22 ocean is the same as the composition in the reservoir, correct?

08:45:40 23 A. Correct.

08:45:40 24 Q. And so at the exit point, the composition of the oil and gas
08:45:50 25 together is the same as that composition was in the reservoir at

08:45:58 1 the bottom of the -- in the reservoir, correct?

08:46:01 2 A. The flowing composition, correct.

08:46:03 3 Q. Now, you're not adding or removing any components when you have
08:46:10 4 something called a constant composition flash, correct?

08:46:15 5 A. That's correct.

08:46:15 6 Q. And you have a constant composition flash of fluids between the
08:46:22 7 reservoir and the exit point at the sea floor, correct?

08:46:28 8 A. Correct. That would be for the flowing composition at every
08:46:35 9 point.

08:46:35 10 Q. Okay. And the constant composition flash is the same thing as
08:46:41 11 a single-stage flash, correct?

08:46:44 12 A. Not in the context that we've been talking about, because here
08:46:54 13 all of my testimony the term "single-stage flash" has been used
08:46:57 14 specifically for a constant composition flash at 60 degrees
08:47:03 15 Fahrenheit and one atmosphere. Within the well, the constant
08:47:08 16 composition flashes would all have been at the temperature of the
08:47:12 17 well and the pressure of the well. So we need to be careful to not
08:47:19 18 confuse the two.

08:47:20 19 Q. Okay. Well, are you familiar with something called a
08:47:26 20 pseudo-steady state?

08:47:27 21 A. Yes.

08:47:27 22 Q. And you believe that a pseudo-steady state is a very reasonable
08:47:33 23 approximation of the process that took place from the seabed to the
08:47:38 24 ocean surface, correct?

08:47:39 25 A. Correct.

08:47:39 1 Q. And by a pseudo-steady state you mean that the flowing
08:47:47 2 compositions between the two decks remain constant over time?

08:47:51 3 A. The overall flowing composition, correct.

08:47:53 4 Q. Where the composition of the fluids remains constant during
08:47:58 5 whatever period of time that is that's what is called a constant
08:48:02 6 composition flash, correct?

08:48:04 7 A. Well, not in this case, because in this case we have two
08:48:09 8 isolated streams that are flashed individually. The total flowing
08:48:17 9 composition between the two streams is constant, but the two
08:48:21 10 streams themselves are not in equilibrium with each other and so we
08:48:27 11 don't have a constant composition flash at any point between the
08:48:32 12 seabed and the ocean surface.

08:48:34 13 Q. Is it your opinion, to be clear, that whatever process is used
08:48:43 14 it is important, I think you said, for us to consider the real
08:48:49 15 world or circumstances in which those fluids traveled from the
08:48:56 16 reservoir up to stock-tank conditions, correct?

08:48:59 17 A. Yes.

08:49:29 18 MS. KARIS: Dr. Zick, I have no further questions.

08:49:34 19 THE COURT: Redirect.

08:49:41 20 REDIRECT EXAMINATION

08:49:42 21 BY MS. CROSS:

08:50:04 22 Q. Good morning, your Honor. Anna Cross on behalf of the United
08:50:07 23 States. Good morning, Dr. Zick.

08:50:09 24 A. Good morning.

08:50:10 25 Q. Just a brief questions. Ms. Karis asked you about a

08:50:14 1 differential liberation expansion test. Can you explain what the
08:50:18 2 Pencor differential liberation expansion test was?

08:50:21 3 A. Yes. In those experiments Pencor took the fluid starting from
08:50:28 4 its saturation pressure and lowered the pressure in increments.
08:50:35 5 The first pressure was -- first pressure below the saturation
08:50:40 6 pressure was about 6000 psi. And they equilibrated the fluid at
08:50:45 7 that pressure, and then they removed all of the gas from the PVT
08:50:51 8 cell; and then they lowered the pressure again for the remaining
08:50:56 9 liquid, re-equilibrated it, new gas would come out of solution and
08:51:01 10 then they removed all of that gas. And they continued the process
08:51:04 11 all the way down to atmospheric pressure.

08:51:08 12 That's the type of test that one normally performs on an
08:51:13 13 oil when they're trying to mimic some behavior that might occur
08:51:22 14 within the reservoir. As the pressure depletes below the
08:51:26 15 saturation pressure, gas comes out of a solution. And gas being
08:51:30 16 much more mobile within the reservoir would move away from the oil
08:51:37 17 and leave the oil left behind. Of course, in the Macondo
08:51:43 18 reservoir, it never dropped below the saturation pressure, so that
08:51:47 19 process would never occur within the reservoir.

08:51:52 20 Within the wellbore, the flowing compositions would
08:51:58 21 always be constant, so the differential liberation, which
08:52:02 22 continually changes composition every time you remove equilibrium
08:52:07 23 gas, it wouldn't apply there either.

08:52:12 24 Outside of the well, the pressures were all below
08:52:14 25 2000 psi or so, and so these -- the data that was collected that's

08:52:20 1 6000 psi down to 2000 would be irrelevant. And the problem with
08:52:26 2 using -- with trying to assign a shrinkage factor from the
08:52:31 3 differential liberation test is because this fluid was so near
08:52:35 4 critical that the first depletion pressure at 6000 psi almost half
08:52:40 5 of the fluid was gas, and so they removed and threw away half of
08:52:47 6 the hydrocarbons of the fluid before the remainder of the depletion
08:52:52 7 tests. So whatever relative volume resulted from the end of that
08:52:59 8 test is totally irrelevant for what happened in the -- to the
08:53:03 9 Macondo fluids as they spilled into the ocean.

08:53:05 10 Q. Does Dr. Whitson advocate use of the differential liberation
08:53:09 11 test as used by Pencor for this situation?

08:53:13 12 A. No. He even criticized Pencor for running that experiment in
08:53:16 13 the first place because of the fact that the fluids exhibited dew
08:53:22 14 points. That experiment is never normally run on a dew point fluid
08:53:27 15 to begin with.

08:53:28 16 Q. Let's turn to the collection vessels that you discussed with
08:53:30 17 Ms. Karis. Your testimony was that it was a two-stage separation
08:53:35 18 process followed by a cooling process; is that right?

08:53:37 19 A. I think that's right. I don't remember the details, but I did
08:53:40 20 look at that at one time.

08:53:41 21 Q. And can you compare the efficiency of a two-stage separation
08:53:45 22 process versus the efficiency of a single-stage separation process?

08:53:49 23 A. It's normally going to be much more efficient.

08:53:52 24 MS. KARIS: I am going to object to -- Dr. Zick has not
08:53:56 25 discussed the two-stage separation process or its efficiency as

08:54:01 1 compared to single stage as part of his opinion in this case. It's
08:54:06 2 not part of the scope.

08:54:08 3 MS. CROSS: Your Honor, it was elicited during cross.

08:54:11 4 MS. KARIS: I think the Court asked him.

08:54:13 5 THE COURT: It was elicited by me. So I guess I'm the
08:54:17 6 culprit here.

08:54:19 7 MR. BROCK: We have a rule of not objecting to the
08:54:21 8 Court's questions.

08:54:23 9 THE COURT: Okay. I'll sustain the objection.

08:54:25 10 MS. KARIS: Thank you.

08:54:25 11 THE COURT: To my comment, to my questions.

08:54:29 12 BY MS. CROSS:

08:54:30 13 Q. Dr. Zick, you presented your oceanic separation analysis in
08:54:36 14 rebuttal; is that right?

08:54:37 15 A. That's correct.

08:54:37 16 Q. And if that -- the formation volume factors from your oceanic
08:54:42 17 analysis were applied to any of the flow rate calculations that are
08:54:45 18 presented here today, what would happen to those flow rate
08:54:48 19 calculations?

08:54:49 20 A. Well, for anybody who used a single-stage assumption for their
08:54:55 21 flow calculations, you would increase the results that they got,
08:55:01 22 the number of stock-tank barrels that they predicted by about
08:55:08 23 13-and-a-half to 14 percent.

08:55:10 24 Q. And if you used a four-stage separation versus a single-stage
08:55:14 25 separation, what impact would that have on the flow rates

08:55:16 1 calculator?

08:55:16 2 A. You would increase their single stage results by about
08:55:20 3 11 percent.

08:55:22 4 Q. Thank you.

08:55:22 5 A. And that's true whether you use my equation of state or
08:55:28 6 Dr. Whitson's equation of state, because regardless of the equation
08:55:34 7 of state, they both predict about 11 percent more stock-tank oil
08:55:38 8 from a four-stage process relative to a single-stage process, and
08:55:43 9 about 13 to 14 percent more stock-tank oil from my oceanic process
08:55:49 10 than from a single-stage separation.

08:55:54 11 MS. CROSS: Thank you, Dr. Zick. No further questions.

08:55:56 12 THE COURT: Okay. Thank you. You're done, sir.

08:55:59 13 THE WITNESS: Thank you.

08:56:00 14 THE COURT: The government can call its next witness.

08:56:35 15 MS. ENGEL: Good morning, your Honor, Bethany Engel for
08:56:38 16 the United States. We call Dr. Mohan Kelkar.

08:56:42 17 THE COURT: Okay. I know there's a *Daubert* motion --

08:56:45 18 MR. BOLES: Yes, your Honor.

08:56:45 19 THE COURT: -- which I have read. I am going to deny it.
08:56:49 20 My understanding is that the real dispute is whether Dr. Kelkar
08:56:55 21 should use 12 microsips or 6 or some other number, and I just think
08:57:01 22 that's an issue for cross-examination. I don't think there's any
08:57:05 23 issue of his general methodology, it's just whether he's using the
08:57:11 24 correct inputs or not. Correct factual data or not.

08:57:17 25 MR. BOLES: Thanks, your Honor.

08:57:20 1 MS. ENGEL: Thanks, your Honor.

08:57:23 2 THE DEPUTY CLERK: Raise your right hand.

08:57:25 3 (WHEREUPON, MOHAN KELKAR, WAS SWORN IN AND TESTIFIED AS
08:57:30 4 FOLLOWS:)

08:57:30 5 THE DEPUTY CLERK: If you would take a seat. And if
08:57:33 6 you'll state and spell your name for the record, please.

08:57:41 7 THE WITNESS: Mohan Kelkar, M-O-H-A-N, and the last name
08:57:44 8 is K-E-L-K-A-R.

08:57:49 9 MS. ENGEL: May we proceed, your Honor?

08:57:50 10 THE COURT: Yes.

08:57:52 11 VOIR DIRE EXAMINATION

08:57:52 12 BY MS. ENGEL:

08:57:53 13 Q. Good morning, Dr. Kelkar.

08:57:53 14 A. Good morning.

08:57:54 15 Q. Please introduce yourself to the Court.

08:57:59 16 THE COURT: Do you --

08:58:01 17 MS. ENGEL: Is that better?

08:58:02 18 THE COURT: Is there any way to put it on the other side,
08:58:07 19 inside of the lapel? Is it on?

08:58:08 20 MS. HIMMELHOCH: It's not on, your Honor.

08:58:10 21 THE COURT: Oh, that's a good reason.

08:58:10 22 MS. ENGEL: That's my first problem. How is that?
08:58:17 23 Better? I think I'm all set.

08:58:26 24 THE COURT: That's a lot better. Thank you.

08:58:28 25 BY MS. ENGEL:

08:58:29 1 Q. Dr. Kelkar, please go ahead and introduce yourself to the
08:58:32 2 Court.

08:58:32 3 A. My name is Mohan Kelkar. I'm currently professor of petroleum
08:58:36 4 engineering at the University of Tulsa. And I've been teaching
08:58:39 5 petroleum engineering for the last 30 years at the University of
08:58:43 6 Tulsa.

08:58:44 7 Q. Please summarize your involvement in this case.

08:58:47 8 A. I was retained by DOJ in April of 2012 to determine the total
08:58:54 9 amount of oil which is released as well as the rate calculation on
08:58:59 10 the last day before the well was shut-in.

08:59:01 11 Q. Prior to your expert work in this case, did you have any
08:59:06 12 involvement in the Macondo spill?

08:59:08 13 A. I was hired by Mineral Management Services in June of 2010 as a
08:59:17 14 part of Flow Rate Technical Group, and in that capacity I was asked
08:59:21 15 to calculate the inflow performance relationship for the reservoir
08:59:27 16 which was used as an input in another group which was working at
08:59:32 17 the same time called Nodal Analysis Group.

08:59:36 18 Q. We'll turn back to your work in this case in a few minutes, but
08:59:39 19 I want to go over some of your educational and professional
08:59:43 20 background first.

08:59:43 21 What are your professional degrees in, Dr. Kelkar?

08:59:45 22 A. I have a BS in chemical engineering and a master's in petroleum
08:59:49 23 engineering and also Ph.D. in chemical engineering.

08:59:52 24 Q. Did you have a particular specialization within those fields?

08:59:55 25 A. For my Ph.D. I worked on the multiphase flow in bubble column

09:00:02 1 reactors, and since that time, I have concentrated on reservoir
09:00:08 2 description and reservoir modeling, as well as worked in the area
09:00:14 3 of multiphase flow.

09:00:16 4 Q. Can we have D-21651, please. You stated a few moments ago
09:00:27 5 you've been a faculty at Tulsa's Petroleum Engineering School for
09:00:31 6 about 30 years. When did you become chair of the Petroleum
09:00:34 7 Engineering Department?

09:00:35 8 A. I became chair in 2002.

09:00:38 9 Q. And do you have a particular specialty within the field of
09:00:40 10 petroleum engineering?

09:00:41 11 A. So in the last 30 years I've worked in reservoir modeling and
09:00:46 12 reservoir characterization, and I also have worked in the
09:00:51 13 production optimization.

09:00:52 14 Q. What are some of the classes that you've taught --

09:00:55 15 THE COURT: Ms. Engel, it still sounds kind of low to me.
09:00:59 16 Can you put that thing where the microphone faces the inside of
09:01:03 17 your lapel, is that possible? I think that would be better.

09:01:06 18 MS. ENGEL: Sure.

09:01:09 19 THE COURT: Let's try that.

09:01:11 20 MS. ENGEL: How is that?

09:01:13 21 BY MS. ENGEL:

09:01:13 22 Q. So what are some of the classes you've taught over the years,
09:01:16 23 Dr. Kelkar, that are relevant to the work that you did in this
09:01:18 24 case?

09:01:18 25 A. I have taught courses in rock properties, fluid properties.

09:01:22 1 I've taught courses in reservoir engineering, which includes well
09:01:27 2 test analysis. I have taught courses in production engineering and
09:01:31 3 also integrated reservoir modeling.

09:01:33 4 THE COURT: What's the last thing?

09:01:35 5 THE WITNESS: Integrated reservoir modeling.

09:01:39 6 BY MS. ENGEL:

09:01:40 7 Q. Do you have any other professional experience that's relevant
09:01:43 8 to your work in this case?

09:01:44 9 A. I had a consulting company I founded about 20 years ago. And
09:01:49 10 in that capacity, I have done a lot of the reservoir modeling work
09:01:54 11 all over the world where I have built reservoir models and
09:01:59 12 predicted the performance and associated uncertainty in those
09:02:03 13 reservoirs.

09:02:03 14 Q. Can we have D-21652, please. Have you received any honors in
09:02:12 15 recognition of your professional work?

09:02:13 16 A. I have been a Distinguished Speaker for the Society of
09:02:17 17 Petroleum Engineers between 2007 and '8. I was given Distinguished
09:02:23 18 Faculty Member award by Society of Petroleum Engineers in 2009.
09:02:28 19 Became Distinguished Member in 2010, and I served on the SB
09:02:35 20 International Board of Directors between 2011 and 2013.

09:02:40 21 MS. ENGEL: Your Honor, the United States offers
09:02:42 22 Dr. Mohan Kelkar as an expert in petroleum engineering and
09:02:45 23 reservoir modeling.

09:02:45 24 THE COURT: All right. Other than the issue raised in
09:02:47 25 your *Daubert* motion, do you have any questions as to his

09:02:50 1 qualifications?

09:02:51 2 MR. BOLES: Only what we can raise on cross-examination.

09:02:55 3 THE COURT: We will accept him as an expert in that
09:02:57 4 field.

09:02:58 5 MS. ENGEL: Thank you, your Honor.

09:02:59 6 DIRECT EXAMINATION

09:02:59 7 BY MS. ENGEL:

09:03:00 8 Q. Dr. Kelkar, did you prepare an expert report in this case?

09:03:03 9 A. I did.

09:03:04 10 Q. Can we see TREX 11549R, please. Is this your expert report?

09:03:08 11 A. It is.

09:03:09 12 Q. Did you also write a rebuttal report in this case?

09:03:12 13 A. I did.

09:03:12 14 Q. Can we have TREX 11550R, please. And is this your rebuttal
09:03:18 15 report, Dr. Kelkar?

09:03:20 16 A. It is.

09:03:20 17 Q. Do you adopt your expert report and rebuttal report as your
09:03:24 18 expert testimony to the Court in this case?

09:03:25 19 A. I do.

09:03:28 20 MS. ENGEL: Your Honor, we offer Dr. Kelkar's expert and
09:03:29 21 rebuttal reports, TREX 11549R and 11550R into evidence.

09:03:36 22 THE COURT: Any other objections?

09:03:37 23 MR. BOLES: No, your Honor.

09:03:38 24 THE COURT: Without objection, those are admitted.

09:03:41 25 BY MS. ENGEL:

09:03:41 1 Q. Let's move to D-21653, please. Dr. Kelkar, you mentioned at
09:03:47 2 the beginning of your testimony that you were asked to calculate a
09:03:50 3 cumulative oil spilled from the Macondo well. Did you form an
09:03:54 4 opinion regarding the cumulative amount of oil spilled?

09:03:57 5 A. I did.

09:03:57 6 Q. What is that opinion?

09:03:58 7 A. I calculated that amount of oil spilled four-and-a-half to 5
09:04:04 8 million barrels.

09:04:04 9 Q. What methodology did you use to reach that conclusion?

09:04:08 10 A. I used the material balance technique.

09:04:11 11 Q. And did you also form an opinion regarding the oil flow rate
09:04:15 12 from the Macondo well on the last day of the spill?

09:04:17 13 A. I calculated the rate to be 54,000 barrels per day through the
09:04:23 14 choke line, and I validated that also by calculating the flow
09:04:27 15 through the kill line.

09:04:28 16 Q. You mentioned briefly earlier that, prior to your expert work,
09:04:32 17 you had some limited involvement as a member of the Flow Rate
09:04:37 18 Technical Group Reservoir Modeling Team; is that right?

09:04:38 19 A. Yes.

09:04:38 20 Q. What do you mean by "limited involvement"?

09:04:41 21 A. As I mentioned that in June of 2010, I was hired by Mineral
09:04:47 22 Management Services to calculate the inflow performance
09:04:51 23 relationship so that that could be used as an input for another
09:04:56 24 group. And I did that work in one-week period.

09:05:00 25 Q. Did you calculate a cumulative flow as part of your work for

09:05:04 1 the Flow Rate Technical Group?

09:05:06 2 A. I did not.

09:05:06 3 Q. When you prepared your expert report in this case, did you have
09:05:12 4 more data available to you than you did in 2010?

09:05:15 5 A. I did.

09:05:16 6 Q. What additional data did you have available?

09:05:19 7 A. I had the raw data which was given to me, but I didn't have a
09:05:24 8 lot of BP internal reports, which became available after that
09:05:29 9 point. The well was shut-in in July of 2013 and there was a lot of
09:05:35 10 pressure information that was available at that time. So
09:05:38 11 significant amount of granularity was added in the data set after I
09:05:43 12 had finished the work on FRTG group.

09:05:47 13 Q. What do you know by "additional granularity"?

09:05:50 14 A. Because I could only look at the raw data, but I didn't have a
09:05:55 15 better understanding about what it all meant and a significant
09:05:57 16 number of internal documents with BP actually provided me with that
09:06:02 17 information.

09:06:02 18 Q. Did you have to use a formation compressibility value for
09:06:06 19 purposes of your Flow Rate Technical Group work?

09:06:08 20 A. I did.

09:06:08 21 Q. And what data did you use to obtain that compressibility value?

09:06:14 22 A. I did a value of 6 microsips.

09:06:15 23 Q. How did you obtain that value?

09:06:17 24 A. I looked at the Weatherford report and I calculated the average
09:06:22 25 of the three values.

09:06:23 1 Q. Why did you use that Weatherford Lab data at that time?

09:06:27 2 A. Because I am not a rock mechanics expert and I just used
09:06:33 3 whatever the data was available at that time.

09:06:34 4 Q. Did you have any other documents discussing compressibility
09:06:38 5 available to you at that time?

09:06:39 6 A. I did not.

09:06:40 7 Q. Let's turn to your opinion regarding the cumulative oil
09:06:45 8 released from the well. Can you please explain for the Court,
09:06:48 9 generally speaking, what a material balance analysis entails?

09:06:51 10 A. Material balance technique is a method where you actually
09:06:54 11 measure the initial pressure and the final pressure and you
09:06:59 12 understand the mechanisms by which oil can be produced, and by
09:07:03 13 knowing the pressure difference and the different mechanisms and
09:07:06 14 their contributions, we can calculate the amount of oil released.

09:07:11 15 THE COURT: You're talking about the pressures in the
09:07:13 16 reservoir?

09:07:14 17 THE WITNESS: Pressures in the reservoir, yes.

09:07:17 18 BY MS. ENGEL:

09:07:18 19 Q. Have you prepared any demonstratives to explain further what
09:07:20 20 you just described?

09:07:20 21 A. I have.

09:07:21 22 Q. Could we see D-21601, please. D-21601. Dr. Kelkar, what are
09:07:50 23 we talking about here?

09:07:51 24 A. So it shows you the three mechanisms by which oil can be
09:07:54 25 produced. So one of the mechanisms by which oil can be produce d

09:07:58 1 is the expansion of oil as the pressure is reduced. And if you can
09:08:04 2 click on the expansion, it shows you that as the pressure is
09:08:07 3 reduced, the oil expands and, of course, some of the oil is going
09:08:10 4 to come to the surface.

09:08:14 5 There is also another mechanism, which is the compaction,
09:08:17 6 and if you click on the compaction, as the pressure is reduced, the
09:08:23 7 formations get compacted from the formations above, and of course
09:08:26 8 like a sponge, some of the oil will come out of the reservoir as a
09:08:32 9 result of compaction.

09:08:33 10 And the third mechanism by which the oil can be produced
09:08:36 11 is aquifer, which is the underlying water. And if you can click on
09:08:40 12 that. The underlying water moves up as the oil is produced, and it
09:08:45 13 pushes some of the oil to the surface.

09:08:48 14 Now, I am just showing those three mechanisms in isolation.
09:08:53 15 In reality, you will see some kind of a combination of these three
09:08:58 16 mechanisms by which the oil is produced. So if you click on the
09:09:02 17 combination, it shows you that you normally have expansion of oil,
09:09:05 18 compaction of the formation and the aquifer moving up, which
09:09:12 19 results in some of the oil produced.

09:09:14 20 Q. Can we look at D-21654, please. So then how does a reservoir
09:09:24 21 engineer typically perform a material balance analysis?

09:09:26 22 A. So traditional material balance is really used to validate what
09:09:31 23 we have calculated using volumetric analysis. Normally our first
09:09:36 24 attempt in calculating the oil in place is always based on some
09:09:40 25 boundary of the reservoir and the volume. And then we start

09:09:42 1 producing the reservoir, we measure the amount of oil produced.

09:09:47 2 And we try to constrain our oil in place by using the amount of oil
09:09:52 3 produced. So we use as an input the amount of oil produced, which
09:09:56 4 is measured quite accurately, and then we calculate the initial oil
09:10:00 5 in place.

09:10:01 6 Q. Did you perform this traditional material balance analysis to
09:10:06 7 form your opinions in this case?

09:10:07 8 A. I did not.

09:10:08 9 Q. Can you describe to the Court how you performed your Macondo
09:10:11 10 analysis?

09:10:11 11 A. The difficulty in Macondo was that we did not know how much oil
09:10:15 12 was produced. As a matter of fact, we were calculating the amount
09:10:18 13 of oil spilled using an initial estimator oil in place. So the
09:10:25 14 traditional material balance uses correction for volumetric
09:10:30 15 analysis. In this case, we had to rely on the volumetric oil in
09:10:34 16 place to determine the amount of oil spilled. And as a result of
09:10:38 17 that, there is an inherent additional layer of uncertainty when we
09:10:43 18 carried out this particular analysis.

09:10:45 19 Q. Can we have D-21601 again, please. And what are we seeing here
09:10:55 20 in the last portion of this demonstrative?

09:10:57 21 A. I think if you could click on the formulas, it shows you the
09:11:02 22 difference between the traditional material balance versus what
09:11:05 23 happened in the *Deepwater*. So if you click on the traditional
09:11:08 24 material balance, it shows that we normally know how much collected
09:11:13 25 oil is, and then we calculate how much oil in place is based on

09:11:18 1 that information.

09:11:20 2 THE COURT: Oil in place before or after the spill?

09:11:23 3 THE WITNESS: At the beginning. At the beginning. So we
09:11:26 4 use actually how much oil is produced, we know what the initial
09:11:30 5 pressure is, we know what the final pressure is. So using that
09:11:34 6 information, we tried to determine how much there was at the start
09:11:37 7 before we started producing.

09:11:39 8 And if you click on the *Deepwater* spill, you can see the
09:11:45 9 problem here is that we don't know how much oil was produced, so we
09:11:50 10 had to make an assumption about the original oil in place. And
09:11:53 11 using that information, we calculate the oil released. So as a
09:11:56 12 result of the reverse process we used here, there is more
09:12:00 13 uncertainty in our material balance analysis than what it would
09:12:04 14 involve in the traditional calculations because there was one more
09:12:08 15 unknown in these calculations.

09:12:13 16 BY MS. ENGEL:

09:12:13 17 Q. Could we have D-21656.

09:12:15 18 THE COURT: Let me ask a couple of question, try and
09:12:17 19 understand this. You're not -- for this material balance
09:12:24 20 methodology, does it in any way involve estimating what oil was in
09:12:32 21 place in that reservoir before any oil was released or produced to
09:12:39 22 how much oil was left after the well was capped or sealed?

09:12:45 23 THE WITNESS: Right.

09:12:46 24 THE COURT: And just figuring out the difference? I'm
09:12:49 25 trying -- go ahead with.

09:12:52 1 THE WITNESS: So in a traditional material balance where
09:12:53 2 actually we actually put the well on production and we measure how
09:12:58 3 much oil is produced, we use that information to determine how much
09:13:02 4 there was to begin with, that's a traditional calculation. In this
09:13:07 5 calculation --

09:13:08 6 THE COURT: Explain that to me. How does knowing what
09:13:11 7 was produced tell you what was there originally?

09:13:14 8 THE WITNESS: I think we have --

09:13:15 9 THE COURT: Until you've produced oil, obviously, that
09:13:17 10 would tell you.

09:13:18 11 THE WITNESS: Right. Well, by the way, the amount of oil
09:13:22 12 in place is not the same as amount of oil produced, because we only
09:13:26 13 produce a fraction of it; typically about 20 to 30 percent. So
09:13:30 14 when we use the material balance, we calculate amount of oil in
09:13:34 15 place and then we use some kind of recovery factor to determine how
09:13:38 16 much ultimately we will produce. So it's just a fraction of it.

09:13:41 17 But I think that this equation on the screen which will
09:13:46 18 explain what the traditional analysis does.

09:13:49 19 So you have certain amount of oil produced, and the
09:13:53 20 equation, like in the case of Macondo, is quite simple, that you
09:13:58 21 have the amount of oil produced, you have total compressibility,
09:14:03 22 which is comprised of different mechanisms which play a role in
09:14:06 23 determining the oil produced. And we know the difference in the
09:14:10 24 initial pressure and the final pressure. So we use this equation
09:14:14 25 and then we can calculate the original oil in place.

09:14:17 1 Our purpose of traditional material balance analysis is
09:14:21 2 to reduce the uncertainty in oil-in-place calculations, which we
09:14:27 3 had determined based on some simpler methods before, which is the
09:14:31 4 volumetric analysis.

09:14:32 5 So in Macondo, what we did is we simply rewrote the
09:14:37 6 equation by moving the oil production on one side and everything
09:14:39 7 else on the other side. And the different colors essentially is
09:14:44 8 indicating the uncertainty we have with respect to different input
09:14:48 9 parameters. And because we didn't have an opportunity to correct
09:14:52 10 for our oil in place, we have a lot more uncertainty with respect
09:14:56 11 to oil in place. And then we, of course, have some uncertainty
09:15:00 12 with respect to compressibility.

09:15:02 13 THE COURT: So where do you get the information in the
09:15:04 14 Macondo calculation for the original oil in place?

09:15:08 15 THE WITNESS: Okay. So the original oil in place is
09:15:10 16 calculated based on geophysical data, geological data. So BP had
09:15:16 17 run the seismic surveys and they had also had some better
09:15:21 18 understanding of the geology, so based on that information, they
09:15:25 19 had determined what is the pessimistic scenario, what's the
09:15:30 20 optimistic scenario and what is the 50th percentile, which is right
09:15:33 21 in the middle. So because we didn't have any oil-in-place
09:15:37 22 calculation based on material balance, we had to rely on that
09:15:39 23 information.

09:15:40 24 THE COURT: Okay.

09:15:43 25 BY MS. ENGEL:

09:15:44 1 Q. Dr. Kelkar, you mentioned an extra layer of uncertainty that
09:15:48 2 results as part of rearranging the calculation. Does that extra
09:15:53 3 layer of uncertainty invalidate the methodology or the results?

09:15:57 4 A. It doesn't invalidate the methodology, it just tells you that
09:16:01 5 there is an additional caution we are to exercise when we are using
09:16:06 6 this equation.

09:16:07 7 Q. What additional information did you use to validate your
09:16:12 8 analysis?

09:16:13 9 A. So after I did the material balance calculation, I also
09:16:16 10 calculated the rate on the last day to ensure that my rate
09:16:22 11 calculations were within the ballpark figure compared to what --
09:16:27 12 how much oil was produced or how much oil was spilled.

09:16:30 13 I also looked at the productive index calculation, which
09:16:35 14 is the value at the productivity of the well on the last day before
09:16:39 15 the well was shut in. And I compared that value with the log and
09:16:44 16 the core data, and I found that the results were consistent.

09:16:48 17 Q. So is the material balance method a tool that you typically use
09:16:53 18 in your reservoir characterization work?

09:16:55 19 A. I think the reservoir engineer will use all of the tools at his
09:16:59 20 or her disposal in building a reservoir model. And material
09:17:04 21 balance is one of the simpler tools we can use to bound that
09:17:10 22 certainty in oil-in-place calculations. So, yes, it is quite
09:17:14 23 commonly used.

09:17:15 24 Q. Is material balance the only way to determine oil production
09:17:18 25 from a reservoir?

09:17:19 1 A. It is not.

09:17:20 2 Q. What are some of the other tools available to you?

09:17:23 3 A. So you can use, for example, reservoir simulation as a way to
09:17:28 4 calculate the reservoir performance. And the advantage you have
09:17:33 5 with a reservoir simulation is that there is some additional
09:17:37 6 dynamic data which you can use in understanding the reservoir
09:17:43 7 behavior.

09:17:43 8 So, for example, material balance will not be able to
09:17:46 9 incorporate the rate information. Material balance may not be able
09:17:51 10 to incorporate the pressure information which is available between
09:17:54 11 the initial and final conditions. And that's the kind of data
09:17:57 12 which can be utilized in reservoir simulation analysis.

09:18:00 13 Q. Why didn't you use a tool like reservoir simulation to evaluate
09:18:08 14 discharge in this case?

09:18:08 15 A. Part of the reason was that because there were already two
09:18:12 16 experts which the government had, Dr. Pooladi-Darvish and
09:18:16 17 Dr. Griffiths, who were already doing that type of work.

09:18:18 18 Q. Did any other expert in this case approach the problem using a
09:18:23 19 material balance methodology?

09:18:24 20 A. Dr. Blunt from -- who is a BP and Anadarko expert.

09:18:28 21 Q. And did Dr. Blunt perform what we see here as the traditional
09:18:33 22 material balance analysis?

09:18:35 23 A. No, he did not.

09:18:36 24 Q. Did the uncertainties, then, that apply to your modified
09:18:39 25 material balance also apply to Dr. Blunt's analysis?

09:18:42 1 A. It does.

09:18:43 2 Q. I want to talk to you a little bit more in detail about some of
09:18:48 3 the inputs, following up on Judge Barbier's questions. Could we
09:18:53 4 have D-21657, please.

09:18:58 5 Now, we've already described the primary inputs to the
09:19:01 6 analysis, but what was -- what sources of data did you rely on to
09:19:05 7 derive those inputs?

09:19:06 8 MR. BOLES: Your Honor, if I may interrupt. It's pretty
09:19:09 9 clear here that from the second to the last bullet point that
09:19:12 10 counsel is about to ask Dr. Kelkar to talk about internal BP
09:19:17 11 e-mails discussing rock compressibility. And that's beyond the
09:19:22 12 four corners of Dr. Kelkar's report. It's absolutely clear,
09:19:26 13 there's three footnotes in his report where he gives the only
09:19:29 14 source for his opinion on -- it's not even an opinion, but for his
09:19:35 15 value of rock compressibility, and that's a single document, a
09:19:38 16 presentation by Dr. Merrill. None of the e-mails that I believe
09:19:42 17 are about to be asked about were cited in the report.

09:19:46 18 MS. ENGEL: We are not quite there, your Honor, actually.
09:19:48 19 But to address the issue, Dr. Kelkar has a pretty lengthy
09:19:52 20 considered list, he looked at a lot of materials, including all of
09:19:55 21 these additional documents that Mr. Boles is referring to.

09:19:58 22 MR. BOLES: There are several thousand documents listed
09:20:01 23 in his consideration materials; I don't think that qualifies as the
09:20:05 24 definition of a four corners.

09:20:07 25 THE COURT: Well, it's not -- as I understand it, this is

09:20:09 1 not a different opinion, this is just additional information that
09:20:15 2 he says he believes validates the numbers that he used, correct?

09:20:20 3 MS. ENGEL: That's right, your Honor.

09:20:21 4 THE COURT: And it's no different than an expert, which
09:20:25 5 all of the experts do, sitting in court and listening to the
09:20:28 6 testimony and then are asked did you sit in and did you hear this,
09:20:32 7 does that change your opinion or whatever. So I am going to
09:20:34 8 overrule the objection.

09:20:36 9 MS. ENGEL: Thank you, your Honor.

09:20:37 10 BY MS. ENGEL:

09:20:37 11 Q. I actually want to talk first to you -- well, let's talk a
09:20:43 12 little bit about the input. We obviously covered some of it
09:20:46 13 already, but aside from these internal BP e-mails and modeling
09:20:50 14 runs, what else did you rely on to derive your inputs?

09:20:53 15 A. So I looked at BP's predrill reports and the post drill report,
09:21:00 16 which were useful in calculating the amount of oil in place. I
09:21:05 17 also looked at some of the internal BP e-mails, and I looked at
09:21:11 18 Dr. Hsieh's testimony.

09:21:13 19 Q. Dawn, could we have D-21658, please. I want to talk first
09:21:20 20 about original oil in place. How did you derive your original
09:21:23 21 oil-in-place values?

09:21:24 22 A. So I looked at BP's predrill technical assurance memo, and in
09:21:32 23 that particular memo at the end -- judge already asked me this
09:21:38 24 question -- that effectively there were three values which were
09:21:41 25 reported in that predrill technical assurance memo, which is P10,

09:21:46 1 P50 and P90, which presented basically the optimistic value, the
09:21:53 2 value which were right in the middle, so there's a 50 percent
09:21:57 3 chance it could be higher and lower, and then the pessimistic
09:22:00 4 value.

09:22:00 5 I picked the value which were right in the middle. And
09:22:03 6 part of the reason I picked that value is because in the predrill
09:22:07 7 memo, BP had also predicted what type of reservoir thickness they
09:22:14 8 will observe when they drilled the well, and that predicted about
09:22:17 9 90 feet of thickness. And when the well was drilled, the thickness
09:22:22 10 turned out to be very close to that value, and that gave us more
09:22:26 11 confidence in picking that P50 value.

09:22:30 12 So I started from that particular value, but then I
09:22:34 13 corrected that value for formation volume factor because the fluid
09:22:41 14 properties were, of course, collected after the well was drilled,
09:22:44 15 the porosity value was measured and the oil saturation was measured
09:22:49 16 after the new well was drilled. So I corrected for those three and
09:22:53 17 came up with 137 million barrels.

09:22:56 18 Q. Let's take a look at TREX 5246.2, and I believe this is the BP
09:23:04 19 predrill technical assurance memo you were just referring to?

09:23:08 20 A. That is correct.

09:23:08 21 Q. Could we have the first callout, TREX 5246.16.1.

09:23:17 22 Dr. Kelkar, is this the table that you were just
09:23:19 23 referring to that you pulled these P90, P50 and P10 values from?

09:23:24 24 A. That is correct. And I started from 181 million barrels, and
09:23:30 25 "STOIIP" represents basically stock-tank oil initially in place.

09:23:38 1 So that's what STOIIP represents.

09:23:40 2 So essentially BP predicted 181 standard million --
09:23:46 3 standard barrels, million barrels, and I corrected for that value
09:23:49 4 using new formation volume factor which was observed, and also
09:23:53 5 corrected for the porosity and oil saturation.

09:23:56 6 Q. You've used the term "formation volume factor" a couple of
09:24:00 7 times, and Judge Barbier heard from Dr. Zick on that already. But
09:24:04 8 can you just refresh us quickly on what formation volume factor is?

09:24:08 9 A. Formation volume factor tells us that if you take a barrel of
09:24:13 10 reservoir oil and bring it to the surface, what is the conversion
09:24:17 11 from barrel of reservoir oil to the barrel of oil in the surface.
09:24:21 12 And there are two processes which, of course, determine that. One
09:24:25 13 is the shrinkage, because some of the gas which is dissolved in oil
09:24:30 14 gets released. And one is the expansion, because the pressure is
09:24:34 15 smaller at the surface compared to the pressure at the reservoir
09:24:37 16 conditions. So it combines basically both of these effects, and
09:24:43 17 it's accounted for in the formation volume factor calculation.

09:24:46 18 Q. And what formation volume factor did you use to calculate your
09:24:51 19 original oil in place of 137?

09:24:52 20 A. So in my original report I used 2.14, which was coming from
09:24:58 21 BP's compositional model, and then in rebuttal report I also
09:25:04 22 addressed some of the oceanic separations from Dr. Whitson and
09:25:08 23 Dr. Zick.

09:25:08 24 Q. Let's stick with your initial report for the moment and take a
09:25:11 25 look at TREX 9732. We can go straight to the first callout, which

09:25:19 1 is .1.1. Is this the document that you've been referring to as
09:25:25 2 BP's black oil tables?

09:25:26 3 A. Yes.

09:25:26 4 Q. Can we have the second callout, 9732.11,12.1.

09:25:39 5 Dr. Kelkar, do you see here the FVF value of 2.14 that
09:25:43 6 you used?

09:25:44 7 A. I do.

09:25:44 8 Q. Where is it?

09:25:45 9 A. That is the value I used for initial reservoir conditions.

09:25:48 10 Q. Is it that highlighted yellow portion at the bottom of the
09:25:52 11 page?

09:25:52 12 A. It is.

09:25:53 13 Q. We can take that down.

09:25:55 14 THE COURT: Go back to that chart before, I think it's
09:25:59 15 the chart before. Or the demonstrative before. Can you go back?

09:26:14 16 MS. ENGEL: Oh, to -- what would you like to see?

09:26:17 17 THE COURT: What you had on the screen before.

09:26:22 18 MS. ENGEL: That is --

09:26:24 19 THE COURT: No, not that one. You had something in
09:26:29 20 between.

09:26:29 21 MS. ENGEL: We had TREX 5246 in between, which was the BP
09:26:34 22 predrill report.

09:26:36 23 THE COURT: Yeah, that's it. I just had a question. So
09:26:41 24 you essentially used their 181 number and then did some type of
09:26:46 25 correction that you described to get to the 137?

09:26:49 1 THE WITNESS: That is correct.

09:26:50 2 THE COURT: Now, I noticed -- is that called stock-tank
09:26:56 3 oil in place?

09:26:57 4 THE WITNESS: Stock-tank oil initially in place.

09:26:59 5 THE COURT: Initially in place. So that's a measurement
09:27:04 6 in stock-tank barrels, not reservoir barrels?

09:27:08 7 THE WITNESS: That is correct. And what BP did to come
09:27:11 8 to that number is they made an assumption about some formation
09:27:16 9 volume factors. So typically when oil companies are doing these
09:27:19 10 calculations, they only can determine the reservoir barrels based
09:27:23 11 on the seismic data and the geology, so they have to make some
09:27:27 12 assumptions about the formation volume factor.

09:27:30 13 So what BP had done was using a value of 1.46 as the
09:27:36 14 formation volume factor to convert reservoir barrels into
09:27:40 15 stock-tank barrels. But it turned out that when the well was
09:27:44 16 drilled, the Macondo fluid was a lot lighter than what they
09:27:48 17 assumed, so you have to correct for that value. So the assumptions
09:27:54 18 they had made at the beginning turned out to be that the fluid was
09:27:57 19 actually a better quality in Macondo than what was originally
09:28:01 20 assumed.

09:28:02 21 THE COURT: Better quality meaning what?

09:28:05 22 THE WITNESS: So when you have an oil which is -- has a
09:28:09 23 high formation volume factor, it has a high compressibility and you
09:28:12 24 probably are going to recover more oil out of a volatile oil type
09:28:17 25 of reservoir than a typical black oil.

09:28:21 1 BY MS. ENGEL:

09:28:21 2 Q. And is this STOIIIP term used interchangeably with "original oil
09:28:28 3 in place"?

09:28:29 4 A. It is.

09:28:29 5 Q. In your experience as a reservoir engineer, what is the purpose
09:28:32 6 of predrill technical memo like we're looking at here?

09:28:35 7 A. So normally the predrill memo is very important because a lot
09:28:39 8 of economic decisions are made based on these type of predrill
09:28:43 9 memos. Ultimately when you're drilling very expensive wells like
09:28:48 10 the one in Macondo, you have to know do you have enough oil to be
09:28:52 11 produced so that it can justify, first, drilling the exploration
09:28:57 12 well then and eventually exploiting the reservoir.

09:29:02 13 Q. Why did you decide to use data from this report in your
09:29:05 14 analysis?

09:29:06 15 A. The reason was that BP had already done the analysis of seismic
09:29:11 16 data and the geological data. They obviously had drilled other
09:29:15 17 fields in the same areas. And, further, that when they drilled the
09:29:21 18 well, the thickness which was predicted in the predrill memo turned
09:29:24 19 out to be correct. So there was a lot of confidence in this
09:29:29 20 information.

09:29:30 21 Q. Dr. Kelkar, did you also calculate a lower value for original
09:29:35 22 oil in place?

09:29:36 23 A. I did use 110 million barrels.

09:29:39 24 Q. And how did you derive that value?

09:29:41 25 A. So the 110 value came about because it was reported in many

09:29:47 1 public reports. In addition to that, Dr. Merrill had also used 110
09:29:54 2 million barrels in all of his simulation work. So I wanted to use
09:29:59 3 that value and I wanted to determine how that value came about, so
09:30:03 4 I started with this 181 million barrels, which is listed here, and
09:30:08 5 then I used the single-stage formation volume factor, which is
09:30:14 6 2.35, and if you divide, correct for that formation volume factor,
09:30:20 7 you arrive at 110 million barrels.

09:30:22 8 Q. Holding all else constant, would a higher value of original oil
09:30:28 9 in place increase or decrease the cumulative oil produced?

09:30:31 10 A. It will increase.

09:30:32 11 Q. We can take that down. Did Dr. Blunt criticize your original
09:30:38 12 oil-in-place calculation?

09:30:39 13 A. He did.

09:30:39 14 Q. On what basis?

09:30:41 15 A. Two reasons: I think one he said is that because I did not
09:30:47 16 consider the geology and geophysics and the connectivity in the
09:30:54 17 reservoir; and also that I had used the wrong formation volume
09:30:58 18 factor.

09:30:59 19 Q. Can we look at D-21659, please. Now, Dr. Kelkar, how do you
09:31:08 20 respond to that first criticism of Dr. Blunt's that you didn't
09:31:12 21 consider geology in your calculation?

09:31:14 22 A. Well, I did consider the geology and geophysics, because I had
09:31:18 23 used BP's report and they had already incorporated the geophysics
09:31:22 24 and geology. So normally when you calculate the P10, P50, P90, you
09:31:28 25 do use some threshold cutoffs to determine how much oil is

09:31:32 1 connected, so I believe that that information was already
09:31:35 2 incorporated.

09:31:36 3 Further, when you look at this chart and you look at the
09:31:39 4 reservoir barrels, not stock-tank barrels, you find that my
09:31:44 5 estimate was not significantly different than Dr. Blunt's or BP was
09:31:49 6 using in their own simulation results.

09:31:55 7 Regarding the formation volume factor values, Dr. Blunt
09:31:59 8 used a single-stage separation, and as Dr. Zick discussed in the
09:32:05 9 morning, I believe that it was more appropriate to use a multistage
09:32:09 10 separation in the calculation of the formation volume factor than a
09:32:13 11 single-stage separation.

09:32:14 12 Q. So how do you get from the total reservoir barrels that we see
09:32:18 13 in this chart to original oil in place?

09:32:22 14 A. You simply take this number and you divide it by the formation
09:32:28 15 volume factor and you calculate the stock-tank barrels.

09:32:32 16 Q. Can we see D-21660, please. So if the to the number -- I'm
09:32:42 17 sorry.

09:32:43 18 Has any other expert in this case used a formation volume
09:32:47 19 factor of 2.14?

09:32:50 20 A. Yes. I think Dr. Emilsen, who is BP's Phase One expert, also
09:32:58 21 had used 2.14 formation volume factor, which came from BP's
09:33:04 22 original PVT tables.

09:33:05 23 Q. Can we see TREX 7401, please.

09:33:09 24 THE COURT: Is that roughly equivalent to a shrinkage
09:33:12 25 factor of 50 percent?

09:33:15 1 THE WITNESS: (WITNESS NODS HEAD IN THE AFFIRMATIVE.)

09:33:16 2 THE COURT: The same thing, right?

09:33:18 3 THE WITNESS: Yes.

09:33:19 4 BY MS. ENGEL:

09:33:19 5 Q. Is this Dr. Emilsen's Phase One report?

09:33:22 6 A. Yes.

09:33:23 7 Q. Can we have callout 7401.30.1. Is this the section of
09:33:29 8 Dr. Emilsen's report that you're referring to?

09:33:31 9 A. Yes. I think you can see the highlighted portion where he had
09:33:35 10 also used 2.14.

09:33:37 11 Q. What value did Dr. Blunt use in his material balance analysis
09:33:41 12 for formation volume factor?

09:33:43 13 A. He used three different values because he looked at three
09:33:47 14 different PVT reports, which were provided as a part of the oil
09:33:57 15 fluid analysis. So he didn't use a single value, but all of the
09:34:00 16 three values he used, which were in the range of 2.27 to about
09:34:05 17 2.35, where it came from a single-stage separation.

09:34:07 18 Q. What is your expert opinion about Dr. Blunt's decision to use
09:34:11 19 that range of formation volume factors that came from single-stage
09:34:15 20 separation?

09:34:15 21 A. As I discussed in my rebuttal report, I believe that both
09:34:24 22 Dr. Whitson and Dr. Zick's analysis that the oceanic separation is
09:34:31 23 the most appropriate method to calculate the formation volume
09:34:35 24 factor is the correct one, and I would prefer to use that over
09:34:41 25 single-stage separation.

09:34:41 1 Q. Did Dr. Blunt's formation volume factors represent what would
09:34:46 2 be commonly used in the industry?

09:34:48 3 A. It would not be. And as Dr. Zick discussed in the morning, oil
09:34:54 4 companies have a vested interest in producing the most oil from the
09:34:58 5 reservoir, and the reason is oil is much more valuable commodity
09:35:02 6 than gas. So when they bring the oil to the surface, they would
09:35:06 7 try to use multistage separation so that oil production is
09:35:10 8 maximized and gas production is minimized. So multistage
09:35:15 9 separation is the process which any company will use when producing
09:35:19 10 oil.

09:35:19 11 Q. Can we have D-21660, please. Do you have any other criticisms
09:35:31 12 of Dr. Blunt's calculation of original oil in place?

09:35:34 13 A. So Dr. Blunt also uses connectivity calculation based on well
09:35:41 14 test analysis, and as I discuss in my rebuttal report, his well
09:35:48 15 test analysis actually ignores a significant amount of pressure
09:35:51 16 data in his calculations.

09:35:53 17 Q. What's the importance of that pressure data that Dr. Blunt
09:35:58 18 ignores?

09:35:58 19 A. I think that anyone who has done well test analysis will tell
09:36:03 20 you that early data, either just before the shut-in or just after
09:36:07 21 shut-in, can be very critical in determining the reservoir
09:36:10 22 properties. And he ignores about 10,000 seconds of data in his
09:36:17 23 analysis.

09:36:17 24 Q. Let's move on and talk about the next input to the material
09:36:21 25 balance analysis, which is total compressibility. Can we have

09:36:24 1 D-21661, please. And what is total compressibility again?

09:36:32 2 A. So the total compressibility is a weighted average of the
09:36:36 3 compressibility of oil, water and the formation.

09:36:40 4 Q. And I want to focus just on your formation compressibility
09:36:44 5 values this morning. What value did you use in your analysis?

09:36:47 6 A. I used 12 microsips.

09:36:50 7 Q. And what did you rely on for that value of 12?

09:36:53 8 A. I looked at a significant number of internal documents which BP
09:37:00 9 had, as well as Dr. Hsieh's testimony.

09:37:02 10 Q. Could we look at D-21600, please. And if I could have my ugly
09:37:11 11 assistant Mr. O'Rourke help me put this up on the board here.

09:37:23 12 MR. BOLES: Your Honor, while they are switching to the
09:37:25 13 demonstrative, if I may just for the record, now that we're
09:37:28 14 specifically at this evidence, just note the objection that
09:37:33 15 these -- all of these BP e-mails are beyond the scope of the expert
09:37:37 16 report that was supposed to disclose not just opinions but his
09:37:40 17 basis for his opinions. And he specifically cites on pages 27 and
09:37:45 18 28 at footnotes 37 and 41 the sole basis for his use of 12
09:37:53 19 microsips, and that's a single PowerPoint and not these e-mails.

09:37:57 20 And, similarly, in his appendix, and this is in the
09:38:00 21 original report, page 45, footnote 58, again, the sole basis cited
09:38:08 22 is the PowerPoint and not these e-mails.

09:38:10 23 THE COURT: My understanding is this is in evidence in
09:38:16 24 one fashion or another?

09:38:18 25 MS. ENGEL: I believe that most --

09:38:20 1 THE COURT: I know I've seen some of these before.

09:38:22 2 MS. ENGEL: Yes, we've been through some of the
09:38:24 3 documents.

09:38:25 4 THE COURT: I don't know if I've seen them all.

09:38:27 5 MS. ENGEL: I don't know if we've seen them all yet
09:38:31 6 either, your Honor, but we will go through them and I can lay the
09:38:33 7 foundation.

09:38:33 8 THE COURT: All right. Overrule the objection.

09:38:38 9 BY MS. ENGEL:

09:38:38 10 Q. So, Dr. Kelkar, what is this demonstrative, D-21600, that we're
09:38:44 11 looking at?

09:38:45 12 A. I think this demonstrative actually discusses the process by
09:38:50 13 which a conclusion or consensus was reached at why 12 microsips
09:38:57 14 value is the most appropriate. And I just want to emphasize that
09:39:01 15 the e-mails here which are discussed here are not unusual in the
09:39:06 16 sense that when you are working on a reservoir modeling project, it
09:39:13 17 is not unusual to find that there is an uncertainty with respect to
09:39:18 18 certain input parameters. And when there is an uncertainty with
09:39:22 19 respect to certain input parameters, different people from
09:39:26 20 different experience gather together and they discuss the issue,
09:39:30 21 and they come to some reasonable conclusion.

09:39:33 22 I've been involved in many reservoir modeling projects
09:39:36 23 where I didn't have the expertise in a particular parameter, and I
09:39:42 24 talked to other people from other disciplines with other expertise
09:39:46 25 and came to the right conclusion about what value should be used.

09:39:52 1 THE COURT: Could you move that microphone just a -- you
09:39:55 2 can push it back from you, whatever is more comfortable for you.
09:39:59 3 Not too far away, need to be right in the middle, but not too
09:40:03 4 close. I'm getting word that if you get too close, it kind of
09:40:07 5 muffles your voice. People are listening elsewhere, too, in the
09:40:11 6 courthouse, okay?

09:40:12 7 THE WITNESS: Okay.

09:40:12 8 THE COURT: Okay. Thank you.

09:40:14 9 MS. ENGEL: Balance out a little bit.

09:40:16 10 THE WITNESS: Is it better?

09:40:17 11 THE COURT: Don't go in the opposite direction, then
09:40:22 12 you'll be too soft. Then I'll get a different type of complaint.
09:40:25 13 All right. Let's try that.

09:40:27 14 BY MS. ENGEL:

09:40:27 15 Q. Who are the discussions here in this demonstrative among?

09:40:30 16 A. I think these discussions are between the reservoir engineers
09:40:36 17 and rock mechanics expert within BP.

09:40:39 18 Q. Did you rely on the documents in this demonstrative in forming
09:40:44 19 your expert opinion?

09:40:45 20 A. I did.

09:40:46 21 Q. Now, what is your understanding of what was happening during
09:40:51 22 the Macondo response action during this period from about July 6 to
09:40:56 23 July 15th?

09:40:57 24 A. The well was shut-in on July 15th, and there was an issue
09:41:03 25 related to well integrity. And a lot of the simulation work,

09:41:07 1 and which I do cite to because I think that the article which I do
09:41:13 2 cite to is really conclusion of all of this information. And that
09:41:19 3 simulation work was important to understand the well integrity.

09:41:22 4 So there was a discussion about what is the most
09:41:24 5 appropriate input which needs to be used in the simulation, and
09:41:28 6 this particular set of documents relate to the compressibility
09:41:33 7 value.

09:41:34 8 Q. Let's take a look, first, at the discussions that occurred on
09:41:39 9 July 6. Could we have TREX 8771, please, and go directly to the
09:41:43 10 callout .1.1. Dr. Kelkar, please explain to Judge Barbier what
09:41:49 11 we're looking at in this e-mail.

09:41:51 12 A. So this is an e-mail from Kelly McAughan, who is a reservoir
09:41:57 13 engineer, to Steve Willson, who is a rock mechanics expert, and you
09:41:59 14 can see that from the e-mail what she is saying is that other REs,
09:42:05 15 or reservoir engineers, were questioning our pore volume
09:42:10 16 compressibility, or PVC, being too low at 6 microsips.

09:42:17 17 Q. And could we move to TREX 8774, please, and go to callout .1.1.

09:42:29 18 A. And this is an e-mail response back from David Schott who is
09:42:35 19 also another reservoir engineer, and he is talking about analog
09:42:39 20 wells like Santa Cruz. And what he is saying in his e-mail is that
09:42:43 21 the sidewall core data is conservative because of the way the
09:42:48 22 grains are aligned, so we should not strictly confine to the
09:42:52 23 sidewall data at Macondo.

09:42:54 24 And just for reference, that the core samples which were
09:42:58 25 collected from Macondo were sidewall cores because they are

09:43:03 1 cheaper. You drill the well and you just take the cores from the
09:43:06 2 side of the hole. Whereas, if you take the whole core, then you
09:43:10 3 have to stop drilling, then take a core sample to the surface, and
09:43:14 4 that is more expensive. So a lot of companies would prefer to take
09:43:19 5 sidewall core data than the whole core data. And what he is
09:43:23 6 talking about is that in general the sidewall core values may not
09:43:27 7 be representative, so we have to somehow correct for it.

09:43:30 8 Q. Let's see the next callout, 8774.1.2. What are we seeing here?

09:43:38 9 A. This is the e-mail from the rock mechanics expert, Steve
09:43:43 10 Willson to Kelly McAughan, again, and the other reservoir
09:43:47 11 engineers, including Bob Merrill who is the person responsible for
09:43:52 12 reservoir simulation.

09:43:53 13 And what he is talking about is the sidewall core samples
09:43:59 14 again, that what we did at Macondo was take a sidewall cores,
09:44:06 15 rotary sidewall cores that's what RSWC stands for, and which you
09:44:11 16 correctly point out, has some inherent biases. So, again, we have
09:44:15 17 rock mechanics here who is talking about the fact that based on
09:44:18 18 some analog wells that are some inherent biases in the sidewall
09:44:22 19 cores.

09:44:22 20 Q. Let's move to the next e-mail chain from July 6, TREX 8772, and
09:44:27 21 look at the first callout .1.1. Dr. Kelkar, what is this e-mail?

09:44:35 22 A. And this e-mail is from a simulation engineer Schott to Kelly,
09:44:42 23 and what he is saying is that, again, based on some of the other
09:44:45 24 analog wells that the sidewall to the whole core needs an upgrade
09:44:51 25 based on Isabela, which is another place where the whole core

09:44:55 1 sample was taken.

09:44:56 2 Q. You used the term "analog well," what is an analog well?

09:45:00 3 A. Analog wells are the wells -- are the reservoirs which are used
09:45:05 4 when you want to complement some of the missing information from
09:45:09 5 the existing reservoir.

09:45:09 6 Q. Let's move to the final e-mail chain from July 6, 8770.1.1.

09:45:21 7 What are we looking at here, Dr. Kelkar?

09:45:23 8 A. This is an e-mail from, again, from Kelly McAughan to other
09:45:27 9 engineers talking about what type of upgrade is required for
09:45:33 10 adjusting the rock compressibility. And since other reservoirs, if
09:45:38 11 you require an upgrade from 10 to 20, that means you have to
09:45:41 12 increase also the value at Macondo by a factor of two.

09:45:45 13 Q. Now, let's take a look at what BP said on July 7th, which is
09:45:49 14 the next series of exhibits discussed in this demonstrative,
09:45:54 15 D-21600.

09:45:56 16 Let's have, first, TREX 8775.1.1. What's your
09:46:02 17 understanding of this e-mail, Dr. Kelkar?

09:46:04 18 A. This is an e-mail from a rock mechanics expert to simulation
09:46:08 19 engineer and the reservoir engineer. And what he is talking about
09:46:12 20 is that based on some of the work he has done that you could argue
09:46:18 21 for a very high compressibility, and Isabela and Santa Cruz
09:46:23 22 comparison, which is the analog wells, would put you at 15
09:46:27 23 microsips. So he's, again, giving some guidance in terms of what
09:46:32 24 is the appropriate compressibility that 15 could be a reasonable
09:46:35 25 value, with 20 as an upside and five as a downside.

09:46:41 1 Q. Let's look at the next e-mail exchange which is TREX 8776.1.1.

09:46:46 2 What are we looking at here, Dr. Kelkar?

09:46:48 3 A. I think what you see in this e-mail is some consensus is
09:46:52 4 emerging as to what is the most appropriate value to be used. And
09:46:56 5 what Kelly McAughan is saying is that what about 6, 12, and 18; 6
09:47:01 6 being the low value, 12 being the middle, and 18 being the high
09:47:05 7 value. And both Steve Willson and Bob Merrill agreed to that type
09:47:14 8 of estimation.

09:47:14 9 Q. Let's move along the timeline now and talk about what BP was
09:47:19 10 doing on July 8th. TREX 8777.1.1, please. What is this document,
09:47:30 11 Dr. Kelkar?

09:47:31 12 A. So this is an e-mail from Kelly McAughan to some of the other
09:47:35 13 engineers talking about the fact that we use the help of rock
09:47:40 14 mechanics expert and we went from 6 microsips to 12 microsips and
09:47:46 15 because in other analog wells, the teams did the same thing. They
09:47:50 16 used the factor of two when they went from sidewall cores to whole
09:47:54 17 core data.

09:47:55 18 Q. Let's take a look at TREX 10841, please. Can we blow that up?
09:48:10 19 Do you recognize this document, Dr. Kelkar?

09:48:12 20 A. I do.

09:48:13 21 Q. What is it?

09:48:14 22 A. It is a document which was prepared by Bob Merrill. And what
09:48:19 23 this document represents is what type of reservoir response you
09:48:24 24 would get when the well is shut-in, so it's trying to predict what
09:48:27 25 type of reservoir pressure increase we will expect to see if the

09:48:32 1 well was shut-in.

09:48:32 2 Q. Let's go to callout 10841.22.1. Dr. Kelkar, what's your
09:48:41 3 understanding of what we see here in this callout?

09:48:44 4 A. Well, what this document is showing is that when Dr. Merrill
09:48:49 5 was using this simulation results, obviously he was concerned on
09:48:55 6 certainty with respect to different parameters. And the two
09:48:57 7 parameters he was concentrating on was the aquifer, underlying
09:49:03 8 aquifer, and he assumed that the most likely value to be 3.8 times
09:49:07 9 the size of the oil reservoir. And he also considered the rock
09:49:12 10 compressibility between 6, 12, and 18, where 12 being the most
09:49:16 11 likely value.

09:49:18 12 Q. Turning to the next callout, 10841.23.1.

09:49:23 13 THE COURT: Excuse me. Can you back up a second? Is it
09:49:31 14 your understanding that the highlighted numbers were highlighted on
09:49:35 15 the original slides?

09:49:36 16 THE WITNESS: Yes.

09:49:37 17 THE COURT: That's not something you added?

09:49:38 18 THE WITNESS: No, no.

09:49:41 19 THE COURT: All right, go ahead.

09:49:41 20 MS. ENGEL: Thank you, your Honor.

09:49:43 21 BY MS. ENGEL:

09:49:44 22 Q. The callout, which is .23.1, and does this callout reflect what
09:49:48 23 you just described to Judge Barbier?

09:49:50 24 A. Yes. That you saw on the next slide it says explicitly that
09:49:53 25 the most likely values are 3.8 times the size of oil reservoir as

09:50:00 1 the aquifer size and 12 microsips.

09:50:02 2 Q. So now, we're up to July 9th on the timeline. Let's take a
09:50:07 3 look at TREX 9324.1.1.

09:50:19 4 MS. ENGEL: Just to clarify, your Honor, in the last
09:50:20 5 exhibit that we were looking at in those callouts, the highlighting
09:50:23 6 is ours, we added the highlighting. The bold was on the original
09:50:27 7 document.

09:50:28 8 THE COURT: Wait, go back. Show me what you're talking
09:50:31 9 about.

09:50:32 10 MS. ENGEL: Sure. 10841.22.1. So we here added the
09:50:39 11 highlighting for you.

09:50:40 12 THE COURT: The yellow highlight, yes. I meant -- I
09:50:42 13 don't know what term I used, maybe I said highlighting, but I meant
09:50:45 14 the bolded numbers. The bolded numbers were in the original?

09:50:49 15 THE WITNESS: Yes.

09:50:50 16 THE COURT: Okay.

09:50:50 17 BY MS. ENGEL:

09:50:51 18 Q. So now can we go 9324.1.1. Dr. Kelkar, this is an e-mail from
09:50:59 19 Kate Baker to Marjorie Tatro at Sandia with a copy to Paul Tooms,
09:51:05 20 Kent Wells, and James Dupree. There is an attachment here called
09:51:09 21 SIWOP Master Pack. Do you know who Kate Baker is?

09:51:13 22 A. She was a consultant to BP.

09:51:15 23 Q. And what about the individuals on the cc line?

09:51:19 24 A. They were some executives to BP. I don't know exactly who they
09:51:25 25 were, but they were some executives within BP.

09:51:27 1 Q. And do you know what the attachment to the e-mail is?

09:51:30 2 A. Again, this goes back to the discussion about what will happen
09:51:35 3 during the shut-in of the well. So prediction of the pressure data
09:51:39 4 during the shut-in of the well.

09:51:41 5 Q. Let's take a look at TREX 92 -- I'm sorry, 9324.3, the third
09:51:49 6 page. Is this the attachment to the e-mail?

09:51:51 7 A. Yes.

09:51:52 8 Q. Let's go to TREX 9324.16. What is your understanding of what
09:52:01 9 Bob Merrill is presenting to the government in this July 9th
09:52:05 10 PowerPoint entitled "Reservoir Depletion"?

09:52:08 11 MR. BOLES: If I may, one more time, note the objection.
09:52:11 12 I objected earlier to the e-mails. I hadn't anticipated that this
09:52:13 13 also would be added, so I am just going to make a general objection
09:52:16 14 to things outside the scope of the expert report being relied on.

09:52:21 15 THE COURT: All right.

09:52:22 16 MS. ENGEL: Your Honor --

09:52:23 17 THE COURT: Overruled.

09:52:25 18 BY MS. ENGEL:

09:52:28 19 Q. So go ahead, Dr. Kelkar. What is your understanding of what
09:52:31 20 Bob Merrill was presenting to the government in this PowerPoint?

09:52:34 21 A. I think this is the same presentation which was -- I referred
09:52:38 22 to before which is, again, trying to predict the response of the
09:52:43 23 reservoir during the time of shut-in. And so what he is trying to
09:52:47 24 calculate here is that how much reservoir has depleted over 86 days
09:52:53 25 so that he can predict the response of the pressure when the well

09:52:56 1 is shut-in.

09:52:57 2 Q. Can we have the first callout, which is 9324.17.1. Now, did
09:53:05 3 this callout contain the work that you just described?

09:53:08 4 A. Yes. And if you look at the results here, what this results is
09:53:13 5 showing you that if you varied the baseline values. So, for
09:53:19 6 example, if you change the compressibility of 12 to 6 to 18, which
09:53:23 7 is the range, then the reservoir pressure would have depleted
09:53:27 8 differently. So if you use 6, the reservoir would have depleted
09:53:32 9 200 psi more. If you use 18, the reservoir would have depleted 100
09:53:37 10 psi less.

09:53:38 11 And same thing with the aquifer. If you had no aquifer,
09:53:42 12 the reservoir would have depleted by 800 psi. If you had 14 times
09:53:47 13 the size of an aquifer compared to 3.8, the reservoir would have
09:53:52 14 100 psi more pressure. So again, this is just a sensitivity of
09:53:56 15 what would have happened to the reservoir based on different input
09:54:00 16 parameters.

09:54:00 17 Q. So now, we're up to July 15th on the timeline. What is your
09:54:05 18 general understanding of the events happening on July 15th?

09:54:08 19 A. July 15th was the day when the well was shut-in around
09:54:13 20 two o'clock in the afternoon.

09:54:14 21 Q. Let's take a look at TREX 9320 and go to the first callout
09:54:20 22 .1.1. What is this document, Dr. Kelkar?

09:54:25 23 A. This is an e-mail which is written by Tony Liao who actually
09:54:30 24 was doing most of the work related to PROSPER, which is one of the
09:54:35 25 commercial softwares, which actually calculates the pressure up in

09:54:39 1 the wellbore. And he is writing an e-mail to different BP people.

09:54:45 2 And what he is talking about is the comparison between
09:54:49 3 the pressure which was observed in the well after the well was
09:54:52 4 shut-in with the model predictions. And this is very important
09:54:56 5 because there has to be an assurance that the well has maintained
09:55:02 6 integrity. So if you can show that the buildup pressure in the
09:55:05 7 well is consistent with what's observed, then your model is
09:55:08 8 reasonable and there is a well integrity.

09:55:10 9 So I think this is a reference to about first three hours
09:55:14 10 after the well was shut-in.

09:55:15 11 Q. Did Dr. Liao use a compressibility value of 12 microsips in
09:55:22 12 this modeling?

09:55:22 13 A. Well, Dr. Liao did not really model this, but Dr. Merrill used
09:55:28 14 12 microsips. And I think he is comparing the results of what
09:55:32 15 Dr. Merrill had predicted with what was observed.

09:55:36 16 Q. Thanks for that clarification. Let's look at 9320.17.1,
09:55:41 17 please. And is this one of the pressure buildup cases you
09:55:45 18 mentioned?

09:55:46 19 A. Yes.

09:55:46 20 Q. And the value highlighted there in yellow is 12 microsips?

09:55:50 21 A. Yes.

09:55:51 22 Q. Let's look at the last callout which is 9320.25.1. What are we
09:55:57 23 looking at on this chart, Dr. Kelkar?

09:56:00 24 A. So what this is showing you is the wellhead pressure. WHP
09:56:06 25 stands for wellhead pressure, so this is the pressure in the

09:56:09 1 capping stack. And then on the X axis there is a shut-in time.
09:56:12 2 And this is a comparison between what was observed at the well
09:56:18 3 compared to what was predicted in the models. And there were two
09:56:22 4 models; one, was the simulation results which was done by
09:56:25 5 Dr. Merrill, and there were other models which were OLGA, and this
09:56:30 6 is a different software, which was also used to predict increase in
09:56:34 7 the pressure.

09:56:34 8 And I think if you refer back to the e-mail, what
09:56:38 9 Dr. Liao is saying that we are in a good place. And essentially
09:56:42 10 saying that whatever pressure we had predicted in the well was
09:56:46 11 consistent with what was observed.

09:56:50 12 Q. You can take that down. Dr. Kelkar, why did you decide it was
09:56:54 13 appropriate to rely on all of these documents we've just reviewed
09:56:57 14 in reaching your conclusion that 12 microsips was the appropriate
09:57:00 15 value for compressibility?

09:57:02 16 A. I think the main reason was that the simulation exercise which
09:57:07 17 was done in this particular effort was related to the well
09:57:12 18 integrity, and BP had every reason to use the most appropriate
09:57:18 19 values in their simulation. And they had used the 6, 12, and 18
09:57:25 20 microsips as the possible range of compressibility, and I thought
09:57:30 21 that since they had used those values, I should also stick to those
09:57:34 22 three values. So I considered the sensitivity with respect to 6
09:57:37 23 and 18, but I used the most likely value to be 12, based on the
09:57:43 24 discussion.

09:57:43 25 And as I refer back, you know, this is not unusual. When

09:57:46 1 you don't have an expertise, you rely on other people to provide
09:57:49 2 you with expertise. And I think all of these documentations
09:57:53 3 clearly told me that 12 microsips is the most appropriate value to
09:57:57 4 be used.

09:57:58 5 Q. In the course of your review of all of these BP documents that
09:58:01 6 we just looked at, did you ever see any reference to 12 being used
09:58:05 7 as a worst case or that it should only be used as a worst-case
09:58:10 8 scenario?

09:58:10 9 A. I did not see any reference.

09:58:11 10 Q. You mentioned earlier that you also relied on the testimony of
09:58:16 11 Dr. Paul Hsieh to re-enforce your opinion that 12 microsips is the
09:58:20 12 appropriate value for compressibility. What was it in Dr. Hsieh's
09:58:23 13 testimony that supports your selection of 12?

09:58:25 14 A. In Dr. Hsieh's testimony there was a phone call which Dr. Hsieh
09:58:31 15 had with Kelly McAughan, I think same person we referred to in
09:58:37 16 these documents, and she had asked Dr. Hsieh to use 12 microsips as
09:58:42 17 a compressibility value.

09:58:43 18 Q. And I believe you said a moment ago that you also used values
09:58:47 19 of 6 and 18 microsips in your analysis. Why did you select those
09:58:53 20 values?

09:58:53 21 A. For the same reason. Those are the values which were used by
09:58:56 22 Dr. Merrill, so I didn't see any reason not to use those values in
09:59:00 23 my analysis as well.

09:59:01 24 Q. And what did those 6 and 18 values represent in your analysis?

09:59:06 25 A. That's just a range of uncertainty I considered with respect to

09:59:10 1 formation compressibility.

09:59:13 2 Q. So what is your analysis of the 6, 12, and 18 range tell you
09:59:17 3 about the sensitivity of the material balance calculation to
09:59:19 4 compressibility?

09:59:20 5 A. So the amount of oil released can be quite sensitive to
09:59:23 6 formation compressibility, and the values can vary over a great
09:59:28 7 deal depending on what formation compressibility you use.

09:59:31 8 Q. Does that sensitivity apply equally to Dr. Blunt's material
09:59:38 9 balance analysis?

09:59:38 10 A. It does.

09:59:39 11 Q. Let's look at D-21663, please. Did Dr. Blunt consider any
09:59:45 12 uncertainties or sensitivities in formation compressibility in his
09:59:49 13 analysis?

09:59:49 14 A. He did not.

09:59:50 15 Q. Did he -- I'm sorry. Let's go to D-21664, please. This is the
10:00:00 16 final element of the material balance analysis pressure drop. How
10:00:05 17 did you derive the initial reservoir pressure you used in your
10:00:08 18 calculation?

10:00:08 19 A. I used the initial pressure data based on BP's post drill
10:00:14 20 information.

10:00:14 21 Q. And how did you calculate -- I'm sorry, what value did you use
10:00:18 22 for initial reservoir pressure?

10:00:20 23 A. I used 11,856.

10:00:23 24 Q. How did you calculate the final reservoir pressure that you
10:00:26 25 used?

10:00:27 1 A. I used the pressure buildup, which was available on the day of
10:00:32 2 shut-in, and over 17 days after the well was shut-in. So I used
10:00:38 3 the Mead method to calculate the average pressure and that turned
10:00:42 4 out to be 10,396 psi.

10:00:44 5 Q. What does this Mead method entail?

10:00:48 6 A. It's a method by which you can fit a rectangular hyperbole to
10:00:54 7 the pressure data, and then one of the parameters which comes out
10:00:58 8 of it is the average pressure.

10:01:02 9 Q. Did you validate your calculation of average pressure or final
10:01:06 10 pressure using that Mead method?

10:01:08 11 A. I did. And I used two literature data sets, and I fitted the
10:01:15 12 data where conventional well test was done, and I compared the
10:01:19 13 average pressure from those two literature data sets with what I
10:01:22 14 obtained from the Mead method. It turned out to be that the
10:01:25 15 comparison was reasonable.

10:01:27 16 Q. Why did you decide to use the Mead method to get your final
10:01:33 17 reservoir pressure?

10:01:33 18 A. The reason I used that method is because one of the most
10:01:37 19 important pieces of information in conventional well test analysis
10:01:41 20 is the rate. You have to know what is the rate at which the well
10:01:45 21 was flowing prior to shut in. And we had a lot of uncertainty with
10:01:50 22 respect to rate information, so I used the method which did not
10:01:54 23 rely on the rates.

10:01:56 24 Q. Can you look at D-21665, please. Did Dr. Blunt calculate final
10:02:06 25 reservoir pressure using the Mead method?

10:02:07 1 A. He did not.

10:02:08 2 Q. What did he do differently?

10:02:10 3 A. He used some type of parameter estimation, which he fitted the
10:02:17 4 data with five parameter model, and one of the parameters which he
10:02:21 5 calculated was the average pressure. But he did not consider the
10:02:27 6 fluid changes which were taking place prior to shutting in the
10:02:31 7 well, and he also ignored the first 10,000 seconds of the pressure
10:02:37 8 buildup data in fitting his model.

10:02:41 9 He did calculate the reservoir permeability as part of
10:02:47 10 his calculation, but he rejected it, and instead he relied on
10:02:52 11 Dr. Gringarten's value in his calculations.

10:02:54 12 Q. You mentioned the term "conventional well test analysis" or
10:02:58 13 "traditional well test analysis" a minute ago. Is what Dr. Blunt
10:03:02 14 did a traditional or conventional well test analysis?

10:03:05 15 A. Not by -- if you look at any standard well testing books.

10:03:12 16 Q. Do you have any other criticisms of Dr. Blunt's calculation of
10:03:16 17 final reservoir pressure?

10:03:18 18 A. One of the things which he did not use in his calculation is
10:03:23 19 that he did calculate the average pressure, but we also had the
10:03:28 20 average pressure data available from Dr. Gringarten, but he chose
10:03:32 21 not to use those values.

10:03:34 22 Q. So Dr. Gringarten also calculated final average reservoir
10:03:37 23 pressure on behalf of BP and Anadarko?

10:03:39 24 A. He did.

10:03:39 25 Q. And did he use bottom hole pressures that he received from

10:03:44 1 Dr. Blunt to make that calculation?

10:03:45 2 A. Essentially, both of them used the same bottom hole pressure
10:03:50 3 data during the shut-in.

10:03:51 4 Q. Can we have D-21666, please. So using those bottom hole
10:03:58 5 pressure that he got from Dr. Blunt, did Dr. Gringarten, then,
10:04:02 6 calculate a final average pressure that was different from
10:04:05 7 Dr. Blunt's?

10:04:06 8 A. He did. And if you look at this particular chart, you can see
10:04:10 9 that Dr. Gringarten calculated the value between 10,364 and 10,460.
10:04:19 10 The value I calculated was 10,396 which is right in the middle of
10:04:23 11 what Dr. Gringarten had calculated.

10:04:26 12 Dr. Blunt's values are significantly higher than
10:04:30 13 Dr. Gringarten's, as well as mine.

10:04:33 14 Q. And what's the significance of that difference of Dr. Blunt
10:04:37 15 having higher average pressures?

10:04:39 16 A. Higher average pressure means less oil released.

10:04:44 17 Q. So if Dr. Blunt had used either your value or Dr. Gringarten's
10:04:48 18 value, he would calculate a higher amount of oil spilled?

10:04:52 19 A. Yes, he would.

10:04:53 20 Q. Is Dr. Gringarten more of an expert in pressure buildup
10:04:59 21 analysis than Dr. Blunt?

10:05:00 22 A. Yes, he is.

10:05:01 23 Q. Now, let's bring all of these inputs to the material balance
10:05:06 24 analysis back together. Can we see D-21668, please. Remind the
10:05:13 25 Court of what cumulative discharge you calculated using your

10:05:17 1 methodology?

10:05:17 2 A. I calculated the value between four-and-a-half to
10:05:20 3 five-and-a-half million standard barrels.

10:05:22 4 Q. Do you have any opinion about whether these values are
10:05:25 5 conservative?

10:05:25 6 A. I believe these values are conservative, because unlike
10:05:30 7 Dr. Merrill who did consider the influence of water influx, I do
10:05:35 8 mention about the water influx but I did not explicitly include the
10:05:40 9 influence of water influx.

10:05:41 10 Also, my lower end of the value, which is 110 million
10:05:44 11 standard barrels of oil in place is based on single-phase formation
10:05:48 12 volume factor, so it tends to be a lot more conservative.

10:05:51 13 Q. You were in the room this morning when counsel for BP asked
10:05:55 14 Dr. Zick why you hadn't used an FVF from his EOS calculation in the
10:06:00 15 material balance, correct?

10:06:01 16 A. Yes.

10:06:02 17 Q. Do you know what FVF, formation volume factor Dr. Zick
10:06:10 18 predicted?

10:06:10 19 A. Yes, I do.

10:06:11 20 Q. What values were those?

10:06:12 21 A. I think they were in the range of 1.96 to 2.05.

10:06:17 22 Q. And if you had used those formation value factors calculated by
10:06:22 23 Dr. Zick in your analysis, what would be the effect on your
10:06:25 24 cumulative oil released?

10:06:26 25 A. The amount of oil released will increase.

10:06:29 1 Q. Can we have D-21669. Now, you testified earlier that you
10:06:36 2 looked at sensitivity of your material balance calculation to
10:06:39 3 changes in formation compressibility. Did you analyze that
10:06:43 4 sensitivity to any other inputs?

10:06:46 5 A. I considered the sensitivity in my rebuttal report to the
10:06:50 6 formation volume factors, because at that time I had the reports
10:06:54 7 available from both Dr. Whitson and Dr. Zick and the oceanic
10:06:59 8 separation analysis. So although I started with the value of 2.14,
10:07:05 9 which was in the BP's table, I also looked at Dr. Whitson's values
10:07:11 10 which were between 2.08 and 2.14, and Dr. Zick's value which were
10:07:16 11 in the range of 1.97 and 2.04. And if you use those values, you
10:07:21 12 will increase the amount of oil released.

10:07:24 13 Q. Did Dr. Blunt consider changes in formation compressibility --
10:07:29 14 I'm sorry, formation volume factor in his analysis?

10:07:32 15 A. He did. I mean, he used three different values corresponding
10:07:37 16 to three different lab reports. But all of those three lab reports
10:07:42 17 were based on single-phase separation.

10:07:45 18 Q. Did Dr. Blunt apply formation volume factors calculated by
10:07:50 19 either Dr. Whitson or Dr. Zick?

10:07:52 20 A. He did not.

10:07:53 21 Q. And would the changes in formation volume factor affect
10:07:57 22 Dr. Blunt's material analysis the same way that they affect yours?

10:08:00 23 A. Yes.

10:08:01 24 Q. So what's wrong with Dr. Blunt's assumption that single-stage
10:08:05 25 separation should be used for formation volume factor?

10:08:08 1 A. Well, I believe that the oceanic separation which both
10:08:13 2 Dr. Whitson and Dr. Zick discusses is much more appropriate,
10:08:17 3 because once the oil is released into the ocean because of the
10:08:20 4 density differences between oil and gas phases, the gas will tend
10:08:24 5 to move faster than oil. And as gas moves through the ocean, it
10:08:31 6 will release some of the oil. And as oil moves separately, it will
10:08:34 7 release some of the oil. So that process is much closer to
10:08:37 8 multistage separation than single-stage separation.

10:08:41 9 Q. Let's turn, now, to your consideration of the potential impact
10:08:45 10 of aquifer support. Could we see D-21670, please. So this concept
10:08:51 11 of aquifer support, is that the same as what you showed Judge
10:08:55 12 Barbier in the animation at the beginning of your testimony?

10:08:58 13 MR. BOLES: Your Honor, if I may object. Judge Shushan
10:09:01 14 has entered an order saying that Dr. Kelkar, because he did not
10:09:05 15 include anything about aquifer support in his initial report, other
10:09:09 16 than to say what he's already said, which I didn't object to, that
10:09:14 17 not including it is conservative. When Dr. Kelkar in his rebuttal
10:09:20 18 report tried to add new analysis about the effect of an aquifer,
10:09:25 19 Judge Shushan in Record Document 10477 said on page 9 that,
10:09:32 20 "assumptions and analysis regarding the existence of an aquifer is
10:09:36 21 not proper rebuttal opinion for Dr. Kelkar."

10:09:40 22 MS. ENGEL: Judge Shushan did, in fact, strike certain
10:09:43 23 portions of Dr. Kelkar's report on aquifer. She left other
10:09:47 24 portions in, and those portions include language that says, "We did
10:09:50 25 not explicitly consider the impact of an aquifer in our analysis,

10:09:53 1 however, we did state in our report that our predicted results are
10:09:56 2 conservative because influence from an aquifer would increase the
10:10:00 3 amount of oil released." That's as far as we're going with
10:10:04 4 Dr. Kelkar right now.

10:10:05 5 MR. BOLES: Then I will withdraw my objection for the
10:10:07 6 time being.

10:10:07 7 THE COURT: Thank you.

10:10:09 8 BY MS. ENGEL:

10:10:09 9 Q. Dr. Kelkar, go ahead and tell us what you evaluated in terms of
10:10:12 10 how the existence of an aquifer, if there was one, could affect
10:10:16 11 your cumulative oil release.

10:10:18 12 MR. BOLES: Your Honor, I'm sorry, I have to object
10:10:19 13 again. It sounds like what she's doing is asking for explicit
10:10:22 14 quantification or other characterization of what an effect of an
10:10:26 15 aquifer would be. Again, in his opening report, which we don't
10:10:29 16 object to and which he's already testified to, Dr. Kelkar said his
10:10:35 17 analysis is conservative because he's not taking into account the
10:10:38 18 effect of an aquifer.

10:10:39 19 Now, counsel is seeking, apparently, to elicit testimony
10:10:41 20 about what the effect of an aquifer is, and that was what was
10:10:45 21 specifically ruled out by Judge Shushan's orders.

10:10:48 22 THE COURT: I -- I don't know --

10:10:52 23 MR. BOLES: I can bring you up the page.

10:10:54 24 THE COURT: Yes, send the page up.

10:10:57 25 MS. ENGEL: Again, your Honor, all I'm eliciting from him

10:10:59 1 is whether the existence of an aquifer would increase or decrease
10:11:04 2 the amount of oil spilled, and that is language that's explicitly
10:11:08 3 in his report.

10:11:09 4 THE COURT: Why don't you just ask him that question?

10:11:11 5 MS. ENGEL: Sure.

10:11:12 6 BY MS. ENGEL:

10:11:12 7 Q. Dr. Kelkar, would the existence of an aquifer, if there were
10:11:17 8 one, increase or decrease the amount of original oil -- I'm sorry,
10:11:20 9 the cumulative amount of oil spilled?

10:11:22 10 A. The amount of oil will increase when there is an existence of
10:11:26 11 an aquifer.

10:11:27 12 Q. Okay. Thank you. And did Dr. Blunt consider the impact of an
10:11:43 13 aquifer in his material balance analysis?

10:11:45 14 A. He did not.

10:11:45 15 Q. Did he make any assumptions about an aquifer?

10:11:50 16 A. He assumed that there is no aquifer support.

10:11:52 17 Q. We can wrap up the discussion of your material balance
10:11:57 18 analysis, now, by talking about some of the pros and cons of the
10:12:00 19 method that you mentioned earlier.

10:12:02 20 Can we have D-21671, please. What are some of the
10:12:08 21 advantages of a material balance methodology?

10:12:10 22 A. I think the material balance method is simple to use. The
10:12:16 23 questions are relatively simple, and it doesn't rely on dynamic
10:12:21 24 information, like flow rates and the pressure data. So the amount
10:12:23 25 of inputs which are required for material balance are easy to

10:12:29 1 obtain. But --

10:12:31 2 Q. What are -- go ahead.

10:12:32 3 A. But the same advantages you have with the material balance
10:12:35 4 technology can also become limitations, because it is a static
10:12:41 5 method and it doesn't account for any gradients. It doesn't
10:12:45 6 account for any variation in the reservoir properties. It doesn't
10:12:48 7 account for any variations in the pressure in the reservoir. So
10:12:53 8 the advantages can become disadvantages because some of the dynamic
10:12:59 9 data, which can be available, cannot be incorporated in material
10:13:02 10 balance calculation.

10:13:04 11 And in this particular case, because we didn't know how
10:13:08 12 much oil was produced, it adds on a layer of uncertainty in
10:13:13 13 material balance calculations.

10:13:14 14 Q. Is Dr. Blunt's material balance analysis subject to those same
10:13:18 15 limitations?

10:13:19 16 A. They are, it is.

10:13:20 17 Q. And what did you do to decrease the uncertainty associated with
10:13:24 18 your own material balance calculations?

10:13:26 19 A. As I mentioned before, I calculated the rate on the last day
10:13:30 20 before the well was shut in to ensure that there is a consistency.
10:13:34 21 And I also looked at the productivity index value to make sure that
10:13:39 22 it's consistent with the core and the log data.

10:13:41 23 Q. Did Dr. Blunt perform any additional calculations or analysis
10:13:44 24 to decrease the uncertainty associated with his material balance
10:13:48 25 calculations?

10:13:48 1 A. He did not.

10:13:49 2 Q. Let's switch gears now and talk briefly about the calculation
10:13:53 3 you performed of the flow rate on the final day of the spill.

10:13:57 4 Could we see D-21672, please.

10:14:03 5 Dr. Kelkar, please describe just briefly the analysis you
10:14:07 6 performed of the flow rate on July 15th.

10:14:08 7 A. I used an industry standard software called PROSPER to do these
10:14:13 8 calculations. I included all of the different components --

10:14:19 9 THE COURT: Excuse me one second. How much more do you
10:14:21 10 have to go?

10:14:22 11 MS. ENGEL: I would say ten, 15 minutes.

10:14:25 12 THE COURT: Why don't we go ahead and take a morning
10:14:28 13 recess, it's almost 10:15, and come back.

10:14:32 14 THE DEPUTY CLERK: All rise.

10:14:33 15 (WHEREUPON, A RECESS WAS TAKEN.)

10:24:43 16 (OPEN COURT.)

10:33:47 17 THE COURT: Please be seated, everyone. Before you begin
10:33:51 18 again, Ms. Engel, I still -- I am still getting people in the other
10:33:57 19 room saying they are having trouble hearing you. I think you're
10:34:01 20 naturally soft-spoken, which is part of the issue, I guess, but I
10:34:05 21 don't know if you can move that anywhere else or speak up a little
10:34:07 22 louder or whatever.

10:34:10 23 MS. ENGEL: I will try to do that, your Honor.

10:34:12 24 THE COURT: That's a little better. The witness is
10:34:13 25 coming across fine.

10:34:15 1 MS. ENGEL: He is the important one; you don't need to
10:34:17 2 hear what I have to say. Could we -- may we proceed?

10:34:21 3 THE COURT: Yes.

10:34:21 4 BY MS. ENGEL:

10:34:22 5 Q. Could we go to D-21672, please. Dr. Kelkar, right before the
10:34:29 6 break, I asked you to describe briefly the analysis you performed
10:34:33 7 of the flow rate on July 15th.

10:34:36 8 A. Yes. So what I did is I used an industry standard software
10:34:42 9 called PROSPER and I calculated the rate by accounting for all of
10:34:46 10 the resistances between the pressure gauge and the bottom of the
10:34:51 11 ocean. I accounted for two-phase flow, I accounted for all of the
10:34:55 12 pipes, all of the equipment in between the two points, and I
10:34:59 13 determined the rate to be 54,000 standard barrels per day.

10:35:04 14 I also validated my calculation by considering the flow
10:35:07 15 to the kill line, which turned out to be 53,200 standard barrels
10:35:13 16 per day.

10:35:13 17 Q. Does PROSPER require you to input information about the
10:35:17 18 reservoir fluid?

10:35:17 19 A. Yes.

10:35:18 20 Q. And what reservoir fluid information did you use in your
10:35:23 21 capping stack calculation?

10:35:24 22 A. I considered three possibilities. I considered BP's fluid
10:35:29 23 model, I considered Dr. Whitson's fluid model and also considered
10:35:35 24 Dr. Zick's fluid model in my calculations.

10:35:37 25 Q. What was the difference that your modeling showed when you ran

10:35:41 1 Dr. Zick's versus Dr. Whitson's equation of state?

10:35:46 2 A. Dr. Whitson's model gave me a rate which is about half a
10:35:50 3 percent less than Dr. Zick's model.

10:35:52 4 Q. Is your capping stack analysis described in more detail in your
10:35:57 5 expert report, which is TREX 15549R?

10:36:00 6 A. It is.

10:36:00 7 Q. And how does your capping stack analysis of flow on the final
10:36:04 8 day relate to your calculation of the cumulative oil discharged?

10:36:08 9 A. There is really no direct relationship, but as I said before,
10:36:14 10 that if I had predicted 2,000 barrels and I had calculated
10:36:19 11 5 million oil spilled, then, of course, there would not have been a
10:36:22 12 consistency. So I think the fact that I calculated 54,000 barrels
10:36:26 13 per day, and if I look at a typical decline in the well, there is a
10:36:31 14 consistency between what I predicted the rate to be versus how much
10:36:35 15 cumulative oil discharge I calculated.

10:36:37 16 Q. Can we move to D-21675, please. Dr. Kelkar, do you have any
10:36:47 17 criticisms of the analysis performed by any other BP or Anadarko
10:36:50 18 experts?

10:36:51 19 A. So I read also Dr. Gringarten's report, who calculated the flow
10:36:57 20 rate over 86 days. And the fundamental premise Dr. Gringarten
10:37:03 21 makes is incorrect, and what he does is that he assumes that the
10:37:08 22 bottom hole pressure is known. And we have no measurement of the
10:37:13 23 bottom hole pressure.

10:37:14 24 The only information Dr. Gringarten has is the BOP
10:37:18 25 pressure, and he has to know the rate before he can calculate the

10:37:22 1 bottom hole pressure. But he assumes certain rates, calculates the
10:37:27 2 bottom hole pressure, and simply then forgets the fact that even
10:37:31 3 though the rates are changing, his bottom hole pressure also needs
10:37:35 4 to change. So effectively he decouples the wellbore from the
10:37:39 5 reservoir in his analysis.

10:37:43 6 Q. Can we have D-21676, please. Does this demonstrative describe
10:37:56 7 the decoupling that you just mentioned?

10:37:58 8 A. Yes. So he first calculates the -- he assumes the rate, then
10:38:03 9 he calculates the bottom hole pressure and then he keeps on
10:38:06 10 adjusting the flow rate to match the pressure data. But to account
10:38:11 11 for the changes in the flow rate, he doesn't really recalculate the
10:38:14 12 bottom hole pressure. So essentially he simply takes the wellbore
10:38:19 13 away from the reservoir and only matches the pressure which he
10:38:22 14 assumes to be given, but in reality, it's not given, because he has
10:38:26 15 to calculate that using the BOP pressure. So that's a fundamental
10:38:30 16 problem with his analysis.

10:38:31 17 Q. Can we have D-21678, please. Dr. Kelkar, to wrap up, could you
10:38:41 18 please summarize your primary opinions in this case for Judge
10:38:45 19 Barbier.

10:38:45 20 A. So the two primary conclusions are the amount of oil spilled in
10:38:49 21 the range of four and a half to five and a half million barrels
10:38:52 22 over 87 days. The rate on the last day is 54,000 standard barrels
10:38:58 23 through choke line, which I validated also by calculating the flow
10:39:02 24 rate through the kill line.

10:39:04 25 MS. ENGEL: Thank you, Dr. Kelkar, we have no further

10:39:06 1 questions.

10:39:49 2 MR. BOLES: So, your Honor, I'm a little entangled here.

10:39:53 3 THE COURT: That's okay. Take your time. You might want
10:40:02 4 to move that mic up a little bit on your tie. Men have a big
10:40:07 5 advantage of that thing hanging right down their neck, you know, we
10:40:11 6 can clip it to, you know.

10:40:13 7 MR. BOLES: Is that a good position?

10:40:14 8 THE COURT: I think so.

10:40:17 9 CROSS EXAMINATION

10:40:17 10 BY MR. BOLES:

10:40:17 11 Q. Good morning, Dr. Kelkar.

10:40:19 12 A. Good morning.

10:40:20 13 Q. Martin Boles on behalf of BP and Anadarko for the
10:40:24 14 cross-examination.

10:40:24 15 MR. BOLES: May I proceed, your Honor?

10:40:25 16 THE COURT: Yes.

10:40:29 17 BY MR. BOLES:

10:40:29 18 Q. Dr. Kelkar, in the material balance calculation of cumulative
10:40:33 19 flow that you've done, you have three basic variables that go into
10:40:38 20 it, correct?

10:40:39 21 A. Three basic inputs, yes.

10:40:41 22 Q. And one of them is compressibility?

10:40:43 23 A. That is true.

10:40:44 24 Q. Let's talk about rock compressibility. You don't have an
10:40:49 25 opinion as to -- that the number for rock compressibility for the

10:40:57 1 Macondo reservoir is 12 microsips, do you?

10:41:00 2 A. No. I think I just used the range between 6 and 18.

10:41:03 3 Q. So in terms of choosing 12 as between 6 and 18, you described
10:41:12 4 that in your deposition as a guess?

10:41:15 5 A. That's the best guess, yes. Educated guess.

10:41:20 6 Q. Best educated guess?

10:41:22 7 A. I don't consider that term to be pejorative really. I mean,
10:41:28 8 you can sit in the oil company's offices, and the executive vice
10:41:32 9 president will ask a young engineer when they're presenting a case
10:41:35 10 for drilling a well, what's your best guess, and you say, well,
10:41:39 11 this is how much oil we will produce and they will make a decision
10:41:42 12 based on that. So the word "best guess" does not necessarily mean
10:41:47 13 it's like playing roulette in Las Vegas. I mean, it is a guess
10:41:51 14 which is based on informed decisions.

10:41:57 15 Q. And it's not based on your analysis of the rock compressibility
10:42:03 16 data, is it, sir?

10:42:05 17 A. I am not a rock mechanics expert, no, I don't; I am not a rock
10:42:09 18 mechanics expert.

10:42:10 19 Q. My question was actually a little different. Your decision to
10:42:13 20 use 12 microsips is not based on your analysis, the rock mechanic
10:42:21 21 measurements on the actual samples of Macondo rock?

10:42:25 22 A. No, I mean, as I mentioned to you before that I am not -- if
10:42:28 23 you are asking the question did I rely exclusively on certain type
10:42:33 24 of information, I think I looked at all of the information which
10:42:36 25 was available and I reached that conclusion. So I am not

10:42:41 1 second-guessing anyone and I am not a rock mechanics expert, so...

10:42:46 2 Q. Well, you're second-guessing the data, aren't you?

10:42:51 3 A. I am not second-guessing expertise, let me put it that way. I
10:42:55 4 think essentially the e-mails which we showed today show that the
10:42:59 5 consensus was reached with respect to the compressibility the day
10:43:05 6 before the well integrity test was conducted. So I am just
10:43:08 7 assuming that same range is applicable in my analysis. So I
10:43:13 8 consider the entire range between 6 and 18 as a possible value of
10:43:21 9 rock compressibility.

10:43:22 10 Q. So it's reasonable to use six microsips as the number for rock
10:43:28 11 compressibility in the material balance calculation?

10:43:31 12 A. I think that any value between 6 and 18 can happen, yeah, I
10:43:35 13 agree with you.

10:43:35 14 Q. And when you use six in your material balance calculation, you
10:43:40 15 came up with a total cumulative flow of 3.4 million barrels?

10:43:44 16 A. That is correct.

10:43:44 17 Q. So that's a reasonable estimate?

10:43:46 18 A. It's one of the bounds of amount of oil spilled.

10:43:51 19 Q. That's a reasonable estimate?

10:43:54 20 A. I mean, I think -- I mean, I'm just calculating the uncertainty
10:43:58 21 on the amount of oil spilled, so I think that if you assume that
10:44:02 22 six microsips is the correct value, then you get 3.4 million
10:44:06 23 barrels of oil spilled.

10:44:06 24 Q. And you acknowledge that six microsips is a reasonable value to
10:44:10 25 input into a material balance calculation?

10:44:12 1 A. That's the three values which actually BP had indicated, so I
10:44:17 2 also considered those values to be within the bounds of, you know,
10:44:20 3 reality.

10:44:20 4 Q. Now, in your expert report where you indicate you're using 12
10:44:36 5 microsips, you cite a single document three different places in
10:44:44 6 your report as your support for choosing 12, don't you?

10:44:49 7 A. I do.

10:44:50 8 Q. And that's a presentation by Bob Merrill dated July 8th?

10:44:59 9 A. I don't remember the exact date, but I think there is a
10:45:01 10 presentation by Bob Merrill on reservoir depletion, yes.

10:45:05 11 Q. Let's -- just so it's clear, let's go ahead and look at one of
10:45:09 12 the footnotes from your expert report. Actually, we'll -- I think
10:45:13 13 we're on the same page, we'll look at presentation.

10:45:33 14 Let's take a look at TREX 10841N.3.1. We've called out
10:45:51 15 some of the parts of this, but you recognize this page of this
10:45:55 16 PowerPoint, don't you, sir?

10:45:56 17 A. Yes, I do.

10:45:57 18 Q. And this is what you're citing in your expert report as opposed
10:46:00 19 to using 12?

10:46:01 20 A. Yes.

10:46:02 21 Q. Now, when you decided to base your decision to use 12 microsips
10:46:11 22 for rock compressibility, based on looking at that document, did
10:46:14 23 you ask yourself why did the author put "most likely" around -- as
10:46:22 24 quotations marks? Why did he use quotation marks around the phrase
10:46:27 25 "most likely"?

10:46:28 1 A. What was your question?

10:46:32 2 Q. Sure. Didn't ask it very well. You see where it says,
10:46:36 3 recommend new, "most likely," and then it has some numbers
10:46:42 4 including 12 microsips?

10:46:43 5 A. Yes.

10:46:44 6 Q. Did you ask yourself when you decided to rely on that document
10:46:47 7 to use 12 microsips as your base case, "I wonder what the author
10:46:52 8 meant when he put 'most likely' in quotation marks?"

10:46:57 9 A. I mean, I assume that it is the most likely value. I am not
10:47:03 10 sure actually.

10:47:05 11 Q. You're not sure if that meant that it was the most likely
10:47:08 12 value?

10:47:08 13 A. But that's what it says. I mean, most likely value, so.

10:47:11 14 Q. You weren't sure when you looked at that PowerPoint and decided
10:47:15 15 to use 12 microsips whether that was meant literally or whether
10:47:19 16 "most likely" in quotation marks was meant to signify some
10:47:29 17 qualification?

10:47:30 18 A. I just assumed that to be the most likely value.

10:47:32 19 Q. And you, to quote you from your deposition, you get the point
10:47:35 20 that that might not, in fact, have been meant to convey that that
10:47:38 21 was the most likely value?

10:47:40 22 A. I think what I was saying in my deposition is that -- I mean, I
10:47:44 23 think you were asking me, if I remember correctly, and correct me
10:47:47 24 if I'm wrong, but what you were asking me is that is it an average
10:47:52 25 or is somewhere in the middle value. And I think you were asking

10:47:57 1 me related to that is it the most likely value or is it some
10:48:01 2 average, and I said, "Yeah, I get the point."

10:48:03 3 And I think the reason is because if you don't have a
10:48:06 4 whole lot of knowledge about the value being -- once you know the
10:48:11 5 minimum is 6 and maximum is 18, is the most likely value 12? Maybe
10:48:15 6 not. I mean, it could be 13, it could be 11. It's possible that
10:48:19 7 the distribution doesn't have to be uniform between those limits.

10:48:24 8 So if somebody would have said that the value is, most
10:48:27 9 likely value is not 12, it's 11 and that's what the report would
10:48:31 10 have said, I would have used 11 in my analysis.

10:48:34 11 Q. And what we're actually talking about when we met the last time
10:48:39 12 was that the data, the measurements on the Macondo rocks themselves
10:48:47 13 indicated a rock compressibility of 6, correct?

10:48:51 14 A. That is correct.

10:48:51 15 Q. And you, yourself, when you studied that same data and did your
10:48:56 16 report for the federal Flow Rate Technical Group, you looked at the
10:49:00 17 Weatherford rock mechanics laboratory measurements and you said
10:49:04 18 rock compressibility is 6?

10:49:06 19 A. That's correct.

10:49:06 20 Q. But at the time this presentation was made, the well was about
10:49:12 21 to be shut-in?

10:49:13 22 A. Right.

10:49:14 23 Q. And the context was that they were specifically evaluating the
10:49:20 24 risk to shut in, correct?

10:49:21 25 A. The well integrity was important, yes.

10:49:22 1 Q. The risk of shutting in the well, right?

10:49:26 2 A. Well integrity, I think -- I assume that's the same thing,
10:49:29 3 right?

10:49:30 4 Q. But the specific risks they were looking at was a risk from
10:49:34 5 buildup of pressure once the capping stack was shut?

10:49:37 6 A. Right.

10:49:38 7 Q. And the higher the compressibility number --

10:49:40 8 A. Yeah.

10:49:41 9 Q. -- the higher you would predict the resulting pressure?

10:49:45 10 A. Yeah, higher the compressibility the pressure will be higher,
10:49:51 11 yes, that is correct.

10:49:52 12 Q. What I was asking you about in the deposition was, do you know,
10:49:55 13 sir, whether when the person who wrote that put "most likely" in
10:50:01 14 quotation marks, he was referring to using a number in the middle
10:50:07 15 spot that would traditionally be used for the most likely value
10:50:10 16 when you have a low, middle, and high, and instead using the most
10:50:15 17 likely number as the low number and then using two alternative
10:50:18 18 higher cases to be sure they were capturing worst-case scenarios?

10:50:23 19 A. Well, I mean, if you're just saying that this particular
10:50:28 20 analysis only looked at the worst-case scenario, then they should
10:50:33 21 have just used 18 because 18 microsips would have given them the
10:50:37 22 worst possible increase in the pressure.

10:50:40 23 And I think when you read the document, what it says is
10:50:44 24 that they considered these possibilities. And I think what
10:50:48 25 Dr. Merrill did in his analysis is what any reservoir engineer

10:50:52 1 would do, is he looked at all of the possibilities and said, "Here
10:50:56 2 are the possible ranges in the pressure values you would expect to
10:50:59 3 see if the well was shut-in at that particular time. And here is
10:51:03 4 the uncertainty with respect to aquifer. Here is the uncertainty
10:51:09 5 with respect to compressibility."

10:51:10 6 So personally, what I see in the document is what I would
10:51:13 7 expect to see in any reservoir simulation exercise.

10:51:18 8 Q. And what you would expect to see in a normal simulation
10:51:21 9 exercise is you put your most likely number in the middle, and then
10:51:25 10 you test a lower possibility at the uncertainty range and a higher
10:51:28 11 one, right?

10:51:29 12 A. Yes. And he did that.

10:51:32 13 Q. And if you're, in fact, going to do something different for an
10:51:36 14 audience that was used to seeing the most likely number with a
10:51:41 15 lower number below and a higher number above, and you were putting
10:51:46 16 instead a higher number, like 12, in the middle, you might describe
10:51:47 17 it as "most likely" in quotation marks just to tip the audience off
10:51:51 18 to that not to take it literally as being the most likely value,
10:51:55 19 wouldn't you?

10:51:58 20 A. I am not sure what you're getting at really.

10:52:04 21 Q. Well, you read the deposition testimony of Bob Merrill?

10:52:08 22 A. I did.

10:52:08 23 Q. And he said that at the time he wrote this PowerPoint he did
10:52:12 24 not regard 12 microsips as the most likely value, didn't he?

10:52:16 25 A. What he said in his testimony is that that value was in the

10:52:21 1 middle of 6 and 18, and I think you asked me that question in the
10:52:27 2 deposition, and I said, "Okay, yeah. Okay, I agree." I think
10:52:31 3 that -- there is a possibility that the distribution between 6 and
10:52:36 4 18 could be different than just simply a uniform distribution or
10:52:40 5 some symmetric distribution. And 12 may not be the most likely
10:52:45 6 value. I accept that. I mean, it's possible.

10:52:48 7 But I didn't have any other information except this
10:52:52 8 document so -- and it said most likely value, so I used 12
10:52:57 9 microsips as the most likely value.

10:52:59 10 So could another rock mechanic come up with a different
10:53:05 11 distribution, sure. I mean, I don't have an expertise in rock
10:53:08 12 mechanics.

10:53:08 13 Q. Well, sir, when you say you didn't have any information besides
10:53:11 14 this, you had the Weatherford measurements from the actual rocks,
10:53:16 15 correct?

10:53:16 16 A. I did.

10:53:16 17 Q. And you've actually been involved in a study of rock
10:53:22 18 compressibility in deep underwater reservoirs in the Gulf of
10:53:27 19 Mexico, haven't you?

10:53:29 20 A. So I guess you're referring to my paper or you're talking
10:53:33 21 about --

10:53:34 22 Q. Yes, I am referring to your published article published, I
10:53:37 23 believe, it was in the *SPE Journal*. Let's take a look at --

10:53:43 24 A. One of the meetings, I think, yeah.

10:53:45 25 Q. Pardon me?

10:53:45 1 A. One of the SPE meetings I think.

10:53:48 2 Q. Let's a look at TREC 11560.1.1, and that's your name there as a
10:54:00 3 coauthor of this article?

10:54:02 4 A. Yes.

10:54:02 5 Q. And in this article you and your coauthors surveyed all of the
10:54:10 6 Gulf of Mexico deep water oil reservoirs that you could get data
10:54:15 7 from, and you looked at the distribution of different reservoir
10:54:21 8 properties for them, right?

10:54:22 9 A. Yes.

10:54:22 10 Q. So let's take a look at TREC 11560.4.1. So when you surveyed,
10:54:40 11 and we're looking at the callout here, the bottom line, it's not
10:54:44 12 highlighted, but it's in the lower left, "F12 rock compressibility
10:54:49 13 is measured in microsips," correct?

10:54:51 14 A. Uh-huh. Yes.

10:54:53 15 Q. And the caption to the table it says, "For each parameter high
10:54:58 16 and low extreme values and medium value are determined according to
10:55:03 17 the extensive study on lower tertiary reservoirs in the GoM." Did
10:55:09 18 I read that correctly?

10:55:11 19 A. You did read it correctly.

10:55:12 20 Q. And so the low value or the low extreme value would be one
10:55:15 21 microsips and the high extreme value for all of these reservoirs
10:55:19 22 you surveyed would be ten, correct?

10:55:22 23 A. Yes.

10:55:22 24 Q. And the medium value was three?

10:55:24 25 A. Yes.

10:55:24 1 Q. Now, you also, when you did your study of the Macondo reservoir
10:55:42 2 for the Flow Rate Technical Group, you, yourself, were asked to do
10:55:46 3 your modeling, not with an expected value and a low and a high, but
10:55:54 4 taking the most likely value as a base case and then using higher
10:55:58 5 numbers for worst-case scenarios, correct?

10:56:01 6 A. That is correct.

10:56:01 7 Q. Now, I want to look at some of these internal BP e-mails that
10:56:22 8 parts of which were not read to you or by you on your direct
10:56:26 9 examination. So let's start with 8771.1.1. So this is one of the
10:56:48 10 e-mails that you knew about, right, sir?

10:56:51 11 A. Yes, I did.

10:56:52 12 Q. And Kelly McAughan, you talked about her on direct examination,
10:56:57 13 is writing to Steve Willson. Do you know who he is?

10:57:00 14 A. Yes.

10:57:01 15 Q. Who is he within BP?

10:57:03 16 A. He is a rock mechanics expert.

10:57:04 17 Q. And she is saying, "We had a meeting with James Dupree today
10:57:10 18 regarding pressure depletion. The other REs were questioning our
10:57:15 19 PVC being 'low' at six microsips." You see low being in quotation
10:57:21 20 marks there?

10:57:22 21 A. Okay.

10:57:23 22 Q. Did you ask yourself when you saw that, I wonder what they mean
10:57:26 23 by that? If they mean that literally or if they mean that in the
10:57:30 24 context of the kind of study we're doing here?

10:57:33 25 A. I think that if you look at the e-mails, and honestly, I could

10:57:40 1 not go into their heads and try to figure these out. But if you
10:57:45 2 look at the subsequent discussion regarding the pore volume
10:57:49 3 compressibility, the discussion concentrates on sidewall core
10:57:54 4 versus whole core. And so if you look at all of the subsequent
10:57:59 5 discussion and the response from David Schott as well as Steve
10:58:04 6 Willson to this e-mail, it talks about the fact that, oh, I think
10:58:07 7 what you're referring to is really the sidewall core
10:58:11 8 compressibility being less than whole core compressibility.

10:58:15 9 So I simply refer to this e-mail as a starting point
10:58:19 10 that, indeed, other reservoir engineers were questioning that value
10:58:22 11 being low because there was some concern about the fact that
10:58:27 12 compressibility values were chosen based on the sidewall cores.

10:58:31 13 Q. Sir, when you say you can't get into their heads as to what
10:58:34 14 they meant by these e-mails, isn't that exactly what you're doing?
10:58:38 15 Basing your decision to use 12 microsips on some e-mails where you
10:58:43 16 haven't talked to the people and you don't know the context of
10:58:45 17 them?

10:58:46 18 A. No, I am not going into their heads. I think that -- the
10:58:49 19 reason I think you keep on saying that I only referred to one
10:58:53 20 reference in my report, but proof of the pudding is basically when
10:58:59 21 what you use in the simulation, because that simulation exercise is
10:59:02 22 the most important exercise you are doing to test the well
10:59:05 23 integrity. And all the e-mails actually reach the same conclusion,
10:59:10 24 that these range of possible values between 6 and 18 is the most
10:59:15 25 appropriate range we should use.

10:59:18 1 Q. Well, we'll see what those e-mails say. I am going to go back
10:59:21 2 over them a little more.

10:59:23 3 A. Okay.

10:59:23 4 Q. In terms of the proof of the pudding, as you say, in what they
10:59:26 5 actually used, you had -- at the time you decided to choose 12
10:59:33 6 microsips for rock compressibility, you hadn't seen the "proof of
10:59:38 7 the pudding" about what BP reservoir engineers, including some of
10:59:43 8 the same ones we've been looking at, like, Bob Merrill, the Senior
10:59:47 9 Reservoir Engineer, you hadn't seen the numbers for rock
10:59:49 10 compressibility that they went back to using after this safety
10:59:54 11 evaluation of the risk of shut-in, had you?

10:59:57 12 A. So are you referring to the certain documents you were showing
11:00:04 13 me at the time of deposition?

11:00:05 14 Q. Sure. Let's take a look at TREX 11551.1.1. And this is that
11:00:26 15 same Senior Reservoir Engineer whose name we saw in the e-mails you
11:00:29 16 talked about on direct examination, Bob Merrill, correct?

11:00:32 17 A. Uh-huh, yes.

11:00:33 18 Q. This is a couple of weeks later when the shut-in is done,
11:00:36 19 right?

11:00:36 20 A. Right.

11:00:37 21 Q. And now, he is writing a technical memorandum trying to predict
11:00:43 22 what pressures would be encountered when the relief well hit the
11:00:48 23 Macondo reservoir, right?

11:00:50 24 A. Yes, yes, I can see that.

11:00:54 25 Q. And he's using -- let's look at TREX 11551.3.1 -- 6 microsips

11:01:06 1 for rock compressibility. Right?

11:01:12 2 A. Yes.

11:01:12 3 Q. And if you based your decision to use 12 microsips on what you
11:01:23 4 thought was a consensus at the time of shut-in, this would indicate
11:01:27 5 a change of that consensus, wouldn't it, sir?

11:01:30 6 A. I don't know what this particular simulation was related to. I
11:01:42 7 haven't looked at the results of this particular simulation. But
11:01:51 8 as I said before, I mean, I think that there are those three
11:01:54 9 possible values. I think if you use a compressibility of 6 -- I
11:01:59 10 think Dr. Merrill also used an aquifer size, which is 3.8 times the
11:02:04 11 size of oil reservoir in the same document, which you are showing
11:02:08 12 me, and if you include the influence of aquifer and compressibility
11:02:13 13 of 6, practically you'll get the same result as no aquifer with 12
11:02:18 14 microsips.

11:02:21 15 There are many combinations. There's a lot of
11:02:24 16 uncertainty in these type of calculations, and you can reach the
11:02:27 17 same conclusion as to amount of oil spilled based on different
11:02:31 18 combinations of these results.

11:02:32 19 Q. When you mention aquifer, you have not included in your -- when
11:02:37 20 you came up with your opinion on the cumulative flow of Macondo,
11:02:41 21 you did not include the contribution of aquifer support to
11:02:46 22 additional -- to what might have been additional flow, correct?
11:02:50 23 You did not regard aquifer support as contributing a quantitative
11:02:54 24 amount in your calculation of cumulative flow?

11:02:57 25 A. No, no, I did not, but I am just showing the same document. It

11:03:01 1 shows the influence of aquifer and that's my point.

11:03:04 2 Q. And in general, because the aquifer is out there in the distal
11:03:09 3 parts of the formation and has a different permeability and there
11:03:14 4 could be faults and so on, aquifer support normally would show up
11:03:18 5 later in a production, not on an 86-day timeframe, right?

11:03:22 6 A. Well, I think that if you look at Dr. Merrill's presentation,
11:03:28 7 it shows a significant difference in average pressure at the end of
11:03:32 8 the shut-in depending on the influence of aquifer. It's about --
11:03:36 9 between 800 psi minus to 200 psi plus. So it's quite significant.

11:03:42 10 MS. ENGEL: Your Honor, Mr. Boles is now asking
11:03:45 11 Dr. Kelkar to analyze aquifer support, which he was fighting pretty
11:03:50 12 hard on direct not to have him do.

11:03:52 13 MR. BOLES: Dr. Kelkar is bringing it into his
11:03:55 14 interpretation of why Dr. Merrill uses 6 microsips for drilling the
11:03:59 15 relief well.

11:04:00 16 THE COURT: Overrule the objection.

11:04:01 17 BY MR. BOLES:

11:04:07 18 Q. Let's go back and pick up the -- and get into these e-mails
11:04:13 19 that you based your guess on that you would use 12 microsips for
11:04:19 20 your base case.

11:04:22 21 Now, you mentioned Steve Willson was the expert
11:04:39 22 geomechanic of the group who we saw in those e-mail strings, right?

11:04:44 23 A. Yes.

11:04:44 24 Q. Let's see what he had to say, TREX 11557.2.1. When he was
11:04:57 25 first apprised of the idea of using some alternative higher numbers

11:05:05 1 for rock compressibility, he e-mailed to Bob Merrill and Kelly
11:05:09 2 McAughan, "I don't think you can go much above 6 microsips and
11:05:14 3 still honor the data," didn't he?

11:05:16 4 A. Yeah.

11:05:17 5 Q. And then later, TREX 11557.1.1, he comes -- he e-mails the same
11:05:29 6 group and some others, "David, I have spoken with Bob Merrill and
11:05:34 7 have more context now around the question being asked." Did I read
11:05:40 8 that correctly?

11:05:40 9 A. You did.

11:05:41 10 Q. And in order to know what the significance is of any subsequent
11:05:48 11 decisions about alternative numbers to use for rock
11:05:52 12 compressibility, you would like to know, wouldn't you, Dr. Kelkar,
11:05:54 13 what that context is that Steve Willson obtained by speaking with
11:06:00 14 Dr. Merrill?

11:06:01 15 A. Not really, because if I read the entire e-mail it says that
11:06:10 16 the initial response was more to do with what we measured on the
11:06:13 17 Macondo, which, as you correctly point out, has some inherent
11:06:17 18 biases. So I am just assuming that people are asking him questions
11:06:21 19 about if there were any inherent biases in the measurements and how
11:06:26 20 they could be corrected. And he is saying, then, I should have
11:06:32 21 something later about this.

11:06:33 22 Q. So you never saw any study or any conclusion by BP that there
11:06:38 23 was biased in the Macondo cores, did you?

11:06:41 24 A. I don't have to, this is what the e-mail says.

11:06:44 25 Q. So you're getting it from these e-mails?

11:06:47 1 A. These are BP experts who are writing these e-mails, so.

11:06:52 2 Q. When Mr. Willson talked about bias, do you know if he was
11:06:56 3 talking upward or downward bias or possibly both or either?

11:07:01 4 A. I think that he is talking about downward bias. And only
11:07:04 5 reason I am concluding is that -- I am not interpreting this
11:07:07 6 e-mail, but subsequent e-mails show that they had to correct for
11:07:13 7 the whole core compressibility by going upward compared to the
11:07:19 8 sidewall cores. I am just assuming that this is an upward bias.

11:07:23 9 Q. They did that on one analog well, correct?

11:07:28 10 A. I don't remember exactly, but I think there were two fields
11:07:31 11 they were referring to, but maybe it could be one. I don't
11:07:34 12 remember exactly.

11:07:35 13 Q. But it would be important to know in terms of knowing whether
11:07:41 14 or not they looked at another field and saw differences in
11:07:45 15 compressibility measurements between two wells, and said, "Maybe
11:07:48 16 there's a bias in rotary sidewall cores, so maybe we should
11:07:53 17 increase what we use for Macondo for the safety evaluation of risk
11:07:56 18 of shut-in and use some higher numbers as well as the measured
11:08:00 19 number." You don't know if that was the context in which all of
11:08:04 20 these e-mails were sent back and forth, do you?

11:08:07 21 A. I mean, I can only read what's in front of me. And the entire
11:08:13 22 e-mail flow never says that we should consider higher value because
11:08:18 23 we are considering well integrity. All the discussion centers
11:08:21 24 around the fact that there is a bias because of sidewall cores, and
11:08:25 25 I just have to believe that discussion.

11:08:27 1 Q. Sir, on your direct examination, you said that sidewall cores
11:08:30 2 are used all the time in this industry, didn't you?

11:08:34 3 A. They are cheaper.

11:08:35 4 Q. And in 30 years of reservoir engineering, you've never heard
11:08:40 5 anybody talk about a downward bias in rock compressibility
11:08:44 6 measurements on rotary sidewall cores, have you?

11:08:48 7 A. I think this is the first time I encountered really rock
11:08:54 8 compressibility to be so prominent, and part of the reason is
11:08:57 9 because the oil reservoir is above bubble point. Most of the times
11:09:02 10 once the reservoir pressure drops below bubble point, the impact of
11:09:06 11 compressibility becomes quite small because gas expansion becomes
11:09:09 12 so much more important.

11:09:10 13 But in this reservoir, it just turns out that rock
11:09:12 14 compressibility has assumed a prominent role.

11:09:15 15 Q. Well, rock compressibility assumed a prominent role in that
11:09:19 16 Society of Petroleum Engineers article that we just saw that you
11:09:22 17 published, didn't it?

11:09:25 18 A. It was one of the parameters. I don't think it was the most
11:09:28 19 important parameter, but it was one of the parameters because we
11:09:31 20 were looking at the water flooding response. But, yeah, I mean, we
11:09:35 21 considered the sensitivity with respect to formation
11:09:36 22 compressibility.

11:09:36 23 Q. It was an important parameter in that article, wasn't it?

11:09:39 24 A. I mean, we considered the sensitivity with respect to rock
11:09:46 25 compressibility. I don't know whether it was -- I don't remember,

11:09:50 1 but it could have been. I mean, I am not saying -- I don't want to
11:09:53 2 say no.

11:09:54 3 Q. You didn't drop any footnotes in that article saying, "By the
11:09:57 4 way, some of these measurements may be off because they're taken
11:10:00 5 with rotary sidewall cores"?

11:10:04 6 A. To be honest, I don't remember when we got the rock
11:10:11 7 compressibility data whether the data came from sidewall or the
11:10:15 8 whole core. I just don't remember that.

11:10:17 9 Q. Let's go back to TREX 11557.1.1, where the rock compressibility
11:10:30 10 expert Steve Willson is telling the reservoir engineers, "I now
11:10:34 11 have context around the question being asked." And you don't know
11:10:40 12 what that context is, do you, sir?

11:10:43 13 A. Well, the only thing I can infer from this e-mail is that --
11:10:49 14 which is the last line in that statement, that which you correctly
11:10:52 15 point out they have some inherent biases. So I assume the context
11:10:56 16 is related to the difference in the sidewall versus whole core.
11:11:02 17 But I don't know. Like I said, I don't know.

11:11:04 18 Q. And you think it would be really important to understand the
11:11:11 19 context of these e-mails that you used to make your decision to use
11:11:16 20 12 microsips?

11:11:18 21 A. All of the subsequent discussions -- and you're showing me one
11:11:25 22 of those e-mails -- but all of the subsequent discussions basically
11:11:28 23 point out to the biases in the sidewall versus the whole core. So
11:11:32 24 I have to assume that that was the discussion which was taking
11:11:35 25 place even outside the context of these e-mails.

11:11:38 1 Q. We will look at the subsequent discussions in a minute, but
11:11:41 2 what I want to focus on, sir, is you think it's really important to
11:11:45 3 understand the context of these documents; like, the context Steve
11:11:51 4 Willson mentions when he says, after having written an e-mail
11:11:55 5 saying, "We have to honor the data. We can't go above 6." And
11:11:59 6 then he has a conversation with Bob Merrill about what's going on
11:12:03 7 with the shut-in coming in. Now he says, "I have more context
11:12:07 8 about the question being asked." And you think it's really
11:12:09 9 important for you to have known that context?

11:12:12 10 A. Sure. I mean, more information you have, I think better are
11:12:17 11 your results for sure.

11:12:18 12 Q. And you don't know what was discussed --

11:12:22 13 A. No, I don't know.

11:12:23 14 Q. -- between Dr. Merrill and Mr. Willson?

11:12:25 15 A. No, I don't know what was discussed, no.

11:12:33 16 Q. And you would agree, wouldn't you, sir, that the BP personnel
11:12:36 17 involved in this modeling were concerned about creating the
11:12:40 18 worst-case scenarios for purposes of ensuring safety during this
11:12:46 19 process?

11:12:48 20 A. I think that the simulation exercise was extremely important
11:12:53 21 from well integrity point of view, absolutely.

11:12:56 22 Q. Yes. But I'm actually being a little more specific, sir. I'm
11:13:01 23 saying that you would agree that the people involved in this model
11:13:04 24 were concerned about creating the worst-case scenarios for purposes
11:13:09 25 of ensuring safety during the shut-in process?

11:13:11 1 A. I absolutely agree. I think they would like to look at the
11:13:20 2 worst-case scenario and ensure that, indeed, the results will cover
11:13:23 3 the broad range of possibilities, yes.

11:13:25 4 Q. Now, let's look at -- after Mr. Willson gets the context, let's
11:13:37 5 see an e-mail that I don't believe you spoke about in your direct
11:13:41 6 examination, 8772.1.1.

11:13:48 7 This is Kelly McAughan, Bob Merrill, "Steve Willson did a
11:13:53 8 check of the calculator for us, too. That is how we arose at 6
11:13:58 9 microsips. I even talked to him last Thursday about it as a check
11:14:01 10 and he said that it is still a good number especially with our
11:14:05 11 lower porosities." Do you see that, sir?

11:14:08 12 A. Yes.

11:14:08 13 Q. "But I will see if he can give us a maximum value as well." So
11:14:16 14 what -- do you, in your discerning of science from the BP e-mails
11:14:23 15 to come up with 12 microsips, what do you make of that, that the
11:14:27 16 geomechanic specialist, Steve Willson, still thinks 6 is a good
11:14:31 17 number, but he will see if he can give us a maximum?

11:14:33 18 A. Yes.

11:14:33 19 Q. Did that figure into your decision to use 12 microsips based on
11:14:38 20 these e-mails?

11:14:39 21 A. I think that what I am reading from this e-mail, and I think
11:14:43 22 this is quite consistent with all of the subsequent e-mails, is
11:14:47 23 that there is some inherent bias in the measurements and he wanted
11:14:53 24 to make sure all of the range of possibilities are considered. And
11:14:57 25 Steve is going to consider basically what is the maximum

11:15:00 1 possible value you can have with respect to rock compressibility,
11:15:05 2 and there is the decision that the value is between 6 and 18.

11:15:09 3 So, look, I am not arguing here that my value of 12 is
11:15:14 4 the correct one versus 6 or 18. I think if you look at the range
11:15:19 5 of possibilities, which is 6 to 18, I simply reproduce my results
11:15:25 6 between 6 and 12 in my material balance calculations because I am
11:15:29 7 assuming that the results which are presented in these e-mails are
11:15:32 8 reflective of what I have done in my calculations.

11:15:36 9 Q. Well, are you assuming that the results that we saw reflected
11:15:40 10 in Mr. Merrill's going back to using 6 microsips after the risk
11:15:46 11 evaluation of shut-in was done and he is modeling the relief well,
11:15:50 12 are you assuming that that reflects the right value for rock
11:15:53 13 compressibility?

11:15:54 14 A. It could be if you take aquifer into account. I mean, the
11:15:58 15 thing is, that's what I'm saying, that I didn't include aquifer,
11:16:02 16 Dr. Merrill included aquifer. And I think these are all of the
11:16:05 17 possibilities one has to look at when you are examining the
11:16:10 18 results.

11:16:14 19 Q. Let's look at TREX 9318.4.1. Here is a BP model done after the
11:16:30 20 shut-in risk evaluation using 6 microsips where there was an
11:16:34 21 assumption of no aquifer. Did you consider this in coming up with
11:16:39 22 your opinion that you would use 12 microsips based on what BP
11:16:43 23 scientists believed?

11:16:45 24 A. I think that I've looked at this document, but there is also
11:16:49 25 another model which also had 14 microsips.

11:16:51 1 Q. Let's take a look at that, TREX 9318.8.1. Part of the same
11:17:02 2 presentation. And sure enough, there it is, last line, rock
11:17:07 3 compressibility of 14 microsips, right, Dr. Kelkar?

11:17:10 4 A. Yes.

11:17:10 5 Q. And let's look what it says up above. "USGS parameters
11:17:16 6 increased C_R ." That's rock compressibility, right?

11:17:20 7 A. Uh-huh.

11:17:21 8 Q. So he is modeling there using the alternative numbers that the
11:17:26 9 government is using at that time -- or do you know?

11:17:29 10 A. I assume USGS is U.S. Geological Survey, so.

11:17:36 11 Q. You mentioned analog well, sir. Let's take a look at TREX
11:17:41 12 9283.43. Have you ever seen this before?

11:17:53 13 A. I have.

11:17:53 14 Q. And this is the predrill prediction of rock compressibility at
11:17:58 15 Macondo done by that same rock mechanics expert, Steve Willson, who
11:18:05 16 acknowledged that there could be bias. Didn't say how much or
11:18:09 17 didn't say it was always one direction, but acknowledged there
11:18:13 18 could be bias in the rotary sidewall core, correct?

11:18:17 19 A. Yes.

11:18:17 20 Q. And you mentioned in your direct examination looking at analog
11:18:20 21 wells, correct?

11:18:21 22 A. Yes.

11:18:21 23 Q. When you did your own evaluation of the Macondo well, it was
11:18:25 24 your opinion that analog wells shouldn't be considered, right?

11:18:29 25 A. Are you talking of my --

11:18:34 1 Q. Before you were a litigation expert, when you were working for
11:18:36 2 the federal Flow Rate Technical Group earlier in the incident, you
11:18:41 3 said, "I am not going to consider analog wells. They're too far
11:18:45 4 away."?

11:18:45 5 A. I had data from one well, and the fluid properties from that
11:18:49 6 well were significantly different, and I was given only one week to
11:18:54 7 perform my analysis. So it was very difficult to use that data,
11:18:59 8 actually.

11:19:00 9 But anyway, yes, I did not use the one -- the data from
11:19:04 10 one oil well, yes, that's true.

11:19:06 11 Q. Well, let's talk about that, your having only one week to do
11:19:08 12 that analysis. As a result of having only one week, you were
11:19:14 13 careful to note to the federal Minerals Management Service, MMS,
11:19:22 14 that there were uncertainties in your analysis, correct?

11:19:25 15 A. Yes.

11:19:26 16 Q. And let's see -- let's take a look at TREX 9841 -- actually,
11:19:39 17 that's not what I want to look at. I want to look at the Kelkar
11:19:44 18 report. Just a minute, I'll get you the page. We're looking for
11:20:09 19 the page on 9859.19 -- before we go, don't change it yet, sorry.
11:20:22 20 This is your report commissioned by the federal Minerals Management
11:20:28 21 Service as part of the Flow Rate Technical Group on the Macondo
11:20:31 22 well, correct?

11:20:31 23 A. Yes.

11:20:32 24 Q. And, again, you wanted to note the uncertainties that were
11:20:36 25 inherent in your analysis, right?

11:20:38 1 A. Yes.

11:20:39 2 Q. So let's look at page 19, 9859.19. And let's highlight the
11:20:48 3 fourth paragraph, please. No. 4. So you said -- this is what you
11:20:52 4 reported, "Uncertainties in rock compressibility. We have used the
11:20:56 5 average rock compressibility 5.61 microsips" -- correct?

11:21:01 6 A. Yes.

11:21:01 7 Q. -- "from the database as a base case and maximum
11:21:06 8 compressibility of 8 microsips for the high case." Correct?

11:21:09 9 A. Yes.

11:21:09 10 Q. In terms of the bias of rotary sidewall cores, you understand
11:21:31 11 that to be caused by the fact that there can be horizontal
11:21:35 12 laminations on rock than cause its strength properties to be
11:21:39 13 different in the horizontal plane versus a vertical plane?

11:21:43 14 A. I think that's the inference I got from the e-mails which I
11:21:47 15 have read, yes.

11:21:48 16 Q. And your analysis of the Macondo rock is that there are no such
11:21:52 17 laminations that would cause that kind of bias, isn't it?

11:21:55 18 A. I didn't really do that type of analysis in Macondo myself.

11:22:03 19 Q. I don't know whether you did the analysis, but you said that
11:22:08 20 you don't see shale laminations in the Macondo sandstone?

11:22:12 21 A. That is true. I think what I said is that there are no
11:22:16 22 laminations in the -- let me see how I said it. I think that the
11:22:23 23 sand is clean, I think that's what I said, the gamma ray log shows
11:22:25 24 the blocky structure of the sand in the model, I think that's what
11:22:30 25 I said, which is true. I mean, the gamma rays actually do indicate

11:22:34 1 very clean sand.

11:22:37 2 Q. I think I am going to leave behind for a moment rock
11:22:40 3 compressibility and go to the next of the three variables in your
11:22:43 4 material balance equation, which I guess we're calling stock-tank
11:22:54 5 original oil in place; is that right?

11:22:55 6 A. Yes.

11:22:55 7 Q. In your direct examination, you talked a fair amount about
11:23:06 8 uncertainty in the material balance analysis that's caused by
11:23:14 9 uncertainty in the original oil in place; is that right?

11:23:16 10 A. I think one of the input parameters where there is an
11:23:21 11 uncertainty of the initial oil in place, yes.

11:23:24 12 Q. Now, you believe that the amount of oil that flowed from the
11:23:40 13 Macondo well can be accurately estimated using material balance,
11:23:45 14 the method you and Dr. Blunt have used, correct?

11:23:50 15 A. I mean, are you saying that -- am I implying that there is a
11:23:55 16 single value? Because I am not.

11:23:56 17 Q. Actually, sir, I am not saying anything. This is the very
11:23:59 18 first sentence from --

11:24:00 19 A. Yeah, I mean, I think that, yeah, within the realm of
11:24:03 20 uncertainty obviously material balance is a reasonably good method
11:24:06 21 to calculate the amount of oil spill, absolutely.

11:24:10 22 Q. That's not actually what you said in your report. What you
11:24:11 23 said in the very first sentence of your executive summary was, "The
11:24:14 24 amount of oil that's spilled from the Macondo well can be
11:24:17 25 accurately estimated using standard industry accepted petroleum

11:24:22 1 engineering techniques."

11:24:23 2 A. Okay.

11:24:24 3 Q. Isn't that right? I mean, do you agree with that or have you
11:24:28 4 changed your opinion?

11:24:29 5 A. I mean, I think what you read is correct. I think that what I
11:24:33 6 believe in, actually, that I think that -- but that does not mean
11:24:37 7 that there are no uncertainties in this analysis. Yes, but --
11:24:40 8 yeah, okay, I think I agree with what you just said.

11:24:45 9 Q. And in terms of uncertainties, it's your opinion that -- well,
11:24:56 10 under direct examination you talked about uncertainties as
11:24:58 11 indicated by the predrill analysis by BP of geology and geophysics,
11:25:05 12 right?

11:25:06 13 A. You're talking about the oil in place?

11:25:08 14 Q. Yes, oil in place.

11:25:10 15 A. Okay. Yes, so I think that there was a predrill report which
11:25:16 16 actually had the P10, P50 and P90 values as to how much oil there
11:25:22 17 was in place, yes.

11:25:23 18 Q. So P10 is what was predrill, that's given a 10 percent
11:25:29 19 probability of being found?

11:25:30 20 A. Right.

11:25:31 21 Q. And P90 a 90 percent probability?

11:25:34 22 A. Yes.

11:25:34 23 Q. And P50 being the middle?

11:25:36 24 A. Yes.

11:25:36 25 Q. And P50 is what you used?

11:25:39 1 A. I did. And I think what I was saying in my direct testimony is
11:25:44 2 that the reason I concentrated on P50 is because of subsequent
11:25:50 3 drilling of the well which provided the thickness of the reservoir
11:25:54 4 at that location, which was consistent with what was predicted in
11:25:57 5 the P50 estimate.

11:25:58 6 Q. And that's what I want to focus on, sir.

11:26:00 7 A. Okay.

11:26:01 8 Q. Because on your direct examination, you -- when you were asked
11:26:04 9 whether there was more uncertainty with material balance than other
11:26:06 10 methods, the thing you said is that, well, you have to rely on
11:26:10 11 geological data and geophysical data. And then you went on to talk
11:26:16 12 about the range of possible oil in place from BP's predrill
11:26:22 13 analysis of geological and geophysical data, right?

11:26:25 14 A. That's true.

11:26:26 15 Q. But it's your opinion, isn't it, sir, that that uncertainty was
11:26:29 16 greatly reduced by the fact that when BP drilled the well they hit
11:26:37 17 exactly the thickness that they had produced -- that they had
11:26:41 18 predicted predrill, right?

11:26:43 19 A. Yes.

11:26:44 20 Q. That narrowed the uncertainty in using the material balance
11:26:52 21 analysis with respect to the original oil in place variable?

11:26:56 22 A. It definitely would narrow the uncertainty because you actually
11:26:59 23 validated your P50 model to some extent by drilling the well.

11:27:03 24 Q. So you have a more precise and reliable estimate of that STOIIIP
11:27:11 25 variable in the material balance equation than you do if you use

11:27:14 1 the predrill predictions that varied all over the place?

11:27:17 2 A. Post drill uncertainty is definitely less than predrill
11:27:20 3 uncertainty, absolutely.

11:27:21 4 Q. Well, in particular here, sir, where the predrill prediction is
11:27:25 5 based on interpretation of seismic data and geology, correct?

11:27:29 6 A. Yes.

11:27:29 7 Q. So they're trying to estimate, looking at different treatments
11:27:34 8 of seismic data, how wide the field may be, right?

11:27:38 9 A. Right.

11:27:38 10 Q. And how long?

11:27:39 11 A. Yes.

11:27:39 12 Q. And how thick?

11:27:41 13 A. Yes.

11:27:42 14 Q. So if you -- if the geophysicists and geologists make a
11:27:48 15 prediction based on that and then they drill exactly the thickness
11:27:52 16 that they predicted as the P50, then you have a far more certain
11:27:56 17 and more reliable estimate of the STOIIIP variable in the material
11:28:02 18 balance equation?

11:28:03 19 A. The uncertainty will definitely be a lot smaller after the well
11:28:07 20 was drilled, yes, that is true.

11:28:09 21 Q. And you have said that you think that the STOIIIP numbers that
11:28:20 22 are being used by you and Dr. Blunt have a remarkable consistency?

11:28:26 23 A. Not the STOIIIP numbers. The hydrocarbon pore volume.

11:28:33 24 Q. So what you refer to as the initial volume of oil numbers being
11:28:38 25 used?

11:28:38 1 A. But that's at reservoir conditions rather than under standard
11:28:44 2 conditions, because he does use different value of the formation
11:28:47 3 volume factor. So his STOIIP is different, but his hydrocarbon in
11:28:52 4 place is similar, yes. That's what I said, yes.

11:28:55 5 Q. And there is one other thing that he does different from you in
11:28:58 6 terms of deriving the STOIIP number, isn't there, sir, pretty major
11:29:03 7 factor?

11:29:05 8 A. He does his own analysis of the pressure data, is that what
11:29:09 9 you're referring to?

11:29:10 10 Q. Yes. But using that pressure data -- by the way, in your last,
11:29:14 11 in the last summary slide I saw summarizing your criticism of
11:29:20 12 Dr. Blunt, I can only just take a note here, you were criticizing
11:29:24 13 his material balance analysis and you said he does not include
11:29:27 14 pressure data, right? If that was listed as one of your criticisms
11:29:36 15 of Dr. Blunt, that would be incorrect, wouldn't it?

11:29:39 16 A. It shouldn't have said that, yeah. I mean, I cannot imagine we
11:29:45 17 would have said that.

11:29:46 18 Q. He didn't use the PT-B pressure data from the time period of
11:29:51 19 the incident, right?

11:29:52 20 A. Yeah, I think dynamic information, he did not use the dynamic
11:29:59 21 pressure data, but that's true of any material balance method.
11:30:01 22 It's a limitation of material balance technique that you cannot
11:30:04 23 include the dynamic data in that analysis, yes.

11:30:07 24 Q. Well, he used the data from the pressure gauge put on the
11:30:13 25 capping stack and used to measure the pressure buildup after

11:30:17 1 shut-in, didn't he?

11:30:18 2 A. He did.

11:30:19 3 Q. And he used the pressure data that was measured before the
11:30:23 4 incident as well, correct?

11:30:29 5 A. Before the -- you're talking about flowing pressure or you're
11:30:33 6 talking about the shut-in pressure?

11:30:34 7 Q. The reservoir pressure.

11:30:35 8 A. He had the initial pressure data.

11:30:40 9 Q. Right.

11:30:41 10 A. And then he used the buildup after the well was shut-in and
11:30:45 11 matched that buildup pressure with his model. So he used the
11:30:49 12 pressure data after the well was shut in, yes.

11:30:52 13 Q. Another criticism you had of Dr. Blunt, while we're on this
11:30:57 14 subject, is that he -- and I am just going to read from your
11:31:02 15 report, that "Dr. Blunt has completely ignored the rate variation
11:31:07 16 that occurred just prior to shut-in as the choke valve closed."
11:31:11 17 Did you write that in your report, sir?

11:31:13 18 A. If you quote it, then I assume I wrote it. Yes.

11:31:18 19 Q. Let's take a look. It's TREX 11550R.7.1. There we go. Is
11:31:36 20 that an accurate excerpt from your expert report?

11:31:39 21 A. It is.

11:31:39 22 Q. And you now know that's not correct, right?

11:31:42 23 A. I think that there was one case he did consider the fact that
11:31:46 24 that were -- from Ratzel report, he did consider the rate
11:31:50 25 variation.

11:31:50 1 Q. Right. In other words, he has a whole appendix devoted to
11:31:54 2 that, doesn't he?

11:31:55 3 A. You're talking about the rate variation prior to --

11:31:59 4 Q. Yes, his appendix is completely devoted to looking at how might
11:32:05 5 rate changes affect the validity of my analysis?

11:32:08 6 A. Well, I think this particular statement which I was making was
11:32:11 7 related to just prior to shutting the well in. If you look at his
11:32:15 8 different rate profiles which he has in that appendix, they don't
11:32:18 9 really include this particular effect, so I am not referring in
11:32:22 10 general to a specific rate variation just prior to shut in.

11:32:26 11 I think that my point was, and I think there is a
11:32:32 12 significant discussion in my rebuttal report, and I think
11:32:35 13 Dr. Gringarten uses the rate variation prior to shut-in, I have
11:32:39 14 used the rate variation prior to shut-in. And what I show is that
11:32:45 15 the relative behavior of the pressure is quite different if you
11:32:48 16 account for the rate variation prior to shut-in.

11:32:51 17 So I am not saying he completely ignores all of the rate,
11:32:55 18 I am just saying just prior to shut-in.

11:32:56 19 Q. Actually, you were saying he completely ignores it, but you're
11:32:59 20 saying now you don't mean that?

11:33:01 21 A. No, that statement just says just prior to shut-in. I mean, it
11:33:05 22 very specifically says that.

11:33:06 23 Q. Well, in fact, he looked at rate data just prior to shut-in,
11:33:11 24 right?

11:33:11 25 A. And he does, he does consider one case, so you're right.

11:33:15 1 Q. Now, Dr. Blunt also analyzes whether the entirety of the
11:34:04 2 oilfield sandstone would be connected to the Macondo well, doesn't
11:34:13 3 he?

11:34:13 4 A. He does.

11:34:15 5 Q. That's a connectivity analysis?

11:34:17 6 A. Yes.

11:34:18 7 Q. Now, you haven't done your own expert analysis of the geology
11:34:23 8 of Macondo reservoir, have you?

11:34:24 9 A. I did not.

11:34:27 10 Q. Just to go over a little background, the geology is that this
11:34:31 11 sandstone reservoir consists not of a uniformly thick and
11:34:38 12 extensively continuous slab, but it's actually made up of a
11:34:42 13 number -- an unknown number of individual sinuous channels of sand
11:34:49 14 that were deposited on the bottom of the ocean?

11:34:51 15 A. Yes.

11:34:51 16 Q. And it's important to know -- since it's not just a continuous
11:34:59 17 slab of sand, it's important to know how much of that colored blob
11:35:03 18 that we see down there in the seismic is actually channels that are
11:35:07 19 connected to the well and how many of them are not, right?

11:35:09 20 A. Yes.

11:35:09 21 Q. In fact, that's one of the primary jobs of a reservoir engineer
11:35:13 22 is assessing connectivity, isn't it?

11:35:16 23 A. If you want to predict something, yes.

11:35:18 24 Q. And you haven't done any independent analysis of whether there
11:35:31 25 are possible compartments or baffles or barriers to flow for fluids

11:35:36 1 traveling from other channels that might not have been directly
11:35:40 2 connected to the well?

11:35:42 3 A. So let me explain it this way. I think that when BP predicted
11:35:47 4 P10, P50 and P90, and typically when you use the geophysical data
11:35:52 5 to evaluate that information, they will use certain seismic
11:35:57 6 threshold, cutoff to determine what volume is connected.

11:36:02 7 So BP had already included certain cutoffs to determine
11:36:07 8 how much oil volume is connected under P10, P50 and P90 case. The
11:36:13 9 fact that they drilled the well turned out that the thickness was
11:36:17 10 consistent with what was observed clearly indicated that BP had
11:36:21 11 done a good analysis of the geological and geophysical data. And I
11:36:25 12 didn't see any reason that I should second-guess what BP had done.

11:36:31 13 Q. Now, what they analyze -- I didn't mean to cut you off. Sorry.

11:36:34 14 A. Just one more thing. And then subsequent to shutting the well,
11:36:40 15 there was a pressure buildup where the pressure measurements were
11:36:45 16 collected. And those pressure measurement indicated a very strong
11:36:50 17 connectivity in the channel sand. So I think both of those pieces
11:36:55 18 of information tells you that the well is well connected to the
11:36:59 19 reservoir and it's a channel sand, and the linear flow behavior is
11:37:05 20 quite indicative in the pressure data.

11:37:07 21 Q. So I guess we agree that it's appropriate and standard use to
11:37:13 22 use the pressure data to assess the degree of connectivity,
11:37:17 23 correct?

11:37:17 24 A. Absolutely.

11:37:18 25 Q. Dr. Blunt did such an analysis, didn't he?

11:37:21 1 A. He did use it.

11:37:22 2 Q. And you did not?

11:37:23 3 A. I mean, I showed that basically in my analysis that the
11:37:28 4 pressure data indicates a strong continuity, but the reason I did
11:37:34 5 not use the type of analysis Dr. Blunt did is because of the fact
11:37:38 6 that there is so much uncertainty in the rate prior to shutting of
11:37:43 7 the well, and I state that in my rebuttal report as well as my
11:37:49 8 original report.

11:37:50 9 It's not like that the well test analysis is impossible
11:37:54 10 to do. I think there are a lot of softwares which are available
11:37:57 11 which you can analyze the well test data. The problem is that when
11:38:01 12 there is a lot of great uncertainty, it is very difficult to do
11:38:04 13 that type of evaluation.

11:38:05 14 Q. I thought I just heard you say in answer to my prior question,
11:38:09 15 sir, that you did look at somebody's pressure analysis and assure
11:38:12 16 yourself that there was complete connectivity of this reservoir.

11:38:16 17 A. No, it's my own pressure data. I mean, I think I showed that
11:38:19 18 in my direct -- I mean in the original report, the half slope on
11:38:25 19 the pressure data and show that basically, showed a very strong
11:38:30 20 connectivity in the reservoir.

11:38:30 21 Q. So your pressure analysis is reliable in terms of connectivity,
11:38:34 22 but Dr. Blunt 's isn't in terms of being able to use pressure from
11:38:39 23 the Macondo buildup to assess connectivity?

11:38:42 24 A. No. I think that he also shows the similar type of strong
11:38:47 25 connectivity in the data -- I don't have any objections to that. I

11:38:52 1 think that what I object to is the fact that he ignores certain
11:38:57 2 pressure data after shut-in, and what I mentioned in my direct
11:39:03 3 examination is that one of the main purposes of the buildup data is
11:39:08 4 to estimate the reservoir parameter, such as skin factor and
11:39:13 5 permeability, and the early pressure data can be quite useful in
11:39:18 6 that analysis.

11:39:19 7 Dr. Blunt does ignore some of the pressure data, and then
11:39:22 8 when he calculates the permeability, he decides to discard it and
11:39:27 9 instead chooses to use a permeability value which is given by
11:39:33 10 Dr. Gringarten.

11:39:33 11 Q. He uses a higher permeability value, isn't that right, than the
11:39:37 12 one that he deduced?

11:39:40 13 A. He uses 329 millidarcies than 300. But my point is he discards
11:39:46 14 his own estimate. He calculates the permeability and he discards
11:39:51 15 it because he says it's not reliable, so I am going to go back to
11:39:56 16 Dr. Gringarten's value. And so --

11:39:58 17 Q. Dr. Kelkar -- I'm sorry, I didn't mean to cut you off.

11:40:00 18 A. Go ahead.

11:40:01 19 Q. Dr. Kelkar, you really think that if Judge Barbier goes and
11:40:03 20 looks at Dr. Blunt's report he is going to see a sentence in there
11:40:07 21 saying, "my determination of permeability is not reliable"?

11:40:10 22 A. Okay. I don't know the exact statement, but I think he says
11:40:13 23 that Dr. Gringarten's value is more reliable, so I am going to use
11:40:17 24 that. Something to that effect.

11:40:18 25 Q. And there's a good reason for that, right, sir? Dr. Gringarten

11:40:22 1 is the world's leading expert on well test analysis, as you told me
11:40:27 2 in your deposition?

11:40:27 3 A. That's not the reason Dr. Blunt actually uses Dr. Gringarten's
11:40:31 4 value. I think his reason is interesting, and it's quite
11:40:34 5 appropriate, is that because in the MDT testing, which is what
11:40:40 6 Dr. Gringarten analyzes, he has rate information; whereas, when
11:40:44 7 Dr. Blunt uses his data, he realizes there is no rate information
11:40:49 8 available.

11:40:49 9 Q. And that's because in assessing permeability in standard
11:40:57 10 petroleum engineering, you want to know the pressure and the rate
11:41:01 11 history?

11:41:01 12 A. Absolutely.

11:41:02 13 Q. And there's only one time that that's available here in a
11:41:10 14 measured way outside of the blowout, outside of the incident, and
11:41:14 15 that was before the incident on April 12th when that wireline tool
11:41:19 16 was put down the well that you're referring to as the MDT, correct?

11:41:23 17 A. Yes.

11:41:23 18 Q. And then when that -- when that tool was sucking sample fluids
11:41:30 19 out of the reservoir, it was measuring flow rate and pressure
11:41:34 20 response, and those are the two things you need to get
11:41:37 21 permeability, correct?

11:41:38 22 A. Yes.

11:41:38 23 Q. And that's what Dr. Gringarten used to derive his permeability
11:41:42 24 number?

11:41:43 25 A. That is correct.

11:41:44 1 Q. And he is the only one in this case who has derived a
11:41:46 2 permeability number with that MDT tool where you know the flow rate
11:41:50 3 and you know the pressure history, and it's not affected by all of
11:41:53 4 these uncertainties of the incident we've talked about?

11:41:55 5 A. Dr. Larsen also did that, but Dr. Gringarten did that, yes.

11:42:00 6 Q. You had a criticism of Dr. Gringarten's use of the MDT to
11:42:06 7 assess or measure or estimate permeability in your rebuttal report,
11:42:10 8 didn't you, sir?

11:42:11 9 A. What I say in my report is not necessarily the criticism of his
11:42:18 10 analysis. I am not an expert in MDT. What I say is that the scale
11:42:23 11 of issues in the permeability measurement can be quite important.
11:42:28 12 And when I refer to that is that when you are making measurements
11:42:31 13 of permeability based on core data versus MDT data versus well
11:42:34 14 tests, you are going to see some variation, and that's because of
11:42:37 15 the differences in the scale.

11:42:39 16 So what I was talking about is that appropriateness of
11:42:41 17 the scale. I don't think I was criticizing, per se, his analysis.

11:42:45 18 Q. And by "scale," you mean how far out into the reservoir is that
11:42:52 19 MDT taking the temperature of the permeability, if you will, or
11:42:55 20 measuring the permeability?

11:42:57 21 A. Yes, I think that's --

11:42:58 22 Q. Sometimes known as a radius of investigation?

11:43:00 23 A. That's correct.

11:43:01 24 Q. And I believe you told me in deposition that you would be
11:43:03 25 reassured of the reliability of an MDT tool estimate of

11:43:07 1 permeability as long as the radius of investigation was several
11:43:11 2 hundred feet out?

11:43:12 3 A. That's what I said.

11:43:13 4 Q. And you don't know as you sit here, sir, whether, in fact, the
11:43:17 5 MDT tool's radius of investigation for measuring permeability out
11:43:22 6 into the reservoir is, say, on the order of 600 feet?

11:43:26 7 A. I don't know.

11:43:27 8 Q. I want to go back again to connectivity. You have not done
11:43:36 9 your own expert analysis of the geology of Macondo, correct?

11:43:41 10 A. No, and I explained the reasons.

11:43:43 11 Q. And you have not analyzed how much of the total volume of oil
11:43:50 12 that was down in the Macondo reservoir was connected to the well?

11:43:56 13 A. What I mentioned -- again, let me just repeat that. I did not
11:44:02 14 do that analysis. But when BP predicted P10, P50 and P90,
11:44:07 15 essentially they used certain cutoffs of connectivity to determine
11:44:11 16 the connected volumes. I didn't see any reason that I should do
11:44:14 17 that analysis myself again.

11:44:15 18 Q. Sir, in that -- you're referring to the BP predrill geology and
11:44:21 19 geophysical report that was shown on direct examination, correct?

11:44:25 20 A. Yes.

11:44:25 21 Q. And there's -- that report doesn't say anything about a
11:44:29 22 connectivity analysis, does it?

11:44:31 23 A. It doesn't.

11:44:32 24 Q. And you don't believe that there are Gulf of Mexico reservoirs
11:44:42 25 of the geological type of Macondo that have a hundred percent

11:44:46 1 connectivity, do you?

11:44:47 2 A. Huh-uh, that's true. But I think that the cutoffs do actually
11:44:54 3 capture that type of connectivity is my point. But, yes, I mean,
11:44:57 4 there are no reservoirs with hundred percent connectivity.

11:44:59 5 Q. But you don't know -- you don't know all of the factors that
11:45:03 6 went into deciding the BP's predrill P10, P50, P90 cutoffs?

11:45:08 7 A. No.

11:45:09 8 Q. And you don't know whether that included connectivity?

11:45:12 9 A. No. They will include connectivity, that's why you get the
11:45:16 10 pessimistic, the optimistic and the P50 cases. I don't know the
11:45:20 11 specific values. I think that's what you're asking me.

11:45:23 12 Q. Well, there are a lot of reasons you can have a P10, P50, P90
11:45:28 13 variation, aren't there, sir?

11:45:29 14 A. Yeah. It is possible that there could be a difference of
11:45:33 15 physical interpretation of the data, and that might have resulted
11:45:36 16 in different values. But in general, when you look at the
11:45:39 17 geophysical analysis, the most common method of defining different
11:45:45 18 volumes is using different cutoffs, certain seismic attribute
11:45:49 19 cutoff, which is used to determine how much volume is there.

11:45:52 20 Q. But that BP predrill report doesn't say anything about
11:45:58 21 connectivity, does it?

11:45:59 22 A. No.

11:45:59 23 Q. So whether or not those numbers factor in a connectivity
11:46:04 24 prediction predrill, you don't know for sure?

11:46:08 25 A. It's not mentioned.

11:46:10 1 Q. And in any event, the best way to know that, as I think you
11:46:14 2 were saying earlier, is to do a post drill evaluation from how the
11:46:19 3 pressure wave moves out and where it hits boundaries and whether
11:46:23 4 it's hitting boundary short of the full extent of the oilfield
11:46:28 5 reservoir, correct?

11:46:29 6 A. That's one way. But it's not that easy.

11:46:36 7 Q. And you think it's absolutely possible that some of the
11:46:38 8 channels in the Macondo reservoir are not or were not connected to
11:46:44 9 the well?

11:46:44 10 A. I have no way of knowing that, yes.

11:46:53 11 Q. Now, I want to take a brief break from walking through the
11:46:59 12 material balance variables of compressibility and original oil in
11:47:06 13 place and talk to you a little bit more about this parameter of
11:47:09 14 permeability.

11:47:25 15 Now, let's see -- let's look at Demonstrative D-21003.1.
11:47:39 16 This was used by United States during their opening statement as
11:47:44 17 sort of a range of permeability estimates. On the left-hand side
11:47:48 18 you see the column that says "Predrill Estimates"?

11:47:52 19 A. Yes.

11:47:53 20 Q. Dr. Kelkar, as a petroleum engineer, you wouldn't put reliance
11:47:58 21 on a predrill estimate once you have post drill data, would you?

11:48:03 22 MS. ENGEL: Your Honor, Dr. Kelkar doesn't offer an
11:48:05 23 opinion on permeability in his report, so I'm not sure where we're
11:48:08 24 going with this.

11:48:08 25 MR. BOLES: Actually, he does, your Honor. On direct

11:48:09 1 examination he talked about productivity index as being an
11:48:12 2 important part of validating his cumulative flow number and he used
11:48:17 3 a number for permeability in there of 300 millidarcies, and I can
11:48:21 4 give you the cite.

11:48:22 5 MS. ENGEL: If he wants to ask him about his productivity
11:48:26 6 index calculation, he can ask that, but I don't understand where
11:48:29 7 we're going with the permeability specific question.

11:48:33 8 MR. BOLES: Where we're going is the reasonableness of
11:48:34 9 permeability numbers that he's used and other experts have used,
11:48:37 10 just as you've asked him about reasonableness of what other experts
11:48:40 11 have done.

11:48:41 12 THE COURT: Okay. Go ahead. I'll overrule the
11:48:43 13 objection.

11:48:46 14 BY MR. BOLES:

11:48:47 15 Q. Dr. Kelkar, I want to refer you to the second column there, the
11:48:51 16 second kind of fuzzy green column that says "Post Drilling
11:48:55 17 Technical Memorandum." Do you see that?

11:48:59 18 A. Okay.

11:49:00 19 Q. And it kind of shows permeability as sort of a fading-out
11:49:07 20 bottom and top, or the top around 500 millidarcies, do you see
11:49:12 21 that?

11:49:12 22 A. Okay.

11:49:13 23 Q. Now, you got -- let's take a look at the chart of
11:49:19 24 permeabilities from that document. Let's look at TREX 9767.19.
11:49:36 25 You've seen that before, right, sir?

11:49:37 1 A. Yes.

11:49:38 2 Q. And you used that in coming up with your permeability of 300
11:49:43 3 millidarcies?

11:49:44 4 A. I used the core average to calculate the productivity index.

11:49:52 5 Q. When you looked at the core data you calculated a permeability
11:49:55 6 of 300 millidarcies, correct?

11:49:57 7 A. Yes.

11:49:57 8 Q. But you also say in your report that BP's post drill summary
11:50:03 9 report indicates a permeability of 300 millidarcies?

11:50:07 10 A. Right, right. I think this is that report.

11:50:10 11 Q. Not 500 millidarcies?

11:50:13 12 A. Yeah, I used the average from here, yes.

11:50:15 13 Q. Now, I want to look at what you did when you looked at the --
11:50:23 14 when you talk about the core data, we're talking about measurements
11:50:26 15 on rock samples by Weatherford Laboratories?

11:50:29 16 A. Yes. And I think -- I believe they were corrected for air to
11:50:36 17 liquids, I think.

11:50:37 18 Q. In other words, those air permeabilities on the two right-hand
11:50:44 19 columns, arithmetic air permeability, that's arithmetic average air
11:50:50 20 permeability, correct?

11:50:50 21 A. Yes, from that particular zone.

11:50:52 22 Q. From each of those different horizons?

11:50:55 23 A. Yes.

11:50:56 24 Q. The numbers on the far right column, that stands for geometric
11:51:00 25 average air permeability, right?

11:51:02 1 A. Yes.

11:51:02 2 Q. And so those numbers were corrected or scaled by BP engineers
11:51:09 3 for what it would -- what their equivalent would be in permeability
11:51:14 4 to oil, right?

11:51:14 5 A. Yes.

11:51:15 6 Q. And you did the same thing when you looked at this data, didn't
11:51:22 7 you?

11:51:22 8 A. For which case? I mean, I just used one value in my report,
11:51:29 9 which is 300 millidarcies.

11:51:31 10 Q. After looking at this data?

11:51:33 11 A. Yes, yes.

11:51:34 12 Q. From the BP post drill technical evaluation?

11:51:37 13 A. Yes.

11:51:38 14 Q. Now, let's go back again to your report to the federal
11:51:45 15 government before you were a litigation expert, TREF 9859, and
11:51:57 16 let's look at page 17, so that's 9859.17. So here you took a
11:52:06 17 couple of columns from the Weatherford measurements, I'm referring
11:52:11 18 to the two right-hand columns, permeability for two different
11:52:20 19 petroleum-based fluids, decalene and xylene?

11:52:25 20 A. Yes.

11:52:25 21 Q. Based on your analysis you concluded that the permeability of
11:52:29 22 the Macondo reservoir was about 70 millidarcies, didn't you?

11:52:32 23 A. Yes.

11:52:34 24 Q. And we talked earlier about since you were rushed and only had
11:52:37 25 a week to do this, you thought it was important to tell the Mineral

11:52:42 1 Management Service a range of uncertainty in your parameters,
11:52:45 2 right?

11:52:45 3 A. Yes. And I think I used 50 percent more than this value. But
11:52:50 4 I think these values are wrong. I mean, clearly I think I
11:52:53 5 discussed that in my deposition that these are way too low. And I
11:52:59 6 think the cores were not clean and I think I just thought that
11:53:02 7 liquid permeability would be more representative in my calculation,
11:53:05 8 but it turns out to be the fact that I was wrong in using these
11:53:09 9 values.

11:53:09 10 Q. Let's take a look at 9859.19 and look at paragraph three now.
11:53:24 11 So when you advised the federal Mineral Management Service about
11:53:27 12 uncertainty and permeability, you said, "This is one of the most
11:53:32 13 important parameters for uncertainty due to its impact on wells
11:53:36 14 productivity." Right?

11:53:37 15 A. Yes.

11:53:37 16 Q. That's because under Darcy's Law flow rate is directly
11:53:42 17 proportional to permeability, right?

11:53:44 18 A. Yes.

11:53:44 19 Q. Double the permeability, you double the flow rate?

11:53:47 20 A. For the given pressure drop, yes.

11:53:48 21 Q. Sure. So if you take your 300 millidarcies permeability in
11:53:53 22 your expert report and double it to over 500 millidarcies like some
11:53:57 23 of the other United States experts have done, you would get a
11:54:00 24 doubled flow rate, wouldn't you? All other things being equal?

11:54:04 25 A. That's an interesting question. It's not that straightforward,

11:54:11 1 and the reason is because when you couple the wellbore to the
11:54:14 2 reservoir, the wellbore constraints can also make a difference in
11:54:18 3 the way you predict the rate.

11:54:20 4 So I don't think the rate will necessarily double,
11:54:23 5 because as you increase the rate the pressure drop in the tubing
11:54:26 6 also increases and it adds more resistance to the flow. So the
11:54:32 7 bottom hole pressure will go up as a result of that and eventually
11:54:35 8 the rate will equilibrate to something less than double the rate.

11:54:40 9 But if you're asking me a question, would the rate
11:54:42 10 increase, the answer is yes.

11:54:42 11 Q. Well, but under Darcy's Law, which is one of the two
11:54:45 12 fundamental equations of reservoir engineering, isn't it, sir?

11:54:49 13 A. That is true, but the bottom hole pressure is not constant when
11:54:54 14 you couple the wellbore to the reservoir. I mean, you are only
11:54:58 15 pressure which is constant in Macondo is the bottom of the ocean.
11:55:02 16 That pressure is given. But the pressure in the tubing can change
11:55:07 17 as the rate increases, and when that pressure drop increases the
11:55:10 18 bottom hole pressure will increase to reflect higher rate.

11:55:13 19 So you're not going to see a doubling of the rate by
11:55:16 20 doubling of the permeability. But I don't know what that value
11:55:20 21 will be, but if you're asking me a question would the rate be
11:55:23 22 higher, the answer is yes.

11:55:24 23 Q. Actually what I was asking is, under Darcy's Law, isn't flow
11:55:28 24 rate directly proportional to the number for permeability?

11:55:31 25 A. For a given pressure drop. And that's important.

11:55:33 1 Q. Fair enough. Fair enough. So you told the federal Mineral
11:55:40 2 Management Service that you've assumed that permeability values can
11:55:47 3 be 50 percent higher than that of the base case values obtained
11:55:50 4 from core measurements, correct?

11:55:52 5 A. Yes.

11:55:53 6 Q. So that would be about 120 millidarcies?

11:55:56 7 A. Yes.

11:55:57 8 Q. So let's take a look at D-24402. I just want to kind of wrap
11:56:11 9 up our permeability discussion by just kind of seeing the big
11:56:15 10 picture here. So in the bottom row in pink, you've read the expert
11:56:19 11 reports of Dr. Larsen, Dr. Huffman, Dr. Pooladi-Darvish, Dr. Hsieh,
11:56:25 12 haven't you, sir?

11:56:26 13 A. I have -- yes. I have not -- yes, I have read the reports,
11:56:36 14 yes.

11:56:36 15 Q. Did you remember that they used permeability numbers between
11:56:39 16 400 and 850 millidarcies?

11:56:42 17 A. Yes.

11:56:42 18 Q. And you used in that calculation that you talked about on
11:56:47 19 direct examination as validating your cumulative flow number, the
11:56:54 20 productivity index, you used a permeability number of 300
11:56:56 21 millidarcies, correct?

11:56:58 22 A. I did use 300 value, millidarcy value, yes.

11:57:02 23 Q. By the way, in that productivity index that you calculated
11:57:06 24 ended up being 25 percent off of what is in your report?

11:57:09 25 A. Yes. Yes, I don't remember exactly, but I think I told you

11:57:14 1 what the correct value was in the deposition.

11:57:17 2 Q. Yes, you did. I appreciated that.

11:57:19 3 Let's now talk about porosity. Let's look at just real
11:57:25 4 quickly D-24403, it's turned out from --

11:57:31 5 THE COURT: Mr. Boles, let me just ask you, can you give
11:57:33 6 me an estimate of how much time you have left?

11:57:35 7 MR. BOLES: Yes, I think in about 10 or 15 minutes.

11:57:38 8 THE COURT: All right. Well, let's just go ahead.

11:57:42 9 BY MR. BOLES:

11:57:42 10 Q. It's turned out in the rebuttal report of Dr. Huffman he makes
11:57:46 11 some, bases some discussion about rock compressibility on the
11:57:51 12 number for porosity in the Macondo well reservoir, and that's the
11:57:56 13 percentage of the rock that's taken up by air space, right,
11:58:00 14 Dr. Kelkar?

11:58:01 15 A. Yes.

11:58:01 16 Q. But you used a porosity of 21.7 percent, correct?

11:58:08 17 A. Yes.

11:58:08 18 Q. Looks to be -- as far as you're aware all of the other experts
11:58:13 19 use that number in this case, on both sides, use that number as
11:58:15 20 well, don't they?

11:58:17 21 A. Yes.

11:58:17 22 Q. And you got that number by calculating the thickness weighted
11:58:23 23 porosity from measurements on the Macondo rock?

11:58:29 24 A. That is true.

11:58:30 25 Q. Last material balance variable, the pressure change. The one

11:58:36 1 big -- one of the big differences between what you did and what
11:58:40 2 Dr. Blunt did has to do with translating the pressure measurements
11:58:47 3 from where they were taken at the capping stack, at the seafloor,
11:58:50 4 down to what you're trying to analyze as a reservoir engineer,
11:58:54 5 which is --

11:58:56 6 A. Bottom hole.

11:58:57 7 Q. -- bottom hole, thank you. And you do that translation by
11:59:01 8 trying to estimate the weight of the oil in the wellbore, correct?

11:59:04 9 A. Yes.

11:59:04 10 Q. That's sometimes called the hydrostatic head?

11:59:07 11 A. Yes.

11:59:08 12 Q. And of course when these measurements start at the capping
11:59:15 13 stack, it's right when the well's been shut-in, correct?

11:59:19 14 A. Yes.

11:59:19 15 Q. So the well's been flowing up, up until the point?

11:59:24 16 A. Yes.

11:59:24 17 Q. And the wellbore fluids that are coming up are hot?

11:59:27 18 A. Yes.

11:59:27 19 Q. Over 200 degrees temperature, right?

11:59:31 20 A. Yes, 240, yes.

11:59:33 21 Q. And then once the capping stack is shut they're not flowing
11:59:37 22 anymore, are they?

11:59:39 23 A. There is some influx of the fluid at the bottom hole even after
11:59:42 24 the well is shut-in; but there is no flow to the surface, that's
11:59:46 25 true.

11:59:46 1 Q. So there's no more hot oil coming into keep hot that entire
11:59:54 2 thousands of feet of oil trapped in the wellbore?

11:59:59 3 A. For few hours there will be some influx of oil. Because the
12:00:05 4 bottom hole does not know the well has been shut-in at the top, so
12:00:10 5 there is some time difference between when the well is shut-in at
12:00:14 6 the surface versus what's happening at the bottom hole. But, yes,
12:00:18 7 I mean, I think the flow rate is substantially reduced when you
12:00:21 8 shut the well.

12:00:21 9 Q. And I am not referring just to a few hours, I am referring to
12:00:24 10 the several weeks of shut-in pressure data from the capping stack
12:00:28 11 to August 3rd.

12:00:29 12 A. Okay.

12:00:30 13 Q. During that time the wellbore will have cooled, correct?

12:00:33 14 A. Yes.

12:00:33 15 Q. And when it cools it gets more dense?

12:00:35 16 A. Yes.

12:00:36 17 Q. And more dense oil weighs more, right?

12:00:39 18 A. True.

12:00:39 19 Q. So the translation from the capping stack to the reservoir is
12:00:43 20 going to be affected by that?

12:00:44 21 A. Yes.

12:00:44 22 Q. In other words, that conversion factor if known for certain
12:00:51 23 would be different over time as the wellbore cooled?

12:00:54 24 A. That is true.

12:00:54 25 Q. And you did not take into account wellbore cooling in your, in

12:00:59 1 calculating your hydrostatic head to convert from capping stack
12:01:04 2 pressure to reservoir pressure?

12:01:05 3 A. I did not.

12:01:06 4 Q. By the way, on direct examination the number for cumulative
12:01:18 5 flow that was put up there for you was 4.5 to 5.5 million, but I
12:01:27 6 believe you said in your deposition that your best estimate is 5
12:01:29 7 million barrels?

12:01:30 8 A. I just took an average of the two numbers, yes.

12:01:35 9 Q. And in your material balance analysis, you used -- I think you
12:01:42 10 already talked about that on direct, so I'll skip that in the
12:01:44 11 interest of getting us all to lunch here.

12:01:47 12 Sir, you're aware that at the end, toward the end of this
12:01:55 13 incident some oil was collected by vessels and didn't go into the
12:02:01 14 ocean, correct?

12:02:02 15 A. Yes.

12:02:02 16 Q. And there was some measurements of collection rates?

12:02:06 17 A. Yes.

12:02:07 18 Q. You don't think that your material balance analysis is
12:02:14 19 unreliable because you haven't explicitly and specifically analyzed
12:02:20 20 those collection rates, do you?

12:02:22 21 A. No. I think what I said is that more data you have in your
12:02:26 22 model, better the model becomes. And I think material balance has
12:02:31 23 that inherent limitation that it cannot incorporate the dynamic
12:02:36 24 data in the analysis.

12:02:36 25 Q. Right. But the material balance analysis done by you and

12:02:40 1 Dr. Blunt is not unreliable merely because you haven't taken into
12:02:46 2 account the collection rates?

12:02:47 3 A. No, it doesn't have the ability to incorporate that
12:02:50 4 information. Period.

12:02:51 5 Q. And it's not unreliable because of that?

12:02:53 6 A. No. I mean, it's -- the assumptions are what the assumptions
12:02:57 7 are in material balance.

12:02:58 8 Q. This is my last question for you, sir. In the United States'
12:03:16 9 pretrial brief, ten-page brief summarizing their case, they mention
12:03:20 10 that trying to distinguish between you and Dr. Blunt by saying that
12:03:25 11 you "ground truth your material balance by calculating a capping
12:03:32 12 stack flow rate," and I heard you testify on direct about your
12:03:36 13 calculation of a capping stack flow rate. You wouldn't refer to
12:03:39 14 what that does for your material balance analysis as being ground
12:03:43 15 truthing it, would you, sir?

12:03:45 16 A. I think what I was referring to, and I said the same thing in
12:03:48 17 deposition, that if I would have calculated the rate of 1,000
12:03:51 18 barrels and if I had calculated four and a half million barrels of
12:03:55 19 oil spilled or five and a half million barrels, then I would have
12:03:58 20 questioned myself that the results are not consistent. The fact
12:04:01 21 that I calculated the rate to be 54,000 barrels was much more
12:04:05 22 reasonable in light of what I had calculated to be the total oil
12:04:10 23 spill.

12:04:10 24 So that's what I meant by consistency. Not that I had
12:04:14 25 quantified exactly the numbers of the oil produced versus the rates

12:04:18 1 at which the well was flowing over 86 days.

12:04:21 2 Q. You were using it to see if you were in the ball park?

12:04:23 3 A. That is correct.

12:04:24 4 Q. Because your calculation of capping stack flow rate didn't come
12:04:28 5 into play in your material balance analysis, did it?

12:04:30 6 A. It did not.

12:04:32 7 MR. BOLES: Thanks, Dr. Kelkar.

12:04:35 8 THE WITNESS: Thank you.

12:04:35 9 THE COURT: Any redirect, Ms. Engel?

12:04:37 10 MS. ENGEL: Your Honor, I do have some if you want to
12:04:39 11 take a lunch break.

12:04:40 12 THE COURT: No, let's go ahead and finish with this
12:04:43 13 witness so he doesn't have to come back. He may have better things
12:04:47 14 to do this afternoon.

12:05:22 15 Just remember I heard everything he said on direct so you
12:05:25 16 don't have to have him repeat it all, okay?

12:05:28 17 MS. ENGEL: Yes, sir.

12:05:29 18 REDIRECT EXAMINATION

12:05:29 19 BY MS. ENGEL:

12:05:29 20 Q. Dr. Kelkar, I just want to ask you a few questions to follow-up
12:05:33 21 on what Mr. Boles asked you.

12:05:35 22 First, he asked you if it was reasonable to use 6
12:05:41 23 microsips for compressibility in your material balance analysis and
12:05:46 24 I think your answer was yes. Is it just as reasonable to use 18
12:05:49 25 microsips in that analysis?

12:05:50 1 A. Yes.

12:05:51 2 Q. You were also asked about this SPE paper that you coauthored.
12:05:58 3 What role did you have in that work?

12:06:00 4 A. It was the work done by one of my students actually. He did
12:06:05 5 the work and he collected the data in that analysis, I was just
12:06:12 6 advising in terms of what type of analysis should be done with
12:06:15 7 respect to that data.

12:06:15 8 Q. So would you consider yourself a principle author of that work?

12:06:19 9 A. I am not the principle author of that work.

12:06:23 10 Q. Now, you were asked also about the compressibility value that
12:06:28 11 you used in your FRTG, you Flow Rate Technical Group work, and we
12:06:35 12 looked at your report a little bit. And at that time, you
12:06:38 13 testified on direct that at that time you only had the Weatherford
12:06:42 14 Lab data available to you, correct?

12:06:44 15 A. Yes.

12:06:44 16 Q. And you didn't have all of these other documents that you've
12:06:48 17 since looked at to adjust your evaluation of formation
12:06:55 18 compressibility, right?

12:06:56 19 A. That is correct.

12:06:57 20 Q. So had you had that additional information available to you at
12:07:02 21 the time you did your Flow Rate Technical Group work, would you
12:07:06 22 have considered this additional information?

12:07:08 23 A. Absolutely. Any more information you have available makes your
12:07:11 24 results better.

12:07:11 25 Q. And might that have altered the formation compressibility value

12:07:15 1 that you used in your FRTG paper?

12:07:17 2 A. Yes.

12:07:18 3 Q. I just want to clarify one thing with respect to I think
12:07:35 4 Mr. Boles asked you if you said or if there was a slide that said
12:07:40 5 Dr. Blunt didn't use any pressure data. And I think let's put up
12:07:44 6 D-21671. And I think that this might have been the slide that
12:07:52 7 Dr. Boles -- or sorry, Mr. Boles, upgrade you -- Mr. Boles was
12:07:56 8 referring to. And here you're discussing the limitations of the
12:08:02 9 material balance methodology, right?

12:08:04 10 A. Yes.

12:08:04 11 Q. And it's one of those limitations of the method that you used,
12:08:08 12 the fact that you can't use certain types of a additional pressure
12:08:12 13 data like you can use in other analyses like reservoir simulation?

12:08:16 14 A. That is correct.

12:08:17 15 Q. You were also asked about the predrill report, which I believe
12:08:27 16 is TREX 5246, BP's Predrill Technical Assurance Memorandum, and
12:08:35 17 asked quite a few questions about whether they were quantifying
12:08:39 18 connected volume in that report. Do you recall that?

12:08:42 19 A. Yes.

12:08:42 20 Q. Is there any reason for BP to be quantifying unconnected volume
12:08:47 21 in their Predrill Technical Assurance Memorandum?

12:08:49 22 A. Well, what I mentioned again in my response is that BP will use
12:08:56 23 certain geophysical attribute threshold to determine the connected
12:09:02 24 volume, because ultimately the oil in place can only be calculated
12:09:05 25 by looking at where the oil is located and how oil is connected.

12:09:10 1 So I think the fact that you have P10, P50, P90 implies that they
12:09:15 2 have also considered the connected volume in their analysis.

12:09:22 3 Q. And just a couple of last questions. Did you try in your
12:09:27 4 expert work here to estimate permeability to a high degree of
12:09:32 5 certainty?

12:09:32 6 A. I did not. I just used a single value in my -- just to check,
12:09:38 7 really, as a productivity index.

12:09:40 8 Q. And did you try to estimate porosity to a high degree of
12:09:44 9 certainty for purposes of your expert report?

12:09:47 10 A. I just used the core data and calculated the average, weighted
12:09:50 11 average.

12:09:50 12 Q. And you were asked right at the very end of your
12:09:57 13 cross-examination about wellbore cooling and whether you analyzed
12:10:02 14 wellbore cooling, and I believe your answer was no. But does
12:10:08 15 wellbore cooling make a difference to your material balance
12:10:12 16 analysis?

12:10:13 17 A. It doesn't. And because Dr. Gringarten has used the wellbore
12:10:17 18 cooling because he directly took Dr. Blunt's data in his analysis
12:10:22 19 and his average pressure values are consistent with what I
12:10:26 20 calculated. So it wouldn't make any difference in the material
12:10:29 21 balance calculations as far as the amount of oil spilled is
12:10:32 22 concerned.

12:10:33 23 MS. ENGEL: Thank you, Dr. Kelkar, I have nothing
12:10:35 24 further.

12:10:36 25 THE COURT: All right. Thank you. Thank you, Doctor,

12:10:38 1 you're done. We will recess for lunch, it's about 12:10. I
12:10:46 2 believe the government has one remaining expert?

12:10:51 3 MS. HIMMELHOCH: That's correct, your Honor.

12:10:52 4 MR. O'ROURKE: We're going to play one 15-minute video
12:10:54 5 after lunch and then the final expert.

12:10:56 6 THE COURT: Dr. Pooladi-Darvish, okay. Thank you. Okay.
12:11:02 7 We will be back at -- well, I didn't give a time. Let's say, let's
12:11:07 8 make it 1:25, that's an hour and 15 minutes.

12:11:11 9 MR. BROCK: I was going to mention to you, Dr. Blunt is
12:11:14 10 here and ready to go first thing in the morning at 8 o'clock. I
12:11:17 11 think we will take most of the afternoon with the tape and the
12:11:20 12 witness and we will be ready to go first thing in the morning.

12:11:22 13 THE COURT: That's fine.

12:11:25 14 THE DEPUTY CLERK: All rise.

12:11:27 15 (WHEREUPON, A LUNCH RECESS WAS TAKEN.)

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REPORTER'S CERTIFICATE

19

20 I, Karen A. Ibos, CCR, Official Court Reporter, United
21 States District Court, Eastern District of Louisiana, do hereby
22 certify that the foregoing is a true and correct transcript, to the
23 best of my ability and understanding, from the record of the
24 proceedings in the above-entitled and numbered matter.

23

24

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

25

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