UNITED STATES DISTRICT COURT

EASTERN DISTRICT OF LOUISIANA

IN RE: OIL SPILL BY THE OIL RIG *DEEPWATER HORIZON* IN THE GULF OF MEXICO ON APRIL 20, 2010	*	Civil Action
	*	No. 10-MD-2179
	*	Section J
Relates to: No. 10-4536	*	New Orleans, Louisiana
	*	
UNITED STATES OF AMERICA	*	January 27, 2015
	*	
v.	*	
	*	
BP EXPLORATION & PRODUCTION INC., ANADARKO EXPLORATION & PRODUCTION LP, ANADARKO PETROLEUM CORPORATION, MOEX OFFSHORE 2007 LLC, TRITON ASSET LEASING GMBH, TRANSOCEAN HOLDINGS LLC, TRANSOCEAN OFFSHORE DEEPWATER DRILLING INC., TRANSOCEAN DEEPWATER INC., AND QBE UNDERWRITING LTD., LLOYD'S SYNDICATE 1036	*	
**********		

DAY 6, AFTERNOON SESSION
TRANSCRIPT OF TRIAL PROCEEDINGS
HEARD BEFORE THE HONORABLE CARL J. BARBIER
UNITED STATES DISTRICT JUDGE

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I N D E X

12:48:27 **AFTERNOON SESSION**

12:58:23 **(January 27, 2015)**

01:02:24 **THE COURT:** Please be seated, everyone.

01:08:57 Any preliminary matters before we resume

01:08:59 testimony?

01:09:02 **MS. FIDLER:** Yes, Your Honor. Danielle Fidler for

01:09:04 the United States. At this time we would like to offer the

01:09:07 exhibits associated with the testimony of Dr. Cox.

01:09:10 **THE COURT:** Okay.

01:09:12 **MS. FIDLER:** And Captain Frank Paskewich.

01:09:14 **THE COURT:** Any objections?

01:09:16 **MR. BROCK:** I think these are fine, Your Honor.

01:09:18 **MS. KIRBY:** No objections here, Your Honor.

01:09:19 **THE COURT:** Good. Those are admitted.

01:09:21 **MS. FIDLER:** Thank you, Your Honor.

01:09:21 **THE COURT:** Sure.

01:09:24 **MR. BROCK:** I think we will have those later.

01:09:25 **THE COURT:** Go ahead.

01:09:25 **MR. BROCK:** Good afternoon.

01:09:25 If we could pull up, please, D-34914.3.

01:09:25 **DAMIAN SHEA,**

01:09:26 having been duly sworn, testified as follows:

01:09:26 **DIRECT EXAMINATION**

01:09:44 **BY MR. BROCK:**

01:09:45 **Q.** Dr. Shea, we are going to move to your second topic now,

01:09:50 site-specific toxicity testing confirms EPA benchmarks. And as
01:09:55 a preliminary matter, I just want to ask a couple of questions
01:09:59 about EPA benchmarks.
01:10:01 When we look at the EPA water quality standards, is
01:10:05 there a difference between benchmarks and criteria?
01:10:10 **A.** Yes, there are.
01:10:11 **Q.** What are the differences?
01:10:14 **A.** The differences are in a regulatory context, from a
01:10:17 scientific point of view, benchmarks and criteria are
01:10:21 essentially the same. So the water quality benchmarks that the
01:10:24 U.S. EPA has developed, they have developed using the water
01:10:29 quality criteria derivation procedure that EPA uses for
01:10:33 criteria.
01:10:34 Now, the criteria, my understanding, have an
01:10:36 additional regulatory aspect to them; whereas, for example,
01:10:40 states can adopt those as standards. The benchmarks are
01:10:44 derived in exactly the same way as the criteria, but they have
01:10:47 some different regulatory context.
01:10:50 **Q.** When you say that the benchmarks are the gold standard for
01:10:54 evaluating water quality, what are you referring to there?
01:10:57 **A.** Well, they are simply the best available science that we
01:11:01 have in order to understand the potential harm related to these
01:11:06 PAHs and BTEX in water and in sediment.
01:11:11 **Q.** In addition to looking at the water and sediment samples
01:11:16 in relation to the EPA toxicity benchmarks, did you also look

at site-specific toxicity tests?

A. Yes, I did.

Q. And do they help to inform your opinion about the potential for harm from hydrocarbons in the Gulf of Mexico and in sediment?

A. I believe the benchmarks themselves are sufficient; but the site-specific toxicity information is helpful, yes.

MR. BROCK: If we can pull up D-34874, please.

BY MR. BROCK:

Q. I'll just ask you, as a preliminary matter, would you please explain what you mean by "site-specific toxicity testing." And perhaps you can use this slide to talk that through.

A. Sure. So I had mentioned earlier that the EPA benchmarks are based upon standard toxicity testing. I showed an example of the fish tank where a chemical was added and scientists observed the response of those fish to various concentrations of that chemical.

In addition to that, we can conduct site-specific toxicity tests; and that is, we can actually collect a sample from a site we believe may be harmed, bring that sample back to the laboratory, and actually conduct toxicity tests on that.

So, for example, water samples and sediment samples were collected in the Gulf of Mexico and brought back to the laboratory. The majority of these toxicity tests were

01:12:42 weathered oil that was sitting on the Gulf of Mexico surface
01:12:46 that was skimmed up, collected in a barge, and they brought
01:12:49 this oil and distributed it to many labs across the country.
01:12:53 And the majority of these toxicity tests were actually
01:12:56 conducted by placing this oil on the surface of the fish tank.
01:13:00 **Q.** How did the site-specific tests differ from the 200 tests
01:13:05 that you referred to earlier that were utilized for the
01:13:08 development of the EPA benchmarks?
01:13:10 **A.** So they are conducted in a similar way in the laboratory;
01:13:12 but in the site-specific tests, we are actually looking at
01:13:17 specific sites within the Gulf of Mexico that we have potential
01:13:20 concern about, and the toxicity at that site is evaluated
01:13:24 directly.
01:13:25 **Q.** Who conducted the *Deepwater Horizon*-specific toxicity
01:13:28 tests?
01:13:29 **A.** This was a combination of tests conducted by NOAA and
01:13:33 their contractors, the Environmental Protection Agency, and
01:13:37 contractors for BP.
01:13:39 **Q.** You reference there in your second bullet point:
01:13:42 "900 high-quality toxicity tests conducted."
01:13:46 Why is that an important point?
01:13:48 **A.** Well, it's a very large number, the largest number of
01:13:51 site-specific toxicity tests that I have ever been associated
01:13:55 with. And they are high-quality toxicity tests, so most of the
01:13:59 data within those 900 tests are reliable.

01:14:03 **Q.** Do those tests look at a number of different species?
01:14:07 **A.** Yes. They look at a number of different species: vertebrates, invertebrates, and plants as well.
01:14:09 **Q.** Life stages?
01:14:12 **A.** Yes, multiple life stages, including the potentially more sensitive life stages of eggs and larvae of fish.
01:14:13 **Q.** What was the total number of tests that were conducted?
01:14:23 **A.** The total number of tests was approximately 1,100 tests.
01:14:25 **Q.** Did you review all of those?
01:14:28 **A.** I did review all of those 1,100 tests, yes.
01:14:30 **Q.** You have referenced 900 here. What's the screening criteria that you used here to go from 1,100 to 900?
01:14:33 **A.** Well, I outlined the actual screening type criteria in an appendix in my first report. Essentially what I was trying to do was to follow the same screening criteria that the Environmental Protection Agency uses in their validation of toxicity tests. And in that context, one of those criteria or characteristics is that the tests utilize standard methods that can be repeated by others.
01:14:38 **Q.** You have in your last bullet point here: "Results from *Deepwater Horizon* toxicity tests consistent with U.S.A. EPA benchmarks."

Will you please describe, for the benefit of the Court, what you mean by that.

01:14:42 **A.** Sure. So I looked at the 900 toxicity tests, looking at

01:15:27 the toxicity results themselves, but then also looking at the
01:15:32 chemistry associated with the water that's in those tanks; and
01:15:34 so detailed chemical analyses was performed on these tests for
01:15:39 most of the tests.
01:15:40 And what I wanted to do was look at, in a general
01:15:43 way, are these toxicity test results consistent with the EPA
01:15:47 benchmark approach?
01:15:49 **MR. BROCK:** Let's see D-34873-A, please.
01:16:02 **BY MR. BROCK:**
01:16:09 **Q.** Will you please describe this slide for the benefit of the
01:16:11 Court and how it helps to inform your opinions here.
01:16:15 **A.** Sure. This is a chart or a listing of the species that
01:16:18 were tested that are actually native and resident to the Gulf
01:16:22 of Mexico. There were five additional species that are not
01:16:24 resident in the Gulf of Mexico that are not listed here that
01:16:28 are standard toxicology organisms that we use around the world.
01:16:32 But if you focus your attention on the top left, you can see
01:16:36 the marine algae that was studied.
01:16:40 Moving down into the invertebrates, including blue
01:16:44 crab, the oyster that lives in the Gulf of Mexico, various
01:16:50 shrimp species that live in the Gulf of Mexico.
01:16:52 Moving on into vertebrates in the finfish. Some of
01:16:55 these finfish live out in the open Gulf waters. Others live in
01:17:00 the estuaries such as the Gulf killifish, and the inland
01:17:00 silverside live on the shoreline areas.

01:17:03 And then the Gulf killifish and the southern flounder
01:17:07 are examples of fish that spend a lot of their time down in the
01:17:11 sediment and feeding off of the sediment; and that's, again, an
01:17:13 example of where contaminated sediment or potentially
01:17:15 contaminated sediment is important.
01:17:17 **Q.** What findings did you make about these tests that
01:17:23 demonstrate consistency with the EPA standards?
01:17:26 **A.** So again, I looked at the results in a general way; and
01:17:29 what I found was that in the cases where toxicity was observed
01:17:34 in these toxicity tests, they contain the type of PAH and
01:17:39 concentration of PAH where the EPA benchmark also would have
01:17:43 expected potential harm.
01:17:44 In those cases where toxicity results showed no
01:17:48 toxicity, the EPA benchmark also showed toxicity. So in a very
01:17:52 general way, these were very consistent with the EPA benchmark
01:17:56 approach.
01:17:57 **Q.** Thank you. Let's turn now to 34914.4., your fourth topic.
01:18:06 And the summary statement here is: "Results are not
01:18:09 surprising."
01:18:12 You have talked a little bit today about oil that
01:18:18 flowed into the Gulf of Mexico during the Macondo spill and the
01:18:23 low percentage of potentially harmful samples that were
01:18:26 identified and the fact that that wasn't surprising to you.
01:18:31 I want to put up now D-34001 and ask you if you can
01:18:38 use this, please, to explain to the Court why the results are

not surprising in terms of the outcome of your work.

A. So I would like to focus your attention on the lower right-hand corner where it shows a natural oil seep, first. There are natural all seeps throughout the Gulf of Mexico. There are at least 600 and perhaps a few thousand of these natural oil seeps in the Gulf of Mexico that have been leaking oil into the Gulf of Mexico for essentially millions of years.

This is very important because what this has created is what we call a hydrocarbon ecosystem. The oil that's been leaking into here has allowed the bacteria to evolve and to have sustained populations to be able to consume this oil. This process is something we call biodegradation.

So these bacteria are present at the bottom waters, in the midwaters, up in the surface. They are everywhere within the Gulf of Mexico. There may be different bacteria species that exist in different areas, but they are capable of actually using the oil as a source of food.

Q. Now, is the way in which this bacteria works part of the biodegradation process?

A. It's exactly the same biodegradation process. These bacteria have evolved to be able to consume the oil and the oil-related chemicals, such as these PAHs, as a source of food, yes.

MR. BROCK: If you will pull up D-34879.

01:20:10 **BY MR. BROCK:**
01:20:11 **Q.** Have you helped us with a demonstrative that demonstrates
01:20:17 the process of biodegradation?
01:20:19 **A.** Yes, I have.
01:20:20 **Q.** If we can play that and if you could just explain for the
01:20:23 benefit of the Court what you are seeing here in terms of the
01:20:26 process.
01:20:26 **A.** So this is an animation depicting a natural oil seep. You
01:20:29 see the oil droplets floating to the surface. Oil is less
01:20:33 dense than water, so it floats towards the surface and moves
01:20:36 there. This is what is happening all throughout the Gulf of
01:20:39 Mexico every day.
01:20:40 Then we focus in on a single oil droplet, and you can
01:20:45 see these bacteria covering the oil droplet. In North Carolina
01:20:49 we call this hogs at the trough. This is truly a feeding
01:20:52 frenzy. These bacteria basically are covering this oil droplet
01:20:57 and eating up the oil as well as the PAHs. So they are not
01:20:58 only consuming the oil, but they are also reducing the
01:21:00 potential toxicity of that oil.
01:21:05 **MR. BROCK:** If we can go back, please, to D-34011.
01:21:20 **BY MR. BROCK:**
01:21:21 **Q.** There's also been some discussion in this case about
01:21:24 dilution. Can you explain what is meant by that term and how
01:21:28 it impacts your opinion here.
01:21:30 **A.** Sure. Dilution, in its most basic form, is simply a high

01:21:35 concentration of something -- in this case, oil droplets or the
01:21:38 PAH chemicals -- encountering clean water, and there's a
01:21:43 diffusion process that dilutes these chemicals. This happens
01:21:47 all the time. It happens particularly in a system that's open
01:21:50 and dynamic like the Gulf of Mexico. So dilution is very
01:21:56 important in reducing the concentration of these chemicals to
01:22:00 levels that are harmless.
01:22:02 **Q.** We also show weathering here as a component of the
01:22:07 process. What is weathering, and how does it impact your
01:22:12 opinion here?
01:22:14 **A.** Well, this is also depicting -- of course, not all of
01:22:16 these biodegradation and dilution processes removed all of the
01:22:22 oil as it was rising to the surface. So, of course, we had
01:22:24 surface oil as well.
01:22:26 In some of these processes, such as some
01:22:28 nonbiological process, evaporation, and so on, they also reduce
01:22:34 the volume of the oil and reduce the amount of pH that's
01:22:38 present. In general we put all of these things together --
01:22:40 these processes together, and we call this weathering.
01:22:43 **Q.** Does biodegradation remove oil from the environment?
01:22:47 **A.** Oh, it absolutely does, yes.
01:22:50 **Q.** Does dilution remove oil from the environment?
01:22:51 **A.** Yes, it does.
01:22:52 **Q.** Does weathering remove oil from the environment?
01:22:55 **A.** Yes, it does.

01:22:59 **Q.** Dr. Rice has maintained that weathering does not decrease
01:23:02 the chronic toxicity of oil. Do you recall him saying that?
01:23:08 **A.** I do recall that.
01:23:08 **Q.** Do you agree with Dr. Rice with regard to the effect of
01:23:12 the weathering of oil?
01:23:14 **A.** I do not.
01:23:14 **Q.** Why is that?
01:23:15 **A.** Because weathering in itself reduces dramatically the
01:23:20 concentration of these potentially toxic chemicals. So, for
01:23:23 example, the BTEX compounds that we had talked about earlier,
01:23:27 by the time the oil reached the surface, nearly all of those
01:23:31 BTEX compounds were gone. That weathering process that
01:23:34 occurred in the water column removed almost all of the BTEX.
01:23:38 By the time the weathered oil was only a day or two
01:23:40 old, the BTEX was completely gone. If you look at the PAH
01:23:47 compounds, by the time the oil is on the surface for maybe two
01:23:50 to three weeks, 95 percent of the PAHs have degraded and have
01:23:54 gone away.
01:23:55 And so the toxic potential of weathered oil is
01:23:58 significantly less than fresh oil, and there's significant
01:24:02 other evidence to support that.
01:24:02 **Q.** In your view, is there a difference between exposure to
01:24:05 oil and exposure to oil that is toxic?
01:24:08 **A.** Absolutely.
01:24:09 **Q.** Why is that?

01:24:10 **A.** Because exposure to oil itself -- knowing that there is
01:24:14 oil present actually doesn't tell you how toxic it is. It may
01:24:17 be counterintuitive for those who don't study oil like I have
01:24:22 for so long, but oil is actually not that toxic of a substance.
01:24:26 And so one needs to know -- and that's precisely what I did in
01:24:30 my analyses and what the EPA approach tells you to do, is
01:24:34 measure those potentially toxic chemicals, compare them to a
01:24:38 benchmark. That's how you determine it. The presence of oil
01:24:39 itself does not tell you that.
01:24:41 **Q.** Thank you.
01:24:42 **MR. BROCK:** Let's go to D-34914.5, please.
01:24:47 **BY MR. BROCK:**
01:24:47 **Q.** We are moving now to your responses to some of the things
01:24:53 that Dr. Boesch and Dr. Rice have advanced.
01:24:57 Have you brought a demonstrative or helped us create
01:25:02 one regarding your response to the approach of the U.S.
01:25:05 experts?
01:25:05 **A.** Yes, I have.
01:25:06 **Q.** We have been talking about some of your responses as we
01:25:09 have been going through your exam today, correct?
01:25:11 **A.** That's correct.
01:25:12 **Q.** We are going to talk about a few more.
01:25:14 **MR. BROCK:** Let's see D-34890, please.
01:25:18 **BY MR. BROCK:**
01:25:19 **Q.** I will ask you just to use this slide, if you will,

01:25:22 please, to talk through your responses to the criticisms of
01:25:29 Dr. Rice and Dr. Boesch in addition to some of the things that
01:25:33 we've talked about.
01:25:33 **A.** Well, at a high level, the first thing is that they
01:25:36 disregarded the use of EPA water quality benchmarks themselves
01:25:41 and, instead, relied upon one or a couple of studies.
01:25:45 Number two, Dr. Rice misinterpreted the
01:25:47 *Deepwater Horizon* toxicity tests that he talked about.
01:25:51 **MR. CHAKERES:** Your Honor, I'm going to object to
01:25:53 this as improper surrebuttal. This topic is nowhere in
01:25:58 Dr. Shea's reports.
01:26:05 **MR. BROCK:** He has addressed the issues in his report
01:26:08 of the toxicity test. He is responding to Dr. Rice in this
01:26:14 bullet point. I think when we get to it --
01:26:17 **THE COURT:** Did he express these opinions in his
01:26:24 rebuttal or whatever y'all call them, the Round 3 reports or
01:26:30 anywhere in his reports?
01:26:32 **MR. BROCK:** He expressly stated the basis for his
01:26:33 toxicity reports. He has talked about those. He'll talk here
01:26:35 about --
01:26:36 **THE COURT:** That's not the point. As I understand
01:26:41 it, each of these experts seem to have filed three different
01:26:45 reports. A first round report, a second round report, and a
01:26:52 so-called rebuttal report, a reply report to the reports of the
01:26:56 other side's experts.

So the question is: Did this expert express these opinions about the U.S.'s experts in any of his reports?

MR. BROCK: Well, I think he would say, on "misinterpreted," that he is being responsive to Dr. Rice. The content of what the reasons he will give for that are in his report, yes, sir.

MR. CHAKERES: Your Honor, I would love to hear a pin cite for that because that is not true. This was in Dr. Rice's third round report as rebuttal to Dr. Shea's testimony that the toxicity tests supported the benchmarks.

THE COURT: Wait, wait. I'm not sure I understood Mr. Brock's answer.

MR. BROCK: I think if you will let me get to this one and then deal with the objection then -- I do think that the material he is using to respond to Dr. Rice is expressly in his report.

THE COURT: That's not the question, whether the materials are in there; it's whether these opinions have been expressed in his reports. That's what we look to.

MR. BROCK: Give me just one second.

THE COURT: Let me ask the witness.

Did you express these opinions in any of your reports? The opinions?

THE WITNESS: The third one, I spoke directly about the limitations of those methods. I actually had an entire

01:28:25 appendix in my report talking about those.
01:28:28 **THE COURT:** But your opinion is that -- you are
01:28:30 talking about what the other side did, what the other experts
01:28:34 did. Did you express those opinions?
01:28:37 **THE WITNESS:** I did make the expression that what I
01:28:39 was using were the U.S. EPA benchmarks, which refers to the
01:28:44 first item and the third item, was the appropriate way and that
01:28:48 what Drs. Rice and Boesch were using were not.
01:28:51 **THE COURT:** Where is that expressed?
01:28:54 **THE WITNESS:** I would have to check my reports to see
01:28:56 exactly where.
01:28:57 **MR. CHAKERES:** Your Honor, we do not dispute
01:29:00 Dr. Shea's characterization. The first and the third bullets
01:29:04 are contained in his second round report as well as parts of
01:29:08 the third round report.
01:29:10 It's the second bullet there is not contained
01:29:12 anywhere in any of his reports.
01:29:14 **MR. BROCK:** I think, if you will just -- if I can get
01:29:17 to this one, I think you will see the basis for it. It's
01:29:21 information that is in his report. I'm not going to ask him
01:29:25 anything that's not in his report.
01:29:27 They are referencing Dr. Rice's third round
01:29:30 report, which we would not -- there would not have been a
01:29:33 report after that. But there is the basis for what we will say
01:29:37 in his report here. I can present it as just the basis for it,

and maybe "misinterpretation," I'll have to leave that out and make the argument at the end.

THE COURT: Well, as I understand it, the government is objecting to the second bullet point as being an opinion that the witness has not previously stated anywhere. Unless it can be pointed out to me, I will have to sustain the objection. The government does not object to the other two bullet points, from what I understand.

MR. BROCK: I will take up the first one. When I get to the second one, I will let you know I'm there; and if there's an issue, we will take it up.

THE COURT: Okay. Well, I thought I just ruled on that.

MR. BROCK: Well, if you did, then I will keep going.

THE COURT: Go from 1 to 3.

MR. BROCK: I will go from 1 to 3.

THE COURT: All right.

MR. BROCK: Let's take No. 1. Let's go to D-34884.

I'm sorry. Let's don't go to that one.

BY MR. BROCK:

Q. Let's just take at a high-level first your view on the issue of Dr. Rice and Dr. Boesch disregarding the U.S. EPA benchmarks and what the significance of that is to you in looking at their analysis.

A. Was there a demonstrative for this? I thought you just

called for it.

Q. We have D-34884.

MR. BROCK: Your Honor, this is the chart that was used in Dr. Rice's examination in a --

MR. CHAKERES: Your Honor, this is the bullet we object to.

MR. BROCK: I'm still talking. When I'll finish --

This is the chart that Dr. Rice used in his examination. We objected to this as being a demonstrative that was inaccurate. It is inaccurate, and we would like to explain to Your Honor why.

You had some questions about it, and they are way off the mark on this one. I think it would be helpful to hear this.

THE COURT: Where did this graph or exhibit come from? I don't recall that.

MR. BROCK: This was used by Dr. Rice --

THE COURT: I know, but what's the origin of it, though? Do we know?

MR. BROCK: I don't know the answer to that.

MR. CHAKERES: If I may, Your Honor, this was contained in Dr. Rice's -- an appendix to Dr. Rice's third round report based on NRDA toxicity test data.

MR. BROCK: There were no fourth round reports.

THE COURT: That's the problem with these reports.

01:32:20 It would be ad infinitum if every time somebody renders a
01:32:25 report, then the other person could render another report, and
01:32:29 then the other person would have to render a report. We
01:32:30 already have three from each expert, three reports.
01:32:34 **MR. BROCK:** He has looked at all of the data that
01:32:36 would relate to what he would say about this. It was something
01:32:40 that was used by them. We told them it was not accurate when
01:32:44 they proposed it as a demonstrative for trial. We would like
01:32:47 to point out why.
01:32:50 **THE COURT:** I'm going to sustain the objection. You
01:32:53 can certainly have him testify about -- if he has previously
01:32:59 expressed opinions about the same data, but I think this slide
01:33:04 can't be testified to by him.
01:33:09 **MR. BROCK:** Pull the slide down, please.
01:33:13 **BY MR. BROCK:**
01:33:13 **Q.** Have you looked at the pompano data that's referenced in
01:33:17 this slide that we were just looking at?
01:33:19 **A.** Yes, I have.
01:33:20 **Q.** Can you describe for Judge Barbier, please, the issue that
01:33:24 you have with Dr. Rice's description of that demonstrative.
01:33:29 **THE COURT:** Wait a minute.
01:33:30 **MR. CHAKERES:** Your Honor, as I said, this is not --
01:33:32 **THE COURT:** That's a pretty clever way, Mr. Brock, I
01:33:33 have to tell you, of asking the same question, doing the same
01:33:36 thing.

Why don't you just ask him what his interpretation of the data is without asking him what somebody else thought about the data?

MR. BROCK: Put the slide back up, please.

THE COURT: No, not on this -- take the slide down.

BY MR. BROCK:

Q. What is your interpretation of the data?

A. My interpretation of the pompano data are that if there's -- there were actually 10 toxicity tests conducted on pompano fish. That was just one. If you look at all 10 of those pompano data and aggregate them together, a few of those tests were indeterminate, meaning some of the chemistry was not quite right in order to be able to interpret properly.

But in aggregate, if you look at all of those pompano tests, they were consistent with my EPA benchmark approach and the analysis that I had conducted in terms of where you would expect toxicity to occur.

Q. We will move on, then.

THE COURT: Okay.

BY MR. BROCK:

Q. Let's look at your third criticism of the expert from the United States. You state that they disregarded known limitations with recent publications.

What are you referring to there?

A. Yes. In that case, the U.S. government experts are

01:34:51 relying primarily upon a paper authored by Dr. Incardona.
01:34:57 Secondarily, relying upon another paper authored by Mager as
01:35:04 well as Incardona; he was a coauthor.
01:35:08 There are well-known limitations to the methodologies
01:35:10 that were used in those papers, and there are flaws associated
01:35:14 with the interpretation of the data in those papers. And those
01:35:17 are the two papers that really drive the threshold that
01:35:20 Drs. Rice and Boesch are using.
01:35:20 **MR. BROCK:** Let's look at D-34881.
01:35:24 **BY MR. BROCK:**
01:35:24 **Q.** Is this a summary of the limitations to the U.S. experts'
01:35:30 key toxicity studies?
01:35:31 **A.** Yes, it is.
01:35:32 **Q.** Would you use this slide, please, to discuss the
01:35:36 limitations on these studies as you see them.
01:35:39 **A.** Sure. The first one is, the threshold that Drs. Rice and
01:35:44 Boesch use from the Incardona paper is driven by an effect --
01:35:49 that they believe is an effect called edema. Edema is better
01:35:53 known as swelling. So if you twist your ankle and it swells, a
01:35:57 day or two later, it goes away. Edema is a reversible process.
01:36:04 One of the main problems with the use of edema in the
01:36:07 way Incardona reported this is there is absolutely no measure
01:36:11 of severity of edema. So you can imagine, two people take
01:36:15 their temperature in the morning and it's 98.6 for both of
01:36:18 them. Late in the afternoon, one takes it again; it's 98.7.

01:36:21 It's increased .1 degree. The other person takes it and it's
01:36:27 103 or 104 degrees. It's a significant increase. But they
01:36:32 both then call their doctor and tell the doctor, "I have a
01:36:34 fever."
01:36:35 That's the analogy to how they are using the edema
01:36:38 data. The edema change is statistically measurable, but it's
01:36:41 analogous to a .1 or .2 increase in your temperature. It's not
01:36:44 meaningful to the organism.
01:36:46 Some of the edema that was observed was meaningful to
01:36:49 the organism, but from the Incardona paper, we will never know.
01:36:53 They reported nothing about severity.
01:36:55 That's really a violation of basic toxicological
01:36:59 principles. If you are going to produce toxicology data, you
01:37:02 need to know the severity of the effect. It needs to be
01:37:08 quantitative, and that's a very serious flaw within the paper
01:37:10 and the use of the data by Drs. Rice and Boesch.
01:37:13 **Q.** What about the second point, "Unusual and unacceptably
01:37:17 high mortality rates in the controls"?
01:37:20 What does that refer to?
01:37:22 **A.** Yeah. So when we conduct toxicity tests in these fish
01:37:27 tanks -- when we don't put any chemical in, we just have a
01:37:32 control situation -- there is always some effect that the
01:37:34 organism experiences at some level. A few of the fish may die;
01:37:38 you may have 5 or 10 percent of the fish die, or they may
01:37:38 experience some abnormality. That's just natural variation

that occurs out in the real world; it occurs in the fish tank.

Usually, we are looking at 10 percent effect or less for these. Maybe we may go up to as high as 20 percent effect in the control. If it's higher than that, then it's very unusual and it's unacceptably high.

Q. How does that influence the results?

A. That influences the results in that you are dealing with a population that -- in the case of the bluefin tuna that were used by Incardona, 40 percent of those animals died without any exposure at all. When you have such a high exposure to begin with, it's very difficult to actually use the data from toxicology experiments in a meaningful way.

Q. You mentioned here the use of the nonstandard blender, and I think we have heard some testimony about the commercial blender that's used in the tests that are conducted in the Incardona and other studies.

What's the issue there?

A. So scientists who study this, including myself, over the last 10 or 20 years have been looking at how can we standardize the method of looking at oil toxicity and exposure to oil-related materials. Basically, we put oil on the surface of water and we generally slowly mix that and allow the toxic chemicals to go into the water. We then take that water and we put it in the fish tank and conduct our toxicity assays.

The federal government has been heavily involved in

01:39:11 developing this standard method. Everyone around the world
01:39:14 uses this method or something similar.
01:39:14 What Dr. Incardona and others have done, and what
01:39:18 Drs. Rice and Boesch rely upon is a nonstandard method. They
01:39:22 actually use a heavy-duty commercial blender. It's a
01:39:24 3 3/4 horsepower motor on it. It blends up and basically makes
01:39:28 an emulsion or milkshake of the water and the oil at 15,000
01:39:33 revolutions per minute for about a minute or so. Then it's
01:39:36 that material that they actually conduct the toxicity tests on.
01:39:40 This test, as Dr. Rice has actually said in his
01:39:44 report, is designed specifically to force the larger PAHs that
01:39:48 are more toxic into the water.
01:39:50 So what this does and the chemistry show that you get
01:39:56 10 times, maybe even 50 times more of these PAHs dissolving in
01:39:59 water than you would in the standard method or than you would
01:40:03 in the Gulf of Mexico.
01:40:04 So what this is doing is it's artificially increasing
01:40:06 the toxicity of that mixture, and that's what they are using
01:40:10 for their exposure. It's an inappropriate method. It's not
01:40:14 standard.
01:40:14 **Q.** What about the issue of not being ecologically relevant?
01:40:18 **A.** Well, this gets to the actual physical high-energy mixing
01:40:21 of the blender. The mixtures, when we look at the detailed
01:40:26 chemistry in the blender mix and we look at the detailed
01:40:30 chemistry in the Gulf of Mexico, they don't match very well.

These higher PAHs that are more toxic are present much more so in this blender method than they were in any of the samples in the Gulf of Mexico.

So this is not an ecologically relevant method. Basically, the Gulf of Mexico is not a blender.

Q. Do you recall being in court when Dr. Rice showed pictures of embryos with deformities?

A. Yes, I was present.

Q. What was the concentration of the PAHs that those embryos were exposed to?

A. Well, he showed three pictures of embryos at approximately 3.4 parts per billion of total PAH, 8.5 parts per billion PAH, and I believe the third picture was 13.9 or 13.8 parts per billion total PAH.

MR. BROCK: If we could call up Demonstrative 34910, please.

BY MR. BROCK:

Q. Is this the slide of what Dr. Rice demonstrated to the Court in his direct examination?

A. Yes. In the left-most column are the pictures that Dr. Rice had shown -- these are taken from that paper by Incardona, by the way -- and then in the right column are the actual exposure concentrations that caused the deformities that are in these pictures.

Q. Do you have an understanding or opinion as to how these

values correlate to the percentage of Gulf samples that you looked at?

A. Oh, yes, I do.

Q. What is that opinion?

MR. CHAKERES: Your Honor, I'm going to object. I don't believe this opinion has been stated in his report data.

MR. BROCK: This is in the report.

THE COURT: Which of his three reports?

MR. BROCK: It's in his --

THE COURT: Do you know, sir?

MR. BROCK: It's the data that he has been talking about, but there is a reference to the comparison to this also.

THE WITNESS: I believe it's Table 1, Report 2.

MR. BROCK: Table 1, Report 2.

THE WITNESS: I believe.

MR. CHAKERES: Your Honor, the thresholds in that table are different than these thresholds.

THE COURT: I can't even find right now where it --

MR. CHAKERES: It's on page 18 of the Round 2 report that was tendered.

THE COURT: Page 18. Okay.

MR. BROCK: There are two pieces to this, Your Honor.

First of all, it's a fact that's in the Incardona paper, but it's also the case that he looked at these values, and he's going -- I am asking him to give a general

01:43:39 opinion about how these exposures compare to exposures in the
01:43:42 Gulf of Mexico based on Table 1 on page 18.
01:43:47 **MR. CHAKERES:** We have no objection to their using
01:43:59 Table 1. Those are different values than they are talking
01:44:02 about right now.
01:44:04 **THE COURT:** I'm looking at the report now on page 18,
01:44:06 his second report.
01:44:11 It says: "Finally, even if the studies relied
01:44:14 upon by the United States were valid, the concentrations of
01:44:17 PAHs that are purported to causes toxicity were rarely exceeded
01:44:21 in the Gulf, it would not change my previous opinion."
01:44:26 That's the same thing you are talking about now?
01:44:28 **THE WITNESS:** That is correct.
01:44:29 **THE COURT:** But it does look like the values are
01:44:32 different than these values on the screen right now. Am I
01:44:34 right?
01:44:35 **THE WITNESS:** That is correct. They are other
01:44:37 endpoints in the Incardona paper compared to these. And so
01:44:41 it's the same type of comparison, but these are -- the data
01:44:48 that you are looking at in Table 1 there, those are also from
01:44:53 the Incardona paper.
01:44:56 **MR. BROCK:** I'm asking him how these compare to the
01:44:58 work that he did in looking at toxicity of water samples in the
01:45:02 Gulf, using the information --
01:45:07 **THE COURT:** I think I just read his opinion.

01:45:09 **MR. BROCK:** All right.
01:45:09 **THE COURT:** If you want to ask him to confirm that's
01:45:10 his opinion, you can do that.
01:45:12 **MR. BROCK:** Okay.
01:45:13 **BY MR. BROCK:**
01:45:13 **Q.** Can I ask you to state your opinion as to how these values
01:45:18 correlate to findings of toxicity in the Gulf of Mexico water
01:45:24 samples?
01:45:25 **A.** So these values are very high concentrations. The
01:45:29 3.4 parts per billion would represent fewer than 2 percent of
01:45:34 the total samples that were there. The overlap with the
01:45:36 exceedances of the EPA benchmark would be pretty significant.
01:45:41 So essentially, the EPA benchmark would be protective of that.
01:45:44 At the 8.5 parts per billion, it would be fewer than
01:45:46 1 percent of all the samples. And at that highest exposure,
01:45:50 nearly 14 parts per billion, it would be about one-half of 1
01:45:53 percent of all of the samples would exceed that concentration.
01:45:57 So these were rarely exceeded.
01:45:59 **MR. BROCK:** Let's look at D-32616.
01:46:02 **BY MR. BROCK:**
01:46:05 **Q.** Do you recognize this slide?
01:46:05 **A.** Yes, I do.
01:46:06 **Q.** Was it used by Dr. Rice in his direct examination?
01:46:11 **A.** Yes, it was.
01:46:12 **Q.** Do you agree with Dr. Rice that these studies show effects

01:46:15 to Gulf of Mexico species?
01:46:17 **A.** No, I do not.
01:46:19 **Q.** The first paper is Incardona. We have just discussed why
01:46:23 you have the view that it's not reliable and that the levels
01:46:27 that he showed were not representative of things in the Gulf.
01:46:31 Let's look at the second paper by Mager. Is
01:46:36 Dr. Incardona an author there?
01:46:41 **A.** Yes, he is.
01:46:41 **Q.** Do you agree with Dr. Rice's conclusions about this study?
01:46:45 **A.** No, I do not.
01:46:47 **Q.** Why not?
01:46:47 **A.** Well, this also utilizes this high-energy blender method
01:46:51 for exposure, which I believe is inappropriate for this
01:46:56 purpose, for trying to replicate what may have happened in the
01:47:00 Gulf of Mexico.
01:47:01 In addition to this, this is not a true toxicology
01:47:03 study. This is essentially a preliminary study which looked at
01:47:07 the possible effect of oil on the swimming speed of a fish, and
01:47:11 they did not do what we call a dose-response study.
01:47:15 And again, in toxicology, you need to be quantitative
01:47:19 if you are going to be using the data in a quantitative way or
01:47:22 for making decision-making. This is what I would consider to
01:47:25 be a preliminary experiment that one would conduct in order to
01:47:29 conduct and design a true toxicology experiment. So the data
01:47:32 that are presented in the paper are not reliable for use in

01:47:36 toxicology assessments.
01:47:38 **Q.** What are the third and fourth papers here?
01:47:41 **A.** The third and fourth papers are both coauthored by a
01:47:45 similar group of scientists. Dubansky and Whitehead are the
01:47:49 senior authors of each of these papers. They are very similar
01:47:53 papers.
01:47:53 They are looking at the potential influence of oil on
01:47:58 the Gulf killifish. This is the fish I mentioned earlier that
01:48:01 is native to the marshes and the coastal areas of the Gulf of
01:48:05 Mexico.
01:48:05 The first of those papers, the third that's shown up
01:48:07 there, what they are looking at there are not effects at all.
01:48:10 What they are looking at are, how does oil potentially
01:48:15 influence how the fish are expressing genes and proteins.
01:48:21 These are not effects, and even the authors and even Dr. Rice
01:48:24 himself has indicated this is an indicator, an indirect
01:48:27 indicator of exposure, not an indicator of effect.
01:48:30 We have direct measures of exposure already, and that
01:48:34 is measuring the PAHs that are present in the water and the
01:48:37 sediment. So this is not an appropriate way to look at
01:48:40 effects.
01:48:41 **Q.** What's the value of studies and papers like this?
01:48:45 **A.** Well, the value of the first two papers is very limited
01:48:48 due to the inappropriate and nonstandard method of exposure.
01:48:52 exposure. Had they used the standard method of exposure, these

might actually be useful information that EPA or others might be able to use.

Now, there are other problems with both of those papers that I have detailed in my reports. They are very technical in nature. And one can go to those reports if you're interested.

The second two papers have some scientific value with regard to understanding how proteins and genes react to a stress like a PAH exposure. So it's molecular biology or geneticists would be interested in this material?

But for the purposes of actually trying to determine or assess potential harm, none of these four papers are valuable.

MR. BROCK: One more slide. D-34888-A.

BY MR. BROCK:

Q. Can you use this, Dr. Shea, to walk through the toxicity approach that you took in comparison to the United States experts?

A. Sure. On the left-hand column, highlighted in blue there, are certain characteristics that I certainly would be looking for in terms of trying to perform an evaluation like this. In the middle column, I have listed what I have performed to try to form my opinions. On the right-hand column, I list what the U.S. experts have used primarily to form their opinion.

So the first one, the proposed PAH toxicity

threshold, as I have said, I have utilized what we consider to be the gold standard, the EPA benchmark method; whereas the U.S. experts relied upon this Incardona method with a .3-part-per-billion threshold that they derived from this blender method exposure.

The second one is the source of the proposed PAH toxicity threshold, and that again gets to this. I used the EPA methodology; they used the Incardona paper that I have obviously talked about.

The third is the studies to develop the PAH toxicity threshold. How many toxicity studies were there? Well, the EPA benchmark method utilized 201 different toxicity methods. The Incardona paper is simply a single study. One could divide that up perhaps into a few studies within Incardona; or you add Mager to that, then you have a few studies, perhaps. But their analysis is driven by the .3 part per billion.

The second is -- we want to look at a multitude of species, if we can, for this type of analysis. The EPA benchmark method uses 28 different species for the analysis. The U.S. experts are primarily looking at this one bluefin tuna from Australia.

The next point is looking at dispersants. I looked at over 5,000 samples for dispersants. The U.S. experts did not look at dispersant chemicals at all.

And then finally, I looked at all of the sediment

01:51:41 data that was available. And again, the U.S. experts did not
01:51:42 rely upon any of those data.
01:51:44 **Q.** Thank you very much.
01:51:44 **MR. BROCK:** Let's look at D-34883.
01:51:46 **BY MR. BROCK:**
01:51:47 **Q.** I will just ask you briefly to summarize your findings
01:51:53 with regard to toxicity and potential environmental harm in
01:51:57 this case.
01:51:58 **A.** Sure. Well, when the oil spill first began, as everyone
01:52:01 was, I was concerned about the potential harm that might be
01:52:04 caused by this oil spill. I had colleagues that were working
01:52:10 on this. I followed the news media reports about this.
01:52:14 When I was asked if I would render an opinion based
01:52:17 upon the data that were available, of course I wanted to do so
01:52:21 to the best of my ability.
01:52:22 What I discovered -- I first read the literature,
01:52:25 re-reviewed literature on oil spills that I had read before,
01:52:30 read the reports from the government; and what I found is that
01:52:34 there was just an enormous quantity of really high-quality and
01:52:37 relevant data that one could actually draw upon to make this
01:52:40 conclusion. I looked at that.
01:52:43 It was the largest environmental investigation of an
01:52:45 oil spill or any single environmental incident at all that's
01:52:49 ever been undertaken. The quality of the data, the enormity of
01:52:53 the data was just amazing, but highly relevant and very useful

for this.

So in using those data and in using the EPA benchmark approach with those data, I concluded that there was no harmful exposure from oil-related chemicals or dispersants in nearly all of the area that was investigated.

And in those few areas where there was potentially harmful exposure to chemicals, they were limited in space and in time, and they were mostly in the area very close to the wellhead and during the summer of 2010.

MR. BROCK: Thank you, Dr. Shea.

That's all we have for now, Your Honor.

THE COURT: All right. Cross-examination.

MR. CHAKERES: Your Honor, Nat Chakeres on behalf of the United States.

CROSS-EXAMINATION

BY MR. CHAKERES:

Q. Dr. Shea, I have you on cross-examination.

Sir, in arriving at your opinion regarding the degree of potential harm in the Gulf of Mexico, as you just discussed, you applied a set of toxicity benchmarks, correct?

A. That is correct.

Q. The benchmarks that you used for PAHs were originally derived and published in a 2003 guidance document by the U.S. EPA, correct?

A. That is correct. They are in a 2003 guidance document.

01:54:36 **Q.** And those benchmarks were derived from a set of toxicity
01:54:40 studies compiled by EPA, correct?
01:54:42 **A.** The toxicity studies were in the EPA database and compiled
01:54:46 by them, yes.
01:54:47 **Q.** Many of them are from the published literature, correct?
01:54:50 **A.** Many of them are from the published literature, yes.
01:54:52 **Q.** And I want to split this out because it's the way you did
01:54:55 it in your report, for clarity.
01:54:57 So there are actually two sets of benchmarks for PAHs
01:55:01 that you applied, correct?
01:55:03 **A.** If you could explain that.
01:55:05 **Q.** Acute and chronic benchmarks?
01:55:07 **A.** There are acute and chronic benchmarks, benchmarks for
01:55:10 short-term toxicity and long-term toxicity, yes.
01:55:13 **Q.** The acute benchmarks were derived based on an acute
01:55:17 narcosis model, correct?
01:55:20 **A.** The mechanism of toxicity used for that is called narcosis
01:55:23 or acute toxicity, yes.
01:55:25 **Q.** Once the EPA derived these benchmarks for acute exposure,
01:55:30 they then went a step further and derived chronic benchmarks,
01:55:36 correct?
01:55:36 **A.** That is correct.
01:55:37 The process for water quality criteria derivation or
01:55:41 benchmark characterization first derives acute toxicity
01:55:45 benchmarks and then, second, chronic toxicity benchmarks.

01:55:48 **Q.** And the way -- to hopefully simplify it and still be
01:55:52 accurate, the way that the chronic benchmarks were derived is a
01:55:56 set of acute studies and chronic studies were compared to each
01:56:00 other, and then a ratio between basically the degree of
01:56:05 toxicity was calculated from the acute and the chronic studies,
01:56:10 right?
01:56:11 **A.** So the acute studies are conducted, the chronic studies
01:56:13 are conducted, and then they are compared within a species to
01:56:17 develop what's called an acute-to-chronic ratio. And again,
01:56:21 this follows the standard EPA water quality derivation, so it's
01:56:26 the same for these PAH benchmarks as it would be for copper or
01:56:29 PCBs or mercury, yes.
01:56:32 **Q.** So there is an acute-to-chronic ratio calculated for all
01:56:36 of the species studied, correct, for which they had chronic
01:56:41 studies available?
01:56:41 **A.** For which they have chronic studies available, correct.
01:56:44 **Q.** And the acute-to-chronic ratio is then simply multiplied
01:56:48 by the benchmarks -- by the acute benchmarks to arrive at the
01:56:52 chronic benchmarks, correct?
01:56:53 **A.** You use that ratio in order to arrive at the chronic
01:56:57 benchmark.
01:57:00 **Q.** When you were talking earlier about how the benchmarks are
01:57:03 protective against things like sublethal effects, those are all
01:57:08 subsumed within the chronic benchmarks, correct?
01:57:11 **A.** They are mostly there. Some of the acute effects are

01:57:15 sublethal as well, but mostly in the chronic toxicity tests.
01:57:18 **Q.** In terms of the chronic effects studies that were used in
01:57:20 the calculation of the chronic benchmarks, those studies were
01:57:24 based upon a total of six species, correct?
01:57:29 **A.** I would have to look back at the documentation
01:57:31 specifically. That sounds about correct.
01:57:35 **Q.** We will take the approximation.
01:57:36 And of those species, approximately two were
01:57:41 saltwater species?
01:57:42 **A.** Yes. In that document itself, it also explains they
01:57:47 looked at very detailed -- the different sensitivity potential
01:57:49 for freshwater and saltwater species.
01:57:53 In the EPA documentation, they are showing and
01:57:55 demonstrating there's no difference in sensitivity between
01:57:58 freshwater and saltwater species for the PAH toxicity.
01:58:02 **Q.** The studies that were relied upon, these were studies
01:58:05 examining exposure to pure PAHs, correct?
01:58:09 **A.** That's correct. As I explained in my direct examination,
01:58:12 the toxicity experiments that are conducted initially to
01:58:16 develop benchmarks utilize pure chemical standards that are
01:58:19 added or a mixture of those chemicals, yes.
01:58:23 **Q.** A total of five PAHs were tested as part of the chronic
01:58:26 studies, right?
01:58:27 **A.** Again, I would have to check the documentation to be sure
01:58:30 of the number, but that sounds about correct.

01:58:32 **Q.** And you don't know, or you didn't at the time of your
01:58:35 deposition, how many of those chronic studies were on embryos,
01:58:38 did you?
01:58:39 **A.** I did not know at the time, and I could not tell you the
01:58:42 exact number now.
01:58:44 **Q.** And the way you used the benchmarks in forming your
01:58:47 opinion in this case is that you apply them as a toxicity
01:58:51 threshold, right?
01:58:52 **A.** I utilized the benchmarks the way EPA has expressly
01:58:56 developed them and to use them as a threshold, correct.
01:58:59 **Q.** If field samples were below the toxicity threshold or, in
01:59:06 this case, a toxic unit of one, under your methodology, you
01:59:11 concluded there was no potential for toxicological harm related
01:59:14 to that sample, correct?
01:59:16 **A.** That is correct.
01:59:17 **Q.** Now, in the derivation of these chronic benchmarks, there
01:59:21 were no studies on any tuna species, correct?
01:59:25 **A.** To my knowledge, there were no studies on tuna species,
01:59:29 that's correct.
01:59:29 **Q.** No studies on blue crab, correct?
01:59:31 **A.** Again, I would have to check, but I don't believe there
01:59:33 were studies on blue crab.
01:59:35 **Q.** No studies on menhaden, right?
01:59:38 **A.** There would have been no studies on the chronic toxicity
01:59:41 to menhaden.

01:59:42 **Q.** Or killifish?
01:59:45 **A.** There would have been no studies on killifish, that's correct.
01:59:48
01:59:49 **Q.** Or mahi-mahi?
01:59:51 **A.** Definitely no studies on mahi-mahi.
01:59:54 **Q.** You don't know if the toxicity threshold of one toxic unit
01:59:57 is protective of mahi-mahi at all life stages, do you?
02:00:02 **A.** If you are asking whether -- could you repeat the
02:00:05 question?
02:00:06 **Q.** Yes. You don't know if the toxicity threshold of one
02:00:09 toxic unit that you used is protective of mahi-mahi at all life
02:00:14 stages, do you?
02:00:15 **A.** We know that the EPA benchmark approach is protective of
02:00:20 sensitive species at sensitive life stages. Whether it is
02:00:23 specifically protective of mahi-mahi, we do not know for that
02:00:27 particular organism.
02:00:28 This is similar, again, to all of the water quality
02:00:31 criteria that the EPA developed. They can't test every single
02:00:35 organism in every single life stage, so they utilize the water
02:00:40 quality criteria to be protective, using safety factors in
02:00:44 their analyses in an attempt to be protective of all those
02:00:47 species and life stages.
02:00:48 **Q.** But without data on those species at all their life
02:00:52 stages, you don't know for sure if these benchmarks are
02:00:54 protective?

02:00:55 **A.** Well, as a scientist, I can't say for sure with a hundred
02:00:59 percent possibility of that without the data, that's correct.
02:01:04 **Q.** There have been a number of publications that have come
02:01:06 out in the peer-reviewed literature regarding the potential
02:01:09 environmental effects from the *Deepwater Horizon* spill,
02:01:11 correct?
02:01:12 **A.** That is true.
02:01:13 **Q.** You didn't adjust your thresholds at all based on any of
02:01:18 those publications, did you?
02:01:19 **A.** I reviewed all of those publications, probably all of the
02:01:25 ones you are referring to anyway, and there were no data within
02:01:28 those publications that led me to believe that the way EPA has
02:01:31 published and utilizes these benchmarks -- there is no reason
02:01:36 for me to alter the way EPA or the other federal agencies have
02:01:40 utilized them.
02:01:40 **Q.** The benchmarks weren't meant to be stand-alone pass/fail
02:01:44 criteria for all applications, were they?
02:01:46 **A.** That would be true of all water quality criteria, correct.
02:01:49 **Q.** These are not water quality criteria, correct?
02:01:51 **A.** That is true. They are derived in the exact same way, but
02:01:55 what you had just said would be true for water quality
02:01:57 criteria, standards, or benchmarks.
02:02:00 **Q.** These are benchmarks, correct, just so the record's clear?
02:02:02 **A.** These are water quality benchmarks that the EPA has
02:02:05 developed, yes.

02:02:06 **Q.** And the benchmarks are supposed to be adjusted for
02:02:09 site-specific conditions, when appropriate; isn't that correct?
02:02:12 **A.** Again, the benchmarks for any water quality criteria can
02:02:16 be adjusted for site-specific information, should the local
02:02:20 representatives who are regulating that area deem it necessary.
02:02:24 **Q.** Despite all of the data related -- site-specific data
02:02:28 related to this spill, you didn't do any adjustment to your
02:02:31 thresholds, correct?
02:02:34 **A.** There was no site-specific information that I found that
02:02:36 would lead me to believe that these benchmarks should be
02:02:39 changed. So I proceeded with exactly the same way that EPA
02:02:43 utilized these: The OSAT, the Geological Survey, and the NOAA
02:02:52 scientists. We used the same one.
02:02:52 **Q.** Are you finished?
02:02:53 **A.** Yes, I am.
02:02:54 **Q.** You are familiar with the concept of photo-enhanced
02:02:57 toxicity, correct?
02:02:58 **A.** Yes, I am.
02:02:59 **Q.** Briefly, that's a phenomenon whereby PAHs can exhibit
02:03:03 greater toxicity in the presence of UV light, correct?
02:03:06 **A.** It is possible for that to happen, yes.
02:03:08 **Q.** And that effect has been demonstrated in some of the
02:03:12 *Deepwater Horizon* toxicity tests that you reviewed, correct?
02:03:15 **A.** Some of those 900 deepwater toxicity tests did utilize
02:03:22 high-energy ultraviolet light to try to determine whether the

presence of that light would increase toxicity. Some of those tests demonstrated an increase in toxicity. Some of those tests demonstrated no increase in toxicity.

Q. There are also publications documenting photo-enhanced toxicity in laboratory bioassays, correct?

A. Yes, there are. The literature is mixed with regard to how that happens and when that happens. We don't know enough about phototoxicity to incorporate that into our toxicology models at this time.

Q. Depending on the organism and exposure regime, photoactivation can increase the toxicity of certain PAHs by one to four orders of magnitude, correct?

A. There have been reports of large increases in PAH toxicity, and there have been reports of no increase. And it's highly variable, yes.

Q. The EPA benchmarks that you applied are not derived to be protective against photo-enhanced toxicity, are they?

A. The EPA benchmarks do not explicitly incorporate any toxicity data associated with this high-energy ultraviolet light that has been utilized. Instead, they are designed to be conservative, protective of aquatic life. Conservative benchmarks to be protective of aquatic life under all the conditions that those organisms would experience.

Q. The EPA specifically warns users that the benchmarks are likely to be underprotective in instances of phototoxicity,

don't they?
A. The EPA -- I don't know that I would say warns. The EPA mentions in their various documents that site-specific conditions can influence the toxicity of any chemical, including PAHs.

Some of those site-specific conditions reduce the toxicity. And, in fact, in the EPA benchmark document, they actually mention that most of those site-specific characteristics would actually reduce toxicity.

MR. CHAKERES: Let's go to Exhibit 13340.

BY MR. CHAKERES:

Q. This is the 2003 guidance document where the benchmarks you used were first published, correct?

A. That is correct.

MR. CHAKERES: Let's go to page 98. If we could go to header 6.5.2, the first section after that.

BY MR. CHAKERES:

Q. You see here at the top it says, "because the PAH mixture ESB" -- you understand that those are the benchmarks, right?

A. That is correct.

Q. -- "derived here is based on narcosis. If there is additional toxicity caused by photoactivation, it may cause the ESB to be underprotective."

Do you see that?

A. Yes, I do.

02:06:15 **MR. CHAKERES:** You can pull that down.
02:06:16 **BY MR. CHAKERES:**
02:06:17 **Q.** Now, the benchmarks are derived in a way to be protective
02:06:24 against -- for 95 percent of the species in the EPA database,
02:06:29 correct?
02:06:29 **A.** That's the intention of all water quality criteria and
02:06:33 benchmarks, yes. They are all derived the same way.
02:06:36 **Q.** So the most sensitive 5 percent of the species in the
02:06:39 database are not protected by the benchmarks, correct?
02:06:42 **A.** In this case, that's not correct. The mysid shrimp is the
02:06:48 most sensitive species that was tested there, and it's actually
02:06:52 protected by this benchmark.
02:06:54 **MR. CHAKERES:** If we could go back to 13340, and why
02:07:06 don't we go to page 57. I believe we have a call-out, 157.1.
02:07:27 **BY MR. CHAKERES:**
02:07:28 **Q.** So this states -- I'll have to translate. "FAV" means
02:07:34 final acute value in the context of these benchmarks, correct?
02:07:37 **A.** That's correct.
02:07:37 **Q.** "This final acute value is greater than the genus mean
02:07:42 acute values" -- so there is the genus-specific acute values,
02:07:44 correct?
02:07:45 **A.** Correct.
02:07:45 **Q.** -- "of the two most acutely sensitive genera."
02:07:48 Do you see that?
02:07:49 **A.** Yes, I do.

02:07:53 **MR. CHAKERES:** We can pull that down.
02:07:55 **BY MR. CHAKERES:**
02:07:55 **Q.** Now, under the approach you took, you applied benchmarks
02:07:57 for 34 separate PAHs, correct?
02:08:00 **A.** That is correct.
02:08:02 **Q.** In the water samples that were tested and the sediment
02:08:06 samples that were tested, typically there were more than
02:08:09 34 PAHs measured, correct?
02:08:11 **A.** That is correct, typically there were.
02:08:13 **Q.** They were on the order of 50 or 60, depending on the
02:08:18 sample?
02:08:18 **A.** If you look at most of the laboratory data that are in
02:08:22 that database, it's approximately 50 PAHs were reported.
02:08:27 **Q.** For those PAHs that you applied no benchmark for, your
02:08:33 methodology assigned them zero toxicity, effectively, didn't
02:08:35 it?
02:08:37 **A.** That is correct, following the way EPA has utilized this,
02:08:40 as well as the other federal agencies, yes.
02:08:43 **Q.** The EPA guidance document actually tells users that when
02:08:47 the concentrations of additional PAHs are known, they should
02:08:51 include those newly quantified PAHs in the derivation of
02:08:55 benchmarks, don't they?
02:08:56 **A.** They suggest that you can utilize that. I actually did
02:08:59 make calculations using all 50 of those PAHs that you are
02:09:02 referring to and found that there was no significant difference

02:09:06 in calculating the toxic units associated with 50 PAHs versus
02:09:12 the 34. And the reason for that is many of those additional
02:09:16 PAHs were at nondetect values or very low levels in the water
02:09:21 column.
02:09:22 **Q.** At the time of your deposition, you had only made that
02:09:24 calculation for a few hundred samples in the database, correct?
02:09:27 **A.** I had looked at the highest concentrations. So, yes, it
02:09:31 would be a few hundred samples, looking at those samples where
02:09:36 that might be affected the most.
02:09:38 **MR. CHAKERES:** I would like to go to Exhibit 13333.
02:09:44 **BY MR. CHAKERES:**
02:09:55 **Q.** This is the Incardona paper you were testifying about a
02:09:58 moment ago, correct?
02:09:59 **A.** Yes, it is.
02:10:00 **MR. CHAKERES:** Can we go to page 3.
02:10:01 **BY MR. CHAKERES:**
02:10:01 **Q.** You see the first figure there? That's a set of what are
02:10:05 called chromatograms. Do you see that?
02:10:07 **A.** Well, these are actually histograms representing the data
02:10:11 that were reported, as opposed to actual chromatograms, yes.
02:10:17 **Q.** We will go with histograms then. We want to make sure
02:10:19 we're on the same page.
02:10:20 You see there is comparisons between -- for three
02:10:24 sets of -- for three sets of exposures, there is field sample
02:10:29 compared to lab samples. Do you see that?

02:10:32 **A.** Yes, I do.
02:10:33 **MR. CHAKERES:** We can pull that down.
02:10:36 I would like to go to demonstrative D-3500. I'm
02:10:41 sorry, D-32500.
02:10:45 **BY MR. CHAKERES:**
02:10:45 **Q.** What I did is I just pulled out the colored version of the
02:10:49 histogram for one of the field samples from that Incardona
02:10:50 paper. Do you see that?
02:10:51 **A.** Yes, I see that.
02:10:52 **Q.** I want to walk through this, and hopefully we don't get
02:10:57 ourselves too confused here. I'm the one that would really get
02:10:59 confused.
02:11:00 So this histogram represents the concentrations of
02:11:05 various PAHs found in this particular sample, correct?
02:11:09 **A.** Yes. This is a representation of the relative amounts of
02:11:14 the PAHs in this sample.
02:11:16 **Q.** And if we start at the left, we have an N0, correct?
02:11:21 **A.** Yes. That would be naphthalene.
02:11:24 **Q.** And then over on the right, we have some Cs. Those are
02:11:27 chrysene, correct?
02:11:29 **A.** Those are chrysene and some what we call alkylated
02:11:33 chrysenes, yes.
02:11:35 **Q.** Next to the N0, naphthalene, there's also some alkylated
02:11:35 naphthalenes, correct?
02:11:38 **A.** That is correct.

02:11:39 **Q.** And so naphthalene is the smallest and lightest PAH,
02:11:44 correct?
02:11:46 **A.** That is correct.
02:11:47 **Q.** It weathers the fastest, correct?
02:11:50 **A.** It does, yes.
02:11:51 **Q.** It dissolves the fastest, correct?
02:11:56 **A.** It dissolves faster than most of the other PAHs. Fluorine
02:12:00 would actually dissolve almost about at the same rate.
02:12:03 **Q.** It, in some degree, can evaporate as well?
02:12:08 **A.** Naphthalene can evaporate as well, yes, as can other PAHs,
02:12:10 yes.
02:12:11 **Q.** Some of these -- so if -- under the benchmarks that you
02:12:15 use, naphthalene is among the least toxic PAHs, correct?
02:12:22 **A.** Naphthalene is among the least toxic, that is correct.
02:12:25 **Q.** You have a separate benchmark for each of the PAHs that
02:12:28 you looked at, a separate benchmark assigned to the toxicity of
02:12:31 each separate PAH of those 34 you used, correct?
02:12:35 **A.** The official language wouldn't be a separate benchmark,
02:12:38 but it's a separate potency divisor which one could interpret
02:12:43 to be a separate benchmark in lay terms, yes.
02:12:46 **Q.** If we move from the more simple, smaller PAHs to the
02:12:51 larger, more complex PAHs, in general, the toxicity of the PAHs
02:12:58 increases as the PAHs increase in size and complexity, correct?
02:13:04 **A.** And so what this is describing here are a series of these
02:13:09 polycyclic aromatic hydrocarbons, these PAHs.

02:13:11 In general, as you go from the left of this graph
02:13:14 towards the right, the size of that PAH increases. And in
02:13:19 general, that means the ability of that PAH to dissolve into
02:13:22 water decreases dramatically.
02:13:24 So, for example, naphthalene, which is on the left
02:13:28 and is smaller, dissolves to a much greater extent than those
02:13:33 chrysenes on the right. The chrysenes basically don't want to
02:13:37 be in water at all.
02:13:38 As you go from left to right on this diagram, the PAH
02:13:41 is getting larger again, the toxicity in general increases.
02:13:45 There are exceptions, but in general, it increases.
02:13:49 **Q.** Right. As we go within these groups, so N0 to N1 for the
02:13:54 benchmarks you used, that's going to more than double the
02:13:59 toxicity -- N1 is more than double the toxicity of N0, correct?
02:14:04 **A.** N1 is slightly more toxic than naphthalene, the parent
02:14:09 naphthalene that's there. And according to that graph, its
02:14:12 concentration is slightly more than twice as much. So you
02:14:15 would have approximately twice as much toxicity, yes.
02:14:17 **Q.** Just so we are clear, I'm not asking for the total toxic
02:14:22 potential from each of these. I'm talking about, irrespective
02:14:27 of the quantity these PAHs are in this histogram, the benchmark
02:14:33 for naphthalene is twice as high as the benchmark for N1,
02:14:39 correct?
02:14:41 **A.** I actually didn't follow that.
02:14:45 **Q.** We will move on then.

02:14:46 **A.** Okay.
02:14:50 **Q.** These greens over here are dibenzothiophenes, correct?
02:14:55 **A.** That's correct. They are dibenzothiophenes. They contain
02:14:58 a sulphur compound in their ring structure.
02:14:59 **Q.** You did not use a benchmark at all for the
02:15:02 dibenzothiophenes, did you?
02:15:05 **A.** That is correct.
02:15:05 **Q.** So you assigned zero toxicity for dibenzothiophenes under
02:15:10 your approach, correct?
02:15:11 **A.** That is correct.
02:15:12 **MR. CHAKERES:** We can pull that down.
02:15:17 **BY MR. CHAKERES:**
02:15:18 **Q.** Now, you testified on direct that one of the benefits of
02:15:21 the EPA benchmarks is that they are updated periodically,
02:15:27 correct?
02:15:28 **A.** I mentioned that one of the benefits of the water quality
02:15:31 criteria process and the EPA water quality benchmark process is
02:15:37 the EPA has a process for incorporating not only new data, but
02:15:42 new knowledge in terms of improving those water quality
02:15:46 criteria. When reliable data are available, they have a
02:15:49 process to do that, yes.
02:15:51 **Q.** So we are clear, the benchmarks you used have never been
02:15:54 updated since 2003, since their first publication, correct?
02:15:59 **A.** The EPA has not updated those benchmarks since that
02:16:02 publication, correct.

02:16:03 **Q.** And you yourself have not attempted to adjust your
02:16:08 thresholds based on any data that came available after the 2003
02:16:14 publication of the guidance document for the benchmarks,
02:16:15 correct?
02:16:16 **A.** Well, I have reviewed the literature as it has been
02:16:19 published that is relevant to this topic. In reviewing that
02:16:23 literature, I found that there was no additional information
02:16:26 that would cause me to change the way EPA officially does this
02:16:30 and, again, the way that the other federal agencies have done
02:16:35 this.
02:16:35 **Q.** So there's no studies since 2003, in your opinion, that
02:16:38 are sufficiently relevant and reliable to adjust the
02:16:42 benchmarks?
02:16:42 **A.** That is correct.
02:16:43 **MR. CHAKERES:** Let's pull up Exhibit 13457. If we
02:16:54 can call out the header, the title, and authors.
02:16:59 **BY MR. CHAKERES:**
02:17:00 **Q.** So you are familiar with this paper, correct?
02:17:03 **A.** Yes, I am.
02:17:04 **Q.** You cite it in your report, correct?
02:17:05 **A.** Yes, I do.
02:17:06 **Q.** And you cite this paper in support of the proposition that
02:17:12 the benchmarks have been validated for things like chronic
02:17:17 effects and sublethal effects, correct?
02:17:21 **A.** That is correct, yes.

02:17:21 **Q.** You also cite this paper in support of the idea that there
02:17:24 are a number of toxicity tests that have gone into the
02:17:29 development of the benchmarks, correct?
02:17:30 **A.** That is correct, yes.
02:17:32 **Q.** In fact, this paper relies on datasets -- I'm sorry. This
02:17:36 paper was published in 2008, right?
02:17:42 **A.** I believe it's 2009.
02:17:44 **Q.** 2009. I stand corrected.
02:17:46 This paper relies on datasets that were not around in
02:17:50 2003, correct, some of the data?
02:17:52 **A.** That's correct. Well, the datasets and the methodology
02:17:56 that they used was not the same, yes.
02:18:00 **Q.** And the two authors, Drs. McGrath and Di Toro, were
02:18:05 significant contributors to the 2003 EPA guidance document,
02:18:05 correct?
02:18:08 **A.** Yes, they were significant contributors to that document.
02:18:12 **Q.** The benchmarks calculated in this paper are different than
02:18:16 the benchmarks you applied in this case, correct?
02:18:18 **A.** Yes, that is correct.
02:18:21 **Q.** In fact, for most of the PAHs for which benchmarks are
02:18:27 published in this paper, they are more protective than the
02:18:32 benchmarks you applied in this case, correct?
02:18:34 **A.** The methodology that they used is different than the
02:18:38 methodology that the EPA has used. And the benchmarks, as you
02:18:41 say, the potency divisors, those values for the PAHs they

report are largely different, yes -- by a certain amount, yes.

Q. And largely more protective?

A. Largely more protective, that's correct.

MR. CHAKERES: We can pull this down.

BY MR. CHAKERES:

Q. I would like to move on to another topic. You testified a little bit about the dispersion of oil. You would agree with me dispersants, when applied to oil, are designed to break the oil down into smaller droplets?

A. Yes. That's their primary purpose.

Q. And that increases the surface-area-to-volume ratio of the oil droplets?

A. Yes, it does.

Q. And by doing that, that increases the bioavailability of the PAHs, doesn't it?

A. Yes, it does.

In fact, I have done my own research on this myself, reported results of how dispersant can increase surface-area-to-volume ratio at a scientific conference and how in our laboratory testing that we did with the eastern oyster and with the blue crab, that under those conditions, it increased the bioavailability of certain PAHs. Whether that holds true for other situations like out in the real world, we simply don't know.

Q. Now, you testified on direct that the water column

sampling was biased towards finding larger concentrations of oil, correct?

A. Yes. The water column sampling, if you read the actual sampling plans that are available publicly, you will find that the plans generally are directing the sampling effort towards finding oil. They are doing this in different ways. They are looking for surface oil itself; and if the surface oil is present, to collect samples near there.

In the subsurface, where you cannot see the, oil they are using other measurements. For example, if you have significant amounts of oil, you may have a slight depression in the dissolved oxygen concentration, or you might have some turbidity or fluorescence response in some of the instruments they're using below the water column. And if you find those anomalies, that's an indication of the possible presence of oil.

And these sampling plans directed the samplers, "If you see those anomalies, that may be the presence of oil, collect the sample there."

Q. With respect to the areas where dispersants were being applied, it was, in fact, difficult for monitoring teams to sample immediately following dispersant application, wasn't it?

A. That would only be true for a certain period of time at the surface, but there were actually a lot of samples collected right at the wellhead. So when dispersant was added at the

wellhead, samples were being collected simultaneously to be able to evaluate that.

Q. And to be more precise with my question, with respect to surface application, it was difficult for monitoring teams to sample surface waters following dispersant applications, wasn't it?

A. My understanding was there was a certain period of time, for safety reasons, to wait before sampling teams went in after the dispersant was applied.

Q. And in addition, there was also the problem of the dispersants were being applied over a large area, correct?

A. You would have to restate that question.

Q. Would you agree that another reason for the difficulty in sampling immediately following surface dispersant applications was that dispersants were being sprayed over large areas?

A. Well, samples were collected when dispersant was applied and boats were available or nearby to sample. If boats were not nearby, then they would not have sampled as quickly.

Q. Now, you testified a little bit about laboratory methods. Just to be clear, there's no legally mandated method for exposing organisms to crude oil solutions in labs, correct?

A. I'm not aware of any, as you put it, legally mandated. I'm aware of what the scientific community considers to be a standard, what the federal government has been involved with with developing that standard.

02:22:56 **Q.** You yourself --
02:22:57 **A.** I have explained that in great detail in an appendix in my
02:23:01 first report.
02:23:02 **Q.** You yourself have never published any studies where they
02:23:06 have been designed to test the effects of crude oil on marine
02:23:09 organisms, correct?
02:23:12 **A.** I have not published any studies on laboratory exposures
02:23:17 to crude oil. I have given scientific presentations related to
02:23:21 that and I have had technical reports, but no peer-reviewed
02:23:23 publications on laboratory exposures to oil, with the
02:23:29 exception, I will say, of using oil as a source of PAH exposure
02:23:34 to endangered freshwater mussels.
02:23:38 One thing we do a lot of in our laboratory is we do a
02:23:41 lot of work with endangered species; and one of the primary
02:23:45 species -- or family, I should say, are freshwater mussels.
02:23:46 And so we have looked at the exposure of PAHs to those mussels.
02:23:56 **Q.** You presented a map relying on something that -- called
02:24:03 Kriging, correct?
02:24:04 **A.** That is correct.
02:24:05 **Q.** And Kriging is a geostatistical method of interpolating
02:24:10 between data points, correct?
02:24:12 **A.** Kriging itself is a general term. When most people --
02:24:18 most people who use the term "Kriging," when they refer to it,
02:24:21 they are referring to spatial Kriging, so you are actually
02:24:24 looking at samples at different locations and trying to draw

contours statistically.

So you can imagine a contour map of elevation of a mountain. The idea here is to take a lot of measurements around that mountain and be able to draw contours.

The same is true for spatial Kriging. We use the data that are in water or in sediment to statistically connect those dots so that we can develop contours. What I did was a step beyond that. We did what's called spatiotemporal Kriging. And so not only do we look at how to connect the dots in space; we also look -- because multiple samples were collected over time -- at the same location.

So if you collect three samples in May and four in June and four in July and four in August all at the same location, you can use spatiotemporal Kriging to actually connect the dots not only in space, but also in time.

So when most people think of Kriging, they think of just the space contour. We were doing a space-time contour, which is the most rigorous way to analyze these data.

Q. You yourself didn't perform the computer modeling that created those contour maps, did you?

A. I have been performing spatial Kriging myself since the early '90s; but the addition of actually being able to do time Kriging in addition to that, there aren't many people in the world who can do that. So I relied upon another person, at my direction, to develop the algorithms to do that. My software

would only do spatial Kriging.

Q. And let's look at this map again.

MR. CHAKERES: If we could go to Exhibit 13444.034. If we can blow up the map.

BY MR. CHAKERES:

Q. Now, this is what you were testifying about earlier, correct?

A. This is an example of the results of the Kriging statistical analyses, yes.

Q. And when you said you did spatiotemporal Kriging and you started talking about May, June, and July, you never present any maps for any months other than May, do you, in your report?

A. No. In order to be brief, I only showed the results for May.

This is basically the worst-case scenario. In May we had the highest concentrations of PAHs, and we had the fewest numbers of samples, and most of them were collected near the wellhead where the oil was actually present.

So what this is showing and what I wanted to illustrate in my report, without showing dozens of maps, was to show what is the worst-case scenario. So this is May of 2010, which shows the largest red area that you will find from any of my analyses. This also, by the way, shows what we call a 50 percent probability, basically a 50/50 chance of this happening. As scientists we are usual looking at 90 percent or

95 percent chance, meaning it's highly likely. This is only a 50/50 chance.

So rather than using what we ordinarily would do at 90 or 95 percent probability, I used the more conservative estimate of 50 percent probability. And then again, this is May of 2010, which shows the highest concentrations.

Q. When you were talking earlier about this looking like a map of a mountain, you don't actually show contours for other probabilities. You don't show the contour for 40 percent or 30 percent, do you?

A. No. If I were to do that, one could use different colors in order to do that.

I will tell you what you would see. If I used 90 percent or 95 percent, which is standard in the scientific community, those red areas would get very, very small.

Q. If you went down from 50 percent, they would get bigger, right?

A. Yes, if you went beyond the 50/50 probability, which is, again, a very conservative estimate. Scientists generally never go down to that level for their estimates.

Q. Now, you say this is very conservative and you say this is the surface waters, correct?

A. This one happens to be -- let me look. This is the surface water, zero to 200 meters, yes.

Q. So you include samples from the surface all the way down

02:28:26 to 200 meters in this exercise, don't you?
02:28:29 **A.** Yes, that is correct. So they are connected by space and
02:28:32 by time in 200 meters.
02:28:35 **Q.** You were testifying earlier, when you had the map of all
02:28:38 the samples out there, that you could only see about 800 dots.
02:28:41 Do you remember that?
02:28:42 **A.** That is correct, yes.
02:28:43 **Q.** Because underneath each of those dots on the surface,
02:28:46 there are other dots beneath them at lower depths, correct?
02:28:51 **A.** That is correct, yes.
02:28:51 **Q.** So all of the dots from the surface, all the dots beneath
02:28:54 them down to 200 meters are combined in this representation --
02:28:59 or in the dataset that you analyzed to come up with this
02:29:03 interpretation, correct?
02:29:05 **A.** All of the sample locations and sample times for May 2010
02:29:11 for the top 200 meters of the water column throughout the
02:29:15 entire Gulf of Mexico are included in this analyses.
02:29:19 **Q.** Now, when you made this map, though, you knew that the
02:29:23 majority of the exceedances under your benchmarks were in the
02:29:28 top 1 meter, didn't you?
02:29:29 **A.** Actually, that's not quite true. The amount of
02:29:36 exceedances increased as you decrease the surface volume, that
02:29:38 would be true. So the PAH concentration was higher adjacent to
02:29:43 the oil. Oil was entrained into the water to some degree and
02:29:47 mixed down into the water column. So we don't really know at

any place or time exactly how much that occurred or to what degree that affects the PAH concentration.

But, in fact, the top 200 meters, the concentrations associated with those are very similar to what would be in the top 10 meters. The top 1 meter, I would have to look at my data to actually determine that, but the difference would not be that great.

MR. CHAKERES: Let's go to Exhibit 13444, page 25. If we can pull out the footnote, footnote 45.

BY MR. CHAKERES:

Q. You say, "The majority of the exceedances were located in the top 1 meter."

You say that there in your report, right?

A. Yes, I do.

MR. CHAKERES: No further questions.

THE COURT: Any redirect?

MR. BROCK: Just a few.

REDIRECT EXAMINATION

BY MR. BROCK:

Q. Dr. Shea, counsel for the United States of America referred several times in his examination of you to your benchmarks. I would like to ask you, whose benchmarks were you using in your presentation here today?

A. Well, I wish I could claim credit for actually developing these, but I cannot. The United States Environmental

Protection Agency has developed these benchmarks over a long period of time --

Q. Has the Unified Command used these benchmarks?

A. Pardon me?

Q. Has the Unified Command used these benchmarks?

A. Unified Command has used these benchmarks, yes.

Q. Has the EPA used these benchmarks?

A. The EPA has used these benchmarks.

Q. Same for the United States Coast Guard and NOAA?

A. Yes.

Q. Why do they use these benchmarks?

A. They use these benchmarks because they are the gold standard for how we compare the concentrations of PAHs in water to the potential harm -- to the toxicity, to the potential harm that would be there.

Q. You made the comment in the cross-examination session that specific conditions would reduce toxicity. What were you referring to there?

A. Yes. So EPA was very clear in their documentation that site-specific characteristics or conditions can change toxicity. And they made the statement, which is true -- I agree with -- that mostly -- usually that means a reduction in toxicity.

So, for example, these PAHs can combine with other organic matter that are in the water, in the sediment; and when

02:32:25 that happens, they aren't bioavailable. The organism cannot be
02:32:28 exposed to the dissolved phase. There are many things in the
02:32:32 environment that actually sequester these PAHs and bind them
02:32:36 up, lock them in, so to speak, so that they cannot get into the
02:32:40 organism.
02:32:40 **Q.** With regard to this case, do we have site-specific studies
02:32:43 that are useful?
02:32:44 **A.** Yes, we do.
02:32:46 **Q.** Is that the 900 studies that you referred to in your
02:32:50 direct examination?
02:32:50 **A.** It's those 900 studies, plus some additional studies that
02:32:54 OSAT has done, yes.
02:32:56 **Q.** What do they tell you?
02:32:57 **A.** What they told me was that the conditions, the toxicity
02:33:00 that was measured at those sites is very consistent with what
02:33:04 the EPA benchmark would expect you to believe, yes.
02:33:09 **Q.** To your knowledge, does EPA understand some of the complex
02:33:13 principles you were discussing on cross-examination, like
02:33:16 molecular weight?
02:33:19 **A.** They understand these complex chemistries and toxicologies
02:33:23 very well, yes.
02:33:24 **Q.** Solubility?
02:33:24 **A.** Oh, yes.
02:33:26 **Q.** Various toxicities of PAHs?
02:33:28 **A.** Yes, they do.

02:33:29 **Q.** Different toxicities of the components that are included
02:33:35 in the PAHs?
02:33:35 **A.** Yes, they understand that very well.
02:33:37 **Q.** Were these principles included by the EPA when they
02:33:41 calculated toxicity benchmarks, to your knowledge?
02:33:44 **A.** Yes. All of these principles were included when they
02:33:47 calculated the toxicity benchmarks, yes.
02:33:49 **Q.** You were asked some questions about McGrath Di Toro
02:33:54 benchmarks. Do you remember those questions?
02:33:56 **A.** Yes.
02:33:56 **Q.** Why did you not use the McGrath Di Toro benchmarks in your
02:33:58 evaluation?
02:33:59 **A.** If I used the McGrath Di Toro benchmarks that were
02:34:03 published in 2009, that would have been less protective than
02:34:06 the EPA benchmarks that EPA uses now and that I used as well.
02:34:11 They would be less protective.
02:34:13 **Q.** Have you attended scientific conferences where experts in
02:34:16 the field have discussed the HEWAF technique that was used in
02:34:20 Incardona?
02:34:21 **A.** Yes. I have attended several scientific conferences where
02:34:26 the HEWAF was discussed and where Incardona has presented, yes.
02:34:29 **Q.** What has been the reaction to that series of tests in the
02:34:33 professional community?
02:34:34 **A.** Well, the first time I heard about it and many of my
02:34:37 colleagues heard about it, I have to say, amongst the

02:34:40 scientists -- I hate to say this, but there was a lot of
02:34:42 laughter in the audience about the HEWAF method, about the
02:34:42 blender method.
02:34:42 **MR. BROCK:** Now let's look at TREX-13282.3.2.
02:34:59 All right. Can you just blow that up just a
02:35:00 little bit and make it a little bigger.
02:35:08 **BY MR. BROCK:**
02:35:08 **Q.** We are looking now at the issue of comparing chemistry of
02:35:14 the blender-prepared samples used in the Incardona tests to
02:35:19 samples that were collected in the Gulf of Mexico?
02:35:21 **A.** Yes, that's correct.
02:35:25 **Q.** Can you read the call-out down there at the bottom.
02:35:29 **MR. BROCK:** Donnie, can you call out the footnote
02:35:33 there and the highlighted part, please.
02:35:33 **BY MR. BROCK:**
02:35:33 **Q.** It says: "Water samples shown are representative of
02:35:42 78 samples collected during May to July 2010 that had
02:35:47 comparable PAH compositions to HEWAFs."
02:35:52 Do you see that?
02:35:52 **A.** Yes, I do.
02:35:56 **Q.** So if we look at the 78 samples that are used here, how
02:36:02 does that compare to the number of total samples that were
02:36:06 collected?
02:36:08 **A.** Well, there were nearly 18,000 samples collected.
02:36:14 **MR. BROCK:** Now let's put up TREX-13282.3.3.

02:36:16 **BY MR. BROCK:**
02:36:21 **Q.** Do you see here we have zoomed in on the concentrations
02:36:25 listed for the examples Dr. Incardona used to show supposed
02:36:29 matches to the blender results? Does this list the
02:36:34 concentrations of PAHs in those samples?
02:36:37 **A.** Yes, it does.
02:36:38 **Q.** And if you look at those concentrations -- could you
02:36:42 remind us just roughly how many samples in the Gulf of Mexico
02:36:47 exceeded the samples that are listed here.
02:36:50 **A.** Well, if you look at the lowest concentration of 3.7 part
02:36:54 per billion, that would be approximately 300 out of the nearly
02:36:59 18,000 samples.
02:37:02 If you go up to 8 parts per billion or 8 1/2 parts
02:37:06 per billion, that would be on the order of 150 samples out of
02:37:10 the 18,000.
02:37:11 And if you go up to the 13, 14 parts per billion, you
02:37:14 are looking at the order of maybe 50 samples total.
02:37:17 **Q.** Can you roughly calculate what percentage of exceedances
02:37:22 you would see at 3.7.
02:37:23 **A.** Yes. That would be approximately 2 percent, similar to
02:37:27 the exceedances of the EPA benchmark that I calculated.
02:37:30 **Q.** What about at .05 percent?
02:37:33 Excuse me. What would it be at 13 parts per billion?
02:37:38 **A.** That would be approximately 0.5 percent at 14 parts per
02:37:41 billion.

02:37:43 **Q.** Thank you.

02:37:43 Now, you did your own analysis of the detailed
02:37:46 chemistry of the blender-derived samples, did you not?
02:37:48 **A.** Yes, I did. This paper included supplementary
02:37:52 information, including an electronic file that included all of
02:37:55 the analytical chemistry associated with this paper. And so I
02:38:00 retrieved all of that analytical data in an Excel spreadsheet
02:38:03 and then analyzed that and created histograms for every single
02:38:09 sample that we have, yes.
02:38:10 **Q.** Did you present that information in your expert report?
02:38:13 **A.** I discussed it in my report.
02:38:17 **MR. BROCK:** Let's look at TREX-13445.15.1.
02:38:18 **BY MR. BROCK:**
02:38:20 **Q.** Do you see that this is PAH in the Gulf of Mexico water
02:38:23 versus the HEWAF water exposure?
02:38:25 **A.** That is correct.
02:38:26 **Q.** What does this show?
02:38:27 **A.** What this is showing in blue is a typical Gulf of Mexico
02:38:31 water sample that was collected. So this would incorporate
02:38:34 heavily weathered oil or PAHs that are associated with heavily
02:38:39 weathered oil, perhaps oil that's been out there for two to
02:38:42 three weeks. And in red -- okay. Let me back up a second.
02:38:45 What you see on the X-axis there, horizontally going
02:38:47 across that axis are the various PAHs. These are actually
02:38:53 close to the 50 PAHs that were analyzed.

And so earlier we were talking about on the left we had naphthalene, which is the smallest PAH. So in general, as you go from left to right on this graph, you are getting to larger and larger PAHs.

Q. What is the significance of this?

A. The significance of this is that if the HEWAF were to actually represent the Gulf of Mexico -- and again, the HEWAF is this blender method -- then these patterns ought to match, and they don't. So there's a significant difference in the vast majority of samples in the Gulf of Mexico compared to the blender method.

Q. You mentioned that water quality standards that are developed and put forth by the EPA are conservative. Will you please explain what you meant by that.

A. Well, the Environmental Protection Agency recognizes that there can be some uncertainty in the derivation of these criteria, and so they build in protective measures. We, as scientists, call that a conservative approach. You want to be more protective. If you are going to have an error, you want to err on the side of overprotecting.

MR. BROCK: Dr. Shea, thank you for your time. Those are all of my questions.

THE COURT: Thank you, sir. You are done.

THE WITNESS: Thank you.

THE COURT: Your next witness is?

02:40:22 **MR. BROCK:** Dr. Taylor.
02:40:26 **THE COURT:** How long do you expect his direct to be?
02:40:28 **MR. BROCK:** I think the direct is in the range of
02:40:29 about an hour and 15 minutes, maybe as long as an hour and a
02:40:33 half, but not longer than that.
02:40:35 **THE COURT:** Let's go ahead and take a 15-minute
02:40:39 recess so we don't interrupt his direct.
02:40:44 **THE DEPUTY CLERK:** All rise.
02:40:46 (Recess.)
02:43:53 **THE COURT:** Please be seated, everyone.
03:05:52 Before you call the next witness, let me clear
03:05:55 up some misinformation that apparently has been given to some
03:06:01 members of the press.
03:06:05 Throughout this trial, throughout all three
03:06:08 phases of this trial, I have allowed the members of the press
03:06:14 to obviously sit in the courtroom with their laptops or other
03:06:21 devices and to -- I guess it's called tweeting those, these
03:06:30 little blips that go out from time to time.
03:06:34 And that's perfectly permissible, at least in my
03:06:37 courtroom. It may not be allowed in other judges' courtrooms.
03:06:41 It's a judge-by-judge decision on that.
03:06:45 As long as you are not live-broadcasting the
03:06:48 trial. That's not permitted. If a reporter wants to do this
03:06:57 tweeting that I know is done from time to time, I have no
03:07:03 problem with that as long as it doesn't disturb anybody,

disturb the courtroom. All right?

So let's proceed.

MS. BRANSCOME: Your Honor, BPXP calls Dr. Elliott Taylor.

ELLIOTT TAYLOR,

having been duly sworn, testified as follows:

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

THE WITNESS: My name is Elliott Taylor. It's E-L-L-I-O-T-T; Taylor, T-A-Y-L-O-R.

MS. BRANSCOME: May I proceed?

THE COURT: Yes.

MS. BRANSCOME: For the record, Kimberly Branscome on behalf of BPXP, and I have Dr. Elliott Taylor on direct examination.

VOIR DIRE

BY MS. BRANSCOME:

Q. Dr. Taylor, please introduce yourself to the Court.

A. My name is Elliott Taylor. I work for a company called Polaris Applied Sciences out of Seattle.

Q. Thank you.

A. Sure.

Q. Dr. Taylor, have you been retained by BPXP as an expert in this case?

A. Yes, I have.

Q. For ease of the discussion today, I will use the term "BP," but do you understand that, by that, I mean BPXP?
A. Yes.
Q. What type of work has been the focus of your professional career?
A. For the last 25 years to 30 years, I have been very much engaged in spill response, preparedness planning, contingency planning, training, and supporting response from a scientific and technical perspective.
Q. Were you personally involved in the response in the *Deepwater Horizon* spill?
A. I was.
Q. Now, we will get into more detail about your personal involvement in the response in a moment, but first I would like to ask you a few questions about your educational and professional background.

Did you help us prepare a demonstrative that summarizes your background?
A. I did.

MS. BRANSCOME: If I could call up, please, D-34301.

BY MS. BRANSCOME:
Q. Dr. Taylor, please describe your educational background.
A. I received a Bachelor's in Science degree from the Universidad Autonoma de Baja, California, and that was in '77. From there I went to Scripps Institute of Oceanography in

La Jolla. I worked for two years there and did some graduate coursework there. I subsequently went to Texas A&M, where I did a Ph.D. in oceanography and completed that degree in 1984.

Q. How did you first become involved in oil spill response?

A. My first involvement was with the *Exxon Valdez* oil spill up in Alaska back in '89.

Q. Why did you first get involved in responding to oil spills?

A. At the time, I was on a teaching appointment. I was teaching at the University of Washington and doing research. The spill happened in March, at the time I was teaching.

And I contacted one of the companies I had done consulting work previously with to see if I could help in any way. And I got involved in the shoreline program, the shoreline response program. I initially did that work from Seattle, given that I was still teaching. Once I finished my teaching appointment, then I rolled into the response on a full-time basis. And that's kind of where I have stayed ever since.

Q. Prior to your involvement in the *Deepwater Horizon* response, have you ever been involved responding to spills in the Gulf of Mexico?

A. I have.

Q. Have you identified a few of those spills specifically on the slide that we are looking at here?

03:10:49 **A.** There are three spills on the slide. The first one is the
03:10:54 *Greenhill* blowout. That was a spill in Louisiana, affected
03:10:59 some of the marshes, where we were asked to come in and do an
03:11:03 assessment, also to identify what shorelines were oiled and
03:11:07 what might need to be treated.
03:11:10 The other one is the *Torm Mary* that happened in
03:11:16 Texas. That was a barge and tanker collision where the spill
03:11:19 was traveling down the river and entering the Gulf of Mexico.
03:11:23 Again, the same thing. We were asked to characterize
03:11:27 and map the oil, identify, and make recommendations on how to
03:11:31 clean the oil up.
03:11:34 There is a third one, which is the *Kab 121* well
03:11:40 blowout. That was a spill that happened from a Pemex platform
03:11:45 down in Mexico. In 2007, a barge damaged risers on that one,
03:11:52 so it was a continuous spill until it caught fire; and then the
03:11:59 fire got put out, and it continued to spill. On that one we
03:12:03 were contacted to come in and provide support from a planning
03:12:06 perspective, looking at everything from on-water response
03:12:11 recommendations, booming, containments, dispersants to
03:12:16 shoreline.
03:12:18 **Q.** Dr. Taylor, I see here we have a new entry on here from
03:12:22 2015. Is that correct?
03:12:24 **A.** That's correct.
03:12:25 **Q.** So have you spent the past couple weeks involved
03:12:29 responding to this spill in Montana?

03:12:31 **A.** I was actually called out literally a week ago today,
03:12:35 early in the morning, to respond to that pipeline spill up in
03:12:42 Montana. And again, the idea is they needed and wanted to get
03:12:46 personnel on site that were trained in documenting where oil
03:12:50 was, the extent of oiling, and to make recommendations on how
03:12:55 to handle that particular spill. And I demobilized late
03:13:03 Saturday so I could get back here.
03:13:05 **Q.** Has this experience that we have just been discussing
03:13:08 played a role in forming your opinions in this case?
03:13:11 **A.** Very much so.
03:13:12 **Q.** Where are you currently employed?
03:13:15 **A.** Polaris Applied Sciences based out of the Seattle area.
03:13:19 **Q.** What is your role there?
03:13:21 **A.** I am a senior scientist and a principal of the company.
03:13:25 **Q.** If you could just give us a general description of what
03:13:26 you do as a principal of that company?
03:13:29 **A.** Well, in addition to working with my colleagues and as a
03:13:34 senior principal training them and bringing them along, I do a
03:13:39 lot of work in spill contingency planning and preparedness. If
03:13:44 I'm not on an emergency supporting that, then often I will be
03:13:48 engaged in looking at spill risks, plans, plan development,
03:13:52 training personnel on how to respond, looking for gaps, and
03:13:59 analyzing preparedness.
03:14:01 **Q.** We see here at the bottom of the slide you helped us
03:14:03 prepare a section on consulting and training on oil spill

preparedness.

Is this the work you were just referring to?

A. In many respects, yes. The IMO work, for instance, really consists of workshops. I have been engaged in over a dozen workshops from West Africa, throughout the Caribbean, in Latin America where countries are working on developing their national contingency plans or trying to close gaps in their plans. So I have been asked in many respects to come in and serve as an expert to help them with that process.

With the API and the ARPEL projects, the bottom two bullets there, that work, and particularly the last few years -- the last five years really -- I have been engaged with those organizations to prepare a guide whereby countries or companies, organizations that handle oil or are responsible for being prepared for spill response, can gauge -- use this guide to gauge where they are in the process and, in particular, identify where they may have gaps that they would want to close in terms of preparedness.

MS. BRANSCOME: At this time BPXP would tender Dr. Taylor as a qualified expert with respect to oil spill response, including shoreline treatment and evaluation.

MS. ANDRE: No objections.

THE COURT: No questions, no objections. Okay. I guess the only comment I have, before you get into it -- I don't know how much it's going to be an overlap; but again, we

have heard a lot about BP's response efforts so far. I hope we are not going to hear a lot of the same things again.

MS. BRANSCOME: Your Honor, Dr. Taylor focuses specifically on shoreline efforts. He was personally involved as a fact witness, but reviewed them to the extent they were relevant to his opinions. We have taken care to make sure that none of these specific topics have been covered by any of our other witnesses.

THE COURT: Okay. Very well. Let's proceed.

DIRECT EXAMINATION

BY MS. BRANSCOME:

Q. Dr. Taylor, I would like to first turn to your personal involvement in the *Deepwater Horizon* oil spill response. When did you first become involved?

A. We received an initial call late in April of 2010, initially from Transocean, and within a couple of days we had a followup call from BP. Transocean put us on standby. BP asked us to mobilize, myself and two colleagues, specifically, to the Gulf of Mexico.

Q. What was your role when you joined the response?

A. It was to work with BP and other responders to set up a shoreline response program and the SCAT program. Specifically I was in Mobile.

Q. Now, did you have a specific title in your role in the response?

03:16:59 **A.** Yes. I started out as SCAT coordinator and then it became
03:17:04 more a SCAT shoreline technical adviser.
03:17:08 **Q.** The Court has heard a bit about SCAT, but if you would
03:17:11 just give a very high-level overview. First, what does it
03:17:14 stand for and generally what is SCAT?
03:17:17 **A.** SCAT is Shoreline Cleanup Assessment Technique, and really
03:17:20 it's the procedure that we use in the field to systematically
03:17:25 document shorelines and then roll those into the recommendation
03:17:29 process for cleanup.
03:17:31 **Q.** Prior to your work on the *Deepwater Horizon* spill, had you
03:17:34 had any personal experience with SCAT?
03:17:37 **A.** Well, it started back in 1989 with the *Exxon Valdez*. So
03:17:42 that's really where SCAT got developed to a large extent.
03:17:46 There were some previous modules, but in '89 really the SCAT
03:17:51 program became rolled out much like we see it today. Of
03:17:55 course, it's evolved over the years. So we have 26 years now
03:18:00 of SCAT program implementation, and I have been very much
03:18:04 involved in that whole process throughout.
03:18:06 **Q.** How widely used is SCAT in responding to oil spills?
03:18:12 **A.** It's now a standard that's used worldwide. It's
03:18:15 recognized as the best approach to deal with and address oiling
03:18:22 of shorelines or riverbanks, for that matter, and it's very
03:18:26 much included in area contingency plans. For instance, in the
03:18:33 U.S., NOAA, the Coast Guard, EPA all recognize it as a tool to
03:18:37 use at the time of a spill response.

03:18:41 **MS. BRANSCOME:** If we could call up D-34303.
03:18:44 **BY MS. BRANSCOME:**
03:18:44 **Q.** This is actually a demonstrative that we have seen various
03:18:49 versions of it, but if you could just explain where you were
03:18:51 based during the response and then where other shoreline
03:18:54 operations were based out of.
03:18:57 **A.** Okay. I was based out of the Mobile command post; and my
03:19:06 other colleagues went to the Houma, Louisiana, command post.
03:19:09 Those were the two main command posts where we were looking at
03:19:13 shoreline response operations.
03:19:14 And so we coordinated between the two to make sure
03:19:17 that everything was lined up, but there were also -- we did
03:19:23 send people to Miami just as that command post ramped up, to
03:19:31 just be prepared in case oil started to show up down in that
03:19:35 part of the coast.
03:19:38 **Q.** How much time did you spend down in the Gulf as part of
03:19:41 the response?
03:19:41 **A.** In 2010 I spent over a hundred days in the Gulf. And then
03:19:49 in 2011 I was down actually in the Gulf for more than three
03:19:54 months over the course of the year. And in 2012 I was there
03:20:01 for, I think, about 30 days in the Gulf.
03:20:06 **Q.** In addition to providing information about your personal
03:20:09 experience with the *Deepwater Horizon* Shoreline Response
03:20:13 Program, were you also asked to look at certain issues as an
03:20:16 expert in the field?

03:20:17 **A.** Yes, I was.
03:20:18 **Q.** What issues were you asked to evaluate in this case?
03:20:22 **A.** In addition to the shoreline program and the SCAT program,
03:20:26 we looked at the comprehensiveness of that program in assessing
03:20:32 and defining the oiling conditions along the shorelines; to
03:20:35 look at the treatment that happened on those shorelines, where
03:20:39 it was appropriate, and how it was treated; and then to look at
03:20:44 the recovery of those shorelines, how they returned back to
03:20:49 pre-spill conditions.
03:20:50 **Q.** Did your personal experience during the response inform
03:20:54 your expert opinions in this case?
03:20:56 **A.** My experience in the Gulf was very, very important to
03:21:00 forming my opinion. Being there day to day on activities,
03:21:05 getting the information from the field, evaluating that
03:21:08 information, providing that information to the command, Unified
03:21:14 Command, helping define what techniques we were going to use
03:21:20 and setting guidelines for cleanup operations, those were all
03:21:24 extremely important.
03:21:25 So the firsthand knowledge, walking on the shorelines
03:21:28 and being out on those beaches, seeing the oil and seeing the
03:21:32 effectiveness of cleanup operations or trying different
03:21:36 techniques to see which one would be more effective is all
03:21:39 very, very important in forming my opinion.
03:21:42 **Q.** In addition to the information that you had at your
03:21:45 disposal because of your personal involvement, did you perform

any additional work in forming your expert opinions in this case?

A. Certainly. I've reviewed lots of reports; the data that we have that's part of the SCAT program, the shoreline program; reports that were generated for Unified Command, like the OSAT reports; as well as scientific publications.

Q. Did you prepare expert reports that contain the opinions that you reached in this case?

A. Yes, I did.

MS. BRANSCOME: If we could pull up D-34343.

BY MS. BRANSCOME:

Q. And this demonstrative contains the cover pages of two exhibits, TREX-13246 and 13247.

Dr. Taylor, do you recognize the two documents up on the screen?

A. Yes, I do.

Q. Are these the expert reports that you prepared in this case?

A. That's correct.

Q. Now, Dr. Taylor, did you actually reach opinions as to the two issues that we asked you to look at in this matter?

A. Yes.

Q. And did you help prepare a slide that would summarize those opinions?

A. I did.

03:22:53 **MS. BRANSCOME:** If we can pull up D-34304.
03:22:58 **BY MS. BRANSCOME:**
03:22:58 **Q.** Dr. Taylor, please tell the Court, what is your opinion
03:23:00 about the extent and the effectiveness of the Shoreline
03:23:04 Response Program and the recovery of the affected Gulf
03:23:07 shorelines.
03:23:07 **A.** It's my opinion, after reviewing all these materials and
03:23:11 from my firsthand knowledge, that the effort that was done to
03:23:14 characterize the oiling conditions along the shorelines in
03:23:18 space and time were very, very comprehensive. It was a
03:23:22 tremendous amount of work done. Teams were very thorough, very
03:23:29 comprehensive. We went through, on a very objective basis,
03:23:32 following very established procedures to document that oiling
03:23:36 and the changes in oiling.
03:23:37 Those changes of oiling reflect two things. They
03:23:40 reflect treatment; that is, operational cleanup where it was
03:23:45 necessary or -- and/or, I should say, they reflect natural
03:23:50 attenuation that is in places where natural processes are
03:23:55 removing and diluting the remaining oil. Those both go to
03:24:03 speak to the recovery of the shorelines.
03:24:04 We look at how the oil diminished through time in the
03:24:08 short -- relatively short time that it took to really drop the
03:24:12 more pronounced oiling down to very low levels of oiling I
03:24:16 think is very important in terms of getting a handle on the
03:24:22 change of oiling through time and the recovery of those

shorelines.

Q. Dr. Taylor, we have been referring to the concept of the Shoreline Response Program. Did you help prepare a demonstrative that would just provide the framework of what the Shoreline Response Program was in the *Deepwater Horizon* response?

A. Yes.

MS. BRANSCOME: If we could pull up D-34324.

BY MS. BRANSCOME:

Q. Well, it's slightly cut off there, but I will help you.

If you could, just using this basic framework, describe for the Court, what are the components to a successful Shoreline Response Program?

A. Yeah. This particular graphic shows three key components to the Shoreline Response Program. If you are going to handle oiled shorelines, the first thing you need to do is really assess what you have for oiling. And so you will need to use a technique to send people out there and then clearly define what the oiling conditions are as well as other characteristics of the shoreline itself. You are going to take those into consideration so that, where appropriate, you can recommend treatment; and you recommend treatment in context of the oiling, in context of the type of shoreline, and in the techniques that might be appropriate.

And that's all part of this -- sort of the SCAT side

of things. And typically that feeds into what is the planning process in the Incident Command System.

Once the treatment has been made, a treatment recommendation has been made, it gets handed off to the operations side of the Incident Command System; and the operational people go out -- the cleanup crews with the equipment will go out and implement the recommended treatment.

When they think that they have reached a point where they have reached the goal of that cleanup, then the operations team will indicate that they are ready for an inspection; and so the same SCAT teams will once again come through and evaluate whether, indeed, the cleanup operations met their targets.

Q. What is the objective of a successful Shoreline Response Program?

A. The overall objective of a Shoreline Response Program is to speed up the natural recovery process. Once oil hits that shoreline, we want to do the right thing that will speed up what otherwise would be a natural recovery. We could allow it to naturally attenuate if that's appropriate, but if we can do anything to speed that process up, that's exactly what we want to do. That's the objective.

Q. And in your opinion, did the Shoreline Response Program that was part of the *Deepwater Horizon* response meet that objective?

03:27:12 **A.** Very much so.
03:27:15 **Q.** How soon after the *Deepwater Horizon* incident did the
03:27:18 Shoreline Response Program begin?
03:27:22 **A.** Well, it started before we even showed up on-site. There
03:27:26 were already personnel with the Coast Guard. Their scientific
03:27:31 support coordinator, NOAA, were already on scene. BP was
03:27:36 already on scene. So they had already started looking at the
03:27:40 Shoreline Response Program in general, and then we got called
03:27:44 in within days. So we were setting this program up within days
03:27:49 of the incident happening.
03:27:51 **Q.** So if I understand the timing correctly, does that mean
03:27:53 that the shoreline program was actually put into place before
03:27:57 oil hit the shore?
03:27:58 **A.** Well before oil hit the shore, yes.
03:28:02 We were putting together a shoreline plan for Unified
03:28:10 Area Command's approval, how we were going to unfold and
03:28:14 realize this process before any oil reached the shoreline.
03:28:17 **Q.** Is that a good thing, in your opinion?
03:28:19 **A.** It was a luxury almost. In most of our spills,
03:28:23 unfortunately, the oil is already there; and so you're almost
03:28:29 in a reactive mode trying to quickly come up to speed with what
03:28:34 you are going to do and how you are going to deal with the oil
03:28:38 on the shorelines. It was a bit of luxury to be able to put
03:28:41 that together before we even had any oil.
03:28:42 **Q.** So turning back to the framework that you have provided

here, I would like to talk first about the first step, survey and assess, if we could.

Now, we have heard some discussion of the term "segments" in relation to shoreline. Are you familiar with that?

A. Oh, yes.

Q. What is it referring to with respect to the shoreline response?

A. A key component of the Shoreline Response Program is our piece-by-piece attack of the shoreline, what you are going to do on that shoreline if it needs something. And so these become little geographic entities of the shoreline.

Typically we will go in and break these into areas that have very similar characteristics, all the sandy beach or all of the rocky shoreline or all of the pieces of marsh, but will break them into manageable chunks.

And then each one of these physical entities then becomes a base component of our entire database. The entire shoreline program is the sum of all these little segments.

Q. So once the segments were defined -- I'd actually like to focus on the SCAT teams who went out and surveyed those segments.

MS. BRANSCOME: If we could pull up D-34325.

BY MS. BRANSCOME:

Q. This contains three representative photographs. Did you

help us collect these photos, Dr. Taylor?

A. Yes.

Q. This refers to different types of SCAT survey techniques; is that correct?

A. That's correct.

Q. We have heard some suggestion in the case that, for example, surveys conducted in the marshes were done only by boats. Do you have a response to that suggestion?

A. Well, the SCAT survey techniques are -- we're using a visual observation of oiling conditions, and the boat survey techniques really are -- in marshes in particular, first of all, just to get to a marsh -- there's not a road to most of these places. You get to a place where you can launch a boat, and then you can actually go and visit the marshes themselves.

So the only way you are going to get to those edges of the marsh, which are potentially where oil may have landed, is to get in the boats and go there.

During the early stages of the response, when we had incoming oil and maybe waves of oil, our objective was really to make sure that we cover these areas relatively quickly so that if there were locations where we had heavy oil that could be addressed by operations, we wanted to get that knowledge to operations as quickly as possible. And so the surveys early on are happening relatively quickly. That's where we use air surveys and boat surveys.

On the ground, as you see in the top right photo, that happens -- it's much easier, of course, to walk on the beaches. But we actually do -- as you see in the boat survey, we do get in the marshes at some point. So once we had a more static situation out there in terms of oil, then we -- typically the teams would go out and they would actually deploy in a marsh to characterize the oiling conditions in that marsh.

Q. Who made up the SCAT teams?

A. The SCAT team is, at a minimum, typically three individuals: somebody representing the Responsible Party, BP, and in that case it was somebody from Polaris; somebody who represented the Coast Guard, the FOSC, and that was either a Coast Guard representative or NOAA; and then somebody from the state. So each state would provide individuals to be on those SCAT teams.

Those are a minimum three people. Often we would have more people, but at a minimum those three individuals are making sure that together they are working, together they are coming to the same conclusions on what was observed in the field.

Q. We have heard a little bit about the searches for subsurface oil, so I don't want to repeat testimony that we have already heard. But generally were the SCAT teams involved in searching for subsurface oil or oil that would not otherwise be visible on the shoreline?

03:33:16 **A.** That is a standard part of the procedure, is to look
03:33:19 for -- first of all, you are looking at the surface, so you are
03:33:23 characterizing the surface oil. But then, once we are at a
03:33:27 static state, very much the next step is to make sure that we
03:33:31 have looked into the subsurface to identify if anything was
03:33:35 below the surface.
03:33:40 During the first couple months when we had incoming
03:33:43 oil, we did not really do a focus on buried oil because you had
03:33:47 new, fresh surface oil. And so the objective during the early
03:33:50 stages was really to focus on the surface oil and remove the
03:33:54 more concentrated areas quickly.
03:33:57 But later, as it went into a more static situation,
03:34:00 once we didn't have further incoming oil, then, yes, pits,
03:34:07 auger holes, trenches, those are all done. It's a standard
03:34:10 part of the procedure. Except in marshes, I must say, because
03:34:13 we don't really dig a lot of holes. We don't like to dig holes
03:34:17 in marshes.
03:34:18 **Q.** Is that because you are mindful of the balance of treating
03:34:23 a given environment with any potential harm that might be
03:34:26 created by that treatment?
03:34:31 **A.** That's a big part of it.
03:34:33 There's two aspects. One is you don't really want to
03:34:35 create -- you want to minimize your impact from simply
03:34:40 surveying on a shoreline, but also, oil doesn't tend to really
03:34:46 sink -- seep into a marsh; whereas on a sandy beach, it can get

covered just by sand motion.

MS. BRANSCOME: If we could pull up D-34309.

BY MS. BRANSCOME:

Q. Now, the Court has already heard a bit about augering and trench digging, but there's one program that I'd like to ask you specifically about, which is we see in the upper right-hand photo here -- you see some individuals actually out in the water. If you could just describe what's happening here, and have you had experience with that technique as part of a response program before?

A. Those pictures, the two on the right-hand side represent what we call the Snorkel SCAT Program. Usually the SCAT program is really looking at shoreline oiling, so we are usually from the waterline up to the furthermost reaches on the shoreline where tides and water levels may push oil and remobilize or distribute oil.

But in this case, we actually instituted -- this is the first time it's ever been used on a spill. We instituted the Snorkel SCAT Program so that teams could go out and look for any oil that was in the very nearshore, in the subtidal on some of the sandbars. And that was -- it's a new process, but we're doing the same thing: we are digging pits; we are bringing anything up off that pit; and then we're describing what we're seeing.

So you get a description of oiling, degree of oiling.

03:36:23 And then obviously the intent there is to make a recommendation
03:36:27 if it's something to be treated.
03:36:33 **Q.** Have you helped us prepare a demonstrative that shows the
03:36:38 geographic region that was surveyed by SCAT teams as part of
03:36:38 the response?
03:36:38 **A.** Yes.
03:36:39 **MS. BRANSCOME:** If we could pull up D-34306.
03:36:42 **BY MS. BRANSCOME:**
03:36:43 **Q.** If you could just orient us. We are looking here at,
03:36:45 obviously, a map of the northern Gulf. But what is the blue
03:36:50 indicated here on this map?
03:36:52 **A.** Everything you see in blue along that shoreline are
03:36:56 locations where the SCAT teams surveyed. At any given point in
03:37:00 time, they inspected those portions of shoreline.
03:37:06 **Q.** How many total miles did SCAT teams survey as part of the
03:37:10 *Deepwater Horizon* response?
03:37:11 **A.** Just net miles, 4,380 miles, net miles. If you add up the
03:37:18 number of times that the SCAT teams went through, it's many
03:37:21 more miles. Many, many more.
03:37:24 **Q.** Actually, you got ahead of me there. I was just going to
03:37:28 ask you, were segments ever surveyed more than once?
03:37:32 **A.** Yes. Yes.
03:37:33 **Q.** Did you help us prepare a demonstrative that illustrates
03:37:36 that for just a select region?
03:37:37 **A.** Yes.

03:37:38 **MS. BRANSCOME:** If we can pull up D-34308.
03:37:40 **BY MS. BRANSCOME:**
03:37:41 **Q.** We are looking here at a map of Barataria Bay and sort of
03:37:44 the surrounding regions. What are we seeing here on the purple
03:37:49 scale on this map?
03:37:50 **A.** This is just really showing you obviously areas that were
03:37:57 surveyed, but in addition to the fact that they were surveyed,
03:37:59 how many times they were revisited by the SCAT teams. So in
03:38:03 some areas you will see -- like in Grand Isle, for instance,
03:38:05 you'll see that they've been visiting the area for perhaps
03:38:05 20 or more times. And that is -- reflects the possible changes
03:38:19 in oiling over time, in the first months where we had different
03:38:25 oiling events, so you had SCAT teams surveying. But then it
03:38:27 also reflects the treatment. So you had operational crews
03:38:31 going out.
03:38:32 And as I said earlier, one of the steps is to inspect
03:38:34 the shorelines after operation. So you would have a SCAT team
03:38:38 go out and resurvey, and if there was more recommended
03:38:42 treatment, then that process would cycle through.
03:38:46 **Q.** What efforts did the SCAT teams make to make sure that
03:38:50 they identified all of the shoreline oiling that was visible?
03:38:58 **A.** Well, initially when we sent the SCAT teams out, we would
03:39:01 look for any sort of imagery that was available, so
03:39:05 overflights, satellite imagery. We were working with NOAA on
03:39:09 the trajectories that showed where oil was being -- was moving

on the water surface. And so if we saw locations where oil was really getting close to the shoreline, we started to get the SCAT teams out there.

And, of course, once you had oil on the shoreline, then we're surveying those areas, and typically will go, extend beyond the areas just to make sure that we didn't just map out a patch and then there might be another patch over here. We wanted to make sure that it gets extended to encompass where there may be oil found.

But then there were other sources of -- that also directed our -- our teams. For instance, you -- we had a call center set up that -- where we were receiving calls from the public or from the states that would say there's a report of oil here or there. And so those often got rolled over to either Coast Guard teams or SCAT teams to go out and check it out. And that's what the team would do.

And if they saw oil, the same thing. They would characterize that oil, but then they would extend it into adjacent areas to make sure that it was all covered. Or the FOSC would say, I want you to survey this bay. And so we would go in and do a survey of the bay.

So we were really getting the requests from a number of places, but everything was all under the Unified Command response and under their approval and direction.

Q. Now, you mentioned that the teams would characterize the

oil. The Court has seen a few maps showing degree of oiling categories, and we are going to look at a series of those maps shortly. But before we do, did you help prepare a demonstrative that actually represents what those categories mean in terms of the quantity and nature of the oil?

A. Yes.

MS. BRANSCOME: Okay. If we could pull up D-34326.

BY MS. BRANSCOME:

Q. If you could explain what we are looking at here relating specifically to the different degrees of oiling.

A. So as you said, in some of the maps that the Court may have seen, you saw different colors, reds and oranges and yellows; and those correspond to these oiling categories.

The teams themselves don't categorize oil. The teams go out and they just map width, length, percent oil in that length and width zone -- that's what we call zones -- and then the character of the oil, if it's thick or if it's a thin bit of oil.

And so that's what the SCAT teams were actually documenting. It's very objective, very quantitative. That information comes back to the SCAT data team, and once it's entered into the database, then the database rolls out whether that falls into a heavy category or a moderate category or a light category.

And these categories were defined in the shoreline

response plan. And that plan, again, was a joint effort by the shoreline programs. So it was a NOAA, BP, state program effort where we defined what criteria are going to fall in -- define the different categories.

Q. Okay.

A. So, for instance, here, a light oil is something that would be occurring in a band. In this particular case, these examples are a meter -- or a 3-foot-wide band where you have about 1 to 10 percent distribution of oil. So you've got these spots of oil distributed along the shoreline, and that oil is less than a centimeter or half an inch thick.

THE COURT: So that's the definition?

THE WITNESS: That's an example.

THE COURT: That's an example?

THE WITNESS: Exactly. That's an example --

THE COURT: I'm a little unclear what you said. These categories were defined somehow?

THE WITNESS: The criteria that are used to lump it into one of these categories are width across the shoreline -- so you can see there's -- for instance, the heavy is more than 2 meters or the light is 1 meter. But it's a matrix.

And it's actually in my report. There's a matrix that uses width, distribution of oil -- that is, percent of oil within that band -- and thickness of oil. And when you add those three criteria together, the program will lump it

into one of these categories.

THE COURT: I'm just thinking that those descriptions, light, moderate, and heavy, are pretty -- it seems like to some extent -- I'm looking at the moderate one. I'm not sure what that is on the right. It's called a black/brown mousse?

THE WITNESS: The one in the moderate --

THE COURT: Yeah.

THE WITNESS: -- yes, that's more of a mousse, correct. It's a little bit more fluid and more emulsified as opposed to this -- the one on the left is still a moderate. It just --

THE COURT: They look very different. Somebody on that one on the right could -- somebody might look at that and say, "That looks pretty heavy to me."

THE WITNESS: That's exactly right, and the whole point --

THE COURT: That's why I'm trying to understand these categories.

THE WITNESS: Very good. The whole point of the SCAT program, we don't want somebody to go out there and say, oh, that looks heavy, or that looks moderate.

We want them to go out there and say, I've got a 10-foot wide band of oil, 50 percent distribution of patches of oil in there. So 50 percent has oil, 50 percent is not oiled.

And it's that thick. That's what we want, and that's what the SCAT teams do. That's it. Very quantitative.

Once it comes back into the Command Post, that gets entered into a database. And then using this matrix of distribution, width, and thickness of oil, it will fold it into one of these categories.

THE COURT: This matrix comes from where, again?

THE WITNESS: That matrix is what we defined in the Shoreline Response Program, and the matrix is something that we have used for over 25 years as part of the SCAT program --

THE COURT: So it wasn't something developed just for the *Deepwater Horizon* spill?

THE WITNESS: No. The matrix concept is the same. The definitions were redefined for this particular spill only in terms of width, band width.

For instance, in Prince William Sound, we used bands of 3 and 6 meters. Here, in this spill we used 3 to 6 feet. And the main reason for that is because the tides. Up in Prince William Sound, you had 15-foot tides, and down here we have 1-foot tides. And so the width of those bands is very different.

So if we were to use the Prince William Sound criteria, all the oil in this particular spill would be lumped into a very narrow band primarily. It would have all fallen into a very light category. But we actually narrowed the band

to be more representative of the tidal range on the shore.

THE COURT: Okay. Thank you.

BY MS. BRANSCOME:

Q. And who specifically was involved in establishing the criteria that were going to be applied to categorizing the oil -- or the matrix, as you discussed, for the *Deepwater Horizon* response?

A. That is exactly the -- that joint effort that I was describing between the shoreline participants. So NOAA, we had Coast Guard, we had state participants, and ourselves that developed the definitions, said, this is how this matrix is going to be defined, and then passed that up to Unified Command for their approval.

So Unified Command looked at this in context with their scientific support coordinator and said, yep, let's do this. This is what we are going to use.

Q. Were these criteria for the different categories applied during the entire period of the SCAT analysis?

A. Yes.

MS. BRANSCOME: So what I would like to do is -- if we could pull up D-34327.

BY MS. BRANSCOME:

Q. We will take a look at one of these maps that shows degree of oiling. Are you familiar with this map, Dr. Taylor?

A. Yes.

03:47:50 **Q.** Here we are looking at a zoomed-out of the entire reason
03:47:55 that SCAT surveyed; is that correct?
03:47:55 **A.** That's correct.
03:47:56 **Q.** It's referred at the top here as "maximum oiling
03:48:00 category." Could you explain, what do we mean by maximum
03:48:04 oiling category?
03:48:04 **A.** That, simply stated, is taking the -- sort of the maximum
03:48:10 ever observed on any one of those segments of shoreline. If at
03:48:17 any point over the course of the response it had, let's say, a
03:48:20 heavy, then it's going to show up here as a red. So it may
03:48:25 have not been heavy in June, and then in July, there was a
03:48:29 heavy hit. It's going to show up as heavy and stay heavy on
03:48:34 this particular map.
03:48:34 So this shows you the maximum oil category that was
03:48:40 documented at any point in time for the entire shoreline
03:48:45 surveyed. So if you see a blue, that means there was never,
03:48:47 never oil observed there. If you see a yellow, as you see
03:48:54 there, most of what we were seeing in that oil category, the
03:48:58 393 miles is in that light category, that is the number that
03:49:02 corresponds to the most oil that were on those shorelines, a
03:49:06 light oiling.
03:49:08 **Q.** So looking at the maximum level of shoreline oiling, how
03:49:11 many miles of shoreline were oiled?
03:49:14 **A.** There were approximately 1,100 miles at any given point in
03:49:18 time that we would characterize as having some oil on it.

03:49:22 **Q.** And we have heard, I believe, that described as the
03:49:25 distance between here almost all the way to the nation's
03:49:28 capital.
03:49:29 When you talk about 1,100 miles being oiled, does
03:49:32 that mean that there's continuous oil coverage along that
03:49:36 1,100 miles?
03:49:37 **A.** No, not at all. That 1,100 miles represents two things.
03:49:46 One, time. So that is a sum over time of the segments that may
03:49:51 have had oil at any given time. The other important aspect is
03:49:54 it represents these different categories. So the 1,100 miles
03:49:59 also has to be partitioned. There are some that were heavily
03:50:04 oiled, but there are other areas that were traces of oil.
03:50:08 So even though you may have miles of trace oil,
03:50:10 obviously it is not contiguous oiling. These are small, small,
03:50:15 little bits of oil that are widely distributed.
03:50:20 **Q.** So in discussing the degree of shoreline oiling, is it
03:50:23 important to take into account the categories of oil in
03:50:26 addition to simply the length of the segments that were
03:50:32 categorized?
03:50:33 **A.** Very much so.
03:50:34 **Q.** Looking here at the maximum oiling level over the entire
03:50:38 time that SCAT was collecting data, how did this distribution
03:50:43 of maximum oiling compare to what you would have expected to
03:50:46 see, given the nature of this spill?
03:50:51 **A.** Well, having been on a number of spills, when I knew that

we had had a well flowing and that was not being capped, I and my colleagues, a number of the colleagues, not just within Polaris, but other colleagues even with the government that I have worked with before, we really thought that we were going to see not only more oiling in length, but also much heavier degree of oiling where it did occur.

So our thought was that there was going to be a lot more oil on the shorelines than what we actually ended up with, fortunately.

Q. And do you have an opinion as to why ultimately there was less oiling at its peak than you had anticipated, given the nature of the spill?

A. Yes. I mean, my thoughts echo, I think, what is shown in the FOSC Report, and that is that a lot of those offshore measures that were done to address oil offshore, whether it's capturing it or dispersing it, burning it, skimming, plus all the protective measures that were put in place, booms along the shoreline, those were all extremely important in reducing the amount of oil that was actually available to reach the shoreline.

MS. BRANSCOME: I would like to return back to D-34324, this time .2, and if we could --

BY MS. BRANSCOME:

Q. I'm going to ask you a few questions -- well, when it appears. That was a preview.

A. Uh-huh.

Q. Well, that's all right. I think we can do it without that.

Do you remember the framework that you had for the Shoreline Response Program?

A. Yes.

Q. I would like to ask you a few questions about the second step in that framework, the recommendations for treatment. Were there documents prepared that actually memorialized what steps Unified Command recommended should be taken on a given segment once the oiling had been categorized on that segment?

A. Yes.

MS. BRANSCOME: If we could pull up D-34329.

BY MS. BRANSCOME:

Q. I realize this is quite small. But what we are seeing up here is an image of TREX-24278. This is a shoreline treatment recommendation for Pensacola Beach.

I will just ask you first, were shoreline treatment recommendation forms like this prepared for all of the segments that were treated as part of the shoreline response?

A. Yes, they were.

Q. So we will just use this one as a representative example. Is that okay?

A. Okay.

Q. If you could just briefly walk the Court through the key

components of the shoreline treatment recommendation.

A. Okay. So as you pointed out, a key part of the SCAT process is if you have oil that meets a certain criteria and needs to be treated under the plan, under the approved plan, then we want to document what treatment -- what type of treatment is recommended.

So in this particular form, you have a list of segments. In this case there's a series of segments along Pensacola Beach that are going to be treated. You have a description of the type of shoreline (sand beaches); what type of treatment is being recommended (surface cleaning); the areas for treatment.

So this might be, say, the top of the intertidal or it may be across the entire beach, but it will define where those zones are and then what type of cleanup techniques are being recommended for that particular shoreline. Along the beaches, for instance, mechanical and manual treatment were mostly recommended.

Then we also -- in that, we will say, here are your goals for cleanup. If you are cleaning up, we are looking for operations to get to this level of cleanup. So that kind of fundamentally is the foundation of the shoreline treatment recommendation.

Q. And I believe we touched on this a little bit earlier when you talked about not wanting to have response workers tromping

on the marshes, as you described.

What steps, or were there steps taken to minimize the impact that any treatment might have on the environment while also achieving the cleanup goals?

A. Very much so. What I just described is really the steps the SCAT team and the shoreline team goes through to define recommended treatment; but then the whole second page of this shoreline treatment form that you see here is we take these recommendations and then we circulate it within the group. It goes to the Sensitive Lands or it goes to landowner, if there's going to be particular sensitivities like ecological resources, turtle nests or birds, and what precautions need to be taken.

It will go to the cultural and historical specialists to look at those segments and identify if there is a concern with operational crews in that area. Sometimes they may want to send somebody out to be working alongside operations so they can keep an eye on things. If there are any safety constraints or concerns, those will get captured there.

So this initial recommendation, which the SCAT team did on the left side, gets passed around, and all these other constraints and best management practices, BMPs -- and sometimes there's a list of all the BMPs that get attached to this -- that becomes then the work order for operations.

Q. And who ultimately approves a shoreline treatment recommendation like the one we are seeing here?

03:56:50 **A.** Okay. So now it's gone through all of these various
03:56:53 individuals. Once it's pulled together like that, then it goes
03:56:56 to Unified Command, and Unified Command will endorse it or
03:57:03 they'll ask for changes, and ultimately it gets approved by
03:57:07 them.
03:57:07 **Q.** Based upon your 25 years of experience responding to oil
03:57:10 spills, how would you describe the thoroughness of the
03:57:13 shoreline treatment recommendation process in the
03:57:16 *Deepwater Horizon* response?
03:57:18 **A.** It was extremely thorough. It really engaged everybody
03:57:22 that had a reason to participate in this process. And, in
03:57:27 particular, it was very protective of the techniques that were
03:57:29 going to be used so that they would be appropriate to each part
03:57:36 of the shoreline.
03:57:37 **Q.** So turning to the third part of the framework --
03:57:39 **MS. BRANSCOME:** We can just quickly pull up
03:57:41 D-34324.3.
03:57:44 **BY MS. BRANSCOME:**
03:57:45 **Q.** -- we are turning now into implementing treatment.
03:57:48 I believe you referenced earlier this is now out of
03:57:51 the SCAT process and being handled by operations. Is that
03:57:54 correct?
03:57:54 **A.** That's correct.
03:57:54 **MS. BRANSCOME:** If we could pull up D-34331.

03:58:06 **BY MS. BRANSCOME:**

03:58:06 **Q.** Dr. Taylor, please tell us what we are looking at here.

03:58:09 **A.** These are just slides that show different examples of techniques that are typically used and were used on the shorelines and the beaches, and sand beaches in particular.

03:58:20 Most of the techniques used are some form of sieving, where you are separating the oil to sand or the oil-sand mix from clean sand. The idea is to minimize removing a lot of sand from the shoreline if it doesn't need to be removed.

03:58:39 As a matter of fact, the upper left diagram shows a sifting process, where they are sifting clean shell out of material that's been recovered. So these are generally sifting operations.

03:58:54 On the lower right, for instance, you see part of what was called Operation Deep Clean. On these very high-use amenity beaches, a lot of areas were actually excavated and processed through sifters to remove oiled sand off the shoreline.

03:59:11 A new technique that was first used on this spill is the Sand Shark, that's the middle one on -- in the middle. It's a sifter, but it's a self-propelling, moving system. It's moving across the sand, and it actually penetrates into the sand about a foot, and so it collects that sand, runs it through a series of shakers and, again, allows the oiled sand to move into a bin, but then the clean sand can fall back

through.

Q. Was BP involved in the development of the Sand Shark?

A. They were. This was one of the techniques that was proposed, evaluated through the ARTES, the Alternative Response Technologies Evaluation group, to look at techniques that might be appropriate, tested it, and tweaked to make it most effective.

Q. Now, you mentioned that for the high-use amenity beaches, there was something called Deep Clean conducted. How did Unified Command determine when cleanup operations should cease on a given shoreline, so when clean was clean enough?

A. Again, that was something that was written into the shoreline program plan. We had several shoreline plans at different phases of the response. But ultimately, and the final plan that we had was the shoreline completion plan.

We had specific -- no further treatment recommendations and guidelines for operations. Those same treatment recommendations and that guidance for no further treatment is duplicated in each of the treatment recommendation forms that we saw.

Q. Were there ever instances in which Unified Command made a decision to allow some degree of oil to remain on a shoreline segment?

A. Most certainly.

Q. And was that ever appropriate, in your view?

A. Very much so.
Q. So why wouldn't you just require that all oil be removed from all shorelines?
A. Well, first of all, let's recognize that in the Gulf of Mexico, there is background oiling. It's there. We have natural sources of oil, plus the man-made sources. So there's already some oil on the shorelines. Widely distributed most of the time and very sparse, but it's there.

So you don't want to set an endpoint that's impractical; but that being said, the key is that we want to clean up the shorelines, we want to accelerate its natural recovery, and return those shorelines to their use, the pre-oiling conditions, as quickly as possible. But we also want to be cautious about the work that we do. So we don't want to be overly aggressive if that's not called for or appropriate.
Q. Has the federal government assessed whether residual oil remaining on a shoreline is toxic or in any way poses a threat to humans or wildlife?
A. Well, a big part of the established no further treatment guidelines that we implemented and that were written into the approved shoreline plan were founded on the results of the OSAT-2 report.

MS. BRANSCOME: If we could pull up D-34332. And this demonstrative contains two call-outs from the OSAT-2

report, which is TREX-12238.

BY MS. BRANSCOME:

Q. Dr. Taylor, are you familiar with this document?

A. Yes.

Q. The Court has heard a bit about the series of OSAT reports, but what is your understanding of what this report was based on?

MS. ANDRE: Objection, Your Honor. I'm sorry, I just feel that, you know, further discussion of the OSATs are cumulative at this point.

THE COURT: All right. I'll let him answer. We are not going too deep into this, right?

MS. BRANSCOME: No.

THE COURT: Okay. Go ahead.

THE WITNESS: Well, it's, again, the scientific advisory group that was tasked to look at oil residues, particularly on sand shorelines, and this is towards the end of 2010. Look at those residues and determine what the character of that oil was.

Their determination and the sum of their results and what was most important to us in terms of setting no further treatment guidelines is what's in the last paragraph; and that is, that residual oil that remains is typically very low in terms of its potential ecological threat and that continued operational treatment beyond a certain point wasn't

04:04:01 necessarily a net benefit to the environment. And so it was
04:04:07 best to let natural processes continue to work on certain
04:04:11 levels of oil and not try to remove every last bit.
04:04:14 **BY MS. BRANSCOME:**
04:04:14 **Q.** Were the results of OSAT-2 -- and I'm focusing
04:04:17 specifically on their findings with respect to residual oil
04:04:21 right now -- were they communicated to other stakeholders who
04:04:24 had an interest in whether residual oil created any kind of
04:04:28 threat to human or wildlife?
04:04:30 **A.** Yes.
04:04:31 **MS. BRANSCOME:** If we could pull up D-34333. And on
04:04:36 this demonstrative, we have a call-out from TREX-12187 and then
04:04:41 an excerpt from Captain Hein's deposition transcript.
04:04:44 **BY MS. BRANSCOME:**
04:04:45 **Q.** Did you review both of these exhibits in forming your
04:04:50 opinion in this case?
04:04:51 **A.** Yes.
04:04:51 **Q.** If you could just orient us, what are we looking at with
04:04:53 this letter on the left here?
04:04:55 **A.** The letter on the left is from the FOSC, that's
04:04:58 Captain Hein at the time, to the States, basically outlining
04:05:05 that OSAT had undertaken this task to look at that residual
04:05:09 oil, and they found that it posed minimum toxicity risk and,
04:05:16 thereby, allowing some oil to reside on the shorelines was
04:05:19 appropriate.

04:05:21 **Q.** We have been focusing up until now primarily on the
04:05:24 beaches. Was there a decision to allow residual oil to remain
04:05:27 in the marshes as well?
04:05:28 **A.** Yes.
04:05:29 **Q.** Was that appropriate, in your view?
04:05:31 **A.** Very much so.
04:05:32 **Q.** Why is that?
04:05:33 **A.** We know that spills have happened in marshes over time,
04:05:39 and we know that aggressive treatment very often delays the
04:05:47 return of the marsh as opposed to allowing oil to naturally
04:05:51 degrade. So you want to be very careful about handling oil in
04:05:55 the marsh so that you don't create more damage.
04:05:57 The whole point, again, is to accelerate the natural
04:06:01 recovery. If we do something that's going to actually delay
04:06:04 the recovery, then it's the wrong thing to do.
04:06:08 **Q.** And did the government also look at the use of natural
04:06:11 attenuation in terms of marsh recovery?
04:06:14 **A.** Very much so.
04:06:16 **MS. BRANSCOME:** If we can pull up D-34334, and here
04:06:18 we're looking at TREX-13015.
04:06:20 **BY MS. BRANSCOME:**
04:06:22 **Q.** It's a NOAA technical memorandum from 2013. Do you see
04:06:25 that, Dr. Taylor?
04:06:25 **A.** Yes, I do.
04:06:27 **Q.** Are you familiar with this technical memorandum?

04:06:29 **A.** Yes.
04:06:30 **Q.** If you could just very briefly explain, what was this
04:06:33 technical memorandum, and what did they conclude with respect
04:06:37 to natural recovery in marshes?
04:06:39 **A.** Again, this was a study that was done -- here you can see
04:06:42 the two authors are Zengel and Jackie Michel, the contractors
04:06:49 for NOAA, but it is looking at oiling in particular in
04:06:53 Barataria Bay on marsh front, and looking in detail at what
04:07:00 techniques might be appropriate to address the oiling in the
04:07:03 marsh. In particular, looking at the more heavily oiled pieces
04:07:07 of marshland.
04:07:09 There were a series of plots that were set up to test
04:07:12 different techniques and combinations of techniques and
04:07:15 determine what would be appropriate to use. Already knowing
04:07:20 that in many cases, we were going to -- the best that you can
04:07:24 do is allow natural attenuation to happen. But it did that
04:07:30 series of tests, and it comes to the same conclusions that we
04:07:33 see from a lot of other studies that had been done previously,
04:07:36 that natural recovery is indeed a preferred option where you
04:07:40 have oiling levels that are typically moderate or less.
04:07:46 **MS. BRANSCOME:** If we could pull up D-34335.
04:07:48 **BY MS. BRANSCOME:**
04:07:50 **Q.** Before we turn specifically to shoreline recovery, if you
04:07:54 could just explain generally for the marshes where treatment
04:07:57 was appropriate, what techniques were used.

04:08:00 **A.** Typically the techniques -- first of all, when we had
04:08:02 incoming oils during Phase 1, all the techniques were really
04:08:07 about removing oil from the water surface, or pooled oil. So
04:08:11 most of that effort was really done using suction systems,
04:08:15 pumps, and vacuums. If there was oil that could be just drawn
04:08:19 up and collected, that's exactly what was done.
04:08:23 Once the pooled oil was removed, then the next step
04:08:26 was really to address only the most heavily oiled parts of the
04:08:31 marsh, but to be very careful about how you dealt with that.
04:08:34 So the test results that were done on those plots and
04:08:38 the outcome of different trials ultimately resulted in using --
04:08:42 for instance, on the left -- flushing, which is just a
04:08:46 low-water flush. If there's still some oil that's a little --
04:08:51 that can be remobilized, you would use that to remobilize it
04:08:55 and collect it in the water next to the marsh.
04:08:59 Once oil was settled in and we didn't have anything
04:09:02 pooled or that could be remobilized, if there were thick
04:09:05 instances of oil in the mat, then the techniques that were
04:09:08 typically used were to rake that out.
04:09:11 If it was very heavy on the vegetation stems itself,
04:09:16 sometimes those were cut, and then those were raked out. The
04:09:19 idea was to minimize impact to the ground, to the soil and to
04:09:22 the roots. We know that if the roots are allowed to remain
04:09:26 there, that very often we are going to get regrowth quicker.
04:09:31 **Q.** We are going to turn and look at the extent to which

04:09:34 regrowth actually occurred; but before we do, Dr. Taylor,
04:09:37 having looked now at the entire framework of the Shoreline
04:09:41 Response Program, what is your opinion about the effectiveness
04:09:45 of that program specifically for the *Deepwater Horizon*
04:09:49 response?
04:09:49 **A.** Well, I think the treatment program was extremely
04:09:52 effective. It really focused the crews in a phased approach to
04:09:58 the heaviest oil, the priority areas. It oriented the crews to
04:10:03 tackle the heavy oiling and, where appropriate, moderate oiling
04:10:08 and get those taken care of first, try to avoid remobilization
04:10:12 of oil into other areas, and then it very quickly reduced that
04:10:17 footprint and reduced those categories of oil that were -- that
04:10:21 we were seeing.
04:10:23 **Q.** Perfect. That's leading me, actually, to my next series
04:10:27 of questions, which is, did you look at changes in degree of
04:10:30 oiling along the Gulf shoreline as part of your analysis?
04:10:35 **A.** Yes, we did.
04:10:36 **Q.** Did you help us prepare -- in fact, actually, you prepared
04:10:39 a series of maps that shows change in degree of oiling over
04:10:43 time?
04:10:43 **A.** Correct.
04:10:43 **Q.** Okay. I'm going to call up the first, and then if you
04:10:46 would just walk us through the different time periods that you
04:10:48 have maps.
04:10:49 **MS. BRANSCOME:** So we're going to pull up D-34005-A.

04:10:53 **BY MS. BRANSCOME:**

04:10:58 **Q.** If you could just orient us to what we are seeing here,

04:11:02 and then we can walk through these maps over time.

04:11:07 **A.** Earlier we saw the entire area from the Louisiana-Texas

04:11:10 border all the way over to Florida, Wakulla County in Florida,

04:11:18 as the area that was surveyed.

04:11:19 What I have done here is really just zoom in on the

04:11:22 sort of central portion of that map just to illustrate how the

04:11:26 categories were recorded along the shorelines and the changes

04:11:29 through time.

04:11:30 So what you are looking at here is pretty much from

04:11:33 near the Florida-Alabama border on the right-hand side over to

04:11:40 encompassing Barataria Bay on the left-hand side. And this is

04:11:45 the maximum oiling map. That's the one we described earlier

04:11:48 where we are talking about the heaviest oil category ever on a

04:11:55 particular piece of shoreline. So this isn't a snapshot in

04:11:58 time. This is actually an addition of the heaviest oil, the

04:12:03 maximum category, at any given time.

04:12:05 So what you can see, for instance, is that out of the

04:12:08 entire area surveyed in the histogram, out of the entire area

04:12:13 surveyed, some 75 percent of that area never had oil observed

04:12:18 on it. 25 percent did, most of which fell into the light

04:12:24 category. That's the 10 percent. That, again, is the maximum.

04:12:27 Now, if we go to the next slide --

04:12:30 **Q.** Okay.

04:12:30 **A.** -- then these are going to be a series of time slices. So
04:12:35 unlike the maximum oil, these are time slices. This is what
04:12:39 the oiling looked like, if you will, in the SCAT database. So
04:12:45 this is all produced from the SCAT database. This is what is
04:12:48 recorded in the SCAT database as the oil along each one of
04:12:51 those segments in the area. Again, this is just the zoom. So
04:12:55 what you see is a certain amount of reds. Down on the delta,
04:13:02 for instance, you can see -- I'm sorry.
04:13:10 You see some red dots down here in the delta, some up
04:13:14 in the Barataria Bay, some on the barrier islands off of
04:13:19 Mississippi and Alabama, and those are areas where in
04:13:23 October 2010 we still had some heavy oil, but those are really
04:13:26 limited areas. The heavy oil, in October 2010, were down to
04:13:31 like almost 1 percent of the shorelines surveyed.
04:13:36 **Q.** Dr. Taylor, you referenced that this data comes from the
04:13:39 SCAT database. Is the SCAT database jointly maintained? Or
04:13:42 who maintains it is probably a better question.
04:13:46 **A.** It is jointly maintained, yes. We had the same teams in
04:13:50 Mobile and a team over in Houma that were managing the
04:13:54 databases, but it was jointly distributed. And ultimately all
04:13:58 that data was written into the NOAA's database as well as BP's
04:14:04 database. It was jointly shared.
04:14:07 **Q.** So this is a database that -- and I said "jointly" without
04:14:10 defining what I meant by that. So we might have federal
04:14:13 government, state governments, BP has access to this database?

04:14:17 **A.** Yes, that's right.
04:14:19 **Q.** Didn't mean to interrupt you. So we're looking at
04:14:22 October 2010. Did you prepare a map for 2011?
04:14:24 **A.** Yes.
04:14:25 **Q.** If we could move forward to that.
04:14:28 So we are looking here at May 2011, the degree of
04:14:31 oiling in the same geographic region?
04:14:33 **A.** That's correct.
04:14:34 **Q.** What changes are we seeing from October to May?
04:14:36 **A.** It gets harder and harder to really discern the changes.
04:14:40 What you actually end up seeing here is more and more blue
04:14:44 lines, which is the no oil observed, and a shift in the
04:14:49 categories from heavy and moderate and even light into trace
04:14:55 categories.
04:14:55 One year after the spill, we're at about 88 percent
04:14:59 of the shoreline surveyed was no oil observed. Most of the oil
04:15:03 that we are seeing now, over 6 percent, is in the trace
04:15:08 category. This is one year after the spill.
04:15:11 **Q.** Did you prepare a similar map for 2012?
04:15:13 **A.** Yes. Yes. So, again, this is just another snapshot one
04:15:18 year later. Now over 90 percent of the shoreline is no oil
04:15:22 observed. It's -- approximately .1 percent of the shoreline
04:15:27 was recorded as heavy and, again, most is in the trace
04:15:32 category. If you step through the next two, it's going to be
04:15:35 very hard to see any significant changes.

04:15:38 **Q.** Okay. Now, at this point -- did you also prepare one for
04:15:43 2014? Just to make sure we get them all up here.
04:15:46 **A.** Yes.
04:15:47 **Q.** Now we are looking at May 2014. And you referenced the
04:15:50 .1 percent, there still contains some heavy oiling. Why, in
04:15:54 your opinion, is there still some heavy oiling at this point?
04:15:58 **A.** There's two factors that play into this. One is if an
04:16:03 area had heavy oil but then SCAT was not allowed to go and
04:16:08 resurvey, it remained in the database as heavy oiled. So there
04:16:12 were a few locations where we were requested not to survey for
04:16:16 some time, and that may have resided that way for some period
04:16:21 of time, not necessarily into May 2014, but through those
04:16:26 slices of time.
04:16:28 The other one is there are small locations of marsh
04:16:33 where the recommendation is to allow that natural attenuation
04:16:37 to happen, but still the oil that's in that area may still
04:16:43 qualify as heavy. Okay.
04:16:46 **Q.** And so how would you characterize the degree of oiling
04:16:50 that's still left in the Gulf shoreline as of May 2014?
04:16:55 **A.** It's very, very sparse. There's very little oil out
04:17:01 there. Where it is, it is, as you can see here, in the trace
04:17:07 category.
04:17:08 And, again, the trace category is anything. If
04:17:11 there's small droplets, there's small bits in a marsh here and
04:17:19 there and maybe over there, that's trace. If I go to a sand

beach in Pensacola and I find one little tar ball, and I walk down the beach and maybe a quarter mile, there's another little tar ball, that's still a trace, so it's still going to show up here. But that's really, again, back into that sort of background level.

Q. That's what I was going to ask you, Dr. Taylor, is how does this compare to pre-spill conditions in the Gulf?

A. It's very comparable. For all intents and purposes, the shorelines are back at pre-spill use and pre-spill conditions, and were relatively quickly, actually.

Q. That actually brings me to the next question, which is, did you also represent this data in graph form?

A. Yes.

MS. BRANSCOME: If we could pull up D-34320.

BY MS. BRANSCOME:

Q. And we see now the degree of oiling categories represented over the entire period of time. What does this graph tell you about the rate of shoreline recovery?

A. Well, the important part here to me is you can see the peak of oiling, which -- and this really is a sum. So you have a stack of miles that were in the heavy category. On top of those, you have the net moderate category. On top of those, you have the light category. So it's a sum of the oiling conditions that you see.

You can see that there's a peak around July, late

July. And then that peak of oiling slowly diminishes. If you look at the green, there's a slow change over time. That's the trace.

What's very important is the change that you see in the heavy and the moderate categories. That also decreased, but very quickly we are back to virtually no shoreline that is in those heavy, moderate categories within a year.

And the light category, those, of course, shifting out of heavy and moderate, they will shift through a light and into a very light. So you are seeing that change and that progression, which represents that combination of treatment and natural attenuation.

Q. Now, understanding that the scale of this makes it difficult to discern patterns in some of the degrees of oiling, did you also help us prepare a graphic representation of -- just focusing specifically on the heavy and moderate oiling over time?

A. Yes.

Q. So, first, we will look at it for beach habitat.

MS. BRANSCOME: That's D-34336.

BY MS. BRANSCOME:

Q. Dr. Taylor, again, what is this telling you about the rate of recovery on the beaches?

A. More than anything, it's telling me that this is a very, very quick drop in the oiling on the beaches. You can see that

the maximum extent -- so if we add up all those miles of shoreline that never had any sort of heavy oiling, that 134 miles -- but in October, so within a few weeks of the well being capped, there are 13.2 miles in that heavy category. That's telling me -- that reflects the very aggressive nature of getting on those beaches and getting that oil off the beaches.

By a year later, there is 5.5 miles of heavy oil left, and those aren't on any amenity beaches. Deep clean is over. Those 5 miles are on sensitive shoreline, sensitive sand shorelines, where a determination was we are going to approach these carefully and slowly. So there's a reason that there are still those.

And the same thing with the moderate, we see this quick decrease and, of course, recognize that some of that heavy has to move through moderate as time goes by. So more than anything else, it tells me that that response was very effective in dropping those miles quickly.

Q. And did you prepare similar graphs for the marsh habitat?

A. Yes.

MS. BRANSCOME: If we could pull up D-34338.

BY MS. BRANSCOME:

Q. Are we seeing a similar trend here for surface oiling in the marshes?

A. Exactly. That's very much a very, very similar trend.

Again, the only marshes that were being recommended for treatment were the heavy category. And even in the heavy category, not all the heavies were being recommended, just the most heavy.

So you have 86 miles of shoreline as a maximum at any point in time that had that qualifier associated with it. Three months after the well was capped, there were 24. A year later, there was nothing.

Again, not all of these are being actually treated with operational treatment. A lot of them are being allowed to naturally attenuate. All the moderates are being allowed to naturally attenuate.

Q. That's what I was going to ask you: What does looking at the data for the moderate oiling of marsh habitat tell you about the success of natural attenuation as an approach for the marshes?

A. It's telling us it is attenuating. It may not be as quick and as pronounced as we see with the heavy because part of the heavy is actual operational treatment, but it is accomplishing the goal that now natural attenuation process is working to diminish the level of oiling on those particular shorelines.

Q. Dr. Taylor, in addition to looking at changes of degree of oiling over time, did you perform additional analysis to assess the recovery of the marshes?

A. Yes.

Q. Did you help us prepare a demonstrative that would assist you in explaining that analysis?

A. I did.

MS. BRANSCOME: If we could call up D-34341.

BY MS. BRANSCOME:

Q. So, Dr. Taylor, what are we looking at here; and how does this relate to the analysis you performed on marsh recovery?

A. Well, when we are looking at shoreline recovery, clearly in the brief slides, we were looking at oiling changes. But another aspect of looking at a recovery is really looking at vegetation, particularly in the marshes. Vegetation is sort of the foundation, the root, actually, of the marsh.

And so in forming my opinion, one of the things that we did was to look at the information that's being collected in several studies. One is the joint study that was set up with BP and the trustees, the federal government, and the States called "The Coastal Wetland Vegetation Site Study." And thus, those 200 sites that are with the dark green. And then a series of sites that LSU has been studying, and there's 55 sites involved there.

So we looked at vegetation metrics to gauge if what the SCAT teams are seeing -- and that is, Boy, it looks like this shoreline -- I mean, we take photographs of everything that we do in the field. So you see those two photographs on the lower right. The SCAT teams are doing this. Every time

they survey, they are photographing. And they are seeing, Well, it looks like we have regrowth. It looks like we are seeing a return comparable to unoiled areas that are adjacent. But we wanted to look at the actual measures -- other measures to see if, indeed, we have something that verifies that.

Q. What does marsh vegetation tell you about the health of the marsh in total, including the root structure and the mat?

A. That vegetation is sort of the foundation for the habitat there. I mean, it anchors the habitat and it creates a basis for the organisms that live there. So the health of that particular habitat is going to be reflective of overall health in the marsh.

Q. So after looking at the data from all of these study sites, including the one that was jointly done with the federal and state governments, what was your conclusions about marsh recovery?

A. The conclusion was very much, again, along the lines of what we know from other spills. And that is, the marshes, if handled properly -- that is, allow them to naturally attenuate -- recover very quickly, particularly if they are only even moderately oiled. Our analysis showed that moderate, light, and very light marshes were back to comparable in vegetation characteristics to nonoiled areas within a year, or at most, at two years for some of the moderate sites.

There were some heavy sites that took -- appeared to

take a little longer. Some of the heavy sites showed a returning trend towards comparable sites. And with the exception of some few locations where we had very, very heavy oil -- and those are very select specific points -- most of the marshes actually looked very comparable to unoiled areas.

Q. Now, the government has presented some testimony that oil exposure in the marshes may have accelerated erosion and caused permanent loss of marshes.

Are you familiar with that trial testimony?

A. Yes.

Q. And did you look at any potential relationship between degree of oiling and erosion in the marshes?

A. We did. We looked at these sites right here as well as a third study that was done, which is called the Erosion Staking Study, which is just a two-year program.

Q. What did you find as a result of that analysis?

A. The results from that analysis where we looked at degrees of oiling and change of the position of the shoreline really didn't show us anything. We had nonoiled areas that eroded. We had oiled areas -- even heavy oiled areas -- that didn't erode. So there was no distinguishable character between rate of erosion and the oiling that we were seeing with maybe the exception of, again, a few select very, very heavily oiled locations. But generally, in most of the sites, we cannot glean a clear relationship between oiling and erosion.

04:27:54 **Q.** And how did the extent of your analysis compare to what
04:27:58 the government's experts examined in reaching their opinion
04:28:01 about potential connection with erosion?
04:28:04 **A.** Well, the government experts relied on a couple of
04:28:10 publications. I certainly looked at those publications; but I
04:28:14 chose to expand and use a much broader dataset to look at
04:28:19 something that would be, I think, much more comprehensive and
04:28:23 representative of what happened in this area.
04:28:28 **Q.** Now, the Court heard yesterday from Ms. Laura Folse in
04:28:32 some detail about what is being done to address any oil that
04:28:37 remains in the environment from the spill.
04:28:38 Are you familiar with those efforts, including the
04:28:41 work that was done as part of OSAT-3?
04:28:44 **A.** Yes, I am.
04:28:44 **Q.** I won't ask you to go back over those efforts in any
04:28:48 detail, but I did want to ask you: Did you form an opinion in
04:28:54 this case about the potential risk posed by so-called residual
04:28:58 oil?
04:28:59 **A.** Yes, I did.
04:28:59 **Q.** And when I say "residual oil," what I'm referring to is
04:29:03 oil that has not yet been identified to the extent it might be
04:29:07 out there.
04:29:07 **A.** Okay.
04:29:07 **Q.** What is your opinion?
04:29:10 **A.** Well, my opinion is, from looking at the results of the

SCAT surveys and the level of effort that went into really determine what might be in the subtidal or what might be buried, all the programs that grew out of that OSAT-3, my opinion is very much in line with the OSAT-3 findings; and that is, there may be some locations where there is some residual oil still out along the shoreline, but it's going to be very sparse. It's going to be very small quantities, typically, and that if there are any larger aggregations of material, it's probably a reforming process. Again, like the OSAT-3 reports, it's likely predictable to form in certain locations and it would be limited in extent and in time.

Q. Dr. Taylor, having reviewed all the evidence that we have looked at here today, the evidence you considered as part of developing your expert reports and what you personally experienced, what is your opinion about the effectiveness of the Shoreline Response Program following the *Deepwater Horizon* incident and the extent of shoreline recovery?

A. It is my opinion that the level of effort that went into this response was extraordinary. It brought together people from around the world, experts from around the world, to really address what needed to be done. It was very effective in defining the oiling conditions, in directing operations to areas that needed to be treated in a very quick way.

It was very effective at choosing, selecting, and defining the type of techniques to be used that were most

appropriate to the different shorelines. It was protective of the shorelines. It was extremely protective of the shorelines in setting best management practices and precautions for what was going to happen on the shoreline.

And those actions, the treatment actions or even the natural attenuation where that was called for, were very effective at really reducing the extent of oil and the degree of oil on the shorelines very quickly. Within the first year, we were looking at a significantly reduced footprint in terms of miles of shoreline and in categories. More importantly, in categories, they changed. And so I think it was an exemplary response, a very hard-fought effort, but it's something to be proud of.

MS. BRANSCOME: Thank you, Dr. Taylor. Please answer the government's questions.

MS. ANDRE: Abby Andre for the United States, Your Honor.

CROSS-EXAMINATION

BY MS. ANDRE:

Q. Good afternoon, Dr. Taylor. I have you for cross-examination.

Now, you don't dispute that at one time, approximately 220 miles were categorized as heavily oiled, do you?

A. Those are the miles -- that's the maximum. So that's --

it's not a point in time. There was never a point in time that that actually happened; but if you sum up all the segments that at any given point in time had been categorized as heavy, then that's what you would get.

Q. And you would agree that as of May 10, 2014, 393 miles of shoreline were still oiled to some degree?

A. The 390-odd miles had some degree of oil. Again, those are -- again, most of the oil that remained in 2014, we are talking a trace category.

Q. Now, it's correct, isn't it, that in 2014, there were 14 miles that were categorized as heavily or moderately oiled still?

A. In 2014? I would have to look at the table to confirm that number. I believe that -- I think that mostly has to be in the moderate category and, again, those are probably areas that are being allowed to naturally attenuate.

Q. We can pull up that table to refresh your recollection.

MS. ANDRE: Please pull up Dr. Taylor's Round 1 report, TREX-13246.075.

BY MS. ANDRE:

Q. This is Appendix G to your Round 1 report. I just want to confirm that that 14 number is correct.

A. Okay.

MS. ANDRE: Could you highlight the last line, please, Mr. Jackson, the May 10, 2014 -- that's fine. Thank

you.

BY MS. ANDRE:

Q. Can you confirm, Dr. Taylor, please, it is correct that as of May 10, 2014, 14 miles are were still categorized in the Gulf always heavily or moderately oiled?

A. That is -- as we have it reported there, yes. On any type of shoreline, that's what we have. Again, most of those are in the moderate category and, again, those four are a -- they are a residual of the SCAT database. So those are miles where, as of the last survey, what is in the database is the 4 miles of heavy oil.

Q. All of these numbers are based solely on SCAT data, aren't they?

A. These are all from the SCAT database, yes.

Q. SCAT collected data based on visual observation of the shoreline, right?

A. That's exactly right. We are documenting visual oil, oil that you can see on the surface and in the subsurface.

MS. ANDRE: You can take that down. Thank you.

BY MS. ANDRE:

Q. So let's discuss the 4,300 miles that SCAT surveyed.

MS. ANDRE: Please pull up TREX-13249.

BY MS. ANDRE:

Q. I'm pulling up a map generated by the ERMA program, which you are familiar with, correct?

04:36:27 **A.** Yes.
04:36:28 **Q.** You have seen this map before?
04:36:29 **A.** Yes.
04:36:30 **MS. ANDRE:** Could you please enlarge the portion of
04:36:32 the map that is the map, excluding the legend. Thank you.
04:36:37 **BY MS. ANDRE:**
04:36:38 **Q.** Dr. Taylor, just to confirm, this blue line is an
04:36:41 approximation of the total area where the SCAT teams surveyed,
04:36:44 correct?
04:36:47 **A.** Well, if it's in ERMA, which it is, this is actually the
04:36:52 SCAT line. So that is the area that SCAT surveyed.
04:36:56 **Q.** And teams were asked to survey segments where oil had not
04:37:01 yet been reported, right?
04:37:04 **A.** In some cases, we were asked to go into areas to -- even
04:37:08 though oil may not have been reported, we wanted to go and make
04:37:12 sure there wasn't oil there, correct.
04:37:16 **Q.** So looking at this map, you would agree that the blue SCAT
04:37:20 line encompasses the gray representation underneath it of the
04:37:27 total extent of surface oiling from the spill, would you not?
04:37:32 **A.** Well, I mean, again, my understanding of the gray area,
04:37:36 what's out on the water, is the sum of days and days of
04:37:41 different observations all stacked together; but the blue line,
04:37:46 indeed, was intended and was defined so that we could ensure
04:37:53 that oil that was arriving at the shoreline would be captured
04:37:58 by the survey teams, whether that was oil that was detectable

via the satellite imagery, which is kind of what this is, or not.

Q. Just to make sure I'm clear, you would agree that the blue line here is larger than this gray representation of the surface slick?

A. If we were just looking at the ends of the -- say, the whitish area on that map, the blue does extend past those ends. Again, the whitish area is what is interpreted from satellite imagery as oil at some given point in time.

Q. Now, Dr. Taylor, you conclude in your report that a vast majority of the Gulf shoreline was not oiled by the Macondo oil spill, correct?

A. Yes.

Q. In your deposition you explained that the area of the Gulf you referred to in your report is the shoreline between Galveston, Texas, and Tampa, Florida?

A. Again, if you remember one of the early slides where we showed where the ICPs, the Incident Command Posts, were set up, that is the area where Unified Command was initially looking at potentially needing to address shoreline response. So it ranged from Galveston over to Miami, where the other command post was.

But then as I explained, the focus of the -- of my report is really on the SCAT line, the SCAT information that's documented right there.

04:39:38 **Q.** Yes. And I understand the SCAT line is mostly what you
04:39:40 have already testified about today; but I just want to clarify
04:39:43 that the conclusion in your Round 1 report that states that the
04:39:46 vast majority of the Gulf shoreline was not oiled, what you
04:39:50 mean there is that the vast majority of the shoreline between
04:39:53 Tampa, Florida, and Galveston, Texas, was not oiled? That's
04:39:57 what you testified in your deposition to, correct?
04:40:02 **MS. BRANSCOME:** Objection, Your Honor, she can ask
04:40:04 him the question and if he is inconsistent, show him his
04:40:08 deposition testimony.
04:40:09 **THE COURT:** Hold on a second.
04:40:19 Well, that's technically right. You should ask
04:40:22 a question and only if he testifies differently --
04:40:25 **MS. ANDRE:** I'll --
04:40:27 **THE COURT:** Rephrase it.
04:40:29 **MS. ANDRE:** I will, Your Honor. Thank you.
04:40:31 **BY MS. ANDRE:**
04:40:31 **Q.** Dr. Taylor, would you disagree that in your report, when
04:40:34 you conclude that a vast majority of the Gulf shoreline was not
04:40:37 oiled by the Macondo spill, what you mean is the vast majority
04:40:41 of the shoreline between Galveston, Texas, and Tampa, Florida,
04:40:45 was not oiled?
04:40:47 **A.** It certainly applies to that portion of the coast as an
04:40:52 area that was encompassed under Unified Command at one point.
04:40:56 It also applies to the portion surveyed.

04:41:02 **Q.** So you disagree that within the meaning of your report,
04:41:08 Gulf Coast is Galveston on the west and Tampa on the east?
04:41:13 **A.** Technically, Gulf Coast actually ranges from the southern
04:41:17 tip of Florida all the way around to the Yucatan.
04:41:25 Peninsula. That is technically the Gulf Coast.
04:41:29 As I said earlier with Unified Command being set up
04:41:33 with a potential of addressing a spill response from Galveston
04:41:38 possibly over to the south coast of Florida, that was the range
04:41:44 that was envisioned as potentially at risk. The vast majority
04:41:49 of that shoreline never had oil. Within the area that we
04:41:53 surveyed -- again, from Louisiana all the way to Wakulla
04:41:58 County, the vast majority of that shoreline was not oiled.
04:42:08 **Q.** So I think that the answer to my question was, yes, that
04:42:11 in your report when you say that the vast majority of the
04:42:15 shoreline wasn't oiled, what you mean by Gulf is Tampa to
04:42:20 Galveston. I just want to make it clear so that the Court
04:42:24 understands what you are saying when you say Gulf, because as
04:42:26 you just said, the Gulf is a very big place.
04:42:29 **A.** Right. It is that region that originally was envisioned
04:42:35 by Unified Command from Texas to Florida and even the footprint
04:42:40 of the area that was surveyed.
04:42:43 **Q.** Let's move on.
04:42:49 Now let's talk about what SCAT teams did and did not
04:42:52 observe as part of their surveys. The SCAT category "NOO"
04:42:56 means that there was no oil observed at the time of the survey,

correct?
A. Correct.
Q. NOO, or no oil observed, does not necessarily mean that no Macondo oil was present in those areas, does it?
A. Well, again, the SCAT teams are really looking for visible oil. So if they are scrutinizing a shoreline -- again, they are walking back and forth across that shoreline, digging pits. If they don't see oil, then that is recorded as no oil observed.
Q. You would have to undertake a chemical analysis of water or soil samples to delineate the presence of oil in NOO areas, wouldn't you?
A. If you are looking at -- yeah, trace quantities of hydrocarbons that are below visible detection, then the only alternative after -- left then is really to start looking at other techniques, nonvisible techniques or chemistry.
Q. And it is possible that in NOO locations, there may have been oil that, while not visible, would have been detectable in a chemical analysis?
A. It's possible. As a matter of fact, we know that there's oil -- whether it's Macondo or other sources of oil -- detectable along most of the Gulf Coast, actually.
Q. So in your report, you state that most of the Louisiana marsh shoreline was never affected by MC 252 oil, don't you?
A. Correct.

04:44:40 **Q.** And that's referring to the SCAT surveys of visible oil,
04:44:44 right?
04:44:46 **A.** Again, SCAT surveys are documenting visible oil, and the
04:44:55 vast majority of the marsh shoreline was not oiled, had no
04:44:59 visible oil, and in most of those -- there are over 5,000 miles
04:45:04 of marsh shoreline. Most of those were never even exposed to
04:45:08 oil.
04:45:09 **Q.** So it is the case, isn't it, that in your report when you
04:45:12 draw that conclusions, that's based solely on SCAT data and no
04:45:16 other soil sample analysis or water sample analysis, correct?
04:45:21 **A.** Correct. I did look like at some soil analysis and water
04:45:25 analysis, but that's not really forming the basis of my
04:45:31 opinion. My opinions on oiling are really tied to the SCAT
04:45:34 information; that is, the visible, observed oil.
04:45:41 **Q.** And it's undisputed that of the 1,100 miles of shoreline
04:45:46 oiled by the spill or categorized as oiled during the SCAT
04:45:50 process, approximately 430 miles of Louisiana's wetlands were
04:45:55 visibly oiled, weren't they?
04:45:58 **A.** Approximately 430 miles had some degree of oiling, that is
04:46:01 correct. Anything from trace up to heavy. Obviously, most of
04:46:05 those were in the moderate and lighter categories.
04:46:09 **Q.** Approximately 55 miles of the Louisiana marsh was
04:46:11 categorized as heavily oiled, though, right?
04:46:15 **A.** At some point in time -- again, if you added up sort of
04:46:18 that max oil, the maximum oil, yes.

04:46:22 **Q.** And as of June of 2013, 86 miles of Louisiana marshes were
04:46:27 still oiled to some degree, right?
04:46:31 **A.** And I think we saw this in the bar graphs, yeah, exactly.
04:46:35 There's still oil in some of the marshes and, again, most of
04:46:38 those -- particularly, a year later -- we are looking at
04:46:41 marshes that, for the most part, are being allowed to naturally
04:46:45 attenuate.
04:46:47 **Q.** Now, you testified in direct to a lot of experience that
04:46:52 you have working on spill responses with Polaris. That
04:46:56 includes regular work in Louisiana, doesn't it?
04:47:00 **A.** What do you mean?
04:47:01 **Q.** How many spills have you responded to in Louisiana?
04:47:04 **A.** Well, you saw the spill -- the *Greenhill* Spill was the
04:47:09 spill that I had previously been on in Louisiana. There was
04:47:12 the *Torm Mary*, which, of course, is right across the border in
04:47:17 Texas.
04:47:17 **Q.** Are there any others?
04:47:19 **A.** Those are the two here in the northern Gulf. And then
04:47:25 there was the Kab spill down with PEMEX in the southern Gulf.
04:47:31 **Q.** And you would agree that this, then, is the most serious
04:47:32 spill you have ever seen hit Louisiana, wouldn't you?
04:47:36 **A.** Well, this is the largest spill I have ever been on. I
04:47:41 think most spill responders that were there are going to tell
04:47:44 you exactly the same thing. It was a very big spill. There
04:47:47 was a lot of oil spilled.

04:47:50 **Q.** It was a very serious spill, too, wasn't it?
04:47:52 **A.** It was serious. It was seriously addressed. It was
04:47:56 seriously taken. And serious in terms of what attention needed
04:48:01 to be given to the shorelines, absolutely.
04:48:04 **Q.** I want to illustrate for the Court a little further what
04:48:06 we are talking about when we discuss heavy oiling.
04:48:11 **MS. ANDRE:** Please pull up TREX-13015.
04:48:13 **BY MS. ANDRE:**
04:48:15 **Q.** I'm putting up a report you already discussed and cited in
04:48:19 one of your demonstratives entitled *"Deepwater Horizon* Oil
04:48:23 Spill: Salt Marsh Oiling Conditions, Testing, and Treatment
04:48:27 History in North Barataria Bay, Louisiana."
04:48:29 You recognize this documents and cited it in your
04:48:32 report, correct?
04:48:33 **A.** Correct.
04:48:34 **MS. ANDRE:** Please turn to page 18, TREX-13015.18.
04:48:38 **BY MS. ANDRE:**
04:48:40 **Q.** So, Dr. Taylor, these are examples of marshes that were
04:48:43 heavily oiled, correct?
04:48:47 **A.** I'm presuming so, yes. I think -- I can't quite read the
04:48:53 caption, but I would assume, based on the dieback that I see
04:48:57 there and the width, that those were heavily oiled.
04:49:00 **MS. ANDRE:** Can you please call out, Mr. Jackson,
04:49:01 just the description of Figure 6 so we can read it. Thank you.

04:49:10 **BY MS. ANDRE:**
04:49:11 **Q.** You see here that Figure 6 is described as persistent
04:49:15 oiling conditions, heavily oiled wrack and vegetation mat,
04:49:19 Bay Jimmy, October 2010.
04:49:23 So that confirms your assumption this is a heavily
04:49:26 oiled mat?
04:49:27 **A.** Uh-huh.
04:49:27 **Q.** Now, you coauthored a report with Dr. Jackie Michel that
04:49:31 states that "In the fall of 2010, much of the heavily oiled
04:49:34 layer on marsh platforms averaged 2 to 3 centimeters in
04:49:39 thickness and did not appear to have significantly weathered or
04:49:43 naturally degraded." Correct?
04:49:46 **A.** I can't remember if those are the exact words in the
04:49:49 paper. I did coauthor a paper. But, again, I would have to
04:49:54 look at the paper to see if that's the exact wording.
04:49:57 **Q.** We can certainly do that.
04:50:04 **MS. ANDRE:** Please call up TREX-12199.
04:50:14 **BY MS. ANDRE:**
04:50:16 **Q.** This is the paper that you coauthored with Dr. Jackie
04:50:19 Michel, correct?
04:50:19 **A.** That's correct.
04:50:21 **Q.** It's entitled "Extent and Degree of Shoreline Oiling:
04:50:25 *Deepwater Horizon* Oil Spill, Gulf of Mexico, U.S.A."
04:50:29 **MS. ANDRE:** Please turn to page 8 of this article.
04:50:40 Highlight the last sentence of the first column and the first

word of the second column, please.

BY MS. ANDRE:

Q. You cited this report in your expert report, correct?

A. Yes, I did.

MS. ANDRE: You know what, Mr. Jackson, what I wanted you to highlight, please, is starting with "In the fall of 2010." Thank you. Then "degraded" here over on the second column.

BY MS. ANDRE:

Q. So just confirming, this report which you coauthored with Dr. Michel says that "In the fall of 2010, much of the heavily oiled layer on marsh platforms averaged 2 to 3 centimeters' thickness and did not appear to have significantly weathered or naturally degraded."

That's what this document says, correct?

A. That's correct.

MS. ANDRE: Thank you. You can take that down.

BY MS. ANDRE:

Q. Now, let's discuss data underlying your assessment of the length of shoreline oiled. You would agree that in order to get a comprehensive picture of shoreline oiling, you would have to consider all available data sources, wouldn't you?

A. Well, I think we did consider an extensive source of information. Again, I think the SCAT information, the SCAT database, and all the observations collected over four years of

surveys is the most comprehensive source of oiling on the shorelines.

Q. But in order to get a complete picture of shoreline oiling, you would want to consider any other available data, in addition to the SCAT surveys, would you not?

A. Again, I think the chemical traces of oil are not going to -- don't really change my opinion in terms of the treatment that was done and the return of those shorelines to basically pre-spill conditions. I did not feel it was necessary to look at trace chemistry.

Q. You are aware, sir, aren't you, that NRD preassessment teams found oil in places where SCAT surveyors had not; not just trace, but other categories?

A. I am aware that there were some specific locations where the preassessment teams identified oil and the SCAT teams had not, but the SCAT teams subsequently were asked to go and revisit.

Q. Now, you would agree also that these NRD preassessment teams also surveyed portions of shoreline like you said but took chemistry samples when they were in the field, correct?

A. That typically is part of the NRDA study and process, yes.

Q. SCAT surveyors did not typically take samples during their surveys, right?

A. No, SCAT typically does not. We had a few cases where we were asked to collect select samples, but that is not part of

04:53:31 the standard procedure.
04:53:32 **Q.** Because the purpose of the SCAT survey was to characterize
04:53:35 oiling for treatment during the response, right?
04:53:38 **A.** Well, it was to characterize oiling, period, or lack
04:53:43 thereof, and then to use those observations to recommend
04:53:49 treatment; but it's not solely for treatment. As a matter of
04:53:53 fact, I think a big part of the NRDA study is using -- turns to
04:54:01 the SCAT information because it is so broad, it covers a wide
04:54:13 area, and it was repeated over time. So there was a lot of
04:54:16 return visits that makes that source of information for the
04:54:20 NRDA process that more robust.
04:54:25 **Q.** But you would agree that the purpose of SCAT is primarily
04:54:27 for response, whereas, the purpose of NRD is primarily for
04:54:31 injury assessment, wouldn't you?
04:54:32 **A.** Those are the major divisions, but it's not a
04:54:35 black-and-white line that's clear.
04:54:40 **Q.** But you did not include any data from shoreline surveys,
04:54:43 including those from the NRD preassessment teams, in your
04:54:48 overall assessment of the length of shoreline oiled?
04:54:52 **A.** No, not length of oiled shoreline because, again, those
04:54:56 are chemical, nonvisible observations. The few cases in which
04:55:01 those preassessments found and identified oil, we were -- the
04:55:07 SCAT teams were asked to go back and revisit, and those where
04:55:13 there was oiling observed did get included into the numbers
04:55:16 into the length.

04:55:19 **MS. ANDRE:** Now, let's please pull up D-34320, which
04:55:27 you testified about earlier.
04:55:28 **BY MS. ANDRE:**
04:55:28 **Q.** It has a figure that is found in your Round 1 report.
04:55:32 **A.** Okay.
04:55:34 **Q.** So this figure is from your Round 1 report and in your
04:55:40 report is entitled "Changes in Oiling Levels Over Time Across
04:55:45 Gulf Coast Area of the Response."
04:55:48 Now, looking at this chart, it looks like heavy and
04:55:52 moderate oiling categories were no longer present starting
04:55:56 around the beginning of January 2012, right here, doesn't it?
04:56:01 **A.** Yeah. Again, it's very hard to say, but that's about --
04:56:04 yes, somewhere in there towards the end of 2011, they really
04:56:07 are down to not discernible on this graph.
04:56:11 **Q.** But there are -- as we have already discussed, there were
04:56:16 segments of shoreline categorized as heavily oiled through
04:56:18 2012, '13, and '14, right?
04:56:21 **A.** There were still some lengths that were -- that remained
04:56:24 in the SCAT database in those categories, correct.
04:56:27 **Q.** So one of the reasons that these categories are hard to
04:56:34 see on this graph is that the Y-axis here goes all the way up
04:56:36 to 4,500 miles to capture the entire SCAT survey, right?
04:56:41 **A.** That's correct. It is to show what was surveyed and the
04:56:46 various categories -- that shift of categories from heavy,
04:56:49 moderate, into a light, and then into a very light, and trace,

through time.

Q. Let's go on to a new topic. Let's discuss your conclusions about marsh recovery.

Now, your conclusions about the recovery of the marsh vegetation are based on observation of vegetation regrowth, right?

A. There are a number of metrics that I looked at that were sampled in those plots and that we analyzed, yeah, to assess vegetation regrowth.

Q. Your assessment was focused specifically on observational evidence of residual oil, soil and bare ground, and vegetation regrowth, right?

A. Those are some of the parameters that were taken into consideration, certainly.

Q. And you conclude that there was limited penetration of Macondo oil into marsh soils, right?

A. Correct.

Q. But you didn't rely on any soil or sediment chemistry data as part of your assessment of marsh recovery, did you?

A. Again, we are really looking at visible oiling. So one of the characteristics I described earlier when we talk about recovery was reduced oiling categories and reduced length and/or degree of oiling, as well as regrowth of vegetation. So it's that combination.

Q. You would agree that soil samples can be useful to

understand what's happening in a marsh and the marsh's overall health, wouldn't you?

A. They can certainly be useful, yeah. If I were doing the NRDA analysis, I would be looking at chemistry, but that's not what I'm looking at.

Q. And you would agree that some peer-reviewed literature has said that sole reliance on visual observation is not sufficient to fully understand marsh health, right?

A. Fully understand, again, that -- if you are looking at the entire microcosm, then there are a lot of different species that you can look at in the soil and on top of the surface, on the plants themselves. But myself and many other researchers that have looked at spills and in marshes very typically will look at the vegetation growth as an indicator of the return of that marsh to pre-spill conditions, the health of the marsh.

If that regrowth occurs, then the foundation is there for the rest of the ecosystem. And there may be other trace levels of things happening that can be assessed and ascertained. But overall, when you have metrics that show that the vegetation has regrown and is comparable to oils that were never -- that's what we are looking at as an indicator of return to -- so nonoiled conditions.

Q. I understand that you were focused on regrowth, and we will talk a little bit more about that, but I was just specifically trying to establish that you would agree that

there is peer-reviewed literature that has said that sole reliance on visual observation is not sufficient to fully understand marsh regrowth. Just the fact that there is peer-reviewed literature that says that, you are aware of that, aren't you?

A. I'm aware of that. And I'm also aware that there is peer-reviewed literature that says the marsh appears to have recovered based on vegetation only.

Q. Talking more about vegetation, I want to clarify a point. Marsh soil and marsh mats are two different things, aren't they?

A. Generally, yes, we are talking about two different things.

Q. Generally speaking, marsh mat lays up on top of the soil, correct?

A. Yeah. Typically that's what's up on top of the soil. It basically is breaking down and forming the soil at some point.

MS. ANDRE: Please call up again TREX-13015.19.

BY MS. ANDRE:

Q. I'm going to show you another couple pictures from the salt marsh report we've already discussed.

MS. ANDRE: Can you please, Mr. Jackson, not only call up the pictures, but the description of the figure.

BY MS. ANDRE:

Q. Now, these pictures depict pooled mousse penetrating marsh mat, correct?

A. That's correct.
Q. So you don't deny that marsh mats were penetrated by Macondo 252 oil in some areas, do you?
A. No. No, I don't. This is something that was seen. And, again, this is that study zone in the NOAA report. These were some of the most heavily, heavily oiled marsh fringes, and the mat is that vegetation material. So this is oil that, again, was able to seep into that vegetation.
Q. Now, it's possible, once a marsh has been exposed to heavy oiling like this, for the pooled oil sitting in the marsh to become remobilized, isn't it?
A. It is. There are a couple things that can happen. One, if you have exposed oil, like you have in the bottom photograph, that is sitting there and not removed, wasn't treated, then that could be remobilized. Of course, this is exactly the type of stuff that we would go to treat. But that could be remobilized if left alone.

MS. ANDRE: Mr. Jackson, you can take that photo down, but let's leave this TREX up.

BY MS. ANDRE:

Q. Let's discuss now the penetration of oil horizontally into the marsh, instead of into the soil, how it moves from the water deeper into the marsh.

Generally speaking, SCAT teams observed that visible bulk oiling penetrated marsh fringes up to 10 to 15 meters,

correct?

A. Most of the oil that we saw in the marshes was what we call fringe oiling. It occurred right along the edges of the marsh, and typically it did not exceed more than about 10 meters, or 30 feet deep into the marsh.

The plants tend to restrict that movement. The stems tend to hold the oil. So it slows that progress. Again, that's most of the heavily oiled areas. If it's moderately or lightly, there's even less movement through.

It's like a cone, it's basically holding it there. And so that's what we are seeing in most cases, fringe oiling. Not only myself, but I think you'll find that also reported in peer-reviewed literature.

Q. Now, for reference, the distance between where you sit today and the far end of this jury box is about 10 meters, isn't it?

A. 30 feet.

Q. Now, in your report -- I want to get into a little bit more what you mean by "fringe." When you say a marsh fringe, that can mean either the external part of the marsh that abuts the Gulf of Mexico directly, or it can mean the internal portion of the marsh that has open communication with water. Is that right?

A. The fringe is -- correct. It is the portion that has an open communication with water, correct.

05:04:43 **MS. ANDRE:** So let's pull up one more photo from
05:04:47 TREX-13015, this time at page 13.
05:04:51 **BY MS. ANDRE:**
05:04:53 **Q.** To make sure we are clear on what you mean by "fringe
05:04:58 oiling" in your report.
05:05:03 Looking at this top photo, first to orient, here you
05:05:07 see boom, right?
05:05:07 **A.** Yes.
05:05:08 **Q.** Here is what you would call the external part of the marsh
05:05:12 that would abut the Gulf of Mexico directly.
05:05:16 **A.** Okay.
05:05:16 **Q.** Correct?
05:05:19 **A.** Well, yes. It's actually in the bay, but yeah.
05:05:23 **Q.** And then the brown here is what you would call a dieback;
05:05:27 the oil has already hit it and it's flattened and takes on that
05:05:34 brown color, correct?
05:05:35 **A.** This may have been an early stage, again, during the early
05:05:39 phases of the spill when we had different waves of oil
05:05:43 incoming.
05:05:44 **Q.** And dieback results in erosion, doesn't it?
05:05:47 **A.** No, not necessarily. Again, that's, I think, what I had
05:05:52 pointed out in my report -- in my second report specifically is
05:05:57 that dieback is not necessarily related to erosion. Even
05:06:02 moderately to heavily oiled shorelines, we cannot find a match
05:06:08 of retreat of those shorelines relative to oil.

There are a few of the very, very heavily oiled cases in which sufficient dieback and non-regrowth did -- appears to have resulted in some erosion relative to adjacent areas; but in most cases, actually, there is not a direct relationship.

Q. You would agree, wouldn't you, that as seen here, once this marsh mat is oiled and, in this case, heavily oiled, those plants die and fall away? There might be more regrowth later, but for this specific vegetation, the impact is that it dies?

A. The vegetation you see there at that time has been oiled, and so the stems, the leaves, at that point in time, they are dying back. It is a dieback.

What you don't know is the effect on the roots and, again, that's what is so critical here is that if that root structure is not disturbed or not heavily oiled, then there's a very likely chance that it will regrow in the next growing season. And that's exactly what we see in most cases, again, with the exception of a few of the very, very most heavily oiled sites or, of course, where there was erosion; but, again, that erosion could be a natural erosion.

We know most of these shorelines are eroding; but where that regrowth happens, then that tells you the roots survived and allowed the shoots to regrow and return, revegetate.

Q. Returning to your definition of "fringe," we already talked about the first thing that you mean by fringe. This

05:08:04 photo shows here -- and this is an example of internal oiling,
05:08:08 correct?
05:08:09 **A.** No. That's a water channel. It's a water channel. So
05:08:18 there's open water communication.
05:08:20 An example of fringe interior is if you were to go to
05:08:23 the upper right of that photograph, it's still marsh, okay, but
05:08:28 oil has not penetrated up there. It's moved along the water
05:08:34 because it's -- these are all tidal channels. So you have
05:08:38 tides that are incoming, tides that are flowing out, and if
05:08:42 that oil gets transported through that water channel, it can
05:08:46 affect the marsh edge. And that's what we are talking about,
05:08:48 the marsh edge along the water.
05:08:52 **Q.** Okay. So in your report, when you say that fringe oiling
05:08:58 resulted in penetration sometimes, as you testified, 10 to
05:09:03 15 meters, that could mean either this outside bit or these
05:09:08 internal portions as seen in the bottom photo, right?
05:09:11 **A.** That's correct. Where there is direct water communication
05:09:14 that transports the oil, it can affect that edge where the
05:09:18 marsh is. And typically that was no more than about the
05:09:22 30 feet. It was typically less, but that was typically no more
05:09:26 than that.
05:09:28 **Q.** Let's move on to our last topic, and that's the impact of
05:09:32 oil on marshes. You would agree that wetlands support
05:09:37 populations of fish, amphibians, reptiles, birds, and mammals,
05:09:41 wouldn't you?

05:09:43 **A.** Certainly.
05:09:43 **Q.** Many species are reliant on wetlands for their
05:09:47 reproduction and early life stages when they are most sensitive
05:09:52 to oil; isn't that right?
05:09:53 **A.** There's a great reliance -- there's a full ecosystem there
05:09:55 and represents all life stages.
05:09:57 **Q.** But you didn't assess the impacts of marsh oiling on
05:10:01 animals or other biota directly, right?
05:10:06 **A.** No, I did not.
05:10:07 **Q.** So oiling in marshes where there is penetration into the
05:10:11 marsh mat does pose risks to the marsh vegetation, but also the
05:10:18 roots and the animals that live there, correct?
05:10:21 **A.** Oil on the surface and on the mat certainly can affect the
05:10:24 vegetation itself and, obviously, any organisms that happen to
05:10:28 live there, that is correct.
05:10:31 **MS. ANDRE:** Thank you. I have no further questions.
05:10:33 **THE COURT:** Any redirect?
05:10:36 **MS. BRANSCOME:** Briefly, Your Honor.

REDIRECT EXAMINATION

05:10:47 **BY MS. BRANSCOME:**
05:11:07 **Q.** Hello again, Dr. Taylor. Just two lines of questions.
05:11:12 The first was, do you recall the photos that you were
05:11:14 just shown of marsh oiling that was in the salt marsh NOAA
05:11:19 Technical Memorandum? Do you recall that?
05:11:20 **A.** Yes.

05:11:21 **Q.** Are you aware that all of those were located in Bay Jimmy?
05:11:25 **A.** Bay Jimmy, Zone K specifically, yes.
05:11:29 **Q.** Are you familiar with what treatment was conducted within
05:11:32 Bay Jimmy with respect to marsh oiling?
05:11:35 **A.** Well, again, that report was specifically setting out a
05:11:38 series of plots along the shoreline in which plots were handled
05:11:44 differently. Some areas were treated with raking, some were
05:11:48 flushed and raked, others were cut, others were left alone, so
05:11:52 no treatment was happening.
05:11:55 Again, that particular length of shoreline was one of
05:11:58 the most heavily oiled shorelines. So, again, with the focus
05:12:03 being on what treatment might be recommended, looking at the
05:12:08 most heavily oiled areas, compare those effects of the
05:12:12 treatment process side by side.
05:12:14 **Q.** So in your view, were those photographs of marsh oiling
05:12:19 representative of marsh oiling generally along the coast of
05:12:22 Louisiana?
05:12:24 **A.** No, definitely not generally. You are looking at some of
05:12:27 the heaviest, heaviest oiling there.
05:12:31 **Q.** You were asked a few questions about an article that you
05:12:34 cowrote with Jackie Michel and some other government scientist.
05:12:39 Do you recall that?
05:12:40 **A.** Correct.
05:12:40 **MS. BRANSCOME:** If we could pull up TREX-12199, just
05:12:47 the cover page, just to orient.

05:12:49 **BY MS. BRANSCOME:**
05:12:50 **Q.** Dr. Taylor, is this the article that you were just asked
05:12:52 about on cross-examination?
05:12:55 **A.** Yes.
05:12:55 **Q.** If you could, just explain who are some of the coauthors
05:13:00 in this article, and what was the purpose of drafting this
05:13:03 paper.
05:13:04 **A.** Well, this is a lot of the heart and soul of the Shoreline
05:13:10 Response Program on the *Deepwater Horizon* spill. So you have
05:13:12 the technical advisers for the shoreline program. You have the
05:13:16 SCAT coordinators. You have all the people that are listed
05:13:21 with a number 1 by their name: Jackie Michel, Scott Zengel,
05:13:27 Zach Nixon, etc. They are all working either for NOAA or are
05:13:34 NOAA employees.
05:13:36 Then you have those of us that were working with BP,
05:13:38 and they are listed there as Polaris.
05:13:43 **Q.** So I would like to just look at some language in this
05:13:46 article that you were not shown on cross-examination.
05:13:48 **MS. BRANSCOME:** If we could look first at
05:13:50 TREX-12199.4.3.
05:14:01 **BY MS. BRANSCOME:**
05:14:02 **Q.** You were asked some question about the condition of marsh
05:14:04 oiling in late 2010. Do you recall that?
05:14:06 **A.** Yes.
05:14:08 **Q.** And would you mind just reading for the Court here the

language that we have highlighted that's contained within this article.

A. Yes. It says: "Heavy to moderately oiled shorelines had declined by 87 percent in one year and 96 percent in two years compared to maximum oiling conditions."

Q. Is this language consistent with the trends that you explained during your direct examination?

A. They are.

Q. Did this paper also look specifically at the extent of marsh oiling in terms of penetration both in depth and along the edge of the marsh?

A. They did.

MS. BRANSCOME: If we could pull up TREX-12199.8.1.

BY MS. BRANSCOME:

Q. We see here this is another excerpt from this article, and it states: "Along most of the marshes, the oil stranded along the marsh edge and bulk oiling usually spread into the marsh no more than about 10 to 15 meters perpendicular to the shoreline due to the small tidal range (approximately half a meter), the density of the vegetation and the residual oil's high viscosity."

Do you see that there, Dr. Taylor?

A. I do.

Q. Is this consistent with what you were explaining to Ms. Andre earlier about the degree of penetration along the

edge of the marsh?
A. Yes. This refers to that fringe oiling, correct.
MS. BRANSCOME: But if we could look also at TREX-12199.2.4.
BY MS. BRANSCOME:
Q. Did this paper also examine the penetration of oil and the depth of the marsh?
A. It looked at penetration into the mat itself.
Q. And this -- if you wouldn't mind actually reading the highlighted language here.
A. "In marshes, the emulsified oil pooled on the surface with little penetration into the marsh soils."
Q. I have just two questions for you on this. First, when we talk about pooled oil, was that oil that was susceptible to treatment during the response?
A. Typically that's what we were tackling. That was exactly the target of oil is to remove anything that's pooled.
Q. Then my second question is: What is the significance to the fact that there was little penetration of oil into the marsh soils?
A. Again, the photo we saw earlier was a mat, so that's vegetation that's laid down on top of the soil. So there's more space in between those fronds that are lying down on the ground for oil to move into.
Once you get to the soil, typically these are

fine-grain soils. They're clays and silts, and there's very little pore space available. Plus they are wet. So oil doesn't tend to go into it, except perhaps through burrows, but it doesn't really penetrate into the soil itself.

Q. What is the significance of that fact to you in terms of looking at prospective marsh recovery?

A. Generally it means that the roots are not at a high risk of impact, particularly from a heavier oil, like was happening in this case. More emulsified oil means that it's more viscous; it can't flow into those fine pore spaces.

MS. BRANSCOME: Thank you, Dr. Taylor. I have no more questions.

THE COURT: I just have one question. I'm kind of curious. Do you know where Bay Jimmy is located?

THE WITNESS: Yes, sir.

THE COURT: Where is it located?

THE WITNESS: North side of Barataria.

THE COURT: How far is that from the Gulf of Mexico?

THE WITNESS: Well, if you start from the barrier islands and move on in, probably about, just guessing, about 20 kilometers.

THE COURT: It's on the north end of Barataria Bay?

THE WITNESS: Correct.

THE COURT: So did you all determine -- I mean, is that how they all got into -- Bay Jimmy, you said, I believe,

is one of the heaviest oiled areas, right?

THE WITNESS: Barataria and Bay Jimmy, yes, sir.

THE COURT: So that area?

THE WITNESS: And there's an interesting study that was done by some of the people out of LSU where they were looking at wind and currents forcing and the tidal movement through Barataria Bay and Bay Jimmy, and they show how the flow in that area tends to concentrate in and move oil. And so that particular study actually explains some of the rationale for why that oil ended up right in those areas.

THE COURT: Okay. Thank you. Thank you, Doctor.

THE WITNESS: Sure.

MR. BROCK: Judge Barbier, that's our last witness today. We have three witnesses to call tomorrow, all experts.

THE COURT: Are you going to play any -- I thought there was a note that you might play some videos today.

MR. BROCK: I have some, but I think I'm going to try to cut back on some of the video.

THE COURT: Okay.

MR. BROCK: I might have about 15 minutes to play tomorrow, and I will figure out how to do that between witnesses.

We have three experts: Dr. Tunnell, Dr. Daines, and Dr. Scott. We are not going to call Mike Robertson, who has an accounting function for BPXP. So we can

take him off the list.

I think what we would ask -- I think what I would like to ask the Court to do, but I need to confirm this tonight, is to allow us to call Mr. Den Uyl on Tuesday morning of next week. I think what we will do is go to Chicago over the weekend and visit with him and let him fly down on Monday. Matt Regan is working on that this afternoon, but I think that's what I would ask of the Court. I think that would give Anadarko sufficient time to present their case on Monday, if that's agreeable to them.

MS. KIRBY: Sure. I think, Judge, even with cross-examination, we won't get through all day.

THE COURT: How many witnesses do you have?

MS. KIRBY: Just three.

THE COURT: Three?

MS. KIRBY: Yes.

THE COURT: How long do you think yours will take total? Do you have any sense?

MS. KIRBY: On direct?

THE COURT: Direct, yeah.

MS. KIRBY: On direct, I think maybe two and a half, three hours total.

MR. BROCK: It's probably a day. Then we would need the next morning for Mr. Den Uyl.

MS. HIMMELHOCH: No issue from the United States,

Your Honor.

THE COURT: Sounds like a reasonable plan. So tomorrow --

MR. BROCK: Dr. Tunnell.

THE COURT: Tunnell, then Daines, then Scott.

MR. BROCK: Yes, sir. We will work some video in during the day also.

THE COURT: All right. Any other matters?

MS. HIMMELHOCH: I alluded to one yesterday, which in fact, I do have to bring to you. We were unable to reach agreement with BP regarding the four documents that I would have used with Dr. Austin had I known they weren't going to call Dr. Bonanno. They have declined to agree to give us those four documents. We really were trying to respect the Court's view on cumulativeness.

THE COURT: Well, what are those documents. Just very generally tell me what they are.

MS. HIMMELHOCH: They are scientific articles that go to the effects of disaster on communities and individuals. They are peer-reviewed published literature.

THE COURT: Who was it that was going to talk about those?

MS. HIMMELHOCH: Both Dr. Austin and Dr. Bonanno reviewed them and discussed them in their various round reports. Dr. Austin could have discussed them on direct. Had

I known Dr. Bonanno was not coming, my colleague would have had her discuss them on direct.

As far as we knew, we had received three witness lists that had Dr. Bonanno on the list. We were facing a time clock. We were facing not wishing to be cumulative. I made the choice not to have Dr. Austin address them.

THE COURT: Were these discussed in either of those witnesses' depositions?

MS. HIMMELHOCH: Yes, they were discussed in Dr. Bonanno's. I don't believe BP actually asked Dr. Austin any questions about these articles.

THE COURT: Well, I suppose, if you wish, you could offer that portion of his deposition with the documents. That's one way to address that if you would like to.

MS. HIMMELHOCH: That would be fine with the United States, Your Honor.

MR. BROCK: Your Honor, from BP.

In this litigation, since the beginning, a party has had the option of dropping an expert without any issue being raised about that. We have done that from the very beginning. You'll remember the various moving around and dropping of experts. So from our point of view, any exhibits that they wanted in the record with their expert, they should have put in the record with their expert, and we would very much object to just putting documents in that have not been --

05:23:32 **THE COURT:** I'll tell you what I'm going to do. I'm
05:23:34 going to allow the government to proffer those with or without
05:23:40 the related testimony.
05:23:43 You can proffer those. BP can file an objection
05:23:46 to your proffer. I'll decide how -- whether and how to
05:23:50 consider it.
05:23:50 **MR. BROCK:** Okay.
05:23:52 **MS. HIMMELHOCH:** Thank you, Your Honor.
05:23:53 **MR. BROCK:** We have certainly never admitted the
05:23:55 deposition of an expert who was not called as a trial witness.
05:24:00 We are talking about the deposition of our expert.
05:24:04 **THE COURT:** There's nothing in the rules that says
05:24:07 you can't do that, that I'm aware of. We use depositions of
05:24:10 experts frequently. I'm not saying you have done it in this
05:24:13 case.
05:24:14 I'm allowing her to proffer that. You can
05:24:16 object to it. When I rule on the trial, I'll decide if it's
05:24:26 something I admit and rely on. If I don't rely on it, it's a
05:24:30 moot issue.
05:24:32 **MS. HIMMELHOCH:** Thank you, Your Honor.
05:24:33 **THE COURT:** Anything else before we recess?
05:24:37 **MS. HIMMELHOCH:** Not for the U.S.
05:24:39 **THE COURT:** Have a good evening.
05:24:40 **THE DEPUTY CLERK:** All rise.
05:24:41 (Proceedings adjourned.)

CERTIFICATE

I, Toni Doyle Tusa, CCR, FCRR, Official Court Reporter for the United States District Court, Eastern District of Louisiana, certify that the foregoing is a true and correct transcript, to the best of my ability and understanding, from the record of proceedings in the above-entitled matter.

s/ Toni Doyle Tusa
Toni Doyle Tusa, CCR, FCRR
Official Court Reporter