ORIGINAL



BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:

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STATE OF ILLINOIS
Pollution Control Board

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| WATER QUALITY STANDARDS AND | ) | |
| EFFLUENT LIMITATIONS FOR | ) | |
| THE CHICAGO AREA WATERWAY | ) | |
| SYSTEM AND THE LOWER | ) | |
| DES PLAINES RIVER: | ) | No. R08-9 |
| PROPOSED AMENDMENTS TO | ) | |
| 35 Ill. Adm. Code Parts | ) | |
| 301, 302, 303 and 304 | ) | |

REPORT OF PROCEEDINGS had before the ILLINOIS POLLUTION CONTROL BOARD held on May 5, 2009, at 1:15 o'clock p.m. at the Thompson Center, Room-9-40, Chicago, Illinois.

A P P E A R A N C E S:

ILLINOIS POLLUTION CONTROL BOARD:
MS. MARIE TIPSORD, Hearing Officer
MR. THOMAS E. JOHNSON, Member
MR. ANAD RAO, Senior Environmental Scientist
LIN SHUNDAR
ALISA LIU
ILLINOIS ENVIRONMENTAL PROTECTION AGENCY:
Ms. Stefanie Diers
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Appeared on behalf of ELPC, Prairie Rivers Network and Sierra Club;

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BY: MR. FREDERIC P. ANDES

Appeared on behalf of the MWRDGC.

CHAIRMAN TIPSORD: Good afternoon. We will take a break for half an hour to close deliberating session. Mr. Andes, I believe, we were on question number eight.

MS. ALEXANDER: Before we start, I just wanted to mention we had an opportunity during the break to find some information concerning just some outbreaks that came up earlier. We can present it now or subsequently as people prefer.

CHAIRMAN TIPSORD: Why don't you go ahead now.

DR. YATES: There is a report by the Centers for Disease Control in the Morbidity & Weekly Report, May 26, 2000, Volume 49, number SS-34, and this is the entitled "Surveillance For Waterborne Disease Outbreaks-United States 1997 to 1998." And there was an outbreak in July of 1997 in Oregon in which individuals recreating in a lake did contract infection caused by schistosoma.

MS. ALEXANDER: I would add that currently we have this as a PDF on our

computer access via wireless. We can present it to the tribunal in whatever way is most convenient as a public comment subsequently.

CHAIRMAN TIPSORD: Yes, I would do that. Sounds good.

MR. ANDES: Do we have any other information since then, since 12 years ago indicating outbreaks of schistosoma in the U.S.?

DR. YATES: I have not had an opportunity to review all of the waterborne disease outbreaks in the United States just during the lunch break.

MR. ANDES: And since you've got involved in this matter, you have not seen any information indicating torrents of schistosoma in Illinois and the U.S., and particularly not the CAWS?

DR. YATES: I have not seen any outbreaks of schistosoma in the CAWS, no.

MR. ANDES: Do you have any information as to what extent this infection limit of 400 would address possible

Shistosoma present in the CAWS?

DR. YATES: No, I do not.

MR. ANDES: Okay. Before moving on to question eight, I want to follow-up on a couple of questions that we've talked about before.

One of them was, I think there's some confusion concerning the sampling method used in the risk assessment, and this is a Figure 2-3 from the Risk Assessment Document.

CHAIRMAN TIPSORD: Which, again, since this is a new transcript, that's Exhibit 71, The Risk Assessment.

We just need one. I'll mark this as an exhibit since it's all Risk Assessment.

MR. ANDES: You might want to look at it. Dr. Yates, you talked about the small sizes of the samples that were analyzed for purposes of risk assessment, and I copied this table because I want to go through with you the process and tell me is it consistent with your understanding. But

I believe as noted in the Risk Assessment Document, which this is a part of, that a 300 liter sample is taken and put through this filter that is shown on the chart, that the material that remains on the membrane in the filter is then -- the membrane is removed, the material on the membrane is alluded, a sample is produced from that. So in essence what we've done is concentrate the 300 liter sample down to a smaller sample. It's not just taking a little piece of the 300 liters. It's concentrating the 300 sample to a smaller size, and that's the sample that is actually taken off to be analyzed. Is that consistent with your understanding?

DR. YATES: Yes, sir.

MR. ANDES: So is there any reason to believe that that concentrated sample would be unrepresentative of the larger sample it was concentrated from? Let me ask it another way. Isn't that an EPA approved sampling method?

DR. YATES: This is the EPA sampling

method. The point I was making is that you have taken the large sample, couple hundred liters, depending on the varying sample -- you take a couple hundred liters, you concentrate it down to some amount, which I do not know, but then you take a small fraction of that concentrated sample, and in the case of Norovirus, it was equivalent to analyzing approximately a tenth of the percent of the original sample, and you only -- so the point is, you analyzed a very, very small fraction of the original sample in the form of a sub sample of the concentrated sample and you analyzed a small fraction of that and then extrapolate those results to the entire sample. My point was that small sample, that small fraction of the concentrated sample that you analyzed may or may not have been representative of the entire sample.

MR. ANDES: Well, let me ask you, so you are saying that there is a small fraction of the concentrated sample?

DR. YATES: Correct, correct.

MR. ANDES: And can you show me where in the Risk Assessment it causes that process and what fraction is it of the concentrated sample?

DR. YATES: If you look at the -- here I'm referring -- the point I was making with the small fraction, specifically where I have information as to the volume that was analyzed is the Norovirus analysis. So I believe this information would be in Appendix D, the report, I believe from Dr. Gerba's laboratory. I believe was Appendix D, which they indicated that ten milliliters of the concentrated sample was sent to their laboratory. I don't know what fraction of the entire concentrated sample that entire sample represents, but ten milliliters of the concentrated sample, which is the sample that has been taken to the membrane sample was sent to Dr. Gerba's laboratory, and if I remember correctly 8.3 of that ten mils of concentrate was analyzed in cell culture using the NPM method for adenoviruses, and then a fraction of the

remainder of that ten milliliters of concentrate was analyzed for Noroviruses, and as you -- and then as you have reported your results in The Risk Assessment for Noroviruses -- and here I'm referring specifically to Table 3.7, and this is in The Risk Assessment, so that's Exhibit 71 -- there is a column in that table entitled "Equivalent Volume Assay" -- so of the 200-ish, 300-ish, whatever, volume of sample that was collected and then concentrated, they analyzed an equivalent volume of somewhere around .2, .18, .23 liters.

MR. ANDES: But initially you said it was a small fraction of the concentrated sample, but then I think you said you weren't sure how much the total amount of the concentrated samples were. If it was a hundred milliliters and they took ten, that's ten percent of the sample?

DR. YATES: Ten milliliters of sample concentrate was sent to Dr. Gerba's laboratory, and 8.3, if I remember correctly, milliliters of that 10 was

analyzed for adenoviruses in cell culture. And then -- I wrote it down somewhere -- a small proportion of the remainder of that ten milliliters was then processed and a portion of that was analyzed for the Norovirus. And I have the exact numbers written down here if you want, but the point is that the -- of the total sample that was collected, and it's a very -- and if you assume that -- you said it -- if 300 liters were collected and they analyzed, say, .2 liters, that's equivalent to less than .1 percent of the total sample volume that was collected.

MR. ANDES: Before concentration?

DR. YATES: No, sir. No, sir. No, no, no.

MR. ANDES: You are talking as a percent of the 300?

DR. YATES: Correct, correct.

MR. ANDES: But the 300 is the sample before concentration.

DR. YATES: Correct. And they reported it as an equivalent volume assay,

which refers back to that original 300 liters of 2.4 liters.

MR. ANDES: Isn't one of the purposes of the filtration process to give you a homogenous sample that then you could take through the process and know that you can, as is done here and is done generally, split it off into pieces to conduct different analytical exercises and know that you are basically taking different portions of that homogenous sample which had all the stuff concentrated into it?

DR. YATES: Let's look at an example. Let's say I take this large sample and concentrate it. One of the reasons for concentrating it is for ease of analysis. It would be difficult, if I could only analyze a couple liters at a time and take 300 and have enough to analyze the whole thing. One of the purposes of the concentration method is to get the sample into a volume that is easily analyzed in the laboratory. So let's say that I ended up, after I concentrate that 300 liters, let's

say I ended up with 30 milliliters. Okay? Let's say just for the purposes of argument, let's say I ended up with 30 milliliters. Let's say that there were two Noroviruses in that 30 milliliters, and I send 10 milliliters of that 30 to the University of Arizona where that sample is analyzed. There is a probability that in that 10 ml sample that I took, there were no Noroviruses, even though the other 20 milliliters did have Norovirus. Okay? So there's one place that you can miss something that's present in a sample.

Let's assume that of those 30 milliliters where there were two Noroviruses, the 10 ml subsample that I sent to the University of Arizona did have a Norovirus in it, for the sake of argument. Okay? I took that 10 mls of concentrated sample, and let's assume it had a Norovirus in it, I then took 8.3 mls out of that 10 -- I need a chalkboard -- I'm a professor. I use a chalkboard. I talk with chalk in my hand. Let's envision this. I've got 10

mls. I have got one Noroviruses in that 10 mls. I take 8.3 milliliters out of it for adenoviruses on cell culture. There is a very high probability because 8.3 out of 10, there is a very high probability that that Norovirus ended up in the part of the sample that I analyzed for adenoviruses --

MR. ANDES: And we are talking about levels of one or two, aren't we, concentrating the samples? So we are talking about the chance of getting one or two. We are talking about the fact of significant amounts --

DR. YATES: I'm using this as an illustration, how you can by analyzing a portion of a sample, there is a probability that you can miss an organism that's there. And having one organism, one Norovirus, especially, is extraordinarily significant because as has been reported by Dr. Tounes and Christine Moe, and a number of others, in this article from the Journal of Medical Virology --

MR. ANDES: I'm sorry, what article?

DR. YATES: We can and will have to present it into evidence. Norovirus is especially significant because as they -- but as they report in this article, we estimate that the average probability of infection for a single one Norovirus particle is close to 0.56789. In other words, the probability of infection from exposure to one Norovirus particle is 50 percent, which is higher than that reported for any virus study to date. So finding even a single Norovirus particle has huge public health consequences. And the point is, the point is if I may finish, the point is, by analyzing a very, very tiny fraction of the sample that was collected, .2 liters out of 300 liters, you could miss large numbers of Norovirus particles, not just one.

MR. ANDES: How could you miss large numbers if you said if there were one or two you might miss them in a sample? The question is, if there are more large samples, why isn't it you are going to have

them in the other part of the sample and not in ours?

DR. YATES: As I mentioned, you analyzed .2 liters out of 300. That's a very, very small amount, a very small amount, less than a tenth of a percent. So even if there were hundreds of Noroviruses in that entire 3 liters, by taking out such a tiny, tiny amount, it was -- you could easily miss viruses in the samples.

MR. ANDES: Doesn't The Risk Assessment address those issues using probabilistic methods?

DR. YATES: I don't believe that, assuming that because the tiny fraction of sample that you analyzed contained zero Noroviruses, meaning that the entire sample was devoid of Noroviruses, I don't believe that was accounted for in the Risk Assessment. Not according to anything I could read. You assumed if the fraction you analyzed didn't contain any, the whole sample was negative.

MR. ANDES: If you do multiple

samples, you do the probabilistic sample, based on that, you are not taking one data point and making conclusions based on that. You are taking a range of data points over a period of time in wet and dry weather, and 125 samples, not one. You are saying that that still, because the sample is small relative to the 300 originally taken, 300 which is a large amount, that this renders this invalid.

DR. YATES: What I'm saying is that there is a very good chance that you have underestimated the public health risk of the presence of Noroviruses in the water. Eave if you took 100 samples or 125, which I don't believe is an extraordinarily high number when making a decision of this magnitude, but that's a different subject -- even if you took 125 samples, if you analyze such a small fraction of each of those samples and don't find anything in that tiny fraction, and then you just discount that entire sample as negative, that is going to buy us the results.

MR. ANDES: If one compares, let's take a look, at the moment, the 300 liters used to concentrate down for purposes of this sampling the kind of numbers we have talked about, in terms of ingestion are actually 30 milliliters for swimming, correct?

DR. YATES: I believe that's what you said, yes.

MR. ANDES: So the .02 milliliters is actually not a miniscule percentage amount one might ingest during swimming?

DR. YATES: I don't believe that the two are related. The point is you assume that that entire 300 liters contained nothing. You only analyzed .2 liters of it. I may have -- what if I ingested one of those 299.8 liters, what if I ingested 30 mills out of that 299.8 liters that you didn't analyze? Guess what? I could have gotten the Norovirus.

MR. ANDES: So do we have to analyze the 300 liters?

DR. YATES: You are making a

decision -- someone -- not you personally -- a decision is being made whether or not there is a public health risk associated with continuing the practice of putting nondisinfected effluent into a water body where you know that recreation occurs. It certainly seems to me that the way that you would want to approach this would be to do a very, very thorough job of assessing the potential health risks. You know that these organisms are present in waste water. We know that these organisms cause disease. There's plenty of evidence. We've known for years and years and years that these cause disease. We know they are present in waste water. We know we can reduce concentrations by disinfecting the waste water. It's as simple as that.

MR. ANDES: Let me ask a couple questions. Is the method that was followed consistent with the EPA methods?

DR. YATES: Which methods, I'm sorry?

MR. ANDES: The way that the

sampling was done, is that consistent with the EPA protocols?

DR. YATES: You've asked two different questions. The way in which the sample was collected and the way in which the sample was concentrated, collected and then desorbed from the membranes and then concentrated. According to the Risk Assessment, the U.S. EPA protocols were followed, yes, sir.

CHAIRMAN TIPSORD: Excuse me.

DR. YATES: Now, the part about the analysis of the sample is a whole different question. There's not, to my knowledge, any EPA protocol that says how, what fraction of that sample do you need to analyze, and as we've already discussed, there's no EPA standard method for analyzing samples for some of the pathogens that were done for this study.

CHAIRMAN TIPSORD: Before we go any further, we haven't entered this article in as an exhibit. It's "Norovirus-How Infectious Is It?" Journal of Medical

Virology from 2008. If there's no objection, we will mark this as Exhibit 255. Seeing none, it's Exhibit 255.

MR. ANDES: The report, the study that you've provided on Noroviruses, you indicated indicates that even one Norovirus creates a 50 percent risk of infection. Have you looked at the presence of Noroviruses in the wet weather sources, including combined sewer overflows, in the CAWS?

DR. YATES: As I said, my focus was on the dry weather because that was when the effluent from the waste water treatment plant was known to be the major source of pathogens in the CAWS.

MR. ANDES: So if it rains every few days and if the effects can last four days or even weeks, would you agree that it would be relevant to assessing the risk and the total risk since people don't swim or people don't canoe or kayak when there hasn't been rain in a few days, would you agree that one might also assess and put in context the

levels of Norovirus in combined with sewer overflows which are untreated sewage as compared to the secondary treatment treated effluent from the treatment plants?

MS. ALEXANDER: Can we clarify that? Is there any evidence in the record to support any substantial numbers of pathogens or indicators lingering a week or two weeks after wet weather? I think the benchmark is about two days. If you want to ask it as a hypothetical --

MR. ANDES: I wouldn't agree with your characterization.

MS. ALEXANDER: I wouldn't agree with your characterization. If you want to ask this as a hypothetical, you can go ahead and do that.

DR. YATES: The point is, you know, based on your own sampling that you are putting human disease causing pathogens into the water. You know that you can reduce the concentrations of those disease causing pathogens through disinfection. You can reduce, therefore, the risk to public health

by implementing that disinfection treatment. So it seems to me that it would be your responsibility to do it. You know you can have an impact.

MR. ANDES: If the conclusion of the Risk Assessment were that in fact, A, the risk is low even with the combined sewers and secondary, that it would not be infected by disinfection, would you still agree with that?

DR. YATES: If you can have an impact, a positive impact by reducing the risk to public health through treatment, then I believe personally that is the responsible thing to do.

MR. ANDES: No matter how small the risk reduction is?

DR. YATES: If I were in the business of public health, I believe it's my job to protect public health to the extent that I can. It's that simple.

MR. ANDES: And if you were dealing with a water body, whereas this one, where combined sewers will continue, over 200

combined sewers will continue discharging and are not effected by this rulemaking, and therefore Noroviruses, to the extent they are present, will be there, and other pathogens, even with disinfection would be in there, would this water body be safe to recreate in?

DR. YATES: I do not believe I have said that. I have said, if I have control over something such as disinfecting the effluent that will result in a decreased risk to public health, I believe that that step should be taken.

MR. ANDES: And if one were to disinfect and, again, hypothetically, but based on the results of this Risk Assessment, one could conclude that the risk reduction would be small, would you be concerned that that would give a false sense of security to recreators that now they can go and recreate in a clean, safe water body, even though the combined sewers are still discharging?

DR. YATES: Again, I couldn't

speculate on what people would be thinking necessarily. I don't know anybody who is recreating there. But, again, I get in a car, I don't put a seat belt on and believe that I can drive recklessly because I know the seat belt will protect me.

MR. ANDES: That's a different question. Would you be promoting people going into the water which still has significant levels, by your terms, of pathogens in it in terms of combined sewers and other sources because they think it's safe, would that be consistent with protection of public health?

DR. YATES: I believe you are mischaracterizing my point. My point is if I have control of a source of public health risk, and there's something that I can do to reduce that public health risk by disinfecting that source, I believe it's the responsible thing to do.

MR. ANDES: No matter how small the risk reduction is? No matter what the economic cost to the community is?

DR. YATES: My job here has nothing to do with determining costs. It's policy and decision. It's someone else's decisions what level of risk they are willing to accept and what cost they are willing to pay to achieve that level of risk.

MS. ALEXANDER: I have a couple follow-ups.

Do you believe that the Risk Assessment is in fact wrong about the flow in the CAWS?

DR. YATES: As I believe I pointed out fairly, specifically in my testimony, I think there are a number of flaws with the Risk Assessment, some of which we've already talked about, and therefore, the conclusions that are drawn with respect to the risk, the risks that are present in "The Risk Assessment," I would just say that there are a lot of assumptions that went into that and there are a lot of problems as we've talked about with analyzing small fractions of samples, with several of the other things that I brought up in my testimony, and so my

confidence in some of the numbers that are presented is certainly not where I would want it to be if I were in the position of having to make a decision about whether or not I was going to require disinfection of this effluent prior to discharge into the CAWS.

MS. ALEXANDER: And one more follow-up. Do you believe that the levels of indicators illustrated on Figure 2 in your testimony do indicate a likelihood of risk to recreators in the CAWS?

DR. YATES: Again, as we've talked about before, it's been shown time and time again, and as we've already talked about earlier this morning, in general, higher levels of indicators are associated with higher levels of pathogens, and some of the levels of indicators that are present in the CAWS are greater than 10,000 higher levels of indicators, higher levels of pathogens. So definitely if you have higher levels of indicators and higher levels of pathogens, you have higher levels of risk.

MR. ANDES: Let me move to another follow-up question. I'm going to direct your attention to Table 3 of in the report. One of the issues, Dr. Yates, you raised earlier was about, adenoviruses, and whether the report was somehow ignoring certain results. Now, as I understand it, in this table, the total numbers, the samples for viruses were then put through a PCR in essence of DNA test, and if positive, which would indicate the presence of adenovirus, the conservative assumption was made that it was called adenovirus even though it that might not necessarily be true; is that correct? So, for example, 7.52 for Calumet outflow was assumed to be all adenoviruses and treated as that 7.52, even though it's entirely possible that not all of that sample was adenovirus?

DR. YATES: That's my understanding of how this was handled.

MR. ANDES: But not all of it would be viable, but it was assumed it was all adenovirus, and factored into The Risk

Assessment as viable?

DR. YATES: My understanding is that the concentration, the MPN/100L was derived from the cell culture assays, which means that those were indeed ineffective viruses.

MR. ANDES: But not necessarily adenovirus, right?

DR. YATES: That's correct. They were infected viruses.

MR. ANDES: And then if the results were negative, it was figured already there's not adenovirus in here, and then that sample would be -- but those concentrations were addressed in the results for enteric viruses. If they weren't adeno, they were likely enteric. They were accounted for there, and then it was just that the sample viruses for enteric viruses were dealt with in another parameter, correct?

DR. YATES: I do not find anything in this document that indicated that a cell culture positive PCR negative sample was then included as an enteral virus positive

sample.

MR. ANDES: But there were measurements of culturable enteric viruses, correct, using an EPA method?

DR. YATES: Yes, a portion of the sample -- my understanding is that a portion of the sample was sent to a laboratory, and that portion of the sample, some fraction of it, I don't know what, was analyzed for enterovirus, yes.

MR. ANDES: So the enteroviruses are not ignored?

DR. YATES: Let me try to explain this.

MR. ANDES: Simply tested with another fraction of the sample?

DR. YATES: One fraction of the sample was tested for enteroviruses, and those reports are shown in, I believe, in Table 3.5. Okay? Another fraction of the sample was sent to the University of Arizona and analyzed for adenoviruses. If there were cell culture positive results, the conclusion was that there were infected

viruses there, either enteroviruses or adenoviruses. There was a follow-up determination done using a PCR process, that if positive, would indicate that the sample contained adenoviruses.

MR. ANDES: And the purpose of testing that sample was for adenoviruses, correct? For that fraction that was the whole point?

DR. YATES: The fraction of the sample that was analyzed at the University of Arizona for adenoviruses, that methodology that was used in cell culture, detected as it states, enteroviruses and adenoviruses, right. The purpose of the analysis according to your table anyway says adenoviruses. The purpose of analysis is to determine whether there were adenoviruses there. But regardless, that cell culture test detected adeno. So if it came up positive in that analysis, one would conclude it contained enterovirus and/or adenovirus. You further then analyze that sample using PCR, and if it was positive,

you said, okay, we've got adenoviruses in this sample. If it was negative, then one would conclude that the cell culture results resulted from infection by enteroviruses.

MR. ANDES: Right.

DR. YATES: Okay. My point is, that those samples that were analyzed for adenoviruses in Dr. Gerba's lab and yet were shown by his own technique to contain enteroviruses were not considered to be enterovirus positive for the Risk Assessment.

MR. ANDES: Because there was another test on other fractions, which was testing for enteroviruses, right?

DR. YATES: But if that sample that was separate, the sample collected on that date that you've already described, went through this concentration to some small volume, okay, when that sample was split, a fraction of it was sent to -- I'm not sure where the laboratory was -- HML -- is that -- I don't know where that lab is -- that fraction was analyzed for enterovirus. If

that fraction from that date was found to be negative, was found to be negative by that laboratory but Dr. Gerba's analysis of a different portion of that same sample was shown to be positive for enteroviruses, did you not include that's a positive enterovirus result? And did you compare the two sets of data?

DR. YATES: I did, sir, yes. And there were numerous occasions, and I had them highlighted in blue. There were numerous occasions on which Dr. Gerba's analysis showed there were enteroviruses, infected enteroviruses in a sample when the other fraction of the sample that was analyzed by the other laboratory was shown to be negative. And this, again, illustrates -- this again illustrates the issues I was talking about earlier with the Norovirus. That when we take a sample and we analyze it, by splitting it up into smaller fractions and analyzing only a portion of that sample, you can miss things.

MR. ANDES: But you also don't know

one was -- you don't know which one was right, right?

DR. YATES: So now you are telling me that the analyses that Dr. Gerba did in his laboratory using this SOP that you have said was a marvelous method, using this method that Dr. Gerba has in his laboratory, which are with all the QAC's and giving all the positive cell culture results, which he has already says means it's adenoviruses or enteroviruses, you are now telling me it's wrong, that there were not viruses?

MR. ANDES: The question is the SOP, was it designed to detect and to adequately capture enteric risk, because if it wasn't and the other one was specifically designed for that and one was focused on adeno and the other was not, the question is are you dealing with apples and oranges? Can you say that because one was specifically designed to capture enteric risks, you are saying one was illegitimate because of the one design by Dr. Gerba, which wasn't designed to look for that?

DR. YATES: By Dr. Gerba's own testimony, and is published in his paper in "Applied Environmental Microbiology" in 2008, this test, using this cell line that he has in his laboratory, detects both types of viruses, adenoviruses and enteroviruses.

MR. ANDES: Are the culture results the same in the two tests?

DR. YATES: Which virus?

MR. ANDES: The two?

DR. YATES: One, the specifics of each media. The point is that Dr. Gerba has testified that they are detected using this assay. The point is that you took a sample, you split it up into different fractions and analyzed it using two different methods, both of which you have said will detect entero viruses. If one said the viruses were there and the other said they weren't, if both of them will detect entero viruses, then that sample should be counted as positive for enteroviruses.

MR. ANDES: I believe the records will show that the focus of Dr. Gerba's

testimony is using that specific test with its media and that methodology to look at adenovirus. And if you were doing a test to design, to look at enteroviruses, that's why -- if they thought -- let me ask you this question. If they thought that this test was going to be fine for detecting both, why would one send off another fraction to have a different test done unless you were specifically focused on getting on a more accurate type of pathogen.

DR. YATES: Probably because there is a standard accepted EPA procedure approved method for the detection of enteroviruses.

MR. ANDES: That they used?

DR. YATES: That was used by the other laboratory and not used by Dr. Gerba.

DR. YATES: Didn't Gerba testify, and you asked me questions, that they are detected, and yes, indeed they both are. Furthermore, if you were being very careful about the entire analysis, the prudent thing to have done would have been to take those

samples, which were PCR negative for adenoviruses, but cell culture positive, and analyze them for PCR by PCR for the enterovirus.

MR. ANDES: Unless one wanted to follow the EPA method for enterovirus and send them to a different lab to do that.

MR. ANDES: In fact that was done as you've testified, correct? You are saying they should have tested them twice?

DR. YATES: You are the one that said that the cell culture process used by Dr. Gerba, and Dr. Gerba has testified to this himself, the cell culture method that was used by Dr. Gerba detects enteroviruses and adenovirus. You are now choosing to ignore the entero virus results if they did not agree with the results from the other laboratory. And the point is they were not analyzing the exact same water. They were analyzing portions of samples.

MR. ANDES: But it's fairly traditional to use split samples, and I will contest whether Dr. Gerba's testimony was

specifically concerning adenoviruses and the use of methodology for detecting that for the whole purpose. Don't make it sound that the he was trying to say that the methodology would detect both.

MS. ALEXANDER: Is this a question?

CHAIRMAN TIPSORD: Listen, Dr. Gerba's testimony is on the record and can stand on what he had to say. I think we need to move on. I think you've made your point. I think that Dr. Yates has made her point. And we could go on for hours arguing over this point. Let's move on.

Excuse me. Dr. Lin has a follow-up.

MEMBER LIN: Dr. Yates, do you have any information to provide us of the pathogen, for example the Cryptosporidium, Giardia, die off or regrowth in the stream?

DR. YATES: The Giardia, the Cryptosporidium and the viruses are not capable of growing out in the stream. These organisms must be inside of a living particle cell. In the case of enteric

viruses, the Noroviruses and the others, they can only grow and reproduce inside of a human cell or in special laboratory cells or in certain kinds of primates. So they are incapable of reproduction or growth out in the water. It's physically impossible for them to do so.

MEMBER LIN: Yes, I know. How about to die-off?

DR. YATES: The rate of die-off of different microorganisms such as viruses and parasites is dependent upon a number of factors, including temperature, sunlight, humidity, the amount of organic material that's present in the water, the presence of natural native bacteria in the water, and it varies from organism to organism, and it varies by those different environmental conditions that I mentioned. So I can't just give you one number. It's very variable.

MR. ANDES: There are some pathogens that do have regrowth and repair in the water body, am I right?

DR. YATES: There are some microorganisms that are able to grow in the water, sure.

MR. ANDES: And if you reviewed Dr. Blanchy's (phonetic) testimony, he provides some reports that specifically discuss situations where there was disinfection and then repair and regrowth in terms of levels coming back up, am I correct?

DR. YATES: That's correct. However, I would note that the concentrations of the organisms after disinfection, even with regrowth, were much lower than the concentrations before disinfection.

MR. ANDES: We can go back to Dr. Blanchy's testimony in terms of how that is characterized. I'll move on.

In terms of question eight --

DR. YATES: Just one minute. I'm going to have to find it here.

MR. ANDES: I'll rephrase a little bit because we've touched on some of these

issues. Correct me if I'm wrong, you don't have any quantitative sense as to the extent to which meeting this new technology based limitation of 400 per hundred milliliter, the extent to which that would reduce overall pathogen levels in a water body?

DR. YATES: Again, the type of disinfectant that's used is going to have an impact on -- different impacts on different kinds of microorganisms. So it would be very difficult to make an overall sweeping generalization as to how effectively every single pathogen would be reduced by one type of disinfectant. However, as we know, disinfection reduces pathogens, and it reduces indicators, it also reduces pathogens. So that's why, because we have this -- what's the word? Because there are so many different kinds of pathogens and you can test for all of them and you can't look for the effects of disinfection on all of them, that's why we use indicators to give us some indications of levels of pathogens in the water.

MR. ANDES: And you are aware of data showing there are pathogens upstream of the treatment plants, correct?

DR. YATES: I have seen the results of the sampling that was done for this study, yes.

MR. ANDES: And disinfection of the effluent obviously won't do anything to address those sources, am I right?

DR. YATES: Disinfection of the --

MR. ANDES: Treatment plant.

DR. YATES: Of the treatment plant effluent is going to have a -- the majority of that impact is obviously going to be on the organisms in the effluent. If there were residual disinfectants that were present in the effluents, that were present, that disinfectant could indeed have effect on organisms in the water from other sources. It would probably be minor, but certainly.

MS. WILLIAMS: If the effluent in impact upstream of the point of where it's discharged, either through stagnation or

some type of hydrological effect where the water is moving upstream, could disinfection reduce those values of pathogens?

DR. YATES: Certainly. If there were residual disinfectant in the water or in the effluent as it was deposited in the CAWS, certainly it could have an impact on pathogens from other sources.

MR. ANDES: Let me follow up with that. Because I'm pretty sure that under the Clean Water Act, the District would not be allowed to use residual disinfectant in the upstream. Perhaps. Presuming at first they would have to chlorinate and then they would have to dechlorinate because they are talking --

MS. ALEXANDER: Is that a question?

MR. ANDES: Is that your understanding?

DR. YATES: I have to know -- I do not know what the laws are in the State of Illinois regarding that, but if you did have to chlorinate, then certainly there would not be residual disinfection left.

MR. ANDES: In fact, there would be disinfectant byproducts, correct?

DR. YATES: That's going to depend on a number of factors.

MR. ANDES: You haven't looked at the risk of disinfecting byproducts?

DR. YATES: I'm not a toxicologist, and I really cannot speak to those risks.

MR. ANDES: On page 8 of your testimony you have a Figure 3 concerning urban rivers.

MS. ALEXANDER: For the benefit of all here, I will put this up on the easel.

MR. ANDES: Have you compared the flow of the Mississippi River to the flow in the CAWS?

DR. YATES: I have some general information on the flow in the Mississippi River.

MR. ANDES: Or the Delaware River? Aren't they larger rivers in terms of flow?

DR. YATES: I truly have no idea what the size of the Delaware River is.

MR. ANDES: We are talking about the

situation where 70 percent of the effluent -- you have no reason to believe that the Delaware River is seven percent --

DR. YATES: I have absolutely no knowledge of the Delaware River. I wouldn't and couldn't speculate.

MR. ANDES: And it's not clear where there's significant delusion flow compared to the CAWS, where there really is very low --

DR. YATES: Let's look at, say, the Fox River. The Fox River I do know a little bit about. Not much, but I do know that the flows in the Fox River are, depending on where, et cetera, the flows in the Fox River are somewhat comparable to the flows in the CAWS. The amount of waste water or the proportion of waste water in the Fox River, at least in general, and my understanding, is less than that in the CAWS. It's not 70 percent, at lease not to my understanding. There may be places where it is, but even correcting for the differences, the concentrations in the CAWS are huge. We

are talking about, you know, almost 20,000 fecal coliforms per hundred mls. Whereas here we are talking about way less than 5500. We are talking huge, huge differences. More than an order of magnitude.

MR. ANDES: Are those data at the effluent?

DR. YATES: Which ones?

MR. ANDES: The ones on the left.

DR. YATES: The ones on the left, these are at the waste water treatment plant, and these are at water monitoring -- the patch mark blue ones are at monitoring stations.

MR. ANDES: The other ones aren't at treatment plants, right?

DR. YATES: No, this is -- the darker blue are at the treatment plant, and these are at the -- the other bar is at a water quality monitoring station.

MR. ANDES: You are not saying that the levels say significantly downstream of the treatment plants in the CAWS are at

20,000?

DR. YATES: I'm sorry, repeat that.

MR. ANDES: Are you saying that the levels downstream, say downstream in the Cal Sag Channel or in the Chicago Sanitary & Ship Canal are 20,000 or are you talking mainly at the treatment plant? I'm trying to figure out where that data comes from.

DR. YATES: At the treatment plant. For example, North Shore, it was 19,538 to be precise. At a downstream monitoring station, and I believe that that indicates that it was three miles downstream, the concentration was in excess of 10,000 per hundred ML.

MR. ANDES: And is that one data point? Is that an average of data points taken from --

DR. YATES: I believe this is just a --

MR. ANDES: Certainly not an average, right?

DR. YATES: These are -- you know, off the top of my head, I'm sorry, at this

exact moment I can't recall.

MR. ANDES: If those are one data point, do we know what the samples are in terms of the other body, in terms of whether those are averages or one data point taken?

DR. YATES: Again, I'm totally blanking on this. I'm really sorry.

MR. ANDES: Okay, thank you.

DR. YATES: Actually, it does say samples were taken from May to October. So I do believe these are averages. As it states here in the legend -- I'm sorry, you guys can't see it -- but in the legend it states that the samples were taken monthly from May to October. So that would certainly imply that those are average values.

MR. ANDES: I'm not sure, is that one sample or are you saying those were average of the all the samples taken during the recreational season?

DR. YATES: Again, I don't remember the exact detail, but the fact that it states here in the legend that the samples

were taken monthly from May to October, that would imply that there are multiple samples that contribute to these numbers and that they are averages of some numbers of samples.

MR. ANDES: These are EPA data, not district data, correct?

DR. YATES: These are data from the U.S. EPA, not Illinois EPA.

MR. ANDES: Can we get more information about where those samples were taken and what they represent?

MS. ALEXANDER: We can clear this up on a break.

MR. ANDES: Okay. And I guess the final question, on say the Fox River, I notice that the levels are actually higher downstream than at the treatment plant indicating, I guess, that there are other significant sources.

DR. YATES: I really don't know whether there's other sources. It could have to do with --

MR. ANDES: It could be repair and

regrowth, right?

DR. YATES: It could be sampling. It could be regrowth. These are fecal coliforms, it could be --

MR. ANDES: So I'm going to skip a few questions. And I think we've addressed this issue, but I want to get it clear, and I believe J5 would be the issue. You haven't looked, am I correct --

DR. YATES: I'm there. Go ahead.

MR. ANDES: You have not looked at the contribution of other sources on the bacteria, on the weather particularly during wet conditions, am I right?

DR. YATES: What I know about other sources is what I've read in the Risk Assessment Report. But, again, I did not focus on the wet weather conditions. I focused on the dry weather conditions.

MR. ANDES: Since the treatment plants discharge during dry and wet weather, you haven't looked at the relative information of the treatment plants during certain other sources during wet weather

events and after, correct?

DR. YATES: Again, as I believe I've stated several times now, the fact is there are pathogens in the effluent. You are putting that effluent in the CAWS. People are recreating in that, and they are being exposed to pathogens which has public health risk associated with it.

MR. ANDES: And in terms of disinfection, that would not eliminate pathogens from the effluent, right? There would still be pathogens in the effluents, correct?

DR. YATES: If you are asking would disinfection reduce the number of all pathogens to zero -- is that the question you had?

MR. ANDES: Sure.

DR. YATES: The answer is, I can't remember the which way the question is -- disinfection of the effluent would not reduce the concentration of all pathogens to zero.

MR. ANDES: And do we know what

levels it would reduce to, given that you've read Dr. Blanchy's testimony concerning this issue and whether conventional disinfection as required here, whether it would in fact disinfect infection significant? Do you have a conclusion that, not fecal coliforms, but actual pathogens, would be reduced to a 400 standard?

DR. YATES: I cannot speak specifically to the degree of pathogens reduction that would result from disinfection to a 400 fecal coliform per ML standard. I can tell you that disinfection will reduce the concentration of pathogens, thereby decreasing public health risk.

MR. ANDES: But you are not saying, correct me if I'm wrong, that the levels that are remaining after disinfection --

MS. ALEXANDER: Levels of what?

MR. ANDES: The level of pathogens remaining after disinfection in this water body from all sources would be protective of the health of recreational users? As would the conditions after this disinfection be

safe for recreational users?

MS. ALEXANDER: What do you mean by safe? That's a vague question. There are levels of safety. We need clarity.

MR. ANDES: Speak to levels of safety then. The claims are being made that this would reduce public health risk. I'm trying to define what you use the level of safe to be.

DR. YATES: I have not stated what would be safe. That, to me, is a regulatory designation.

MR. ANDES: You are speaking to a regulatory body.

DR. YATES: As I've already stated, it's someone else's role to determine what is an acceptable risk. All I'm saying is one can disinfect the waste water to reduce the concentrations and thereby reduce the risk. What the acceptable level of risk is, is someone else's role to determine.

MR. ANDES: I'm going to skip to 12 and go to other questions later.

MS. WILLIAMS: Can we go back? I

want to ask one of Fred's questions. Is that okay? I'd like to hear the answer to Question 9.

CHAIRMAN TIPSORD: Question 9? There's J9 and then 9.

MS. WILLIAMS: No, just 9. It doesn't have any subparts. The question quotes you as saying, "I also note that disinfection is a longstanding standard practice in most major metropolitan areas in the U.S. and is implemented in many smaller communities, as well," et cetera, and the question is, are you aware in other parts of the world, such as Western Europe waste water disinfection is the exception? I would like to know if you agree with that statement and that question in 9?

DR. YATES: I have to say that with respect to Europe, I don't have a lot of direct knowledge. It's my understanding that there are -- that there does seem to be an increase in certain areas of the use of disinfection. However, I had occasion to speak directly with a colleague in Canada

who informed me that it is required by law in their province that all waste water be disinfected prior to discharge. So it's not just that waste water effluents are disinfected prior to discharge in the United States. It's practiced in other places in the world.

MR. ANDES: But you are aware, I gather, that there are cities in Western Europe that do not practice disinfection, correct? You said it was increasing.

DR. YATES: I have not done a survey of waste water treatment plants in Western Europe to determine which ones require disinfection on and which ones do not.

MS. ALEXANDER: I have a quick follow-up concerning the data on Figure 3 because I think I understand what the problem was.

Dr. Yates, do you have an understanding of what the source is of the data only with respect to the Chicago area, the Little Canal and the North Shore?

DR. YATES: The Chicago area

waterways data, my understanding is that those come from the District's own sampling, results of their own sampling. I believe the other data comes from the United States Environmental Protection Agency. I believe Region 5. I believe that's here.

MR. ANDES: Can we find out exactly which data points are presented there because that's not clear to me?

MS. ALEXANDER: That's the part that we can clear up on break.

MR. ANDES: Is there any further follow-up?

MS. ALEXANDER: No.

MR. ANDES: I'm going to skip around a little bit. On question 14, you stated that the district sampling in the CAWS near the outfalls indicates higher bacteria level of higher than five times the primary contact standard. Do you know of a technical basis for that five times the primary contact standard or was that just a rule of thumb?

DR. YATES: I do not have -- sitting

here thinking, going through everything I've read, I do not know that I have ever read where the five times -- the factor of five comes from. I do not know.

MR. ANDES: And right now, there isn't any federally recommended secondary contact criteria, correct?

MS. ALEXANDER: What do you mean by federally recommended? I mean, because what we are talking about here is a recommendation? Are we talking about formal regulatory? We need to clarify that.

MR. ANDES: Yes, we have primarily contacted recommended criteria, but they don't have a secondary contact criteria, correct?

DR. YATES: That is my understanding. However, as you know, even if EPA does not have a, you know, formal enforced standard for secondary contact recreation, again, in the interest of protecting public health, if you know that you are doing something that is putting the public at risk, and you know that you can do

something about it, to reduce that risk, even if EPA doesn't regulate it, doesn't mean you have to do it or doesn't mean that you shouldn't do it.

MR. ANDES: I guess we'll get into the policy call then whether you balance how much risk you are reducing to how much it costs, what the greenhouse case and picks are and everything else.

DR. YATES: Again, that is something that's not my role. It's somebody else's role to take all these factors into consideration and determine how much risk they are willing to accept and how much they are willing to pay to reduce that risk to whatever level they've considered acceptable.

MR. ANDES: I'm going to go back to some that we've already -- that I'm skipping over -- in question 18D.

DR. YATES: 18B or D, I'm sorry?

MR. ANDES: D as in David.

Are you familiar with the expert work report of the expert scientific

workshop on critical needs for the development of your revised recreational water quality criteria?

DR. YATES: Yes, sir.

MR. ANDES: Isn't it true that this report pointed out that fecal coliform are detected sometimes where fecal contamination is not present possibly resulting in an inaccurate assessment of effected recreational safety?

DR. YATES: Yes, it certainly is one of the things that was pointed out in that workshop report, that there are times when coliforms can be present when there isn't fecal contamination. However, the converse is also very true and very well documented, that we can find pathogens in water, water that has actually caused disease outbreaks, in the absence of coliform bacteria.

MR. ANDES: It goes both ways then?

DR. YATES: It does go both ways.

MR. ANDES: Okay. You've discussed the importance of, not point sources in making recreational waters unsafe, citing an

EPA statement that, "It's the main reason that approximately 40 percent of our surveyed rivers, lakes and astute rivers are not clean enough to make basic uses, such as fishing or swimming." And I'll provide the document that includes that quote.

CHAIRMAN TIPSORD: I've been handed the "Analysis of the United States Protection Agency Noncompliance with Beaches and Environmental" by Dr. Yates and Rachel T. Noble, and I don't see a date on this. But if there's no objection, we'll mark this as Exhibit 256. Seeing none, it's Exhibit 256.

MR. ANDES: And I believe that statement was on pages 8 and 9 of this report. In your opinion, would not point sources make the CAWS unsafe at times even if disinfection was provided at the treatment plants?

DR. YATES: I assume you are referring to wet weather conditions?

MR. ANDES: Probably, primarily, yes.

DR. YATES: I just want to be clear.

MS. ALEXANDER: Can we break the question down? Can you ask the question referring to wet weather sources because I think the answers may be completely different.

DR. YATES: Certainly if there are wet weather sources contributing pathogens to the CAWS, then the effects of, as we've already said, the effects of disinfecting the effluent would not be as great in terms of pathogens, reducing pathogen risks as they would be during dry weather times when the waste water treatment plant effluent was the main source of pathogens to the CAWS.

MR. ANDES: I'm not sure that answered the question, but I'll move on.

In your same report you stated, on page 5, that "The EPA must justify the level of risk upon which any criteria are based." Do you believe that the same would apply in this rulemaking proceeding?

DR. YATES: That the EPA should you justify the level of risk?

MR. ANDES: Or in this proceeding the Agency too should look at and base the level of risk upon which to make requirements.

DR. YATES: Maybe I'm referring to which -- obviously, I was referring to the U.S. EPA.

MR. ANDES: And obviously the same would be true for the state?

DR. YATES: Do I believe that the level of risk has to be justified?

MR. ANDES: Yes.

DR. YATES: I think that would be reasonable.

MR. ANDES: But nothing in your testimony speaks to what the precise levels of risk are or would be with or without disinfection, correct?

DR. YATES: That's correct.

MR. ANDES: Are you aware -- and I assume you've reviewed a fair amount of the record in this matter -- are you aware of any justification that's been provided in the record by the Illinois EPA concerning

levels of risk that would be resulting from disinfection?

DR. YATES: Justification for?

MR. ANDES: In other words, is there anything you've seen in the record how the level of infection would be reduced by disinfection?

MS. ALEXANDER: By the record, are you referring to what IEPA specifically has presented?

MR. ANDES: Yes.

DR. YATES: I don't know that. I haven't seen exactly anything that IEPA has presented.

MR. ANDES: Okay.

DR. YATES: I'm racking my brain, but I don't --

MS. WILLIAMS: When you say that, does that include the proposed rulemaking language in this proceeding?

DR. YATES: I have not seen the proposed rulemaking language.

MR. ANDES: Did you review the

statement of basis that was included with the rule or any of the testimony by the agency?

DR. YATES: I do not believe I have seen the testimony by the Agency.

MR. ANDES: What have you reviewed in the record regarding --

DR. YATES: I've reviewed the testimony of a number of experts.

MR. ANDES: Including the Illinois EPA's experts?

DR. YATES: I have reviewed the testimony of Dr. Blanchy, of Dr. Gerba, Dr. Pertropolis, Dr. Hass, Dr. Gerba, Dr. Dorevich. So I'm not sure if that's what you are referring to by the -- I'm not sure.

MS. ALEXANDER: I'm sorry, you referenced IPA's experts. Do you mean their staff members?

MR. ANDES: Yes.

DR. YATES: I do not believe I have reviewed the testimony of the staff members of the IEPA.

MR. ANDES: Did you review the statement of basis they included with when they started this rulemaking?

MS. WILLIAMS: Are you referring to the statement of reasons, Fred?

MR. ANDES: Yes, thank you.

DR. YATES: I am not sure that I have read that.

MR. ANDES: I noticed also in this report that there were statements made toward the back -- I'm sorry, on page -- starting on page 25.

DR. YATES: Are you speaking of the analysis?

MR. ANDES: Got it.

DR. YATES: I wanted to make sure I had the right report.

MR. ANDES: Under No. 5, the statement is made that the CPSP, the Critical Path Science Plan proposes epidemiology or quantitative risk assessment management, QRAM studies, to establish criteria is not the appropriate way to deliberate studies to develop criteria. And

then it goes on to say in the second paragraph that -- I'm sorry, in the first paragraph, that the experts at the expert workshop indicated that the preferred approach for defining the quantifying human health risks from exposure to pathogens in water is to conduct epidemiological studies, going on to say epidemiological studies is the primary way to be proceeding the quantifications should only occur as an adjunct or precursor to epidemiological studies. Do you stand by those studies?

DR. YATES: Yes, in the context of this, the issue for which this document was prepared, yes.

MR. ANDES: So in this particular proceeding where evidence has been introduced as to both a quantitative microbial Risk Assessment and epidemiological Risk Assessment that is currently ongoing, you would agree that those should be relevant in the Agency making its decision as a matter of public policy?

DR. YATES: I believe that those should be considered as the decision is made regarding whether or not effluent should be disinfected prior to discharge or not. I believe both of those, in addition to other things, should be considered, yes.

MR. ANDES: Okay. I'm going to skip again to question 25. This concerns statements in your testimony. If I can find that again here under the pile. In the Risk Assessment, those response methods were selected and considered for general population. You provided those response parameters for those populations?

DR. YATES: First of all, I would point out that my statements were that sensitive populations weren't taken into account in the Risk Assessment, and there are other places in the risk assessment where you can take into account sensitive subpopulations other than that in the dose response portion of the Risk Assessment. For example, it's documented that the severity of illness, for example, can be

higher in the sensitive subpopulations or the mortality rate can be higher in sensitive subpopulations. So just because you don't have dose response data for sensitive subpopulations doesn't mean that you just ignore them.

MR. ANDES: So the answer to the question is, you are not aware of dose response parameters that could be used to deal with sensitive populations?

DR. YATES: That's not entirely true because there are dose response data that have been derived from studies of children, for example, and those would be considered as a sensitive population.

MR. ANDES: For primary contact water?

DR. YATES: Doing a dose response study is not dependent on the kind of water.

MR. ANDES: And what particular studies are you speaking of?

DR. YATES: If I remember correctly, there are some of the studies that have been done on children include polio, polio virus

studies. That's the only one I'm sure of at this moment. There may be others, but that's the only one coming immediately to mind.

MR. ANDES: As I understand it, the largest issue in determining sensitivity to effluxion is the immune status of the individual. And people do develop immunities through antibodies to particular pathogens, am I right?

DR. YATES: I would not necessarily agree that the largest factor in determining sensitivity to infection is the presence of antibodies, no.

MR. ANDES: But it's a factor?

DR. YATES: It is a factor.

MR. ANDES: Are there studies indicating that routine exposure, for example, by going out on the water frequently could build up the antibody and one would be less sensitive?

DR. YATES: There are situations where exposure to an organism actually can make you -- can make it more likely that you

would be reinfected.

MR. ANDES: Is that true as to pathogens?

DR. YATES: Norovirus.

MR. ANDES: But do you have any studies to that effect?

DR. YATES: Not here with me. But in speaking with Dr. Christine Mode, who has done the human challenge studies for Norovirus, she, two weeks ago, verified that.

MR. ANDES: There are others where repeated unexposure would make one less infectible?

DR. YATES: There are exceptions, that if you develop antibodies as a result of exposure to that pathogen, it would make it less likely that you would be less likely to become infected by that particular pathogen, likely.

MR. ANDES: Say in terms of immunocompromised people, as a matter of public health, would it be your recommendation that people who are

immunocompromised maybe not recreate on the CAWS?

DR. YATES: Could you define immunocompromised?

MR. ANDES: Let's say people taking immunosuppressive medications.

MS. ALEXANDER: She's already testified that she's not here to make specific recommendations. If that's what you are asking for on the record, that's not what she's here to do.

MR. ANDES: I was not asking as a regulation ought to be made. As a matter of public health you have opined as to what makes sense as to public health. Would one tell people who are taking immunosuppressive medications that perhaps they not go on this water body disinfected or not, given the infection sources?

DR. YATES: I really couldn't speculate as to that or not. I'm not a physician.

MR. ANDES: On question 26, this concerns, on the confutation of wet and dry

weather conditions, do you believe recreational activities are conducted more frequently near the treatment plant outfalls or in other areas?

MS. ALEXANDER: I'm going to object to that. There is a little vagueness here. Near the outfalls, do you mean within a mile or two of them? Do you mean right where the water is falling into the river or what do you mean by that?

MR. ANDES: I would say near the sampling stations.

MS. ALEXANDER: Any of the sampling stations?

MR. ANDES: In close proximity to the outfalls.

MS. ALEXANDER: We are back to the vagueness. Is close proximity a mile or two feet?

MR. ANDES: Let's say it's a mile.

MS. ALEXANDER: Okay.

DR. YATES: So the question is, if you could remind me again.

MR. ANDES: We have three treatment

plants --

DR. YATES: Right.

MR. ANDES: -- on this set of waters. Do you believe that recreational activities are conducted more frequently in close proximity to the treatment plants, within say a mile downstream of them or in other areas of the system, including upstream?

DR. YATES: I don't have specific knowledge of where the recreation occurs upstream or downstream.

MR. ANDES: And since data used in The Risk Assessment included data near the outfalls, wouldn't that tend to over estimate the risk for people who are recreating in other areas, including upstream of those outfalls, if we are looking at an overall assessment of risk recreating on this set of water body?

DR. YATES: Well, again, we've already talked about what I feel are some of the major shortcomings of the Risk Assessment. So it sounds like what you are

saying is that in this one particular case we may have assumed that there may be a little bit higher risk for some individuals, but in the context of the overall Risk Assessment how important that whole thing is, it's really rather difficult to say. And furthermore, if I remember correctly in The Risk Assessment that was done, you assumed that there was equal use of upstream and downstream locations when it's my understanding that more miles of the CAWS are below or downstream of the treatment plants. So I don't understand how you could justify assuming that there was equal recreation both up and downstream.

MR. ANDES: I'm not sure what you are referring to.

DR. YATES: In the, if I remember correctly, in the Risk Assessment you assumed equal recreation occurred upstream and downstream. Whereas the total number of miles of waterways downstream of the treatment plants is much, much higher, and so there was kind of an unequal. The two

just don't jibe.

MR. ANDES: If more samples are taken, and we can go back to the risk assessment during wet weather of CFO's, that would tend to increase the risk of assessment, would it not? Remember all those risks were taken into account and included.

DR. YATES: I think we're mixing apples and oranges here. I think we are talking about different things. One had to do with where people were recreating, and my point is that you were assuming that people were recreating equally upstream and downstream when it's my understanding that the downstream portion of the CAWS represents a much larger percentage of the system, if you will.

MR. ANDES: Can you point me to where it's equally upstream and downstream? I believe samples taken within four widths of the outfalls were used to represent the whole downstream area, including miles downstream of the outfalls, which wouldn't

that tend to overestimate the risk?

DR. YATES: I'm not really sure I can say that at this point. I'm sorry, I don't think I'm following.

MR. ANDES: Let me continue on the issue of wet and dry. Assume you know people may be exposed on rainy days or days immediately after a rain event.

DR. YATES: I don't have specific knowledge of when people are recreating here.

MR. ANDES: Are you aware that The Risk Assessment did not take into account the fact that rain may decrease recreational use?

DR. YATES: Say that again.

MR. ANDES: It didn't take into account any decrease in recreational use when it's raining?

DR. YATES: I'm not certain that I was aware of that specific point.

MR. ANDES: If so, if it used the same assumption for recreational use in wet and dry weather, that would tend to

overestimate the risk somewhat because it's likely that somewhat less people are recreating in rain storms than during dry weather, correct?

DR. YATES: I don't have any information to enable me to agree to that statement.

MR. ANDES: And would you disagree with the notion that including sampling data from both dry and wet weather is necessary to look at the impacts of disinfection of the overall risk associated with the water body considering people recreate in all sorts of weather conditions?

DR. YATES: Again, it depends what you are talking about. If I am a person and I am recreating in that water body on a dry weather day, then I don't really care what my risk is on a wet weather day. I care about what my risks when I'm recreating when I know that there are pathogens being put into the water from the treatment plant. So, again, I care about the risk when I'm recreating.

MR. ANDES: So do you think we should not to have look at the wet weather risk, only the dry weather risk?

DR. YATES: I'm saying for the individual recreator it may or may not have an impact. What I'm saying is something I've said several times already, I believe, and that is you have control over the concentration of pathogens that are input into the water during the dry weather. You can reduce those pathogens, thereby reducing public health risk by disinfecting that effluent.

MR. ANDES: And therefore? And that's where you stop.

DR. YATES: I believe I said by disinfecting the effluent you could reduce the effect of pathogens, reduce the effect of pathogens to the people recreating in the water. I believe I said all that.

MR. ANDES: When do you want to break?

CHAIRMAN TIPSORD: We've got about ten minutes. As long as we leave about five

to 3:00. The call is supposed to initiate at 3:00.

MR. ANDES: I'm going to move to question 29, concerning dose response assumptions. Are the pathogens dose response parameters that were employed in the Risk Assessment typically used in Agency's risk assessment?

DR. YATES: It depends on what organisms are the risk assessments are being done for. So the dose response values that are reported in the Risk Assessment Document are correct for the pathogens that you cite them for, you know. So when you say this is the dose response for, you know, a given -- for Salmonella or this is the dose response for Cryptosporidium, the number that you give as the dose response for the numbers or the values that you give for the dose response are correct. The issue is that there are occasions when you say, well, we don't have a value for the dose response for this organism so we are going to use the dose response for that organism. That's

where I would say that there are issues.

MR. ANDES: And one of the questions you raised was concerning the adenovirus dose response parameter. But the dose response parameter cited is for respiratory infection of adenovirus, do you believe it accurately reflects dose response parameters for gastrointestinal virus?

DR. YATES: I really couldn't speculate on how the dose response parameters for respiratory acquired adenovirus infection relates to the dose response parameters for gastrointestinal adenoviruses. The point is that one can acquire respiratory adenovirus infections from adenoviruses that are present in fecal material, and therefore in sewage, and there was no attempt made to do a Risk Assessment for the respiratory route of acquiring adenovirus infection. And, again, I'm not the only person who has pointed this out. This is another one of the concerns that the EPA has brought to your attention.

MR. ANDES: But I think there are

two separate issues there, and the EPA issue was responded to in the comments and responses. And the question was, in doing the dose response on gastrointestinal illnesses, the issue was as stated here, was that in the risk assessment, they said uninfectivity in respiratory infections are very high, so using that high dose response value would seem inappropriate for gastrointestinal illnesses where the infectivity is much lower, but you are saying you should use it any way because it's conservative.

DR. YATES: I don't believe that's what I said, sir. I said one should look at the potential for respiratory transmission of adenoviruses since you have the transmission of adenovirus. I do not know, as I also stated, whether the dose response parameters for respiratory transmitted adenoviruses. I don't know how those relate to the dose response parameters for the gastrointestinal adenoviruses. I just don't know.

MR. ANDES: If there is not a route, if there is not a pathway in canoeing for respiratory inhalation of significant levels of adenoviruses, would that still be something that you want to look at? I believe The Risk Assessment looked at these issues qualitatively. Do you believe there is a significant risk of inhaling from canoeing on the CAWS?

DR. YATES: Now, you are changing the kinds of activities you are talking about. But nonetheless I have not done a study to look at the volume of water one might be exposed through the respiratory route during those kinds of activities, so I could not speculate as to whether those risks would be high or low. The point is I don't know.

MR. ANDES: The EPA, in looking at primary contact recreational criteria, are they looking at that? Are they focusing a lot of attention on inhalation?

DR. YATES: They are looking at nongastrointestinal illnesses yes, sir.

MR. ANDES: My question is, are they spending any significant amount of attention on inhalation?

DR. YATES: They are looking at other types of end points, in addition to gastrointestinal illness, of which respiratory effects are included. They are also looking at other kinds of infections, eye infections and ear infections. Things like that. The other thing I would point out is that even the respiratory adenoviruses can be transmitted, especially in children. They can be transmitted through the fecal-oral route. So as far as I know, your Risk Assessment did not take that into consideration. Even the so-called nonenteric adenoviruses can be transmitted through exposure through ingestion.

MR. ANDES: Would you expect the dose response parameters to be similar?

DR. YATES: I couldn't speculate to that because I'm not aware of any studies on that.

MR. ANDES: Are all adenoviral

pathogens equally capable of producing gastrointestinal effects?

DR. YATES: Based on my knowledge of adenoviruses, there are two of them that are most frequently associated with gastrointestinal effects. Those are adenoviruses 40 and 41. There are other adenoviruses that are most frequently associated with respiratory effects. There are some adenoviruses that may be most frequently associated with causing respiratory effects but may produce gastrointestinal effects. The more important thing is whether the cause is a respiratory effect or gastrointestinal effect. The adenoviruses replicate in the gastrointestinal tract, and therefore are shed in fecal material, and therefore they are present in sewage. And as I've also mentioned in even some of the respiratory adenoviruses that produce respiratory effects, some of them can be spread through ingestion. And that's especially true in children.

MR. ANDES: Have you looked at the extent to which the biological treatment of secondary sewage, the treatment and risk to the respiratory from effluents of raw sewage? So you are dealing with secondary sewage, the extent to that would contain those or the extent to which those would be removed.

DR. YATES: I cannot specifically tell you of any study that I can call to mind right now that has looked at the removal of, specifically adenoviruses, by secondary treatment.

MR. ANDES: But you are aware of studies indicating that there were significant removal of pathogens in secondary pathogens?

MS. ALEXANDER: Can I object?

MR. ANDES: Some?

DR. YATES: Certainly some is fine.

MR. ANDES: You are aware of removal of pathogens by secondary treatment?

DR. YATES: Yes, there is some removal of pathogens during secondary

treatment, yes. Significant, that's a different matter.

MR. ANDES: Do you know how much?

DR. YATES: It varies based on the specific type of secondary treatment process. It varies even with the same type of secondary treatment process. It varies from plant to plant, different operating conditions. But it could be, especially for viruses, it could -- it's extremely variable, and it could be as low as, I don't know, 10, 20, 30 percent. Maybe up to 80 or 90 percent. Something like that.

MR. ANDES: Can you provide any documentation for those numbers?

DR. YATES: Sure. If you look -- I don't have them with me, but if you would look at standard textbooks such as --

MR. ANDES: I'd like to get specifics.

MS. ALEXANDER: She was about to finish her sentence about which ones, I believe.

DR. YATES: Standard textbook, which

was referenced in my testimony, "Waste Water Microbiology," written by Gabriel Baton. I believe published by Academic Press. It's in my testimony.

MR. ANDES: So would you disagree with the conclusions of Dr. -- I can't remember if it's Dr. Orlis or Garlack -- in their papers which discussed there was significant removal of pathogens in secondary treatment?

DR. YATES: I do recall it. I don't remember the word "significant." To me 99 percent removal is not significant.

MR. ANDES: Oh, okay.

DR. YATES: I don't know. I didn't define what percentage significant was.

MR. ANDES: Thank you. Can you clarify why 99 percent is not significant?

DR. YATES: Certainly. If you have a million pathogens in the water and you remove 99 percent of them, you still have 10,000, and if you are dealing with something like a Norovirus, where one Norovirus particle can give you a 50 percent

probability of infection, you understand why I say 99 percent removal is not significant.

CHAIRMAN TIPSORD: With that, we need to take a break. We'll try to be back here at 3:30.

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

MS. ALEXANDER: Before we start, we just wanted to put on the record the clarification concerning the source of the data that is in Figure 3 that is currently displayed.

DR. YATES: Right. I did go back and check my notes. And indeed these do represent the geometric means of monthly sampling, and those data were gathered by the Region 5 EPA as I had thought. I did verify that that was indeed the case.

MR. ANDES: And you are speaking to the data on the board?

DR. YATES: The data on the right, the nonChicago area waterways, the Fox River, the Mississippi River and the

Delaware.

MR. ANDES: Are the District data also geometric means?

DR. YATES: Yes, I believe they are.

MR. ANDES: And do we know what particular months and years those were from?

DR. YATES: Yes, May through October, in I believe, 2002.

MR. ANDES: I could not read that on the --

CHAIRMAN TIPSORD: Go ahead. We are ready.

MR. ANDES: We'll go back to Question 10. This concerns the statement concerning the likely presence of dangerous pathogens. The District's treated waste water has been shown to have relatively low levels of pathogenic microorganisms during dry weather conditions, therefore, please provide scientific evidence to explain the following, A, what evidence is there that the pathogens listed in Table 1 exist in high concentrations in the CAWS.

MS. ALEXANDER: I'm going to object

to the question because it assumes facts not in evidence or I object to your characterization that the District's treated the waste water has been demonstrated to have relatively low levels of microorganisms. I think that's the topic that's been hotly contested all of today, and also on vagueness. I'm not sure what you mean relatively low. Relative to what?

DR. YATES: So if you could --

MR. ANDES: So my statement was, if you could go through the various pathogens and pathogen categories listed in Table 1 and tell me what evidence there is that these pathogens exist in high concentrations in the CAWS.

DR. YATES: So as I believe I've already stated, based on the sampling that's been done by the District, a number of the pathogens that are listed in Table 1 have been found in the CAWS. Those include the adenoviruses, as I believe I explained earlier, the cocci A and B virus, and the echo viruses, which are members of the

entero virus group. So you did do analysis for entero viruses. And did you find enteroviruses in there? I do not know because you did not do further characterizations of which of the enteroviruses you did find. You also found Norovirus in there. I believe you also found salmonella, as well as Giardia and Cryptosporidium.

MR. ANDES: And in terms of the enteroviruses, weren't those all characterized as coxsackie viruses which would tend to over-estimate the risk?

DR. YATES: I have not seen any information regarding the characterization of the enteroviruses that were detected.

MR. ANDES: Part of my question was whether these categories of pathogens exist in -- what levels they exist in.

DR. YATES: Well, you have provided for some of these pathogens at least concentrations based on your analysis, and I've already spent, I think, quite a bit of time discussing how it's very difficult to

interpret the actual significance of those numbers because of the fact that only a fraction of each of the samples was analyzed for each of those pathogens. So I could not specifically comment on the numbers that you reported.

MR. ANDES: Putting aside the issue of sampling, if these are taken to be the levels that were detected, the question is are those levels high?

DR. YATES: I guess it would depend on how you define high. If you define high as above zero, yes.

MR. ANDES: And if you define high by reference to some dose response information or other information out there indicating some threshold for likely health effects.

DR. YATES: Well, again, as I've mentioned for the Norovirus, ingestion of a single Norovirus particle is sufficient to give you a 50 percent probability of infection. So detection of one Norovirus particle, right there gives you what I would

consider to be a very significant public health risk. 50 percent probability of infection is very, very high.

MR. ANDES: And there are Noroviruses all around us.

DR. YATES: Not that I know.

MR. ANDES: Do people sneeze?

DR. YATES: I'm sorry?

MR. ANDES: Where are Noroviruses present?

DR. YATES: Well, the Noroviruses are in the intestinal tract of individuals that are infected, and anything that has been contaminated by the fecal materials of individuals who are infected.

MR. ANDES: I mean, they are present in the environment more than just this water body, correct? One could encounter them in other environments?

DR. YATES: Noroviruses are present in environments that are fecally contaminated with human fecal material.

MR. ANDES: Are they found in drinking water?

DR. YATES: If the drinking water contains human fecal material and it has not been disinfected to remove them, then, yes, they could be present in drinking water.

MR. ANDES: Disinfection doesn't remove them all, right?

DR. YATES: I believe I've said a number of times, you cannot guarantee 100 percent removal of pathogens using disinfection. You reduce the concentration.

MR. ANDES: So in your table when it says the Noroviruses are known to cause 23 million cases of viruses in U.S., are those from all sewage contaminated water bodies? What are the causes of those viruses?

DR. YATES: Realize again these are an estimate of the number. These are not all documented, which again points to the fact that we really don't have a good idea of the actual number of all of these cases of illnesses that occur. However, the sources of, specifically Norovirus infection, can be water. They can be food -- those are probably the main two

sources of Norovirus infection, water and food.

MR. ANDES: Drinking water you are saying?

DR. YATES: I believe I said water.

MR. ANDES: I'm asking, are you talking primarily about ingestion of water in drinking?

DR. YATES: No, I wouldn't. I would say ingestion of water period, whether it be from drinking or whether it be from recreation. Both of those have been shown to be sources of exposure to Norovirus that can result in illness.

MR. ANDES: So do you have -- of the 23 million cases of Norovirus in the U.S., do you have any numbers?

DR. YATES: I could not break out the number that could be attributed to recreation versus other sources.

MR. ANDES: There are other sources that indicate that the predominant amount of recreational water body illnesses are attributed to treated water such as pools?

DR. YATES: If you look at the CDC, reported outbreak of waterborne disease outbreaks, it is generally the case that a higher percentage of outbreaks are reported to occur in treated water bodies. However, as has been indicated by others, and I will reiterate the point, that the reported number of outbreaks versus the actual number of outbreaks that occur, is well-known that they are vastly under-reported. It's very, very difficult to pinpoint the exact source of illness, especially when the case is that the symptoms are as nonspecific as vomiting and/or diarrhea.

MS. ALEXANDER: Can I just follow-up? It may be more likely to be under-reported in treated water venues or other recreational water venues?

DR. YATES: I don't really necessarily have any specific documentation I can point to for this, but it's certainly, just using my own common sense and professional judgment, I would believe that it would be more likely that if there were

an outbreak, it would be more likely to notice that it was an outbreak and report it as such in a treated water venue than in a nontreated venue, simply because of the nature of the site itself. Because at a pool or something like that, you have an identified population. You know in general who is coming and going. It's only open certain hours, et cetera, et cetera. So I believe it would be more likely that you would recognize an outbreak in a treated water venue. But as I said, I don't have any documentation to support that.

MR. ANDES: As we go through these pathogens on Table 1 as to adenovirus, you point out that it's highly resistant to disinfection using standard UV light, correct?

DR. YATES: Yes.

MR. ANDES: So the UV disinfection systems that we've had testimony about here, in terms of cost and timing and practicality and engineering aspects, would likely not do much to remove adenoviruses?

DR. YATES: What I can say is using the -- this is just based on my knowledge of the studies that have been done on UV disinfection for adenoviruses, there are studies that show using the standard UV wavelengths, they are not as effective against adenoviruses as they are against other viruses and other pathogens for that matter. However, there are a number of studies that are going on that are specifically looking at other types of UV disinfection and are showing that other types of UV disinfection may be more effective for inactivating adenoviruses. So there's more and more data coming out.

MR. ANDES: So there's research ongoing?

DR. YATES: Correct.

MR. ANDES: And what types of UV are you speaking of?

DR. YATES: There's different kinds of UV, there's low pressure UV and high pressure UV. I'm not an engineer so.

DR. YATES: Are you speaking of

types that are being used in California with reclaimed water?

DR. YATES: Not necessarily, no. These are types of UV that are being examined by drinking water utilities for use in disinfecting drinking water. By waste water utilities that are being looked at for use in disinfecting waste water as well.

MR. ANDES: But there's nothing you know of that's currently being used that would do a good job of treating adenoviruses?

DR. YATES: I do not have sufficient knowledge at this point of all the different types of UV that are currently in use to be able to say that that is the case.

MR. ANDES: As to the next set of viruses, the coxsackie viruses, including meningitis, you estimate those to cause 10 to 15 million symptomatic infections here in the U.S. I assume that asymptomatic would be more in addition. Do you have a sense of what the primary causes are of those?

DR. YATES: The primary causes of?

MR. ANDES: Of those infections.

DR. YATES: How they occur, you mean, what the source is?

MR. ANDES: The path.

DR. YATES: The source of the virus to the individuals?

MR. ANDES: Yes.

DR. YATES: Off the top of my head, no, I do know. However, there have been waterborne disease outbreaks that have been caused by these viruses.

MR. ANDES: Where?

DR. YATES: In the United States. I couldn't tell you exactly what states.

MR. ANDES: In treated water venues?

DR. YATES: I could not tell you, recall off the top of my head if they occurred in treated or only untreated or both.

MR. ANDES: Not aware of any nondisinfected water body that this would be an issue?

DR. YATES: I do not know. I have not memorized that literature to be able to

answer that question one way or the other.

MR. ANDES: How about as to echo viruses?

DR. YATES: The same response would be the case. But they have been associated with waterborne disease, but as to whether they occurred in treated or untreated or both, I really could not recall that at this exact moment.

MR. ANDES: I would ask as to rotaviruses, what the likely cause is usually for that? That causes more than three million cases?

DR. YATES: Yes, it does. Rotavirus is, again, an organism that can be transmitted through water. It can also be transmitted through person to person contact. It's extraordinarily common, especially in young children. It causes quite a bit of lost time at school, lost time at work.

MR. ANDES: As to rotaviruses, it sounds like these are in terms of potency. Are these more potent in terms of the facts

than, say, the Noroviruses?

DR. YATES: I'm not sure what you mean by more potent.

MR. ANDES: You specify it's a major cause of diarrhea in young children?

DR. YATES? Right.

MR. ANDES: Does it cause more effects or long-term effects than simply where there's a situation where one will cause a problem, and here we are talking about ten million?

MS. ALEXANDER: That's a compound question. You are asking about more effects, and in fact, activity rates. Can we break those apart?

DR. YATES: With respect to its infectious dose, my understanding is that a single rotavirus particle is sufficient to cause disease. I'd also note that Dr. Charles has stated on numerous occasions very publicly and he's already published to this effect, that one should consider that exposure to a single pathogen is sufficient to initiate a negative -- to initiate harm,

harmful effects in the exposed individual. So really there is, as you know, Dr. Has -- as Dr. Has would put it, there is a nonzero probability in ensuing from exposure to a single one of any of these pathogens. So, yes, indeed one can have negative health effects as a result of exposure to a single rotavirus particle.

With respect to, if I can remember back that far, kind of you are talking about the severity, I believe, of the illness. One of the issues with rotavirus is that it is very, very common in young children, and as with young children, diarrhea can be especially severe because it's very easy for young children to become dehydrated very readily. So one of the things that tends to happen is that you have a young child, they have quite a bit -- a large volume of diarrhea -- I hope that's not too graphic for the reporter -- they have a large volume of diarrhea, and one of the concerns is that they can become dehydrated. And if you become dehydrated

that can be severe and can lead to death. And there is -- that's why there is death in third world countries from gastroenteritis because they don't have access to medical care that we do, but if you look at rotavirus, the Centers For Disease Control has actually compiled statistics on the number of doctor visits, hospitalizations, emergency room visits, et cetera, specifically as a result of exposure to rotavirus, and I can't remember the numbers exactly, but it's on the order of couple hundred thousand I believe, doctor visits and tens of thousands of hospitalizations annually as a result of rotavirus, gastrovirus.

MR. ANDES: And the major causes of the infection?

DR. YATES: I believe I've already answered that question.

MR. ANDES: One dirty diaper can cause substantial effluence in the environment and create a problem?

DR. YATES: Yes.

MR. ANDES: Salmonella is also listed here, and you include Typhoid among the diseases. And that causes two to four million cases of illness per year?

DR. YATES: Salmonella in general. There aren't two to four million cases of typhoid a year. That's one of the success stories as a result of disinfection in the United States. We have dramatically reduced the infection of cholera and typhoid because these organisms are readily killed or inactivated by typical disinfection. And the implementation of the indicator standard to tell us how well we've done with disinfecting has really done a good job at telling us that we've reduced level of bacterial pathogens like Salmonella.

MR. ANDES: Are you aware that void of typhoid was one of the reasons this waterway system was constructed?

DR. YATES: No, I was not.

MR. ANDES: And in fact, has been fairly successful. You are not aware of any outbreaks in this area since then?

DR. YATES: I have no specific outbreaks of any outbreaks that have occurred on the CAWS ever.

MR. ANDES: In terms of shigella, which is about 300,000 cases of illnesses per year and causes --

DR. YATES: Many of the shigella outbreaks are specifically associated with recreational water exposures.

MR. ANDES: From?

DR. YATES: Nontreated waters.

MR. ANDES: Nontreated waters?

DR. YATES: Correct.

MR. ANDES: Specifically?

DR. YATES: Lakes.

MR. ANDES: With swimming?

DR. YATES: I do not know that swimming necessarily was the manner in which the people were exposed. It is ingestion however.

MR. ANDES: Drinking or --

DR. YATES: Ingestion.

MR. ANDES: -- ingestion during swimming and/or ingestion from drinking the

water?

DR. YATES: Ingestion through water getting into your mouth through whatever means, intentional or non.

DR. YATES: Did that include people who didn't recreate in the water, simply that was their drinking can water supply?

DR. YATES: Now I'm a little bit confused. What we are talking about or what I have stated is there have been outbreaks of shigella associated with recreational exposures. I didn't say anything about drinking water exposures. I'm not talking about drinking water exposures. So I didn't say anything about drinking water outbreaks of shigella.

MR. ANDES: Has any specific instance of that come to mind?

DR. YATES: I would have to go back and read the CBC reports that come out biannually and morbidity mortality reports. I couldn't bring any one specific outbreak to mind. Suffice it to say they occur in the United States.

MR. ANDES: I assume that would include water bodies where disinfection is practiced since you said most systems practice disinfection?

DR. YATES: I have no information about whether or not those water bodies are receiving treated or untreated sewage effluent.

MR. ANDES: Okay. Thank you. And by the way, in looking at these various parameters, the various categories of viruses, et cetera, that are laid out here, are generally included in the analyses that have been done here, am I correct? For example, Noroviruses are included in what's been assessed in this Risk Assessment?

DR. YATES: Several of the -- as I've indicated earlier, several of the organisms which is listed in this table which is just examples of some of the organisms that can be present in fecal material and therefore in sewage, several of the organisms in this table have been included in this study, yes.

MR. ANDES: Well, are there any here? In fact, most of these have been included one way or another in the study, am I correct?

DR. YATES: If most is -- I haven't counted them. If most is more than half, I would say yes. I didn't count them.

MS. ALEXANDER: But they have not all, is that correct?

DR. YATES: They have not all. And, again, I do not know when enteroviruses were detected whether they were coxsackie's or echos or what they were or if they were polio's. Probably not polio's anymore but --

MR. ANDES: And cholera we didn't look at, but I think we've discussed that already?

DR. YATES: Right.

MR. ANDES: And Giardia and crypto were looked at, correct?

DR. YATES: Correct.

MR. ANDES: And Giardia, domestic and wild animals are significant

contributors, correct?

DR. YATES: They are contributors to the -- I can't speak specifically to the CAWS. I have no idea whether animals contribute any Giardia or Cryptosporidium to the CAWS. In general, if you go out into the environment into water up in the mountains if there's never been a person there may be Giardia there because they came there from an animal though.

MR. ANDES: And as to Cryptosporidium, you mentioned here relatively resistant removal by traditional processes, you are speaking of chlorination for example.

DR. YATES: Yes, Cryptosporidium is actually relatively resistant to traditional chlorination, which is why the Environmental Protection Agency promulgated the surface water -- well, that is not true, which is why the Environmental Protection Agency has promulgated the long-term to enhance water service treatment rule which requires specific treatment processes to remove

Cryptosporidium, which include things like filtration, not disinfection. Disinfection is also there, but the primary removal is not disinfection in the cases.

MR. ANDES: So one might have to add additional treatment systems to take care of that too?

DR. YATES: Again, what EPA or what people have found for Cryptosporidium is one of the best ways to remove it is through, in a traditional drinking water treatment plant that practices chlorination, a filtration step does a good job of reducing the level of Cryptosporidium. It also has been found, however, that ultraviolet light is a very effective way of reducing concentrations of cryptosporidium.

MR. ANDES: Which doesn't work so well for some of the viruses.

DR. YATES: As I've already said, there's a variant -- for different disinfectants that are more or less effective against different pathogens.

MR. ANDES: Let's go back to

question 10, and I think you've answered some of these but let's just make sure. You don't have, correct me if I'm wrong, an estimate of the current health risk to the recreating population due to bacterial levels in the CAWS without disinfection?

MS. ALEXANDER: I'm sorry, we've got to clarify that. What do you mean the current health risk? Do you mean is there any risk, yes or no? Do you mean something like a level? How would that be measured? I'm not clear what you are asking.

MR. ANDES: Well, the EPA has ways of assessing and quantifying levels of risk. So I'm asking what is, based on standard methods, including this risk assessment of quantifying risk, is there a quantitative estimate of the current health risk due to bacteria levels without disinfection in the CAWS?

DR. YATES: Is there a health risk due to bacteria? Are you referring to pathogenic bacteria? I'm not sure what you are referring to.

MR. ANDES: I would assume pathogenic bacteria. And what level you think it exists as far as a health risk to people recreating in the CAWS now?

DR. YATES: The only information that I would have that would enable me to at least start to be able to get any sense of that risk would be the information that's provided in the Risk Assessment that was presented. So other than that, I am not aware of any specific information regarding specific pathogenic bacteria in the CAWS. On the other hand, as we've discussed a number of times, the presence of high levels of indicators in the CAWS gives one reason to believe that there are pathogenic microorganisms that are present in the CAWS, including pathogenic bacteria, and those in and of themselves carry a health risk to the recreators.

MR. ANDES: The next question, and again, I think I know where our discussion has gone, but do you have any information as to the rate of illness among sensitive

populations for those who engage in limited contact recreation on the CAWS under current conditions?

DR. YATES: Well, if you are asking specifically about sensitive populations, I really don't have specific information regarding the risk to sensitive populations. I could say, however, that based on publication by Charles Gerba, John Rose and Dr. John Has, that in at least in a publication that they have in the International Journal of Food Microbiology from 1996 that I guess, and can introduce, they indicated that about 20 percent of the United States population is in that sensitive population. I believe in Dr. Gerba's testimony he stated that 25 to 30 percent of the population could be considered to be sensitive. So we know that a high percentage of the -- we know that 20 to 30 percent of the U.S. population is considered sensitive. You can categorize that as high or low, whatever you want, and they do cite in that 1996 article that there

are a number of situations in which the severity of illness from exposure to a particular microorganism is higher in those sensitive subpopulations. They also indicate that for certain of the microorganisms there is a higher case fatality ratio, a higher level of death among the sensitive subpopulations than the members of -- than the nonsensitive subpopulations. And another situation, another article that was written by Dr. Charles Gerba, along with Dr. Nina Wachuku from the United States Environmental Protection Agency, this is an opinion from Current Microbiology, 2004, Dr. Gerba states that there's a growing body of evidence that children under age 19 may suffer disproportionately from some environmental risk, and these risks may arise because children's neurological and digestive systems are still in developmental stages. Kids are more likely to be exposed to pathogens because of being kids. They put things in their mouth. They put their hands

in their mouths. They engage in other activity that make them more likely to be exposed, and they also cite specifically that there are two studies that provide quantitative epidemiological evidence that kids are at risk of entero virus illnesses as a result of exposure to water volume contact with recreation.

MS. ALEXANDER: Let me introduce into evidence the two studies that were just references?

MR. ANDES: I don't recall the exact numbers Dr. Gerba used when he came here?

CHAIRMAN TIPSORD: Mr. Andes, let's get these marked first.

CHAIRMAN TIPSORD: The first is sensitive population who is at the greatest risk. The International Journal of Food Microbiology 1996, authors are Charles Gerba, Joan Rose and Charles Has. I'll mark this as Exhibit 257 if there's no objection. Seeing none, it's Exhibit 257. And then Microbial Risk Assessment, Don't Forget The Children, by Nina Wachuku, W-A-C-H-U-K-U,

and Charles P. Gerba from Science Direct from 2004. I will mark that as Exhibit 258 if there's no objection. Seeing none, it's Exhibit 258.

DR. YATES: It's actually, if I could correct it, the name of the journal is current opinion in microbiology. Science Direct is just the source from which I got that journal.

CHAIRMAN TIPSORD: Thank you.

MR. ANDES: So is it, I gather, in looking at one, the Wachuku report, I noticed that it notes in the conclusion that children may have the greatest environmental exposure for enteric pathogens, especially swimming. There's nothing about these particular reports that talks about secondary contact recreation, canoeing, kayaking, things like that. It's a general discussion of sensitivity of particular populations?

DR. YATES: That's correct. It's saying that children especially are more sensitive than other populations, and that

they are at increased risk to a number of infections that are transmitted through the environment and that they specifically cited as I mentioned two studies that showed that they are at, children are at increased risk of enterovirus illnesses as a result of contact with recreational waters. Again, whether they were exposed through swimming in water that contained the pathogens or whether they were exposed through those pathogens in recreating, engaging in nonswimming activities is not the important part. The point is children are at increased risk from enteroviruses that they are exposed to through recreating in water.

MR. ANDES: With all due respect, that is the critical point here in terms of assessing risk, and it seems that these studies talk about lake beach users, insufficiently chlorinated outdoor pool, marine and fresh water bathers, swimming associated outbreak of Norovirus, swimming associated adenovirus infections.

DR. YATES: Again, the point is,

children are at increased risk from exposure to enteroviruses in recreating in water. It can be through swimming. It doesn't matter if there are enteroviruses in the water whether they are exposed to them through ingestion of water as a result of swimming or whether they are exposed to them as a result of ingesting water as a result of other recreational activity on the water. The point is children are at increased risk.

MR. ANDES: In fact, on page 2 of that study, it indicates that infants and children have a greater environmental, even though you develop proper sanitary standards, it has been suggested that they have greater exposure during swimming than adults during swimming.

MS. ALEXANDER: And why would that preclude that, being exposed to less water during nonswimming activity in the water?

DR. YATES: It's already been shown it's not just greater exposure to the water itself and greater volumes of water, but it also has to do with their immune status as

it also states there. Their neurological, immunological and digestive systems are still in developmental stages, which puts them at increased risk. So it's not just the volume of water that they are exposed to through swimming. It's putting things in their mouths. It's the fact that their bodies are not necessarily as capable of handling those infections. They may not have any previous exposures, so they wouldn't have immunity, et cetera, et cetera.

MR. ANDES: Is it your understanding that a Risk Assessment looked at a variety of exposure scenarios, including young children possibly being exposed while they are recreating on the waters?

DR. YATES: Are you talking about the GeoSyntec Risk Assessment?

MR. ANDES: Yes.

DR. YATES: I am not aware that children were not included, but I'm not aware of children being treated in The Risk Assessment in any different manner than

anyone else.

MR. ANDES: And if you don't have the separate dose response occur for them, how would you treat them differently in doing a quantitative Risk Assessment?

DR. YATES: Through other parts of quantitative Risk Assessment, which includes the exposure assessment, the propensity to develop illness as a result of that exposure, et cetera, et cetera. So not just have -- a dose response is just one part of doing a quantitative risk assessment.

MR. ANDES: Different entries including inhalation and ingestion were looked at?

DR. YATES: But I do not believe that children or any other sensitive subpopulations were treated differently, assuming that potentially for children and other sensitive subpopulations they might, or for children especially, they might have been exposed to higher volumes of water or that the outcomes of the exposure might have been more severe in those sensitive

subpopulations.

MR. ANDES: One of issues, and without Dr. Gerba here, I can only recollect is, one of the issues he was asked to do was look at risks for bacteria from recreating in the CAWS relative to risks from public bathrooms. I believe he stated pretty strongly that the risks from public bathrooms were more significant. Do you have any reason to doubt that?

DR. YATES: I would say it would be highly dependent on what public bathrooms you were in. You might find public bathrooms where the risks might be high and the risks might be extremely low.

MR. ANDES: I'll go back to question 10 and subparagraph D, and I'll rephrase it based on our discussions. If we're talking about a proposed standard of 400 per hundred milliliters, which could be met through chlorination or UV, so if you postulate for a moment that that limitation could be met either of those ways, based on what you are saying that could lead to control of some

viruses, for example, but not protozoa, so you could end up dealing with viruses but not crypto, if you do it one way. You could end up with crypto, not viruses, if you do it another way. So what assurance is there that this requirement of doing 400 per hundred milliliters of infection so going to lead to control of the pathogens in the treatment plant effluents putting aside all the other sources?

DR. YATES: Again, as I've already said, and you just acknowledged, different disinfection on technologies have different capabilities of reducing levels of different pathogens to different degrees. However, that does not mean that you get no reduction in pathogens as a result of a particular disinfectant, applying a particular disinfectant. So while you may get more removal from a particular pathogen using a different disinfectant, doesn't mean you get no removal of that particular pathogen. So the point is by implying disinfection, you will get presumably some level of removal of

a variety of pathogens, and as you decrease the level of pathogens through that disinfection on process, you are going to decrease the risk to individuals who are recreating and being exposed to that effluent after it's been discharged into the CAWS.

MR. ANDES: On adenoviruses though, where you stated in the table are highly resistant to UV disinfection, and it sounds from your testimony like we would need to reduce these to very low levels, if UV is not going to reduce them to very low levels, what effect is it having on the risk?

DR. YATES: First of all, I believe that the specific language in the table was using standard UV technology, and as I've already mentioned, there are studies that are going on looking at alternative UV technologies. So I believe that there are going to be, and maybe already are. As I've said, I'm not a waste water treatment engineer, but I believe that there are going to be more effective ways to reduce

adenovirus concentrations using UV. Having said that, even though the concentration of adenoviruses might not be reduced as much as the concentration of other organisms, if you applied standard UV as the treatment, you would get reduction of a number of adenoviruses. As you reduce the number of adenoviruses, you reduce the risk from those adenoviruses.

MR. ANDES: If you are spending the money to put in the UV, but then you are finding that it only deals with some of your pathogens and not others, would you then say that they need to do something else to address the remaining risk?

DR. YATES: Well, again, I'm not the person who is determining what the acceptable level of risk is, but if you disinfect, you know that you are reducing risk because you are reducing pathogens. And, again, it would be up to someone else to determine what level of risk you are going to accept, which would then determine what level of disinfection or other types of

treatments one would have to employ to achieve that level of risk. The point is if you employ disinfection, you are decreasing the level of pathogens, you are decreasing the level of risk.

MR. ANDES: You can say if we say using UV and reducing crypto and one can question if you are not seeing significant level of crypto anyway. But say you are addressing crypto and Giardia through UV. So maybe you are reducing that risk to the extent there is one, but you are not addressing adenoviruses. Can you give the public any sense how much safer are we making it if we are reducing some and we're not doing much to reduce others?

MS. ALEXANDER: I'm going to object to the characterization. She didn't testify that you are not reducing adenoids. I think the testimony was that you are not reducing them less by other methods.

MR. ANDES: But the comment is using highly resistant to infection using UV.

DR. YATES: Highly resistant to

other pathogens studied at that time, yes.

MR. ANDES: Do we have a sense what that means quantitatively. Is that 20 percent, 30 percent?

DR. YATES: Again, it really varies depending on the study. There have been several different studies, and I couldn't quote to you a specific difference in percentages. All I can say is that when the EPA promulgated the Long-term II Enhance Surface Water Treatment Rule, and they used adenovirus as the worst case scenario which they did only with respect to UV treatment processes. It did result in increase in the amount of UV that one would have to apply in order to achieve the, what EPA considered to be an acceptable level of for dinging water, but I couldn't tell you the exact difference in percentages.

MR. ANDES: And the waste water effluent matrix is significantly different than a fairly delude drinking water stream.

DR. YATES: They are very different, however, UV is employed more frequently to

treat waste water than it is to treat drinking water. UV is at least the latest data that I've seen on drinking water treatment disinfection processes. UV is still fairly uncommon, and much of the U.S. that's used to treat drinking water specifically for ground water systems. But there is a greater use of UV in the waste water industry and it's actually been used longer to my knowledge in the waste water industry.

MR. ANDES: So if we have a lot of cities around the country that are using UV, that means they are not doing much to reduce adenovirus; they are getting low levels of adenovirus in their system?

DR. YATES: I couldn't say unless I look at all the studies that had been done, look at removals of adenoviruses by those treatment plants and those studies. I really couldn't speak to that. I haven't seen those studies.

MR. ANDES: Are you familiar with any cities that are doing chlorination and

UV?

DR. YATES: Again, I'm not a waste water treatment engineer, so I couldn't say specifically whether anyone is doing that. There may be, but I really wouldn't know.

MR. ANDES: As to those doing chlorination, it sounds like those systems have an issue in terms of removal of crypto and Giardia, am I correct, in terms of those being resistant to removal by chlorination?

DR. YATES: Again, it would depend on what other treatment processes were being employed in the treatment plant, so I really couldn't generalize.

MR. ANDES: Okay. I'll move to question 11. And it relates to what I think we've just spoken about. You state on page 11 that while the concentrations of pathogens may be reduced incidentally during primary and secondary treatment processes, disinfection is specifically designed to decrease the concentration of pathogens and microorganisms. Do you agree that reduction of the concentration of pathogens is, of

specific pathogens, is assumed based on a specific level of indicator activation by a particular disinfection system?

DR. YATES: I'm a little bit confused when you are talking about primary and secondary treatment in one place and then you are bringing in disinfection.

MR. ANDES: Let's put aside primary and secondary issues. Dr. Orlis and Gorland spoke about that at great length. The question is, when you say you'll be reducing the concentrations of pathogens, you are really assuming that based upon indicators and activation by particularly this disinfection system, which you believe that the levels of pathogens would be reduced as well, specific pathogens.

DR. YATES: Specifically I can't take credit for that statement. I do have to attribute it's source, and did in my testimony, and it's in my references I believe, its attributable, which I am not sure how you say his name, 2003, it's chapter in the book called "The Handbook Of

Water and Wastewater Microbiology." Those are not my words. I actually quoted him.

MR. ANDES: I'm sorry, I didn't see a footnote.

DR. YATES: It's there. Back to your specific question. When they determine -- when they look at the waste water disinfection process or drinking water disinfection process for that matter, what they do is they do studies where they spike that water with known concentrations of pathogens and determine how much removal occurs as a result of the disinfection process, and so there is a linkage that's made between the removal of the indicator organisms and the removal of pathogens, which is why then you can use indicator concentrations to give you some information about the level of pathogen reduction that's occurred. Because you do spiked studies where you add known numbers of pathogens and known numbers of indicator organisms, apply your disinfection process and then follow the disinfection or reduction in those

levels that occur, and that's one of the bases for establishing indicator levels, because we know we can't monitor levels for all the different pathogens. We know what it takes to do that. That's why we use indicators. We have a backup based on studies that have been done on pathogenic organisms as well.

MR. ANDES: So when -- this in Dr. Blanchy's testimony -- you spoke at length, some of those studies look at whether removing, addressing the indicators through, say, a 400 effluent standard would in fact reduce pathogens, and in fact concluded that it wouldn't do very much to reduce the pathogen levels, particularly as compared to the more extreme forms of treatment for reclaimed water. So you say that the risk levels would not be accurate, and that was based on these various treatment studies. Do you have any reason to question the studies that he referred to?

DR. YATES: Well, again, I think that there is a recognition that some of the

pathogens that we now know about are not as easily inactivated by some of the treatment processes -- the disinfection processes as are the indicator bacteria, which is why, especially in the case of drinking water, EPA has stopped relying exclusively on the total coliform standard which had been in place for many, many, decades and is imposing other types of treatment requirements, because they know that there are many times when the coliforms are absent and yet the pathogens are indeed present. So the coliforms are actually under-predicting risks.

MR. ANDES: And I believe we talked about other situations where there was studies indicating that coliforms were present and that the pathogens were not.

DR. YATES: There have been environments where that has been the case.

MR. ANDES: Let me go back to page 11 because I want to be clear on sourcing the specific sentence you mentioned here. I don't see a reference. So I'm not

sure which reference we're --

DR. YATES: I'm sorry, I believe if you look at page 8 of my testimony. The first paragraph under subsection B, it says, "Conventional waste water treatment plants that don't disinfect their effluent." That sentence I reference Oragui 2003 for that point. It's not a direct quote, but I have a reference.

MR. ANDES: So the statement in 11 also references Oragui, which for the foundation --

DR. YATES: It is, correct. The fact is that you may get some reduction, and I would characterize is as rather minimal reduction in primary and secondary treatment processes, the disinfection step is there specifically, designed specifically to reduce the levels of pathogens. The other steps are taking care of things like oxygen demand, organic compounds, nitrogen, phosphorous, those types of things. That's what it's intended to do. It's the disinfection step that is specifically

designed to reduce the level of human pathogens.

MR. ANDES: As to the -- and we can obviously take a look back at the Oragui study or report. I know that the removal through secondary seemed to be characterized differently by Dr. Zorus and Dorevich.

DR. YATES: It's a matter of degree.

MR. ANDES: We can talk about that the further we get. It seemed like they were talking about more than minimal.

DR. YATES: Again, it's a matter of definition. I don't think they defined X percent removal. They may define 99 percent as high, the example I gave as not high.

MR. ANDES: The second part of that question, 11A was, do you agree that the degree to which the assumption holds true, and that's obviously the assumption of the relation between inactivating indicators and reducing levels of pathogens depends to some extent on the microorganism in question and the specific disinfection applied, the disinfection technique applied.

DR. YATES: Certainly, yes.

MR. ANDES: Let's me move on to question 12.

MS. ALEXANDER: I'm sorry, I'd like to ask 11B as a follow-up, if you are not going to. Which is your statement, those whose age or physical condition make them more vulnerable to infection and implies that it causes a lower dose to infect, please provide evidence that the outcome of infection is more severe but still requires the same number of organisms to infect the sensitive populations?

DR. YATES: So basically I believe you were questioning my use of the term infection and certain individuals being more susceptible to infection. And what I would say to that is that indeed there are individuals who are more susceptible to infection than others. For example, for the Norwalk virus in the human challenge studies done by Dr. Christine Moe, it has been found that in order to be infected by those Noroviruses you have to have a specific

genetic marker. And so you might be able to give one individual a single Norovirus and that would cause them to become infected, whereas another individual you could give them a larger number, and they wouldn't become infected because they don't have the marker. I would also cite a comment that was made in the 2004 paper by Dr. Gerba and Nina Wachuku that we just introduced into evidence a few moments ago. The 2004 current opinion in microbiology article, where they reference a paper that indicates that children actually could have a higher probability of becoming infected from the same dose as adults. So you could give children the same number of viruses or other pathogens as you do adults and because of differences in the physiological development of the child, they actually might have a higher probability of becoming infected from that same dose. The other thing I would point out is that --

MR. ANDES: Could I stop you there?

DR. YATES: Yes, certainly.

MR. ANDES: Where is that statement?

DR. YATES: I don't have a hard copy of the paper right in front of me.

MR. ANDES: Because I read the statement, no studies have been conducted to determine the impact --

DR. YATES: Go to the end of that paragraph, if I remember.

MR. ANDES: While the severity of illness is greater in children than adults, it's currently not known if the severity is related to dose in enteric viruses.

DR. YATES: That's not what I'm referring to.

MR. ANDES: That's what I'm interested in. There is a statement that a reduction in stomach acid taken from secretions are estimated to be different in children infected from a given dose than adults?

DR. YATES: Yes, and they do cite a study.

The other point that I would make is that when you do human challenge

studies, the way you do those studies is you divide your subjects up into groups and you give all the members of each group the same dose of the organism. It's very well documented in these studies that, let's say you have five individuals in one group and they all receive a hundred of a particular organism, some of those individuals will become infected and some of them won't. And that's actually the basis for developing what we call the ID50, the Infectious Dose 50. So different individuals do have different susceptibilities to becoming infected based on the dose.

MR. ANDES: But the specific --

DR. YATES: I just found the sentence that I read from that Gerba paper. It's in the section entitled, "Infectivity" -- on the last page -- it's the second to the last sentence there that says, "reduced stomach acid in Pepcid secretions predisposes children to having a greater probability in a given dose."

MR. ANDES: The sentence before is?

DR. YATES: It says, "No studies have been done." Agree.

MR. ANDES: So that's really just speculation.

DR. YATES: My point is that there are people who have evidence that suggest that individuals may indeed be predisposed to becoming infected at a lower dose, and we have absolute data from human challenge studies, of which you have a group of individuals, all of whom are given a same dose of the same organism, and some of them become infected and some of them don't. Now, they may or may not have identified exactly what the reason for that is, but it is indeed the case that some individuals will become infected from a given dose and some will not.

MR. ANDES: And that's always the case, but we are talking specifically here about children versus adults. And I'll read the earlier statement here concerning dose response. "Models have been developed from studies in the oral exposure of polio virus

types I and III in which infants and premature babies were used as subjects. The dose response of those viruses is similar to that observed of echo virus 12 and rotavirus in adults. However, infection is directly culpable because this is likely to be dependent upon the type --

DR. YATES: Right.

MR. ANDES: How does that --

DR. YATES: All I'm saying is there are individuals who have published in the literature and they have referenced a paper here.

MR. ANDES: Which reference?

DR. YATES: Number 24 is referenced in this article, and those individuals have referenced that based on the physiology of children, specifically their stomach and their gastrointestinal tract could predispose them to becoming infected from a lower dose than adults. That's all.

MR. ANDES: Okay. We will -- since we've just seen these reports -- reserve the right when we continue, whenever we do

continue, to ask some further questions about those reports and the ones that are cited. I don't know if there's any, if those are going to be introduced into evidence or not.

DR. YATES: No, I wasn't planning to.

MR. ANDES: Okay. Go to number 12 then. Based on what we've spoken about, I gather you don't know how much actual water is swallowed and inhaled and directly exposed by rowers, paddlers, boaters and fishers in the CAWS?

DR. YATES: I have not done those studies to determine that. However, as you know, in order to do a Risk Assessment, you have to make some assumption and the people who did the Risk Assessment study did make assumptions because they had to come up with numbers. So I don't know how much actual water is swallowed or inhaled, et cetera, but I don't believe the people who did the Risk Assessment did either. That's why they had to come up with some assumption.

MR. ANDES: The epidemiological study, the CHEERS study that's going on now will give us a better idea of that answer?

DR. YATES: That's my understanding, yes.

MR. ANDES: So that would also be information that the Board would want to consider in making a decision here?

DR. YATES: I would imagine that the Board would consider that information, yes.

MR. ANDES: The next question was what is the actual micro exposure dose exposed by paddlers, boaters and fishers in the CAWS?

DR. YATES: Well, I guess the actual number of microorganisms they would consume would depend on the amount of water they ingest, as well as the concentration of microorganisms that were present in that water.

MR. ANDES: So one would look at the Risk Assessment and the epidemiological study together to get some perspective on that since you can't measure directly the

actual microbial exposure dose but you can make some assumptions.

MS. ALEXANDER: What's your question? Is that the only thing someone would look at or is that one thing you could look at?

MR. ANDES: Right. You could you look at those two things combined, and I think that goes back to your analysis report in terms of the use of Risk Assessment and EPI studies together, assume that the actual data collector from the EPI study, along with some of the projections developed through The Risk Assessment would combine to give you some perspective on those?

DR. YATES: Well, I wouldn't want to guess exactly how these studies might be used by people making the decision about whether other not to disinfect this effluent, but I would assume that they would consider that a single epidemiological study and a single Risk Assessment wouldn't necessarily provide adequate information to enable them to make those decisions.

MR. ANDES: Certainly it could end up validating, or not, some of the assumption and findings made in the Risk Assessment, correct?

DR. YATES: You are referring to the epidemiological study?

MR. ANDES: Yes.

DR. YATES: Not having seen the results of it, it's possible. I don't know.

MR. ANDES: And none of us have seen the results. Again, you are not aware of any outbreaks of disease associated with recreational use with outbreaks on the CAWS?

DR. YATES: As I said, just because there haven't been any reported outbreaks doesn't mean that there haven't been any illnesses associated with recreating on the CAWS. I've mentioned before that it's very well-known that outbreaks are vastly under-recognized and under-reported and especially when you are dealing with the situation where the kinds of illnesses that result from exposure to these pathogens are the result of things like gastroenteritis or

respiratory infections or eye infections or something like that. Those are not reportable diseases. So if somebody has gastroenteritis, they are not running to their doctors. Unless it becomes very severe, they are not running to the doctor. So there is at this point in time no way to know how much illness or infection is resulting. Again, as has been mentioned by others, you could have infection that results from exposure to pathogens in the CAWS, and that infected person may, the person who actually recreated in the CAWS may never develop any outward signs of that infection, yet they can act as a source of infection for others who may become ill and you would never know that original source of infection was recreating in the CAWS. So it's very, very difficult to document these kinds of health effects.

MR. ANDES: And The Risk Assessment, that was done, looked at the risk of infection, correct? I mean, obviously EPI studies are more focused on symptoms, but

risk assessment, like this one, looked at risk of infection?

DR. YATES: I believe that The Risk Assessment cites risks of illness.

MR. ANDES: And if we can go back to the report, I think it talks about risk of infection.

DR. YATES: I would direct you to -- let's see if I can find it. Tables, let's look at 59, total expected illnesses. Pathogen concentration with no effluent disinfection, table 511, proportion of recreational user types contributing to gastrointestinal illnesses with no effluent disinfection on Table 511.

MR. ANDES: I believe that those tables were derived based on Dr. Gerba's assessment or assumption based on his expertise that conservative assumption was made that 50 percent of those infected would become ill.

DR. YATES: I have absolutely no idea. I do not recall reading anything to that effect anywhere in this document.

MR. ANDES: We can find it later. And are you also aware that secondary risks were looked at in this report?

DR. YATES: Yes, I am.

MR. ANDES: Do you know of any studies published in the peer review literature that estimated how much water people swallowed with recreating, and I guess we can ask that as to swimming and as to nonprimary contact uses.

DR. YATES: So I just want to make sure, I'm sorry, I was still distracted by the other -- the question was do I know of any studies that estimated how much water people swallow when recreating, was that the question?

MR. ANDES: Yes.

DR. YATES: Yes, I do. Dr. Al DuFour, and I'm sorry I don't have -- I don't believe I brought a copy of this, but there is a publication by Dr. Al DuFour who is with the Environmental Protection Agency, he has a publication from 2006. And again, I apologize, in which they did studies of

individuals and used -- they actually did studies in swimming pools because what they looked at was the amount of cyranic acid, I believe I'm pronouncing that correctly, that was excreted by the individuals after swimming. And this particular chemical is conserved so they could estimate based on those studies what volume of water was ingested, and I know someone else has testified about those studies. I can't remember exactly who that was. If it was -- I just don't remember exactly.

MR. ANDES: Any other studies?

DR. YATES: Yes, there have been other studies. I believe in my testimony I reference some studies of divers, who one would not expect, especially if they are wearing full diving gear, head gear, one would not necessarily expect they would ingest water, but there was a study done by Dr. Jack Zivan and others in the Netherlands looking at the number of water ingested by divers. I don't remember what volume that was, but it was actually measurable volumes

of water ingested during that course of activity.

MR. ANDES: Any others?

DR. YATES: Most of the -- I'll stop there. To my knowledge, those are the only studies that I know of where they specifically measured the volume of water that was ingested. There is another citation that I found on the Web. It's an EPA study in which they look at over 500 individuals, and again, used that same analysis for the cyranic acid and came up with volumes of water that people were ingesting during the course of swimming.

MR. ANDES: From swimming pools?

DR. YATES: It was because they, with the cyranic acid, that is what's present in chlorine used in swimming pools, yes.

MR. ANDES: And I'd like to get a citation of that study at some point.

DR. YATES: I will do that.

MR. ANDES: And the Netherlands study as well.

DR. YATES: The citation to the Netherlands study I believe is in my testimony. Shivan, it's the first one on page 30. Shivan and Anna Marie Deroto, Cushman published in 2006 in Environmental Health Perspectives.

MR. ANDES: I take it you are not aware any studies of quantities of water that would be swallowed by boaters, rowers, fishermen?

DR. YATES: No. All I know is as I mentioned quite a bit earlier this morning, is that when we did our Risk Assessment for those noncontact type recreational activities, we used a volume of 30 milliliters, and that volume was approved by both Dr. Gerba and Dr. Hass, among more than a dozen other individuals, but that was again an assumption not based on actual studies.

MR. ANDES: And that was for swimming?

DR. YATES: No, that was for nonbody contact, what we called nonbody contact

recreational activities which were nonswimming activities, kayaking, canoeing those kinds of activities.

MR. ANDES: The report, and again we haven't read that report yet, but it talks about body contact recreational activities in the title.

DR. YATES: I shouldn't -- there's -- I should not call it nonbody contact. I should call it nonswimming recreational activities. Those are considered to be body contact recreational activities. Kayaking, canoeing, all of those were defined for those purposes as body contact recreational activities. I misspoke when I said nonbody. I meant nonswimming.

MR. ANDES: The purpose was to look at the risk from the drinking water, from the drinking water pathway, is that correct?

DR. YATES: Correct. This was a reservoir that was going to be used as a site to store water that would then be used as a source of drinking water, and the question was whether recreational activities

should be allowed on that.

MEMBER JOHNSON: Doctor, have you ever spent a hot, humid August day in the City of Chicago?

DR. YATES: I was born in Chicago.

MEMBER JOHNSON: Well, you blew my line. It looks like you are gonna.

CHAIRMAN TIPSORD: Actually, Mr. Andes, if you are done with that immediate line of questioning, it is almost 5:00 o'clock, and unfortunately Dr. Yates, it looks like you are going to be coming back to Chicago.

DR. YATES: Like I said, I was born here, and the pizza is pretty much unrivaled if I could say.

MR. ANDES: We'll have that on the record.

CHAIRMAN TIPSORD: And we will speak to Ms. Alexander in more detail about the availability.

MS. ALEXANDER: I may not be able to be here, but I'll make sure what the available dates are.

CHAIRMAN TIPSORD: I want to thank you all, and again we'll start tomorrow morning and we'll begin with Ms. Frisbie. Thank you very much.

STATE OF ILLINOIS )
) SS.
COUNTY OF C O O K )

I, DENISE A. ANDRAS, being a Certified Shorthand Reporter doing business in the City of Des Plaines, Illinois, County of Cook, certify that I reported in shorthand the proceedings had at the foregoing hearing of the above-entitled cause. And I certify that the foregoing is a true and correct transcript of all my shorthand notes so taken as aforesaid and contains all the proceedings had at the said meeting of the above-entitled cause.

Denise Andras

DENISE A. ANDRAS, CSR
CSR NO. 084-0003437