ORIGINAL

ILLINOIS POLLUTION CONTROL BOARD

May 20, 2009

IN THE MATTER OF:	)	
	)	
WATER QUALITY STANDARDS AND	)	
EFFLUENT LIMITATIONS FOR THE	)	R08-9
CHICAGO AREA WATERWAY SYSTEM AND	)	(Rulemaking -
THE LOWER DES PLAINES RIVER:	)	Water)
PROPOSED AMENDMENTS TO 35 Ill.	)	
Adm. Code Parts 301, 302, 303	)	
and 304	)	

TRANSCRIPT OF PROCEEDINGS held in the above-entitled cause before Hearing Officer Marie Tipsord, called by the Illinois Pollution Control Board, pursuant to notice, taken before Rebecca Graziano, CSR, within and for the County of Cook and State of Illinois, at the James R. Thompson Center, 100 West Randolph Street, Room 9-040, Chicago, Illinois, on the 20th Day of May, A.D., 2009, commencing at 10:00 a.m.

A P P E A R A N C E S

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Ms. Marie Tipsord, Hearing Officer
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Mr. Anand Rao, Senior Environmental Scientist
Mr. G. Tanner Girard, Acting Chairman
Ms. Andrea Moore
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MS. TIPSORD: Good morning, everyone. My name is Marie Tipsord, and I've been appointed by the Board to serve as hearing officer of this proceeding entitled Water Quality Standards and Effluent Limitations to the Chicago Area Waterway System and Lower Des Plaines River, proposed amendment 35 IL Admin code 301, 302, 303, and 304. This is docket number R08-9. And for those of you who are still keeping count, this is day 28 of our hearings.

With me today to my immediate right is Board Member Dr. Tanner Girard. Tanner is a board member who is overseeing this rulemaking, the presiding board member. To his immediate right is Dr. Shundar Lin, and to Dr. Lin's right is Andrea Moore, also a board member. To my left is Board Member Gary Blankenship. To my immediate left is Anand Rao, and to his left is Alisa Liu from our technical unit. Also today Nicole Mayor (phonetic) is here. Nicole is our extern this summer from Kent and will be attending the hearing today to see how we do things in the real world.

Today we're going to continue to hear testimony from members of the public, and we're

going to begin with Dr. Kevin J. Boyle, and then go to Dr. David Thomas, and, time allowing, we'll go to Gerald Abalin (phonetic). Again, time allowing.

The testimony will be marked as an exhibit and entered as if read. And after marking the pre-filed testimony as an exhibit, we will proceed to questions for the testifier, beginning with IEPA, the Metropolitan Water Reclamation District of Greater Chicago, and I believe Midwest Generation has pre-filed questions for these witnesses today.

MS. FRANZETTI: For two of them. Not for --

MS. TIPSORD: Depending upon how that order works out. And I see that, once again, the District is probably going to take the lead first, since they filed the most questions for Dr. Boyle and Dr. Thomas both, I believe.

MR. ANDES: Well, I think as to Dr. Thomas, it might make sense that Midwest Gen go first.

MS. TIPSORD: Okay. That's fine. Whatever works out best for all of you. Anyone may ask a follow-up question, and you feed not wait

until your turn to ask questions. I do ask that you raise your hand, wait for me to acknowledge you. After I have acknowledged you, please state your name and whom you represent before you begin your questions. Please speak one at a time. If you're speaking over each other, the court reporter will not be able to get your questions on the record. Please note that any questions asked by a board member or staff are intended to build a complete record for the Board's decision, and not express any preconceived notion or bias.

Also, scheduling-wise, for those of you who were here when I first announced this -- it's not a surprise, but let me say it again -- today the James R. Thompson Center is participating in a building-wide -- floor-by-floor evacuations in preparation for building-wide evacuations tomorrow afternoon. What that means is they will start at 1:00 o'clock testing the system, and every 15 minutes or so will declare certain three floors to be evacuated, and people are required to go to the stairs, walk down three flights, and take the elevators back up to the floor.

My understanding is on

floor-by-floor, they're not as hard as they are for building-wide, but they do ask that you participate. So to avoid that and avoid the noise, what I would like to do is go for about an hour, hour and a half this morning probably until somewhere around quarter to 12:00 or 12:00-ish, and we'll take a ten to fifteen minute break. If you're really starving, you can grab a snack. We'll come back in, and then we'll go until 1:00, 1:15 if we can stand the noise, and then we'll take an hour break. This floor is scheduled for 1:45. So if we come back at 2:00 or 2:15, we should miss this floor's evacuation drill and be able to get back in. Otherwise, you'll have to walk down three flights, and that will take us an hour anyway.

With that, Dr. Girard?

DR. GIRARD: Good morning. On behalf of the Board, I welcome everyone to hearing day 28 in this rulemaking. Thank you for the exceptional time and effort everyone as invested in this activity. We look forward to your testimony and questions today.

MS. TIPSORD: Thank you. And with that, Mr. Armstrong, did you have an opening

statement, or do you want to go directly to the testimony?

MR. ARMSTRONG: Just to the testimony.

THE COURT: All right. Then let's have the witness sworn in, and we'll enter the testimony.

(Witness sworn.)

MS. TIPSORD: If there's no objection, we will mark the pre-filed testimony of Dr. Kevin J. Boyle as Exhibit 286. That includes all the attachments. Seeing no objection, it is Exhibit 286.

MR. ARMSTRONG: And one point of clarification. Dr. Boyle, did you notice any typos in that testimony upon reviewing it?

THE WITNESS: Yes, I did. The testimony on Page 9, Lines 9 and 10 --

MS. TIPSORD: I'm sorry. You're going to have to speak up, Doctor. We can't hear you up here.

DR. BOYLE: Sorry. I noticed on Page 9, Lines 9 and 10, I said I used a linear regression model where some variables are not statistically significant. In the editing, two

sentences got combined together, and what I should be saying is I used the linear regression where some the insignificant variables are removed from the outfit paper that I based my testimony on.

MR. ARMSTRONG: And this relates to pre-filed Question 42 from the Metropolitan Water Reclamation District.

MS. WILLIAMS: Can you repeat what the sentence is supposed to say?

THE WITNESS: Yeah. I used a linear equation restricted model where some variables that are not statistically significant are excluded.

MR. ARMSTRONG: And I'm sorry, that's 43 of the District's questions.

MS. TIPSORD: Thank you. With that, Mr. Andes?

MR. ANDES: Good morning, Dr. Boyle.

DR. BOYLE: Good morning.

MR. ANDES: Let's start with Question 1, and I'll indicate when I'm skipping over a question. Sometimes we'll come back, and sometimes I'll let you know if we're not going to do that.

On Page 1, Line 12, you indicate that the benefits you have calculated represent the

amount Cook County households are willing to pay. How have you determined that Cook County households are willing to pay $47 per household to derive economic benefits you were alluding to?

DR. BOYLE: I'd like to thank the Board for allowing me to testify today.

The approach that I used is called the benefit transfer. It's a procedure that is in USPEA's guidelines for conducting economic benefit analyses. The benefit transfer takes the results from existing studies that have been conducted. I used a meta analysis procedure to statistically summarize those results, and so that benefit transfer approach resulted in an equation where you can predict a customized value for a new setting.

The benefit transfer that I used was based on studies of stated preferences. There are 18 study preferences that Dr. Van Houtven at the Research Triangle Institute in North Carolina had summarized if his benefit transfer -- excuse me -- in his meta-analysis.

And so starting out with those initial studies, Van Houtven, in his meta-analysis, provided a statistical study. I used that

statistical summary as the benefit transfer to predict the calibrated estimate for the Chicago Cook County area of $47.

MR. ANDES: So you haven't actually asked the people of Cook County how much they're willing to pay. Am I right?

DR. BOYLE: We have not.

MR. ANDES: I don't know if you followed the papers here. Are you aware of controversy regarding Cook County possibly raising taxes?

DR. BOYLE: I have not followed the recent papers here in Cook County, but I would not think that that would influence the results of my testimony.

MR. ANDES: So if the people of Cook County and the Cook County board are reluctant to raise taxes at all right now, that wouldn't influence whether Cook County residents would be willing to pay another $50 per household?

DR. BOYLE: It's two different questions. One is increasing taxes, and the other is the value that Cook County households would place on good water quality. And the value that I'm

reporting is the value that Cook County households place on improved water quality, not a referendum on increasing taxes to Cook County residents.

MR. ANDES: But if the District were to have to disinfect, that would directly increase taxes on Cook County residents. Are you saying they would be willing to pay another $50 in taxes?

DR. BOYLE: You're mixing two things here. There's the benefit side of it, and the cost side of it. So the cost to the disinfection is also a benefit that the public will receive in terms of improved water quality. What I'm giving you is the benefits of improved water quality, not the cost side of the equation.

MR. ANDES: Okay. So you're not saying that Cook County residents would be willing to pay another $50 in taxes for disinfection?

DR. BOYLE: I'm saying the value of the Cook County households, the best estimate we have is $47 per household for improved water quality and cost.

MR. ANDES: But you've done it in a meta-analysis. You haven't actually asked the people of Cook County?

MR. ARMSTRONG: Objection. Asked and answered.

MR. ANDES: Okay. Question 2, in your answer to the question, "What is the purpose of your testimony," you first state that the purpose is to analyze the economic benefits of water quality improvements associated with the new recreational use designations proposed for the CAWS, but then go on to state the conclusion of your analysis, in terms of costs that Cook County households are purportedly willing to pay to achieve the water quality improvements.

What are the actual economic benefits, and who would receive actual tangible economic benefits from the improvements?

DR. BOYLE: Well, first of all, you're doing the switching between benefits and cost again, just like you did in the last question. I didn't phrase it in terms of cost. I phrased it in willingness to pay for improved water quality.

This is the standard economic definition of the benefit of something that you'd learn in an Economics 101 class. The willingness to pay is how much someone will pay for an item that

they want to get. It could be a bottle of water like I have right here today. It could be a public good, like water quality. So what we're measuring is willingness to pay for an improvement of water quality.

MR. ANDES: Let's move on to Question No. 3. You make the statement on Page 1, "Willingness to pay is based on preferences for recreational opportunities, concern about health risks, and a sense of responsibility and stewardship toward the ecosystem."

Tell us how you would determine these preferences, concerns, and senses in this situation.

DR. BOYLE: We didn't determine those senses in this situation. What we did is we estimated willingness to pay. The economic literature suggests that the -- what you call referring to the responsible stewardship to the ecosystem health risk recreation, that's the reason people will pay for improved water quality.

Some people will pay for improved water quality because they recreate on it and would like to see it improve. Some people don't recreate,

but would in the future if it is approved and would be willing to pay. Other people -- I estimate non-use benefits -- don't use the river, but would still pay something to see that water quality in the river is improved. And there's a large body of literature out there that shows that people are willing to pay for improvements in water quality.

Later in my testimony, I site some, what are called hedonic property values that --

MS. TIPSORD: Speak up a little bit.

DR. BOYLE: I will. Hedonic property values are studies where if you look at how property values are related to water quality. And what we've been able to show in those studies is where water has higher water quality, people pay even more for those properties. It's an opportunity where they can actually express that value.

MR. ANDES: Those are generally studies concerning homeowners of property located on the water body. Am I right?

DR. BOYLE: There's studies of homeowners on the water body, and then there's also studies that have looked at how that value tapers

off as you move farther away from the water body.

MR. ANDES: Okay. On the next question, on Page 3, you describe the two types of benefits to households' direct use benefits and indirect intrinsic benefits. Are those benefits both linked to EPA's estimated reduction in fecal coliform levels and disinfected discharges?

DR. BOYLE: The answer to that is yes, but I should clarify that we estimate a total value that includes both use and intrinsic, or what I refer to as non-use. We don't estimate them separately, we estimate them together. The reason that we do that is if you estimate separate use and then separate intrinsic, there are problems in economics, as far as how you add them together. So it's much more direct to estimate them at the same time.

In the meta-analysis, it's a ten point water quality index. With that index, what we look at is change in ambient fecal coliform levels in the CAWS, and that is the trigger that increases the total values we estimated.

MS. WILLIAMS: Can I ask a follow-up? This question says, "For the benefits linked to

IEPA's estimated reduction and fecal coliform levels, can you explain to us what you believe -- " and you answered yes. So please explain what you looked at to determine IEPA's estimated reduction in fecal coliform levels in your answer.

DR. BOYLE: They're based on Mr. Twait's testimony before this Board of what his understanding the impact would be, and so he gave orders of magnitude of what it might be. We have 100 -- or a two order of magnitude difference in the fecal coliform levels.

MS. WILLIAMS: And you're talking about if the actual discharge from the Metropolitan Water Reclamation District as opposed to in the receiving stream?

DR. BOYLE: I believe that Mr. Twait was talking about discharges, and we assumed it would be the same change in the ambient water quality of the river.

MR. ANDES: What is your basis for that assumption?

DR. BOYLE: What was our basis for that assumption?

MR. ANDES: Right. Have you -- go

ahead.

DR. BOYLE: In this, I had -- Mr. Armstrong is just pointing out the specific numbers to us here from Mr. Twait's testimony, where he said that it could be 5,000 to 400, or as great as 100,000 to 100 change. In doing this -- I'm an economist, and I had Christopher Ellis of Industrial Economics in Cambridge, Massachusetts, who has a Ph.D. in public health from the Harvard School of Public Health, and his specialty is water quality, and he helped me using the water quality index that was developed by McCullen to calculate this difference in fecal coliform levels.

MR. ANDES: So have you -- either you or Mr. Ellis, who's not here to ask him these questions, reviewed any of the other testimony in this matter concerning -- there's been testimony concerning the extent to which reductions in the District's effluent would cause or not cause reductions in actual ambient water quality levels. Neither you nor Mr. Ellis has reviewed that information. Am I right?

DR. BOYLE: I have not reviewed that information, but I understand from discussions with

the attorneys that there is some controversy about that. If there was a specific number that was agreed on, the advantage using this benefit transfer approach with the equation is we could calculate out a new number that would be based on that specific number that was agreed upon. We used what we could do for a best estimate with the available information. But if more information was available, it doesn't nullify our analysis. We could recalculate it with a different number if that was agreed to.

MR. ANDES: Well, if -- so if the reduction in ambient levels is not proportional to the reduction in effluent discharges, that would take your numbers down to some extent, right? If the reduction in ambient levels was less than the reduction in effluent levels, then your numbers would go down in terms of dollars?

DR. BOYLE: That's possible. I don't have specific numbers if front of me.

MR. ARMSTRONG: Just to --

MR. ANDES: Would it go up? I'm asking a hypothetical. If the effluent levels -- if the reduction in effluent levels was less than

proportional to the reduction in -- if the reduction in ambient levels was less than proportional to the reduction in effluent levels, then your numbers would have to go down. It couldn't go up, right?

DR. BOYLE: Well, there's ratios, and there's physical numbers. So we're just talking about the ratio, but not the physical numbers. If the ratio went down, then our number would go down.

MR. ANDES: Okay. Thank you.

MS. WILLIAMS: I'd like to ask a follow-up. A similar question but reversed, I think, a little bit. You relied on effluent data for the starting point as well, correct? You didn't use numbers from the receiving stream for the existing conditions either, did you?

DR. BOYLE: We have -- in the equation, there's the baseline of current conditions of water quality. That is based on the Metropolitan Water District's monitoring stations. And so we have current ambient levels in the CAWS, and then we -- from Mr. Twait's testimony, we have a calculation of what the change would be from the current ambient level.

MS. WILLIAMS: Do you know where your

current ambient level data was taken?

DR. BOYLE: It was taken from -- information from the Metropolitan Water District's monitoring stations. If you give me a minute, I can probably find the exact -- so what we used was fecal coliform data supplied by the EIPA taken at Metropolitan Water District's sampling stations downstream from the plants from January of 2004 through May of 2007.

The sampling sites were on the main stem of the Chicago River, and below the confluence of the Cal Sag Canal, and they were looking at the spring and summer months when most of the recreation would occur. The winter months were excluded.

MS. WILLIAMS: Thank you.

MR. ARMSTRONG: And the state will submit the sampling data that Dr. Boyle and Mr. Louis used in CD form.

MS. WILLIAMS: Excuse me? You said the state will submit it?

MR. ARMSTRONG: Yes.

MS. WILLIAMS: Can you clarify, for the record, what you mean when you say the state

will submit it?

MR. ARMSTRONG: We will submit the data that Dr. Boyle just referred to --

MS. WILLIAMS: You mean the Attorney General's office will submit the data, right?

MR. ARMSTRONG: Yes.

MS. WILLIAMS: I just wanted to be clear in the record that the proponent is not the one that's --

MR. ARMSTRONG: Very good point.

MR. ANDES: So Dr. Boyle, are you aware that there are other sources of bacteria to the CAWS, including hundreds of combined sewer overflow points plus other storm water runoff?

DR. BOYLE: I'm aware that they're all contributors to it.

MR. ANDES: And is it your understanding that the disinfection requirements would not address those sources at all?

DR. BOYLE: I understand that, but I also understand that we're basing our change on the current ambient level in the river that allows for those other contributing sources to the current level. When we look at the change, though, we're

not talking about those other sources. We're just talking about the change in terms of the three treatment plants.

MR. ANDES: So there will be a reduction in the levels of bacteria discharge by the treatment plants, but no reduction in the bacteria discharge by the other sources?

DR. BOYLE: Let's clarify that for a minute. What we're talking about here in the analysis I did was changes in fecal coliform counts. We have nine elements that go into this water quality index, and one of them is fecal coliform. One is not bacteria, so we're looking at changes in fecal coliform counts, and what we're looking at is just changes in releases from treatment plants. We're not looking at any changes in those other sources, but those other sources are in the baseline current ambient water quality.

MR. ANDES: But you're assuming that the baseline amount would be reduced by a percentage that will yield an economic benefit, and you said earlier that you were determining that reduction by looking at Mr. Twait's information about the reductions in the treatment plant discharges and

applying that. That was your -- those were the numbers you used in determining a percent reduction. Am I correct?

DR. BOYLE: Right. So we're talking about the treatment. We're not talking about the other sources in my statements there, correct.

MR. ANDES: But were you assuming that the ambient water quality will improve by a percentage, roughly equivalent to the numbers in Mr. Twait's analysis?

DR. BOYLE: Yes.

MR. ANDES: Even though some of the sources will not be reduced at all?

DR. BOYLE: What we're talking about is -- we're talking about the share that's coming from the plants.

MR. ANDES: Do you know what that share is?

DR. BOYLE: Fecal coliform?

MR. ANDES: Yes.

DR. BOYLE: We're talking about a percentage reduction, and so we're just looking at that in terms of the reduction in the baseline. We're not talking about any changes in any of the

other sources.

MR. ANDES: But you don't have a number in terms of what percent of the total loadings of fecal coliform are from the treatment plants versus CSOs. Am I correct?

DR. BOYLE: I do not have that number in front of me right now.

MR. ARMSTRONG: I'd like to ask a clarifying question. What order of magnitude reduction did you estimate, based upon disinfection of effluence in the ambient levels?

DR. BOYLE: It was a two order of magnitude.

MS. TIPSORD: I'm sorry. You'll have to speak up.

DR. BOYLE: Two order of magnitude. Excuse me.

MR. ANDES: So you assume 100 times lower level in the ambient water quality due to disinfection?

DR. BOYLE: That's correct.

MR. ANDES: But you don't have any numbers in terms of -- well, I'm sorry. You understand, based on what you just said, that there

is no reduction at all in the CSO's storm water sources from this rulemaking?

DR. BOYLE: I'm not sure whether I understand whether they are or not. We're not taking any account for any of those. What I understand is we're just looking at the treatment plants and changes from them, not from any of the other sources.

MR. ANDES: You're assuming the overall ambient water quality is going to decline by 100 times in fecal coliform levels, because Mr. Twait said that the effluent levels have declined by 100 times, even though there are other sources in the calculation here that aren't being reduced at all?

MR. ETTINGER: I'd like to object to some of the statements that Mr. Andes is making, because I don't think it's been proven that none of the other things that might be done to control dissolved oxygen levels or other things to meet other portions of this proceeding would not also reduce the amount of fecal loading to the system. He, of course, is free to pose his question as a hypothetical, but not to testify as to what, for

example, efforts to reduce BOD in the system might do on fecal.

MR. ANDES: That's fine. We'll move on. Question No. 5 --

MS. TIPSORD: For the record, Mr. Ettinger, did you -- you've got him? Sorry. Go ahead.

MR. ANDES: Question No. 5, "How is the value of the use and intrinsic benefits related to your estimate that ten percent of households actual use the CAWS?"

DR. BOYLE: Okay. Let me, kind of, go back. We estimated total value, not use and intrinsic separately. So when we estimate the total value, the equation that we used to do it had one variable. It was a percent of the people that had used the waterway for recreation.

One of the studies in the meta-analysis was based on -- it was a Croke study that was done here in Chicago in the mid-1980s. In that study, they found that ten percent of the households that they sampled used the river -- or excuse me -- used waterways for recreation. We used that as the assumed level of participation and

recreation on the waterway by households in the Chicago area and Cook County.

MR. ANDES: Now, the ten percent isn't all canoeing and kayaking. Am I right?

DR. BOYLE: It's all types of uses, as I understand it. They don't clearly define what it is. They have a general term of use, and so I would assume that it would include all types of uses along the river.

MR. ANDES: On -- and actually, let me go to the Croke study for a moment, and I'll introduce the Croke study. The name of the study is Estimating the Valve of Improved Water Quality in an Urban River System.

MS. TIPSORD: We have some more copies up here if anybody needs them. If there's no objection, we'll mark Estimating the Valve of Improved Water Quality in an Urban River System from J. Environmental Systems, Volume 16(1), 1986-87, by Kevin Croke, Robert Fabian, and Gary Brenniman, School of Public Health University of Illinois at Chicago as Exhibit 287. Seeing no objection, it's Exhibit 287.

MR. ANDES: On the -- Dr. Boyle, on

the fourth page, under definition of water quality, I note that in the third paragraph it reads, "To the extent that Chicago area rivers are used for recreation, activities are more likely to be focused on outings, such as picnicking, hiking, and photography, rather than activities such as boating, fishing, and swimming."

So does -- the ten percent use includes all of those activities and outings being more common. Is that right?

DR. BOYLE: That -- the ten percent would be based on all of these activities. I don't know whether outings are more common. That's their -- the author's assertion. They don't present any data in their paper that tells us that that assertion is, in fact, correct.

MR. ANDES: You don't have any reason to disbelieve the author's assertion though?

DR. BOYLE: I don't have any data to support that either. I have no reason to believe it or disbelieve it.

MR. ANDES: Okay.

DR. BOYLE: I think it's clear that those are the types of activities. It's not clear

what share is attributed to each one of those types of activities.

MR. ANDES: Okay. Next question, "Do the use and/or intrinsic benefits for the public's willingness to pay for these benefits record actual or only perceived water quality improvements?"

DR. BOYLE: They're based on actual water quality improvements.

MR. ANDES: Well, isn't the issue -- doesn't the issue come down to what the public perceives is happening as to water quality, rather than what is actually happening? If something is happening but they don't perceive it, how does that affect their willingness to pay?

DR. BOYLE: Perceiving it is not a necessary prerequisite to have people value a change in water quality. All of the studies that the Van Houtven meta-analysis is based on are based on what are called stated preference studies, where you go out and you do surveys to illicit people's preferences for improvements in water quality. Those studies present described changes and scenarios from what baseline conditions are in water quality and what the improvement will be, and then

people's willingness to pay is based on those changes.

Most of the value is non-use value. If you look at the Croke -- I'm not sure of the correct way to pronounce it -- you just put it in front of me on Page 19, Table 2, you can see that for the people that had use values, that was 27 or 28 of the respondents. The non-use was 252 to 268 of the respondents. A vast majority are giving non-use values.

So that's based on their understanding that there is an improvement in the water quality. Those people that give non-use values are not going out there and actually seeing it. And there are changes that can occur in water quality that you can't necessarily perceive the change, but if you understand it, you will have a higher value for the change.

There are things that can happen, for example, like the change in dissolved oxygen. People can't necessarily see a change in dissolved oxygen, but they can understand the technical description of the improvements that would occur in water with dissolved oxygen changes, and they would

have a value for that improvement.

MR. ANDES: Well, when we're -- let's clarify something. When I'm asking about perceiving, I'm not saying that they can visibly see a change in the water quality. The question is isn't the willingness to pay based on their having an understanding that water quality is improving?

DR. BOYLE: Yes. It's based on the understand that water quality is improving.

MR. ANDES: Okay. So in the next question, "Is your estimate of the public's willingness to pay in Cook County based on people believing that reduced fecal coliform in the CAWS will represent a real improvement in water quality?"

DR. BOYLE: It's based on their understanding that there will be a change in fecal coliform and that that would improve water quality.

MR. ANDES: Okay. So if the actual improvement of water quality were different in that perception, would that change people's willingness to pay?

MR. ARMSTRONG: I'm going to object. That's vague in terms of what perception are you referring to?

DR. BOYLE: I'm sorry. I'm confused, because you just told me it wasn't perception, it was the actual, and now you're asking me between actual and perception.

MR. ANDES: We're not using visual perception. Let's ask about understanding. If people understand or believe that water quality is going to improve, but it actually won't. In real water quality terms, there's no or very little improvement, but they believe that it will improve, they believe that it is improving, how does that affect their willingness to pay?

DR. BOYLE: Their willingness to pay is affected by their understanding of what the actual change would be. You're talking about whether there's very little or a small change. People can still have values for very little or small changes. You know, we're talking about -- we did a .7 change in a water quality index. That's ten points, and so I'd consider that a relatively small change in water quality. And yes, people can value small changes in water quality.

MR. ANDES: But they won't value them as much as large changes, correct?

DR. BOYLE: That's fair to say, yes.

MR. ANDES: And it's all based on their understanding of the amount of the change?

DR. BOYLE: It's based on a correct description of what the baseline conditions of water quality are and what the improvement would be.

MR. ANDES: So if the -- so if the question really is what the public believes, what if the public believed that reducing fecal coliform levels at these effluents would not significantly reduce fecal coliform levels in the system, would that change their willingness to pay?

DR. BOYLE: Well, I'm having a little bit of trouble with this believes in the abstract. When you do these studies, you present them with information that, at the time, is the best information of what the baseline conditions would be and the change. And, you know, the work that I've done and other people have done in the literature shows that if you provide a good description, a good, sound description, the respondents will understand it, they'll believe it, and they'll give you honest responses to it. If, for some reason, the number that you give them is not a correct one

that's different from the perception, then there would be a problem.

MR. ANDES: Dr. Boyle, in this rulemaking, there is controversy about the extent to which reductions at these treatment plants will actually improve water quality in the system. So if, for example, survey respondents were to be given a statement based on Dr. Blatchly's testimony, which I assume you haven't reviewed, which indicated that there would be very little change in the overall ambient levels, would it be logical to suppose that if they believe that they would be less willing to pay a significant amount or be willing to pay a smaller amount for that reduction?

DR. BOYLE: Well, let's separate it out into two ways. One is we didn't do a survey here. We did a meta-analysis where we're transferring the numbers from 18 other studies to this one. So we're not comparing it to a survey that was done of Cook County households and then say, "Whoops, the information we provided in that survey is wrong and it should be this." We used the equation to do the transfer, okay?

With that, if the numbers turned

out to be different from what the information I had to base my current analysis on, the advantage of this benefit transfer with the calibration equation is that a different value could be calculated.

And if you go -- I mean, you're talking about small. But if I go back to Mr. Twait's testimony, he said the differences could be as great as from 100 to 100,000? So, you know, we -- rather than doing two orders of magnitude, we could've done three orders of magnitude. We took the more conservative approach in interpreting that.

MR. ANDES: Well, but --

DR. BOYLE: Let me finish, please. If the numbers came out and they were different, this calibration equation, we could put in the different number and calculate on a different number. It doesn't invalidate the basic principles or process of the analysis. We could adjust for that.

MR. ANDES: So it's all dependant, first, on your assumption that the reductions identified by Mr. Twait of 100 or more reduction -- 100 times or more reduction in effluent levels would equate to at least that in ambient levels. So if another assumption were made, based on another

testimony in this proceeding -- and there has been other testimony that disagrees with that -- you could rerun it and you would get different results?

DR. BOYLE: If there was a different number, we could rerun it, yes.

MR. ANDES: Okay. So it's all dependant. And in that respect, it's dependant on what you're telling the hypothetical response. The information you're giving them determines -- or is at least a significant factor in determining what their willingness to pay is?

DR. BOYLE: Yeah. But we're not doing a survey. I mean, you're creating a hypothetical here that's taking what was done out of context, okay? There were 18 studies of water quality that have been done around the country that Van Houtven used in his statistical studies. Those studies looked at a variety of water quality on the water quality index that's commonly used by USEPA and other agencies.

From that, you can predict what the change in water quality would be, and calculate out what the value that a household would place on that. So we're not doing a hypothetical survey here

or talking about what they do or don't understand. We start with the assumption that the people in those 18 studies understand what they're being asked to value. And collectively using that information, we can predict a calibrated estimate for what the value is for the Cook County household. That's where the $47 per household came from.

MR. ANDES: So your estimate was based on an overall analysis of 18 studies around the country, only one of which, the Croke study, concerned Cook County?

DR. BOYLE: Correct.

MR. ANDES: Okay. So -- and we have several questions that deal with this issue. If the public were -- if the assumption were built into this hypothetical, that, in fact, there were no significant risks now to recreators, so therefore, the disinfection would not make much of a difference in risk that would change the outcome of this analysis. Am I right?

DR. BOYLE: Risk is not one of the elements that go into that scale. If you can just give me a moment here.

So this is in response to your

Question 27B, later on. But the variables that go into that water quality index are dissolved oxygen, PH, biochemical oxygen demand, nitrates, phosphates, temperature, turbidity, total solids, and then the fecal coliform. Those are the ones that are going in. And so risk, as you say, is not a variable that's going into that water quality index.

MR. ANDES: If one were to -- and again, this is hypothetical. But some of the methods that are used in looking at use and non-use benefits include surveys, correct?

DR. BOYLE: Yes.

MR. ANDES: And if one were to survey the residents of Cook County, would one think that the extent of risk to the recreators be relevant in determining their willingness to pay?

DR. BOYLE: Risk is something that can influence willingness to pay. When economists do surveys, they are very careful about how they use risk, and there has to be some real demonstrated risk before you put it in.

What we're doing here is looking at a total value study so you're surveying households. Risk doesn't come into play necessarily

in the non-use component of it. It could come into play in the use component of it. But as I understand it, the use designation of the river right now is for incidental contact, and so there's a policy in place to try and reduce the exposure of risk to anybody using the river.

So if you were doing a survey, you probably would not be talking about risk as if somebody was going swimming or having substantial contact or adjusting the water. You'd be telling the people about the current use designation on the river.

MS. WILLIAMS: Mr. Boyle, I'd like to ask a follow-up. You had said that risk was not a component of the water quality index that you relied on, correct?

DR. BOYLE: Yes.

MS. WILLIAMS: Is another way of expressing that to say that your study did not attempt to quantify the benefit of reduced risk of illness to recreators in the CAWS? Could that be an additional benefit that was not within the scope of your study?

DR. BOYLE: I'm not sure. I'd have to

go back and look at the studies that were done to give you a clear and definitive answer to that.

But what we're looking -- you know, risk, to me, as an economist, is you know what's going to happen to people. And what we're using for our water quality index is what's happening to the water. And so we're looking at physical measures of changes in water quality. If there was some change in risk associated with the use designations, some of that probably would be captured in the number of -- that I reported, because we're talking about that change of fecal coliform. If there was something else unrelated to that, then that would not be done and that would be an addition.

MR. ANDES: Now, Dr. Boyle, if -- again, in a hypothetical survey, focusing on use benefits, if people believed or understood that there's not a significant risk to canoe or kayak on the CAWS, and then one were to ask them, "Would you be willing to pay for reductions in the fecal coliform levels," logic would say they probably wouldn't be willing to pay very much if they don't believe there's any risk right now. Am I right?

DR. BOYLE: No, I don't think you're right, because you've got to overlay the policy, you know, the current use designation that's out there to protect people right now in terms of incidental contact with the water. And so if there was a change, that would reduce that so you could have a more liberal use designation, yes, they would value it.

I would also think that people -- taking risk aside -- would consider that having fecal coliform in the river is an undesirable characteristic and would like to see that removed.

MR. ANDES: But that's a non-use benefit, right? That's not a use benefit if we're telling them it won't change the risk of using the water body, they might be able to pay something because they'd feel better if it had less fecal coliform. But that's a lot different than saying, "What would you pay to make it safe?"

DR. BOYLE: You're misusing the term use and non-use. Use value is a value that somebody can use as a whole, and so it's the value that they would place on a change in the water quality of the river. People -- you know, research I've done, I've

done a lot of work with beautification. People will pay for improved visible clarity of the water. There's no risk associated with that change, but if it improves the desirability of the water, people will pay for that improvement of water quality. I would think that the same would hold for removing fecal coliform from the river.

MR. ANDES: What's your evidence for that?

DR. BOYLE: It's my professional judgment from doing a lot of water quality studies and doing a lot of evaluation studies. I've been at this since the early 1980s. I've done studies around the world. The weight of evidence tells me that people will pay for changes in water quality, and you do not have to have just a risk trigger for people who have a value for improvement in water quality.

MR. ANDES: So you think -- and I'm talking about now in these economic times -- if you said to people, "There's no change in risk to recreators from these measures, but there will be less fecal coliform in the CAWS, in the Chicago Sanitary and Ship Canal," that they would agree to

pay money for that to happen?

MR. ARMSTRONG: I'm going to object. That's a compound question. In these economic times, are you concerned about the current economic position, or are you concerned with the other issue relating to the connection between fecal coliform and risk?

MR. ANDES: Well, let's ask this question generally as to people in Cook County. And if you said to them, "We're going to reduce fecal coliform levels in the Chicago Sanitary and Ship Canal. It won't reduce the risk to recreators, the health risk to recreators, but it'll reduce fecal coliform levels. It will reduce bacteria levels in the system," you think that people would be willing to pay money for that?

DR. BOYLE: I do. I have -- I'm participating in a study for the state of Oklahoma right now looking in changes in water quality in the Illinois River water shed in Lake Tenkiller, and there's no health risk, and people are still willing to pay for improved water quality.

And you did put -- make it a compound question in these economic times, and that

survey was done last fall when we really had the collapse before things were coming back. And yes, people were -- in Oklahoma, one of the hardest hit states, were willing to pay during these economic times.

MR. ANDES: Well, what kind of improvements in water quality?

DR. BOYLE: What types of improvements? It was mainly beautification that they were looking at. It was poultry waste in the water shed. So it wasn't human waste, but it was mostly from the poultry operations.

MR. ANDES: And did that affect the visual characteristics of the water body's beautification?

DR. BOYLE: In some cases, yes. In some cases, no.

MR. ANDES: Did it affect the uses of the water body, including the degree to which it can nourish an aquatic community?

DR. BOYLE: Yes.

MR. ANDES: Okay. Let's move on. I believe that the series of questions from eight through 14, I believe, we've covered. I don't

expect to go back from this last line of questioning.

MS. TIPSORD: Excuse me, Mr. Andes. Mr. Harley has a follow-up.

MR. HARLEY: My name is Keith Harley. I'm an attorney for the Southeast Environmental Task Force.

I want to go back to the point relating to current economic conditions. Did your study take into account how the public would perceive job creation, how the public would value job creation during these economic times, which would result from improvements at water reclamation district plants?

MS. TIPSORD: And a point of clarification, are you talking about the Oklahoma study?

MR. HARLEY: No. I'm talking about the work that was done in preparation for today's hearing.

MS. TIPSORD: Thank you.

DR. BOYLE: We did not consider jobs. I was not asked to look at jobs. Whether jobs are -- an increase in jobs is a benefit or not

depends on whether an economy is what's called full employment. So if you're not at full employment and you're creating jobs that reduce the unemployment rate, then it is a benefit.

So if you do have an increase in jobs in a down turn in the economy, it would be an additional economic benefit. But we did not look at that. We only looked at the change with respect to water quality.

MR. HARLEY: Thank you.

MR. ANDES: And you're not aware of any evidence in the record or anywhere else indicating that a significant number of additional jobs would result from acquiring disinfection at these three plants, are you?

DR. BOYLE: I think somewhere in your questions you actually mentioned additional jobs that might occur from some of these activities. I can't put my finger on it, but I think you actually raised that issue in your questions at one point.

MR. ANDES: That would've been in another context, but we'll move on.

Question No. 15, on Page 3, you claimed the local site-specific information was used

in your economic benefits for the CAWS. I guess my first question is what information -- what local site-specific information is that?

DR. BOYLE: We used the ten percent recreation from the Croke study that we've already discussed, we used the average household income for Cook County, and then we also used the predicted change in fecal coliform counts.

MR. ANDES: So you didn't use any other information from the Croke study, including the telephone survey results?

DR. BOYLE: We did not use other results from the Croke study.

When you're doing benefit transferring, there's two types of transfers you can do. One's called a value transfer, where you take information from a specific study and transfer it over. The other is called an equation transfer, where you can calibrate your estimate and include things like the percent of recreation income. And those equation transfers have been shown in the literature to be much more accurate, and so we used an equation transfer, rather than just taking the results from the Croke study.

MR. RAO: I have a follow-up question. This ten percent population used in waterways that you took from the Croke study, that was from almost 25 years ago, right?

DR. BOYLE: Right.

MR. RAO: Do you think that may have changed since then, increased?

DR. BOYLE: I do think it's increased. You know, it's general knowledge that there's been an increase in a lot of different recreation activities. The attorneys provided me with a couple of reports that talked about changes in recreation activities, that I believe that Mr. Armstrong is going to submit to you for the record.

In addition, you know, at this point -- yesterday they took me for a boat ride out along the river and seeing all the new development and walkways and stuff that weren't there a few years ago. You have to -- it's pretty easy to see that recreation activities along the river have increased and are increasing. We left about noon time, and when we came back at the end of the day, there were kids out kayaking on the river and a lot of people along the banks, families walking. And so

I saw substantial recreation that would not have been there without the improvements along the riverbank.

MR. RAO: How would --

MR. ARMSTRONG: And I do have a couple of exhibits to introduce at this time.

MR. RAO: How would a higher percentage of population using the waterways affect your results?

DR. BOYLE: The equation we used is -- I'll just -- on Page 58 of my testimony -- but if we used a higher value, that would have increased the value. So if it was greater than ten percent, we would've -- we would be reporting a larger number.

MR. RAO: Thank you.

MR. ANDES: The additional -- the increase in recreational use is all taking place without disinfection. Am I right?

DR. BOYLE: You know, I don't know the details, but I understand that the Metropolitan Water District does disinfect at some plants and not at some plants.

MR. ANDES: The plants on the CAWS -- it's a factual matter that it does not disinfect.

So if you're speaking about increased recreational activity along the CAWS, that would be without disinfection. I'm sure all the parties here would stipulate to that.

So given that, all of these increases and recreational activities, am I right, have taken place without the District disinfecting the plants on the CAWS?

DR. BOYLE: But an improvement in water quality could increase recreational use, and even people that are using it right now would be willing to pay something, I believe, professionally to see the water quality improved.

MR. ARMSTRONG: And in terms of my exhibits, I have a May 2000 report from Friends of the Chicago River entitled Waterways for Our Future that I'd like to introduce.

MR. ANDES: So if recreation activities have increased, and your testimony is consistent with other witnesses who have testified as well to significant increases in recreational activity without disinfection of the CAWS treatment plants, do you have any way to separate that out -- those improvements that are happening any way from

any improvements that might happen due to disinfection?

DR. BOYLE: I didn't value the improvements that have happened any way. I valued the improvements from the current ambient water quality with these activities going on right now, and improvement in water quality had changed from that.

You know, I've been through a lot of these hearings, and this is an old argument, okay, that recreation is going up. It's great, you know. Let's not worry about it. It overlooks the fact that if water quality improves, more people might use it, and it also overlooks the fact that people who use it would have greater enjoyment if it was improved. It overlooks the fact that people who don't even use it, the non-users, care about water quality.

MR. ANDES: When the Board is trying to assess the economic reasonableness of this requirement and considering the 900 -- more than $900 million that will be spent by the taxpayers of Cook County, don't you think it's relevant to determine to what extent the improvements would

happen anyway, to what extent this is really needed to address real health risks?

MR. ARMSTRONG: I'm going to object. Dr. Boyle's not here to testify on what the Board should consider. He's here to testify on the economic transfer analysis that he performed.

MR. ANDES: The last statement he made went well beyond economic transfer equations.

MS. TIPSORD: I think he can answer.

DR. BOYLE: Can I have him reask the question? I lost track.

MS. TIPSORD: Sure.

DR. BOYLE: Do you want to read it back?

(Whereupon, the record was read as requested.)

MR. ARMSTRONG: I would also like to object on the characterization of the cost of disinfection.

MR. ANDES: Then treat it as a hypothetical. There's been testimony about it.

DR. BOYLE: I'm just going to backtrack to my testimony before. What we're valuing is a change in water quality and a change in

fecal coliform count that goes into the water quality index. That water quality index does not have risk as an element that goes in, and so we're measuring the willingness to pay for improvement of water quality for a change in the fecal coliform index.

I guess in terms of your broader question, both the benefits and cost are relevant. I mean, that's a basic thing that we teach in economic classes. So I'd agree that both benefits and costs should be considered.

MR. ANDES: Okay.

MS. TIPSORD: And Mr. Andes, before you go on, two things. Mr. Harley has a follow-up. Go ahead with that.

MR. HARLEY: In terms of the scope -- in terms of the scope of your work, did you consider the economic value which might be created by onshore activity, for example, new recreational facilities, new residential developments?

DR. BOYLE: We -- there are two parts for that. The new residential development, that part of it, the higher value that would be associated with water quality should be captured in

the number that we have, and we're presenting an average value for Cook County households. Those households located right along the CAWS expect to have higher values than the other ones, and so that would be captured.

In terms of new economic activity, in terms of businesses located along the river, I'm assuming, canoe rentals and the like, we did not look at that type of benefit.

MR. HARLEY: Thank you.

MS. TIPSORD: The second thing, Mr. Armstrong had offered as an exhibit the May 20th Waterways for Our Future, the Friends of the Chicago River report. If there's no objection, we will mark that as Exhibit 288. Seeing none, it's Exhibit 288.

MR. ARMSTRONG: Also, on the issue of increased use of the Chicago Area Waterway System, I have a Comprehensive Annual Financial Report of the Metropolitan Water Reclamation District of Greater Chicago for 2007. I'd like to enter that as an exhibit.

MR. ANDES: We might have already.

MS. TIPSORD: I was going to say, is this different than the CD that we have?

MR. ANDES: We might have already put this in.

MR. ARMSTRONG: We've got the budget book in.

MR. ANDES: But I don't -- it was awhile ago.

MR. ARMSTRONG: Okay.

MS. TIPSORD: Let me double check.

MR. ANDES: Okay.

MS. TIPSORD: Hang on. I have the list of exhibits here.

MR. ANDES: I thought we put it in. It may be that these documents were just requested by the state and we provided them. I'm not sure. I remember providing them.

MS. TIPSORD: You put some of the budget stuff in.

MR. ANDES: Okay.

MS. TIPSORD: I do remember.

MS. WILLIAMS: It was around 160, 161 that we put those budget books in, I think. So you might want to try and --

MS. TIPSORD: We have the 2007 budget book in its entirety, the 2008 budget book in its

entirety.

MR. ARMSTRONG: I think these might be -- this might be a separate document from the budget book itself.

MS. TIPSORD: Okay. And the 2008 selected pages also. All right. In that case, if there's no objection, we will mark Comprehensive Annual Financial Report of the Metropolitan Water Reclamation District of Greater Chicago for the year ending December 31st, 2007, as Exhibit 289.

MR. ARMSTRONG: I was specifically referring to material on Pages 16 and 23, but since we've moved on from that line of questioning...

MS. TIPSORD: All right. Seeing no objection, it's Exhibit 289.

MR. ANDES: Question 16, you state on Page 4 of your testimony that the water quality improvements will occur if the implementation of wastewater disinfection at the North Side Stickney and Calumet wastewater treatment plants. What form of disinfection technology did you assume would be employed?

DR. BOYLE: We didn't make any assumption about what technology would be employed.

MR. ANDES: Can you account for introduction of possibly carcinogenic disinfection byproducts into the CAWS in your analysis?

DR. BOYLE: We did not.

MR. ANDES: Based on your previous testimony, is it correct to say that the water quality improvement in your analysis is solely based on the implementation of disinfection at those three plants?

DR. BOYLE: It's based on a change in fecal coliform. If it's brought about by disinfection, you can back up to it. But it's based on change in the fecal coliform count.

MR. ANDES: Well, it's not based on any other changes in sources of fecal coliform to the water body, correct?

DR. BOYLE: Correct.

MR. ANDES: Only those plants?

DR. BOYLE: Yes.

MR. ANDES: And you do acknowledge there are other sources, am I correct, such as CSOs, storm runoff, feces and birds and other animals, all which can introduce bacteria and pathogens into the CAWS?

DR. BOYLE: I do understand, from conversations, that those other ones -- but I'll reiterate my point before, that we're starting from an ambient water quality in the CAWS that is the current water quality that includes all those other sources.

MS. TIPSORD: Your voice is falling, Doctor.

DR. BOYLE: Okay. Sorry.

MR. ANDES: But since you've not quantified those sources relative to the treatment plants, and those sources will not be reduced, the actual reduction of pathogen levels is unknown after disinfection, correct, in terms of ambient levels? You don't really know that?

DR. BOYLE: I wasn't asked to give any opinion on pathogen levels. I'm an economist, so, you know, I'm not --

MR. ANDES: Let's ask about fecal coliform levels --

MS. TIPSORD: Let him finish, please.

MR. ANDES: I'm sorry.

DR. BOYLE: I was going to say what we did is looking at a change in fecal coliform levels.

MR. ANDES: So you don't know what the actual changes in fecal coliform levels in ambient water quality would be since you haven't considered these other sources. Am I correct?

DR. BOYLE: No, I don't think you're correct. Those other sources are in the baseline. What we're looking at is just the predicted change from the treatment plants, not a change in all of those other sources.

MR. ANDES: But you assumed the baseline would be reduced by a percentage based on Mr. Twait's numbers concerning the reduction in the effluent. If the effluent is, say, half of the water, then obviously -- and if it were a 50 percent reduction, obviously the change in ambient would be, say, 25 percent. Am I right?

DR. BOYLE: I think that it's not quite -- being stated quite correctly, okay? What you have is you have the ambient level water quality that has all the different sources contributing to it. When we're talking about the reduction that goes on that baseline, it's a reduction based on how much it's going to be reduced coming out of the plant, not an overall reduction. So we're not

trying to include reductions in those other sources. We're just -- it's just a prediction of what the change is going to be coming out of the plants.

MR. ANDES: Did you do a mixing analysis to determine how the reduction in effluent levels affects the ambient water quality levels?

DR. BOYLE: I've already answered that. We've assumed that there's a direct proportional change between the two of them. We haven't done any adjustment between that. If it's -- you know, that rate of coming out is the same reduction on the ambient one.

MR. ANDES: Thank you. Let's move on to Question 17. Did your approach consider degradation of air quality, increased truck traffic, other adverse impacts that will result from construction and operation of disinfection facilities?

DR. BOYLE: We didn't, and we weren't asked to. We were looking at the benefits of it. That's something that would be done if a cost analysis was being conducted. But it's not part of the benefit analysis. There's not a standard economic approach to doing that in the benefits.

MR. ANDES: So you looked at benefits. You didn't look at the countervailing costs?

DR. BOYLE: That's correct.

MR. ANDES: In a region such as metropolitan Chicago, which is already a Clean Air Act non-attainment zone, does your model take into account further degradation of air quality and its impact on property values?

DR. BOYLE: We're looking at water quality, not air quality.

MR. ANDES: But if a change in water quality controls has an impact on air quality -- an adverse impact on air quality, you're not looking at that. Am I right?

DR. BOYLE: We're looking at the benefits.

MR. ANDES: Let's move on to Question 19. In answering the question, "What is the approach you filed to compute economic benefits," you provided an outline in this section of your testimony of your methodology. Did you produce a report that details your work?

DR. BOYLE: We we did. It's R2008-009 in the record.

MR. ANDES: Is that available in the record in this case?

MR. ARMSTRONG: You're referring to your pre-filed testimony?

DR. BOYLE: My pre-filed testimony, yes.

MR. ANDES: Well --

MS. TIPSORD: Would that be Exhibit 2?

DR. BOYLE: I don't know the exhibit number.

MR. ANDES: There's a summary of calculations in Exhibit 2. I'm wondering was there an actual report done which explained how you -- that's a summary of your calculation. Is there an actual report that shows your calculations that shows your work?

DR. BOYLE: There's a -- the tables in the back, but that was -- that summary is what I was asked to submit, and there was no report behind that.

MR. ANDES: Okay. There's no report that reflects your calculations?

DR. BOYLE: Correct. I just thought you were asking me about my pre-filed testimony

there. We did do the calculations in a spreadsheet, and we can submit an electric copy of that spreadsheet to the Board so you can follow through all the calculations that we did with the water quality index and the calibration equation.

MS. TIPSORD: Thank you.

MR. ANDES: Thank you.

MR. ARMSTRONG: That would include the MWRD data that Dr. Boyle previously referred to.

MR. ANDES: I'm going to skip over 19 C and D for now. I may come back to those questions later. But let's move on to 20. On Page 6 of your testimony, you make the statement that third, the affected populations are similar. Please explain how you characterized and compared the affected populations.

DR. BOYLE: Those are the two variables that I referred to before with the percent of our recreation users in the average household income. Income is a standard economic variable that you would include in this analysis that you'd want to look at, and then we also know that some of the people that recreate influence the value that they place on it. So you want to account for people who

recreate.

MR. ANDES: Well, when you're talking about similar -- you're talking about -- that the people of Cook County, or similar to the affected populations in the 18 studies in Van Houtven? Is that -- is that what you were trying to say?

DR. BOYLE: We're trying to say that we could calibrate to them through those two variables. Those are the two standard variables that are used by economists in this type of analysis.

MR. ANDES: I'm trying to figure out how do you know that the affected population here, whether users or non-users, is similar to the affected populations in those 18 studies around the country? That's your statement, the affected population is similar. I assume that means the population here is similar to the affected populations in those 18 studies.

DR. BOYLE: And what we mean is that through the variation of those 18 studies, we can predict a value for Cook County households using those variables to make a similar adjustment.

MR. ANDES: Okay. And I still don't

think I have an answer to the question. How -- did you look at the affected populations -- let's put aside that you looked at household income. Did you look at the affected populations in those 18 studies and compare them to the Cook County affected population to determine that they are similar enough -- that they are similar, which is the statement you made here?

DR. BOYLE: What we're trying to do is do -- when you do a benefit transfer -- I'll go back to the two types of benefit transfers you have to do. One is a value transfer, where you take study from one area and you transfer it to another. In that one, you've got to match them up line by line for the different characteristics. When you use an equation transfer, which is the more accurate approach, you need variables in there that represent key characteristics. Income and recreation are the two here.

And when we do that through prediction, we're able to predict a value for those ones, and so they're similar to the prediction of putting in the average household income for Cook County residents and the percent of recreation.

MR. ANDES: So you looked at -- if I'm correct, you tried to do specific information on household income and percent users in Cook County, and determined that, in those respects, the Cook County population was similar to the population studied in the other studies?

DR. BOYLE: What we're saying is that you can use the equation to predict a value for those people that are similar. If you're looking at whether that type of prediction is valid, one of the things that Van Houtven did is they took their meta-analysis that they did, the equation I'm using, and they tried to predict another study you mentioned in your questions, Mitchell and Carson, and they tried to say, "Can we use our equation to predict what Mitchell Carson found in their study?" And they be found that they could with this linear restricted equation. That's the equation that we used in our analysis.

MR. ANDES: Now, did you look at other factors such as climate in terms of, for example, warm versus cold, which can affect the extent of recreational use?

DR. BOYLE: We did not bring in

climate. Once again, we're doing a total value, not just recreation one. And these are -- you know, when Van Houtven did it, they looked at what variables and the characteristics that matter in terms of affective people's preferences. And we used the variables in their equation that they found to affect whether people would pay more or less for water quality.

MR. ANDES: Wouldn't you think, though, that people would be willing to pay more if they're, say, in California on a coast where they can use their beaches or other recreational facilities year-round, versus in Chicago where that's definitely not possible?

DR. BOYLE: That's an empirical question of whether they would or wouldn't. We're not just doing beach use. We're not getting a value here for total recreation. We're getting a value here for change in water quality.

And so the appropriate question is whether people in California would value a change in water quality the same as people in Chicago would value a change in water quality. We're not asking a value for, you know, what's your total value of

beach use in California and comparing that to the total value of water quality here in Chicago.

You're making a key economic mistake here, I think, of talking in terms of total value and overlooking the concept of marginal value, and what we're estimating here is marginal value for change in water quality.

MR. ANDES: Wouldn't it -- beyond income and percent of use, wouldn't it also be relevant to calibrate for the availability of competing recreational facilities? Because if you have a lot of other ways to recreate, including on the water, one might value less a change in water quality in one particular water body, whereas if you only have one water body to recreate at, say, if you're in a rural area and there's one big lake, one might value that much more highly? And that doesn't -- you're not addressing that fact. Am I right?

DR. BOYLE: Well, again, you're trying to reduce this to just a recreation value study. If we go way back to the beginning, you know, if we go back to the, you know, Croke study, when they're looking at it, they had, you know, 28 recreational

users, and 268 that were non-use values. So you're trying to box it down and talk about just one little component.

Second, what you're referring to is substitutes in economic terms, and, you know, the other available waters. Whether it's recreation or non-use values, substitutes do come into play. But when we're looking at the 18 studies that were done in the Van Houtven study, all of them had a variety of substitutes that came into play. They weren't doing studies that had no substitutes and were totally excluding them.

MR. ARMSTRONG: I would like to ask a follow-up question at this point that might cut through some of this issue of comparing populations. What is the benefit of using a meta-analysis in terms of different populations?

DR. BOYLE: A meta-analysis is -- the purpose of it is so that you can predict a calibrated estimate to the population where you're doing the study. That's the primary reason why the equation transfer is more accurate than the value transfer.

MR. ARMSTRONG: And then the

meta-analysis controls for differences between populations?

DR. BOYLE: Yes.

MR. ANDES: But you didn't control for the differences I just identified, right? You didn't control for climate, you didn't control for availability of other recreational facilities, correct?

DR. BOYLE: Those were not variables in the Van Houtven study, so they were not available to us. Controlling for climate is not something that is commonly done when you're doing these benefit transfers. You can always find something that is not controlled if you look far enough.

MR. ANDES: But doesn't --

DR. BOYLE: Let me finish, please, okay?

MR. ANDES: Sure.

DR. BOYLE: Let me go back. We're using the most accurate procedure to do it. We're following the standard variables for adjustment that are found to be significant in these types of studies, and we're using the equation out of Van Houtven where they show that they could take

this, predict it to another area, and validate it. And so using the variables that are available to them in the analysis.

If all these ones were widely significant in the literature, then, you know, it would be logical to expect that Van Houtven would have a lot of these variables in it. When you go in and look at the evaluation literature, you'll find that income, percent or recreation are two variables that always come in significant in terms of explaining differences. You can throw other variables on the table, but generally they do not move the values around too much.

MR. ARMSTRONG: And now I'd like to introduce the Van Houtven study at this time as an exhibit.

MS. TIPSORD: I've been handed Valuing Water Quality Improvements in the United States Using Meta-analysis: Is the Glass Half Full or Half Empty for National Policy Analysis, George Van Houtven, John Powers, and P-a-t-t-a-n-a-y-a-k are the authors -- I'm looking for a date -- February 20th, 2007. If there's no objection, we will mark this as Exhibit 290. Seeing none, it's

Exhibit 290.

MR. ANDES: With all due respect to Van Houtven and his compatriots, wouldn't it make sense to you that there would be a difference in terms of willingness to pay if one can use the recreational resource and value improvements in water quality year-round, rather than a few months out of the year? Wouldn't that make sense?

DR. BOYLE: I'm going to go back to the same point. We did a total value study. Recreation is a small part of it. We're not doing a total value of recreation through the whole season. We're estimating the value for change in water quality. The marginal value, not the total value of recreation, and not just recreation. The total value, which includes use and non-use.

MR. ANDES: I'm not sure that answers my question. It was a yes or no. Don't you think it's common sense that one would value marginal -- even marginal changes in water quality more if one were using that resource around the calendar, rather than a few months out of the year?

DR. BOYLE: Okay. I'm going to take your question as a hypothetical.

MR. ANDES: Sure.

DR. BOYLE: So if we're doing a recreation demand study and we're looking at recreation, it's possible that if you used it year-round that that recreation value could be higher.

MR. ANDES: Okay.

MR. ARMSTRONG: And again, that's only one part of your analysis use, and you did not conduct a recreation demand study in this case?

DR. BOYLE: No. I was just responding to his hypothetical.

MR. ANDES: And let's also ask another hypothetical. Wouldn't it make sense if one had two situations. One, we're talking about improving water quality on one water body, and there are a number of other recreational -- water recreation sources to use, versus another were there's only one place where you can recreate on the water. It would make sense that people would be more willing to pay for the marginal improvement where there's only one lake, versus where you're improving one water body, but there are a bunch of others to choose from. Am I right? Wouldn't that be common sense?

DR. BOYLE: I'll be with you in just a second. So you're creating another hypothetical --

MR. ANDES: Yes.

DR. BOYLE: -- where you're saying there's just one water body. So do you want me to pretend that Lake Michigan doesn't exist and none of the waters up in Wisconsin exist and none of the other ones exist?

MR. ANDES: No. The CAWS was the second part of the hypothetical where there are a variety of recreational sources. I'm saying wouldn't the willingness to pay be less there than if you're out in Nebraska somewhere -- and not to insult Nebraska -- but say that there's one lake where people can recreate at, one would think their willingness to pay would be more than on the CAWS where they can go a lot of other places. Isn't that right? Wouldn't that be common sense?

DR. BOYLE: The marginal access value -- once again, I'm following his hypothetical, just making this a recreation study. The marginal access value of a recreational user day probably would be higher if there were no substitutes around, no other waters to choose from. That does not make

any statement about the marginal value of water quality. Marginal value of water quality could still be substantial even when there are substitutes around.

MS. TIPSORD: Ms. Meyers?

MS. MEYERS: Ms. Meyers, Glen Openlands, for the record. Wouldn't that negate the value, though, of proximity?

DR. BOYLE: Wouldn't what negate the value of proximity?

MS. MEYERS: Wouldn't there still be a value of a waterway being closest, or at least much closer, to a resident in order to use, enjoy, to build next to, wouldn't that, in itself, contribute to the value? If it's right in your backyard, compared to some ways away, doesn't that make it more valuable to that individual?

DR. BOYLE: The closer it is to you, all other things considered, the more valuable it would be.

MS. MEYER: Okay.

MR. ANDES: So then people who live a block from the lake, that might be more valuable to them than people -- if they lived four blocks away

from the CAWS, but a block away from the lake, do you think that makes much of a difference in terms of their assessment of the recreational values?

DR. BOYLE: I'm not sure that question is clear. Could you rephrase it for me, please?

MR. ANDES: If you looked at the differential values for various people around the Cook County area in terms of whether they're closer to Lake Michigan, the CAWS, the Des Plaines River, the Fox River, other sources or other areas where they can recreate.

DR. BOYLE: I think that was a statement, not a question.

MR. ANDES: Have you looked at the differential values for those people who are located in the Cook County area with regard to how close they are to various water bodies?

DR. BOYLE: We have not.

MR. ANDES: Okay.

MS. TIPSORD: Mr. Harley, you have a follow-up?

MR. HARLEY: Conversely, how does your assessment take into account people who do not live in Cook County, but would be attracted to use the

CAWS if the CAWS was disinfected?

DR. BOYLE: They are not accounted for, but they would have a value for improving water quality --

MR. HARLEY: I'm sorry?

DR. BOYLE: I said they're not accounted for, but they would have a value for improving water quality in the CAWS, but they're not in the benefit estimate that I report.

MR. HARLEY: Thank you.

MS. WILLIAMS: Is the same true for tourists to Cook County?

DR. BOYLE: The same is true for tourists to Cook County.

MS. TIPSORD: Mr. Harley?

MR. HARLEY: Just a clarifying follow-up, does your assessment take into account the value of increased tourism to use the CAWS that might occur as a result of disinfection?

DR. BOYLE: No. We're just looking at the value to Cook County households. We're not looking at the value of two people who might travel here to enjoy it, and we're not looking at any enhanced economic activity that they may contribute

to Cook County.

MR. ARMSTRONG: Also, to allude back to a question that Illinois EPA had earlier asked about medical -- possible medical benefits of disinfection, does your study attempt to quantify, in any way, benefits from reduction of illnesses associated with disinfection of the CAWS?

DR. BOYLE: No. We're just looking at changes in fecal coliform count. We're not looking at any illnesses that may be prevented by change in water quality.

MR. ANDES: Okay. Let's go to the Van Houtven report, and I want to read to you some statements out of the summary and conclusions and get your thoughts. And this starts on Page 224 toward the bottom of the page, where the authors state, "The results of our review and analysis of water quality valuation estimates have mixed implications for national policy analysis using benefit transfer. Although the existing emperical literature in this area is extensive, only a small subset of these values could be meaningfully combined through meta-analysis. One major reason for this limitation is that water quality is defined

and characterized in a variety of ways across studies.

"Thus, on the one hand, meta-regression results provide a reasonable basis for predicting how average WTP, willingness to pay, varies for broad changes in water quality, and can be used as a benefit transfer function.

"On the other hand, some of the main limitations of these models as benefit transfer tools for national policy analysis are a consequence of the variation in WTP that is not -- bold not -- explained by the meta-regressions.

"For example, our results provide very limited evidence about how WTP is related to the spatial characteristics of water quality changes. The meta-regression does not measure how WTP varies with respect to the proportion or amount of waters that are improved or the distance of the water quality changes from populations. This lack of specificity imposes limitations on the precision of policy-relevant benefit transfers, since policies almost always impact water bodies in spatially nonuniform ways.

"Consequently, despite the large

and diverse body of existing studies, there is a continued need to water quality valuation research that can be used to address the requirements of national and region-scale benefit assessments."

You don't disagree with any of that, do you?

DR. BOYLE: That's standard language that most economists put in conclusions, because you're tempering the results of your analysis.

MR. ANDES: You have similar extensive -- that's -- these are summaries of their analysis. This is not boilerplate. Are you -- you're not saying this is boilerplate that every economist uses, right?

DR. BOYLE: Of some type. There's always some tempering language that you put in about the general reliability of your results.

MR. ANDES: Do you have any reason not to believe that their specific statements about the 18 studies they reviewed are -- do you have any reason to disbelieve their conclusions?

DR. BOYLE: Well, some of it's described in the studies, and some of it is suggestion for future research. It's not all

conclusions. But, you know, they did do some spatial testing. They had variables for estuaries, whether it was local fresh water, whether it was in the Midwest, whether it was in the south, and none of those variables were significant of changing the values as you moved around different parts of the country. So they did do some testing on the spatial distribution of the values.

MR. ANDES: But they characterize it as very limited evidence, correct?

DR. BOYLE: They -- I don't know whether I would call that very limited evidence.

MR. ANDES: So you disagree with their conclusion when they say all results provide very limited evidence?

DR. BOYLE: I think when they're saying very limited evidence, they're saying that they did not find that there was statistical variation with those spatial geographic features that they included in their model.

MR. ANDES: In fact, they didn't say, "We find that to be a significant variable." They indicate that had this lack of specificity of those variables imposes limitations on precision. If they

were insignificant variables, why would those be limitations.

DR. BOYLE: Because that affects how you would use them in terms of calibration. Let me just go back to the -- where you started. Let's see. That was Page 224, correct?

MR. ANDES: Right.

DR. BOYLE: And so, I mean, when you did this, you're reading down through two paragraphs. Whenever you write something, you know, usually a paragraph is a complete thought, and so you're merging them together.

MR. ANDES: I wasn't trying to merge them. I was just reading them.

DR. BOYLE: And so the first one -- let me just read the first paragraph back. "The results of our review and analysis of water quality evaluation estimates have mixed implications for national policy analysis using benefit transfer. Although the existing emperical literature in this area is extensive, only a small subset of these values could be meaningfully combined through meta-analysis. One major reason for this limitation is water quality is defined and characterized in a

variety of ways across studies."

And so what they're saying there is they're talking about when they went and looked at the studies on emperical literature. They have 18 that they used here. They're saying that there are other studies that had been done, but they were not minimal to being -- to using the ten point water quality index, or for some other reason that they couldn't be included. Perhaps they were in recreation demand, and they just looked at access to waters, and they didn't look at changes in water quality. So they're talking about the broad studies that are out there and what they could -- were able to use in their analysis. So that's the first paragraph.

The second paragraph, "Thus, on the one hand, our meta-regression results provide a reasonable basis for predicting how average willing to pay varies broad changes in water quality." And note, they're saying it provides a reasonable basis. It can be used as the benefit transfer function, and they're saying that can be used as an benefit transfer function.

"On the other hand, some of the

main limitations of these models as benefit transfer tools for national policy analysis are a consequence of the variation of the willingness to pay that is not explained by the meta -- regressions. For example, our results provide very limited evidence about how willingness to pay is related to spatial characteristics of water quality changes."

I interpret that statement to say that they did not find anything significantly different between the areas that they were able to control for in their equation, but they're allowing, perhaps, there could have been that they weren't able to identify.

MR. ANDES: Dr. Boyle, let me ask you --

DR. BOYLE: Can I finish my answer.

MR. ANDES: Finish. Sure.

DR. BOYLE: And it says that meta-aggression does not measure willingness to pay with respect to the portion of the amount of waters that are approved or the distance to water quality changes from the population. This lack of specificity proposes limitations.

But in all of the studies, they

had people that were located a variety of distances away from the water bodies, and we're looking at different mixes. So I just don't see how that statement follows from the analysis that they've done.

MR. ANDES: So you'd disagree with their conclusion?

DR. BOYLE: I'm agreeing with some and disagreeing with others.

MR. ANDES: Okay. And they specifically said their regression did not measure how willingness to pay varies with proportion amount of waters improved or distance, so therefore they really couldn't make any conclusions about that. It sounds like you're making a conclusion saying you disagree with their interpretation of their own meta-analysis.

DR. BOYLE: I'm saying that there could be -- I'm not disagreeing that they didn't have a variable. There was not a variable in their equation. But there are a number of different interpretations that could be placed on that.

MR. ANDES: They said this lack of specificity and imposed limitations on precision.

You're saying that they shouldn't have concluded that, they should have concluded it wasn't a significant variable?

DR. BOYLE: Can you read that back to me, please?

(Whereupon, the record was read as requested.)

MR. ANDES: They're saying their results have a very limited evidence on spatial characteristics. Their regression didn't measure how one varies with respect to those factors, and that that lack of specificity imposed a limitation on precision of their transfer calculations. You're saying they shouldn't have concluded that, they should have concluded that spatial characteristics weren't a significant variable?

DR. BOYLE: That's the result of their analysis. You know --

MR. ANDES: That's not what they said.

DR. BOYLE: What?

MR. ANDES: I'm sorry. That's not what they said.

DR. BOYLE: I know. But if you look at their empirical results, if you go back to the

table on Page 219, Table 5, they did have variables that they included in that they were not able to -- they were not statistically significant.

So there were things that they tested in their analysis, and I'm saying that this conclusion could be -- have been stated much more clearly and specifically to the empirical results of their analysis.

MR. ANDES: And which --

DR. BOYLE: Can I finish?

MR. ARMSTRONG: Can you please not cut my witness off?

MR. ANDES: Sorry. I thought you were done.

DR. BOYLE: When we did the uncertainty analysis, we used these equations that had these insignificant variables in them to see how turning them on a local water change in the Midwest would affect the benefit of that estimate. So we did take those into account in the uncertainty analysis to look at what the bounds might be.

MR. ANDES: You're saying the factor of being in the Midwest reflects spatial characteristics or distance of water quality changes

from the population?

DR. BOYLE: Well, there's some spatial characteristics. Distance from the population is a different variable. So there are variables in the equation that were insignificant that they could've made one speculation about. They -- you can always say that there are variables outside of your equation that might have an effect. We don't know what that effect would be if we included them.

MR. ANDES: They said specifically there were two things they did not measure in their regression. The proportion or amount of waters that are improved, and the distance of the water quality changes from populations did not measure. They said that these -- the regression did not measure how WTP varies with respect to those. Are you saying they're wrong, they did measure those?

DR. BOYLE: No. I'm saying those were the parts that were left out. What the effect of those would be is unknown.

MR. ANDES: Okay. So you're not saying that they looked at them and they were insignificant. You're agreeing with them, they did not look at those, and then they go on to say the

failure to look at those variables imposes limitation on the precision of their calculations.

DR. BOYLE: And I'm saying that they may have overstepped their bounds with that, because it's relevant to say that those should be investigated in future analysis to see whether they were -- would have an effect. It is not appropriate to jump to the conclusion that they would have affected the estimates.

I guess there's two other points here. One is that we're doing a total value study. We're not doing just a recreation demand study. And so if you're doing a recreation demand study, you know, how close you are to water affects the value that you have.

If you look at the studies that they did, used in their analysis -- I'm just trying to find it here -- they had studies that -- in there that have a mixture of these conditions that would be similar to the Chicago situation. For example, on Page 212, Table 2, is where they list all of the studies. Number five is the Gramlich study. And, you know, they had different scenarios in there. One was looking at improving water quality in the

Charles River in Boston, and then they also did a nationwide value.

But their value, looking at water quality in the Charles River, is very similar to looking at water quality in the CAWS. Austin has Austin Harbor right by other -- you know, another major water quality, just like Lake Michigan.

So I think, you know, trying to draw the inference that, you know, this is -- it's irrelevant because they didn't look at it, the studies that they have that are the basis -- the reason that a metal analysis is so good for this is it allows for the averaging and the inclusion of information from a variety of studies, rather than just one study that would be the extreme that you have of just having one lake, no substitutes along ways away, and another one having many and they're all close together.

MR. ANDES: Well, let's -- I have a question about that, and we'll go back to my initial question. First, as to the Gramlich study, which was one of the studies here, as I understand that, that looked at improving to a level clean enough for swimming. Am I right?

DR. BOYLE: And wildlife.

MR. ANDES: Right. Okay. That's different than improving to a level for canoeing and kayaking.

DR. BOYLE: But what Van Houtven was able to do with his colleagues is map that into the water quality index. The ten point water quality index is an index that has been around since the 1970s. It's been developed by McCullen. I think Mr. Armstrong has that study to introduce into evidence.

But that is related to what USEPA has done for years using boatable, fishable, and swimable. So there are ways to map that back into that index. And so they were able to take the study with those changes and put them in the ten point index of water quality that's being used.

MR. ARMSTRONG: And I do have the McCullen study to introduce at this time as an exhibit.

MS. TIPSORD: I've been handed Water Quality Index Application in the Kansas River Basin from February, 1974, USEPA and Kansas City, Missouri. If there's no objection, we will mark

this as Exhibit 291. Seeing none, it's Exhibit 291.

And Mr. Andes, would it interrupt your flow too much if we took a couple minutes now?

MR. ANDES: I'm fine.

MS. TIPSORD: All right. If that's okay, we'll take a ten-minute break and come back. Grab a snack, and we'll go until at least 1:00 o'clock before we break for lunch.

(Whereupon, a break was taken, after which the following proceedings were had.)

MS. TIPSORD: Mr. Andes?

MR. ANDES: Thank you. We may come back to the Van Houtven report for some other questions later, but let's move on.

MR. ARMSTRONG: I do have some follow-up questions on the Van Houtven study if you're going to be moving on right now.

MR. ANDES: Sure.

MR. ARMSTRONG: Thank you. In the context of the quoted language that we were just discussing, that was a call for additional research. Was that done?

DR. BOYLE: That is my interpretation

of it. At a previous section, there was implications for a benefit transfer, but this was conclusions and recommendations. It's typical in the studies of recommendations you make for research.

MR. ARMSTRONG: Are you aware of any additional research that has been conducted along the lines that we have discussed?

DR. BOYLE: Not to my knowledge at this point in time.

MR. ARMSTRONG: And the analysis methodology described in the Van Houtven study, is that accepted within your field?

DR. BOYLE: A benefit transfer is an accepted approach to estimated values, as is contingent evaluation, which was the study framework that was used for the underlying values, those 18 studies. Those approaches are outlined in EPA's guidelines form conducting economic analysis. It provides the road map for how you do a benefit transfer, which we follow. It's also been admitted as evidence in court decisions.

MR. ARMSTRONG: Was the Van Houtven article specifically relied upon by any bodies

conducting benefit transfers that you're aware of?

DR. BOYLE: I believe there are some that have been done by USEPA where they have used the results of the Van Houtven study, but I don't have reports with me here today.

MR. ARMSTRONG: Thank you.

MS. TIPSORD: Mr. Andes?

MS. WILLIAMS: Are we going to still be on this study, Mr. Andes? Because I have a couple follow-ups on this article as well.

MR. ANDES: Sure.

MS. WILLIAMS: But if we're --

MS. TIPSORD: No, he was going to move on, so go ahead.

MS. WILLIAMS: Okay. I would just like -- I mean, I think, Dr. Boyle, I'm willing to accept, at face value, your testimony that this methodology is widely used and accepted, but I think it's something we may be a little bit unfamiliar with here, so I think some of the basic terms and concepts in this article could use a little bit further explanation.

And I believe on Page 214 of this article, Exhibit 290, there's a discussion of the

terms water quality index and water quality ladder. Are you --

DR. BOYLE: Are you on Van Houtven?

MS. WILLIAMS: I hope so. Yes. It's 214, Section 4.1, the water quality commodity. And I just wondered if you could help us a little bit to understand this terminology of water quality index and water quality ladder.

DR. BOYLE: And where exactly on the page are you so I can --

MS. WILLIAMS: The second paragraph.

DR. BOYLE: Okay. I'm just reading the paragraph --

MS. WILLIAMS: That's fine.

DR. BOYLE: -- and then I'll respond.

The term water quality ladder was terminology used by USEPA. It started in the early 1980s, and it was moving water quality up thresholds. It was when they were doing their initial economic evaluations for the Clean Water Act, and so it was increasing it to boatable, to fishable, to swimable, to drinkable. And so that was, kind of, where the terminology ladder came from, because you're, kind of, going up rungs or

thresholds on water quality.

The index has all those physical measures of water quality that I mentioned before that go in to develop that ten point index. Those points, those thresholds of the water quality ladder, were mapped over to specific levels on the water quality index so that the two of them related to each other. But the ladder was the thresholds that USEPA was trying to meet with improvements of water quality as part of the Clean Water Act.

MS. WILLIAMS: So you articulated four rungs, I guess, of the ladder, boatable, fishable, swimable, and you added --

DR. BOYLE: Boatable and drinkable. I believe that my recollection is correct.

MS. WILLIAMS: So when you say fishable, do you understand what that rung of the ladder is intended to respond to?

DR. BOYLE: I don't have that information right here in front of me today to answer that question. I don't know whether it means free of fish consumption advisories or not. I would have to go back and check that. I don't have that right here today with me.

MS. WILLIAMS: Do you know if any of those rungs correspond to aquatic life uses?

DR. BOYLE: In the -- it was late 1990s, early 2000s -- my dates are foggy in my mind, but I think it was late 1990s -- the EPA changed the ladder to include healthy aquatic ecosystems or aquatic life uses, and so that ladder, from what was referred to in here from the early studies, has been changed by USEPA, and so they have a different ladder of thresholds that they're using today.

MS. WILLIAMS: Can you also turn briefly to the Table 1 on Page 210 of this article?

DR. BOYLE: I'm there.

MS. WILLIAMS: I guess just generally, do you have an understanding of what the table is trying to explain for the reader?

DR. BOYLE: This is this table that we referred to, Table 1, Summary Statistics for U.S. Water Quality Evaluation Studies, is reviews of all the studies that Van Houtven and his colleagues were able to identify.

So whenever you do a meta-analysis, you go out near -- you try to identify all the studies that are in the literature.

So this is one that's -- the studies that they were able to identify, and that's the set that they started working from, down to the 18 that they actually used in their analysis, and so there's descriptions of these articles.

The first one here is -- whether it was published in a peer review journal, whether it was a Ph.D. or masters thesis, or some other thing, like a government report, year of publication, major characteristics of the studies are summarized here.

MS. WILLIAMS: And so some of the studies summarized here were not relied on?

DR. BOYLE: That is correct. The reason that they were not relied on is some of the studies, they were not able to map them into the water quality index. When economists go out and do these studies, they aren't necessarily always thinking that they're all going to go in and be able to merge together at the end. And so the way some of them were designed would not make them commensurate to be able to put them all together in a meta-analysis.

When you do a meta-analysis, you

want to have studies that essentially evaluation common items. You want it to apples and apples, not apples and oranges. So there's always some synthesizing and removing that you go down to get your useable set.

MS. WILLIAMS: The last item on that table is titled what are -- well, I assume WQ means water quality -- descriptor/indicator used?

DR. BOYLE: Yes.

MS. WILLIAMS: And then it lists five topics?

DR. BOYLE: Yes.

MS. WILLIAMS: And then provides information on number and percent. And could you just explain a little bit for us what -- how to read this table and what it means?

DR. BOYLE: This last one, the water quality descriptor, this would be a summary of how water quality was described to people in the original study. The first one would be -- is recreation, boatable, fishable, swimable. My interpretation of that is that they were using the old EPA ladder of going through thresholds.

The next one, rating, good --

poor, fair, good and excellent was a qualitative rating of water quality. Pollutant concentration would've been specific pollutants and the concentrations. Secchi depth are measurements of the amount of clarity in the water, and then fish consumption and advisory would be whether there was a fish consumption advisory and perhaps the type of fish consumption advisory. And the fish consumption advisories that are being done are perhaps on one meal a month, or women of childbearing age should not eat the fish. So it would be some type of fish consumption advisory with that.

MS. TIPSORD: Your voice is falling off again.

MS. WILLIAMS: So, for example, taking --

DR. BOYLE: Okay. I'm getting dry. Let me have a drink of water.

MS. WILLIAMS: So, for example, taking this last item, fish consumption advisory, the table then says publications, the number, so that means there were nine?

DR. BOYLE: There were nine studies.

MS. WILLIAMS: And percent of the

total would be ten?

DR. BOYLE: Ten, yes.

MS. WILLIAMS: What did the next two items mean?

DR. BOYLE: That means the next item is there were 31 estimates. That means that the nine studies presented 31 value estimates, or, you know, an average of three and a half value estimates per study. When you do these studies, you look at different scenarios, and you present values for them so that they don't just present one single value.

And then the last number was three percent. So these fish consumptions were ten percent of the studies, but only three percent of the value estimates reported. So these studies tend to report fewer value estimates than the other studies -- than other studies did, other types of studies.

MS. WILLIAMS: And so in looking at the pollutant concentration line, 51 percent of the value estimates were based on pollutant concentration?

DR. BOYLE: Fifty-one percent of the estimates were based on pollution concentrations,

yes.

MS. WILLIAMS: Okay. I think that helps me understand. That's all I have on the study.

MS. TIPSORD: Mr. Andes?

MR. ANDES: I'm going to skip a few questions I may come back to, but I think we've probably covered this --

DR. BOYLE: Can you just remind me where you are on the list?

MR. ANDES: I shall. We're on Question 24. Are you familiar with all of the studies surveyed by Van Houtven?

DR. BOYLE: I've read 15 of the studies before I did this benefit transfer, and then was able to subsequently review the other studies.

MR. ANDES: Okay. And your assessment of the quality of those various studies?

DR. BOYLE: They're all high-quality studies. They're done by well respected economists. They're published in peer review journals. Peer review is the highest scientific standard for grant proposals or scientific research, and they are dissertations, and dissertations receive substantial

scrutiny from the graduate committee. So these studies are meeting the highest quality standards.

MR. ANDES: Okay. I believe we've already answered 27. As to 28, I believe you talked about what reclamation district data were used in your confrontation, but let's go back to that. I want to be clear on which data were used.

DR. BOYLE: So we used data that we got from the Illinois EPA from the Metropolitan Water District sampling stations, and the data were from January 2004 through May 2007. They were sampling sites along the main stem of the Chicago River and below the confluence of the Cal Sag Canal. And the months of the year --

MR. ANDES: I'm sorry. Let me go back to that for a minute. From the main stem of the Chicago River, and from the ship canal below the confluence of the Cal Sag?

DR. BOYLE: Well, the confluence confluence of the Cal Sag. When we provide --

MR. ANDES: I just want to provide --

DR. BOYLE: Below the confluence and the Cal Sag the ship canal were excluded. I'm sorry. I misspoke.

MR. ANDES: Oh, oh, okay. So let's go back to -- what was in included?

DR. BOYLE: I can provide the -- when you get the spreadsheet, it has all the ones that we're doing. But they were mainly in the main stem of the Chicago River.

MR. ANDES: Okay. So they were mainly in the main stem of the Chicago River. You said the ship canal below the Cal Sag was --

DR. BOYLE: I can give you examples. The North Shore Channel at Touhy Avenue, the North Branch of the Chicago River at Wilson Avenue, the South Branch of the Chicago River at Madison Street. And so this, you know, goes down, and when you get that spreadsheet it will go through each sampling station where the data was taken from.

MS. WILLIAMS: Dr. Boyle, can you clarify to us how you're using the term main stem of the Chicago River? I think you may be using that terminology differently than we are in this proceeding.

DR. BOYLE: Yeah. I guess, perhaps, I misspoke, saying that the main stem -- it was, you know, the geographic sections of where it is here.

Those location descriptions are the ones that were in the data where they -- you know, it was provided for us. So it's, you know, the North Branch of the Chicago River or the South Branch of the Chicago River. I probably shouldn't have used the term main stem.

MS. WILLIAMS: Thank you.

MR. ANDES: So I heard the North Shore Channel at Touhy, the north branch of the river at Wilson, and the south branch --

DR. BOYLE: I can't go through all of these right now and give them to you, because they're color-coded in the spreadsheet, and this is black and white, and I can't -- without having that in front of me, I can't identify all of them from the different colors. But all of that information is in the electronic spreadsheet that we will provide to you and the Board.

MR. ANDES: And were you saying that there were -- is it your understanding that you covered all of the main segments of the CAWS, other than the ship canal below the Cal Sag Channel? Is that what you're saying?

DR. BOYLE: Not the Cal Sag Channel.

MR. ANDES: Not the Cal Sag Channel?

DR. BOYLE: Right.

MR. ANDES: Okay. How about the ship canal?

DR. BOYLE: The Cal Sag Ship Canal, that little section there? It would be easier if we have a map, per se, to see --

MR. ANDES: I didn't bring that.

DR. BOYLE: -- which section you're --

MS. WILLIAMS: You mean after last time you didn't bring your maps?

MR. ANDES: I thought you would bring yours.

MS. WILLIAMS: I'm not really sure if this map will help you, because it doesn't have all the --

DR. BOYLE: It looks like the same one here. Yeah, it's not the one that I saw that has all the sections marked on it.

MR. ANDES: We can determine it once we get the spreadsheet. I was just trying to understand what process was gone through to determine which data from which segments was considered.

DR. BOYLE: The segments that were considered were done in consultation with the information we got from Illinois EPA, and they were the monitoring stations that would be -- that would mesh the ambient flow below the treatment plants, and I -- you know, I -- when I go through here, I don't have all these different segments, you know, with the name changes. It's not memorized right now in my head. But you will be able to map each of those out when you get that information.

MR. ANDES: Okay. Okay. I was trying to understand why the Cal Sag would've been excluded since there's a treatment plant on that channel. But perhaps we'll have greater clarity when we see the spreadsheet. So that -- that may be a question we'll have more follow-up on after we've seen that.

Let me move on to Question 29. We've covered some of this, and I'll summarize the initial statement. We've talked about your use of numbers from Mr. Twait's testimony about reductions in fecal coliform levels in the treated discharge, and you've testified -- correct me if I'm wrong -- that you used those values in your analysis?

DR. BOYLE: Yes.

MR. ANDES: Okay. And we've talked about how you translated that into improvements in water quality in the ambient waters. I'm not going to ask that question again.

Question C, did you consider the volume of the discharges from the plants compared to the total flow in the system?

DR. BOYLE: And what do you mean by volume? Are you talking about water volume or fecal coliform?

MR. ANDES: Water volume.

DR. BOYLE: What we looked at was the current fecal coliform. That's what goes into the current water quality index and the predicted change. Volume of water does not go into that water quality index.

MR. ANDES: Okay. We talked about the fact -- we've talked about our sources of the fecal coliform loadings, so I'll skip over Question D and E. I think we've asked and answered that one before.

On F, did you consider whether disinfection would result in decreased levels of total pathogens in the CAWS, rather than only fecal

coliform?

DR. BOYLE: I think I've already answered that, that pathogens were not one of the variables in the water quality index.

MR. ANDES: And correct me if I'm wrong, you did not assess whether disinfection would result in a decrease in risk or decrease in pathogenic illnesses?

DR. BOYLE: We did not look at risk or pathogenic illnesses.

MR. ANDES: On -- and we'll go to Question 30. On Page 8 of your testimony, you indicated that IEPA's estimated reduction in fecal coliform density at the treatment plant would result in a 0.7 improvement in the index value from 6.1 to 6.8 out of ten. Is that correct?

DR. BOYLE: That's correct.

MR. ANDES: Okay. Is it your conclusion that a .7 increase in one of the nine measures of water quality is worth over a billion dollars?

DR. BOYLE: Yes, it is. And so that estimate is $37 per household. You get to that billion dollars through aggregating across

households in time.

MR. ANDES: Now, let me ask a question on that, and we can go back to the Croke study. the -- let's see. I had that right in front of me a minute ago. Here it is. Here it is.

In the Croke study, which is the only one of the 18 in Van Houtven that concerned Cook County, and if we go to table two, which I believe is on Page 19, it looks as if willingness to pay from -- and we're looking at users for a moment -- the willingness to pay for being able to do outings was $43. Outings and boating was another $.67 cents. Outings, boating, and fishing was another about $6.

Now, the -- if I'm right, the change in index from boating to boating and fishing is 2.6 points, from 2.5 to 5.1. So to a 2.6 increase in the Croke study, people are willing to pay an extra $6. So 2.6 points, $6 they were willing to pay. You've got .6 points, and people willing to pay $47. Can you explain the difference there?

DR. BOYLE: Well, there are several things. One, you have to consider is this was done

in the 1980s, so that that number needs to be brought up to current dollars, and so that would increase once you had adjusted for inflation.

But the other thing is that when you do a meta-analysis, you're bringing in the information from all of the studies. That's the reason that a meta-analysis is accurate. Some of them are going to have lower numbers, and some are going to have higher numbers, and the meta-analysis uses all that information to get the best estimate available.

MR. ANDES: But this is the one study that was done in Cook County with actual survey respondents. Wouldn't that make sense to you to be the most relevant?

DR. BOYLE: No. It is a relevant study, but it's not necessarily the most relevant. If I came in here and I just used the Croke study, you would've gone to the literature and found the literature that -- saying that doing a value transfer -- just taking one one study to another study is less reliable. You'd be asking me why I just used the Croke study.

MR. ANDES: Let's not speculate about

what I'd be asking. The question is for you.

DR. BOYLE: Okay. But what you want to do is you want that information that encompasses the information from all of the studies. And so you've got -- when you have variation of water quality across all of them, you get more information across the index, better gradation on the index, and you get a better estimate overall of what the change would be.

Any study that you have has error. It could be above or it could be below. And the meta-analysis smooths that error out to give you your average prediction, which has been shown to be the best type of benefit transfer.

MR. ANDES: But this study, the Croke study, which you acknowledge is of high quality, peer reviewed, high quality, just like the other studies, shows a radically different picture of asking Cook County residents what they would pay. A radically different picture than the picture you're painting through your meta-analysis.

So my question is: How do you explain that difference when this is asking the right population in questions about the value of

these various recreational activities, and their answer is radically different than yours?

DR. BOYLE: There can --

MR. ANDES: There's a much lower willingness to pay than you're concluding. I'm trying to understand the difference.

DR. BOYLE: And what I'm telling you is that each study has information to contribute. Each study has error associated with it. The Croke gives you one number. It isn't necessarily our best number. It is one number to you consider valid in your data. The process of doing it is to put together the information of all the studies with all the information that they have, and look at what that collective information provides is the best estimate.

MR. ANDES: And so you didn't weigh the one study as to this locality anymore than any other?

DR. BOYLE: No. There's no -- there hasn't been any practice of weighting a study like like that, more or less. There'd be no rule in terms of that weighting, other than some ad hoc rule of thumb. There's weighting that goes on in terms

of how many observations a study presents. You know, I guess there was a question earlier about how many value estimates were presented. You don't want one study to provide 100 value estimates and have another study provide two or three and have more weight than the analysis.

So Van Houtven looked at weighting in terms of number of observations. But there's no precedent for weighting individual studies more than another one, other than on the basis of observations that you can actually observe.

MR. ANDES: So you don't think this study is particularly relevant in engaging the willingness to pay of people in this area?

DR. BOYLE: I think it's relevant information, but I don't think it's the only piece of information.

MR. ANDES: And you're saying it's no more relevant than a study in Colorado, Iowa or Florida?

DR. BOYLE: Because there are different things that are done in different studies that help you understand the full range of how people value water quality. And, you know, the key

thing is mapping it back into that water quality index, and other studies are providing other information.

You know, if we talk about error, when you're talking about, you know, 300 observations, that's not a lot of observations for a study like this. You know, some of the other studies have more observations, so there would be more accuracy in their estimate.

MR. ANDES: Oh, accuracy in looking at that population, not necessarily as relevant as this one, correct?

MR. ARMSTRONG: Objection. You've already asked him about the relevancy of this study relative to other studies. Asked and answered.

MS. TIPSORD: I would agree.

MR. ANDES: Okay. Let's move on to Question 31. On Page 8, in your testimony you state you used the value reflecting average household income for Cook County of $62,488. Are you aware that in the Van Houtven paper it was stated that most studies report average or median annual income?

DR. BOYLE: I am. But the reason we use average income is if you go to Page 217 of the

Van Houtven article, Table 3, they define what they use for income in their equation. They have income -- it's average household income. And so we had to use the variable in the same metric as they use in the equation.

MR. ANDES: So just to clarify, so did -- if studies reported -- I'm trying to understand. If studies report a median household income, did Van Houtven not use the studies?

DR. BOYLE: I believe Van Houtven used an average for those areas. I don't have it right here in front of me. I think somewhere in the article, he does say that they used census data to apply the average if it was not available in the study.

MR. ANDES: Okay. So if a study -- so if a study reported a median, he went outside the study and used the averages instead?

DR. BOYLE: I believe that's correct. I don't have that right here in front of me, but I believe that's correct. You need to measure all the variables in the same units. You could not have a variable where some observations are medians and some are averages. There's no precedent in the

literature for using medians or means. You could use the average, mean, or you could use the median, as long as you used one consistently.

Usually the median is smaller than the mean, and what happens is if you use the median, the coefficient estimate that you'd get would be larger because of the reduction from the average to the mean. You'd both get, essentially, the same result whichever way you go. So there's no precedent that says you should use one or the other in an economic analysis.

MR. ANDES: Okay. Let's move on to Question 32. I believe we've answered parts A and B. What categories of use were defined in the Croke study in which use was predominant?

DR. BOYLE: I think we've already been there on this one, and I agreed with you that there was outings, boating, and fishing cited in the study, but they didn't present any data that -- other than their own assertion about what those were for the activities, the predominant one.

MR. ANDES: Okay. But what they said was that outings were predominant, correct?

DR. BOYLE: I think so. Can you show

me the exact quote that you're referring to?

MR. ANDES: I'm looking for that now. I don't have a page number. The fourth page under definition of water quality, the third paragraph. I think we have touched on this issue before, so I don't think we have to go back in terms of your statement on that.

Is it your understanding from reading the report that their focus, in terms of outings, was mainly on removing odors and debris?

DR. BOYLE: I'm sorry. I was looking at the wrong sheet there. I'm trying to find the specific words, but I believe that it was how changes and odors and debris would affect outings, outings and boating, and outings, boating, and fishing.

MR. ANDES: Okay. And you don't have any basis for believing disinfection if the three treatment plants would change odors or debris?

DR. BOYLE: I was not asked to make any evaluation on that. I was asked to look at changes of fecal coliform.

MR. ANDES: Okay. I'm going to skip a couple of questions I don't think we'll be coming

back to, and we'll go to 35. On Page 9, you indicate that you assigned this variable, and this was the year in which the study was published in 1973. "I assigned this variable a value of 27, which reflects the date of the most recent study from 2000 from the 18 studies used in the meta-analysis."

Is it correct that the date of the most recent study in the Van Houtven paper was 2003, not 2000?

DR. BOYLE: It's correct that the most recent study was published in 2003. But if you look at the definition of a variable, Page 217, Table 3, second to the last line, the study here in '73, it says year SP survey was fielded, minus 1973. And so that's not when the study was published, that was when the data collection was actually conducted. It takes a couple of years to collect your data, analyze it, write it up, and get it published. So there's a delay between when data is collected and the study is fielded.

If you go down to Table 4 at the bottom of the page, second line on the bottom, you'll see that the maximum value over on the

right-hand-side is 27. So if you take the 73 and you add 27 to it, 2000 is the year that the most recent study was fielded. So they use the year the study was fielded, not the publication date.

MR. ANDES: Okay. Because your testimony on Page 9 says the variable reflects the year in which the study that produced the economic benefit was published.

DR. BOYLE: If I did, that's a mistake on my part. That's a mistake on my part. It's the year the study was fielded, and that's what we used in our analysis.

DR. BOYLE: So you used that consistently?

DR. BOYLE: We did.

MR. ANDES: So for each study, you went back and checked -- I assume the publication takes a while with all of these studies?

DR. BOYLE: We didn't go back and look at all studies. We used the year of the most recent study in the prediction. We didn't predict a value for each study. We used an overall prediction. The methods have been improving over time, and so we took the most recent study because it would have the

most up to date methods involved in it. So that's another quality indicator. So we were looking at what year the most recent study had been conducted. So that would've been 2000.

MR. ANDES: Okay. Moving on to the next question, isn't a result of the Van Houtven meta-analysis that a one unit increase in water quality had an average benefit of $14?

DR. BOYLE: No. This is where you're looking at -- you're trying to treat this as a total evaluation equation versus a marginal. What this is is an equation that predicts the marginal. You're just looking at the contribution of that that has the change in water quality, but all those other variables in the equation affect what that margin or value is, and you have to turn on all of those variables to get it, and you're just focusing on the water quality one.

MR. ANDES: Well, on Page 221 of the Van Houtven paper, it says the results of the linear specifications -- this is in the last full paragraph. The results of the linear specification suggests that each unit increase on the WQI ten scale that includes a recreational use description

increases willingness to pay by an average of $14.

DR. BOYLE: That's correct. They are just talking about the derivative -- taking the mathematical derivative of one variable in the equation and what that contributes. So if I looked at it, that's one part of it. But you have to look at the affects of all variables in the equation.

So they're just talking about the interpretation of the coefficient on that, not what the effect would be on your left-hand-side or your dependant variable, but all of those variables are explaining. This is something that we -- you know, we go over in a basic economics class all the time, marginal versus total. This is a marginal value equation. You have that marginal value equation. This is the contribution in terms of just the water quality variable, but those other things affect what the value is, and you need to have assigned values to all of them.

MR. ANDES: But the main change we're talking about here is in water quality.

DR. BOYLE: But you have to do the math correctly. You have to use the equation correctly.

MR. ANDES: Right. And no reason to think they didn't use the equation correctly, right?

DR. BOYLE: But you're taking their statement out of context. They're taking that coefficient and giving the reader an understanding for what that one coefficient in the understanding means in terms of dollars. You need to have assigned variables to all the variables in their equation.

If you go back there to page, let's say, 219, where they report all of their equations, you can't just pull out one variable from one of those equations and say this is the total answer. Each of those variables -- when you estimate an equation, you have a dependant variable, which you're trying to explain, and then you have independent variables that explain the variation. Our dependant variable is the value that the public place on the marginal change of water quality.

When you do that, you're going to use all the variables that you have on the right-hand-side. You're picking on this because it happens to be a linear specification, and you can separate them out and look at the effects one at a

time, but that doesn't mean you ignore those other variables.

MR. ANDES: But one would expect this would be the most important variable is change in water quality, whereas they show a one unit increase, increase in willingness to pay about $14, you have a .6 increase, increasing willingness to pay by $47.

DR. BOYLE: That's because the $47 accounts for all of the other variables in their equation. If you go to, let's say, where they -- Section 8, where they're looking at the implications for a benefit transfer, and you go to the end of it where they're doing their validity assessment, they say our parsimonious -- this is Page 224, the top of the page. It's an incomplete paragraph, about halfway down. The line on the left starts out "To fishable increment."

It says, " our parsimonious linear meta-regression equation predicts average willingness to pay of $111 and $113." And so they're using their whole equation when they do it to predict out those numbers. That's that validity that they do to compare to the Carson and Mitchell

study.

So whenever you're writing an article, you go through and you do something to explain the affect of individual variables, but then you need to use the whole equation in what you're doing. So the $14 that they're talking about is with respect to the individual variable, but when they came back and they want to look at that marginal value for change, they use all the variables in the equation, and you can see that they came up with something that's quite a bit different.

MR. ARMSTRONG: Could you please explain what a marginal change means?

DR. BOYLE: A marginal change means how much people would pay for a change in water quality going from, you know, 6.1 on the scale to 6.8, versus the value if you just have it -- of how much would the water quality of 6.58 be. That's, kind of, a total value for that. The marginal is just the change, and then there are other factors that affect this equation.

MR. ANDES: Okay. And is that -- let me ask you, in looking at those numbers, quoting on 224, are those with respect to people's willingness

to pay -- is that based on Carson and Mitchell in terms of willingness to pay for improvement of water quality across the U.S.?

DR. BOYLE: Those are predictions for -- to compare to Mitchell and Carson across the U.S.

MR. ANDES: So asking someone what would you pay for improved water quality, generally, not as to what you would pay for improvement of water quality on a particular water body, correct?

DR. BOYLE: That is for all surface water bodies in the U.S. prediction.

MR. ANDES: Okay. So it's not -- it's not an estimate of if we took this particular water body and improved water quality, what would you be willing to pay for that. That's not what we're getting at in these numbers.

DR. BOYLE: No, because they're trying to compare to Carson and Mitchell.

MR. ANDES: Which is a national -- what would people be willing to pay for better water quality across the country?

DR. BOYLE: Yes.

MR. ANDES: Okay.

MR. ARMSTRONG: In the context of this article, why were they trying to compare the results to the Carson Mitchell transfer function?

DR. BOYLE: Because the Carson and Mitchell study is the study that's used most often by EPA. And whenever you do something and you want to do a validity analysis -- this is called convergent validity -- and if you can get two studies to predict out similar values, then you would assume that it's valid. So they picked what has been commonly used in policy to see how their meta-analysis did, and they found out it worked well.

When they talked about issues or implications for benefit transfer policy and analysis, they said a key issue is always whether the estimate equations can provide a reliable benefit transfer functions for predicting willingness to pay for specified water quality changes, and then over here they find that the linear meta-regression equation there estimates similar to Carson and Mitchell.

And I think back to what we talked about, those paragraphs you had before, that led to

their conclusion, that our meta-analysis results provide a reasonable basis of predicting how average water quality varies.

MS. TIPSORD: Let's go ahead and continue.

MR. ANDES: So the $111 dollars, for example, is if you ask someone if you want to improve water quality across the U.S. from fishable all the way to swimable, what would you pay, and they would say $111. Is that a good way to summarize it?

DR. BOYLE: That's what they're trying to predict, yes.

MR. ANDES: So the amount someone might be willing to pay to make an incremental change in fecal coliform for a particular water body, not all the way to swimable, might be -- would probably be somewhat less than that?

DR. BOYLE: Yeah. We came up with a number of 47, so it's less than that number.

MR. ANDES: Okay.

MS. TIPSORD: I think it's going to get -- start getting very difficult to hear. Let's take a lunch break and come back about five after

2:00. This all should be over by then.

(Whereupon, a break was taken, after which the following proceedings were had.)

MS. TIPSORD: Mr. Armstrong has handed me a couple more exhibits. Do you want to explain what these are?

MR. ARMSTRONG: Sure. These are in response to the Illinois EPA's pre-filed question No. 13 asking for some guidance documents that were listed in Dr. Boyle's pre-filed testimony, and those two documents are the O and B 2003 guidance on development of regulatory analysis, and USEPA's 2000 guidelines for preparing an economic analyses.

MS. TIPSORD: And circular A4, is that the O and B document you referred to?

MR. ARMSTRONG: Yes.

MS. TIPSORD: I have circular A4, September 17th, 2003, to the heads of executive agencies and establishments. If there's no objection, I'm going to mark that as Exhibit 293. Seeing none, it's 293.

And the document, which I have, Chapter 1 Introduction Background to the Guidelines

for Performing Economic Analyses, I will mark that as Exhibit Number 292 if there's no objection. Seeing none, it's Exhibit 292.

MR. ARMSTRONG: I believe the 2000 guidelines includes all chapters of the guidelines.

MS. TIPSORD: Okay.

MR. ARMSTRONG: There's multiple chapters in there.

MS. TIPSORD: Okay. The cover page, then, is the Chapter 1?

MR. ARMSTRONG: Yes.

MS. TIPSORD: Okay. Great. And then also while we're waiting for -- we can do this off the record.

(Whereupon, a discussion was had off the record.)

MS. TIPSORD: Mr. Andes, if you would like to continue.

MR. ANDES: Sure. Let's go to Question No. 39. Can you explain if we go to Page 58 of your testimony, the first line of the table, what that variable is about?

DR. BOYLE: So on Page 58 is a table, and what this table represents is the variables --

coefficients on the variables from the Van Houtven meta-analysis that you used in the benefit transfer, the value that we assigned to each of those variables to use that equation to compute the effect, and then the product of those two variables is the third column, and the sum of those is the number that's in the bottom of the right-hand column.

The first row is the change in the water quality index. The coefficient on that is 4.44. The assigned value for the change of fecal coliform that we talked about of the index is .7, and the product of those two is 3.11.

MR. ANDES: So that line represents the benefit of a .7 unit increase in the water quality index?

DR. BOYLE: No. That's just from that variable. The benefit is $57 at the bottom. This is a linear equation of the marginal value. Each one of those variables enters separately, and you have to take the effect of all of them to get the full margin of value.

MR. ANDES: And what does that specific function represent?

DR. BOYLE: That is the Van Houtven meta-analysis that they used to analyze the differences in the 18 studies that they based their study on.

MR. ANDES: Now, the first variable represents change in the water quality index, correct?

DR. BOYLE: Yes.

MR. ANDES: A .7 change in the water quality index?

DR. BOYLE: Yes.

MR. ANDES: So that aspect of your calculation, the marginal change in the water quality index for the water body results in a number of 3.11?

DR. BOYLE: Correct.

MR. ANDES: Or $3.11, right?

DR. BOYLE: Correct.

MR. ANDES: Okay. Now, the second line of the table, am I correct that shows the increase -- that shows the value based on the change in water quality index, assuming there's also a recreational benefit?

DR. BOYLE: Assuming that -- what this

is is studies that told respondents about recreation uses of the water, and 47.6 percent and 48 percent of those studies told respondents about the recreation use of the water. And so we use that value in the meta-analysis. That's conservative. If I was going to do an original study of the CAWS, I would have told people about the recreational uses, and that would've resulted in a higher value. But what we did is since we haven't done a study there, we took the average of the studies that composed the meta-analysis.

MR. ANDES: So that's based on whether you would tell the people that there was a recreational benefit?

DR. BOYLE: Not whether you tell them it's a recreational benefit, whether you told them about recreational use of the water.

MR. ANDES: So in 47.6 percent of the studies, people were told about recreational uses of the waters?

DR. BOYLE: Correct.

MR. ANDES: Okay. And then you add -- if you added together that dollar amount and the dollar amount for the change in water quality index,

you get a total of $8.06?

DR. BOYLE: For those two variables, yes.

MR. ANDES: And can you explain the third variable to me?

DR. BOYLE: The third variable is the affect of the current ambient water quality coefficient estimated there by Van Houtven as 1.93. The assigned value that was computed for the index is 6.1 -- and we discussed that this morning -- and the product of those two is 11.77.

MR. ANDES: So that's based on what people are willing to pay to retain the current water quality status?

DR. BOYLE: No. What that says is this -- remember, this is a margin. You're trying to switch it back to a total value. This is marginal, and it says that the marginal value depends on what the base is that you're starting. You've got to remember, this equation, the value that you're predicting, is the marginal value, and all of these variables are variables that affect that margin of value. And so what it's saying is that if the basis is 6.1, it's adding $11.77 to the

value of the marginal change.

MR. ANDES: So if the -- if the base water quality status is higher, this number will go up?

DR. BOYLE: That's what they found.

MR. ARMSTRONG: Dr. Boyle, does that mean that as water quality increases people would then apparently be more willing to pay for increases in water quality?

Let me rephrase that. If you have a very low quality stream or waterway, a specific increase in water quality would be valued less there than in a water body that was of a higher base quality?

DR. BOYLE: A marginal change would be valued higher. That's what their results said, yes.

MR. ANDES: Doesn't -- isn't that exactly the opposite of what Croke said as to Cook County, where they said that people were more willing to pay for -- to get water quality to a basic level but less willing to pay after that?

DR. BOYLE: Well, Croke had different marginal values. Croke did not have a baseline variable that they had. So you can't make a direct

one to one comparison there. They don't have a variable that -- you know, they give you the values that they estimated. They don't have an equation that tells you how those values might change if the baseline as different.

MR. ANDES: Well, but in Table 1 and Table 2 of the Croke study, they seem to indicate that people are willing to pay $33 to improve water quality for outings, but then to move it to the next step with boating, another $4 dollars, boating and fishing another $8, and I believe there's a conclusion at the end, indicating that, in fact, people are more willing -- and this really goes toward the last paragraph, I believe -- they talk about getting out of water quality, and that accounts for two-thirds of the total benefits. So people are willing to pay for the initial improvements to get it up to a minimum level, but after that less willing to pay?

DR. BOYLE: Can you just tell me where you're reading? You mentioned the tables, but I don't know where you are in the text.

MR. ANDES: I'm sorry. The tables are Table 1 and Table 2. Those are Pages 18 and 19.

Let's talk about those numbers. It says in the first paragraph on 18, the mean household value for a river system with outing quality water is $33, but $4 dollars for yearend recreational value is added by raising water quality to support boating.

The next increment in value achieved by permitting the rivers to support fishing is about $8. That would seem to say that the greater willingness to pay is when you're trying to get the water body up to levels that allow some minimal level of activity, and it's smaller, less willingness to pay after that, for the margins.

DR. BOYLE: Well, there's two things. One is we're talking about the baseline, and the baseline is not defined here. They are finding a value that the margin of value goes down as you go up. But you've got to take in the whole effect here, and you got to take in the first variable that we talked about, the water quality change, change of recreational use, and base.

What the Croke study is reporting here is a nonlinear function where it is declining. The Van Houtven equation is a linear equation, and when they did their validity analysis, they found

that they had a higher validity of using the linear equation to predict out changes than they do the nonlinear one. And so values just increase linearly in the Van Houtven equation that we used, and that's one of the reasons that you use a benefit transfer function when you do it like a meta-analysis, because it's different results from different studies, and you use that information collectively to find out what the best prediction is.

MR. ANDES: Have you assessed or are you aware of Van Houtven assessing why the results of the Croke study seem opposed to the results of other studies? Apparently if they are all put together by Van Houtven and other studies said something different, do we have any understanding of why, in Cook County, this was the way things came out in the survey, but other water bodies gave a different result?

DR. BOYLE: I do not know of any analysis that anyone has done to compare why the Croke study is different in terms of that relationship when you look at the results overall.

MR. ANDES: Okay. I believe that Question 43 is modified somewhat by the couple of

lines that were inadvertently deleted. Can we go back to that for a minute so we can understand what was deleted on Page 9? Because our questions related to that -- making sense of that statement.

DR. BOYLE: I can't explain exactly how this -- how this came about, but the statement did read, "I used a linear equation model where all variables are statistically significant to compute the household economic benefit." And there were -- originally there were, when we were putting together, there were several sentences there in the editing that's what ended up.

But what I was referring to is in the Van Houtven paper, they estimated -- this is Table 5, Page 219. They estimated six equations. They estimated a linear equation, a semilog equation, and a log linear equation. And for each of those three equations, they estimated what they call a full and a restricted, and the restricted excluded a set of variables that were insignificant.

And what I was trying to say is that I had excluded those variables that were insignificant in using the linear restriction. The reason I chose that equation is that was the

equation that Van Houtven and his colleagues showed was valid in their comparison with the Mitchell and Carson study results that we talked about this morning.

MS. TIPSORD: Excuse me. Dr. Lin, you have a follow-up.

DR. LIN: I have follow-up on Questions 59 and 41. Would variable coefficient --

DR. BOYLE: I can't hear.

DR. LIN: The variable coefficient on Page 58, are those values subjected by you, or did you look in other studies?

DR. BOYLE: The available coefficients were estimated by Van Houtven based on the 18 other studies.

DR. LIN: Oh, I see.

DR. BOYLE: Those are the ones that were taken from this table in Van Houtven I was just talking about, and I was explaining why we chose that equation that the coefficients are repeated here.

MR. LIN: Okay. On Page 57, Column 2, on Page 58, Column 3, are almost exactly the same except the second variable. One is .68 and one

is .76.

DR. BOYLE: Okay. The second variable, if we --

MR. ANDES: Well, in 58, isn't that just the product of the two factors? I believe 58 is --

DR. BOYLE: I'm just double checking before I answer. But yes, four, six, and seven should be --

MR. ANDES: .7 times .68 would be .76, I think.

DR. BOYLE: Yes, that's correct.

MR. ANDES: I think on Page 58 that second value is the product of the first two factors on Page 7 of 57. I think that's why they differ.

DR. LIN: On Page 57 it's .68. On Page 58 it's .76.

DR. BOYLE: Yeah. They are the product, because it's -- as you see on Page 58, in the left-hand column, you got WQI ten change, the first variable, times WQ recreation of use, and then that's multiplied. So you got .7 times .68 to give you the .76 and I should correct my testimony, because I said .67 was a percentage that mentioned

-- it's actually .68, and .476 is the product of it. So thank you for catching me on that.

MR. ANDES: So let's go back for a moment to -- now that we have a sense of those numbers, let's go back to Page 58 for a second and Question 42. If you were to use this equation benefit when there's no water quality improvement -- let's assume for a moment there's no water quality improvement. So the value in Column 2 for the first variable would be zero. The value for the second variable in Column 2 would be zero, so then the products in Column 3 would be zero. So you take away $8.06, you still have $48.94 left of a benefit, even though there's no change in water quality.

DR. BOYLE: That's math that you can do. But again, you're using the equation wrong. The equation was not estimated for any situation where there was no change in water quality, and that would not make sense. Somebody's not going to give you a margin of value if there's no change in water quality.

So you take out -- you take a value of zero that's outside the data for which the equation was an estimate, and it just doesn't apply.

This is only used for data where there is a change in water quality.

MR. ANDES: It can only be used in that situation?

DR. BOYLE: That's what the data was. It was not used with any data or if there was no change in water quality.

MR. ANDES: But I'm saying what if you did?

DR. BOYLE: It would be an inappropriate use of the equation. Whenever you do an analysis like this, you have to consider the data with which the equation is estimated. You can always do mathematical manipulations beyond it, but this equation was estimated just when there were changes in water quality in the value.

MR. ANDES: But that --

DR. BOYLE: To go to zero would be going outside in that range, and it is not a correct use of the equation.

MR. ANDES: Can you find where in Van Houtven it indicates that you cannot apply this to a situation were there's no water quality improvement?

DR. BOYLE: I can, but it's so common

understanding to myself and my peers, I don't think any of us would ever bother putting in that little tidbit. You know, you're writing for your peers. They understand what you've used.

MR. ANDES: Well, but the question is, say -- okay. Let's say there's a really, really small increase in water quality -- a timing increase in water quality. And yet, under this system, you're going to add $48 onto whatever increase in water quality there is. It can be, you know, an infinite decimal, .0001 and .0001, which would even be multiplied out, and then you have little values in the first two variables, and $48 to the rest of them.

So you're pretty much guaranteed that the benefits always going to be at least $48. How does that not -- let's say there's a very slight increment in water quality, it's still going to have al $48 benefit.

DR. BOYLE: But once again, you're confusing a total and a marginal, okay? And when you have a total value equation, what the total value would be, you would want -- you would take a derivative of that, the first derivative, to find

out what the effect would be. You'd get the -- you'd have to have water quality in there so that that comes out, but there can also be a constant with other variables, and the total value equation would be multiplied by water quality, the derivative of a single variable with the exponent or anything would be one, and you have a constant that falls out of there.

And that's what happens in this marginal value equation, is there's a constant for these other factors that affect water quality, and they are -- you're right. There is a specific amount that you add in, but it's because you've got a marginal value where you've taken a derivative of your total value function. And so you can play these little games with the equation, but it's an incorrect use of it.

MR. ANDES: Where -- so it's incorrect to add these up based on a smaller increment of water quality?

DR. BOYLE: No. That's what I'm saying. Adding them up is the correct thing to do. The incorrect thing to do is ignore the other relevant variables that are in the equation.

MR. ANDES: We're not asking you to.

DR. BOYLE: Sure you are. You're asking me to make them zero.

MR. ANDES: How do the other variables change if the water quality impact is lower?

DR. BOYLE: In the marginal equation, they stay the same. They don't change with it. In the total value equation, they would be multiplied times water quality, and so that interaction would cause it to go up and down. But the marginal one, there is this fixed amount, the constant in the derivative, that affects what the value is that people place on it.

MR. ANDES: So I'm asking about the marginal. In 57, if we're talking about willingness to pay $57 for disinfection for the marginal increase in water quality due to disinfection --

DR. BOYLE: Fifty-seven is the marginal value.

MR. ANDES: Right. And if the increment in water quality is lower, it sounds like that makes a small change in that $57. So even if you have a tiny change in water quality, you're still going to have, like, a $50 willingness to pay?

DR. BOYLE: Right, because changes in water quality are very important to people.

MR. ANDES: Even if they're tiny, tiny, tiny changes?

DR. BOYLE: Yes.

MR. ANDES: And it's pretty much the same willingness to pay, about $50, as a more significant increase in water quality that you assume from disinfection. It's, sort of, between about $50 and $57, and it really -- people are just as willing to pay for a tiny, tiny change in the water quality as they are in what they might view as a significant change in water quality?

DR. BOYLE: You're loading the question with lots of words here.

MR. ANDES: I'm a lawyer.

DR. BOYLE: If you go back to Van Houtven, and you look at their data -- I'm talking about Table 4 on Page 217 -- the second row is the water quality index change. The minimum value of that is one, and the maximum value of that is 8.9. And so, you know, those are the ranges that they looked at when they were doing it.

You know, if you -- if you tried

to take that value, you know, down to zero, keep letting it get lower and lower and lower, but not making it be zero, you're doing the same thing as making it zero, and that's not occurring to use of the equation.

MR. ANDES: So if we're making it really small, that's the same as zero?

DR. BOYLE: That's what I'm hearing you say. You keep saying very, very small. And so to me, in a mathematical sense, that's when you have -- when something is coming down -- you know, if this is zero and you keep bringing it down, this is the change, and you keep bringing it down closer and closer and closer, but it doesn't quite get to the table, you're making it pretty close. So you're just rephrasing it another way.

MR. ANDES: Well, let's talk in terms of half of the improvement in water quality that would be brought about allegedly by disinfection. It sounds like the value is still going to come out in the mid 50s, okay? You'll change it, maybe, $3 or so. So you're at about $54. So you're saying it's $54 to get half the benefit of disinfection, it's $57 to get all the benefit of disinfection?

DR. BOYLE: Because you have to control for all those other factors. If I went out -- we've got to control for the factors across the study, the differences in the population, the local things that you made me talk about earlier. You have to control for all of them.

And so when you control for all of them across studies, that's showing where -- those are explaining why values differ from study to study. If I went out and did an original study -- and let's say that that $57 is today's dollars, okay -- my best guess is that people are going to give me a value of $57, not the $3 dollars or the estimates on the individual equation coefficients.

MR. ANDES: But my question was then if you said -- all right. If you asked them a different question, which is, assuming for a moment, you said, "We're going to make the District disinfect its treatment plants, and the levels of fecal coliform are going to go way down," you're saying they would say, "Yeah, that's worth $57 to me," and then you came to them and said, "All right. I'm going to make them reduce it, but only half as much or one tenth as much. So there's still going

to be 75, 90 percent of that fecal coliform going out." They'd say, "Okay. That's worth $54 dollars to me."

Do you really think that's the way people would value the commodity, the improvement in water quality?

DR. BOYLE: I'm thinking that this is the best evidence we have in front of us. It's been shown to work. It's established procedure, and that's our best estimate, and I don't think that the values are going to change that much for -- you know, even if we take it in half, you know .7 is not a big change. So we're talking about a relatively small change to begin with, and take that in half. I don't think it's going to change that much.

You know, as we talked about this morning, I've done a lot of work valuing water quality. You know, my first work was done in Wisconsin and Illinois with issues like this. You know, people value environmental quality, and they have a strong basic value for it to wanting to see water cleaned up.

And then, you know, it moves around. But there's nothing, I think, that you need

to -- this is a really important point. There's nothing that says that the -- you know, if the doubling of water quality, that the value has to double. There's nothing in economic theory or the math or anything that says that. That's based on peoples preferences. And the preferences that I've seen is a strong preference for improved water quality, and that strong preference comes through. And then as we move through, oftentimes the change in value is less than proportionate to the physical change in water quality that we're seeing.

MR. ANDES: So what you're saying is -- correct me if I'm wrong -- that it doesn't make much difference how much improvement of water quality they're being told is going to happen. If you say there's going to be an improvement of water quality, pretty much they're willing to pay between $50 and $57?

DR. BOYLE: I haven't said that. I said that it -- that it's not going to be necessarily large, but, you know, it depends on what -- the changes that you're talking about, and, you know how big that change is.

MR. ANDES: But it sounds like you

just said it doesn't depend very much on how big the change is, because those factors account for, at most, $8 out of the $57. $49 are pretty much no matter what the water quality improvement is, they're going to be willing to pay $57.

DR. BOYLE: Well, the base matters too. So it's the base and the one that mattered. So if you look at all of them collectively, you know, this $3, $5 and about $12, I'm not buying into it's necessarily between $50 and $57. I'm saying it does not have to be proportionate, but I'm saying it doesn't have to necessarily fall between that $50 and $57 range.

MR. ANDES: But the base doesn't change in any scenario. That's the base number. So whatever --

DR. BOYLE: Well, the base could change, depending on the application. You were saying -- you were giving me a hypothetical of some study, and I was responding to the hypothetical.

MR. ANDES: Well, but the first two variables regard the change you're going to be making in water quality. The third one is here's the base we're starting from. The base we're

starting from is the same in any of these hypotheticals I'm giving you. That doesn't change.

DR. BOYLE: You didn't tell me that before.

MR. ANDES: Okay. Well, I'm --

DR. BOYLE: You've been talking about those three variables, so I was still --

MR. ANDES: Let's talk about the first one.

DR. BOYLE: -- incorrectly assuming that we're still talking about all three variables.

MR. ANDES: We were speaking about the first two. Excuse me a moment.

Okay. Let me follow up on that question for a moment. We were talking about the possibility of a zero value or a negative value. The Carson and Mitchell study -- and I don't know if you've introduced that. If not, I can do that.

MR. ARMSTRONG: No, we haven't introduced it yet.

MR. ANDES: And this report title is The Value of Clean Water: The Public's Willingness to Pay for Boatable, Fishable and Swimable Quality Water.

MS. TIPSORD: Did you say boatable?

MR. ANDES: Boatable.

MS. TIPSORD: If there's no objection, we will mark the aforementioned article from the Water Resources Research, Volume 29, July 1993, as Exhibit Number 294. Seeing no objection, it's Exhibit 294.

MS. WILLIAMS: Wait a minute. I'm not objecting. I might be off. The last -- so Chapter 1 Background --

MS. TIPSORD: Is 292.

MS. WILLIAMS: Okay.

MS. TIPSORD: Circular A4 is 293.

MS. WILLIAMS: Thanks. Sorry. Thank you.

MS. TIPSORD: Soon we'll be at 300 and it just won't matter anymore. Go ahead, Fred.

MR. ANDES: On Page 2447 of the Carson and Mitchell study, on the first column, the last paragraph, states, "When asked to value the boatable minimum level, they were asked how much they would be willing to pay, quote, to keep the nation's fresh water bodies from going below the boatable, minimum level where they are now," unquote.

Isn't that an attempt to assess the possibility of degradation of water quality below the current levels?

DR. BOYLE: It is.

MR. ANDES: Okay. So doesn't that indicate that the concept of looking at a negative change in water quality is possible in this approach?

DR. BOYLE: No. When I looked at the Van Houtven study initially to decide whether it was appropriate or not, the first thing I saw, which you're probably looking at, is Table 2, Page 212, that Carson and Mitchell had avoiding a reduction. Next one, the Croke study had an approvement, and so I was concerned about how they handled reductions and improvements, and so I called Van Houtven to ask him what he did with that in his analysis, because it wasn't reported here in his paper.

What they did is they tried an approach where they treated the reductions as an increase, and so it set the baseline at the new lower quality, and looked at that as an approvement, and statistically tested whether that had an affect on the results, and it didn't. So the equation that

Van Houtven reports here is where all of the changes in water quality are for improvements.

MR. ANDES: If it didn't make a difference -- it didn't make a difference if you included that particular scenario?

DR. BOYLE: It didn't make it a difference when he did that coding of the data.

MR. ANDES: So therefore --

DR. BOYLE: It doesn't make it appropriate to make it negative, because all of the numbers were estimated as positive changes.

MR. ANDES: Well, once you turn them around. But the underlying information used by Carson and Mitchell was useful. In the possibility of that scenario, which I might have rephrased, it was still a scenario under the current levels. You still used it, right? Or you just redefined what the current level was?

DR. BOYLE: He looked -- he created -- he coded the new level as the baseline, and looked and did it as a change and tested whether that significantly affected the results and did not find that there was an effect. So he could've had an equation that was plus or minus from zero, but the

equation he reports here is for only positive changes in water quality.

MR. ANDES: To make it more comparable. But he could've done plus or minus?

DR. BOYLE: It's possible he could've done that, yes.

MR. ANDES: Okay. On the next question, in producing your estimate, you assume that 100 percent of the hypothetical Cook County residents would be surveyed in person?

DR. BOYLE: I did not assume that 100 percent would be interviewed in person. I assumed that an in-person interview would be used to conduct the data collection. There's no blue ribbon panel that came after the Exxon Valdez oil spill about how these studies should be conducted, and that panel that had two Nobel laureates in economics and probably the most well-known survey researcher recommended personal interviews. Mr. Armstrong has that to introduce in evidence, and it's a federal registered publication.

And so what we did is we assumed that personal interviews were conducted of a sample, not that personal interviews were conducted with

every single person. If you go back to the Van Houtven definition of variables, Page 217, Table 3, in-person equals one if the study was administered in person. So that doesn't mean 100 percent of the population was sampled. That just means an in-person interview was used to collect the data from a sample of people.

MR. ANDES: I don't see the word sample of people. I guess my reading would be that means that you actually interviewed everyone in person. Where do you see the representative sample of people interviewed part?

DR. BOYLE: They don't say it there. But, you know, if I go back to these studies, we can find that they are all samples. I don't know any person with any common sense that would do an in-person interview of every single person. It's too expensive, and, you know, the survey research literature suggests that all you need is a sample to get a representative estimate.

We have -- hang on just a second. NOAH has standards and guidelines for statistical surveys that will -- Mr. Armstrong will give the panel. But nowhere once in there do they recommend

that you go out and you conduct a survey with every single person. The standard practice that is used is you take a representative sample.

And then the question is: How do you implement that survey? Do you use in-person, do you use telephone, do you use mail survey, do you use what are called internet surveys? And the belief is for a survey like this, you get the highest quality with an in-person survey so that they can explain what's being valued as a customized script that each of the interviewers follow, and that's why the panel recommended in-person surveys.

MS. TIPSORD: Okay. Before we go any farther, the NOAH panel is the National Oceanic and Atmospheric Administration. Is that correct?

DR. BOYLE: Yes. Sorry about that.

MS. TIPSORD: That's all right. And I have before me Proposed Rules to the Department of Commerce, National Oceanic and Atmospheric Administration, 15 CFR, Chapter IF, Natural Resource Damage Assessment Under the Oil Pollution Act of 1990, Friday, January 15th, 1993. If there's no objection -- this is a Westlaw copy -- I'll mark this as exhibit 295. Seeing none, it's exhibit 295.

Then I've also been handed Office of Management and Budget Standards and Guidelines for Statistical Surveys, September 2006. If there's no objection, we'll mark this as exhibit 296. Seeing none, it's exhibit 296.

DR. BOYLE: Could I finish my answer? I stopped so she could jump in.

MR. ANDES: Sure.

DR. BOYLE: Another variable in this table is the response rate. It's right above in person. If you note, if you're doing a sample and you had surveyed every single person in the population, your response rate would be 100 percent to all studies. And if you look down below at Table 4, the response rate goes from a minimum of 14 percent up to a maximum of 87 percent. So it's clear that these studies have not surveyed every single person in the population that were of interest to them.

MR. ANDES: And what are -- you're just assuming that a representative sample would be interviewed in person?

DR. BOYLE: We are assuming that a representative -- that a representative sample could

be drawn of Cook County households, and the survey would be done with in-person interviews.

MR. ANDES: Now, in the Van Houtven paper, the notes on Page 222 that the effect of in-person on willingness to pay is found to be positive in all cases, which is consistent with the hypothesis that in-person interviews encourage yea-saying by residents.

DR. BOYLE: That's their opinion, and I do not agree with it. There's limited evidence that they encourage yea-saying. As a matter of fact, yea-saying is technically defined as something that's different from in-person interviewing. The issue of yea-saying occurs whether you do in-person, telephone, mail, an internet survey, and that is -- yea-saying is where somebody is unresponsive to the stimulus that you provided. It's not something that's unique to in-person surveys.

I think the more appropriate interpretation of that, and the reason the NOAH panel recommended in-person, is that if people have a lot of uncertainty about what it is they're being asked to value, you would expect to have more values. If you can put graphics in front of them,

have somebody explain it so that they have a better idea of what it is, they have -- there's more confidence in the value, and your value would probably go up, and I think that's the reason that the NOAH panel recommended it.

But this is -- you know, in here, this is speculation by Van Houtven and colleagues that's not supported by the literature generally.

MR. ANDES: Well, they state as a fact that the effect of in-person on WTP is found to be positive in all cases. Do you disagree with them on that?

DR. BOYLE: I agree that the values go up. I'm not agreeing with the reason that -- for why they're saying that. I don't agree with the interpretation of yea-saying. I'm one of the people that's done the most research on yea-saying in the literature, and never once has yea-saying been linked to personal interviews in the effect of the interviews on the outcome.

MR. ANDES: So you think Van Houtven's wrong?

DR. BOYLE: Van Houtven isn't doing a test of yea-saying. A test of yea-saying in a

specific study is where the stimulus has varied and it didn't change. What Van Houtven is looking at is differences across studies, and finding those that did do personal interviews had higher value estimates.

MR. ANDES: In all cases. In all cases. And then you said that is consistent with the hypothesis, which he doesn't discredit here, that in-person interviews encourage yea-saying by respondents. I would read that as he says that it makes sense by intent to confirm that hypothesis.

DR. BOYLE: I don't --

MR. ANDES: You're saying you don't believe that hypothesis?

DR. BOYLE: It's not consistent with literature.

MR. ANDES: Now, is it consistent with the information in Van Houtven's report?

DR. BOYLE: It's not consistent with the information in Van Houtven's report. Yea-saying is when you're testing whether an individual in an experiment, one subject is unresponsive to the different changes that you're giving to him. What Van Houtven is looking at is does the change -- do

you get a different value with different methods. He's finding that you do get a different value with different implementation methods. That is not a test, even in a macro or global sense, of whether there would be a change for individual subjects when you did it.

MR. ANDES: Well, maybe we're looking at it from a laymen's standpoint. I read this as having someone in front of you asking if you if you're willing to pay for water quality makes you more likely to say, "Yes, I am," as opposed to if it's over the phone or on paper. Does that make sense to you?

DR. BOYLE: It is, but the reason -- I think the appropriate reason for it is not yea-saying. The appropriate reason is that in a personal interview, you can give people more information than you can in the other survey modes. You can control how you're giving that person information, you probe whether they have problems, and the interviewer has scripts that are designated that they can respond to them, and they respond to them, and the evidence is they get higher values. It's not because of yea-saying. It's because you've

done a better job of describing the change in water quality versus -- you know, suppose somebody is calling you up on the phone and you're doing a telephone interview, right? And, you know, what's going on in the background? You don't know. You've got to listen to what they're saying over the phone. You don't have any visual cues to look at, or what have you. It's a lot harder. There's much less information you can provide there.

So people have less certainty about what it is they're being asked to value. The personal interview approach is the best approach. That's why the NOAH panel, the leading survey researchers in the country, recommend that that be done.

MR. ANDES: But let me ask you: If they're recommending it be done because it gives more accurate answers, here what we're saying is it's not always -- it's not that it goes up sometimes and down sometimes, it's all cases. It increases the willingness to pay. So somehow -- are you saying that whenever people are educated by the issues, they'll always be more willing to pay for water quality? Why wouldn't it be simply more

accurate, not always in one direction, unless there's some kind of behavioral impact of having someone in front of you and being embarrassed to say you're not willing to pay for water quality?

DR. BOYLE: What did you eat for breakfast this morning?

MR. ANDES: I don't remember.

DR. BOYLE: You don't remember?

MR. ANDES: I'm not testifying, though.

DR. BOYLE: I'll do a hypothetical. Let's assume that you had -- you eat cereal for breakfast, and you go to the grocery store, and you go to the cereal aisle, and all the boxes are brown boxes. How much would you pay for a box of cereal? Probably not too much, right?

MR. ANDES: Right. If I'm hungry -- if I'm hungry, I'm going to pay for a box of cereal.

MR. ARMSTRONG: Well -- I'm sorry. Continue on with your example.

DR. BOYLE: The example is that when you go, you can see the box, you can see whether it's Cheerios or Raisin Bran, you know whether it's a small box or a large box. You have more

information. So if you go and there's very, very little information, you're not going to pay much for that box of cereal. But if you know more and you can formulate when you're going to get, then you will pay a higher value.

MR. ANDES: So you'll pay more if they make water quality seem more attractive to you?

DR. BOYLE: Not if they see --

MR. ANDES: I thought we were asking neutral questions here about --

DR. BOYLE: Not if they make it seem more attractive if it's a descriptive explanation so you can understand what is going on and what is the change in water quality. They're always neutral. You're not trying to guide it. You're putting the information out there so people can reveal their preferences, and you want to put the best description possible, and personal interviews allows you to do that.

Any CV study right now, pretty much, that is going in terms of litigation has to be the highest quality. It's either using personal interviews, or if they use one of the other approaches, they use some way to check it against

personal interviews to know if their results are valid.

MR. ANDES: Okay. So you don't think that -- despite what Van Houtven says about effective in-person on willingness to pay is positive in all cases, he believes that that confirms -- that that encourages increase and willingness to pay, you don't think that should be adjusted for at all or considered in looking at the impact, which that particular factor has a value of $46 in your calculation, correct?

MR. ARMSTRONG: I'm going to object. Dr. Boyle has explained where he got the variable from. He's explained the reasoning for it. We're running short on time here. I'm not really sure what you're trying to illicit here.

MS. TIPSORD: I have to agree. I'm confused. I think we're covering the same ground again.

MS. MOORE: Over and over.

MS. TIPSORD: So maybe if you would rephrase it a little bit. I mean, he's already told you he doesn't agree with Van Houtven's premise or the premise as you've stated it, and he's explained

where the variable came from. So if you want to try rephrasing it, but I have to agree. I think we're covering the same ground.

MR. ANDES: Okay. So you believe, then, it's appropriate to ascribe a $46 dollar value to that particular variable?

DR. BOYLE: I believe it is appropriate that if a high quality study was done of Cook County residents, that it would be done in person, what the meta-analysis equation says is that studies would add $46 to our estimate.

MR. ANDES: Let's go to the next question. In putting together your estimates on Page 58, you assumed that the -- the value used indicates a study of willingness to pay by Cook County residents that have published in a peer review journal?

DR. BOYLE: I do, and I've already explained that peer reviewed is the highest sub type of scientific evidence, and so we assume that it's peer review.

MR. ANDES: And that has a value of $58?

DR. BOYLE: Yes.

MR. ANDES: So if we go to Van Houtven on Page 216, he indicates that the -- this is in 4.4 -- indicates the publication selection process may result in estimation bias, if, for example, reviewers and editors were inclined to accept higher value estimates, or if analysts are less likely to submit lower estimates. Do you disagree with that?

DR. BOYLE: I disagree 100 percent with that. I've served as an editor of journals in our field, including the top journal. Never once did I make a publication decision on how big the value estimates were. Never once did I even think to look and say whether they're big or little. You're looking at the methods that they used and whether the methods are appropriate for what they're doing. Never once did I get a letter from peer reviewers saying, "You shouldn't accept this. The value is too high," or, "You shouldn't accept it because it's low."

I've published over 80 journal articles. Never once have I had a review come back saying that you're questioning it based on the magnitude of the estimates. Reviews are based on the theoretical basis and empirical basis, how well

the study was done, not whether the study was good or bad.

You know, in the Van Houtven study, the meta-analysis, the procedures of Van Houtven are great. They're the basic, accepted procedures for doing a meta-analysis. Unfortunately, he has a lot of idle speculation, and this is another example. But I couldn't disagree with this more.

MR. ANDES: So you would also disagree with his statement on 222, if published, it is interpreted as a filter that favors larger, significantly significant values, and his results suggests presence of publication bias?

DR. BOYLE: I would agree. I knew you were going there, so I answered that in my previous answer.

MR. ANDES: Okay. And this is pretty substantial. The value for this $58 is actually more than the net number of $57 that you calculated at the end, correct?

DR. BOYLE: Right, because there are things that bring it down.

MR. ANDES: So if the result was not

peer review, that would get a value of zero? Say if there was a study that was not a peer reviewed, would that get a value of zero here?

DR. BOYLE: That variable would be coded as zero. The value wouldn't be zero.

MR. ANDES: So if you had everything else here but you didn't have peer review, the result would be a willingness to pay of zero?

DR. BOYLE: If you left those other ones at that, but I wouldn't know how to use studies that were not peer reviewed as the basis for what I would make for a projection. But yes, you can do that, but it would not have been a good decision.

MR. ARMSTRONG: And why would you want to use peer-reviewed studies?

DR. BOYLE: Because it's the highest scientific standard for research. It's been reviewed independently by your peers in terms of the quality of the research.

MS. TIPSORD: Dr. Boyle, I know it's been a long day, but your voice is beginning to fade out again.

DR. BOYLE: Okay. I appreciate it when you let me know, and I'm sorry about that.

MS. TIPSORD: Okay. Just so you know, you're not the first, and you probably won't be the last.

MR. ANDES: I'm going to move on to Question 46, and this has several sub questions. Using the transfer function you draw from Van Houtven and your assigned variables for everything except magnitude and water quality change, I'd like to ask first what you calculate to be the annual household economic benefit if the water quality index for CAWS water quality were to be improved by 1.4 points, rather than 0.7 points on the ten point scale.

DR. BOYLE: And you all those answers for me on Question 47 in the table that was in the pre-filed questions. So your response -- I'm assuming you did the math, right -- is $65.50.

MR. ANDES: Okay. So we'll have an exhibit, and the exhibit is the table that is on Page 9 of our questions titled Estimated Benefit, Various Changes in CAWS Water Quality in Dollars Per Household Per Year.

MS. TIPSORD: If there's no objection, we will mark this as Exhibit 297. Seeing none, it's

Exhibit 297. It's also in the pre-filed questions under Question No. 47.

MR. ANDES: Let's focus on the first few lines. And I think you're assuming our math is right, and we hope it is. Under your scenario, the .7 increase in the water quality index, the value is $57.50. Double the improvement of water quality will go up $8, small positive improvement .0007 would go down $8. And you don't have any reason to doubt those numbers, correct?

DR. BOYLE: I don't.

MR. ANDES: Okay. So am I correct -- and if we are trotting old ground, tell me -- that this is a product of review that any improvement in water quality is perceived as having, I guess, in this scenario, the significant value of $49, only a little bit less than a significant increase in water quality?

DR. BOYLE: I think we're treading the same ground again, and I've stated that there's nothing in theory or appearance that says the change in value has to be proportionate to the change in water quality, the physical change. And so, you know, this is the same stuff we're going over again.

MR. ANDES: Okay. Let me move on to Question 50. You believe -- why do you -- first, if you believe that the benefit you calculate for the water quality improvement of .7 points would ensue from improving water quality on the CAWS only?

DR. BOYLE: That is my assumption.

MR. ANDES: Now, wouldn't it be true that the Chicago area residents would focus some of their willingness to pay for water quality improvements on water bodies other than the CAWS?

MR. ARMSTRONG: I'm going to object to that. We covered that this morning.

MS. TIPSORD: Forgive me. I don't quite remember.

MR. ANDES: I don't think so.

MS. TIPSORD: I think we talked about what impact there would be, but I don't think this specific question. So please answer it.

DR. BOYLE: Can I just have the court reporter read the question back?

(Whereupon, the record was read as requested.)

DR. BOYLE: So the water quality, if we did an original study, the values that they would

be giving would be based on the change of water quality and the waters that they were asked to value if they were asked to value the CAWS. I don't think there's any reason to think that they would include values for other waters.

MR. ANDES: Well, so if we had two different surveys scenarios, and one of them was how much would you pay to improve water quality in the CAWS, and the other one was how much would you improve to pay water quality in the CAWS, Lake Michigan, the Des Plaines River, and the Fox, do you think they'd give the same answer to both questions?

DR. BOYLE: No. They'd give different answers to both questions.

MR. ANDES: And how is that reflected in your estimates?

DR. BOYLE: I only report an estimate for the CAWS. I don't report an estimate for Lake Michigan and other waters.

MR. ANDES: But if the -- my initial question was don't they -- wouldn't they focus some of their willingness to pay improvements of other water bodies?

DR. BOYLE: And what question would

they be answering when you're asking them that?

MR. ANDES: Are you willing to pay to improve water quality?

DR. BOYLE: Well, you wouldn't ask a question that that's vague. You would ask a question that's more specific that would tell them what water bodies you're valuing, and what the baseline water quality is and what the change in the water quality is in those water bodies.

MS. TIPSORD: So -- if I may, so what you're saying is that if you did the survey you would ask about the CAWS and study the CAWS, and that's what you've done here is look at the CAWS?

DR. BOYLE: Yes.

MS. TIPSORD: But if you were to do one for Lake Michigan, you wouldn't necessarily ask about all the water bodies, you would then ask about Lake Michigan?

DR. BOYLE: Yes.

MS. TIPSORD: And not count for CAWS in the Lake Michigan?

DR. BOYLE: Right. You'd have the baseline for Lake Michigan, and the change that you are talking about with Lake Michigan that you'd be

trying to value.

MR. ANDES: In looking at their overall willingness to pay for improved water quality, I assume that most of that you would think would focus on water bodies that are most amendable to supporting recreational use, meaning those water bodies that are already attractive to recreation and other attributes, such as accessibility, proximity, ancillary facilities, such as beaches and boat ramps, and lack of competing commercial boat traffic. Would that be correct?

DR. BOYLE: I think I've already testified that most of the value is non-use value, and I would think that it would not necessarily depend on the recreation component of it. They'd be valuing for an improvement in water quality, and the recreation part of it would be for the people who recreate. And those who recreate, they may be more willing to pay for an improvement in the one with the lower water quality.

You know, for example, when I went for a ride on the CAWS yesterday, and people were talking about -- they were saying one of the nice things about the CAWS is on a windy day you can come

in there for a motor boat and a kayaker and it's not as great on the lake, you can come into the CAWS to give themselves more opportunities. They may be willing to pay for the water quality in the poor water quality one to increase their opportunities. But that's speculation. We haven't done that study. We don't know, but that's what my economic intuition would tell me.

MR. ANDES: Let's move to the next question.

MS. TIPSORD: Let's go ahead and take a ten minute break before you move to the next question.

(Whereupon, a break was taken, after which the following proceedings were had.)

MS. TIPSORD: Mr. Andes, if you would like to go ahead?

MR. ANDES: Excuse me just a moment.

We've reviewed the remainder of our questions, and we believe that they have all been asked and answered.

MS. MOORE: Oh, my gosh. It's a miracle.

MR. ANDES: You're welcome. So we're done.

MS. TIPSORD: Thank you very much, Mr. Andes.

MR. ANDES: You're welcome.

MS. TIPSORD: Ms. Williams, I understand you have a few questions? Oh, okay. Mr. Harley would like to follow up.

MR. HARLEY: Keith Harley, Southeast Environmental Task Force. Mr. Andes' questions dealt with the benefits side of the equation. I wanted to deal with the cost side of the equation for a moment. In coming up with the estimates of the cost that you would bear, the cost of disinfection, did you assume that Cook County residents would bear the entire cost of disinfection?

DR. BOYLE: We did not make any assumption about who would bear the cost. We made the assumption that Cook County residents would be direct beneficiaries of the improvement, but we didn't make any assumption about who would bear the cost.

MR. HARLEY: If the costs were borne

not solely by the Water Reclamation District but by state or federal sources of funds, would that, in any way, change the way that the benefits would be viewed by Cook County residents?

DR. BOYLE: I don't think so. I mean, the benefits are based on the change in water quality, not how the costs, per se, are distributed. So, you know, this is the value they place on that approvement. You know, on our side -- on the benefit side, what's missing is the people who live outside of Cook County in nearby communities who might value improvement not counted, or we've talked about tourists coming to Chicago that might have their visit enhanced by improved water quality. Those ones are not being counted so.

So if you're looking outside of the area, we're missing people that would -- from outside Cook County that would benefit from it that, from a policy perspective, might justify the cost being applied over a broader population. I don't think that changes our benefit estimate.

MR. HARLEY: Thank you.

MS. TIPSORD: Ms. Williams?

MS. WILLIAMS: Dr. Boyle, I think I'm

going to start with my final pre-filed question to clear up some of the housekeeping matters. Question 14 refers to the obligation that state law places on the Board if it was to rely on your findings in its final rule, it needs to provide any publications relied on or any underlying data that the public requests such.

So can you tell us if there's any other reports or data you relied on that need to be entered into the record today?

DR. BOYLE: Can I just go -- I got to take a minute and go through the reports that I have here.

MS. WILLIAMS: No, no, take your time.

DR. BOYLE: There is a dissertation by Edith Brashares that looked at the affect of fecal coliform on property values in Michigan, 1985, that I referenced in my report that has not been entered in to my knowledge. There's also a general oral by Legit and Boxtoll where they looked at the effect of fecal coliform of property values in the chess peak bay that I referenced in my report that has not been entered. I know that Mr. Armstrong has all these. And then there's also a study by Champ and Bishop

that we did an adjustment of the prediction for an overestimation bias that we based it on, and that has not been entered. I believe everything else has been entered.

MR. ARMSTRONG: And I do have those.

DR. BOYLE: Have these all been entered here?

MR. ARMSTRONG: Yes.

DR. BOYLE: So the ones you have on Question 13 have already been answered?

MS. WILLIAMS: Right. And I think you referenced all of the articles in Question 12, the only one that hasn't been answered yet about --

DR. BOYLE: Yes. And then it's also the electronic copy of the spreadsheet that we promised that we would send.

MS. TIPSORD: Okay. Estimates of the In-stream Value of Lake Water Quality in Southeast Michigan by Edith Brashares -- it's B-r-a-s-h-a-r-e-s -- from 1985 will be marked as Exhibit 298 if there's no objection. Seeing none, it's Exhibit 298.

Donation Payment Mechanisms and Contingent Evaluation and Empirical Study of

Hypothetical Bias by Patricia A. Champ, C-h-a-m-p, and Richard C. Bishop, and this is from Environmental and Resource Economics, 2001, will be marked as Exhibit 299 if there's no objection. Seeing none, it's Exhibit 299.

And is there a drum role, please? Evidence of the Affects of Water Quality on Residential Land Prices, Christopher G. Legit and Nancy E. Boxtoll, from the Journal of Environmental Economics and management, I believe this is a 1999 document, July 27th, will be marked as Exhibit 300, if there's no objection. Seeing none, it is Exhibit 300.

MR. ANDES: Have we set a record?

MS. TIPSORD: We're getting really close, if we haven't already passed it. It was actually published -- Exhibit 300 was published in 2000. Go ahead, Ms. Williams.

MS. WILLIAMS: I'm going to skip back to my Question 1. I think you touched a little bit on this already, but I'd like to ask it anyway. Has your approach for calculating economic benefits been used in other states to set water quality standards? If so, which states and what action did these states

take?

DR. BOYLE: Well, just like in this case, the economics have been used, but they haven't been the only piece of information. So I had -- in terms of the state of Maine, I've used hedonic models, and I've estimated water clarity for beautification for legislative rulemaking, and that resulted in the funding of the Lakes Protection Program in the state, which had been cut on a previous budget cut. So it was one piece of information that was used there.

In the state of New Jersey, right now we are doing original studies for the state of New Jersey on the value of groundwater quality to look at policies related to cleaning up contaminated water in New Jersey.

Another one that I'm involved in -- and this one is a court case in Oklahoma relating to contamination of the Illinois River and the Lake Tenkiler, where the state is taking action to stop the contamination of those bodies, and there was an original evaluation study that was done there, and a benefit transfer.

Those are three that I've been

involved in. I know other economists have been involved in other ones in other states, but I don't have those right at the -- you know, to give you specifics of those ones.

MS. WILLIAMS: Was the benefit transfer used in all three, or just the last one?

DR. BOYLE: The benefit transfer was used in Maine in that we extrapolated to other lakes from where the study was conducted, and it's also been used in the state of Maine in the lake program to decide which lakes are going to get priority for protection estimates. And so we've done benefit transfers to other lakes. Oklahoma had a benefit transfer. The work that we're doing in New Jersey is an original evaluation study.

MS. WILLIAMS: And in Maine and Oklahoma, did you also rely on a water quality index?

DR. BOYLE: I did not rely on a water quality index in those ones. In Maine, it was beautification, and the primary water quality indicator that the state uses is Secchi depth measures of clarity to have a state volunteer water quality monitoring program, and that's the key

policy variable, and so we use clarity measures.

In Oklahoma, we had specific information about water quality in that case, and so we were using that specific information there, and so we didn't use the index in that one.

MS. WILLIAMS: Can you explain what you mean by specific information?

MS. MOORE: I'm sorry. I couldn't hear.

MS. TIPSORD: We couldn't hear you.

MS. WILLIAMS: What does he mean by specific information on water quality?

DR. BOYLE: We have -- that is a large project where there are a number of physical and biological studies going on that are providing a massive amount of data about what water quality was like and was not like in the river, was like and was not like in the lake, water clarity are some of the measures, dissolved oxygen. And so we had specific information that we were using, and we did not use the water quality index.

The water quality index is a common usage, and I used it here for Van Houtven, but it's not used in all applications.

MS. WILLIAMS: You looked at a baseline of water quality and compared it to improvements that were to be expected, correct?

DR. BOYLE: Yes.

MS. WILLIAMS: Can you explain at all why you -- for a regulatory proceeding like this one, I think it would have seemed logical to me to look at the baseline regulatory standard and the improved standard. Can you explain why that wasn't the way you looked at it? Do you understand what I'm asking?

DR. BOYLE: Yeah. Well, the standard -- I don't have the specific wording here -- doesn't specifically map into the water quality index. It's not an element that goes in there, so you're looking at the variable that's changing as a sequence of the policy. And so --

MS. WILLIAMS: Right. And that's why I'm saying in this case, isn't what's changing as a result of the policy change, it's the current standard to the new standard.

DR. BOYLE: It is. And in any type of application, you've got the old standard and the new standard. But what you always are measuring is the

change in service that's going to come about from the standard. What we were lead to understand is the current service is a current level of fecal coliform and the change in service for a reduction. So in any one that you're not putting in what the specific policy is, but you're putting in what the changes and services are, and the change in service here is the change in fecal coliform to affect water quality. So that's what you'd be putting in this any economic value study, even if you were doing an original study.

MS. WILLIAMS: So can you explain what change of service -- how you're using that term?

DR. BOYLE: Here, the service I'm referring to is the change of fecal coliform, which would change water quality. It's the service you're providing to the public is improved water quality through the change in fecal coliform, and we were lead to understand that the changes in use designation are being brought about by changes in fecal coliform.

MS. TIPSORD: We're getting a lot more trains coming by, so both of you need to speak up a little bit more.

DR. BOYLE: Okay. Thank you.

MR. ARMSTRONG: Dr. Boyle, would it be accurate to say the policy says your analyzing would be the disinfection of effluent from the MWRDGC's treatment plants?

DR. BOYLE: We value a change in effluent. We didn't -- it doesn't necessarily have to be disinfection. Whatever policy was implemented to bring about that change.

MR. ARMSTRONG: Okay.

MS. WILLIAMS: Does your report address any environmental benefits of this rulemaking from improved aquatic life uses? This is Question 2.

DR. BOYLE: We don't measure specific values for improved aquatic life issues. We estimate a total value. You would expect that one of the reasons primarily on the non-use value would be that the improved aquatic life uses might be one of the reasons that people would give a non-use value.

MR. ANDES: Excuse me. Let me follow up. You're not making any connection with disinfection and improving the aquatic life uses,

are you?

DR. BOYLE: No.

MR. ANDES: Okay.

MS. WILLIAMS: Well, I want to understand how what you just said is reflected -- well, let me strike that. Let me rephrase it.

I believe you mentioned earlier in your testimony that dissolved oxygen improvements can be appreciated in value. Is that something you did in this analysis?

DR. BOYLE: We only looked at changes in fecal coliform. We did not look at any changes in dissolved oxygen.

MS. WILLIAMS: Why not?

DR. BOYLE: Because we were not provided with any information that DO was going to change. We were not provided with any information that dissolved oxygen levels were going to change. We were only provided with information about fecal coliform.

MR. ARMSTRONG: And Dr. Boyle, that was with respect to -- disinfection would not change dissolved oxygen? Or you just didn't look at dissolved oxygen at all. Is that correct?

DR. BOYLE: We were not asked to, no.

MS. DEXTER: Did you look at temperature impact at all?

DR. BOYLE: They're all in that index, and those did not change. It was only fecal coliform that changed.

MS. DEXTER: Thanks.

DR. BOYLE: If -- you know, the same with fecal coliform is different. If there are changes in dissolved oxygen, that equation can be used to recalculate a new number.

MS. WILLIAMS: Okay. And I guess I'm trying to understand why it wasn't in this case. Let's -- so for example -- and this is the last area, I think, that I wanted to get at from my pre-filed questions is part of question six, and to get exactly how the water quality index was calculated, what inputs were included. I believe you testified your colleague did that part of the work. Is that correct?

DR. BOYLE: Yes, he did.

MS. WILLIAMS: And is that information included in the table that you're providing?

DR. BOYLE: The spreadsheet. You can

go through and see every calculation that was made in those spreadsheets to get the 6.1 and 6.8.

MS. WILLIAMS: Are you able to explain for us where the 6.1 comes from?

DR. BOYLE: The 6.1 comes from taking the current value of those nine variables that go in that I listed off this morning, and put their levels into the equation. That equation has coefficients, just like the benefit transfer equation does, and it prints out an index, and that's where the 6.1 comes from. So it's the current data from the water quality --

MS. TIPSORD: I'm sorry, Dr. Boyle. We got a train going by.

DR. BOYLE: I stumbled too. I said the 6.1 is taken -- the current data from the MWRD water monitoring stations and plugging them into that equation, and that index value is 6.1.

MS. WILLIAMS: And do you understand, for example, for temperature what value is represented in that 6.1? I mean, is each parameter a one? I guess that's what I'm asking.

DR. BOYLE: No.

MS. WILLIAMS: So if fecal was

perfect -- it doesn't work that way?

DR. BOYLE: No. It's not just you add them up. They have to have a conversion index. This water quality index application to the Kansas River Basin by McCullen, it was an U.S. Environmental Protection Agency report. It was the, kind of, initial one that started all of this. You know, so this gives you the basis, and where the coefficients come from, and then all we did is apply those coefficients to the local data.

MS. WILLIAMS: So can you explain to us what the coefficient is that relates to fecal coliform so that we can go back?

DR. BOYLE: This will also be in the spreadsheets when you get it, but the weight for fecal coliform is .16.

MS. WILLIAMS: And what about for dissolved oxygen and temperature?

DR. BOYLE: Dissolved oxygen is .17, and temperature is .10.

MS. WILLIAMS: Did you say .10?

DR. BOYLE: Yes. And what -- all these weights are normalized so that they sum to one.

MS. WILLIAMS: Are you able to tell us what the maximum possible change in water quality index could be for fecal coliform parameter? So when you're -- you've told us that there's a .7 improvement going from 6.1 to 6.8, but you have only looked at one parameter in that index, correct?

DR. BOYLE: Yes.

MS. WILLIAMS: So what is the minimum -- I would, kind of, like to understand the range that that parameter could have on the index.

DR. BOYLE: Across all of them?

MS. WILLIAMS: Just for fecal coliform. If you were -- if the improvement that we were measuring was off the chart for fecal coliform, what would be the maximum improvement in the water quality index you would see? Is .7 as much improvement as you can get, or is there a way to get to .8 or .9?

DR. BOYLE: .7 is associated with a two orders of magnitude change. If -- you know, looking at Mr. Twait's testimony, he said it's possible that there could be a three orders of magnitude change. If it was three orders of magnitude, it would be greater than .7. But we'd have to go through and

work that out. I can't give you the number right now.

So if it's greater -- you know, if it's greater than two orders of magnitude, it would be greater than .7. If it's less than two orders of magnitude, it would be less than .7.

MS. WILLIAMS: I don't think I have any further questions. I mean, I think it would've been helpful a little bit to understand -- for us to understand for dissolved oxygen and temperature a little better what goes into this index if we wanted to make use of it for those improvements, but I'm not sure that without your colleague you can get into that in anymore detail today. So I think that's all I have.

MS. TIPSORD: Any other questions for Dr. Boyle?

DR. GIRARD: Dr. Boyle, I have a question. So essentially what you have here is a predicted model. You've predicted that residents of Cook County who are serviced by the District would be -- would see the economic benefit as $47 per household per year if the fecal coliform level is reduced in the waterway. Is that correct?

DR. BOYLE: Yes.

DR. GIRARD: And now in terms of, you know, either this study or some of the other studies that have been done in the past, has -- have there been any studies where they've looked at whether or not the predicted value, you know, would be set up as a hypothesis after the improvements are put into a system to see whether or not the model actually was good at predicting the economic benefits that people would feel were accrued?

DR. BOYLE: There have been studies that have been done like that. Well, let me just say there are a couple different types of studies that have been done. One is to have a predicted model, but then have an original one that you do at a site and ask how well it does predict. That research is what leads to the conclusion that an equation transfer like this is more accurate than just a single -- taking a single value from a study and transferring it.

In terms of looking at the primary evaluation studies, there have been ones that have been done to look at the validity of those. For example, in terms of referendums and how people vote

and whether it will be the same after the change is realized, and it's found that the prediction is very good there.

And then in terms of the Van Houtven study, they did do a prediction like that compared into the Mitchell and Carson to see how well they can predict, and found that the results were quite similar. I do not know of any specific ones where they've done a prediction and let a change happen, and then go in and do another one. But they have done ones where they did an original study of what the value was for and the prediction, and found that they could be quite accurate.

DR. GIRARD: Thank you.

MS. TIPSORD: Anything further? Dr. Boyle, thank you very much for your time. We appreciate your testimony today. Have a safe flight back.

DR. BOYLE: Thank you.

MS. TIPSORD: It is a quarter after 4:00, and I don't think we would be very productive to start with another witness today. We discussed off the record some additional hearing dates. So with that, we are adjourned today. Thank you all

very much.

STATE OF ILLINOIS)
) SS
COUNTY OF COOK)

REBECCA A. GRAZIANO, being first duly sworn on oath says that she is a court reporter doing business in the City of Chicago; that she reported in shorthand the proceedings given at the taking of said hearing and that the foregoing is a true and correct transcript of her shorthand notes so taken as aforesaid and contains all the proceedings given at said hearing.

Rebecca Graziano
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SUBSCRIBED AND SWORN TO
before me this 29th day
of May, A.D., 2009.

Notary Public

My

OFFICIAL SEAL
DIANA LEVERSO
Notary Public - State of Illinois
My Commission Expires Aug 17, 2009