Exhibit 1

Transcript of Dr. Christopher Portier

Date: January 12, 2018
Case: In Re: Roundup Products Liability Litigation

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UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA

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IN RE: ROUNDUP PRODUCTS LIABILITY LITIGATION) MDL No. 2741) Case No.) 16-md-02741-VC
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DEPOSITION OF DR. CHRISTOPHER PORTIER

Friday, January 12th 2018

AT: 11.00 am

Taken at:

Hilton London Heathrow Airport
Terminal 4
Hounslow TW6 3AF
United Kingdom

Job ref: 173050

Pages: 1 - 126

Reporter: Claire G. Hill RPR CRC

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Also Present:

David Ross Elliott
Videographer

I N D E X

E X H I B I T S

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Friday, January 12th 2018
(10.54 am)
THE VIDEOGRAPHER: Good morning, this is the beginning of media 1, volume I in the video deposition of Dr. Christopher Portier. This is being held at Hilton London Heathrow Airport Terminal 4, Hounslow, TW6 3AF, in the United Kingdom. This is being taken on 12th January 2018, at 10.55 am as indicated on the video screen.
This deposition is in the matter In Re Roundup® Products Liability Litigation, the MDL number is 2741, and the case number is 16-md-02741-VC. It's being heard before the United States District Court in the Northern District of California.
The court reporter today is Claire Hill, of Planet Depos, and my name is David Ross Elliott, and I am the official certified videographer here, also on behalf of Planet Depos.
And now I would like to ask all of counsel to introduce themselves, please, and who they represent.
MR. LASKER: Yes, this is Eric Lasker of Hollingsworth LLP, representing Monsanto.
MS. GREENWALD: Robin Greenwald of Weitz &

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Luxenberg representing the plaintiffs.
MR. KALAS: John Kalas, Hollingsworth LLP, representing Monsanto, appearing via telephone.
THE VIDEOGRAPHER: Would the court reporter please swear in the witness?
CHRISTOPHER PORTIER,
having been duly sworn,
testified as follows:
DIRECT EXAMINATION BY MR. LASKER:
Q. Good morning, Dr. Portier.
A. Good morning.
Q. So since the last time we have met, there has been a new epidemiologic study published that looks at whether there is an association between glyphosate-based herbicides and non-Hodgkin's lymphoma, correct?
A. Correct.
Q. That is a study that was lead authored by Andreotti and other scientists that is set to be published in the Journal of the National Cancer Institute in 2018, correct?
A. Yes.
Q. Let's go ahead and mark as exhibit 28-1 the new study.
(Exhibit 28-1 marked for identification)

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Q. This is the 2018 glyphosate study, correct, Dr. Portier?
A. Yes.
Q. This paper was coauthored by 12 scientists who work for various agencies or entities within the National Institutes of Health, correct?
MS. GREENWALD: Objection, form.
A. No, that is not correct.
Q. Okay. Are there individuals here who you believe are not associated with the National Institutes of Health?
A. That is correct.
Q. Which scientists are not associated with the National Institutes of Health?
A. Anneclaire De Roos is with Drexel University. Charles Lynch is with the State Health Registry of Iowa, Iowa City, Iowa. No, I'm sorry, he's with the Department of Epidemiology, University of Iowa. And also with the State Health Registry of Iowa, in Iowa City.
Q. So ten scientists with the National Institutes of Health and two independent academicians?
A. That appears to be the case, yes.
Q. The Journal of the National Cancer

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Institute is a highly respected scientific journal, correct?
MS. GREENWALD: Objection, form.
A. I don't consider journals that way, in terms of whether they're respected or not. It's the individual publications in the journals that matter, about how good the publications are. It's a highly read journal.
Q. And there is a ranking scheme, if you will, for journals called an impact factor, you're familiar with that, correct?
A. Yes, I am.
Q. With respect to impact factor, as far as how impactful the journal is, the Journal of the National Cancer Institute is one of the most impactful cancer journals in the world, correct?
MS. GREENWALD: Objection, form.
A. I wouldn't know.
Q. Okay. The -- directing you to the abstract, for the National Cancer Institute -- the 2018 National Cancer Institute study, this study, I am quoting from the abstract --
MR. TRAVERS: My name is Jeffrey Travers, Miller Law Firm, representing the plaintiffs.
Q. So Dr. Portier, the 2018 National

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Cancer Institute journal study updated the Agricultural Health Study's previous evaluation of glyphosate in the 2005 De Roos study with cancer institute -- cancer incidence from registries through the end of 2012 or 2013, correct?
MS. GREENWALD: Objection, form.
A. That is correct.
Q. You previously had criticized the earlier AHS analysis in De Roos 2005 as not having sufficient follow-up time, correct?
A. That is one of my -- that was one of my concerns, that is correct.
Q. Let's mark as 28-2 a publication that has you as the lead author.
(Exhibit 28-2 marked for identification)
Q. This is an article that you were the lead author of, that was published in the Journal of Epidemiology and Community Health.
A. That is correct.
Q. And this was a publication in which you were discussing differences between the IARC evaluation and the European Food Safety Authority analysis of glyphosate in cancer, correct?
MS. GREENWALD: Objection, form.
A. You have lost me through the

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sentence. Could you repeat it, please?
Q. In this article, you were comparing the IARC analysis of glyphosate and the EFSA analysis of glyphosate, correct?
MS. GREENWALD: Objection, form.
A. I am not sure we're comparing it. We are commenting on the scientific issues that we saw with the EFSA evaluation and to some degree how those compare with IARC.
Q. On page 742, the second page of this publication, you state, and it's in the left-hand column, at the top, discussing the prior 2005 De Roos study, that:
"... the median follow-up time in the Agricultural Health Study was 6.7 years, which is unlikely to be long enough to account for cancer latency."
Correct?
MS. GREENWALD: Where are you reading from? I can't find it.
MR. LASKER: It is in the upper left-hand column, first paragraph, last sentence.
Q. So again, on page 742?
A. Yes.
Q. I'll state it again. One of the

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criticisms you state of the De Roos 2005 study was that "the median follow-up time in the AHS was 6.7 years, which is unlikely to be long enough to account for cancer latency", correct?
A. That is correct.
Q. It is your opinion that because the latency period for cancers can be long by years, evaluations of studies should consider whether the exposure occurred sufficiently long ago to be associated with cancer development, correct?
MS. GREENWALD: Objection, form.
A. I will put it in my own words. Cancer latency is one of the things you must consider in evaluating the epidemiological literature. In this case, I referenced a paper that looked at the estimates of how long it took for non-Hodgkin's lymphoma to form, and 6.7 years was a little short.
Q. Just so the record is clear, let me mark as exhibit 28-3, this is your initial expert report in this case.
(Exhibit 28-3 marked for identification)
A. Okay.
Q. If you can turn to page 5 of your initial expert report, and the second to last

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paragraph, the final sentence in your report, you state:
"Because the latency period for cancers can be long (years), evaluation of studies should consider whether the exposure occurred sufficiently long ago to be associated with cancer development."
Correct?
A. That is correct.
Q. And that is still your opinion, correct?
MS. GREENWALD: Objection, form.
A. The evaluation should consider, yes, whether exposure occurred sufficiently long ago.
Q. For NHL, you have opined that the latency period is likely to be in excess of six years, correct?
MS. GREENWALD: Objection, form.
A. I don't see that in here. I did a review of that information somewhere in this document. I don't see it in front of me, so I can't tell you exactly what I said.
Q. Let's mark as the next document in line, which will be 28-4.
(Exhibit 28-4 marked for identification)
Q. This is a document that you attached

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to your expert report, and it is comments that you made to the United States Environmental Protection Agency on October 4th 2016, correct?

A. Correct.

Q. If you turn to page 6 and 7, this may be what you're thinking about, the analysis you did of NHL latency, correct? (Pause).

A. Yes.

Q. In this analysis you presented to the Environmental Protection Agency, your opinion was that the latency period for NHL for any association with glyphosate is likely to be in excess of six years, correct?

MS. GREENWALD: Objection, form.

A. I don't say six years exactly, I say it's going to be a little longer than what Weisenburger said, and Weisenburger had one to five years, up to six years.

Q. Well, your sentence at the bottom of the paragraph is comparing the lag time to chemotherapy and radiation, which you have, immediately above that, as being median 5.5 years, or median latency of five to six years, correct?

A. That's chemotherapy for Hodgkin's disease, not radiation, but yes.

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Q. And you state that it would not be surprising for the glyphosate lag time to be longer than that from chemotherapy and radiation treatment, correct?

MS. GREENWALD: Objection, form.

A. It would not be surprising for the glyphosate lag time to be longer than that from chemotherapy and radiation treatment, correct.

Q. So for an epidemiology study of glyphosate and non-Hodgkin's lymphoma to be meaningful, it should be looking at exposures that predate diagnoses by more than five to six years, correct?

MS. GREENWALD: Objection, form.

A. No, not correct. It should consider that. Clearly they should consider that, but that's not the only exposures they should look at.

Q. Okay, that's fine. The 2018 National Cancer Institute study looked at cancer -- incidence data for some 54,251 pesticide applicators extending nearly 40 years after the introduction of glyphosate on to the market, correct?

MS. GREENWALD: Objection, form.

A. I don't know about the 40 years, but certainly it is 54,000, give or take, applicators, both private and commercial.

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Q. They had cancer incidence data through 2012 or 2013, correct?

A. Depending on the state, yes.

Q. So that is roughly 40 years after the introduction of glyphosate-based herbicides into the market?

A. 1982.

Q. 1974?

A. Okay, I don't know when it was, that's my problem with it.

Q. You would agree that the 2018 National Cancer Institute study allows for a longer cancer latency period for non-Hodgkin's lymphoma than any other glyphosate epidemiologic study, correct?

A. I can't attest to that.

Q. Do you know when the exposure periods were for -- or when the cancer diagnosis periods were for the other epidemiologic studies of glyphosate?

MS. GREENWALD: Objection, form.

A. Yes, I do. But my concern with answering the question as you stated it is I am aware of other agricultural studies that are looking at glyphosate currently, and I can't be certain they don't actually have longer lag times. But they would be at least as long as this one.

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Q. Which studies are those?

A. There's a study in France, with 112,000 -- farmers, they are farmers, they are not pesticide sprayers. And in Norway also, with a cohort of farmers, about 100,000 people.

Q. Have either of those cohorts announced their results with respect to glyphosate and non-Hodgkin's lymphoma?

A. Not that I'm aware of.

Q. Do you have any --

A. If you were asking me about published studies --

Q. Yes.

A. -- if you rephrase it --

Q. I will rephrase it. Are you aware of any analyses from either of those -- either of those cohorts regarding glyphosate and non-Hodgkin's lymphoma that have not been published?

A. No.

Q. The 2018 National Cancer Institute study allows for a longer cancer latency period for non-Hodgkin's lymphoma than any other published

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glyphosate epidemiologic study, correct?
A. Correct.
Q. You also previously criticized the 2005 De Roos study because it had only 92 non-Hodgkin's lymphoma cases as compared to 650 cases in a pooled case control analysis in the United States, correct?
MS. GREENWALD: Objection, form.
A. I certainly noted, I am not sure I criticized, but I certainly noted that it had a smaller sample size of exposed cases than did -- of cases, period, than did the pooled study by -- that De Roos did in 2003.
Q. Okay, well, you made a distinction between exposed cases and cases. The pooled analysis that you're referring to in your observation was also by De Roos, but a 2003 study, correct?
MS. GREENWALD: Objection, form.
A. If we can find it in here, but to the best of my memory, that is correct.
Q. And the De Roos 2003 study, in its analysis of glyphosate, only had 36 exposed non-Hodgkin's lymphoma cases, correct?
A. No, I think it had more than that,

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somewhere around -- I am not sure, to be honest. I thought it was more than that.
Q. Okay, well, luckily I have the study with me, so we can look at it together. Exhibit 28-5.
(Exhibit 28-5 marked for identification)
Q. This is De Roos 2003. This is the -- exhibit 28-5 is the 2003 pooled analysis of U.S. case control studies that you were referring to, correct?
A. Yes, it is.
Q. If you look at page 5 of the study, table 3, it has a listing of all the different pesticides that were being examined in the study, correct?
A. That is correct.
Q. And you will see glyphosate on that list, about -- almost towards the bottom?
A. Yes, I do.
Q. The 2003 De Roos pooled analysis of glyphosate was based upon 36 exposed non-Hodgkin's lymphoma cases, correct?
A. That is correct.
Q. The 2018 National Cancer Institute study had 440 exposed NHL cases out of a total of

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575 non-Hodgkin's lymphoma cases looked at, correct?
MS. GREENWALD: Objection, form.
A. Those are about in the range of the numbers I remember, I can't be absolutely certain.
Q. The numbers are right here on the table, we can add them up, correct?
A. Yes, we can add them up.
Q. And with respect to the number of 92 non-Hodgkin's lymphoma cases in the 2005 study, the 2018 National Cancer Institute study is about six times larger than the De Roos 2005 study, correct?
A. Five, five and a little bit.
Q. Well, there are significantly more non-Hodgkin's lymphoma cases with exposure to glyphosate in the 2018 National Cancer Institute study than there are in all of the case control -- the published case control studies of glyphosate and non-Hodgkin's lymphoma combined, correct?
MS. GREENWALD: Objection, form.
A. Could you -- could you repeat it again?
Q. Sure. There are significantly more non-Hodgkin's lymphoma cases with exposure to glyphosate-based herbicides in the 2018 National Cancer Institute study than there are in all of the

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published case control studies of glyphosate and non-Hodgkin's lymphoma combined, correct?
MS. GREENWALD: Same objection.
A. I don't know what "significantly" means here. We can add the numbers up and I can tell you if it's double or if it's triple or if it's 1.5 times, but I don't know what "significant" means, so I can't.
Q. You would agree that there are more exposed non-Hodgkin's lymphoma cases in the 2018 National Cancer Institute study than in all of the published case control studies combined, correct?
A. That is correct.
Q. The scientists, I guess it's ten scientists from the National Institutes of Health, state in the abstract of the 2018 NCI study, that -- in their conclusion:
"In this large prospective cohort study, no association was apparent between glyphosate and any solid tumours or lymphoid malignancies overall including non-Hodgkin's lymphoma and its subtypes."
Correct?
A. First, let me correct something. This is not an NCI study. Having worked at NIH, I know what this is, this is a study produced by

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scientists, some of whom work for the National Institutes of Health. In the acknowledgments at the end, it makes it very clear that the funders had nothing to do with carrying out this study, they simply supported funding of the study, so you can't really refer to it as being NCI's study. If NCI had done this, and it was an official document from NCI, it would carry a different type of review than what this has received.

In answer to your question, that is what it says, in their conclusion at the end of this abstract, word for word.

Q. The statement, and we can call it the 2018 National Cancer Institute journal study, that there is no -- that no association was apparent between glyphosate and non-Hodgkin's lymphoma, and its subtypes, accurately report the findings set forth in this publication, correct?

MS. GREENWALD: Objection, form.

A. No, it doesn't, and first of all, it's the Journal of the National Cancer Institute, which actually is not owned by the National Cancer Institute, it's Oxford Press owns that journal, NCI got rid of it, but they bought the title to it.

The -- there's nuances to this that are --

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within the document, that talk about limitations on this interpretation, so that simple sentence does not give a good interpretation of the overall paper.

Q. Do you disagree with the conclusions set forth in the abstract of this 2018 National Cancer Institute journal study that no association was apparent between glyphosate and non-Hodgkin's lymphoma and its subtypes?

A. I would agree to the statement that given the analyses they did, given the limitations they saw, and -- the bottom line from their analyses is they saw nothing. That's not an interpretation, that is a statement of fact of how they evaluated and analyzed the data.

Q. And this statement of the study findings was accepted by the Journal of the National Cancer Institute after independent peer review, correct?

MS. GREENWALD: Objection, form.

A. I assume it was. I can't be certain. But they peer review everything, so I would be surprised if it was not.

Q. If you go to page 7 of the study, the left-hand column, first -- beginning full paragraph, "In our study", do you see that?

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A. Uh-huh.

Q. Again, the ten NIH investigators and two academicians state:

"In our study, we observed no associations between glyphosate use and NHL overall or any of its subtypes."

Did I read that correctly?

A. You did, yes. You read that correctly.

Q. And the NIH investigators and academicians state further:

"This lack of association was consistent for both exposure metrics ..."

Did I read that correctly?

MS. GREENWALD: Objection, form.

A. "This lack of association was consistent for both exposure metrics", that is what it says.

MS. GREENWALD: That's not a full sentence, by the way. That's only part of the sentence.

Q. Let's take -- I will be going through the entire sentence, believe me, but I want to take this in steps. Let's take a look at the rate ratios in this study for non-Hodgkin's lymphoma that are

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reported on table 2. And I am going to put this on the screen as well, so we can also see that.

So the findings with respect to non-Hodgkin's lymphoma are set forth right here, correct?

A. That is one of the findings for non-Hodgkin's lymphoma in their broad analysis.

Q. And this is -- with respect to this analysis, they also -- they present the rate ratios for non-Hodgkin's lymphoma in the cohort among individuals who were not exposed to glyphosate-based herbicides, and also in four groupings of individuals that were grouped based upon intensity-weighted lifetime days of glyphosate use, correct?

MS. GREENWALD: Objection, form.

A. This presents their analysis based upon different exposure classifications where 40 percent of the exposure classifications are from imputation, which I feel is probably leading to severe misclassification, and because of that severe misclassification, that is why they are seeing these null results. However, they do have null results here, that is clearly what they are interpreting.

I have a second problem with this

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particular set of numbers, in that in the De Roos paper, the analysis for dose response was against the lowest exposure group --

Q. And we are going to be talking about that. That is exactly where I'm going --

MS. GREENWALD: Let him finish it, let him finish his answer, please.

MR. LASKER: We will be asking about --

MS. GREENWALD: I understand that.

MR. LASKER: We will be asking about that, but I would like to have an answer to my question, and we will get to that issue, both of those issues you raised --

MS. GREENWALD: Mr. Lasker, he has the right to finish the answer to his question.

Q. The data for intensity-weighted cumulative exposure dose response for non-Hodgkin's lymphoma is presented in table 2 in the 2018 National Cancer Institute journal publication, correct?

MS. GREENWALD: Objection, form.

A. Say it again, please?

Q. The analyses that the NIH investigators and academicians conducted for a dose response based upon intensity-weighted cumulative

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exposure is set forth in table 2 of the 2018 National Cancer Institute journal study, correct?

MS. GREENWALD: Objection, form.

A. The numerical results of that analysis are in that table, that is correct.

Q. Okay. And these scientists measured intensity of exposure, and we can look at page 2 of the publication, where they lay this out, but the intensity score was based on literature-based measurements, and information provided by the applicator, specifically whether the participant mixed or applied pesticides, repaired pesticide-related equipment, used personal protective equipment and application method used, correct?

MS. GREENWALD: Objection, form. You didn't read that correctly.

Q. I'll read it again:

"The intensity score was derived from an algorithm based on literature-based measurements and information provided by the applicator, specifically whether the participant mixed or applied pesticides, repaired pesticide-related equipment, used personal protective equipment, and application method used."

Correct?

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A. There's a very nice publication on the intensity score which lays it all out completely. This is a short summary of what they wanted to say about it, but that is what it says on the document.

Q. Okay. And --

A. Actually, though, it's not quite correct.

Q. So you disagree with the statement that appears in the 2018 National Cancer Institute journal in which the NIH investigators describe their intensity measure?

MS. GREENWALD: Objection, form.

A. The way they have written it is "the intensity score was derived from an algorithm based on literature-based measurements and information provided by the applicator"; however, 37 percent of the applicators did not fill out the second questionnaire, and those responses were imputed. So in fact, that statement is indeed false.

Q. The NIH scientists, in their calculation of intensity-weighted cumulative exposures, reported rate ratios for each of their exposure groups that was below 1.0, but not statistically significant, correct, than that set

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forth here in this table?

MS. GREENWALD: Objection, form.

A. You have lost me a little bit under there.

Q. I'll restate the question.

A. Thank you.

Q. In table 2 of the 2018 National Cancer Institute journal publication, the NIH investigators and academicians set forth their calculations of rate ratios for each exposure group to glyphosate-based herbicides and reported rate ratios for each exposure group below 1.0, correct?

MS. GREENWALD: Objection, form.

A. So they reported rate ratios for quartiles of exposure against what they claim is an unexposed group, and they have calculated for each of those a rate ratio that is below 1. However, I don't agree with those rate ratios.

Q. Yes, and I am going to ask you exactly about that now. So in your analysis, in your supplemental expert report, you provided your own different dose response analysis, correct?

A. I provided an indication of what the dose response analysis would have looked like had they used the same approach as was used in the De

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Roos paper.
Q. Okay. Just so I understand what you have done, in conducting your dose response analysis, you remove the unexposed group from the analysis, correct?
A. Each analysis that's shown here is a pair-wise analysis against a reference group. They did their pair-wise analysis against the reference group of controls. In the De Roos paper, they argued that they did not want to use the controls because they differed socio-economically and demographically from the treateds, and so they did their comparison, their referent group was the first quartile -- first tertile. Here I made the referent group the first quartile, so my pair-wise pair -- comparisons are the treated groups above the first quartile against the first quartile.
Q. I just want to understand what your analysis is. So in your analysis, you remove the unexposed group and then you compare Q2 to Q1, Q3 to Q1 and Q4 to Q1 within the exposure groups, correct?
A. Correct.
MS. GREENWALD: Objection, form.
Q. In that analysis, as a result of that analysis, the numbers that are reported by the NIH

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investigators and academicians as being all below 1, in your calculation, those numbers are now all 1 or higher, correct?
MS. GREENWALD: Objection, form.
A. My -- the, the -- the numbers become greater than 1 if you use that analysis, I won't call it my numbers, it's -- if you use that analysis, the numbers are greater than 1.
Q. Okay, and in your supplemental expert report, through this analysis, you state that the study shows increased rate ratios for non-Hodgkin's lymphoma relative to the lower -- to the lowest exposure group, correct?
A. I probably say that, it's going to be close to that. Increased or flat.
Q. Let's look exactly, because I don't want to put words in your mouth. Let's mark as exhibit 28-6 your supplemental expert report in this case.
(Exhibit 28-6 marked for identification)
Q. At page 2 of your report, about three quarters of the way down the page, you are presenting this calculation that we just discussed, correct?
A. Yes.

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Q. You state, in your opinion, that through this calculation that you provide for the -- for dose response, that the 2018 study shows increased rate ratios for non-Hodgkin's lymphoma relative to the lowest exposure group, correct?
MS. GREENWALD: Objection, form.
A. That's not what the sentence says.
Q. You state:
"Thus ..."
A. "Thus, unlike the previous study, this study shows increased relative risks for NHL relative to the lowest exposure group."
I am not declaring that these are increased relative risks, I am declaring that they are increased relative to what was seen in the De Roos study 2003.
Q. I see. Is it your opinion that the 2018 National Cancer Institute journal study, based upon this calculation, that removes the unexposed, shows evidence of a dose response between glyphosate-based herbicides and non-Hodgkin's lymphoma?
MS. GREENWALD: Objection, form.
A. No, it raises concern on my part about why they changed the analysis method, why all

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of a sudden are the controls the same as the treated groups when before they were not. There's no mention of a comparison demographically, socio-economically, between the controls and the treated groups, and it makes a difference which way you do the analysis, and that is what I am pointing out here.
Q. In the --
A. Leading to a slightly different interpretation of the overall study as well.
Q. In your -- well, first of all, in the dose response analysis that's set forth here in the National Cancer Institute journal study, they set forth an evaluation of trend, a P trend analysis, in support of their statement that there was no evidence of a dose response between glyphosate-based herbicide exposure and non-Hodgkin's lymphoma, correct?
A. Yes, they put that in there.
Q. And that's a standard methodology in analyzing dose response, correct?
MS. GREENWALD: Objection, form.
A. That is correct, that P value comes from an adjusted analysis of all of the available data. I do not have that information, hence

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I cannot calculate that P value. You need the individual raw data to be able to do that.

Q. Okay. The 2018 -- so in other words -- so it's -- I'm correct then that you did not calculate a P trend for your dose response analysis, is that correct?

MS. GREENWALD: Objection, form.

A. I cannot calculate a P trend for that dose response analysis. All I can give you is the raw numbers of what it would look like, but it may not even look like that when they do the adjusted analysis, the second or third decimal point might change a little bit, because of that type of more complicated analysis, but it would look approximately like that.

Nor am I saying here that I believe it's significant, you do know that, I haven't said that here.

Q. The 2018 National Cancer Institute journal study publication also provides confidence intervals for each of its estimates of rate ratio in its exposure groups, correct?

MS. GREENWALD: Objection, form.

A. That is correct. Again, as I mentioned before, I cannot calculate those

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confidence bounds without having the original data and doing a much more complicated analysis like they have done.

Q. And you are not stating, I take it then, that any of the numbers you present in your supplemental expert report for your dose response analysis are statistically significant above 1, correct?

MS. GREENWALD: Objection, form.

A. I don't know its significance above 1, that is correct.

Q. Now, you stated that -- a couple of times about the fact that in the 2005 study, the authors conducted a dose response within the exposed groups because the authors felt that the never exposed and exposed subjects differed in terms of socio-economic factors and other factors like smoking, correct?

MS. GREENWALD: Objection, form.

A. That's what they -- that's what De Roos wrote in her paper.

Q. So let's look at the De Roos 2005 study. This will be exhibit 28-7.

(Exhibit 28-7 marked for identification)

Q. If you look at table 1 in the 2005 De

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Roos study which I just handed you, exhibit 28-7, I believe.

A. Table 1?

Q. Yes. They present data on smoking history in the cohort as of their period of analysis, 2005, in 2005, correct?

A. Yes, smoking history is listed here.

Q. And they find that, as compared to -- for never smokers -- I am sorry, for the never exposed group, there was approximately 57 percent range of individuals without -- that had never smoked, and for those who were exposed, there was about 53 percent had never smoked, correct?

MS. GREENWALD: Objection, form.

A. It's in the table, you can read the direct -- the exact numbers, but that's approximately correct.

Q. If we go to the 2018 --

A. I will point out --

MS. GREENWALD: Mr. Lasker, you have to let him answer these questions.

A. I will point out that on page 51, in the results section, they specifically talk about that issue, and it says:

"This is a population with relatively low

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smoking prevalence; in both the exposed and never-exposed groups, more than half of the subjects reported that they had never smoked. Significant differences existed between never-exposed and lowest-exposed subjects for all of the characteristics in table 1. Lowest- and higher-exposed subjects also differed on several factors, the most notable being that higher-exposed subjects were more likely to be commercial applicators", etcetera.

So they state it themselves, I am not making it up.

Q. That wasn't where I was going, Dr. Portier. If you can look at the 2018 National Cancer Institute journal study?

A. Okay.

Q. This study also has a table 1, correct?

A. Correct.

Q. In table 1, they provide the same analysis of smoking history for individuals as of the date of their analysis, correct?

MS. GREENWALD: Objection, form.

A. They provide proportions of -- fractions of the population that fall into different

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categories of smoking usage.
Q. And at the time of their analysis for the 2018 study, as compared to the difference of 57 versus 53 percent, in the earlier study, as at the time of the 2018 analysis, the group that had never used glyphosate, had never smoked, was 53 percent, 53.5 percent, and for those who had been exposed, it was in the 52 percent range, correct?
A. 53.5 for never, 52.6 for median, for less than the median glyphosate exposure, and what's the last one, 52.1 for above the median glyphosate exposure.
Q. So the data, the comparison on this demographic factor had changed by the date of the 2018 analysis as compared to the 2005 analysis, hadn't it?
MS. GREENWALD: Objection, form.
A. I can't answer the question, because they don't -- they didn't do an analysis to tell me if it had changed or not.
Q. Were you aware of the fact that the smoking history rates for nonexposed versus exposed had changed as between the date of the 2005 paper and the date of the 2018 paper when you did your revised dose response analysis?

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MS. GREENWALD: Objection, form.
A. I don't know if it's changed. You're stating it as if it has changed, when in fact it might not have. There's a statistical analysis for doing that.
Q. Have you done that statistical analysis?
A. With these numbers, with these numbers, small differences can lead to large differences here. And it's not just the controls you have to look at, you have to look at the treateds as well, and this is a comparison against median, yes, median below and median above, as compared to the quartiles, which is where the analysis is.
Q. Dr. Portier, did you do that analysis?
A. I can't do that analysis. I do not have that information. I cannot do that type of analysis.
Q. Okay. The -- going back to the findings in the 2018 National Cancer Institute journal study, and again, as set forth on page 7 of the study, that first paragraph, in the left-hand column, it starts:

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"In our study, we observed no associations ..."
The NIH investigators and academicians state, as the -- the next part of their analysis, that they observed no associations between glyphosate use and non-Hodgkin's lymphoma after -- when their analyses were both unlagged and when they were lagged, correct?
MS. GREENWALD: Objection, form.
A. I am trying to find it in this paragraph, but I am not seeing it. Oh, there it is, unlagged and lagged analyses:
"This lack of association was consistent for [blah blah blah] unlagged and lagged analyses ..."
It says that, that is correct.
Q. Okay. And in your expert report, your supplemental expert report, you note that no significant increased rate ratios were seen when the investigators focused their analysis on exposures that occurred 20 years prior to non-Hodgkin's lymphoma outcome, 15 years prior to non-Hodgkin's lymphoma outcome, 10 years prior to non-Hodgkin's lymphoma or 5 years prior to non-Hodgkin's lymphoma, correct?

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MS. GREENWALD: Objection, form.
A. I don't believe I said all of that.
Q. In your expert report, on page --
A. I always --
MS. GREENWALD: Mr. Lasker, if you don't let him finish answering his questions, we are going to call the judge. You have to let him finish. He's got a right to finish his answers. I understand this is a timed deposition, but he has to answer his questions -- your questions.
MR. LASKER: Okay, and if he continues to give long answers, I am happy to talk to the judge --
MS. GREENWALD: These are not long.
MR. LASKER: I don't know who the judge is who is going to be happy to be called at 1.30 in the morning, but I am happy to call him.
MS. GREENWALD: These are not long answers.
A. If you are going to my expert -- my supplemental report and show me the wording, that's fine. Otherwise I was simply going to say it was more likely that I said they saw no significant changes in their lagged analyses, rather than the detailed statement for every single lagging.

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Q. Okay, let me look at your -- let's look at your supplemental expert report.
A. I can't find it. Is this it?
Q. That's it. Bottom of page 1 and then the top of page 2:
"Analyses were also done [do you see that] using 5-, 10-, 15-, 20-"--
A. Yes.
Q. So now again, looking at what you stated in your expert report, you note that no significantly increased rate ratios were seen when the investigators focused their analyses on exposures that occurred 20 years prior to non-Hodgkin's lymphoma outcome, 15 years prior to non-Hodgkin's lymphoma outcome, 10 years prior to non-Hodgkin's lymphoma outcome, or 5 years prior to non-Hodgkin's lymphoma outcome, correct?
MS. GREENWALD: Objection, form.
A. I said:
"No significantly increased RRs were seen in these analyses although the general trend was towards higher RRs in the exposure groups as the lag times increased."
That's exactly what I said.
Q. Okay. And that was exactly where

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I was going actually with that second part, you state in your report that there was a general trend towards higher rate ratios in the exposure groups as the lag times increased, correct?
A. I believe that's what it said, yes.
Q. In other words, the reported rate ratios, while not statistically significant, were larger when investigators looked solely at exposures to glyphosate-based herbicides that took place before 1992 or 1993, than were reported when they looked at exposures to glyphosate-based herbicides up to 2007 or 2008, correct?
MS. GREENWALD: Objection, form.
A. It's a difficult form. Basically I'm saying that if you look at the rate ratios that appear for the current analysis, then five-year lag, then the 10-year lag, then the 15-year lag, then the 20-year lag, they appear to be increasing.
Q. And so if I understand that correctly, a 20-year lag, just so that we understand, would be 20 years prior to -- and so that, you're correct -- 20 years prior to 2012 or 2013 which is the last date of non-Hodgkin's lymphoma?
A. No, no, it would be for each

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individual person, so -- and it would be before they got NHL.
Q. Okay. So the latest it could be would be 20 years before 2012 or 2013?
A. No, somebody who gets -- someone who gets an NHL in, say, 2005, then their 20-year lag, if they were exposed completely over the period, would have been 1985.
Q. Okay. Okay. So the exposure period for the 20-year lag would have been any time prior to 1992 or 1993?
A. It couldn't be after 1992 and 1993, that is correct.
Q. And for the 5-year lag, it could not be after 2007 or 2008, correct?
A. That is correct.
Q. Okay. And what you found, or what you're reporting is that the reported rate ratios, while not statistically significant, were larger when the investigators looked at individuals whose exposures to glyphosate-based herbicides took place prior to 1992 or 1993 than they -- when they looked at individuals whose exposures to glyphosate-based herbicides could have occurred up to the dates 2007 to 2008, correct?

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MS. GREENWALD: Objection, form.
A. No, that's not what I'm saying. I am sorry, that is not what I said.
Q. Okay.
A. Because you're confusing what a lagged analysis is. A lagged analysis has a very serious assumption in it, it assumes that no other glyphosate exposure matters whatsoever. So regardless of what you're seeing for other -- other people, you're only looking at the 20-year past. And so that assumption is a very strong assumption. So I would never say that I believe that the 5-year is in some way reduced from the 20-year. You do that analysis to see if, in fact, there is something going on with the data relative to timeframe, but you have to recognize the fact that you're discarding data and doing it and carrying a very heavy assumption.
Q. When you include in the analysis -- sorry, when the investigators include in their analysis all the exposures up until the present day, without any lagging, their rate ratios are lower than when they calculate them based upon exposures that go back for individuals before 1992 and 1993, correct?

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MS. GREENWALD: Objection, form.
A. For their analysis, using imputed exposures, for 40 percent of the population, that they were looking at, where I believe their controls are misdiagnosed, yes, they saw relative risks that were lower when they used all the data than when they used only the 10-year data, the 10-year lag.
Q. Okay. That's 10-year, 5 -- let me restate the question.
A. 5-year, 10-year, and 20-year and 15-year, yes.
Q. So what the NIH investigators and academicians found is that when they conducted their analyses for all exposures up to the present for glyphosate-based herbicides, they reported lower rate ratios with association to non-Hodgkin's lymphoma than when they looked at the data that was looking at exposures prior to 1992 and 1993 alone, correct?
MS. GREENWALD: Objection, form.
A. They reported lower rate ratios that could be entirely due to the misclassification and potential bias from the imputation of the 40 percent of the exposures.
Q. The -- returning to the conclusions

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of the investigators, the NIH investigators in their study, in the 2018 study, the -- and continuing along with that same sentence that we have been looking at, the next statement that the investigators make with regard to the 2018 NCI study was that there was no association between glyphosate-based herbicide exposure and non-Hodgkin's lymphoma when the rate ratios were adjusted for pesticides linked to non-Hodgkin's lymphoma in previous AHS analyses, correct?
MS. GREENWALD: Objection, form.
A. To put the sentence together, this lack of association was consistent after further adjustment for pesticides linked to NHL in previous AHS analyses, so it's consistent, it's not equal.
Q. You agree that in assessing the glyphosate epidemiologic studies, the most reasonable comparison to make -- the most reasonable comparison is to use the most fully adjusted risk estimates, correct?
A. No, I don't agree with that. I do agree, using a reasonable set of adjusted risk estimates, where the adjustments are not for every single variable in the data set, but for a reasonable set of variables.

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Q. Can I ask you to go back to your initial expert report? I can't remember, I am sorry, what that was, number. What's the number on the top of that?
A. 28-3.
Q. Thank you. At page 15 of your initial expert report in this litigation, at the top of the page, you state:
"As noted by both the IARC monograph 112 (2015) and by Chang and Delzell (2016), when comparing studies, the most reasonable comparison is to use the most-fully-adjusted risk estimates."
Is that what you state?
A. That's what I state, but that's not what you asked me.
Q. Okay, well, the record will reflect what I have asked you. Let me --
A. This is when I am evaluating studies that have already been done, the best comparison is to use their fully adjusted analyses, but I would never do an analysis that's fully adjusted for everything, and that's what I thought you had asked me.
Q. You would agree that the most likely source of confounding in the glyphosate

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epidemiologic studies would be exposure to other pesticides, correct?
MS. GREENWALD: Objection, form.
A. Confounding. Yes, I would guess that would be the most likely source of confounding.
Q. In your initial expert report -- well, strike that, let me start -- let me back up a step.
In your supplemental expert report, you state that the 2018 NCI journal study is one of the epidemiologic studies that you would consider in connection with the other epidemiologic studies as well as the other scientific evidence, correct.
MS. GREENWALD: Objection, form.
A. In making an evaluation of causality, I would look at all of the available data, and this is one study amongst all the available data.
Q. In your initial expert report, and this is also on page 15, you look at what you listed as six core epidemiologic studies, and you identify McDuffie (2001), Hardell (2002), De Roos (2003), De Roos (2005), and Eriksson (2008) and Orsi (2009), correct?
A. That is correct.
Q. You note that each of them report

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odds ratios or rate ratios equal to or above 1.0, and you performed a statistical analysis finding that the probability of this happening was 0.016, which you stated was unlikely to be due to chance, correct?

MS. GREENWALD: Objection, form.

A. I said it is strongly suggesting the studies do not agree with an underlying PRR of 1. I didn't say it's due -- it's unlikely to be due to chance.

Q. Okay. Now, with the 2018 National Cancer Institute journal study, one of the six core epidemiologic studies now has a rate ratio below 1, correct?

MS. GREENWALD: Objection, form.

A. No, these six core studies are these six core studies. If I were to substitute De Roos for Andreotti, or Andreotti for De Roos, then that would -- well, no, that wouldn't be the case, because Andreotti never gave me -- excuse me, Andreotti did not give us the ever never use of glyphosate calculation, so I would be using a different calculation, I couldn't use the ever never, so it would be negative, but it wouldn't be negative as like the ever nevers.

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So yes, but my problem is I'm not sure I would do that substitution, because there is such problems with the Andreotti study, that I might be concerned about doing that. I have to think about that, in terms of looking -- when you do a meta-analysis or any type of grouped analysis with this type of data, you want to make sure that they are comparable studies and I am not sure Andreotti is comparable anymore.

Q. Can I break that down. First of all, while there was no calculation provided in the 2018 National Cancer Institute journal publication itself, from the data that was presented, it is a pretty simple mathematical analysis to show that the ever never rate ratio is below 1.0, correct?

MS. GREENWALD: Objection, form.

A. The uncorrected unadjusted rate ratio can be calculated from these data and that number would be less than 1.

Q. The second issue, am I correct in my understanding that you do believe that the De Roos 2005 study is sufficiently reliable to be included in your view of what are the core epidemiologic studies for glyphosate?

MS. GREENWALD: Objection, form.

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A. The De Roos 2005 study was included in my core set of studies.

Q. Am I correct in my understanding that you believe that the 2005 De Roos study was sufficiently reliable to include as one of the core epidemiologic studies of glyphosate in non-Hodgkin's lymphoma?

MS. GREENWALD: Objection, form.

A. Yes.

Q. And going back to your analysis of the core studies, you are aware that two of the other core studies, McDuffie and De Roos 2003, have now been pooled into the North American pooled project, compare study, correct?

A. I have heard about that. I haven't seen a paper on it.

Q. Okay. Do you know whether or not the fully adjusted odds ratio for the North American pooled project looking at self-respondent information is 0.95?

MS. GREENWALD: Objection, form.

A. No. I have seen some slides that have been given in a talk, I wasn't at the talks, I don't remember.

Q. Okay. The 2018 National Cancer

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Institute study provides rate ratios for non-Hodgkin's lymphoma and seven different subtypes, correct?

MS. GREENWALD: Objection, form.

A. Seven, probably of seven, but yes, subtypes of NHL.

Q. If you look at the highest exposure group as reported by the NIH investigators for non-Hodgkin's lymphoma and for those subtypes, seven of those eight numbers, seven of those eight rate ratios are below 1.0, correct?

MS. GREENWALD: Objection, form.

A. Let's see. (Pause). That would not be true if you're arguing that all of the exposure groups for those seven are below 1. That would not be correct.

Q. That was not my question though. My question was, with the highest exposure group recorded --

A. Okay, sorry.

Q. -- for -- in the 2018 National Cancer Institute journal study, for non-Hodgkin's lymphoma, and six of the seven subtypes of non-Hodgkin's lymphoma, the rate ratio reported in the study is below 1.0, correct?

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A. Yes, which is probably due to the misclassification of exposure in the control group.

Q. So for the seven comparisons we have, the rate ratio reported for the highest exposure is below 1 and for one of the rate ratios we have in the highest exposure group, it's above 1, correct?

A. It's reported to be above 1, that is correct. Again, probably due to the exposure misclassification of the controls.

Q. And using the same math that you used to calculate your 0.016 number, the odds of this pattern happening in the 2018 NCI paper by chance is about 1 in -- 1 out of 32, correct?

MS. GREENWALD: Objection, form.

A. I would have to get a piece of paper and calculate it. It's a binomial calculation. So it's not as easy as the one I did before, because now you've got to put in the combinatoric term at the front end, but it could be around 1 in 32, I've no idea, but again, that's -- my interpretation would be that that's probably due to the exposure misclassification of controls.

Q. Let me ask you this in general: do you believe that the 2018 National Cancer Institute journal study strengthens or weakens the

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epidemiologic evidence in support of your opinion that there is an association between glyphosate-based herbicides and non-Hodgkin's lymphoma?

MS. GREENWALD: Objection, form.

A. I believe that the 2018 Andreotti study has no impact on my evaluation of the epidemiology data. It is neither good nor bad. What was seen is almost what one would have expected to see, because of the exposure misclassification.

Q. Starting on page 2 of your supplemental expert report, you discuss various issues in the 2018 National Cancer Institute journal study which you opine could have led to non-differential exposure misclassification, correct?

MS. GREENWALD: Objection, form.

A. It's -- yes, it's too broad, as to where we're talking about here. Page 2?

Q. Page 2, and I think you start talking about, in the middle of the page -- you start talking about your critique of the 2018 study, and the possibility, you state here, of an increase in non-differential exposure misclassification, in the middle of the page, do you see that? (Pause).

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A. No, I'm afraid I don't:
"No such comparison has been ..."

Q. The paragraph that starts:
"As noted for the earlier study ..."
At the very end of that paragraph, you talk about:
"... an increase in non-differential exposure misclassification and reduces the RRs in this study."
Do you see that?

A. Yes.

Q. What is nondifferential exposure misclassification?

A. Nondifferential exposure misclassification means that you are placed in the wrong exposure category but it's not -- the reason, or the -- it's not associated with the actual outcome. So it's nondifferential in the sense that it's not likely to cause a bias.

Q. In other words, if there is a misclassification of exposure because there's no information about disease outcome, individuals who ultimately -- strike that.
Individuals who subsequently get non-Hodgkin's lymphoma are as likely to have

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misclassified exposure information as individuals who don't get non-Hodgkin's lymphoma, correct?

MS. GREENWALD: Objection, form.

A. Along those lines, yes. I hate to just go with your wording, because I would like to see it written down, that's why I hesitate. But that's close enough.

Q. On page -- strike that.
One of the differences between the cohort study and the case control study is that in the case control study, the subjects have knowledge of their disease outcome at the time that you're obtaining, if it's a questionnaire-based study, like the glyphosate case control studies, at the time you're obtaining exposure information, correct?

A. That is correct.

Q. So with a case control study, you have the concern of a differential exposure misclassification based on disease outcome, correct?

MS. GREENWALD: Objection, form.

A. You have a possibility of recall bias, and I really never thought about recall bias being an exposure misclassification, but I guess it is a differential exposure misclassification.

Q. And that possibility of

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a differential exposure misclassification does not exist in cohort studies, because at the time you're obtaining the exposure information, the subjects have no knowledge of whether they will be getting non-Hodgkin's lymphoma in the future, correct?

MS. GREENWALD: Objection, form.

A. In a perfectly run, well conducted, with no problems of lack of participation, cohort study, you would not likely see differential recall -- differential exposure misclassification.

Q. If you have differences in participation in a cohort study at the time of the difference, participating or not, the subjects likewise don't have any knowledge of whether or not they will get non-Hodgkin's lymphoma in the future, correct?

A. At the time they provide -- they decide not to respond? Not -- technically, no. Probably that's true for most of them, but you could have a rare case where somebody got NHL but didn't die of it, therefore they don't show up in the registry and when they chose not to respond, they knew they had NHL.

Q. Okay. Do you have any basis to believe that that was a significant issue in the AHS

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study?

A. No.

Q. The -- on page 2 of your expert report, in that same paragraph we were just looking at, you provide percentages of different -- different response rates or agreement rates for glyphosate, do you see that, in the questionnaire? 82 percent agreement, 53 percent --

A. That is the agreement between first and second questionnaire for people in the first phase of the AHS.

Q. Okay. And that is -- those numbers are taken from a study that was published with a lead author of Dr. Blair, in 2002, correct?

A. Blair 2002 is where I got that from, that is correct.

Q. Let's mark the Blair 2002 study as the next in line.

(Exhibit 28-8 marked for identification)

Q. The numbers that you report for the agreement in the questionnaire responses for glyphosate come from tables 1 and table 2 of this study, correct?

A. I believe that is correct.

Q. And Dr. Blair in this same

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publication also provides on page 96 the data for agreement in questionnaire responses for other issues including smoking, drinking and dietary factors, correct?

A. Table 3?

Q. No, in the text actually, if you look at the second column on page 96, the paragraph:

"We also compared responses for tobacco use ..."

Do you see that?

A. Yes.

Q. And for tobacco use, they found over 90 percent agreement for smoking ever never, and 76 percent agreement for numbers of cigarettes per day, correct?

A. Correct.

Q. And towards the bottom of that page, they provide information on agreement with respect to alcohol, drinks per day, 71 percent, correct?

A. Kappa 0.63, yes.

Q. For vegetable servings per day, they had 35 percent agreement, correct?

A. Correct.

Q. And for fruit servings per day, they had 40 -- 40 percent exact agreement, correct?

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A. That is what it says.

Q. And epidemiologists frequently use questionnaire data and questionnaire responses on smoking and drinking and dietary factors in conducting epidemiologic research, correct?

MS. GREENWALD: Objection, form.

A. Yes, I don't know what that said, I am sorry.

Q. Okay, I'll ask you again. Epidemiologists frequently use questionnaire data and questionnaire responses on smoking and drinking and dietary factors in conducting epidemiologic research, correct?

MS. GREENWALD: Same objection.

A. They would usually ask questions -- if you're doing an epidemiology study that is in any way related to health and the environment, you would typically ask about smoking, alcohol use and dietary factors.

Q. And there are numerous epidemiological publications in the peer-reviewed literature that look at associations of health outcomes with smoking, alcohol use and dietary factors based upon questionnaire responses, correct?

A. That is correct.

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Q. The AHS -- the investigators for the Agricultural Health Study cohort specifically set up their cohort among farmers and pesticide applicators because they believed that those individuals would have more reliable recall of pesticide use than the general population, correct?
MS. GREENWALD: Objection, form.
A. The correct term is private applicators and commercial applicators, and I believe that's what they said. I am a little lost on the farmers issue, they keep referring to it as farmers, but it's private applicators, which could be different.
Q. Can you point to any published analysis that has looked at the reliability of the questionnaire responses for pesticide exposures in any of the glyphosate case control studies?
MS. GREENWALD: Objection, form.
A. I am a little lost on what you are asking me so could you please do it again?
Q. Sure. We were just looking at a publication that looked at questionnaire responses and the agreement for glyphosate exposure information in the Agricultural Health Study cohort questionnaires, correct?

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A. Correct.
Q. Can you point to any published analysis that has provided similar information as to the reliability of pesticide exposure responses in the published glyphosate case control studies?
MS. GREENWALD: Objection, form.
A. There are analyses of exposure from the glyphosate case control studies where they went in and looked at purchase of glyphosate by the various people involved, and looked at that and how it related to the recall of the exposure. But in terms of going back and asking the same question of the same person twice, and looking for agreement, I am unaware of any in these other studies.
Q. And the one analysis you discussed, about looking at purchase records, that analysis was mentioned within one of the case control studies itself, correct?
A. They actually -- I think they had a separate paper on it, but it's tied to that case control study, and there was another similar thing but it's just mentioned in one of the other case control studies.
Q. Can you identify the separate publication you believe exists?

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A. I would have to go back to my expert report and dig through it, I am sorry.
Q. In your supplemental expert report, as you mentioned earlier, the Blair 2002 paper was referring to the phase one questionnaires. In your supplemental expert report, you state that the reliability of questionnaire responses to the second phase questionnaire would likely have the same concordance, if you will, or agreement as for the first phase questionnaire, correct?
MS. GREENWALD: Objection, form.
A. I state that no such comparison has been provided for the phase two evaluation, but it's highly likely the same lack of agreement is present.
Q. The second phase questionnaire was administered after the administration of Roundup Ready crops, correct?
MS. GREENWALD: Objection, form.
A. Again, when was Roundup Ready crops introduced in the United States, 198-something? I don't know, I don't remember. I thought it was in the middle, it was like 2002 or something like that, so the follow-up for this was sort of right on top of glyphosate-ready crops coming into the United States, is my understanding.

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Q. Would you agree that a farmer using -- well, let's take a break, we need to change our media. We can do it right now.
THE VIDEOGRAPHER: This is the end of media 1, volume I, in the video deposition of Dr. Christopher Portier, going off the record at 12.13 pm as indicated on the video screen, thank you.
(12.13 pm)
(A short break)
(12.22 pm)
THE VIDEOGRAPHER: This is the beginning of media 2, volume I in the video deposition of Dr. Christopher Portier. We are on the record at 12.22 pm as indicated on the video screen.
(BY MR. LASKER)
Q. Dr. Portier, now, farmers who grew Roundup Ready crops follow some detailed weed management guidelines that specify when and how often each year the farmer should apply glyphosate-based herbicides, correct?
MS. GREENWALD: Objection, form.
A. I have no idea. It's not my expertise.
Q. Would you -- would it be fair to say

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that a farmer growing Roundup Ready crops would have even more reliable recall about their use of Roundup® glyphosate-based herbicides than farmers prior to the adoption of Roundup Ready crops?

MS. GREENWALD: Objection, form.

Q. Let me state the question again. It would be fair to say that a farmer growing Roundup® Ready crops would have even more reliable recall about their use of Roundup or glyphosate-based herbicides than farmers prior to the adoption of Roundup® Ready crops.

MS. GREENWALD: Objection, form.

A. Anything I said would be speculative. It's really not my area of expertise.

Q. Continuing with your expert report on the bottom of page 2, you reference two publications, one by Acquavella in 2006 and the second by Blair in 2011, correct?

A. That is correct.

Q. And in both of these papers, the investigators compare the information provided in the Agricultural Health Study algorithm for intensity of exposure to glyphosate and to other pesticides with measures of glyphosate or other pesticides in urine, correct?

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A. The Acquavella does a little more than that, because they also look at taking in an expert in occupational exposure to figure out the exposure as well, but in essence, both papers are looking at metabolites in urine.

Q. Okay. And the basis for the comparison in these publications is that glyphosate levels in urine provide an accurate measure of the actual internal glyphosate dose, correct?

MS. GREENWALD: Objection, form.

A. I wouldn't say that's the basis. The argument is that they should be in some way closely related to each other.

Q. Let me just restate my question. In comparing the intensity score to the urine levels of glyphosate to see agreement, the reason for that comparison is the premise that the measure of glyphosate in urine is an accurate measure of internal dose, correct?

MS. GREENWALD: Objection, form.

A. It's a reflection of the internal dose, and by looking at the kappa statistic, you're looking at whether or not there is agreement up and down but not necessarily the exact magnitude of the dose.

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Q. For the Acquavella paper, now Dr. Acquavella was a former employee of Monsanto, he's not an Agricultural Health Study investigator, correct?

A. As far as I know, he is not part of the Agricultural Health Study.

Q. And in his study, he compared responses to a questionnaire that his group prepared to urine levels of pesticide, not answers to the Agricultural Health Study questionnaire, correct?

MS. GREENWALD: Objection, form.

A. I am not certain. I would have to look at the paper again.

Q. Okay. And one of the analyses -- well, let's actually mark this as the next in line.

(Exhibit 28-9 marked for identification)

Q. One of the analyses that Dr. Acquavella and his group conducted, and it is on table 4 on page 72, was to group the subjects in his analysis by the intensity score of exposure as measured by their questionnaire, and then see how the urine levels of glyphosate and the other pesticides, as the case may be, tracked with those intensity groupings, correct?

A. Several things in that statement that you asked me to be correct about. First of all, they are using the Agricultural Health Study's method for calculating exposure intensity and their weights for exposure intensity. The questions they asked are the same as the questions that appear in the AHS, but it is their questionnaire, but it's the same questions, as best I can tell.

Now, what was the last part of that?

Q. Okay. In this table 4, what they're doing is they are grouping individuals by the intensity category under the AHS algorithm, and then they are comparing -- for each of those intensity groups, they are looking at the levels of, for our purposes, glyphosate in the urine, correct?

MS. GREENWALD: Objection, form.

A. Correct.

Q. For the highest intensity score on the AHS algorithm for glyphosate, those people in those -- in that highest intensity group also had the highest level of glyphosate detected in their urine, correct?

A. It appears that one of those people had 230 parts -- 33 parts per billion in the urine, and the middle groups had -- group had 66, so yes, that seems to be the highest ever seen in any of

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their people.
Q. And also by geometric mean and median, the individuals who were in the highest intensity category by the AHS -- AHS algorithm had the highest level of glyphosate detected in their urine, correct?
A. No, they -- the mean of the glyphosate levels in people in the highest dose group, highest intensity category, is higher than the mean from the other two categories.
Q. Okay. So there were both a higher median and a higher mean glyphosate levels in urine for the individuals who were in the AHS highest intensity score group, correct?
MS. GREENWALD: Objection, form.
A. There were the highest median and the highest mean in the highest intensity category, that is correct.
Q. Dr. Acquavella, at page 73 of his publication, stated -- and this is in his second column, about two thirds of the way down, you see the sentence that starts:
"The average exposure intensity algorithm proposed by Dosemeci and colleagues ..."
And that's referring to the AHS intensity

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algorithm, correct?
A. I am aware of the paper, yes.
Q. "The average exposure intensity algorithm proposed by Dosemeci and colleagues is an important step (sic) toward improving exposure assessment for epidemiologic studies."
Correct?
MS. GREENWALD: Objection, form.
A. "Is an important start", not "step".
Q. "... an important start toward improving exposure assessment ..."
A. They go on to say:
"The ability to estimate average exposure intensity would provide a basis for improved dose-response analysis. However [then it says] this algorithm (and indeed any generic approach to exposure prediction that is based on passive dosimetry) is limited because it ignores important pesticide specific physical/chemical properties that can greatly influence dose such as dermal penetration and vapor pressure."
So they are cautious in what they're saying about what this means.
Q. And the Agricultural Health Study investigators in fact modified their intensity

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algorithm based upon findings of urine levels and these correlations with the intensity -- with the intensity score, correct?
A. They did modify it. I am not sure -- I remember the reasoning for doing the modification but between phase one and phase two, they modified the intensity score measures, weights.
Q. And Dr. Acquavella and his group also concluded that the dose -- a dose response analysis based instead solely on days of exposure could have substantial exposure misclassification, correct?
MS. GREENWALD: Objection, form.
A. So that presumes -- I am sorry it's taking me a little while. It presumes that the total amount of exposure you get is the thing that's most important in causing the disease. And that's a pure assumption. If it's number of repeats every day of the -- of an exposure, that leads to getting the disease, then the days of exposure would probably be a better exposure measure than intensity.
For most epidemiologists, they would argue the intensity measure is probably a better measure.
Q. The second paper by Dr. Blair and others in 2011 were conducting a similar analysis

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but they were using questionnaires that were devised and propounded by the AHS investigators, correct?
MS. GREENWALD: Objection, form.
A. They were doing their analysis based on the AHS response, so yes, they were using -- they took a subset of -- if I remember correctly, they took a subset of the AHS population, a very small subset, and did urine biomarkers on them, and then compared their intensity responses with that.
Q. Okay. And then --
A. They also went on to demonstrate what that means in terms of exposure misclassification.
Q. And we are going to discuss both of those things. Let me mark the paper first, as exhibit 28-10.
(Exhibit 28-10 marked for identification)
Q. Dr. Blair and his coauthors, they looked at chloropyrifos and they looked at 2,4-D, they didn't look at glyphosate, correct?
A. That is correct.
Q. For their analyses, in the abstract and the conclusions, they state, and we'll talk about the second part of their analysis as well in some detail, but they state that correlations between algorithm scores and urinary levels were

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"quite good", correct?
MS. GREENWALD: Objection, form, that's really read out of context.
A. The whole sentence reads:
"Although correlations between algorithm scores and urinary levels were quite good (i.e. correlations between 0.4 and 0.8) exposure misclassification would still bias relative risk estimates in the AHS towards the null and diminish study power."
Q. I understand. That second part, we're going to talk about, that's your concern, about the 2018 NCI study, correct?
MS. GREENWALD: Objection, form.
A. Part of my concern about the 2018 epidemiology study, there is a second concern dealing with the imputation.
Q. Okay. But for the first part of their analysis, the -- Dr. Blair and his coauthors concluded that the correlation between algorithm scores and urinary levels were quite good, correct?
MS. GREENWALD: Objection, form.
A. It's what they said. Now, I don't know that a 0.4 correlation, I would characterize as quite good, but I don't do as much epidemiology data

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as they do, so in the context of epidemiology data, it might be quite good. In the context of animal data, it would not be.
Q. Okay. And Dr. Blair and his coinvestigators at NIH also concluded that the algorithm -- the intensity algorithm used in the AHS provided better measures of exposure than simple measures of duration of use, correct?
MS. GREENWALD: Objection, form.
A. I would assume that they have concluded that since they did not use duration of use as one of their exposure metrics.
Q. Just to be clear, in the 2018 National Cancer Institute journal on occasion they used both, correct?
A. I guess they used duration. Yes, they used both, you're right. I didn't think of it as duration, I thought of it as more days of use and things, whereas duration is a single period, but anyway.
Q. The duration of use period that -- the second exposure assessment or analysis using cumulative days is the same methodology that is set forth for the Eriksson analysis, correct, for duration?

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A. I believe it is.
Q. But be that as it may, Dr. Blair and his coauthors concluded from their analysis that the intensity algorithm provided a better correlation or measure of exposure than duration of use, correct?
MS. GREENWALD: Objection, form.
A. I don't know, you would have to show me where it says this. I don't remember specifically them saying that.
Q. If you can look at page 540? In the second column of the publication:
"Several conclusions can be drawn from evaluation of the impact of exposure misclassification ..."
The first point they make is that correlations between questionnaire or observer information on pesticide use in measured urinary levels are in the range found for other factors that are usually considered to be reliably obtained for epidemiological studies such as tobacco and alcohol use, diet, physical activity and health assessments, correct?
A. That's what it says, that's correct.
Q. And that's what we were talking about earlier, correct?

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A. That's correct.
Q. Then the second point they make is that:
"... exposure estimates from an algorithm based on several determinants thought to affect exposure are more highly correlated with measured levels of these pesticides in the urine than some specific individual determinants (i.e. kilograms of active ingredient used, hours of mixing and application, or numbers of acres treated) and would result in less attenuation of relative risks."
Correct?
MS. GREENWALD: Objection, form.
A. That's what it says, and in the case where relative risk is really truly positive.
Q. Then the other issue --
A. Now, that said, they don't say their intensity score, they just are talking about any general intensity score, is going to be better than any cumulative score.
Q. Okay, but their analysis in their paper, of course, is to their intensity score, correct?
A. That is correct, but their statement here is to any intensity score.

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Q. Okay. Ad then Dr. Blair, as you already noted, and I want to turn to this, in the 2011 publication, discusses how exposure misclassification in the AHS questionnaires could lead to bias towards the null, correct?

A. Correct.

Q. You discussed that in addition to this concern, you also have concerns about the imputation methodology used in the 2018 NCI study, correct?

A. That's correct. Are we not going to discuss this regular risk -- relative risk analysis that Blair did?

Q. No, we're not.

A. Okay. I just want to put the paper down.

Q. There is a different publication from NIH investigators with the lead author of Heltshe that you discuss in your report that addresses the implication method, correct?

THE VIDEOGRAPHER: Going off the record at 12.40 pm.

(12.40 pm)

(A short break)

(12.43 pm)

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THE VIDEOGRAPHER: Back on the record at 12.43 pm as indicated on the video screen.

Q. So we had just marked the Heltshe paper, 28-11.

(Exhibit 28-11 marked for identification)

Q. Now, in your supplemental expert report on page 3, you note that the Heltshe paper showed -- reported lower levels of pesticide use in phase 2 among nonresponders than among cohort members who responded to the phase 2 questionnaire, correct?

A. The prevalence in respondents was 53 percent, 52.7 percent, whereas nonrespondents, it's estimated to be 45.2 percent.

Q. Okay. And you state in your report that this suggests either a systemic -- systematic bias toward imputing no exposure, or that there is some aspect of nonresponse that is correlated with cohort members having less exposure during this period, correct?

A. Well, there's more to the systematic bias here issue, because I also discuss the fact that 38 of the -- 33 of the 38 pesticide they evaluated had smaller values for prevalence use from those respondents versus nonrespondents, and I also

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noted in table 1 that in the prediction of the 20 percent they took out -- no, that's table 3, that there's a serious underprediction.

Q. Now, the -- so what you're pointing out is that there's lower levels of glyphosate exposure in the nonresponders in this imputation analysis than there are in the responders, correct?

A. The imputed exposures in the nonresponders are lower than the exposures in the respondents.

Q. Now, the AHS investigators compared, in a separate publication, responders and nonresponders to the second phase questionnaire to assess any differences in these populations, correct?

MS. GREENWALD: Objection, form.

A. Which publication are you talking about?

Q. It is Montgomery 2010, and why don't we take a look at that now. We'll mark that as 28-12.

(Exhibit 28-12 marked for identification)

Q. If you look at -- and this Montgomery 2010 paper is comparing the -- nonparticipants and participants in the second phase questionnaire,

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correct?

A. I am sorry, say it again, please?

Q. The Montgomery 2010 paper is comparing respondents and nonrespondents to the second phase questionnaire, correct?

A. Comparing the responses from the nonresponders and the responders given in phase 1 to whether any of that links to them not responding to phase 2.

Q. Right, okay. And in their comparison, and you can turn to page 493, the left-hand column, you see on the left the first paragraph, full paragraph that starts "applicators", do you see that?

A. Yes.

Q. The NIH investigators found that applicators were more likely not to participate, and this is referring to the phase 2 questionnaire, if they had never mixed or applied pesticides or if they personally applied pesticides less than one half of the time, consistent with the idea that those with more of a connection to the subject of the study would be more likely to participate, correct?

A. That's what it says, and they're not

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all NIH researchers, are they? But that's being repetitive.

Q. So the imputation finding that nonresponders use less pesticides in phase 2 than responders is consistent with data from questionnaire 1, which showed that the individuals who didn't respond to the second phase questionnaire were also less likely to use pesticides in phase 1, correct?

MS. GREENWALD: Objection, form.

A. I can't come to a conclusion of that, unless I read the whole paper.

Q. Okay. Had you read the Montgomery 2010 paper before?

A. I had scanned it.

Q. Did you recall this fact, that individuals who responded to the second phase questionnaire were more likely to have used pesticides in phase 1 than individuals who had not responded to the phase 2 questionnaire?

A. I don't remember that exact sentence, no, I am sorry, I do not. I would prefer to look at it in terms of what the responses were to see if the percentages are approximately the same, and that would take me some time.

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Q. Let's go back to Heltshe and talk about the imputation methodology more generally. The investigators note, the NIH and other investigators note, at the beginning of the Heltshe paper, in their introduction, this is on the first page, in the left-hand column:

"Multiple imputation has been widely accepted and has been used to account for missing data in large national surveys and studies, including NHANES III, National Assessment of Educational Progress, Children's Mental Health Initiative, and the Framingham Heart Study."

Do you see that?

A. Yes, I do.

Q. Do you agree in general, and we'll get to the 2018 NCI study in a second, but do you agree in general that multiple imputation is a widely accepted methodology for use in epidemiological research?

MS. GREENWALD: Objection, form.

A. I am not sure I have the history in the field sufficient to be able to say it's widely accepted, I just don't think I can answer that appropriately.

Q. Okay. And have you looked at the

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use, the publications they reference here, of other illustrations of where multiple imputation has been used in epidemiological research?

A. I looked at the NHANES III because I used to be in charge of it.

Q. And multiple imputation was used in that study, correct?

A. Very sparingly.

Q. And the NIH investigators and others in the Heltshe paper, the methodology they used to assess the imputation was to take the individuals who had responded to phase 1 and phase 2, and then they took a random sample of 20 percent of them, put them aside, pretended, if you will, that they had not responded, and used their imputation method to derive exposure information for those individuals, and then compared those imputed figures with the actual questionnaire responses for those same people, correct?

MS. GREENWALD: Objection, form.

A. For the 20 percent, correct.

Q. And --

A. It's more complicated than that, because it's -- the imputation is four different imputations, and it's -- algorithms are complicated.

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Q. But the general approach --

A. The general idea is what you've said.

Q. Okay. And for overall pesticide use, all pesticide use, the investigators found that, through their imputation method, they calculated that 85.3 percent of those cohort members had used pesticides during the second phase period, and when they looked at the actual questionnaire, 85.7 percent of those farmers had used pesticides, correct?

MS. GREENWALD: Objection, form.

A. This is for any pesticide?

Q. Yes.

A. This would be where?

Q. It's mentioned in the abstract and it's also mentioned in the "Results" section on page 412.

A. It's not in any of the tables?

Q. It's not in the tables. So if you look at the abstract, in the very beginning of the paper, at the bottom --

A. I see it, yes. That's what it says, but of course for this -- the numbers for glyphosate are the more important numbers.

Q. I understand that. I'm taking this

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in steps. So for all pesticide use --
A. Any pesticide use.
Q. Any pesticide use, the NIH investigators found that their imputation method matched pretty closely with the actual information for total pesticide use, 85.7 percent versus 85.3 percent, correct?
MS. GREENWALD: Objection, form.
A. That's Heltshe's paper and I would have -- it's hard to judge. You're asking me to make -- to say that the numbers are close, but I would love to see standard error, and other things associated with it, so I could do a statistical comparison. They are three percentage points apart, that could be enough.
Q. 0.3 percentage points.
A. 0.3 --
Q. 85.2 -- actually, yes, 85.3 --
A. 0.4 percent, 0.4 percent apart, that's probably not statistically significant, but I can't know it until I see the standard errors.
Q. But you would agree, and you can also look, if you want to look at the standard errors on page 412, in the results section?
A. Results imputation assessment with

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imputation adjusted standard error 0.59 percent. So they're not statistically significant from each other.
Q. Okay. So for -- and I recognize this is for any pesticide use, not for glyphosate, but for any pesticide use, the Heltshe analysis showed that the imputed -- the imputation methodology worked pretty well, correct?
MS. GREENWALD: Objection, form.
A. I would argue -- they showed they matched the numbers up fairly well. I would argue that with 85 percent of the people using at least one pesticide, there's not a lot of room for mistakes in that. So it's okay. Certainly you wouldn't use an imputation method that didn't give you that type of quality.
Q. And the NIH investigators, and it's on page 412, in their discussion of those findings, with respect to any pesticide use, state that the 85.7 percent versus 85.3 percent comparison:
"... indicates that the logistic regression model underpinning the multiple imputation procedure did indeed preserve essential features of the data."
Correct?

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MS. GREENWALD: Objection, form.
A. Can you point me to that?
Q. Sure, in the imputation methodology, right under the numbers that you just looked at, the NIH investigators state that the 85.25 percent versus 85.68 percent for any pesticide use:
"... indicates that the logistic regression model underpinning the multiple imputation procedure did indeed preserve essential features of the data."
Correct?
MS. GREENWALD: Objection, form.
A. As it pertains to the prediction of any pesticide usage, that's what it means here, but yes, as it pertains to any pesticide usage, meaning at least one, not just any.
Q. And with respect to any pesticide use, you would agree with that?
A. Correct, it does not pertain to glyphosate use.
Q. I understand that.
A. Good.
Q. But with respect to any pesticide use, you think that -- you agree that's a fair statement, that the multiple imputation method

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preserved the essential features of the data?
MS. GREENWALD: Objection, form.
A. The logistic regression model preserved the essential features of the data to get that 85.25 percent, yes.
Q. You agree with that?
A. I agree that's one interpretation of it. My other interpretation was earlier, and that is that they have not much leeway, if it had been 50 percent, if true was 50 percent and they were trying to predict 50 percent, we would have a much stronger statement because that's a difficult -- that's a more difficult prediction to make. They also don't sort of give me an indication of what the five imputations looked like for these five cases that they're doing here, so it would have been nice to see that, to get a better feel for how stable they are, and it would have been nice to see what the five sets of covariants were.
Now, they saw that, so they have more knowledge than I have, so I can't easily disagree or agree with them.
Q. You have no basis, from anything you read in this paper, to disagree or to conclude that the NIH investigators were incorrect in stating that

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for any pesticide use, the multiple imputation procedure preserved essential features of the data, is that correct?
MS. GREENWALD: Objection, form.
A. I have no reason to challenge the statement as it's written in the paper, that's correct. I have no data that allows me to question it one way or the other for that end point.
Q. So the -- as you noted, the Heltshe investigators also looked at 38 individual pesticides, including glyphosate, correct?
A. I believe it's 38, yes.
Q. There is no statement in the text of this publication where the investigators state that the imputation methodology did not work for glyphosate, is there?
A. I don't recall exactly.
Q. Do you recall any statement in the text of this publication?
A. I would have to read the whole thing, but I don't -- I don't recall that statement being in there, but that doesn't mean it isn't in there.
Q. Okay. Now, in your supplemental expert report, you focus on one measurement in the Heltshe paper called the Brier score, correct?

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MS. GREENWALD: Objection, form.
A. You know, in answer to your previous question, can we go back to it for a second?
Q. Sure.
A. So you asked if there's any place in here where it says that, and technically, table 3 says exactly that.
Q. Okay, no, I understand your interpretation of that. My question was whether or not the --
A. What table 3 says, 52.73 percent prevalence in the observed, 45.42 prevalence in the predicted and the imputed with standard errors that clearly make it statistically significantly different between what was predicted and what was observed.
Q. Okay. I understand that, and I understand, and I want to get to your analysis of that. My question, though, was the investigators, in their text of the paper, if they state, in any place, that they believe that the imputation method does not work for glyphosate?
MS. GREENWALD: Objection, form, and asked and answered.
A. There are 38 compounds, give or take,

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in here, I don't know how many actually right now, but I think it's 38, as you said, of which they probably only mentioned five.
Q. They don't mention glyphosate specifically? They don't talk --
A. They do not mention glyphosate specifically, or 33 or so of the others.
Q. And a number of the investigators who are coauthors on this Heltshe paper are also coauthors on the 2018 National Cancer Institute journal study of glyphosate and non-Hodgkin's lymphoma, correct?
MS. GREENWALD: Objection, form.
A. Some of them are. Certainly Andreotti, certainly Sandler, but yes, some of them are definitely in both publications.
Q. Okay, so let's -- in your supplemental expert report, you focus on one measure in the Heltshe paper called the Brier score, correct?
MS. GREENWALD: Objection, form.
A. I discuss the Brier score, that is correct.
Q. Have you ever used the Brier score in any of your own research?

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A. No, I have used something similar, but not the Brier score per se.
Q. Have you ever calculated a Brier score prior to this litigation?
A. No.
Q. Before reviewing the Heltshe paper, had you ever heard the term "Brier score"?
A. No.
Q. In your supplemental expert report, you state that the smaller the Brier score, the more accurate the imputed exposure, correct?
MS. GREENWALD: Objection, form.
A. That's correct.
Q. Where did you get that information?
A. Directly from the publication they cite for the Brier score.
Q. Okay. Have you looked at any other literature with respect to Brier scores other than the Heltshe paper and what is cited in the Heltshe paper at that point?
A. Oh, you know, I do a lot of searches, when I do these things. I might have looked at one or two others but I can't -- I can't be certain.
Q. Am I correct in my understanding that the range of possible Brier scores is zero to 1.0?

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A. That is my understanding as well.
Q. Okay. Is it your understanding that a Brier score of zero shows perfect accuracy and a Brier score of 1.0 shows the worst possible accuracy?
MS. GREENWALD: Objection to form.
A. It's something in that range, yes.
Q. What is the cutoff point at which you believe a Brier score indicates accuracy that would make the imputation methodology unreliable?
A. I don't -- they didn't do it that way and neither do -- neither, I think, does Brier in their scoring, they don't talk about a bright cutoff point.
Q. So let's take a look at table 3, where they report the individual Brier scores for each individual pesticide.
A. Okay.
Q. Now there's also a calculation in this table for something called a reference Brier and something called a Brier skills score, correct?
A. Correct.
Q. What is the reference Brier?
A. The reference Brier is a Brier score, it's the same thing as a Brier score, but based upon

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sort of a random draw, so it's -- you're looking at how much you can improve from the reference Brier by doing your own predictions.
Q. And random score, is your understanding of the reference score then, that it is just a 50/50, would be the reference score?
A. I don't -- I don't -- I didn't dig into it that much, because they are only using the reference Brier to get the Brier skill score, and I was just more interested in the Brier score. The Brier skill score tells you how much better you did with your prediction than the reference Brier, but I wanted to know how well they did with their score, so I was looking at Brier score only.
Q. Okay. Based upon your understanding of a Brier score then, the pesticides, for example, methyl bromide at the top and dichlorvos at the bottom, and this is in the publication, have -- the imputation methodology was most accurate for those pesticides, correct?
A. They discussed those pesticides specifically in the paper, because those pesticides were, by their definition, rare use pesticides, under 200 people in the entire cohort using it, and they expected the Brier scores to be small, because

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it becomes sort of a digital prediction, so it's not surprising they are very small, and they probably did better, but part of that is due to the small sample size.
Q. But according to your understanding of Brier scores, with -- given the small sample size, the imputation methodology worked best for these pesticides or very well, 0.004 for methyl bromide and for dichlorvos, correct?
MS. GREENWALD: Objection, form.
A. In comparison, across all the chemicals that are listed here, those had the lowest scores. How well they do is dependent upon -- it's to some degree dependent upon sample sizes, they point out here, because it's a sum of squared error but anyway, relative to the others, these are the lowest scores.
Q. Okay. And so relative to others, the imputation methodology worked best for methyl bromide and dichlorvos, correct?
MS. GREENWALD: Objection, form.
A. If you are defining best as being the lowest Brier score, that is correct.
Q. Well, okay, that's -- I guess that sort of begs the question. Is it your

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understanding, for example, based upon your understanding of Brier score, that the imputation method worked better, was more accurate for methyl bromide and dichlorvos than it was for glyphosate?
MS. GREENWALD: Objection, form.
A. I think we're looking at the score a little bit too simply. It's like thinking of sums of square error in a regression analysis, and not putting it in the context of the whole analysis.
I would say that given two data sets with the same number of responses, and two different Brier scores, the lower Brier score is the better prediction than the other Brier score. But given the diversity and the mixture of this, I would clearly say methyl bromide is doing better than glyphosate, that I would say without any doubt, any doubt in my mind.
Q. Okay. And the NIH investigators separately report how close the imputed prevalence of an individual pesticide use came to the actual prevalence of use in the holdout group, correct?
MS. GREENWALD: Objection, form.
A. Say it again?
Q. Okay, let me put it in context. We had earlier discussed the any pesticide use

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analysis, and showing the prevalence in the imputed group versus the prevalence in the -- for the holdout group, the imputed prevalence versus the actual prevalence, correct?

A. That is correct.

Q. And they did that same analysis, showing how close the imputed prevalence was to the actual prevalence for each of the individual pesticides, correct?

A. That is correct.

Q. Okay. And that information is set forth on figure 2, correct?

A. And it's set forth in table 1.

Q. Table 1, I think is actually a different comparison, that's -- that's not the holdout group comparison, correct? The numbers, the numbers are not right.

A. I am sorry, it's table 3 and figure 2.

Q. Okay. So in figure 2 they provide the relative errors of the imputed prevalence to see how well imputed prevalence matches up with actual prevalence in the holdout group, correct?

A. That is correct, and it is relative -- relative errors, instead of absolute

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errors.

Q. Right. So they are comparing what they found in the holdout group for actual exposure and what they found in imputed exposure, and then calculating the relative error between those numbers, correct?

A. They are taking the prevalence seen in the observed, subtracting the prevalence seen in the imputed, and dividing by the prevalence seen in the observed.

Q. Okay. And that is a measure of how -- a statistical measure of how close the imputed is to the observed in that holdout group, correct?

MS. GREENWALD: Objection, form.

A. It's -- it's relative to what the actual percent exposure is.

Q. Okay. And for the methyl bromide, methyl bromide, and dichlorvos and also coumaphos, which we -- which had very, very low Brier scores, as reported in table 3, those pesticides had the largest relative error as far as imputed prevalence versus actual prevalence for usage in phase 2, correct?

A. And I believe the smallest absolute

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error.

Q. Correct, but as far as relative error is concerned, comparing the imputed prevalence versus the actual prevalence, those pesticides with those very low Brier scores had the largest relative error in estimation, correct?

MS. GREENWALD: Objection, form, and asked and answered.

A. In relative error, yes, but I wouldn't have based -- that's -- relative error is not what I would want to use in evaluating this information to tell me whether the imputations worked for glyphosate. I would want absolute error and the standard deviations associated with the absolute error.

Q. And the relative error figure though is the figure that the AHS investigators set forth in their table comparing these 38 different pesticides, correct?

A. They put a relative error picture in here, which shows a different disturbing problem with the data set, but yes.

Q. As a rule, the individual pesticides with the lowest Brier scores in fact had the highest relative error as far as imputed prevalence versus

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actual prevalence of use in the phase 2 questionnaires, correct?

MS. GREENWALD: Objection, form.

A. That's because in calculating the relative error, you were dividing by the probability of being exposed to this thing, and those have the lowest probabilities of being exposed, so you're dividing the differences by those extremely low probabilities, as compared to something like glyphosate, where you had 50 percent probability so you're dividing by 0.5, instead of 0.002, and so that makes the relative error grow big for things that have very small P values. When you look at absolute error, it's quite a different picture.

Q. Is it your understanding that the Brier score is calculated -- sorry, that relative error is calculated by an equation that puts the Brier score equivalent in the denominator?

A. This is not Brier score, this is relative error. This is prevalence in observed minus prevalence in predicted divided by prevalence. That's my understanding of what this picture is.

Q. So with respect to a Brier score then, am I correct in my understanding that as between different pesticides, you cannot simply

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compare the numeric value of the Brier score, if there is a different prevalence of use of those pesticides?
MS. GREENWALD: Objection, form.
A. If it's a big difference, it's something you would be very careful about making a comparison of, as far as I understand the Brier score.
Q. Okay. And in fact, the Brier scores for these -- the pesticides that have the highest relative error are -- well, strike that.
The Brier scores that had the lowest Brier scores, which relate to these pesticides with high relative error, when you talk about petroleum oil, petroleum distillates, methyl bromide, maneb/mancozeb, trichlorfon, metalaxyl, dichlorvos, coumaphos and phorate -- I'll show you where that is -- those all have very, very low Brier scores and they have among the highest relative errors seen in this study.
MS. GREENWALD: Objection, form.
A. But they have among themselves the lowest prevalence seen in this study.
Q. Okay, but I'm correct that those pesticides have the lowest Brier scores and the

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highest relative error as between imputed and actual exposure, correct?
MS. GREENWALD: Objection, objection, asked and answered.
A. I answered it.
Q. That's correct?
A. No, I said they also have the lowest prevalence, so yes, they have those lowest scores, but the explanation in the paper is look at the prevalence, it is not surprising.
Q. In fact, the Brier scores for the -- the Brier score for any pesticide use which we just talked about, the 85.3 and the 85.7, the Brier score for any pesticide use is higher than the Brier score for almost all of the 38 individual pesticides, correct?
MS. GREENWALD: Objection, form.
A. Where is that Brier score? It must be in the text somewhere.
Q. On page 412, the first column, towards the bottom:
"For use of any chemicals ..."
Do you see that?
A. No, sorry, I am not getting -- let me look at yours for a second.

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Q. It's right down here (indicates).
A. Oh, I was in the wrong column.
Q. That would make it hard.
A. "For use of any chemicals, B = 0.1092, BRf = 0.1227, for a SS = 0.1103, an 11% improvement in accuracy using ..."
So it's 0.1092.
Q. All right. So if you look at figure -- table 3, which you're looking at, the Brier score for their any pesticide use analysis where they had an 85.3 imputed prevalence versus an actual prevalence of 85.7, the Brier score for that analysis is higher than the Brier score for most of the individual pesticide analyses that they present, correct?
MS. GREENWALD: Objection, form.
A. I don't know about most, but it's certainly -- probably it is more than 50 percent. It's higher than more than 50 percent. I would -- I would definitely say yes.
Q. By my count, there may be six individual pesticides that have Brier scores at or higher than the Brier score for any pesticide use?
A. Including glyphosate, yes. Which has the highest Brier score.

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Q. So if the "any pesticide use" was in this table, it would have one of the highest Brier scores of any of the analyses, correct?
MS. GREENWALD: Objection, form.
A. Yes.
Q. And that Brier score would be for an analysis in which there was a match, a statistically -- a statistical match in the imputation of 85.3 percent pesticide use with the actual prevalence of 85.7 percent pesticide use, correct?
MS. GREENWALD: Objection, form.
A. I am sorry, this doesn't deal with pesticide use. The Brier score is dealing with frequency of use. It's measuring frequency of use, so the two are not related. We can get perfect agreement on prevalence and completely miss out agreement on the magnitude of use.
Q. And also we could have a perfect match on prevalence of use between actual and imputed, and a complete mismatch in the Brier score, correct?
A. I can have -- say it again, I am sorry.
Q. Sure. We can have a perfect match,

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as we do for any pesticide use, we can have a perfect match for prevalence of use between the imputation and the actual, and a complete mismatch with the Brier score, correct?

MS. GREENWALD: Objection to form.

A. That is correct. In fact, you can also have terrible agreement on prevalence and terrible Brier score, as is the case for glyphosate.

Q. Okay. The -- and so in looking at the table 2 -- figure 2, I am sorry, as far as the relative error, or the agreement, if you will, for actual versus imputed pesticide use, we can see we have five pesticides that have relative errors at or above 0.2 or close to that in the positive direction, and then the others are all -- the other pesticides are all in the negative direction, correct?

A. That is correct.

Q. And as far as the relative error is concerned, with respect to these 38 pesticides, glyphosate falls basically in the middle, correct?

MS. GREENWALD: Objection, form.

A. No, it falls at the top of the bottom third. It's in the bottom third.

Q. With respect to how far away from

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zero they are, given that we have five pesticides at the top that are on the other side of the line, correct, far from zero?

A. Yes.

Q. As far as a -- with relative error of zero, zero being perfect, I'm just assuming that's correct, right? Is that -- my understanding correct?

A. That's my -- a relative error of zero in this picture would be perfect. It would be an absolute -- absolute error of zero and a relative error of zero.

Q. With respect then, given that we have these five that are greater than 0.2 off from 0.0 and then we have the others below, glyphosate, with respect to relative error, comes in basically in the middle of these 38 pesticides, correct?

MS. GREENWALD: Objection, form and asked and answered.

A. It does, but it's relative error, and I believe absolute error is the more informative issue here. The other thing about this picture that is annoying, or surprising, is that more than 50 percent of the chemicals, in fact 90 percent or 80 percent of the chemicals, have a negative

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relative error. That suggests a systematic bias, because it should be 50/50, if their prediction technique was working pretty well.

Q. Now, the AHS investigators or the NIH investigators, I guess, in their --

A. AHS is probably more correct.

Q. In their abstract, at the top, at the beginning of the page, when they talk about -- we already talked about the observed and imputed prevalence of any pesticide use as 85.7 and 85.3 percent respectively. They then go on to say that the distribution of prevalence in days per year of use for specific pesticides were similar across observed and imputed in the holdout sample.

Do you agree with that statement?

A. No.

Q. Okay. I want to talk a little bit also about the skill score, the Brier skill score. And the Brier skill score, as I understand your testimony and your understanding, is a calculation of how the degree by which the imputation method improved the derivation of exposure as compared to whatever the reference Brier is, correct?

MS. GREENWALD: Objection, form.

A. That is correct.

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Q. And you sitting here today are not sure what the reference Brier refers to in this analysis?

A. I would need to go look at it very carefully and re-read through it. If you would like, I would be happy to do that.

Q. I don't think we have time during the deposition, if you haven't done that already. But with respect to the Brier skill score, as far as how much -- how well the imputation method worked in improving the exposure information compared to the reference Brier, reference Brier, glyphosate actually performs better than, by my count, 27 of the other pesticides that are individually measured?

MS. GREENWALD: Is that a question?

Q. Is that correct?

MS. GREENWALD: Objection, form.

A. I would need to count through them, but let me take a quick look here. I will again restate that the Brier is more informative than the reference Brier in this case but yes, it looks like it's got -- in this case, the score, the bigger the score, the better, and here it's got a fairly good size score, so yes, it's one of the better scores. Still, it's statistically significantly different in

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prevalence between imputed and observed.
Q. But when -- and you don't understand, sitting here today, what -- when talking about how improved the measure is, compared to reference Brier, you don't know what the reference Brier is referring to at this point?
MS. GREENWALD: Objection, form.
A. I do not know what the -- I can't specifically tell you exactly what the reference Brier is, other than give you a feel for the fact that it's sort of against a random prediction model.
The -- there's no P values here, it's not significantly changed, I don't know what this Brier skill score actually means in terms of statistical significance. I do know the prevalences are different.
Q. Okay. When you say it's not statistically significant, you actually don't know one way or the other?
A. There's no P values associated with it, it's just a score.
Q. So you don't know if it's statistically significant or not, correct?
MS. GREENWALD: Objection, form.
A. I don't think anyone ever does that.

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There's no statistic, there's no -- there's no probability measure associated with it, so there's no statistic to give you a P value.
Q. Brier scores are often decomposed into three different terms, correct?
MS. GREENWALD: Objection, form.
A. I would have to go back to the original article and read it to better understand what that statement says.
Q. Okay. Have you ever heard of the fact that Brier scores can be decomposed into measures of reliability, resolution and uncertainty?
A. I vaguely remember reading that in the paper.
Q. I take it you don't have sufficient expertise with Brier scores to be able to answer questions about that issue here today?
A. That is correct.
Q. Let's go off the record, I am going to be finishing up, but I just want to gather my thoughts, I want to find out how much time I have left.
THE VIDEOGRAPHER: Ten minutes. Going off the record at 1.25 pm.
(1.25 pm)

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(A short break)
(1.35 pm)
THE VIDEOGRAPHER: We are back on the record at 1.35 pm as indicated on the video screen.
Q. Dr. Portier, I am going to hand you three documents that I have marked as exhibits 28-13, 28-14 and 28-15, and these are e-mails of yours that you produced in connection with our subpoena for this deposition, correct?
(Exhibit 28-13 marked for identification)
(Exhibit 28-14 marked for identification
(Exhibit 28-15 marked for identification)
A. They appear to be, yes.
Q. Okay. And in these e-mails you are having communications respecting -- with respect to the 2018 National Cancer Institute study with three individuals, Robert Bellé, Tiffany Stecker and Martin Pigeon, correct?
MS. GREENWALD: Objection, form.
A. I am sending e-mails to these three people, yes.
Q. Who is Martin Pigeon?
A. He works for Corporate Europe. He is -- he wrote a book on glyphosate. He is a journalist of some type, or environmentalist.

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Q. In this e-mail, which is marked as 28-13, Martin Pigeon is referring to a lawyers' letter, do you see that?
A. Yes, I don't know what that means.
Q. Okay. Who is Robert -- how do you pronounce his last name?
A. What does that mean? No idea. I am sorry.
Q. Robert -- is it Bel-lay?
A. Bel-lay.
Q. Who is Robert Bellé?
A. He says so in the letter.
"I am advisor for Sandrine Le Feur a French deputy (LERM) which works with Nicolas Hulot fighting against glyphosate renewal in Europe."
Q. In this e-mail exchange with Mr. Bellé, you set forth various issues that you had with the 2018 NCI journal study, correct?
MS. GREENWALD: Objection, form.
A. The issues I had with the 2018 Andreotti study, yes.
Q. One of the issues you note in your e-mail is the results of sensitivity analyses in that 2018 study, correct?

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A. I am sorry?
Q. You have -- "in addition", you set forth first your dose response analysis, we already talked about that, and then you have:
"In addition, in their discussion of their sensitivity analysis, page 4 ..."
A. Yes.
Q. "... you can see that as they cut back on who to include the relative risk gets increasingly higher supporting an overall concern for these results."
Correct?
A. That's what it says.
Q. Okay. What is your understanding of the reason for sensitivity analyses in epidemiological studies?
A. To evaluate how sensitive the findings are to specific assumptions or specific ways in which you brought the data together.
Q. And in the 2018 NCI study, they conducted sensitivity analyses to determine the extent to which any potential error -- imputation error in the -- that was used in the analysis impacted their results, correct?
MS. GREENWALD: Objection, form.

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A. Not correct.
Q. What sensitivity analyses are you referring to that they used in your e-mail?
A. The sensitivity analyses I am referring to are sensitivity analyses that -- so first of all, they gave one number for each of these analyses, so it's very hard to judge from what they have given their overall conclusions on this, but they gave one number, high dose versus control, where they used the exposures only from the phase one evaluations, for the entire data set.
Second sensitivity analysis they did was to move the NHL evaluation to 2005, still used the imputed data and the other data during phase two, and calculated an analysis.
The third one they did was, what was the third one? Now I have to look at the paper.
Q. It's page 4, I think as you note in your e-mail.
A. Yes. Truncated the follow-up period to 2005, they did that one. Which one did I miss?
Q. I believe it's when they looked at the individuals who responded to phase 1 and phase 2, and used just the actual data and did not use any data from nonresponders.

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A. I said that one, that was the second one I talked about. So they did -- they threw out the nonresponders, another form of dealing with missing data. They went back to 2005.
Q. And then they only looked at the phase 1 responses as the third one, correct?
A. And they only looked at the phase 1 responses, that's correct, that's the three.
Q. What you stated to this adviser to this French government official was that the relative risks got increasingly higher in these sensitivity analyses as compared to the primary analysis, correct?
A. That's what I said, yes.
Q. And you viewed that as an indication that there was a concern for the results, correct?
A. I don't know that I said that. Overall concern for these results, yes.
Q. In fact, the findings in the sensitivity analyses, and particularly when they took out the nonresponders and when they took out the second phase questionnaires, to again take out the imputed data, matched pretty closely with the primary results in the study, didn't they?
MS. GREENWALD: Objection, form.

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A. I would have to go back and look at each number separately. Plus look at the P for trend.
Q. For the sensitivity analyses for where they took out the nonresponders and only looked at individuals with actual data in the first and second questionnaire, their rate ratio, the highest exposure quartile, was 0.82, as compared to, in their primary analysis, including the phase 2 nonresponders, where there was a rate ratio of 0.87, correct?
A. I didn't see the 0.82, so could you point me to that?
Q. I am sorry, you are correct:
"... using only exposure information reported at enrollment ..."
So here for the analysis where they looked at the first phase questionnaire and the actual data, because they had actual data from all the cohort members in the first questionnaire, correct?
MS. GREENWALD: Objection, form.
Q. Dr. Portier, the AHS --
A. "... using only exposure information reported at enrollment, the rate ratio in the highest exposure quartile was 0.82."

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Q. So that is actual data, because all the 57,000 cohort members --
A. That is correct.
Q. -- or 54,000, provide actual data?
A. That is correct.
Q. So with using actual data from the phase 1 questionnaire, the rate ratio for the highest exposure group was 0.82 compared to, with the full analysis, 0.87, correct?
A. Did I get this -- is this not the -- is that the intensity or is that the frequency? I guess that must be intensity. The P trend is better, but the actual -- the relative risk of the highest dose is not.
Q. So the relative risk is essentially unchanged when they looked at the answers, the actual data just from the first question as compared to their analysis, their full analysis, correct?
MS. GREENWALD: Objection, form.
A. I am sorry?
Q. The rate ratio for the highest exposure group with their sensitivity analysis of looking only at actual data in phase 1 questionnaire, the rate ratio was essentially identical to the rate ratio in the highest exposure

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group for when they looked at their full analysis, including imputed data, correct?
MS. GREENWALD: Objection, form.
A. This was intended to be discussed in the context of the imputations.
Q. I am still asking -- I still haven't got an answer to my question. With respect to the sensitivity analysis, when they only looked at actual data from the first phase questionnaire, they had a rate ratio that was essentially identical to the rate ratio for that highest exposure group when they included all the imputed information, correct?
MS. GREENWALD: Objection, form.
A. It's not statistically significant, that's correct.
Q. With respect to the other sensitivity analysis, where they looked at first phase questionnaire and second phase questionnaire responses for the 63 percent of the cohort that responded to both questionnaires, they have a rate ratio, again, it's a 0.9 for that highest exposure group, again, not different from the finding with their overall analysis when they included the imputed information, correct?
MS. GREENWALD: Objection, form.

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A. It's bigger than the overall analysis.
Q. 0.9 versus 0.87?
A. That's all it says, is higher.
Q. So do you believe that 0.9 is meaningfully different than 0.87 as far as a rate ratio between those two analyses?
MS. GREENWALD: Objection, form.
A. I am pretty sure it's not statistically significant.
Q. So it's not statistically significantly different, correct?
A. Correct.
Q. So basically the same findings, when they looked at just the first phase questionnaire responses, or when they looked at the individuals who responded to the first and second phase questionnaire, as when they included the imputed data, correct?
MS. GREENWALD: Objection, form.
A. No, they're not the same findings. It's higher. They are not statistically significantly different but it is not the same finding. The same finding would be 0.87.
Q. Just to be clear, for those who

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answered the first questionnaire, if you just look at the first questionnaire, that's lower then by your analysis?
A. 0.82, that's correct, but my statement was in the context of the imputations.
Q. Neither sensitivity analysis uses any of the imputed data, correct?
A. But you are comparing it against the imputed data.
Q. I understand, and both of those findings, compared to findings that use imputed data, have rate ratios that are not statistically significant, correct?
A. Statistically significant from one and not statistically significant from the other ones, probably.
Q. So the sensitivity analysis did not show any statistically significant difference when the investigators did not use imputed data, correct?
MS. GREENWALD: Objection, form.
A. That's correct. It's still in the same ballpark.
Q. And you also state that if, in the next paragraph, or I think it's maybe two paragraphs after, that if there is an individual who was -- who

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answered the first questionnaire, and had not used glyphosate, so they were unexposed, and then did not respond to the second phase questionnaire, they would be designated as unexposed using the imputation methodology, correct?

A. That statement is what I wrote, that statement is incorrect.

MS. GREENWALD: Eric, your time is up.

MR. LASKER: I will finish up with one question and I'll be done.

Q. Did you ever send another e-mail following up to Mr. Bellé explaining to him that that statement was incorrect?

A. No. You would have it if I did. I spoke with him on the phone. I don't recall if I told him that or not, but I spoke with him on the phone.

Q. No more questions.

MS. GREENWALD: Give us just a couple of minutes. I know I have one but I don't know if I have more than one.

THE VIDEOGRAPHER: Going off the record at 1.48 pm.

(1.48 pm)

(A short break)

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(1.52 pm)

THE VIDEOGRAPHER: We are back on the record at 1.52 pm.

CROSS-EXAMINATION BY MS. GREENWALD:

Q. Dr. Portier, when Mr. Lasker was asking you questions about exhibit 28-11, which is the Heltshe article, towards the end of the questions, he asked you the following question and you gave the following answer. It is at 97/04 of the realtime:

"Question: I take it you don't have sufficient expertise with Brier scores to be able to answer questions about that issue here today?

"Answer: That is correct."

So my question is: what were you referring to when you answered that question "that is correct"?

A. That -- I was answering relative to the discussion he was talking about, breaking Brier scores into three different pieces, and discussing that issue, I don't believe that's in this paper, but when I went back and looked at Brier scores, I didn't spend enough time looking at that to be able to address that specific question related to Brier scores.

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Q. Sitting here today, and as you did your supplemental report, do you have sufficient understanding of Brier scores to interpret the use of those scores in the Heltshe paper which is exhibit 28-11?

A. Yes, I do. It's quite clear. You don't actually need a lot of expertise in the Brier scores to be able to look at this paper and say glyphosate was a problem. The Brier score for glyphosate is the worst, the absolute difference in the prevalence for glyphosate is the worst from all of these predictions. When you look at the relative risks, the relative proportion responding -- proportions exposed, in figure 2 or whatever it was, more than half of them were above or below zero. All of those point to a systematic problem with the estimation, and the Brier scores are just part of that overall picture.

MS. GREENWALD: I don't have any other questions, thank you.

MR. LASKER: We are done.

THE VIDEOGRAPHER: In that case, this is the end of media 2D and the video deposition today of Dr. Christopher Portier. We are now going off the record at 1.54 pm as indicated on the video

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screen, thank you very much.

(1.55 pm)

(Deposition concluded)

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CERTIFICATE OF DEPONENT

I, Dr. Christopher Portier, hereby certify that I have read the foregoing pages, numbered 1 through 126 of my deposition testimony taken in these proceedings on January 12th 2018, and with the exception of the changes listed below and/or corrections, if any, find them to be a true and accurate transcription thereof.

Signed.....

Date.....

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CERTIFICATE OF COURT REPORTER

I, Claire Gwyneth Hill RPR MBIVR, Accredited Real-time Reporter, of Planet Depos, hereby certify that the foregoing testimony was recorded by me stenographically and thereafter transcribed by me, and that the foregoing transcript is a true and accurate verbatim record of the said testimony.

I further certify that I am not a relative, employee or counsel of any of the parties of the within cause, nor am I an employee or relative of any counsel for the parties, nor am I in any way interested in the outcome of the within cause.

Signed: 
Claire Gwyneth Hill
Dated: 1/15/2018

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