ILLINOIS POLLUTION CONTROL BOARD
August 22, 2006

IN THE MATTER OF:

PROPOSED NEW 35 ILL. ADM. CODE PART 225) R06-25
CONTROL OF EMISSIONS FROM)
LARGE COMBUSTION SOURCES (MERCURY))

REPORT OF PROCEEDINGS held in the above-entitled cause before Hearing Officer Marie Tipsord, called by the Illinois Pollution Control Board, taken before Laura Bernar, CSR, a notary public within and for the County of Cook and state of Illinois, at the James R. Thompson Center, 100 West Randolph Street, Chicago, Illinois, on the 22nd day of August, 2006, commencing at the hour of 9:00 a.m.

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Mr. Anand Rao, Senior Environmental Scientist
Mr. Nicholas J. Melas, Board Member
Mr. Thomas Fox, Board Member
Mr. Thomas Johnson, Board Member

HEARING OFFICER TIPSORD: Good morning. My name is Marie Tipsord, and welcome back everyone. This is Day 7 of the second set of hearings and we're moving right along. I believe today starting with Dr. Peter Chapman and then we'll go to Gail Charnley and after that we'll see. At this time can we have Dr. Chapman.

(Witness sworn.)

MR. BONEBRAKE: Madam Hearing Officer, I would tender a copy of Mr. Chapman's written testimony.

HEARING OFFICER TIPSORD: If there's no objection we'll mark Dr. Chapman's prefiled testimony as Exhibit No. 129. Seeing none, it's Exhibit 129.

MR. BONEBRAKE: I believe Mr. Chapman was going to open with a short introduction, then he'll follow with his responses to the questions of the Agency, and then a couple of questions from Prairie.

HEARING OFFICER TIPSORD: Great. Thank you very much. Go ahead, Dr. Chapman.

THE WITNESS: Thank you very much, Madam Chair, Members of the Board, Counsel, members of the audience. My name is Peter Chapman. I received my Ph.D. in 1979. My areas of expertise are in terms of aquatic ecology, ecotoxicology, and ecological risk assessment. I've published about 150 papers and

scientific literature, and a great number of them concerned with metals including mercury; metals being one of my major areas of expertise and focus over the last many years, and, as you'll see, you'll see the details in my written testimony. I won't go into them.

What I'd like to do now is spend just a few minutes summarizing my testimony. Basically what we're looking at is two things: We're looking at inorganic mercury emitted from coal-fired power plants and we're looking at metal mercury or organic mercury in fish. And the whole basis of my testimony is there is not a linear relationship between the two because matters are very complex. My testimony is very well supported by the testimony of others such as Marcia Willhite, which I'll allude to. Basically what happens when mercury comes into the atmosphere is it comes from a variety of sources. When it's in the atmosphere, it can circulate and the sources include anthrogenic, human sources. They also include natural sources. And although the estimates vary, it seems to be more or less general agreement somewhere around 50 percent of the mercury in the atmosphere is natural rather than anthrogenic. You've heard testimony it takes different forms in the atmosphere. I'm not going to get into that

because I'm going to stick to the biology and what happens and the physical chemical effects when the mercury is deposited in water. From the atmosphere it can be deposited to land or to water in the inorganic form. There's other place, other ways mercury in the inorganic form or sometimes in the methylated form can get into waterbodies. So we have these waterbodies, we have the inorganic mercury here. Once it's there it tends to absorb to particles settled down to the sediments. It's very complex what happens then because in terms of the conversion from the inorganic to the methylated organic form, you need have anoxic conditions, in other words, no oxygen. This doesn't occur in all waterbodies. You won't find this in most water ponds. You'll find this in certain sediments. It needs bacteria to produce this, and the process is regulated by a whole variety of circumstances that were well described by Marcia Willhite in her testimony. For instance, pH, selenium, organic carbon, a whole bunch of different factors can regulate whether this mercury actually becomes methylated or not in the sediments. And the amount in the sediments, as Marcia Willhite pointed out correctly in her testimony, of the total mercury that's methylated is very small. It's less,

generally less than 1 percent, sometimes way, way less than 1 percent. So we have the small amount of methylmercury that can be formed. It can be formed from both recently deposited sediments and from recently deposited mercury and mercury that's been there for a long period of time. From here it can and does get into the food chain and accumulate up to fish, but the problem is that it's a very complex process. We can't say in any way, shape, or form that if you've got "X" amount of inorganic mercury deposited from any source, let alone from one source into a waterbody, it'll produce this amount of methylmercury in fish.

In terms of the Illinois data, we went to the data bases, and you'll see in my testimony there's a couple of figures and a couple of tables. What we looked at was the total mercury which would include the methylmercury in sediments and tried to see if there was a relationship between that and the methylmercury in fish. And we couldn't see a relationship. Now, grant it the data are not extensive and there's a lot more text, but we used available data. We also tried to take a look and see if the methylmercury concentrations in fish could be related to where the power plants were using information where

prevailing wind currents were coming from, and we couldn't see a relationship. And that's not surprising, because I mentioned, mercury comes from a whole variety of sources. It's a global issue. It's not just an Illinois issue.

Finally, we looked at the issue of if mercury concentrations decreased, low levels that in Illinois indicate impairment, would you still be able to eat the fish, and the answer is no because PCBs would still be an issue. So that summarizes very briefly my testimony. What I'd like to do now, if it's okay with the Board, is proceed with the first questions. I'd like to proceed with the IEPA questions, if I may.

HEARING OFFICER TIPSORD: Go ahead.

THE WITNESS: Shall I read the question?

HEARING OFFICER TIPSORD: Yes. Read the question and then the response. Thank you.

THE WITNESS: Question 1: Under section 2.0 on Page 2 of your testimony, you state, "The goal of the proposed rule, as summarized in Marcia Willhite's written testimony at Page 4 ("in order to ensure that 95 percent of largemouth bass in Illinois waters may be consumed by sensitive subpopulations, a 90 percent reduction of mercury in fish tissue is needed") will not

had be achieved." Is your statement consistent with other testimony on this issue as provided by Jim Ross in testimony provided on June 19, 2006, at the hearing held in Springfield (as found on Page 127 of that day's transcript)?

My statement is consistent with Marcia Willhite's testimony which this references. As to whether my written testimony is consistent with Jim Ross's verbal testimony, quite frankly I've read and reread his verbal testimony, and I'm not sure what he's saying.

HEARING OFFICER TIPSORD: Question No. 2.

MR. KIM: Dr. Chapman, your reading of Marcia Willhite's testimony, do you read that to mean that you believe her testimony was that she was stating that there's a one-to-one correlation between percent reduction of mercury and then a resulting percent reduction of mercury found in fish tissue?

THE WITNESS: That seemed to be what she was saying, but then it got confusing because there seemed to be contradictions and we seemed to be going instead of one-to-one to a corresponding decrease, and I wasn't sure what corresponding meant. So I got kind of confused on that issue.

MR. KIM: So but when you say that -- So when you say your reading of the one-to-one correlation, that's essentially your take of Ms. Willhite's testimony as provided in written prefiled form; is that correct?

THE WITNESS: That is correct.

MR. KIM: Thank you.

MR. HARLEY: Good morning. My name is Keith Harley. I'm an attorney for an organization called Environment Illinois. Dr. Chapman, Question 1 in your testimony characterizes the question that's posed to you as whether or not reducing inorganic mercury emission from coal-fire power plants will lead to the same reduction in fish; is that correct?

THE WITNESS: That's correct.

MR. HARLEY: So if we were to get a 50 percent reduction in mercury emissions from coal-fired power plants, would we see a 50 percent reduction in mercury fish tissue samples; is that correct?

THE WITNESS: That's basically the one-to-one.

MR. HARLEY: That's the question that was posed to you?

THE WITNESS: Okay. The question -- No. Let me clarify. Question 1 simply asks if my statement

is regarding Marcia Willhite's testimony.

MR. HARLEY: I'm sorry. I'm referring to Page 2 of your prefiled testimony.

THE WITNESS: Oh, I'm sorry. Could you repeat?

MR. HARLEY: The question that was posed to you is will reducing mercury emissions from coal-fired power plants result in the same proportional reduction of mercury reductions in fish tissue; is that correct?

THE WITNESS: That's correct.

HEARING OFFICER TIPSORD: Excuse me, Mr. Harley. For clarification in the record, the question that you're referring to is the actual question that is posed in Mr. Chapman's testimony, not the prefiled questions.

MR. HARLEY: Thank you for clarifying that.

THE WITNESS: Thank you. I was confused as well.

MR. HARLEY: Dr. Chapman, where did that question come from?

THE WITNESS: I posed that question.

MR. HARLEY: Did you pose the question to yourself whether any reduction would be seen in fish tissue based on reductions of mercury emissions from

coal-fired power plants.

THE WITNESS: I didn't pose that specific question because --

MR. HARLEY: Thank you, Dr. Chapman.

HEARING OFFICER TIPSORD: And why didn't you pose that question?

THE WITNESS: That's what I was going to answer. Because when I looked at the written testimony, what I got from that was that the State was looking at a one-to-one reduction. They were looking for linear reduction. They were quoting the Florida studies, and it seemed to me fairly apparent that if you got an "X" amount reduction in the inorganic mercury from power plants, then you get the same amount of reduction of methylmercury in fish, and that will not occur.

HEARING OFFICER TIPSORD: Will there be a reduction in methylmercury in fish, in your opinion, if the air emissions of mercury is reduced?

THE WITNESS: It depends on how much of a reduction, how much reduced the air emissions, how much of a reduction you get. But whether you get a measurable reduction is very questionable. So you will you get measurable reduction, but it's a question of how much you reduce and where. Because the problem is that

as I mentioned mercury is a global issue. And based on looking at Illinois, in some areas of Illinois, it seems that the most of the mercury that may be occurring in the waterbodies and getting to fish is not coming from the power plants. In other areas the winds would indicate that there is deposition occurring. So it'll vary across the state. I can't give a simple answer to this because it's a very, very complex issue.

HEARING OFFICER TIPSORD: Mr. Bonebrake?

MR. BONEBRAKE: Just a follow-up for clarification, Dr. Chapman. Did you indicate in your written testimony that based upon your understanding of the deposition modeling that had been performed by a gentleman who we'll refer to as Krish and I'll do better with that name than his last name, that you would not expect to see a measurable reduction in fish tissue mercury levels in the State of Illinois?

THE WITNESS: That is correct based on his analysis. Thank you for that because I spelled out the name for the court reporter, so Krish is a lot easier.

HEARING OFFICER TIPSORD: Go ahead, Mr. Kim.

MR. KIM: Just to follow-up on Mr. Bonebrake's question, is it correct to say then that you did not perform any independent analysis of your own

along the lines of Krish's testimony, and, in fact, you simply did, as you just stated, looked at his testimony and assumed it was accurate and then you based your suppositions from that point forward.

THE WITNESS: That is correct.

HEARING OFFICER TIPSORD: Now I have to ask the next question. Which suppositions? I mean because as we heard yesterday, I mean he had one set of suppositions for 2010, another set of suppositions for 2020. And his modeling showed differing results for 2010 and 2020, and different results for CAMR/CAIR versus the Illinois rule. So under all of those modeling?

THE WITNESS: The one I took was the additional reduction could be as high as 4 percent of the inorganic mercury emitted. And based on that, my conclusion that you really wouldn't see a measurable difference.

HEARING OFFICER TIPSORD: A measurable difference from --

THE WITNESS: From the 4 percent. Basically if mercury from the power plants were reduced by an additional 4 percent, the outputs, would you see a measurable decrease in the methylmercury concentrations

in fish in Illinois.

HEARING OFFICER TIPSORD: Right. But my question is did -- Is there a difference with the 5 percent under CAIR/CAMR, and then you're saying that there is no additional difference between what you get with CAIR/CAMR and what you get with Illinois?

THE WITNESS: That's right.

MR. RAO: Just for the point of clarification, you mentioned 5 percent reduction in mercury emitted by power plants. Is it emitted or is it what's deposited on the waterbodies?

THE WITNESS: I was talking about 4 percent, I believe, not 5 percent.

MR. RAO: Deposition, right, not emissions?

THE WITNESS: I was talking emissions.

MR. RAO: I thought Mr. --

THE WITNESS: He was talking about depositions. I'm sorry. You're right. Depositions.

HEARING OFFICER TIPSORD: Mr. Harley?

MR. HARLEY: But your question that you pose to yourself to answer in your prefiled testimony is an emissions, not a deposition question; is that correct?

THE WITNESS: That's correct.

MR. HARLEY: And it talks about the

reduction of emissions, not the reduction of depositions; is that correct?

THE WITNESS: That's right. Because that's a first step in the process. And then in my testimony I follow through and looked at deposition and looked at the processes that occurred in the waterbodies.

MR. HARLEY: A follow-up question. Already in your testimony you've talked about the high variability in different waterbodies in terms of reduction. And yet you also indicate that there will be no measurable reductions in any waterbody in Illinois based on the data that you reviewed; is that correct?

THE WITNESS: No. I didn't say there'd be no measurable reduction in any waterbody. I said there'd be no measurable, and I have to look to see the exact wording, but what I meant is if you're looking at Illinois in general, which is what you're looking at, you're not going to really see a measurable reduction.

MR. HARLEY: How is it possible to talk about Illinois in general in reference to waterbodies when waterbodies by definition, according to your testimony, are highly variable.

THE WITNESS: Because when you look at it, what you're trying do, my interpretation of the rule is

you're trying to reduce across Illinois, across the waterbodies, the mercury that's in fish. So there's no longer an issue. That's the major issue, not a single waterbody. So we're looking generically. Certainly, and if you look at the studies, for instance, done in Florida or other locations, you'll see that there's a very great difference between what they found. There's some waterbodies where reductions occurred, some waterbodies where no reductions occurred, and some reductions where concentrations actually increased.

MR. HARLEY: In light of the Florida study and in light of the variability of waterbodies, in reference to conditions where methylmercury might be produced, is it fair to say that we might see the same results in Illinois as they saw in Florida: Some reductions, some no effect, and perhaps even some increases in some waterbodies.

THE WITNESS: It's possible, but I can't say for sure because one of the problems we have, candidly, is there's not a lot of data. And I'm frankly going to put this gently, quite surprised at the lack of data on which this is all occurring. Because I would have expected there to be a lot more data on where the mercury is coming from, what's occurring, a lot more

information on the mercury in the waterbodies, and the data really is somewhat sparse for this. So it's difficult with the sparseness of the data and incompleteness of the data to make those sort of conclusions. That's something I would have candidly, again, expected IPA to be following up on to produce more information on that which I haven't seen.

MR. HARLEY: Would your own testimony also be more confident if you had had access to more data?

THE WITNESS: More data is always good. It depends on which data. Data by itself can often be an oxymoron.

MR. HARLEY: Thank you.

HEARING OFFICER TIPSORD: Mr. Kim?

MR. KIM: Dr. Chapman, when you say that you believe that there's a sparseness of data, that you believe more data should have been collected, are you referring to short-term studies, long-term studies? What exactly is it that -- something akin to the Florida study or the Massachusetts study?

THE WITNESS: Well, the Florida study was mainly a modeling study. It wasn't so much a data-gathering study. What I'm looking at are what are the main sources of mercury reaching Illinois? Where

are they coming from? And I'm not just talking atmospheric. I'm talking other sources such as runoff, waste plants. There's all sorts of different sources where mercury can be coming from. Where are they coming from? And then looking as well to see how this relates to the methylmercury in fish. And a lot of the information we have on methylmercury in fish is information below detection levels where assumptions are being made, detection limit is right, and so on. You certainly haven't characterized all the waterbodies in Illinois in terms of mercury levels and sediments and waters or fish. And I'm not saying you have to do them all, but if you don't have a good cross-section then you don't have a good understanding of what's happening across Illinois.

MR. KIM: Do you know how many waterbodies there are in the State of Illinois?

THE WITNESS: No, I don't.

MR. KIM: Do you know what kind of resource from a financial standpoint would be required to conduct even a cross-section of waterbodies?

THE WITNESS: I don't, but I imagine there would be substantial resources required.

MR. KIM: Do you have any understanding or

do you have any guess as to how long it would take to conduct the kind of cross-section and data gathering that you're referring to?

THE WITNESS: It would depend on the resources you put to it.

MR. KIM: Have you seen the beautiful surroundings of our state agency?

THE WITNESS: Do you want me to answer that?

MR. KIM: No. I think speaks for itself.

MR. RAO: Dr. Chapman, I had a clarification question. In your Question No. 1 on Page 2 of your prefiled testimony, I guess I'm assuming you're talking about that you will not see the same extent of reduction when you, I think to quote it, it says power plants in Illinois under the proposed rule reduced organic methylmercury concentrations in fish living in Illinois waterbodies to the same extent. And when you say same extent, I'm assuming you're talking one-to-one reduction?

THE WITNESS: Yes.

MR. RAO: But in your opinion will there be some measurable reductions? Because in response to Mr. Harley's question, you said you're not going to see any measurable reductions.

THE WITNESS: Well, I was talking, in that respect, about the difference between the CAMR and the additional, you know. Because we're talking from Krish's testimony about a 4 percent difference in deposition and in scientific terms we usually lack at significant differences as a difference of 95 percent or so. And so it would be very difficult to, I think, measure that and see that across the state, particularly given how complex a situation is from when inorganic mercury is deposited and sometimes reemitted from waterbodies. It don't always stay there. And the whole process of going through forming the methylmercury and then the methylmercury getting into the fish. It's a very, very complex process we don't fully understand. But there's so many steps, so much variation between waterbodies, that it's -- I don't think there's much science out there to support a one-to-one relationship in any shape or form.

MR. RAO: My question was will there be any significant measurable reductions, not one-to-one.

THE WITNESS: Okay. Let me clarify. Are you talking about the difference between the rule and what U.S. EPA is proposing, or are you talking about --

MR. RAO: The rule itself, the Illinois

proposed rule. I'm not comparing it.

THE WITNESS: You're not comparing it. If you just put in the rule as opposed to -- which includes, you know, what's being done by the CAMR and so on, you will see some reduction. How much I cannot say.

HEARING OFFICER TIPSORD: And now I have to ask this: According to Krish's testimony and what we're hearing today, under CAMR in 2010, there will be a 5 percent deposition reduction. And you're saying that under the Illinois rule which will include CAMR, you do believe there's going to be a reduction in mercury -- methylmercury in fish, correct?

THE WITNESS: I think there will be some reduction, yes.

HEARING OFFICER TIPSORD: Okay. That's fine. Thank you.

MR. KIM: And just as a very general proposition, you would agree that without necessarily going to the specific number, the greater the reduction in mercury emissions, the greater expectation you would have that mercury, methylmercury found in fish tissue would increase. I'm not saying on a one-to-one basis, but I'm saying -- decrease, I mean. Would you agree with that?

THE WITNESS: What you're talking about is as you reduce inputs, you'll see the amount of methylmercury in fish decrease. It depends, again. You can't say if you reduce it point one percent in the emissions you'll see something measurable. It's a question of, you know, you might actually see some -- there might be some reduction that wouldn't be measurable. It would be so tiny. So I just have trouble answering this directly, and I'm not trying to shirk the question, it's just that this is not an easy question to answer.

HEARING OFFICER TIPSORD: Which is why there are so many questions.

THE WITNESS: I appreciate that, and I hope I'm helping.

MR. KIM: I think we'll come back to this a couple of questions down the road.

HEARING OFFICER TIPSORD: Question No. 2.

THE WITNESS: Question No. 2: On Page 5 of your testimony you state that "methylmercury produced in waterbodies from inorganic mercury can be augmented by direct precipitation of methylmercury from other sources, including: The atmosphere, runoff from land or inputs from other waterbodies such as wetlands." What

are the sources of methylmercury in the atmosphere, on the land or in other waterbodies?

Other sources of mercury that can form the basis for methylmercury production that can augment that in other waterbodies are various and can include, for example, Leksi contamination such as waste dumps, current industrial related sources such as mining and oil processing, alkylate plants, waste from nuclear reactors, pharmaceutical plants, all refining plants, military ordinance facilities, incineration waste, dispose of batteries and fluorescent lamps, medical and dental sources and geological, e.g. natural sources.

HEARING OFFICER TIPSORD: Question No. 3.

THE WITNESS: Question 3: On Page 6 of your testimony you refer to testimony provided by Marcia Willhite in support of your statement that "runoff may be a significant source of mercury in southern Illinois"?

Yes. I specifically reference her June 14, 2006 verbal testimony.

HEARING OFFICER TIPSORD: Question No. 4.

THE WITNESS: Citing to the analysis of mercury in effluent of point source discharges, you emphasize the potential 1.5 ton maximum loading (as

found on Page 6 of your testimony), isn't it true that to reach the potential maximum loading of 1.5 tons per year state wide, all point sources would have to simultaneously discharge in their maximum level and maximum mercury effluent concentration?

First of all, I do not emphasize this potential maximum loading. In fact, I place quotation marks around the word maximum in my written testimony. Although I cannot confirm what's involved in this potential maximum loading, I'm citing the TSD in Marcia Willhite's testimony. My understanding is that this is a maximum value.

HEARING OFFICER TIPSORD: Question No. 5.

MR. RAO: Just a clarification. Do you expect that maximum value to occur in real life?

THE WITNESS: I can't say. I've seen situations where the maximum value, in fact, was not the maximum value and the higher values did occur. And I just don't have the background for all those calculations to determine what might actually occur. So I don't want to postulate.

HEARING OFFICER TIPSORD: Question No. 5.

THE WITNESS: Regarding footnote 20 at the bottom of Page 6 of your testimony, please describe the

"available data on mercury related to combined sewer overflow discharges from MWRDGC" and demonstrate how you calculated the loading as being tens of pounds per year.

Answer: Note that my correct statement was that, quote, inputs can be on the order of tens of pounds per year, unquote. I examined available combined sewer overflow CSO data from publically available records of the Metropolitan Water Reclamation District of Greater Chicago's, MWRGDGC, Stickney Plant Tunnel and Reservoir Plant, TARP, pumpback records for the years 2000 to 2005. Whenever there is a heavy storm event in the city, TARP, T-A-R-P, collects waste water when the primary treatment facilities are overcapacity. This waste water is stored in the tunnel system until such time as it can be pumped back through the treatment plant, treated, and discharged. Although mercury concentrations are not measured in direct CSO discharges, they are measured in water that does not actually overflow but which is to be pumped back for waste water treatment prior to that treatment. These measurements may provide a reasonable approximation of mercury concentrations in other CSOs in the system which do not currently go through any type of treatment prior to direct discharge. These data were used together with

flow data to estimate the amount of mercury that could be discharged yearly from CSOs during treatment bypass. Average annual concentration data were used. Per IEPA's approach, a value of half the detection was used when data were below detection limits. The MWRDGC web site has flow records available for five of the major CSO points: North branch, Racine Avenue, 95th Street, 122nd Street, and 125th Street. The annual flow from each of these five CSO discharges was calculated. Together with the average annual total mercury concentration obtained from the Stickney TARP pumpback data to calculate what the estimated annual concentration of total mercury would be in all of these five CSO discharges combined. As an example for 2005, the annual average Stickney TARP pumpback total mercury concentration was 0.14 micrograms per liter while a total flow from the five CSOs combined was 2,433 million gallons. Concentration times flow with appropriate conversions, gallons to liters, for example, gives a value of 2.8 pounds per year from these five CSOs. Higher values have been recorded in previous years. For instance, 55.9 pounds per year in 2000. There appears to be a trend of decreasing loadings. However, since both the MWRDGC and the City of Chicago own hundreds of CSOs throughout the Chicago area, a vast

majority of them unmonitored, and there are likely other CSOs in other areas of the state with similar potential. My statement that quote, inputs can be on the order of tens of pounds per year, end quote, may be conservative it. The intent of this exercise was simply to show that there are likely many sources of mercury input surface waters which were not accounted for by IEPA's analysis.

MR. KIM: Dr. Chapman, my understanding is based upon the description of data that you just described that much of this is available to the public, and I would imagine probably a lot of it is available on-line. And I don't know if that's exactly how you acquired the data.

THE WITNESS: That is.

MR. KIM: I know that you've performed and you gave an example of some basic calculations to come up with the figures that you ultimately made reference to in your footnote. Would it be possible to have a list of the links of the data sets that you used and the calculations that you performed to arrive at your answer?

THE WITNESS: Yes.

MR. BONEBRAKE: You were asking for web site link information?

MR. KIM: I'm guessing it's probably a lot of paper, so if it's available on line, I think a web site address is probably sufficient.

THE WITNESS: The only thing I'd ask is I am going back to holidays, so if you can wait until early September I'd appreciate it.

MR. KIM: That's fine.

HEARING OFFICER TIPSORD: Mr. Harley?

MR. HARLEY: Dr. Chapman, in developing your testimony, was it your assumption that in order to regulate mercury from coal-fired power plants, the Pollution Control Board would have to regulate every anthrogenic source of mercury that may enter a waterbody?

THE WITNESS: No. But if your overall goal, and you need to be clear about what your overall goal is, to reduce the amount of methylmercury in fish in the waterbodies in Illinois, you need, first of all, to determine what all the sources are and then determine which are the ones that are most important to regulate. You shouldn't just make an assumption that is, unfortunately I'll have to see, concur that one source is the only source of mercury. In this case there's, you know, clearly many sources and you need to look at

it more fully, more holistically.

MR. HARLEY: In developing your testimony, was it your assumption that in order to regulate mercury from coal-fired power plants, the Illinois EPA needed to propose and a board needed to enact a rule which would accomplish a one-to-one correspondence between reductions and emissions and levels of methylmercury fish tissue?

THE WITNESS: I can't speak to the exact wording of the rule. That's something I looked at and my eyes glazed over. Sorry. But basically my assumption in all of this was that what the State of Illinois wanted was to reduce the amount of methylmercury in fish. From Marcia Willhite's testimony and other sources it seemed, at least initially, that they were looking to a one-to-one relationship; that if you reduced, as I've said repeatedly, by -- say a factor of "X" the amount of emissions from a coal-fired power plant, the same reduction of "X" methylmercury in fish. And I continue to repeat that that's not something that will occur.

MR. HARLEY: Dr. Chapman, setting aside the issue of one-to-one reduction, to clarify the record, it is your testimony that CAMR/CAIR 2010 reductions plus

the reduction that would be added on by the Illinois rule would, in your opinion, lead to some reductions in methylmercury levels in fish tissue?

THE WITNESS: And just to clarify, what you're talking is the U.S. EPA plus the additional from IEPA? There would be some reduction. How much I can't say.

MR. HARLEY: Thank you, Doctor.

HEARING OFFICER TIPSORD: Question No. 6.

THE WITNESS: What is the basis of your opinion as stated on Page 7 of your testimony that, "other local sources of mercury will have inputs to different waterbodies that likely are, in some cases, greater than these from coal-fired power plants"?

Answer: As noted in my answer to Question 2, there can be a variety of other sources of mercury to waterbodies. In come cases mercury from these sources to those waterbodies will be greater than that coming from atmosphere sources including, but not restricted to, coal-fired power plants. For example, I personally experienced with contaminated site assessments where elevated levels of mercury in waterbodies were primarily related other inputs than atmospheric.

MR. KIM: Couple of questions: First of all, when you state -- make reference to other local sources of mercury, what are you specifically referring to?

THE WITNESS: Other sources of -- I'm sorry. Atmospheric or local sources.

MR. KIM: Just the reference that you have in your testimony. I believe the quoted portion from the question states other local sources of mercury will have inputs to other waterbodies.

THE WITNESS: Basically it depends what's there. If you have alkaline plant there you'll have mercury coming out. Mills have a lot of mercury. If you've got, as I mentioned before, pharmaceuticals, disposal of substance containing mercury, hospitals, dentists, you know, major source of mercury from the amalgamum and so on. Atmospheric deposition can come from other areas as well. But, you know, locally you can have some very big differences, and the sources can overwhelm anything that comes in from the atmosphere for any source. And we've seen that repeatedly in contaminated sites assessments and other similar assessments.

MR. KIM: And if it's all right with the

hearing officer, Dr. Hornshaw has a follow-up question that I won't do justice to.

DR. HORNSHAW: We have of what we call special mercury advisory for waterbodies that are significantly worse than the rest of the bodies of the state where we have a state-wide advisory. The state-wide advisory cautions women of childbearing age and children under 15 to eat no more than one meal per week of any predator species, and then the special mercury advice is more restricted than that; for women of childbearing age and children usually a recommendation to eat no more than one meal per month. And we also have recommendations for the general population as well. We have 14 bodies of water and one entire river system on a special mercury advisory. So I was wondering, in these waters where we already know conversion of methylmercury is substantial, what would you expect as a percent reduction in those waters from the reductions that we're talking about from the CAMR rule and -- the CAMR rule plus the Illinois rule.

MR. BONEBRAKE: Just for clarification we've been asking some questions about the impact in the aggregate of CAMR and the Illinois rule. And when these questions had been presented, I had been assuming that

they're asking for the aggregate impact of CAMR reductions across the nation and not just Illinois. Is that the predicate for your question, Dr. Hornshaw?

DR. HORNSHAW: Yes. But directed towards specific waterbodies rather than the entire state where we already know we have a problem.

THE WITNESS: Okay. I cannot say because, first of all, I don't know exactly where those waterbodies are in relation to other -- to potential sources of different types. So I don't know the relative importance. It's so hypothetical it's -- I can't really say, I'm afraid.

MR. KIM: Dr. Hornshaw, to, I guess, set up his question to you, repeated information that had been, you're lucky you weren't here for the entire, that he had previously provided either through oral testimony or through prefiled testimony. I guess were you, in the course of preparing for the hearing today, were you familiar with the background facts and the different advisory levels that he just described in his preface to his question to you?

THE WITNESS: I've looked at the different advisory levels, but I haven't looked in detail at each of the sites in which they apply.

HEARING OFFICER TIPSORD: Question No. 7.

THE WITNESS: Question 7: In your professional opinion, what are the most important factors to mercury bioaccumulation in fish tissue and how would you recommend those factors be controlled in order to reduce mercury levels in fish tissue?

Answer: There are many factors that affect mercury bioaccumulation in fish including a source of biodegradable inorganic mercury and proceeding through to production of methylmercury and it's uptake by fish via their diet. Site specificity is critically important related the conversion of inorganic mercury to methylmercury. Reducing mercury levels in fish is best accomplished by reducing the levels of methylmercury that are available to them via their food in the waterbodies they live in. Research on this issue is continuing. For example, as stated in my written testimony based on very recently published research, quote, decreases in sulfate deposition alone with no changes in mercury inputs could result in lower methylmercury levels in fresh water fish, end quote. Thus the apparently obvious approach to reduce mercury levels in fish tissue, namely by reducing inputs of inorganic mercury aquatic systems, may well not be the

best approach. At this point in time given the advancing state of mercury research, it is not clear what the best approach or combination of approaches is and whether such are best-applied generically or site specifically.

HEARING OFFICER TIPSORD: Mr. Kim?

MR. KIM: When would you imagine from a scientific standpoint you would research or theories would advance to the point that you would have a better idea of what the best approach is.

THE WITNESS: Two comments: First of all, we never have absolute certainty in science and we're often blamed for saying we need more data. But you can reach a reasonable level of certainty. The research I'm quoting just came out a couple of months ago in a very prestigious journal. It was quite exciting. There seemed to be a number of breakthroughs occurring nowadays that may lead us to have information sufficient once you have, in this case of Illinois, a good understanding where the sources are, what's coming and what's happening, to make some decision in maybe a few years, reasonable decision in maybe a few years. This may well be possible.

MR. KIM: Do you understand, however, that

the Illinois -- that the State of Illinois acted within the confines of the directives of the federal CAMR does not have that period of time to act in a manner so that the state could have its own plan, is that correct, based upon your understanding?

MR. BONEBRAKE: I'm just going to object to that to the extent that it calls for a legal conclusion. But you can answer, Dr. Chapman.

THE WITNESS: I was going to answer. As I said, the regulations and rules, you know, not my thing at all by any means.

But just comment generally that I've had a number of cases in my career where I've watched things occur which seemed to be the obvious solution, and a lot of time and money was expended on them and it turned out to not be the obvious solution. A good example is in Canada where we've done a lot of work with the pulp mills, and the issue there was deformed fish, fish with lesions and so on. And they went to various high levels of treatment, but that did not obviate the problem. They spent all this time and money and energy. And then there was no time, money, and energy to dedicate what turned out to be the real problems and address them. So my personal concern, I speak personally now, not as a

scientist, is that we not rush into things, and maybe we need to take the time to make sure we don't make the mistakes and lose the opportunity to fully address the issues that need to be addressed. My personal opinion.

MR. KIM: Do you believe that if a state decides to engage in an initiative such as the Illinois Mercury Rule, that it's the State's responsibility to conduct that science and research before they go forward with some kind of proposition?

THE WITNESS: I cannot speak as to whose responsibility it is, but -- in a legal sense. But I would think simply in a human sense that if you're going to put something forward and it's going to make a heck of a difference or you hope it's going make a heck of a difference, you'd have enough research to be absolutely sure that it was going to occur.

MR. KIM: Do you have any understanding or any knowledge as to the resources available to the State of Illinois to conduct the type of research and study that you're referring to?

THE WITNESS: I do not.

MR. KIM: Do you have any idea how much -- You said you're referring to Canada, the studies concerning pulp mills. Do you have any estimate as to

how much from a financial standpoint conducting those types of studies or data collection, how much that would cost?

THE WITNESS: I don't.

HEARING OFFICER TIPSORD: Dr. Chapman, I'm kind of curious, because a couple of times you've talked about the lack of data to support the Illinois rule as far as to do a correlation between reducing the mercury emissions and methylmercury in predator fish. Would you agree then that that would be true also of the federal rule? Because it seems to me a lot of the basis of what's in Illinois is actually natural information. Do you also believe that the CAMR rule may be premature because of lack of data?

THE WITNESS: I can't say because I haven't looked into that in any great detail. As I mentioned, my areas of expertise are scientific. I tend to avoid looking at rules, per se, unless I have a reason to do so.

HEARING OFFICER TIPSORD: Mr. Harley?

MR. HARLEY: In answering the last question and also in your prefiled testimony, you stress the potentially important rule of sulfates in waterbodies and producing methylmercury created conditions; is that

correct?

THE WITNESS: Yes.

MR. HARLEY: Do the emissions of coal-fired power plants also contribute sulfates, sulphate deposition into waterbodies?

THE WITNESS: I'm not sure.

MR. HARLEY: Another question I'd like to ask you is also related to the prefiled testimony in the way that you've framed the question that you then answered in your testimony under Question 2. In light of your concerns about levels of certainty, in Question 2 you pose the question will reducing inorganic mercury emissions from coal-fired power plants in Illinois under the proposed rule ensure that impairment restrictions can be lifted. Would you please comment on what level of certainty is attached to the word ensure in the way you characterized your question to yourself.

MR. BONEBRAKE: Just for clarification, you're referring to Question No. 2 on Page 2 of his testimony.

MR. HARLEY: Thank you, Mr. Bonebrake. I am.

THE WITNESS: Basically I'm looking for not 100 percent certainty because, as mentioned, we never

get that in science, but a reasonable level of certainty. And one of the issues related to Question 2 is that the mercury is not the only factor causing impairment. We also have PCBs which are not addressed by the proposed rule.

MR. HARLEY: And also later your question can be lifted for waterbodies. Did you mean for all waterbodies or any waterbody, especially in light of the high variability in waterbody conditions?

THE WITNESS: I'm talking about waterbodies generically across the state of Illinois.

MR. HARLEY: Is it possible that restrictions could be lifted for some and not others?

THE WITNESS: I would not be surprised if that were the case. You know, if you had substantial reductions in mercury inputs from all sorts of sources, it's still -- in some cases you will have mercury, as I mentioned, in the deeper sediments that will still be cycled through and forming methylmercury, and it'll vary site specifically. So I would not expect total uniformity. I'm talking generically.

MR. HARLEY: And when you talk about the proposed rule in the way that you phrase Question 2 to yourself, when you say the proposed rule, did you mean

CAMR/CAIR 2010 plus the Illinois rule?

THE WITNESS: I was talking about the Illinois rule.

MR. HARLEY: The reductions that would be achieved through the Illinois rule alone.

THE WITNESS: By the Illinois rule over and above CAMR.

HEARING OFFICER TIPSORD: Mr. Rao?

MR. RAO: Dr. Chapman, on Page 10 of your testimony, actually it was referenced to in Question No. 10, you state that there is no consistent relationship between total mercury concentrations in sediments and mercury concentrations, primarily metal mercury, in fish tissues of impaired waters. Are you aware of any peer review studies dealing with the relationship between total mercury concentration in sediments and mercury concentration in fish tissues?

THE WITNESS: There have been a number of studies that have looked at the total mercury concentrations in sediments, but realize it's inorganic and methylmercury combined. Ideally what you want to do is measure the methylmercury concentrations in sediments. I've been involved in a number of these where you look at the methylmercury concentrations in

sediments. You look at them in the creatures eating the sediments, and then you try to relate it back to fish. And if you're looking at it in terms of methylmercury, then you can draw up some reasonable conclusions. But in terms of total mercury which includes inorganic and organic, there's nothing that's really reached reasonable conclusions in the literature that I'm aware of.

MR. RAO: So it would make more sense to analyze the relationship between methylmercury rather than total mercury?

THE WITNESS: Yes. Because that's what you're concerned about. And as Marcia Willhite said and pointed out in her testimony, the concentrations, well to proportion of methylmercury in sediments compared to total mercury can be quite variable in different sediments, in different circumstances. What you're concerned about is not the inorganic mercury. Inorganic mercury effects will be acute, and you have to have very high concentration to have an acute effect. They do not biomagnify. They do not move through the food chain. And inorganic substances are taken out by organisms through a very different process of passive diffusion rather than accumulation through the lipid, through the

fat, which the methylmercury has. It's a totally different ball game, so to speak. I could go on, but I won't bore you.

MR. RAO: Thank you.

HEARING OFFICER TIPSORD: Mr. Kim?

MR. KIM: Just to back up a little bit. Where Mr. Harley was asking you a question about different advisories, is it your understanding that in Illinois we may have waterways that have advisories that would be specific as to mercury, and we may have other advisories that may be based upon combination of mercury and PCB levels?

THE WITNESS: I believe there are waterbodies where mercury is the major issue, possibly the only issue, and others where it's mercury and PCBs. But, again, I haven't looked into that extensively.

MR. KIM: As to the waterbodies that may have a mercury-only designation in terms of being identified in the advisory, is it possible then that if mercury emissions were limited in the matter that's being proposed by the Illinois rule, that some or a number of those waterways may be able to have that mercury-only advisory lifted?

THE WITNESS: Can you clarify? Are you

talking about the CAMR plus the rule, or are you talking only about the rule?

MR. KIM: Well, I guess -- and I'm just sort of following up on your testimony. I'm -- And maybe this is just a little problem I'm having in my head. But obviously under -- and I'm not trying to testify, but my understanding is under the federal scheme, CAMR will be in place for any state that does not decide to adopt its own rule. So I guess when people are saying CAMR plus Illinois or Illinois alone, I'm having, in my mind, a hard time distinguishing -- I'm speaking in terms of the Illinois rule while not attempting to take a blind eye to the fact that whatever states decide to vote on CAMR go and vote on CAMR. So in my mind I'm not sure how to make that distinction when people are saying, well, Illinois rule plus CAMR or just the Illinois rule. I'll let you try to make that distinction if you want to try.

MR. BONEBRAKE: Just a point of clarification, if I will, Mr. Kim. One of the conceptual differences is CAMR is a rule of national applicability, so it may create emission reductions in other states. And we've had a lot of testimony in this proceeding regarding transport of mercury. So I think

there probably, and I'm not going to testify either, but there are potential differences in an Illinois-rule-only scenario versus Illinois rule plus the impact of rules adopted in other states. And I guess that was the point of distinction that I was trying to raise earlier in my clarification that I had raised and I think you're now addressing.

HEARING OFFICER TIPSORD: If I may, if I may. I think we established earlier with Dr. Chapman that what the modeling approach that he looked at from Krish's testimony was the CAMR rule implementation versus CAMR rule plus Illinois. And so I think that when we're asking these questions, we are looking to what you looked at, Dr. Chapman, and based on what you looked at using Krish's modeling. Am I adequately addressing that?

MR. KIM: That's fair.

HEARING OFFICER TIPSORD: So I think when we're all asking these questions, we're all asking you to use the modeling data you used in forming the basis of your testimony and asking questions that further clarify that.

THE WITNESS: Just to clarify, Madam Chair. So unless it's specifically stated otherwise, I will

assume despite the wording of the question that what they're talking about is the 4 percent difference in deposition that Krish talked about. Is that okay?

HEARING OFFICER TIPSORD: That's fine.

THE WITNESS: I do need the question again because I've lost it at this point. You might want to rephrase that. I'm not sure.

MR. KIM: I'm trying to backtrack in my head to find out what the question was. I think the question was would you expect, I'm going to speak generically, under the Illinois rule with the understanding that the hearing officer has just provided, that it is possible that some of the waterways in the State of Illinois that have been identified under a mercury-only advisory would be able to have -- would be able to have that advisory lifted as a result of the implementation of the Illinois rule?

THE WITNESS: It's possible. Anything is possible. Given there's only a 4 percent difference in deposition between CAMR and the rule, you'd have to be awful close to the level in terms of methylmercury in fish and you'd have to have a waterbody that was really just a tipping point for that to occur. So it's possible, but would it occur in a lot of areas? No. As

I've stated before, I'm not looking for -- I don't believe in my professional opinion that 4 percent deposition difference will result in a measurable across-the-state difference in the methylmercury fish, but variations do occur in waterbodies.

HEARING OFFICER TIPSORD: Question No. 8.

THE WITNESS: In Section 4.0 of your testimony on Pages 9 and 10 you state that, "The relationship between the power plant mercury emissions and mercury in fish in Illinois can be assessed using two key pieces of information: Sediment mercury data and fish tissue mercury data." You further state, "there is no consistent relationship between total mercury concentrations in sediments and mercury concentrations in fish tissues of impaired waters." How would you explain the very wide-spread occurrence of elevated mercury fish tissue levels; i.e., two-thirds of the Illinois waterbodies have been tested?

Answer: My statement was that, quote, "there is no consistent relationship between total mercury concentrations and sediments and mercury concentrations in fish tissues," end quote. I was addressing the fact that it's not a one-to-one; i.e., a linear relationship. It is clear from the data that

fish in Illinois have accumulated tissues. Their widespread occurrence is likely a result of numerous types of mercury inputs in the aquatic environment as addressed in Question 2, coupled with conditions appropriate for methylmercury production and its assimilation into the food chain.

HEARING OFFICER TIPSORD: Question No. 9.

THE WITNESS: Question 9: On pages 10 and 11 of your testimony you state that, "[coal-fired power plant] emissions cannot be directly related to mercury concentrations in fish collected from nearby waters." Why not?

For two reasons: First, because there are other courses of mercury to waterbodies; and, second, because as detailed in my testimony, emissions are of inorganic mercury while mercury in fish is largely organic mercury. I previously noted in my written testimony the complexity of the relationship between inorganic mercury in waterbodies and organic mercury in fish in those waterbodies.

HEARING OFFICER TIPSORD: Question No. 10.

THE WITNESS: Question 10: On Page 11 of your testimony, you state that "Illinois' proposed rule would only result in a 4 percent reduction in deposition

in Illinois from Illinois coal-fired power plant emissions compared to CAMR." What percent reduction in deposition would occur under CAMR from units that buy credits to comply rather than control?

I have no idea. This isn't my area of expertise. As noted in my written testimony and previously in my verbal testimony, I relied on Dr. Vikayaraghavan's testimony for the 4 percent value.

HEARING OFFICER TIPSORD: Question No. 11.

THE WITNESS: No. 11. By your answer to the second question you pose in your testimony, are you recommending that Illinois not aggressively address the 26 percent of waters currently listed as impaired only for mercury?

Answer: I am making no policy recommendations. My written and present testimony deal only with scientific realities.

HEARING OFFICER TIPSORD: Question 12.

THE WITNESS: Question 12: The Illinois EPA's technical support document (TSD) states that the average mercury concentration of 397 largemouth bass samples collected between 1985-2004 is 0.17 or 0.19 milligram per kilogram, depending on how non-detects are treated (TSD, Pages 62-63.) Further, Dr. Hornshaw

submitted tables showing that approximately two-thirds to three-quarters of all waters with fish sampled for mercury between 1998-2001 had predator species that would require a consumption advisory. Give this information, would you agree that more than 26 percent of the state's waters might be impaired due to mercury?

The answer: I would agree there are a number of waterbodies in Illinois that have fish with mercury concentrations above consumption advisory level. Exactly what percentage of the state's waters is currently involved, I cannot say given that Dr. Hornshaw's data series stops at 2001, and given that the state has not sampled all the waters in Illinois. Designation of impairment is a decision and that is not my area of expertise.

MR. KIM: When you reviewed the technical support document and Dr. Hornshaw's testimony, and this sort of falls into something that Dr. Hornshaw asked you previously, do you have an understanding as to the method by which Illinois conducts fish sampling, and specifically how it conducts the process that it follows to conduct mercury sampling in fish tissue?

THE WITNESS: I read it. Candidly, I've been holidays for over a week, and I can't recall it at

this point.

MR. KIM: Do you recall in your review of the testimony or the transcripts reference to a program entitled the Illinois Fish Contaminant Monitoring Program?

THE WITNESS: I recall reading about and seeing that program mentioned, yes.

MR. KIM: Maybe just to jog your memory, I'm going to -- I'd like to ask you just some basic leading questions concerning the program just to sort of see if you can pick it up where it is I'm trying to go here.

Do you recall that under that program, which I will go by the acronym FCMP, that there's a criteria or there's a policy, rather, that two or more samples that exceed a criterion for fish tissue are necessary for issuing or changing an advisory?

THE WITNESS: I don't recall.

MR. KIM: Do you recall or do you have any recollection based upon your review of that program any inherent limitations concerning the number of fish that would be sampled through an implementation of that program?

THE WITNESS: To answer that question correctly, I'd have to go back and look through it and

provide you with a full answer. I'd be very reluctant to do so based on my limited recollection having read that a couple of months ago.

MR. KIM: Okay. If your review of your -- that information resulted in your conclusion that it is very possible that more Illinois waterways are impaired due to mercury but have not been specifically identified under the FCMP, would that change your testimony in any way?

THE WITNESS: That's a hypothetical question, but it wouldn't change my testimony in any way because the bottom line for my testimony is simply that there's this big disconnect between the amount of inorganic mercury coming from coal-fired power plants and the assumption that there's a linear reduction in the amount of methylmercury in fish in waterbodies.

MR. KIM: Okay.

HEARING OFFICER TIPSORD: Question No. 13.

THE WITNESS: Would the information presented above change your answer to your second question regarding lifting impairment listings for mercury?

Answer: No, it would not. As I noted in my written testimony and as Marcia Willhite's verbal

testimony confirms, the amount of methylmercury in fish is site specific and is not related simply to the amount of inorganic mercury that's deposited to waterbody.

HEARING OFFICER TIPSORD: Question 14.

THE WITNESS: In Table 2 of your testimony there are several entries in which two fish mercury samples having the same concentration are paired with two different sediment mercury values; e.g., lines 3 and 4 for the 1988 Jackson County samples. Do the two sediment values represent the averages for the 2.5 years before and after the 1988 fish sample or something else? Are the two fish values of 0.167 milligram per kilogram for a single sample, two samples, or all samples collected from Jackson County in 1988?

Answer: The duplicate samples reflect multiple sites within the same county for which different fish samples with the same value were collected but different sediment values. Specifically for the samples with 0.167 milligram per kilogram of mercury there were two sites with different GPS coordinates that both show the fish tissue concentration but the sediment mercury concentrations of those sites different. The other duplicates were also due to multiple sites with identical averages.

HEARING OFFICER TIPSORD: Question 15.

THE WITNESS: There are two 1990 Cook County samples in Table 2 having a fish mercury concentration of 0.47 milligram per kilogram and sediment values of 0.061 and 0.1 milligram per kilogram, and there's a 1990 Cook County fish sample in Table 3 also having a mercury concentration of 0.47 milligram per kilogram but with a sediment mercury value of 0.074 milligrams per kilogram. If this is the same fish mercury sample, please explain the discrepancy between the list of sediment mercury values.

Answer: My apologies. This discrepancy is due to an averaging error that occurred. When the calculations were being done for Table 2, one value was inadvertently excluded from the average. The fish tissue value is correct at 0.47 milligram per kilogram, but the sediment value should be 0.074 milligram per kilogram as in Table 3, not 0.061 milligram per kilogram. They should be one value for 1990 with fish tissue at 0.47 and sediments at 0.074. I apologize for this error, but note that it has no material effect on my written testimony.

MR. BONEBRAKE: Prairie questions.

THE WITNESS: Question one: Do you expect

that a 90 percent reduction mercury emissions from Illinois power plants will result in similar reduction of methylmercury concentrations in fish in Illinois? If not, why not?

Answer: No, I do not. Because, as explained in my written testimony, the relationship between deposition of inorganic mercury from power plants and other sources and accumulation of organic mercury in fish is complex, site specific, and very highly unlikely to be linear.

HEARING OFFICER TIPSORD: Question 2.

THE WITNESS: Do you believe there is a linear relationship between mercury reductions in power plant emissions and mercury reductions in fish tissue?

Answer: I do not.

HEARING OFFICER TIPSORD: Question 3.

THE WITNESS: Do you believe that a 90 percent reduction in mercury emissions from coal-fired power plants in Illinois will cause a water restriction for mercury to be lifted in Illinois? If not, why not?

Answer: No, I do not for two reasons which are fully -- which are explained more fully in my written testimony. First and foremost, coal-fired power plants in Illinois are not the only sources of inorganic

mercury to Illinois waters. Some reduction in mercury in Illinois waters would be expected due to reductions in mercury emissions. But such reduction is not expected to be immediate or to have a linear relationship to any reduction in air emissions as previously stated in my testimony.

Second, it would be difficult to predict the level of reduction in the aquatic environment and time frame for any such reduction due to the fact that mercury is an element and does not biodegrade with the tide. So reducing one of the sources cannot be expected to reduce levels already in the aquatic system. Mercury impairment, TMDL classifications for Illinois waterbodies are a reflection of numerous inputs to the environment natural and manmade over a long period of time. Reducing one input that is not directly related to the total concentrations already in the waterbodies will not, in my opinion, result in the lifting of mercury TMDL fish consumption restrictions.

HEARING OFFICER TIPSORD: For the record, those last three questions are from Prairie State Generating Company. Is there anything else for Dr. Chapman?

MR. BONEBRAKE: If I may have just a moment. No further questions on our end.

HEARING OFFICER TIPSORD: Anything else?

MR. KIM: No. We hope Dr. Chapman gets to enjoy the rest of his holiday.

HEARING OFFICER TIPSORD: Dr. Chapman, thank you very much. We appreciate your taking the time to be with us.

THE WITNESS: Thank you.

HEARING OFFICER TIPSORD: We'll take a ten-minute break.

(Short break taken.)

MR. BONEBRAKE: Madam Hearing Officer, I would tender the written testimony of Dr. Gail Charnley.

HEARING OFFICER TIPSORD: We will enter this as Exhibit 130. Seeing no objection, this is Exhibit No. 130.

MR. BONEBRAKE: I think Miss Charnley had a short introduction and then she was going to turn first to the questions of IEPA.

THE WITNESS: As advertised, I'm Gail Charnley, and I am a toxicologist. I have a Ph.D. in toxicology from MIT. I've spent the last 30 years studying the relationships between chemical exposures

and adverse health effects. I'm a risk analyst. I have been the director of the Toxicology and Risk Program at the National Academy of Sciences. I've been the executive director of the Presidential Congressional Commission on Risk Assessment and Risk Management. I've been the president of the International Society For Risk Analysis. And I now work part-time on a consulting basis.

So as to the questions. No. 1: Prior to this rule-making, have you ever provided expert testimony on the relationship between power plant mercury emissions and fish methylmercury concentrations?

Yes. I provided expert testimony to the Pennsylvania State Senate Environmental Resources and Energy Committee on June 6, 2006; to the Idaho House Environment Energy and Technology Committee on March 2, 2006, and to the Montana Governor's Board of Environmental Review in September of 2005. I had an informal conversation about that subject with Illinois legislators on March 16, 2006, and I've been invited to make a presentation to the Pennsylvania House Environment Resources and Energy Committee in September.

1B: Have you ever conducted and published any scientific research on the relationship

between power plant mercury emissions and fish methylmercury concentrations?

Answer: I no longer conduct laboratory research. I have published two articles on power plant mercury emissions and fish methylmercury concentrations. The American Council on Science and Health published a report on power plant mercury emissions and fish methylmercury concentrations using some of the information from one of my articles.

1C: Have you ever conducted and published any scientific research on the toxicology of methylmercury?

Answer: I have a Ph.D. in toxicology from MIT. I have published two articles on the toxicology of methylmercury. I have studied the relationship between chemical exposures and public health for over 30 years.

1G: Have you ever conducted an environmental health risk analysis of power plant emissions for any of the coal-fired power plants in Illinois?

Answer: Not in Illinois, no.

1E: Were you asked by the National Research Council/national Academy of Sciences to provide

an independent review of any draft versions of the report entitled Toxicological Effects of Methylmercury (2000)?

Answer: No. I was employed by the Academy during part of the time that that committee deliberated, so it would have been considered a conflict.

Question No. 2: How do you reconcile the statement in your testimony on Page 2 that "About half of global mercury emissions are naturally occurring" with the cited source for this information (see footnote No. 1) which indicates, both in text and in a pie-chart, that only one-third of mercury emissions are naturally occurring?

Answer: The cited source also says that its estimates of emissions are highly uncertain. I should also have included Pacyna, et al., P-A-C-Y-N-A, et al, 2003, Friedli, et al., F-R-I-E-D-L-I, 2003, and Pyle, P-Y-L-E, and Mather, M-A-T-H-E-R, 2003, as sources. Based on those sources about 55 percent of global emissions can be attributed to natural sources. That estimate is higher than EPA's -- USEPA's because of higher estimates for mercury emissions from volcanoes and forest fires. My statement that, "about half" of

emissions are naturally occurring lies somewhere between the two estimates and is intended to reflect their inherent uncertainty.

Question 3: Do you dispute that the National Research Council's Committee on the Toxicological Effects of Methylmercury produced a recommendation on the reference dose for methylmercury exposure that supported USEPA's numerical value of 0.1 micrograms per kilogram per day?

Answer: The Academy Committee produced an RFD recommendation, yes, but the suggested RFD does not fully support the USEPA position. USEPA developed its current reference dose with an uncertainty factor of 10 for within human variability and a one-fold factor for data base gaps. In contrast, the NAS panel suggested an uncertainty factor of three-fold for human variability with an additional three-fold for data base gaps (both of these factors, when put together, result in a ten-fold factor). Although the total factor is the same in both cases, the reasons for the factors are different.

MR. BONEBRAKE: Just for clarification, Dr. Charnley, your shorthand RFD, is that short for reference dose?

THE WITNESS: RFD is shorthand for reference dose.

HEARING OFFICER TIPSORD: Mr. Harley?

MR. HARLEY: Good morning, Dr. Charnley. My name is Keith Harley. I'm an attorney representing a group called Environment Illinois.

Dr. Charnley, are there any potential benefits at all that can be achieved by regulating mercury emissions from coal-fired power plants?

THE WITNESS: I should think so, but I'll get to that when we talk about benefits. I was going to go through my questions here. Is there something -- Is there a question you had related to the National Academy of Sciences report?

MR. HARLEY: I'm referring to the first part of your testimony in which you question many of the assumptions which would underlie both the federal rule and both the Illinois rule in terms of the benefits being achieved by regulating mercury emission from coal-fire power plants. I'm just wondering in light of those fundamental questions you have about the value of regulating those emissions, do you see that there is any benefit whatsoever to be achieved by regulating these emissions?

MR. BONEBRAKE: Just so it's clear, you mean any regulation, or are you referring, Mr. Harley, specifically to the Illinois rule?

MR. HARLEY: Any regulation whatsoever.

THE WITNESS: I think reducing methylmercury emissions from power plants and other sources is a good idea in general, yes, and I'll be talking about this much more specifically as we go along.

MR. HARLEY: Just one follow-up quickly. From power plant specifically?

THE WITNESS: Yes.

MR. HARLEY: Thank you.

HEARING OFFICER TIPSORD: Question No. 4.

THE WITNESS: On Page 4, you state that "Figure 24 in the Florida report shows clearly that between 1994 and 2000, the time period of interest, there was no decline in deposition." Do you disagree with the assertion that the plot shows a general decline from 1994-1999, as well as an overall decline for the longer time period of 1994-2002?

HEARING OFFICER TIPSORD: Excuse me, Dr. Charnley. Before you answer that, just for purposes of the record, the Florida report referenced there is the Florida report that is in the Board's record. It's

the integrating atmospheric mercury deposition with aquatic cycling from South Florida from the Florida Department of Environmental Protection.

THE WITNESS: Thank you.

Answer: I don't disagree with that assertion. What I dispute is the relevance of the statement on Page 78 of the Florida report that deposition of mercury at one site declined by 25 percent between 1994 and 2002. That is the statement used to support a relationship between emissions, deposition, and fish. The problem is the fact that the TSD includes fish data from Florida that support its position and excludes fish data that do not.

HEARING OFFICER TIPSORD: Question No. 5?

THE WITNESS: In regard to the Florida and Massachusetts studies, do you contend that the results are scientifically invalid because they weren't published in a peer-reviewed journal (see Page 6)?

Answer: In my testimony on Pages 4 and 6, I merely state that those studies have not been peer-reviewed or published in peer-reviewed scientific journals. Publication is not related to scientific validity. The results may be valid. The way Illinois EPA is using them is not.

MR. MATOESIAN: Could you explain what you mean by not valid?

THE WITNESS: Well, the TSD only uses the fish methylmercury data from two sites: From the Florida report where, in fact, methylmercury levels did decrease. But the study itself looked at 12 sites in Florida, and in some of those sites methylmercury levels didn't change, and in one of them they actually -- it actually went up. So I thought that representing the Florida study as showing methylmercury decreases given that it did in some cases and it didn't in others didn't convey the full weight of the scientific evidence.

HEARING OFFICER TIPSORD: Question No. 6.

THE WITNESS: You state that "reducing mercury emissions should not be oversold as a means of improving public health and protecting children in general" (Page 8). How would you define an "oversold" situation for Illinois?

Answer: The implication made in the TSD is that reducing Illinois power plant mercury emissions by 90 percent will reduce Illinois fish methylmercury concentrations by 90 percent and that this will reduce health risks for methylmercury. As most Illinois residents, methylmercury exposure is unlikely to come

from Illinois fish, a reduction in health risk as a general matter is unlikely. If there is a group of people in Illinois who subsist on mercury contaminated Illinois fish which the TSD has not clearly established and conditions are such that reducing Illinois power plant emissions does reduce fish methylmercury concentrations in the particular fish consumed by that particular group, a reduction in risk is certainly possible for that group. Extrapolating from that theoretical situation to Illinois residents in general is what I mean by oversold.

For example, the August 6 edition of the Chicago Tribune states, "Governor Rob Blagojevich proposed some of the toughest mercury pollution controls for utilities in the nation. He did so, he said, in response to a frightening Tribune series on mercury contamination in fish. The Tribune series to which he referred was based on seafood for sale in Chicago area stores, not on Illinois freshwater fish and subsistent fishers. His proposed rule will have no impact on methylmercury levels in seafood at the supermarket.

HEARING OFFICER TIPSORD: Mr. Harley?

MR. MATOESIAN: First, where in the TSD were you referring to a direct 90 percent reduction equated

to a 90 percent mercury reduction?

THE WITNESS: Well, I note that first the TSD establishes that in order to achieve the goal, which I read as being making it possible for all women of childbearing age and children in Illinois to eat as many predator fish caught from Illinois waters as they chose, that a 90 percent reduction in methylmercury concentrations would be necessary. And then the TSD goes on to say that the 90 percent reduction in emissions is the goal of controlling the emissions. So their juxtaposition led one to conclude, well, that is -- by reducing emissions by 90 percent there seems to be an implication anyway that that would lead to a 90 percent reduction in methylmercury concentrations in predator fish.

MR. MATOESIAN: So it wasn't an actual statement. It's an inference?

THE WITNESS: No, not as I recall. But the way that they're juxtaposed and presented together certainly implies that they're related.

MR. MATOESIAN: Are you aware that Illinois, for instance, has a large menu of programs to reduce mercury in the environment?

THE WITNESS: I'm not familiar with all of

Illinois's menu to reduce mercury in the environment, no.

MR. MATOESIAN: And I can't remember if you were at the June hearing in Springfield or not.

THE WITNESS: No.

MR. MATOESIAN: Where Dr. Keiler went over deposition in great depth, and I believe his assumption or his studies cited roughly a 70 percent reduction in mercury.

THE WITNESS: In deposition.

MR. MATOESIAN: In deposition from local power plants.

MR. BONEBRAKE: Are you presenting a question, Mr. Matoesian?

MR. MATOESIAN: I was questioning whether she was -- excuse me -- familiar with that testimony.

THE WITNESS: I read it, but I don't remember. What I'm talking about is what's in the TSD.

MR. MATOESIAN: Now, would you agree that the goal of public policy, though, should be to detect as many people as possible if not everyone?

THE WITNESS: Of course.

MR. MATOESIAN: And then public policy, certainly public health, should be based upon an

abundance of caution.

THE WITNESS: Reasoned abundance of caution, yes.

MR. MATOESIAN: And you stated that the fish at the supermarket which generally would not be locally-caught fish, wouldn't be affected. I believe that was in the Chicago Tribune article. But shouldn't Illinois do what it can within its jurisdiction? I mean you wouldn't expect us to regulate internationally-caught fish, would you?

THE WITNESS: I wasn't implying that, no.

MR. MATOESIAN: Okay. But would you agree that Illinois should at least try to take care of what it can legally take care of?

THE WITNESS: Of course.

HEARING OFFICER TIPSORD: Mr. Harley?

MR. HARLEY: The language about the risk of overselling, reductions in mercury emissions from coal-fired power plants as a means to protect public health and children in general is in the context of your general concern about the lack of information about people consuming fish in Illinois; is that correct?

THE WITNESS: That's part of it, yes.

MR. HARLEY: And you indicate on Page 7 of

your pretrial testimony that there's no information available on the extent to which Illinois anglers consume what they catch; is that correct?

THE WITNESS: That is what I gathered from the TSD, yes.

MR. HARLEY: And there's no information --

THE WITNESS: In fact, it states as much, I believe.

MR. HARLEY: There's no information about the number of people who could be characterized as subsistent anglers in Illinois; is that correct?

THE WITNESS: Correct.

MR. HARLEY: What's the definition of a subsistence angler?

THE WITNESS: Well, I don't know what the dictionary definition is. When I use that phrase I think of people who catch and eat the local fish as their primary and use it as their primary protein source.

MR. HARLEY: Would one serving of fish, predator fish caught in Illinois waters be subsistent fishing?

THE WITNESS: One serving --

MR. HARLEY: Would consuming one serving of

fish per week caught in Illinois waters constitute subsistent fishing?

THE WITNESS: I don't think of that as subsistence fishing, but if there's a technical definition, I'm not familiar with it.

MR. HARLEY: Then certainly once per month would not constitute subsistence fishing, would it?

THE WITNESS: Correct.

MR. HARLEY: You're aware that there are advisories in place in Illinois for all waterbodies limit -- suggesting that people limit their fish consumption to one serving per week of fish caught in those waterbodies?

THE WITNESS: Yes.

MR. HARLEY: Do you agree with those advisories?

THE WITNESS: I haven't performed an analysis of that.

MR. HARLEY: Would you defer to people who had performed a credible analysis?

THE WITNESS: Sure.

MR. HARLEY: Are you aware that there are certain waterbodies in Illinois where there are even more stringent and specific advisories that would limit

people to one serving per week?

THE WITNESS: I'm aware that there are, yes.

MR. HARLEY: That would not -- You would not characterize that as being subsistent fishing, would you?

THE WITNESS: Correct.

MR. HARLEY: Dr. Charnley, could you describe for the Pollution Control Board your notion of the Precautionary Principal in Toxicology and Public Health?

THE WITNESS: The precautionary principal is not part of toxicology. Precautionary principal is a risk management strategy that relies on decisions that are health protective when we're uncertain about risks. But it does presuppose that we do know something about risk.

MR. HARLEY: Do the fish advisories that exist for Illinois waterways provide an adequate characterization of risk of consuming fish from those waterways in your opinion?

THE WITNESS: I don't know.

MR. HARLEY: In light of the fact that you don't know, wouldn't the precautionary principal suggest that we should resolve your uncertainty in such a way as

to protect the residents of Illinois rather than endanger them?

THE WITNESS: From the way you've asked that question, it sounds like I've said something about how there shouldn't be fish advisories. I've never said that.

MR. HARLEY: I'll withdraw the question.

HEARING OFFICER TIPSORD: Question No. 7.

THE WITNESS: You have largely focussed on the results of the Seychelles Islands studies in your discussion on methylmercury and developmental toxicity and give limited to the discussion of the Faroes Islands study and essentially none to the New Zealand study. Do you dispute the findings (regarding methylmercury-related development neurotoxicity) of the New Zealand study as described in the TSD? Do you disagree with Dr. Louise Ryan's evaluation of the modeling results for the three epidemiological studies (see technical Support Document, Appendix A, Pages 26-27).

Response: Yes. I dispute the findings of the New Zealand study as described in the TSD. The description of the findings of the New Zealand study in the TSD is inaccurate reflecting the inaccurate summary

of the study in Appendix A. The TSD describes the findings of the New Zealand study as follows: Quote, a case control study was conducted in New Zealand of 74 children representing white, Maori, and Pacific Islander ethnic groups. When tested at the age of 4, 52 percent of this group had abnormal results when compared to 17 percent of the children in the control group.

Here is how a Harvard School of Public Health report describes the findings of the same study. From the 73 women with elevated hair mercury levels, 31 children were identified and administered tests of neurologic development. Results were either questionable or abnormal in 16 subjects, 52 percent, compared to five subjects, 17 percent in the reference group. The TSD thus misrepresents the number of children involved in the study, describes results as abnormal instead of questionable or abnormal and states that more children were affected than actually were. What I dispute about the TSD's portrayal of the Ryan analysis is that it implies that IQ deficits were observed, and this is the TSD's portrayal of the Ryan analysis is that it implies that IQ deficits were observed in the three epidemiologic studies. Neither the New Zealand nor the Seychelles Island studies

reported a statistically significant IQ deficit. The Faroes Islands study did not evaluate IQ, so an estimate of an effect was made based on other studies. USEPA points out that there is only limited evidence linking IQ and methylmercury exposure. Using IQ as a surrogate for other effects allowed USEPA to monetize potential effects of methylmercury exposure for the purpose of performing its regulatory impact analysis which it is required to perform by the US Office of Management and Budget. Furthermore, USEPA relies on an assumption about the model it uses to monetize benefits that is inconsistent with the way it evaluates methylmercury risks. Because, as the USEPA puts it, it is technically more simple and practical to do so. In other words, the IQ model was chosen as a policy matter to simplify the regulatory impact analysis. This is an example, I believe, of the TSD's biased analysis; in other words, failure to describe simplifying assumptions that are based on policy, not science, and conveying the notion that a statistical analysis used to monetize benefits actually reflects a biological effect.

HEARING OFFICER TIPSORD: Question No. 8.

THE WITNESS: Has the Hibbeln, that's H-I-B-B-E-L-N (2006) work received widespread acceptance

in the scientific community? Has it undergone peer-reviewed publication?

Answer: The Hibbeln work has gone through peer review and is in press in the Lancet, one of the highest-quality medical journals in the world. I include reference to it in my testimony because it is consistent with some other studies suggesting that eating fish during pregnancy can be beneficial. That notion was not considered by the Illinois EPA. Dr. Hibbeln has published quite a number of other peer-reviewed studies on the neurodevelopmental benefits of Omega-3 fatty acids, the components of fish believed to contribute children's brain development.

Question 9: On Page 12, you state that "it is my opinion and that of many other scientists that the results of the Faroe Islands study at best should be attributed to combined exposure to methylmercury and PCBs." Is your opinion (and presumably that of others) supported by data that you have independently generated regarding breast milk PCB concentrations in the Faroes Islands study (maternal) participants? On what basis to you reject the position expressed by the NRC's Committee on the Toxicological Effects of Methylmercury in the 2000 NRC report?

Response: The NAS committee did not completely rule out a potential real for PCB exposure in the Faroes outcome because it listed PCBs as a source of uncertainty in Table 8-2 of their report. In any case, I have not rejected the Mercury Report Committee's position because the Committee did not express a position with regard to confounding by PCBs from breast milk. The Committee evaluated only prenatal exposure to PCBs, not postnatal exposure via breast milk, about which publications were occurring at the time of the NAS report. PCB exposure has been associated with poorer performance on the Boston Naming Test which is the end point upon which the NAS and USEPA methylmercury risk assessments were based. According to a report by Darsen, the level of postnatal PCB exposure in the Faroes was 18 times higher than the level associated with neurologic effects in the Lake Michigan studies. PCBs have been associated with developmental neurotoxicity in infant monkeys fed PCBs postnatally in formula at a dose equivalent to about half that experienced by the children in the Faroes.

In other words, the level of PCBs to which the Faroese children were exposed via breast milk was almost double the level demonstrated to produce

neurologic effects in infant monkeys, 18 times higher than the levels associated with neurologic effect in children near Lake Michigan, and 600 times higher than USEPA's recommended exposure limit or reference dose for PCBs. With any other similar exposure the USEPA would very likely be taking immediate action to prevent further exposure. The fact that the Faroe Islands currently has a do not consume pilot whale blubber advisory for pregnant women, the source of the majority of the PCBs in mother's milk is consistent with this being recognized as a serious health problem. A comparison of PCB and methylmercury exposures in the Faroes and Seychelles is depicted graphically in Exhibit 3 of my testimony, and we have copies of that if it's of interest; if not, if you remember it from my testimony.

HEARING OFFICER TIPSORD: Actually, excuse me, Dr. Charnley. If you have a color copy we'd like to put that in as an exhibit because I think the testimony has black and white, and since you went to all the troubling to print them out.

We'll admit this as Exhibit No. 131.

THE WITNESS: So while I can't absolutely prove that postnatal PCB exposure contributed to the

effects seen in the Faroese children, I consider it impossible to conclude that they did not based on the available toxicological information.

MR. MATOESIAN: Ma'am, did you do any independently-generated work on this?

THE WITNESS: I took the -- Well, actually, this is adapted from the 2001 paper by Darsen, et al., where he calculated intake of PCBs from breast milk using the data from the Faroese investigators. I checked his calculation independently and found my answer was the same as his.

MR. MATOESIAN: Have you done any additional independent research on this topic?

THE WITNESS: Myself, no.

MR. MATOESIAN: Okay. As PCBs tend to accumulate in the fat tissue, correct?

THE WITNESS: Correct.

MR. MATOESIAN: Not in the muscle tissue.

THE WITNESS: Correct.

MR. MATOESIAN: So you wouldn't see it in the pilot whale meat.

THE WITNESS: Not in the meat.

MR. MATOESIAN: Or in fish meat tissue. It would be in the fatty tissue of fish, right?

THE WITNESS: Right.

MR. MATOESIAN: And mild caught fish can be very lean and with fatty tissue would they not, or are they not?

THE WITNESS: I'm not an expert in fish fat.

What these data show are the PCB levels actually in the mother's milk. So they're reflecting whatever they ate from whatever fish or pilot whale source, so these are measurements.

Question 10: On Page 11 you write that, "it is not surprising that where there were fewer benefits from fish, the effects of methylmercury were more likely to be manifests". Under what circumstances, and for which particular studies, would you consider there to be fewer benefits from eating fish?

Response: There were fewer benefits from eating fish in the Faroe Islands compared to the Seychelles because people in the Faroes didn't eat as much fish as people in the Seychelles. In the Faroes, more than half the mothers reported eating between zero and two fishing meals per week with the remaining mothers classified as eating more than two meals per week. In the Seychelles, mothers ate an average of twelve fish meals per week. In addition the pilot whale

blubber consumed in the Faroes is like to be rich in Omega-6 fatty acids which compete at the cellular level for the same sites as Omega-3 fatty acids, thereby reducing the beneficial influence of the Omega-3 fatty acids found in fish.

HEARING OFFICER TIPSORD: Question No. 11.

THE WITNESS: You write (on Page 12) that, "the US Centers For Disease Control (CDC)reports that children and women of childbearing age in the US have methylmercury levels in their blood well below those that have been reported to produce adverse effects". Do you believe that this can be interpreted as a CDC claim that there are no children and women of childbearing age with methylmercury levels that have resulted in adverse health effects?

Response: I believe that the statement speaks for itself. And the representative sample of US women tested, no one had blood mercury levels that have been associated with adverse health effects. CDC states that, "All women of childbearing age had levels below 58 micrograms per liter" which identifies as the statistical lower limit on the dose associated with effects on the Faroes. CDC also states, "blood mercury levels in both the 1999-2000 and 2001-2002 subsamples

are below levels considered associated with known health effects". And, "finding a measurable amount of mercury in blood or urine does not mean that the level of mercury causes an adverse health effect."

Question 12, do you agree that the, "5 percent likelihood of poorer performance on the Boston Naming Test among children in the Faroe Islands" was associated with 85 micrograms mercury per liter in umbilical blood, not non-cord blood?

Response: I agree that that is what the National Academy of Sciences Mercury Report Committee calculated. However, this association does not necessarily constitute a causal relationship, especially because the Faroes' children had average exposures from mother's milk to the neurotoxicant PCBs at doses that were, on average, 600-fold above USEPA's reference dose. The NAS did not look at PCB exposures from mother's milk.

Thirteen: Do you contend that there is no exposure level at which women whose exposures exceed USEPA's methylmercury reference dose are "at risk" of having developmentally-impaired children?

Response: Of course not. As I state in my testimony on Page 19, the extent to which someone is

at risk above an RFD is determined by the dose response relationship, not by the fact of exceeding the RFD. This obvious error in interpretation of the RFD that all exceedances result in risk is specifically discussed and discounted in the original publication of the RFD methodology by the USEPA scientists Barns and Dorsum.

Fourteen: You discuss the Seychelles study as being negative as interpreted by the authors of the study.

Response: Yes. I provide several quotes in my testimony taken directly from the authors that are omitted by the TSD and that contradict the implications made in the TSD.

Question 14A: Please explain benchmark dose analysis and what the BMDL signifies.

Response: Benchmark dose analysis is a statistical procedure used to characterize dose response relationships. USEPA defines benchmark dose as, "a dose that produces a predetermined change in response rate of an adverse effect compared to background." The results of a benchmark dose analysis are generally used to identify a statistical lower confidence limit or BMDL on a dose associated with an adverse effect for the purpose of estimating a level of exposure considered to be

without adverse effects such as a reference dose.

When data are considered negative as in the Seychelles study, a benchmark dose cannot be calculated because it would be infinite. However, a BMDL can be calculated reflecting the nature and power of the experimental design. When it is possible that there is no effect of treatment, a BMDL reflects overly the statistical constraints imposed by the experimental design. Even when data are negative, an effect cannot be completely ruled out because exposure could have caused a small increase in an adverse health effect that was not detected for some reason. That case a BMDL represents a precautionary health protective value that could be used as the basis of a reference dose for health protective policy reasons. It's not a real number reflecting a measured effect. It's a statistical creation generated for policy reasons.

Question 14B: Are you aware that the Seychelles investigators have published a BMD analysis of their results in the children at 66 months of age and more recently at 9 years of age?

Response: Actually, their analyses produced BMDLs, not BMDs. As I just pointed out. You can't calculate BMDs from negative studies.

14C: Are you aware of statement from the van Wigngaarden, that's V-A-N, new word W-I-G-N-G-A-A-R-D-E-N, et al., in neurotoxicology which is in press and available on-line "benchmark mercury concentrations of around 20 parts per million in maternal hair from the nine-year follow-up of the Seychelles cohort are slightly below...estimates previously reported for this cohort at 66 months follow-up. Additionally, they are within the range of benchmark findings reported for the Faroe Islands and New Zealand"?

Response: That question is an example of how the IEPA has effectively mischaracterized the conclusions of the investigators themselves. What the authors actually state is, "In conclusion, benchmark mercury concentrations of around 20 parts per million in maternal hair from the nine-year follow-up of the Seychelles cohort are slightly lower but not meaningfully different from estimates previously reported for this cohort after 66 months of follow-up".

D --

MR. MATOESIAN: Excuse me, but they are within the range of benchmark findings reported for the Faroe Islands and New Zealand. You don't dispute that?

THE WITNESS: I don't know what you mean by within the range.

MR. MATOESIAN: Well, the second sentence in that quote.

THE WITNESS: They're within the range of benchmark findings reported for the Faroe Islands and New Zealand. I guess I have to say I don't have an opinion on that because I don't know who within the range means here. And they're in the same order of magnitude, yes.

D, are you aware of the following statement from the Seychelles investigators (Davidson, et al., neurotoxicology, in press, available on-line): "Secondary analyses have generally supported the primary analyses, but more recently have suggested that latent or delayed effects might be emerging at exposure above 10 to 20 parts per million as the child matures"?

Response: Yes. The authors also state the following: "These nonlinear analyses suggest that the Seychelles study must consider the potential for adverse effects of prenatal methylmercury exposure at maternal hair levels above 10 to 12 parts per million, but the numbers of observations in that exposure range are limited. One possible interpretation of these

results is that adverse effects may be emerging as children enter adolescence...the data suggest that determining the true developmental effects of low level prenatal exposure to methylmercury such as those stemming from maternal consumption of fish during pregnancy may be quite complex. Continued longitudinal data collection in the Seychelles cohort as the children mature is needed to confirm whether late effects of prenatal exposure will appear." Thus, unlike the TSD, the investigators are careful to convey the high level of uncertainty associated with any conclusions based on these results. The authors also state in the same paper that, quote, "There is no convincing evidence for an association between prenatal exposure and child development in this fish-eating population ".

E: Are you aware that the starting point (BMDL) from the Boston Naming Test from the Faroe Islands study is 12 parts per million in maternal hair?

Response: No. I am aware that Table 7-2 in the National Academy of Sciences Mercury Report indicates that the benchmark dose for the Boston Naming Test from the Faroe Islands is 15 parts per million methylmercury and maternal hair and that the BMDL is ten parts per million.

Question 15: You refer to the Daniels et al. study in which umbilical mercury levels were used as a marker for methylmercury exposure.

Response: I refer to it because the TSD does not, and I believe it to be a significant part of any objective analysis.

Question A: Are you aware of any other studies that used this tissue as the marker of exposure in analyses of the effects of in utero exposure to methylmercury on neuropsychological function of children?

Response: Yes. In the Faroes mercury concentrations were measured in stored cord tissue from about half of the cohort members examined. It is a marker that permits retrospective analysis of potential prenatal mercury exposure. Daniels, et al. stated that maternal fish intake during pregnancy was associated with increased umbilical cord mercury concentrations.

B, are you aware of the statement in Daniels et al., quote, we noted a threshold for the relation between fish and cognitive development, indicating benefit from eating fish in cognitive development -- I don't know if I have this right -- indicating benefit from eating fish at least once every

two weeks, but no incremental increase in benefit with more frequent fish consumption"?

MR. BONEBRAKE: Hang on just a second. Read 15B from the original.

THE WITNESS: Are you aware from the statement in Daniels et al., quote, "We noted a threshold for the relation between fish and cognitive development, indicating benefit from eating fish at least once every two weeks but no incremental increase in benefit with more frequent fish consumption"?

Response: Yes. The authors also state in the next sentence, quote, "This threshold could indicate that some fish, but not large amounts of fish, are needed to benefit development". That conclusion would be consistent with the results with O-K-E-N, et al."

C, are you aware that the average fish intake in the Faroe Islands study was about two meals per week and that almost half the women ate three or more fish meals per week.

Response: I am aware that more than half the participants ate between zero and two meals per week while fewer than half ate more than two meals per week. I'm also aware that exposure to methylmercury and

PCBs in the Faroes was higher than that reported by Daniels, et al., and that an Omega-6 fatty acid rich diet was consumed via whale blubber in the Faroes so the beneficial effects of fish would have been substantially reduced compared to Daniels et al.

Question 16: You refer to a talk by Dr. Hibbeln on the relationship between IQ, fish intake, and methylmercury exposure. Have any data from this study with Dr. Hibbeln as an author been published in the peer-reviewed literature?

Response: His work has been peer-reviewed and is in press in the Lancet. The IEPA relies primarily on unpublished, unpeer-reviewed studies from Florida and Massachusetts to support its regulatory proposal. As far as I know there are no plans to have the Florida and Massachusetts studies peer-reviewed or published.

Question B: Do you have access to the results of the study so that you can make a scientific determination regarding its quality?

Response: Not yet. Based on my discussions with Dr. Hibbeln, I have no reason to believe that the version soon to appear in the Lancet will reflect anything other than that which he spoke

about in January.

Seventeen: You mention the Oken, et al. study in Massachusetts of the relationship between fish consumption, mercury levels in the mother, and performance of the infants.

A: Are you aware that in that study, for each increase of 1 PPM of mercury in the mother's hair, the score of the baby decreased (got worse) by 7.5 points?

Response: That is what the authors reported, yes.

B, are you aware that in an ancillary analysis, performance of infants whose mothers had hair levels corresponding to intake above the EPA reference dose performed more poorly on the test of memory than infants whose mother's hair mercury levels were below the EPA reference dose.

Response: Yes, the 14 women whose hair mercury level exceeded EPA's reference dose had children who performed somewhat more poorly than the children of the women who had lower hair mercury. The authors concluded that, quote, "these findings based on a relatively small group of women merit further investigation and verification in other populations

consuming moderate amounts of seafood". In other words, the authors concede that their results are basically preliminary due to the small sample size. Their results are not confirmed by the results in the Seychelles which involved significantly higher methylmercury exposure, (6.9 parts per million in hair methylmercury on average), 779 infant mother pairs, and no effect on VRM scores."

C, did you hold the position of adjunct faculty member with the Harvard Center For Risk Analysis?

Response: At one time, yes, I became an adjunct faculty member so that I could work on a specific project involving evaluation of the health effects of siri (sic).

D, are you aware that in the analysis of the potential benefits of fish consumption performed by the Harvard Center For Risk Analysis and funded by the fishing industry, the effects on the child's IQ related to the mother's methylmercury intake and fish consumption was estimated under various scenarios of changes in fish consumption pattern, including women decreasing consumption of high mercury fish while maintaining the same overall fish consumption,

decreasing total fish consumption by 17 percent, or increasing their fish consumption by 50 percent with no regard to mercury levels?

Response: Yes. I'm aware of the analysis.

E: Are you aware that, under every scenario, the effect of methylmercury on IQ was greater than any effect resulting from Omega-3 fatty acids, and that an indiscriminate increase in fish consumption resulted in a net loss of 270,000 IQ points a year?

Response: That's what their analysis concluded under the particular assumptions made like depending on linear extrapolation of neurotoxicity at high methylmercury dose through the origin, and, thus, assuming threshold for adverse effect. That assumption is not valid based on our understanding of the toxicology of methylmercury, general principles of toxicology, or methods used to determine the RFD. A better extrapolation would have been to consider the RFD as zero risk and extrapolate existing data to this point. The authors also assume that it's the entire US population of reproductive-age women that indiscriminately chooses to increase fish consumption without choosing fish species with lower mercury levels.

According to the authors, that result translates to a loss of 0.07 IQ points for every child born in the US. Interestingly, the indiscriminate scenario also shows that in terms of quality adjusted life years, there is a net gain of 90,000 years despite calculated IQ loss based on fish-reducing coronary heart disease and stroke.

So indiscriminately increasing fish consumption apparently improves life overall according to the author's calculations. Benefits analyses like these can be useful for the purpose of comparing policy alternatives but do not reflect actual biological observations. Speaking of biological observations, a recent Japanese study evaluated the interaction between methylmercury and Omega-3 fatty acids on developmental neurotoxicity using a rat model. Exposing pregnant dams consuming an Omega-3 deficient diet to methylmercury produced developmental neurotoxicity in the pups. Restoration of dietary Omega-3 fatty acids completely eliminated developmental neurotoxicity despite exposure of dams to the same dose of methylmercury. These results suggest that diets with sufficient Omega-3 fatty acids might alleviate the damage to higher brain function caused by methylmercury.

Question 18: I'm sorry.

HEARING OFFICER TIPSORD: Dr. Hornshaw?

DR. HORNSHAW: Following up on the statement you just made, and it's part of my position as the chairman of the Illinois Fish Contaminant Monitoring Program, I discuss with anglers occasionally what they eat, and I also talk with my counter-parts at the Illinois Department of Natural Resources, the field staff who are also aware of what anglers are targeting and taking home. And two fish species that they particularly target, predator species are walleye and flat-head catfish, and they actively target these fish species. And I believe these two fish species are notoriously low in Omega-3 fatty acids. So maybe our fish advisory program is on the right track with trying to keep the consumption of these fish to one meal per week for women of childbearing age or in the case of the Rock River, flat head catfish, one meal per month. Would you agree then that the program that we're trying to establish to reduce mercury in these particular predator species would have important health benefits for these populations that actively target high mercury Omega-3 fatty acid fish?

THE WITNESS: That was high mercury low

Omega-3 fatty acid fish?

DR. HORNSHAW: Yes.

THE WITNESS: I'm not an expert on the levels of Omega-3 fatty acids in those particular species, but I do agree that overall targeting high methylmercury contaminated fish is a good idea.

DR. HORNSHAW: And trying to reduce content of mercury in this fish is also a good idea to the extent that we can.

THE WITNESS: To the extent that that's possible, yes.

DR. HORNSHAW: Thank you.

HEARING OFFICER TIPSORD: Question No. 18.

THE WITNESS: You mentioned that the greatest source of mercury exposure in the Faroe Islands was from consumption of whale meat, and that this may account for the fact that effects were observed in that study.

Response: I'm aware that the Faroe Islands investigators considered whale meat to be the largest source of methylmercury exposure in their studies. I'm also aware that Faroes residents ate far fewer fish meals than their counter-parts in the Seychelles. In addition, the greatest exposure to PCBs

was from whale blubber which is why a Do Not Consume advisory now exists in the Faroes for pregnant women for this source of PCB contamination.

A, are you aware that deficits were observed in the New Zealand longitudinal prospective study, in which methylmercury exposure was from fish?

Response: Yes. I am aware that such benefits were reported. I am also aware that there were some technical problems with the New Zealand study, and that no national or international organization has used it to determine limits on methylmercury exposure.

B: Are you aware of a number of cross-sectional studies documenting adverse effects of methylmercury on neurological function in children in which exposure was through fish?

Response: Yes. In the Portuguese study, the mothers ate an average of about 2.5 meals weekly, and in the Amazon study, prenatal fish consumption was unknown. No neurodevelopmental effects were reported in the Cree study, a population that subsists on fish, although prenatal fish consumption in that study was also unknown.

C: Are you aware that deficits were related to methylmercury levels in the Oken, et al.

study in Massachusetts, in which exposure was through fish?

Response: Yes. Average fish consumption in the Oken, et al. study was 1.2 fish meals weekly. As a reminder average fish intake in the Seychelles was ten times higher or twelve meals per week.

Question 19.

HEARING OFFICER TIPSORD: Excuse me. Mr. Harley?

MR. HARLEY: In your response to subpart B you mentioned a study, was it a Portuguese study?

THE WITNESS: Yes.

MR. HARLEY: In which effects were documented at what level of consumption?

THE WITNESS: In the Portuguese study the mothers ate an average of about 2.5 meals weekly.

MR. HARLEY: Two point five meals weekly. In your opinion does that constitute the use of fish as subsistence?

THE WITNESS: No.

MR. HARLEY: Does that constitute the use of fish as a primary protein source in the areas that --

THE WITNESS: I don't know what the

Portuguese people in this study consumed other than fish, so I can't answer that.

MR. HARLEY: Is there any legal limit that you're aware of that would prevent a person in Illinois from consuming 2.5 meals of fish weekly?

THE WITNESS: Legal limit in the sense that you're arrested if you eat more than that?

MR. HARLEY: Yes.

THE WITNESS: I don't think so.

MR. HARLEY: Thank you.

HEARING OFFICER TIPSORD: Question No. 19.

THE WITNESS: You discuss the issue of co-exposure to PCBs in the Faroe Islands study.

A: Did you hold the positions of Director, Toxicology and Risk Assessment Program, NAS, in 1994, and senior science advisor and project director, 1992-1997?

Response: Yes.

B: Do you consider the analysis of the health effects of methylmercury performed by the NAS to be of high scientific quality?

Response: Yes. What I don't entirely agree with is the Committee's referenced dose recommendation which is a subject upon which reasonable

people can disagree, and, as I pointed out in my testimony, is a matter of making competing policy choices, not necessarily scientific ones. The fact that other national and international organizations have chosen different exposure limits for methylmercury based on different studies illustrates my point. Moreover, the NAS panel did not analyze neurotoxicity in the Faroe Islands children in relationship to the contribution of PCBs from mother's milk, perhaps because publications on the extra ordinary contamination of this source were just occurring at the time of the NAS publication. In a current analysis of the methylmercury literature that includes the Faroe Islands data must address this post NAS analysis of PCBs in the mother's milk. In contrast, the Seychelles Islands also analyzed for PCB exposures and did not find any. Thus, it is not surprising that the Faroes and Seychelles Island studies, while equally well-done, in many respects have different outcomes.

C: Are you aware that the correlation between PCB and mercury levels of the mothers of the Farroe Islands study was 0.28-0.42, depending on the congener.

Response: Grandjean, et al., 2001, reported as 0.42 in their abstract on Page 305 and

conclude on that basis that, quote, the association between cord, PCB and cord blood mercury suggested possible confounding".

G, is there any reason to believe that postnatal PCB exposure would be highly correlated with in utero mercury exposure, given that PCB levels in breast milk would be similar to levels in the mother's blood or cord tissue (on a lipid basis)."

Response: No. In any case, the Faroe investigators evaluated PCB exposure for fewer than half of the study participants. However, this question misses the key toxicologic difference between the Faroe and Seychelles Islands. PCB's exposures were, on average, twice as high in Faroe children as were fed to infant monkeys given a mixture of PCB similar to that found in Faroe mother's milk. Infant monkeys developed neurological problems after such exposure. Faroe children also developed neurological problems after higher PCB exposures. Seychelles children receiving even higher doses of methylmercury than Faroe children but without the PCB exposures did not develop neurotoxicity. The logical conclusion is that the Faroe children were exposed to something that caused neurotoxicity besides methylmercury. Their exposure to

600 times EPA's referenced dose for PCBs, a known neurotoxicant, is the most likely candidate for the toxicity in the Faroes, but not the Seychelles -- the additional toxicity evoked in the Faroes, but not the Seychelles' children. NAS did not study the toxicity from PCB exposure to the Faroe children for mother's milk.

E: Is there a reason to believe, or data to support, the hypotheses that the length the breast feeding which would be a major determinant of the postnatal PCB exposure to the infant, would be correlated with prenatal methylmercury exposure?

Response: No. However, the length of breast feeding would be a major determinant of PCB exposure in Faroe children. The NAS did not study this likely source of neurotoxicity in Faroe children.

F: Isn't it the case that if prenatal exposure to methylmercury and postnatal PCB exposure are not correlated, postnatal PCB exposure cannot be responsible for effects attributable to methylmercury?

Response: No. Methylmercury exposure is occurring postnatally as well. And at no time have I said that the effects attributed to methylmercury should be attributed to PCBs instead. I have said that it is

certainly biologically plausible given the toxicology and exposure information that is available for PCBs that the effects observed are due to the combined exposure. The Faroe's investigators have stated that, "the possible neurotoxic influence of PCB exposure did not explain the methylmercury associated neurobehavioral deficits." Which means that PCBs alone did not account for the observations, but that their potential contribution to the outcomes cannot be ruled out.

MR. MATOESIAN: Excuse me. Is there a synergistic effect between methylmercury and PCBs?

THE WITNESS: A synergistic effect? By that you mean greater than additive?

MR. MATOESIAN: Yeah, yeah.

THE WITNESS: I don't think we know.

MR. MATOESIAN: Do you have some scientists postulate that there may be?

THE WITNESS: No. What I know is that PCBs affect the same end points apparently that methylmercury can affect. So if one is exposed to both of them, one might presume that you would see at least an additive effect. I don't know whether it would be greater than additive or not.

MR. MATOESIAN: Okay.

THE WITNESS: G: Are you aware that the Faroe Islands investigators published results in 2006 from these same children at 14 years of age and methylmercury-related effects continued to be observed but that no effects of PCBs were identified?

Response: I am aware, actually, that the 2006 results showed that the correlation between prenatal PCB exposure which was available for only half the subjects showed "weak associations with outcomes that did not reach statistical significance". I am also aware that at an earlier study when the Faroe Islands' investigators controlled for the effects of prenatal exposure to PCBs, the correlation between methylmercury exposure and poorer performance on the Boston naming test was no longer statistically significant. Those results are consistent with a contributory role played by PCBs. Perhaps more importantly, PCB exposures by way of mother's milk to Faroe Islands inference used to determine USEPA'S RSD should be further studied. Nearly all of those infants were breast-fed but for differing times. Published PCB levels in mother's milk varied among women. It follows that these infants had unknown but likely different PCB exposures. It is these exposures to PCBs that should be studied in relationship

to neurotoxicity outcome."

Twenty: You discuss the review of exposure to PCBs on neuropsychological function in children by Schantz, Widholm, and Rice.

A: Are you aware that in addition to discussing the 1997 paper by the Faroe Islands group on the effects of methylmercury at seven years of age, Schantz, et al., also discuss a 2001 analysis of the effects of PCBs in this same study?

Response: Yes.

B: Are you aware of the conclusion from that subsequent analysis: "After adjusting for mercury exposure in the statistical analysis, the association of test scores with PCB exposure was reduced to a nonsignificant level on both the Boston Naming Test and the CPT" (Schantz et al., Page 366)?

Response: That statement does not appear on Page 366. It appears on 368. It is a conclusion stated by Schantz, et al., not by Grandjean, et al., 2001. Here is what Grandjean, et al., concludes regarding their own study in the Faroes: "While no PCB effects were apparent in children with low mercury exposure, PCB-associated deficits within the highest tertile of mercury exposure indicated a possible

interaction between the two neurotoxicants. The limited PCB-related neurotoxicity in this cohort appears to be affected by concomitant methylmercury exposure".

Grandjean, et al, 2001 also state, quote, "The results of this study suggest that in the Faroese population, methylmercury neurotoxicity may be a greater hazard than that associated with PCB, but PCB could possibly augment the neurobehavioral deficits at increased levels of mercury exposure."

Interestingly on Page 374 of the Schantz, et al. paper, (co-authored by Rice) the following conclusion is reached: "As the data from ongoing PCB studies are published, the weight of evidence for PCB effects of neurodevelopment is growing. In particular, studies in Taiwan, Michigan, Oswego, New York, the Netherlands, Germany, and the Faroe Islands have now all reported negative associations between prenatal PCB exposure and measures of cognitive functioning in infancy or childhood". In other words, many studies indicate that as PCB exposure increased, cognitive functioning decreased.

I am also aware that USEPA must have been concerned about the potential contribution PCBs might be making to the outcome because it calculated

BMDLs both adjusted and unadjusted for PCBs.

C: Are you aware that there was no indication of any effects of PCBs in this study when the children were 14 years old?

I responded to that question already when I responded to Question 19G.

HEARING OFFICER TIPSORD: Dr. Hornshaw?

DR. HORNSHAW: Dr. Chapman mentioned that there are a number of impaired waters that have both PCBs and mercury as the cause of impairment. If we accept that PCBs and mercury have additive effects, wouldn't that make it even more important to control mercury as much as possible for these waters?

THE WITNESS: I think it would be important to control both methylmercury and PCBs.

DR. HORNSHAW: PCBs are almost entirely a legacy contaminant for which we have no realistic means for control which means if we're going to control anything, it has to be mercury. Would you agree with that?

THE WITNESS: Yes.

MR. BONEBRAKE: I'll just object to that. It calls for a legal conclusion, but you've answered it.

MR. MATOESIAN: Can I just ask you a

question then? So are you suggesting that we should be more concerned about cleaning up PCBs?

THE WITNESS: I'm not really extrapolating that statement to anything about risk management strategy. I'm simply pointing out that USEPA's reference dose and the National Academy of Science's report which was the subject of this question did not address exposure to PCBs postnatally.

MR. MATOESIAN: But in general concerning PCBs and mercury, if we -- there's been a lot of testimony, I guess, about PCBs, but if those were somehow taken care of, wouldn't the issue still exist about mercury in the waters?

THE WITNESS: Yes.

MR. MATOESIAN: So wouldn't, again, you need to control them both?

THE WITNESS: Yes.

MR. BONEBRAKE: I'm not clear what you -- to accomplish what results, Mr. Matoesian?

MR. MATOESIAN: Well, for instance, to reduce or eliminate the fish consumption advisories.

THE WITNESS: I'm sorry. Start at the beginning of the question again.

MR. MATOESIAN: Well, if we wanted to get

rid of the fish advisory so that people could eat as many fish as they wanted to, you'd have to get rid of both factors, correct?

THE WITNESS: I think -- No, that's not what I'm saying. What I'm saying is that when you look at the neurotoxicity of methylmercury in the Faroe Islands, you need to include consideration of postnatal exposure to PCBs. And what that means is that because the USEPA's reference dose is based on just the methylmercury in that study, it is more stringent than it would be if the PCB's exposure had also been accounted for. So if you were to operate from a different reference dose, for example, then you might make different decisions about the nature and extent of reducing methylmercury exposure in fish.

MR. MATOESIAN: But you agree that that's a reasonable policy decision?

THE WITNESS: Which is a reasonable policy decision? To reduce methylmercury?

MR. MATOESIAN: To establish the reference dose that USEPA did? Isn't that what you state on Page 19?

MR. BONEBRAKE: I'm sorry. Are you referring us to a particular page?

MR. MATOESIAN: Yes. Different factors were used, but then I believe equally competent.

MR. BONEBRAKE: Page 19 was it?

MR. MATOESIAN: I believe so.

MR. BONEBRAKE: Can you point us to some text on that page, please.

MR. MATOESIAN: Yes. I'm sorry. I lost it. It was 15, the last paragraph. Can you just explain how none of those choices are necessarily right or wrong and different policy choices made by equally competent scientists looking at the same data.

So you're not suggesting that there's anything wrong with EPA's establishing a reference dose; is that correct?

THE WITNESS: I think that in that case it failed to include consideration of concomitant exposure to PCBs, and, therefore, is inaccurate to the extent that an RFD can be accurate or inaccurate. I guess what I'm trying to say is that I think that it's based on erroneous assumptions.

DR. HORNSHAW: Isn't a large portion of the US population also exposed to PCBs?

THE WITNESS: I don't know.

MR. MATOESIAN: What about Illinois?

THE WITNESS: I don't know. I don't have personal knowledge of your PCB exposure.

MR. MATOESIAN: Well, you state on Page 6 that, the one full paragraph, the last two sentences, you say mercury emissions in Illinois may or may not affect the mercury levels in Illinois fish, and even if it does, reducing Illinois methylmercury fish tissue concentrations to below the Illinois fish tissue mercury consumption advisory levels will not eliminate fish consumption advisories in Illinois because of the presence in Illinois fish or substitutes such as polychlorinated biphenyls.

THE WITNESS: Yeah. And I based that statement on the testimony of Peter Chapman.

MR. MATOESIAN: So you're using his information?

THE WITNESS: Correct.

MR. MATOESIAN: And assuming that his information is correct?

THE WITNESS: Correct.

MS. BASSI: Mr. Matoesian, is it not correct?

MR. MATOESIAN: Well, I just want to be sure if she did that independently or if she's just using --

HEARING OFFICER TIPSORD: I would note that you just asked a question of the attorney.

MR. MATOESIAN: Not that I'm sworn in. Thank you.

MS. BASSI: Clarifying his question.

MR. BONEBRAKE: Move on then.

HEARING OFFICER TIPSORD: Question No. 21.

THE WITNESS: You discussed the issue of levels of mercury in the mothers of the large epidemiological studies reviewed by the NAS compared to those in the U.S. population.

A: Are you aware that according to the NAS modeling in the Faroe Islands study there is no evidence of a threshold within the range of exposures in the study down to about one microgram per liter in cord blood.

Response: No. The dose response modeling performed by the NAS is consistent with a less than linear response or sublinearity; that is, their modeling does not rule out a threshold. Committee states on Page 294, quote, "sublinear models would be appropriate, for instance, in the presence of a threshold," and then proceeds to apply the K power model which is consistent with sublinearity to calculate

benchmark doses."

B: Are you aware that an umbilical blood level of 1 microgram per liter would be an average equivalent to a maternal blood level of 0.6 micrograms per liter based on an analysis of a dozen papers of the relationship between maternal and cord blood, and that an RFD based on that difference would be below the level of -- I'm sorry -- the question that's being asked is and that this is below the level of half of the women in the U.S. of reproductive age?

I did not understand the question. I did not understand what "this is" referred to. I think what's meant is, and the last phrase of the question would be, "and that an RFD based on that difference would be below the level of half the women in the U.S. of reproductive age." Is that what is meant?

MR. MATOESIAN: Yes.

THE WITNESS: Response: According to the authors of that analysis, yes, one microgram per liter cord blood is equivalent to 0.6 micrograms per liter maternal blood. However, one of the authors of that study served on the NAS Mercury Committee, and yet that committee did not choose to make any adjustments along those lines assuming, instead, a one-to-one

relationship. USEPA also believed their analysis to be too uncertain to draw such a conclusion and chose to use a one-to-one assumption. Furthermore, both the NAS and USEPA used an uncertainty factor for within human variability to address this and other unknowns.

As for the second part of the question, no, an RFD based on that difference would not result in one half of US women of reproductive age being below it. If an adjustment were made consistent with that cord blood maternal blood differential, the RFD would actually go up; that is, be less stringent than the current RFD, and there would be few or no women above it. A ten-fold uncertainty factor which is what USEPA now uses for methylmercury, comprises two components: Three for toxicokinetic differences or differences in how the body handles the chemical, and three for toxicodynamic differences or differences in susceptibility to the toxicity of a chemical. If we were to replace the toxicokinetic part of the ten-fold uncertainty factor with an adjustment for the maternal blood cord blood differential, we would use the default factor of three for the remaining toxicodynamic part of the uncertainty factor. The resulting RFD would be BMDL times 0.6 divided by three which is approximately

two-fold higher than the current RFD. Interestingly, according to a report by Iwasaki, more than 90 percent of Japanese women have mercury levels that exceed USEPA's current reference dose for methylmercury. As far as I know there is no epidemic of poor neurodevelopmental performance in Japan.

MR. BONEBRAKE: Could you spell Iwasaki for the court reporter.

THE WITNESS: I-W-A-S-A-K-I.

C, are you aware that when the Faroe Islands children were tested again at 14 years, deficits were also observed starting at the lowest exposures as evidenced by the graphic presentations in the publication?

Response: No. The graphic presentations do not show that. They showed the associations between cord blood mercury level and continuous performance test reaction time for Boston Naming Test scores. They do not show where the results become abnormal or significantly different from each other. They simply show the distribution of results. There are no unexposed children in the Faroes study, so there is no true control group; and, therefore, no basis to distinguish effects at the lowest exposures from

those of an unexposed group.

D: Are you aware that at both 7 and 14 years, the relationship between exposure and effect was log-linear; in other words, that effects were relatively greater at lower exposures?

Response: No, they were not. According to the NASA Mercury Committee, the most biologically plausible dose response model was not log-linear. It was the K power model specifically ruling out super linearity for a log -- supralinearity or a log-linear relationship. "The Committee believes that an additive (linear) or perhaps sublinear model is the most justifiable from a biological perspective, thus ruling out square root and log transformed models. The Committee concludes that considerable caution should be used in fitting models based on log or square root transformations of exposure which might not be appropriate in dose response settings such as those for methylmercury where there are no internal controls and where the dose response is relatively flat."

Question 22.

HEARING OFFICER TIPSORD: Actually, we have E, F, G, and H of Question 21 still.

MR. BONEBRAKE: We may have had a mistake in

duplicating. So we'll move on to the next question and circle back. Would that be acceptable?

HEARING OFFICER TIPSORD: If we need to, yes. Go ahead.

THE WITNESS: I don't have the other questions in front of me, so there's obviously been an error.

Let's move on to 20 for now, I guess. You state that USEPA did not include the Seychelles study in the derivation of the reference dose.

A: Are you aware that the NAS performed an integrative analysis including all three studies: The Faroe Islands, Seychelles, and New Zealand?

Response: Yes. And then the NAS excluded the integrative analysis as the basis for a reference dose considering it, quote, premature, end quote, and, quote, exploratory, end quote.

B, are you aware that EPA derived exploratory reference doses based on a number of end points, including the integrative analysis, and that this analysis also yielded a reference dose of 0.1 micrograms per kilogram per day?

Response: Yes. And then EPA chose one end point to carry through the dose conversion and

application of the uncertainty factor to calculate the RFD; namely, the NRC recommended BMDL of 58 parts per billion mercury and cord blood from the Boston Naming Test.

C: Are you aware that the BMDL from the integrative analysis is 34 micrograms per liter mercury in blood, lower than the 58 micrograms per liter for the Boston Naming Test for the Faroe Islands study?

Response: I am aware that, according to the NAS Committee, quote, "The integrative analysis does not permit the direct calculation of a BMDL". I am also aware that the EPA's, USEPA's water quality criterion document for mercury lists 32 micrograms per liter mercury in blood as a quote, unquote, BMDL, not 34. And, just as a reminder, you can't actually compare BMDLs. You can't compare a statistical lower bounds as they reflect study design, not comparative toxicity. It is not surprising that a BMDL based on three widely divergent studies might be lower than a BMDL based on a single end point from a single study."

D: Are you aware that the reference doses from the New Zealand study were lower than those from the Faroe Islands or Seychelles, and that if EPA had relied on the New Zealand study, the reference dose

may have been lower than the current 0.1 micrograms per kilogram per day as evidenced in the IRIS summary?

Response: I am aware that a lower reference dose can be calculated based on the New Zealand data. I am also aware that neither the NAS Committee nor EPA considered the New Zealand data to be appropriate as the basis for calculating a reference dose. I am also aware that other organizations have calculated reference dose equivalent either equal to or less stringent than EPA's calculation and none relied on the New Zealand study. The principal reason that the New Zealand study is not used as the basis of any group's safe dose assessment is that the determinations of a BMDL from this study is highly dependent on the results of one individual. When this individual is excluded, a BMDL from the New Zealand study is similar to that derived from the Faroes. When this individual is included, a BMDL from the New Zealand study is similar to that derived from the Seychelles. Since the New Zealand study can be used to support either the results of the Faroes or the Seychelles depending on the exclusion or inclusion of results from one individual, the study is not strong enough to serve as the sole basis of the RFD, nor can it be used to support either

the reports of the Faroes' or the Seychelles' studies except in a general sense.

E, are you aware that the hair level that may be associated with the deficits in the Seychelles study at nine years, 12 parts per million in maternal hair, is the same as the point of departure for the EPA reference dose?

Response: I am aware that the authors of the Seychelles study reported that at nine years, the average BMDL across 26 endpoints was 20 parts per billion in maternal hair with a range of 17 to 23 parts per million, not 12.

F: Are you aware that the analysis by Dr. Louise Ryan of Harvard University calculated that the IQ loss in the children associated with increased maternal hair mercury levels was almost identical for all three studies?

Response: As I pointed out already, neither did the New Zealand nor the Seychelles Island studies reported a statistically significant IQ deficit, and the Faroe Islands study did not evaluate IQ, so that effect had to be estimated based on other endpoints. Dr. Ryan used IQ as a surrogate for other effects in order to monetize potential effects of methylmercury

exposure for the purpose of performing a regulatory impact analysis.

Twenty-three: Please state the definition of the reference dose according to USEPA.

Response: "An estimate, (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure to the human population (including sensitive sub groups) that is likely to be without an appreciable risk of deleterious effects during a lifetime".

A, does this definition include the phrase "with uncertainty spanning perhaps an order of magnitude"?

Response: Yes.

B: Is there anything in the definition that indicates that there is any more certainty concerning the level at which adverse effects occur below the reference dose than above it?

Response: Yes. By definition. The phrase, quote, likely to be without an appreciable risk of deleterious effects during a lifetime" indicates that risks at or below the reference dose are unlikely. In addition, the original publication on USEPA's RFD methodology addresses the likelihood of risks both above

and below the RFD and concludes that more certainty exists with regard to adverse effects occurring above the RFD than below."

C, is there any reason to believe that there is certainty about the lack of risk of adverse effects below the reference dose compared to the risk of adverse effects above it?

Response: The precautionary approach that USEPA takes to determine reference doses account for uncertainty in order to identify a dose below which no effects are anticipated. Because of that precautionary approach, risks below a reference dose are unlikely and risks above it depend on the shape of the dose response curve of concern. As I state in my testimony, "USEPA is careful to point out that while exposure at or below a reference dose indicates that a health risk is unlikely, people who are exposed to a substance above its reference dose should not be considered at risk: "... exceeding the reference dose is not a statement of risk." USEPA's regulatory impact assessment for the Clean Air Mercury Rule states, "It is also important to note that the reference dose does not define a right line above which individuals are at risk of adverse effects".

In other words, while exposures at or below a reference dose are unlikely to pose a risk, the converse, that exposures exceeding a reference dose are likely to pose a risk, is not the case." And that's the end of the quote from my testimony.

Furthermore, the methylmercury RFD is based on observations from the most sensitive life stage of humans, the species and life stage we want to protect. There is no interspecies extrapolation required, removing an important source of uncertainty. An entrust species uncertainty factor of ten has been applied just in case there are kids who could be even more sensitive than the group of kids tested. The benchmark dose upon which the RFD is based is a conservative lower bound; in other words, accounts for uncertainty by erring on the side of protecting children on a 5 percent likelihood of poor performance on the Boston Naming Test. And, remember, none of the kids in the Seychelles appears to have problems at even higher methylmercury exposure levels. Thus, there is no reason to believe that there is uncertainty about the lack of risk of adverse effects below the reference dose compared to the risk of adverse effects above it. Moreover, ensuring that more certainty exists about the

lack of risk of adverse effects at or below the reference dose when compared to the lack of risk of adverse effects above it is standard operating procedure by USEPA and other health groups around the world. This standard operating procedure is based on sound toxicologic principles that have been studied and accepted by all erudite practitioners of risk analysis.

I'm getting a sore throat.

HEARING OFFICER TIPSORD: You have one question left.

You know what, let's go ahead. Let's go ahead and take lunch break and we'll come back.

(At which time a lunch break was taken.)

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STATE OF ILLINOIS)
) SS:
COUNTY OF COOK)

I, Laura Bernar, a Notary Public within and for the County of Cook and State of Illinois, and a Certified Shorthand Reporter of the State of Illinois, do hereby certify that I reported in shorthand the proceedings had at the taking of said hearing and that the foregoing is a true, complete, and correct transcript of my shorthand notes so taken as aforesaid, and contains all the proceedings given at said hearing.

_____

LAURA BERNAR, CSR
CSR NO. 084-003592