ILLINOIS POLLUTION CONTROL BOARD
June 13, 2006

IN THE MATTER OF	)
	)
PROPOSED NEW 35 ILL ADM. CODE 225 CONTROL OF EMISSIONS FROM LARGE COMBUSTION SOURCES (MERCURY)	) R06-25 (Rulemaking - Air)

TESTIMONY OF DR. DEBORAH RICE

BEFORE MARIE E. TIPSORD
HEARING OFFICER

The testimony of Dr. Deborah Rice, a witness called in the rulemaking proceeding before the Illinois Pollution Control Board taken on June 13, 2006, at 9:00 a.m., at the offices of the Environmental Protection Agency, Springfield, Illinois, before Holly A. Schmid, Notary Public and Certified Shorthand Reporter, CSR No. 084-98-254587 for the State of Illinois.

A P P E A R A N C E S

MEMBERS OF THE ILLINOIS POLLUTION CONTROL BOARD:
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Ms. Andrea S. Moore, Board Member;
Mr. Anand Rao, Board Staff;
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Ms. Kathleen Bassi;
Mr. Stephen Bonebrake;
Mr. Sheldon Zabel;
Mr. Jim Ingram, Dynegy, Inc.

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Mr. David Rieser;

COUNSEL FOR
Ms. Meleah Geertsma

E X H I B I T S

ready to begin this morning. Good morning. My name is Marie Tipsford. I'm a hearing officer in this proceeding. It's entitled in the matter of Proposed Rule ILL. 35 ADM. Code 225, Control of Emissions from Large Combustion Sources, Mercury. The docket is R06-25.

I'm going to introduce the panel again today because, as you can see, we have grown. To my left is Dr. Tanner Girard and to my right is Board Member Andrea Moore, the presiding board members assigned to this matter. At the far end, on my left, is Tom Johnson, board member, and at the far end on my right is Nicholas Melas, also board member. To Andrea Moore's right is Tim Fox, her attorney assistant. To Dr. Girard's left is Anand Rao, and to his left is Alisa Liu from our technical unit. With us again today are Connie Newman and Aaron Conley.

This is the second day of hearing, and we will proceed day to day, until the Agency is through, or until Friday June 23, whichever occurs first. We will convene at 9 a.m. each day and proceed, until close to five. Thursday is a board meeting day, so on June 15, we will convene at 9 a.m. and recess, until after

lunch at around 10:30 or so.

During breaks, I am available to answer any procedural questions. You may also direct procedural questions to Mr. Fox or to Aaron Conley. Any members of the press should speak to Connie Newman.

I want to emphasize that the Board and staff cannot discuss the substance of the proposal off the record, nor can we discuss any substantive issue. Substantive issues should be raised during the hearing. If you are not sure whether your issue is a substantive issue, please ask and we can also place your issue on the record.

Today we will continue with the Agency's prefiled testimony, and allow anyone who wishes to ask questions of the Agency to do so. The prefiled testimony will be taken as if read and entered as an exhibit. I emphasize again, anyone may ask a question. However, I ask that you raise your hand, wait for me to acknowledge you, step to the microphone, and after I acknowledge you, please state your name and whom you represent before you begin your question.

Please speak one at a time. If you're speaking over each other the court reporter will not be able to get your question on the record. Please note,

any question asked by a board member or staff are intended to help build a complete record for the Board's decision and not to express any preconceived notion or bias.

At the back of the room are sign-up sheets for the notice and cover sheets, which I covered yesterday, if you have any questions, please see me at a break. Dr. Girard, anything this morning?

DR. GIRARD: No, just good morning. We look forward to your testimony and questions today, and let's get to work.

MS. MOORE: Same thing.

MADAM HEARING OFFICER: Let's begin Mr. Kim.

MR. KIM: We have a copy of Dr. Rice's prefiled testimony.

MADAM HEARING OFFICER: I have with me Dr. Deborah's Rice's prefiled testimony. I will enter this as an exhibit, if there's no objection.

MR. BONEBRAKE: Steven Bonebrake, Your Honor -- I'm used to saying -- we moved the mic to the other table, as the court reporter mentioned she was having a hard time hearing the folks at that table yesterday. She was having an easier time hearing us, so

hopefully, my voice will project well today. No objection. We do, however, reserve questions during cross-examination regarding the qualifications of Dr. Rice.

MADAM HEARING OFFICER: So noted. This will be marked as Exhibit 3 and entered. We have Dr. Rice sworn in and just a reminder, Mr. Hornshaw -- Dr. Hornshaw, I apologize, and Mr. Ross Was sworn in yesterday. You are still sworn in today. That continues. Go ahead, Mr. Kim.

MR. KIM: Continuing on with our testimony, and in the order that we outlined yesterday, we are now moving on to testimony and questions and answers from Dr. Deborah Rice. Following Dr. Rice, we will have Agency employee Jeff Sprague and he will conduct his question and answer session. So we will proceed with Dr. Rice, and I believe she's going to begin with the Dynegy Midwest Generation questions, and I think those are the only questions that were posed, specifically, to her.

DR. RICE: Question 1: "Has Dr. Rice been retained by the Agency to provide testimony in this matter?" The answer is yes. "A: When was she first contacted by the Agency concerning this rulemaking

proceeding?" I don't know the exact date, but it was about the first of February of this year.

MADAM HEARING OFFICER: Mr. Bonebrake?

CROSS-EXAMINATION MR. BONEBRAKE:

Q. Good morning, Dr. Rice, a follow-up question. Are you being compensated to testify today?

A. Yes.

DR. RICE: Question 2: "On page 3 of Dr. Rice's testimony, she refers to cross-sectional and longitudinal studies. A: What are `cross-sectional studies?'" Cross-sectional studies can -- are considered -- they are very often described as a snapshot, and that is that the study is measuring exposure and effect at the same time. "What are `longitudinal studies?'" as part B. A longitudinal study provides the opportunity to follow a cohort or group of people over time, so that exposure can be measured at one point, or sequentially, and effects may be measured at a time that's different from the exposure or, again, sequentially over time.

MADAM HEARING OFFICER: Mr. Bonebrake.

MR. BONEBRAKE CONTINUES:

Q. Dr. Rice, are cross-sectional versus longitudinal studies considered to be more reliable?

A. Generally, longitudinal study -- it's a more powerful -- I don't know if I would use the words "more reliable," but it's a more powerful study design because it allows the opportunity -- for example, we're talking about methylmercury, so let's talk about methylmercury. If we think that it's in utero exposure that's important, we can measure the exposure in utero and not test the children, until much later, and in some cases, years later. Whereas that's not possible with a cross-sectional study. With a cross-sectional study, we go in, for example, and measure the effect. We measure the performance of the children and the body burden of the children at the same time.

MADAM HEARING OFFICER: Go ahead, Mr. Bonebrake.

MR. BONEBRAKE CONTINUES:

Q. Is the Seychelles Islands study a longitudinal study?

A. It's a longitudinal study. It's unlike the other two studies. It's not a prospective study, which is kind of another term. Prospective study means that the mothers were actually recruited before the children were born. In the Seychelles Islands study, the mother-infant pairs were not recruited, until after

the babies were already born, so at that time, the investigative team went in and collected hair from the mothers, so it can be argued that the measure of exposure might not have been quite as precise in the Seychelles as it was in the other two studies. No. 3: "What is the pathway for exposure to methylmercury for most persons?" Fish. Four: "What is the pathway for exposure to methylmercury for most Illinois residents?" Fish.

MADAM HEARING OFFICER: Mr. Bonebrake?

MR. BONEBRAKE CONTINUES:

Q. When you say "fish," Dr. Rice, what is the water body source of the fish for the Illinois residents?

A. I don't know very much about Illinois -- well, I know nothing about Illinois-specific data. I can tell you that in the United States, in general, the vast majority of fish that are eaten are commercially caught fish, so they may be ocean fish or they may be fresh water fish.

Q. Do you know what percentage of commercially caught fish are caught in the oceans, versus the fresh water of the United States?

A. I don't know the exact figure, but I know

the majority of it will be ocean fish.

Q. Thank you.

DR. RICE: Number 5: What causes are there for persons', particularly children's, auditory and visual impairment, memory deficits, decreases in IQ, deficits in visuospacial ability and changes in motor function, other than pre- or post-natal exposure to methylmercury?" You know, the answer to that is that there are a myriad of causes or potential causes. There nay be congenital conditions. There may be genetic deficits. There may be specific diseases. There may also be other chemical exposures, including, but not limited to, methylmercury, but I think the important point here is that methylmercury produces a constellation of effects that, to my knowledge, are not produced by any other single cause or any other single exposure. One of the kind of hallmarks I think of methylmercury exposure is that it, not only produces cognitive deficits, but it also can produce motor and sensory deficits that aren't produced, or we don't think about them being produced in quite so robust a way by other neurotoxicants.

MADAM HEARING OFFICER: Go ahead, Mr. Bonebrake.

MR. BONEBRAKE CONTINUES:

Q. What other chemicals, Dr. Rice, cause the types of effects that are identified in question No. 5?.

A. Illicit and licit drugs of various kinds. Lead, certainly. I mean, lead is the poster child for environmental neurotoxic effects. PCB's, dioxins, maybe, although we really don't know as much about dioxins as we like. I think those are the main ones, but lots of drugs, lots of things that mothers take during pregnancy. Smoking during pregnancy, alcohol consumption during pregnancy, marijuana, cocaine, anti-epileptic drugs. There are lots of things that can cause impairment in the fetus.

Q. What about DDT, Dr. Rice?

A. It wouldn't be DDT, per se. It would be the metabolytic (phonetic) DDT, which is DDE. There have been studies that looked at DDE. I think that the evidence for in utero exposure of DDE producing impairment in the fetus is mixed. My conclusion, from looking at the literature, is that there doesn't seem to be an effect. If there is an effect, the signal is very, very weak. For example, in the Oswego (phonetic) study, there's no effect of DDE, for example.

DR. RICE: Six: "On page four of her

testimony, Dr. Rice states that there is no evidence of a threshold below which there are no adverse effects. A: Is it Dr. Rice's opinion that there is no threshold for developmental neurotoxic effects of methylmercury?" And I will just -- this is kind of a compound question, so I will just answer this part. It's really -- I don't have an opinion. It's really unknown whether there is a threshold or not. The scientific data that we have -- the scientific evidence that we have doesn't identify a threshold, which, you know, as a scientist, I have to say it's always -- when you have no data for it's not the same thing as saying we know there isn't. The only thing I can say is that, with the data that we have, there is no evidence of a threshold, and that it is not safe --

MADAM HEARING OFFICER: Excuse me, Mr. Bonebrake.

MR. BONEBRAKE CONTINUES:

Q. I'm sorry, Dr. Rice. Are you aware of any agencies, state or federal agencies, that have taken the view that there is a threshold, Dr. Rice?

A. Not that there is a threshold. I mean, the EPA has a reference dose, which kind of implies a threshold, but I don't think that -- I left the -- I was

with the Agency, and I left three years ago, and it was not the opinion of me and my colleagues at that time that we thought there was a threshold for methylmercury. That's really call I can say.

Q. Do you know if the Illinois Environmental Protection Agency has a specific exposure level for fish advisories in the state of Illinois?

A. Only from listening to testimony yesterday.

Q. Do you know if the Illinois Environmental Protection Agency considers the fish advisory numbers to be thresholds?

A. I have no idea. I can't speak to Illinois-specific issues.

CROSS EXAMINATION BY MS. GEERTSMA:

Q. Meleah Geertsma, M-E-L-E-A-H, G-E-E-R-T-S-M-A, for the Environmental Law and Policy Center, and I just had follow-up question for Dr. Rice. Dr. Rice --

MADAM HEARING OFFICER: Excuse me. Could you move to the microphone because I'm having a hard time hearing you.

MS. GEERTSMA CONTINUES:

Q. Dr. Rice, is there a difference in

definition of "threshold" in the way a scientist would use it, as opposed to, say, a policy maker who is setting a certain level of concern?

A. Yeah, absolutely. I mean, risk assessors and policy people have to do risk management, so they are always looking for a number as the starting point for risk management decisions, and people who are pure scientists in the academic community aren't really -- don't really have that burden, and so when I say there's no evidence for a threshold, I'm talking about that as a scientist, and not as a risk assessor, which is no longer my hat.

DR. RICE: The second part of that question, "and that it is not safe to eat any fish containing any level of methylmercury, regardless of the frequency of fish consumption." No. That's not my opinion. My opinion -- and this -- actually, this is kind of -- that question was a good segway into this because my opinion is that, although we don't know everything we need to know about the toxicity of methylmercury, my opinion is it's reasonable to advise people to keep their fish consumption so that it's below the EPA reference dose, which allows fish consumption.

MR. BONEBRAKE CONTINUES:

Q. Dr. Rice, does that mean that the population that keeps its fish consumption below the U.S. EPA reference dose is safe from appreciable risk from the consumption of methylmercury?

A. Well, as I said, we really don't know, and so to say to keep fish consumption -- keep mercury consumption below the reference dose is reasonable is really a risk management decision. Is it without appreciable risk? I would say that that's probably true, but I really don't know. You know, again, it's -- proving the negative is impossible.

Q. Has U.S. EPA said that consumption at its reference dose level would be free from appreciable risk?

A. Yes. That's part of the definition of the reference dose.

MS. GEERTSMA CONTINUES:

Q. Is appreciable risk a term that is strictly defined in terms of a certain outcome number of outcomes, or again, is that more of a policy determination about what levels of potential risks an advisory body thinks is appropriate?

A. I would say that's policy language, rather than science language.

DR. RICE: "What effects would Dr. Rice expect to see in a population" -- we are now on 6-B. "What effects would Dr. Rice expect to see in a population consuming fish with methylmercury tissue concentration below 0.05 ppm?" That's a low level of mercury in fish, and again, really, the answer here is the same as my answer to the last question, and that is fish consumption should keep mercury intake below the reference dose. Now, normal common fish intake in the United States would certainly, at .05 ppm, would keep methylmercury intake below the reference dose, but I did a couple of calculations, and I will just give you a couple of examples. For 150-pound person, if they take in 4 ounces of .045 ppm seven days a week, that's under the reference dose, and again, we can't say that that's without any effect, but you know, as a risk management policy decision, that's probably reasonable. On the other hand, a 70-pound person, a child, and that's fairly large child, consuming three ounces seven days a week would be above the reference dose, so there's not a clear-cut answer, you know, "Go ahead and eat everything below .05." Again, you have to multiply frequency times amount of fish you're eating times the amount of mercury in the fish.

MADAM HEARING OFFICER: Mr. Bonebrake.

MR. BONEBRAKE CONTINUES:

Q. Is U.S. EPA's reference dose linked to chronic exposure, that is, longterm exposure?

A. It's part of the definition of the reference dose is that it's a lifetime exposure, so it's an amount that one ought to be able to eat every day without producing appreciable risk.

Q. Does that also mean that, on some days, you can exceed that number, and still be below the RfD, so long as other days you don't eat any fish, so therefore, the average is below the RfD?

A. I think that, again, this is a risk assessment issue and a risk management issue. I think, for most people, averaging is reasonable, and I think that it's very clear that fish consumption advisories allow averaging because they have advised one meal a week, one meal every two weeks, one meal a month, depending on the state and the fish advisory, but I think there's also recognition that there's a limit to that. You know, there's nobody -- and I don't think there's any state that I know of -- that advises that you can eat one meal a year of something -- you know, that you can take in an entire year's worth of mercury

in one meal, and that would be an okay thing to do, so it's -- yes. Probably most people would think some averaging is all right, but there's a limit on that.

Q. Just a related question. There have been incidents of what's referenced to sometimes as poisoning, for instance, I believe in Iraq. From your perspective, Dr. Rice, is there a level at which acute poisoning will occur, that is, a level of exposure to methylmercury?

A. Oh, absolutely. The first poisoning episode -- there were two poisoning episodes in Japan and the one in Iraq that you referred to, and by "poisoning" what we mean is gross toxicity, that the people are demonstrably obviously ill, and some of them even die. That's poisoning.

Q. At what level does poisoning occur?

A. It's really hard to say. From the poisoning episodes in Japan, at first, they didn't know it was producing the effects. They thought it was an infectious agent. Nobody had ever seen methylmercury poisoning before, so it was really months, many months before people understood that it was methylmercury, and so it's really impossible to determine the level of exposure and certainly, the cumulative exposure in that

and that population. In the Iraqi population, people got their sooner because they recognized that there was such a thing as methylmercury poisoning, and there were estimates done on how much people were exposed to, and the body burden at which exposure -- at which poisoning occurred, and poisoning occurs somewhere around 20 ppm in hair, frank poisoning in adults. The level is lower for effects on the fetus.

Q. Does the 20 ppm in hair correspond to a level or amount in fish that needs to be consumed to generate that level in hair?

A. Well, it would. I mean, one could calculate, but we're not terribly concerned about protecting people from frank poisoning.

Q. Have you ever seen any data suggesting that fish in Illinois have mercury concentrations above 20 parts per million?

A. I haven't seen any data from Illinois at all.

Q. Have you seen any data suggesting that the --

A. But I would say that we're confusing mercury in fish and mercury in hair.

Q. Let me back up, then, if I may, Dr. Rice.

Did you say that you can back calculate an exposure level that would be linked to the 20 parts per million in hair?

A. One could, yes.

Q. Have you?

A. I haven't. I think the World Health Organization did that.

Q. Do you know what that calculation resulted in?

A. I can't remember, no.

MADAM HEARING OFFICER: I think we are ready for 6-C.

DR. RICE: "How many meals per week would be required to cause these effects; that is, how much fish would a person have to consume in a week for these effects to occur? Again, you have to multiply the amount of fish times the frequency of consumption, times the amount eaten, so I think I have really kind of covered that. D: "Are these effects consistent with what researchers found in the Seychelles Islands?" The Seychelles Islands report their results to be negative, so this is kind of an odd question, but having said that, we -- that .05 ppm, as far as we know, ought to be okay to eat. If there are effects below that, I would

expect them to be the same kind of effects that have been identified in the epidemiological studies which include the list that we have already talked about.

MR. BONEBRAKE CONTINUES:

Q. The fish that were consumed by the population at issue in the Seychelles Islands study, those fish, on average, have methylmercury concentrations of about .05 ppm?

A. They were actually pretty low. Well, we don't really know what people were consuming, but what the Seychelles Islands folks did was they went back to markets in the Seychelles Islands, and they just bought fish that were commonly available in the markets on the assumption that those were the fish that people were eating. They don't have food diaries or food questionnaires or anything like that. They don't know what those mothers were actually eating, but what they did was they went and got a dozen or so species of fish, and they analyzed the methylmercury in those fish and they were generally fairly low. They were .05 to .1. These are ocean fish I guess -- I guess the folks in the Seychelles are eating fairly low off the food chain, generally, but the Seychelles Islands has a commercial tuna fishing industry, and they have one of their main

economic sources of income is a huge -- huge tuna fish cannery, which is now owned by the Heinz Corporation, and so people do eat some meals of high mercury fish, although it's unclear how often they do that.

Q. When you use the term "high mercury fish" what do you mean?

A. I'm not sure what I mean. I think of tuna as being relatively high. It depends on what species of tuna you are eating. Tuna can be as low as .1 something. It can be .3 something for other species of fish, on average, but it can be -- individual tuna fish can be well over 1 ppm.

Q. I think you mentioned that the results from the Seychelles Islands study -- I think you used the word "negative."

A. No. What I said was they reported it to be negative. The results aren't, in fact, negative, which I think we are going to talk about later.

Q. When you say they reported results as negative, what is your understanding of what the author is reporting?

A. We're going to get there.

Q. I can reserve, until we get to later questions.

DR. RICE: E: "Where are the Seychelles Islands located? In the Indian Ocean off Africa. This is a population of people that are largely African in their ethnicity. F: "What is the source of fish that Seychelles Islands populace consumes?" I'm not exactly sure what that means, but it would be locally caught ocean fish, so I guess that takes care of both potential questions there. G: "Does Dr. Rice consider the Seychelles Islands study to be well conducted and valid?" I do. H: "Does the National Academy of Science conclude that the Seychelles study was well conducted and valid?" Yeah. The National Academy -- the NRCNAS panel reviewed the mercury literature, including a lot of emphasis and some modeling, actually, of three longitudinal studies from the Seychelles Islands from the Faroe Islands and from New Zealand, and they concluded that all three studies were well conducted and valid studies. Two of those studies reported effects associated with methylmercury exposure and the Seychelles Islands the authors reported no evidence for adverse effect.

MS. GEERTSMA CONTINUES:

Q. Dr. Rice, when you call a study valid and -- well conducted and valid, between different well

conducted and valid studies, will there be differences in a quality of the data based on how exposures and outcomes are measured by the various team?

A. Yes. I mean, to say that they are all well conducted and valid does not necessarily mean that they are equal, you know, that, for example, the biggest study was the Faroe Islands study with well over 900 children. In fact, the NRC committee estimated that, given the effect size in the Faroe Islands, the Seychelles Island study had about a 50 percent chance of detecting an effect, even if one was there, statistically detecting an effect, so there were, in addition to the NRC panel, there have been other panels, and I think I served on both of them, reviewing those studies and talking about all of the areas that go into well-conducted and valid, but the conclusion of a scientific community is that all three studies are well-conducted, valid studies.

MR. BONEBRAKE CONTINUES:

Q. Is it true, Dr. Rice, that some environmental agencies, both, in this country and other countries in the world have relied upon the Seychelles Islands study to develop numbers that are similar to the U.S. EPA RfD --

A. There's a whole list of questions about that. Do you want me to answer this now or when we get there?

Q. This particular question, if you wouldn't mind, if you could answer that now.

A. Are there other agencies.

Q. Are there agencies other than the U.S. EPA that have relied upon the Seychelles Islands study to establish reference does or similar measures?

A. There is one Agency that I know of that relies exclusively on the Seychelles. There are other agencies that include it, as did EPA.

MADAM HEARING OFFICER: EPA. IEPA?

DR. RICE: U.S. EPA. I need to make that distinction.

DR. RICE: "According to the" -- this is I. I don't know "I" what.

MADAM HEARING OFFICER: Six.

DR. RICE: "According to the investigators in the Seychelles study, they evaluated 60 primary endpoints through age nine, concluded that their data "do not support the hypothesis that there is a neurodevelopmental risk from prenatal exposure resulting solely on ocean fish consumption." See Myers, et al.

2003, last sentence in the abstract. Is this correct?"
Yes. This is, in fact, an accurate quote from their abstract, but the way that it's worded I think is important, and it's a scientific wording, and it gets back to the idea that because their data don't detect an effect doesn't mean that there isn't one there, and so being good scientists, that's the way that they word it. I think it's important to point out, however, a couple of things. One is that, at the same time that the Seychelles Islands investigative team is saying that their study does not support evidence for an effect, they have also done benchmark dose analysis from, both, their 66-month data, and now they have in press benchmark dose analysis from their nine-year data and benchmark dose analysis is -- I guess we are going to talk about that at some point later today, hopefully -- is a way of determining a defined effect level, so on the one hand, the investigative team is saying they don't have evidence for an effect. On the other hand, they are doing benchmark dose analysis to determine where that adverse effect level is, so I'm not entirely clear how, at this point, the investigative team feels about it, but I think, in addition to that, it's important to point out that other folks have done

additional analysis from the Seychelles Islands data. One was done by -- one was done as part of the NRC analysis and a subsequent analysis was done by Louise Ryan of Harvard University for the U.S. Environmental Protection Agency, in which she modeled the relationship between IQ at nine years and methylmercury exposure, and she found a decrement that is the same order of magnitude as that in the Faroe Islands.

MR. BONEBRAKE CONTINUES:

Q. The benchmark studies that you just mentioned, Dr. Rice, are those contained in any published peer-reviewed literature at this point?

A. The 66-month data is published. I mean, it's referenced in my review. I can't remember exactly where they published it. The nine-year data is in press in neurotoxicology. It's peer-reviewed. It's in press.

Q. Dr. Rice, do you know of other scientists who have looked at the Seychelles Islands study and reached the same conclusion as that stated by the study authors, that is, that there's not a neurodevelopmental risk from prenatal methylmercury exposure resulting solely from ocean fish consumption?

A. I'm sorry. Would you repeat the question?

Q. Do you know if other scientists have

reached the same conclusion as that reached by the authors of the Seychelles Islands study based upon their independent review of that data?

A. I know of no other independent analysis of the data, which would be the only way to draw such a conclusion.

DR. RICE: 6-J: "In fact, didn't the children in the Seychelles Islands study who were exposed to the most methylmercury perform better on the test of neurodevelopment than those who were exposed to less? It's kind of unclear. What the Seychelles Islands folks decided to do was to test these kids repeatedly, including when they were young infants, and on. Now their nine-year data have been published and early on they saw -- they did see a positive association between the performance and methylmercury, and by "positive" I mean better on motor performance, but when you take the data as whole, and they have done a lot of nonlinear analysis subsequent to their initial studies where, instead of just looking at a linear relationship, or forcing a linear relationship, they actually try to determine whether the relationship has some waves to it, and when you look at that data as a whole, there's really certainly no overriding evidence that performance

is better as a consequence of methylmercury exposure, and in fact, their non-linear analysis revealed that, for IQ at nine years, once you get passed a certain point, that performance is actually worse.

DR. RICE: K: "Did the Seychelles population consume more fish than is typically consumed by Illinois residents?" I don't know they consumed, on average, 12 meals a week.

MR. BONEBRAKE CONTINUES:

Q. When you use the term "meal," what quantity of fish per consumption, time of consumption, are you talking about, Dr. Rice?

A. I don't know that the Seychelles Islands folks actually specified portion size. I have not seen anywhere where they specified that. They may have, but I haven't seen it.

Q. Do you know if the methylmercury concentrations in the fish that were being eaten 12 times per week were comparable to methylmercury levels in fish in the United States?

A. I have testified to that, already, and that is that they went out and collected fish from the market and those are the only data that we have, and in general, the levels were between .05 and .1, but we

actually don't know what the people were eating because they just didn't -- they just don't have those data.

Q. Do you know if the study authors, themselves, said that, in the Seychelles Islands, women of childbearing age consumed fish containing similar concentrations of methylmercury to those in the United States?

A. I'm sorry. I didn't hear the first part of the question.

Q. Do you know if the study authors, with respect to the Seychelles Islands study, determined that women of childbearing age in the Seychelles Islands consumed fish of similar concentrations of methylmercury to those in the United States?

A. I don't know.

Q. I think you mentioned earlier the number of subjects in question in the Faroe Islands study. Do you know the number of mother-infant pairs that were at issue in the Seychelles Islands study?

A. The cohorts started with over 800, but at their nine-year data, they were down to 600 something. I don't have the exact numbers.

Q. Do you know when the Seychelles Islands study started?

A. The cohort was put together the late 80's, I think. Well, no, the kids are 16 now, so --

Q. Were the children in question tested at various points in time?

A. Yes, they were.

Q. At what points in time in their childhood, Dr. Rice?

A. I don't remember exactly because people have kind of, you know, ignored the early baby data as data came out from older ages. They tested them at 66 months. They tested them at nine years, but they also tested them a couple of times, I think, at 29 months. I can't remember, exactly.

Q. Does six, 19, 29 and 66 months sound about right to you?

A. Yeah. That sounds about right.

Q. Do you know if the Seychelles Islands study authors determined that, for each of those study points, there was not a demonstrated adverse effect between methylmercury consumption and health effects?

A. That is the conclusion of the study authors, yes.

DR. RICE: "Are there other studies showing that the children of mothers who eat fish do

better on tests of neurodevelopment than do the children of mothers who eat less fish?" There are studies that show a relationship between increased fish consumption and better performance, but they are not very well covariant controlled, which I think I won't answer right here. "Dr. Rice" -- so I mean that's kind of my general thing, and this gets into specific studies. "Is Dr. Rice familiar with the results of the study that Dr. Hibbeln of the National Institutes of Health reported based on a cohort of children in the United Kingdom?" I'm aware of his presentations. I've heard them -- I've heard a couple of them. To my knowledge, nothing with his name as an author has been published, and what he has reported has been an association between increased fish intake in women in the United Kingdom -- this is part of a large nutritional study ongoing in the United Kingdom -- and better performance of cognitive tests in the kids, and as I say, I have heard a couple Powerpoint presentations. I think the last one I heard was a year ago. At that time, he didn't have any omega-3 -- you know, the hypothesis that fish is good for children's development because of omega-3 fatty acid intake. He didn't have any of those data, and I think more important -- I think there's two issues here. One

is that, to my knowledge, the study is not published, so I can't really speak to it in any reasonable way, but I sat in the audience both times and the study was really pretty severely criticized from the audience. You know, the problem with this study, and all of these studies, that are that the biggest determinant of a child's IQ is the mother's IQ, so that, if you're not controlling from maternal IQ and you're not controlling for the environment of the child, then you are missing the two most important covariance. In the United States, increased fish consumption in women is associated with increased education and increased income, which strongly suggests that it's also going to be associated with increased IQ, so that there's a potential, very serious uncontrolled confounder in these studies. Now, this study of Dr. Hibbeln, if he is, in fact, the first author of what he's doing now, is not published. I haven't even seen it in document form and it's -- so I don't think it's been peer-reviewed. Some of what I just said is going to get shorter because it really applies to all of these. One, "In the UK study, didn't the children of mothers who ate more fish during pregnancy have higher IQ's than the children of mothers who ate less, even though the mothers who ate more fish

were exposed to more methylmercury." I am assuming that we're still talking about the Hibbeln study, and my memory just doesn't go back a whole year in regard to the details of an unpublished study, and No. 2: "Is Dr. Rice familiar with the results of Daniels, et al., who studied the same group of children in the UK, and found that increasing cord blood mercury levels were not associated with increased cognitive impairment, but that increased prenatal fish consumption was associated with improved cognition?" Yes. I am aware of this study, which is published, and so I can look at it, and the same criticism holds, and that is that there's a very important uncontrolled covariant, and the thing I think is particularly telling about this study is that the better performance was not only associated with increased intake of dark meat fish, which has omega-3's in it, but also white fish, which has practically no omega-3's in it, which really suggested there's uncontrolled cofounding. When they looked at methylmercury -- well, again, this was designed to be a nutrition study and some of this contaminant stuff has just been piggy-backed on it. The way they looked at mercury was they looked in cord tissue, which is not a standard marker for methylmercury exposure, and I don't

know what their relationship would be between mercury levels in cord tissue and any of the markers that we usually look at. Moreover, they divided the kids into turtiles with respect to mercury levels. They just divided them into thirds, rather than actually doing what one would expect if they were really interested in looking at methylmercury, and that is to do some kind of a regression analysis. You know, to actually take the data points from each child and model or look at the relationship between exposure and effect, and they didn't do that, so I don't know how to interpret their negative mercury results.

MR. BONEBRAKE CONTINUES:

Q. Dr. Rice, you mentioned that the Daniels study was published. What is the significance, from your perspective, of publication of a study such as this?

A. Well, the significance for me, in terms of this testimony, was that, unlike the Hibbeln study, which I was trying to recall from a year later, I could actually look at this one, but because it's published, it's published in a peer-reviewed journal.

Q. What is the significance of a study being peer-reviewed, Dr. Rice?

A. Well, it's -- well, what it means is that a couple of reviewers have looked at it and vetted it and said that it's worthy of publication, but what we all understand is that the peer review process isn't perfect, so to say that something is peer-reviewed doesn't mean that there's no flaws in it.

Q. And did the study authors in the Daniels study, then, conclude that there was not an adverse effect demonstrated from consumption of low levels of methylmercury contained in fish?

A. I don't have the study in front of me. I think what they said was that -- I think it was just, basically, a one sentence thing where they said that levels of methylmercury were low and were not associated with effects of performance or something. I can't remember exactly what they said, but I'm not really sure how they -- they just used a non-standard marker, so it's really kind of hard to interpret the results.

MADAM HEARING OFFICER: Actually, I have a follow-up. Dr. Rice, then you have reviewed this Daniel study.

DR. RICE: Mm-hmm.

MADAM HEARING OFFICER: Prior to this testimony?

DR. RICE: Yes.

MADAM HEARING OFFICER: Just wanted to be clear on that.

MR. BONEBRAKE CONTINUES: So it is correct then, Dr. Rice, that, at least, two of the studies that you have considered, the Seychelles Islands study and the Daniel studies, have found that consumption of fish containing methylmercury, at least, at reasonably low levels is not associated with or linked to adverse effects.

A. Well, that's a bit misleading to throw the Daniels study in with the longitudinal studies. There are multiple cross-sectional studies that find an effect of methylmercury, but to answer your answer directly, the Seychelles -- the Seychelles investigators report no effect. Additional analyses say there is a deficit in the Seychelles Islands study. The Daniels study reports no effect related to methylmercury, but the data are hard to interpret.

Q. With respect to the comment you just made regarding the Seychelles Islands studies, have the authors of the Seychelles Islands study come forth in a publication and said that the statements they made in their 2003 article were wrong, that is, that, in fact,

there was an association of adverse effect in methylmercury exposure notwithstanding what they said in 2003?

A. They do have some positive results. They have one positive result on motor performance at nine years, for example. The fact that they have gone through -- as I said before, I don't know how to interpret the fact that they have gone through and done benchmark dose analysis from their data. I haven't seen Gary Myers come out and say that he rescinds the 2003 sentence.

Q. So that's really my question. As far as you know, the statement in the 2003 article is the public statement of Myers, et al., with respect to the Seychelles Islands study?

A. What I'm saying is it's one statement. It is a statement.

Q. It's still a valid statement. It's not been rescinded, as you said, Dr. Rice?

A. I haven't read anything that it has been. I really don't know.

CROSS EXAMINATION BY MR. ZABEL:

Q. Just one question for clarification, Doctor. You use the word "non-standard marker. Could

you explain that, please?

A. Well, in most of the studies of the relationship between methylmercury and performance, people have looked at maternal hair mercury or they have looked at cord blood mercury. These folks looked at methylmercury in cord tissue, and the methylmercury levels in cord tissue were pretty low, and I guess there are two issued related to that. One is that we don't know how to get from cord tissue back to what we understand as markers of exposure that then can get us back to intake. In other words, how much methylmercury the woman was actually taking in to get to this cord tissue. I mean, we know how to get from blood, cord blood, back to intake, but we don't know how to get from cord tissue back to intake, so that's one issue. The other issue is an analytical issue, and that is that the lower the levels that we're trying to detect, the more error there is going to be in the actual analysis of the methylmercury or other chemical, and the more you can appreciate that, the more noise you have in your analytical measure, the less accurate it's going to be, and that will bias the results. That will bias the results towards the null. In other words, that will decrease the probability or the possibility of finding

an effect, even if there is one, so you don't want to be using a marker for which the levels are very low. I mean, I think -- I don't want to make a whole lot about this Daniel study because I don't think there's a whole lot we can make from it.

MADAM HEARING OFFICER: I have a follow-up, and let me just say I'm just a lawyer, so this stuff is really going over my, head to a large extent, but the question asked by Dynegy and Midwest Generation refers to increasing cord blood mercury levels. You just said that they measured cord tissue.

DR. RICE: Tissue.

MADAM HEARING OFFICER: Levels and not the blood mercury.

DR. RICE: Right.

MADAM HEARING OFFICER: You indication there's a distinction between those?

DR. RICE: Yes, there is.

MADAM HEARING OFFICER: Thank you.

MR. ZABEL CONTINUES:

Q. Maybe it would be helpful if you would explain the data that's necessary to get from cord blood or hair measurements back to intake and that's missing, apparently, in the cord tissue data, or for the cord

tissue data.

A. Yeah. Okay. To get from cord blood to intake requires -- well, to get from anything back to intake any marker requires a pharmacokinetic model. We know a lot about the relationship -- we know how to get from -- and EPA has done this and other people have done this. We need to know the body weight of the woman. We need to know the fraction -- we need to know -- the -- well, we need to know the fraction of methylmercury that's going to be absorbed. We need to know the fraction of methylmercury that's then going to get into the bloodstream. We need to know the blood volume, and if we know all of those things, then we know how much mercury is actually going to end up in the maternal compartment in maternal blood, and then we have information on the relationship between the amount of mercury in the blood of the mother and the blood of the infant. What we don't know anything about is the relationship between methylmercury and in the blood of the mother or the blood of the infant and how much ends up in umbilical cord. We don't know anything about that relationship, so since we are missing that kind of final piece or series of pieces, we don't know how to get back from that to the intake of the mom.

MR. BONEBRAKE CONTINUES:

Q. Do you know if, in connection with the Daniels study, the authors of that study had information about methylmercury hair concentration levels in the study population?

A. I don't know if they did or not. They didn't present them.

MR. ZABEL CONTINUES:

Q. How do you get from the mercury concentration in hair back to the intake? You described blood, I believe.

A. Okay. You would assume a particular ratio show of hair to blood. Obviously, hair is an excrescent compartment, and so it's farther away from the fetus than cord blood is, and so you have to make a series of assumptions. The assumption ratio is usually 200 to 250, but I think that brings up an important point. For example, in the Faroe Islands study, they had, both, hair and cord blood, and what they found was that cord blood was a better predictor of the performance of the child than was maternal hair and mercury. Whereas, in the Seychelles Island and New Zealand, they only had maternal hair, so then you have -- you are quite right. Then you have to get from hair to blood, and back

through blood, back to the intake of the mother, so there's an additional assumption there, and the Seychelles Islands folks, as I said before, this is an African population. They looked at that ratio of hair to blood in just a very few individuals, and so it's hard to make a lot out of it, but unlike Caucasion population where the ratio seems to be 200 to 250 to one, and you also have to appreciate that that's going to be different from woman to woman, so that's an additional source of variance that's not captured in the analysis. The ratio in the Seychelles Islands was over 400, and if that's really true, then the exposure in the Seychelles Islands was lower than we think it was, than we have assumed it was.

MR. ZABEL:

Q. Just for clarification, the 200 to 250 ratio you said was assumed. Is it based on empirical data?

A. Yes, it is. It's based on empirical data on I think Caucasions?

Q. Coming back to your description on the use of blood, you listed several items that were necessary to make the connection back to intake.

A. Right.

Q. Are those all based on empirical data?

A. Yes, they are.

MR. BONEBRAKE CONTINUES:

Q. Do you recall, Dr. Rice, what the average methylmercury hair concentrations were in the Faroe Island study population?

A. Hair concentrations? I think they were 4.4, or something like that. It's all in my document. I don't necessarily have these things off the top of my head.

Q. Is there a hair methylmercury concentration level that corresponds to U.S. EPA's reference dose?

A. Yes. It's about one, 1.2, depending on who is doing the dividing.

Q. Parts per million.

A. Parts per million, I'm sorry.

Q. Do you recall what the methylmercury concentration was, on average, in the Seychelles Islands study population?

A. I think it was 6.3, and I'm not sure that the averages were expressed the same. They can be means. They can be medians. They can be geometric means, and all of those are going to give you slightly difference

slants, colors of averages, and so I'm not sure that those were presented exactly the same way.

Q. So Dr. Rice, if my math is right, the average, or mean methylmercury hair concentration in the Seychelles Islands study population is about five times the methylmercury hair concentration that corresponds to U.S. EPA's reference dose. Is that right?

A. The average is, yes, but it's important to understand that the range completely overlaps, but the lowest body burdens for the Faroe Islands are really at the 50 percentile of U.S. women, so while there's no question that, when you take the population as a whole, the Faroe Islands is greater than U.S. women. Nonetheless, there is a fair degree of overlap between the two populations, and that's really relevant to the issue of there not being a threshold for effects.

Q. Do you recall, Dr. Rice, if the study population in the Daniels study had methylmercury hair concentrations above one to 1.2 parts per million?

A. You know, if they reported hair concentrations I don't recollect them, so I can't speak to that. I was paying attention to their marker of methylmercury exposure. Maybe they had hair, I don't know.

Q. I have a copy of the Daniels study, and I have got multiple copies for the Board and Mr. Kim and Dr. Rice. May have I distribute those?

MADAM HEARING OFFICER: Sure. If we run out of copies and someone does need an additional copy, we can get some more made. Mr. Kim, I will give you a second to check this and if there's no objection, we will admit this as Exhibit 4.

MR. KIM: No objection.

MADAM HEARING OFFICER: Seeing none, we will admit this as Exhibit 4.

(Exhibit No. 4 was admitted.)

MR. BONEBRAKE CONTINUES:

Q. Dr. Rice, do you recognize this article?

A. I do.

Q. What is it?

A. It's "Julie Daniels, et al., Fish Intake During Pregnancy and Early Cognitive Development of Offspring."

Q. Is this a copy of the article that we've been discussing?

A. It is, yes.

Q. The Daniels article. If you could, turn with me to page 400 of this article, third from the

back. You will see there's a paragraph at the upper left starting "Although."

A. Mm-hmm.

Q. That first sentence reads, "Although total cord mercury levels increased with maternal fish intake, our data did not suggest adverse developmental effects associated with mercury." And below that there's -- probably four or five sentences down there's a sentence that reads, "Mercury concentrations in hair samples taken in the United Kingdom were 1.6 ppm, much lower than concentrations from hair samples from the Faroe Islands (4.3 ppm) where adverse effects of prenatal exposure to methylmercury were clear." Do you see that, Dr. Rice?

A. I do.

Q. Does that refresh your recollection about the levels of methylmercury in the hair of the study population in the Daniel?

A. Well, no, because this isn't the Daniels study population. This references a completely independent report from the United Kingdom that's looking at methylmercury in hair. It's a report, apparently, from England, but that doesn't provide any specific information about hair mercury levels in the

Daniels study. As I said before, the Daniels study is looking at umbilical cord mercury concentrations.

Q. Was the study population in the Daniels study comprised of residents of United Kingdom?

A. Yes.

Q. Do you have any reason to believe that the study population in question in Daniels the average hair methylmercury level differs from the average in the United Kingdom?

A. I have no way of evaluating that.

DR. HORNSHAW: Could I ask a follow-up question?

MADAM HEARING OFFICER: Sure, Dr. Hornshaw.

DR. HORNSHAW: I'm not familiar, myself, with the Daniels study. Was that a study of people who admitted to eating fish or is that a study of the general population?

DR. RICE: No. It's a general population study. It's a big cohort looking at nutrition, nutrition and health.

DR. HORNSHAW: Thank you.

MADAM HEARING OFFICER: Anything further? Question No. 7 I believe we're on.

DR. RICE: "Dr. Rice states in her testimony at page four as follows: `In fact, there is evidence from both the Faroe Islands and New Zealand studies that the change in adverse effect in the child as a function of maternal methylmercury level may be greater at lower maternal methylmercury levels than at higher ones. What does this mean?" I wish we had a flip chart. What it means is that the slope of the relationship between exposure and effect is greater at lower body burdens. If I draw in the air, will that mean anything to you? Let's do that on a chart. That will be easier.

MADAM HEARING OFFICER: We will have to admit it as an exhibit after you're done for purposes of the record.

(At which point in the proceedings, a 10 minute break was taken.)

MADAM HEARING OFFICER: I think we are ready to go back on the record. Dr. Rice.

DR. RICE: All right. We're at 7-A. "What does this mean?" If this is increasing exposure, and this is adverse effect, and this is zero, this is, essentially, no mercury here. What it means is that, when you plot this, that the effect is actually

relatively greater at the low end, so it keeps going up, but the slope here is greater than the slope here, so no, it doesn't mean that, after a certain amount, that there's no longer an effect. What it means is that the effect is actually greater down in here at very low exposures, which of course, the most relevant for focusing on -- and the most relevant for protection of public health. This is what you're really concerned about here.

MADAM HEARING OFFICER: For purposes of the record, Dr. Rice was drawing on a chart which will be entered as Exhibit No. 5 in the proceeding.

(Exhibit No. 5 was admitted.)

MADAM HEARING OFFICER: Mr. Bonebrake.

MR. BONEBRAKE CONTINUES:

Q. Dr. Rice, the slope that you just drew, is that based on the results of the Faroe Island and New Zealand studies?

A. Yes. The Faroe islands study, the shape of the relationship is best fit by a non-linear function. That was published -- I mean, Dr. Ryan found that when she did her analysis for the NRC, but it's also part of a report that was done for EPA by the Faroe Island folks, and then it was published in the

peer-reviewed literature, and it's best fit by a logarithmic function, which means that sometimes called supralinear where the effect is actually greater at lower levels, and talking to Dr. Ryan, that was also true for the New Zealand study, although, to my knowledge, that's not published anywhere.

Q. That slope would not fit the Seychelles Islands study results given the reported results of no link between adverse effects and methylmercury. Is that right?

A. I don't know. I mean, you would have to actually model those relationships and the Seychelles Islands' team did do some non-linear analysis, and some of their models were fit by something better other than a linear relationship, but I don't know exactly what family of curves they looked at, so I really can't speak to that.

DR. RICE: "Does this mean that the greater the exposure the less likely there will be to have adverse effects?" No. C: "Does it mean there is a threshold after which there are no deleterious effects?" No. 8: "In her testimony" --

MADAM HEARING OFFICER: Excuse me. Dr. Forcade.

CROSS EXAMINATION BY MR. FORCADE:

Q. Bill Forcade with Jenner & Block for Midwest Generation. Dr. Rice, your chart shows exposure on one axis and effect on another axis, and I believe, as I can see from here, that it shows an adverse effect as soon as you leave zero exposure. Is that consistent with the statements you made earlier that there was no identifiable threshold or non-threshold or are you predicting there is, in fact, a negative effect as soon as you leave zero exposure?

A. This is not to be taken at absolute terms, but I drew it that way because of my earlier statement that there is no -- there is no evidence for a threshold, which doesn't mean, necessarily, that there isn't one, but as far as we know, within the range of exposures in the studies, in the Faroe Island study and the New Zealand study, there is no evidence for a threshold within those ranges, which would mean that the slope would go back to zero.

Q. But you're not changing your original position that you don't know whether there is a threshold?

A. What I'm saying is that there's no evidence for one, and that's the best we can do as

scientists.

MADAM HEARING OFFICER: Mr. Bonebrake.

MR. BONEBRAKE CONTINUES:

Q. Isn't it also true that there is no evidence of an effect in a methylmercury exposure level approaching zero? I mean, is there some number small enough where there simply is not a number indicating effect, Dr. Rice?

A. There are numbers small enough that nobody's really looked. The next question is about the open study, and I guess we're going to get into that, which is a study in the U.S. where they didn't model the data. They just did linear analysis. They just did a linear regression on the data, and they found an effect, and they found an effect within the range of exposures in this population in Western Massachusetts, and so that not only suggests that there's not a threshold, but that there's not a threshold within the range of -- that there are effects below the EPA reference dose is what that study suggests.

Q. My question was, though, that, at some level of methylmercury exposure, some low level there is no evidence of an effect. Is that right, Dr. Rice?

A. I'm sorry, I didn't understand the

question. It sounded backwards.

Q. At some level approaching zero, there is no evidence of an effect. Is that right?

A. What I'm saying is that there's no evidence either way. We have no evidence down there and I'm not sure what you mean by "approaching zero" because everybody is carrying some level of methylmercury, so there is a background level.

Q. Just trying to get a clarification because, as Mr. Forcade pointed out, your line starts out "Up from zero."

A. That's the best we can do with the data that we have. That's the best assumption we have with the data that we have.

MADAM HEARING OFFICER: Question No. 8, then.

DR. RICE: "In her testimony, Dr. Rice mentions the results of the Oken, al. Is it true that the authors concluded that the children they studied in Massachusetts scored higher in neurodevelopmental tests when their mothers had eaten more fish?" The answer to that is the study found a relationship between better performance on memory in these infants. These are seven-month old infants related to fish, increased fish

consumption, and again, this study is designed -- it's piggy-backed on another nutritional study, so it has the same problem of uncontrolled and potentially very important confounding, and we know, as I said before, that there's a relationship between increased fish consumption in the U.S. and education of the mother and family income. This study also found, however, that there was a negative relationship between increased mercury body burden in the mother as measured by hair, hair level in the mother, and performance of the child, so fish intake goes in one direction. Methylmercury exposure goes in the other direction, and this would not be a confound. I mean, if it's true that being smarter and having a higher income and all of that best predicts -- is predictive of fish consumption in the United States, then, if those confounders, or covariants, were controlled for, the mercury effect ought to be stronger, and what the investigative team concluded was that they recommend that women eat fish, but they recommend that women eat fish low in mercury. A: "Wasn't the authors' recommendation resulting from the study that pregnant women eat more fish?" Yes. Eat fish low in mercury. B: "What was the basis of Dr. Rice's conclusion on page five of her testimony that

the hair mercury levels of the mothers in Western Massachusetts are typical of those in the U.S.?" NHANES data, which we talked about yesterday, and that's a national -- National Nutrition and -- Health and Nutrition Examination Survey, and it's on ongoing survey of people, not just women, but people in the United States of tens of thousands of people that's designed to be representative of the population of the United States, and it is a nutrition health survey, and it's only been relatively recently that a lot of chemical exposures have been added to this survey. Methylmercury was added to the survey in 1999, and so far, data have been published for couplets of years, 1999 and 2000, and then 2001 and 2002, and what the folks in the Oken study found was that about 10 percent of the women in their study had hair levels that would be associated with mercury levels over the reference dose, over the EPA RfD, and depending on how you want to do the analysis from NHANES, somewhere between 10 and 15 or 16 percent of women have methylmercury levels that would be associated with those over the RfD, so that was the basis of my statement that these levels are probably representative of those in the United States.

MADAM HEARING OFFICER: Mr. Bonebrake.

MR. BONEBRAKE CONTINUES: And the hair level that's associated with the U.S. EPA RfD I think we talked about earlier is somewhere in the one part per million to 1.2 part per million range. Is that correct?

A. That's correct, and they found -- this study reported that 10 percent of the women were over 1.2 I believe.

Q. And the average methylmercury concentration in the Seychelles Islands study population as we talked about earlier I believe is somewhere around six parts per million?

A. I think that's about right, yeah.

DR. RICE: C: "Does Dr. Rice have information regarding the relative consumption of freshwater versus ocean fish in Massachusetts?" All of C is not my area of expertise, so I'm going to let some other expert witness answer that question. D: "Is a mother's hair mercury level a normal measurement taken in the delivery room or obstetricians's office?" No, but it's been done in multiple studies, and it's easy enough to do, obviously. E: "Have there been representative samples taken across the U.S. to confirm the statement quoted in 8-B above?" Yeah. I have already answered that. F: "If so, then what are the

results of subsequent studies on those babies: NHANES doesn't address -- they don't go in and look at performance of any kind on infants. I mean, it's not designed to be a neuropsychological study, so there haven't been any studies that followed up NHANES in the United States. It's thousands and thousands of people. 9: "Dr. Rice refers to IQ decrements in her testimony. A: What is a benchmark for determining whether IQ has been decreased?" I think there's a little bit of misapprehension about what we're talking about here. We're not talking about some bright line that you cross and then you have an IQ decrement. What I mean by "IQ decrement" is this relationship here. If this is now decreasing IQ, you have to think about this backwards. Then there's a relationship, as exposure increases, IQ decrease and that's what we're talking about, increase-decrease.

MADAM HEARING OFFICER: Let me point out that Dr. Rice was, again, pointing to what is Exhibit No. 5.

DR. RICE: 9-B: "Is there any disagreement among experts regarding what is IQ" -- I will just answer these sequentially because they are really three different questions. "Regarding what is

IQ?" Now, I mean, they are kind of theoretical arguments in the field about how well IQ loads on some inherent G-factor, but that's not really relevant to what we're talking about. "How it should be measured," no. There is really no disagreement. There are a number of so-called instruments, that is, IQ tests that can be used. Some of them are age appropriate. You don't use the same thing with a two-year-old that you use with a six-year-old or a 20 year-old, so some of the different instruments are really for different ages, but even for children and adults, there are different tests. They are all highly correlated with each other, and there are tests that are very well accepted as being valid. "How it should be measured and how changes in IQ should be determined?" I think that for the purposes of this testimony and for the Board to understand is that, whatever it is that IQ tests are measuring, which I don't think the theory of that is probably of terrible concern, IQ -- performance on IQ tests is very predictive of a variety of things. The performance on an IQ test is predictive of how much money you're going to make in your life, which is part of the documents that we have submitted. It's predictive of how well you do in school. It's predictive of how far you go in your

education, but I think it's also important to predict -- to understand that IQ is predictive of how well you do in society. It's really predictive of your SES status, your social economic status. It's predictive of whether you're living in poverty. It's predictive of whether you're on welfare. It's predictive of out-of-wedlock births, if you're a female. It's predictive of ending up in jail, if you're a male. So performance on an IQ test, whatever it's measuring, is predictive of very important and real, real world consequences.

MADAM HEARING OFFICER: Mr. Bonebrake.

MR. BONEBRAKE CONTINUES:

Q. Dr. Rice, are you aware of any studies regarding trends in IQ in Illinois residents?

A. No.

Q. How about the same question with regard to the United States.

A. IQ tests are re-normed every once in a while because there's a drift, and there's arguments about why that drift is occurring, but I don't think that that's really relevant to what we're talking about here. What we're talking about here is a relatively short point in time and looking at the relationship between IQ and contaminant exposure, methylmercury

exposure.

Q. Is it your view, Dr. Rice, that consumption of methylmercury will cause a decrease in IQ?

A. Yes.

Q. And would you expect, therefore, to see, in a population eating methylmercury, a decrease in IQ?

A. On a population level, you really -- that's not the way you determine that. I mean, you don't -- if you did an IQ test of everyone in the United States this year, and you did one three years from now, and you saw a decrease in IQ, you really wouldn't know what to attribute that to, and we've all been exposed to methylmercury for quite some time I think, so there's just really no way to test the hypothesis that you're putting out there.

Q. My question is are you aware of any studies regarding trends in IQ?

A. No. I think you asked if I would expect. I think that was your question.

Q. Then my question I will state to you is are you aware of any studies in the United States concerning whether there's trends in IQ's among the citizens of the United states?

MR. KIM: I think she's already answered that.

MR. BONEBRAKE CONTINUES:

Q. I'm not sure that she has. Was your answer no?

A. My answer is that there is a drift in IQ tests, and so they are re-normed periodically and different instruments are re-normed at different times, so that the mean is always 100. Their normed so that they conform to a bell curve, so that the mean is always 100. One standard deviation about 68 percent of the population going between 85 and 115. Two standard deviations, which is about 95 percent of the population will go between 70 and 130.

Q. Is this drift that you mentioned, is that indicative of a trend?

A. Nobody knows what to attribute that to. Most people attribute -- it actually is going up. It actually goes up. It's called a Flynn Effect, and most people attribute it to the fact that people are a lot more literate now. They are a lot better educated, and also, there may be some nutritional factors that come into play, and the fact that people don't now have a lot of diseases and parasites that really prevent them from

reaching their genetic potential, in terms of brain development.

Q. So IQ's in the United States are increasing?

A. I can't say that. I don't know.

Q. Are you aware of any studies regarding IQ trends in Japan?

A. No.

Q. Is Japan a big fish eating country?

A. Yes.

Q. Would you expect to see, Dr. Rice, a decrease in Japanese IQ's, in light of their fish consumption?

A. Japanese have been eating fish for thousands of years. I really wouldn't know what to say about their methylmercury consumption.

Q. Has methylmercury been present in fish for thousands of years?

A. I don't know.

Q. For hundreds of years?

A. I don't have the data to really interpret the question that you're asking.

Q. Do you know if methylmercury has been present in fish for hundreds of years?

A. I, personally, am not a fish tissue person, so I don't know.

Q. Do you know if there are sources of methylmercury in this world that are not man-made?

A. Yes, there are.

Q. Do those non-man-made sources lead to methylmercury in fish?

A. I would assume that they would because they result -- volcanos and fires, for example, result in emission to air, so my assumption would be that they would contribute to methylmercury in fish eventually, yes.

Q. So it would be logical, then, to assume that for thousands of years, people have been eating methylmercury?

A. I would assume so, but we have no idea about the relative quantity compared to now, so it just really doesn't get you anywhere.

MS. GEERTSMA CONTINUES:

Q. Dr. Rice, you just used the phrase "reaching genetic potential." Would you say that the roll of a person practicing public health is not just to prevent severe defects or mental retardation, but also in maximizing the population's full genetic potential?

A. Absolutely. That is the role of public health.

DR. RICE: 10: "What is the relationship between mercury measured in a mother or child's hair and the mercury measured in umbilical cord blood?" I think we have already kind of addressed that question. The usual assumption is that it's somewhere between 200 and 250 to one. It may have been different in the Seychelles Islands. We don't have enough data to actually say that with any certainty, but I think that it's really important to understand that using maternal hair mercury as the marker really adds a lot of -- it adds another source of variance because, for any woman-fetal pair, any woman, you know, maternal-infant pair, there's going to be some ratio between her hair mercury and her blood mercury, and then between her blood and her fetus' blood, and we already know that there's a great deal of variance between maternal blood and fetal blood. It can be as little as almost one to one. It can be over three to one, but we don't have the corresponding data for hair, so again, if you're using hair as a marker, you're likely to be mischaracterizing, misclassifying exposure to the fetus on the basis of hair, which would bias the results of the study towards

the null. 11: "On page seven of her testimony, Dr. Rice states that fetal blood has 70 percent more mercury than that of the mother. Does Dr. Rice agree that there is disagreement among toxicologists concerning this relationship between fetal and maternal blood levels?" No. I don't agree with that. B: "Does Dr. Rice agree that this relationship may not be consistent?" I think "consistent" is not a term that would be used by a scientist in this regard. It's variable, and it's variable, probably, for biologic reasons, so that the ratio can be, in fact, over three to one, so that a mother who has that kind of relationship between her and her fetus in terms of blood, she is going to be putting her fetus then at relatively more risk than a woman whose ratio is only 1.1 to 1.7.

MR. BONEBRAKE CONTINUES:

Q. When you speak of variability, is it also true the variability could go the other way, and a woman could have a relationship with her fetal blood that's lower?

A. Yes. 1.7 is the central tendency, so that means that there are some that are higher and some that are lower.

DR. RICE: 12: "Did Dr. Rice provide,

both, deposition and trial testimony in the matter of Public Media Center versus Tri-Union Seafoods, LLC, et al, consolidated case Nos. CGC-01-402975 and CGC-04-432394 in the Superior Court of the State of California, City and County of San Francisco, the Tri-Union case?" The answer is yes. A: "What matters did Dr. Rice address in her testimony in the Tri-Union case?" I addressed the health effects of methylmercury. B: "Did Dr. Rice's testimony address whether there was a safe level of methylmercury consumption?" No. I didn't. I derived a maximum allowable dose level, a so-called mattel (phonetic) under Proposition 65, which is not, in any way, designed to represent a safe level. It's actually a level at which there has to be a warning label, so I didn't derive a safe level.

MR. BONEBRAKE CONTINUES:

Q. Was the warning level at issue there designed to reflect or correspond to a safe level for consumption purposes?

A. No.

DR. RICE: "What comprises a safe level of fish tissue methylmercury content?" I was asked questions associated with that, yes. "The health impacts of methylmercury exposure?" Yes. "Whether she

authored previous papers concerning the Faroe island study, the impact of PCB exposure in the Faroe Islands methylmercury study, and the appropriateness of federal and state fish advisories." I was asked only about one study that I was a third author on, and I was asked questions about the appropriateness of, specifically, the EPA, FDA fish advisory, and I was also asked questions about state advisories. C: "On or about May 11, 2006, did the Court enter or file a decision in the Tri-Union case?" I guess I'm no lawyer, so I don't know what it means to file, so I can't speak to this with any degree of expertise at all.

MADAM HEARING OFFICER: Dr. Rice, did the judge issue a decision in the case?

DR. RICE: Yes. The judge issued a decision in the case.

MR. BONEBRAKE CONTINUES:

Q. The testimony you just described that you provided, was that, both, a deposition and at trial?

A. I'm sorry?

Q. You just described some testimony that you provided.

A. Yeah.

Q. My understanding from your initial answer

was you provided, both, deposition and trial testimony.

A. Yes.

Q. So my question was were all those matters addressed in, both, your deposition and trial testimony?

A. No. No, they weren't.

Q. Who were you testifying on behalf of in this case?

A. The State of California.

Q. And do you know the name of the attorney, or attorneys, who were representing the other side in the case?

A. Mr. Hanelon (phonetic) was the lead attorney, and I don't know the law firm.

DR. RICE: C-1: Did the Tri-Union court reject Dr. Rice's testimony concerning methylmercury," and 2: "If so, why"?

MR. KIM: Before she answers, we have no problem with the question of did the Tri-Union court reject Dr. Rice's testimony. However, the follow-up question, "If so, why?" again, this was similar to a question to a concern or an objection that we raised yesterday with Mr. Ross and contrary to Mr. Ross' situation, the question was asked of Mr. Ross as to what the Illinois EPA had, and I may not have the exact

wording correct. What we asked the Illinois attorney general's office to pursue in terms of a legal client, and Mr. Ross had made reference to that request and that claim in his testimony. Contrary to this situation, Dr. Rice did not have any hand in authoring the case or the opinion at hand here. She is not an attorney, and she did not make any reference to this case in her testimony, so again, it's the same thing. Any testimony she would give speculating or trying to answer why the court did what she did -- did what it did -- would be, basically, outside the scope of what she would be asked here to testify, and it would be irrelevant in terms of information received by the court.

MADAM HEARING OFFICER: Just to be clear for the record, your objection is to C-2.

MR. KIM: Yes.

MR. BONEBRAKE: If I may respond, the issue, in part, is I believe the Court did address questions pertaining to Dr. Rice's testimony, and I have a copy of the decision. We can talk some more about that. Obviously, Dr. Rice' testimony is fairly complex, technically. Dr. Rice I'm sure would have a view of the Court's findings regarding her testimony, which also, by necessity, would address technical issues, so therefore,

I think we are probably in a situation where the decision deals with kind of a combined set of legal and technical findings by the court. It would seem to be Dr. Rice would be in a position to provide her views on why the court did what it did from a technical perspective, at the very least, and one of the questions I was going to ask Dr. Rice was has she read a copy of the decision.

MADAM HEARING OFFICER: Dr. Rice, we'll let you answer C-1, and I'm going to go with Mr. Kim on this. I don't think that Dr. Rice is in a position to explain why the court did something, especially when the court should have been able to explain that itself, and I haven't seen the decision, yet. I think you need to put it in the record, and let the document speak for itself.

Q. I can certainly put it in the record. I can have her authenticate it, and maybe we can take some questions from there. I think the questions I might be inclined to ask are of kind of a technical nature, but we can take those on a case-by-case basis.

MADAM HEARING OFFICER: Take those on a case-by-case basis.

MR. BONEBRAKE: Why don't we get a

copy now for the record. It's over 100 pages, so I have three copies.

MADAM HEARING OFFICER: I'm going to mark this and enter this into the record as Exhibit No. 6 if there's no objection. We'll mark this as Exhibit No. 6.

(Exhibit No. 6 was admitted.)

MR. BONEBRAKE: I'm sorry. Was that No. 6?

MADAM HEARING OFFICER: Yes. So Dr. Rice, did the Tri-Union court reject your testimony concerning methylmercury?

DR. RICE: They rejected California's case. I'm not sure that I can answer, specifically, about my testimony. The issue of the use of the technical information was really a legal argument about the use of the epidemiological studies for Proposition 65, and apparently, the court rejected that. There were other issues, as well. I mean, this wasn't the only issue, so I mean I guess that all I can say about it.

MR. BONEBRAKE CONTINUES:

Q. Did the court determine that you had provided misleading testimony in this decision, Dr. Rice?

MR. KIM: Again --

MADAM HEARING OFFICER: Before we go there, first, I think -- has she seen the decision?

MR. BONEBRAKE CONTINUES:

Q. Dr. Rice, have you seen the decision?

A. I have not read the decision.

Q. You have not read the decision?

A. No.

MR. KIM: Has this been formally offered?

MADAM HEARING OFFICER: Yes, and I asked if there was any objection.

MR. BONEBRAKE: Can you turn with me to page 41 of the decision, Dr. Rice. Do you see, in paragraph 121, Dr. Rice, the statement "Dr. Rice provided misleading testimony of the single exposure to methlymercury of the kind at issues in this case can cause adverse effects in humans."

MR. KIM: Again, I'm going to object if he's going to quote passages from the case, which she has just testified she never read, and it's, approximately -- pretty thick, I'm not sure -- 118 pages. I really don't see any need to go into questioning her on what the judge was thinking and why

the judge decided what he decided. It's irrelevant. she's never read it. She didn't have a hand in writing it. The document speaks for itself.

MR. BONEBRAKE: I guess I would point out to the hearing officer there are various statements in this decision that we believe relate to the credibility of Dr. Rice to provide testimony. I was pointing out I believe there are various statements in this decision that bear on the credibility of Dr. Rice with respect to the testimony that she is offering today. We believe that the decision by the California court is very relevant to the Board's deliberations concerning Dr. Rice's testimony, so we do believe that the decision is relevant.

MR. KIM: We did not object to the admission of the document.

MADAM HEARING OFFICER: The objection is to questioning her on passages which she has not read and I tend to agree with Mr. Kim. It's also difficult, given the minimal number of copies as, understandably, given the size of it for us to be able to follow along, and do this, and I hesitate to let you read select passages out loud without the opportunity to review it, so I think I'm going to go with Mr. Kim on this one, and

ask that you not ask her directly about the passages from the case.

MR. BONEBRAKE CONTINUES:

Q. Were you paid to testify in the Tri-Union case, Dr. Rice?

A. Yes.

Q. By whom?

A. The State of California.

Q. Have you had any discussions with the State of California regarding the decision which has been marked as Exhibit 6?

A. I know that it exists.

Q. Have you had any discussions with the state, Dr. Rice, concerning that decision?

A. Specifically, concerning this decision?

Q. Yes.

A. I'm aware of the fact that the State of California is asking the judge to reconsider his opinion on the basis of numerous errors of fact.

Q. Has the State filed anything with the court with respect to your understanding that they were seeking reconsideration?

A. I believe they have.

MR. KIM: As a matter of fact,

probably after the break lunch break, we would be trying to get a clean hard copy of the Motion for Reconsideration just so the Board can see that document, as well.

MADAM HEARING OFFICER: Okay.

MR. BONEBRAKE CONTINUES: Is it your understanding that a Motion for Reconsideration has been filed?

MR. AYRES: It has.

MR. BONEBRAKE: Do you know if a response for the Motion for Reconsideration has been filed?

MR. KIM: We're not aware at this time. It may be. I don't know.

MADAM HEARING OFFICER: I would note that you are free to, in your own testimony, challenge any of Dr. Rice's statements and further elicit information from this when you present your case, but at this time, I think it's more appropriate to move on.

MR. BONEBRAKE: Just so it's clear, I may have some questions during the course of the day as we continue to ask questions that relate to some of the technical aspects of the court's decision, so is your ruling that I'm not precluded from asking that type of

question?

MADAM HEARING OFFICER: We will rule on those as they come up. Are we ready to move on to question 13, then?

DR. RICE: 13: "With respect to the United States Environmental Protection Agency's RfD for methylmercury, is the reference dose measure of methylmercury exposure, e.g., consumed, rather than a measure of the concentration of methylmercury in the body?" Yes. That's true. B: "Is there a benchmark, or deleterious effect level, related to concentrations of methylmercury in the body at which certain impacts might be expected in a portion of the population?" I'm assuming here that "benchmark" refers to the benchmark dose analysis that the NRC committee did and what they did was they estimated -- they started with actually a linear curve here. They started with this relationship and then they estimated for a number of endpoints for the Faroe Islands studies, for the New Zealand study, for the Seychelles Islands study for various ways of combining the data, including integrated analysis of all three studies. A point on the curve that was associated with a doubling of the number of children who would follow into the abnormal range, and it was -- the cutoff

was comparable. I mean, obviously, they are looking at a bunch of different endpoints, but the analogy that was made by some of the members of the panel and the members of the EPA peer-reviewed committee was that it was about comparable to an IQ of 75, so the point that they chose as the starting point for derivation of the reference dose was, instead of about five percent of the population having an IQ below 75, 10 percent of the population would be pushed into that range, so that was the starting point. I mean, I don't know if that's what was meant by this question, but I didn't know else to interpret it.

MR. BONEBRAKE CONTINUES:

Q. Is that number, 58 parts per billion cord blood?

A. Well, it's a little bit -- I don't know. The 58 is kind of out there. What they did was they did lots of different endpoints from all three of the studies, 58 parts per billion corresponds to one of them, corresponds to one endpoint from the Faroe Islands study. They did lots of others. EPA does not consider that its reference dose is based only on that one endpoint. The integrative analysis from all three studies, for example, is 34 parts per billion as a

starting point, so I don't think we can say that 58 parts per billion is the number.

Q. Didn't the National Research Counsel determine that the Boston Naming Test from the Faroe Islands study should be used for purposes of developing a benchmark and the RfD?

MADAM HEARING OFFICER: I didn't get the --

MR. BONEBRAKE CONTINUES:

Q. The Boston Naming Test.

A. The benchmark naming post was done on lots of different endpoints, so the answer to your first question is no. The NRC panel -- and these people are my colleagues. I have known them for many years, so I talked to them after it was all over, and their understanding was that the EPA required there to be a so-called critical study, critical endpoint. In other words, you take all the data and you kind of rashet it down to one endpoint, and they had a lot of discussion about what endpoint that would be and so their recommendation was to use the Boston -- to use the Faroe Islands study and the Boston Naming Test. Now, I was actually at the Agency. I'm an author of the EPA reference dose for methylmercury, and I went to my

health director and I said -- because there was all of this data. I mean, there were all of these benchmark doses for all of these endpoints, and I said, "Does the EPA have to use one study and one endpoint?" And she looked at me and she said, "What you're supposed to do is use common sense," so the reference dose, if you go on Iris, you will see that the reference dose is based on a number of these endpoints. When you go through and do the calculation and then calculate intake, almost all of them actually converge on a reference dose of .1, so in that respect, it doesn't matter, almost, which endpoint you choose from the New Zealand study or the Faroe Islands study or the integrative analysis. You can pretty much choose anything, and it all converges on .1 so it's -- that's reassuring. That's really reassuring that the reference dose isn't based on one spurious finding in one study.

MADAM HEARING OFFICER: Is this a follow-up?

MS. GEERTSMA: I have a question based on something that was said earlier.

MADAM HEARING OFFICER: Let's go ahead and finish with that.

MS. GEERTSMA CONTINUES:

Q. In response to Question 11 earlier in the testimony, 11 earlier today about fetal blood having 70 percent more mercury than that of the mother, I was wondering, did the benchmark dose analysis that you just described, did that assume a ratio of 1.7 or did it use some other ratio that was known at the time?

A. The benchmark dose is based on cord blood. The issue then comes into play when you have to go from cord blood back to the intake by the mother, so is that EPA, when we derived our reference dose, we didn't know what that ratio was, and there's been subsequent sophisticated analysis by Dr. Allen Stearn that -- he's the author of the 1.7. We assumed it was unity. We knew that it wasn't -- we called that out as a data gap at the time, so for the benchmark dose analysis, that ratio was irrelevant because it's cord blood.

MR. BONEBRAKE CONTINUES:

Q. Has U.S. EPA said in publicly-available documents that its reference dose is based on the Faroe Islands study?

A. I'm not sure. I know what's up on Iris now is -- it's considered to be dependent on a number of endpoints. What was up on Iris in the past, I'm not sure. I think it's gone -- but that's historical. I

mean, various people from the EPA have published. I'm not sure what you mean by the EPA, if there's -- I guess you're referring to, specifically, documents that have EPA as the author. I'm not sure. I'm not sure whether they have in the past or not.

MADAM HEARING OFFICER: Can I ask you to clarify a term. You've used the "Iris" a couple of times.

DR. RICE: Integrated Risk Information System. It's part of EPA's website, and it's a list of chemicals and the toxicity values that can be reference doses, or reference concentrations, which are inhaled concentrations, and there's something called a Cancer Slope Factor and so those are listed with the kind of justification rationale for a whole list of chemicals.

MADAM HEARING OFFICER: Thank you.

MR. BONEBRAKE CONTINUES:

Q. We talked a little about the 58 part per billion standard. Is there in corresponding human hair methylmercury level to 58 parts per billion?

A. About 10, 10 or 11 ppm.

Q. Ten or 11 ppm? Are you aware of any study in the United States showing methylmercury hair levels above 10 or 11 parts per million?

A. There certainly are people in the United States with hair levels of 10 or 11 ppm, absolutely. You usually see that in people who are subsistence fishers or very high consumer of predatory fish, swordfish, expensive fish very often. Swordfish and tuna -- and what is it? Padigonian tube fish, which is now called sea bass or it was called sea bass before the fishery was fished out by people in the United States buying it, so those levels certainly do exist, but it's important to keep in mind that that 58 ppb is not a safe level. It's a defined adverse effect level, so that you would expect there to be effects lower than that, and I have mentioned several times that there's no effect for a threshold, even below that.

Q. All the fish you just mentioned are ocean fish. Is that right, Dr. Rice?

A. They are, but certainly, I mean, I live in Maine and I'm not an angler, so those are the fish I think, but you could certainly push your mercury level up pretty quickly eating some predatory freshwater fish, as well.

Q. What study, or studies, Dr. Rice, are you referring to when you talk about folks with hair mercury levels above 10 or 11 parts per million based on fish

consumption of the type you just mentioned?

A. I think that Jane Hightower has something in publication. What exists, unfortunately, is a lot of data that's not published, data from various states and various groups, so that, I can't point you, and again, my area is not really the correlation between fish intake and body burden, so there are other people who can speak to that better than I.

MADAM HEARING OFFICER: Mr. Rieser?

CROSS EXAMINATION BY MR. RIESER:

Q. Similarly, with respect to your last statement about you push body levels up if consuming freshwater predatory fish. Are there any studies that document that?

A. I don't know if there are or not, but there really don't need to be. We understand very well the kinetics of the relationship between intake of methylmercury and what your blood level ends up being. In fact, there are little calculators on the web that allow you to do this and we have a program in Maine where we can punch in the parameters, and the blood level gets spit out, so you don't really need to do a study. We know enough about the kinetics to understand very well if you're taking in methylmercury at so many

ppm, what your blood level is going to end up being.

Q. Are the calculators on the web supported by a study?

A. They are supported by a whole literature. I mean, as I say, we know the pharmacokinetic of methylmercury and all of that is databased.

DR. RICE: Where am I?

MADAM HEARING OFFICER: 13-C.

DR. RICE: "Has U.S. EPA developed a benchmark or deleterious effect level in the body for methylmercury, and if so, what is the current benchmark?" Again, I'm not sure what that is supposed to mean, but I have explained the benchmark dose analysis, so I don't know if that's good enough.

MR. BONEBRAKE: That's fine.

DR. RICE: D: "Did U.S. EPA base its calculation of its RfD on a benchmark level of methylmercury in the body, and if so, what benchmark level was used?" I think we have just gone over that. EPA considers its reference dose to be based on a number of endpoints that were derived by the NRC panel, and again, we took that -- defined the effect level, which is a doubling of the number of kids who would be in the abnormal range and divided that by 10, so-called factor

of 10 uncertainty factor, and a lot of that uncertainty factor could actually be considered to be data derived because, just on the basis of kinetics, alone, we know that there's going to be a factor of three or four that you have to put on to protect women who maybe slow excreters of mercury and their fetuses have high levels of mercury and so forth, but again there is no evidence for threshold, so there's really no evidence -- everything we know suggests that there still may be effects down to the RfD.

MR. BONEBRAKE CONTINUES::

Q. Does U.S. EPA view its RfD to be something other than a bright line where above you are going to have effects and below you will not?

A. Yes. That's one of the things that EPA -- "bright line" is kind of a term that EPA managers throw out fairly regularly, and yes, the RfD is not carved in stone. I mean, you have the data that you have, and you work with it as best you can, and you do the best risk assessment that you can possibly do. I think it's important to understand in this case, however, very often the Agency is confronted with having to derive a reference dose for a chemical where you've got one study and erosions and it may not be all that good of a study

or maybe you have a couple of studies. Maybe the model is not that good. Maybe the endpoints aren't that good. Maybe the data the is s not that good and you end up putting on multiple uncertainty factors, 1,000, 300, 1,000, 3,000, and so in those cases, you've got to say that the RfD is not a bright line. There's so much uncertainty associated with it. The methylmercury risk assessment is a goal standard assessment. I mean, we know more about methylmercury than we do just about anything else. We have these big epidemiological studies. We have lots of data, so yes, the reference dose is not a bright line, but this reference dose is pretty good.

DR. RICE: "Please explain what is meant by Dr. Rice's statement at page four of her testimony that U.S. EPA's RfD .1 micrograms per kilogram per day is based on either the Faroe Islands study or the integrative analysis of all three studies, and I think we have gone over that at this point. 14: "Is U.S. EPA 's reference dose related to the Boston Naming Test results in the Faroe Islands study, and if so, in what way?" and I think I have already explained that, as well, that the Boston Naming Test was, if we were going to do -- the recommendation of the NRC panel was, if you

were going to do critical study, critical effect, that was the endpoint that they recommended, but there's lots of other data out there. 15 --

MR. BONEBRAKE CONTINUES:

Q. Just for clarification, then, the 58 parts per billion was related to the Boston Naming Test endpoint from the Faroe Islands study?

A. Yes.

DR. RICE: 15: "Is there disagreement among experts regarding what the appropriate RfD is for methylmercury and the manner in which it should be calculated?" RfD's, to my knowledge, are only derived by EPA and I don't think -- if there's any disagreement within EPA it's that the reference dose is probably too high, but I really haven't talked to all of the experts, so I guess I really can't answer that question.

MR. BONEBRAKE CONTINUES:

Q. You said that there's views within U.S. EPA that the reference dose is too high. Hasn't U.S. EPA, as recently as 2005, stated that its reference dose is appropriate, Dr. Rice?

A. Yes, and I think that's still their official stand, yes.

Q. And do other agencies, or have other

governmental agencies, that is, other than U.S. EPA, published thresholds that are similar to RfD's, even if they don't call them "RfD's"?

A. 16 is a whole laundry list of other agencies.

Q. I guess the question, then, is, with respect to 15, is there disagreement among experts with respect to RfD's or thresholds that are equivalent to the RfD and the manner in which those kinds of numbers should be generated?

A. I'm not sure there's disagreement about the manner in which they should be generated. I think we all want to do the best risk assessment that we can, and there's an understanding of what goes into that. There's no question that other bodies have come up with other numbers, and we're going to kind of go through that.

DR. RICE: 16: "Have other federal and state agencies, agencies in other countries and domestic international organizations developed different reference doses or similar values with respect to methylmercury?" The answer to that is yes. "What study did the U.S. Agency for Toxic Substances and Disease Registry use as the basis for its minimal risk level for

methylmercury?" They considered -- they use the Seychelles study is my understanding. That's what's in their current document, and they considered that the highest exposure in the Seychelles study represented a no-effect level for the purposes of their MRL. I think it's and their MRL is 0.3 micrograms per kilogram per day, so it's three times that of the EPA reference dose.

MADAM HEARING OFFICER: "MRL" is minimal --

DR. RICE: Minimal risk level, and I think it's important to understand that ATSDR's mandate is to go in and determine health effects of contaminated sites, so the reference dose in the MRL are for different purposes, and I'm not sure they can really be considered to be comparable numbers. ATSDR's tasked with the very, very difficult proposition of going into a community where there's a superfun site or some terrible toxic waste dump, and determining and assessing health effects in that community or assessing whether there are risks in that defined community , so it's been called kind of a -- the MRL is a clean-up value, whereas the RfD is a dirty down value. The RfD is something that you don't want to get to. The MRL is something that you have already got, this really contaminated

site, and how clean does it have to be before you're really putting people's health at risk? So it's really kind of different.

MR. BONEBRAKE CONTINUES:

Q. What is the regulatory or statutory basis for the description you just provided regarding the meaning of the minimal risk level, Dr. Rice?

A. I'm just explaining to you what ATSDR's charge is as an agency. They do something quite different, and I guess my analogy is, when EPA, for example, does their Cancer Slope Factor, they consider for the general population that they don't want the cancer risk to be any higher than one in a million people, but when EPA regions go in to a contaminated site and they are talking about cleaning up that site, then the standard changes to one in 100,000, or in some cases, one in 10,000, in recognition that there's only so much clean-up you can do, so they really are not exactly apples and oranges, but they really are different things.

Q. So it's your testimony that the MRL, then, from the U.S. Agency for Toxic Substances and Disease Registry is not a health-based standard.

A. No. It is a health-based standard. They

consider it a health-based standard.

DR. RICE: B: "What study did the World Health Organization rely on to establish its tolerable daily intake threshold?" They relied on the Faroe Islands and the Seychelles study, so they didn't consider the New Zealand study. What is interesting is that the starting point, the hair level that they started at to derive their -- it's a provisional tolerable daily intake, actually -- was the same as the reference dose. It was about 11 ppm in hair which is -- we all know what that's comparable to now. How many hours are we into this? EPA applied a factor of 10 as an uncertainty factor, which is not a safety factor. It's an uncertainty factor, from that level. WHO, it's JEXA (phonetic), actually, just applied a smaller uncertainty factor, so I mean, really, the basis for their level, which is higher than the EPA reference dose. It's .23 and .23 micrograms per kilogram per day, so it's about double. The U.S. EPA's reference dose really uses pretty much the same starting point, but they applied non-integer uncertainty factors, and they added them, which is something that EPA just would never do, and I wasn't part of that committee, so I don't know why they did that. "What study did the Dutch

Environmental Protection Agency rely on to establish its tolerable daily intake threshold?"

MADAM HEARING OFFICER: I don't think you answered the tolerable data.

DR. RICE: It's .23 micrograms per kilogram per day. I couldn't find a Dutch Environmental Protection Agency. They have some agency that sounds kind of like the Environmental Protection Agency. I had on my shelf a document from 1995, and that was before most of the data came out, the modern data came out. There was some data from New Zealand, and data from Iraq, and that's what they used, and they said that, for women of childbearing age that they recommended .08 micrograms per kilogram per day, which is lower than the EPA reference dose. If there's publication subsequent to 1995, I couldn't find it, so "What did the U.S. Food and Drug Administration rely on to establish its minimal risk level for mercury?" U.S. EPA, FDA's stand on this is unclear to me. They have a very old number they derived back in the 70's and it's .4 micrograms per kilogram per day that's four times the -- it's based on paresthesias. It's based on overt toxicity in adults in the Minamata poisoning episode. It's based on adults having frank neurological signs of methylmercury

poisoning. However, in 2003, David Atchison, who is the chief -- he's the chief medical officer for the FDA's science division said publicly -- and this is on the record -- that FDA agrees with the EPA reference dose, so I'm not entirely sure, and I don't think they have rescinded that, but they haven't come out with a new number. They are asked by a couple of advisory panels to do a risk assessment. In fact, they were pretty much ordered to, and it's my understanding that they have never done that, so I don't know where FDA stands on this.

MR. BONEBRAKE CONTINUES:

Q. But as far as you know the last published number was .4 micrograms per kilogram per day?

A. Back in the 70's, and more recently, their head of science has said that they buy into the RfD.

DR. RICE: "What study did the expert group convened by Toxicological Excellence in Risk Assessment rely on to establish its RfD?" This is private group. I mean, anybody can derive an RfD I guess, and the only thing that I could find on their website was something that IGF Keiser had done, had done a site-specific risk management range -- again, it's not really comparable to a reference dose -- for clean-up of

an Alcoa point comfort location in Texas, so it's a site-specific clean-up level, and that was based on the Seychelles Islands. That was all I could find.

MR. BONEBRAKE CONTINUES:

Q. You weren't able to find a specific numeric level?

A. Yes. They have a range. Their range was .3 to 1.1 micrograms per kilogram per day for clean-up or this Alcoa location.

Q. Based upon your research and review, Dr. Rice, then, is it true that none of the agencies or other organizations we just discussed have issued an RfD or comparable number that's more rigorous or stringent than U.S. EPA's?

A. I think the number that I quoted from the Netherlands was lower than EPA's number.

Q. Excluding that number -- and I think we were uncertain about that number. Excluding that --

A. I don't think we are uncertain about the number. It's a 1995 document, and it was really unclear why anybody would be asking me about the Netherlands. That's why I'm not sure that there's a later document.

Q. But excluding that, the numbers you were seeing were equal to or higher than U.S. EPA's reference

dose. Is that right, Dr. Rice?

A. Yes. I think of the numbers that are designed to be comparable to a reference dose. One is lower. Then there's EPA. Then there's the WHO reference level that's higher that I would say is designed to be comparable to an RfD, and then, depending on how you want to interpret the MRL, that's also higher.

MR. KIM: Just for clarification, when Mr. Bonebrake asked the numbers you are seeing -- he's referring to the specific identified organizations and figures that are in Question 16. Is that right?

MR. BONEBRAKE: That is correct.

DR. RICE: It's the one he asked me about specifically.

MR. KIM: I just want to make sure that's the universal.

DR. RICE: That's the universal of numbers we are talking about. 18: "At page two of her testimony, Dr. Rice refers to mercury poisoning episodes in Japan and Iraq. Is it true that individual exposures in these two cases and these two instances and some cases exceeded 200,000 micrograms of methylmercury?" I don't know if that's true or not. There's really no way

to know what the exposures were in Japan in Minamata. Maybe this kind of calculation was done -- been done for Iraq. I don't really know. These are poisoning episodes where people actually died, so I just didn't do it because I didn't think that it was particularly relevant.

MR. BONEBRAKE CONTINUES:

Q. It's not relevant because those are instances of acute poisoning, as opposed to chronic dose?

A. No. I wouldn't characterize them as acute. Well, "acute" to a toxicologist means one exposure or maybe two exposures. We talk about acute exposure to animals meaning that you are just giving them one dose. I would characterize the exposures in Iraq as being sub acute, maybe. I mean, they were relatively short term, certainly, compared to lifetime exposures. The exposures in methylmercury in Minimata in Negata went on for years before people really figured it out and people stopped eating some of these fish. I don't know how to -- I guess I wouldn't characterize that exposure as chronic, depending on -- there's policy definitions of these numbers. EPA defines "chronic" as more than a tenth of your life. I don't know. I

wouldn't characterize it as chronic. It's certainly not comparable to eating a little bit of methylmercury your entire life.

DR. RICE: 19: "Does Illinois EPA use EPA's RfD in calculating fish advisories?" All of this I am going to let somebody else answer. Somebody else would have a better --

MADAM HEARING OFFICER: All of Question 19?

MR. KIM: Yeah. I think Dr. Rice is going to defer Question No. 19 and Dr. Hornshaw I believe is the person who handled those. He's right here if you would like us to do this now.

DR. RICE: I was actually going down through C.

MR. KIM: So 19 A, B and C. So would you like us to do that, just to answer the questions?

MR. BONEBRAKE: Who was Dr. Rice referring to? I missed that.

MR. KIM: Dr. Hornshaw.

MADAM HEARING OFFICER: For purposes of the record, it might work, since there's other subsets that Dr. Rice is and reminding Dr. Hornshaw, you were sworn yesterday and still sworn in.

MR. BONEBRAKE: If I may, I think there are some related questions and questions that have been proposed to Dr. Hornshaw, so if I may reserve some related follow-up because I'm not sure what all those questions are, but they may be a little different than what's being asked here.

MADAM HEARING OFFICER: The first question is "What is Illinois -- does Illinois EPA use a U.S. EPA's RfD in calculating fish advisories?"

DR. HORNSHAW: The first thing I have to do is correct that because Illinois EPA doesn't do the Fish Contaminant Program, first of all. I need to correct this question. Illinois EPA doesn't issue the fish advisory. It's the Fish Contaminant Monitoring Program issued them, as I said earlier, and the fish contaminant Program does use EPA's reference dose in calculating fish advisories. The most stringent advisory is "Do not eat." We have that for all the contaminants. The most stringent advisory we issue for any of the contaminants is "Do not eat." I don't know if you intended that question to be asked.

MR. BONEBRAKE CONTINUES:

Q. If I may, I think you mentioned that the FMCP does rely on U.S. EPA's reference dose?

A. Yes.

Q. Why was U.S. EPA's reference dose selected?

A. Because it was what we did at the time that the National Academy issued its report on mercury reference dose. We figured that was the best appropriate Health Protection Value. "Health Protection Value" is the term of art that's employed by the Great Lakes protocol, and we base all of our advisories on the Great Lakes protocol, so we had to come up with a Health Protection Value, and we thought that the National Academy of Science's acceptance of .0001 milligrams per kilogram per day was the most appropriate Health Protection Value.

Q. Can you define for us what is a "Health Protection Value" I think is the phrase you were using?

A. Yes. It's a value that has, essentially, the same meaning as U.S. EPA's reference dose and that should be acceptable for daily exposure for lifetime. A: Actually this was asked of Dr. Rice, and I don't know if she wants to try and answer part of it, too.

MADAM HEARING OFFICER: The question is "Are you aware of any states with more stringent fish advisories than Illinois?"

DR. RICE: I don't even know what the Illinois fish advisory is.

MADAM HEARING OFFICER: Dr. Hornshaw, are you aware of any states --

DR. HORNSHAW: It's my understanding that Indiana has more advisories more stringent than ours, but that's based on their choice to combine the effects of PCB's and either chlordane or mercury in fish that have more than one contaminant, which the Fish Contaminant Program has chosen not to do at this time.

MR. BONEBRAKE CONTINUES:

Q. Dr. Hornshaw, what is the more appropriate -- I mean, what is that more stringent standard in Indiana?

A. My understanding -- and I have discussed this with the people at the Department of Health in Indiana -- but I'm still not sure how they exactly they use this. They call it a "bump-up." If the contaminant, if there's more than one contaminant in any fish that's under concern, whichever contaminant would derive the more stringent restriction, that's the basis for the advisory. Then it goes up one level above that for the second contaminant, so for instance, they would advise no more than a meal per week based on PCB

contamination, and there's also mercury contamination found in the fish. Then they would bump it up to one meal a month as the advisory, and we would not do that.

Q. I think you mentioned the most stringent standard in Illinois was "Do not eat." When is that standard applicable?

A. If you have the Technical Support Document tables in Section 4, Table 4.2 and 4.3 lists those for methylmercury, it's greater than 5.6 currently. The fish Contaminant Program will change that one milligram per kilogram to be consistent with FDA action level when we convene this year to do the advisories for next year.

MR. KIM: That's on page 53 of the Technical Support Document.

MR. BONEBRAKE CONTINUES:

Q. If you wouldn't mind, that change will be up or done.

A. It will go from what's in the table now I think it's 5.6 milligrams per kilogram to one milligram per kilogram is the level where we will say, "Do not eat."

Q. With respect to the 5.62 standard, Mr. Hornshaw, are you familiar with any data that has been collected by IEPA or that IEPA currently has in its

possession that identifies tissue mercury levels that are --

A. There are none. The last I am aware of is 1.4.

Q. It's 1.4 parts per million?

A. Milligrams per kilogram, parts per million.

Q. I will have some related follow-up separately for Dr. Hornshaw.

DR. HORNSHAW: Less stringent fish advisories? I'm aware that Missouri changed their advisory this past year or last year. They now issued a statewide advisory, but it only tells people or women of childbearing age in children under I think 15 to eat no more than a meal per week of any bass species greater than 12 inches. Where we talk about all predator species and don't give a size range. Similarly, Iowa this year changed their advisory. They had one or two advisories that were based on the FDA action levels on PCB's or mercury and they have since adopted some kind of risk-based approach that we use, and I believe their cutoff less stringent than ours. I think they use .2 for one meal per week, all the way up to one meal per week.

Q. The current unlimited fish consumption advisory in Illinois is 0.05 parts per million. Is that correct?

A. That's correct.

Q. Are you aware of whether other states have issued official advisories with a higher unlimited fish consumption number that is above 0.05?

A. I can't answer that now. I know, in the past, there were some states that use different value in the Great Lakes area, but since all the Great Lakes states are using Great Lakes protocol, they are all very similar in our fish advisories. I can't speak for the rest of the country.

MADAM HEARING OFFICER: I believe we are back to question D where Dr. Rice is going to take back over.

DR. RICE: D: "Has U.S. EPA issued an official advisory?" EPA issued a conjoint official advisory with the Food and Drug Administration. E --

MADAM HEARING OFFICER: Excuse me.

MR. BONEBRAKE CONTINUES:

Q. Dr. Rice, what is that advisory?

A. Don't eat swordfish, tile fish, King Mackerel and something else. Shark. And then eat a

variety of fish species. Eat fish containing as much as 12 ounces a week of fish that contains low levels of mercury, including light tuna. Albacore tuna has more mercury in it than light tuna, so if you are going to eat Albacore tuna, in a particular week, don't eat more than six ounces. That's my recollection of, more or less, what the advisory says.

Q. And you use the term "low levels" in that answer. Do you have an understanding of what "low levels" means in connection with that advisory?

A. FDA considers low levels to be what's in light tuna. I mean, they really want to protect tuna, and so it's about .1, and it's a little bit of a moving target because FDA is now back to doing fish tissue analysis. It's .14. It's down to .118, but it's something a little bit over .1.

Q. The .1 is .1 parts per million?

A. Yes .1 parts per million.

DR. RICE: E: "Do the U.S. EPA and the U.S. Food and Drug Administration advise the public that women can safely eat fish with low levels of mercury, including up to 12 ounces of tuna?" I guess I could have looked at this as a cheat sheet. Yes. "Does Dr. Rice agree that state and federal fish advisories

inform the public that certain amounts of fish may be safely consumed, even if they contain methylmercury?" You know, I really haven't read all the state advisories. Again, state fish advisories are not my area. Federal fish advisories I guess referenced to just the one that exists, and so I will just speak to that one, and yes, that is implicit I guess in the advisory that you can consume fish, even if they contain methylmercury.

MR. BONEBRAKE CONTINUES:

Q. Do you disagree with that advisory, Dr. Rice?

A. I disagree with the advisory. I don't disagree with the assertion that fish can be safely eaten even if they contain methylmercury, which I think we went through on another question.

Q. Does your home state of Maine have a fish advisory?

A. Yes, we do.

Q. For methylmercury?

A. All of the bodies of water in Maine are under a fish advisory because of methylmercury, but Maine has some of the highest levels of fish in the country because we're on the jetstream downwind of the

power plants.

Q. Do you disagree with the fish advisory in Maine for methylmercury?

A. Maine. Yeah, Maine subscribes, mostly, to at low levels, to the FDA advisory and my supervisor, Dr. Andrew Smith, and I have had conversations about this because it's not -- it's pretty easy to get above the EPA reference dose with this advisory. EPA also differs from the advisory in that we allow some consumption of fish that contain high levels of methylmercury such as swordfish. I don't disagree with that, particularly for people who aren't pregnant or could be getting pregnant soon. I don't disagree with that part of the advisory at all.

Q. Are there portions of the advisory that you do disagree with?

A. As I stated, I think that the safest thing to do is to keep intake below the reference dose. Eating 12 ounces -- for a child to eat 12 ounces of light tuna a week, puts that child -- again, depending on weight -- above the reference dose, and since I'm a co-author of the reference dose, I disagree with that aspect of this joint advisory, which was very much a compromise for EPA and FDA who had vastly differing

opinions about the risks that methylmercury in fish poses.

MADAM HEARING OFFICER: Mr. Zabel.

CROSS EXAMINATION BY MR. ZABEL:

Q. As you said, you mentioned that Maine is downstream, downwind of the jetstream of power plants. Is it your opinion that the mercury content in Maine fish is the result of domestic power plant emissions?

A. Not solely, not by any means.

Q. How much, Doctor?

A. I don't know. I don't know.

Q. Ten percent?

A. I don't know. Senator Collins refers to Maine as the tailpipe of the nation, based on this reality, and obviously, it's not just mercury. She's also refers to other air pollutants, but there's certainly natural sources of methylmercury in Maine, as well.

Q. You are downstream of China, as well, in the jetstream, are you not?

A. But you're a lot closer.

Q. We're a lot smaller, too, in terms of emissions. Is that correct, Doctor?

A. I don't know.

Q. If you don't know, how can you make a statement like that? You have no data to support it. Is that correct?

MR. KIM: I'm going to object. I don't think she was making a quantitative statement.

MR. ZABEL: She was making a majoritive statement and trying to get away with it, and that's what I do not like about these proceedings. I will withdraw the question, Madam Hearing Officer.

DR. RICE: I just might say that a child eating six ounces a week of Albacore tuna puts them at 380 percent of the reference dose, which is why I disagree, one of the reasons, and I mean, you can do these calculations. They are easy to do. The multiplication is very straightforward. It's very, very easy for, particularly, a child to get over the reference dose very quickly.

MADAM HEARING OFFICER: Mr. Zabel.

MR. ZABEL CONTINUES:

Q. How many Albacore tuna are there in Maine?

A. Freshwater or salt water.

Q. In Maine. Maine water bodies.

A. Maine water bodies. I'm not a fish person. I'm going to guess and say none.

Q. I will accept the guess then.

DR. RICE: Where are we?

MADAM HEARING OFFICER: G.

DR. RICE: "Is it true that U.S. EPA's RfD addresses the amount of methylmercury that may be consumed every day for an entire life?" Yes. I mean, that's integral to the definition of a reference dose, so presumably, one could eat .1 micrograms per kilogram per day every day, and still not be producing appreciable adverse effect, although I've already sort of testified to the fact that we don't really know that there's no effect below the reference dose. H: "Is it also true that if an individual's average daily consumption of fish over a period of weeks or months is less than the RfD, that individual's consumption is considered by U.S. EPA to be less than the RfD, even if that individual, on certain days during that period, consumes more than the RfD?" I'm not sure that EPA has made a formal statement on this, specifically, relating to methylmercury in fish. It's implicit in the advisory that you can -- that there's some averaging that's reasonable. If you can eat one Albacore tuna fish sandwich and not eat any other fish for the rest of the week and that puts you below the cumulative reference

dose for the week, it's implicit in the advisory that that's allowable, but I want to also say that it's part of EPA guidelines that, for reproductive and developmental effects, that EPA considers that one dose is sufficient to produce an effect. In other words, because of the way the fetus develops, there are critical periods that you may be able to produce an effect, if you give a particular contaminant or drug, on day 20, or during a particular day three months into pregnancy and so to be -- so EPA's position is that, even if the data or exposure over an extended period of time, if you don't really know the mechanism, and you don't really know the critical effect, which we almost never do, or I'm sorry, the critical time period, that it can be assumed, or should be assumed that only one exposure may be enough to produce effect, and of course, that argues against the idea of averaging. I think probably good public health policy is somewhere in the middle of that. You wouldn't want to see a pregnant woman sit down and eat two pounds of fish with three ppm of methylmercury any time during her pregnancy or the months leading up to her pregnancy, but that's not to say is that I would be terribly alarmed over one meal that is slightly above the reference dose, as long as

the woman is paying attention to how much cumulative mercury she's eating. I know that's a really long answer.

MR. BONEBRAKE CONTINUES:

Q. Are you familiar with the federal CAMR?

A. Not terribly, no.

Q. Are you familiar with U.S. EPA's reconsideration of the federal CAMR?

A. No.

Q. So you haven't read any of the documents associated with U.S. EPA's reconsideration?

A. You know, I have tried to read some of the documents, but some of that is so outside my field because it's really all about deposition and power plants, and I just cannot speak to it with any expertise or insight, whatsoever.

Q. Do you recall any discussion in the documents that you did see indications that U.S. EPA simply did not have data to support the view that a one dose of methylmercury during pregnancy would cause adverse effects?

A. I don't recollect seeing that. I'm not surprised that there's no data because there's not -- there are just no studies where a woman goes from zero

mercury, one big spike of mercury, and then zero mercury. We all have a background of mercury, and again, it's the idea that just because we don't have data to support that -- my argument is on theoretical -- my argument is on what we know about development of the fetus and so it's not -- it's not a data-based argument, so it's not at all surprising that a sentence like that would be in there.

Q. So your view is an extrapolation from the existing data, rather than a conclusion drawn directly from the data, itself,

A. It's not drawn from the data, no it's not.

MADAM HEARING OFFICER: Dr. Rice, it is right nearly 12 o'clock. That ends Question No. 19 which puts us halfway through the numbers of questions. That means that why don't we go ahead and take a lunch break. Try to get back as close to one as possible.

(At which point the hearing was adjourned for lunch.)

Q. MADAM HEARING OFFICER: I believe we are ready to start with question 20 of Dr. Rice.

DR. RICE: 20: "With respect to the PCB's, it appears from Dr. Rice's testimony Appendix A to the TSD, and the references thereto that Dr. Rice has

studied the developmental neurotoxicant effects of PCB's in infant monkeys exposed through breast milk. Is that correct?" Not entirely. What we did was a study in which infant monkeys were actually fed -- infant monkeys -- a formula of which there is such a thing, and to which we added a mixture of PCB's that was designed to be representative of the PCB mixture in Canadian milk. PCB's are a mixture. There's a possible 209 different kinds of different PCB's, depending on how many chlorine atoms there are, and where they are on the ring, and they may have different toxicities, so our study was designed to look at the mixtures that is found in the breast milk of Canadians, which is really the same as that found in the breast milk of Americans. "Does Dr. Rice agree that PCB's are an established neurotoxic?" It is a neurotoxicant, indeed. It's a developmental neurotoxicant. B: "Has the EPA issued an RfD for PCB's?" They have issued two for two different commercial mixtures. "If so" -- this is B-I -- "If so, what is that RfD?" As I said, they have two for commercial mixtures. They are both based on data from monkeys, not from data in humans. One is a so-called aerochlor (phonetic) 1254, and this is a mixture in which it has a relatively high component of chlorine

atoms in the mix. It's not representative of the mixture in humans, but it's a better approximation than 1016, which is the other one. The reference dose is two times 10 to the minus fifth milligrams per kilograms per day, and that's based on suppression of immune function in adult Reyes monkeys. The other reference dose for PCB's that the EPA has is for aerochlor 1016. That's based on developmental effects in Reyes monkeys and that's five times 10 to the minus fifth milligrams per kilogram per day. Two: "Has Illinois EPA issued fish advisories for PCB's?" Somebody else will have to address that.

MR. KIM: I believe Dr. Hornshaw is not here right now.

MR. BONEBRAKE: We can address that question later.

DR. RICE: C: "How did the level of PCB exposure in the Faroe Islands compare to U.S. EPA's RfD for PCB's?" There's no way of knowing that because what we have in the Faroe Islands is levels in cord tissue. We don't have intake. We don't have any measures of intake at all, so it's impossible to say. D: "How did the level of PCB exposure in the Faroe Islands compare to the level that produced effects in

the infant monkeys that Dr. Rice experimented with?" Again, really the same as C, we have an external dose, but we don't know anything about the actual exposure to PCB's in the Faroe Islands, so it's really not possible to answer that question.

MR. BONEBRAKE CONTINUES: A follow-up question. Do you recall, Dr. Rice, if the court in the Tri-Union Seafoods case addressed the question of whether the PCB's found in the Faroe Islands population exceeded the reference dose for PCB's?"

MR. KIM: By way of clarification, when you say "addressed" are you referring to the opinion that was handed out as an exhibit earlier today?

MR. BONEBRAKE: The opinion or otherwise.

MR. KIM: I'm assuming the same ruling on the opinion itself stands.

MADAM HEARING OFFICER: Dr. Rice has already indicated she hasn't read the opinion, so she can't really comment. Could you rephrase the question, perhaps?

MR. BONEBRAKE: I think the question includes, but is not limited to the opinion, so if she otherwise knows if the court addressed the question of

whether the PCB level Dr. Rice knows whether the PCB level present in the Faroe Islands exceeded the RfD for PCB's.

DR. RICE: We certainly talked a lot about PCB exposure in the Faroe Islands in that trial. I don't remember whether we talked about how it related to the reference dose. I really don't recall, but as I say, we don't know the intake in the Faroe Islands, and so I can't really make any substantive statement whether it exceeded the reference dose or not.

MR. BONEBRAKE CONTINUES:

Q. Well, can we turn to page 34, paragraph 105 of Exhibit 6, which is a copy of the opinion?

MR. KIM: Again, if we're --

MADAM HEARING OFFICER: Let's listen to the question before you object.

MR. KIM: Sure. Page 34.

MR. BONEBRAKE CONTINUES:

Q. Page 34, paragraph 105. The question will relate to the first sentence in that paragraph, which reads, "The average daily exposure to PCB's among Faroe's women exceeds the United States reference dose for PCB by 172 times, and the average daily exposure to methylmercury exceeds the RfD for methylmercury by four

times." Dr. Rice, do you believe that to be an incorrect statement by the court?

MR. KIM: Again, before we go any further, I'm not sure of the abbreviations the court is using. I note after that statement, there is --

DR. RICE: This is testimony for Jay Murray for the fishing industry.

MR. KIM: This is testimony of a different witness. I don't know if Dr. Rice was present during that testimony, but regardless --

DR. RICE: I wasn't.

MR. KIM: This was a statement by the Court restating other testimony that was provided during the course of the hearing or the trial, presumably, so again, the statement speaks for itself to the extent that some recitation or citation is going to be made in here.

MADAM HEARING OFFICER: His question is does she agree or disagree with that statement, and given these parameters, whether or not she disagrees, or agrees, she can make that qualification.

DR. RICE: In relation to PCB's again, I don't know how Dr. Murray came up with this calculation. He surely must have somehow tried to back

extrapolate from body burden to intake, and to my knowledge, there hasn't been a good PK model. There hasn't been good pharmacokinetic modeling for PCB's to get in humans or any other species to get from the body burden back to intake, so I have no way of knowing how he came up with 172. I didn't hear his testimony. I didn't read -- I just don't know.

MADAM HEARING OFFICER: So you can't really express an opinion.

DR. RICE: My opinion is that we really don't know. My opinion is that the appropriate pharmacokinetic modeling has not been done, so we have no way of knowing.

DR. RICE: Is it -- this is E: "Is it true that mothers in the Faroe Islands mercury study had PCB concentrations in their bodies that were among the highest body burden concentrations in the world?" The PCB body burdens in the Faroe Islands are high compared to the U.S. population. I mean, the world, most of the population in the world haven't been assessed, but there's no question that the PCB body burdens, the average PCB body burdens, in the Faroe Islands are higher than those in the U.S. or in Europe, but again, I think it's important to point out that the distributions

overlap and they overlap fairly substantially.

MR. BONEBRAKE CONTINUES:

Q. What do you mean by the "distributions overlap," Dr. Rice?

A. I mean that some of the folks in the Faroe Islands had body burdens and PCB's that were the same as some of the people in the United States.

Q. Some had PCB concentrations much higher?

A. I haven't seen -- I don't know the whole distribution. Certainly, the average is much higher. I think it's probably reasonable to assume that there were a lot of people in the Faroe Islands that had higher body burdens than most of the people in the United States.

DR. RICE: "Is it correct that when the Faroe Islands study is adjusted for PCB exposure, the investigators in that study concluded that any correlation between methylmercury and performance on the Boston Naming Test was not significant?" No. I don't think the Faroe Islands study team concluded that. There were -- the NAS committee addressed this co-exposure to PCB's in the Faroe Islands in great deal because it's an important issue. You know, methylmercury is a neurotoxicant. PCB's are

neurotoxicant. They are both developmentally neurotoxic, so it's an issue that really needs to be addressed, and they did this in a couple of ways. They head the Faroe Islands investigators -- or they did -- control -- look at the benchmark doses with and without control for PCB's. They also divided the cohort for which there were PCB data available by turtiles. In other words, they divided them into thirds, lowest, middle and high, and looked to see if there was any difference, systemic difference, in the effects of methylmercury, depending on whether the kids had low or high PCB body burdens and there was no evidence for any kind of systemic change. The Faroe Islands investigators also looked to see whether there was a statistical interaction between methylmercury and PCB's in their cohort and they didn't find one. The conclusion of the NRC panel was that the effects of methylmercury and PCB's appeared to be independent of each other, and I might say -- and this adds I think even more assurance in this regard -- the Faroe Islands folks chose not to look at their cohort when they were babies. They didn't look at them, until they were seven years old, and then they also looked at them again at 14 years of age. The 14-year data are now published and

what they found at 14 years was that there was still effects on Boston Naming. There were still effects on attention, measure of attention, which is reaction time on a vigilant task and there were still effects on motor performance, which is three of the endpoints that were significant at seven years. When they did their 14 years analysis, there was absolutely no evidence for effect of PCB's, so I think that adds further reassurance that there's nothing really wonky about the Faroe Islands study or the Faroe Islands data or interpretation of that study.

MR. BONEBRAKE CONTINUES:

Q. When was that additional analysis you just referred to?

A. It's online in Environmental Health Perspective. No. It's online in Neurotoxicology and Teratology.

Q. When was that work performed, Dr. Rice?

A. Well, I mean, the guys are 16 and 17 now, so the 14-year data was collected several years ago and there was actually one paper already published on the 14-year data reporting deficits in sensory regarding sensory effects that were -- had been found at seven years that were still found at 14 years, but this is now

further analysis on their cognitive endpoints.

DR. RICE: "Did you co-author a paper in 2003 that found a correlation in the Faroe Islands study between the prenatal PCB exposure and poor performance on the Boston Naming Test?" I think what we stated in that paper was that we did author a paper. We state that the results are not significant after control for methylmercury. The PCB effects are not significant after control for methylmercury exposure. When we were talking about the 2001 paper -- they actually published two papers on their seven-year data. One was on the effects of methylmercury controlling for PCB's, and then, because there was so much concern in the community about the co-exposure to PCB's, they also published a paper in 2001 on the effects of PCB's and what they found was that, when they control for methylmercury, there was no effect of PCB's on the Boston Naming Test, and that there was no evidence -- in their 1997 paper, the authors reported that there was no evidence for an interaction between methylmercury and PCB's, and that's what we reported in our paper.

Q. So with respect to your 2003 report and you were a co-author of that report. Is that right?

A. Yes.

Q. And that report did you say found a correlation or no correlation? I wasn't clear from your answer.

A. No correlation. There was no correlation between methylmercury and PCB's. That's what the authors reported. I mean, that wasn't -- I mean, we didn't have the raw data. In their 2001 paper, the investigators said that, after control for methylmercury, there was no effect of PCB's on the Boston Naming Test.

Q. Can we turn to page 41, paragraph 120 of Exhibit 6, which is again, the order -- call it the decision -- in the Tri-Union Seafoods case, and I was interested in the second sentence in that paragraph.

MADAM HEARING OFFICER: Could you give the page number again?

MR. BONEBRAKE: Yeah. It's actually top of page 41, and it's in paragraph 120, and it's the second sentence in that paragraph, and it reads, "Dr. Rice's paper reports that a number of endpoints in the Faroe Islands study, including the Boston Naming Test, were negatively associated with methylmercury, until the authors controlled for the effects of PCB's." Do you agree with that description of your paper, Dr. Rice?

A. No.

Q. So you think the court got it wrong?

A. Yes.

Q. Is that -- the paper that's referenced there, has it been published?

A. The Chaset, et al., paper.

Q. The 2003 report?

A. Yes.

Q. So as far as you now, Dr. Rice, that is available publicly?

A. Yes. It is available publicly.

MADAM HEARING OFFICER: Could I ask where that was published?

DR. RICE: Environmental Health Perspective, so it's actually available free online.

DR. RICE: H: "Is it possible that PCB's could have had an influence on the results of the Faroe Islands study by producing or contributing to environmental toxicity?" Yes. It's possible that that's true. You know, these statistical methods aren't perfect and just because the effects weren't statistically significant doesn't necessarily mean that there wasn't an effect. The NRC panel really did the best job they could at looking at the co-exposure of

methylmercury and PCB's. Their conclusion was that the effects, if there are effects, they are independent, so even if there is a PCB effect in the Faroe Islands, it's independent of that of methylmercury, and that's not my opinion. That's the NRC's opinion and I really have no further light to shed on that.

MR. BONEBRAKE CONTINUES:

Q. When you say "independent," what, specifically, do you mean, Dr. Rice?

A. I'm trying to think of how to explain this without talking about it statistically. If you look at the relationship between methylmercury body burden and performance on any measure, you will get some relationship. You can do the same thing for PCB's. It happens that the correlation between children, between methylmercury body burden and PCB body burden was low enough that those effects could be teased out. They could be separated from each other. Does that make sense?

MADAM HEARING OFFICER: It's your question.

MR. BONEBRAKE CONTINUES: That's fine if, that's your answer. We can let it stand.

DR. RICE: 21? Is that where we are?

"Isn't it true that women and children studied in the Faroe Islands study ate almost exclusively whale meat and/or whale blubber?" I'm assuming that only includes meat, and not vegetables. I don't know, but anyway, folks in the Faroe Islands also ate a significant amount of fish. It's an island. It's a group of islands, in fact, in the North Atlantic, so in addition to eating whale, they also ate fish. Now, some women in the population ate whale. Not everybody ate whale. Some women ate whale blubber, and it's important to understand that the whale meat contains methylmercury and the whale blubber contains PCB's, and so some women liked the meat, and not the blubber, and vice versa, which is one of the things that allowed the effects of PCB's or potential effects of PCB's and those of methylmercury to be discriminated. I mean, if everybody ate meat and blubber, then you couldn't tell the difference. "How much whale meat or whale blubber does the average American eat?" I'm going to take a guess here and say not much. "How much whale meat or whale blubber does the average Illinois resident eat?" 22: "Is it Dr. Rice's opinion that people should not eat fish because of potential for exposure to methylmercury?" I think we have covered that before by

saying that we can't be sure that anything is absolutely safe, but I certainly wouldn't recommend that people don't eat fish or never eat fish. I eat fish. Last night for dinner I had crab cakes and salmon, which are both low in methylmercury, I might point out, so I wouldn't say that. 23: "How do average mercury levels in Illinois fish that are typically consumed compare to average mercury levels of" -- okay. This is not any question. This is an Illinois person question.

MR. KIM: Dr. Hornshaw is here now, so he can answer this, if you like.

MR. BONEBRAKE: My preference would be to cover it when Mr. Hornshaw is presenting later.

DR. RICE: 24 falls into the same category. So go on to 25?

MR. BONEBRAKE: Yeah.

DR. RICE: "At page six of her testimony, Mr. Rice refers to a study involving dentists. Do dentists have higher or lower incident of heart disease than other American men exposed to mercury?" You know I was unaware whether there was any literature on this at all because I didn't know why anybody would do this, so I went to Medline, which is a database for looking up publications, and I only found

one study from Japan that even addressed the issue, and they actually found a lower incidence in dentists. Now, I don't know why that would be true and it's only one paper, so I don't think any weight could be put on it at all.

CROSS EXAMINATION BY MS. BASSI: Well, why in the study where you were talking about in your testimony, apparently, at page six which I forget right now, but you were talking about excluding dentists. Why would dentists have been excluded from the study participants?

A. I'm --

Q. For cardiovascular effects.

A. I'm assuming that's why this question was asked. Because dentists are exposed to mercury vapor, which is inorganic mercury. It's not methylmercury. A different form of mercury in the body, and so it may have very different effects than methylmercury does, and in fact, the dentists in that study -- 60 percent of the cohort was dentists, and they actually had higher total mercury levels than the cohort as a whole, but we have no idea how much of that was methylmercury. Most of it would have been inorganic mercury from exposure to mercury vapor in their dental practice.

Q. Does the fact if they are exposed to mercury vapors then it's probably inhaled as opposed to ingested?

A. Yes.

Q. Does that make a difference from what you know?

A. Yes. It will make a difference in the distribution, and it will also mean that none of it gets converted into methylmercury in the body. It goes into the blood. It's mercury vapor. It's elemental mercury, which is reactive, and it will be changed into inorganic mercury, but that's not methylmercury and the effects can be quite different.

Q. Thank you.

MR. BONEBRAKE CONTINUES:

Q. In that testimony, Dr. Rice, you state -- and again, it's at page six of your testimony. In a study of male health professional in the US, a non-statistically significant relationship was found between coronary heart disease and toenail mercury levels after dentists were excluded from the analysis. Is it typical for toxicologists to rely upon non-statistically significant results?

A. No. I mean, if that were the only study,

one would want to say that replicated. The problem was that, by the time they eliminated 60 percent of their cohort, they didn't have a whole lot of statistical power to detect an effect because they didn't have very many people left. Now, it could be that it's the lack of power that led to the non -- to the fact that it was not statistically significant or it could have been that, really, there wasn't any effect there and it's hard to interpret that on the basis of just one study, but there are other studies that did find statistical effects, and you have to add that piece of evidence into the rest of the evidence.

Q. But would you agree that, typically, a toxicologist would not rely upon a non-statistically significant result?

A. It depends on the context. I wouldn't say that categorically, no.

DR. RICE: "What factors cause heart disease?" We're on 26 now? "What factors cause heart disease in men?" Well, you know, the only information I have on that, really, is probably what everybody else reads. It's really not my area, but obviously, there's a constellation of things that produce heart disease in men related to lifestyle, lack of exercise, food intake,

various aspects of foods intake, probably genetics, as well as potentially environmental factors, environmental contaminants, like lead, for example, and methylmercury.

DR. RICE: 26-A: "How many of these are mercury related?" I think that the mechanism -- see, now, I don't really know how much is known about the mechanisms of other factors that are involved in heart disease. How do you get from taking in high cholesterol to heart disease? The biochemical mechanism is unfamiliar to me. It's just not my area, but I know that in the finished study of the effects of methylmercury, elevated hair methylmercury -- hair mercury was associated with elevated oxidized LDL levels, which are a risk factor for heart disease, and there was also an increase in carotid wall thickness in the finished study, which is another risk factor for heart disease, and I guess that's really the only thing I can say about, that and the mechanisms of methylmercury toxicity related to heart disease are really not very well characterized, either, in humans or in animals, so there's a limited amount of data available I think. "In her testimony, Mr. Rice indicated there's an association between methylmercury and heart cardiovascular disease. Is there currently a

level of uncertainty concerning such association?" Those questions are always hard to answer because it very often depends on who you are talking to, what circles you run in. That's like saying, "Is there uncertainty about global warming?" Not among the vast majority of researchers, but that doesn't mean that there's nobody out there who won't say there's no evidence of global warming. However, I think that the evidence for the relationship between cardiovascular disease and methylmercury is probably less strong than that. "Is Dr. Rice aware of any studies reporting an inverse association between fish consumption and cardiovascular effects, i.e., fish consumption has a protective effect against cardiovascular disease?" Yes. There certainly are studies out there, but there's also -- there are also studies that say that fish intake may be protective up to a point, but when you get too much methylmercury in your body, then that protective effect goes away and actually reverses, so having too much methylmercury in your body then contributes to risk for cardiovascular disease.

MR. BONEBRAKE CONTINUES:

Q. I had a follow-up. I think the question before when you were talking about uncertainty, would it

be your view, Dr. Rice, that there are other experts in the field that have the view that there has not been an established connection between methylmercury consumption and cardiovascular effects?

A. I'm sure that there are people out there that would say that and I think there are other issues about trying to quantify those effects. The relationship between exposure and effect has been quantified, unlike this graph here where it has been quantified. Is there a threshold for adverse effect? We don't know, and that makes a big different when you are trying to do cost benefit analysis or quantification. The other issue or another issue is that a couple of these studies that really found an effect a robust effect, relied on toenail methylmercury, or toenail mercury concentrations, so that's fine for establishing an effect, a relationship, but then how do you get the same issue we were talking about this morning. How do you get from toenail mercury back to intake? We just don't know how to do that, yet, so using these studies for quantification really requires a lot more talk among groups of experts I think to do that.

DR. RICE: "Are such results found in

the Chicago Western Electric Study in Japan and the Nurse's Health Study and the U.S. Physicians' Health Study?" Yeah. I'm aware of these studies. I have looked at these studies. I think probably the best one of these is the U.S. Physicians' Health Study. The problem with all of these studies is something that we have talked about already, and that is these are not randomized controlled studies. In other words, people choose to eat fish or not. They choose to exercise. They choose to eat vegetables. Increased fish consumption in the United States might be a surrogate for healthy lifestyle. The folks that looked at this, by far the best, are the folks that did the U.S. Physicians' Health Study because they tried to control for exercise and intake of other foods, of red meat, of vegetables of various dietary nutrients and tried to control for those when they looked at the benefits of fish consumption on the cardiovascular effects, but just recently, last week, or the week before, out of this big cohort, this big longitudinal cohort that's been followed now for many years, is an increase in atrial fibrillation associated with increased fish consumption in this cohort, which doesn't take away the benefit that is they found on myocardial infarction and so forth, but

immediately people started saying, "Well, you know there are uncontrolled confounders out there. These people probably have a really healthy lifestyle, and that's not being captured. They exercise all the time and that's why there's increase in atrial fibrillation." So you really can't have it both ways.

MS. BASSI CONTINUES:

Q. I'm sorry. What does "increase in atrial fibrillation" mean? Is that good or bad?"

A. It's a bad thing.

Q. Thank you.

DR. RICE: Before I launched into this big explanation, yeah.

MADAM HEARING OFFICER: That only a handful of us would have understood. Not me.

DR. RICE: 28: "How does the methylmercury reference dose of .1 microgram per kilogram per day relate to cord blood concentrations relate of 5.8 micrograms per deciliter?" It's the same for Boston naming Test, and again, we talked about that at great length this morning. It's only one blood level. There are other blood levels out there. The integrative analysis that was done by Dr. Ryan would yield a level of about 3.4, for example, so that's how

it relates.

MR. BONEBRAKE CONTINUES:

Q. Does cord blood concentration of 5.8 micrograms per liter, does that incorporate U.S. EPA's uncertainty factor?

A. Yes.

MS. GEERTSMA CONTINUES:

Q. This is backing up to the atrial fibrillation, not to belabor it, but just a clarification. Did you mean that recent analyses of that cohort have shown that there is, in fact, a negative cardiovascular outcome associated with increased fish consumption?

A. Yes.

DR. RICE: "What is the basis for Dr. Rice's statement on page seven of her testimony that 16 percent of U.S. female population of childbearing age had blood levels of methylmercury greater than 3.4 micrograms per deciliter?" Again, that's from NHANES and it's, specifically, by a study, a publication by Catherine McHaffey (phonetic) who is an investigator at EPA who has access to the NHANES data base.

MR. BONEBRAKE CONTINUES:

Q. Just for clarification, the NHANES survey,

though, addressed mercury concentrations in hair. Is that correct?

A. No. It has blood and hair.

DR. RICE: 30: "Does Dr. --

MADAM HEARING OFFICER: Mr. Forcade had a question.

MR. FORCADE CONTINUES:

Q. Excuse me. I've noticed that there has been a subtle shift here occasionally in the reference to a certain amount per deciliter and a certain amount per liter?

A. Then I misspoke. I'm sorry. It's per liter. I'm an old lead person and we do deciliters.

Q. Just wanted to clarify.

DR. RICE: Thank you. 30: "Does Dr. Rice contend that there has been a reduction in IQ in the U.S. population over time?" I think we covered that this morning.

MS. BASSI: Would you repeat that, please? What was your answer?

DR. RICE: No. 31: "Is mercury a natural occurring element?" Yes. A: "Was methylmercury present in fish from natural sources, even prior to the industrial revolution?" I have no direct

knowledge of that or information about that, but I would assume that it must have. B: "Is methylation of mercury a natural process?" Yes. C: "Even without anthropogenic sources, would some level of methylmercury be present in the environment and in fish?" and again, I gave the example this morning of fires and volcano, and so I'm assuming that surely must be true. There was also anthropogenic sources of methylmercury emission because the Greeks and other European societies mined mercury hundreds of years ago.

DR. RICE: 32: "Does Dr. Rice have an economic degree or any training regarding economic analysis?" No, I don't. I have a Ph.D. in toxicology. 33: "What is the basis for Dr. Rice's conclusion regarding loss earnings among the women with mercury in their blood levels and their children?" This is really not my analysis. I can't speak to it with any authority at all. I included it in my review for the sake of completeness, just to let the Board know that these kind of analyses are out there, but as I answered previously, I don't have an economic degree, and I don't know how to do this modeling and this cost benefit analysis, so I can't speak with any expertise to I think any of this question.

MR. BONEBRAKE CONTINUES:

Q. Just for purposes of clarification, Dr. Rice, what is in your testimony and reports attached to the TSD with respect to societal costs or benefits associated with methylmercury or methylmercury control are simply a reiteration of what you have read from other people's work?

A. Only as it applies to the monetization, the Trasande, et al., paper, which I think is the only one I talked about in terms of monetization. The other things that are in there about the fact that cardiovascular effects have not been included, and we have talked about the strength of the evidence for those. That, potentially, is something that maybe monetized in the future that isn't captured. I also talk about the fact that IQ predicts all kinds of other things, besides lost wages, which we talked about this morning. I'm very familiar with the National Longitudinal Survey of Youth. It's a database from the Department of Labor, and that was the basis of the statements that I made this morning, so I don't back off those statements at all. It's just with regard to the monetization. I don't know how to do monetization.

Q. Just to make sure I understand, your view,

as you are an expert in the area of identifying the types of impacts that someone who is monetizing should take into consideration, but you're not an expert in the monetization process?

A. That's exactly right, yes. I think I used the example, for example, when EPA did its monetization for led. The cardiovascular effects being a lot more costly than the lost wages.

MADAM HEARING OFFICER: Ms. Bassi, did you have a follow-up?

MS. BASSI: At the end I think, please. Thank you.

MADAM HEARING OFFICER: I need to make a point of clarification, actually. This question refers to Appendix A, page 28? Is that of Dr. Rice's testimony? TSD?

MR. BONEBRAKE: That one actually is directed to the TSD, but there's also some testimony, as well, that deals with -- I think you're heading is "Societal Costs" in your testimony, so this issue was addressed both places.

MADAM HEARING OFFICER: Just wanted to clarify where that was in the record. Thank you.

DR. RICE: 34: "One of the reports

that Dr. Rice discusses in her report to Illinois EPA is that of Trasande, et al. A: Are the authors of the Trasande, et al., report pediatricians?" I don't know about Dr. Schetker (Phonetic) but, both, Dr. Landervan (phonetic) and Dr. Trasande are pediatricians. Dr. Landervan is head of -- he's at Mt. Sinai, and he is head of the Center for Children and -- Children and Environmental Health, or something, and Dr. Trasande is the associate director, and this team of authors has authored other reports on monetization of these kinds of effects. They have done a similar analysis for lead. They have also done analyses for other decrements associated with childhood diseases, such as learning disabilities and asthma. The societal burden cost of some of the pollutants that are out there. Dr. Landervan has worked in the area of neuropsychological effects of contaminant in children for three decades. He's very inter nationally renowned, very distinguished professor. "Are they economists?" I don't know if Dr. Schetker is an economist or not. I only know the other two. C: "Is Dr. Rice aware of the corrections that Trasande report authors must make following a critical analyses by U.S. EPA economists?" I submitted my report in March, and in April, EPA put up

what they call "A note to Trasande" at Trasande, et al., on their website in which they state that Trasande, et al., will be publishing a letter in Environmental Health Perspectives adjusting I guess their analyses, their monetization because they made a mistake in their calculations, and I'm aware of the note. I've read the note. I have not seen the letter. I looked right before I came to see if the letter was up on Environmental Health Perspectives, yet and I couldn't find it. They are not -- I don't know about "must make." I mean, scientists if they find an error or an error is pointed out, they make the correction, or they publish a retraction or a correction, or whatever it is they have to publish.

MR. BONEBRAKE CONTINUES:

Q. Dr. Rice, do you know if that correction has been made at this point?

A. I think I just testified that I looked for the letter on the Environmental Health Perspectives website, and I couldn't find it. If it's gone up, it's gone up in the last few days, and that's all I know. I don't have any personal knowledge of that.

DR. RICE: D: "Is Dr. Rice aware that Trasande, et al., must retract their initial conclusions

and substantially lower their estimates of the cost of power plant mercury emissions?" Again, that's what EPA says on its website in their note and they explain the way -- the mistake that Trasande, et al., made, and it would result in about a tenfold decrease in their estimates for monetization, but I haven't seen the Trasande, et al., calculations. They, I guess, misunderstood that it was a tenfold -- the IQ decrements were over tenfold and not a onefold, but again, EPA has a document out there on its website, and as far as I know, that's as far as its gone right now.

MR. BONEBRAKE CONTINUES:

Q. So it's your understanding, Dr. Rice, that the projected costs that were earlier considered in the Trasande analysis would be reduced to about 10 percent of what they originally projected?

A. According to EPA, and that's all I know. I really -- as far as I know, the letter isn't out, so I really can't say anything more than that. I don't know whether Trasande, et al., are going to agree, so I know it's on EPA's website and that's all I know. 35: "At page eight of her testimony, Dr. Rice refers to a Department of Labor survey of IQ's, and the impact of a 3 percent reduction in IQ's. Is Dr. Rice aware of any

study or report indicating that consumption of fish has caused a 3 percent or greater decline in IQ in Illinois residents?" I don't know anything specific to Illinois. We have very good data on the relationship and we have several analyses now on the relationship between IQ and methylmercury intake. I would assume that it wouldn't be substantially different in Illinois. I don't know about the Great Lakes. I know that in coastal states, including the East and West Coast and in the Gulf, people in those states, in general, eat more fish and their mercury levels are higher, and that comes from NHANES those are NHANES data. To my knowledge, the Great Lakes states have not been broken out, and whether that would be true around the Great Lakes, I don't know. CDC, Center for Disease Control, who are the people who do the NHANES database are very, very careful to the degree to which they are willing to break down their data because they have to be very careful that individuals are not recognizable on their database, so you can't, for example, get state-specific data. It's just too small an area, too few number of people for CDC to publish on.

MR. BONEBRAKE CONTINUES:

Q. You mentioned the coastal states. Is it

also true that the populations in those coastal states eat more ocean fish than do the populations in states such as Illinois, which are inland?

A. I'm not sure that -- I mean, that's a pretty obvious and interesting question. I don't think that anybody's published on that, whether that's true to their increase -- due to their increase of consumption of ocean fish. I don't know.

Q. Make sure I understand. Your testimony was that the coastal state populations have higher levels of fish consumption and higher mercury levels in their bodies?

A. They have higher levels of mercury in their bodies, and there are some data that they also have higher levels of fish consumption, but to my knowledge, it hasn't been broken down. I haven't seen data published or even unpublished that break it down in terms of ocean versus freshwater fish.

DR. RICE: 36: "Are there any peer-reviewed studies that definitely attribute, in Illinois, or even in the United States, neurological or physical impairment to consumption of methylmercury in freshwater fish?" To my knowledge, that hasn't been done. I mean, you're interested in the amount of

mercury, the relationship between methylmercury and performance and the effect, and then you need data -- I mean, if you really are concerned about freshwater fish, specifically, then you need data on relative consumption patterns, how much freshwater fish do people eat and how much mercury is in that freshwater fish, and from there, it's a straight extrapolation to how much of a deficit there would be. To my knowledge, nobody has done that, certainly not specific to Illinois. I don't know why you would do that exercise, frankly. 37: "What is the main source of methylmercury exposure in the U.S.?" I think that was also Question 3 or something. Fish. 38: "Is demethylation of methylmercury in the body necessary for a toxic effect to occur?" That's also a very interesting question. Methylmercury in the adult brain is demethylated. It goes into the brain, and then some of it, at least, is demethylated, and it's an open question whether some of the toxic effects, particularly delayed neurotoxicity, is a function of how much inorganic mercury is in the brain because, once it is demethylated, it doesn't come back out. Now, inorganic mercury doesn't get into the brain, so it's not like the inorganic mercury in the blood is getting into the brain and producing an effect. Really, it's the methylmercury

that's going across what's called the blood brain barrier, and then some of it is demethylated. How much of that is responsible for the neurotoxic effects? We don't really know. We have been studying methylmercury for 30 years or more, and we still don't know the answer to that question. For the fetus, though, methylmercury doesn't really have enough time to be substantially demethylated, so surely, in that case, it's methylmercury that's having all, or most, producing all or most of the neurotoxicity.

MR. BONEBRAKE CONTINUES:

Q. If methylmercury is demethylated, is it no longer toxic to human beings?

A. I thought I answered that. I guess I'm not being clear. It's unknown in the brain. The degree to which the methylmercury that's demethylated and then stays in the brain is contributing to the neurotoxic effects, particularly delayed neurotoxicity during aging. Maybe it's a major player, but we just don't know. For other organ systems, like the kidneys, for example, there's no question that inorganic mercury produces toxicity.

DR. RICE: 39: "Is Dr. Rice's conclusion that the risks of eating fish outweigh the

benefits of ingesting omega-3 fatty acids supported by other experts?" I guess what's being said here is the assertion that I think that we shouldn't eat fish, and I don't agree with that. I don't think I have ever said they thought that people shouldn't eat fish, that injection of fish outweighs the benefits of ingesting the omega-3 fatty acids, so I guess I can't answer that question the way it's worded. I might say, though, that there was an analysis done by the Harvard Center for Risk Assessment, and it was done for the fishing industry. It was paid for by the Tuna Foundation in which they looked at the benefits of, potential benefits, of omega-3's to the development of the fetus, and they also looked at the decrements produced by methylmercury and they did so under various scenarios, including various kinds of increased fish consumption, either paying attention to how much methylmercury is in fish or not paying attention to how much methylmercury is in fish, and in every case, the IQ loss produced by consumption of -- of methylmercury in fish outweighed the benefits. Any potential benefits from omega-3 fatty acids.

MR. BONEBRAKE CONTINUES: Hang on for just a second. I'm looking at the report reference.

MS. BASSI CONTINUES:

Q. I would like to go back to where you were discussing about IQ and the decrements in IQ and so forth, and at various times today, and in your testimony I think in your testimony, but at least today, you stated that IQ in the United States is not decreasing, but that there are monetary or economic losses due to the effects of methylmercury ingestion due to the loss in IQ or to IQ decrements, and these, to me, seem diametrically opposed. If IQ is increasing, where are the decrements? Or are you saying that we would all be real geniuses.

A. If we didn't eat mercury? Yeah. I mean these are relative. I mean, they have to be relative because, if we were all really stupid, I guess we would all have our same jobs and our same salary. I don't know if that's true or not, but within a population, IQ predicts all of these things, including lost wages, and so it's relative to everybody else in the population at that time. I mean, I guess it really doesn't account for -- if IQ 30 years ago was higher or lower than it is now, so it's really a very kind of short term effect. I mean, even though it's over the lifetime of the individual, it's short term in that way. I mean, it's

not subject to sort of these longterm 100-year fluctuations in IQ.

Q. Well, it also seems strange to me that you say that increased consumption of fish occurs among women who are have higher IQ's and more education and more money, and if this is true, but eating fish results in IQ decrements in their children, again, it just seems inconsistent to me. Maybe it's statistics? Maybe it's just that.

A. No. I'm assuming that that relationship now represents more educated women's awareness of all of the health advice about eating healthy, eating your vegetable and exercise. I don't think it's reflective of what they were eating when they were two.

Q. Okay.

MADAM HEARING OFFICER: Are there any other questions for Dr. Rice? Going once? All right then I guess we're through with Dr. Rice. Thank you very much.

MR. KIM: What we were going to do next was the testimony that sort of accompanied Dr. Rice's testimony concerning health impacts was also going to be presented by Jeff Sprague of the Illinois EPA and he has received some prefiled questions, and

he's prepared now to answer those. We would probably keep Dr. Rice on the panel and just as sort of a preface to Mr. Sprague's testimony, he was really identified as a witness way back when we had the original hearing schedule and there was some concern that Dr. Rice, from a logistical standpoint, was not going to be available and he can get into more of this in his testimony, obviously, but I guess I just want to sort of point out that Mr. Sprague is -- was offered up as sort of a back-up to Dr. Rice, so there is some of the questioning that is sort of redundant, and I'm sure he will explain how many of the questions he would have forced off on Dr. Rice, anyway.

(A small break was taken.)

STATE OF ILLINOIS)
COUNTY OF ST. CLAIR)SS

I, Holly A. Schmid, a Notary Public in and for the County of Williamson, DO HEREBY CERTIFY that pursuant to agreement between counsel there appeared before me on June 13, 2006, at the office of the Illinois Pollution Control Board, Springfield, Illinois, Dr. Deborah Rice, who was first duly sworn by me to testify the whole truth of her knowledge touching upon the matter in controversy aforesaid so far as he should be examined and her examination was taken by me in shorthand and afterwards transcribed upon the typewriter (but not signed by the deponent, and said deposition is herewith returned.

IN WITNESS WHEREOF I have hereunto set my hand and affixed my Notarial Seal this 21st day of June, 2006.

_____

HOLLY A. SCHMID
Notary Public -- CSR
084-98-254587